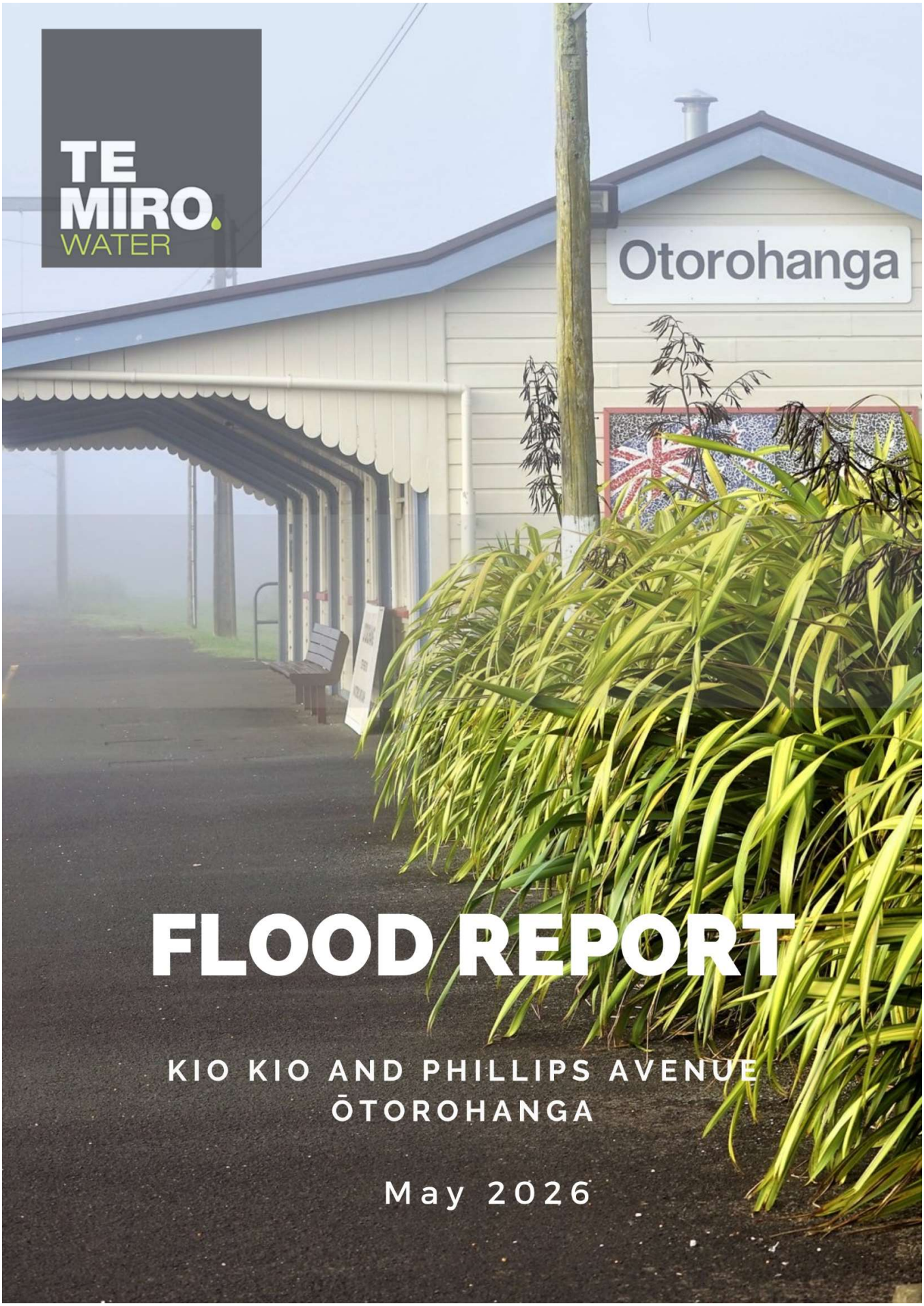


TE MIRO WATER

FLOOD REPORT

KIO KIO AND PHILLIPS AVENUE ŌTOROHANGA

May 2026



Version Control

Version	Date	Author	Reviewer	Change Description
1.0	25 May 2026	Mike Chapman	Britta Jensen	Final Draft for Council Review
1.1	22 May 2026	Mike Chapman and Saeed Ashouri	Britta Jesnen	ŌDC Review by Langley Carver & Chris Ryan

This report has been prepared for Ōtorohanga District Council for the project described to us and its extent is limited to the scope of work agreed between the client and Te Miro Water Limited and the data available for the design and/or model build. No responsibility is accepted by Te Miro Water Limited, or its directors, servants, agents, staff, employees, or subcontractors related to the inherent flood model limitations, or the accuracy of information provided by third parties

TE MIRO. WATER

CONTENTS

WHAKATAKINGA | PURPOSE 1

1 FLOOD EVENT CONTEXT 2

2 MODEL SCENARIO AGREEMENT 3

3 FLOOD MODEL SPECIFICATION 4

4 FLOOD LEVEL RESULT DISCUSSION 5

4.1 KIO KIO STATION ROAD AND CHERRY LANE 6

4.2 PHILLIPS AVENUE 7

5 FLOOD HAZARD ASSESSMENT 8

6 WHAKAKAPINGA | CONCLUSIONS 10

7 KŌPIRI | LIMITATIONS 10

WHAKATAKINGA | PURPOSE

The purpose of this report is to summarise the flood modelling results and hazard assessment for flood affected properties at Kio Kio Station Road and Phillips Avenue in Ōtorohanga. Te Miro Water (TMW) wish to acknowledge the distress to all those people affected during and following this event. In April 2026 TMW built and tested a computer flood model to determine flood hazard at the affected properties. A comparison of flood model levels to actual surveyed debris lines is provided. The debris lines represent the best estimate of the maximum flood level reached during the February 2026 flood event. This flood report will support Ōtorohanga District Council (ŌDC) currently in the recovery phase. The intention is to define what a theoretical 'modelled' event and hazard assessment looks like at each property and to explain findings in a clear, concise, easily understood language for a broad range of readers.

TMW were engaged by Ōtorohanga District Council (ŌDC) to conduct a flood hazard assessment for some of the properties affected during the 2026 February flood event. A total of 12 dwellings were impacted by flooding. Eight properties on Kio Kio Station Road, one property on Cherry Lane and three properties on Phillips Avenue. These properties were issued restricted use notices (yellow placards) by ŌDC. Yellow-placarded properties require further assessment or remediation before reoccupation. This report does not constitute a flood mitigation strategy or flood risk "tolerance" assessment. The confirmation of maximum flood levels and the associated hazard assessment are the key outcomes at this point requested by ŌDC. Appendix A provides flood depth and hazard maps, location plans of affected properties and debris line survey locations.

All flood level and survey information in this report is in vertical datum NZVD2016. A detailed model build report would typically support a report of this nature including technical details such as model parameters and result hydrographs. To date these details are not included in the report given the tight timeframes to support ŌDC during flood recovery. The model methodology has undergone robust internal peer review and quality assurance. A model build summary can be provided to ŌDC to support our findings in due course, currently the key priority is to disseminate this flood information as soon as possible.

1 FLOOD EVENT CONTEXT

Following review of recorded Waikato Regional Council (WRC) rainfall data and discussions with ŌDC response staff, the storm that occurred within the Kio Kio Station Road catchment is generally considered to be in the order of a 100-250yr rainfall event; a significant event resulting in flooding above floor level. By comparison, the event that resulted in flooding of Phillips Avenue, also above floor level, was more localised. Phillips Avenue being in the order of a 10-20yr rainfall event. The recorded maximum Waipa River level during the event was relatively low in the order of a 2yr 'in bank' level consistent with the localised storm. Heavy rainfall was not widely distributed throughout the much larger Waipa River catchment.

TMW staff spoke to several residents during the debris mark survey. Residents spoke of their experience – they knew the rainfall had subsided on the Friday evening around 8pm (the town centre flooded Friday evening due to rapid runoff from direct rainfall trapped somewhat by the stopbanks around the town). Some Residents then woke at approximately 4am on the Saturday morning to find floodwater close to or entering their homes above floor level. Essentially once the rain stopped on Friday evening, the maximum peak flood level occurred some 8 hours later early Saturday morning at Phillips Avenue and Kio Kio Station Road. FENZ undertook several rescues to evacuate residents using boats.

2 MODEL SCENARIO AGREEMENT

Following discussion with the ŌDC recovery team, various model scenarios were identified for simulation in the computer flood model as follows:

Description of Kio Kio Station Road and Cherry Lane flood model scenarios:

Note: "RCP 8.5" (stated below) stands for - Representative Concentration Pathway 8.5 – this is a climate change projection model used by scientists to simulate a "worst-case" climate future. RCP 8.5 is also adopted in the Waikato for engineering design. Using RCP 8.5 means we use ~20% more rainfall in the model compared to current day rainfall.

1- 100-year RCP8.5: The model uses 100-year ARI with RCP8.5 climate change scenario from HIRDS V4 as the rainfall input for the rain on grid zone and lumped catchments.
2- 100-year Historical: The model uses 100-year ARI historical from HIRDS V4 as the rainfall input for the rain on grid zone and lumped catchments.
3- 10-year RCP8.5: The model uses 10-year ARI with RCP8.5 climate change scenario from HIRDS V4 as the rainfall input for the rain on grid zone and lumped catchments.
4- 2-year RCP8.5: The model uses 2-year ARI with RCP8.5 climate change scenario from HIRDS V4 as the rainfall input for the rain on grid zone and lumped catchments.

Description of Phillips Avenue flood model scenarios:

1- 100-year RCP8.5 "global": The model uses 100-year ARI with RCP8.5 climate change scenario from HIRDS V4 as the rainfall input for the rain on grid zone and lumped catchments. It also uses 100-year RCP8.5 Waipa River flow time series from WRC's 1D model as the upstream boundary condition.
2- 100-year historical global: The model uses 100-year ARI historical from HIRDS V4 as the rainfall input for the rain on grid zone and lumped catchments. It also uses 100-year RCP8.5 Waipa River flow time series from WRC's 1D model as the upstream boundary condition.
3- 100-year RCP8.5 local: The model uses 100-year ARI with RCP8.5 climate change scenario from HIRDS V4 as the rainfall input for the rain on grid zone and lumped catchments. It also uses 10-year RCP8.5 Waipa River flow time series from WRC's 1D model as the upstream boundary condition.
4- 10-year RCP8.5 global: The model uses 10-year ARI with RCP8.5 climate change scenario from HIRDS V4 as the rainfall input for the rain on grid zone and lumped catchments. It also uses 10-year RCP8.5 Waipa River flow time series from WRC's 1D model as the upstream boundary condition.

5- 10-year RCP8.5 local: The model uses 10-year ARI with RCP8.5 climate change scenario from HIRDS V4 as the rainfall input for the rain on grid zone and lumped catchments. It also uses estimated 2-year historical Waipa River gauge data.

3 FLOOD MODEL SPECIFICATION

This paragraph provides a brief overview of the flood model software type and basic model build parameters. The 2-D flood model is developed in TUFLOW flood modelling software. It uses the 2, 10, 100-year ARI rainfall event including RCP8.5 climate change scenario and 100-year historical rainfall. Existing culverts (1D elements) are incorporated in the model, using Waikato Regional Council's culverts dataset. The Bridges in the model are extracted from the National bridge layer, and some reasonable assumptions are made for the bridge specifications. The National LiDAR (2025) from LINZ has been used as the source of topography which is 1m grid size (NZVD2016 as the vertical datum). The upper catchments have been represented as lumped catchments. SCS hydrology method has been used for assigning the soil infiltration in the model. A detailed flood model log and assumptions will be provided after generating the final version of the flood model in due course.

4 FLOOD LEVEL RESULT DISCUSSION

The maximum modelled flood level for each of the scenarios listed in Section 2 are provided in Table 1 for Kio Kio Station Road and Cherry Lane and Table 2 for Phillips Avenue. Water levels are also shown next to each affected property in the flood maps in Appendix A.

At 55 Kio Kio Station Road, the surveyed debris line is 38.1mRL (survey mark 12,11 from Table 1). The debris line was taken directly from the side of the dwelling. The modelled 100yr current day rainfall is 38.04mRL. This level closely aligns and is consistent with the recorded rainfall event being in the order of a 100-250yr event according to WRC. The modelled 100yr rainfall is applied uniformly to the entire catchment and there will be some difference to the spatially varying actual rainfall that fell during the event – estimated from radar.

Debris lines were not captured on properties inside the boundary of the large lot subdivision cluster at 50 Kio Kio Station Road. The closest debris line for this area was captured along the road on the hedge line boundary adjacent to the subdivision – the survey level is 38.06mRL (survey location 10). By comparison the modelled flood level at property 50C for the 100yr is 38.05mRL with current day 'historic' rainfall. The 100yr modelled level and surveyed level is very similar.

Discussions with ŌDC staff suggest the modelled flood level of 38.05mRL correlates well to observed flood depths during the event and known floor levels. For example photos of 50A Kio Ko Station Road show floodwaters above the windowsills. The flood therefore reached a minimum 38.04m plus some assuming the windowsill is ~900mm above floor level. A modelled flood level of 38.05m is therefore consistent with what was observed.

At 113 Phillips Avenue the surveyed debris line is 37.8mRL (survey location 1) and the modelled 10yr with climate change is ~200mm higher at 38.02mRL. This 10yr modelled level is generally consistent with the recorded rainfall being in the order of a 10-20yr event according to WRC. The modelled 100yr level by comparison with current day rainfall is 38.52mRL some ~700mm above the surveyed level. Modelled levels are even higher at 39.13mRL using 100yr rainfall across the entire Waipa River catchment. The debris line surveyed at 113 Phillips Avenue. was taken directly from the side of the dwelling.

The survey maps shows various other debris lines captured, for example at the State Highway 3 bridge immediately to the south of Kio Kio Station Road and other marks taken within the town centre. These survey locations are shown in the Appendix maps however they are not directly relevant for the affected 12 dwellings.

