

5.4 Tapu Community and the Tapu River

5.4.1 Description of Environment

The Tapu River catchment is located five kilometres north of the Waiomu community. It is a steep well-forested catchment that is drained by the Tapu River.



Figure: The Tapu River catchment

The physical characteristics of the Tapu River catchment are summarised in the following table.

Catchment Area	26.7 km ²
% Urban Area	<< 1%
% Indigenous Forest/Scrub	94%
% Included in Coromandel Forest Park	64%
Average Channel Slope	3%
Time of Concentration	90 minutes

Table: Summary of physical characteristics of the Tapu River catchment

The Tapu community is located at the base of the Tapu River catchment on a coastal alluvial fan. The community consists of mainly residential development on the true left bank of the Tapu River. State Highway 25 runs through the Tapu community and crosses the Tapu River using a dual lane multi-span bridge. The Tapu-Coroglen Road runs parallel to the Tapu River.

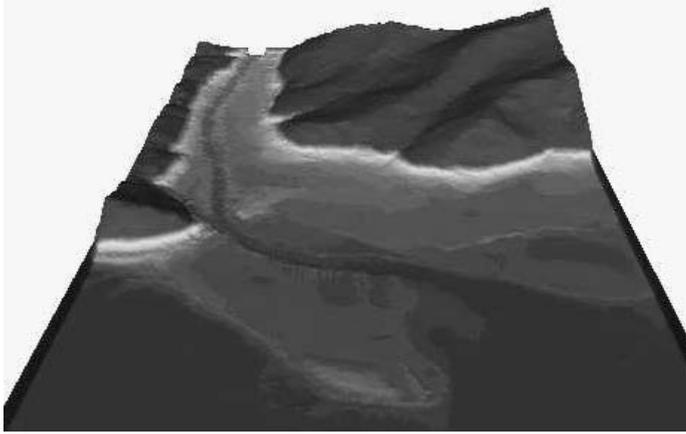


Figure: The Tapu River coastal alluvial fan (looking inland from the Firth of Thames)

During significant flood events in the Tapu River, overland flow occurs along the Tapu-Coroglen Road. A proportion of this overland flow re-enters the Tapu River upstream of the State Highway 25 bridge. The remainder flows around the southern approach to the State Highway 25 bridge, through the Tapu Motor Camp and re-enters the Tapu River downstream of the State Highway 25 bridge. Overland flow also occurs downstream of the State Highway 25 bridge, where flood waters flow across the reserve on the true right bank of the Tapu River.

