




Planning | Surveying | Engineering | Environmental


Stormwater & Flood Management Opportunities and Constraints

Ken Lewis Limited

Document Information

Client	Ken Lewis Limited
Site Location	Donald Road, Kaitaia
Legal Description	Lot 1 DP 173052
CKL Reference	A24315
Office of Origin	Auckland

Author	Neil Yin & Bronwyn Rhynd		
Signed		Date	5/06/2025

Reviewed & authorised by	Bronwyn Rhynd		
Signed		Date	5/06/2025

Revision	Status	Date	Author	Reviewed By	Authorised By

Contents

1	Introduction	1
1.1	Background	1
1.2	Flood mapping	1
2	Site and catchment conditions	2
2.1	Site characteristics	2
2.2	Catchment delineation	4
3	Proposed Development	5
4	Stormwater management key considerations	6
4.1	Key drainage systems	6
4.2	Water quality treatment	6
4.3	Increased volume and peak flows	7
5	Stormwater Management Options assessment	7
5.1	Treatment options	7
5.2	Conveyance options	8
5.3	Flood and flow management	8
6	Stormwater management strategy	8
6.1	Upper Terraces	9
6.2	Lower Plateaus - Steeper areas	10
6.3	Summary	10
7	Summary and conclusions	11
8	Limitations	12

Figures

Figure 1: 1% AEP flood extents (refer NRC flood mapping)	2
Figure 2: Aerial site location with contour	3
Figure 3: Overland flow paths and slopes	4
Figure 4: Subject site sub catchments	5
Figure 5: Proposed site Master Plan.....	6
Figure 6: Stormwater strategy, illustrated	11

Tables

Table 1: Potential Treatment devices.....	7
---	---

Appendices

Appendix 1 Drawings

1 Introduction

The 62ha site at Donald Road, Kaitiaki, has been identified in the Far North District Council's Proposed District Plan as being an area of large lot residential development. However, through applying urban design principles the opportunity for the zone to change to medium density residential has been explored.

This report presents the opportunities and constraints for stormwater management at the proposed site, focusing on strategies to mitigate runoff effects on downstream environments while ensuring compliance with relevant engineering standards and regional plans. It assesses the serviceability of the development areas and explores management options to address stormwater runoff effectively, safeguarding receiving environments and adhering to best practicable approaches from the source to discharge points.

1.1 Background

This constraints and opportunities assessment has identified several directions and inputs to consider for developing a comprehensive stormwater management strategy for the site.

The stormwater management system is designed to implement the best practicable approach for managing stormwater runoff, starting from the (runoff) source within the urban growth area and extending to the discharge points. This approach aims to mitigate the impacts of proposed urban development on downstream environments. The overarching principles for developing a stormwater strategy for this site is to include:

- Adherence to the Master Plan layout
- Flow attenuation ensuring post-development runoff does not exceed pre-development levels for 2-year and 10-year events
- Managing flows to achieve 80% of pre-development levels for 100-year events
- Addressing and mitigating impacts from 50-year and 100-year flood events
- Ensuring compliance with the Far North District Council (FNDC) Engineering Standards and the Northland Regional Council (NRC) Proposed Regional Plan

1.2 Flood mapping

A recent and comprehensive regional flood model is available from the Northland Regional Council (NRC), which provides an overview of the flood mapping for the 1%AEP rainfall event, including the effects of climate change, for the wider Kaitiaki area, as well as other regions across Northland. The flood extent is shown in the Figure 1 below. The extent of flooding on the subject site is limited to the lower open channel areas, primarily due to its relatively high elevation.

