Byron Shire Council

Planning Proposal 26.2021.3.1

Amendment of Byron Local Environmental Plan 2014

150 Lismore Road, Bangalow

Pre Gateway Version #1

Date: June 2021
#E2021/84328

Document History

Doc No.	Date	Details Comments eg Resolution No.
E2021/84328	August 2021	Draft Planning Proposal to Council

Contents

Part 1 Introduction

1.1 Objective and intended outcomes

The objective of this planning proposal is to amend Byron Local Environmental Plan (LEP) 2014 to rezone part of Lot 4 DP 635505, 150 Lismore Road, Bangalow from RU1 Primary Production to IN1 General Industrial and E3 Environmental Management.

Amendments to the floor space ratio map and minimum lot size map are also proposed to reflect the industrial zoning.

1.2 Subject land

This planning proposal relates to part of 150 Lismore Road, Bangalow legally described as part of Lot 4 DP 635505, as shown below in Figure 1.

Figure 1.0. Subject site highlighted and area to be rezoned outlined in dark blue.

The area subject to the rezoning is separated from the remainder of the lot by Maori Creek and directly adjoins the existing Bangalow Industrial Estate.

The site is a grassed area containing a few scattered trees and no development. The site has historically been used for light agricultural purposes including grazing cattle however the site has limited agricultural capability due to its isolation, separated by Maori Creek to the east, Lismore Road to the south, the rail corridor to the north and the existing industrial estate to the west.

Access to the site is via Dudgeons Lane and all essential services are available to the subject land.

The site is not mapped as bushfire prone land, containing acid sulfate soils or high environmental value vegetation.

Part of the site is mapped as flood prone land. This is generally in relation to Maori Creek as shown in figure 2. A flood study has been prepared in support of this rezoning.

Figure 2.0. Flood prone land mapping

Maori Creek is mapped by Department of Primary Industries as key fish habitat as shown in figure 3. A minimum 20m E3 Environmental Management zoned buffer is proposed. This will provide an area to be revegetated as part of any future subdivision. The stormwater management plan concludes that stormwater can be managed on site and any stormwater entering the creek can meet Council's water quality guidelines.

It is recommended that the planning proposal be forwarded to Department of Primary Industries, Fisheries for comment as part of the public exhibition.

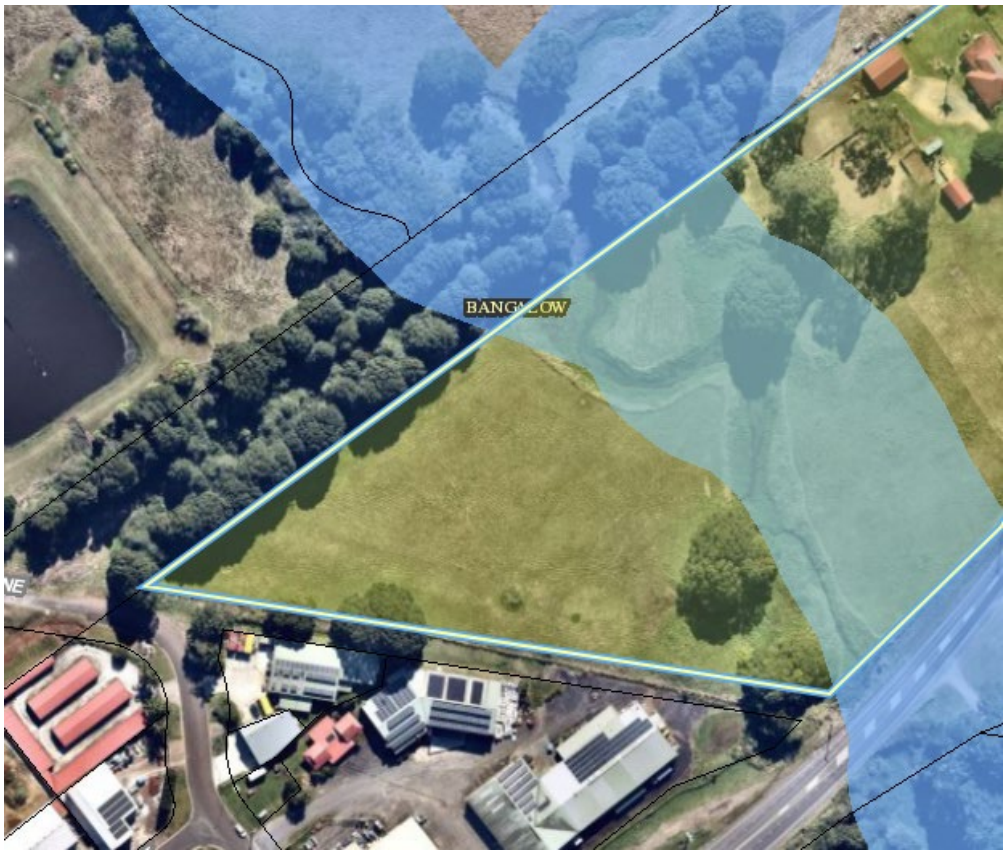

Figure 3.0. Key fish habitat

1.3 Background

The subject site is identified within the Byron Shire Business and Industrial Lands Strategy 2020 as an investigation area for future industrial lands.

The strategy was endorsed by the Department of Planning, Industry and Environment in October 2020.

The strategy identifies key issues that require further investigation prior to rezoning the land for industrial purposes. These issues are addressed in Part 3 of this planning proposal.

To support this planning proposal the following studies have been prepared

- Flood impact assessment
- Stormwater management plan
- Preliminary contaminates site investigation
- Traffic impact assessment
- Road safety audit

Part 2 Explanation of provisions

The planning proposal intends to rezone part of Lot 4 DP 635505 from RU1 Primary Production to IN1 General Industrial and E3 Environmental Management. The minimum lot size will be changed from 40ha to 1000 square metres and a floor space ratio of 0.75 will be applied for the General Industrial zoned area. Floor space ratio does not currently apply to the subject land.

The zoning, minimum lot size and floor space ratio all mirror the existing controls that apply to the adjoining Industrial estate.

This will be achieved by amending the following maps within the Byron LEP 2014 as shown in appendix 1

- Land zoning map
- Minimum lot size map
- Floor space ratio map

Part 3 Justification

Section A Need for the planning proposal

Q1. Is the planning proposal a result of an endorsed local strategic planning statement, strategic study or report?

The subject land is identified in Byron Shire Business and Industrial Lands Strategy 2020 as investigation area 7.

As identified in the strategy the strengths of this site include:

- single ownership
- adjoins and can be accessed from existing industrial area
- relatively flat and cleared area
- adjacent to disused railway corridor
- minimal visual impact due to relatively flat topography and presence of existing industrial estate
- multi directional access

The strategy also notes key considerations and further investigation which is addressed below:

Table 1. Byron Business and Industrial Lands Strategy 2020 Area 7

Consideration	Comment
Distance from Pacific Highway and access via Bangalow village	A road safety audit and traffic assessment conclude that the existing access to Lismore Road is suitable for the proposed rezoning. The location is suitable for industrial purposes given its proximity to the existing Industrial estate.
Aboriginal cultural heritage sensitivities	TBLALC have conducted a site walk over and created a report to accompany this planning proposal. The report concludes that the rezoning is unlikely to have a negative impact on Aboriginal cultural heritage. Conditions of consent for any subsequent development application will include a provision to cease works should any cultural material be revealed as part of development works.

Riparian buffer, flooding and stormwater drainage	The flood study accompanying this planning proposal concludes the site can accommodate the proposed rezoning and there is no significant impact to peak flows for the culverts under Lismore Road. The stormwater management plan concluded that stormwater quality measures can be accommodated on site, allowing it to achieve Council's stormwater management targets for water quality. A minimum 20m E3 Environmental Management zoned buffer is proposed for the site. This space can be revegetated at the subdivision stage in line with Council's B1 Biodiversity DCP 2014 chapter which will require a Biodiversity Conservation Management Plan.
Important farmland classification - requiring detailed assessment of agricultural capability and impact on surrounding land as part of any planning proposal consistent with Environmental Planning and Assessment Act 1979 Section 9.1 Direction 5.3: Farmland of State & Regional Significance on the NSW Far North Coast	The site is mapped as important farmland. Assessment against the relevant criteria in the North Coast Regional Plan is presented in Q3 of this planning proposal. The area subject to the rezoning is not suitable for long term sustainable farming due to its size and isolation being separated from by Maori Creek as well as Lismore Road, the rail corridor and the existing Industrial estate.
Traffic flow implications for Lismore Road	The traffic study indicates that the intersection is capable of providing safe access for the site, even if the subdivision generated traffic movements that were to be substantially higher than predicted.
Gateway to Bangalow landscaping to enhance visual amenity	Impact on visual amenity will be minor as the proposed industrial land will be screened by the existing industrial estate on entry to town. Additional vegetation for screening can be planted as part of any future subdivision approval.

Investigations to ensure that any proposed development is consistent with relevant State and regional planning provisions this may include the management of areas of high environmental value, flooding and heritage/cultural significance	Maori Creek is mapped as key fish habitat. The stormwater management plan concludes that stormwater quality targets can be met and an E3 buffer will apply. The planning proposal is supported by flood assessment and Aboriginal cultural heritage report.

Q2. Is the planning proposal the best means of achieving the objective or intended outcomes, or is there a better way?

Yes. The Planning Proposal is considered the best means of enabling the land to be used for industrial purposes and providing additional industrial land within Bangalow. This site is the only investigation area in Bangalow within the Business and Industrial Lands Strategy.

Section B Relationship to strategic planning framework

Q3. Will the planning proposal give effect to the objectives and actions of the applicable regional, or district plan or strategy (in this case the North Coast Regional Plan 2036)?

Yes. The planning proposal is consistent with the North Coast Regional Plan 2036, which is a 20-year blueprint for the future of the North Coast. The NSW Government's vision for the North Coast is to create the best region in Australia to live, work and play thanks to its spectacular environment and vibrant communities.

The following actions have been identified as relevant to this proposal

Table 2. Relevant actions from the North Coast Regional Plan 2036

Action	Comment
1.1 Focus future urban development to mapped urban growth areas.	The site is not currently mapped in the urban growth area, however the site is identified in the Business and Industrial Lands strategy. An assessment against the variation criteria is presented below.
2.1 Focus development to areas of least biodiversity sensitivity in the region and implement the 'avoid, minimise, offset'	The site is a cleared area used historically for light agricultural uses. The site is bound by Maori Creek which is mapped as key fish habitat. A buffer of E3

hierarchy to biodiversity, including areas of high environmental value.	zoning will be provided to enable revegetation along the creek.
2.2 Ensure local plans manage marine environments, water catchment areas and groundwater sources to avoid potential development impacts.	The Stormwater Management Plan prepared by BMT Global considered the impact on the adjoining Maori Creek and concluded that the development could occur without any significant impact on water quality, flooding or fish habitat.
3.1 Reduce the risk from natural hazards, including the projected effects of climate change, by identifying, avoiding and managing vulnerable areas and hazards.	The site is mapped as being flood prone land, and in this regard a flood study was prepared for the site and accompanies this report. The area proposed to be zoned IN1 is reflective of the scenarios within the flood study. The environmental buffer will also act as a flood buffer. The site is not identified as being subject to any other natural hazards.
6.6 Deliver an adequate supply of employment land through local growth management strategies and local environmental plans to support jobs growth.	The site is identified in Byron Business and Industrial Lands Strategy as additional employment land for Bangalow.
16.2 Ensure Aboriginal communities are engaged throughout the preparation of local growth management strategies and local environmental plans.	Consultation will occur through the public exhibition process. An Aboriginal Cultural Heritage Assessment was completed by Tweed Byron Local Aboriginal Land Council and accompanies this planning proposal.
18.2 Undertake Aboriginal cultural heritage assessments to inform the design of planning and development proposals so that impacts to Aboriginal cultural heritage are minimised and appropriate heritage management mechanisms are identified.	An Aboriginal Cultural Heritage Assessment was completed by Tweed Byron Local Aboriginal Land Council and accompanies this planning proposal.
21.2 Maximise the cost-effective and efficient use of infrastructure by directing development towards existing infrastructure or promoting the co-location of new infrastructure.	The proposed area to be rezoned is adjacent to the existing industrial area and has access to all essential services and infrastructure.

The site is mapped as important farmland and to support the rezoning an assessment against the Important Farmland Interim Variation Criteria in the NCRP.

Table 3. Important farmland interim variation criteria

	Criteria	Comment
Agricultural capability	The land is isolated from other important farmland and is not capable of supporting sustainable agricultural production.	The subject area of land to be rezoned is constrained by Maori Creek to the east and the existing industrial estate to the west. It is further constrained by Lismore Road to the south and the rail corridor to the north. The land is isolated from the rest of Lot 4 DP 635505 by Maori Creek and is only accessible via Dudgeons Lane. This makes it impractical to use the land for agricultural purposes and therefore not capable of supporting sustainable agricultural production. The area of land in question is 1.1ha and the removal of this area from the RU1 zone will have minimal impact on the availability of viable agricultural land.
Land use conflict	The land use does not increase the likelihood of conflict and does not impact on current or future agricultural activities in the locality.	There is minimal potential for land use conflict as the subject area is 160m away from the nearest sensitive receiver (dwelling house on Lot 4 DP 635505) which is located on the same lot. Further measures in relation to noise attenuation can be applied at DA stage is deemed appropriate. The industrial use will not impact on agricultural production as the land is separated from the rest of the lot by Maori creek and requires access to be obtained via Dudgeons Lane, making agriculture impractical for this portion of the site.
Infrastructure	The delivery of infrastructure (utilities, transport, open space, communications and stormwater)	All essential services are available to service the site. The site is directly

	required to service the land is physically and economically feasible at no cost to State and Local Government.	adjoining the existing industrial estate. The traffic assessment shows the existing road can cope with the additional traffic. The stormwater management plan concludes that the site can accommodate the increase in stormwater.
Environment and heritage	The proposed land uses do not have an adverse impact on areas of high environmental value, and Aboriginal or historic heritage significance.	The adjacent Maori Creek is identified as possibly providing fish habitat on NSW Department of Primary Industries maps. The Stormwater Management Plan prepared by BMT Global Pty Ltd (Appendix 2) found that stormwater management targets are able to be achieved if the land is developed for industrial purposes in the future. An E3 Environmental Management zone buffer is proposed to further protect the environmental values of Maori Creek. Revegetation of this area will be required at the subdivision stage. A site walk over from TBLALC concluded that the rezoning is unlikely to compromise Aboriginal cultural values.
Avoiding risk	Risks associated with physically constrained land are identified and avoided, including flood prone, bushfire-prone, highly erodible, severe slope and acid sulfate soils.	The land is not subject to any of the risks identified in his table with the exception of flooding. A flood study was prepared by BMT which informed the area suitable to be rezoned for industrial purposes. The area proposed to be zoned IN1 is reflective of the scenarios within the flood study. The environmental buffer will also act as a flood buffer.

The site is not within the Urban Growth Area as contained in the North Coast Regional Plan 2036. While the site is identified in Byron Business and Industrial Lands Strategy the NCRP 2036 has not been updated for some time and as such a variation to the urban growth area is required.

Table 4. Urban Growth Area Variation Principles

	Criteria	Comments
Policy	The variation needs to be consistent with the objectives and outcomes in the North Coast Regional Plan 2036 and any relevant Section 117 Directions and State Environmental Planning Policies, and should consider the intent of any applicable local growth management strategy.	The variation is considered appropriate as the planning proposal is generally consistent with the NCRP, Ministerial Directions and is identified for industrial purposes in Byron Business and Industrial Lands Strategy.
Infrastructure	The variation needs to consider the use of committed and planned major transport, water and sewerage infrastructure, and have no cost to government. The variation should only be permitted if adequate and cost-effective infrastructure can be provided to match the expected population.	The site is directly adjacent to the existing industrial estate with all services available.
Environmental and farmland protection	The variation should avoid areas: • of high environmental or heritage value; and • mapped as important farmland, unless consistent with the interim variation criteria prior to finalising the farmland mapping review	The site is not mapped as high environmental value or heritage value. The site is mapped as important farmland and is consistent with the variation criteria as addressed in the table above.
Land use conflict	The variation must be appropriately separated from incompatible land uses, including agricultural activities, sewage treatment plants, waste facilities and productive resource lands.	The site is directly adjacent to the existing industrial estate. The site is isolated by Maori Creek, Lismore Road and the disused rail corridor. It is unlikely that any land use conflicts will occur as a result of this proposal.

Avoiding risk	The variation must avoid physically constrained land identified as: flood prone, bushfire-prone, highly erodible, having a severe slope, and having acid sulfate soils.	The land is not subject to any of the risks identified in his table with the exception of flooding. A flood study was prepared by BMT which informed the appropriate area of the industrial zoning. The area proposed to be zoned IN1 is reflective of the scenarios within the flood study. The environmental buffer will also act as a flood buffer.
Heritage	The variation must protect and manage Aboriginal and non-Aboriginal heritage.	An Aboriginal Cultural Heritage report supports this proposal. The site contains no listed heritage items.
Coastal area	Only minor and contiguous variations to urban growth areas in the coastal area will be considered due to its environmental sensitivity and the range of land uses competing for this limited area.	The site is not located in the coastal area and is not subject to coastal processes.

Q4. Will the planning proposal give effect to Council's endorsed local strategic planning statement, or other local strategic plan?

Byron Shire Local Strategic Planning Statement (LSPS) was endorsed by DPIE in September 2020.

At this time the Business and Industrial Lands Strategy was not yet finalised with an action contained in the LSPS to finalise the strategy and implement priority actions (TA6).

The Business and Industrial Lands Strategy was endorsed by DPIE in October 2020 with a key action to consider landowner planning investigations for possible new industrial areas as identified in the strategy through the assessment of any submitted planning proposal (action 13).

This site is located as an investigation area within the Business and Industrial Lands Strategy and therefore this planning proposal is considered to give effect to both Byron Shire LSPS and Business and Industrial Lands Strategy.

Q5. Is the planning proposal consistent with applicable State Environmental Planning Policies (SEPPs)?

The State Environmental Planning Policies relevant to this Planning Proposal are as follows:

Table 5. Relevant SEPPs

State Environmental Planning Policy (SEPP)	Compliance of Planning Proposal
Coastal Management SEPP 2018	The site is not mapped within the coastal management SEPP
Koala Habitat Protection SEPP	The site does not contain any potential koala habitat.
SEPP 55 – Remediation of Land	A preliminary contaminated land site investigation was completed, and a report accompanies this proposal. The report concludes that the Investigation Area would not represent a significant risk of harm to end users of the proposed rezoning proposal.
Primary Production and Rural Development SEPP 2019	The site is not mapped as state significant farmland under the SEPP. There are no specific provisions related to this planning proposal.

Q6. Is the planning proposal consistent with the applicable Ministerial Directions (s.9.1 directions)?

Consistency with the Local Planning Directions is assessed in the following table:

1. Employment and Resources

S. 9.1 Direction	Application	Relevance to this planning proposal	Consistency
1.1 Business and Industrial Zones	Applies when a relevant planning authority prepares a planning proposal that will affect land within an existing or proposed business or industrial zone (including the alteration of any existing business or industrial zone boundary).	The proposed rezoning will add to the supply of employment lands within the Byron Shire and the site is directly adjacent existing industrial zoned land in Bangalow. The site is located as an investigation area for future industrial land in Byron Business and Industrial Lands Strategy which has been endorsed by the Department of Planning, Industry and Environment.	Consistent
1.2 Rural Zones	Applies when a relevant planning authority prepares a planning proposal that will affect land within an existing or proposed rural zone (including the alteration of any existing rural zone boundary).	A planning proposal must not rezone rural land to an industrial zone unless by an approved strategy or is of minor significance. In this case, the site is identified in the Byron Business and Industrial Lands Strategy which has been endorsed by the Department of Planning, Industry and Environment. The land is of minor rural significance due to the small size and isolation from the larger residual lot.	Justifiably inconsistent

S. 9.1 Direction	Application	Relevance to this planning proposal	Consistency
1.3 Mining, Petroleum Production and Extractive Industries	Applies when a relevant planning authority prepares a planning proposal that would have the effect of: a) prohibiting the mining of coal or other minerals, production of petroleum, or winning or obtaining of extractive materials, or b) restricting the potential development of resources of coal, other minerals, petroleum or extractive materials which are of State or regional significance by permitting a land use that is likely to be incompatible with such development.	Not applicable	Not applicable
1.4 Oyster Aquaculture	Applies when a relevant planning authority prepares any planning proposal that proposes a change in land use which could result in: a) adverse impacts on a Priority Oyster Aquaculture Area or a “current oyster aquaculture lease in the national parks estate”, or b) incompatible use of land between oyster aquaculture in a Priority Oyster Aquaculture Area or a “current oyster aquaculture lease	The planning proposal does not impact on any priority oyster aquaculture areas.	Consistent

S. 9.1 Direction	Application	Relevance to this planning proposal	Consistency
	in the national parks estate" and other land uses.		
1.5 Rural Lands	Applies when a relevant planning authority prepares a planning proposal that: a) will affect land within an existing or proposed rural or environment protection zone (including the alteration of any existing rural or environment protection zone boundary), or b) changes the existing minimum lot size on land within a rural or environment protection zone.	The proposal will rezone a small area of farmland that is isolated from the remainder of the lot. The area is separated by an industrial estate, road, rail corridor and Maori Creek and is considered not significant for agricultural purposes. The variation to the North Coast Regional Plan farmland criteria is presented above in table 3.	Consistent

2. Environment and Heritage

S. 9.1 Direction	Application	Relevance to this planning proposal	Consistency
2.1 Environment Protection Zones	The objective of this direction is to protect and conserve environmentally sensitive areas. A planning proposal must include provisions that facilitate the protection and conservation of environmentally sensitive areas.	The adjacent Maori Creek is mapped as key fish habitat. The stormwater management plan states that stormwater quality targets can be achieved. An 20m minimum E3 Environmental Management zoned buffer if proposed to protect Maori Creek.	Consistent

S. 9.1 Direction	Application	Relevance to this planning proposal	Consistency
	A planning proposal that applies to land within an environment protection zone or land otherwise identified for environment protection purposes in a LEP must not reduce the environmental protection standards that apply to the land (including by modifying development standards that apply to the land). This requirement does not apply to a change to a development standard for minimum lot size for a dwelling in accordance with clause (5) of Direction 1.5 “Rural Lands”.		
2.2 Coastal Protection Zones	This direction applies to land that is within the coastal zone, as defined under the Coastal Management Act 2016 - comprising the coastal wetlands and littoral rainforests area, coastal vulnerability area, coastal environment area and coastal use area - and as identified by the State Environmental Planning Policy (Coastal Management) 2018.	The site is not within the coastal zone	Not applicable
2.3 Heritage Conservation	A planning proposal must contain provisions that facilitate the conservation of: a) items, places, buildings, works, relics, moveable objects or precincts of environmental heritage significance to an area, in relation to the historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value of the item, area,	The planning proposal does not impact on any heritage items or the existing heritage provisions in Byron LEP 2014. A site investigation was undertaken by TBLALC and the accompanying report notes that rezoning presents a very low risk of harm to Aboriginal cultural heritage.	Consistent

S. 9.1 Direction	Application	Relevance to this planning proposal	Consistency
	object or place, identified in a study of the environmental heritage of the area, b) Aboriginal objects or Aboriginal places that are protected under the National Parks and Wildlife Act 1974, and c) Aboriginal areas, Aboriginal objects, Aboriginal places or landscapes identified by an Aboriginal heritage survey prepared by or on behalf of an Aboriginal Land Council, Aboriginal body or public authority and provided to the relevant planning authority, which identifies the area, object, place or landscape as being of heritage significance to Aboriginal culture and people.		
2.4 Recreation Vehicle Areas	A planning proposal must not enable land to be developed for the purpose of a recreation vehicle area (within the meaning of the Recreation Vehicles Act 1983): a) where the land is within an environmental protection zone, b) where the land comprises a beach or a dune adjacent to or adjoining a beach, c) where the land is not within an area or zone referred to in paragraphs (4)(a) or (4)(b)	Not applicable	Not applicable

S. 9.1 Direction	Application	Relevance to this planning proposal	Consistency
	unless the relevant planning authority has taken into consideration: (i) the provisions of the guidelines entitled Guidelines for Selection, Establishment and Maintenance of Recreation Vehicle Areas, Soil Conservation Service of New South Wales, September, 1985, and (ii) the provisions of the guidelines entitled Recreation Vehicles Act, 1983, Guidelines for Selection, Design, and Operation of Recreation Vehicle Areas, State Pollution Control Commission, September 1985		
2.5 Application of E2 and E3 Zones and Environmental Overlays in Far North Coast LEPs	This direction applies when a relevant planning authority prepares a planning proposal: a) that introduces or alters an E2 Environmental Conservation or E3 Environmental Management zone; b) that introduces or alters an overlay and associated clause.	An E3 Environmental Management zoned buffer is proposed along Maori Creek. The applicants have agreed to this application and the zoning will provide an area for plantings to protect Maori Creek. The application of the environmental zone will be in accordance with requirements of the Northern Councils E Zone Review Final Recommendations.	Consistent
2.6 Remediation of Contaminated Land	This direction applies to:	A preliminary contaminated site investigation was prepared and concluded that the investigation	Consistent

S. 9.1 Direction	Application	Relevance to this planning proposal	Consistency
	a) land that is within an investigation area within the meaning of the Contaminated Land Management Act 1997, b) land on which development for a purpose referred to in Table 1 to the contaminated land planning guidelines is being, or is known to have been, carried out, c) the extent to which it is proposed to carry out development on it for residential, educational, recreational or childcare purposes, or for the purposes of a hospital – land: (i) in relation to which there is no knowledge (or incomplete knowledge) as to whether development for a purpose referred to in Table 1 to the contaminated land planning guidelines has been carried out, and (ii) on which it would have been lawful to carry out such development during any period in respect of which there is no knowledge (or incomplete knowledge).	area would not represent a significant risk of harm to end users of the proposed rezoning proposal.	

3. Housing, Infrastructure and Urban Development

S. 9.1 Direction	Application	Relevance to this planning proposal	Consistency
3.1 Residential Zones	This direction applies when a relevant planning authority prepares a planning proposal that will affect land within: a) an existing or proposed residential zone (including the alteration of any existing residential zone boundary), b) any other zone in which significant residential development is permitted or proposed to be permitted.	The planning proposal does not impact on residential land	Not applicable
3.2 Caravan Parks and Manufactured Home Estates	In identifying suitable zones, locations and provisions for caravan parks in a planning proposal, the relevant planning authority must: a) retain provisions that permit development for the purposes of a caravan park to be carried out on land, and b) retain the zonings of existing caravan parks, or in the case of a new principal LEP zone the land in accordance with an appropriate zone under the Standard Instrument (Local Environmental Plans) Order 2006 that would facilitate the retention of the existing caravan park.	Not applicable	Not applicable

S. 9.1 Direction	Application	Relevance to this planning proposal	Consistency
3.3 Home Occupations	Revoked	Not applicable	Not applicable
3.4 Integrating Land Use and Transport	This direction applies when a relevant planning authority prepares a planning proposal that will create, alter or remove a zone or a provision relating to urban land, including land zoned for residential, business, industrial, village or tourist purposes. A planning proposal must locate zones for urban purposes and include provisions that give effect to and are consistent with the aims, objectives and principles of: a) *Improving Transport Choice – Guidelines for planning and development* (DUAP 2001), and b) *The Right Place for Business and Services – Planning Policy* (DUAP 2001).	The site is located to the existing industrial area in Bangalow. The traffic assessment concludes that the current road infrastructure is suitable for the rezoning and resulting development. The industrial area is located approximately 1600m from the town centre. There are currently no footpaths linked to the industrial area with vehicles likely to be the predominant way to access the site. The proposal is partly consistent with this direction.	Consistent
3.5 Development Near Regulated Airports and Defence Airfields	This direction applies when a relevant planning authority prepares a planning proposal that will create, alter or remove a zone or a provision relating to land near a regulated airport which includes a defence airfield.	Not applicable	Not applicable

S. 9.1 Direction	Application	Relevance to this planning proposal	Consistency
3.6 Shooting Ranges	This direction applies when a relevant planning authority prepares a planning proposal that will affect, create, alter or remove a zone or a provision relating to land adjacent to and/ or adjoining an existing shooting range.	Not applicable	Not applicable

4. Hazard and Risk

S. 9.1 Direction	Application	Relevance to this planning proposal	Consistency
4.1 Acid Sulfate Soils	This direction applies when a relevant planning authority prepares a planning proposal that will apply to land having a probability of containing acid sulfate soils as shown on the Acid Sulfate Soils Planning Maps.	The land is not mapped as containing acid sulfate soils	Not applicable
4.2 Mine Subsidence and Unstable Land	This direction applies to land that: a) is within a Mine Subsidence District proclaimed pursuant to section 15 of the Mine Subsidence Compensation Act 1961, or b) has been identified as unstable land.	Not applicable	Not applicable

S. 9.1 Direction	Application	Relevance to this planning proposal	Consistency
	This direction applies when a relevant planning authority prepares a planning proposal that permits development on land that: a) is within a mine subsidence district, or b) has been identified as unstable in a study, strategy or other assessment		
4.3 Flood Prone Land	This direction applies when a relevant planning authority prepares a planning proposal that creates, removes or alters a zone or a provision that affects flood prone land. A planning proposal must include provisions that give effect to and are consistent with the NSW Flood Prone Land Policy and the principles of the Floodplain Development Manual 2005 (including the Guideline on Development Controls on Low Flood Risk Areas). A planning proposal must not rezone land within the flood planning areas from Special Use, Special Purpose, Recreation, Rural or Environmental Protection Zones to a Residential, Business, Industrial, Special Use or Special Purpose Zone.	Part of the site along Maori Creek is mapped as flood prone land. A Flood Study was carried out by BMT Global which concluded that the land can be developed in accordance with the NSW Flood Prone Land Policy and Floodplain Development Manual. The flood study informed the appropriate location of the industrial zoning. An environmental zoned buffer of 20m is required to protect Maori Creek and reduce impacts of flooding, with a larger buffer in areas of higher flood risk, particularly in the southern portion of the lot. The development will not result in any additional or unacceptable risks to life or property in the vicinity.	Justifiably inconsistent

S. 9.1 Direction	Application	Relevance to this planning proposal	Consistency
4.4 Planning for Bushfire Protection	This direction applies when a relevant planning authority prepares a planning proposal that will affect, or is in proximity to land mapped as bushfire prone land. In the preparation of a planning proposal the relevant planning authority must consult with the Commissioner of the NSW Rural Fire Service following receipt of a gateway determination under section 56 of the Act, and prior to undertaking community consultation in satisfaction of Schedule 1, clause 4 of the Act, and take into account any comments so made.	The site is not mapped or in proximity to bushfire prone land.	Consistent

5. Regional Planning

S. 9.1 Direction	Application	Relevance to this planning proposal	Consistency
5.1 Implementation of Regional Strategies	Revoked	Not Applicable	Not Applicable

S. 9.1 Direction	Application	Relevance to this planning proposal	Consistency
5.2 Sydney Drinking Water Catchments	Applies when a relevant planning authority prepares a planning proposal that applies to land within Sydney drinking water catchment.	Not Applicable	Not Applicable
5.3 Farmland of State and Regional Significance on the NSW Far North Coast	This applies to Byron Shire Council except within areas contained within the “urban growth area” mapped in the North Coast Regional Plan 2036. A planning proposal must not: a) rezone land identified as “State Significant Farmland” for urban or rural residential purposes. b) rezone land identified as “Regionally Significant Farmland” for urban or rural residential purposes. c) rezone land identified as “significant non-contiguous farmland” for urban or rural residential purposes.	The site is mapped as regionally significant farmland in the North Coast Regional Plan 2036. The site is isolated being separated by Lismore Road, the rail corridor, the existing industrial estate and Maori Creek. This isolation reduces the capabilities of this site to be used for farming purposes. The variation to the farmland criteria is justified above in table 3.	Justifiably inconsistent
5.4 Commercial and Retail Development along the Pacific Highway, North Coast	This Direction applies when a relevant planning authority prepares a planning proposal for land in the vicinity of the existing and/or proposed alignment of the Pacific Highway.	Not applicable	Not applicable

S. 9.1 Direction	Application	Relevance to this planning proposal	Consistency
5.5 – 5.8 Revoked	Revoked	Not applicable	Not applicable
5.9 North West Rail Link Corridor Strategy	This Direction applies to Hornsby Shire Council, The Hills Shire Council and Blacktown City Council.	Not applicable	Not applicable
5.10 Implementation of Regional Plans	Planning proposals must be consistent with a Regional Plan released by the Minister for Planning.	The consistency of this Planning Proposal with the North Coast Regional Plan is addressed in Section B above. The planning proposal is generally consistent with the North Coast Regional Plan as the site has been identified as a potential site for industrial uses in Byron Business and Industrial Lands Strategy.	Consistent
5.11 Development of Aboriginal Land Council Land	This direction applies when a planning proposal authority prepares a planning proposal for land shown on the Land Application Map of State Environmental Planning Policy (Aboriginal Land) 2019.	Not applicable	Not applicable

6. Local Plan Making

S. 9.1 Direction	Application	Relevance to this planning proposal	Consistency
6.1 Approval and Referral Requirements	A planning proposal must: a) minimise the inclusion of provisions that require the concurrence, consultation or referral of development applications to a Minister or public authority, and b) not contain provisions requiring concurrence, consultation or referral of a Minister or public authority unless the relevant planning authority has obtained the approval of: (i) the appropriate Minister or public authority, and (ii) the Director-General of the Department of Planning (or an officer of the Department nominated by the Director-General)	The planning proposal will not include any new provisions requiring concurrence or referrals and is considered to be consistent with this Direction.	Consistent
6.2 Reserving Land for Public Purposes	A planning proposal must not create, alter or reduce existing zonings or reservations of land for public purposes without the approval of the relevant public authority and the Director-General of the Department of Planning and Environment (or an officer of the Department nominated by the Director-General).	The planning proposal does not create, alter or reduce existing zonings or reservations of land for public purposes	Consistent

S. 9.1 Direction	Application	Relevance to this planning proposal	Consistency
6.3 Site Specific Provisions	This direction applies when a relevant planning authority prepares a planning proposal that will allow a particular development to be carried out. A planning proposal that will amend another environmental planning instrument in order to allow a particular development proposal to be carried out must either: a) allow that land use to be carried out in the zone the land is situated on, or b) rezone the site to an existing zone already applying in the environmental planning instrument that allows that land use without imposing any development standards or requirements in addition to those already contained in that zone, or c) allow that land use on the relevant land without imposing any development standards or requirements in addition to those already contained in the principal environmental planning instrument being amended. A planning proposal must not contain or refer to drawings that show details of the development proposal.	The planning proposal will not enable a particular type of development	Consistent

Section C Environmental, social and economic impact

Q7. Is there any likelihood that critical habitat or threatened species, populations or ecological communities, or their habitats, will be adversely affected as a result of the proposal?