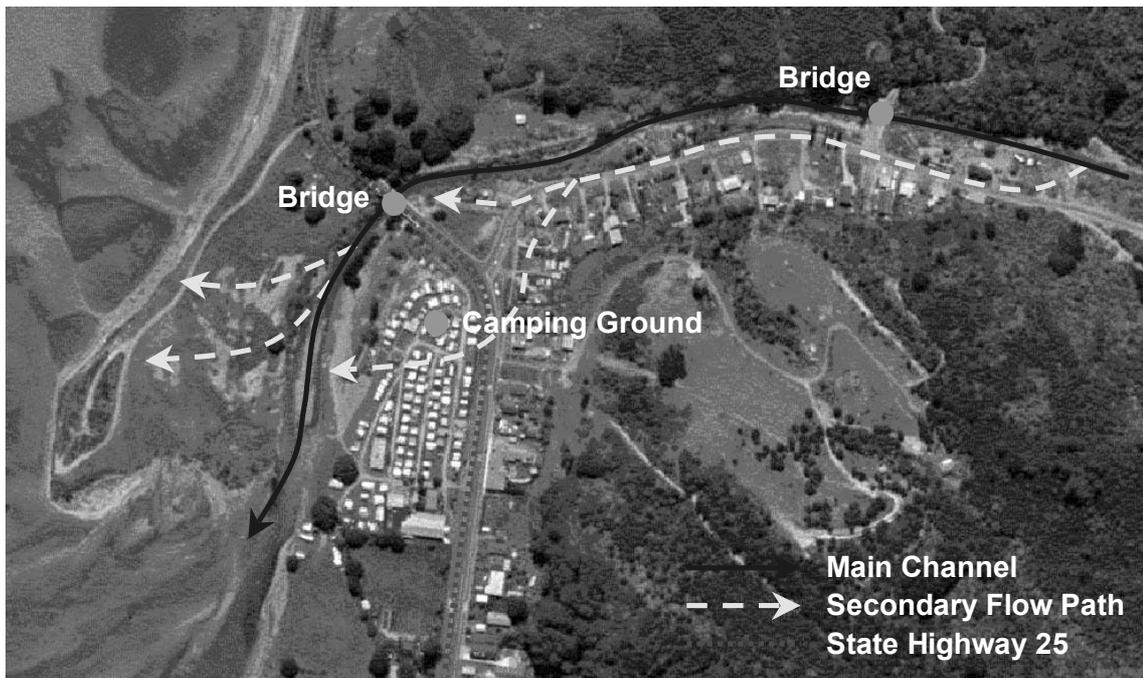


Figure: Flooding scenario within the Tapu community during a 100 year event

Damage to properties within the Tapu community is focused on those properties immediately adjacent to the Tapu River and those that are within the secondary flow paths.



Figure: Property damage within the Tapu community during the ‘weather bomb’.

5.4.2 Previous Works

An informal embankment has formed between the Tapu River and the Tapu-Coroglen Road from the deposition of channel clearings. However this has very little positive effect on the flood hazard affecting the Tapu community, given the numerous low points and drainage trenches.



Figure: The informal embankment between the Tapu River and the Tapu-Coroglen Rd

5.4.3 Hydrological Assessment

A summary of the hydrological assessment completed for the Tapu River catchment is presented in the following table.

Event Return Period (years)	2	10	20	50	100
AEP (%)	50	10	5	2	1
Rainfall Intensity (mm/hour)	21	30	36	45	55
Peak Stream Flow (m ³ /s)	110	159	186	235	283

Table: Summary of Tapu River catchment hydrology

To put these figures in perspective, the following flow estimates have been compiled from historical flood events that have significantly affected the Tapu community.

Event	Peak flood flow (m ³ /s)	Event Return Period (years)
Weather Bomb	275	100

Table: Summary of historical flood events on the Tapu River

5.4.4 Hydraulic Assessment

The performance of the Tapu River channel was assessed by constructing a quasi two-dimensional hydraulic model extending from the outskirts of the Tapu community to the Firth of Thames. Quasi two-dimensional hydraulic models are one-dimensional hydraulic models that include overland flow paths (in this case, the significant flow path along the Tapu-Coroglen Road).

The quasi two-dimensional hydraulic model was calibrated for the 'weather bomb' flood event using the peak flood levels surveyed by Civil Engineering Services immediately after the event and the peak flow estimate derived using the slope-area method.

The quasi two-dimensional hydraulic model of the Tapu River was used to simulate the the 100 year flood event for two scenarios (assuming the existing situation with overland flow and assuming that the flow be restricted to the channel using floodwalls).

This hydraulic assessment of the Tapu River derived the following facts:

- The bank full capacity of the Tapu River is around 135 m³/s at the start of the modelled reach (this flow was assessed as the five year event).
- The State Highway 25 bridge does not represent a significant restriction to the bank full flow in the Tapu River channel.
- Overland flow through the Tapu Motor Camp occurs during events greater than the 10 year event.

5.4.5 Hazard Assessment

The flood hazard affecting the Tapu community is summarised on the following aerial photograph.