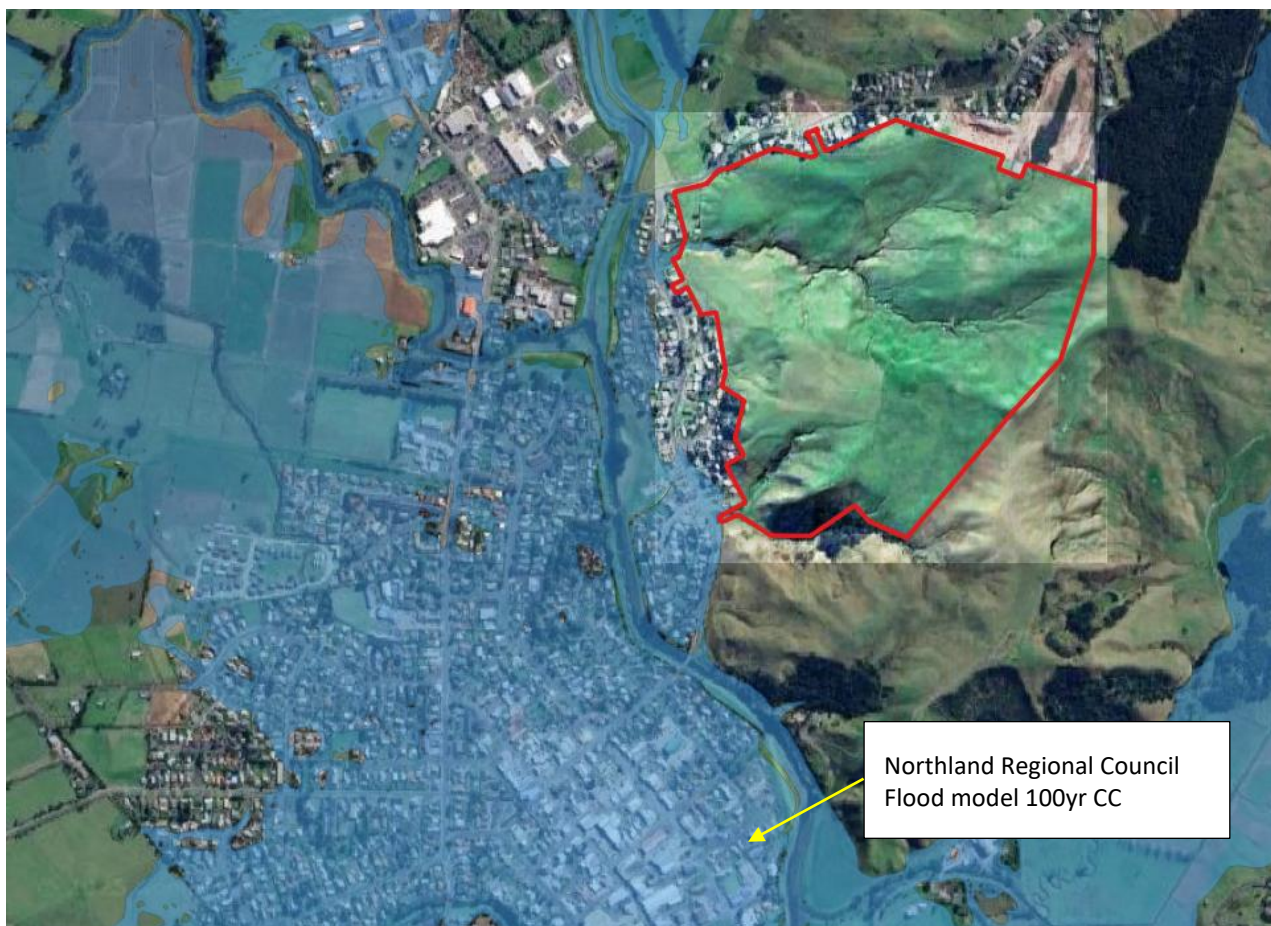


Figure 1: 1% AEP flood extents¹

2 Site and catchment conditions

The property (62.46 ha) is situated adjacent to Donald Road and Allen Bell Drive. The following sections outline the site characteristics and hydrological catchments.

2.1 Site characteristics

The site's general elevation is higher than the roads, and the surface runoff predominantly converges toward two main discharge points, exiting the property, eventually draining via Allen Bell Drive into the Awanui River (Figure 2).

