

IN THE MATTER of the Resource Management Act 1991 (“RMA” or “the Act”)

AND

IN THE MATTER of a submission in respect of the **PROPOSED WAIKATO DISTRICT PLAN** by **KIRRIMUIR TRUSTEE LIMITED** pursuant to Clause 6 of Schedule 1 of the Act

STATEMENT OF EVIDENCE OF AJAY DESAI ON BEHALF OF KIRRIEMUIR TRUSTEE LTD

1. **INTRODUCTION**

Qualifications and experience

- 1.1 I hold a Bachelor of Civil Engineering (2011) and Master of Civil Engineering Degree (2014), specialising in Water Resources and Environmental Engineering, from the University of Pune, India. I am currently a member of Engineering New Zealand (MEngNZ), Chartered Institution of Water and Environmental Management (MCIWEM) and Institution of Civil Engineers (GMICE).
- 1.2 I have extensive stormwater, wastewater and water network modelling experience which includes projects in the United Kingdom, Middle East and more recently in New Zealand. I have a wide range of modelling and spatial analytical skills which include 3-water hydraulic modelling using a variety of software packages, model build and verification, irrigation modelling and master planning, flood risk assessment, GIS, options assessments, solution designing, and SuDS (water sensitive design) optioneering.
- 1.3 I have been the principal author and lead stormwater engineer for a wide range of flood modelling reports to support private land development, urban design and planning frameworks. I have been involved in and prepared numerous catchment scale flood models, detailed stormwater pipe models and integrated catchment management plans for private clients as well as for district and regional councils.
- 1.4 Examples of project experience relevant to my evidence include:

- 1.5 Rymans' Karori and Park Terrace Village, 3-waters engineer. I prepared the infrastructure reports and evidence for this 3.3ha retirement village as well as designing attenuation, on-site erosion control and stormwater treatment devices.
- 1.6 Lead stormwater engineer completing the Stormwater Modelling flood analysis and numerous stormwater runoff and overland flow path assessments for:
- (a) Sleepyhead Estate Development, Ohinewai – 178ha;
 - (b) Drury South Precinct Development – 361ha; and
 - (c) Drury East Development – 231ha.
- 1.7 One of the Lead Technical Reviewers for Auckland Council's Healthy Waters team, providing technical assistance and reviews of Flood Plains and Stormwater models built using variety of modelling packages including InfoWorks and Mike by DHI. some of the reviews are –
- (a) Motions Central Rail Link (CRL) Modelling;
 - (b) Auckland region LiDAR 2016 Quality Assessment;
 - (c) Cockle Bay (DHI – 3way coupled model);
 - (d) Puhinui (DHI– 3way coupled model);
 - (e) Mahurangi (InfoWorks ICM);
 - (f) Oira Ngakoroa (InfoWorks ICM); and
 - (g) Papatoetoe Tamaki (DHI– 3way coupled model);

Involvement in project

- 1.8 Wood & Partners Consultants Ltd (“Woods”) has been engaged by Kirriemuir Trustee Limited (“KTL”) to complete a preliminary stormwater assessment to support the rezoning application for several sites to the west of Tuakau on Geraghtys Rd, from Rural to Residential zoning.
- 1.9 I was Stormwater Engineer leading the stormwater management and flooding work for the client which involved working collaboratively with Waikato Regional Council (“WRC”) technical representatives to discuss and agree on the key assumptions and decisions required. It also required consultation with Waikato District Council (WDC) and any other stakeholders.
- 1.10 I last visited the site on 9th of December 2020.