The site is mostly cleared and has historically been used for light cattle grazing. No high environmental vegetation is mapped on site.

The site is bound by Maori Creek in the East which is identified as key fish habitat by the Department of Primary Industries. An objective of the Fisheries Management Act is to conserve key fish habitats.

An environmental zone buffer is proposed to minimise any impact on Maori Creek. This area will be required to be revegetated at the subdivision stage.

The Stormwater Management Plan found that stormwater management targets can be achieved if the land is zoned for industrial purposes.

Q8. Are there any other likely environmental effects as a result of the planning proposal and how are they proposed to be managed?

The storm water management plan demonstrates that the site can comply with Council's stormwater management and water quality controls without having an adverse impact on the environment.

The eastern portion of the site along Maori Creek is mapped as flood prone. This area will have an environmental zone applied. A flood study has been prepared to demonstrate the sites capability and impact of flooding into Maori Creek.

Maori Creek is mapped as key fish habitat. The creek on this site is within a grass paddock with very limited riparian vegetation. The subsequent requirements to revegetate this area will create a beneficial environment helping to provide habitat, stabilise the creek bank and filter water runoff.

A Traffic Impact Assessment and Road Safety Audit have been prepared to accompany this planning proposal. Both traffic studies show that the proposed industrial development will have minimal impact on the existing road network.

Q9. Has the planning proposal adequately addressed any social and economic effects?

The planning proposal will provide additional industrial land in Bangalow which will provide additional local employment opportunities. The site is adjacent to the existing industrial estate which provides connectivity to services and concentrates industrial uses on the outskirts of Bangalow. The sites isolation means there is unlikely to be any nearby land use conflicts.

A site visit and cultural heritage report was undertaken by Tweed Byron Local Aboriginal Land Council. The report notes that the site has an agriculture history and the scope of works related to the rezoning presents a very low risk of harm to Aboriginal cultural heritage.

Section D State and Commonwealth interests

Q10. Is there adequate public infrastructure for the planning proposal?

The site is directly adjacent to the Bangalow industrial estate with all services available.

The existing road network and intersection to Lismore Road is suitable for the additional industrial zoned land as demonstrated by the supporting road safety audit and traffic impact assessment.

Additional signage and no parking areas will be required along Dungeons Lane to enable access to the subject site as outlined in the road safety audit. This will be implemented as part of any subsequent subdivision development application.

Q11. What are the views of state and Commonwealth public authorities consulted in accordance with the Gateway determination?

Consultation with state authorities will occur after a gateway determination is received.

It is recommended that the following agencies are consulted during public exhibition;

- Department of Primary Industries – Agriculture
- Department of Primary Industries - Fisheries
- Arakwal

Part 4 Mapping

Amendments will be required to the following Byron LEP 2014 map sheets:

- LZN_003A
- FSR_003AA
- LSZ_003

The existing and proposed maps are contained in appendix 1.

Part 5 Community consultation

Community consultation will be conducted in accordance with the Gateway determination.

Notification of the exhibited planning proposal will include:

- updates to Council's website
- referral to relevant State agencies
- notification in writing to affected landowners

Part 6 Project timeline

The proposed timeline for the completion of the Planning Proposal is as follows:

Plan making step	**Estimated completion**
Gateway Determination	November 2021
Agency Consultation	November 2021
Public Exhibition Period	November – December 2021
Submissions Assessment	February 2022
Submission of endorsed LEP amendment to Parliamentary Counsel for drafting	March 2022
Council to make the LEP amendment	April 2022
LEP amendment notification	April 2022

Conclusion

This Planning Proposal seeks to amend Byron Local Environmental Plan (LEP) 2014 to rezone part of lot 4 DP 6355050, 150 Lismore Road from RU1 Primary Production to IN1 General Industrial and E3 Environmental Management.

The subject site is identified as an investigation area in Byron Business and Industrial Lands Strategy and is directly adjacent to the existing industrial zoned land in Bangalow.

The planning proposal is supported by a traffic impact assessment, flood study, stormwater management plan and preliminary contaminated land study. The studies conclude that this site is suitable for industrial purposes and will not have significant impacts on traffic or the environment.

There is sufficient information to seek a Gateway determination and proceed to public exhibition.

Appendix

Appendix 1 – Existing and proposed maps

Appendix 2 - Flood impact assessment

Appendix 3 - Stormwater management plan

Appendix 4 - Preliminary contaminated site investigation

Appendix 5 - Traffic impact assessment

Appendix 6 - Road safety audit

Appendix 1 – Existing and proposed maps

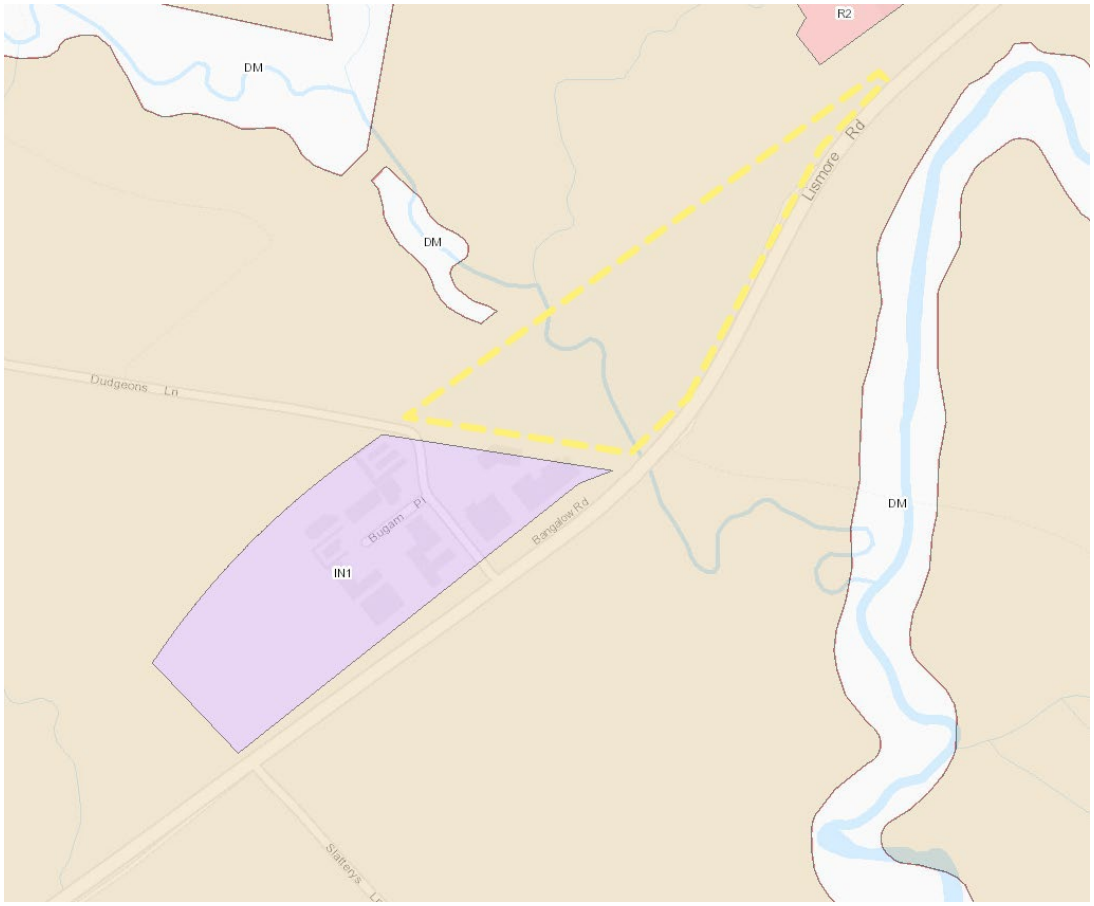

Figure 4.1. Existing zoning

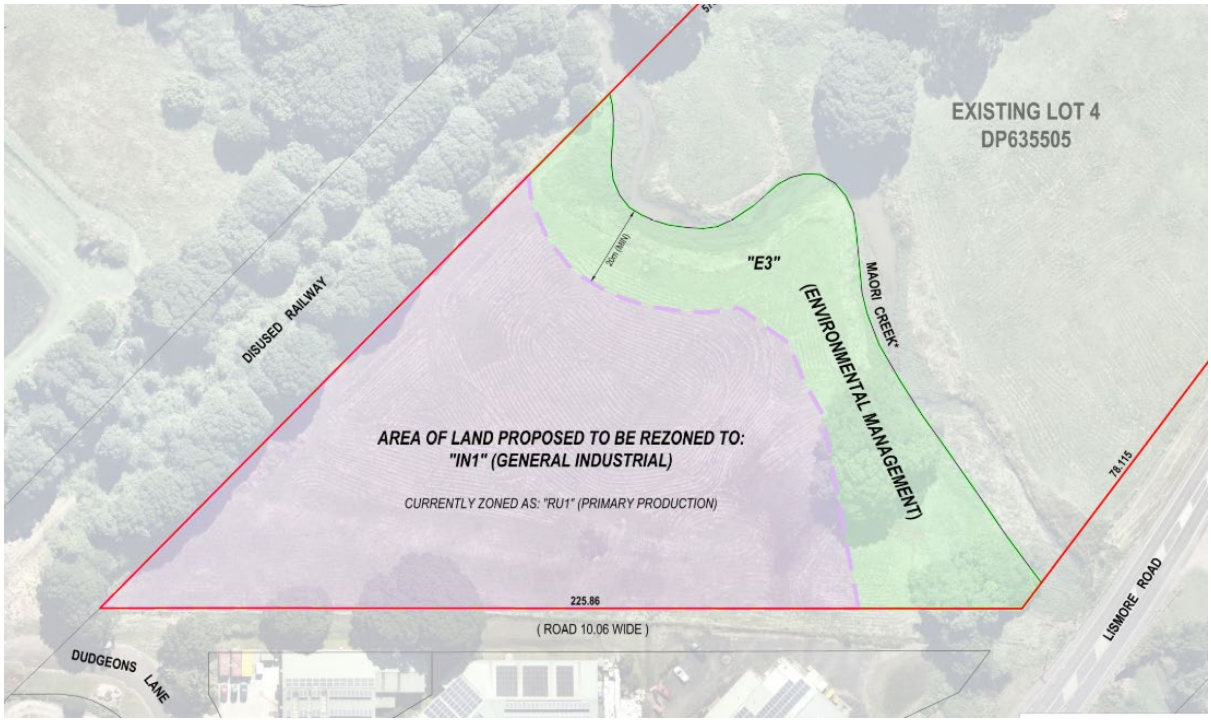

Figure 4.2. Proposed zoning

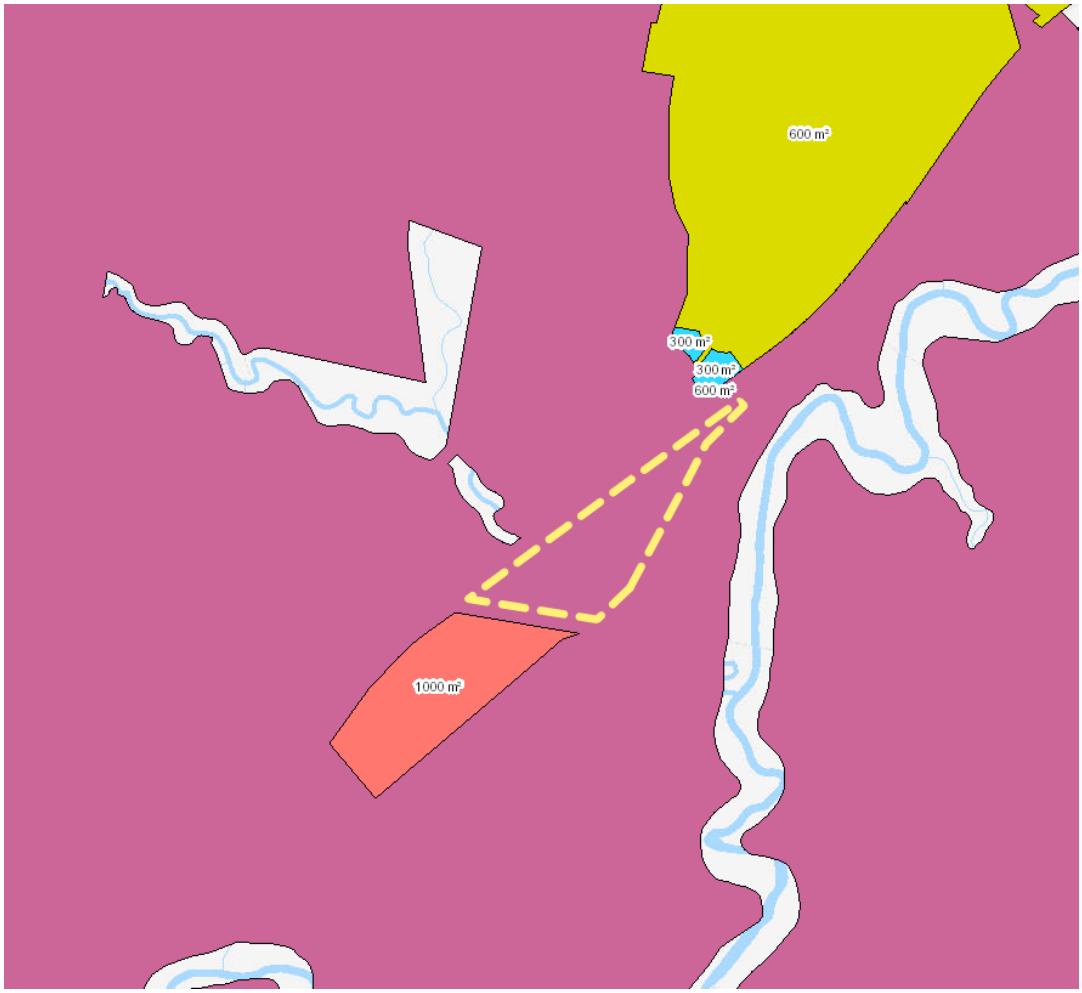

Figure 5.1. Existing lot size

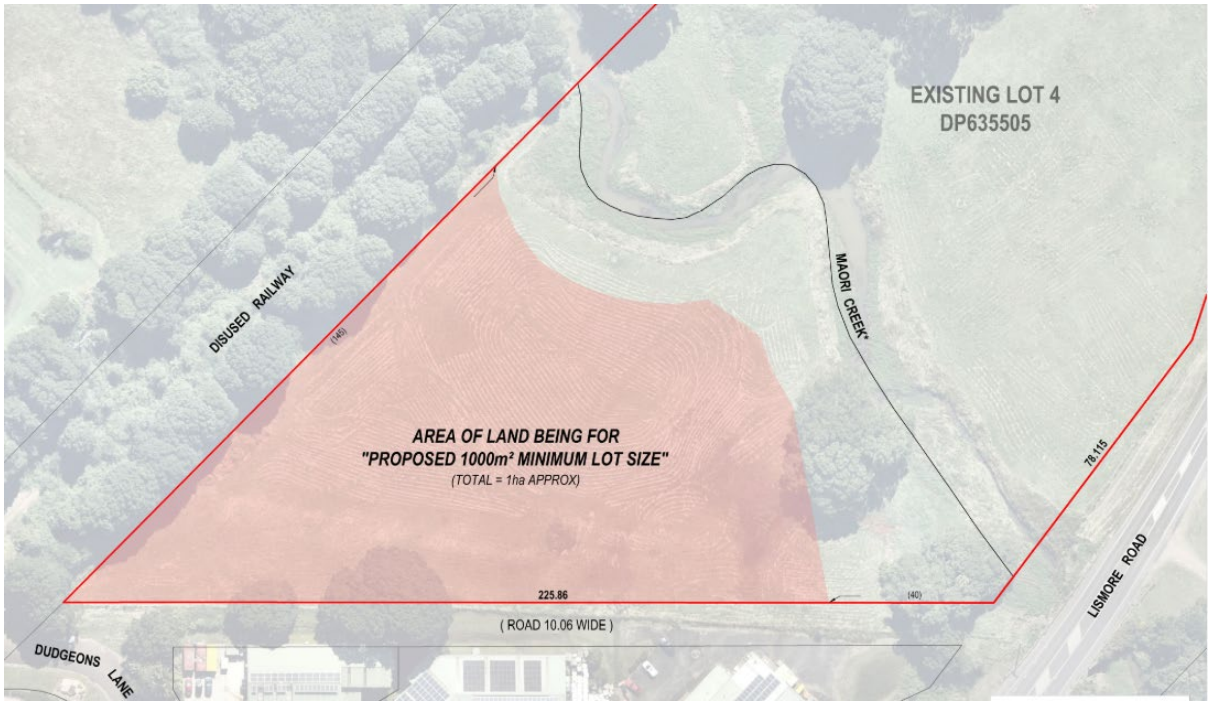

Figure 5.2. Proposed lot size

Figure 6.1. Existing floor space ratio

Figure 6.2. Proposed floor space ratio

Bangalow Industrial Estate Flood Impact Assessment

Reference: R.A10672.001.00.docx
Date: May 2021

Document Control Sheet

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Document:	R.A10672.001.00.docx
Title:	Bangalow Industrial Estate Flood Impact Assessment
Project Manager:	Damion Cavanagh
Author:	Teegan Burke
Client:	Andrew More
Client Contact:	Andrew More
Client Reference:	

Synopsis: **This report provides a summary of hydrologic and hydraulic modelling assessments at Bangalow Industrial Estate Lot4 DP635505**

REVISION/CHECKING HISTORY

Revision Number	Date	Checked by		Issued by	
0	20th May 2021	DCC		TB	

DISTRIBUTION

Destination	Revision										
	0	1	2	3	4	5	6	7	8	9	10
Andrew More	PDF										
BMT File	PDF										
BMT Library	PDF										

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1 Introduction

1.1 Project Overview

A portion of land described as Lot 4 on DP 635505 is proposed for rezoning from rural (RU1) to a land use compatible with industrial/commercial uses. The rezoning will facilitate the sub-division of this land to provide several individual allotments. The development will (in effect) extend the current Bangalow Industrial Estate to the east.

Review of flood mapping for the Byron catchment identifies the lot as flood prone, with the majority of the site inundated in a 1% AEP flood event. Council require demonstration that future development of the lot achieves flood requirements as outlined in Council's Local Environment Plan and Development Control Plans related to flooding. Generally, these guidelines set building requirements, i.e. floor levels, requirements for emergency management etc, and also require development to not give rise to offsite impacts as a result of filling and or the placement of infrastructure.

Filling of the site would be required to increase the amount of developable land.

BMT has been engaged to prepare a flood assessment for the site to determine existing design flood levels for 1%, 5% and 20% AEP for the site utilising BMT's Byron Creek catchment hydrologic and hydraulic flood models, with the application of the recent Australian Rainfall and Runoff 2019 guideline. Investigation of the potential peak flood level impacts for two scenarios of differing developed fill pad alignments is also required.

The methodology applied in this project includes:

- Inspection of study area to view site and nearby structures;
- Data collation and review;
- Model configuration (Section 2);
- Design Event Modelling (Section 3);
- Impact Assessment (Section 4); and
- Conclusion (Section 5).

1.2 Site Location

The site location is shown in Figure 1-1. The site is located immediately to the south-west of Bangalow, and lies in between the existing Bangalow Industrial Estate, Lismore Road, Maori Creek and the North Coast Railway Line. The site is located within the Byron Creek catchment, a tributary of the Wilsons River. Flooding at the site can occur from both Byron Creek and from Maori Creek.

Note that the development is proposed only on the western portion of the lot highlighted (i.e. on the western side of Maori creek). This portion of the site is approximately 1.5 ha and has approximately 200 m fronting Maori Creek.

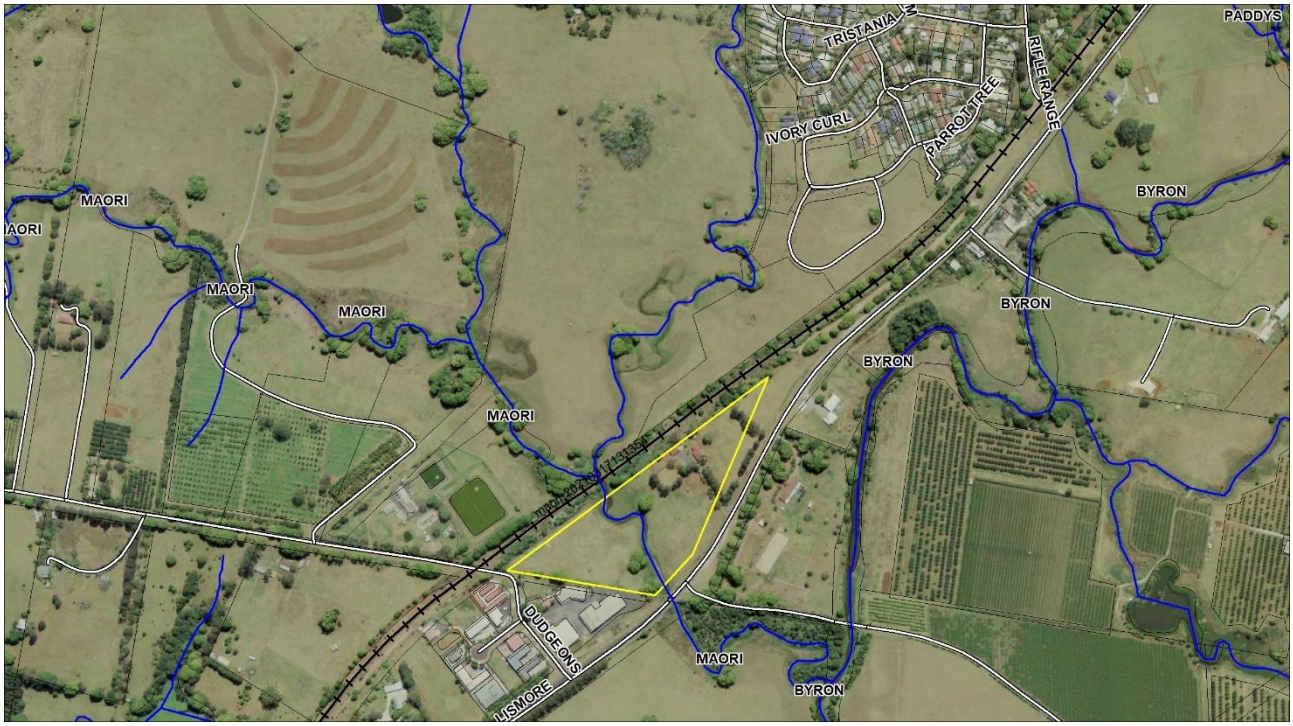


Figure 1-1 Site Locality

2 Model Configuration

A hydrologic model and hydraulic model of the Byron Creek catchment previously developed by BMT has been adopted as the basis for this assessment in agreement with the client, on the basis that Council's existing hydrologic model is based on ARR-1987 and the hydraulic model is dated (i.e. 1-dimensional model). The hydrologic model produces flow hydrographs which are applied as inputs to the hydraulic model.

A joint calibration approach of these models has been previously undertaken calibrating both the XP-RAFTS hydrologic and TUFLOW HPC hydraulic models in tandem, successfully achieving calibration to the March 2017 and February 2020 Byron Creek flood events. These models are deemed fit-for-purpose for the current flood assessment.

The available model was updated to include the following minor modifications:

- Truncation of the model (at a distance suitably downstream of the site to prevent tailwater effects);
- Addition of structures to represent the rail bridge upstream of the site and the Lismore Road culverts downstream of the site; and
- Refinement of the hydraulic roughness at the culvert structure through Lismore Road.

The following sections provide additional detail on the configuration of each of the hydrologic and hydraulic models. Key datasets used in the assessment are summarised in Table 2-1.

Table 2-1 Key Datasets Used in the Study

Item	Source	Description
Site Survey	Canty's Surveying	Survey of the site (captured in 2021). This data includes dimensions and invert levels for the cross-drainage structures upstream and downstream of the Site.
LiDAR data	Geoscience Australia	1m LiDAR data captured in 2010
Byron Creek catchment hydrologic and hydraulic models	BMT	Developed by BMT for flood impact assessments in the Byron Creek catchment
Hydrologic design event data	ARR Datahub	Design rainfall depths, losses, temporal patterns and areal reduction factors (for application to the XP-RAFTS hydrologic model)

2.1 Hydrologic Model

XP-RAFTS is a runoff routing modelling software program used to simulate the relationship between rainfall falling within the catchment and runoff generated. XP-RAFTS is extensively used throughout Australia for hydrologic analysis of conveyance systems.

XP-RAFTS contains a loss model component and a routing model component. The former determines how much of the rainfall contributes to runoff, i.e. what is not lost to infiltration or depression storage. The latter determines how the runoff is routed through the sub-catchments resulting in flow hydrographs.

Rainfall losses are represented in the model as initial and continuing losses which is standard practice.

Model sub-catchments are delineated based on local topography and the drainage network, and these are assigned a number of parameters such as slope, roughness percentage imperviousness, etc, to enable the calculation of runoff routing. The sub-catchments are joined by 'links' representing the channels.

The XP-RAFTS hydrologic model sub-catchment schematisation for the truncated model is shown in Figure 2-1. The model parameters are described below, and summarised for the sub-catchments (relevant to the hydraulic model) in Table 2-2 and Table 2-3. The configuration of the hydrologic model and its parameters was been previously confirmed to be fit-for-purpose through joint calibration with the hydraulic model.

The model schematisation was consistent for all rainfall patterns, this includes the catchment areas, slope, fraction impervious, PERN value and routing.

- Catchment slope:
  - Estimated by calculating the equal-area slope of the longest flow path within each sub-catchment;
- Fraction imperviousness:
  - The approach recommended by Catchment Simulations Solutions for split subcatchments was employed where the first subcatchment is for pervious area (0% impervious), and the second is for impervious area (100% impervious);
  - The majority of the Byron Creek subcatchment is undeveloped, and was treated as 0% impervious;
  - For subcatchments that covered areas of development, the relative 2nd subcatchment area at 100% imperviousness was calculated based on the proportional developed catchment area at 40% impervious;
- PERN values:
  - Input as a Manning's "n" representative of the average sub-catchment roughness (XP-Solutions, 2013); and
  - A PERN value of 0.06 was adopted throughout for pervious areas (1st subcatchment) and 0.025 for impervious areas (2nd subcatchment).
- Catchment links:
  - Muskingum channel routing was applied to the connections between subcatchments to calculate hydrograph attenuation and lag;
  - The K value represents the time in hours which water takes to travel from topmost section of the channel within a sub-catchment to sub-catchment outlet. The K value was calculated based on a velocity of 2 m/s divided by the subcatchment's stream length; and
  - The default X value of 0.2 was applied uniformly across all catchments.

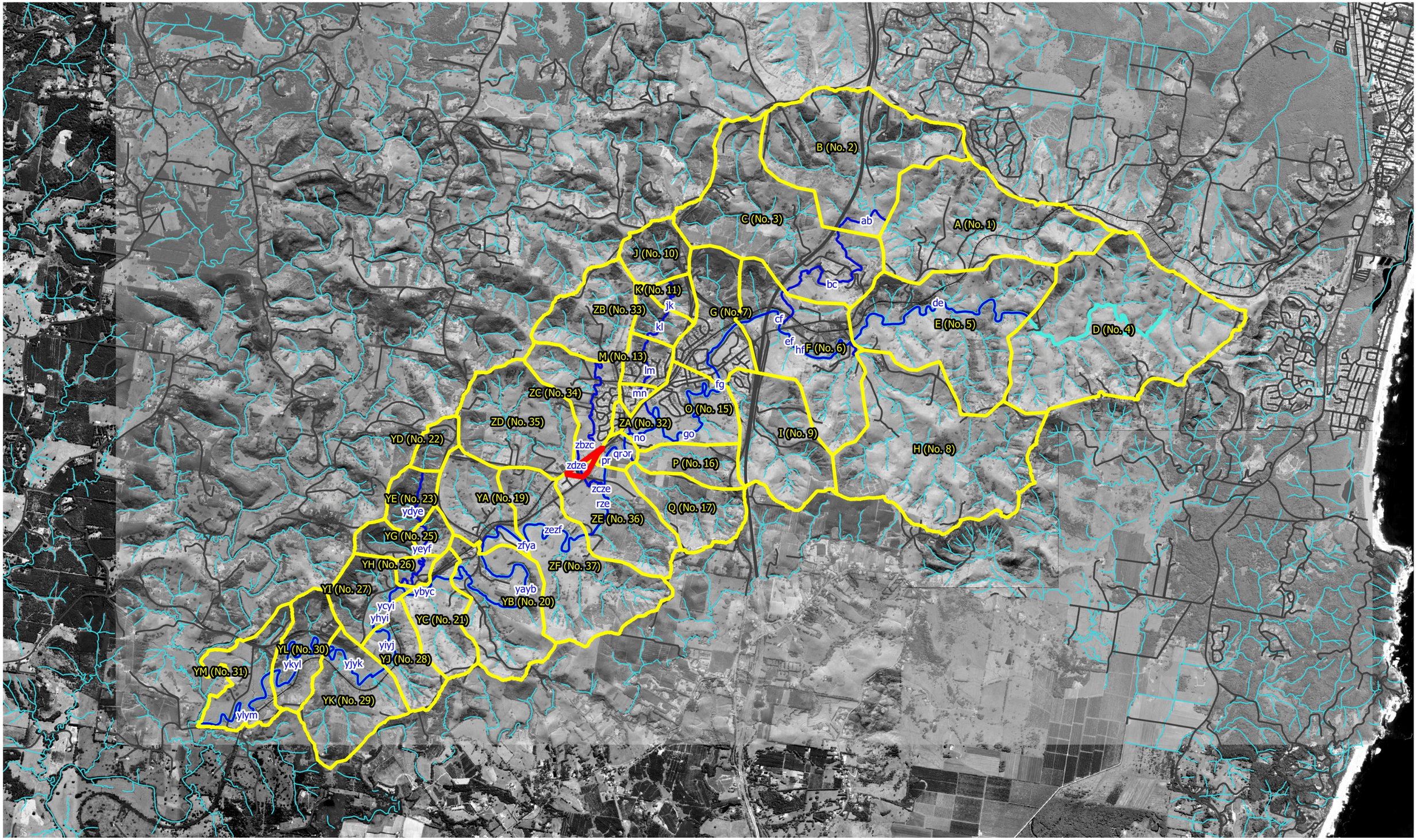
- BX factor = 1
- Event Rainfall and Losses: The application of rainfall and losses to the hydrologic model is dependent on the design event modelled and is described further in Sections 3.2.1.

Table 2-2 XP-RAFTS Link Parameters

Link Name	Length (m)	K	Link Name	Length (m)	K
AB	849	0.12	MN	248	0.03
BC	2289	0.32	NO	930	0.13
CF	1268	0.18	OR	804	0.11
DE	3505	0.49	PR	689	0.10
EF	2120	0.29	QR	689	0.10
FG	1006	0.14	Rze	1232	0.17
GO	3271	0.45	zaR	211	0.03
HF	2323	0.32	zbzc	2046	0.28
JK	483	0.07	zcze	1689	0.23
KL	605	0.08	zdze	1689	0.23
LM	707	0.10			

Table 2-3 XP-RAFTS Subcatchment Parameters

Subcatchment		Area (ha)	Slope	Subcatchment		Area (ha)	Slope
A (No. 1)	1	278.94	0.75	N (No. 14)	1	6.756	3.01
B (No. 2)	1	295.85	1.38		2	4.504	
C (No. 3)	1	297.88	1.53	O (No. 15)	1	106.21	0.05
D (No. 4)	1	421.13	0.72		2	2.52	
E (No. 5)	1	303.43	0.39	P (No. 16)	1	56.53	1.92
F (No. 6)	1	218.81	0.6	Q (No. 17)	1	94.9	1.61
G (No. 7)	1	106.18	1.52	R (No. 18)	1	17.58	0.19
	2	8.24	1.52	ZA (No. 32)	1	3.846	4.42
H (No. 8)	1	381.81	0.63		2	2.564	
I (No. 9)	1	160.37	2.23	ZB (No. 33)	1	110.89	2.32
J (No. 10)	1	56.38	6.85	ZC (No. 34)	1	92.83	1.25
K (No. 11)	1	23.67	3.16		2	3.32	
L (No. 12)	1	32.36	4.96	ZD (No. 35)	1	167.51	1.32
M (No. 13)	1	31.32	1.44				
	2	3.64	1.44				



Legend

- Site
- XP-RAFTS subcatchments
- XP-RAFTS routing links
- Roads
- Railway
- ByronCreek
- Streams

Title:

Hydrologic Model Schematisation

Drawing: 2-1

Rev: A

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2.2 Hydraulic Model

2.2.1 Introduction

A 2D hydraulic model of the lower Byron Creek catchment has previously been developed by BMT, using TUFLOW HPC software. The truncated model used in this assessment includes approximately 6.7 km of Byron Creek extending from the Pacific Highway, upstream of Bangalow to around 1 km downstream of the site.

The TUFLOW HPC hydraulic model schematisation is shown in Figure 2-2 and is detailed in the remainder of Section 1.2.

2.2.2 Model Topography

The base topography is developed from LiDAR data captured for the Lismore and Ballina regions in 2010. This has a stated vertical accuracy of 0.3m (95% confidence interval). The LiDAR data has been compiled into a Digital Elevation Model (DEM) of 1m horizontal grid resolution covering the entire Byron Creek catchment. The LiDAR was found to be in close agreement to spot heights captured as part of site survey in March 2021 by Canty's Surveyors.

Whilst the LiDAR data captures the general topography to a high level of detail, it cannot penetrate water and so the majority of the main channel of Byron Creek is poorly represented in this dataset. The model includes topographic modifications to remove artificial bumps or ridges created by triangulation in the DEM creation process and makes for a smoother bed which helps with model stability.