¹ refer to publicly available NRC flood mapping



Figure 2: Aerial site location with contour

The site naturally drains towards the west through a series of streams, gullies and open channels, which reach the lower levels of the site. The natural surface drainage continues through the neighbouring sites, and streets, towards to Awanui River. The flow is either piped under Allen Bell Drive and/or passes via surface flow through dedicated overland flow paths.

There is an overland flow path that enters the site at the northern boundary which continues through to the recent subdivision (to the north). There are no other defined flow paths entering the site.

The natural overland flow paths and ground contour/slopes associated with the current site conditions is shown in the following figure:

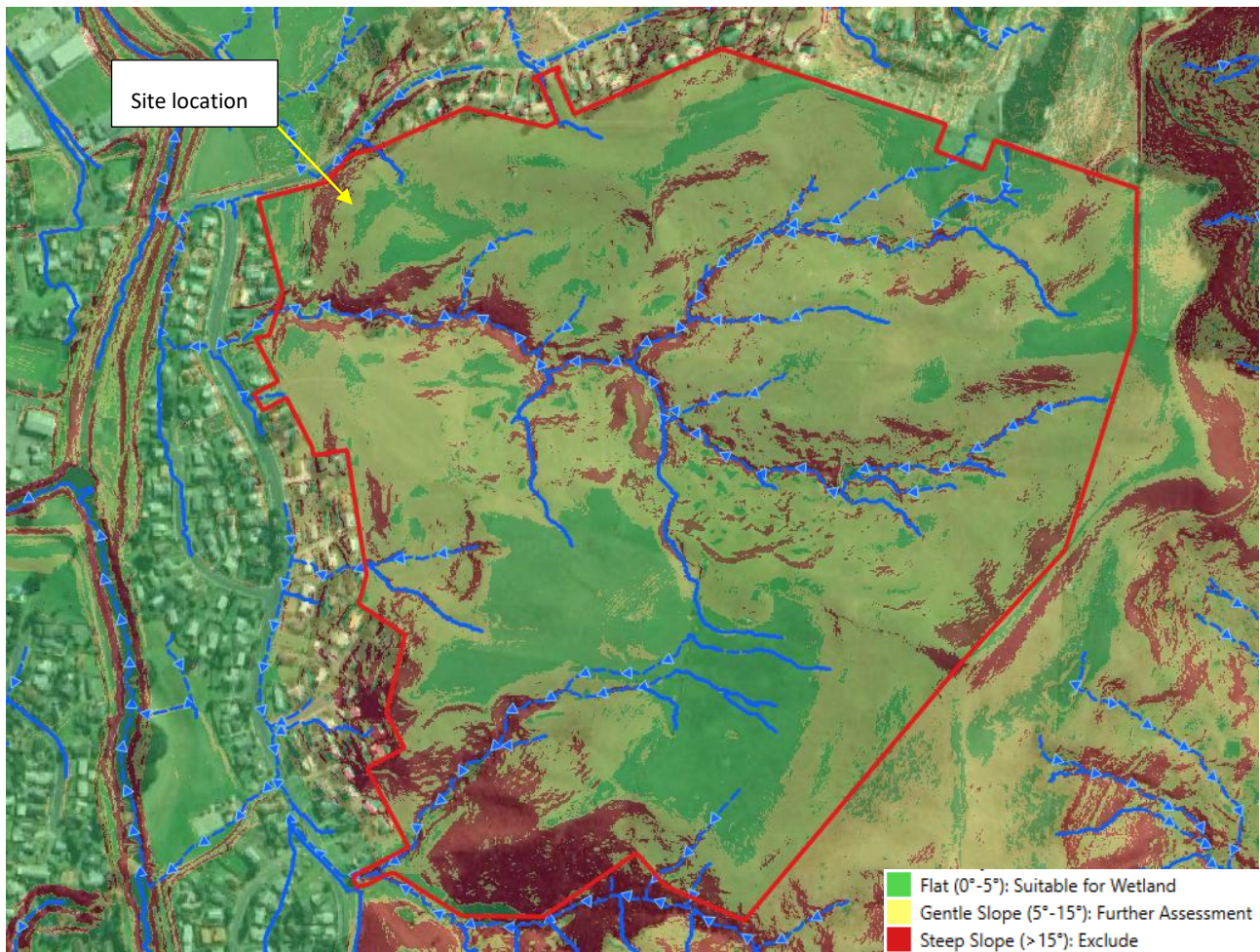


Figure 3: Overland flow paths and slopes²

2.2 Catchment delineation

The site is located in variability of contour which naturally is divided into several sub catchments with respect to the hydrological response during rainfall events.

