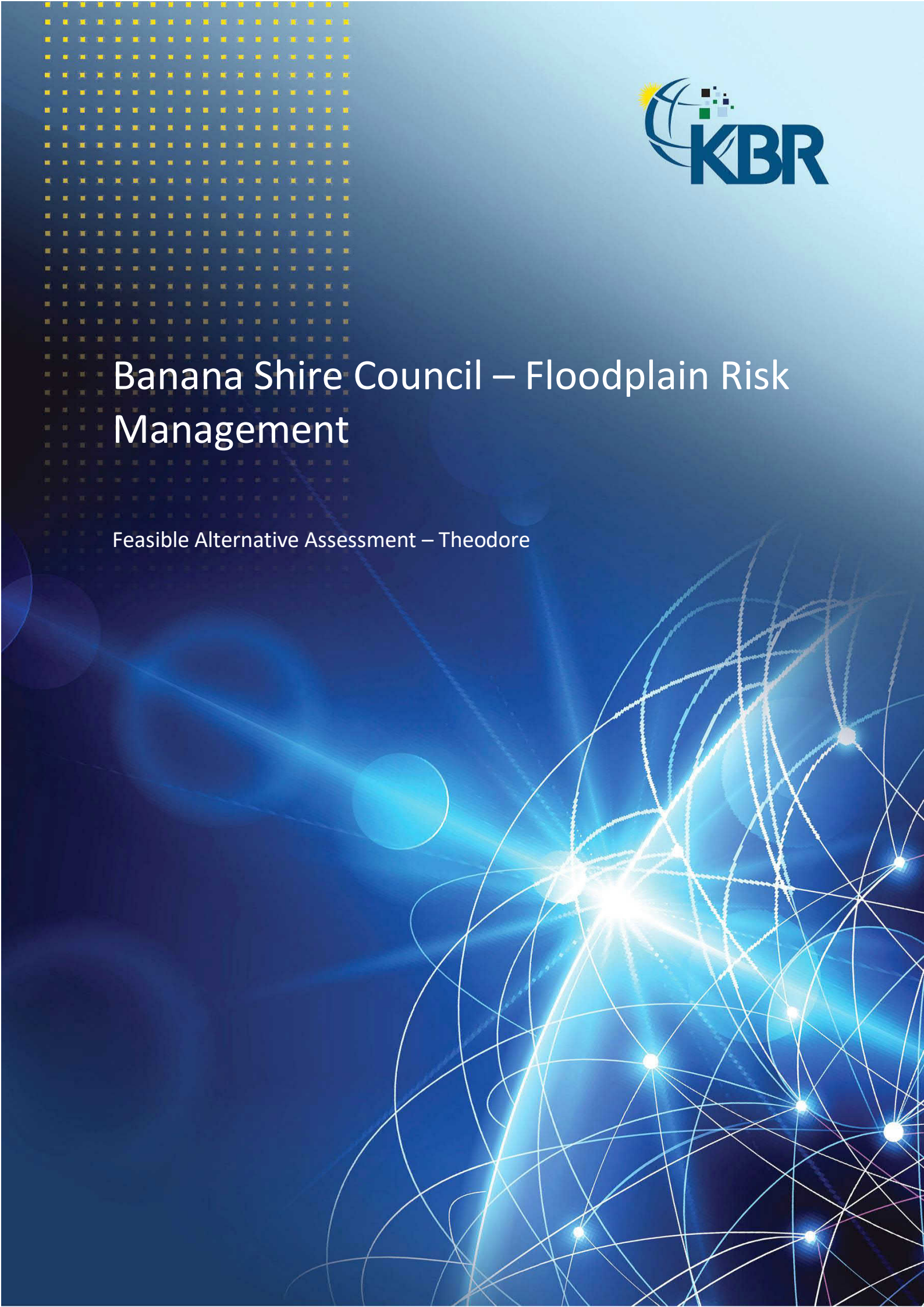
Banana Shire Council – Floodplain Risk Management

Feasible Alternative Assessment – Theodore



Banana Shire Council – Floodplain Risk Management

Feasible Alternative Assessment-Theodore

Prepared for:

BANANA SHIRE COUNCIL

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Prepared by:

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04 September 2019

BEW956-TD-WR-REP-0003 Rev. 0

Limitations Statement

The sole purpose of this report and the associated services performed by Kellogg Brown & Root Pty Ltd (KBR) is to undertake a feasible alternative assessment in accordance with the scope of services set out in the contract between KBR and Banana Shire Council ('the Client'). That scope of services was defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

KBR derived the data in this report primarily from previous flood modelling and structural mitigation review. The passage of time, manifestation of latent conditions or impacts of future events may require further exploration at the site and subsequent data analysis, and re-evaluation of the findings, observations and conclusions expressed in this report.

In preparing this report, KBR has relied upon and presumed accurate certain information (or absence thereof) relative to study area provided by government officials and authorities, the Client and others identified herein. Except as otherwise stated in the report, KBR has not attempted to verify the accuracy or completeness of any such information.

The findings, observations and conclusions expressed by KBR in this report are not, and should not be considered, an opinion concerning flood risk. No warranty or guarantee, whether express or implied, is made with respect to the data reported or to the findings, observations and conclusions expressed in this report. Further, such data, findings, observations and conclusions are based solely upon previous flood modelling outcomes in existence at the time of the investigation.

This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between KBR and the Client. KBR accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party.

Revision History

Revision	Date	Comment	Signatures			
			Originated by	Checked by	Technical Approval	Project Approval
0	04/9/19	Issued for use	A Djozan Ali Djozan 2019.09.06 10:53:25 +10'00'	M Gould Megan Gould 2019.09.06 11:01:48 +10'00'	A Densten Digitally signed by Anthony Densten Date: 2019.09.10 15:29:10 +10'00' Adobe Acrobat Reader version: 2018.011.20058	A Densten Digitally signed by Anthony Densten Date: 2019.09.10 15:29:55 +10'00' Adobe Acrobat Reader version: 2018.011.20058

Contents

Summary

Banana Shire Council is in the process of revising their Planning Scheme in accordance with the Department of Infrastructure, Local Government and Planning (DILGP) State Planning Policy for Natural hazards, risks and resilience – Flood (July 2017). As part of their review, they are considering the back-zoning of one block of land in Theodore with an overview to reduce the flood risk to the remaining township due to development of this site.

The subject site is currently zoned as Village.

Banana Shire Council is considering changing the zoning of the site to Rural which will discourage residential development on the site.

Kellogg Brown & Root Pty Ltd has undertaken a flood assessment to support this proposed change to the Planning Scheme and to consider whether there are feasible alternative options to the back-zoning.

The flood assessment demonstrates that potential development in the subject block of land consistent with the current Planning Scheme arrangements is predicted to result in significant impacts to the south and east of the subject land (including numerous residential properties) under both Castle Creek and Dawson River Defined Flood Event (DFE) scenarios.

A number of options were investigated as alternatives to the back-zoning option which could allow for development on the site. More detailed assessment of these options would need to be undertaken if Banana Shire Council wished to consider an alternative approach further. However, based on the review of the flood behaviour, it is considered that the adoption of an alternative option to back-zoning would be challenging without a significant reduction in the available developable area or the construction of major mitigation structures. This is due to the significant peak flows predicted to be conveyed through the subject site and the impacts predicted to be associated with proposed development and the requirement to elevate properties above the Design Flood Event (DFE).

Based on the outcome of this assessment, none of the alternatives considered are deemed feasible and consistent with the objectives of the State Planning Policy.

1 Introduction

In recent times Banana Shire has suffered some of its worst flooding on record with many businesses and homes flooded, people displaced and agriculture devastated. Flooding has caused significant distress and long lasting impacts leaving some residents concerned regarding a repeat event. Additionally global warming may make summer downpours more likely and more intensive at the end of the century. The way we have transformed our environment and the development of areas within a defined floodplain can leave us more exposed to risk in future from flooding.

With these concerns in mind Banana Shire Council (BSC) previously commissioned Kellogg Brown & Root Pty Ltd (KBR) to undertake a series of flood studies, develop coherent flood mitigation strategies and develop a Floodplain Management Plan for the region, encompassing the major population centres and townships. These townships included:

- Taroom
- Baralaba
- Jambin
- Wowan
- Theodore
- Biloela
- Goovigen
- Moura
- Thangool
- Dululu

The extent and scope of previous work undertaken by KBR is presented in Figure 1.1.

A number of documents were developed under the floodplain management study that have provided details of flood risk and mitigation strategies. The undertaking of the feasible alternative assessment has specifically referenced the following documents:

- KBR, Banana Shire Flood Study – Stage 2, Structural Measures Report, September 2016
- KBR, Banana Shire Flood Study – Stage 2, Non-Structural Measures Report Vol. 2 Flood Hazard Mapping, October 2016
- KBR, Banana Shire Flood Study – Stage 2, Floodplain Management Plan, January 2017.

Following the preparation of these documents the Department of Infrastructure, Local Government and Planning released guidance material related to State Planning Policy 'Natural hazards, risks and resilience – Flood' (July 2017). This planning document outlines the State's position in regard to flooding and requires that the risks associated with natural hazards, including the projected impacts of climate change, are avoided or mitigated to protect people and property and enhance the community's resilience to natural hazards.

BSC is reviewing their current Planning Scheme with an overview to maintain compliance with the State Planning Policy. As part of this review, BSC is considering to back-zone a block of land within Theodore which they understand may result in significant flood risk if developed, based on the current Planning Scheme arrangements.

KBR has been commissioned by BSC to prepare a feasible alternative assessment. The assessment will support their application for changes to the Planning Scheme for back-zoning of the subject block of land in Theodore.

