REPORT

Tonkin+Taylor

Private Plan Change Request

Infrastructure and Flooding Report

Prepared for
CCKL Maitai Dev Co LP & Bayview Nelson Ltd
Prepared by
Tonkin & Taylor Ltd
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Landmark Lile Ltd	1 electronic copy
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1 Introduction

This report has been prepared to be used as supporting material for an application for Private Plan Change (PPC) to the Nelson Resource Management Plan under Schedule 1 of the Resource Management Act.

The purpose of this report is to support a planning analysis of the environmental risks and opportunities and costs and benefits of the Plan Change and where consideration of the design of planning provisions or the use of existing Plan provisions to avoid remedy or mitigate any effects appropriately.

This report summarises the work undertaken by Tonkin & Taylor Ltd (T+T) for the assessment of wastewater, water supply, stormwater, and flooding hazards to service the PPC request (PPCR).

The report is based on a draft structure plan[1] prepared by Rough & Milne Ltd.

[1] Rough & Milne Ltd. Draft Structure Plan Maitahi and Bayview Nelson, Tasman - Attachment B1:1 Dated 25 March 2021

2 Wastewater

The applicant is proposing to rezone rural land to residential and will require a connection to the public wastewater network.

Existing wastewater networks on Nile Street, Walters Bluff and Brooklands could potentially provide connection points to service the land to be rezoned residential.

Below is a summary of the existing wastewater networks and potential upgrading that may be required to service the rezoned land.

2.1 Existing wastewater network

2.1.1 Nile Street

The existing wastewater line on Nile Street runs from the intersection of Nile Street and Maitai Valley Road, to the Weka Street and Neale Street pumping stations via Tory Street, Hardy Street, Milton Road, Cambria Street and Collingwood Street (refer Figure 2.1).

A capacity analysis of the existing line has been undertaken and it was found that over half of the line does not have sufficient capacity to meet current Peak Wet Weather Flows (PWWF), based on the Nelson Tasman Land Development Manual (NTLDM) guidelines.

We have been advised by Nelson City Council (NCC) that there are no known capacity issues at the Weka Street or Neale Street pumping stations; however, additional emergency storage may be required at Weka Street to service any future development.

Figure 2.1 - Downstream flow path from Nile Street to Neale Street pumping station

2.1.2 Walters Bluff and Brooklands

The existing wastewater network servicing Walters Bluff connects to the Cemetery pumping station at 156 Atawhai Drive, and the existing wastewater network servicing Brooklands connects to the Brooklands pumping station at 382 Atawhai Drive.

A capacity analysis of these existing wastewater lines has been undertaken, indicating that there is sufficient capacity to service the additional flows from the PPCR area, to the west of Kaka Valley, based on the NTLDM guidelines.

We have been advised by NCC that there are no known capacity issues at the Walters Bluff and Cemetery pumping stations; however, additional emergency storage may be required to service any future development.

2.2 Connecting to the NCC wastewater network

2.2.1 Nile Street

An analysis of the future PWWF's for the PPCR, indicates that the full length of the existing line from Nile Street to Weka Street pumping station will need to be upgraded to service the development in the Kaka valley and on the south-east side of Bayview Ridge that separates Kaka valley from the western facing slopes that extend from Walters Bluff to Dodson valley.

A new wastewater rising main will be required from the development, connecting to the existing wastewater line at Nile Street. The new line will generally be located within the grass berm on Matai Valley Road.

A new pumping station will be required for this section of rising main. The pumping station will either be located within the Development or adjacent to Maitai Valley Road.

During the initial stages of the development, provision of onsite wastewater storage within the development to prevent discharge of wastewater into the existing Nile Street line during PWWF's, may make it feasible to connect into the existing line prior to upgrading works being undertaken.