² reference: QGIS

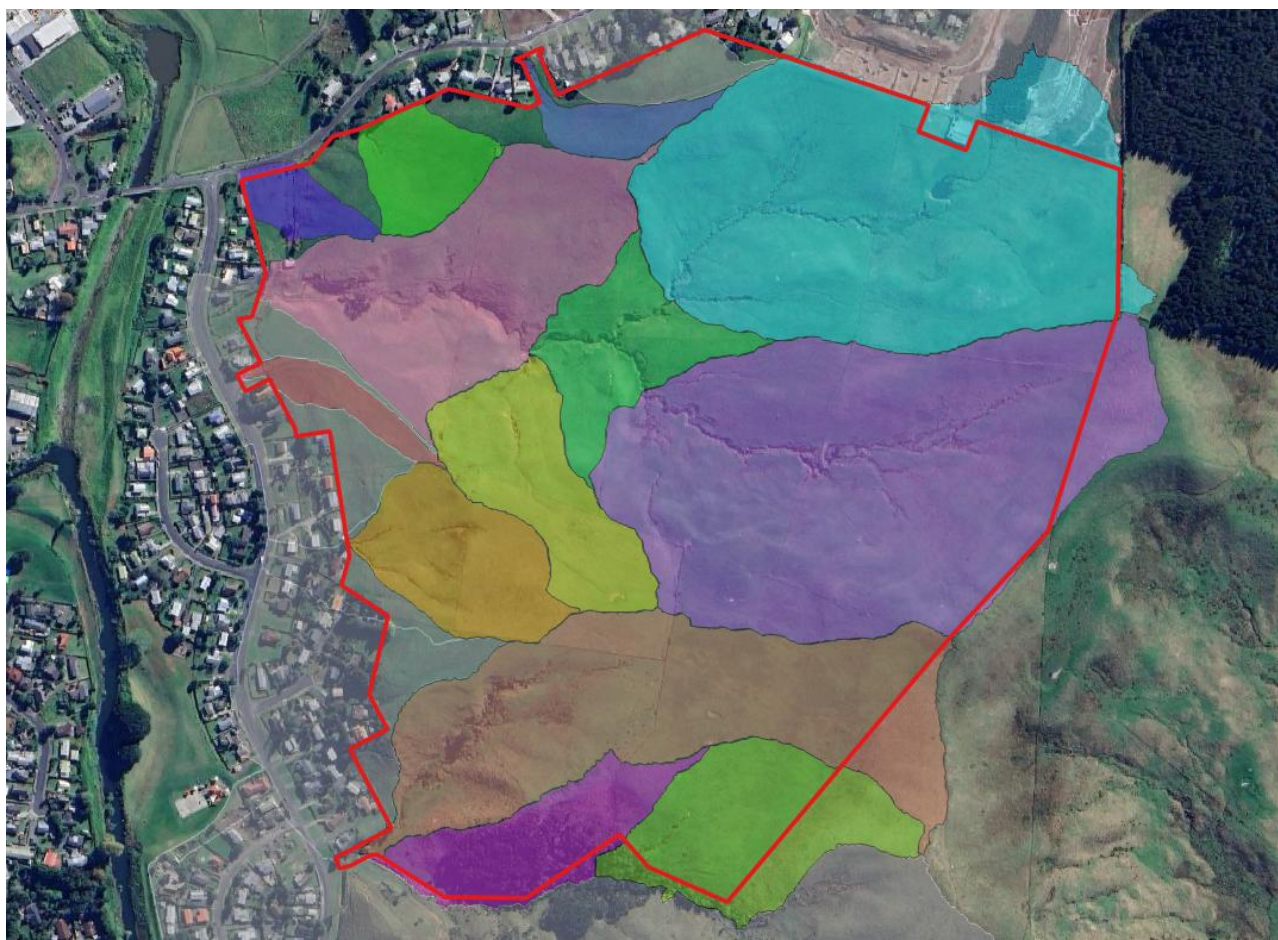


Figure 4: Subject site sub catchments³

3 Potential Development

There is a proposed Masterplan for the site which will deliver a medium density urban outcome. This Masterplan reflects the natural green spaces that will remain to be utilised for multi-purpose facilities including stormwater and flood management, as well as multi-modal transport such as cycling and walking. This Masterplan is presented in the following Figure 5, and also appended for reference.

³ Subcatchments delineation based on LiDAR 1m DEM



Figure 5: Proposed site Master Plan

4 Stormwater management key considerations

Stormwater management is developed with key considerations aligned with the urban outcomes and the sensitivity of the receiving environment. The following characteristics are considered the key considerations for this site.

4.1 Key drainage systems

The main drainage systems for the Masterplan include the green corridors that service the overall site. This green corridor then provides a conveyance linkage to the receiving environment, either to the public network or overland flow path.

4.2 Water quality treatment

As the stormwater runoff from the development is discharging into multiple open channel and permanent stream environments, it is imperative that treatment of the runoff is undertaken prior to discharge.

Significant proportions of contaminants can be found in stormwater runoff from residential catchments and can be either dissolved or attached to colloidal particles of clay or silt. These contaminants can generally be grouped as per the below:

- Sediments
- Metals
- Total petroleum hydrocarbons (TPH)
- Nutrients

Removal of these contaminants must be achieved to the highest practicable level prior to discharging into the sensitive downstream environments

4.3 Increased volume and peak flows

The development site discharges to an open stream environment that is deemed sensitive to accelerated erosion of the stream bed and the stream banks. Therefore, the design will include erosion protection stormwater management measures, through implementation of extended detention of runoff from frequent rainfall events, such as 90th rainfall event. The runoff volume produced by this event will be detained onsite and slowly released over the 24-hour duration following the storm.