4.1 KIO KIO STATION ROAD AND CHERRY LANE

Comparison of surveyed debris lines and modelled flood levels and the flood levels at the affected dwellings (NZVD 2016):

Table 1 Modelled flood levels at the affected dwellings at Kio Kio Station Road and Cherry Lane

Affected dwelling	100-year RCP8.5	100-year historical	10-year RCP8.5	2-year RCP8.5
50 Kio Kio Station Road (including A, B, C)	38.35	38.05	37.60	36.71
55 Kio Kio Sation Road	38.35	38.04	37.60	36.73
36 Kio Kio Sation Road	38.36	38.05	37.60	36.71
120 and 124 Kio Kio Station Road	37.35	36.91	36.66	36.57
1575G State Highway 3 (Cherry Lane)	41.99	41.86	41.70	41.26

Comparison of surveyed flood levels and modelled flood levels at Kio Kio Station Road (refer to Appendix-Figure 1 for location of these points)

Survey Location No.	Description	Surveyed level (2dp)	100-year RCP8.5	100-year historical	10-year RCP8.5	2-year RCP8.5
5	Silt line	38.133	38.36	38.05	37.60	37.16
6	Silt line	38.094	38.36	38.05	37.60	37.22
7	Silt line	38.304	38.45	38.15	37.84	37.35
8	Silt line	38.265	38.45	38.15	37.92	37.79
9	Silt line	38.129	38.45	38.15	37.72	37.60
10 (50c Kio Kio)	Silt line	38.060	38.35	38.05	37.60	36.71
11	Silt line	38.095	38.34	38.03	37.59	36.73
12 (55 Kio Kio)	Silt line	38.114	38.34	38.03	37.59	36.73
13	Silt line	38.095	38.35	38.04	37.60	36.74
14	Silt line	38.324	38.72	38.37	38.02	38.02
21	Grass flow	37.833	38.59	38.28	37.94	37.53
22	Debris line	38.467	38.88	38.52	38.05	37.69

4.2 PHILLIPS AVENUE

Comparison of surveyed debris lines and modelled flood levels and the flood levels at the affected dwellings:

Table 2: Modelled flood levels at the affected dwellings at Phillips Avenue

Affected dwelling	100-year RCP8.5 global	100-year historical global	100-year RCP8.5 local	10-year RCP8.5 global	10-year RCP8.5 local
113 Phillips Avenue	39.13	38.67	38.52	38.42	38.02
117 Phillips Avenue	39.11	38.66	38.52	38.42	38.03
107 Phillips Avenue	39.10	38.66	38.52	38.42	38.03

Comparison of surveyed flood levels and modelled flood levels at Phillips Avenue (refer to Appendix-Figure 15 for location of these points)

Survey Location No.	Description	Surveyed Water Line/Debris Line	100-year RCP8.5 global	100-year historical global	100-year RCP8.5 local	10-year RCP8.5 global	10-year RCP8.5 local
1 (113 Phillips Avenue)	Debris line	37.832	39.13	38.67	38.52	38.42	38.02
33	Debris line	35.629	38.20	37.18	36.88	36.72	35.70
34	Debris line	35.659	38.20	37.18	36.88	36.72	35.70
42	Building waterline	37.790	39.01	38.60	38.48	38.39	38.01
43	Building waterline	37.775	39.05	38.62	38.49	38.40	38.02
44	Building waterline	37.811	39.09	38.65	38.51	38.41	38.02
45	Building waterline	37.731	39.11	38.66	38.52	38.42	38.02

5 FLOOD HAZARD ASSESSMENT

The flood hazard assessment has been conducted based on the best practice flood hazard categories from Australian Rainfall Runoff (ARR2019) – a similar matrix was used by Auckland Council following the anniversary weekend flood event in 2023. The hazard classification in Figure 1 is based on the combined analysis of the flood model depth and flood velocity and applies to flooding outside the dwelling, for example exposure to the flood hazard if residents attempted to leave the property. The 12 affected properties all fall within the H3-H5 hazard range according to the categories shown in Figure 1 and as summarised in Table 3. We expect there will be some variation in hazard across each site as depth and velocity varies given the dwellings are within large lots.

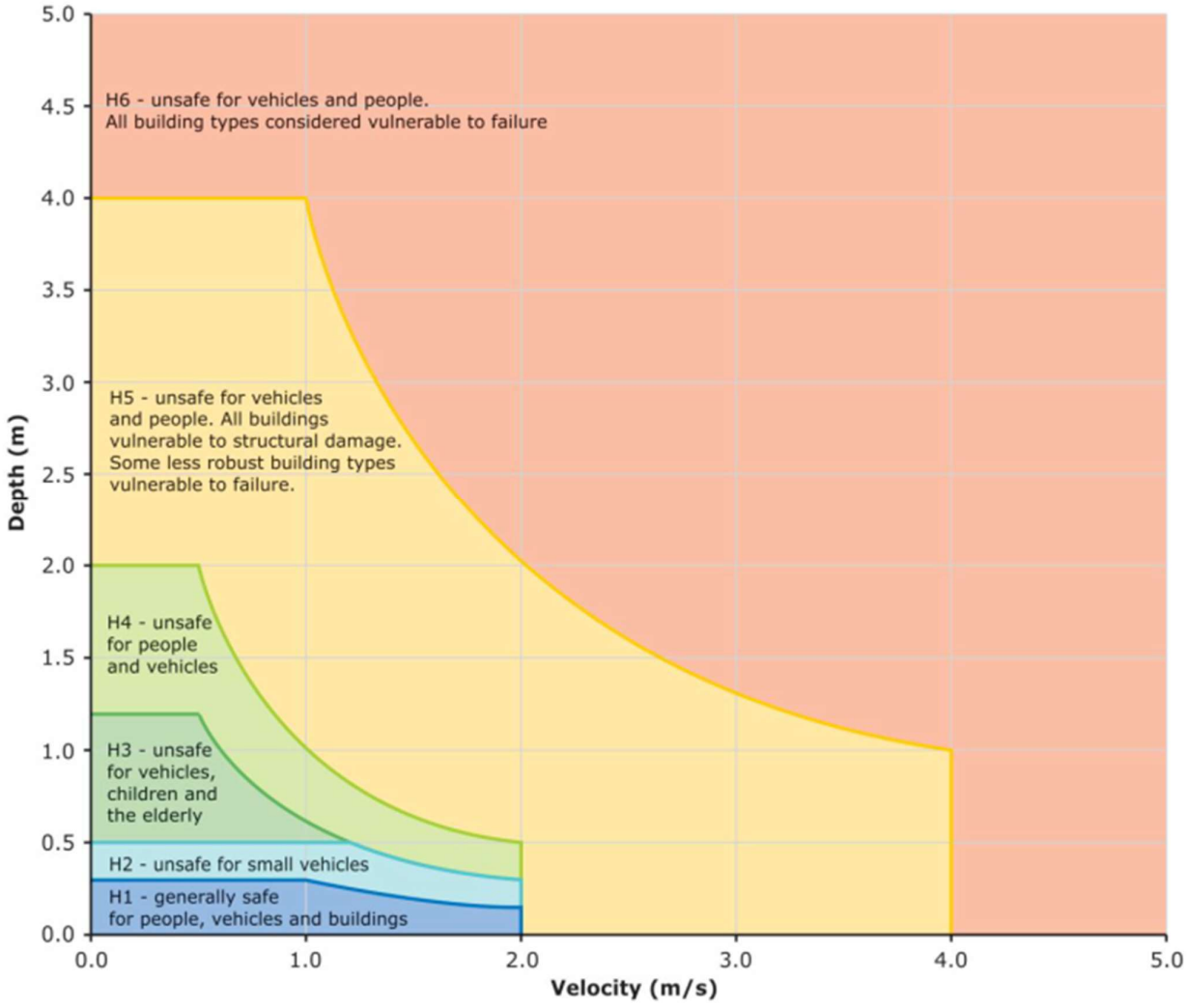


Figure 1 Hazard Assessment Categories

Table 3: 100-year Hazard classification for yellow stickered dwellings:

Property	Hazard Classification	Notes
36 Kio Kio Station Road	H3-H5	Majority H4
50 Kio Kio Station Road	H3-H5	Majority H4
50A Kio Kio Station Road	H3-H5	Majority H4 and H5
50B Kio Kio Station Road	H4-H5	Majority H4
50C Kio Kio Station Road	H4-H5	Majority H5
55 Kio Kio Station Road	H4-H5	Approximately 50/50
120 Kio Kio Station Road	H3	All in H3
124 Kio Kio Station Road	H3-H4	Majority H3
1575G State Highway 3 (Cherry Lane)	H3-H5	Majority H3
107 Phillips Avenue	H4	All in H4
113 Phillips Avenue	H3-H4	Majority H4
117 Phillips Avenue	H3-H4	Approximately 50/50

The 12 affected properties that were issued restricted use notices (yellow placards) are exposed to H3-H5 hazard range.

Figure 1 shows:

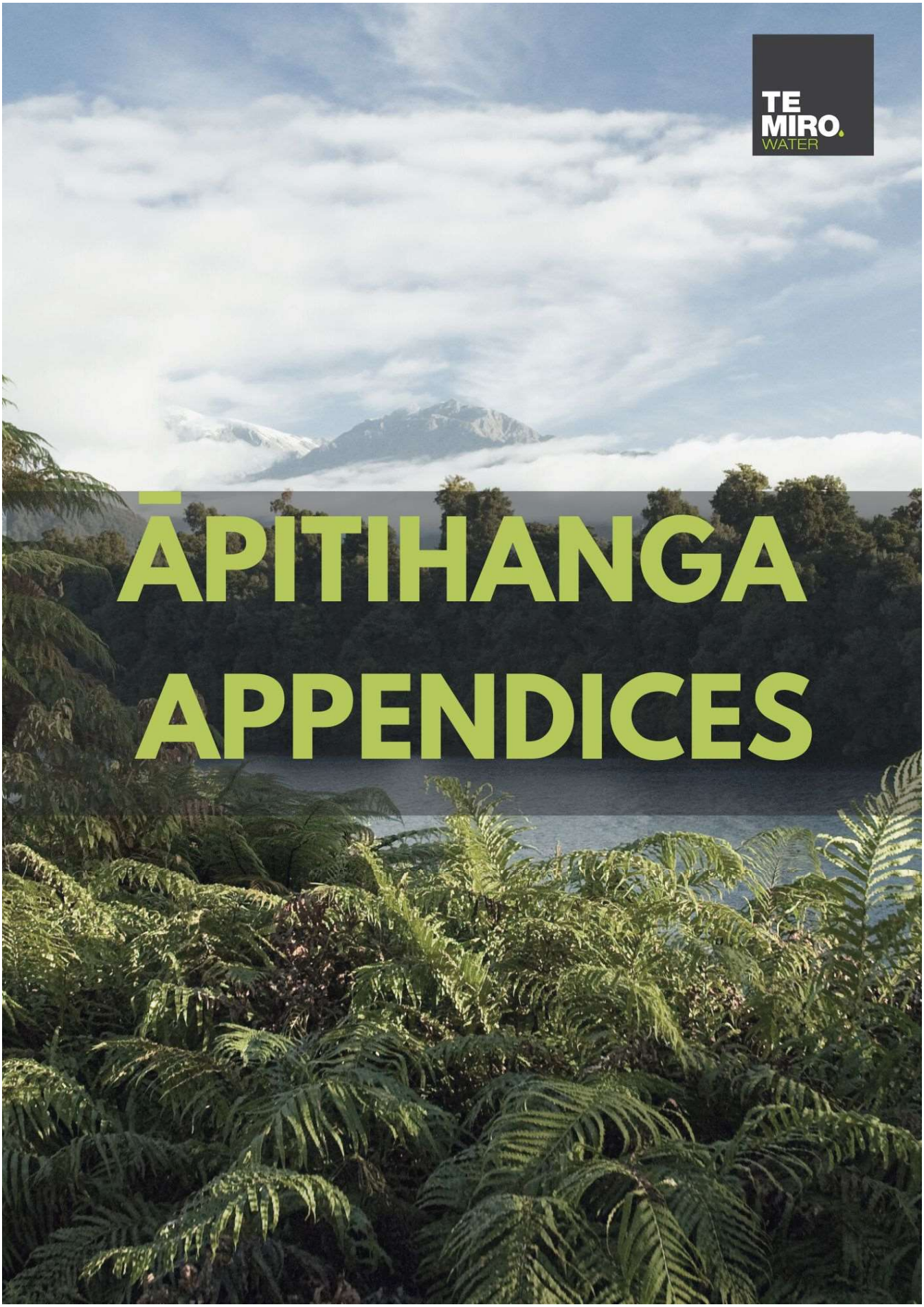
H3 – Unsafe for vehicles, children and the elderly.
H4 – Unsafe for people and vehicles.
H5 – Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure.

6 WHAKAKAPINGA | CONCLUSIONS

- A computer flood model was built to support ŌDC during the recovery phase following the February 2026 flood event.
- 12 dwellings were yellow stickered requiring further assessment.
- Flood debris lines were surveyed within 2-3 days following the event to estimate peak flood level and depth.
- The flood hazard shows that all 12 dwellings fall between H3-H5 during a modelled 100yr + climate change event. Resident are exposed to this hazard range if they attempt to leave the property at peak times during the event.
- H3 being unsafe conditions outside the building footprint for vehicles, children and the elderly.
- H4 being unsafe for all people and vehicles.
- H5 being unsafe for vehicles and people of all ages. This category of flood can cause damages to the buildings.
- The Kio Kio 100yr modelling results with current rainfall show maximum flood levels very similar to surveyed debris lines consistent with this event being in the order of 100yr-250yr rain event.
- The Phillips Avenue modelling results for the 10yr event with 'in bank' Waipa River level and current rainfall is broadly similar also to the debris line survey at 113 Phillips Avenue consistent with this rainfall vent being in the order of a 10-20yr event.
- Overall the modelled maximum flood levels generally align with the observed maximum flood levels based on debris line survey and discussions with ŌDC staff.

