

5.3 Waiomu Community, the Waiomu Stream and the Pohue Stream

5.3.1 Description of Environment

The Waiomu Stream and Pohue Stream catchments are located around two kilometres north of Te Puru community. They are both steep, well forested catchments that are drained by the Waiomu Stream and the Pohue Stream.

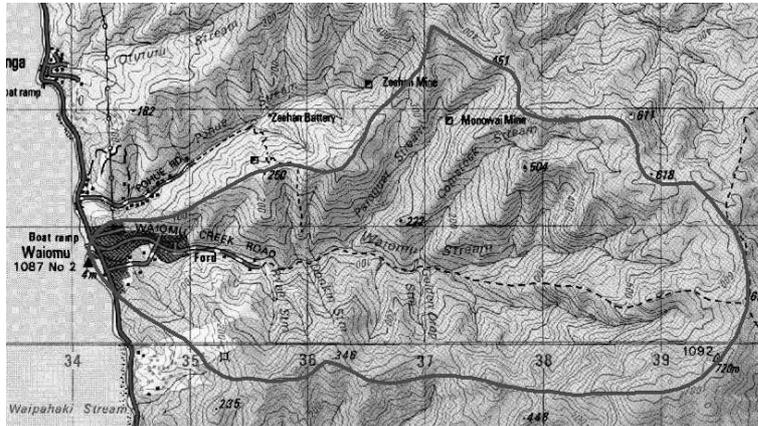


Figure: The Waiomu Stream catchment



Figure: The Pohue Stream catchment

The physical characteristics of the Waiomu Stream catchment is summarised in the following table.

Catchment Area	10.4 km ²
% Urban Area	2%
% Indigenous Forest/Scrub	97%
% Included in Coromandel Forest Park	83%
Average Channel Slope	6%
Time of Concentration	45 minutes

Table: Summary of physical characteristics of the Waiomu Stream catchment

The physical characteristics of the smaller Pohue Stream catchment is summarised in the following table.

Catchment Area	3.5 km ²
% Urban Area	< 1%
% Indigenous Forest/Scrub	96%
% Included in Coromandel Forest Park	77%
Average Channel Slope	9%
Time of Concentration	30 minutes

Table: Summary of physical characteristics of the Pohue Stream catchment

The Waiomu community is located at the base of the Waiomu Stream catchment within the lower section of the river valley. The community consists of mainly residential development on both banks of the Waiomu Stream, but also includes the Waiomu Bay Holiday Park. State Highway 25 runs through the Waiomu community using a dual lane multi-span bridge. A portion of the Waiomu community is located within the valley created by the Pohue Stream. Development within this portion of the community is residential on the true left bank of the Pohue Stream.

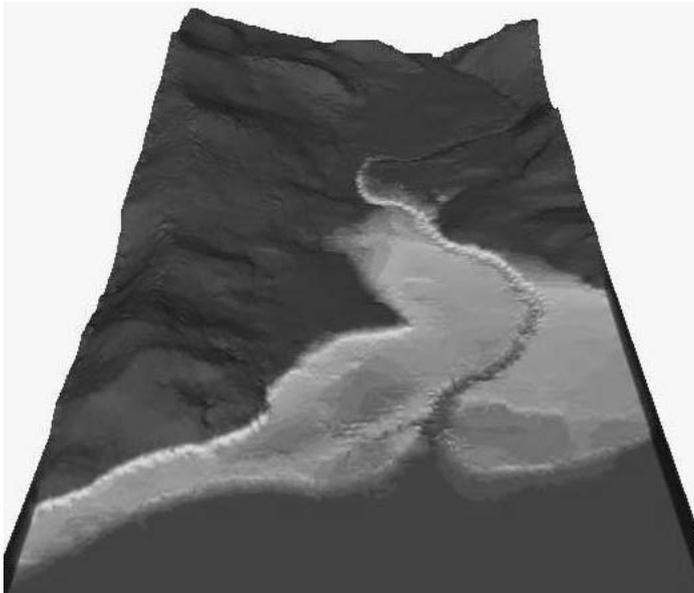


Figure: The Waiomu Stream coastal alluvial fan (looking inland from the Firth of Thames)

During significant flood events in the Waiomu Stream, overland flow occurs across the meander where the Waiomu Bay Holiday Park has been established. A proportion of this overland flow re-enters the Waiomu Stream upstream of the State Highway 25 bridge. The remainder ponds behind State Highway 25 in the vicinity of Trotter Avenue. Minor overland flow also occurs downstream of the Waiomu Creek Road ford.

During significant flood events in the Pohue Stream, overland flow occurs along Pohue Creek Road, re-entering the Pohue Stream downstream of the Pohue Creek Road culvert.



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

Damage to properties within the Waiomu community is focused on those properties on the true right bank of the Waiomu Stream and those properties on the true left bank of the Pohue Creek.