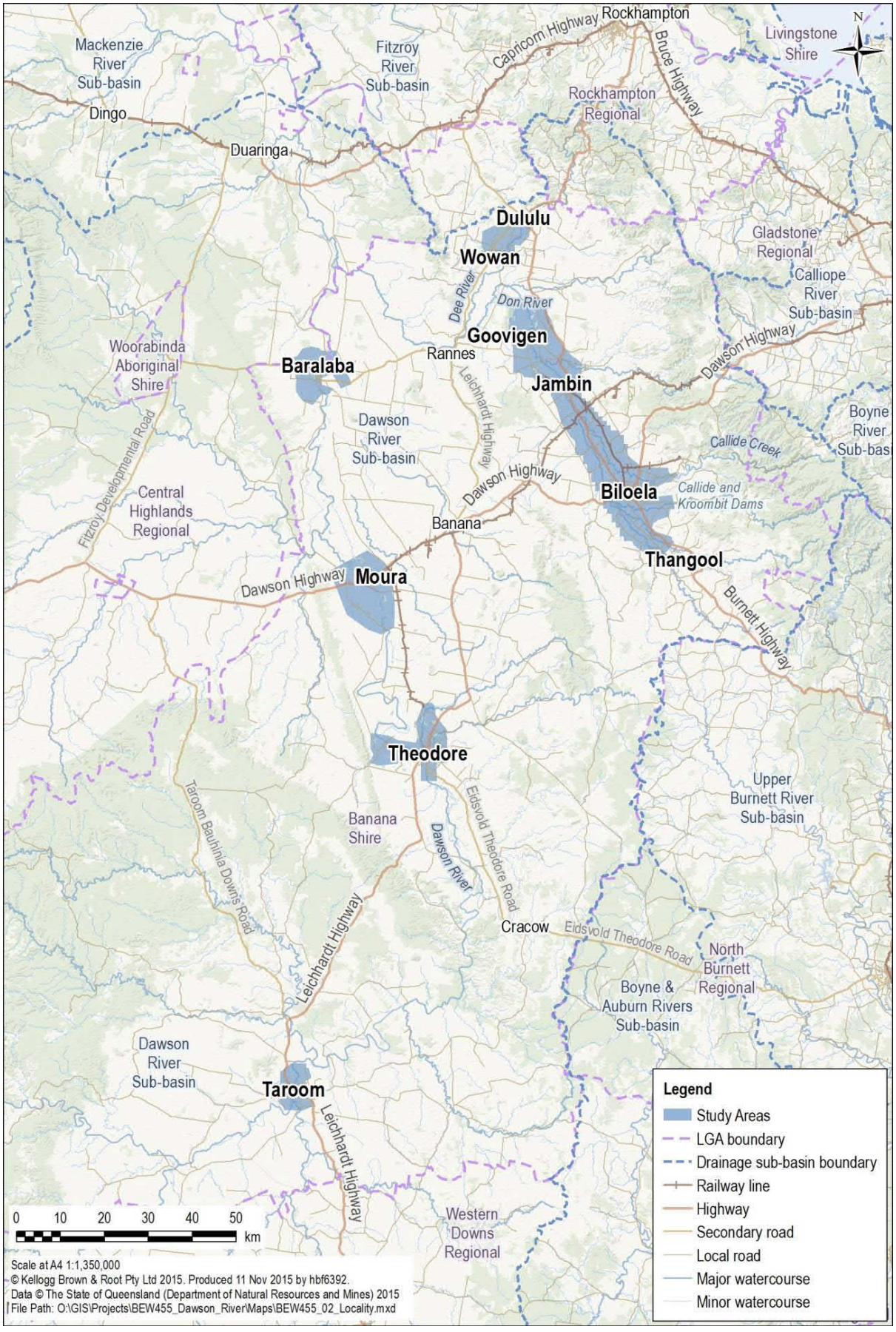


Figure 1.1 Banana Shire Flood Modelling Extents

2 Study objectives

The main objectives for the preparation of a feasible alternative assessment for Biloela are outlined below.

- investigate the flood behaviour and flood risks in the subject sites based on the flood modelling results
- investigate the existing land uses within the subject sites
- investigate the current Planning Scheme arrangements for the subject sites considering the predicted flood behaviour and risks
- investigate the proposed Planning Scheme arrangements (proposed changes) for the subject sites considering the predicted flood behaviour and risks
- investigate the consistency of the proposed changes to the Planning Scheme with the requirement of the State Planning Policy with an overview to demonstrate compliance
- identify and investigate alternative options for reducing flood risk in these areas.

3 Site description

The subject block of land comprises Lot 279 on SP295927 which is located to the north of Theodore township. The block of land is bounded by The Boulevard to the west, residential area and Eleventh Avenue to the south and farm lands to the east and north. Castle Creek runs just off the south-eastern corner of the block of land. The Dawson River floodplain is located further west of the site. The site is predominantly flat with site levels varying between approximately RL 139.7 m and 141.1 mAHD with an average slope in the order of 0.2%. This site totals an area of approximately 68 ha.

Based on available aerial imagery the subject site is predominantly vacant land.

Refer to Figure 3.1 for the site location.

Figure 3.1 Locality Plan

4 Flood behaviour on the subject site

The Theodore floodplain represents a highly complex flood regime as it is located at the confluence of the Dawson River and Castle Creek. In larger events both Castle Creek and Dawson River break their banks and flood the majority of the Theodore township. The subject block of land is anticipated to be flooded from different directions depending on the stage of the flooding.

In a local flooding event (predominantly from Castle Creek) the block of land is predicted to be flooded with a maximum flood depth of up to approximately 1.8 m, peak velocity of approximately 0.7 m/s and a flow conveyance of approximately 80 m^3/s under the DFE. In the local flood event, the flood hazard on the block of land is predicted to range between H3 and H4 for the DFE, in accordance with the Hazard Vulnerability Classification, Australian Emergency Management Institute (2014). This means that the block of land is predominantly unsafe for people and vehicles.

In a regional flood event (predominantly from the Dawson River) the block of land is predicted to be flooded with a maximum flood depth of up to approximately 2.3 m, peak velocity of approximately 0.4 m/s and a flow conveyance of approximately 300 m^3/s under the DFE. In the regional flooding event, the flood hazard on the target block of land is predicted to be predominantly H5 for the DFE meaning that the target block of land is unsafe for people, vehicles and some buildings.

Flood maps demonstrating the flood hazard for the baseline scenario for regional and local flooding under the DFE are included in Appendix A.

5 Current Planning Scheme arrangements

The Town Planning Scheme for the Town of Theodore (June 2005) indicates that the subject block of land is located within the Village zone. Refer to an extract of the Town Planning Scheme – Zoning Map for the Town of Theodore (2005) which is provided in Figure 5.2.

The Planning Scheme provides the overall outcomes sought for the Village zone as shown in Figure 5.1

The purpose of the Village Zone Code is to achieve the following overall outcomes:

1. Townships provide a mix of land uses, services and facilities that serve surrounding rural areas and contribute to the existing township character;
2. Townships are viable centres as much as residential communities;
3. Townships are consolidated within the boundary of the Zone; expansion beyond the boundary is likely to compromise the use of Rural Zoned land for its intended purpose;
4. The Central Business Areas in each township are clearly identifiable, and separate to adjoining residential areas;
5. Village communities continue to have limited water and sewer infrastructure, and some sealed roads;
6. New development is consistent in location, design, scale and character to that of surrounding development, and has no significant adverse impacts upon the natural environment;
7. Land capabilities and constraints are recognised by the delineation of different Areas; the overall outcomes for each being specified below:

A. The overall outcomes sought for the **Village - Central Business Area** are:
   i. Consolidation of business and community purposes, and industrial uses, where there is no other Village – Industrial Area;
   ii. Town and village centres are clearly identifiable;
   iii. The character of the Area is preserved.

B. The overall outcomes sought for the **Village - Industrial Area** are:
   i. Consolidation of industrial uses in areas of existing industrial development;
   ii. The viability of existing and future industrial activities are protected against the encroachment of incompatible uses.

C. The overall outcomes sought for the **Village - Rural Residential Area** are:
   i. Land is predominantly used for dwelling houses on small rural lots.;
   ii. Low population densities in the Zone mean that people enjoy a rural lifestyle with accessibility to community facilities;
   iii. The nature of the land within the Zone is essentially residential and therefore the size and scope of rural activities is limited;
   iv. Uses such as animal husbandry and hobby farm cropping and agriculture are of a scale that do not result in adverse impacts on residential amenity;
   v. New rural residential development is located such that it represents an infill of existing available rural residential land, or is an extension of existing rural residential development;
   vi. New rural residential development respects the natural values and rural landscape values of the land and the surrounding area, by being visually non-intrusive or sufficiently buffered from these areas;
   vii. Reticulated water supply is available and is to be provided to all new development;
   viii. The majority of land in the Zone is afforded an urban standard of road access;
   ix. Allotment size in the rural residential zone is sufficient to permit the sustainable on-site treatment and disposal of domestic effluent;
   x. Low key uses which provide otherwise unprovided essential goods and services to the immediate rural residential community are located within the Zone, where potential impacts on residential amenity due to traffic, noise, and the built environment are minimised;
   xi. Commercial and industrial uses are generally inconsistent with the residential nature of land within the Precinct.

Figure 5.1 Outcome Sought for Village Zone

BSC is concerned that the type of development allowed by the current Planning Scheme for the subject site may result in flood impacts in the surrounding areas and/or loss of floodplain storage as the site provides significant flow conveyance in the DFE.