Purpose and scope of evidence

- 1.11 My evidence describes the process and technical assessments to develop and address the flood hazard and stormwater management systems proposed to be incorporated into the development.
- 1.12 My evidence is structured as follows:
- (a) Existing catchment and proposed development (Section 3)
 - (b) Relevant Planning context (Section 4)
 - (c) Stormwater Management (Section 5)
 - (d) Flood Assessment (Section 6)
 - (e) Consultation with Waikato Regional Council (Section 7)
 - (f) A brief conclusion (Section 8)
- 1.13 A summary of my evidence is contained in Section 2.
- 1.14 My evidence should be read together with the evidence of:
- (a) Mr John Olliver, Planning

Expert Witness Code of Conduct

- 1.15 I have read the Code of Conduct for Expert Witnesses, contained in the Environment Court Consolidated Practice Note (2014) and I agree to comply with it. I can confirm that the issues addressed in this statement are within my area of expertise and that in preparing my evidence I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

2. SUMMARY OF EVIDENCE

- 2.1 My evidence describes the process and technical assessments to develop and address the flood hazard and stormwater management systems proposed to be incorporated into the development.
- 2.2 Stormwater from the KTL site drains to an unnamed local stream which discharges to Kairoa Stream which is approximately 200m to the south of the site. The Kairoa Stream discharges to the Waikato River which is approximately 1km to the south west of the site.

- 2.3 The KTL site is covered by the draft Catchment Management Plan (CMP) developed by Tonkin and Taylor (2014) to support the Tuakau Structure Planning process. This CMP sets out the Flood Hazard Management and Stormwater Management Plan approach to be adopted for any proposed development within Tuakau.
- 2.4 The CMP provides Staging Plans and Growth Sectors based on the proposed land uses to identify key constraints. There are culvert upgrades required for any urban growth upstream of the KTL site but no infrastructure upgrades are required to develop the KTL site itself. Flood Hazard is contained within the proposed open space network.
- 2.5 The KTL submission seeks a Residential zoning to be applied for the KTL site from the current Rural zone in the Proposed District Plan. There are no industrial or commercial zonings proposed.
- 2.6 A review of the statutory framework, relevant stormwater guidelines and policies was carried out to inform the appropriate stormwater requirements.
- 2.7 A treatment train approach is proposed to be adopted in order to meet the water quality and erosion control requirements for discharges to a river environment outlined in Waikato Regional Council ("WRC") document TR2018/01 for development within any of the stormwater management zones.
- 2.8 Water quality treatment is proposed for all trafficked areas including roads, parking areas and driveways. The treatment train approach involves at least two devices prior to discharge to the receiving environment and can be comprised of at-source treatment options and use of communal devices.
- 2.9 A stormwater management toolbox has been prepared which provides options for devices that can be utilised within the development.
- 2.10 Extended detention / volume control criteria are required for discharges to a stream environment to manage erosion and scour of natural stream/watercourses which will be discussed and adopted in consultation with WRC.
- 2.11 Volume reduction is proposed through re-use from roof runoff. The strategy can adopt a naturalised interface through inclusion of the existing ponds.
- 2.12 Flood assessment has been undertaken by WRC using Mike by DHI modelling package for Waikato River to define the 1% AEP flood extents. These are provided in WRC's Hazard portal and covers the Tuakau Swamp to the west

of the site under the Flood Management Area overlay in the Proposed Waikato District Plan.

- 2.13 Flood assessment undertaken by WDC as a part of the Catchment Management Planning and Tuakau Structure Planning process which provides the flood extents for the Kairoa Stream and all its tributaries.
- 2.14 The proposed structure plan designates the flood areas as indicative open space network with no development proposed within the 1% AEP Floodplain. Flood attenuation may not be required for discharges as there is no downstream flood risk identified within the Kairoa Stream or Tuakau Swamp.
- 2.15 I have reviewed the Section 42A Framework Report prepared by WDC and there are no concerns identified that would preclude this zone change. There are no issues raised in the Section 42A Framework report relating to my area of expertise which cause concern.

3. Existing catchment and proposed development

- 3.1 The submission by KTL sought the rezoning of all or part of six properties. The land proposed to be rezoned is Rural in the Proposed District Plan (PDP). The KTL submission sought that they be rezoned to Residential in accordance with the Residential zone rules in the PDP.
- 3.2 The site is generally flat and bisected by a shallow gully system running generally north-south, including two ponds. Approximately 10ha of the western part of the site is vegetated and discharges towards Waikato River stopbanks and Tuakau Swamp managed by WRC.
- 3.3 Stormwater from the KTL site drains to an unnamed local stream which discharges to Kairoa Stream which is approximately 200m to the south of the site. The Kairoa Stream discharges to the Waikato River which is approximately 1km to the south west of the site.