7 KŌPIRI | LIMITATIONS

This report has been prepared for Ōtorohanga District Council for the project described to us and its extent is limited to the scope of work agreed between Council and Te Miro Water Limited and the data available for the design and/or model build. Te Miro Water Limited accepts no responsibility, or its directors, servants, agents, staff, employees, or subcontractors related to the inherent flood model limitations, or the accuracy of information provided by third parties and/or the use of any part of this report in any other context or for any other purpose. The modelled flood levels are based on an existing ground surface generated from LIDAR. We recommend a site survey is undertaken of existing levels to compare to LIDAR prior to setting any foundation or floor level.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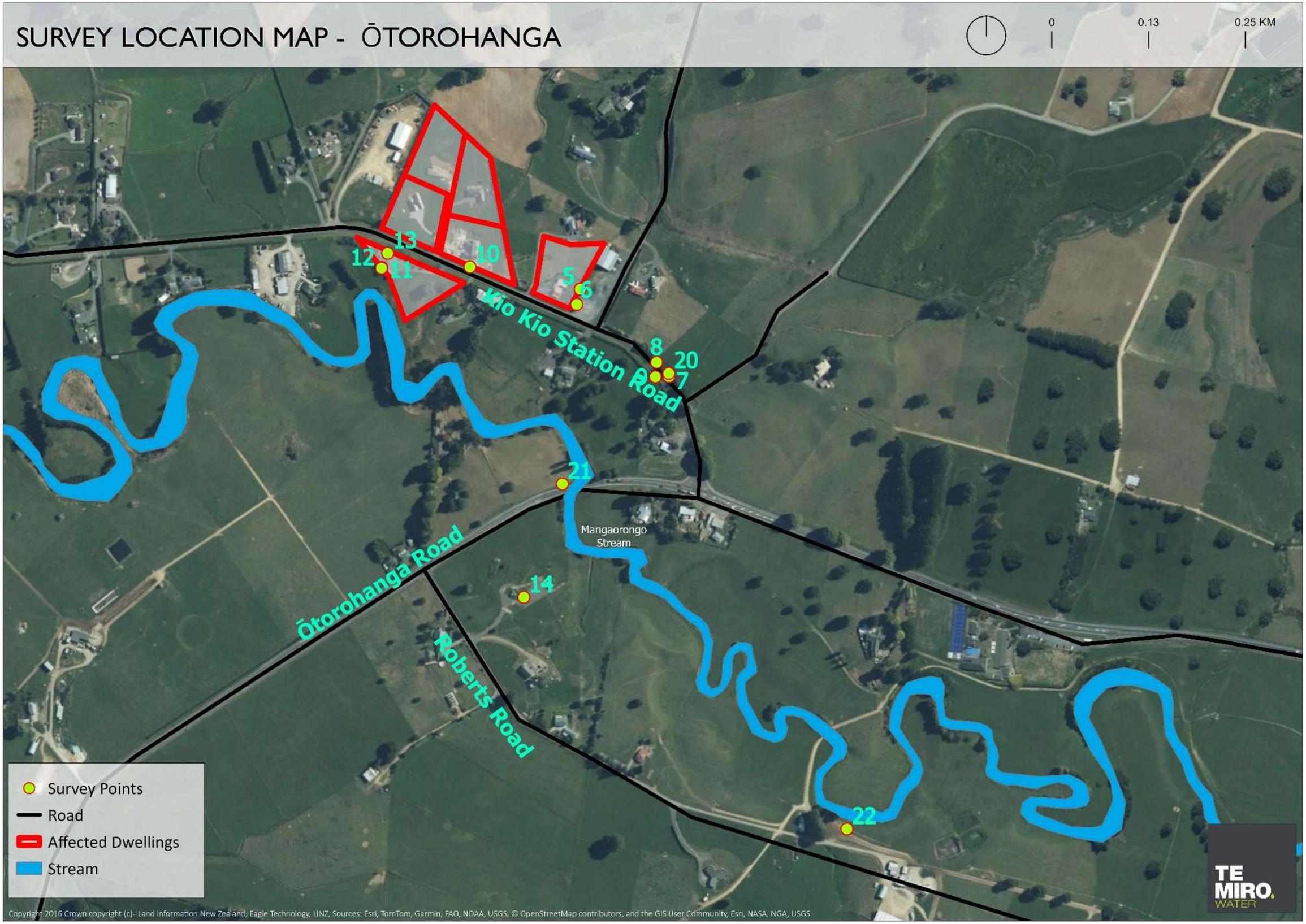