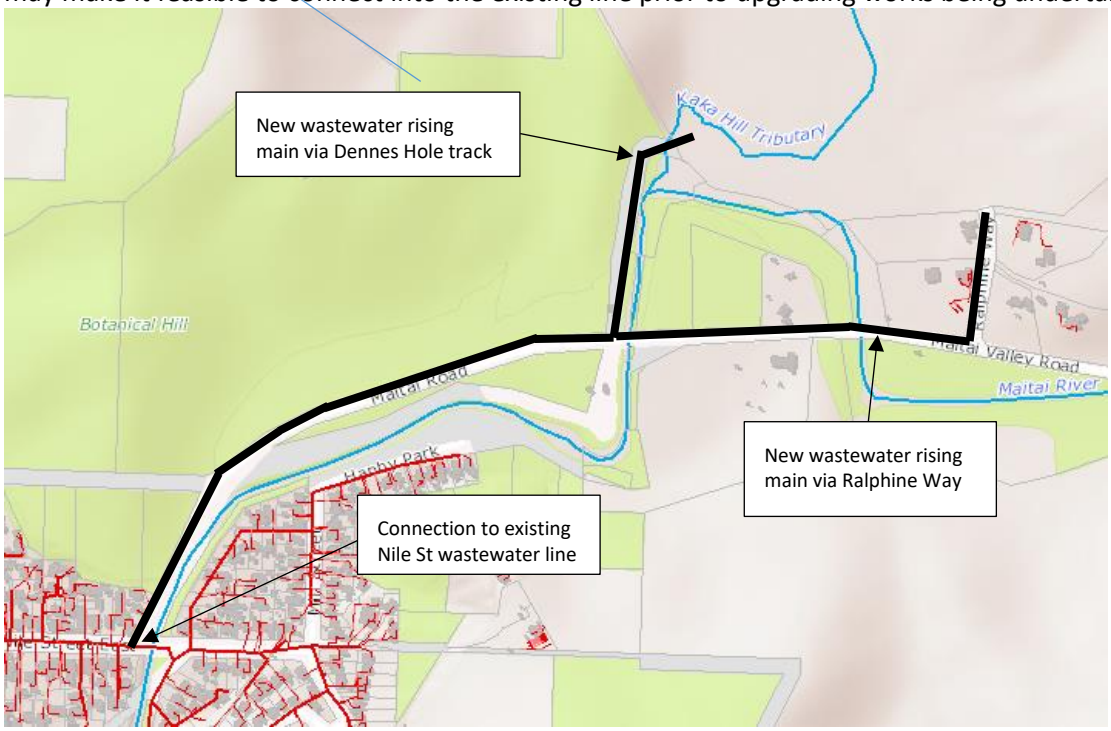


Figure 2.2 - Potential rising main along Maitai Valley Road

2.2.2 Walters Bluff and Brooklands

Short sections of new wastewater line will need to be installed from the ends of existing wastewater lines to the boundary of the PPCR area.

Depending on the final locations selected, easements over private properties may be required for some of the new sections of wastewater lines.

3 Water Supply

The applicant is proposing to rezone rural land to residential and will require a connection to the public water supply network.

3.1 Connecting to the NCC water supply network

Discussions with NCC have indicated that an existing 600 mm diameter high pressure trunk water main on the eastern side of Tasman Street, approximately 700 m from the intersection of Nile Street and Maitai Valley Road can service development within the PPCR area.

This will require a new connection to the existing 600 mm water main at the Nile Street/Tasman Street intersection and providing a new water main along Nile Street and Maitai Valley Road, entering the site either via the Dennes Hole track or Ralphine Way. This connection will service the entire PPCR area.

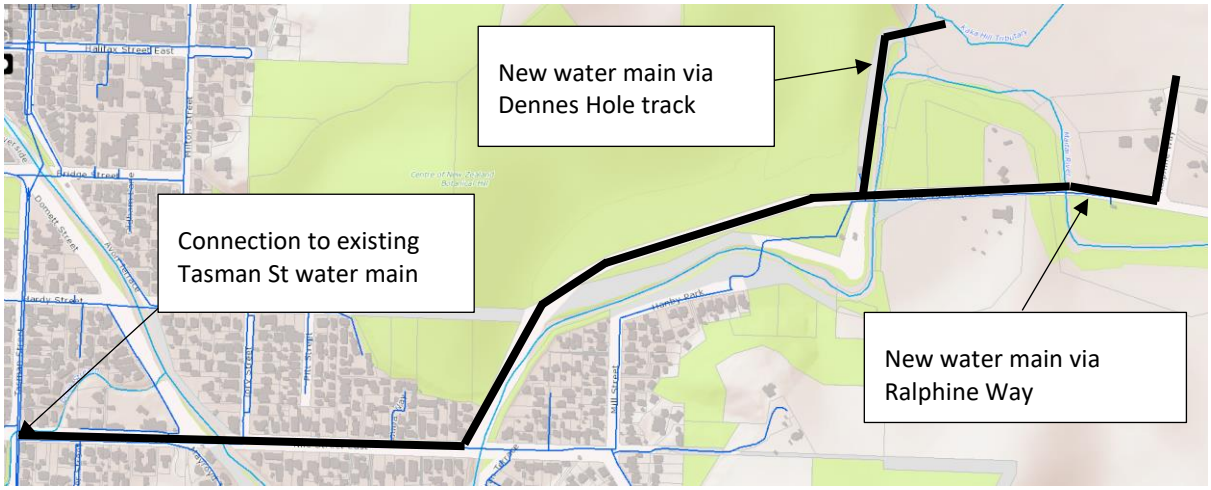


Figure 3.2 - Potential connection to existing water supply network

3.2 Reservoir options

A series of new reservoirs will be required to service potential development in the PPCR area.

This could potentially include a large reservoir at a level that can be filled from the Tasman Street watermain without any requirement for pumping.

A second reservoir would be required to service rezoned land above this level, which would be filled by pumping from the lower reservoir.

Options also exist to provide a connection from the proposed reservoir at RL 230 m, to the existing Walters Bluff and Atawhai Reservoirs to provide further resilience to the existing public water supply network.