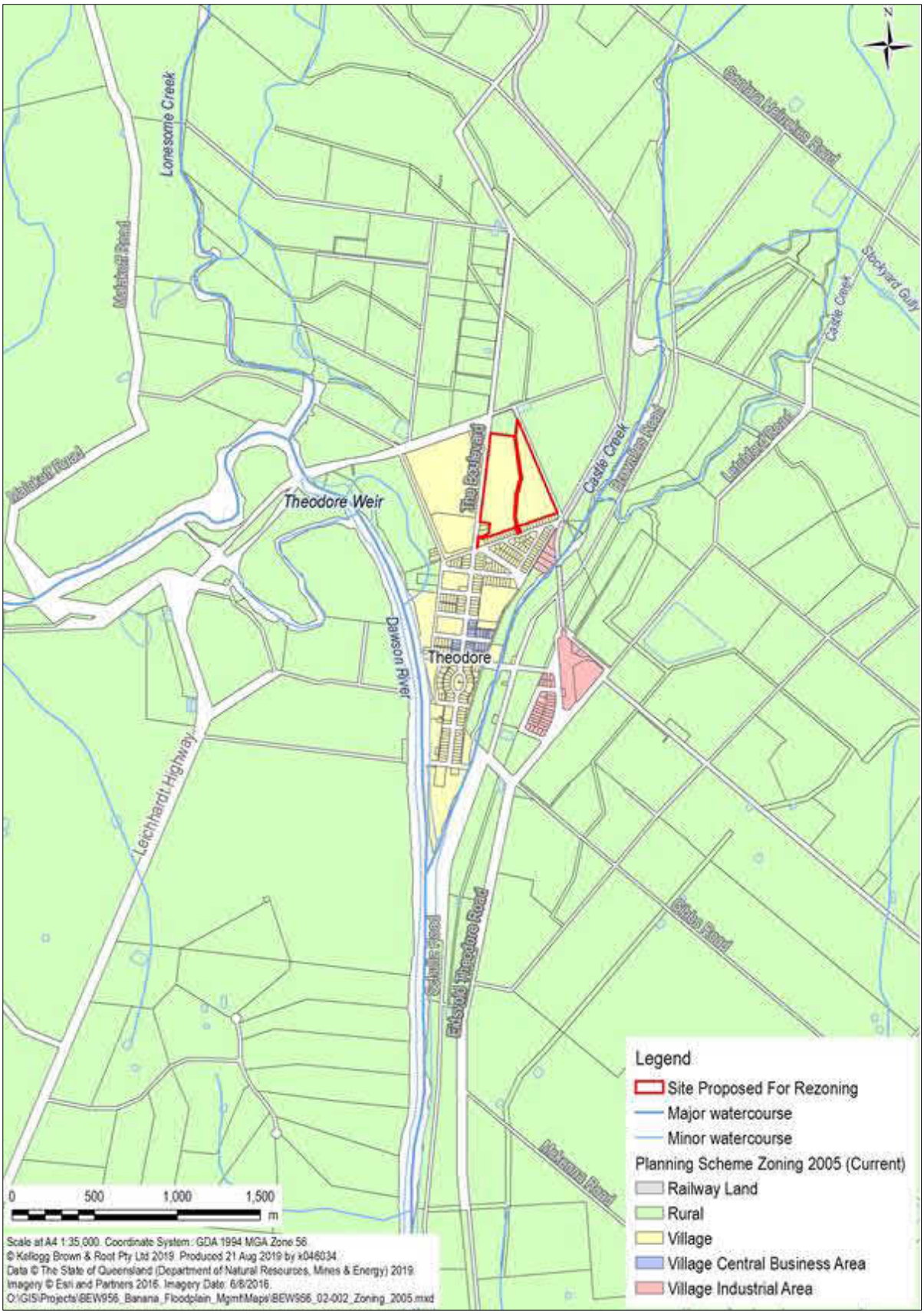


Figure 5.2 Town Planning Scheme – Zoning Map-2005

6 Flood impact assessment

KBR has previously developed detailed flood models for Theodore, considering two scenarios:

- Local Flooding from Castle Creek
- Regional flooding from the Dawson River.

Theodore (including the subject block of land) is anticipated to be impacted by regional flooding from the Dawson River and/or local flooding from Castle Creek. The models developed to assess flooding under these two scenarios have been adopted as baseline cases for this study and used to undertake an impact assessment of potential development on the subject site.

6.1 DEVELOPMENT CASE SCENARIOS

The Banana Shire Flood Study Stage 2 – Floodplain Management Plan (KBR, January 2017) has recommended planning and development control measures as non-structural flood measures to manage the flood risks and enhance the resilience of the community in a flood event. The objective is to change peoples' behaviour through land use planning and development controls in addition to emergency management and community education. The recommendations for planning and development control measures include:

- 1% AEP flood event with climate change is adopted as the Defined Flood Event (DFE)
- proposed Banana Shire Council Planning Scheme includes a flood code that sets performance outcomes and outlines acceptable solutions
- proposed Banana Shire Council Planning Scheme provides guidance on the information required to be submitted with Development Applications
- adoption of 500 mm freeboard for habitable floors above the DFE and 300 mm allowance above the DFE where the building is non-habitable and for overland flow paths.

The impact assessment has adopted an assumed level for development, based on the recommended planning and development control measures above. Review of the current Planning Scheme arrangement indicates that the current allowable habitable floor level within the township has been defined by BSC as level 143.26 mAHD (inclusive of 300 mm freeboard) which is lower than the level recommended by the Floodplain Management Plan.

The amount of fill and anticipated loss of conveyance imposed by the development may vary depending on the specific layout. For the purpose of this assessment, a hypothetical development layout has been adopted that will impose the worst possible obstruction against the flow conveyance. The entire site has been raised to the level of 1% AEP plus climate change (DFE) plus 500 mm of freeboard.

Table 6.1 Minimum Development Levels

Minimum Development Level	Maximum Flood Level Around the site in DFE (m AHD)	Minimum Development Level Adopted (m AHD)
Defined Floor Level	143.20	143.7

The post development scenario was simulated for the DFE. The results for the development case scenario were then compared to baseline scenario results to allow for assessment of the potential impacts of the proposed development (as allowed under the current Planning Scheme, with proposed controls as per the Floodplain Management Plan recommendations). Flood impacts are presented for the DFE events, regional and local, in Appendix A.

Flood maps demonstrating the flood hazard on the subject site for the DFE are included in Appendix A. Hazard 'afflux' maps are also included for the DFE demonstrating where the hazard classification has increased or decreased as a result of development.

6.2 IMPACTS ASSESSMENT

Based on the flood modelling results, development of the subject block of land as per the current Planning Scheme arrangements (as described above) is predicted to result in changes in flood behaviour and flood impacts as outlined below.

6.2.1 Local Flooding (Castle Creek)

The proposed development in the subject block of land is predicted to result in the following impacts:

- afflux of up to approximately 400 mm in the residential area to the south of the subject block of land under the DFE
- increases in peak velocities of up to only 0.5m/s is predicted and only to a limited area to the south of the subject block of land as a result of the development under the DFE
- the proposed development is predicted to result in worsening of the flood hazard by up to 1 category.

6.2.2 Regional Flooding (Dawson River)

The proposed development in the subject block of land is predicted to result in the following impacts:

- Afflux of up to approximately 130 mm in the residential area to the south of the subject block of land and lesser afflux in the order of 30–40 mm to an extensive area to the east of the subject block of land.
- No significant increases in peak velocities are predicted as a result of the development in the subject block of land under the DFE.
- No significant worsening of the flood hazard classification is predicted as a result of the proposed development in the subject block of land.

7 Proposed changes to the Planning Scheme

An extract from the Draft BSC Planning Scheme – 2016 – Zoning Map provided by BSC shows that the site is planned to be re-zoned from Village to Rural.

The Planning Scheme provides the overall outcomes sought for the Rural zone as shown in Figure 7.1.

(1) → The purpose of the Rural Zone Code is to¶
(a) → provide for rural uses and activities; and¶
(b) → provide for other uses and activities that are compatible with:¶
(i) → existing and future rural uses and activities; and¶
(ii) → the character and environmental features of the Zone; and¶
(c) → maintain the capacity of rural land for rural uses and activities by protecting and managing significant natural resources and processes;¶
(2) → The purpose of the Code will be achieved through the following overall outcomes:¶
(a) → intensive animal industries minimise or avoid adverse impacts on surrounding land uses;¶
(b) → development is sensitive and responsive to the rural character and scenic amenity and maintains vegetation cover in significant areas;¶
(c) → development, having regard to its location and design, protects people and premises from natural hazards and contamination;¶
(d) → extractive industries and associated processing occur in a way that significant environmental impacts are contained within the site and provides for the effective site rehabilitation;¶
(e) → development adjacent to an extractive resource or transport route permits the efficient extraction of the entire resource, the safe and efficient transport of materials to and from the site and provides effective and on-going separation of extractive industry activity from any sensitive uses;¶
(f) → non-resident workforce accommodation is incompatible with the purpose of the Rural Zone and are located in a more suitable zone;¶
(g) → tourism uses only locate where they have a nexus with the surrounding rural activities or places with high environmental values;¶
(h) → infrastructure is provided at a standard normally expected in rural locations and is allowed to operate safely and efficiently without interference by incompatible uses or works;¶
(i) → development is separated from existing and potential industry land uses located in rural areas including established uses identified in the Special Industry Zone;¶
(j) → and where affected by an overlay for:¶
(iii) → bushfire or flood risk:¶
(A) → the use and works support and do not unduly burden disaster management response or recovery activities;¶
(B) → development does not result in an increase in unacceptable risk to people or property as a result of exposure to natural hazards and environmental constraints affecting the land;¶
(C) → works are resilient to and do not contribute to an increase in the severity of natural hazard events;¶
(D) → works retain the natural processes and protective function of landforms and vegetation in natural hazard areas;¶

Figure 7.1 Outcome Sought for Rural Zone

The re-zoning of the site to 'Rural' reflects the existing predominant land use and reduces the potential for new urban types of land uses which are sensitive to flooding, from expanding into an area subject to known flooding.

The rural zone will enable the existing land use activities to continue and for flooding impacts on new development to be assessed and regulated through the provision of the Flood Assessment Benchmarks in the Rural Zone Code.

The effect of this zoning change will make urban development inconsistent with the zone and discourage urban uses from establishing in this area.

An extract from the Draft BSC Planning Scheme 2016 is included in Figure 7.2.

