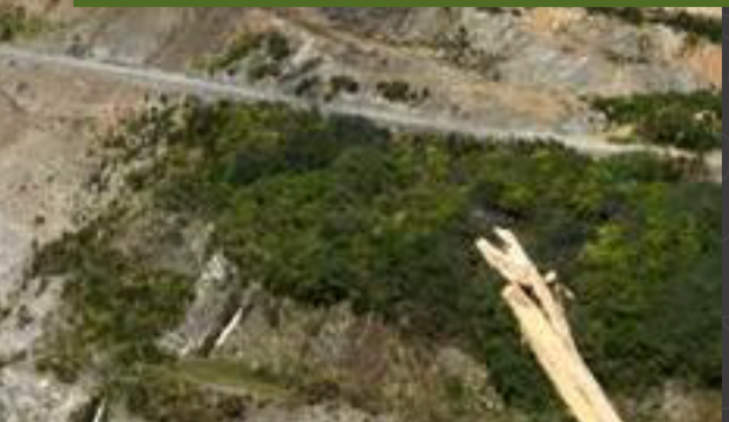
Flood and Climate Change Risk Assessment Belmont Quarry

26/11/2025



Flood and Climate Change Risk Assessment Belmont Quarry Land Exchange

Report

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Executive Summary

Winstone Aggregates is seeking approval for a land exchange as part of its Belmont Quarry Development. The exchange involves Crown-owned recreational reserve land. To inform the land swap a flood hazard risk assessment is required. The purpose of this assessment is to confirm that the land the Crown is acquiring is not subject to flood hazards, under current and future climate conditions, that would prevent it being used for conservation purposes.

The flood risk was assessed for the 4 parcels of Winstone Aggregates' land proposed for land swap with the Department of Conservation (DOC). The Wellington Water hydraulic model for the Western Hills was used as the basis of the analysis after it was updated with asset data collected from the field to better represent the Belmont Quarry and surrounding area. The flood risk was assessed based on both a 1 in 100-year event were it to occur today and in the year 2130 taking into account climate change.

The impact of climate change on the parcels was also assessed. The impact of sea level rise is not relevant to this location owing to the parcels' elevations. The main impact on the parcels from climate change is due to increased extreme rainfall which is projected to increase by 35% under the RCP 8.5 M climate change projection.

The flood risk associated with the non-stream components of the parcels has been assessed to be minimal. The main locations of potential flood risk are the stream channels due to concentrated flows. In undertaking this analysis, it was found that there are no locations within the study area where the flood risk is elevated over what would be expected in the streams throughout the Belmont Regional Park and the flooding does not pose an unusual risk to the land or infrastructure within the parcels. Owing to the small catchment sizes the flood levels are expected to quickly dissipate at the end of the rainfall.

These conclusions also apply under the impacts of climate change. The increased rainfall was found to impact the flood hazard similarly to what would occur in streams throughout the Belmont Regional Park.

It is confirmed that, in their capacity as authors of this report, the authors have read and agree to abide by the Environment Court of New Zealand's Code of Conduct for Expert Witnesses Practice Note 2023. The authors' qualifications are set out at Appendix A.