4. RELEVANT PLANNING CONTEXT

- 4.1 A review of the statutory framework, relevant stormwater guidelines and policies was carried out to inform the appropriate stormwater requirements.
- 4.2 A summary of technical guidance documents to be considered in preparation of the Stormwater management approach is summarised in Table 1 below:

Table 1: Summary of Guidance Documents

Guidance Document	What it says	Relevance
Resource Management Act (1991)	Overarching environmental legislation.	Yes
National Policy Statement for Freshwater Management (2014)	National Statement outlining objectives for managing freshwater in New Zealand and policies for Regional Councils to adopt in order to meet these objectives.	Yes
Waikato Regional Policy Statement	Document outlining key objectives for the Waikato Region	Yes
Vision and Strategy for the Waikato River	Document outlining key objectives for the Waikato River specifically and strategies/policies to achieve those objectives	Yes
WRC TR2018/01 – Stormwater Management Guideline	Benchmark document for technical guidance and design criteria for stormwater management devices	Yes
WRC TR2018/02 – Waikato Stormwater Runoff Modelling Guideline	Guideline document for hydrology in the Waikato Region	Yes
Regional Infrastructure Technical Specifications (RITS)	Standards for the design and construction of public infrastructure within Waikato District. Stormwater Runoff Modelling Guidelines	Yes
NZS4404 – Land development and Subdivision Infrastructure	Provides detail on stormwater management including WSD, flood risk management, freeboard allowance etc	Yes
WRC TR2011/05 – Significant Natural Areas of the Waikato Region – Lake Ecosystems	Provides guidance on the prioritisation of natural areas for biodiversity management. Contains Lake water levels.	Yes
ARC TP10 – Stormwater Management Devices: Design guidelines manual	Superseded document for technical guidance and design criteria for stormwater management devices.	Yes – provides guidance in technical design for sizing of stormwater management devices
Auckland Council - Guideline Document 2017/001 Version 1 - Stormwater Management Devices in the Auckland Region	Based on ARC's TP10 document. Document for technical guidance and design criteria for stormwater management devices.	Yes – provides guidance in technical design for sizing of stormwater management devices

Te Ture Whaimana o Te Awa o Waikato (Vision & Strategy)

4.3 The Vision and Strategy for the Waikato River (Te Ture Whaimana o Te Awa o Waikato) responds to four fundamental issues, which are as follows:

- (a) The degradation of the Waikato River and its catchment has severely compromised Waikato River iwi in their ability to exercise mana whakahaere or conduct their tikanga and kawa;

- (b) Over time, human activities along the Waikato River and land uses through its catchments have degraded the Waikato River and reduced the relationships and aspirations of communities with the Waikato River;
- (c) The natural processes of the Waikato River have been altered over time by physical intervention, land use and subsurface hydrological changes. The cumulative effects of these uses have degraded the Waikato River; and
- (d) It will take commitment and time to restore and protect the health and wellbeing of the Waikato River.

4.4 While the Site does not discharge directly to the Waikato River, the Vision and Strategy will be considered as part of stormwater management given that Kairoa Stream ultimately forms part of the Waikato River's significant catchment.

4.5 The Vision and Strategy is part of the Waikato Regional Policy Statement, but in the event of a conflict, it takes precedence over any national policy statement.¹ It outlines objectives and strategies to achieve the restoration of the Waikato River. The following objectives (As per section 2.5.2 of the Vision and Strategy) will be considered:

- (a) The recognition and avoidance of adverse cumulative effects, and potential cumulative effects, of activities undertaken both on the Waikato River, and in particular those effects that threaten serious or irreversible damage to the Waikato River;
- (b) The recognition that the Waikato River is degraded and should not be required to absorb further degradation as a result of human activities; and
- (c) The restoration of water quality within the Waikato River so that it is safe for people to swim in and take food from over its entire length.