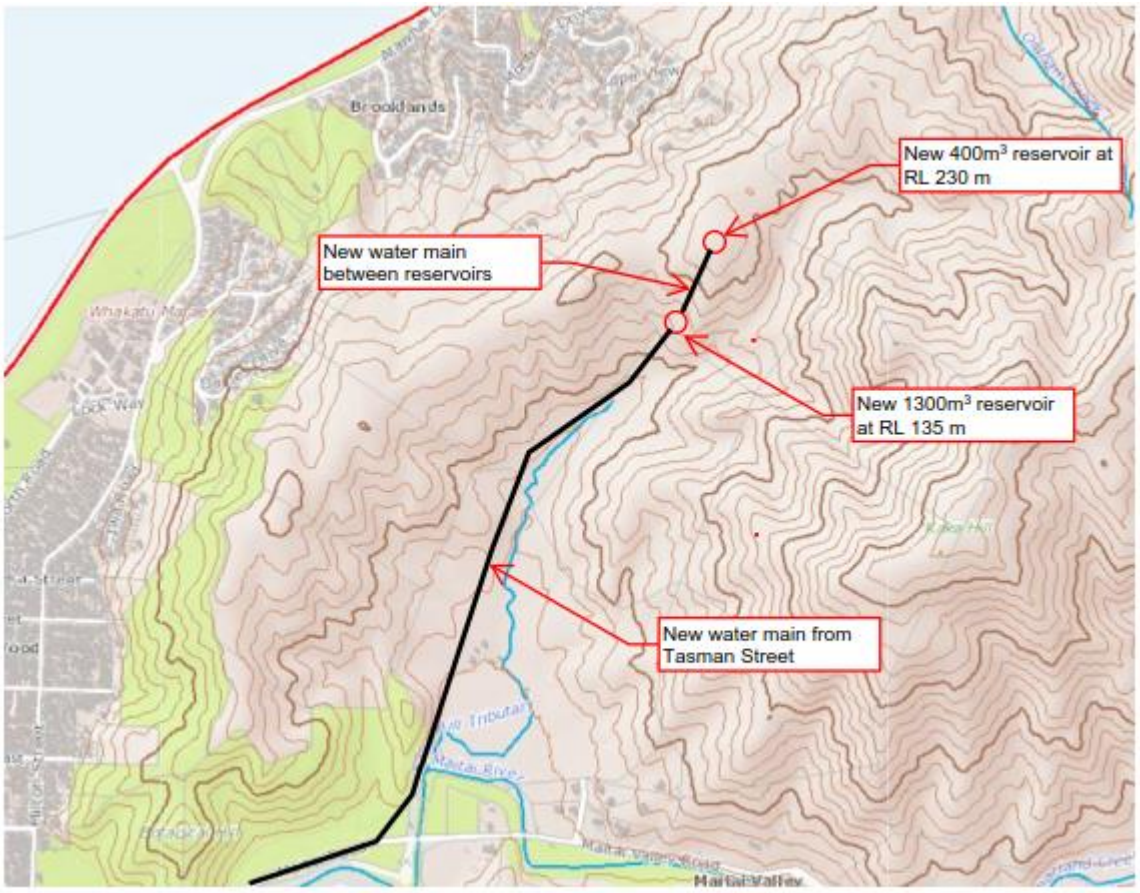


Figure 3.3 - Potential reservoir locations

3.3 Temporary connection to Nile Street water main

During the initial stages of development, it may be feasible to connect to the existing 150 mm diameter water main near the intersection of Nile Street and Maitai Valley Road. However, this water main has lower operating pressure than the 600 mm diameter Tasman Street main and without additional pumping, would only be able to service properties up to RL 55 m. This would require a temporary reservoir within the PPCR area at approximate RL 90 m to service these properties.

4 Dry services

The applicant is proposing to rezone rural land to residential and will require a connection to power supply, communications and data networks.

4.1 Power

Residential areas adjacent to the PPCR area, including Ralphine Way (Maitai Valley) and Davies Drive (Walters Bluff), are currently serviced by an underground power supply network. Subject to discussions with the service providers, this power supply will be extended into the PPCR area to service the rezoned land.

4.2 Communications

Residential areas adjacent to the PPCR area, including Ralphine Way (Maitai Valley) and Davies Drive (Walters Bluff), are currently serviced by an underground communications network. Subject to discussions with the service providers, this network will be extended into the site to service the PPCR area.

4.3 Data

Ralphine way is currently serviced with ADSL broadband and Davies Drive with fibre broadband. Subject to discussions with the service providers, these networks will be extended into the site to service the PPCR area.

5 Flooding

This section demonstrates that the applicant has considered the risks of flooding and that by adopting the recommendations below, the site is generally suitable for rezoning as proposed.

5.1 Maitai floodplain

The lower floodplain area of Kaka Valley adjacent to the Maitai River represents one of the most suitable areas for development due to the flat nature of the topography and ease of access.

T+T have undertaken an assessment of potential development within the lower floodplain. This has consisted of:

- Kaka Hill Tributary Hydrological Assessment
- Existing Flood modelling
- Kaka Hill Tributary realignment
- Maitai Floodplain development
- Stormwater Management
- Maitai Riverbank erosion

5.1.1 Kaka Hill Tributary hydrologic assessment

A range of commonly used hydrological methods for estimating peak flows were compared in order to establish design peak flows in the Kaka Hill Tributary. Table 5.1 below provides a preliminary peak flow rate range based on the methods used to estimate the pre-development and post-development peak flows in the Kaka Hill Tributary.

Table 5.1 - Peak runoff estimates for Kaka Hill Tributary at Maitai River confluence

Annual exceedance probability (AEP)	Climate	Pre-Development (m^3/s)	Post-development (m^3/s)
10% AEP	2130 RCP8.5 rainfall	13.2 - 13.3	14.8 - 14.9
6.67% AEP		14.7 - 15.4	16.4 - 17.4
1% AEP		19.5 – 24.5	22.0 – 26.3

It is assumed that any areas of rezoned land within the Kaka Hill Tributary catchment will be developed in accordance with the NTLDM which requires runoff to be managed to mitigate the effects of any additional volume or peak discharge rate that would otherwise result from the development. As a result, the flowrate from these areas will be limited to the predevelopment flow rate.

5.1.2 Existing flood modelling

NCC's existing flood model shows flood risk at the lowest part of the site, up to approx. RL 17.5 m (NZVD 2016). The model considers flooding due to outbreak of flows from the Maitai River but does not represent overland flowpaths for catchment runoff from the Kaka valley.