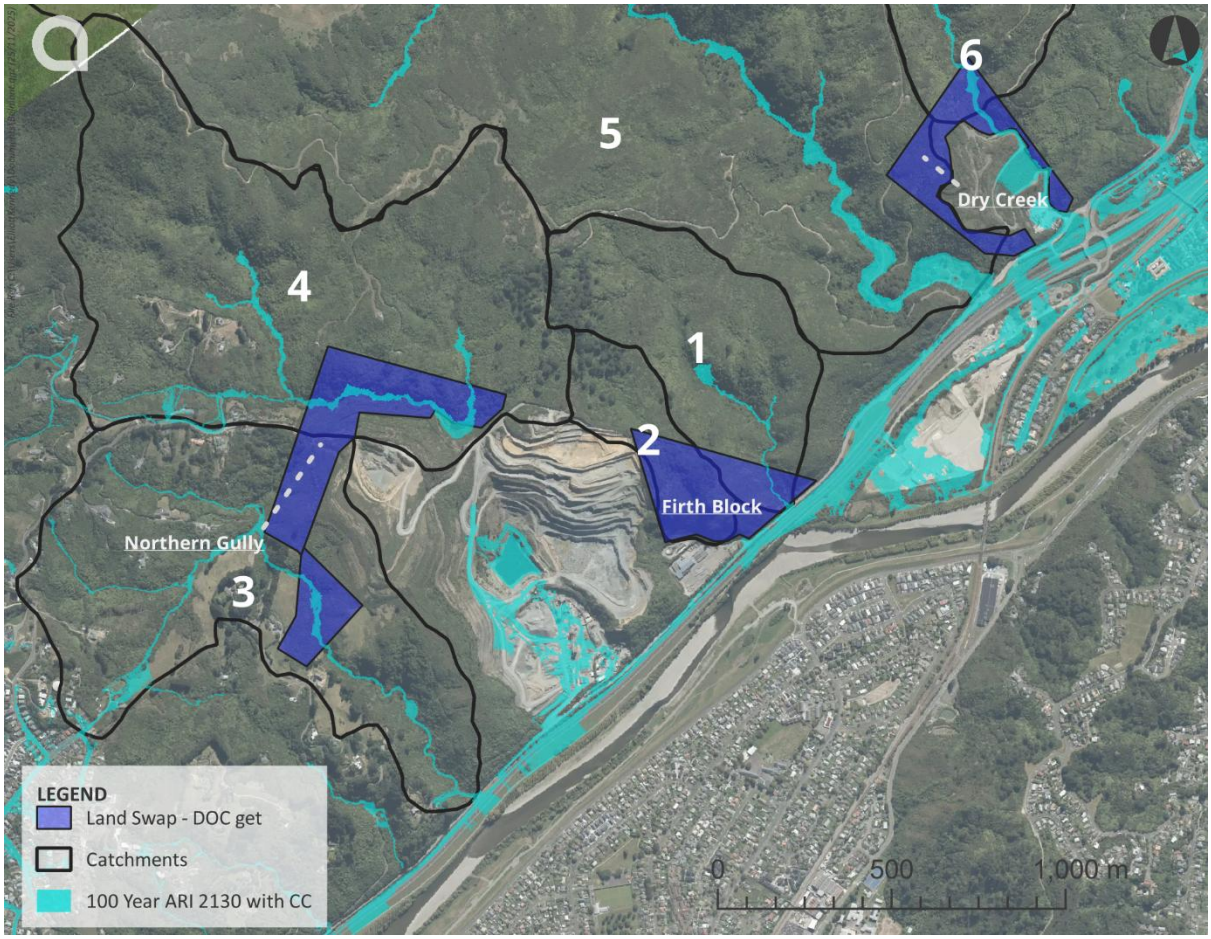

Figure 1: 1 in 100-Year flood event maximum extent (2130 with CC)

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1. Modelling

The four land areas proposed for land swap are described as Northern Gully, Southern Gully, Firth Block and Dry Creek. These areas are located across five sub catchments. The flood risk for each has been assessed using the Western Hills hydraulic model. This report assesses the flood risk in the context of the proposed land parcels.

A 900 mm culvert that connects the Northern Gully stream to the lower catchment was added to the model. This culvert also has a secondary intake.

The model uses a combination of rain on grid and sub catchment hydrographs to reflect the flows in each sub catchment. The model was built in alignment with the Wellington Standard for stormwater modelling. The model uses a nested storm event.

The increased intensity in rainfall was based on an RCP 8.5 M climate change projection through to 2130 as per the Ministry for the Environment's climate change risk assessment guidelines.

2. Flood Risk Assessment

The following image shows the sub-catchments which are relevant in the assessment of the flood risk to the land parcels. The sub-catchments have been numbered to provide for easy referencing throughout this report.