Legend

- Site
- Outflow Boundary
- Model extent

XP-RAFTS Catchments

- local flows
- total flows

- Roads
- Railway
- ByronCreek
- Streams

Title:

Hydraulic Model Schematisation

Drawing: 2-2

Rev: A

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2.3 Structures

The structures in the vicinity of the site were added to the hydraulic model, and included:

- Upstream rail bridge:
  - Details estimated from on-site inspection, and consideration of 1m topographic data:
    - Deck level: 42.9 mAHD;
    - Deck depth: 0.9m;
    - Sub-structure form loss: 0.2;
  - Included as a TUFLOW layered flow constriction element.
- Downstream Lismore Road culverts:
  - 3 x 3.5w x 2.5h (supplied site survey);
  - Upstream invert 36.7m AHD (supplied site survey);
  - Downstream invert 36.65m AHD (assumed);
  - Included as a nested 1D element, connected to the 2D model domain at the upstream and downstream ends.

2.4 Land Use

Land use data has been delineated in order to apply appropriate hydraulic resistances spatially within the model to different land use types. Land use data has been delineated based on available aerial imagery and the mapped land uses are shown in Figure 2-3.

Each land use category was assigned a Manning's n hydraulic resistance value. These values were initially set to be within industry acceptable ranges and then refined during the model calibration process. Table 2-4 lists the land use types and associated Manning's n value applied.

Table 2-4 Adopted Manning's n values

Land Use	Adopted Manning's n Value
Creek / Water Body	0.028
Light Vegetation	0.04
Medium Density Vegetation	0.06
Dense Vegetation	0.08
Rural Mixed Use	0.045
Roads	0.025
Urban block	0.1

Mannings n Roughness
- Mixed Use Rural Residential
- Roads
- Urban Block
- Creek / Water
- Dense Vegetation
- Medium Vegetation
- Light Vegetation

Legend
- Site
- Outflow Boundary
- Model extent
- Roads
- Railway
- ByronCreek
- Streams

Title:
Hydraulic Model - Land Use

Drawing: 2-3

Rev: A

BMT endeavours to ensure that the information provided in this map is correct at the time of publication. BMT does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

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2.5 Boundaries

Hydraulic model inflows are derived from the hydrologic model and consist of 3 total inflows and 11 local inflows for the truncated model. The total inflows represent hydrographs from multiple upstream subcatchments and include the main Byron Creek inflow at the upstream limit of the model near the Pacific Highway, as well as total inflows for two of the larger tributary catchments. The local inflows apply runoff generated from within individual hydrological subcatchments and are spread across the 2D model domain.

The downstream boundary of the truncated model is located approximately 1 km downstream of the site. A normal slope boundary was applied for design events. The locations of the model boundaries are shown in Figure 2-2.

3 Design Event Modelling

3.1 Approach

Design event modelling has been undertaken in accordance with Australian Rainfall and Runoff Guidelines 2019 (ARR 2019) for the 1%, 5% and 20% AEP events.

Rainfall intensities and other hydrologic parameters were derived from ARR 2019 and applied to the calibrated hydrologic model to produce hydrographs for the required design events for a number of durations (1 hour to 24 hours). As required by ARR 2019, the temporal pattern ensemble approach was applied, where 10 temporal patterns per storm duration are simulated for each design event and a pattern that resulted in an 'average' peak flow was adopted.

An initial assessment was undertaken using the hydrologic model to determine which duration was critical for the area of interest, in terms of comparing the single peak adopted flow from the temporal pattern ensemble per duration. This was undertaken separately for each AEP for the Byron Creek catchment. For AEPs where a number of storm durations produced a similar adopted 'average' peak flows from the ensemble of temporal patterns, the critical duration was left undetermined and multiple durations were taken forward for hydraulic modelling.

The hydraulic model was then used to determine the critical duration that produced the highest peak water level at the study area.

Once the critical duration/s had been established, those durations were then used in the hydraulic model to determine the design flood levels and for the purposes of assessing flood impacts.

It is noted that hydrologic modelling and initial hydraulic modelling was also undertaken for flooding from the local Maori Creek catchment in isolation (with no elevated water levels on Byron Creek). However it was determined that at the Site, the peak flood levels in Maori Creek were significantly lower than those resulting from Byron Creek flooding (more than 0.5m lower) in all three AEP events. As such, local flooding effects of Maori Creek were not considered any further in assessing the relevant design flood levels at the site.

Sensitivity scenarios that consider a 10% and a 30% increase in rainfall intensity for the 1% AEP event have also bene undertaken, in accordance with Council's DCP 2014 and Climate Change Strategic Planning Policy (CCSPP).

3.2 Hydrologic Design Event Modelling

This section describes the process for deriving design event flows for application to the hydraulic model.

3.2.1 Parameters

Hydrologic parameters such as design rainfall depths were extracted from the ARR datahub[1] focussing on the study area. A summary of the adopted parameters is provided below:

- Rainfall depths:

[1] http://data.arr-software.org/ extracted on 11/05/2020

- Intensity Frequency Duration data was extracted at the centroid of each hydrologic sub-catchment;

- Temporal patterns:
  - Point temporal patterns were adopted as both the regional and local catchment areas are less than 75km^2;
  - The relevant ensemble of 10 temporal patterns were considered for the rare event (1% AEP), intermediate event (5% AEP) and the frequent event (20% AEP);
- Losses:
  - The Initial Losses (IL) from the ARR datahub were selected and adjusted with a 0.4 multiplication factor and probability neutral burst initial loss values as recommended by NSW Department of Planning Industry and Environment for use in NSW;
  - A Continuing Loss (CL) of 1.0 mm/hr was adopted based on the calibration inputs.
- Areal reduction factors:
  - The impact of applying Areal Reduction Factors on the peak flows was examined and found to not make a significant difference. Areal reduction factors were not applied, to provide a slightly conservative estimate of peak flows.

3.2.2 Hydrologic Model Results and Design Event Storm Selection

Critical durations were derived for the regional Byron Creek catchment in the vicinity of the site. For each AEP/duration combination, the relevant ensemble of 10 storm patterns was simulated in the hydrologic model and the storm patterns resulting in average[2] peak flow at subcatchment 18 (Byron Creek) were assessed.

Figure 3-1 presents an example of the critical duration assessment for the regional 5% AEP event. The results are plotted in the form of a box and whisker plot and are explained as follows:

- Storm durations modelled range from 1 hour to 24 hours;
- Each duration shows an ensemble of ten peak flow results as points;
- The mean and median flow values are indicated by asterisks and horizontal lines respectively;
- The green boxes represent the interquartile range (the 25th percentile (Q1) to the 75th percentile (Q3));
- The vertical lines (whiskers) extend out to the maximum and minimum values or, if those values are considered outliers, then the lines extend out from Q1 to Q3 by a distance of 1.5 times the interquartile range with outliers shown as points beyond the lines;
- The adopted temporal pattern for each duration is taken as that which results in the 4th largest peak flow (stated in the text box along with a unique temporal pattern identifier); and

[2] The average pattern was taken as giving the 4th largest peak flow.

- The vertical yellow banding highlights the critical duration; the duration for which the adopted average flow is highest.

In Figure 3-1 the 5% AEP critical duration is shown to be 6 hours and the peak flow is around 192m^3/s generated from temporal pattern with the ID 4730. However, the adopted average peak flows for both the 9 hour and the 12 hour storms are very similar (less than 10 m^3/s difference). Durations above 12 hours and less than 6 hours show a notable drop off in adopted average flow values.

A similar finding was apparent for Byron Creek flows for all modelled AEPs with the peak flow appearing to be from either the 6 hour, 9 hour or 12 hour storm duration with only minor differences in flow between them.

Representative events from all three durations (and for each AEP), are summarised in Table 3-1 for regional Byron Creek flows. These were therefore simulated in the hydraulic model and the results mapped in terms of critical duration for peak level (see Section 3.3).

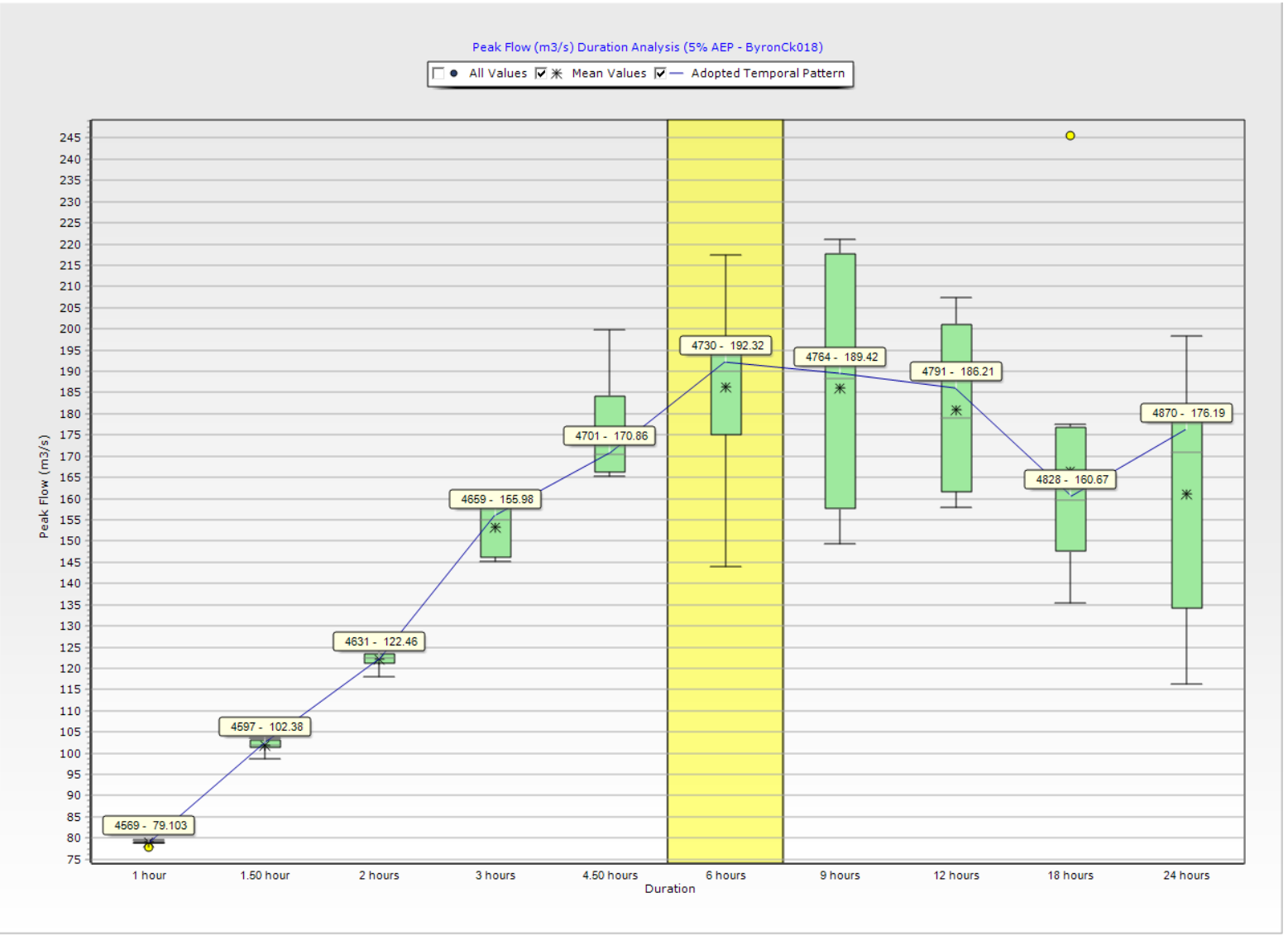


Figure 3-1 Peak Flow Duration Analysis for 5% AEP – Byron Creek Regional Subcatchment 18

Table 3-1 Hydrologic Model Design Event Peak Flow Results (m^3/s)

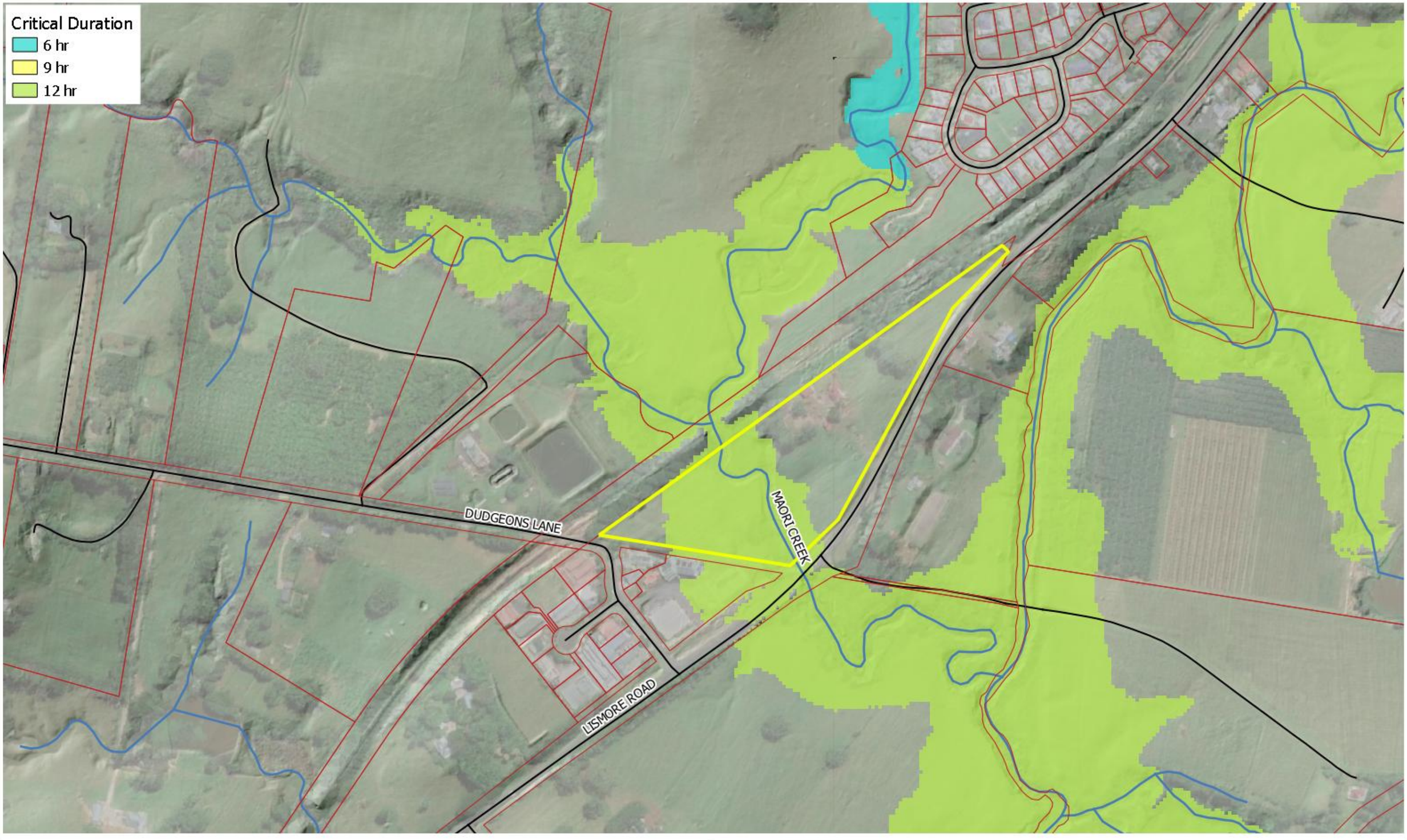
AEP	Regional (Subcatchment 18)		
	Duration (hrs)	Peak Flow (m^3/s)	Temporal Pattern ID
1%	**6**	**289.8**	**4694**
	9	277.3	4442
	12	285.9	4785
5%	**6**	**192.3**	**4730**
	9	189.4	4764
	12	186.2	4791
20%	6	117.3	4740
	9	**123.5**	**4776**
	12	119.3	4805

3.3 Hydraulic Model Critical Duration Assessment

Figure 3-2 to Figure 3-3 show the critical durations in terms of peak level across the study area for the 1%, 5% and 20% AEP events. It can be seen that for the area of interest, the following storms dominate in terms of providing the peak design flood level along Byron Creek and backing up towards the Site, and have been adopted for further design event mapping and impact assessment:

- 1% AEP: 12hr
- 5% AEP: 9hr and 12hr (enveloped)
- 20% AEP: 9 hr

It is noted that the adopted storm, based on peak flood levels in the area of interest, differ from that identified as being critical by the hydrology model in terms of flow in Byron Creek for the 5% and 1% events (refer Table 3-1).



Legend

- Site
- Cadastre
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Title:

1% AEP Critical Duration Map

Drawing: **3-2**

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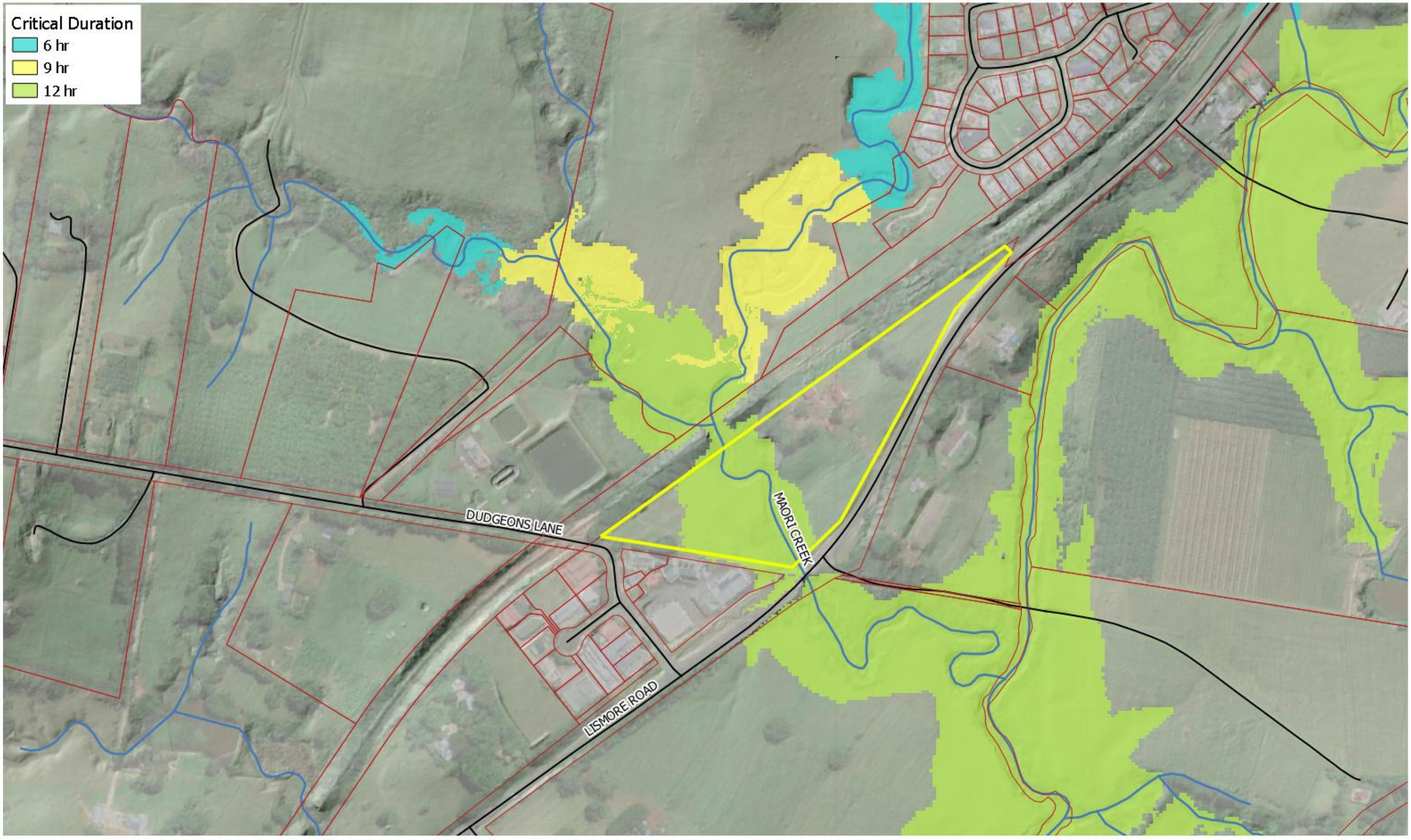

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Title:

5% AEP Critical Duration Map

Drawing: 3-3

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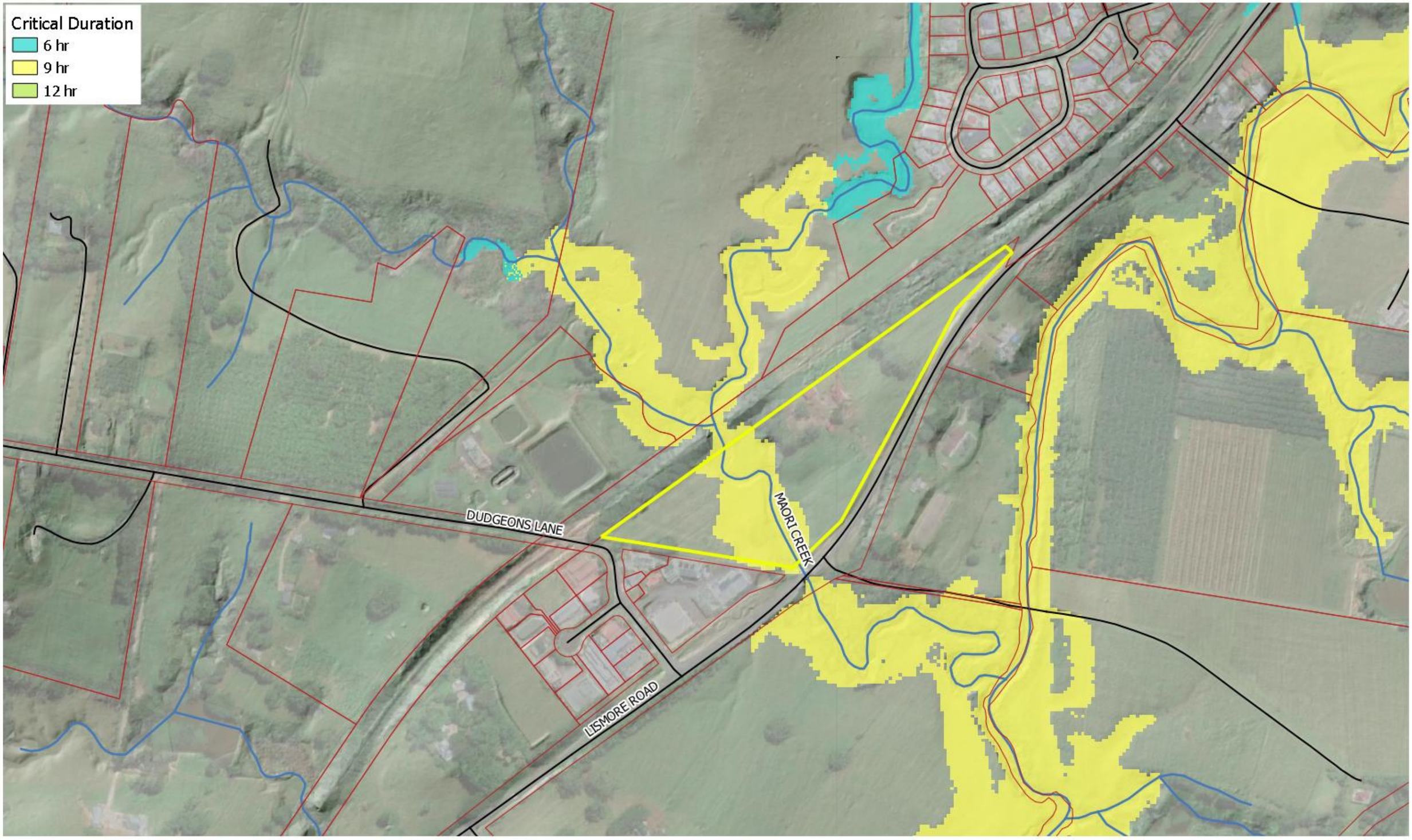

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Title:

20% AEP Critical Duration Map

Drawing: 3-4

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3.4 Design Results

3.4.1 Existing Case AEP Flood Levels

Appendix A provides peak flood level maps for the 1%, 5% and 20% AEP events for the storm durations identified as being critical within the study area (see Section 3.3). Contours are shown at 0.1m intervals.

The existing peak water levels at the Site are approximately:

- 1% AEP: 40.98 m AHD
- 5% AEP: 40.46 m AHD
- 20% AEP: 39.93 m AHD

There is insignificant variation in the peak flood level across the length of the site that bounds Maori Creek, between the North Coast Railway Line and Lismore Road, as Lismore Road and the high downstream Byron Creek tailwater conditions cause a constriction.

Based on these results, the flood planning level at site is 41.48 m AHD (1% AEP level + 0.5m freeboard). While 0.5m freeboard is typically adopted for residential dwellings, and it is understood that 0.2m freeboard may be acceptable for industrial land uses.

3.4.2 Climate Change Sensitivity Scenarios

In accordance with Council's DCP 2014 and Climate Change Strategic Planning Policy (CCSPP) and assessment of climate change impacts to flooding in the 1% AEP event are required.

However, it is noted that Council's (year) 2050 and 2100 climate change scenarios primarily consider sea level rise and ocean tailwater conditions, and do not include an increase to rainfall intensity. As the site in Bangalow is well above sea level, consideration of sea level rise changes will have no impact and are not relevant, i.e. there will be no difference between the current day 1% AEP flood level and the climate change year 2050 and 2100 scenarios' flood levels at the site (FPL, 2050 FPL and 2100 FPL are all equivalent at the site). As discussed in Section 3.4.1, this level has been determined to be 41.48 m AHD (depending on the extent of freeboard allowed for).

However, the CCSPP also requires the assessment of additional climate change sensitivity scenarios, of which testing 10% and 30% increases to rainfall intensity for the 1% AEP event are relevant to the site.

The increases in rainfall intensity for the 1% AEP event were applied to the hydrologic model, providing flow hydrographs for application to the hydraulic model for the 12 hr critical duration storm (identified in Section 3.3).

Peak flood level impact maps for the climate change sensitivity scenarios, compared to the existing case conditions, are presented in Appendix D. Impacts have been mapped for any variance in peak flood level by +/- 0.01 m or more. The results show:

- For the 10% increase in rainfall intensity (Figure D-1), the 1% AEP peak flood levels increase by 0.10 m through to site, and by 0.10 m to 0.12 m directly upstream and downstream of the site;

- For the 30% increase in rainfall intensity (Figure D-2) the 1% AEP peak flood levels generally increase by between 0.2 m to 0.5 m in the vicinity of the site, with the site itself experiencing a 0.25m increase.

4 Development Impact Assessment

4.1 Introduction

As the site is flood prone, filling of the site would be required to raise ground levels above Council's flood planning level (1% AEP + freeboard) to increase the amount of developable land. Council requires that it is demonstrated that such development would achieve the relevant flood requirements as outlined in Council's Local Environment Plan and Development Control Plans related to flooding. Generally, these guidelines set building requirements, i.e. floor levels, requirements for emergency management etc and also require development to not give rise to offsite impacts as a result of filling and or the placement of infrastructure.

A flood impact assessment has been undertaken for two fill scenarios in the hydraulic model. The proposed development fill pads were represented in the TUFLOW model as a "z shape" topographic modification, with the fill level set to an arbitrary high level, well above the existing 1% AEP flood levels. No batter was accounted for, to provide a "worst case" assessment of the proposed fill extents.

The fill pad for Development Scenario 1 was aligned to be set back from Maori Creek, in the western portion of the site, and has an area of approximately 0.99 ha, Figure 4-1. The Development Scenario 2 fill pad aimed to increase the developable area by pushing the fill pad boundary back towards the creek, with an area of approximately 1.03 ha.

The impact assessment has been undertaken for the critical duration(s) resulting in the highest flood level at the site for each of the 20%, 5% and 1% AEP events, as detailed in Section 3.3 . For all three modelled AEP floods the peak levels are a result of regional flooding of Byron Creek.

Figure 4-1 Fill Pad Alignments for Development Scenarios

4.2 Results

The flood impact assessment for the proposed development scenarios compare the peak flood level results from the developed cases to the existing case site conditions. Impacts have been mapped for any variance in peak flood level by +/- 0.01 m. Peak flood level impact maps for the developed scenarios are presented in Appendix B and Appendix C. The results show that the peak flood level impact at the site does not exceed +/- 0.01 m for all events (1%, 5% and 20% AEP) for both Development Scenario 1 and 2.

The results for the culvert under Lismore Road were inspected, which show that that the culvert reached maximum capacity in all events, and there was no difference between the percentage of time that it remained full in the development scenarios. The peak flows for each event increased by less than 1 m^3/s for the development scenarios.

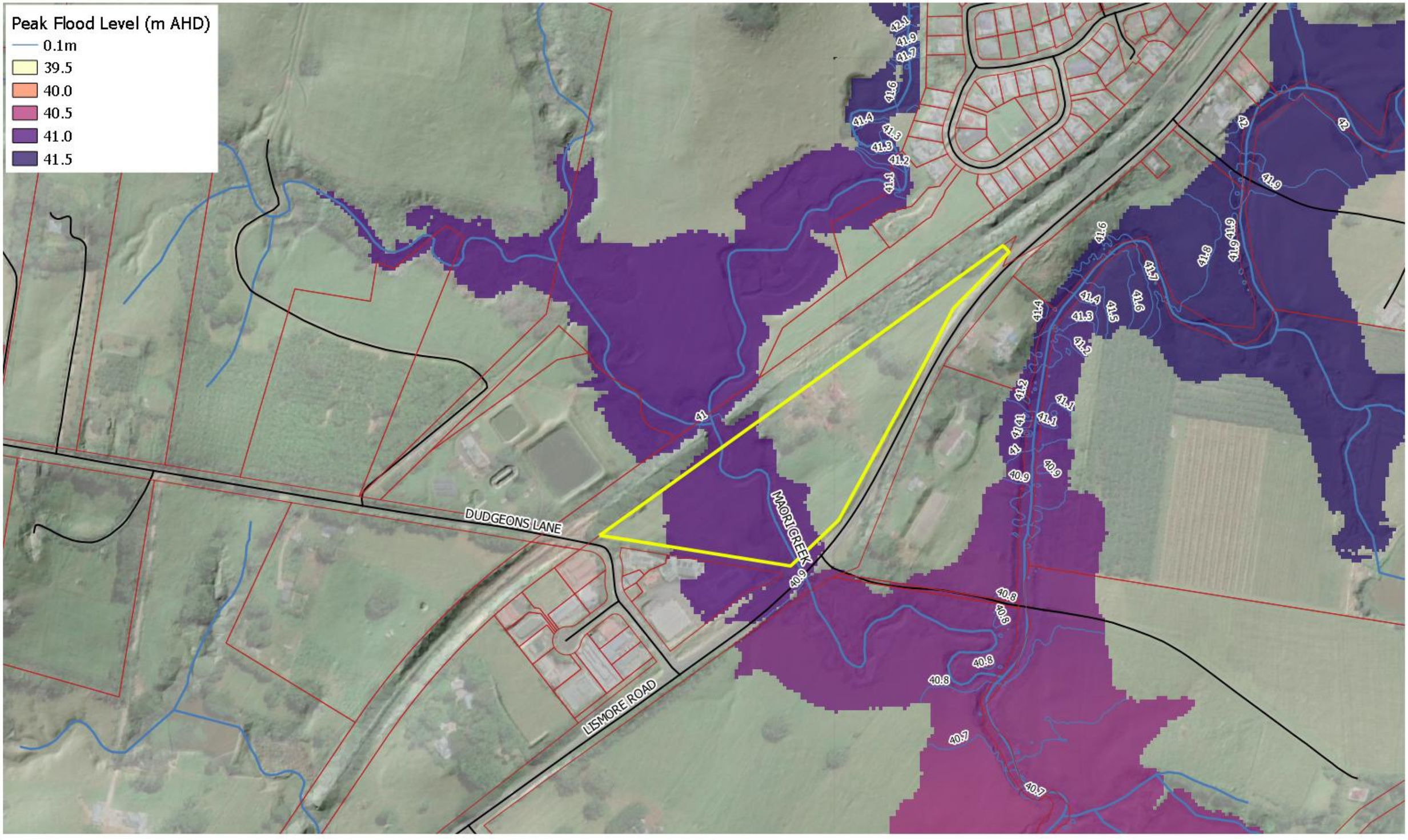
Considering the water level impacts for the proposed development do not exceed +/- 0.01m, the likelihood of any substantive risk of contribution to cumulative impact is considered unlikely.

5 Conclusions

The following points summarise the key outcomes from the assessment.

- The assessment utilised a truncated version of a previously developed and calibrated in-house hydrologic and hydraulic models of the Byron Creek catchment to inform and assess site design flood levels and potential impacts associated with filling of the site.
- Design flood levels for the 20%, 5% 1% AEP events have been established in accordance with the Australian Rainfall and Runoff 2019 guideline. The peak flood levels at the site are controlled by Byron Creek flooding.
- The current climate flood planning level (FPL) at the site has been determined as 41.48 m AHD (1% AEP peak flood level + 0.5m freeboard). The freeboard ultimately adopted for the site may vary from this assumed amount.
- The current day FPL is also equivalent to the 2050 and 2100 FPLs, as the Climate Change Strategic Planning Policy (CCSPP) identifies these climate change scenarios to only relate to increase in ocean boundary levels and sea level rises, which are not applicable at the site's topographic elevation.
- An impact assessment of climate change sensitivity scenarios indicates that a 10% and 30% increase in rainfall intensity would increase 1% AEP peak flood levels by 0.1m and 0.25m through the site, respectively.
- Two development scenarios were assessed for impacts against the existing conditions 20%, 5% 1% AEP events. Fill pads were incorporated into the hydraulic model for the proposed development extent and assumed to be raised to above the FPL. The results show that the peak flood level impact at the site does not exceed +/- 0.01 m for all events (1%, 5% and 20% AEP) for both Development Scenario 1 and 2.
- There was no significant impact evident to peak flows and the time full for the Lismore Road culverts for either of Development Scenario 1 and 2, in any of the events.