4.6 The following strategies to meet the above objectives set out in 2.5.2 of the Vision and Strategy will also be considered:

- (a) Ensure that the highest level of recognition is given to the restoration and protection of the Waikato River;

¹ Section 12(1) of the Settlement Act.

- (b) Encourage and foster a 'whole of river' approach to the restoration and protection of the Waikato River, including the development, recognition and promotion of best practice methods for restoring and protecting the health and wellbeing of the Waikato River; and
- (c) Ensure that the cumulative adverse effects on the Waikato River of activities are appropriately managed in statutory planning documents at the time of their review.

National Policy Statement for Freshwater Management

- 4.7 The National Policy Statement for Freshwater Management (NPSFM) sets out the statutory framework for the management of freshwater across New Zealand. The NPSFM requires Regional Councils to recognise the national significance of freshwater. Overall, freshwater quality within a region must be maintained or improved.
- 4.8 Key provisions of the NPSFM that are relevant to the SMP are Objectives A1, A2 and A4 and Policy A4. These are as follows:

Objective A1

To safeguard: a) the life-supporting capacity, ecosystem processes and indigenous species including their associated ecosystems, of fresh water; and b) the health of people and communities, as affected by contact with fresh water; in sustainably managing the use and development of land, and of discharges of contaminants.

Objective A2

The overall quality of fresh water within a freshwater management unit is maintained or improved while: a) protecting the significant values of outstanding freshwater bodies; b) protecting the significant values of wetlands; and c) improving the quality of fresh water in water bodies that have been degraded by human activities to the point of being over-allocated.

Objective A3

The quality of fresh water within a freshwater management unit is improved so it is suitable for primary contact more often, unless: a) regional targets established under Policy A6(b) have been achieved; or b) naturally occurring processes mean further improvement is not possible.

- 4.9 The stormwater management will be adopted to give effect to the NPSFM. Relevant features of the SMP are as follows:
 - (a) Provide reduction of nitrogen and phosphorus from stormwater runoff from the site which will help to contribute to the enhancement of the water quality of the receiving environment.

- (b) The treatment train approach will ensure that discharges from the site will not have any effects on the health of people and communities as affected by their secondary contact with freshwater nor on the mauri (life supporting capacity) of the downstream environment.

Waikato Regional Policy Statement

4.10 Consideration will be given to the following aspects of the Waikato RPS:

- (a) Objective 3.12: Built Environment (Ngā Wāhi Ka Whakawhanakehia)
 - (i) Requires that subdivision, use and development of the built environment occurs in an integrated and coordinated way that is sustainable, affordable and planned; and
- (b) Objective 3.14: Fresh Water Bodies (Ngā Huinga Waimāori)
 - (i) Seeks to maintain and enhance the values of freshwater bodies in the region, manage the allocation and use of fresh water and manage lakes, riparian areas and wetlands to promote water quality, biodiversity, cultural values and public access;
 - (ii) Recognises Te Ture Whaimana o Te Awa o Waikato - the Vision and Strategy for the Waikato River as the primary direction setting document for the Waikato River;
 - (iii) Acknowledges the special relationship that tangata whenua have with water resources; and
 - (iv) Promotes a catchment-based approach to water quality interventions to ensure the integrated management of water resources.
- (c) Objective 3.24: Natural Hazards (Ngā Pūmate Ā-Taiao)
 - (i) Promotes a regionally consistent approach to managing natural hazard risks through district and regional plans.
 - (ii) Advocates for collaboration between organisations and the sharing of information. A Regional Natural Hazards Forum has been established to promote organisational integration and sharing across jurisdictional and plan boundaries;

- (iii) Takes a risk-based approach to the management of natural hazards; and
- (iv) Requires that local authorities consider the potential effects of high impact, low probability natural hazard events and plan ahead.

Draft Catchment Management Plan, Tuakau Structure Plan

- 4.11 The KTL site is covered by the draft Catchment Management Plan (CMP) developed by Tonkin and Taylor to support the Tuakau Structure Planning process. This CMP sets out the Flood Hazard Management and Stormwater Management Plan approach to be adopted for any proposed development within Tuakau.
- 4.12 The CMP provides Staging Plans and Growth Sectors based on the proposed land uses to identify key constraints. There are culvert upgrades required for any growth upstream of the KTL site but no infrastructure upgrades are required to develop the KTL site itself. Flood Hazard is contained within proposed open space network.
- 4.13 All Stormwater management matters are to be considered under a Best Practicable Option (BPO) approach to prevent or minimise any environmental effects.