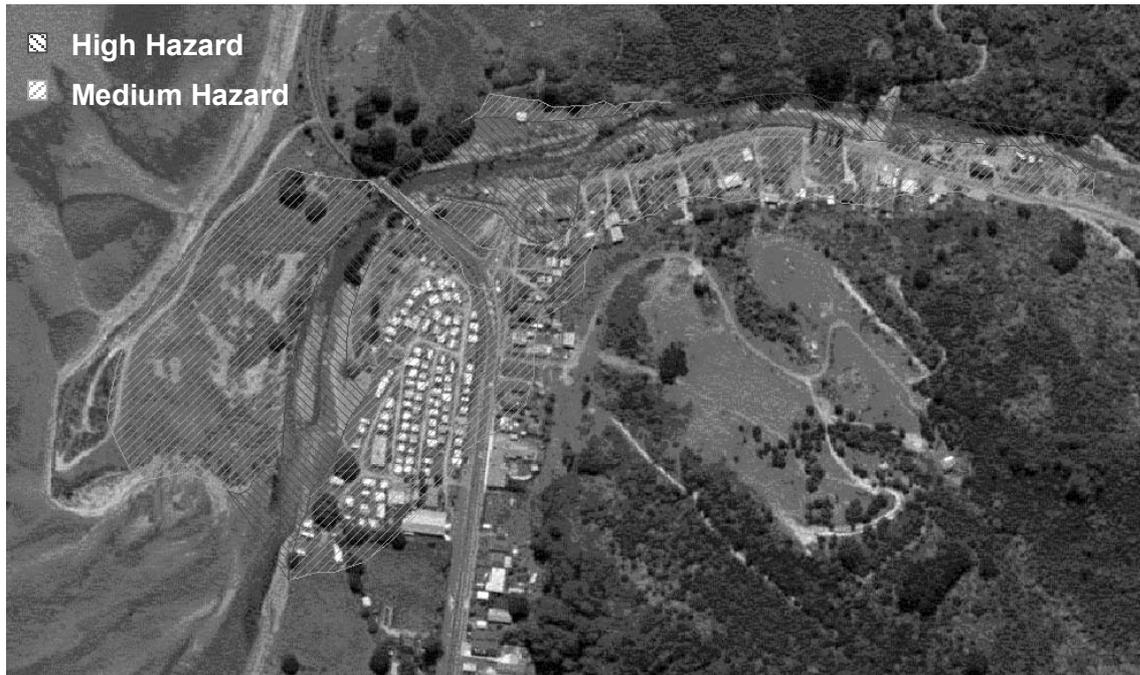


Figure: Tapu community flood hazard map

5.4.6 Hazard Mitigation Proposals

The hazard mitigation proposals for the Tapu community are presented in three sections:

- Planning and building controls.
- The proposed river and catchment management works for the Tapu River catchment.
- The proposed engineering works within the lower section of the Tapu River (within the Tapu urban area).

5.4.6.1 Planning and Building Controls

The following map shows the recommended planning and building controls for the Tapu community based on the current environment (without the adoption of any new engineering works).