This urban development will increase peak flows from the pre-development conditions due to the increased impervious coverage. Therefore, attenuation of flows to the 2 and 10- year ARI storm events to predevelopment rates will be applied.

Regarding the 100-year ARI storm event, an analysis must be undertaken to determine if there are any downstream structures that may potentially be flooded, and if the development will make the risk or hazard any worse than what is currently being experienced. Based on the findings of the analysis the runoff may need to be attenuated to 80% of pre-development rates to allow for risk mitigation of downstream infrastructure and zones.

5 Stormwater Management Options assessment

There are several aspects to stormwater management however for the purposes of this assessment these are grouped into treatment, conveyance, flood and flow management. As such the following sections present management options that can be considered for this site.

5.1 Treatment options

Based on the contaminants of concern (nutrients in particular), effective water quality treatment will likely need to incorporate a treatment-train approach consisting of on-lot treatment followed by centralised/communal devices. Examples of potentially suitable devices are shown in Table 1 below.

Table 1: Potential Treatment devices

On Lot treatment devices	Centralised Treatment devices
Raingardens Bioretention Swales Proprietary Treatment Devices Permeable Pavements	Large scale bioretention systems (e.g. linear bioretention systems) Constructed wetland systems Linear swales/conveyance channels

The exact sizing, location and nature of the treatment devices required will depend on the final configuration and layout of the development area. However, it is anticipated that any centralised devices will be accommodated within, or adjacent to centralised conveyance channels (see below).