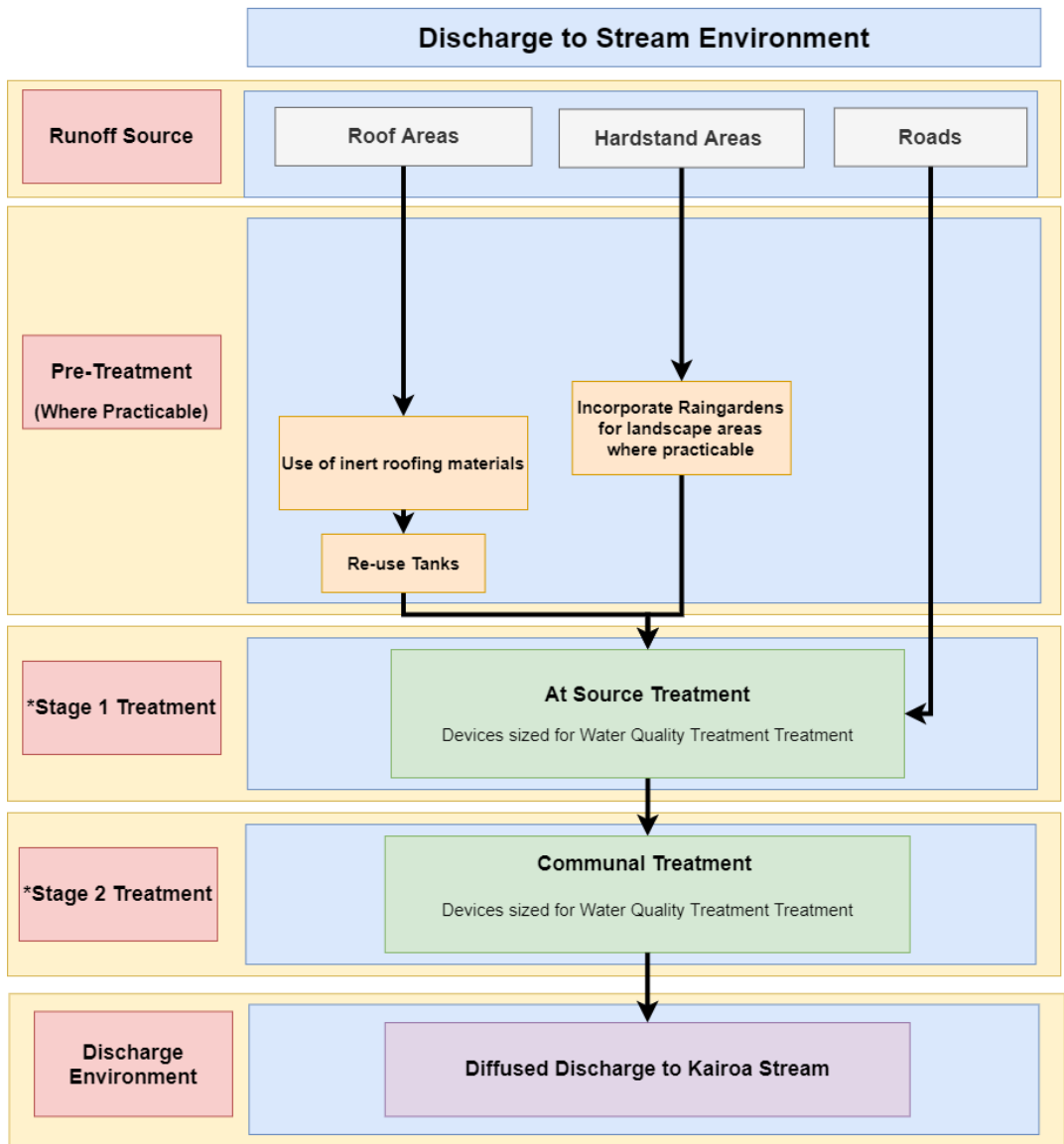
5. Stormwater Management

- 5.1 The KTL submission seeks Residential zonings to be applied for the KTL site from the current Rural zone in the Proposed District Plan. There are no industrial or commercial zonings proposed.
- 5.2 A treatment train approach is proposed to be adopted in order to meet the water quality and erosion control requirements for discharges to a river environment outlined in Waikato Regional Council ("WRC") document TR2018/01 for development within any of the stormwater management zones.

Water Quality

- 5.3 The stormwater contaminants resultant from an urban environment (total suspended solids, heavy metals and hydrocarbons) are managed through a treatment train approach.

- 5.4 Water quality treatment is proposed for all trafficked areas including roads, parking areas and driveways. The treatment train approach involves at least two devices prior to discharge to the receiving environment and can be comprised of at-source treatment options and use of communal devices as shown in the stormwater management flow chart in Figure 1.
- 5.5 The stormwater management flow chart will be further revised and finalised in consultation with WRC.
- 5.6 No high contaminant yielding cladding or roofing materials are recommended.
- 5.7 It is my opinion that the stormwater management framework for the development provides for best practice contaminant removal for stormwater runoff from urban land use. A stormwater management toolbox has been prepared which provides options for devices that can be utilised within the development. The stormwater management toolbox is shown in Table 2.



**Denotes WRC minimum requirements with respect to water quality treatment for stream environment and volume control/extended detention criteria when discharging to a natural watercourse.*

Figure 1: Stormwater Management flow chart