Figure: Property damage within the Waiomu community during the 'weather bomb'

5.3.2 Previous Works

The Waiomu Stream has previously been subject to severe bank erosion on the true left bank opposite the Waiomu Bay Holiday Park. To address the risk to properties that this posed, the Earthquake Commission funded the placement of rock rip rap following the weather bomb (late 2002).



Figure: Erosion control works in the Waiomu Stream

5.3.3 Hydrological Assessment

A summary of the hydrological assessment completed for the Waiomu Stream 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)	29	41	48	61	73
Peak Stream Flow (m ³ /s)	59	83	97	124	148

Table: Summary of Waiomu Stream catchment hydrology

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

Event	Peak flood flow (m ³ /s)	Event Return Period (years)
February 1985	110	20 - 50
Weather Bomb	145	100

Table: Summary of historical flood events on the Waiomu Stream

A summary of the hydrological assessment completed for the Pohue Stream 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)	34	50	58	74	100
Peak Stream Flow (m ³ /s)	23	34	39	50	67

Table: Summary of Pohue Stream catchment hydrology

5.3.4 Hydraulic Assessment

The performance of the Waiomu Stream channel was assessed by constructing a one-dimensional hydraulic model extending from the Waiomu Creek Road ford to the Firth of Thames.

The one-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 one-dimensional hydraulic model of the Waiomu Stream was used to simulate the 100 year flood event (assuming that the flow would be restricted to the channel using floodwalls).

This hydraulic assessment of the Waiomu Stream derived the following facts:

- The bank full capacity of the Waiomu Stream is around 80 m³/s at the Waiomu Bay Holiday Park (this flow was assessed as the 10 year event).
- The State Highway 25 bridge does not represent a significant restriction to the bank full flow in the Waiomu Stream channel.

The performance of the Pohue Stream channel was assessed using Manning's equation for open channel flow (construction of the one-dimensional hydraulic model was not possible for the Pohue Stream channel given the gradient of the channel and the waterfall at the outlet of the Pohue Creek Road culvert).

This hydraulic assessment of the Pohue Stream derived the following facts:

- The bank full capacity of the Pohue Stream is around 40 m³/s. This flow was assessed as the 20 year event.
- The Pohue Creek Road culvert has a capacity of 20 m³/s. This represents a significant restriction in the Pohue Stream channel and has resulted in sediment accumulation upstream of the culvert.

5.3.5 Hazard Assessment

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



Figure: Waiomu Community flood hazard map

5.3.6 Hazard Mitigation Proposals

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

- Planning and building controls
- The proposed river and catchment management works for the Waiomu Stream and Pohue Stream catchments.
- The proposed engineering works within the lower section of the Waiomu Stream (within the Waiomu urban area) and the lower section of the Pohue Stream (within the Pohue urban area).

5.3.6.1 Planning and Building Controls

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



Figure: Recommended planning and building controls for the Waiomu 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 Waiomu community to improve the capacity of the lower Waiomu Stream channel and Pohue Stream channel. The higher the level of flood protection that is adopted by the Waiomu community, the fewer development restrictions there will be on land within the Waiomu flood hazard zone.

5.3.6.2 River and Catchment Management Works

It is proposed that the river and catchment management works within the Waiomu Stream and Pohue Stream catchments 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 100 percent of the Waiomu Stream catchment and 80 percent of the Pohue Stream catchment.
- Removal of channel obstructions and accumulated sediment in the middle and upper reach of the Waiomu Stream, the Pohue Stream and the tributaries to both (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 works within the Waiomu Stream and Pohue Stream catchments is presented in the following tables.

	Initial Capital Costs	Ongoing Annual Costs
Channel Management	\$707	\$707
Pest Management	\$7,500	\$1,470
Riparian Management	\$659	\$8
Soil Conservation	\$22,780	\$557
+ Design and Management (20%)	\$6,329	\$ 548
+ Contingency (10%)	\$3,798	\$ 329
GRAND TOTAL	\$41,800	\$3,700

Table: Indicative costs for the proposed river and catchment management works within the Waiomu Stream catchment

	Initial Capital Costs	Ongoing Annual Costs
Channel Management	\$456	\$456
Pest Management	\$3,500	\$686
Riparian Management	\$829	\$21
Soil Conservation	\$8,934	\$216
+ Design and Management (20%)	\$2,744	\$ 276
+ Contingency (10%)	\$1,646	\$ 166
GRAND TOTAL	\$18,200	\$1,900

Table: Indicative costs for the proposed river and catchment management works within the Pohue Stream catchment

5.3.6.3 Engineering Works

The proposed engineering works for the lower Waiomu Stream have the following general objectives:

- Improvement of the performance of the Waiomu Stream channel and floodway downstream of the Waiomu Creek Road ford.
- Provision of additional flood protection for the Waiomu community, where economic.

The key limitation on engineering works in the lower Waiomu Stream is the close proximity of urban development to the channel.

The engineering works for the lower Pohue Stream have the following general objectives:

- Improvement of the performance of the Pohue Stream channel and floodway over the section that is within the Pohue urban area.
- Relieving the restriction created by the Pohue Creek Road culvert.

