CHANGING LANDSCAPES, CHANGING WATERS?

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

INTRODUCTION

*Land development transforms landscapes, but what happens beneath the surface? As **Tauranga** expands, once-porous volcanic soils are compacted, altering natural water movement. This research investigates how **urbanization** affects the hydrological cycle—particularly **infiltration** and **runoff**—helping to shape smarter stormwater management strategies for the region.*

AIM

*This project seeks to quantify the **hydrological impact** of land development by tracking changes in groundwater levels and surface runoff as farmland transitions to urban areas. By installing **Levellogger** sensors and a custom-designed **weir**, the project aims to observe how Tauranga's volcanic soils respond to increasing impermeable surfaces over time.*

METHOD

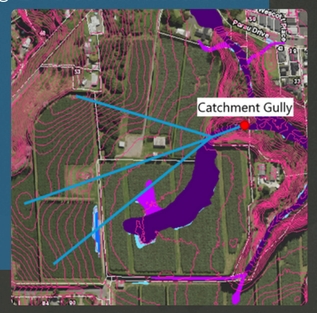
To capture the evolving water cycle, the project uses the following:

- ***Rain gauges** to determine the amount of minor losses due to interception from plant and tree leaves.*
- *A **Levellogger** sensor to track underground water table fluctuations on a daily basis to create a large dataset.*
- *A **sharp-crested weir** to measure runoff that collects in a local catchment.*
- ***Chicago Design Storm** methodology to design for extreme rainfall scenarios.*
- ***HEC-HMS modelling** to simulate water flow patterns and create theoretical estimates.*

(The weir's optimal dimensions were determined using peak discharge calculations from HEC-HMS, ensuring accurate runoff measurement throughout the study)

Fig. 1: Rain Gauge

Fig. 2: Parau Rd. Research Site



RESULTS

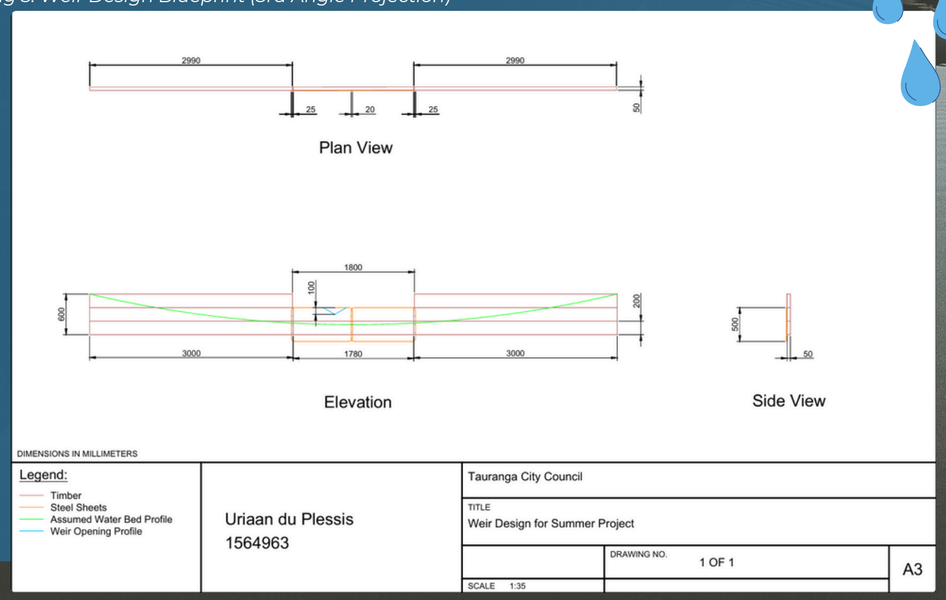
These findings set the foundation for long-term monitoring and future stormwater policy updates.

- *The **5-year storm** event model of the site predicts a peak discharge of 0.857 m³/s.*
- ***Site contour mapping** identified three sub-basins contributing runoff to the monitored gully.*
- *A **weir** with a **1.8m x 0.2m** opening and a **120° V-notch** was designed out of timber and street signs, ensuring precise low-flow measurement while having capacity for storm events.*
- *A **hand auger** method was chosen over CPT drilling for cost-effective groundwater monitoring sensor placement.*

Fig 3: Chicago Design Storm Hyetograph (Tauranga)

Fig 4: Parau Rd. Site Discharge from Design Storm

Fig 5: Weir Design Blueprint (3rd Angle Projection)



DISCUSSION

*Previous studies suggest Tauranga's soils have higher sensitivity to compaction. The compaction process reduces **infiltration** and increases **surface runoff**. As land development on the site progresses, a shift in the infiltration-runoff balance is anticipated, influencing **flood risk** and **groundwater recharge**. Long-term monitoring will reveal whether current mitigation strategies—such as retention ponds and permeable surfaces—are effective in maintaining pre-development hydrological conditions.*

CONCLUSION

*Urban expansion is inevitable, but its hydrological impact doesn't have to be. This research will provide **critical data** to guide Tauranga City Council in developing tailored stormwater management strategies that reflect the **unique permeability** of the local soils. By bridging science and policy, a resilient, flood-resistant future for the region can be ensured.*

NEXT STEPS

*Over the next **five years**, this study will track how land development impacts Tauranga's hydrology.*

- ***Data Collection:** Once installed, the Levellogger will begin monitoring groundwater, while the weir records runoff flow during rainfall. Periodic field surveys will document soil changes.*
- ***Analysis & Trends:** Comparing pre- and post-development data will reveal shifts in infiltration and runoff. HEC-HMS models will be refined to improve stormwater predictions.*
- ***Final Comparison:** Observed data will be tested against theoretical predictions—was peak discharge accurate? How much permeability was lost? Were stormwater controls effective?*
- ***Policy Impact:** Findings will guide Tauranga City Council in updating stormwater strategies, ensuring sustainable urban development.*

ACKNOWLEDGEMENTS

***Design:** Uriaan du Plessis*
***Supervisors:** Bodo Hellberg & Mark Lay*
***Acknowledgements:** Tauranga City Council, Niel Blazey, Marlene Herewini*

Tauranga City