Appendix A Peak Flood Level Impact Maps



Legend

- Site
- Cadastre
- Roads
- Streams

Title:

1% AEP Peak Flood Level

Drawing: **A-1**

Rev: **A**

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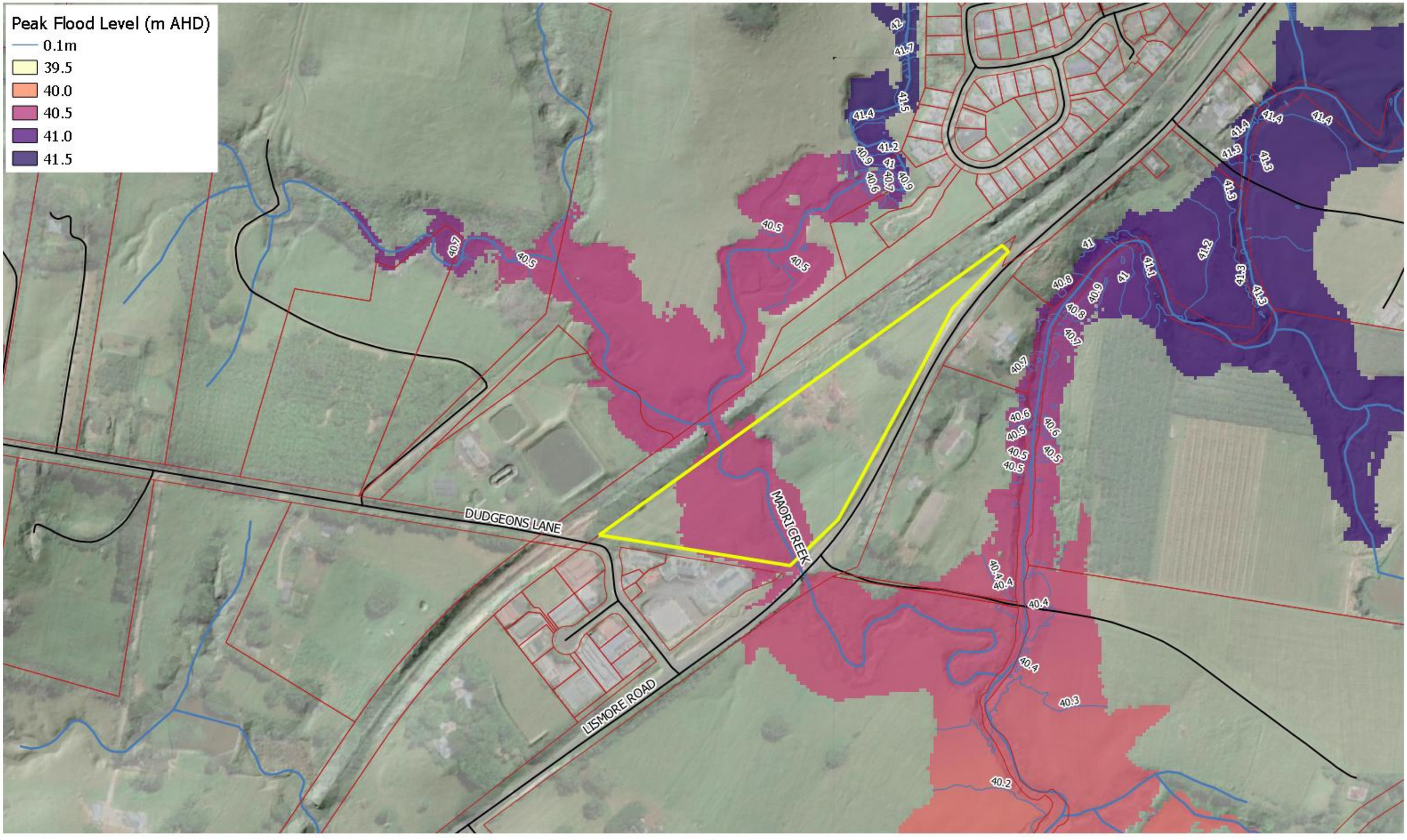

Legend

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- Roads
- Streams

Title:

5% AEP Peak Flood Level

Drawing: **A-2**

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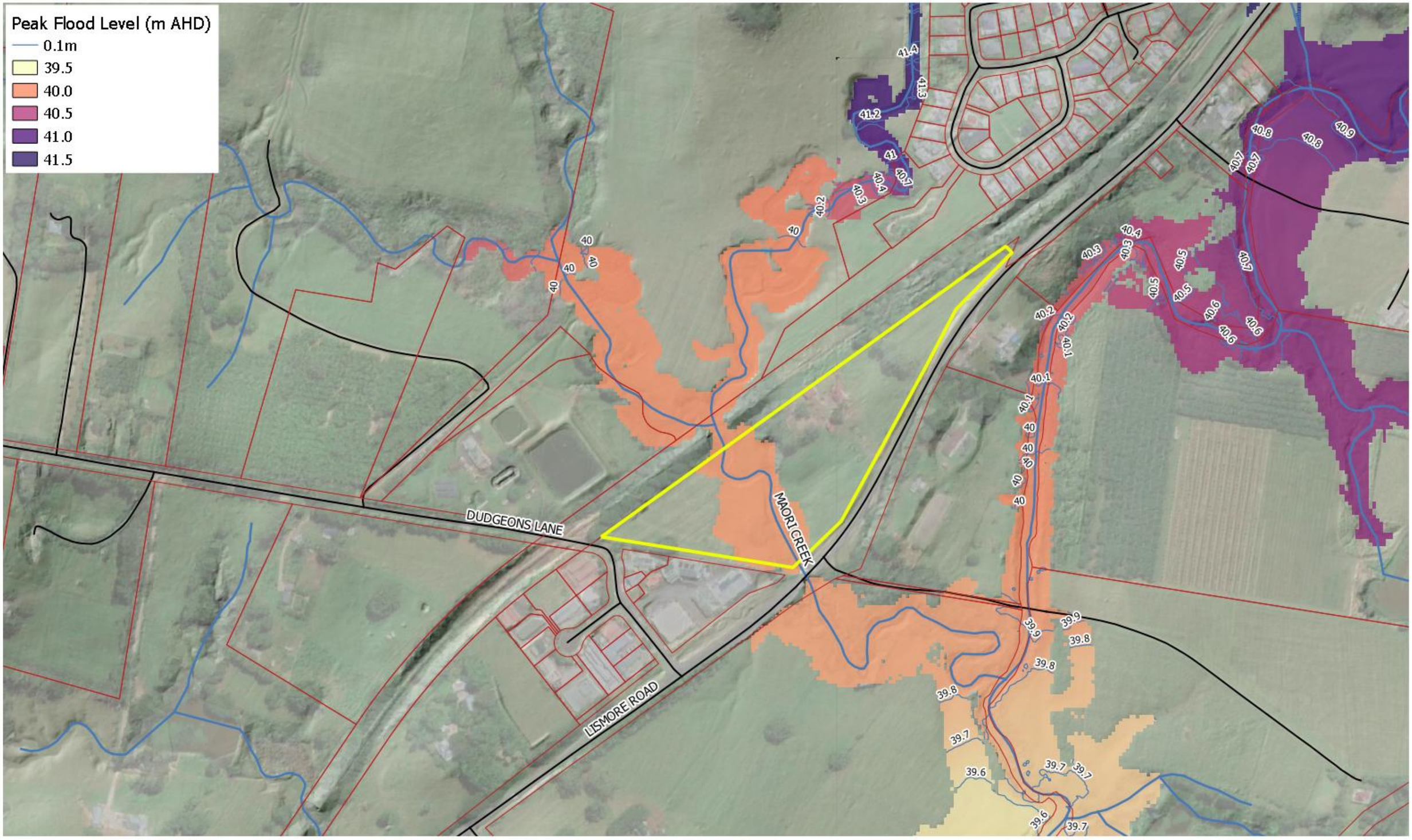

Legend

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Title:

20% AEP Peak Flood Level

Drawing: **A-3**

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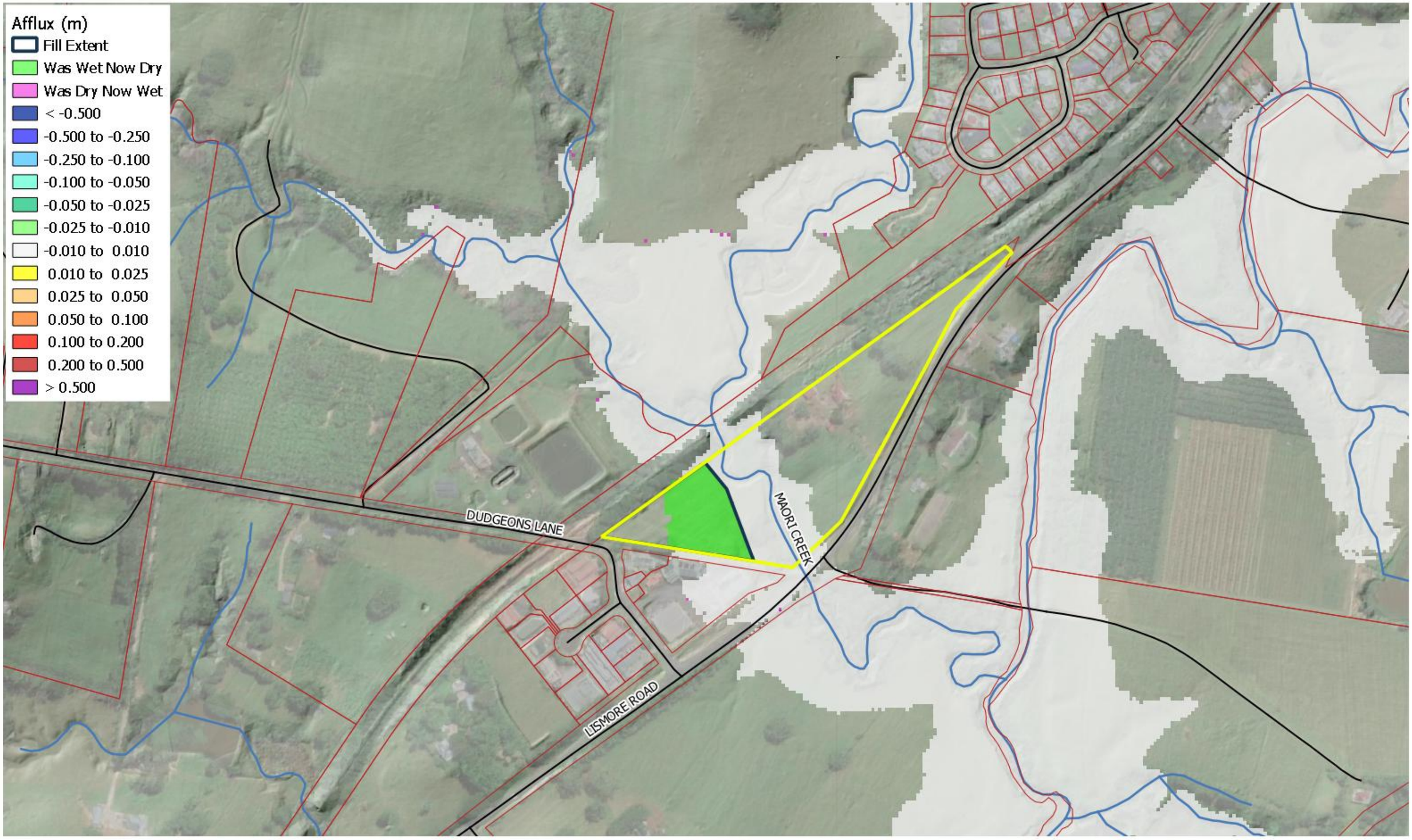
Appendix B Peak Flood Level Impact Maps – Development Scenario 1



Legend

- Site
- Cadastre
- Roads
- Streams

Title:

1% AEP Peak Flood Level Impacts - Development Scenario 1

Drawing: **B-1**

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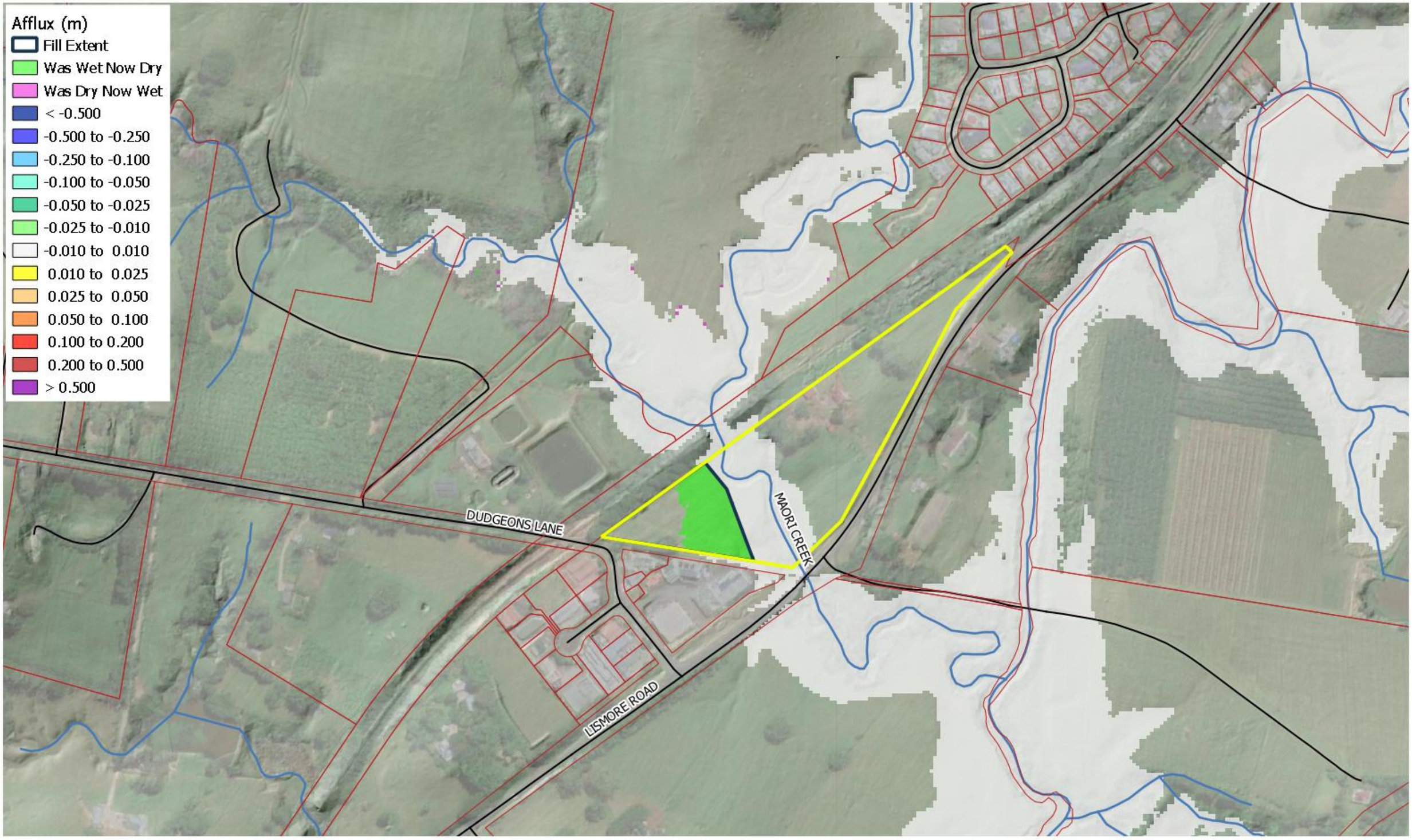

Legend

- Site
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- Roads
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Title:

5% AEP Peak Flood Level Impacts - Development Scenario 1

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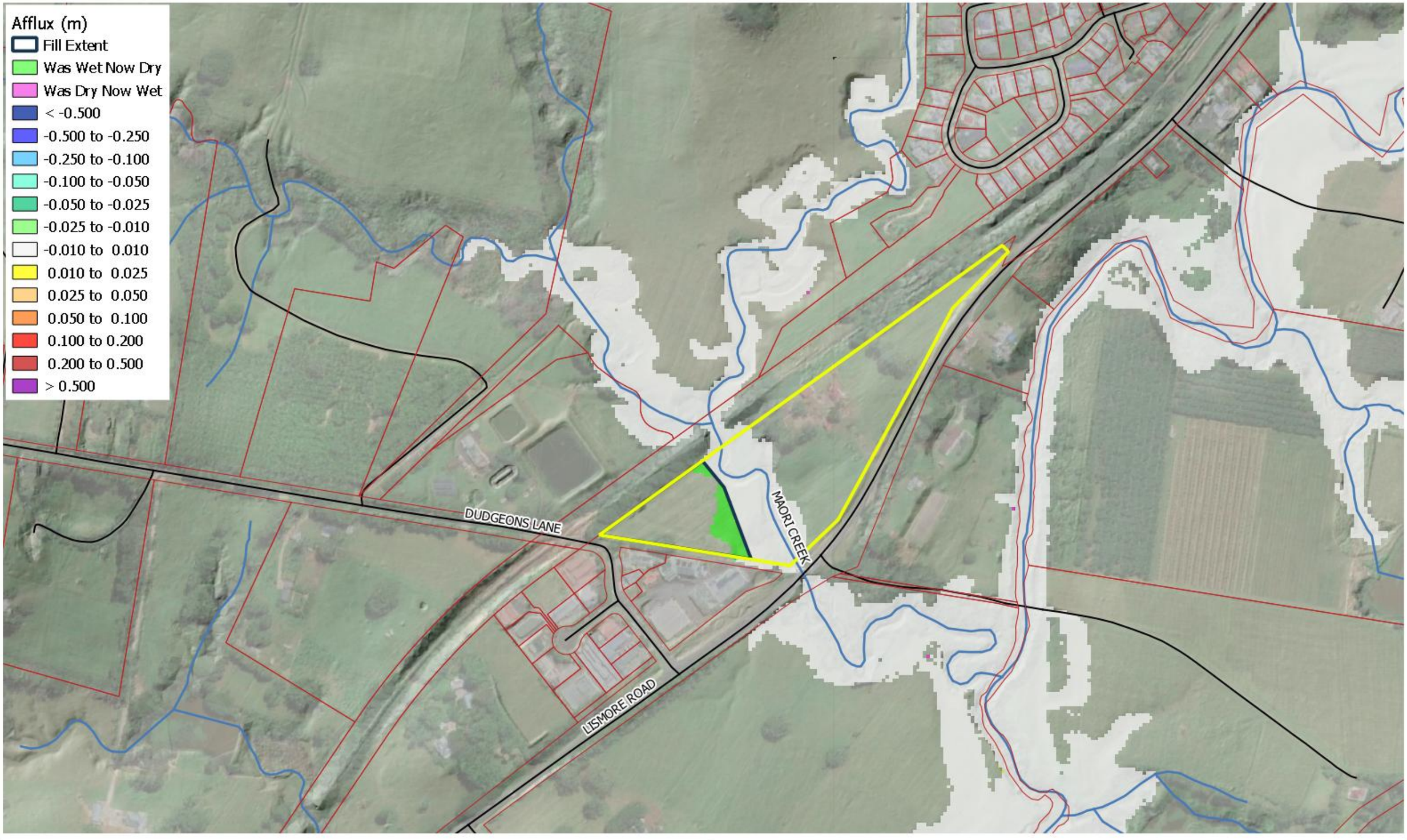

Legend

- Site
- Cadastre
- Roads
- Streams

Title:

20% AEP Peak Flood Level Impacts - Development Scenario 1

Drawing: **B-3**

Rev: **A**

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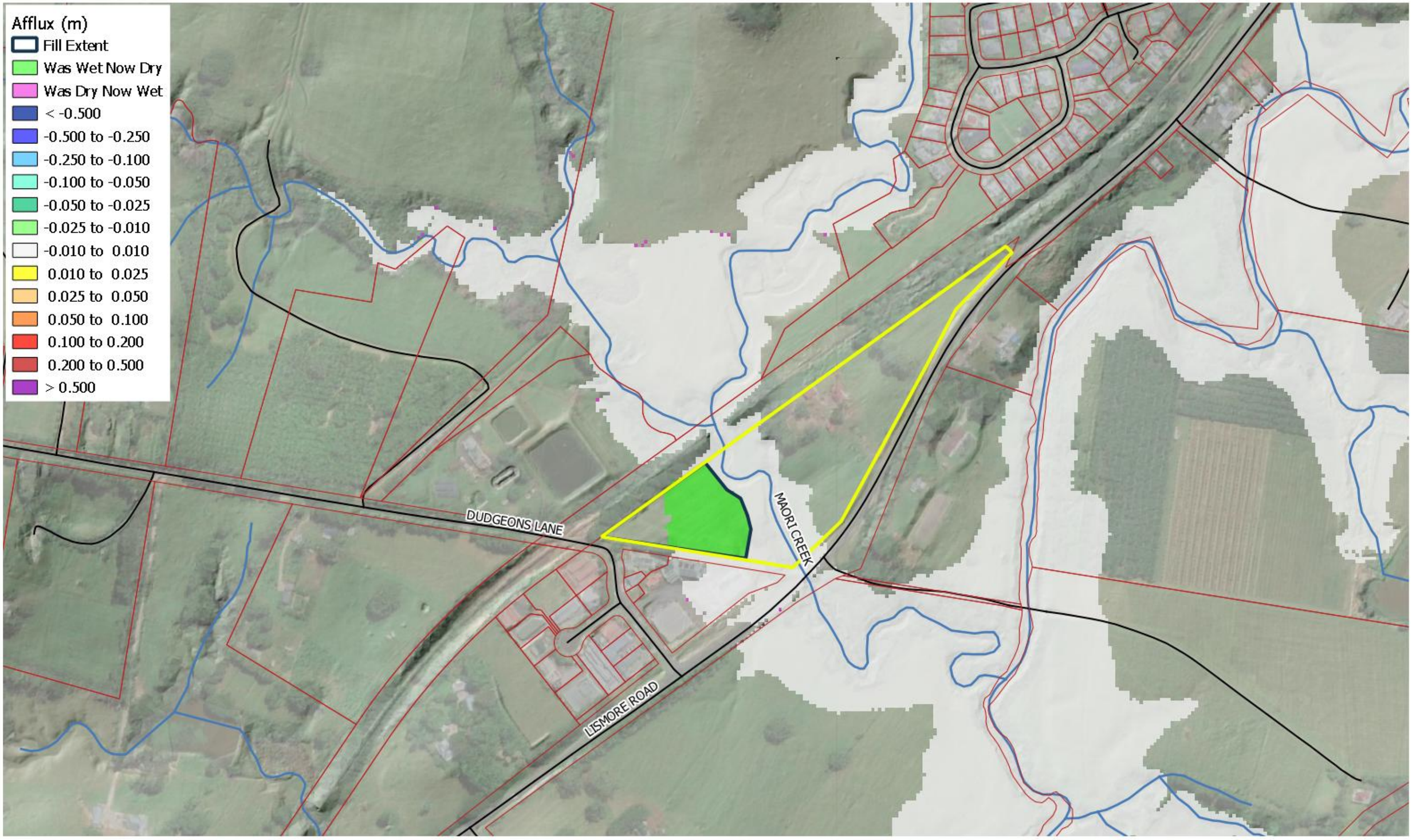
Appendix C Peak Flood Level Impact Maps – Development Scenario 2



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- Roads
- Streams

Title:

1% AEP Peak Flood Level Impacts - Development Scenario 2

Drawing: C-1

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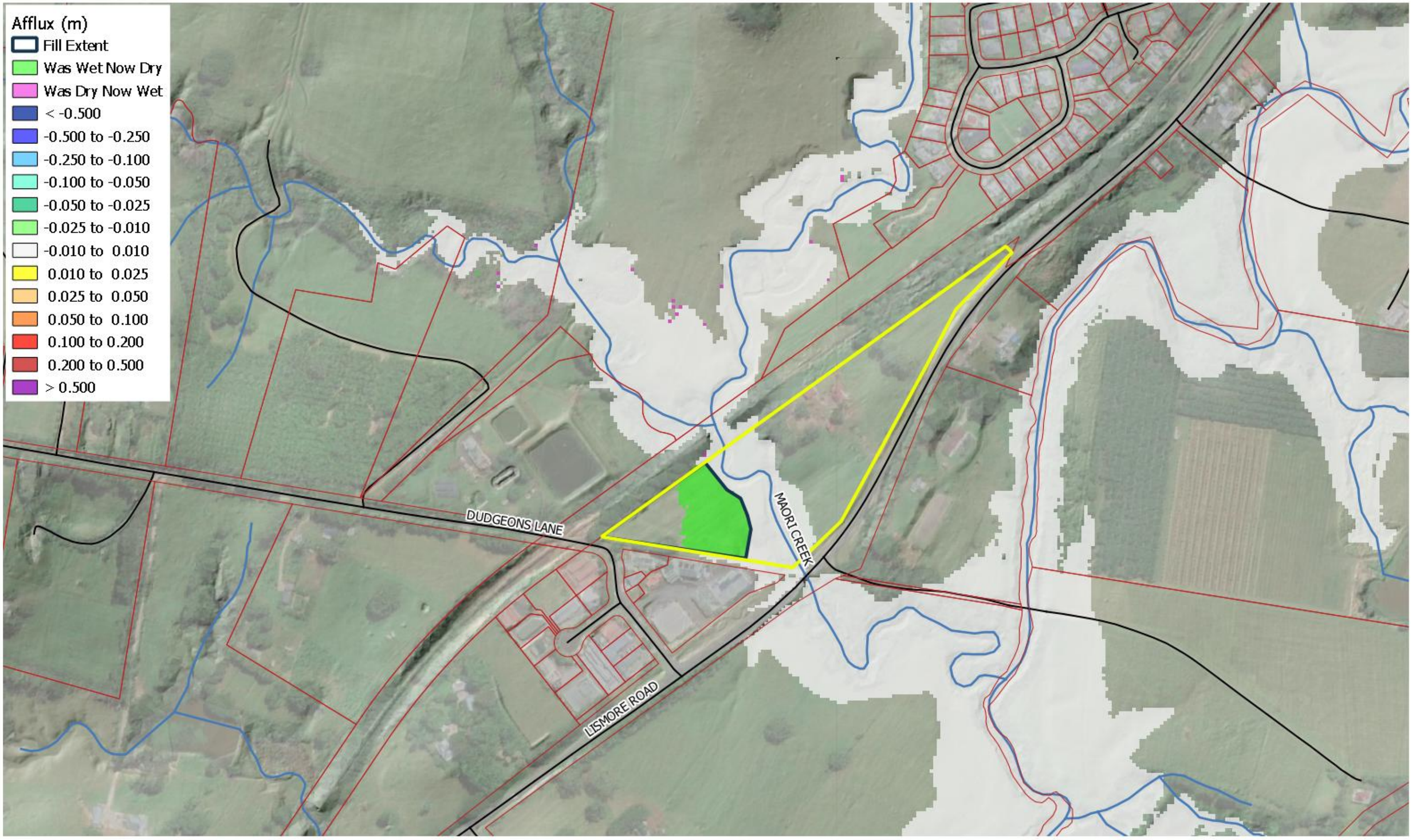

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- Site
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- Roads
- Streams

Title:

5% AEP Peak Flood Level Impacts - Development Scenario 2

Drawing: C-2

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Title:

20% AEP Peak Flood Level Impacts - Development Scenario 2

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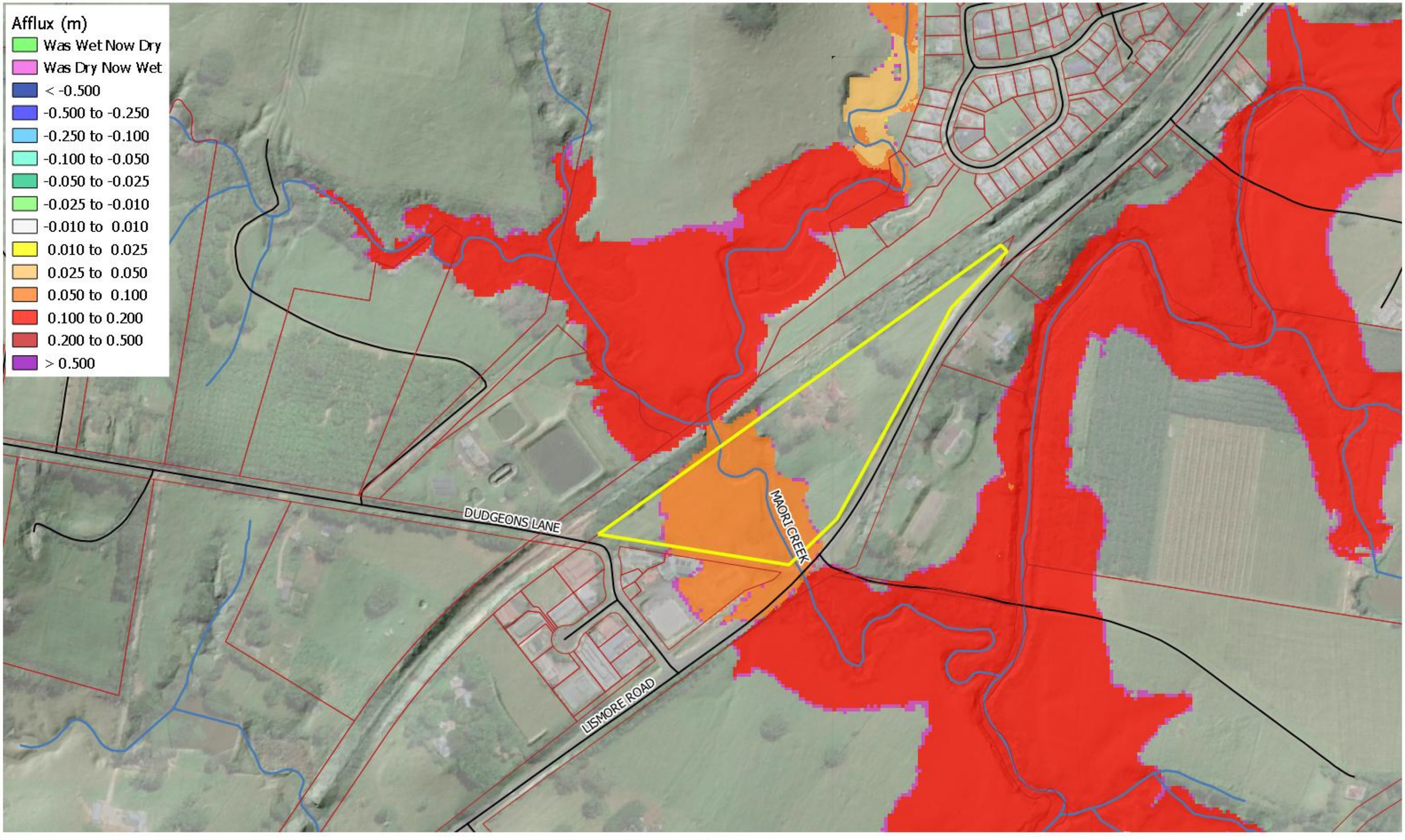
Appendix D Peak Flood Level Impact Maps – Climate Change Sensitivity Scenarios



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- Site
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- Streams

Title:

1% AEP Peak Flood Level Impacts - Climate Change Sensitivity (10% Rainfall Intensity Increase)

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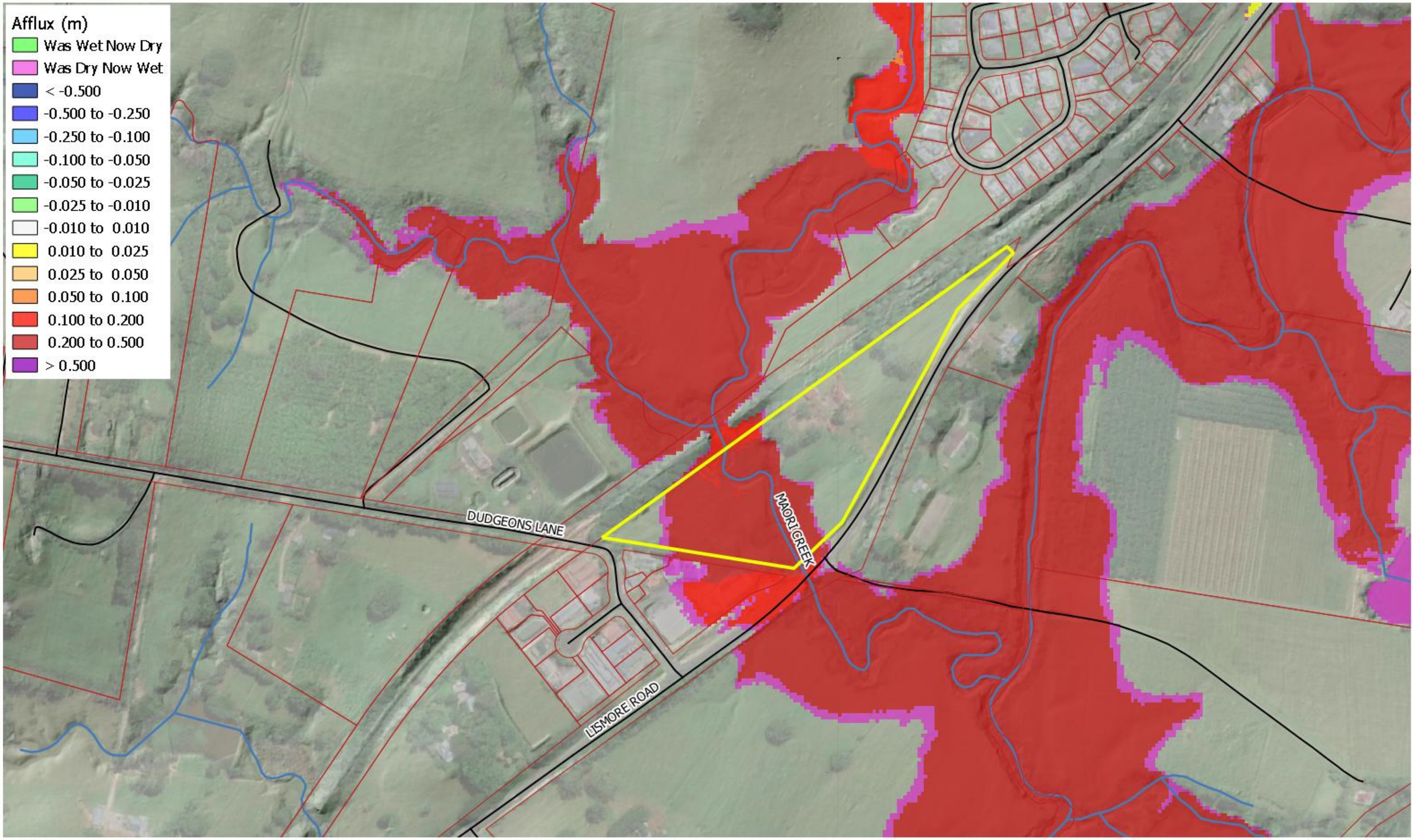

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Title:

1% AEP Peak Flood Level Impacts - Climate Change Sensitivity (30% Rainfall Intensity Increase)

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Bangalow Industrial Estate Conceptual Stormwater Management Plan

Reference: R.A10672.002.00.docx
Date: May 2021

Document Control Sheet

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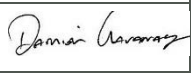
Document:	R.A10672.002.00.docx
Title:	Bangalow Industrial Estate Conceptual Stormwater Management Plan
Project Manager:	Damion Cavanagh
Author:	Damion Cavanagh; Dylan Johnston
Client:	Andrew More
Client Contact:	Andrew More
Client Reference:	

Synopsis: **This report presents the outcomes of conceptual stormwater quality and quantity assessments completed for a proposed rezoning of land at the Bangalow Industrial Estate.**

REVISION/CHECKING HISTORY

Revision Number	Date	Checked by		Issued by	
0	21 May 2021	B. Filer		D. Cavanagh	

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Executive Summary

This report has developed and assessed a conceptual stormwater quality and quantity system for the proposed Bangalow Industrial Estate extension. Both water quality and quantity modelling have been completed as a combined exercise for an indicative system that could be promoted at the Site.