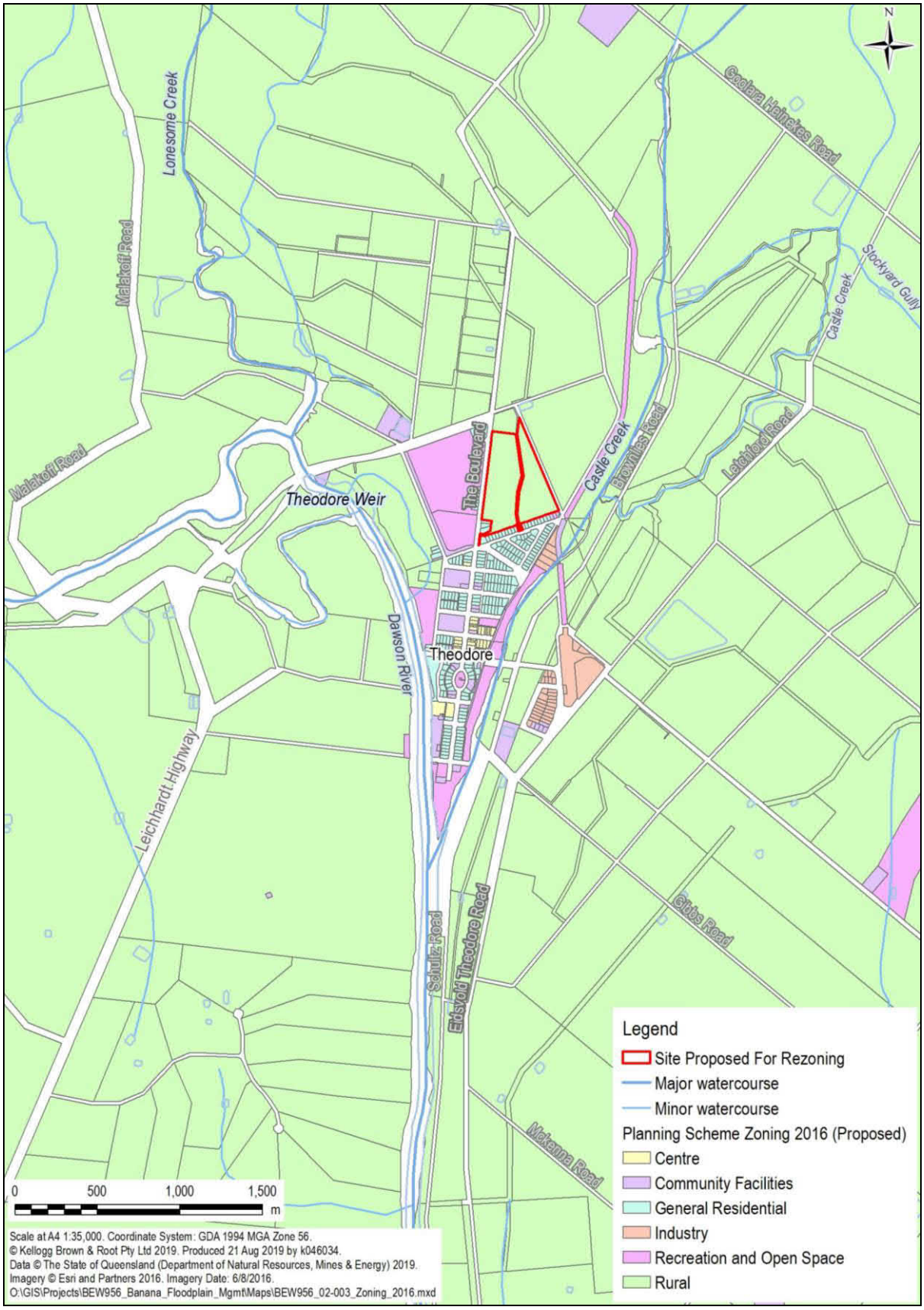


Figure 7.2 Extract from Draft BSC Planning Scheme 2016

8 Consistency of the proposed Planning Scheme Approach with the requirements of the State Planning Policy

The State Planning Policy State 'Natural hazards, risks and resilience – Flood' (July 2017) seeks to ensure that:

> 'The risks associated with natural hazards, including the projected impacts of climate change, are avoided or mitigated to protect people and property and enhance the community's resilience to natural hazards.'

The State Planning Policy – State interest policy 4 requires that:

> 'Development in bushfire, flood, landslide, storm tide inundation or erosion prone natural hazard areas:
>
> (a) avoids the natural hazard area
>
> (b) where it is not possible to avoid the natural hazard area, development mitigates the risks to people and property to an acceptable or tolerable level'

The approach taken by the proposed Planning Scheme of avoiding the establishment of urban uses on the subject site aligns with State Planning Policy of avoiding the natural hazard areas.

9 Feasible alternatives assessment

Based on the flood assessment undertaken, a potential development consistent with the arrangements of the current Planning Scheme is anticipated to result in significant flood impacts to the areas to the south and east of the site including road network and a number of dwellings.

A number of alternate development options were investigated to potentially mitigate the impacts and allow for the current zoning to be retained for the site. The mitigation options investigated are as follows:

- A number of levee options have been assessed in the Banana Shire Flood Study Stage 2 – Structural Measures Report, August 2016. The major focus of these levee options has been on protection of the currently populated areas. The subject block of land is located outside the protection of the proposed levees particularly from Dawson River flooding. The proposed levees will need to be modified to also provide protection for this block of land. Further modelling and assessment would need to be undertaken if a levee option was to be adopted as a preferred feasible alternative to the proposed back-zoning. It is also noted that any proposed levee option may need to incorporate raise stumped houses outside the levee as a measure to mitigate the impacts as a result of the levee.
- Incorporate planning controls to the site to restrict the amount of fill associated with the development. The required minimum building platform level could be achieved by the use of a high set building arrangement, such as a suspended slab on stilts structure. The objective for this option is to minimise the flood impacts by restricting the fill whilst still achieving the required minimum building platform levels. No flood modelling has been undertaking for assessment of this option. Further assessment would need to be undertaken to determine the allowable fill on the site if BSC considers this option as a feasible alternative.
- Provision of a drainage system through the subject block of land to compensate for loss of flood conveyance. No flood modelling has been undertaken to further assess this option.
- Provision of mitigation of the impacts on dwellings by raising the houses which may potentially be impacted as a result of the proposed development.

10 Outcome of feasible alternatives assessment

Based on the flood assessment undertaken, potential development consistent with the arrangements of the current Planning Scheme is anticipated to result in flood impacts in the vicinity of the subject site. BSC is seeking to back-zone the site to 'Rural' which is consistent with State Planning Policy. Alternative development options have been considered in the previous section and are discussed further below.

Structural solutions such as the construction of a flood levee have been considered however the scope and extent of these levees was found to be significant. In addition, the previous assessment has not included this area of land. Assessment of a levee system is provided in 'Banana Shire Flood Study – Stage 2 , Volume 1 – Structural Measures Report' (September 2016).

The entire township is flooded in a flood greater than the 1% AEP event and options for flood mitigation are limited. The proposed development is expected to result in increased flood risk to existing residents if filled to the proposed DFE level with hazard and flood depths particularly increased for local Castle Creek flows.

In general the township operates to evacuate residents and alternatives were not considered to be feasible for the following reasons:

- The limited growth of Theodore can be accommodated within areas free of flood hazard located further east of the existing township on the other side of Castle Creek or to the south east along the Leichhardt Highway.
- The construction of a levee system would be at a significant cost to the rate payers of Theodore region (estimated to be approximately $15–25M) and would only provide flood protection up to the 2% AEP event. These costs would include technical investigation and design, land resumption, construction and maintenance. Given this area is not required for future expansion of Theodore the cost benefit of such a significant investment would be unlikely to be justified.

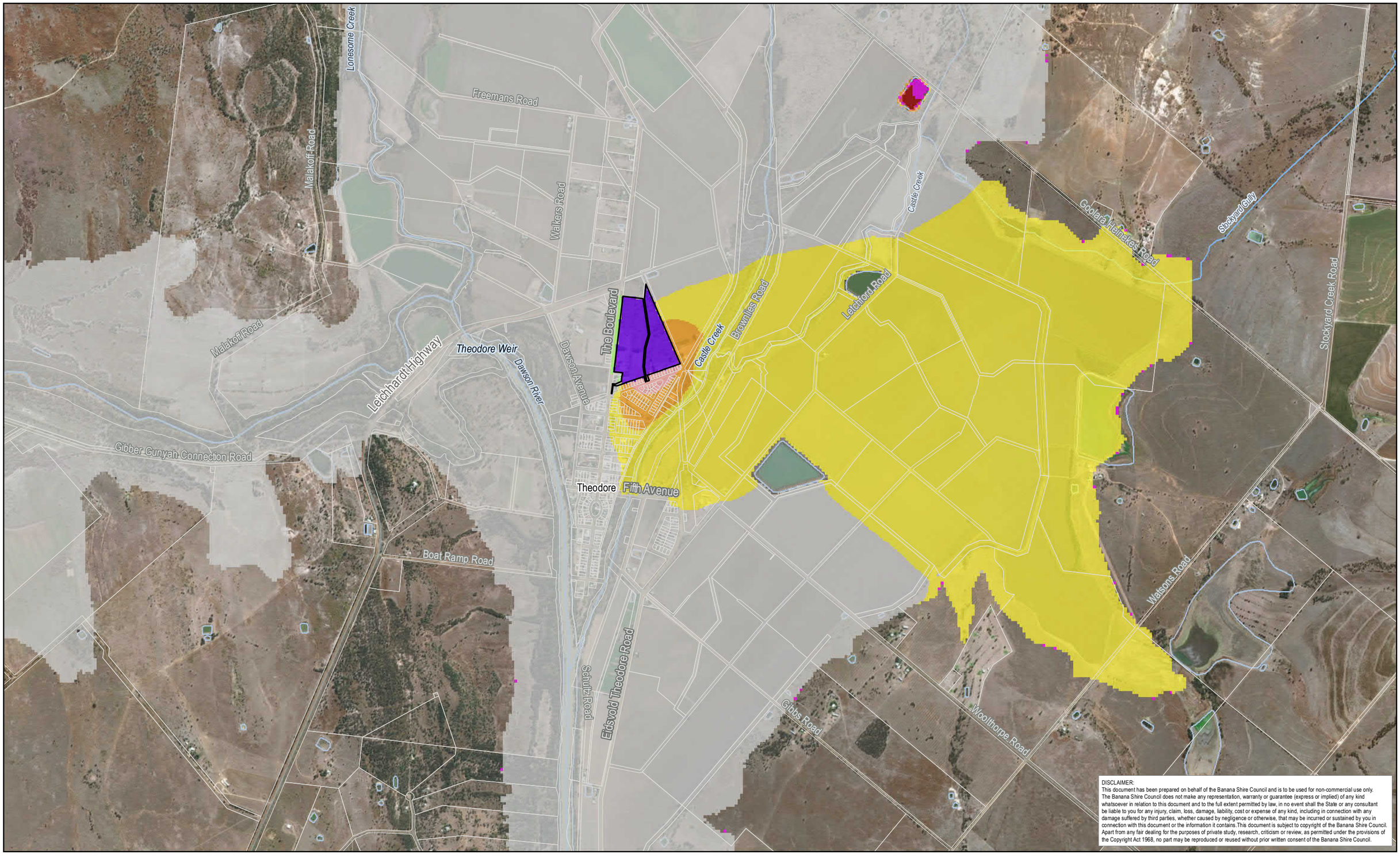
Other potential mitigation options such as imposing planning control on the proposed development (such as having the buildings as high set to allow flood to flow under the slabs) are also not considered feasible for the following reasons:

- These areas are not required to accommodate growth of Theodore. Sufficient land exists in Theodore outside the flood impact zone. Such planning conditions will create disadvantages to the development.
- These type of developments may achieve the minimum building floor level requirement but may not comply with other development requirements such as providing safe vehicular or pedestrian access to the development during a major flood event. This is not consistent with the intent of the State Planning Policy.