Figure 1. Survey locations

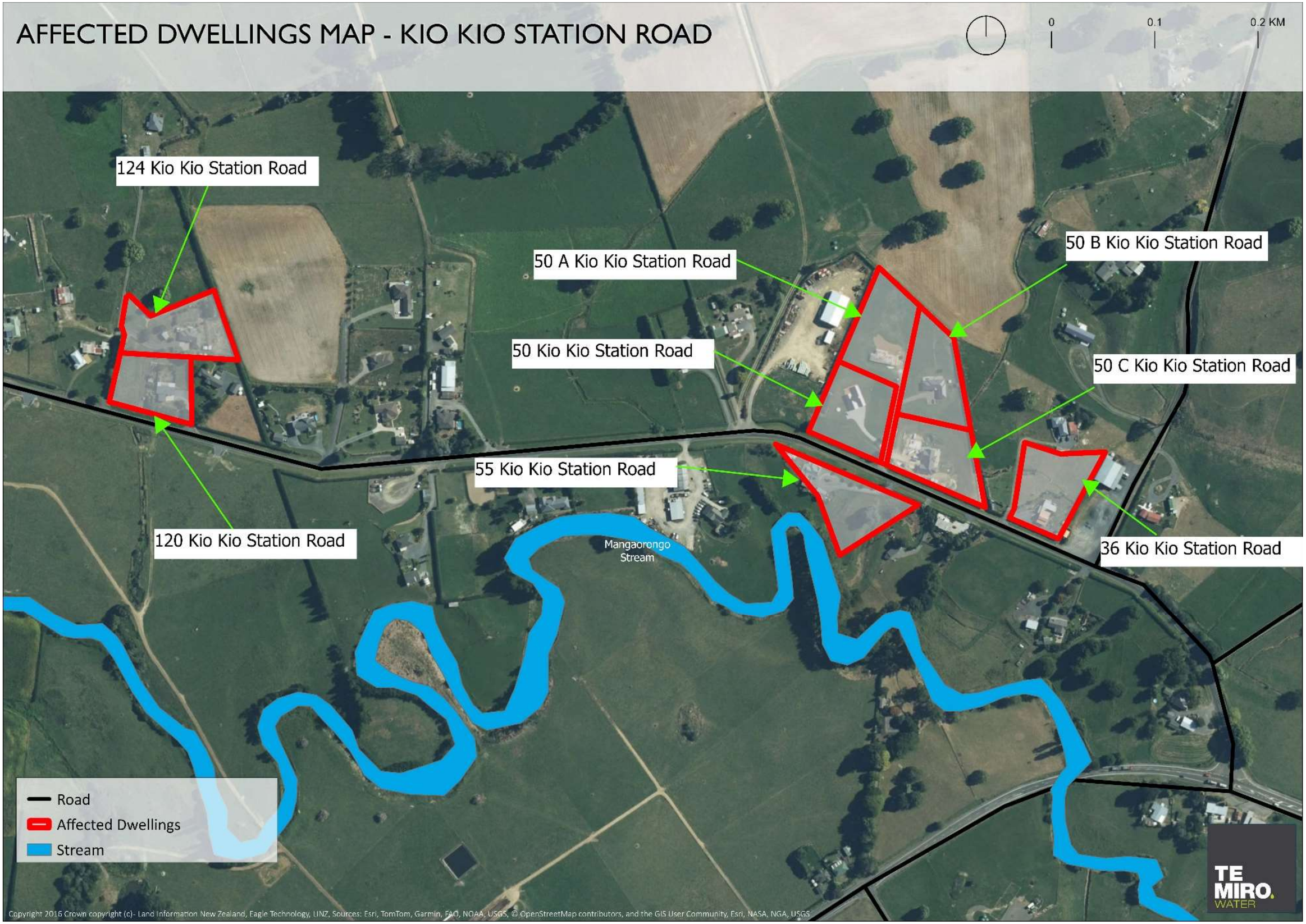

Figure 2. Affected dwellings at Kio Kio Station Road

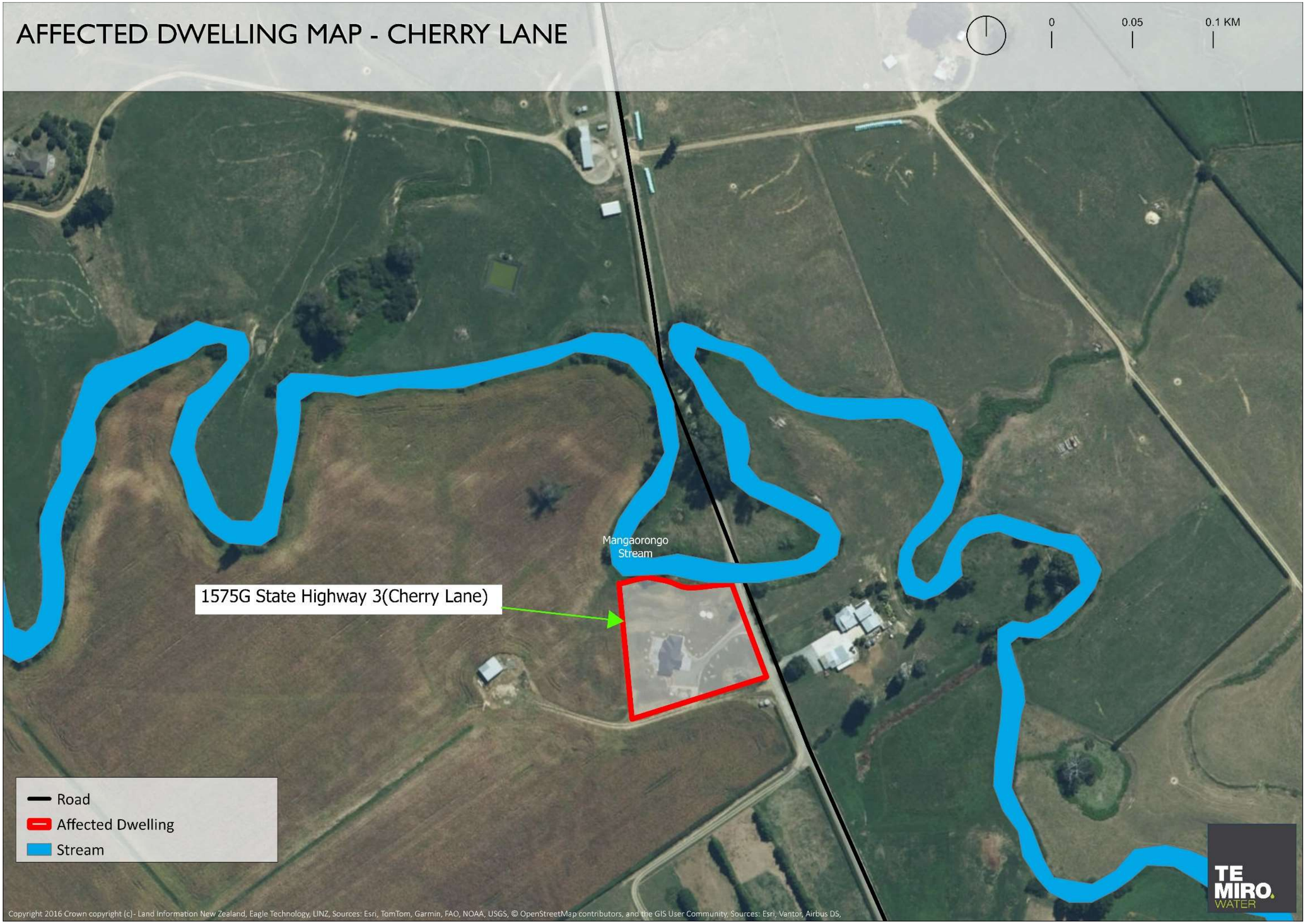

Figure 3. Affected dwelling at Cherry Lane

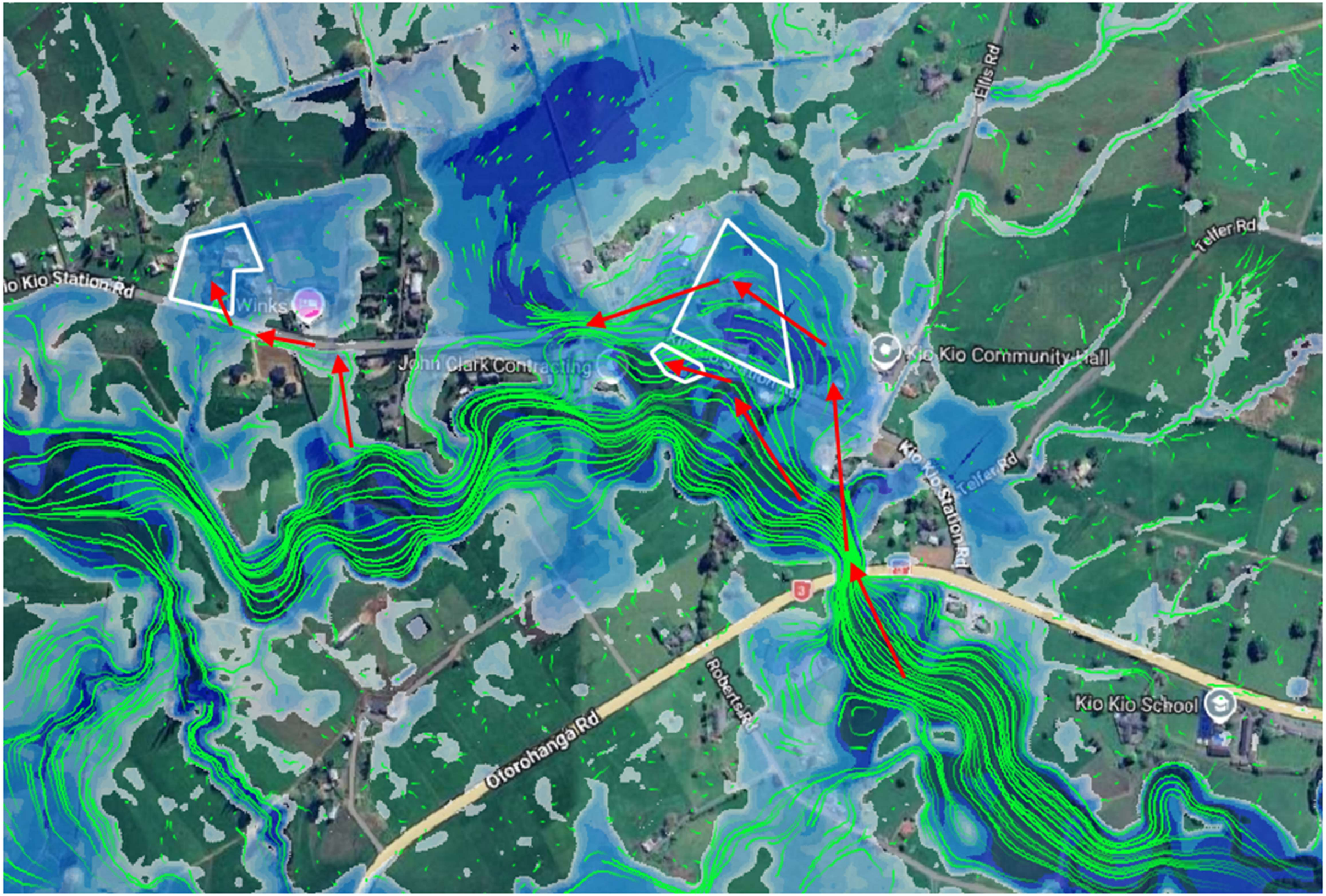

Figure 4. Flood map and velocity arrows showing flow direction

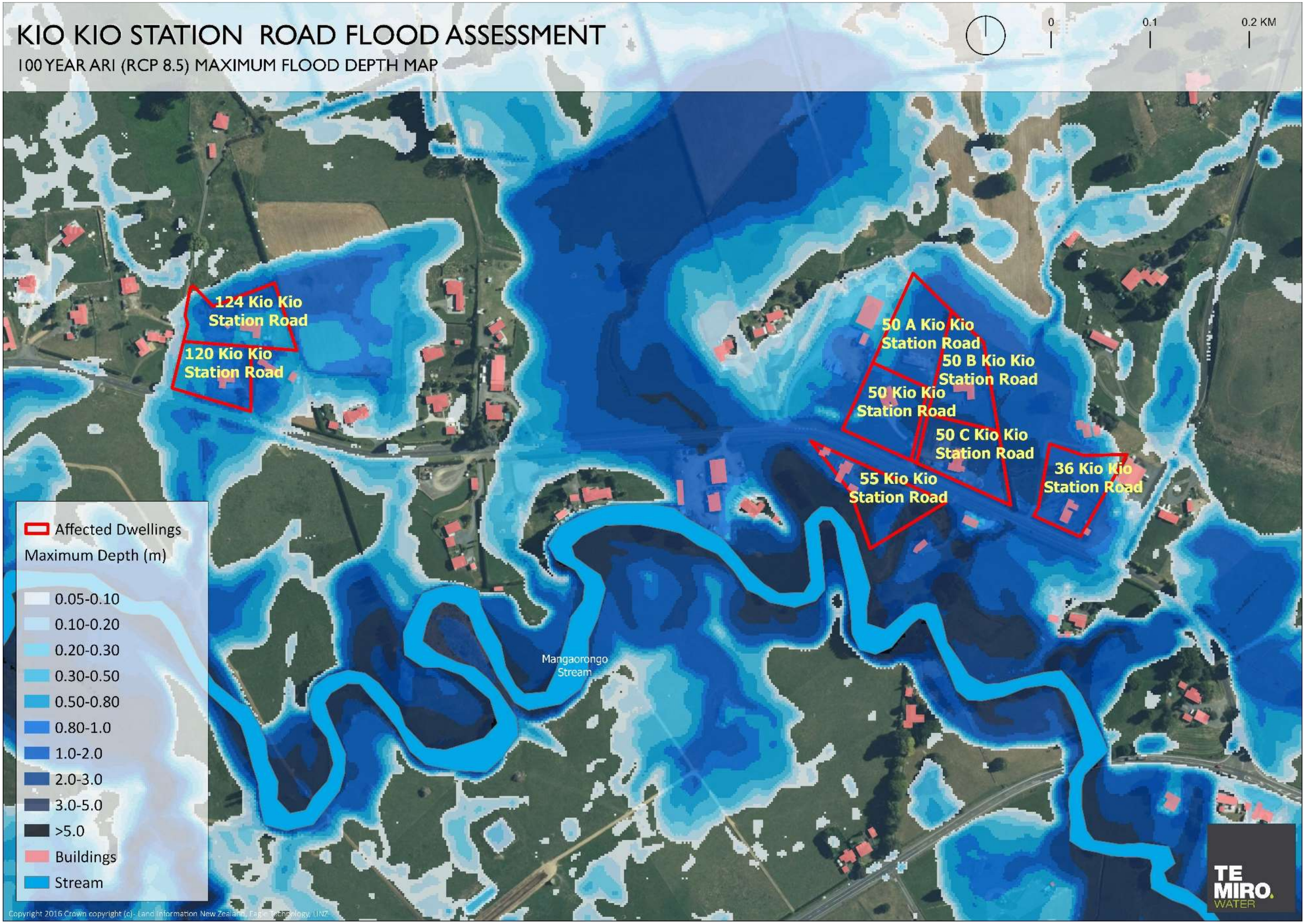

Figure 5. 100-year ARI RCP8.5

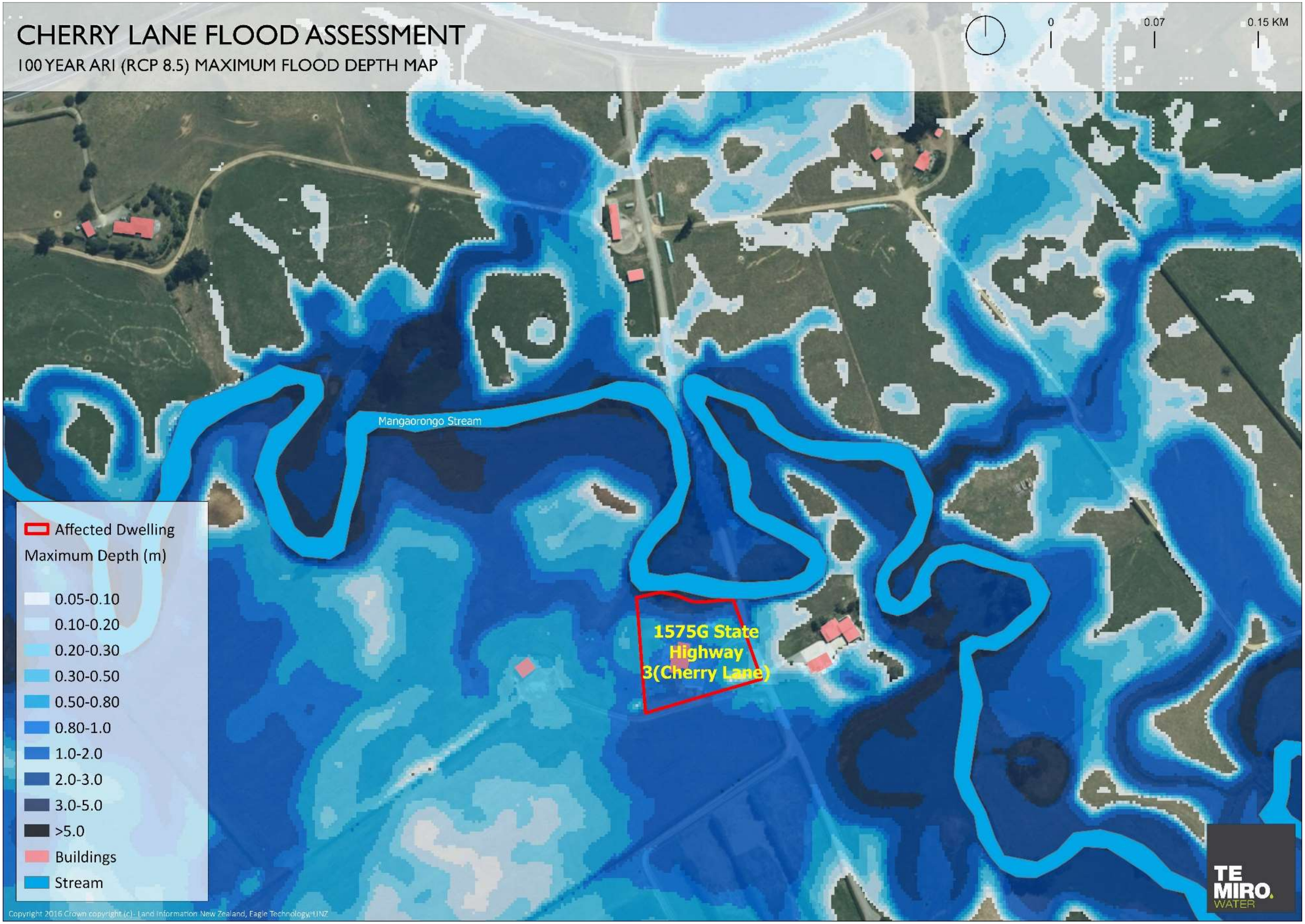