T+T are currently updating the Maitai River model in accordance with latest guidance from the Ministry for the Environment (MfE) with respect to climate change, and latest information from NIWA with respect to design rainfall intensities and storm patterns. As the peer review process has not been completed, the reported levels in this report are provisional. Using this model, the updated

preliminary flood level at this site in the 2130 1% AEP (annual exceedance probability) event is approximately RL 17.2 m (NZVD 2016).

Figure 5.1 shows the preliminary flood mapping for the 2130 1% AEP event. This shows the extent of flooding within the PPCR area and along Maitai Valley Road.

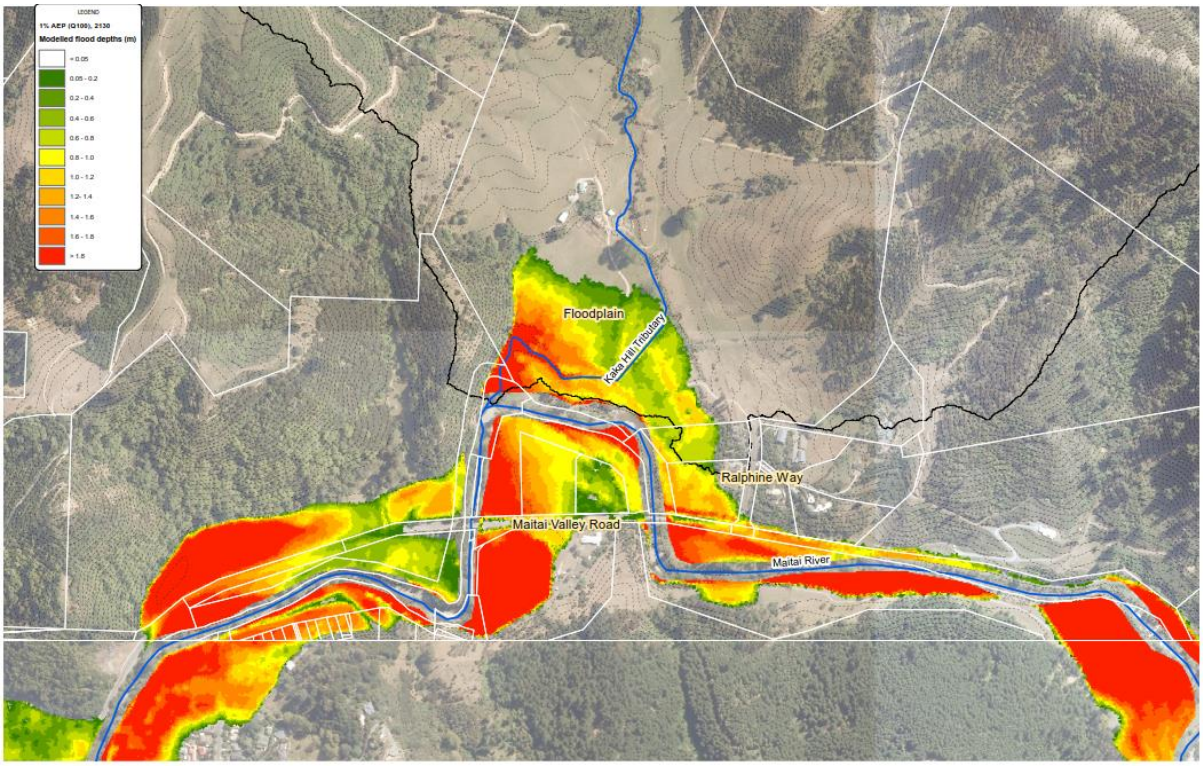


Figure 5.1 – Extents of flooding for 2130 1% AEP event

Figure 5.2 shows the extents of the proposed residential and open space areas with the existing lower floodplain area. These are estimated to be approximately 3.6 ha and 2.8 ha respectively. The total area of the proposed rezoning within the lower floodplain is approximately 6.4 ha.

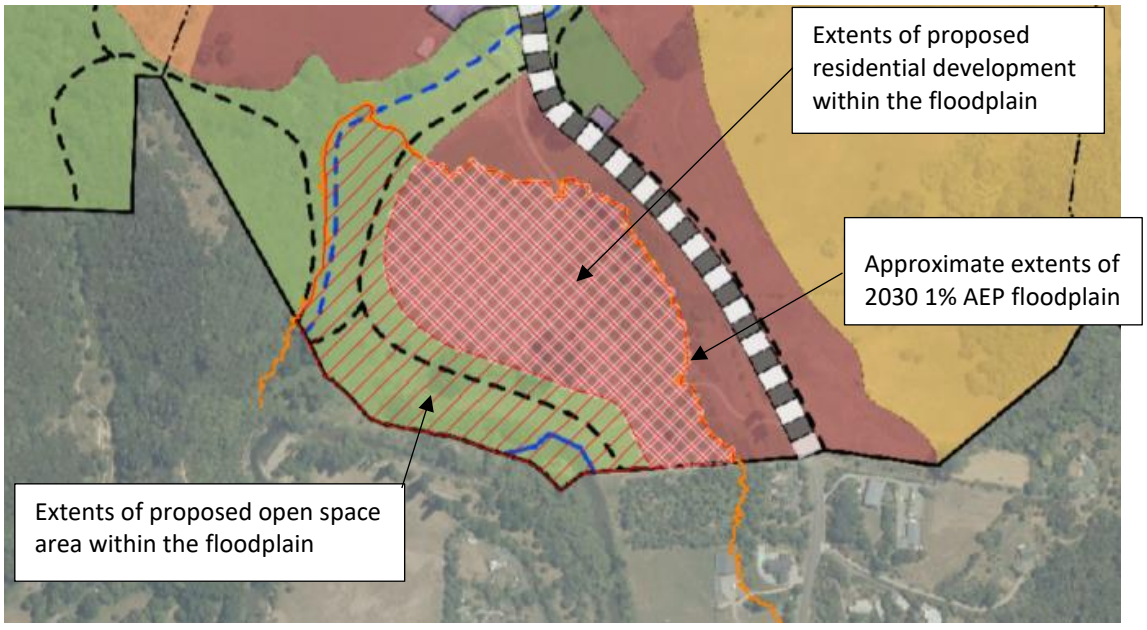


Figure 5.2 – Extents of the proposed residential and open space areas within the existing lower floodplain