Based on the outcome of this study none of the potential mitigation options discussed in this report are deemed feasible alternatives to back-zoning.

Appendix A

Flood maps



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KBR

ABN 91 007 660 317

BEW956-0001-TD-HY-GIS-0002-0001

POSITION	NAME	SIGNATURE
PREPARED	A. DJOZAN	
MAPPED	P. CAMERON	
CHECKED	A. DENSTEN	
APPROVED	A. DENSTEN	

Legend

- Site Proposed For Rezoning
- Was wet now dry
- Was dry now wet

Difference (m)

- < -0.30
- -0.30 – -0.20
- -0.20 – -0.10
- -0.10 – -0.05
- -0.05 – -0.03
- -0.03 – 0.03
- 0.03 – 0.05
- 0.05 – 0.10
- 0.10 – 0.20
- 0.20 – 0.30
- > 0.30

Banana SHIRE SHIRE OF OPPORTUNITY

Locality: Theodore **Projection:** GDA 1994 MGA Zone 56

0 0.5 1
kilometres

Scale at A3 - 1:25,000

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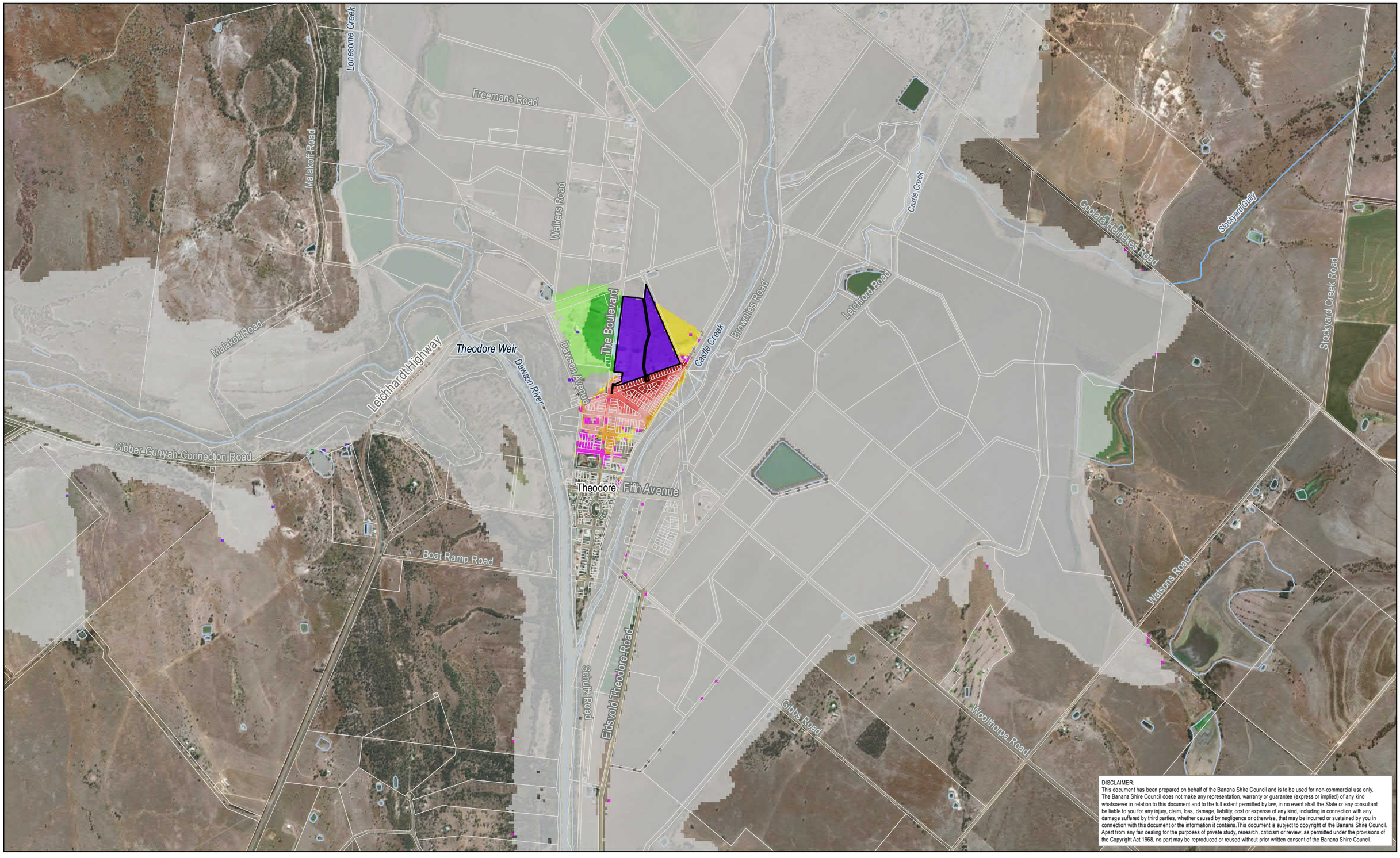
Model Result: afflux_theodore_100y72hcc_dev01_minus_baseline_h

Banana Shire Council
Feasible Alternative Assessment
Theodore - Dawson River Flooding
Flood Difference
1% AEP Design Event
Plus Climate Change (DFE)

02-FAA-001

02/09/19

0



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PREPARED	A. DJOZAN	
MAPPED	P. CAMERON	
CHECKED	A. DENSTEN	
APPROVED	A. DENSTEN	

Legend

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Difference (m)

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- -0.05 – -0.03
- -0.03 – 0.03
- 0.03 – 0.05
- 0.05 – 0.10
- 0.10 – 0.20
- 0.20 – 0.30
- > 0.30

Banana SHIRE
SHIRE OF OPPORTUNITY

Locality: Theodore **Projection:** GDA 1994 MGA Zone 56

0 0.5 1
kilometres

Scale at A3 - 1:25,000

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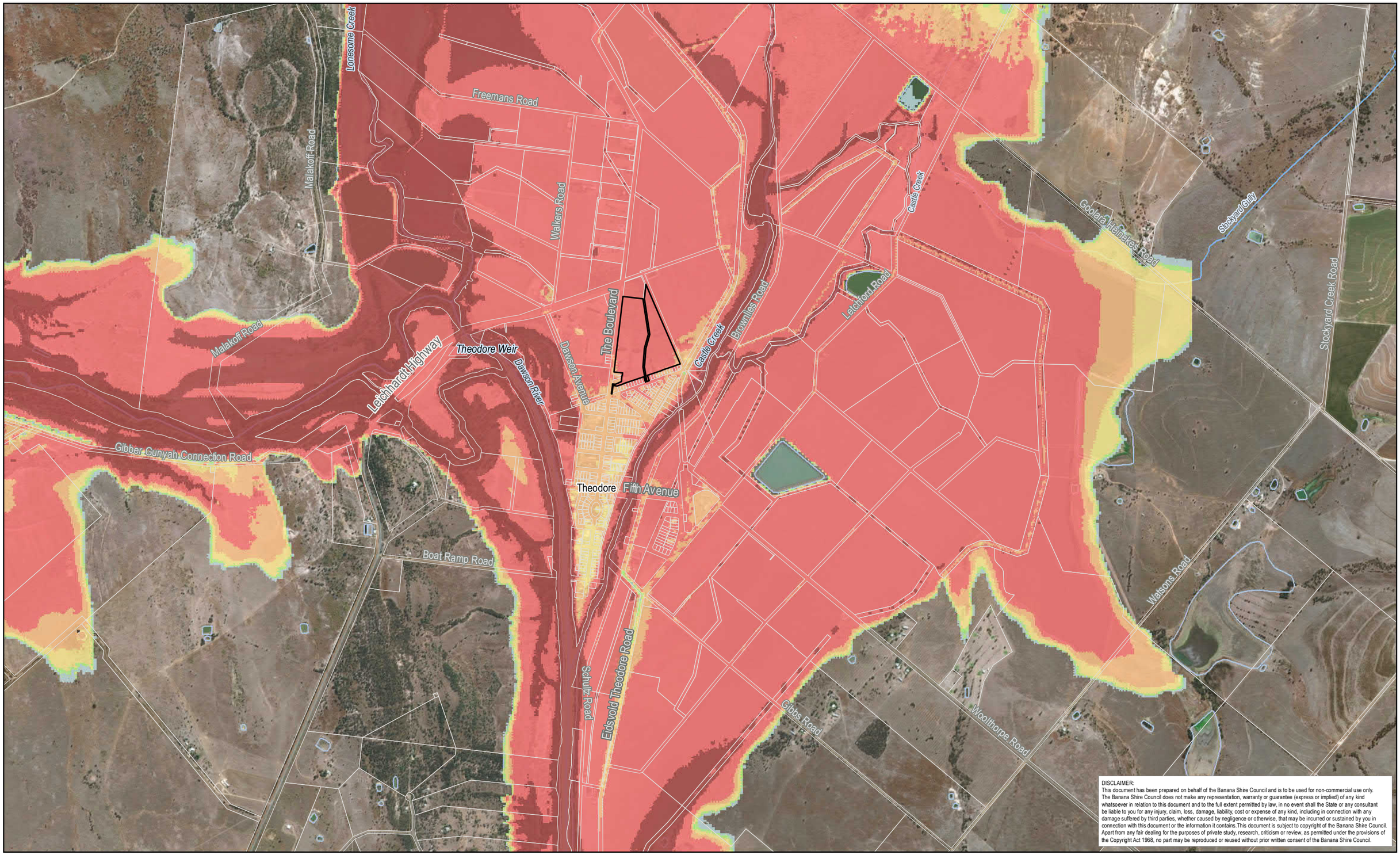
Model Result: afflux_castle_100y6hcc_dev01_minus_baseline_h

Banana Shire Council
Feasible Alternative Assessment
Theodore - Castle Creek Flooding
Flood Difference
1% AEP Design Event
Plus Climate Change (DFE)