5.8 A summary of the stormwater removal capabilities for devices is provided in Tables 3 and 4.

Table 2: Stormwater Management Toolbox

Stormwater Device	Typical Applications	Water Quality Treatment	Erosion Control	Flood Attenuation
Rain tanks	Roof areas	NA	Yes	No
Inert roofing material	Roof areas	NA	No	No
Living roofs	Roof areas	NA	No	No
Bioretention devices	Roofs, carparks, driveways, footpaths.	Yes	Yes	No
Permeable pavement ¹	Carparks, driveways, footpaths, cycleways.	Yes	No	No
Swales	Carparks, driveways, roads, parking bays, footpaths.	Yes	No	No
Filter strips		Yes	No	No
Wetland swales	Open space areas.	Yes	Yes	No
Dry pond with extended detention		No	Yes	Yes
Wet pond with extended detention		Yes	Yes	Yes
Wetlands	Accommodated in open space areas.	Yes	Yes	Yes
Proprietary devices such as StormFilters or cellular storage	Roofs, carparks, driveways, roads, parking bays, footpaths.	Yes, depending on device	Yes, depending on device	No

Table 3: Removal rates for various stormwater devices (Source: Waikato Regional Council Technical Report 2018/01 - Table 6-10 & 6-11)

Practice	Removal Rates (%)				
	TSS	Nitrogen	Phosphorus	Zinc	Copper
Swales	75	20	30	50	60
Filter strips	70	20	20	50	60
Sand Filters (with organic matter)	80	35	45	90	90
Bioretention Devices (Normal)	80	40	60	70	75
Bioretention Devices (Anaerobic Zones)	80	50	80	70	75
Infiltration Devices	80	30	60	80	70
Dry Ponds (no EDV)	40	10	20	10	20
Dry Ponds (with EDV)	60	20	30	20	30
Wet ponds	75	25	40	30	40
Wetlands	80	40	50	60	70
Green roofs	Volume reduction and some water quality treatment	Volume reduction and some water quality treatment	Volume reduction and some water quality treatment	Volume reduction only	Volume reduction only
Water tanks	Volume reduction only	Volume reduction only	Volume reduction only	Volume reduction only	Volume reduction only
Oil water separators	15	0	5	5	5

Table 4: Stormwater Device Capabilities (Source: Waikato Regional Council Technical Report 2018/01 -Table 6-8)