5.2 Kaka Hill Tributary realignment

The upper and middle extents of the Kaka Hill Tributary flow in a confined valley, while the lower reach currently flows through a straightened and channelised section of the historic floodplain, which appears to be man-made. Historically, the lower Kaka Hill Tributary is likely to have flowed through multiple channels spread throughout the lower floodplain especially during periods of higher flow. It is also noted that the Kaka Hill Tributary runs dry in sections of the lower reach during summer periods.

The lower intermittent reaches of the Kaka Hill Tributary are likely to be realigned within the proposed open space zone as part of the PPCR. Realignment around the south-west side of the floodplain where there is existing riparian planting offers immediate ecological benefits and is more closely aligned to the original stream location.

Preliminary estimates of peak flows for the Kaka Hill Tributary at the point of discharge to the Maitai River indicate that a suitably sized watercourse channel would be required to convey a 1% AEP event, to drain the lower portion of the Kaka Valley catchment flows safely through the lower part of the Development.

The size of the channel would be assessed as part of any resource consent application.

5.3 Maitai Floodplain development

River management practises by Nelson City Council and their predecessor over several decades has exacerbated flood effects on the southern margin of the PPCR area and reduced pre-existing flood storage capacity on NCC land.

T+T consider the following option is feasible to enable any development that may be proposed as a result of rezoning of land within the currently identified floodplain area without significant adverse impacts either within or beyond the PPCR area.

5.3.1 Floodplain storage neutral

To ensure that the existing floodplain storage volume below the 2130 1% AEP is not reduced by future development, it is desirable to retain a minimum flood storage volume equivalent to the existing storage by infilling approximately half of the floodplain area above the 1% AEP level and a subsequent cut of the lower floodplain, as shown in Figure 5.3.

A preliminary assessment of this option indicates that approximately 3.6 ha of the floodplain area could be filled and utilised for development under this scenario. This will require lowering of the levels in the open space area within the floodplain (refer Figure 5.1) and lower reaches of the Kaka Stream to provide neutral storage. Additional flood storage in the lower reaches of the Kaka Stream, outside of the current floodplain is also available if this is required to achieve neutral storage.

Further modelling of this option will need to be undertaken as part of any resource consent application, to demonstrate the downstream effects. If the downstream effect is shown to be less than minor, due to there being no reduction in the overall floodplain storage and evidence of no substantial increase in downstream flooding, then development of the floodplain area as per this option can occur, pending NCC acceptance and any future resource consent approval.

If modelling shows that the downstream flooding effects are more than minor, varying the extents of filling within the floodplain storage area, or increasing the floodplain storage volume will need to be investigated in order to achieve a solution that satisfies any resource consent application.

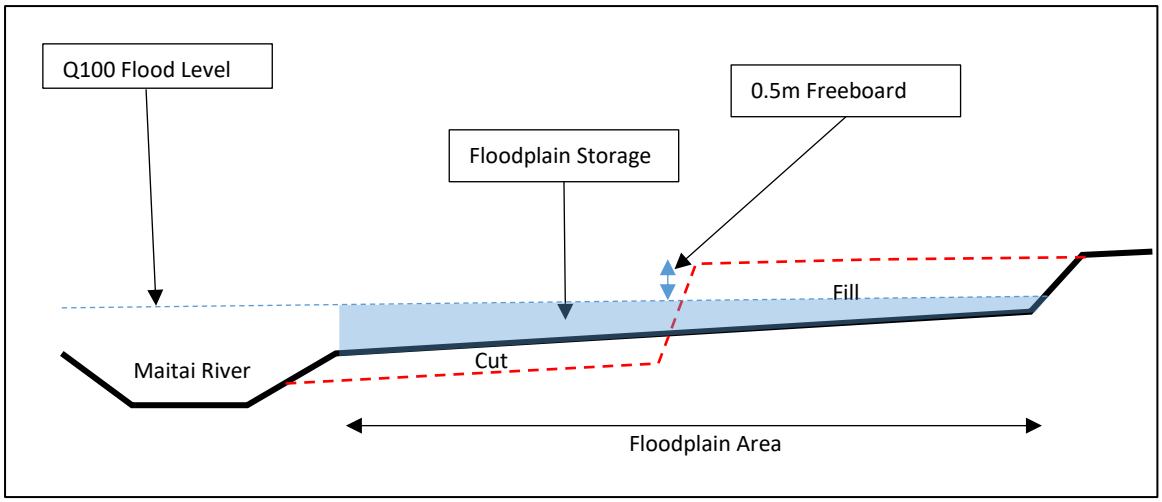


Figure 5.3 - floodplain balance

6 Stormwater

6.1 Kaka Hill Tributary catchment

Figure 6.1 – Extents of Kaka Hill catchment

As a requirement of the NTLDM, stormwater runoff discharging into a flood zone is required to be detained to mitigate the effects of any additional volume or peak discharge rate that would otherwise result from the Development. The NTLDM requires that retention and detention shall be provided so that post development peak flows shall not exceed pre-development peak flows for both the 10% AEP and 1% AEP events.