Figure 6. 100-year ARI RCP8.5

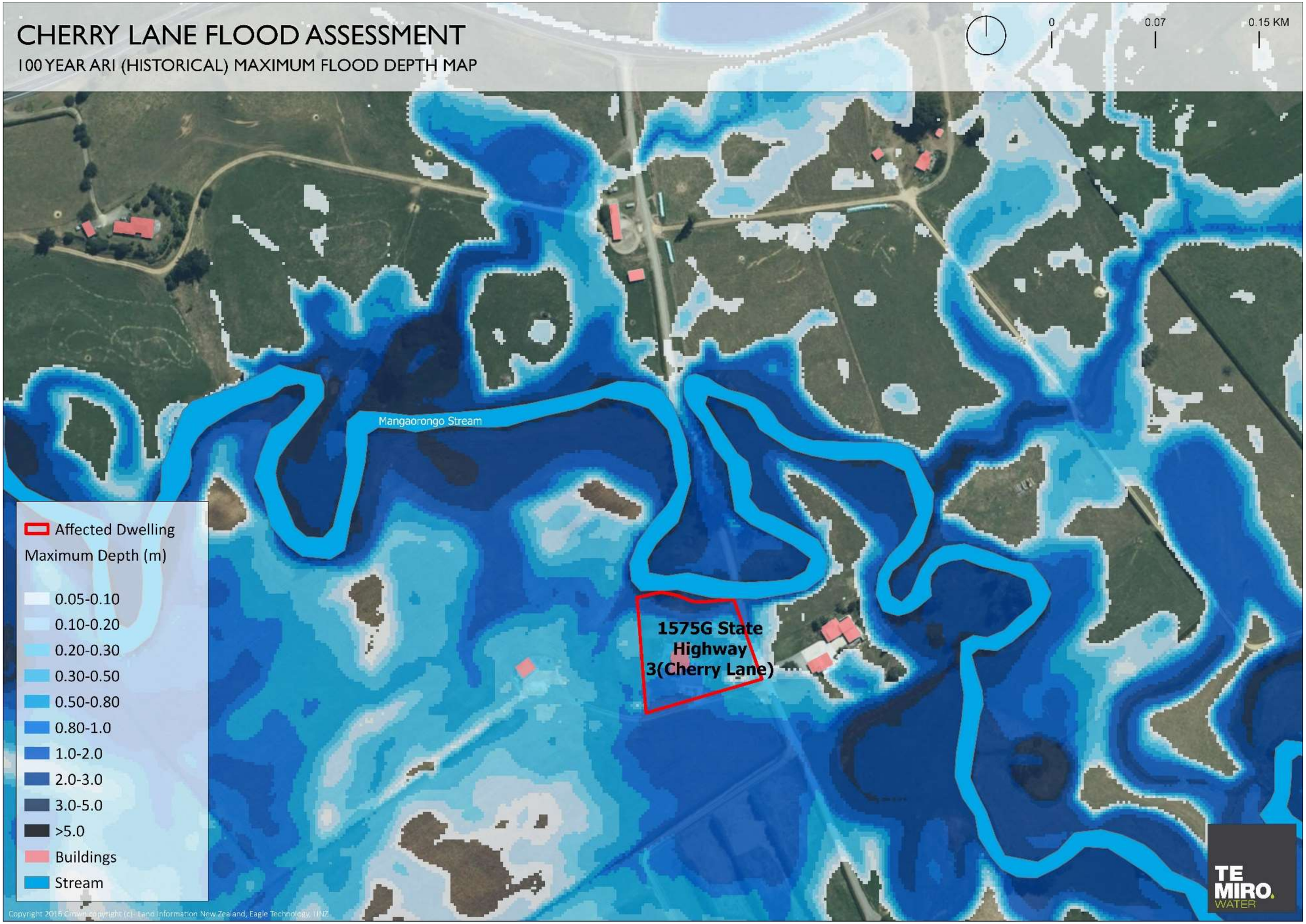

Figure 7. 100-year ARI Historical

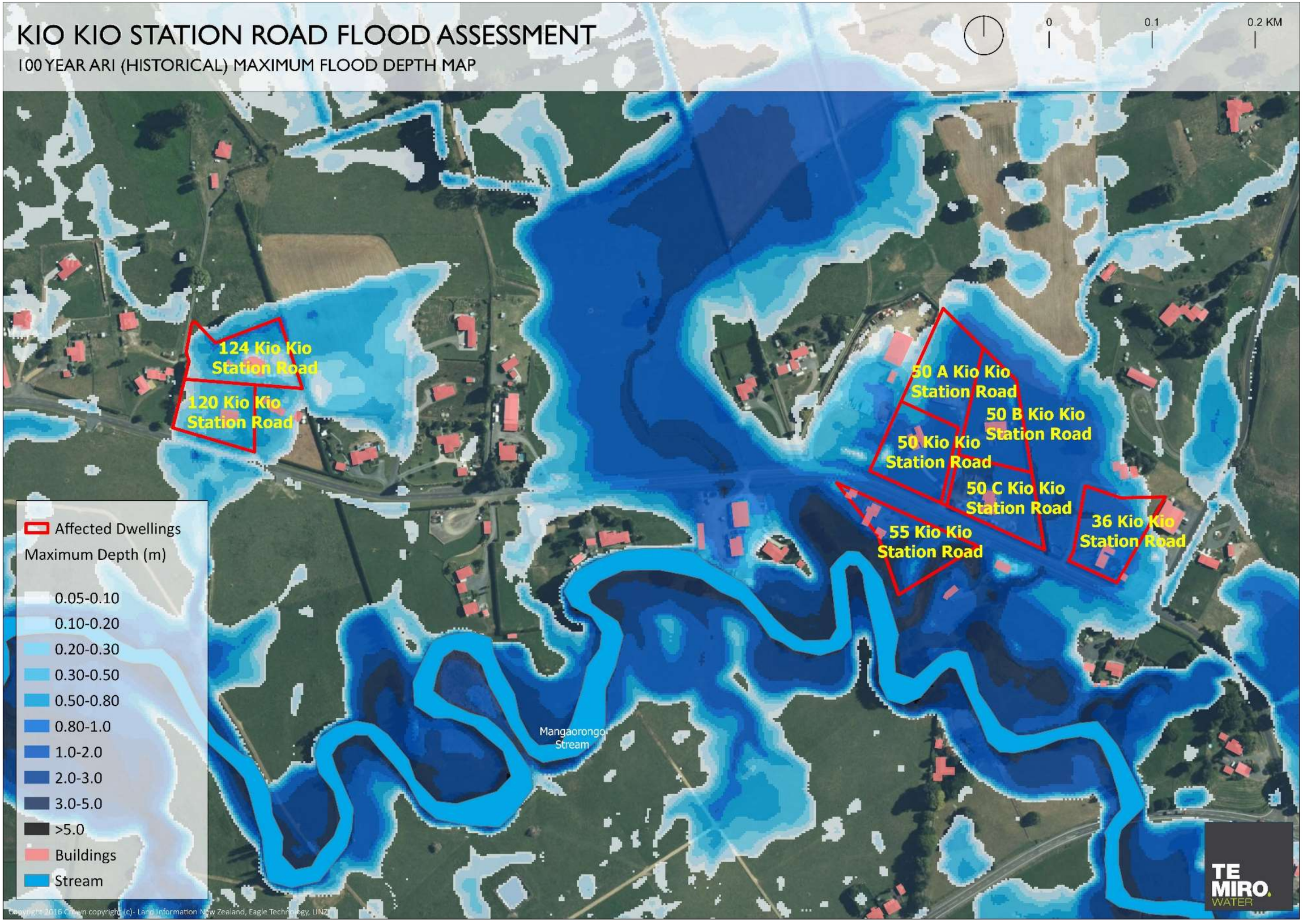

Figure 8. 100-year ARI Historical

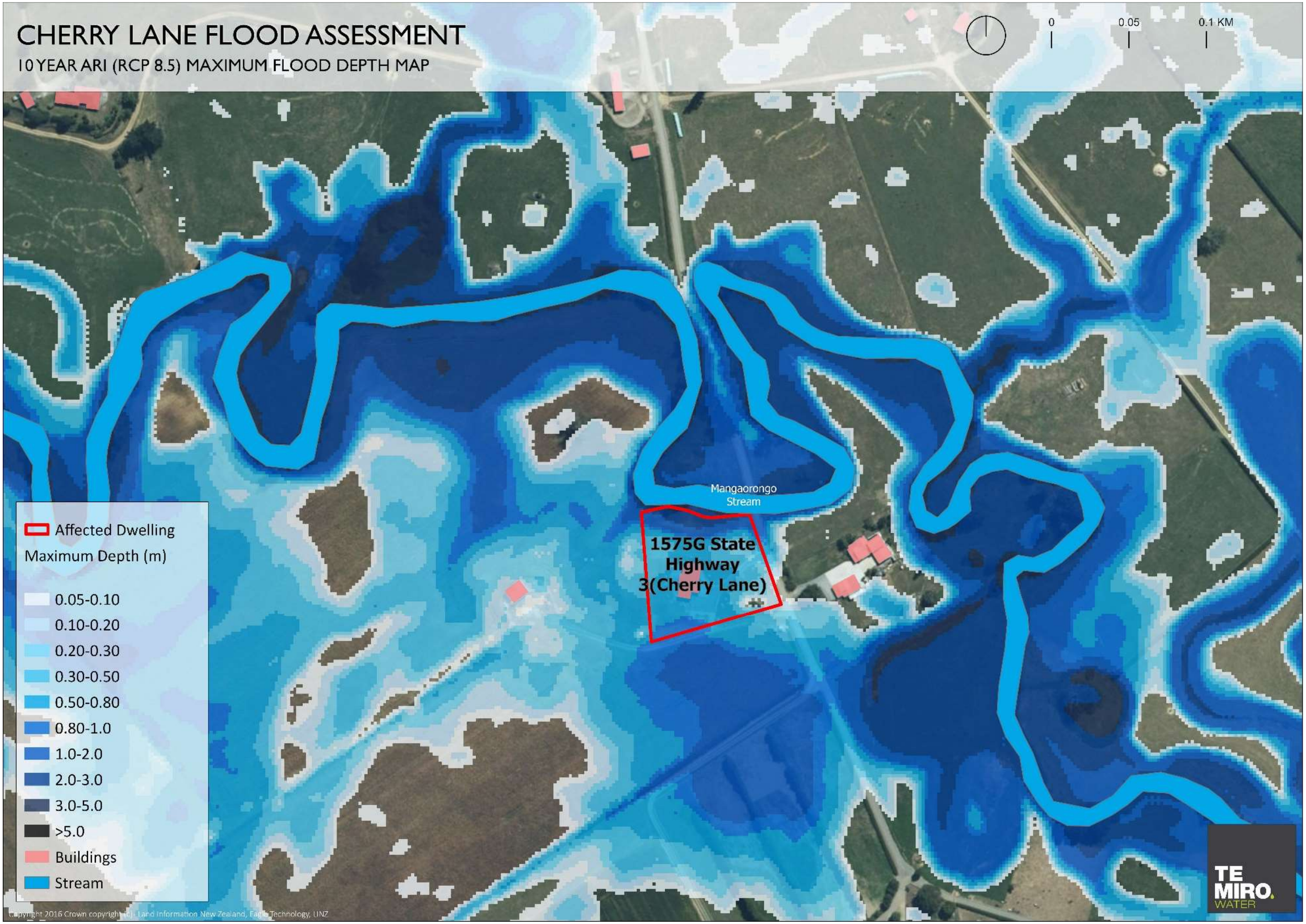

Figure 9. 10-year ARI RCP8.5

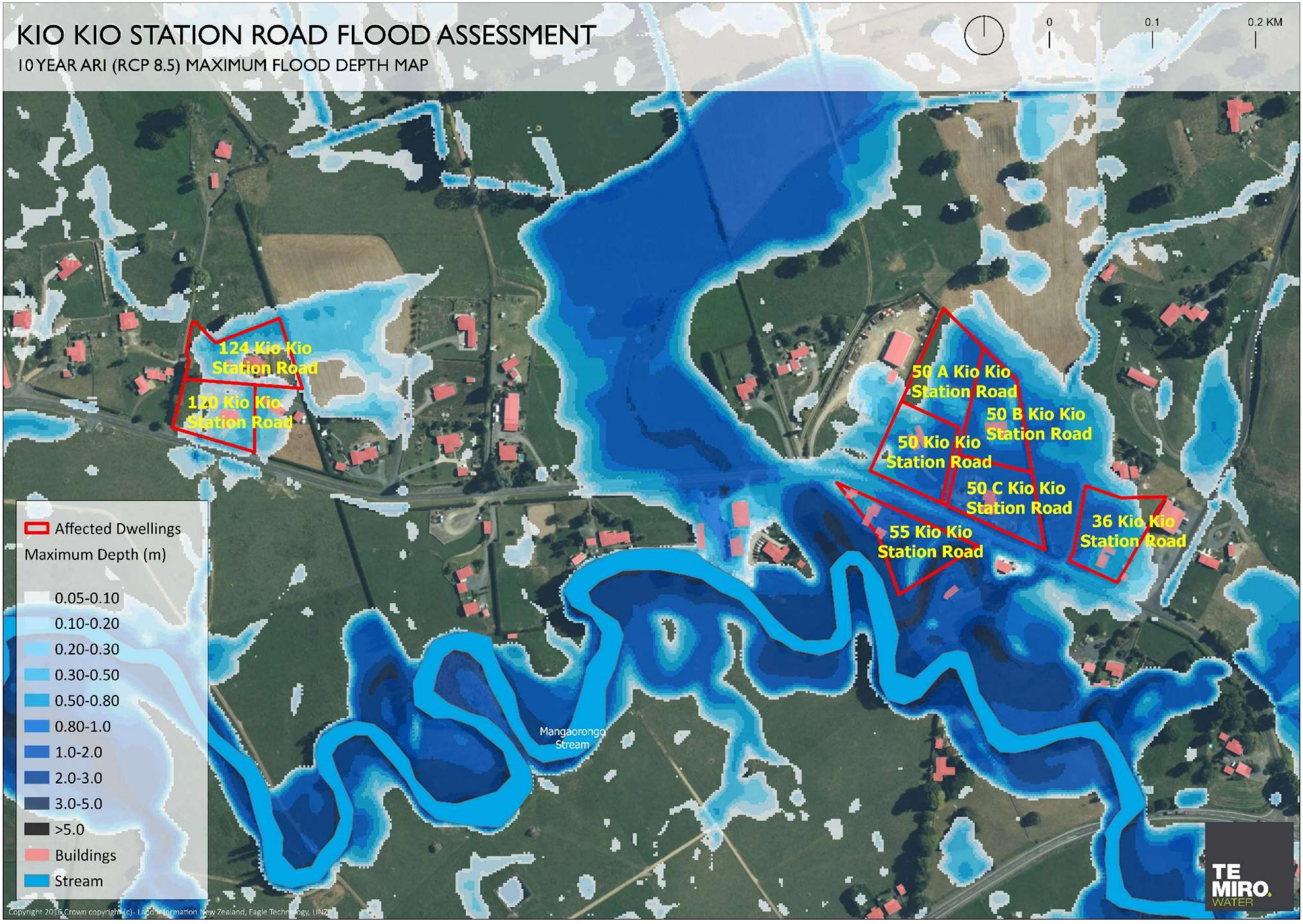

Figure 10.10-year ARI RCP8.5

KIO KIO STATION ROAD FLOOD ASSESSMENT

2 YEAR ARI (RCP 8.5) MAXIMUM FLOOD DEPTH MAP