02-FAA-002

02/09/19

0



KBR

ABN 91 007 660 317

BEW956-0001-TD-HY-GIS-0002-0003

POSITION	NAME	SIGNATURE
PREPARED	A. DJOZAN	
MAPPED	P. CAMERON	
CHECKED	A. DENSTEN	
APPROVED	A. DENSTEN	

Legend

Site Proposed For Rezoning

Hazard Vulnerability Classification (cumulative)
- H1 Generally safe
- H2 Unsafe for small vehicles
- H3 Unsafe for all vehicles, children and the elderly
- H4 Unsafe for vehicles and all people
- H5 Buildings vulnerable to structural damage
- H6 All buildings vulnerable to failure

Banana SHIRE
SHIRE OF OPPORTUNITY

Locality: Theodore **Projection:** GDA 1994 MGA Zone 56

0 0.5 1
kilometres

Scale at A3 - 1:25,000

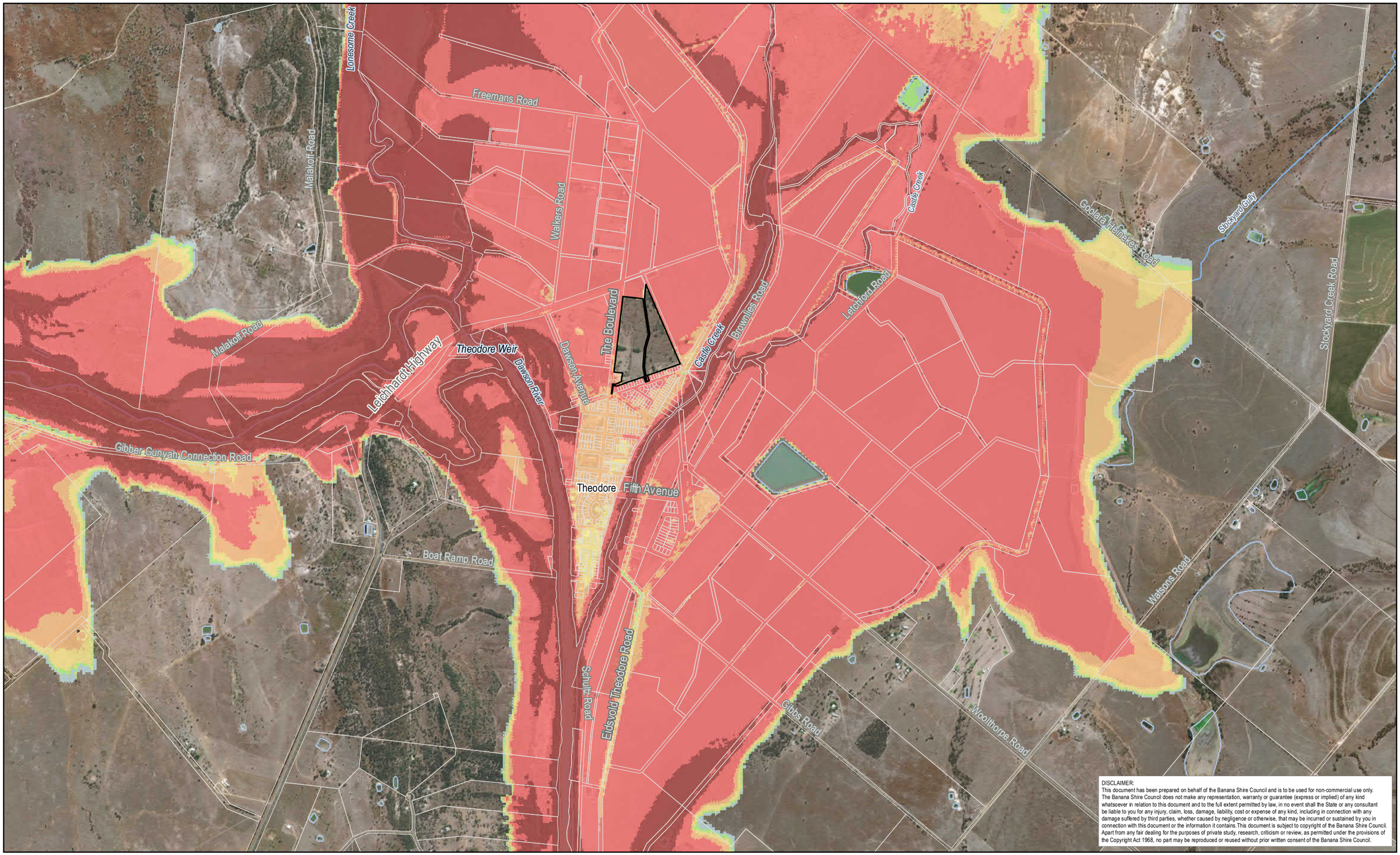
Model Result: Theo_20m_100y72hCC_100_ZAEM1_Max

Banana Shire Council
Feasible Alternative Assessment
Theodore - Dawson River Flooding
Flood Hazard
Baseline Scenario-DFE

02-FAA-003

02/09/19

0



KBR

ABN 91 007 660 317

BEW956-0001-TD-HY-GIS-0002-0004

POSITION	NAME	SIGNATURE
PREPARED	A. DJOZAN	
MAPPED	P. CAMERON	
CHECKED	A. DENSTEN	
APPROVED	A. DENSTEN	

Legend

Site Proposed For Rezoning

Hazard Vulnerability Classification (cumulative)
- H1 Generally safe
- H2 Unsafe for small vehicles
- H3 Unsafe for all vehicles, children and the elderly
- H4 Unsafe for vehicles and all people
- H5 Buildings vulnerable to structural damage
- H6 All buildings vulnerable to failure

Banana Shire
SHIRE OF OPPORTUNITY

Locality: Theodore **Projection:** GDA 1994 MGA Zone 56

0 0.5 1
kilometres

Scale at A3 - 1:25,000

Model Result: Theo_20m_100y72hCC_dev01_ZAEM1_Max

Banana Shire Council
Feasible Alternative Assessment
Theodore - Dawson River Flooding
Flood Hazard
Developed Case Scenario-DFE

02-FAA-004

02/09/19

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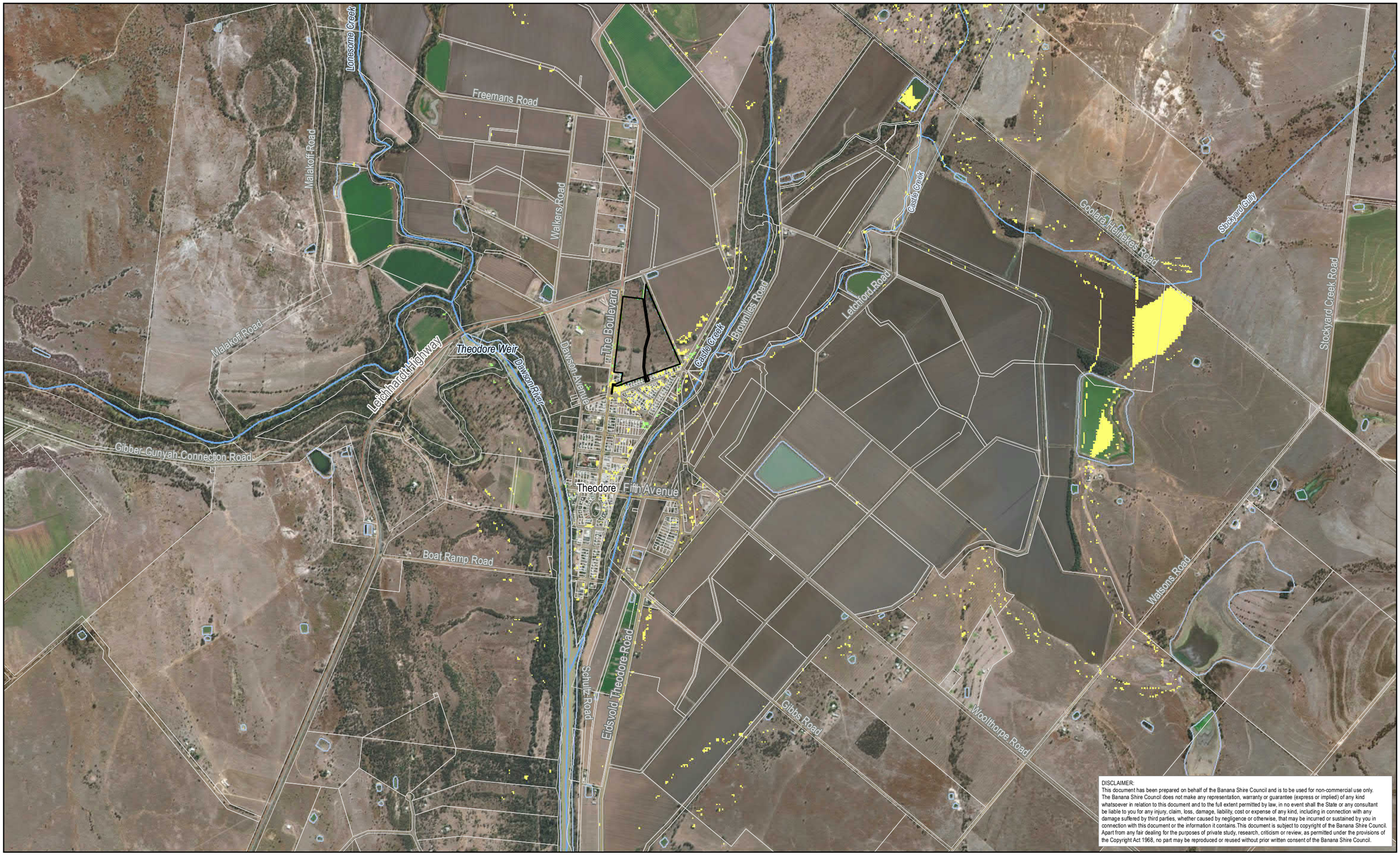

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ABN 91 007 660 317

BEW956-0001-TD-HY-GIS-0002-0005

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PREPARED	A. DJOZAN	
MAPPED	P. CAMERON	
CHECKED	A. DENSTEN	
APPROVED	A. DENSTEN	