Water quality modelling results indicate that the stormwater quality objectives will be achieved for the additional industrial estate area with use of commonly accepted treatment systems including swales and a bio-retention system. The proposed systems integrate with the current (indicative) site design and aim to avoid potential constraints such as riparian setbacks to Maori Creek. Further design development is required to further test aspects of civil integration for the selected stormwater management measures and system performance should be confirmed again at this later stage.

In terms of water quantity, assessments were completed using hydrologic models of the likely benefit of a detention basin to retard peak flows. The Byron Creek catchment at the location of the site is extensively rural and downstream of Bangalow. Modelling indicated that the inclusion of the 1 ha industrial allotment resulted in insignificant change to peak flows downstream of the site. As such, the addition of a detention basin was not considered of measurable value and has been excluded from the conceptual design.

Contents

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List of Tables

1 Introduction

1.1 Project Overview

A portion of land described as Lot 4 on DP 635505 is proposed for rezoning from rural (RU1) to a land use compatible with industrial/commercial uses. The rezoning will facilitate the sub-division of this land to provide several individual allotments. The development will (in effect) extend the current Bangalow Industrial Estate to the east.

BMT has been engaged to prepare a high-level Stormwater Management Plan (SMP) for the site that integrates stormwater quality and quantity control measures. The concepts included in this SMP are high level and reflect a potential full-site design that allows for individual lot runoff to be treated at a single location, rather than on each lot once subdivided. The future progression of land sale and use, and potentially development of individual SMPs for each separate lot may also be a realistic outcome for the overall development.

The SMP takes into account flood conditions prevalent at the site which have also been assessed by BMT as part of a broader scope of works.

The stormwater quality and quantity measures outlined in the SMP are to as far as practicable, integrate with the site and environment (particular riparian corridors) such that outcomes are cost effective, maintainable and aesthetically suited.

The report is structured as follows:

- Section 2 – Stormwater Objectives and Modelling Overview.
- Section 3 – Opportunities and Constraints.
- Section 4 – Stormwater Assessments.
- Section 5 – Findings and Conclusion.

1.2 Site Location

The site is located immediately to the south-west of Bangalow, and lies in between the existing Bangalow Industrial Estate, Lismore Road, Maori Creek and the North Coast Railway Line. The site is approximately 1.5 ha and has approximately 200 m fronting Maori Creek.

The site location is shown in Figure 1-1. Note that the development is proposed only on the western portion of the lot highlighted (i.e. on the western side of Maori creek).

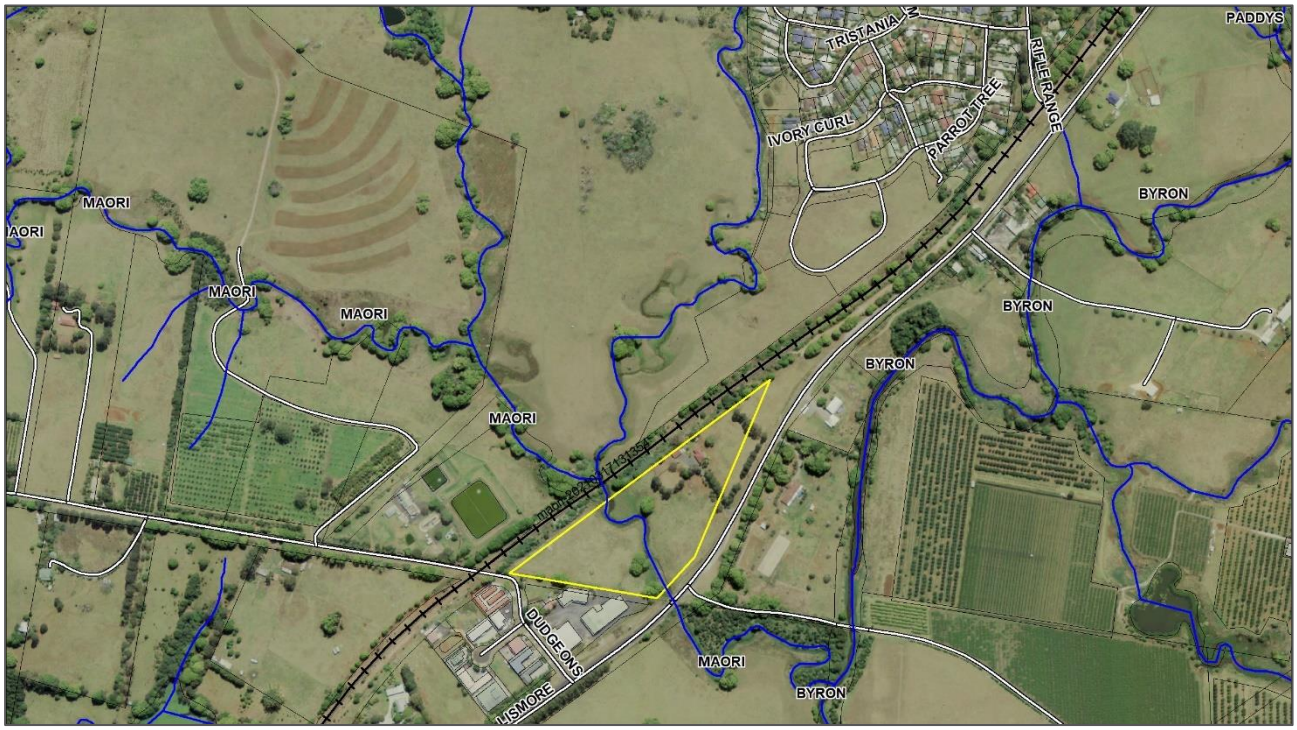

Figure 1-1 Site Locality

1.3 Existing and Proposed Development

In reference to the locality map shown in Figure 1-1. The existing land use is cleared rural paddocks, with scattered trees mainly in the southern end adjacent Lismore road and Maori Creek.

The future land use of the site is industrial and or commercial. The land is be serviced and include an internal road that accesses several future allotments. Specific individual uses of the lots are currently unknown. The creek frontage will be retained as riparian setback. As identified in the flood study, fill will be required along the eastern portion of the site to provide flood immunity.

A potential future lot layout is shown in Figure 1-2.

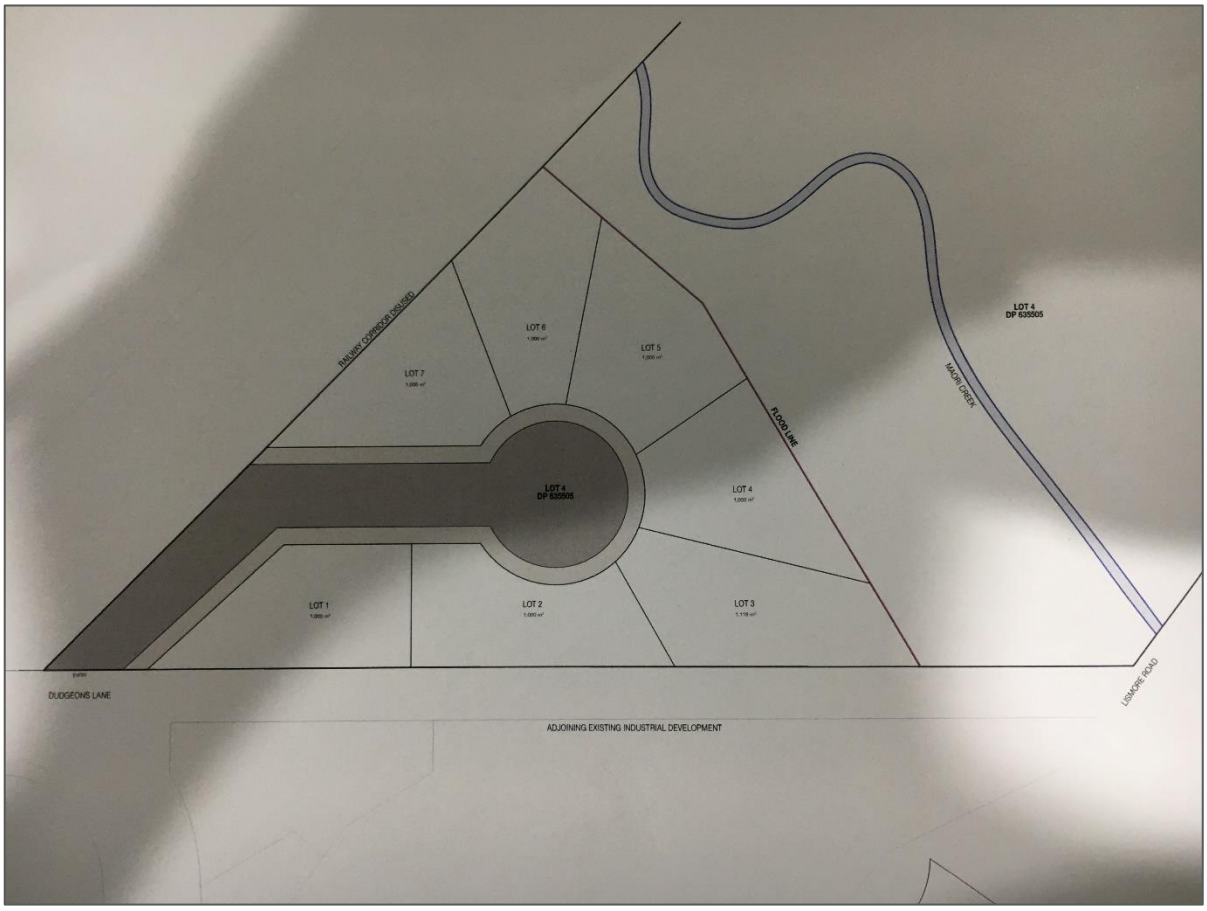

Figure 1-2 Potential site lot layout

1.4 Site Topography and Drainage

The site is gently sloping from west to east. The highest site elevation in the west is around 43.4 m AHD and at its lowest approximately 38m AHD at the creek line. The site has a slight depression in the south eastern corner.

The North Coast Railway Line sits on an embankment varying at 1 to 2 m higher than typical site elevations. The railway line has a bridge over Maori Creek as shown in Figure 1-3. Flow in Maori Creek is from north to south.

Lismore Road is also elevated above the site and Maori Creek. Maori Creek drains towards Byron Creek via 3 large concrete culverts as shown in Figure 1-4. Byron Creek is approximately 500m downstream of this crossing of Lismore Road (see also Figure 1-1).

Site survey was conducted to supplement existing LiDAR survey which was collected by NSW Government (Land and Property Information) in 2010. Survey of site ground levels relative to LiDAR were found to be within close agreement. Levels and other relevant details of Lismore Road, the North Coast Railway Line and cross-drainage structures were also obtained during site survey to inform hydraulic flood modelling (Cantys Surveying, March 2016). A digital elevation model of the existing site is shown in Figure 1-5.

Figure 1-3 Railway Bridge over Maori Creek

Figure 1-4 Culverts structures under Lismore Road on Maori Creek

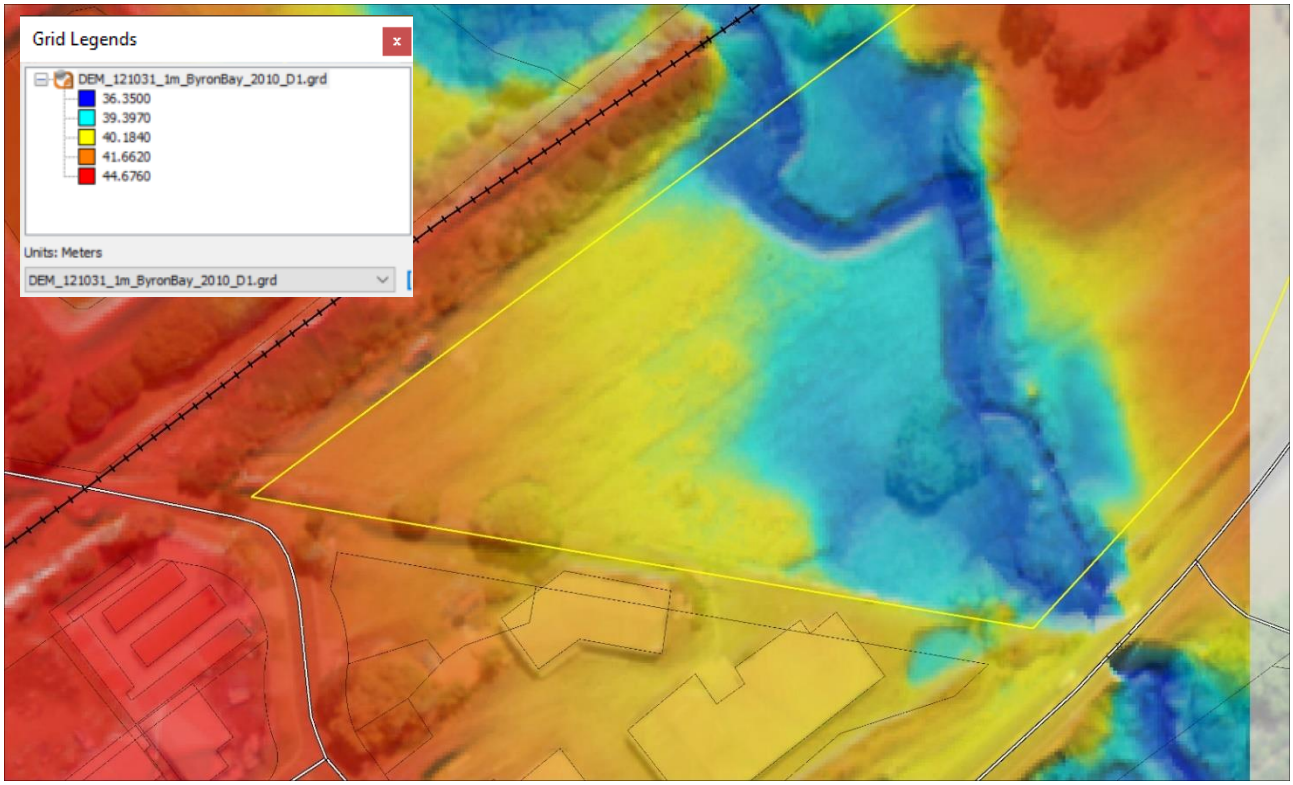

Figure 1-5 Existing Site Digital Elevation Model

1.5 Flooding

BMT has completed a Flood Impact Assessment (FIA) study of the proposed site filling using a 2-dimensional flood hydraulic model developed as part of previous flood studies for the Byron Creek catchment. The impacts of filling on peak flood levels have been assessed within the FIA.

2 Stormwater Objectives and Modelling Overview

2.1 Stormwater Management Objectives and Targets

2.1.1 Stormwater Quality Objectives

The stormwater management objectives to be achieved by this project include both quality and quantity objectives (Byron Shire Council, 2014 and 2014a).

As the proposed development involves an area of land greater than 2,500 m^2, the operational phase stormwater solution for the site must provide measures to address the "key" pollutants for all stormwater flows up to 25% of the 1-year ARI peak flow from the development site. Key pollutants are outlined in Table 2-1 (BSC, 2014a).

Table 2-1 Byron Shire Council Stormwater Quality Objectives

Table B3.2 – Pollutants and Retention Criteria

Pollutant / Issue	Retention Criteria
Litter	70% of average annual load greater than 5mm.
Coarse Sediment	80% of average annual load for particles 0.5mm or less.
Fine Particles	50% of average annual load for particles 0.1mm or less.
Total Phosphorous	45% of average annual load.
Total Nitrogen	45% of average annual load.
Hydrocarbons, motor fuels, oils & grease	90% of average annual load.

2.1.2 Stormwater Quantity Objectives

In terms of stormwater quantity, the on-site stormwater detention requirements of Council apply (except for discharge to tidal waterways). Council's guidelines identify requirements that post-development flow is to be controlled to be no greater than the pre-development flow for all storm events up to the critical 100-year ARI event.

2.2 Stormwater Quality Modelling Overview

2.2.1 Model Description

Stormwater quality modelling was undertaken to estimate the hydrology and load of common stormwater pollutants (i.e. TSS, TP and TN) generated by the site using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC). MUSIC includes algorithms to evaluate the hydrology and concentrations / loads in stormwater runoff from urban catchments as well as estimate the performance of selected stormwater management measures to capturing these pollutants and achieve load and/or concentration reductions in discharges of stormwater.

MUSIC was designed to continuously simulate urban stormwater systems over a range of temporal and spatial scales utilising historically representative rainfall data. MUSIC is considered within the engineering industry to be an appropriate conceptual design tool for the analysis of runoff water quality in the urban environment.

The hydrologic algorithm in MUSIC is based on the model developed by Chiew & McMahon (1997). The model simplifies the rainfall-runoff processes and requires input of the following variables to perform the hydrological assessment:

- Rainfall data (time steps varying from 6 minutes to 1 days);
- Areal potential evapotranspiration (PET) rates;
- Catchment parameters (area, % impervious and pervious areas);
- Impervious and pervious area parameters (rainfall threshold, soil and groundwater parameters); and
- Storm event and base flow stormwater pollutant concentrations.

MUSIC can be applied for comparison of alternative scenarios that adopt the same base inputs. Although the magnitude of the estimates may not be equivalent to actual site conditions (due to limitations in available data for a particular site), the relative differences between scenarios is expected to be appropriate for decision making.

The MUSIC modelling approach applied to estimate stormwater pollutant loads for the Site is described in the following sections.

It should be noted that MUSIC modelling approaches have followed those recommended within the MUSIC Modelling Guidelines developed by Healthy Land and Water (2018). While currently a consultation draft, this version is noted to be extensively similar to earlier MUSIC modelling guidelines published by this organisation.

2.2.2 Rainfall and APET

The meteorological template includes the rainfall and areal potential evapotranspiration (APET) data and forms the basis for the hydrologic calculations within MUSIC.

The nearest Bureau of Meteorology (BoM) continuously recording rainfall station is located at the Federal Post Office (Station 58072) approximately 15 km west of the Site and is significantly elevated compared to the Site. This gauge was found not to be representative of the long-term rainfall at the Site due to its location.

Due to the sparsity of long-term rainfall intensity records in proximity to the site, the Alstonville Tropical Fruit Research Station (Site 58131). This gauge is commonly utilised for MUSIC assessments and is recommended by Ballina Shire for assessments across their Shire. A 20 year simulation period has been adopted extending from 1/1/1989 to 1/1/2009. During this period mean annual rainfall was noted at 1,631 m.

Average monthly areal potential evapotranspiration (PET) rates adopted for the MUSIC modelling are summarised in Table 2-2. These values are specific also to the Alstonville gauge.

A 6-minute time step was adopted for the MUSIC modelling.

Table 2-2 Adopted Average Monthly Areal PET Rates

Month	Mean daily areal PET (mm)
January	6.41
February	5.99
March	5.04
April	3.56
May	2.29
June	1.75
July	1.76
August	2.24
September	3.39
October	4.91
November	5.90
December	6.68

2.2.3 Land Use

Land use categories based on the existing and proposed site conditions are summarised in the respective modelling sections (refer to Section 2.2.3 and Section 4.3.1 for land use descriptions for stormwater quality and quantity modelling, respectively).

For stormwater quality purposes the site's land use has been treated as a single industrial/commercial land use (i.e. 'lumped' land use) in accordance with the methodology outlined in HLW (2018). This approach is appropriate for modelling development applications in MUSIC and also for broad-scale planning. Currently definition of individual uses and site designs for allotments is unknown and this makes splitting the catchment into road, ground level and roof impractical due to the large number of assumptions required. Further detail on areas is included in Section 4.3.1.

2.2.4 Rainfall-Runoff Parameters

Modelling of the rainfall-runoff process in MUSIC requires the definition of one impervious surface parameter and eight pervious surface parameters. The impervious surface parameter (rainfall threshold) and pervious surface parameters utilised were the default MUSIC hydrologic parameters for Commercial / Industrial land use, as summarised in Table 2-3.

Table 2-3 MUSIC Rainfall-Runoff Parameters (HLW, 2018)

Impervious Area Parameters	Commercial and Industrial
Rainfall Threshold (mixed urban surfaces, mm)	1.0
Pervious Area Parameters	
Soil Storage Capacity (mm)	18
Initial Storage (% of capacity)	10
Field Capacity (mm)	80
Infiltration Capacity Coefficient – a	243
Infiltration Capacity Exponent – b	0.6
Groundwater Properties	
Initial Depth (mm)	50
Daily Recharge Rate (%)	0
Daily Baseflow Rate (%)	31
Daily Deep Seepage Rate (%)	0

2.2.5 Runoff Quality Parameters

MUSIC requires stormwater constituent concentrations for storm flow and base flow for the site's land uses. These concentrations are converted to logarithmic values for input into MUSIC. The adopted log_{10} values are summarised in Table 2-4.

Table 2-4 Lumped Land Use Concentration Parameters (mg/L-log10) (HLW, 2018)

Surface Type	TSS		TP		TN	
	mean	std. dev	mean	std. dev	Mean	std. dev
Industrial/Commercial Base Flow	0.78	0.45	-1.11	0.48	0.14	0.20
Industrial/Commercial Storm Flow	1.92	0.44	-0.59	0.36	0.25	0.32

2.3 Stormwater Quantity Modelling Overview

A detailed local hydrologic model has been developed for the Byron Creek catchment. The hydrologic model was developed as part of the process of developing a flood hydraulic model for the catchment. These models have been utilised to complete the Bangalow Industrial Estate Flood Impact Assessment (FIA) for the development and has been reported separately.

The hydrologic model has been also been utilised in this Stormwater Management Plan to assess quantity management requirements to accord with Council guidelines as per Section 2.1.2. For full details on the hydrologic model please refer to the Bangalow Industrial Estate Flood Impact Assessment.

3 Opportunities and Constraints

This section identifies site opportunities and constraints for stormwater management. The opportunities and constraints were identified in consideration of existing site conditions, and the intended future use of the site.

3.1 Opportunities

Some of the key opportunities identified for this Site include:

- Setbacks from Maori Creek that were required to maintain flood storage volumes and minimise flood impacts. Some of these areas remain out of riparian setbacks (to Maori Creek) and can be considered for stormwater management; and
- Site slopes are gentle and trend towards Maori Creek. The fall of land can be maintained after filling for flood immunity, this can maintain gentle grade lines towards potential treatment systems (quantity and or quantity) adjacent (but setback) from Maori Creek. Gentle grades of less than 4% are suited to the use of swales.

3.2 Constraints

Some of the key constraints identified for this Site include:

- Setbacks from Maori Creek for preservation of riparian corridors. Setbacks to this level 3 stream are 30m from the creek bank (which is relatively close to the creek centreline for Maori Creek); and
- Ground water levels require confirmation. High ground water may interfere with the operation of specific types of stormwater management measures that utilise infiltration.

In summary, the approach considered for stormwater management makes maximum benefit from the natural opportunities afforded by the site. Consideration has been applied to using areas external to the proposed fill platform that is within the site boundary, but external to areas required for riparian setback.

4 Stormwater Assessments

The following sections provide the stormwater quantity and quality assessments.

4.1 Model Preparation

To support the quality and quantity modelling the catchment of the proposed development has been determined. It has not been necessary to break the catchment up into smaller catchments, due to limited upstream catchment area and uniformity of drainage path (i.e. it's possible to drain the entire site to a single location).

The process for preparing data for models includes:

- review of the existing site including site inspection;
- review of site survey conducted by others;
- preparation and review of GIS data for the existing site and the post-developed site, particularly elevation data and cadastral boundary information;
- consideration of potential sites for placement of stormwater quality and/or quantity devices; and
- consideration of the nature of the existing land use and post-developed land use.

Without providing exhaustive information on the above model preparation steps, Figure 4-1 has been prepared to illustrate the developed sites catchment and land use for the purposes of modelling.

It is likely that upstream catchments including the existing Bangalow Industrial Estate and railway embankment can be diverted around the site using an existing easement and or shallow grassed diversion channel around the site. For the purposes of MUSIC modelling, there are no upstream flows accessing the site. Additionally, Areas outside of the fill extent (adjacent Maori Creek) are not proposed to be developed and do not form part of the MUSIC model.

Figure 4-1 MUSIC Model Catchment Extent and Land Use (red bounded area)

4.2 Selection of Stormwater Management Measures

The process of selecting potential stormwater management measures has been to primarily avoid site constraints and take advantage of identified opportunities. Some of the key considerations in selecting and siting potential management measures have included:

- Presence (or likely presence) of suitable gradient;
- Presence (or likely presence) of available space to effect treatment;
- Presence (or likely presence) of subsurface features which may restrict treatment options including services, groundwater, etc;
- Presence of riparian setbacks;
- Visual appearance of the selected infrastructure in the environment and likely compatibility; and
- Ability to access and ease of maintenance.

Further descriptions are provided in the following sub-sections and in Section 3.

The stormwater management measures selected for the developed site are outlined in Figure 4-2 and are described further in the following sections.

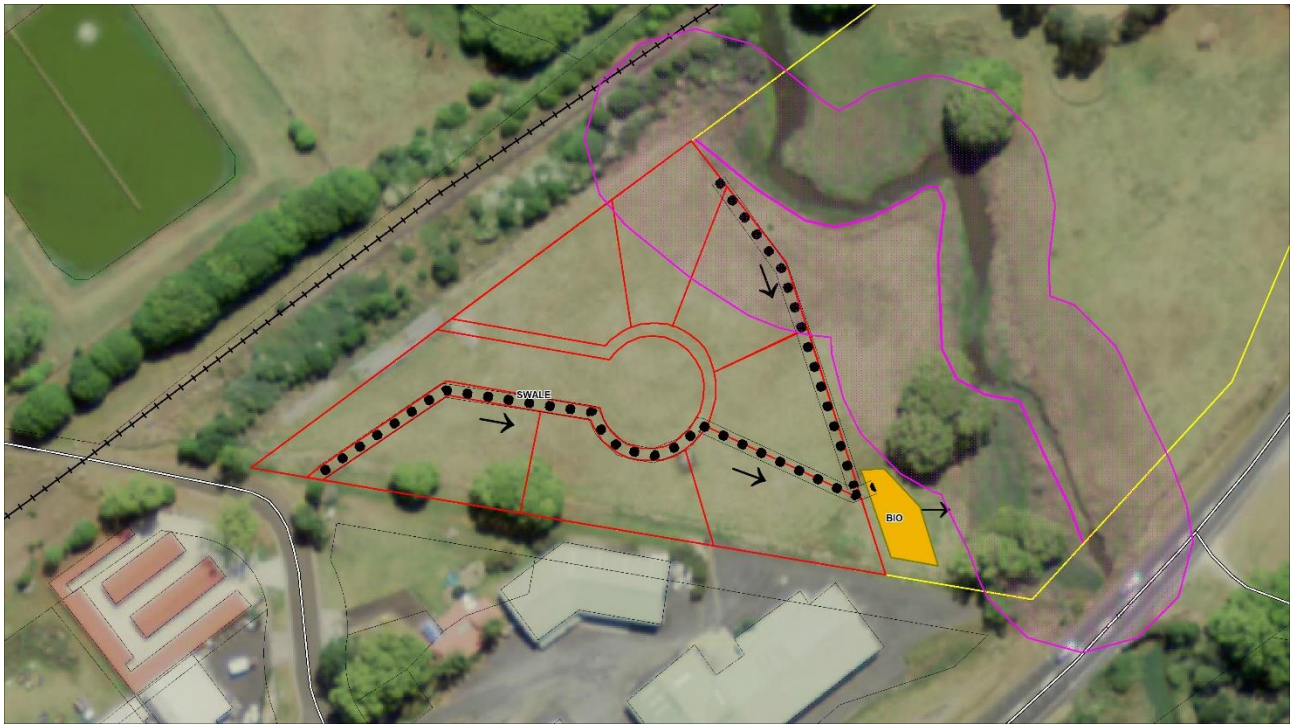

Figure 4-2 Types and Locations of Selected Stormwater Management Measures

4.3 Stormwater Quality Modelling

4.3.1 Changes in Load Generation and Load Reduction Targets

MUSIC models have been developed for the site's catchment to enable accurate estimation of the effect of the development on pollutant discharge. The total modelled area is 1 ha. The existing site is cleared agricultural (grazing land). With the proposed development, the area of hardstand (i.e. road, roof, driveway, etc) increases with a corresponding decrease in the pre-existing land-use, as outlined in Table 4-1.

Table 4-1 Developed Land Use

Surface Type	Area (ha)	Imperviousness (%)
Industrial / Commercial	1	90%*
Total	1	90%*

* Recommended in Table 3.7 HLW, 2018m typical Impervious Fraction for Lumped Catchment Land Use

Developed unmitigated modelling results are provided in Table 4-2.

Table 4-2 MUSIC Modelling Results – Developed Unmitigated Site

Parameter	Annual Loads Existing Site (unmitigated)
Total Suspended Solids (kg/yr)	2,000
Total Phosphorus (kg/yr)	5.2
Total Nitrogen (kg/yr)	33.4
Gross Pollutants (kg/yr)	337

4.3.2 Stormwater Quality Measures

A variety of stormwater management measures have been integrated into the existing case MUSIC model as treatment nodes. Selected measures include:

- Swales; and
- Bio-retention system.

Stormwater management measures selected are outlined in Figure 4-2. The MUSIC model structure is outlined in Figure 4-3.

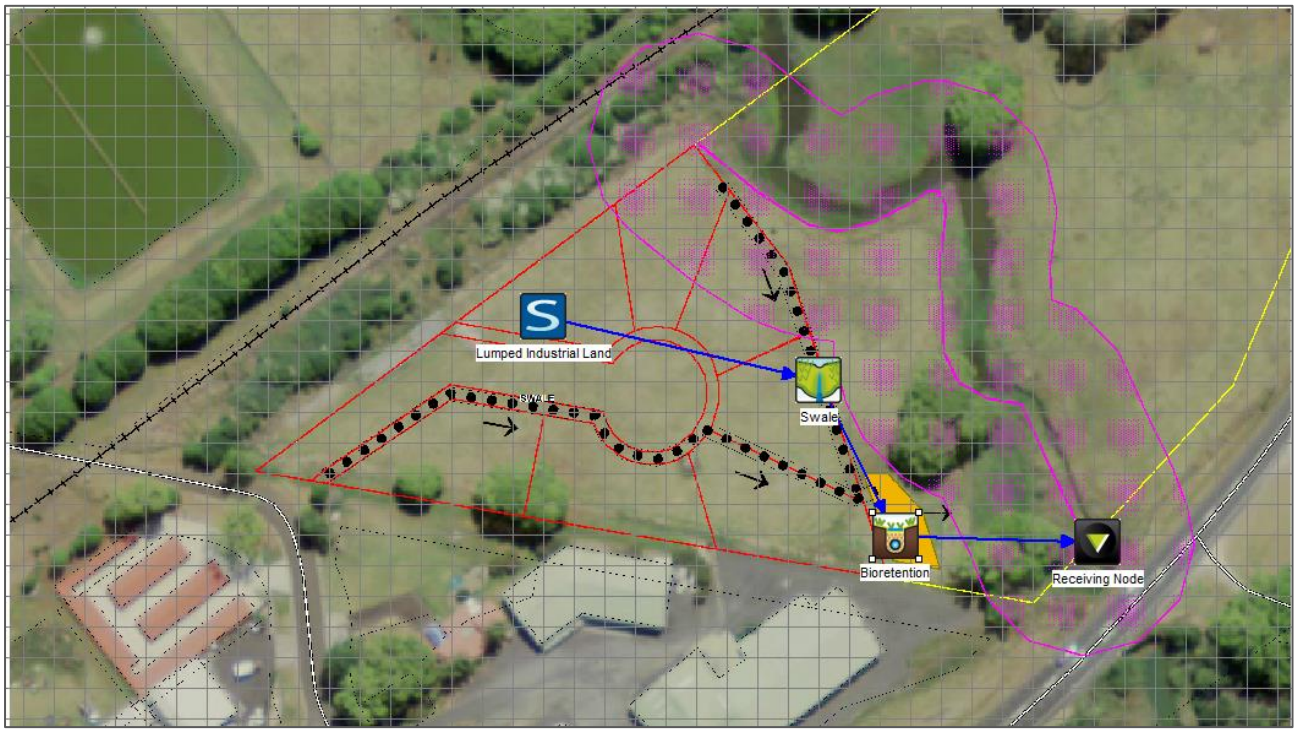

Figure 4-3 MUSIC Model Arrangement

Swale(s)

The location of swales are indicative, but it is likely that they could be accommodated adjacent the internal road (with site accesses designed accordingly), and or along the eastern fill boundary draining towards the location of the proposed bio-retention basin. Swales are an ideal pre-treatment for bio-retention systems due to their propensity to collect coarse to medium sized sediments and ability trap a large percentage of gross pollutants.

The swale sizing for flow capacity is estimated at this stage, however, a part of detailed design the swale would be sized to convey the required major/minor flow by itself or in combination with a piped network. Normally major flows are contained within the road reserve and with the provision of an easement this flow path could be directed towards the site's stormwater quantity control systems.

Properties for the swale are provided in Table 4-3.