The overall preference is for stormwater to be managed as close to source as reasonably practicable. This typically requires the use of smaller devices such as rainwater tanks, pervious paving, swales and raingardens, as well as larger devices such as wetlands and detention ponds or dams.

Management of stormwater at source also helps to maintain predevelopment channel flows in the upper Kaka Steam to minimise the risk of scour and sediment mobilisation.

Different devices provide differing levels of treatment, retention and detention. It is unlikely that a single device will achieve all the quality and quantity management requirements for the development, and a range of options are available to manage stormwater.

T+T have considered a number of different ways that this may be achieved by implementing a combination of:

- Individual onsite detention and treatment
- Meandering swales, channels and flood benches/check dams
- Robust riparian and catchment vegetation planting
- Integrated stormwater wetlands
- Detention in the lower catchment area by way of a single in-stream detention pond and/or off-stream detention ponds.

A brief description of these options is provided below. Further refinement of these options will be required upon confirmation of the development plans submitted for any resource consent application.

6.1.1 Individual onsite detention and treatment

Specific stormwater devices can be used to retain or detain water for re-use on site, infiltrate water into the ground, or slowly release the water to the catchment to moderate peak flows, thereby reducing downstream flows during high rainfall events. Managing the water quality of stormwater runoff prior to it entering the Kaka Stream by treating the “first flush” through the use of bioretention devices is another significant benefit of providing onsite treatment.

Some examples of these devices include:

- Rainwater tanks with retention and detention
- Pervious paving
- Bioretention devices such as planted areas that store, filter and release stormwater.

6.1.2 Meandering swales and channels

Meandering swales and channels increase the effective length of the channel, and so reduces the velocity and erosion, and increases the time for nutrient deposits before the water is discharged into the receiving environment.

6.1.3 Riparian planting

Riparian planting is typically undertaken in the zone of land where stormwater runoff must pass over before it reaches a water body and acts as a buffer to moderate the adverse effects of adjacent land uses on waterways. The vegetated buffer acts like a sponge by reducing peaks and prolonging flows. Other benefits include increased water quality and a greater ecological quality and diversity.

6.1.4 Wetlands

The proposed open space area within the existing floodplain provides a natural area for the provision of wetlands within the development. Some of the benefits of wetland areas include, improved water quality, reduced impacts of flooding and the enhancement of wildlife habitat.

6.1.5 Detention

6.1.5.1 Instream detention pond

There is opportunity to provide a single instream pond located at the lower end of the catchment, as indicated in Figure 6.1. This option provides attenuation to the undeveloped and developed catchment. The final location, size, and shape of any pond will require further assessment upon

confirmation of the development plans submitted as part of any future resource consent application.

- The pond and spillway will be designed to accommodate post development peak flows so that the discharge shall not exceed pre-development peak flows.
- This option may reduce the available developable area on the lower flat area of the site immediately upstream of the dam. However, it may provide opportunities for additional wetland areas.