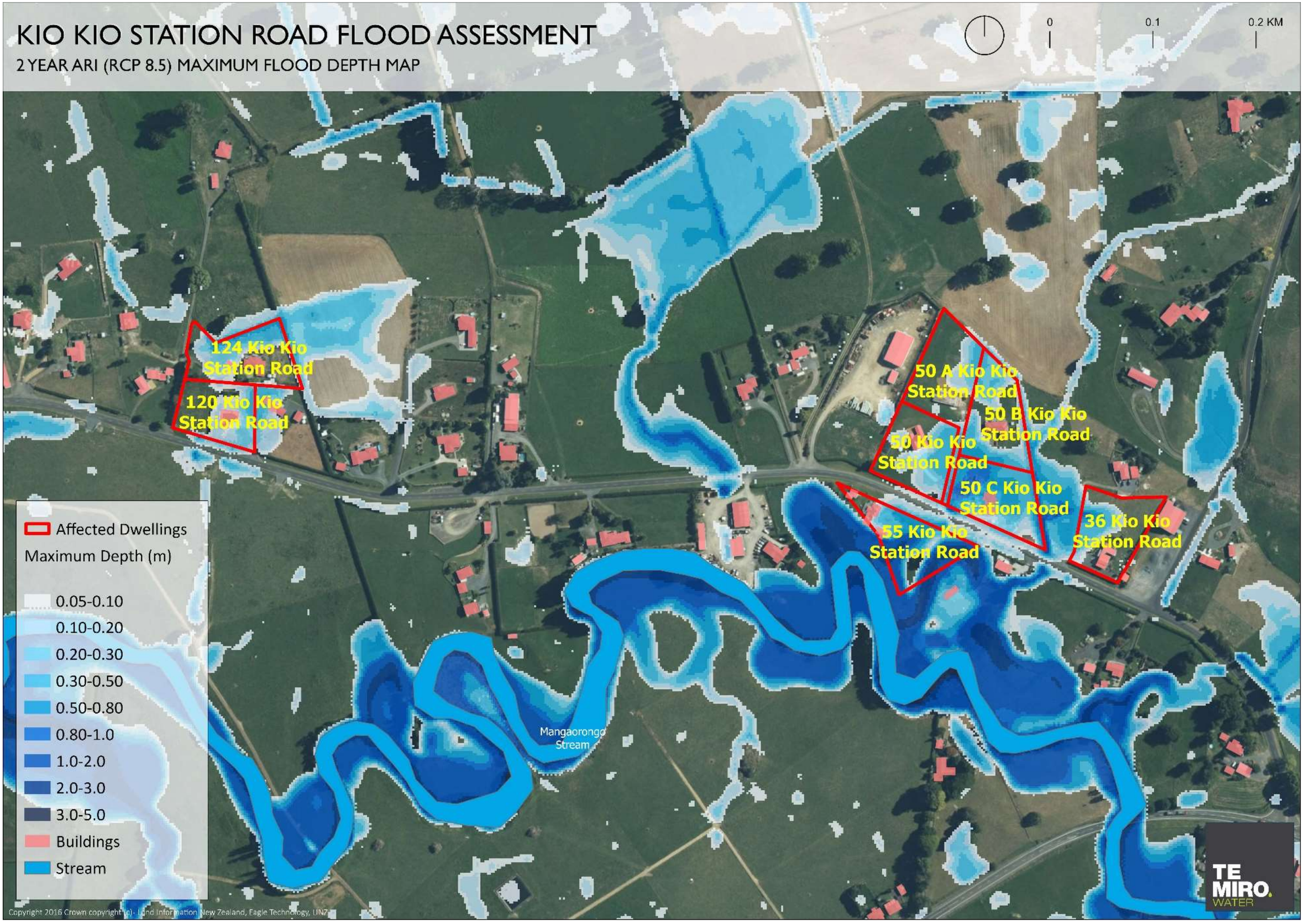

Figure 11. 2-year ARI RCP8.5

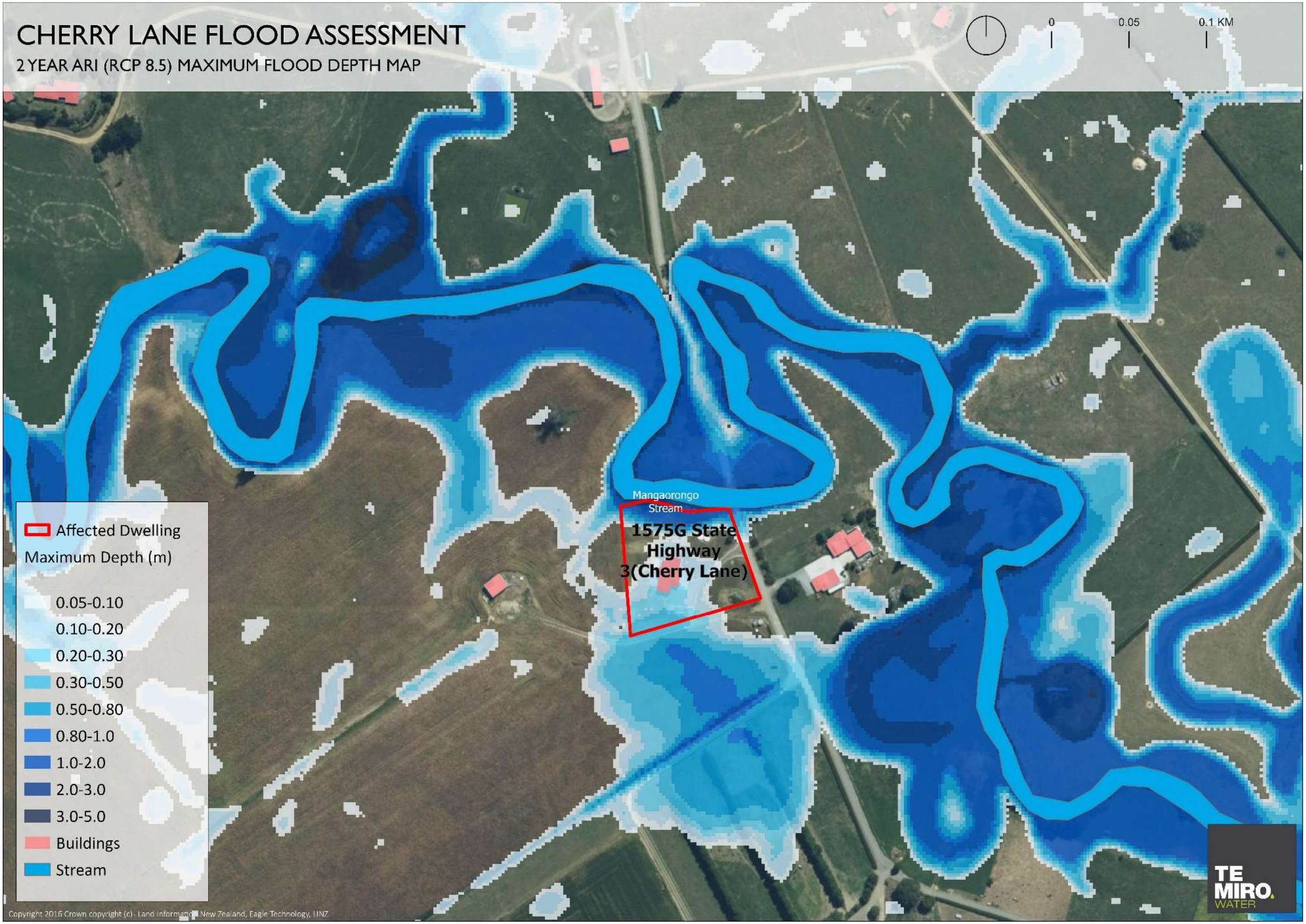

Figure 12. 2-year ARI RCP8.5

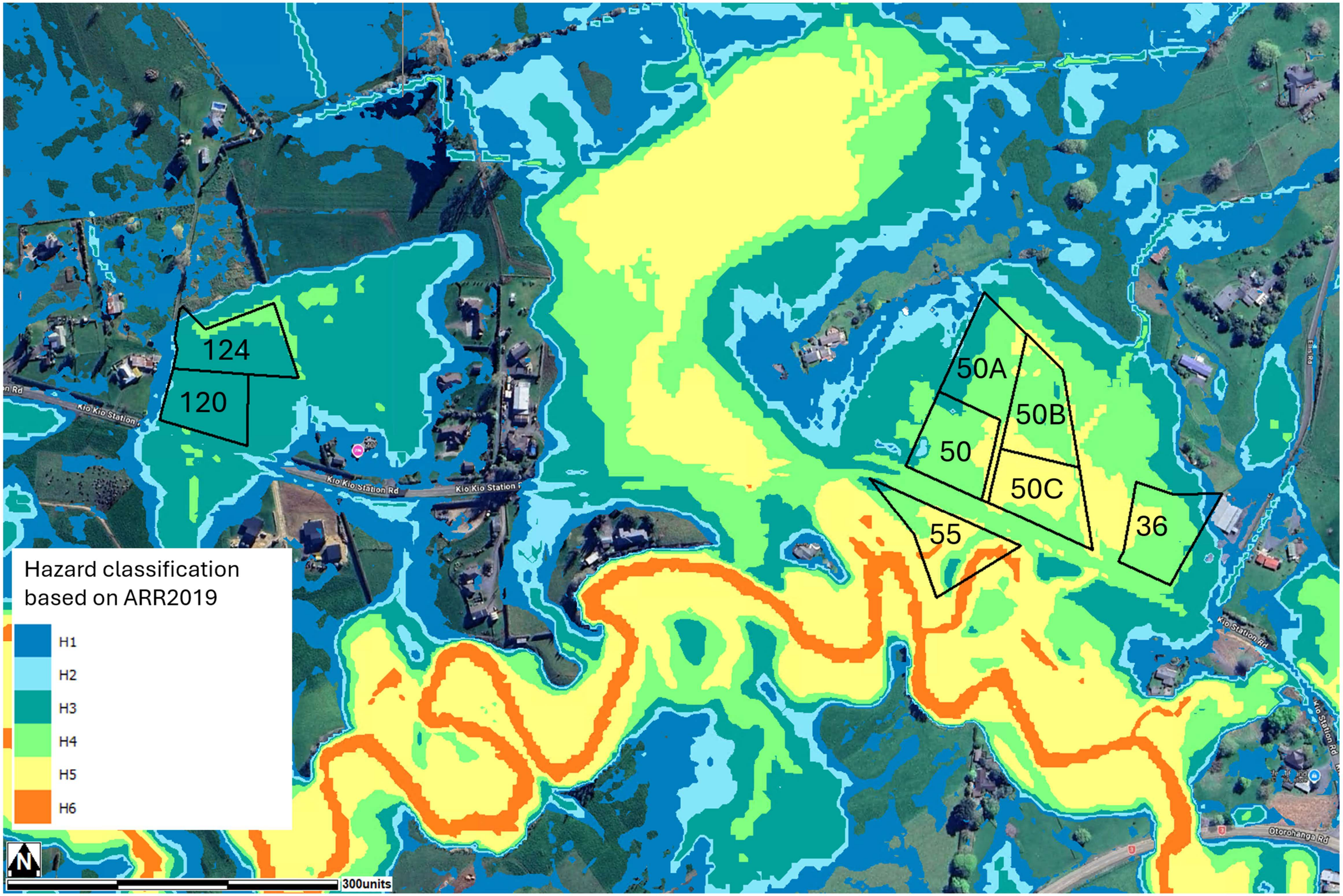

Figure 13. 100-year ARI (RCP8.5) flood hazard classification (based on ARR 2019)

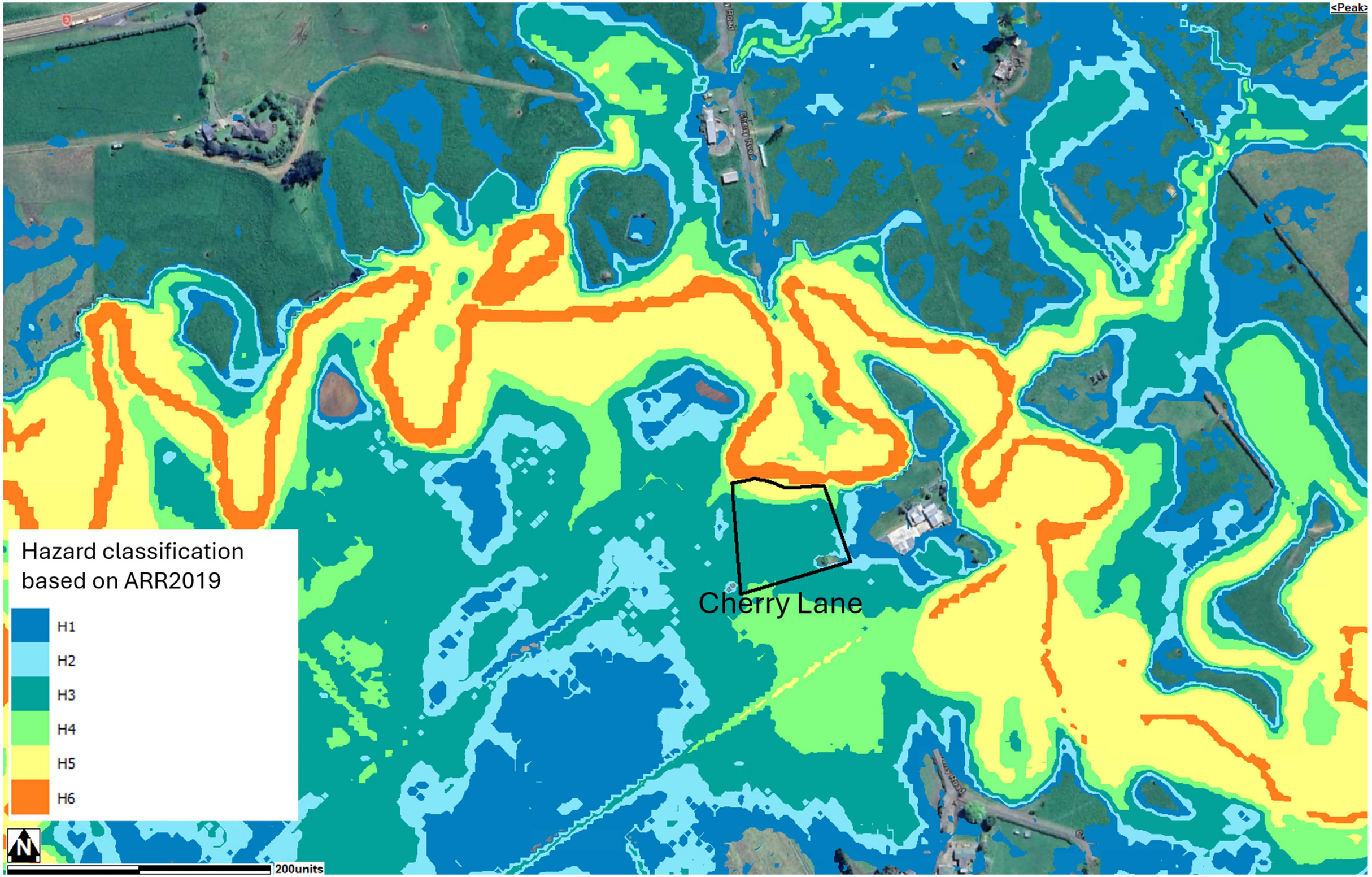

Figure 14. 100-year ARI (RCP8.5) flood hazard classification (based on ARR 2019)