Legend

Site Proposed For Rezoning

Hazard Classification Difference

-5
-4
-3
-2
-1
0
1
2
3
4

Banana SHIRE
SHIRE OF OPPORTUNITY

Locality: Theodore

Projection: GDA 1994 MGA Zone 56

0 0.5 1
kilometres

Scale at A3 - 1:25,000

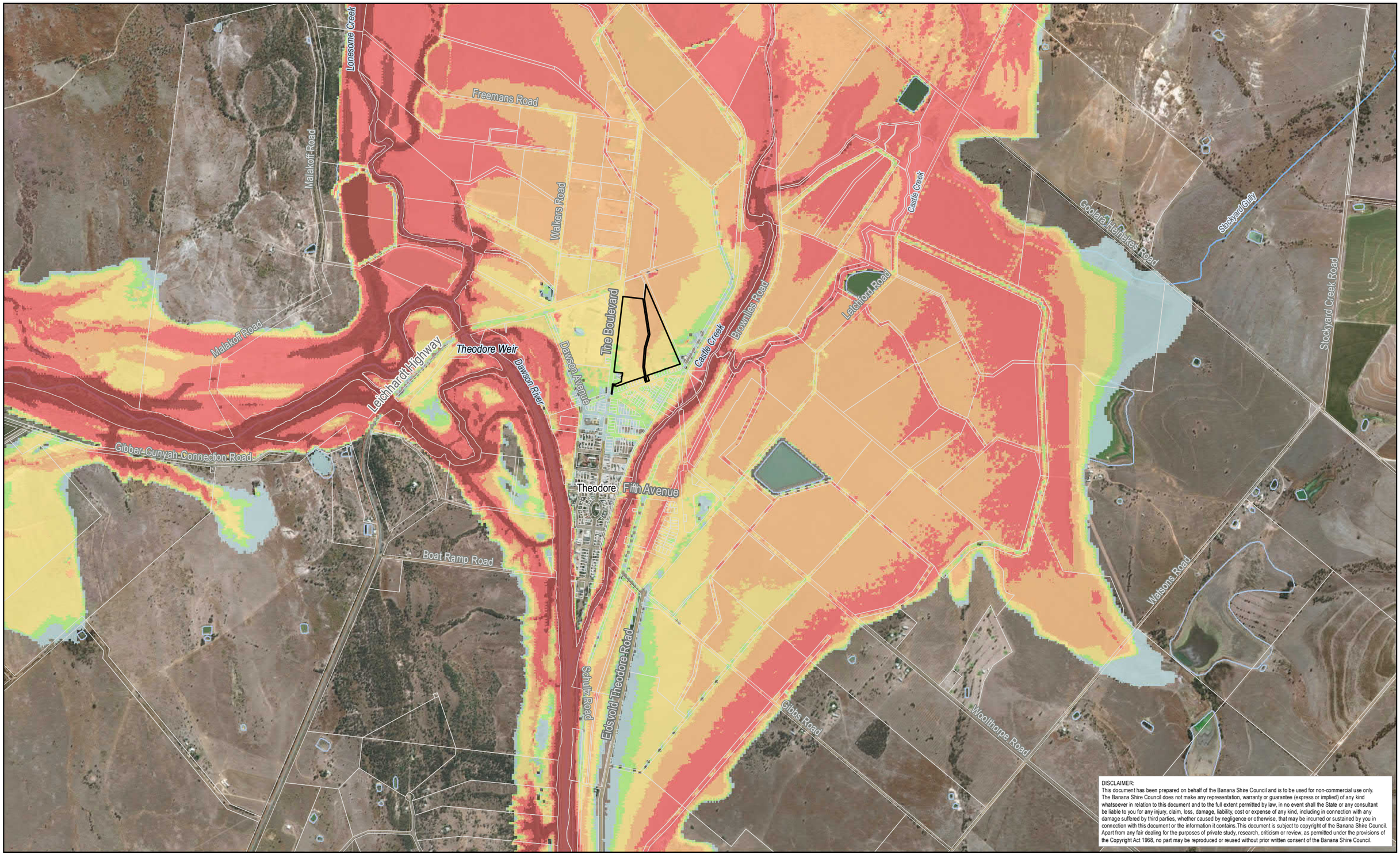
Model Result: Hazard_Difference_Theo_20m_100y72hCC_dev01_ZAEM1_Max_Minus_100_ZAEM1

Banana Shire Council
Feasible Alternative Assessment
Theodore - Dawson River Flooding
Changes In Flood Hazard
Developed Case Scenario-DFE
Minus Baseline Scenario-DFE

02-FAA-005

02/09/19

0



KBR

BEW956-0001-TD-HY-GIS-0002-0006

POSITION	NAME	SIGNATURE
PREPARED	A. DJOZAN	
MAPPED	P. CAMERON	
CHECKED	A. DENSTEN	
APPROVED	A. DENSTEN	

Legend

Site Proposed For Rezoning

Hazard Vulnerability Classification (cumulative)
- H1 Generally safe
- H2 Unsafe for small vehicles
- H3 Unsafe for all vehicles, children and the elderly
- H4 Unsafe for vehicles and all people
- H5 Buildings vulnerable to structural damage
- H6 All buildings vulnerable to failure

Banana SHIRE
SHIRE OF OPPORTUNITY

Locality: Theodore

Projection: GDA 1994 MGA Zone 56

0 0.5 1
kilometres

Scale at A3 - 1:25,000

Model Result: Theo_20m_Castle_100y6hCC_100_ZAEM1_Max

Banana Shire Council
Feasible Alternative Assessment
Theodore - Castle Creek Flooding
Flood Hazard
Baseline Scenario-DFE

02-FAA-006

02/09/19

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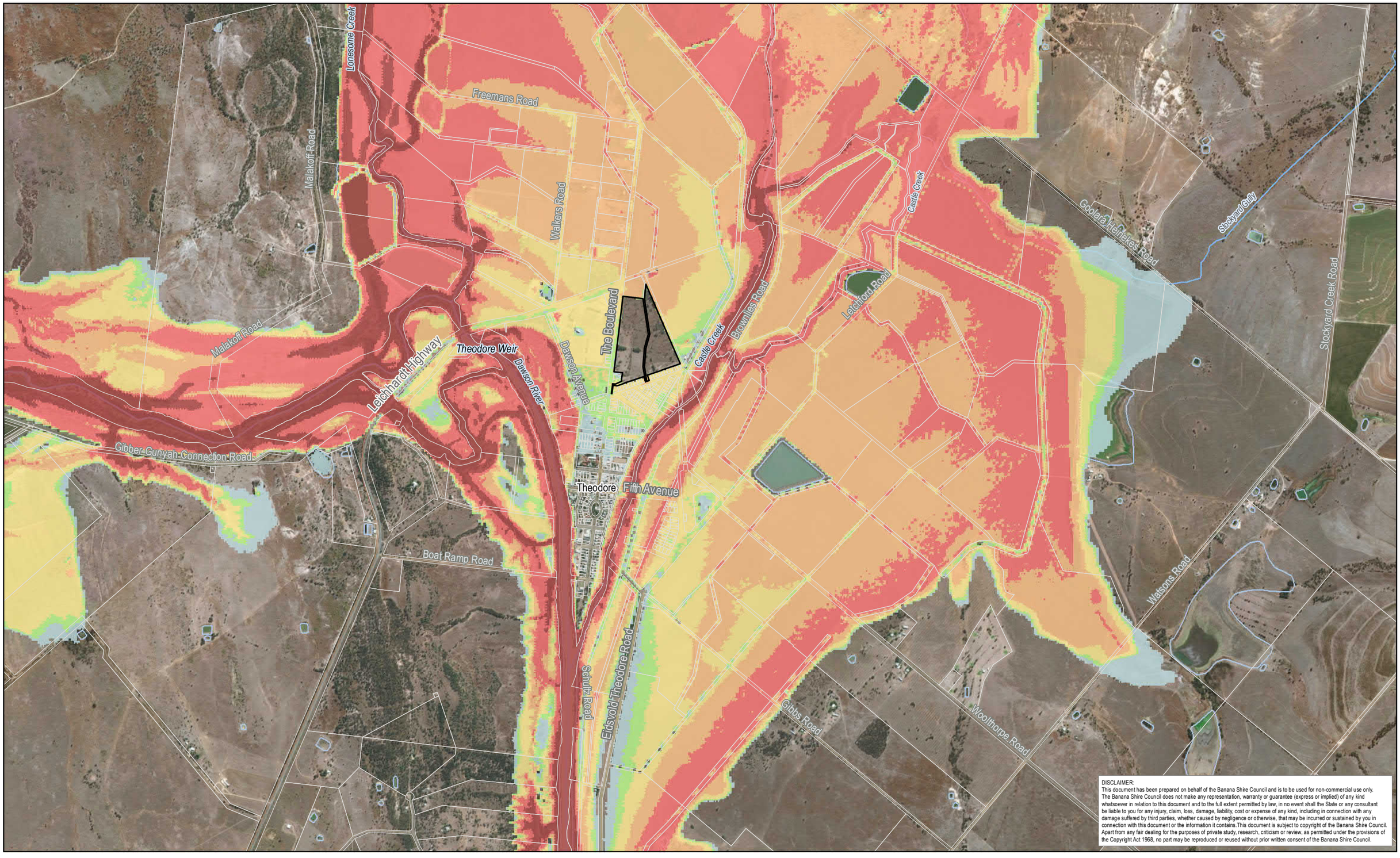

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ABN 91 007 660 317

BEW956-0001-TD-HY-GIS-0002-0007

POSITION	NAME	SIGNATURE
PREPARED	A. DJOZAN	
MAPPED	P. CAMERON	
CHECKED	A. DENSTEN	
APPROVED	A. DENSTEN	

Legend

Site Proposed For Rezoning

Hazard Vulnerability Classification (cumulative)
- H1 Generally safe
- H2 Unsafe for small vehicles
- H3 Unsafe for all vehicles, children and the elderly
- H4 Unsafe for vehicles and all people
- H5 Buildings vulnerable to structural damage
- H6 All buildings vulnerable to failure