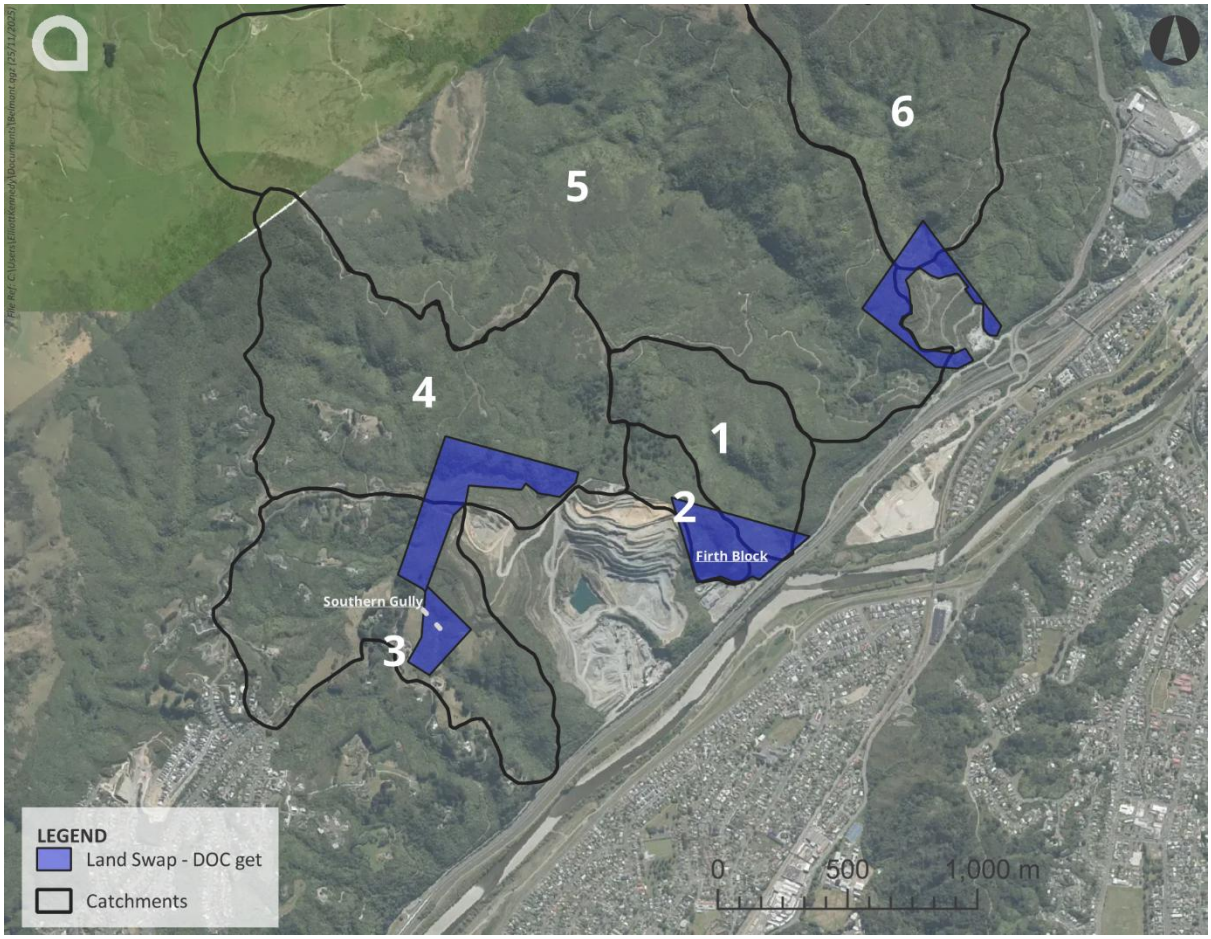


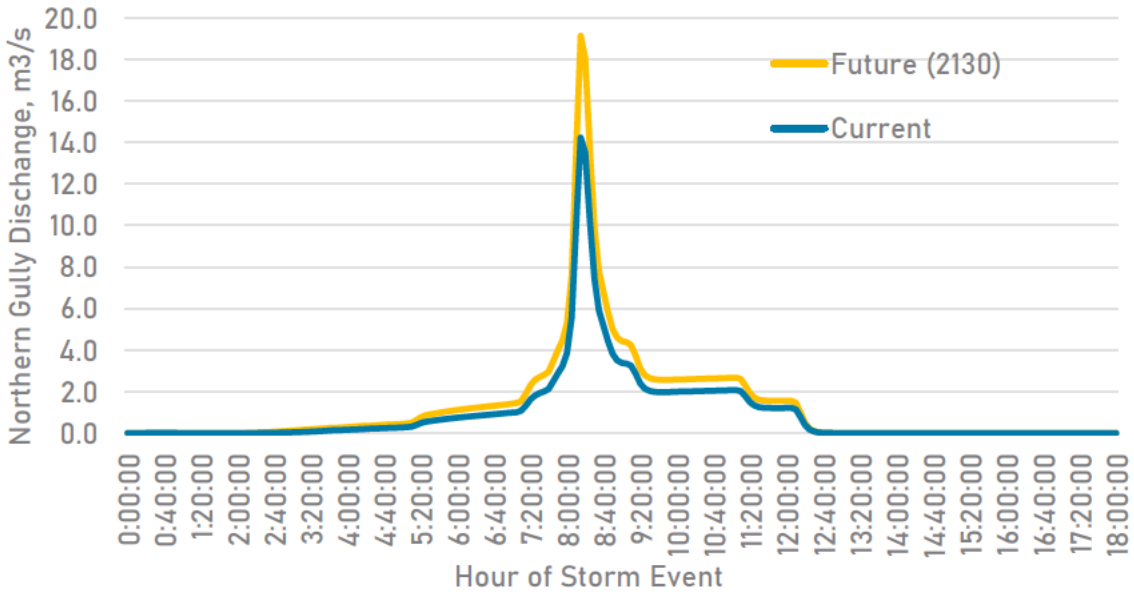
Figure 2: Delineation of the water shed with the sub catchments