Table 4-3 Specifications for swales

Parameter	Swale
Low Flow bypass (m^3/s)	0
Length (m)	60
Bed slope (%)	1
Base Width (m)	0*
Top width (m)	4
Depth (m)	0.3
Vegetation height (m)	0.1
Exfiltration Rate (mm/hr)	0

*provides for mowable 1:4 batters

Bio-retention Basin

A single bio-retention basin style system is proposed to improve the quality of the site's runoff. Key design parameters for the bioretention include:

- It will bypass three month flows around the sediment basin as a 'high flow' bypass. This will protect bio-retention system vegetation. Currently the high flow bypass has not been set. Application of the high flow bypass is not expected significantly affect the performance of the bio-retention basin as high flows will primarily exist the basin by the weir with minimal treatment. The high flow bypass system would need to be located between the site's drainage system and the bio-retention system.
- The bio-retention basin style proposed is that of a pipeless system. As per the methodology of the outlined in HLW (2018). Key assumptions which will need to be confirmed include the depth of groundwater on-site below the location of the proposed system, as well as confirmation of surrounding soil hydraulic conductivity. As per regional soil mapping, the locality of the site is

characterised by well-drained Krasnozems soils (red soils), although some lenses of alluvial soil exist along drainage lines as per DECCW mapping Sheet 9540-9640.

- The bio-retention basin will be planted out in suitable species for nutrient retention and uptake.
- As the system is unlined on its base, exfiltration to groundwater has been assumed at the rate of 3 mm/hr which is appropriate for a medium clay soil. Soil conditions/saturated hydraulic conductivity (through double ring infiltrometer testing or similar) would need to be confirmed on site as part of detailed design activities.

Properties for the bio-retention system are provided in Table 4-4.

Table 4-4 Specification for bio-retention basin

Parameter	Value
Low Flow bypass (m^3/s)	0
High Flow bypass(m^3/s)	100
Extended Detention Depth (m)	0.3
Surface Area (m^2)	275
Filter Area (m^2)	240
Unlined Filter Media Perimeter (m)	60
Saturated Hydraulic Conductivity (mm/hr)	180
Filter Depth (m)	0.5
TN content of Filter Media (mg/kg)	400
Orthophosphate Content of Filter Media (mg/kg)	30
Exfiltration Rate (mm/hr)	3
Lined	No
Vegetated	Vegetated with Effective Nutrient Removal Plants
Overflow Weir Width (m)	3
Underdrain Present	No
Submerged Zone	No

Modelled Results

The modelled results of the developed mitigated site are included in Table 4-5.

Table 4-5 MUSIC Modelling Results – Developed Unmitigated Site

Parameter	Annual Loads Existing Site (unmitigated)	% Reduction
Total Suspended Solids (kg/yr)	249	87
Total Phosphorus (kg/yr)	1.41	72.1
Total Nitrogen (kg/yr)	17.7	44.9
Gross Pollutants (kg/yr)	0	100

Outcomes of the MUSIC modelling indicate that the stormwater objectives will be achieved for the proposed development. Design of the stormwater measures will ensure integration for the selected stormwater management measures with the civil design.

Access

Access to the bio-retention system will be required via easement from the internal service road. Allowance for this access will be determined during detailed site design. If the bio-retention system is to be handed to Council, then an easement may also be required over this access providing this long-term access.

4.4 Stormwater Quantity Modelling

In terms of quantity management, BMT has considered the potential benefit of integrating a detention basin into the stormwater treatment system to mitigate peak flows. However, the proposed development is relatively small in a primarily rural catchment with a hydraulic restriction immediately downstream. Hence, prior to simply adopting the detention basin, the likely hydraulic benefit of the proposed detention basin has been assessed.

The Byron Creek catchment hydrologic model (see the Bangalow Industrial Estate Flood Impact Assessment for further details) was used to assess differences in peak flows with and without the development. To achieve this, the model was adjusted to represent both the pre-and post-development scenarios. For the developed scenario, an imperviousness value of 90% was adopted for the proposed site, while in the existing scenario, it was assumed to be 100% pervious.

Flow results for critical duration events were obtained for the sub-catchment located directly downstream of the Industrial Estate area. As Table 4-6 indicates, differences in peak discharges between the developed and existing scenarios are negligible. This finding is further supported by Figure 4-4, which displays the flow scheme of the Industrial Estate downstream sub-catchment for both the developed and existing 1% AEP, 5% AEP and 20% AEP scenarios. As can be observed, both the developed and existing discharge level trends match one another, with no notable change.

Table 4-6 Peak Discharge results for critical duration events at Industrial Estate downstream sub-catchment

Event (AEP)	Developed Scenario Peak Discharge (m^3s)	Existing Scenario Peak Discharge (m^3s)	Difference (Developed – Existing)
1%	339.15	339.17	-0.02
2%	293.60	293.60	0
5%	226.46	226.46	-0.04
10%	186.20	186.20	-0.02
20%	145.63	145.63	-0.05
50%	84.60	84.60	0
63.2%	68.97	68.97	0

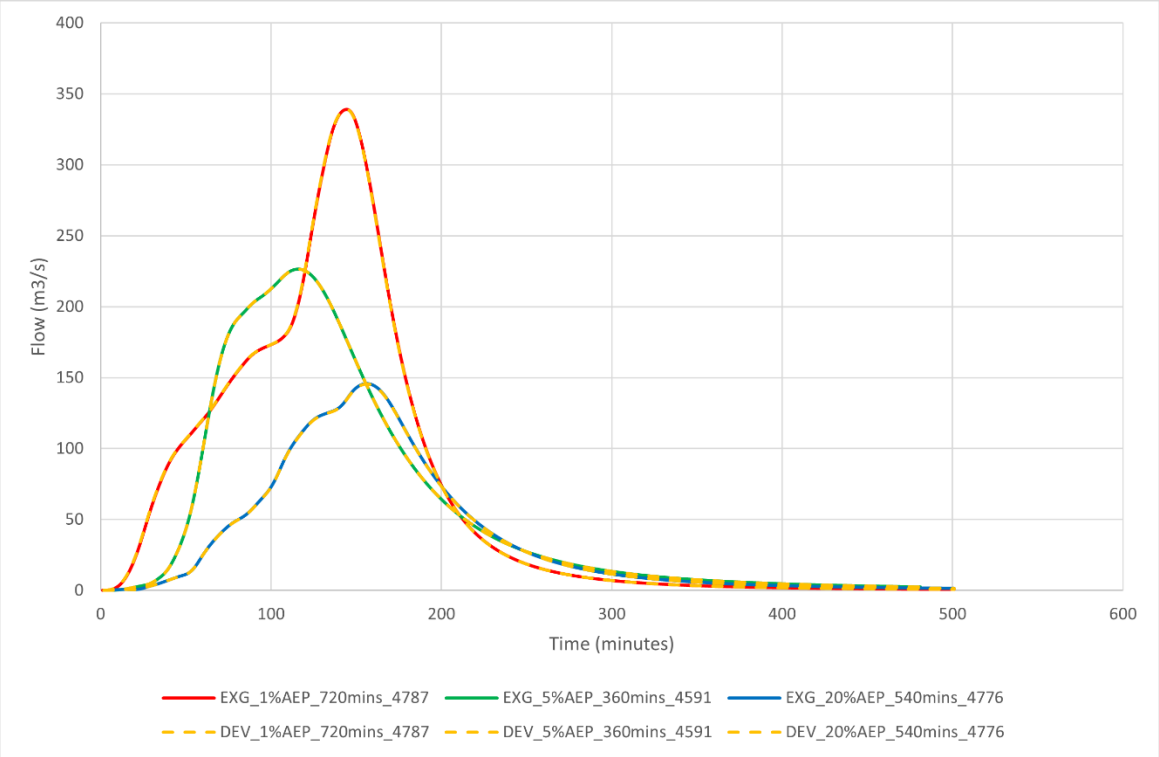

Figure 4-4 Critical duration hydrographs for Industrial Estate downstream sub-catchment

4.5 Riparian Corridor

Hydro lines are referred to by the Water Management (General) Regulation 2018. The hydro line spatial data is a dataset of mapped watercourses and waterbodies in NSW. It is based on the Spatial Services (Department of Finance, Services & Innovation) NSW Hydro Line dataset. Hydro line mapping for the site, shows the presence of Maori Creek in the east.

There are a variety of 'controlled activities' on waterfront land, where 'waterfront land' includes the bed and bank of any river, lake or estuary and all land within 40 metres of the highest bank of the river, lake or estuary. The proposed site development may require assessment to ensure that no more than minimal harm will be done to waterfront land as a consequence of carrying out the controlled activity if controlled activity works are proposed within the 40m boundary.

Within the waterfront land extent, there is a recommendation for minimum vegetated riparian zones (VPZ) that varies according to the steam order of the waterway. Using the Strahler system of stream order, Maori Creek is stream order 3. This provides a VPZ of 30m either side of the bank of the channel.

The hydro line mapping appears relatively coarse at the site scale and this may be due to the methods used to create this dataset. When compared to LiDAR for the site a relatively clear top of bank is observed typically within about 10m of the physical location of Maori Creek as observed in LiDAR and aerial photography. In the southern portion of the site the landform appears to include a former flowpath and historical outer creek banks. As Maori Creek is located in areas of alluvial and krasnozems soils, its location is expected to meander over long time scales in responses to flood events, etc. Adopted these older outer banks of the former flowpaths would impose excessive restriction on site use and results in VPZs of in excess of 70m from the current assumed creek bank.

In the north-eastern corner of the site it is proposed to bring the development boundary close to the actual top of bank as this ground has higher elevation and is most suited to development. While the development will pull significantly away from the creek line in the southern portion with setbacks in excess of 50m from the estimate top of bank. This balance of give and take with the VPZ is expected to provide an average VPZ approximately equivalent to the required VPZ across the site. Additionally, the proposed stormwater quality systems have been located outside of the VPZ. The site is primarily cleared grass lands with sporadic mature camphor laurels in the southern extent. As part of the development the VPZ would be revegetated with native endemic riparian plant species.

Figure 4-5 includes approximate mapping details of the potential development, including approximate location of top of bank (showing DEM and aerial underneath), along with the 30m VPZ to Maori Creek. It can be seen by eye that an approximate balance of area for the VPZ is achieved with the alignment. Further assessment of areas could be completed at later project stages as required.

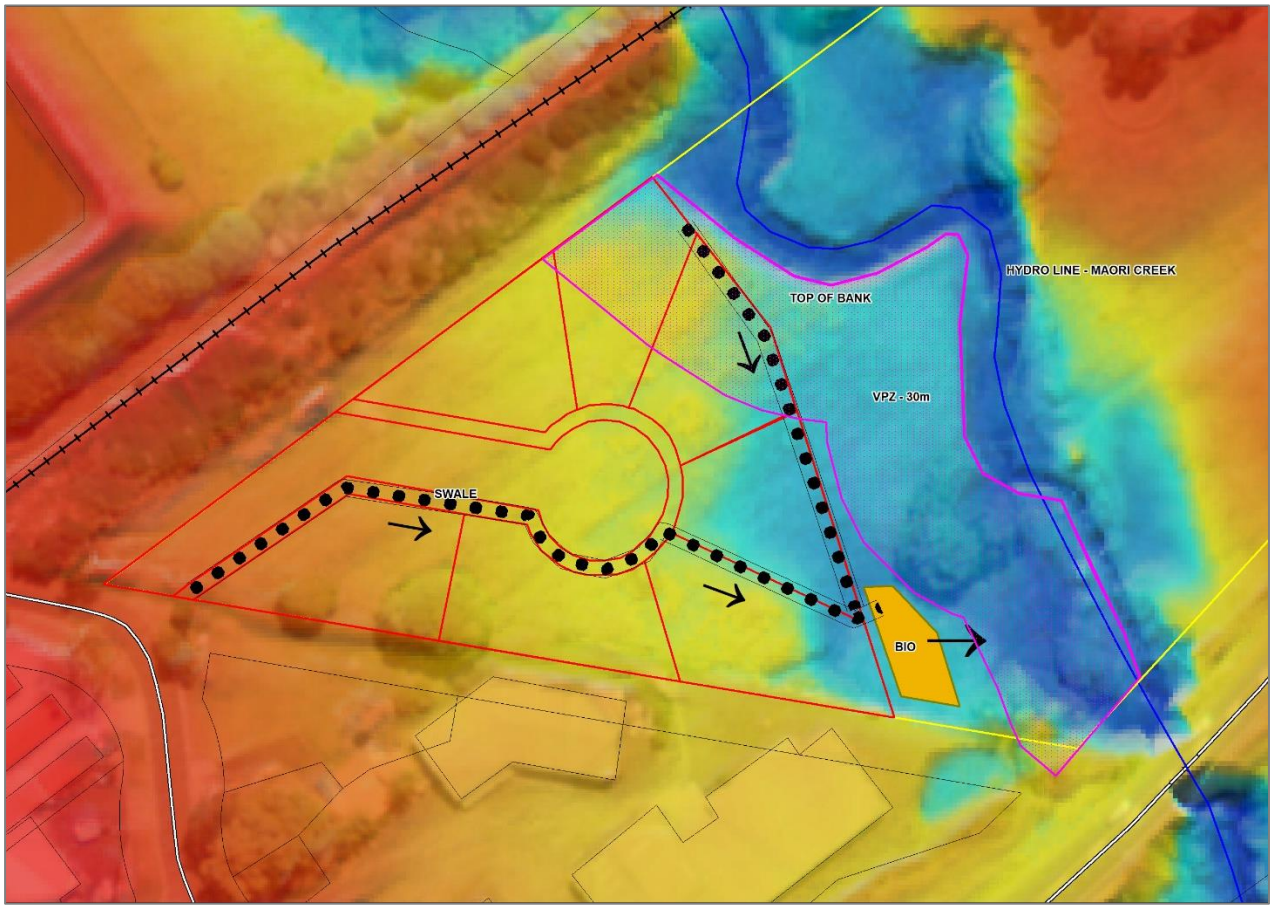

Figure 4-5 Approximate location of Hydro Line, Top of Bank and VPZ

5 Findings and Conclusions

This report has developed and assessed a conceptual stormwater quality and quantity system for the proposed industrial/commercial development adjacent the current Bangalow Industrial Estate.

Stormwater objectives are relevant for both water quality and quantity, where water quality objectives include a set of pollutant load reduction targets, and quantity objectives require mitigation of peak post-development flows to existing case conditions.

In terms of water quality, the assessment approach has been to utilise MUSIC to test the performance of the conceptual stormwater management systems and demonstrate achievement of Council's water quality objectives.

MUSIC models were established for the development based on diverting upstream flows and draining the site via swales to a bio-retention system. Site inspections completed during the study furthered site understanding of opportunities, constraints, and existing site features and assisted in the identification of potential stormwater management options and locations. The high-level conceptual design is also cognisant of riparian corridor locations and setbacks to the bank of Maori Creek.

The outcomes of the MUSIC modelling indicate that the stormwater objectives will be achieved for the development using a variety of standard water sensitive urban design approaches and proprietary systems. Design of the stormwater measures will ensure integration for the selected stormwater management measures with the civil design.

Water quantity modelling was completed using an XP-RAFTS hydrology model developed previously by BMT for the Byron Creek catchment. The model was initially used to test the benefit of a detention basin in the middle of a large rural area when connected to a relatively small impervious development (the Site). It was found that the inclusion of the new industrial area did not significantly increase the peak flows downstream from the Site and it is not recommended to include a detention basin in the current design.

Overall, this SMP, including the design and assessment of mitigation measures identifies that stormwater quality measures can be accommodated in the project, allowing it to achieve Council's stormwater management targets for water quality, subject to confirmation of assumptions, and further design to integrate solutions into the overall civil design of the site. Stormwater quantity management was found not to be required on the basis of the small additional contribution of peak flow from the Site to flows in Byron Creek which generate the highest peak flood levels in the area.

6 References

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Preliminary Contaminated Site Investigation
For proposed Rezoning at
Lot 4 DP635505,
150 Lismore Rd,
BANGALOW, NSW 2479

Melaleuca Group Pty Ltd

Report Number: 642 Version 1

Revision History

Revision	Date	Description	Prepared By	Distribution
A	20/05/2021	Draft	Dr Melissa Van Zwieten	A More, M Lyndon (NRLS)
B	21/05/2021	Final	Dr Melissa Van Zwieten	A More, M Lyndon (NRLS)

Date: 21st May 2021

Prepared for:
A More

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Executive Summary

Melaleuca Group Pty Ltd has been engaged by A More to complete a Preliminary (Contamination) Site Investigation (PSI) for Lot 4 DP635505, 150 Lismore Rd, Bangalow, NSW 2479. This investigation is to assess the potential risk for landusers at the site to allow for the approval of a rezoning proposal. The proposal is to rezone the southern portion of the site from RU1 Primary Production to IN1 General Industrial.

It is considered the site has potentially been used for Agricultural purposes for over 100 years with the majority of pursuits likely to have been low intensity such as grazing. That is, no intensive Agricultural pursuits are known to have occurred on the site. No historical structures are known to have existed.

The Investigation Area consists of lands in the southern portion of the site, south of Maori Creek. The Investigation Area is approximately 1.5ha. However, this includes some lands in close proximity to the creek and considered too low lying for the purposes of future development (i.e. riparian corridor). As such the Investigation Area was reduced to approximately 1ha.

A review of available historical imagery from 1958 has confirmed the verbal history provided to Melaleuca Group.

However, to determine with surety if soils at the site may be impacted by past landuses and the range of COCs identified, 21 samples were collected for laboratory analysis for the heavy metals of Lead and Arsenic. In addition, these samples were analysed for Organochlorine pesticides. Sample locations were based on a systematic sampling grid.

The results indicate soil contamination of the study area has not occurred by the Lead or Arsenic nor by any of the Organochlorine pesticides tested.

Based on the findings of this Preliminary Site Investigation, it is considered the Investigation Area would not represent a significant risk of harm to end users of the proposed Rezoning and subsequent Industrial land uses.

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1. Introduction

1.1 General

Melaleuca Group Pty Ltd has been engaged by A More to undertake a Preliminary (Contaminated) Site Investigation (PSI) and prepare a report for Lot 4 DP635505, 150 Lismore Rd, Bangalow NSW 2479. This investigation is to assess the potential risk for landusers at the site to allow for the approval of a rezoning proposal. The proposal is to rezone the southern portion of the site from RU1 Primary Production to IN1 General Industrial. Please refer to **Figure 1** for the site locality plan and **Figure 2** for the proposed site layout.

The objective of this preliminary investigation has been to determine if land contamination has occurred from historical and current land use activities occurring on site or immediately nearby. To determine if the site poses a significant risk of harm to end users (and nearby sensitive receptors), soil samples have been collected and analysed for a range of contaminants typically associated with the land uses identified as having occurred on site. The results of the soil analysis are compared to relevant EPA acceptable levels in order to assess the significance of risk.

This investigation is to Stage 1 of the Managing Land Contamination Planning Guidelines (DUAP and EPA, 1998). If contamination levels exceed the adopted EPA acceptable levels, a detailed investigation is then required (i.e. a Stage 2 investigation). If the contamination levels are below the relevant acceptable levels, and information gathered as part of the investigation also supports that contamination was unlikely to have occurred; only a Stage 1 investigation would be required.

This preliminary investigation has been used to identify the following:

- Past and present potentially contaminating activities occurring on or near the site; and
- The presence of Potential Contaminants of Concern associated with the identified land uses.

The investigation will also:

- Discuss the site condition;
- Provide a preliminary assessment of the site's contamination status; and
- Assess the need for further investigations.

Relevant documents considered in the preparation of this investigation included:

- Council of Standards Australia (2005) *AS 4482.1-2005 Guide to the sampling and investigation of potentially contaminated soil – Non-volatile and semi-volatile compounds*;
- NSW DEC (2017) *Contaminated Sites – Guidelines for the NSW Site Auditor Scheme 3rd Edition*;
- NSW EPA (1995) *Contaminated Sites – Sampling Design Guidelines*;
- NSW EPA (2020) *Consultants reporting on contaminated land, Contaminated land guidelines*; and
- National Environment Protection Council (NEPC) (2013) *National Environment Protection (Assessment of Site Contamination) Measure*

This preliminary assessment report is written in accordance with NSW EPA (2020) Consultants reporting on contaminated land, Contaminated land guidelines and the Northern Rivers Regional Councils (NRRC) Regional Policy for the Management of Contaminated Land (NRRC 2006).

1.2 Limitations

The findings of this report are based on the objectives and scope of work outlined above. Melaleuca Group Pty Ltd performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental assessment profession. No warranties or guarantees expressed or implied, are given. Subject to the scope of the work, Melaleuca Group Pty Ltd assessment is limited strictly to identifying typical environmental conditions associated with the subject site, and does not include evaluation of any other issues. This report does not comment on any regulatory issues arising from the findings, for which a legal opinion should be sought. This report relates only to the objectives and scope of work stated, and does not relate to any other works undertaken for the client.

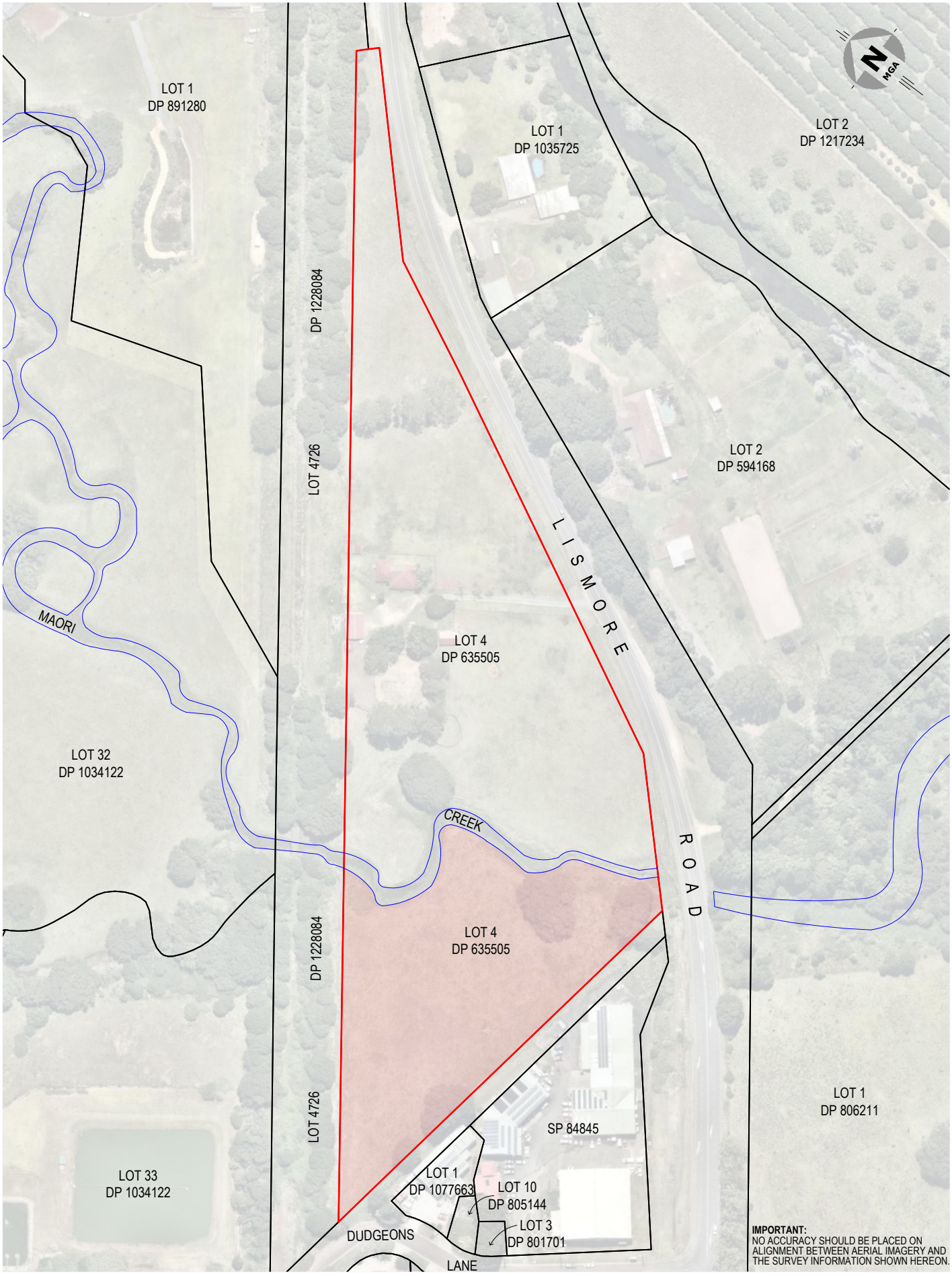
The report and conclusions are based on the information obtained at the time of the assessment. Changes to the subsurface conditions may occur subsequent to the investigation described herein, through natural processes or through the intentional or accidental addition of contaminants, and these conditions may change with space and time.

The site history and associated uses, areas of use, and potential contaminants were determined based on the activities described in the scope of work. Additional site information held by the client, regulatory authorities or in the public domain, which was not provided to Melaleuca Group Pty or was not sourced by Melaleuca Group Pty Ltd under the scope of work, may identify additional uses, areas of concern and/or potential contaminants. The information sources referenced have been used to determine the site history and desktop information regarding local subsurface conditions. Whilst Melaleuca Group Pty Ltd has used reasonable care to avoid reliance on data and information that is inaccurate and unsuitable, Melaleuca Group Pty Ltd is not able to verify the accuracy or completeness of all information and data made available.

Further chemicals or categories of chemicals may exist at the site, which were not identified in the site history, and which may not be expected at the site. The absence of any identified hazardous or toxic materials on the subject site should not be interpreted as a warranty or guarantee that such materials do not exist on the site. If additional certainty is required, additional site history or desktop studies, or environmental sampling and analysis should be commissioned.

Similarly, ground conditions including material types/composition can vary between sampling locations. Additionally, contaminants and combination of these can vary between sampling locations. These aspects should be considered when extrapolating between sampling locations. At each sampling location, the nature, extent and concentration of contamination is inferred only. However, the laboratory test methods used to characterise the contamination at each sampling location are also subject to limitations and provide only an approximation of the contaminant concentrations.

The results of this assessment are based upon site inspections and fieldwork conducted by Melaleuca Group Pty Ltd personnel and information provided by the client. All conclusions regarding the property area are the professional opinions of the Melaleuca Group Pty Ltd personnel involved with the project, subject to the qualifications made above. While normal assessments of data reliability have been made, Melaleuca Group Pty Ltd assume no responsibility or liability for errors in any data obtained from regulatory agencies, information from sources outside of Melaleuca Group Pty Ltd, or developments resulting from situations outside the scope of this project.



0 50m

Figure 1

NORTHERN RIVERS LAND SOLUTIONS
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BALLINA NSW 2478
PO Box 1324
M: 0414 217 664
P: 61 2 6681 6696
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SCALE:	1:2500 (A4)
SURVEYOR:	
DRAWN:	BB
DATE:	5th APR '18
CAD REF:	18023-01
CLIENT:	MORE
PROJECT:	
LGA:	BYRON
SOURCE:	AERIAL: NEARMAPS

LOCALITY PLAN
LOT 4 IN DP635505
150 LISMORE ROAD, BANGALOW

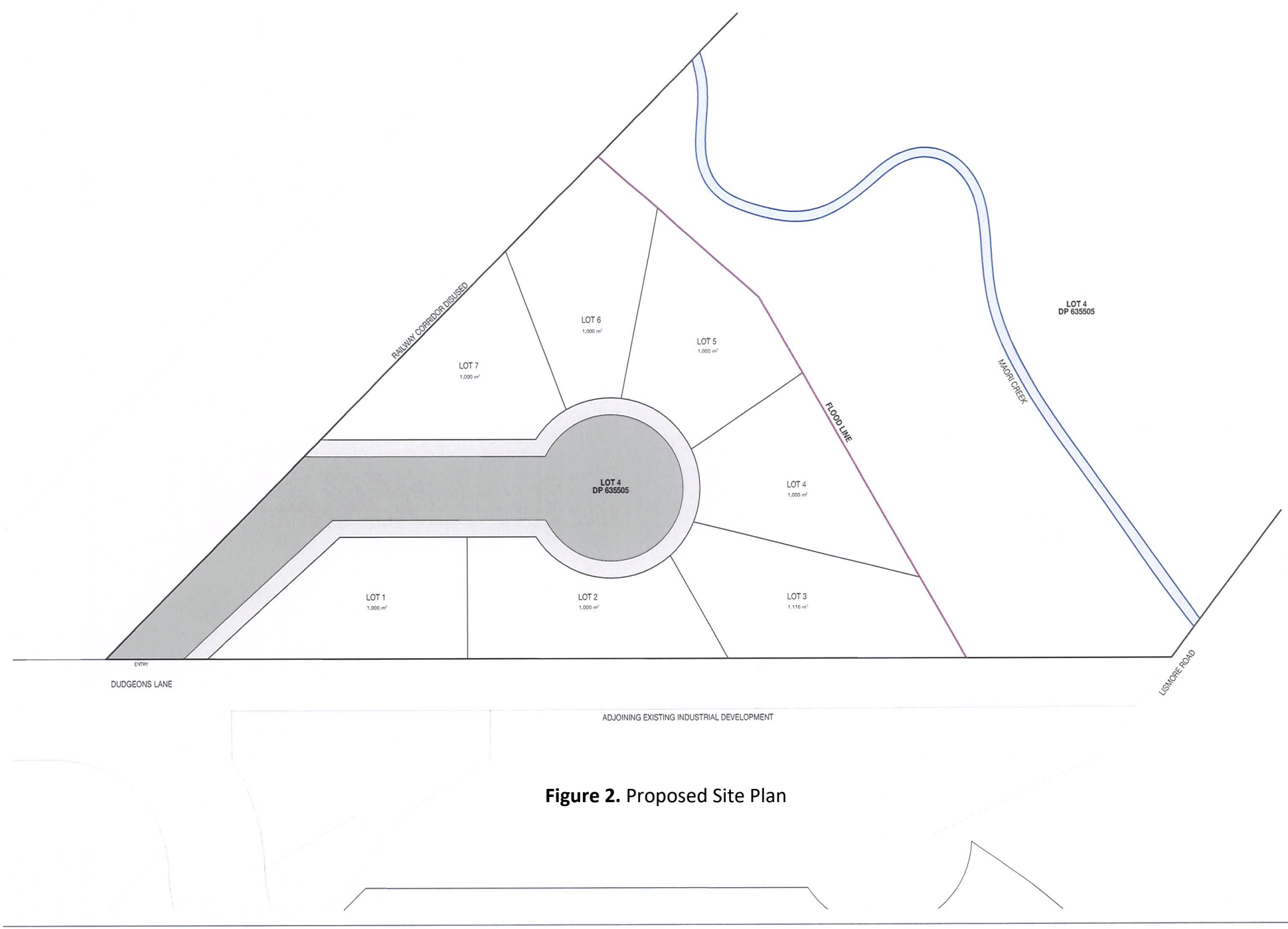

Figure 2. Proposed Site Plan

Beach Architects
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project
PROPOSED MIXED-USE DEVELOPMENT

address
150 Lismore Road
Bangalow

client
Andrew More

project stage
LAND REZONING

drawing name
Concept Site Plan E

project number	drawn by	checked
93	DC	DC

drawing #	scale	revision
02	see below	05

scale bar
0 5m 10m 15m 20m

drawing orientation

revision details

Rev.	Issue Name	Issued By	Issue Date	CO
05	Concept site	Dan	14/4/21	05

2. The Site

2.1 Site Identification

The subject site is approximately 4.65 ha.in size and irregular in shape. The site has two (2) road frontages. Lismore Road forms the eastern boundary of the site and access to the northern portions of the site and dwelling is from this road. Dudgeons Lane allows access into the current Investigation Area being located in the south-west corner of the allotment. That is, only the area south of Maori Creek (i.e. forms northern boundary) is the subject of this investigation and as such, access is from Dudgeons Lane. Industrial lands from the remainder of the southern boundary of the site. The disused Northern Rivers Railway forms the western boundary of the site.

Surrounding land uses include Rural-residential properties along with Industrial. Bangalow's Sewage Treatment Plant is located west of the site (on other site of disused railway). The site is located approximately 1.8 m south-west of the Bangalow CBD.

As indicated, the entire site is not the subject of this investigation. The Investigation Area is the area south of Maori Creek and includes both the riparian corridor and usable lands. As such, the total area is approximately 1.5ha, however, the usable land is estimated at approximately 1ha.

2.2 Zoning

The land is zoned RU1 Primary Production under the Byron LEP 2014. Lands surrounding the site are either similarly zoned (i.e. RU1 Primary Production) or zoned IN1 General Industrial (lands adjoining and to south).

2.3 Site Usages

The Site as a whole is considered to have been used for a number of Agricultural activities. It appears, usage has only been for the low-intensity activity of grazing.

Historical aerial images from 1958, 1979, 1987, 1991, 1997 (available from https://portal.spatial.nsw.gov.au/portal/apps/webappviewer/index.html?id=f7c215b873864d44bccddda8075238cb) and Google Earth images from 2004 were reviewed.

In the 1958 image, no structures are visible on the property. Similarly, no evidence of intensive Agriculture such as cropping is evident. Surrounding lands appear similar indicating broadscale grazing is likely on the site and surrounds. This site is relatively devoid of treed vegetation. No intensive Agricultural pursuits are evident. The site is presumed to have been once part of a larger holding. A review of available parish maps from 1917 and 1969 indicate the possibility of a larger allotment that extended to the north and east and west (i.e. nearly to outskirts of Bangalow and both beyond the railway to the west and Lismore Rd to the east). It is noted Dudgeons Lane formed the southern boundary of the site in 1958.

The 1979 image indicates the site still being used for grazing purposes. Few trees are present on the site with the exception of some trees along the western boundary. The Sewage Treatment Plant to the west can be seen in this image. Few other changes in landuses are visible in this image.

Industrial landuses to the south of the site are apparent in the 1987 image with these increasing in subsequent aerial imagery. Grazing is still apparent on the site. No dwellings or any other structures are visible. Tree growth is still considered low.

The current dwelling can be seen on imagery from 1991. This dwelling is located in the northern section of the site and well outside the bounds of the current Investigation Area.

Imagery from 1997 (to date) continues to show a site that is relatively devoid of trees, a single dwelling and no intensive Agricultural practices such as cropping.

This same imagery (i.e. 1997 to date) show the Industrial estate expansion. Dudgeons Lane is rerouted in the 1997 image. Increases in residential dwellings in the locality is apparent, especially with the expansion of Bangalow.

Thereby, in summary, it appears the site was predominantly used for non-intensive agricultural activities (i.e. grazing). If any intensive practices were undertaken at the site (and specifically within the Investigation Area), these were short-term activities and not captured by images.

Available historical imagery to 1997 are provided in Appendix A. General views of the Investigation Area in its current (2021) condition are also provided in Appendix A.