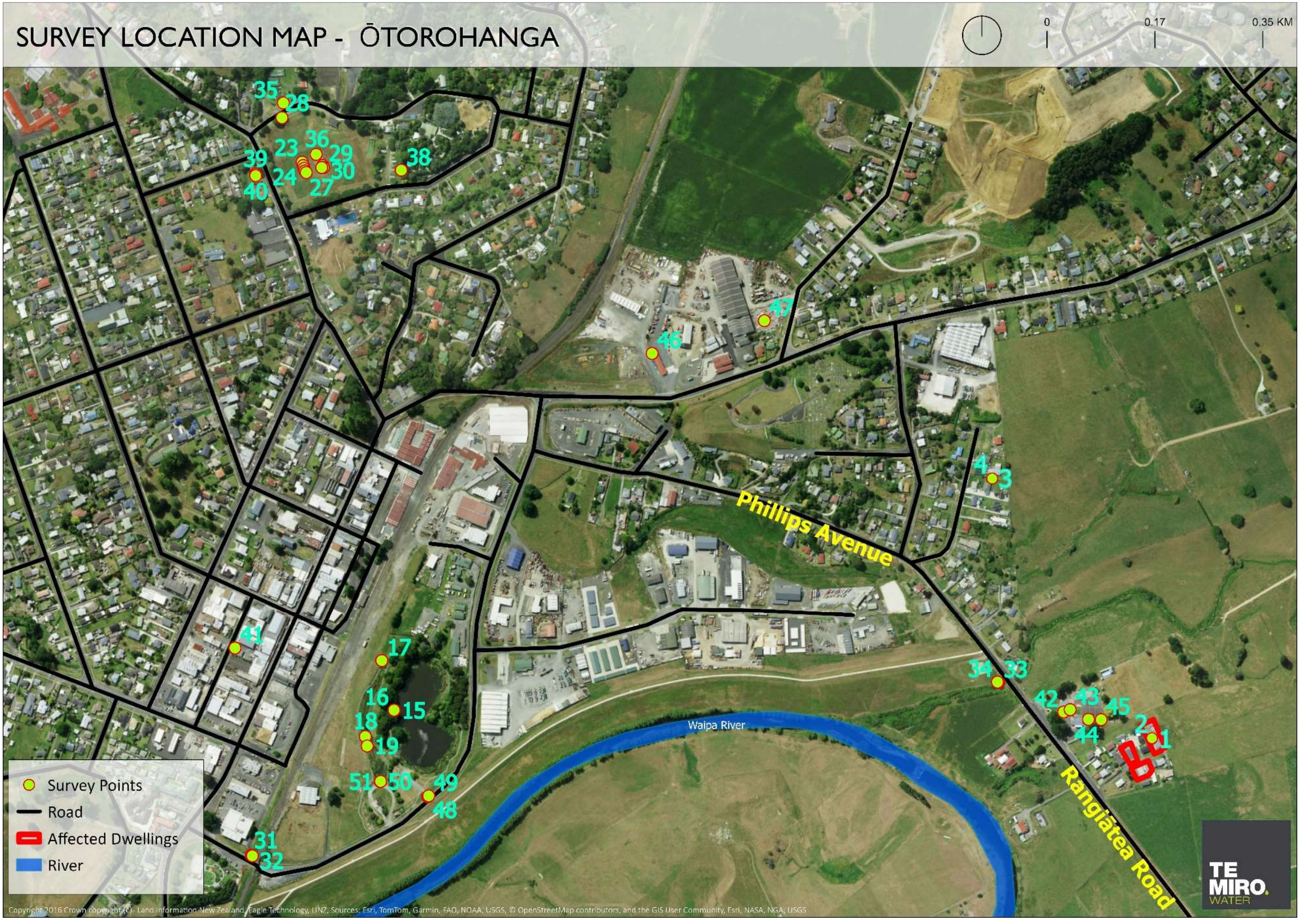

Figure 15. Survey locations



Figure 16. Affected dwellings

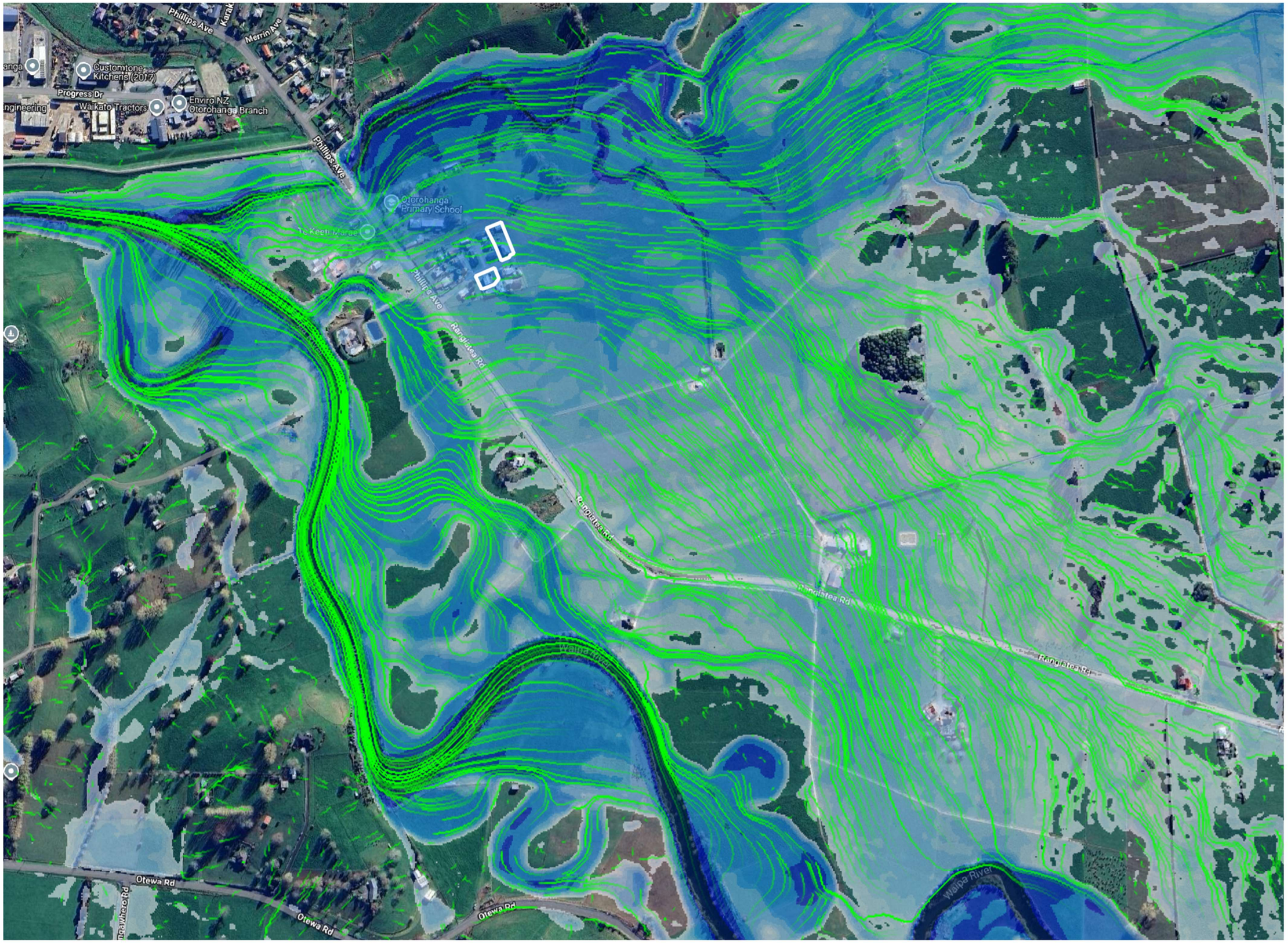

Figure 17. Flood map and velocity arrows showing flow direction

PHILLIPS AVENUE FLOOD ASSESSMENT

100 YEAR ARI (RCP 8.5) MAXIMUM FLOOD DEPTH MAP - GLOBAL

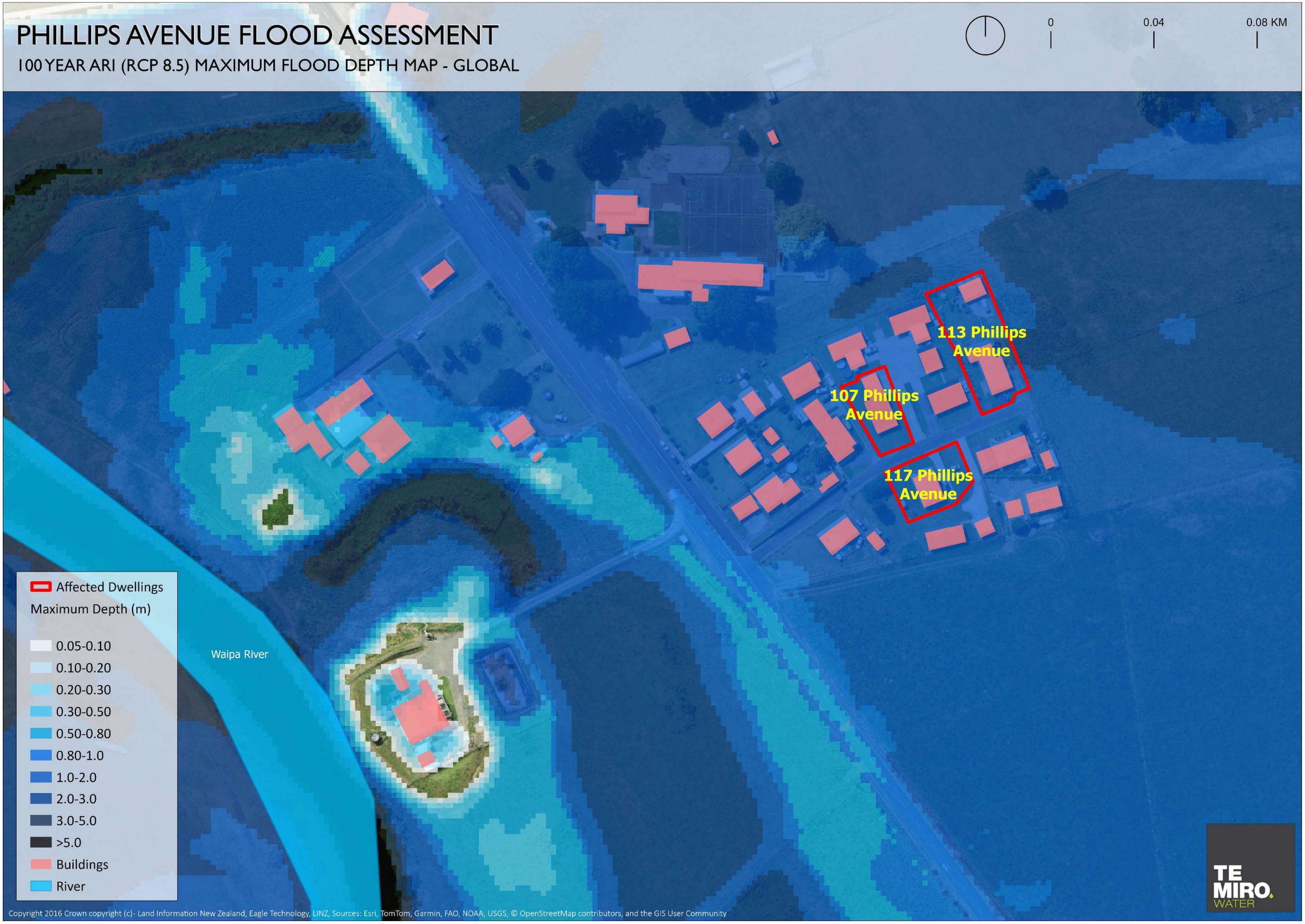

Figure 18. 100-year ARI (RCP8.5) global

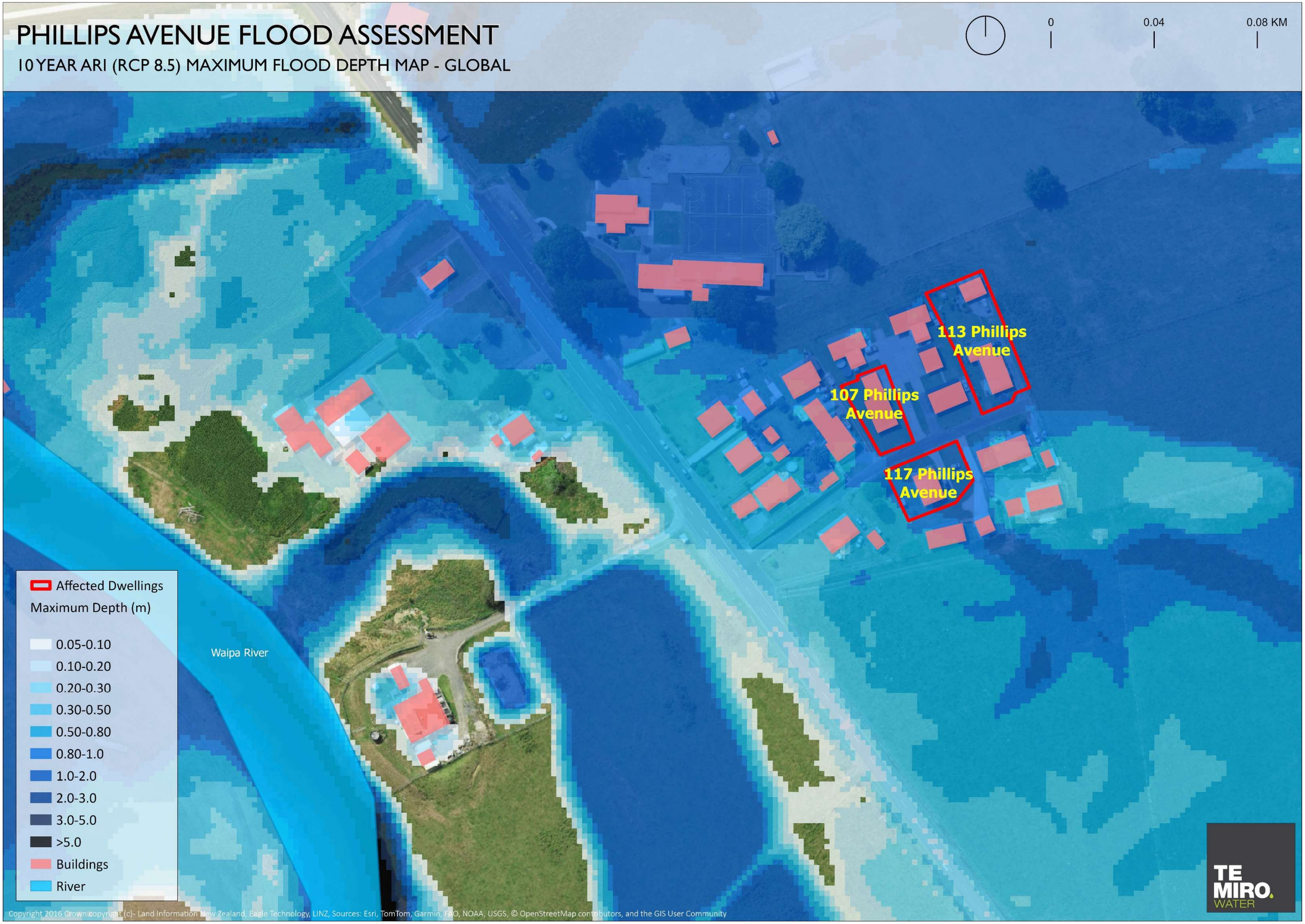

Figure 19. 10-year ARI (RCP8.5) global