5.2 Conveyance options

The conveyance options for the development area are essentially either (or a combination) of the following;

- Piped Networks
- Overland flow/conveyance channels
- Road corridors for surface flow

Based on the existing drainage patterns and the varying topography, the most effective means of providing conveyance is likely to be combining the primary and secondary flows into corridors that can be either centralised or within the road reserves in the steeper sections.

In the flatter topography, this can be undertaken in the combined pipe and overland flow path located in road reserves.

The conveyance channels can be integrated into green corridors and can serve as multi-use spaces by providing naturalised low-flow channels and appropriate landscaping to incorporate them into the reserve areas. This will provide additional non-water and ecological benefits as well as optimising the use of space.

The main drainage outlets from the site may be the existing culverts, which will require upgrading to meet the current design standards.

5.3 Flood and flow management

No hydraulic modelling has been undertaken to date, therefore there may be a need to provide peak flow attenuation as there is downstream capacity constraints should the Area be fully developed. The extent of the constraints has yet to be determined however will be refined through collaboration with Northland Regional Council and Far North District Council.

To maintain naturalised channels and baseflows, headwater basins/wetlands with detention storage can be incorporated at the head of the main drainage channels to provide a steady flow of water and reduce erosive forces arising from frequent storm events. This will also mitigate the effects of increased runoff from frequent storms on the receiving environment.

6 Stormwater management strategy

The stormwater management strategy has been developed to guide the future development to deliver a system that supports the urban form and protects the receiving environment. The strategy for this site and masterplan has been defined by topography and flow conveyance through the growth area. There are 2 dominant areas to which shape the stormwater management strategy, which are:

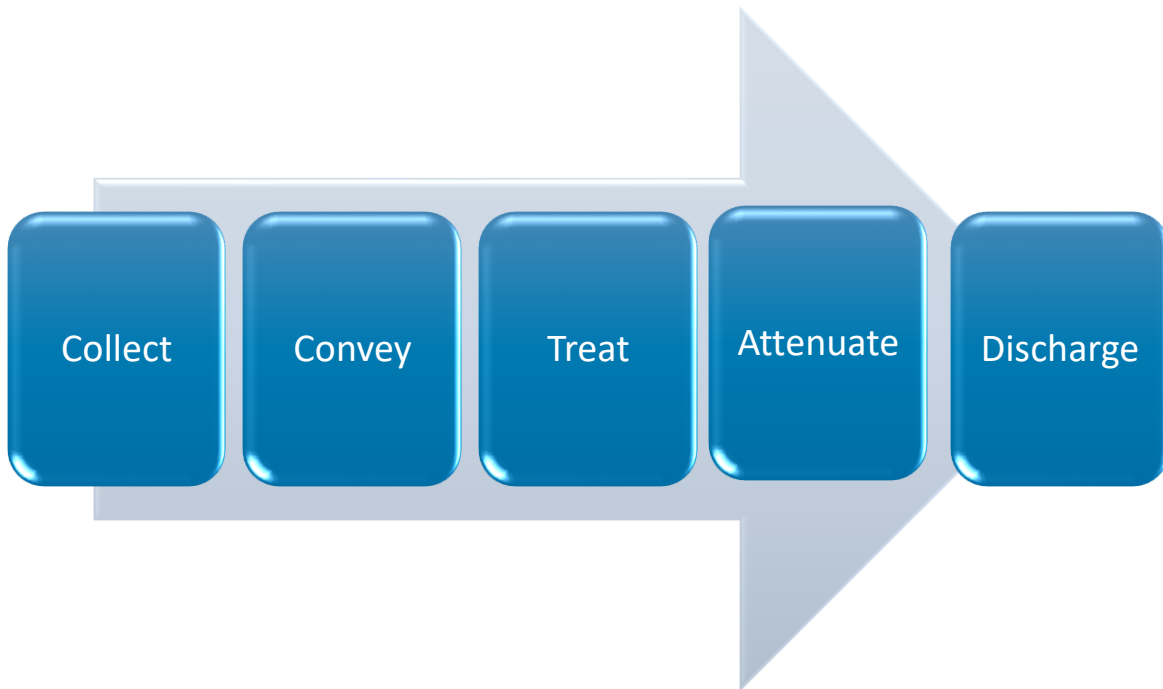
- ✓ Upper Terraces
- ✓ Lower Plateaus

Each of the areas have a unique requirement with respect to the strategy for management of stormwater, which is presented in the following subsections.