2.4 Inventory of Known Chemicals and Wastes and their Location

An inventory of chemicals and/or wastes stored at the site was not available. However, it is assumed, some general chemical use for property maintenance would have occurred throughout the site's history. It is surmised this would have been minimal as the site has only been used for grazing purposes. No historical structures are known to have existed within Investigation Area.

2.5 Possible Contaminant Sources

Despite the lack of recent or major use of chemicals at the site, historical use may be possible at the site. Table 1 below lists the sources of potential contamination at the site and their associated contaminants of concern.

Table 1: Potential Contaminants of Concern for Identified Activities

Identified Contaminant Source	Potential Contaminants	Targeted Contaminants
Agricultural Activities		
General maintenance (e.g. pasture management)	**Fertiliser** (Calcium phosphate, Calcium Sulfate, nitrates, ammonium sulfate, carbonates, potassium, copper, magnesium, molybdenum, boron, cadmium) **Fungicides** (carbamates, copper sulfate, copper chloride, sulfur, chromium, zinc) Herbicides (Ammonium Thyocyanate, carbamates, organochlorines, organophosphates, arsenic, mercury, triazines) **Pesticides** (Arsenic, lead, organochlorines, organophosphates, sodium tetraborate, carbamates, sulfur, synthetic pyrethroids)	**Metals** (Arsenic and Lead being common constituents of pesticides or Lead-based paints) **Pesticides** (a-BHC, Hexachlorobenzene, b-BHC, g-BHC (Lindane), d-BHC, Heptachlor, Aldrin, Heptachlor epoxide, transchlordane, Endosulfan I, cischlordane, Dieldrin, 4,4-DDE, Endrin, Endosulfan II, 4,4-DDD, Endosulfan sulfate, 4,4-DDT, Methoxyxhlor.

2.6 Historic Use of Adjacent Land

Historically, the general location has been dominated by a similar history as that outlined above (Section 2.3). That is, neighbouring properties are generally considered to have been used for grazing purposes only. The Sewage Treatment Plant is evident to the west from 1979 and the Industrial Estate to the south, appear to have commenced in the 1980s. Residential development has also occurred in the locality.

2.7 Local Usage of Ground/Surface Waters

A search of existing licensed groundwater bores within 250 m of the Investigation Area was conducted using the WaterNSW (2021) website. Only one (1) borehole is recorded within 250m. This groundwater bore (GW306083) is located approximately 220m north-west from the Investigation Area. The groundwater bore is described as being 5.9m deep, date of construct is 2006 as a Monitoring Bore. The Water Bearing Zone is recorded as being between 3.5 to 5.9m bgl with the Standing Water Level as 3.5m bgl. The location is considered upstream of the site. Given the topography, soil conditions and distance to nearest groundwater bore, it is considered unlikely any Contaminants of Concern, if located, would migrate to groundwater.

2.8 State and Local Authority Records

2.8.1 Contaminated Land Records

A search of the Contaminated Land Record (EPA 2021a) for the Byron Local Government Area (LGA) did not identify any site notices relating to the site or adjoining the site.

2.8.2 Protection of the Environment Operations Act Licenses

A search of the current list (EPA, 2021b) of licensed activities as per Schedule 1 of the Protection of the Environment Operations Act 1997 identified the Bangalow Sewage Treatment Plant to the west as holding a POEO licence.

2.8.3 Cattle Tick Dip Sites

The closest cattle dip site is known as DUDGEONS. This dip site is located approximately 900m to the south of the Site and Investigation Area and well outside the bounds of the 250m Investigation Buffer.

A search of the NSW Department of Primary Industry (DPI) Cattle Dip Site Locator tool (https://www.dpi.nsw.gov.au/animals-and-livestock/beef-cattle/health-and-disease/parasitic-and-protozoal-diseases/ticks/cattle-dip-site-locator) indicates the status of the dip site is 'lapsed' (which means the dip is still standing, capable of dipping operations either immediately or with some minor refurbishment).

3. Site Inspection and Condition

3.1 Topography

The Investigation Area is considered to be relatively flat to gently sloping for the majority of the area. The area includes some steep embankments of Maori Creek. Elevation across the site ranges from approximately 45 to 50m AHD. The Investigation Area has similar elevations.

3.2 Visible Signs of Contamination

The Investigation Area was investigated on foot in order to identify any signs of contamination. No obvious signs of contamination (such as plant stress, surface spills, waste materials, odours etc.) were evident during the site investigation.

A visual inspection of adjacent land to the Investigation Area was also completed. There were no clearly visible signs of contamination adjoining the Investigation Area.

3.3 Flooding Potential

The Investigation Area in general is not mapped as flood liable. However, areas immediately adjacent to Maori Creek are mapped in the 1 in 100 yr flood zone.

3.4 Locally Sensitive Environments

There are no known sensitive environments adjacent to the site such as Coastal Wetlands or Littoral Rainforest (SEPP (Coastal Management) 2018). The areas immediately adjacent to Maori Creek are identified on the Biodiversity Values Map (*Biodiversity Conservation Act* 2016).

3.5 Local Geology and Soil Description

NSW DPI (2004) describes the geology of the majority of the Investigation Area as Tertiary volcanics - Lismore Basalts. The area in the vicinity of Maori Creek is described as having an alluvial geology (Quaternary Valley fill). Morand (1994) describes the geology of the entire Investigation Area as being Lamington Volcanics: Lismore Basalts - Tertiary basalt with bole and minor agglomerate.

The Investigation Area is mapped by Morand (1994) as being the residual soil landscape unit *Ewingsdale* (ew) which are described as:

> **Landscape** – very low to low undulating hills and rises on Lismore Basalts. Relief 10-30m, sloes 3-10%. Extensively cleared closed-forest, now generally sod grassland.
>
> **Soils** – deep (100-300cm), well-drained Krasnozems (Gn3.11, Gn4.11, Uf5.21, Uf6).
>
> **Limitations** – soils of low available water-holding capacity and high aluminium toxicity potential with localised stoniness. Localised mass movement hazard (shallow slumping along drainage lines).

While only upper soils (i.e. samples collected in upper 0-150mm) were investigated, observations made and soils encountered in this Investigation Area were considered consistent to that described above.

3.6 Location and Extent of Imported and Locally Derived Fill

No fill (imported or site-derived) was observed during site investigations.

3.7 Location of Bore Hole Tests

All soil samples were taken from surface samples, thus no boreholes were constructed for this investigation.

3.8 Depth to Groundwater Table

Depth to groundwater was not investigated for this investigation. Given the elevation and topography of the site, it is considered likely groundwater would be relatively deep. However, some perched groundwater may be shallow and in connection to Maori Creek. Thereby, while it is acknowledged some perched groundwater may exist, these aquifers are likely to be relatively small.

3.9 Local Meteorology

The average annual rainfall recorded at the Byron Bay (Cape Byron Automated Weather Station; closest open station) is 1,458.6mm, with the highest volume of rainfall (>100mm) generally falling between December through to April (June also records an average rainfall >100mm). The driest months are July to September. The average maximum temperature is 28.1°C (in summer) and the average minimum temperature is 12.3°C (in winter). Rainfall is considered to be relatively consistent between Bangalow and Byron, however, temperatures would be expected to have a broader range given further from the coastline.

4. Conceptual Site Model Development

A Conceptual Site Model (CSM) considers all the site-specific geophysical characteristics along with the contamination source, potential receptors and pathways to the receptors. This is a dynamic process that is constantly being updated during the investigation process as additional information becomes available. Prior to completing field work, a CSM was developed to allow for the design of a sampling strategy.

Figure 3 illustrates the Preliminary Conceptual Site Model with the various considerations provided in the following sections.

4.1 Areas of Environmental Concern

The Area of Environmental Concern (i.e. the entire Investigation Area) is considered to be that which coincides with past use of the site (grazing).

4.2 Potential Contaminants of Concern

A range of possible contamination sources and targeted COCs are detailed in Table 1, Section 2.5. These PCOCs are summarised in Table 2 below based on the historical landuses at the site (and within the Investigation Area. That is, the PCOCs listed are considered the most likely to have been used and/or provide an indicator for usage rates of chemicals at the site.

Table 2 Potential Contaminants of Concern based on Areas of Concern

Area of Environmental Concern	Potential Contaminants of Concern
Investigation Area Agricultural Activities: Grazing	**Heavy Metals** (e.g. Lead from lead-based paints on historical structures, if once present (none known); Arsenic from pesticides) **Organochlorine Pesticides** (e.g. Dieldrin often used as an insecticide)

4.3 Potential Impacts on Groundwater

In general, it is not considered likely that any PCOCs would have migrated to groundwater. Groundwater is considered likely to be deep. However, if shallow perched aquifers do exist, the clay content of the local soils is likely to bind with PCOCs. That is, the majority of COCs are known to bind tightly to organic matter and clay particles. As the uppers soils of the site are considered relatively high in clay and/or organic matter, it is considered any COCs present would be bound to the upper soil layers. As such, leaching of any PCOC is considered unlikely. Only with physical soil movement (i.e. burial) would impact soils have an opportunity to come in contact with groundwater.

4.4 Potential Exposure Pathways and Receptors of Contamination

Potential Exposure pathways are through contact with soils impacted by COCs. This contact may occur on or off-site through soil ingestion and/or inhalation. Transport mechanisms can be through wind and water erosion, soil movement (i.e. by man) and/or leaching of COCs into groundwater.

Potential receptors include on and off-site residents and sensitive ecosystems in the locality.

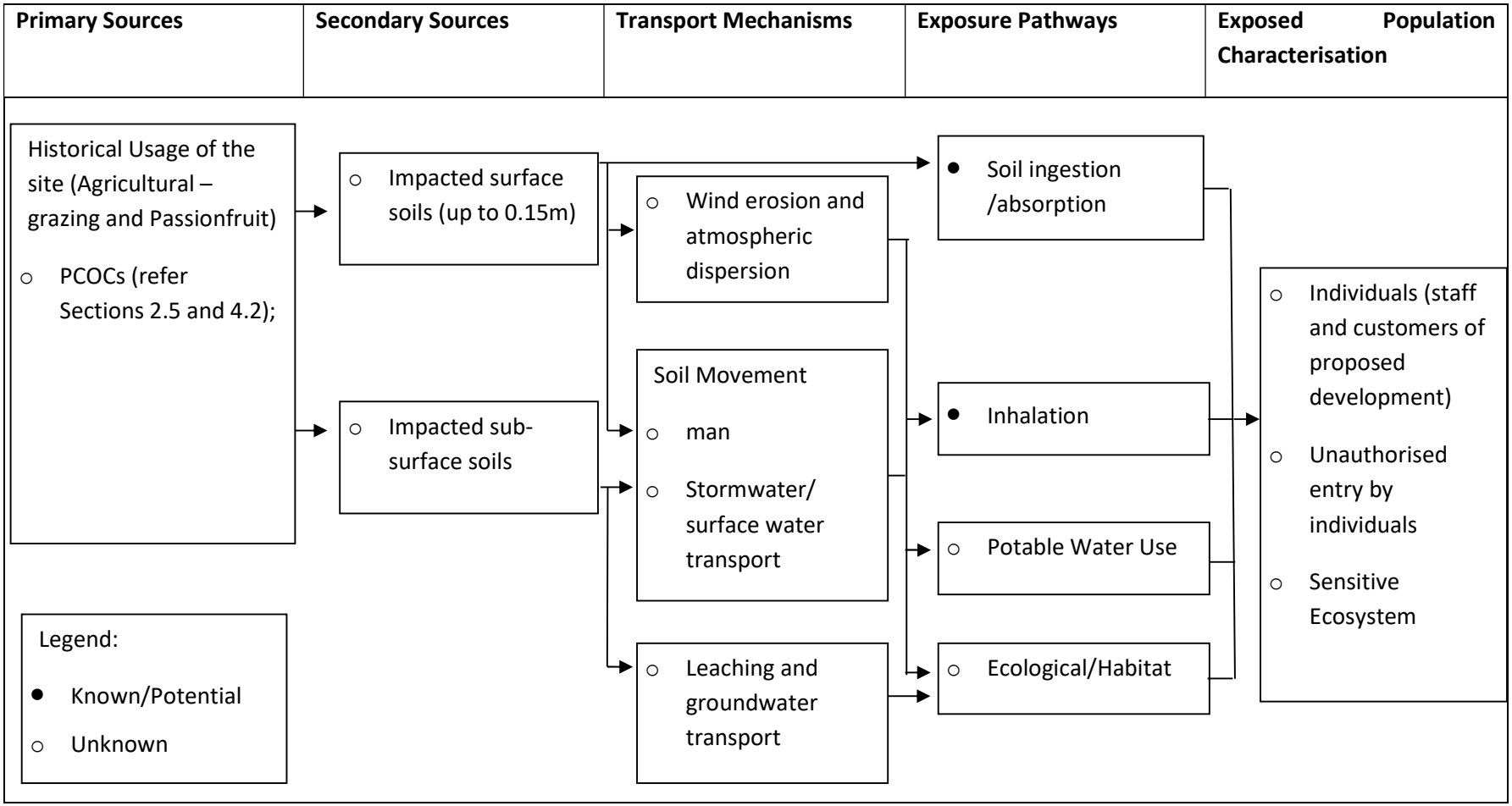

Figure 3. Preliminary Conceptual Site Model - Flow Diagram

5. Sampling and Analysis Plan and Sampling Methodology

5.1 Sampling, Analysis and Data Quality Objective (DQOs)

The objective of this preliminary investigation is to gather information with regard to the type, location, concentration and distribution of contaminants to determine if the subject site represents a risk of harm to end users and sensitive receptors. To determine this, soil sampling and laboratory analysis has been conducted upon surface soils collected from the study area.

5.2 Rationale

While the Investigation Area is considered to be approximately 1.5ha in size this also includes lands immediately adjacent to Maori Creek. These areas have been excluded from sampling as it is considered highly unlikely any structures would have been placed this close to the creek. Further, any intensive agricultural pursuits also would not have occurred in these areas.

As such, the area identified for soil sample was considered approximately 1 ha. The NSW EPA Sampling Guidelines indicates a minimum of 21 samples should be collected across this area. With no evidence of structures of intensive agricultural pursuits, it was determined this was considered appropriate and sample locations were based on a systematic grid-like pattern. **Figure 4** indicates the location of each individual sample point.

All soils were found to be Red Clay Loam consistent with the *Ewingsdale* soil landscape. Samples were analysed for Lead and Arsenic and organochlorine (OC) pesticides (including Aldrin, Cis-chlordane, Trans-chlordane, HCB, DDD, DDE, DDT, Alpha-BHC, Beta-BHC, Delta-BHC, Lindane, Dieldrin, Endrin, Heptachlor, Heptachor epoxide, Alpha-endosulfan, Beta-endosulfan, Endosulfan sulfate, Methoxychlor).

Organophosphate (OP) pesticides were not analysed as the site history did not identify any likelihood of these pesticides occurring and no elevated levels of OC or arsenic were identified at the site (samples are stored for OP analysis if required). The bacterial decomposition of OP pesticide is very rapid and the occurrence of elevated levels of OP's in the environment is rare (i.e. based on over 1000 soils analysed in soils of Northern NSW by EAL).

Polychlorinated Biphenyls (PCBs) were not analysed, as a source of contamination was not identified (i.e. PCB sources identified from electrical supply industry or mining). TPH and BTEX were also not analysed on the soils as these organic analytes are only typically analysed for service station sites, or at sites with above or under-ground onsite hydrocarbon storage. Similarly, Poly-Aromatic Hydrocarbons (PAH) was not analysed as this COC is usually associated with fill material which were not located on the site.

5.3 Sampling Methodology

Surface samples (0 – 150mm depth) were collected using a stainless-steel spade, with soil being placed in snap lock plastic sample bags. The sampling procedure utilised in this investigation was in accordance with AS 4482.1 – 2005.

All soil samples were placed into an esky with ice bricks, and delivered to the Environmental Analysis Laboratory at Southern Cross University, Lismore. Refer to Appendix B for the laboratory certificate.

Figure 4. Sampling Plan.

6. Basis for Assessment Criteria

The acceptable limits of the parameters tested are based on the NSW DEC (2017) Contaminated Sites - Guidelines for the NSW Site Auditor Scheme (3rd Edition) and the NEPM (2013) guidelines. In particular Column 1 of Table 'Soil Investigation Levels for Urban Redevelopment Sites in NSW'. Column 1 represents Human - Based Investigation Levels (HBIL) for developments being 'Residential with gardens and accessible soil including children's daycare centres, preschools, primary schools, town houses or villas'. The investigation levels adopted for this investigation are presented below in Table 3.

Table 3: Soil investigation levels of key COCs (NEPC 2013).

Contaminant	Acceptable Limit Column 1 (mg/kg)	Ecological Investigation Limit
Arsenic	100	100
Lead	300	1,100
OC's (aldrin and dieldrin)	6	..
OC's (DDT, DDD, DDE)	240	..

6.1 Background Levels

Metals occur naturally within soils and are a natural constituent of geological materials that erode and assist in the formation of soils. The background levels of metals analysed, obtained from ANZECC and NHMRC (1992) Table 4 'Environmental Soil Quality Guidelines', are presented below in Table 4.

Table 4: Background ranges for potential contaminants.

Contaminant	Background Range (mg/kg)
Arsenic	0.2 – 30
Lead	<2 – 200

7. Results

The results from the laboratory soil testing regime and comparison to the guideline limits is provided below in Table 5. The soil sampling numbers correlate with the soil sampling locations as shown on **Figure 4**.

Results for both Lead and Arsenic are provided below. For organochlorine pesticides, 27 chemical constitutes of these organochlorine pesticides were tested for. A summary of these results are provided below with full results provided in Appendix B.

All metals were found to be within expected background ranges and below the adopted assessment criteria.

Organochlorine pesticides were below detection levels in all samples.

The duplicate sample returned similar concentrations for all Contaminants of Concern tested, thereby provides quality assurance on the field and laboratory testing effort. The rinsate sample also returned acceptable results (i.e. metals below detection levels).

Table 5: Results – Heavy Metals and Organochlorine Chemicals

Contaminant	SP1	SP2	SP3	SP4	SP5	SP6	SP7	Acceptable Limit (mg/kg)	Background Range (mg/kg)
Arsenic (mg/kg)	4	2	2	2	2	5	2	**100**	**0.2 – 30**
Lead (mg/kg)	9	7	7	21	21	27	7	**300**	**<2 – 200**
DDT (mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**240**	**<0.2**
Aldrin + Dieldrin (mg/kg)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**6**	**<0.2**
Other Organochlorine Pesticides- SUM (mg/Kg)	ND	ND	ND	ND	ND	ND	ND	**..***	**<0.2**

ND: Not Detected; *Other Organochlorine limits exist. If detected, these chemicals would have been presented

Table 5 (cont): Results – Heavy Metals and Organochlorine Chemicals

Contaminant	SP8	SP9	SP10	SP11	SP12	SP13	SP14	Acceptable Limit (mg/kg)	Background Range (mg/kg)
Arsenic (mg/kg)	2	1	2	2	2	1	1	**100**	**0.2 – 30**
Lead (mg/kg)	7	7	12	19	21	7	10	**300**	**<2 – 200**
DDT (mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**240**	**<0.2**
Aldrin + Dieldrin (mg/kg)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**6**	**<0.2**
Other Organochlorine Pesticides- SUM (mg/Kg)	ND	ND	ND	ND	ND	ND	ND	**..***	**<0.2**

*Other Organochlorine limits exist. If detected, these chemicals would have been presented

Table 5 (cont): Results – Heavy Metals and Organochlorine Chemicals

Contaminant	SP15	SP16	SP17	SP18	SP19	SP20	SP21	Acceptable Limit (mg/kg)	Background Range (mg/kg)
Arsenic (mg/kg)	2	2	1	1	1	1	1	**100**	**0.2 – 30**
Lead (mg/kg)	19	18	8	8	16	10	13	**300**	**<2 – 200**
DDT (mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**240**	**<0.2**
Aldrin + Dieldrin (mg/kg)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**6**	**<0.2**
Other Organochlorine Pesticides- SUM (mg/Kg)	ND	ND	ND	ND	ND	ND	ND	**..***	**<0.2**

*Other Organochlorine limits exist. If detected, these chemicals would have been presented

8. Discussion and Conclusion

A Preliminary (Contamination) Site investigation (PSI) for the development at the site was warranted to ensure past land uses have not resulted in contamination. If located, the PSI would identify the requirement for additional investigations.

It is considered the site has potentially been used for Agricultural purposes for over 100 years with the majority of pursuits likely to have been low intensity such as grazing. It is known the site was clear of treed vegetation in 1958 representing a 63-year history for the site (and Investigation Area).

A review of available historical imagery (from 1958) has confirmed the verbal history provided to Melaleuca Group. No intensive agricultural pursuits such as cropping areas were observed indicating with the predominant landuse has been grazing.

However, to determine if soils at the site may be impacted by the range of COCs identified, 21 samples were collected for laboratory analysis for the heavy metals of Lead and Arsenic. In addition, these samples were analysed for Organochlorine pesticides. Samples were located in a systematic grid-like pattern across the area.

The results indicate soil contamination of the study area has not occurred by the Lead or Arsenic nor by any of the Organochlorine pesticides tested.

Based on the findings of this Preliminary Site Investigation, it is considered the Investigation Area would not represent a significant risk of harm to end users of the proposed rezoning proposal.

9. References

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Melaleuca Group declares that does not have, nor expects to have, a beneficial interest in the subject project.

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The work was conducted, and the report has been prepared, in response to specific instructions from the client or a representative of the client to whom this report is addressed, within the time and budgetary requirements of the client, and in reliance on certain data and information made available to Melaleuca Group. The analysis, evaluations, opinions and conclusions presented in this report are based on that information, and they could change if the information is in fact inaccurate or incomplete.

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Appendices

Appendix A: Historical Information and Site Photographs

Figure A1. 1958 Historical Aerial of Investigation Area and surrounding area of site. Approximate location of Investigation Area is circled.

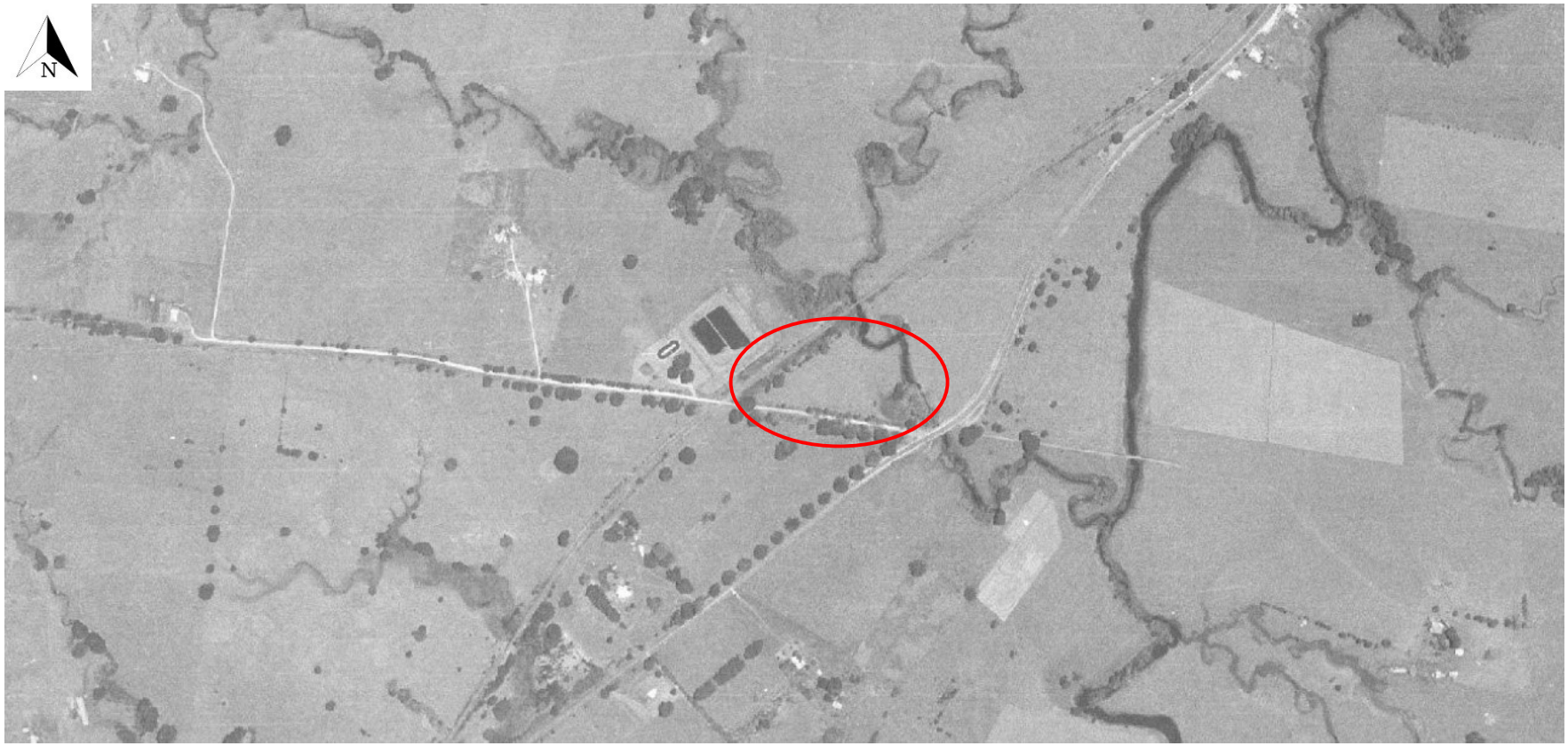


Figure A2. 1979 Historical Aerial of Investigation Area and surrounding area of site. Approximate location of Investigation Area is circled.

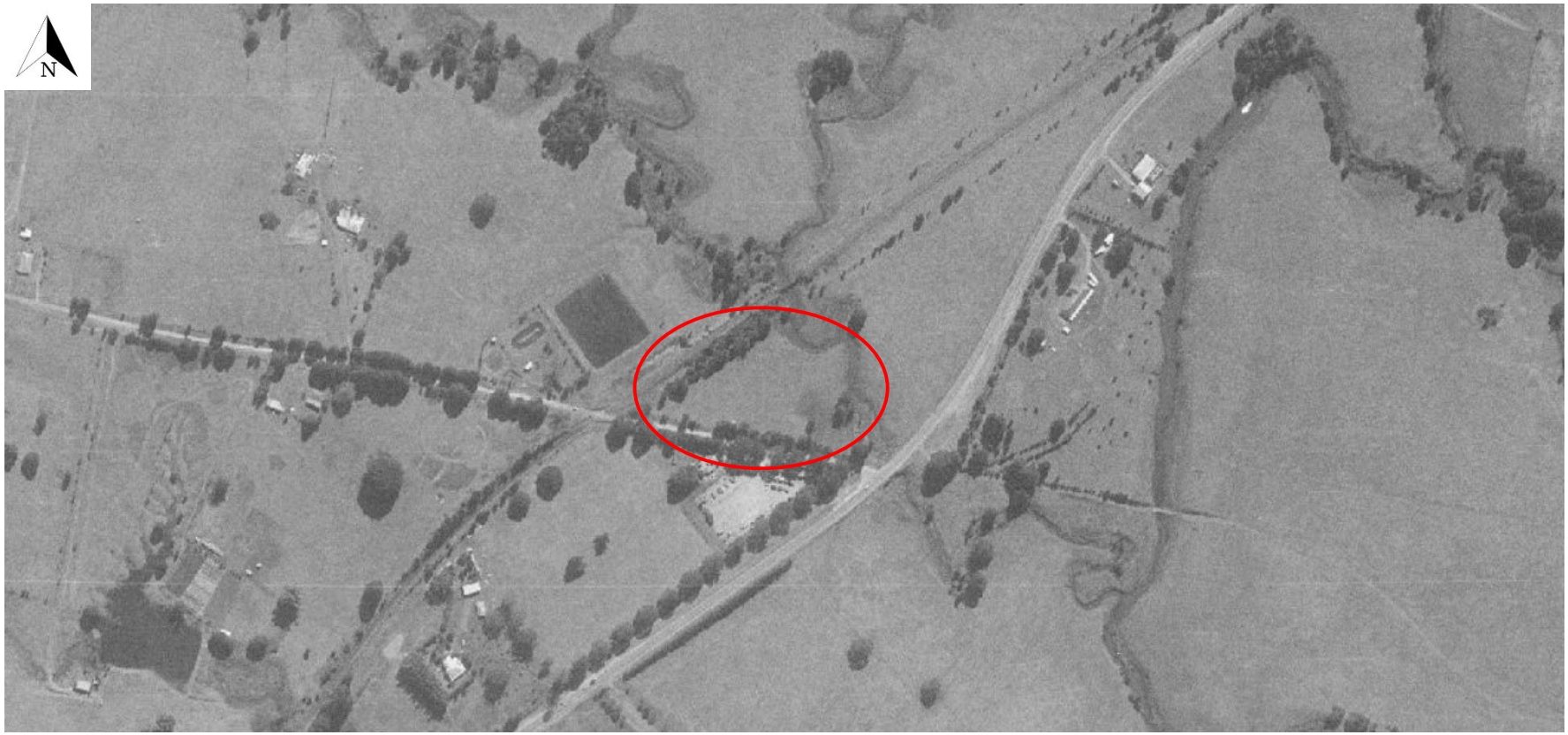


Figure A3. 1987 Historical Aerial of Investigation Area and surrounding area of site. Approximate location of Investigation Area is circled.

Figure A4. 1991 Historical Aerial of Investigation Area and surrounding area of site. Approximate location of Investigation Area is circled.

Figure A5. 1997 Historical Aerial of Investigation Area and surrounding area of site. Approximate location of Investigation Area is circled.

Plate A1. General view Investigation Area (Photograph taken at entrance from Dudgeons Lane)

Plate A2. General north-easterly view of Investigation Area (Photography taken near SP7).

Plate A3. General westerly view of Investigation Area (Photograph taken near SP6)

Plate A4. General view of Maori Creek (Photograph taken near SP21 with southerly view).

Appendix B: Laboratory Results

RESULTS OF SOIL ANALYSIS

22 samples supplied by Melaleuca Group Pty Ltd on 7/05/2021 . Lab Job No. K6656.

Samples submitted by Melissa Van Zwieten. Your Job: Andrew More Soil.

118 Beacon Road TEVEN NSW 2478

ANALYTE	METHOD REFERENCE	Sample 1 SP1	Sample 2 SP2	Sample 3 SP3	Sample 4 SP4	Sample 5 SP5	Sample 6 SP6	Sample 7 SP7	Sample 8 SP8	Sample 9 SP9	Sample 10 SP10
	Job No.	*K6656/1*	*K6656/2*	*K6656/3*	*K6656/4*	*K6656/5*	*K6656/6*	*K6656/7*	*K6656/8*	*K6656/9*	*K6656/10*
TEXTURE (SAND, CLAY, SILT)	** inhouse	Silt	Silt	Silt	Silt	Silt	Silt	Silt	Silt	Silt	Silt
MOISTURE %	** c	32	33	32	41	36	28	32	31	37	39
ARSENIC (mg/kg DW)	*a*	4	2	2	2	2	5	2	2	1	2
LEAD (mg/kg DW)	*a*	9	7	7	21	21	27	7	7	7	12
PESTICIDE ANALYSIS SCREEN											
Hexachlorobenzene (HCB) (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor epoxide (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o,p'-DDE (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alpha Endosulfan (mg/kg)	*c*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
p,p'-DDE (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin (mg/kg)	*c*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Endrin (mg/kg)	*c*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o,p'-DDD (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o,p'-DDT (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Beta Endosulfan (mg/kg)	*c*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
p,p'-DDD (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
p,p'-DDT (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan sulphate (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Ketone (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Organochlorine Pesticides SUM (mg/kg)	*c*	*N.D.*	*N.D.*	*N.D.*	*N.D.*	*N.D.*	*N.D.*	*N.D.*	*N.D.*	*N.D.*	*N.D.*

METHODS REFERENCE:

a. [13]Nitric/HCl digest - APHA 3125 ICPMS

b. [13]Nitric/HCl digest - APHA 3120 ICPOES

c. Analysis sub-contracted - SGS report no. SE219496.. N.D. denotes Not Detected.

*** denotes these test procedure or calculation are as yet not NATA accredited but quality control data is available*

NOTES:

1a. HIL A Residential with garden/accessible soil (home grown produce <10% fruit and vegetable intake (no poultry), also includes childcare centres, preschools and primary schools

1b. HIL B Residential with minimal opportunities for soil access; includes dwellings with fully and permanently paved yard space such as high-rise buildings and apartments.

1c. HIL C Public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools and footpaths. This does not include undeveloped public open space.

1d. HIL D Commercial/industrial, includes premises such as shops, offices, factories and industrial sites.

(REFERENCE: Health Investigation Guidelines from NEPM (National Environmental Protection, Assessment of Site Contamination, Measure), 2013; Schedule B1).

2. Environmental Soil Quality Guidelines, Page 40, ANZECC, 1992.

3a.Table 1 Maximum values of specific contaminant concentrations for classification without TCLP (NSW EPA 2014, Waste Classification Guidelines Part 1: Classifying Waste)

3b.Table 2 Maximum values for leachable concentrations and specific contaminant concentrations when used together (NSW EPA 2014, Waste Classification Guidelines Part 1: Classifying Waste)

4. Analysis conducted between sample arrival date and reporting date.

5. ** NATA accreditation does not cover the performance of this service.

6. .. Denotes not requested.

7. This report is not to be reproduced except in full.

8. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (refer scu.edu.au/eal or on request).