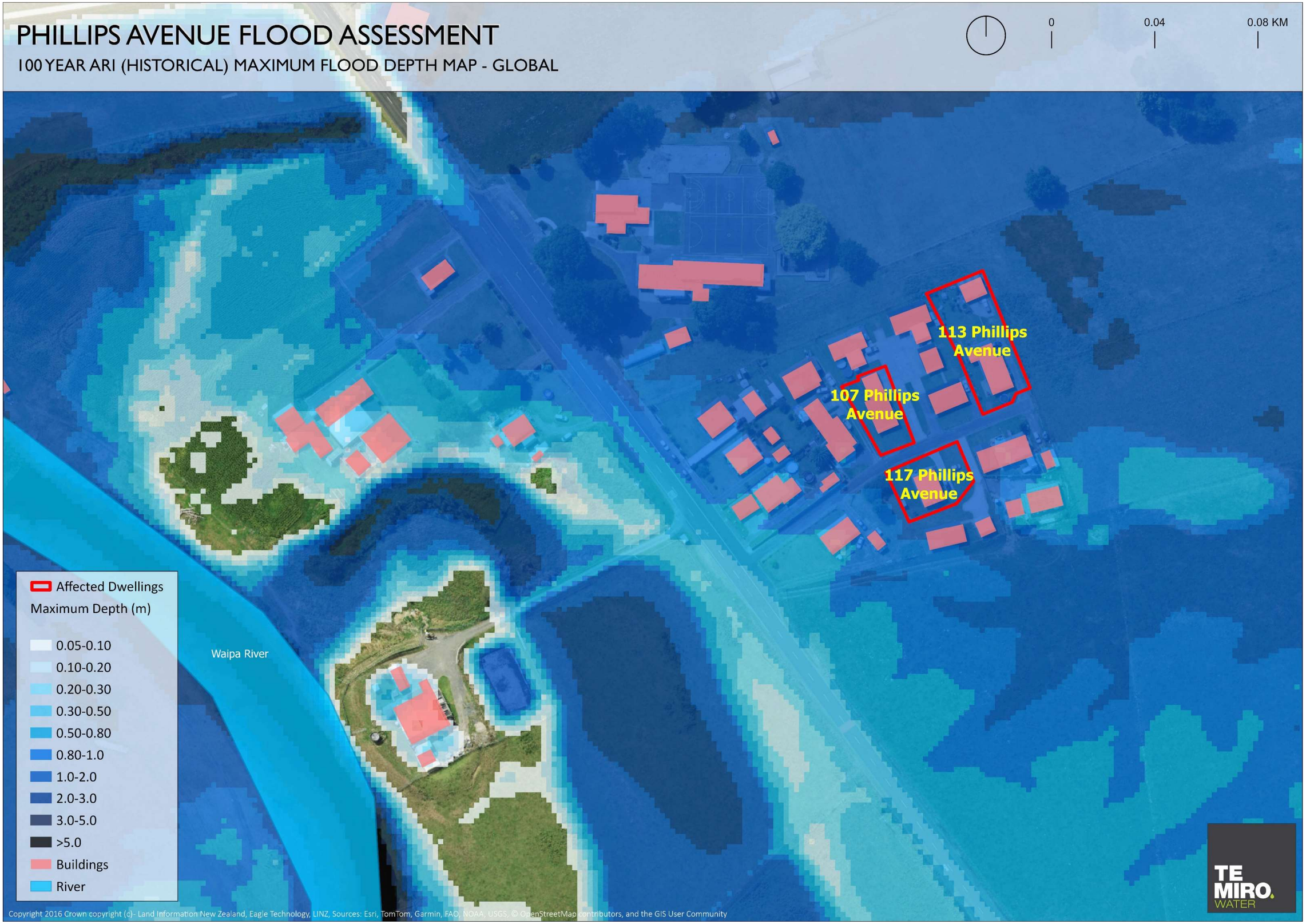

Figure 20. 100-year historical global

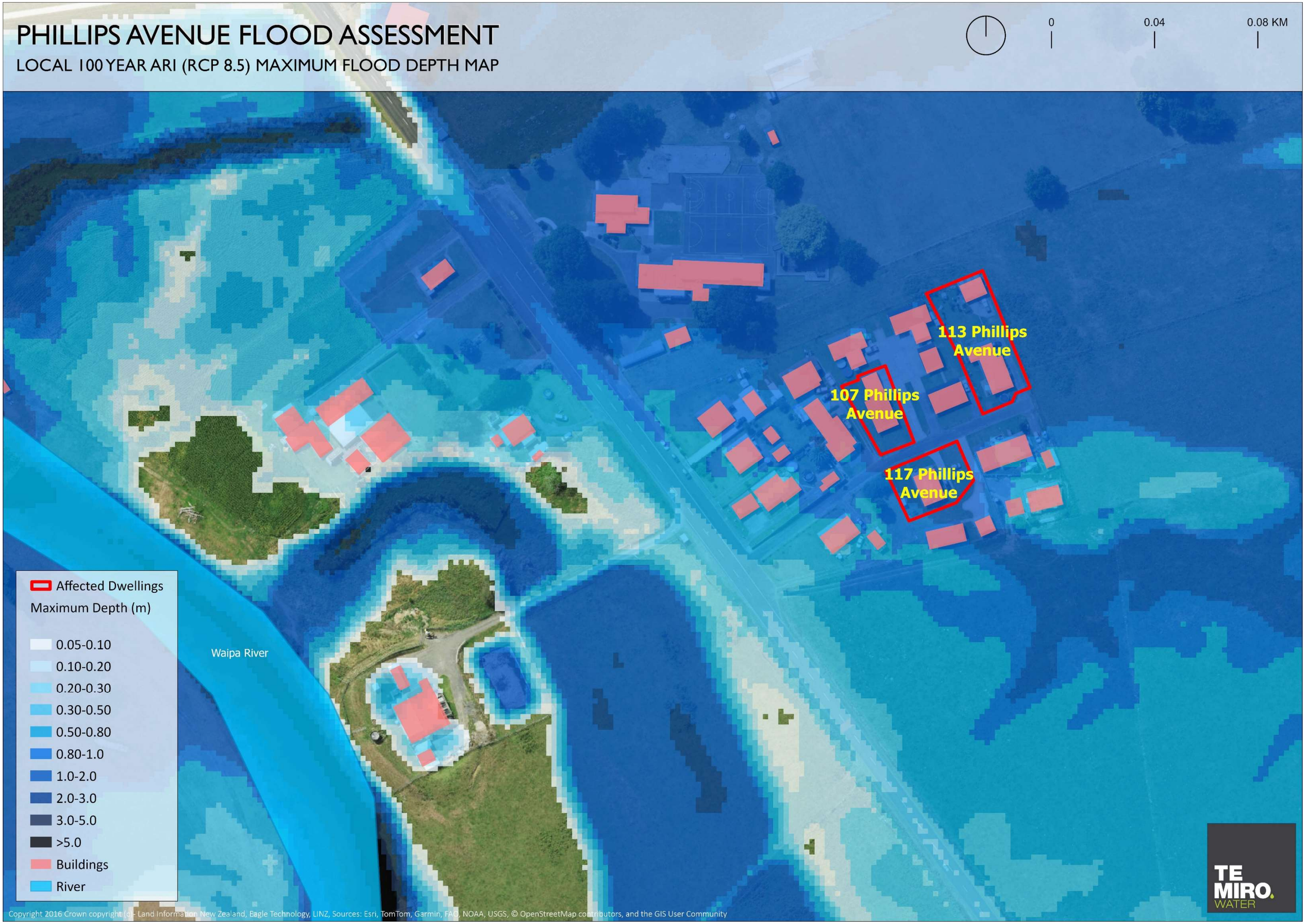

Figure 21. 100-year ARI (RCP8.5) local

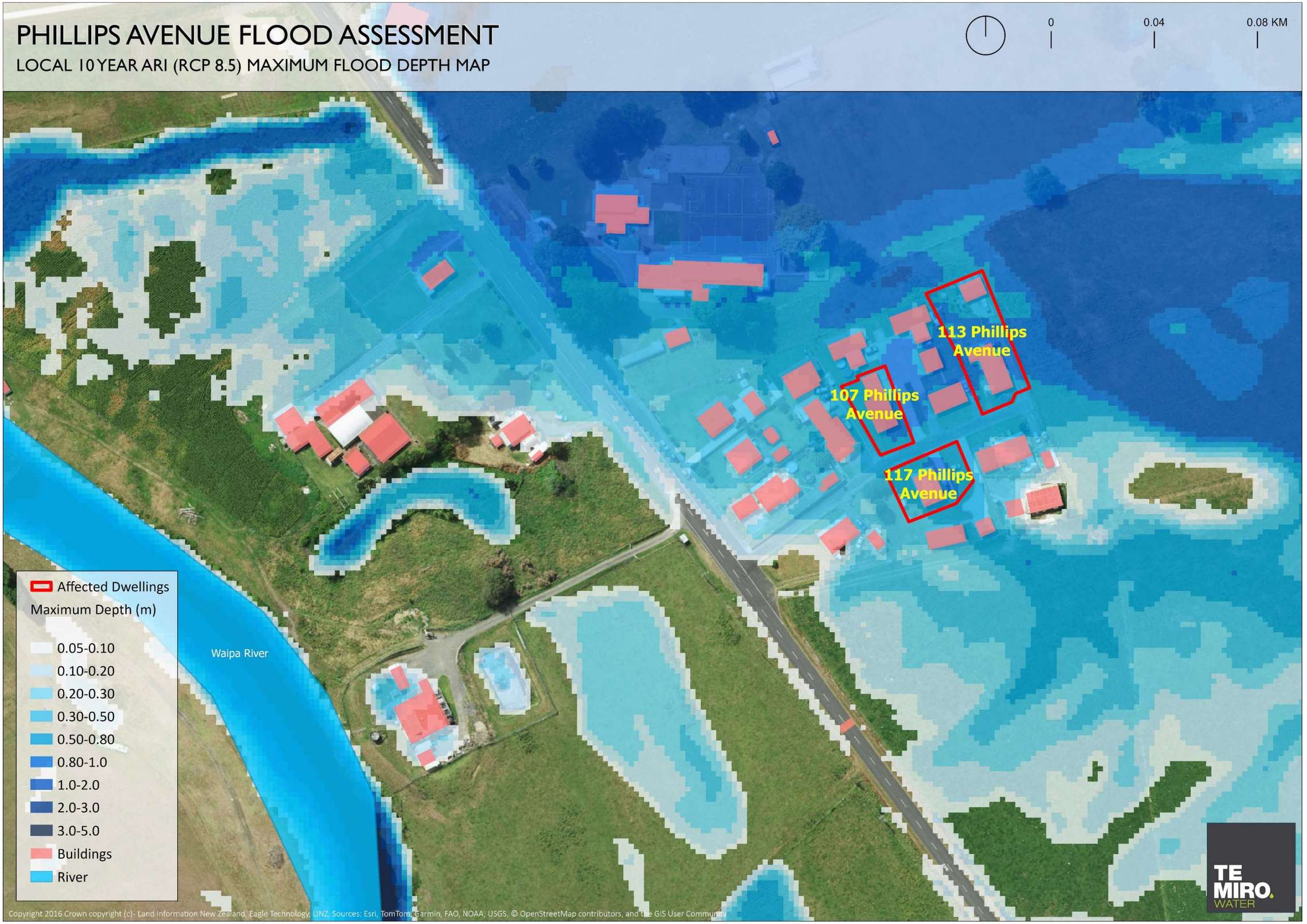

Figure 22. 10-year ARI (RCP8.5) local

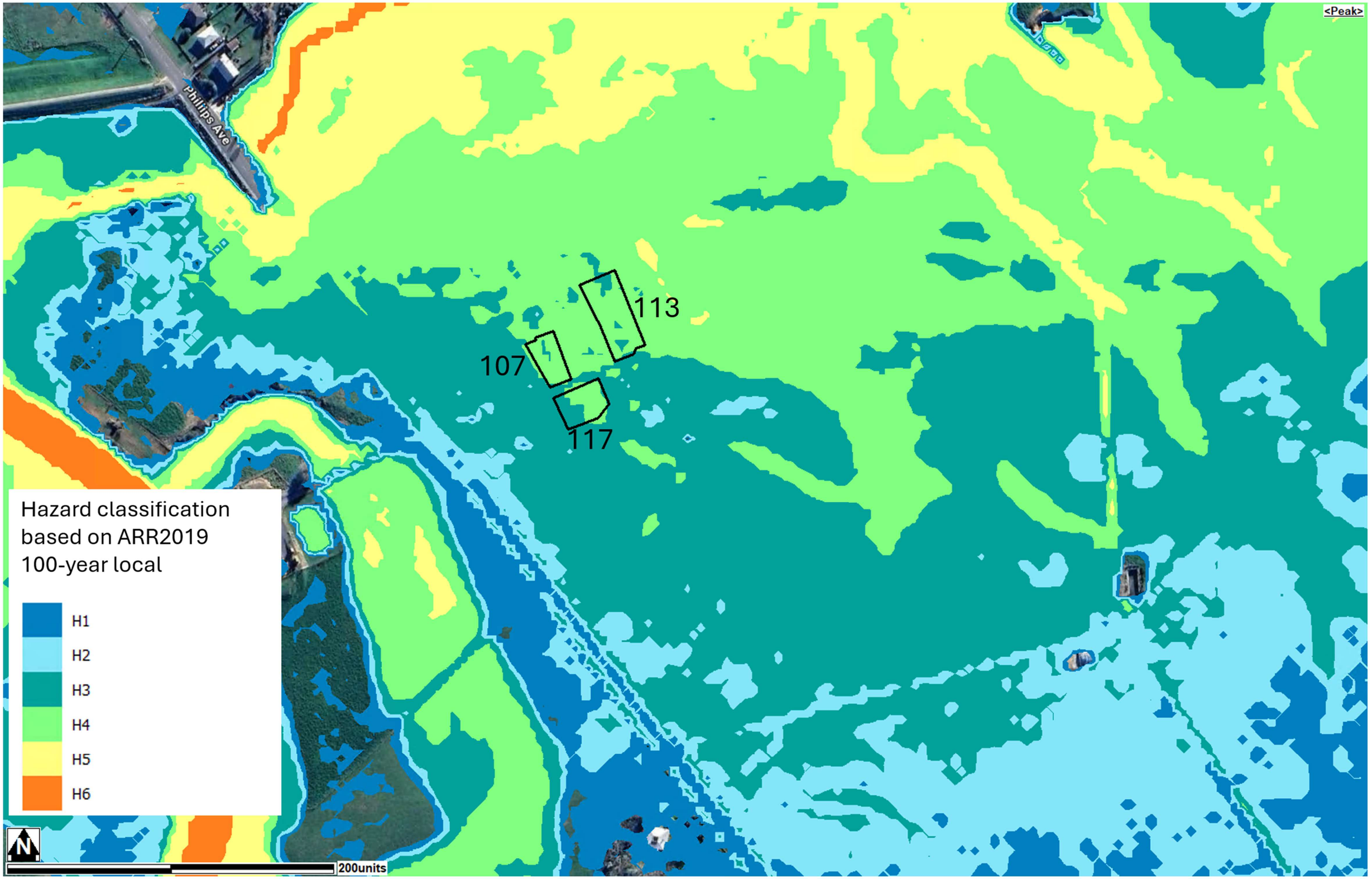

Figure 23. Local 100-year ARI (RCP8.5) flood hazard classification (based on ARR 2019)

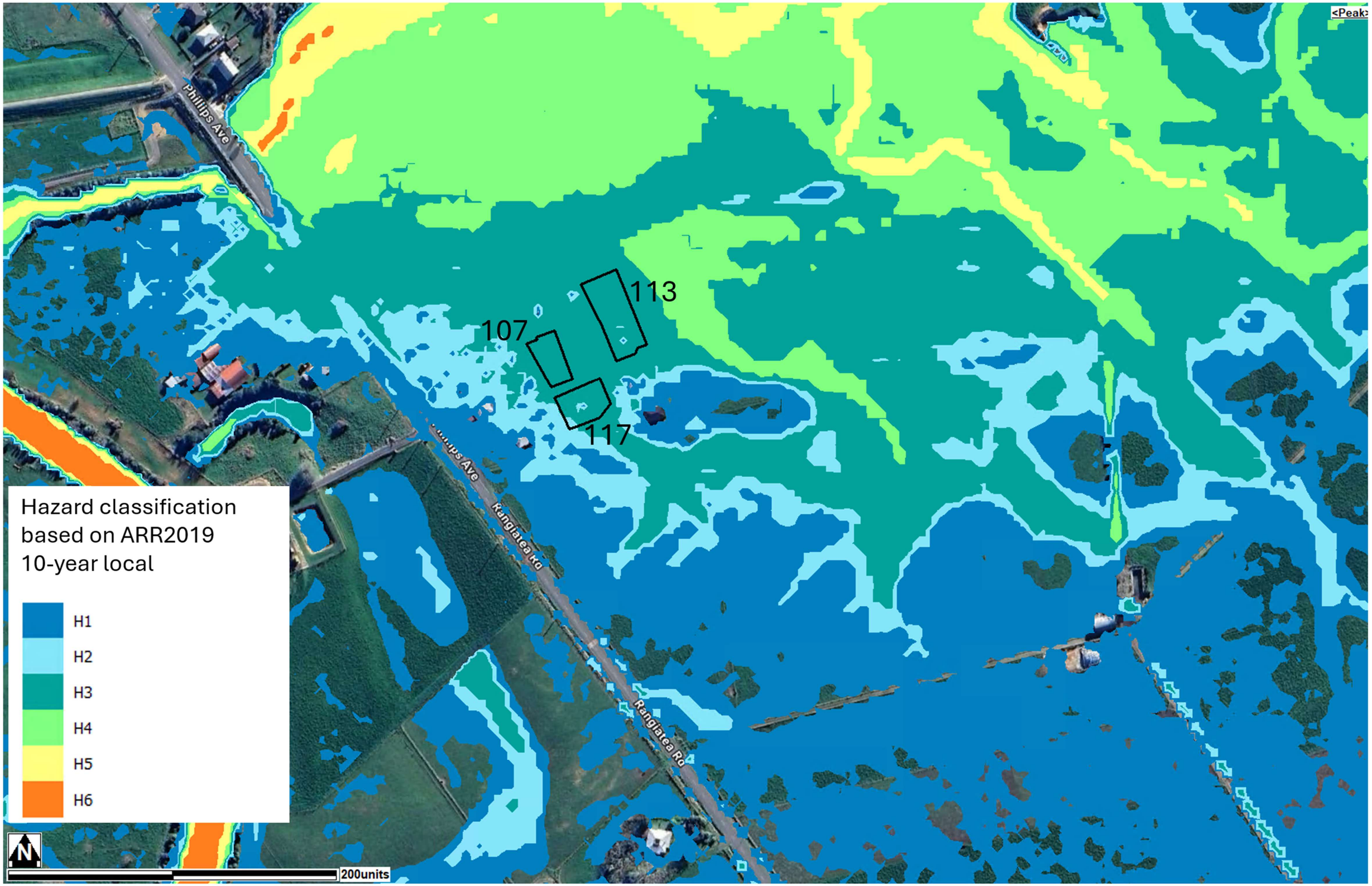

Figure 24. Local 10-year ARI (RCP8.5) flood hazard classification (based on ARR 2019)