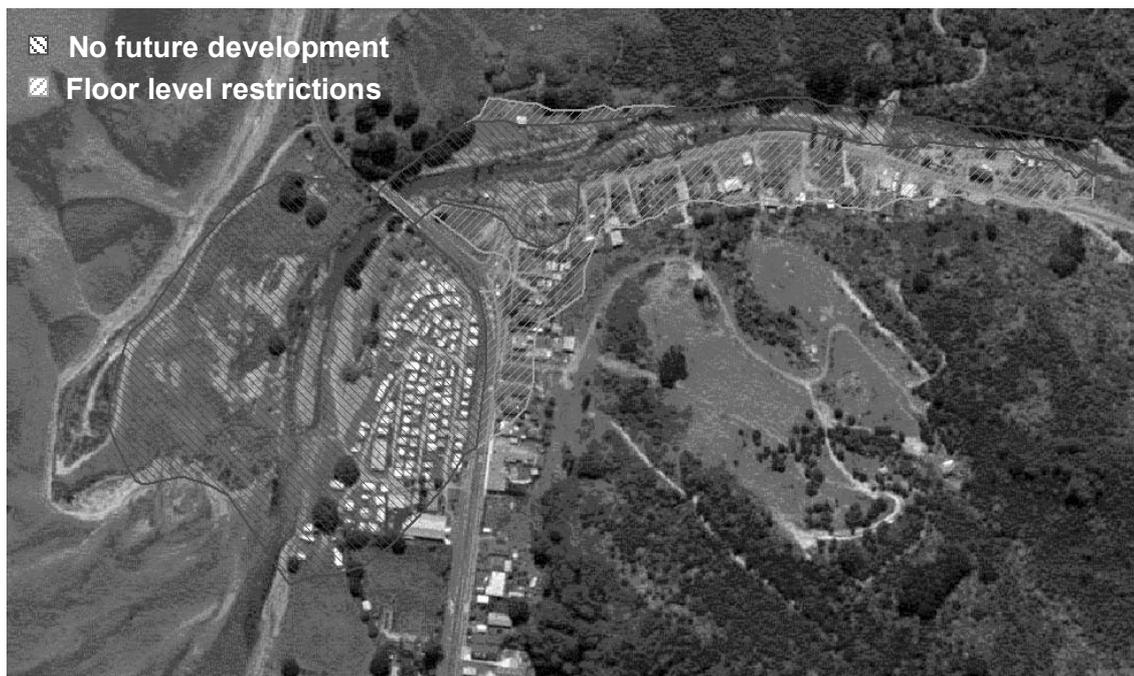


Figure: Recommended planning and building controls for the Tapu community

It is important to note that these proposed planning and building restrictions will vary depending on the engineering works that are adopted by the Tapu community to improve the capacity of the lower Tapu River channel. The higher the level of flood protection that is adopted by the Tapu community, the fewer development restrictions there will be on land within the Tapu flood hazard zone.

5.4.6.2 River and Catchment Management Works

It is proposed that the river and catchment management works within the Tapu River catchment will cover the following areas:

- Protection of existing indigenous vegetation from livestock through retiring and fencing land.
- Implementation of a goat and possum control programme to complement the existing goat and possum control programme that covers 70 percent of the Tapu River catchment.
- Removal of channel obstructions and accumulated sediment in the middle and upper reach of the Tapu River and tributaries (where appropriate access is available).
- Re-vegetation of areas prone to erosion (landslide material and riparian margins).

The indicative cost estimate for the river and catchment management programme within the Tapu River catchment is presented in the following table.

	Initial Capital Costs	Ongoing Annual Costs
Channel Management	\$6,062	\$6,062
Pest Management	\$40,950	\$8,026
Riparian Management	\$11,719	\$307
Soil Conservation	\$83,604	\$1,994
+ Design and Management (20%)	\$28,467	\$3,278
+ Contingency (10%)	\$14,234	\$1,639
GRAND TOTAL	\$185,100	\$21,400

Table: Indicative costs for the proposed river and catchment management works within the Tapu River catchment

5.4.6.3 Engineering Works

The proposed engineering works for the lower Tapu River have the following general objectives:

- Improvement of the performance of the Tapu River channel and floodway within the Tapu urban area.
- Removing the risk to people and property due to the overland flow path along the Tapu-Coroglen Road.
- Provision of additional flood protection for the Tapu community where economic.

The key limitation on engineering works in the lower Tapu River is the relative size of the area that will directly benefit from any works and the close proximity of the Tapu-Coroglen Road to the Tapu River (a limited berm available for the construction of floodwalls).

Proposal 1: Base Level Engineering Works

Proposal 1 maintains the existing performance of the lower Tapu River channel by implementing a programme to remove accumulated debris and sediment from the lower Tapu River. The extent of the proposed base level engineering works is shown on the following aerial photograph.