Banana SHIRE
SHIRE OF OPPORTUNITY

Locality: Theodore

Projection: GDA 1994 MGA Zone 56

0 0.5 1
kilometres

Scale at A3 - 1:25,000

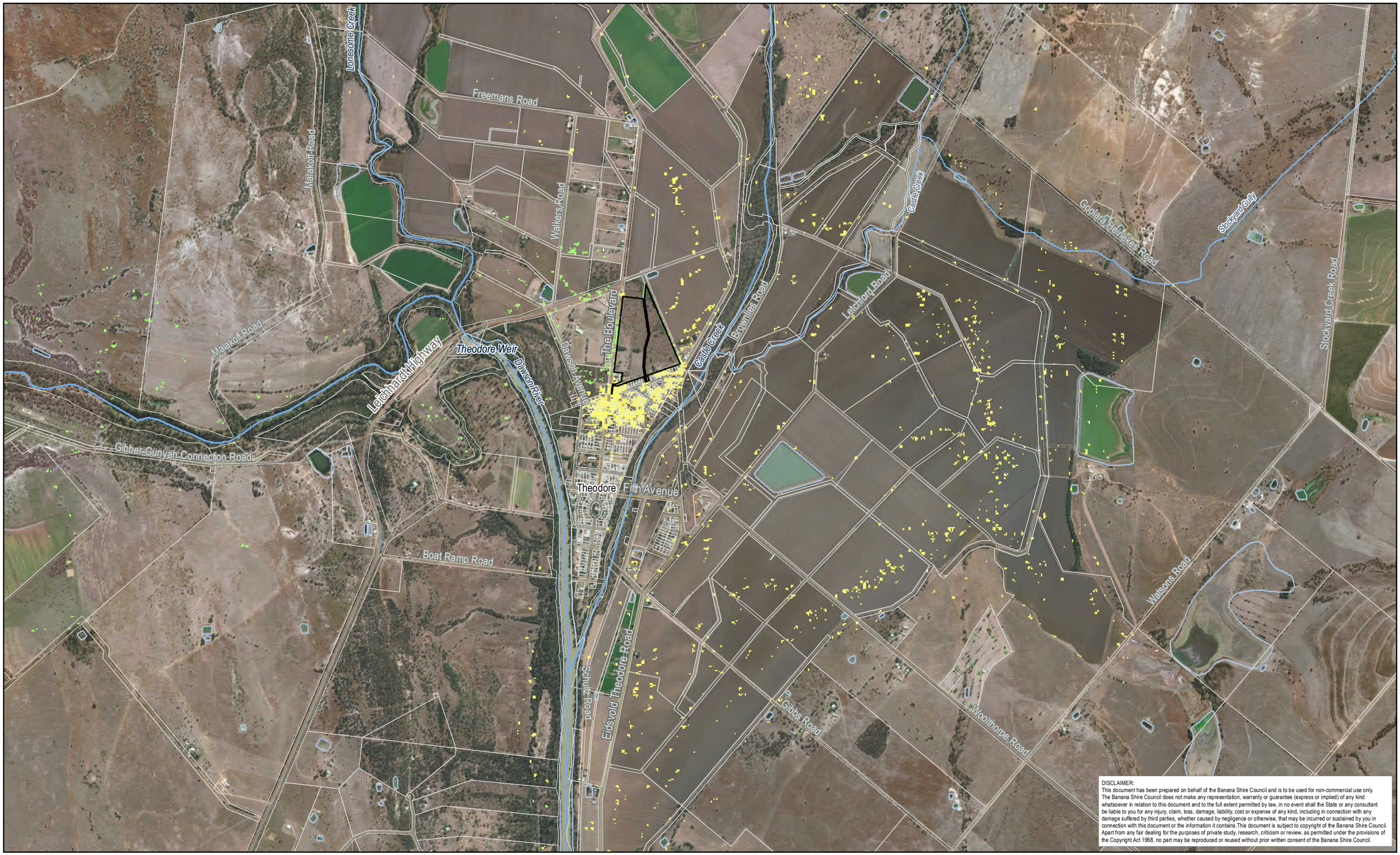
Model Result: Theo_20m_Castle_100y6hCC_dev01_ZAEM1_Max

Banana Shire Council
Feasible Alternative Assessment
Theodore - Castle Creek Flooding
Flood Hazard
Developed Case Scenario-DFE

02-FAA-007

02/09/19

0



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BEW956-0001-TD-HY-GIS-0002-0008

POSITION	NAME	SIGNATURE
PREPARED	A. DJOZAN	
MAPPED	P. CAMERON	
CHECKED	A. DENSTEN	
APPROVED	A. DENSTEN	

Legend

Site Proposed For Rezoning

Hazard Classification Difference

-5
-4
-3
-2
-1
0
1
2
3
4

Locality: Theodore

Projection: GDA 1994 MGA Zone 56

0 0.5 1
kilometres

Scale at A3 - 1:25,000

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Model Result: Hazard_Difference_Theo_20m_Castle_100y6hCC_dev01_ZAEM1_Max_Minus_100_ZAEM1

Banana Shire Council
Feasible Alternative Assessment
Theodore - Castle Creek Flooding
Changes In Flood Hazard
Developed Case Scenario-DFE
Minus Baseline Scenario-DFE

02-FAA-008

02/09/19

0

KBR

BEW956-0001-TD-HY-GIS-0002-0009

POSITION	NAME	SIGNATURE
PREPARED	A. DJOZAN	
MAPPED	P. CAMERON	
CHECKED	A. DENSTEN	
APPROVED	A. DENSTEN	

Legend

Site Proposed For Rezoning

Hazard Classification Difference

-5
-4
-3
-2
-1
0
1
2
3
4

Banana SHIRE SHIRE OF OPPORTUNITY

Locality: Theodore

Projection: GDA 1994 MGA Zone 56

0 50 100 150 200 250
metres

Scale at A3 - 1:10,000

Model Result: Hazard_Difference_Theo_20m_100y72hCC_dev01_ZAEM1_Max_Minus_100_ZAEM1

Banana Shire Council
Feasible Alternative Assessment
Theodore - Dawson River Flooding
Changes In Flood Hazard
Developed Case Scenario-DFE
Minus Baseline Scenario-DFE

02-FAA-009

02/09/19

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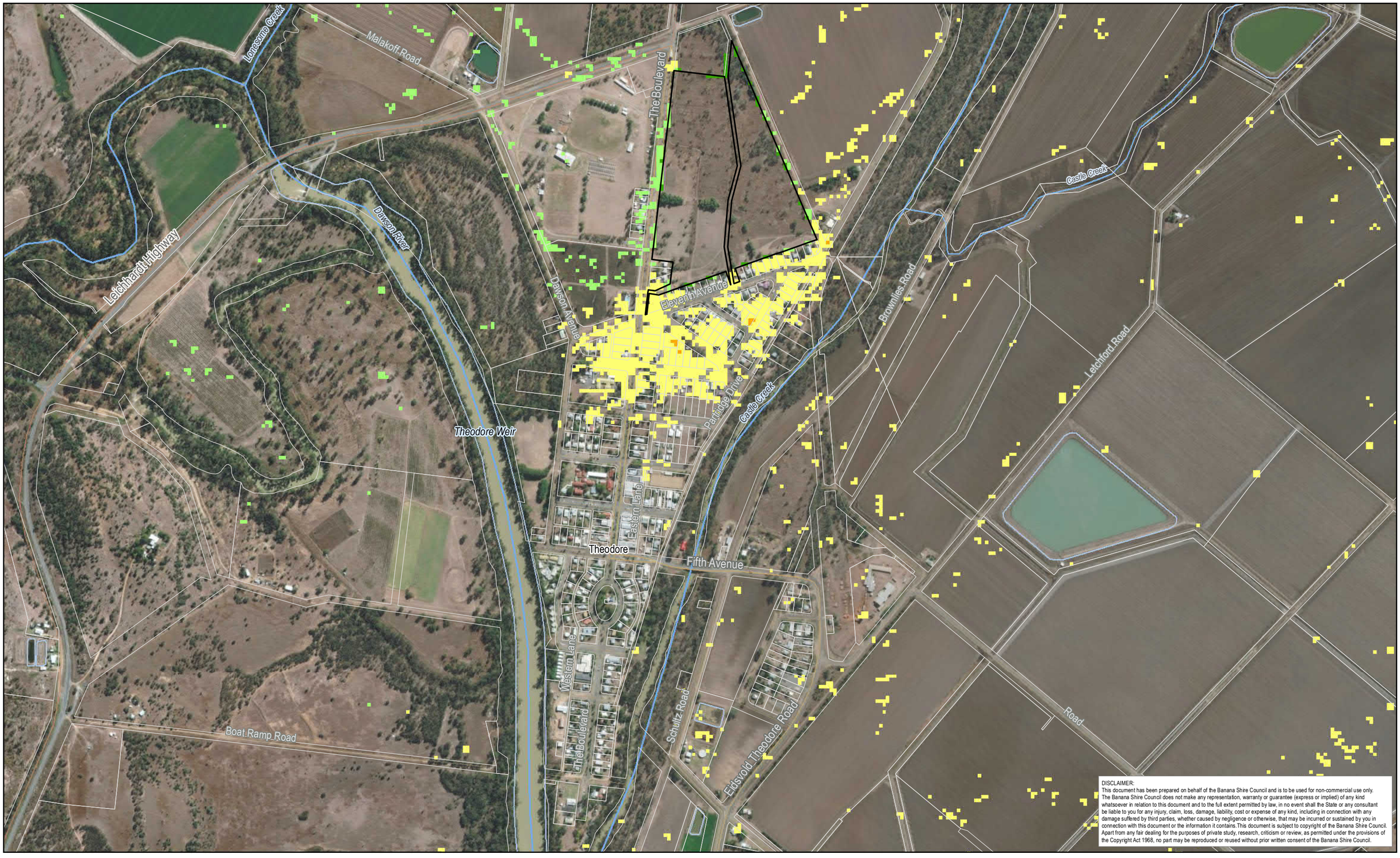

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BEW956-0001-TD-HY-GIS-0002-0010

POSITION	NAME	SIGNATURE
PREPARED	A. DJOZAN	
MAPPED	P. CAMERON	
CHECKED	A. DENSTEN	
APPROVED	A. DENSTEN	

Legend

Site Proposed For Rezoning

Hazard Classification Difference

-5
-4
-3
-2
-1
0
1
2
3
4

Banana SHIRE
SHIRE OF OPPORTUNITY

Locality: Theodore

Projection: GDA 1994 MGA Zone 56

0 50 100 150 200 250
metres

Scale at A3 - 1:10,000

Model Result: Hazard_Difference_Theo_20m_Castle_100y6hCC_dev01_ZAEM1_Max_Minus_100_ZAEM1

Banana Shire Council
Feasible Alternative Assessment
Theodore - Castle Creek Flooding
Changes In Flood Hazard
Developed Case Scenario-DFE
Minus Baseline Scenario-DFE

02-FAA-010

02/09/19

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