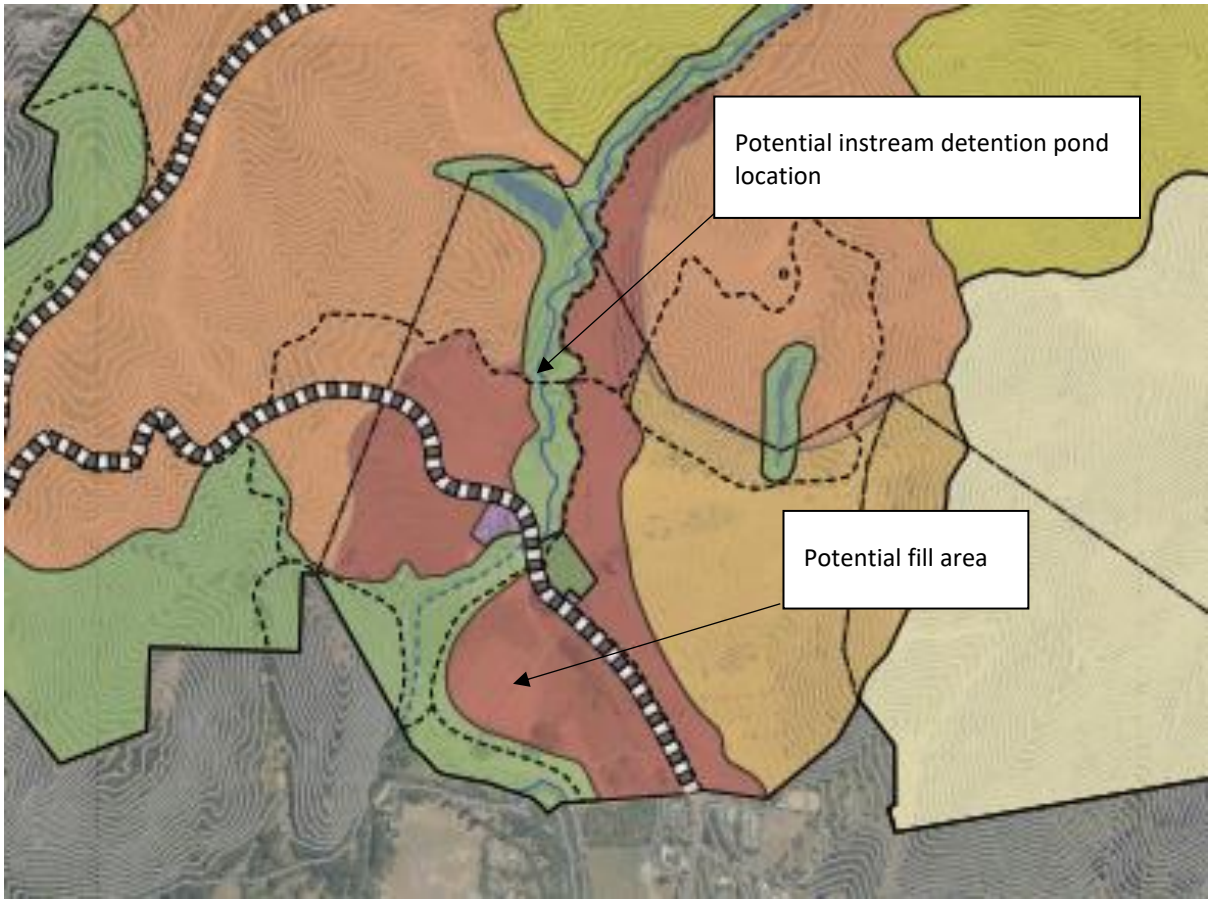


Figure 6.1 – Potential instream detention pond location

6.1.5.2 Off stream detention ponds

This option provides for detention ponds located within the proposed open space area within the existing floodplain zone. The final size and shape of the ponds will require further assessment upon confirmation of the development plans for the area proposed for rezoning and consideration of upstream detention provisions. The extent of the proposed residential area within the existing floodplain will also require further assessment when the size and location of any proposed detention ponds are known. Example pond locations are shown in Figure 6.2:

- The spillway will flow directly into Maitai River floodplain.
- This option meets the Water Sensitive Design (WSD) principles, which seek to treat stormwater effects close to their source (relevant to the proposed high density residential areas.
- This option may reduce the available developable area within the existing floodplain area (refer section 5.1.2).

- This option would contribute to mitigating the effects of any additional volume or peak discharge rate that would otherwise result from a proposed development.

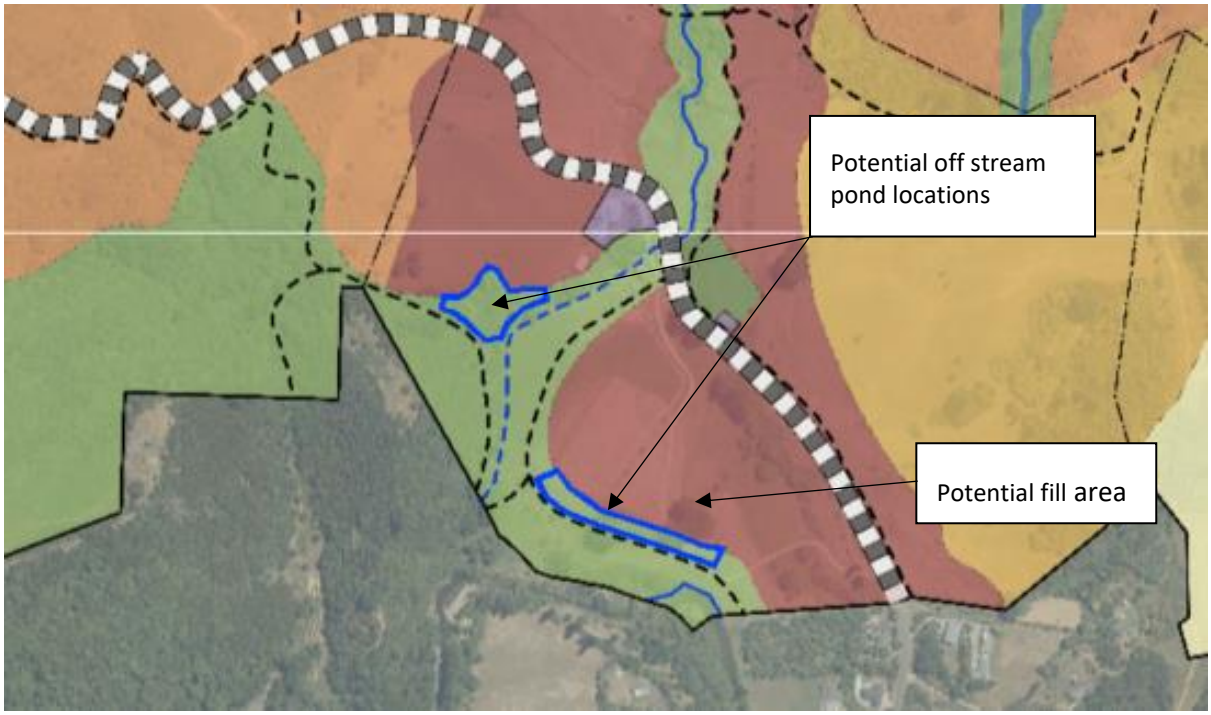


Figure 6.2 - Potential lower detention pond arrangement

6.2 Atawhai Hillslope catchments

An initial assessment of the capacity of the existing piped stormwater network in these catchments suggests that there is no spare capacity in the existing network to accommodate additional flows from the proposed development.