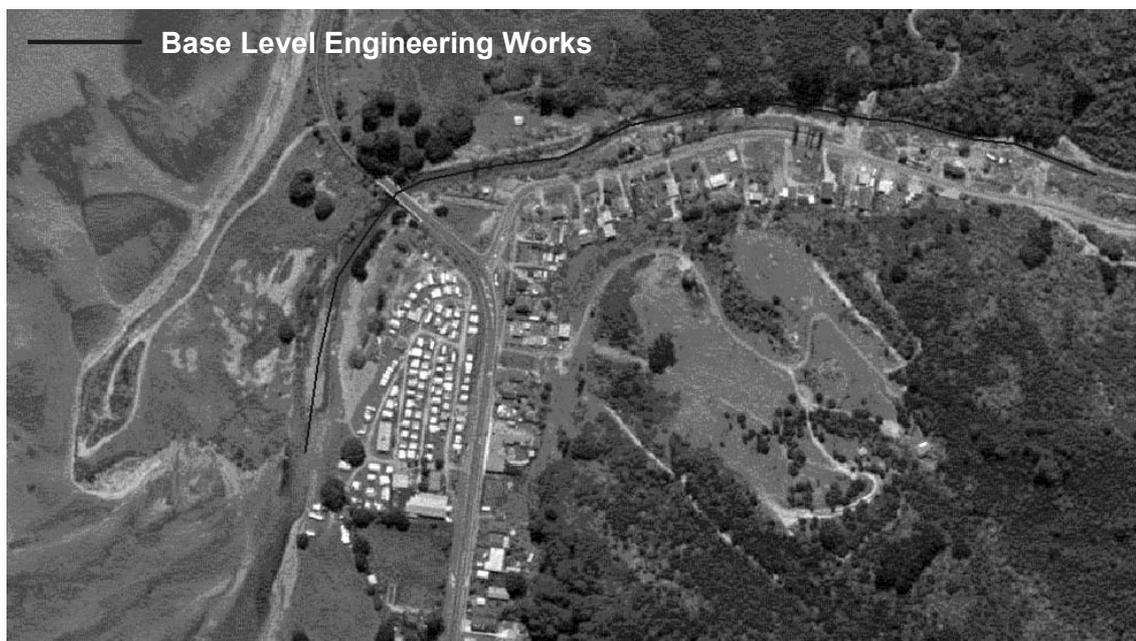


Figure: Base level engineering works on the Tapu River

The indicative cost estimate for base level engineering works on the Tapu River is presented in the following table.

	Initial Capital Costs	Ongoing Annual Costs
Channel Maintenance	-	\$10,800
Channel Monitoring	-	\$1,440
+ Design and Management (15%)	-	\$1,836
+ Resource Consents (20%)	\$2,448	-
+ Contingency (10%)	-	\$1,224
GRAND TOTAL	\$2,500	\$15,300

Table: Indicative costs for base level engineering works on the Tapu River

The pros and cons of adopting this proposal are:

- ✓ Low initial capital cost.
- ✓ The lower Tapu River is maintained at the current level of performance.
- ✗ Little or no reduction in the risk to the Tapu community due to the flood hazard.

Proposal 2: Intermediate Engineering Works

Proposal 2 improves the existing performance of the lower Tapu River channel to contain the 20 year flood event (186 m³/s) by implementing the following works:

- Construction of an earth embankment between the Tapu River and the Tapu-Coroglen Road to improve the performance of the Tapu River. This will include a controlled spillway point for events that exceed the design standard of the works (the 20 year flood event).
- Placement of rock rip rap to improve the stability of the channel and protect the other works associated with this proposal.
- Raise those houses that are identified as being at risk from flooding.
- Implement planning and building controls within the Tapu Motor Camp to reduce the impact of overland flow. This may include establishing a designated overland flow path that remains clear of buildings and camp ground sites.

Proposal 2 also includes the channel monitoring and maintenance works detailed under Proposal 1 (base level engineering works).



Figure: Intermediate level engineering works on the Tapu River

The indicative cost estimate for intermediate engineering works on the Tapu River is presented in the following table.

	Initial Capital Costs	Ongoing Annual Costs
Channel Maintenance	-	\$10,800
Channel Monitoring	-	\$1,440
Channel Improvements	\$60,000	\$1,800
Earth Bund and Floodgate	\$32,500	\$875
+ Design and Management (15%)	\$13,875	\$2,237
+ Resource Consents (20%)	\$18,500	-
+ Contingency (10%)	\$9,250	\$1,492
SUB TOTAL	\$134,125	\$18,644
+ House Raising	\$40,000	-
+ Changes to the Camping Ground	?	?
GRAND TOTAL	\$174,200	\$18,700

Table: Indicative costs for intermediate level engineering works on the Tapu River

The pros and cons of adopting this proposal are:

- ✓ Risk to Tapu community reduced for a majority of properties that are currently affected.
- ✓ Recommends a combination of controlling the risk and removing people from it.
- ✓ Limits the works along the edge of the Tapu River to an earth bund (important given the narrow berm between the Tapu-Coroglen Road and the Tapu River).
- ✗ Significant initial capital cost, resulting in a relatively high rates burden on properties that directly benefit.
- ✗ Requires buy-in from property owners.
- ✗ May result in the closure of the Tapu Motor Camp.