The key limitation on engineering works in the lower Pohue Stream is the limited number of properties that will directly benefit from any works.

Proposal 1: Base Level Engineering Works

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



Figure: Base level engineering works on the Waiomu Stream and Pohue Stream

The indicative cost estimate for base level engineering works on the Waiomu Stream and Pohue Stream is presented in the following tables.

	Initial Capital Costs	Ongoing Annual Costs
Channel Maintenance	-	\$6,500
Channel Monitoring	-	\$1,500
+ Design and Management (15%)	-	\$1,200
+ Resource Consents (20%)	\$1,600	-
+ Contingency (10%)	-	\$ 800
GRAND TOTAL	\$1,600	\$10,000

Table: Indicative costs for base level engineering works on the Waiomu Stream

	Initial Capital Costs	Ongoing Annual Costs
Channel Maintenance	-	\$4,500
Channel Monitoring	-	\$1,500
+ Design and Management (15%)	-	\$ 900
+ Resource Consents (20%)	\$1,200	-
+ Contingency (10%)	-	\$ 600
GRAND TOTAL	\$1,200	\$7,500

Table: Indicative costs for base level engineering on the Pohue Stream

The pros and cons of adopting this proposal are:

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

Proposal 2: Full Engineering Works

Proposal 2 improves the existing performance of the lower Waiomu Stream channel to contain the 100 year flood event (148 m³/s) by implementing the following works:

- Replacement of the Waiomu Creek Road ford to eliminate the existing overland flow path down Waiomu Creek Road.
- Construction of an earth embankment on the true right bank (in the vicinity of the Waiomu Bay Motor Camp) to eliminate the existing overland flow path across the Waiomu Bay Motor Camp and the existing ponding area in the vicinity of Trotter Avenue.
- Placement of rock rip rap to improve the stability of the Waiomu Stream and Pohue Stream channels and protect the other works associated with this proposal.

Proposal 2 retains the existing performance of the Pohue Stream channel to contain the 20 year flood event (40 m³/s) and improves the stability of the channel by the placement of rock rip rap.

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



Figure: Full engineering works on the Waiomu Stream and Pohue Stream

The indicative cost estimate for full engineering works on the Waiomu Stream and the Pohue Stream is presented in the following table.

	Initial Capital Costs	Ongoing Annual Costs
Channel Maintenance	-	\$6,500
Channel Monitoring	-	\$1,500
Channel Improvements	\$155,000	\$5,000
Floodwalls	\$68,000	\$2,040
+ Design and Management (15%)	\$33,450	\$2,256
+ Resource Consents (20%)	\$44,600	-
+ Contingency (10%)	\$22,300	\$1,504
Property Purchase	\$222,625	-
GRAND TOTAL	\$546,000	\$18,800

Table: Indicative costs for full engineering works on the Waiomu Stream

	Initial Capital Costs	Ongoing Annual Costs
Channel Maintenance	-	\$4,500
Channel Monitoring	-	\$1,500
Channel Improvements	\$22,000	\$760
+ Design and Management (15%)	\$3,300	\$1,014
+ Resource Consents (20%)	\$4,400	-
+ Contingency (10%)	\$2,200	\$ 676
SUB TOTAL	\$31,900	\$8,450
+ House Raising	\$120,000	-
GRAND TOTAL	\$151,900	\$8,500

Table: Indicative costs for full engineering works on the Pohue Stream

The pros and cons of adopting this proposal are:

- ✓ Risk to Waiomu 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.

A variation to Proposal 2 is the upgrade of the Pohue Creek Road culvert. However this will significantly increase the capital cost by around \$120,000.

Due to the significant increase in capital cost of this variation, it has not been included in this report to the same level of detail as the other proposals.

5.3.6.4 Summary of Indicative Costs and Local Rates

A summary of the indicative costs for the flood hazard mitigation proposals prepared for the Waiomu Stream catchment, the Pohue Stream catchment and the Waiomu community is presented in the following table.

Mitigation Proposal	Initial Capital Cost	Ongoing Annual Cost
River and Catchment Management	\$59,000	\$5,400
Engineering Works Proposal 1	\$2,800	\$17,500
Engineering Works Proposal 2	\$577,900	\$27,300

Table: Summary of total indicative costs for the Waiomu community

It is proposed that the catchment management, river management and engineering works developed to assist the Waiomu community be funded according to the funding policy contained in this report.

A summary of the direct and community rates that will be charged to an average property within the Waiomu community to fund the proposed engineering works is presented in the following table.

Mitigation Proposal	Capital Repayment Phase		Maintenance Phase	
	Direct	Community	Direct	Community
Engineering Works Proposal 1	\$199	\$40	\$196	\$39
Engineering Works Proposal 2	\$1,093	\$150	\$305	\$61

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

5.3.6.5 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 Waiomu community:

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

If the owner of a property within the Waiomu 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 Waiomu community will be:

- \$7,500 (if within the hazard zone).
- \$1,500 (if outside the hazard zone).