Device	Peak flow control	Water Quality Treatment			
		Sediment Removal	Metal Removal	Total Petroleum Hydrocarbons (TPH) Removal	Nutrient Removal
Dry pond with extended detention	High	Moderate	Pb – Moderate Cu – Low Zn – Low	Low	P – Low N – Low
Wet pond with extended detention	High	High	Pb – High Cu – Moderate Zn – Moderate	Low	P – Moderate N – Low
Wetland	High	High	Pb – High Cu – High Zn – High	High	P – High N – High
Filter systems	Low	High	Pb – High Cu – Moderate Zn – Low	High	P – Moderate N – Low
Raingarden	Low	High	Pb – High Cu – High Zn – High	High	P – High N – Moderate
Infiltration devices	Moderate	High	Pb – High Cu – High Zn – High	High	P – High N – Moderate
Swales and filter strips	Low	High	Pb – High Cu – Moderate Zn – Moderate	Moderate	P – Moderate N – Low
Rain tank	Moderate – only useful during smaller, frequent rainfall events	None	None	None	None
Permeable Pavement	Low	Low	Low	Low	Low
Living Roofs	Low	Low	Low	Low	Low

Erosion Protection and Re-use

- 5.9 Extended detention / volume control criteria are required for discharges to a stream environment to manage erosion and scour of natural stream/watercourses which will be discussed and adopted in consultation with WRC.
- 5.10 Volume reduction is proposed through re-use from roof runoff.

6. Flood Assessment

- 6.1 Flood assessment has been undertaken by WRC using Mike by DHI modelling package for Waikato River to define the 1% AEP flood extents. These are provided in WRC's Hazard portal and covers the Tuakau Swamp to the west of the site, and results in it being contained in the Flood Management Area overlay in the PDP.
- 6.2 WRC has also informed that updates to the flood modelling is being undertaken to ascertain the 1% AEP with climate change flood extents which will be made available when complete.
- 6.3 Flood assessment undertaken by WDC as a part of the Catchment Management Planning and Tuakau Structure Planning process which provides the flood extents for the Kairoa Stream and all its tributaries.

Flood Protection & Management

- 6.4 The proposed structure plan designates the flood areas as indicative open space network with no development proposed within the 1% AEP Floodplain. Flood attenuation may not be required for discharges as there is no downstream flood risk identified within the Kairoa Stream or Tuakau Swamp.
- 6.5 The KTL site sits elevated and to the north-east of the Tuakau Swamp and there is no development proposed within the flood management area.
- 6.6 The proposed development footprint will be further refined and finalised in consultation with WRC and WDC with any new recent information made available at detailed design and subsequent consenting stage.

7. **CONSULTATION WITH WAIKATO REGIONAL COUNCIL**

- 7.1 Initial feedback has been sought from the WRC Land Drainage team and close coordination is planned with WRC team at various stages of the development of the appropriate stormwater management for the KTL site.

8. **CONCLUSIONS**

- 8.1 The modelling undertaken by WRC and WDC has not identified any flood hazard within the KTL site that cannot be managed during the detailed design phase of the project.
- 8.2 The stormwater management approach for the land to be rezoned has been developed to respond to the particular characteristics of the Site and receiving environment.
- 8.3 The proposed stormwater approach incorporates a water sensitive design approach that manages the impact of land use change from predominantly rural/farmland to urban.
- 8.4 The proposed approach promotes at source stormwater management which is in line with Waikato Regional Council's Stormwater Management Guidelines.
- 8.5 The proposed structure plan is consistent with the principles contained within the Tuakau Structure Plan and stormwater management approach has been developed on the principles of Best Practicable Option suggested within the plan.
- 8.6 The stormwater approach minimises the adverse effects on the water quality and ecological values of the receiving environment through the implementation of stormwater management devices to be selected using a toolbox of options and a minimum two stage treatment train approach.
- 8.7 As a result of the work undertaken to date, there is in my professional opinion no reason related to stormwater or flooding why the rezoning of the plan change area, as sought by Kirriemuir Trustee Limited, cannot be approved as proposed.

Ajay Desai
12/02/2021