Proposal 3: Full Engineering Works

Proposal 3 improves the existing performance of the lower Tapu River channel to contain the 100 year flood event (283 m³/s) by implementing the following works:

- Construction of a timber floodwall between the Tapu River and the Tapu-Coroglen Road to improve the performance of the Tapu River.
- Placement of rock rip rap to improve the stability of the channel and protect the other works associated with this proposal.

Proposal 3 also includes the works detailed under Proposal 1 (base level engineering works).



Figure: Full engineering works on the Tapu River

The indicative cost estimate for full engineering works on the Tapu River is presented in the following table.

	Initial Capital Costs	Ongoing Annual Costs
Channel Maintenance	-	\$10,800
Channel Monitoring	-	\$1,440
Channel Improvements	\$120,000	\$3,600
Floodwall and Floodgate	\$167,500	\$8,275
+ Design and Management (15%)	\$43,125	\$3,617
+ Resource Consents (20%)	\$57,500	-
+ Contingency (10%)	\$28,750	\$2,412
Property Purchase	\$6,500	-
GRAND TOTAL	\$423,400	\$30,200

Table: Indicative costs for full engineering works on the Tapu River

The pros and cons of adopting this proposal are:

- ✓ Risk to Tapu community reduced for a majority of properties that are currently affected.
- ✗ Significant initial capital cost, resulting in a relatively high rates burden on properties that directly benefit.
- ✗ Involves the construction of a substantial floodwall (important given the narrow berm between the Tapu-Coroglen Road and the Tapu River).

5.4.6.4 Summary of Indicative Costs and Local Rates

A summary of the indicative costs for the flood hazard mitigation proposals prepared for the Tapu River catchment and the Tapu community is presented in the following table.

Mitigation Proposal	Initial Capital Cost	Ongoing Annual Cost
River and Catchment Management	\$185,100	\$21,400
Engineering Works Proposal 1	\$2,500	\$15,300
Engineering Works Proposal 2	\$134,200	\$18,700
Engineering Works Proposal 3	\$423,400	\$30,200

Table: Summary of total indicative costs for the Tapu community

It is proposed that the catchment management, river management and engineering works developed to assist the Tapu community be funded according to the funding policy contained in this report. The exception to this is the raising of those house considered to be at risk, which has been assumed as the responsibility of individual property owners.

A summary of the direct and community rates that will be charged to an average property within the Tapu community to fund the proposed engineering works is presented in the following table. It is important to note that in line with the above assumption regarding the funding of the house raising, the capital cost of this has been omitted from the rates calculations.

Mitigation Proposal	Capital Repayment Phase		Maintenance Phase	
	Direct	Community	Direct	Community
Engineering Works Proposal 1	\$359	\$72	\$352	\$70
Engineering Works Proposal 2	\$400	\$100	\$429	\$86
Engineering Works Proposal 3	\$1,880	\$376	\$693	\$139

Table: Summary of direct and community rates for the Tapu community

5.4.6.5 Flood Hazard Mitigation Recommendation

It is recommended that Environment Waikato and the Thames Coromandel District Council use the following flood hazard mitigation proposals as a basis to begin consultation with the Tapu community:

- Planning and building controls within the Tapu flood hazard zone.
- River and catchment management works within the Tapu River catchment.
- Engineering works proposal 2 on the lower Tapu River.

If the owner of a property within the Tapu community chooses to cover their share of the initial capital costs of the recommended engineering works proposal using a lump sum payment, the approximate payment for a average property within the Tapu community will be:

- \$3,600 (if within the hazard zone).
- \$800 (if outside the hazard zone).