6.1 Upper Terraces

This medium-sized lot development, with an average lot size of 600m², requires a carefully designed hierarchy of stormwater management tailored to the characteristics of the receiving environment. The two distinct receiving environments, being the Allen Drive reserve and the existing downstream piped system, necessitate nuanced approaches.

The stormwater management strategy outlined below offers solutions specific to each environment:



Collect

Collection of runoff includes downpipes from roof areas, surface flow of paved areas such as driveways, tanks for water supply and harvesting.

Convey

Conveyance within the lot will be privately owned and managed by the lot owner.

Conveyance of runoff within the road corridor will be by pipe network or swales.

Treat

Runoff is treated for reduction in contaminants that will be entrained in the runoff. Treatment will be applied in the communal wetland/raingarden within the green corridors.

These sub catchments topography which includes the naturalized overland flow paths, lends to a communal device rather than interspersed devices.

Attenuate

Attenuation of the rainfall events up to 10yr and 100yr event is likely to be required due to downstream flooding.

Discharge

There are various discharge regimes within the urban site (subject site):

- neighboring sites immediately downslope for surface flow

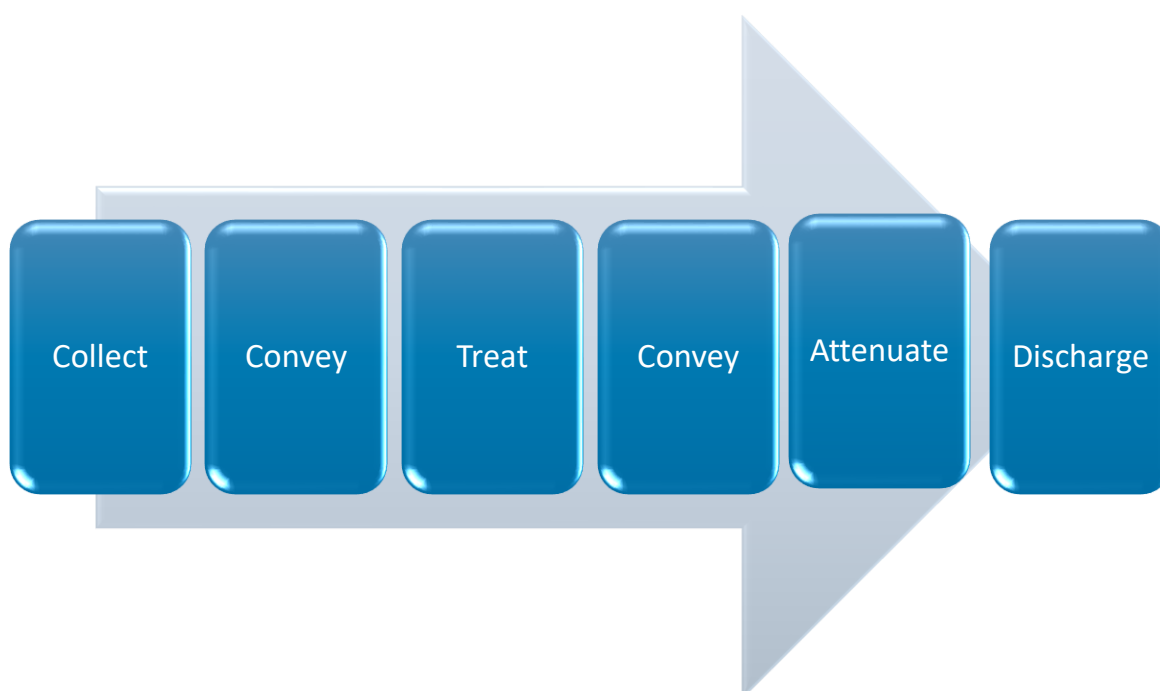
- Stream, within the green corridors
- Piped conveyance to communal treatment

By applying the above approach there is flexibility to developing a successful outcome for this Upper Terrace area.