9. Results relate only to the samples tested.

10. This report was issued on 19/05/2021.

Additional NOTES:

DW = Dry Weight. na = no guidelines available

NATA WORLD RECOGNISED ACCREDITATION
Accreditation No. 14960
Accredited for compliance with ISO/IEC 17025 - Testing

checked: .....
Graham Lancaster (Nata signatory)
Laboratory Manager

Sample 11	Sample 12	Sample 13	Sample 14	Sample 15	Sample 16	Sample 17	Sample 18	Sample 19	Sample 20	Sample 21	Sample 22	*RESIDENTIAL A Guideline Limit*	
SP11	**SP12**	**SP13**	**SP14**	**SP15**	**SP16**	**SP17**	**SP18**	**SP19**	**SP20**	**SP21**	**SP18d**	***Composite - Column A***	***Individual - Column A***
K6656/11	*K6656/12*	*K6656/13*	*K6656/14*	*K6656/15*	*K6656/16*	*K6656/17*	*K6656/18*	*K6656/19*	*K6656/20*	*K6656/21*	*K6656/22*	*See note 1a*	*See note 1a*
Silt	Silt	Silt	Silt	Silt	Silt	Silt	Silt	Silt	Silt	Silt	Silt	..	..
39	30	38	33	38	37	36	34	34	31	35	31	..	..
2	2	1	1	2	2	1	1	1	1	1	1	*25*	*100*
19	21	7	10	19	18	8	8	16	10	13	8	*75*	*300*
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*3*	*10*
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*2*	*6*
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*2*	*6*
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*2*	*6*
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*60*	*240*
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	..	..
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*60*	*240*
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	*2*	*6*
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	*3*	*10*
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*60*	*240*
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*60*	*240*
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	..	..
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*60*	*240*
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*60*	*240*
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*68*	*270*
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*3*	*10*
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*75*	*300*
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*3*	*10*
N.D.	*N.D.*	*N.D.*	*N.D.*	*N.D.*	*N.D.*	*N.D.*	*N.D.*	*N.D.*	*N.D.*	*N.D.*	*N.D.*	..	..

checked: .....
Graham Lancaster (Nata signatory)
Laboratory Manager

Attention : Andrew More

20th May 2021

Dear Andrew,

Proposed Industrial Subdivision
Lot 4 in DP 635505
150 Lismore Road, Bangalow
Traffic Engineering Assessment

I refer to your request for our assessment and report regarding a proposed industrial subdivision at the above location.

1. The Location of the Site

The location of the subject site is shown in attached Fig 1.

The site is located immediately adjacent to Lismore Road. However, all vehicle access is proposed to be via Dudgeons Lane which intersects with Lismore Road.

2. Road Classifications and Management

Lismore Road is a state controlled road managed by the NSW Department of Marine and Road Services.

Dudgeons Lane is a local road managed by Byron Shire Council.

3. The Proposed Subdivision

It is understood that development plans are only preliminary at this stage. However, TPS has made a traffic engineering assessment of the subdivision proposal based on the attached Lot Layout shown in Fig 2.

The "Indicative Lot Layout" plan shows the following potential Lot development and building gross floor areas (based on gfa = 50% of Lot area).

Lot No.	Usable Area (sq.m.)	Gross Floor Area (gfa)
1	1,000	500
2	1,000	500
3	1,116	500
4	1,000	500
5	1,000	500
6	1,000	500
7	1,000	500
Total	7,116	3,500

TPS Traffic & Parking Systems Pty Ltd
ABN: 97 137 698 278

Unit 1, 9 Technology Drive, Arundel 4214
PO Box 3062
Helensvale Town Centre, 4212

t 1300 997 026

sales@trafficparking.com.au

4. Development Traffic Generation

Recent surveys conducted by RMS and reported in RMS Technical Direction 2013/04A describes the following traffic generation rates for industrial estates of the type expected to be developed on the subject land.

Business parks and industrial estates

In 2012 eleven of these two types of sites were surveyed, four within the Sydney urban area, four within the Lower Hunter, one in the Illawarra and one in Dubbo. Summary vehicle trip generation rates were as follows:

Weekday Rates	Sydney Average	Sydney Range	Regional Average	Regional Range
AM peak (1 hour) vehicle trips per 100 m^2 of GFA.	0.52	0.15-1.31	0.70	0.32-1.20
PM peak (1 hour) vehicle trips per 100 m^2 of GFA.	0.56	0.16-1.50	0.78	0.39-1.30
Daily total vehicle trips	4.60	1.89-10.47	7.83	3.78-11.99

The RMS survey findings confirm survey results from Queensland where generation rates for industrial developments were found to lie in the range of 5.0vpd/100sq.m.(gfa) to 10.0vpd/100sq.m.(gfa) depending on the location of the development and the nature of industrial activity being conducted.

Based on the RMS "Regional Average" survey findings reported in the above table, the proposed subdivision will generate the following approximate traffic movements when the development is complete.

Probable Traffic Generation (VPH In+Out)

	Vehs (in+out)
AM Peak Hour	25
PM Peak Hour	30
Daily	275

5 Existing Traffic Volumes

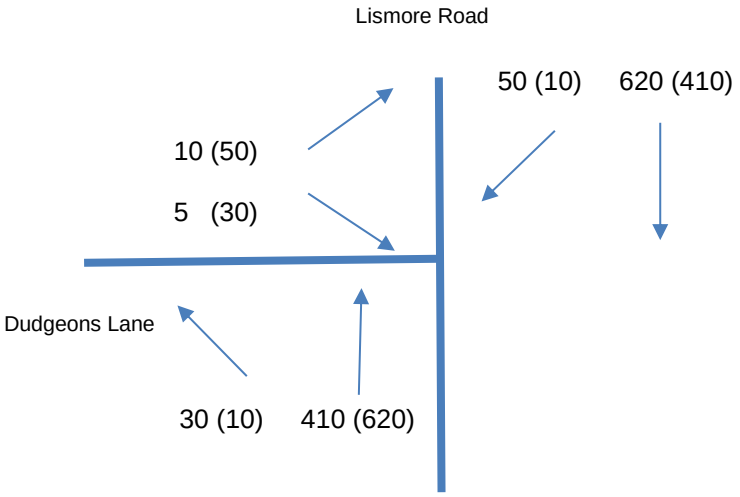
TPS does not have traffic survey data for the Lismore Road / Dudgeons Lane intersection. However, RMS published survey data indicates that Lismore Road carried approximately 6,600 vpd at the site in 2011. There is no more recent RMS data published for Lismore Road in proximity to the subject site.

Assuming a compound annual growth rate of 2% in the 10yr period 2011 to 2021, Lismore Road would currently be carrying approximately 8,100 vpd past the site. Assuming that a 2% compound rate continues for the next 12 years (10yrs following completion of the development), Lismore Road will carry approximately 10,300vpd past the site in 2033.

Aerial photography indicates that there is currently approximately 9,000 sq.m.(gfa) of industrial development in the existing industrial estate which is serviced via the Dudgeons Lane and Lismore Road intersection. Based on the RMS "Regional Average" rates shown in the Table in Section 4 above, the existing development generates approximately 700 vpd (in+out) and 70vph in peak hours via the Dudgeons Lane / Lismore Road intersection.

6. Estimated Future (2033) Traffic Volumes Following the Subject Development

Based on the estimates given in Sections 4 and 5 of this report we estimate that peak hour intersection volumes in 2033 following the subject development will be approximately as shown in the following diagram.



Estimated 2033 AM (PM) Peak Hour Traffic Volumes

7. Current Lismore Road / Dudgeon Lane Intersection Design

The existing intersection configuration is of considerable quality, consisting of a right turn lane, left turn lane and acceleration lane as shown below in aerial photography. All these lanes are approximately 160m in length, including tapers.

Whilst the posted speed zone in which the subject intersection is located is 80kph, the existing intersection design is consistent with a 100kph design speed (Ref :Table 5.2, AustRoads GRD Part 4A).

8. Estimated Future Intersection Capacity

Based on estimated future traffic volumes shown in Section 6, an assumed truck content of 7.5% (based on RMS data) and SIDRA 9.0 analysis, the intersection will operate with degrees of saturation and queue lengths in 2033 shown in the following SIDRA 9.1 outputs. That is, presuming that the subdivision is fully developed to the maximum potential indicated in Section 3 by 2033.

The most critical traffic movements (from a capacity and safety perspective) are the right turn movement out of Dudgeons Lane to Lismore Road and the right turn movement from Lismore Road to Dudgeons Lane in peak hours.

The SIDRA analyses for 2033 peak hours indicate that the intersection is capable of providing safely for the subject subdivision, even if subdivision generated traffic movements and movements in Lismore Road were to be substantially higher than those estimates shown in Section 6.

LANE SUMMARY

Site: 101 [Lismore / Dudgeon 2033 AM (Site Folder: General)]

2033 AM Peak
Site Category: (None)
Stop (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Lismore													
Lane 1	30	7.5	1763	0.017	100	5.6	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	410	7.5	1859	0.221	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	440	7.5		0.221		0.4	NA	0.0	0.0				
North: Lismore													
Lane 1	620	7.5	1847	0.336	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	50	7.5	836	0.060	100	8.0	LOS A	0.2	1.7	Short	130	0.0	NA
Approach	670	7.5		0.336		0.7	NA	0.2	1.7				
West: Dudgeon													
Lane 1	10	7.5	687	0.015	100	11.0	LOS A	0.0	0.4	Short	20	0.0	NA
Lane 2	5	7.5	126	0.040	100	35.6	LOS C	0.1	0.9	Full	500	0.0	0.0
Approach	15	7.5		0.040		19.2	LOS B	0.1	0.9				
Intersection	1125	7.5		0.336		0.9	NA	0.2	1.7				

LANE SUMMARY

Site: 101 [Lismore / Dudgeon 2033 PM (Site Folder: General)]

2033 PM Peak
Site Category: (None)
Stop (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Lismore													
Lane 1	10	7.5	1763	0.006	100	5.6	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	620	7.5	1859	0.333	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	630	7.5		0.333		0.2	NA	0.0	0.0				
North: Lismore													
Lane 1	410	7.5	1859	0.221	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	10	7.5	621	0.016	100	9.6	LOS A	0.1	0.4	Short	130	0.0	NA
Approach	420	7.5		0.221		0.4	NA	0.1	0.4				
West: Dudgeon													
Lane 1	50	7.5	477	0.105	100	14.0	LOS A	0.4	2.6	Short	20	0.0	NA
Lane 2	30	7.5	139	0.216	100	36.1	LOS C	0.7	5.3	Full	500	0.0	0.0
Approach	80	7.5		0.216		22.3	LOS B	0.7	5.3				
Intersection	1130	7.5		0.333		1.8	NA	0.7	5.3				

9. Effect of the Pacific Motorway Upgrade

TPS is not aware of any circumstances or traffic volume changes arising from the most recent upgrade of the Pacific Highway which might have affected the subject site accessibility to any significant degree.

Even if the upgrade works were to have resulted in 2033 traffic volumes in Lismore Road being greater than the estimates shown in Section 6, the SIDRA analyses shown in Section 8 of this report indicate that any increases would have had to have been substantial before any significant effect on site accessibility would have occurred. This is not apparent.

10. Subdivision Access On Dudgeons Lane

The proposed location of the subdivision access on the back of a horizontal curve in Dudgeons Lane will ensure that adequate sight distances will be available to and from both directions along Dudgeons Lane.

The function of Dudgeons Lane and future traffic volume expectations for Dudgeons Lane will be such as to only require a T-intersection access arrangement with priorities to Dudgeons Lane approaches, without the need for auxiliary turn lanes.

11. Conclusions

Based on the investigations and traffic estimates etc. described in this report we are of the opinion that the proposed subdivision should be approved with respect to traffic engineering matters, provided that final Lot configurations allow road widths and Lot access arrangements within the subdivision to satisfy Council standards for industrial development.

If you have any questions, please call me on 0419 722451 or email me at gholdsworth@trafficparking.com.au .

`Yours sincerely,

Glen R Holdsworth
RPEQ 4152
B. Eng.(Civil), M.Eng.Sc.(Highway Eng.)
RPEQ, MITE, MIEAust, MPA
Ref : TPS241Rep3

Fig 1 The Subject Site

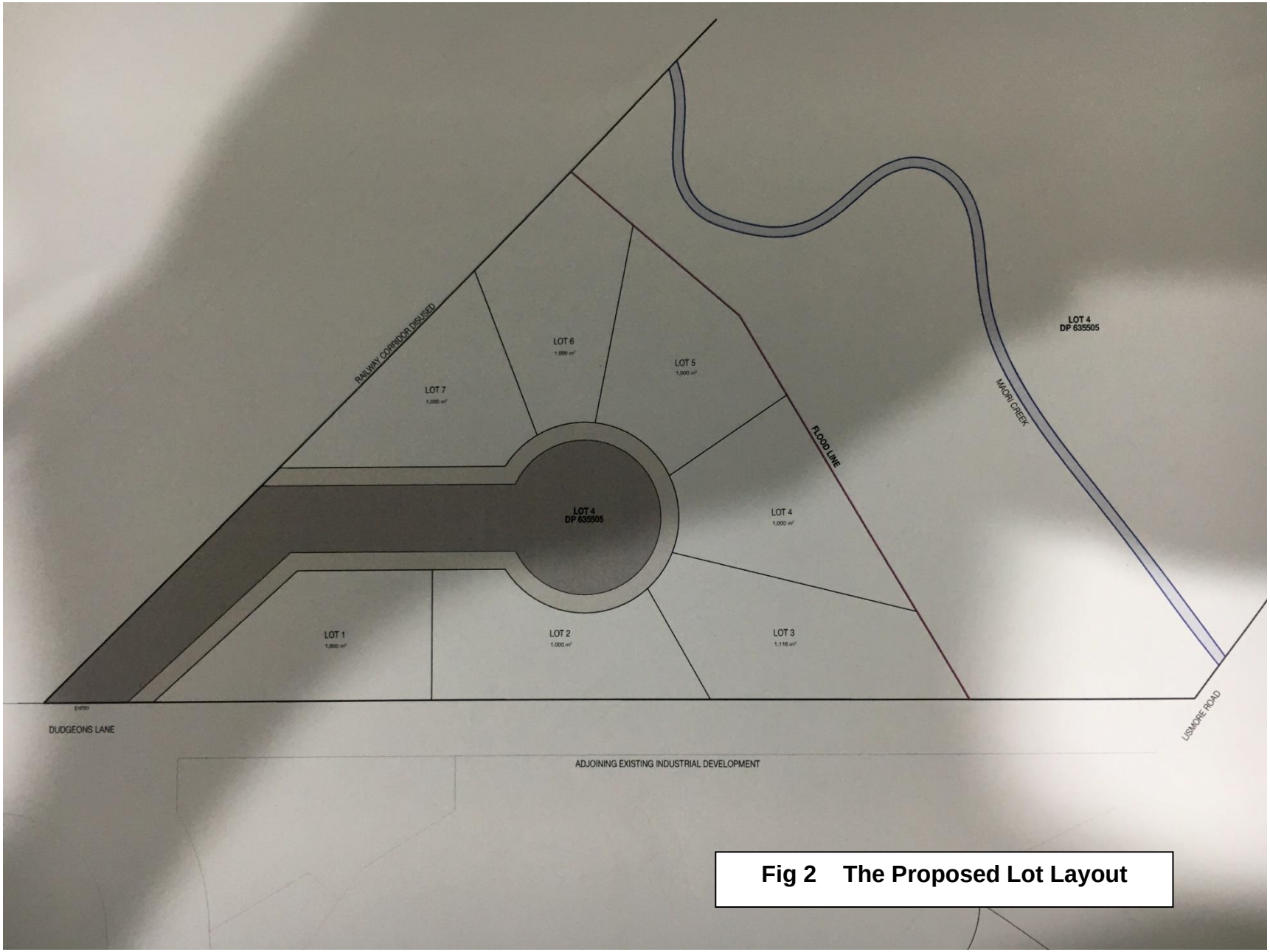


Fig 2 The Proposed Lot Layout

Traffic Engineering – Road Safety Audit

Existing Road Stage

At 150 Lismore Road, Bangalow NSW

On Behalf of Andrew More

About TTM

For 30 years, we've been at the centre of the Australian development and infrastructure industry. Our unique combination of acoustics, data, traffic and waste services is fundamental to the success of any architectural or development project.

We have over 50 staff, with an unrivalled depth of experience. Our industry knowledge, technical expertise and commercial insight allow us to deliver an exceptional and reliable service.

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Revision Record

No.	Author	Reviewed/Approved	Description	Date
1.	R V Jones	B Baker	Road Safety Audit Report RevA	13/02/2021
2.	R V Jones	B Baker	Road safety Audit Report RevB	20/05/2021
3.				
4.				
5.				

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Contents

Table Index

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1 Introduction

1.1 Background

TTM Consulting has been engaged by Andrew More to undertake a Road Safety Audit (RSA). TTM understands that Byron Shire Council / TfNSW has requested that an RSA be undertaken. The RSA is an existing stage audit for the existing intersection of Lismore Road / Dudgeons Lane, Bangalow. Vehicles will drive through This existing intersection to access the proposed industrial subdivision. This Road Safety Audit has reviewed the following locations.

- The existing intersection of Lismore Road / Dudgeons Lane, Bangalow.
- The proposed access intersection from Dudgeons Lane.

This report identifies possible safety issues, and these are noted by the audit team using a combination of onsite investigations and a review of background material. Recommendations for potential remedial treatments will be made in response to each safety issue that is raised as part of this audit process.

1.2 Site Location

The location of the design is highlighted in Figure 1-1.

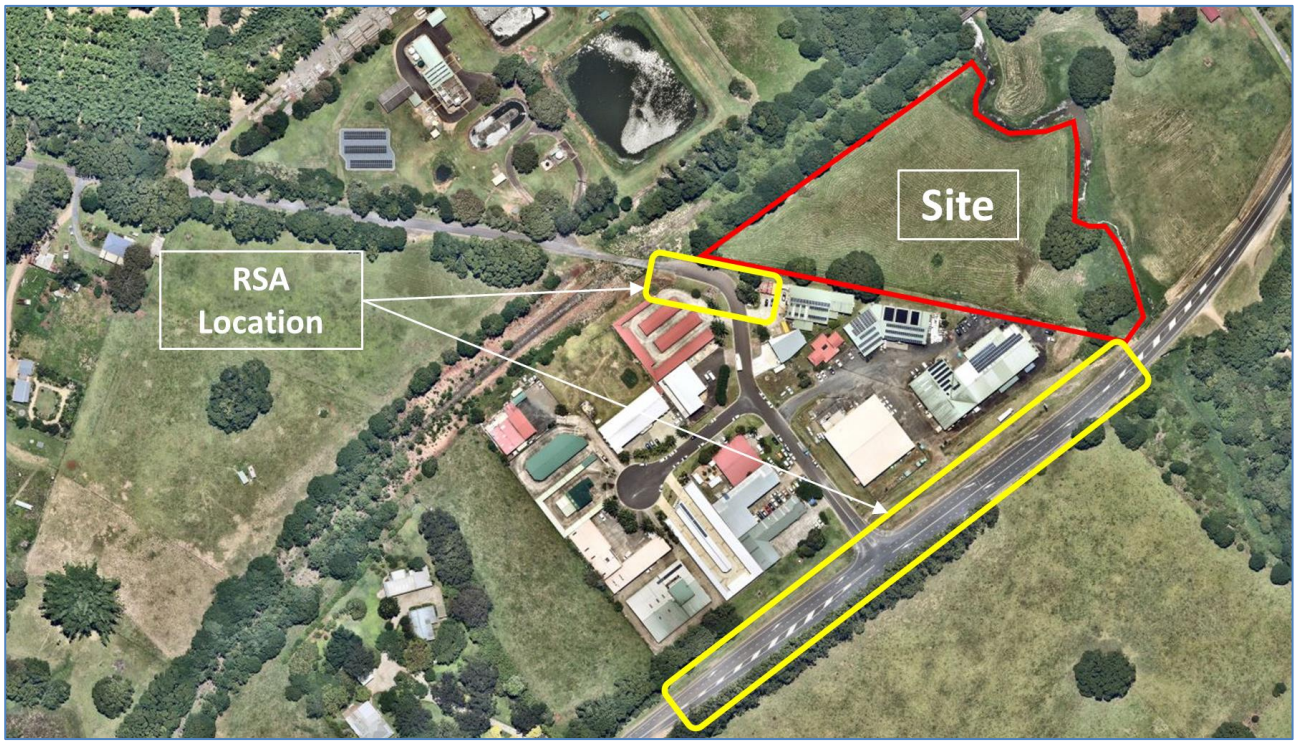


Figure 1-1: Road Safety Audit Location

1.3 Audit Stage

This report results from a existing stage Road Safety Audit, which has been undertaken in accordance with the requirements of Austroads Guide to Road Safety Part 6: Managing Road Safety Audits (2019) and Austroads Guide to Road Safety Part 6A: Implementing Road Safety Audits (2019). The audit report generally follows the format and topics outlined in the Austroads Checklist 6 for Existing Stage Audit.

This audit covers only the study area and has sought to identify potential safety hazards. The auditors would like to point out that no guarantee is made that every deficiency or hazard has been identified. If all recommendations in this report were to be followed, this would not guarantee that the study area is 'safe'; rather, adoption of the recommendations should improve the level of safety at this location.

1.4 Audit Team and Audit Process

The persons undertaking in this road safety audit are:

- Richard V Jones – Level 3 Road Safety Auditor (Lead Auditor); TTM Consulting Pty Ltd
- Brendan Baker – Level 1 Road Safety Auditor, TTM Consulting Pty Ltd
- Ben Williamson – Leve 3 Road Safety Auditor, TTM Consulting Pty Ltd

1.5 Responding to the Audit Report

A project manager is under no obligation to accept all the audit recommendations. Also, it is not the role of the auditor to agree to or approve of the project manager's response to the audit. Rather, the audit provides the opportunity to highlight potential problems and have them formally considered by the project manager, in conjunction with all other project considerations.

This formal Road Safety Audit report should be responded to in writing. If any recommendations in this report are rejected by the Project Manager, then in each case reasons for this rejection should be included in the written response. Acceptance of a recommendation may require no further comment, but an explanation of how or when the action will be taken may be useful and should be provided where possible. To assist the project manager with this process, the table of findings and recommendations contains an area for a formal response.

1.6 Site Inspection

A site inspection of the audit area was conducted on Wednesday 5th May 2021. The inspection was conducted in the day (1pm to 2pm) to assess the conditions noted in Austroads. The weather condition during the inspection was dry but cloudy, and the road surface was wet. The inspection was carried out on foot and by car.

1.7 Project Documents Used in the Audit

The following project documents were used in conducting the audit:

- TPS Traffic Engineering Assessment (20 May 2021)

The Traffic Engineering Assessment states that the expected peak hour trips generated by the proposed industrial subdivision would be in the region of 25 to 30 trips. This would equate to only an additional trip every 2 minutes at the intersection during the peak hour.

1.8 Recommendations from Previous Audits

No previous Road Safety Audit have been carried out in relation to this section of the project.

2 Existing Road Environment

2.1 Road Network

The Road Safety Audit was carried out in the area that covers the following roads and their classification.

The classifications of these roads are as follows:

Table 2.1: Road Network

Road	Speed Limit	Lanes	Classification	Management
Lismore Road	80 km/h	2 (undivided 9m wide)	State Road	TfNSW
Dudgeons Lane	unrestricted	2 (undivided 9m wide)	Rural	BSC

The existing Lismore Road / Dudgeons Lane intersection is shown in Figure 2-1

Figure 2-1: Lismore Road / Dudgeons Lane intersection

It was noted during the site inspection that the intersection of Lismore Road / Dudgeons Lane has recently been resurfaced, with line marking still to be carried out.

Figure 2-2: Lismore Road / Dudgeons Lane resurfacing works

2.2 Crash Data

Crash data for the past 5 years were obtained from TfNSW Centre for Road Safety (Crash Map) website Figure 2-3, where the following intersections were obtained:

- Lismore Road / Dudgeons Lane
- Dudgeons Lanes / Site Access

There was one (non-casualty) crash at the Lismore road / Dudgeons Lanes intersection (2015 – therefore six years ago), where a driver turning right side swiped another vehicle. No crashes were recorded for the Dudgeons Lane / Site Access location.

Figure 2-3: Crash Locations (TfNSW data Jan 2015 – Dec 2019)

3 Road Safety Audit Findings

3.1 Audit Criteria

A ranking system for each of the issues has been adopted using the following priority ratings in Table 3.1:

Table 3.1: Road Safety Audit – Priority Ratings

Priority	Risk Ranking	Suggested Treatment Approach
A	High	Highest priority for action from a safety view point
B	Medium	Action needs to be taken from safety view point
C	Low	Action is desirable from a safety view point
D	Comment	An observation which may improve overall performance or safety, Be of wider significance and possibly outside the scope of this RSA, but where action should be considered

It is noted that the priority ranking is based on the subjective assessment of the audit team.

4 Formal Statement

4.1 Audit Team Statement

We, the undersigned, declare that we have reviewed the material and data listed in this report and identified the safety and operational deficiencies outlined in the preceding sections.

It should be noted that while every effort has been made to identify potential safety hazards, no guarantee can be made that every deficiency has been identified. We recommend that points of concern be investigated, and necessary corrective actions are undertaken.

Richard V Jones – Level 3 Road Safety Auditor (Team Leader) 20/05/2021

Brendan Baker – Level 1 Road Safety Auditor..... 20/05/2021

Ben Williamson – Level 3 Road Safety Auditor..... 20/05/2021

Appendix A Road Safety Audit Findings

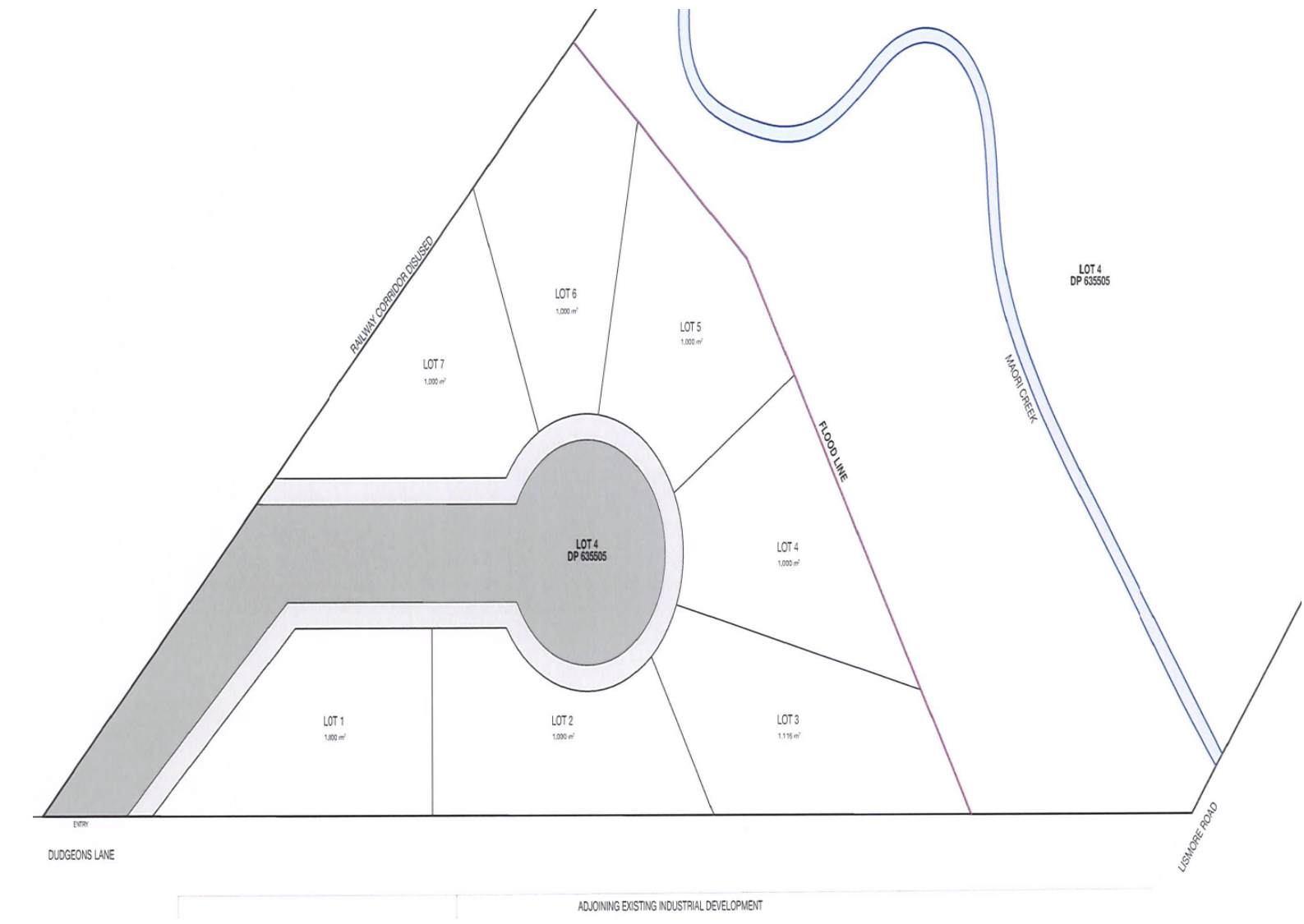
Reviewer:	Richard V Jones (TTM Consulting)	Responder:	
Date:	20/05/2021	Date:	

Item	Audit Findings/Recommendations	Rankings	Client		
			Accept Yes/No	Response	Status
1	The sight distance to the south from Dudgeons Lane along Lismore Road is slightly obscured by a small crest about 180m south of the intersection. The SISD for a 90km/h design speed is 214m, the available distance viewed on site was 185m. The SISD for the 80km/h speed is 181m, which is achieved. There is an increased risk of a side swipe or t-bone crash at this location when vehicles traveling from the south are exceeding the posted 80kmh speed limit, possibly resulting in a serious injury or a fatality.  View from the crest towards the intersection with Dudgeons Lane. (above)	Medium	Yes	There is nothing to address for the purpose of the Planning Proposal. Additional signage can be assessed and installed if required as part of a future development application for the subdivision of the land.	

	 View from Dudgeons Lane southbound towards the crest (above) *It is recommended that additional warning signs are provided on the approach to the crest warning drivers of this crest and a further warning sign of the side road (with distance marked e.g. 200m).*				

Item	Audit Findings/Recommendations	Rankings	Client		
			Accept Yes/No	Response	Status
2	Unrestricted parking opposite the proposed intersection, may lead to sideswipes on parked vehicles and could also reduce sight lines for vehicles exiting the proposed development.  *It is recommended that yellow lines or no parking signs are provided to control parking at this location.*		Yes	Can be addressed at subdivision stage.	
Item	Audit Findings/Recommendations	Rankings	Client		

Appendix B Indicative Development Site Layout


RAILWAY CORRIDOR DISUSED
LOT 7
1,000 m²
LOT 6
1,000 m²
LOT 5
1,000 m²
LOT 4
DP 635505
FLOOD LINE
MAORI CREEK
LOT 4
DP 635505
LOT 4
1,000 m²
LOT 1
1,000 m²
LOT 2
1,000 m²
LOT 3
1,116 m²
ENTRY
DUDGEONS LANE
LISMORE ROAD
ADJOINING EXISTING INDUSTRIAL DEVELOPMENT

Appendix C Crash Data (TfNSW)

Crashes Map - Byron

Navigation and Help

Select your LGA:

Byron

Reporting year

(All)

Degree of crash

(All)

Type of crash

All

Speed limit

(All)

RUM code group

(All)

Type of location group

(All)

Speeding involved in crash

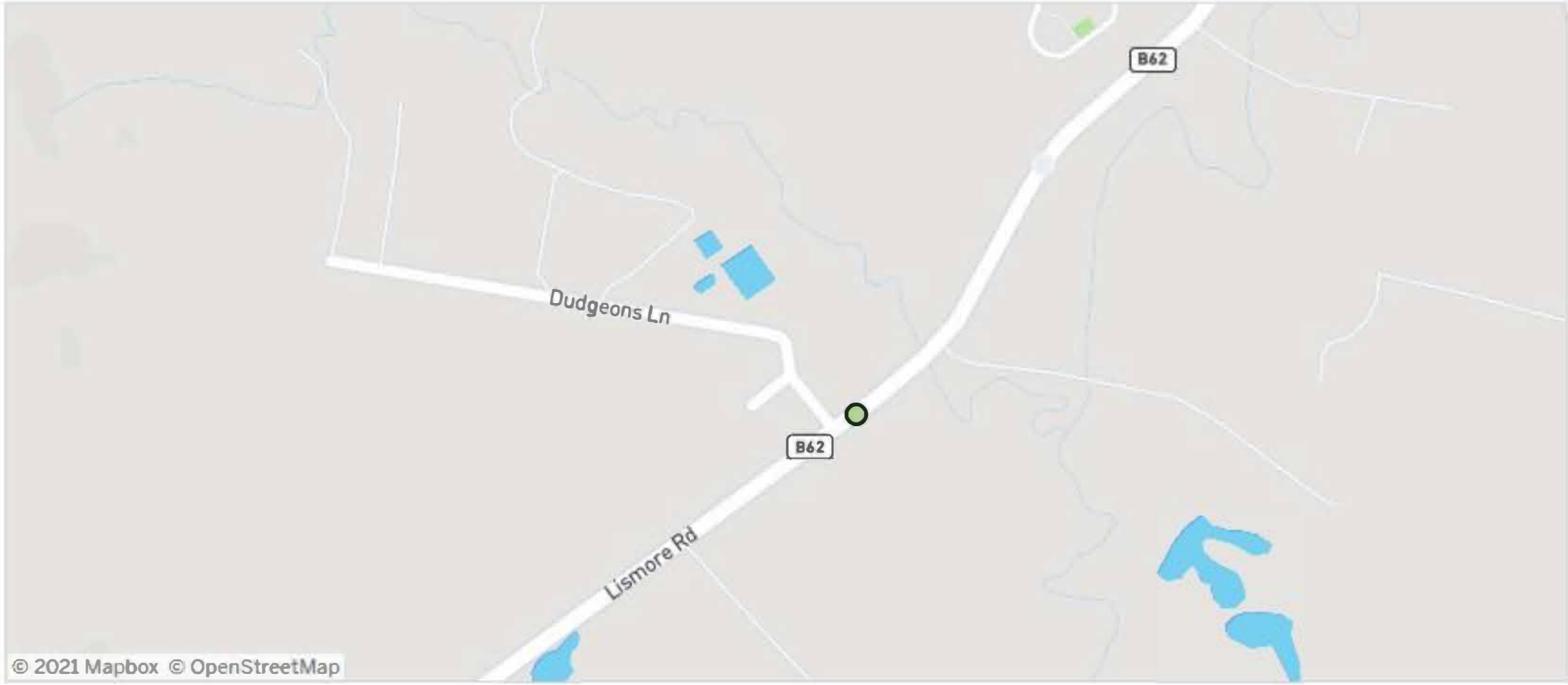
(All)

Fatigue involved in crash

(All)

Road classification

(All)



Degree of crash

Fatal | Serious Injury | Moderate Injury | Minor/Other Injury | Non-casualty (towaway)

Reporting ..	Crash ID	Degree of crash	RUM - code	RUM - description	Type of location	Natural lighting	Longitude	Lattitude	No Killed	No Injured
2015	1080636	Non-casualty (t..	36	Right turn sideswipe	2-way undivided	Daylight	153.510353	-28.698562	-	-