Therefore, options for the management of stormwater runoff will need to be incorporated for residential development in all catchments include:

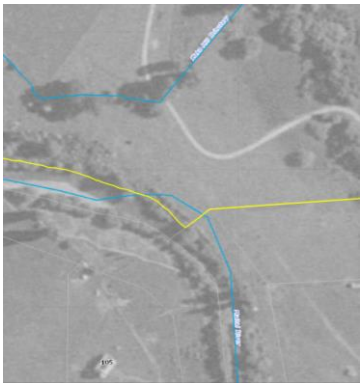
- The provision of detention devices to mitigate the effects of any additional volume or peak discharge that would otherwise result from the proposed rezoned areas. This may include a series of detention ponds close to source, on site detention devices, or a combination of both. As a result of these measures, the flowrate from the proposed rezoned areas will be limited to the pre-development flow rate.
- Upgrading of the existing piped network or providing a new piped system to convey runoff from the proposed rezoned areas through existing residential land.

Further consideration of stormwater management options will need to be undertaken as part of any future resource consent application.

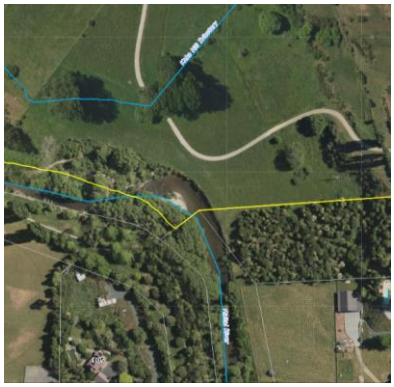
6.3 Maitai Riverbank erosion

The northern bank of the Maitai River at the southern end of the site has been subject to significant erosion since the 1940's. Photograph 5.1 below shows the movement of the Maitai River into the Floodplain and beyond the original boundary since the 1940's. It appears that that the river has retreated approximately 40 m to the north over this period, resulting in the loss of land within PPCR area and neighbouring land to the south-east.

1940 – 1959 Aerial



1980 – 1989 Aerial



2017 Aerial

Photograph 5.1 - Maitai River northern bank erosion, (source Top of the South Maps)

In addition to the planting and infilling of the floodplain with trees we have also observed that stopbanks have been constructed around the southern side of the river. These stopbanks that protect land on the southern side of the river have had the effect of reducing flood storage capacity and constraining natural flood paths thereby directing increased flow towards the PPCR land and other private land.

From our initial observations it appears that the river works, including construction of stopbanks, and planting of trees in the low level floodplain on the southern side of the river, has significantly contributed to the northern migration of the river and loss of land within the PPCR area.

Works to provide measures to prevent further erosion will need to be carried out in conjunction with the development arising from the PPCR, and these observations will be useful in attributing cause of the erosion and loss of floodplain capacity, best remedial and or restoration works and basis for determining a reasonable esplanade width.

7 Summary

7.1 Wastewater

Existing wastewater networks on Nile Street, Walters Bluff and Brooklands could potentially provide connection points to service residential land development within the PPCR area. Significant upgrading of the Nile Street wastewater line, from Nile Street to Neale Park will be required to provide sufficient capacity to service the proposed development. Easements over private properties may be required for some of the new sections of wastewater lines to connect to existing wastewater lines at Walters Bluff and Brooklands. Additional storage capacity may need to be provided at some downstream pumping stations.

7.2 Water Supply

Connecting to the existing 600 mm diameter high pressure trunk water main on the eastern side of Tasman Street, can service the entire potential development within the PPCR area. A series of new reservoirs will be required within the PPCR area to provide sufficient supply and firefighting storage.

7.3 Dry Services

Power, communications and data networks are present adjacent to the proposed PPCR area and these networks will be extended into the site.

7.4 Flooding

NCC's existing flood model shows flood risk at the lowest part of the PPCR area, up to approx. RL 17.5 m. T+T's updated preliminary flood level at this site (2130 1% AEP event) is approximately RL 17.2 m.

An option to allow development within the existing floodplain has been assessed, consisting of cutting and filling within the floodplain so that the existing floodplain storage volume is not reduced. Further modelling of this option needs to be undertaken to understand the downstream effects. If modelling shows that the downstream flooding effects are more than minor, varying the extents of filling within the floodplain storage area or providing additional flood storage capacity will need to be investigated in order to achieve a solution acceptable to NCC. Any resource consent application for development within the floodplain area will need to demonstrate feasible flood mitigation measures supported by site specific modelling.

7.5 Stormwater

Stormwater runoff discharging into a flood zone is required to be managed to mitigate the effects of any additional volume or peak discharge rate that would otherwise result from development of the Options to achieve this include:

- Individual onsite detention and treatment
- Meandering channels and flood benches/check dams
- Integrated stormwater wetlands
- Detention in the lower catchment area by way of an instream detention pond or off stream detention ponds.

In addition to this, options also exist to improve the catchment management through riparian planting in areas not designated for development, to better manage and reduce runoff and to offset development increases in runoff.

The existing northern bank of the Maitai River has been noted as eroding. Erosion protection measures and an assessment of pre-existing floodplain flow paths will need to be undertaken in conjunction with residential development of the proposed rezoned land.

Stormwater discharge into existing NCC stormwater network will be required for development along the Atawhai hillslope catchments will also require consideration of near source stormwater treatment options.

8 Applicability

This report has been prepared for the exclusive use of our client CCKL Maitai Dev Co LP & Bayview Nelson Ltd, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that this report will be used by NCC in undertaking its regulatory functions in connection with the proposed Development.

Tonkin & Taylor Ltd

Report prepared by:	Authorised for Tonkin & Taylor Ltd by:
	
.....	.....
Maurice Mills	Mark Foley
Senior Civil Engineer	Project Director

MGM
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