6.2 Lower Plateaus - Steeper areas

These lower Plateau areas are located in sub catchments which have steeper slopes nearer the receiving green corridors or piped systems. Therefore, there is limited space to have communal approach to treatment and attenuation collectively.

Based on the position of discharge and attenuation requirements to mitigate effects, the strategic approach follows the regime presented diagrammatically below:



Therefore, there is a similar approach to the elements within the diagram above, as the Upper Terraces, however there is an extra step where the treatment is separated from the attenuation.

6.3 Summary

To summarise the application of the stormwater management strategy of both the Upper Terraces and Lower Plateau areas, an illustrative approach to the treatment and conveyance locations is shown in the following figure. In addition, the overland flow path from the upstream catchment (outside of the site) is shown to be accommodated within the road corridor.



Figure 6: Stormwater strategy, illustrated

7 Summary and conclusions

This report assesses the feasibility of stormwater management to support a medium-density residential zone change at the 62ha Donald Road site, Kaitaia, which is currently identified for large lot residential development in the FNDC Proposed District Plan. The proposed Master Plan aims for a medium-density urban outcome.

The comprehensive stormwater strategy focuses on mitigating runoff impacts on downstream environments and ensuring compliance with FNDC Engineering Standards and NRC Proposed Regional Plan.

A key opportunity identified is the site's relatively high elevation, which reduces the 1% AEP flood encroachment into the site as this is located within the lower channel areas. This elevated position makes the site ideal for urban development from a flood risk perspective and provides opportunities to protect the receiving environment effectively.

The proposed stormwater management strategy is designed to address the sensitivity of the natural receiving environment. Core components of the strategy include:

- Implementing a treatment-train approach using devices like raingardens, bioretention systems, or constructed wetlands to achieve the highest practicable level of removal for contaminants such as sediments, metals, TPH, and nutrients before discharge.
- Providing erosion protection through extended detention of runoff from frequent rainfall events.
- Attenuating peak flows so that post-development runoff does not exceed pre-development levels for 2-year and 10-year events and potentially attenuating 100-year events to 80% of pre-development rates if downstream analysis indicates a need.
- Utilising a combination of piped networks and overland flow channels, potentially integrated into green corridors, for conveyance.

The stormwater management strategy is tailored to the site's varying topography by differentiating approaches for the Upper Terraces and Lower Plateaus, with regard to the location and integration of treatment and attenuation. Utilizing the green corridors will provide an integrated and well-designed approach to incorporate the stormwater management elements that are required to mitigate effects whilst introducing a naturalised and accessible outcome for the urban form.

In conclusion, a feasible and comprehensive stormwater management strategy can be successfully implemented at the Donald Road site to accommodate the proposed medium-density development. The proposed stormwater management strategy effectively addresses environmental protection and regulatory requirements, confirming the suitability of the site for a medium-density residential zone change.

8 Limitations

This report has been prepared solely for the benefit of our client with respect to the particular brief and it may not be relied upon in other contexts for any other purpose without the express approval by CKL. Neither CKL nor any employee or sub-consultant accepts any responsibility with respect to its use, either in full or in part, by any other person or entity. This disclaimer shall apply notwithstanding that the memo/report may be made available to other persons including Council for an application for consent, approval or to fulfil a legal requirement.

Appendix 1 Drawings



- LEGEND**
- - - Site boundary
 - Primary road
 - Secondary road
 - Footpath link
 - Residential development parcels
 - Overland flow path / Streams
 - Stormwater treatment devices (wetlands/raingardens)
 - Revegetation areas
 - Reserve area
 - Pedestrian / cycle linkages