2.1. Northern Gully

The Northern Gully land parcel sits across 2 sub-catchments (that of sub-catchment 3 and sub-catchment 4). Sub-catchment 3 is a recovering bush clad parcel with no impervious surfaces. As the land parcel in sub-catchment 3 is the top of the catchment there no ponding or significant flows under either the current or future RCP 8.5 M climate change projection for a 1 in 100-year flood event. As a result the overall flood risk of this portion of the parcel is negligible.

Part of the Northern Gully area is also located within catchment 4. This gully stream enters a 900mm culvert under the quarry access road. In a 100-year event a peak flowrate of 14.2 m3/s of water arrives at the intake to the culvert. Under an RCP 8.5 M projection this is

expected increase to 19.2 m3/s by 2130 for a 1 in 100-year event. The culvert was found to have a peak capacity of around 5 m3/s. During the peak of the rainfall it was found that a pond forms at the culvert intake with a volume of 6600m3 and a depth of approximately 4m in a 1 in 100-year storm event in 2130 (with climate change impacts). This pond was found to quickly drains when the rain subsides. The volume and depth of flooding is not considered to impact on the use of land for conservation. On site observation at the culvert intake was of a shallow pond, typically knee deep, and no observable land damage from high flows.



2.2. Firth Block

The Firth Block sits across two separate catchments (catchment 1 and 2) which both drain to the same culvert that discharges to the Hutt River. The hydrograph for the combined flow at the culvert outlet, with and without climate change, are presented below. The flood flows within the parcel proposed for exchange were found to be similar to what would be expected in streams across the Belmont Regional Park.

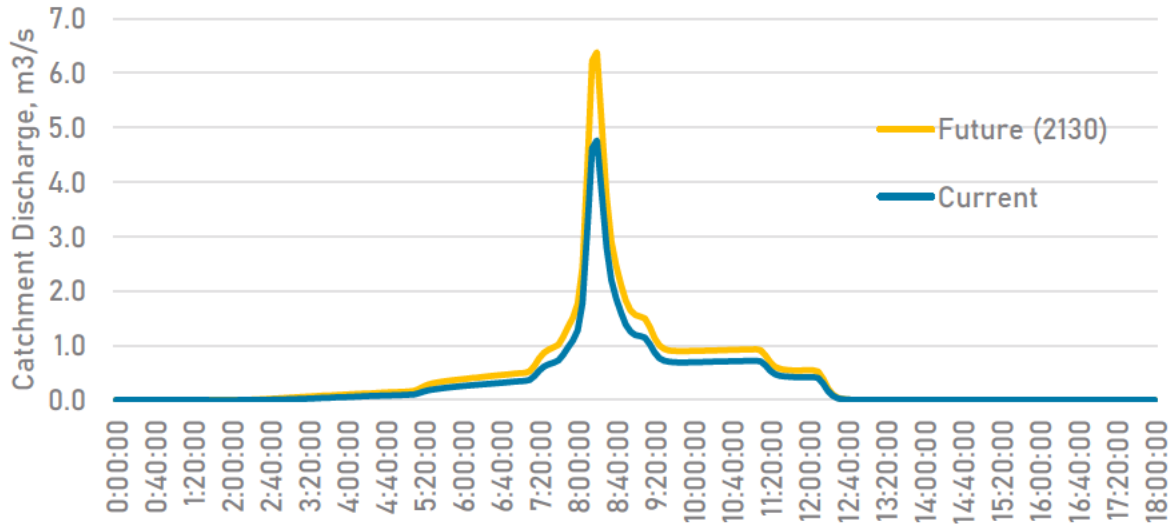
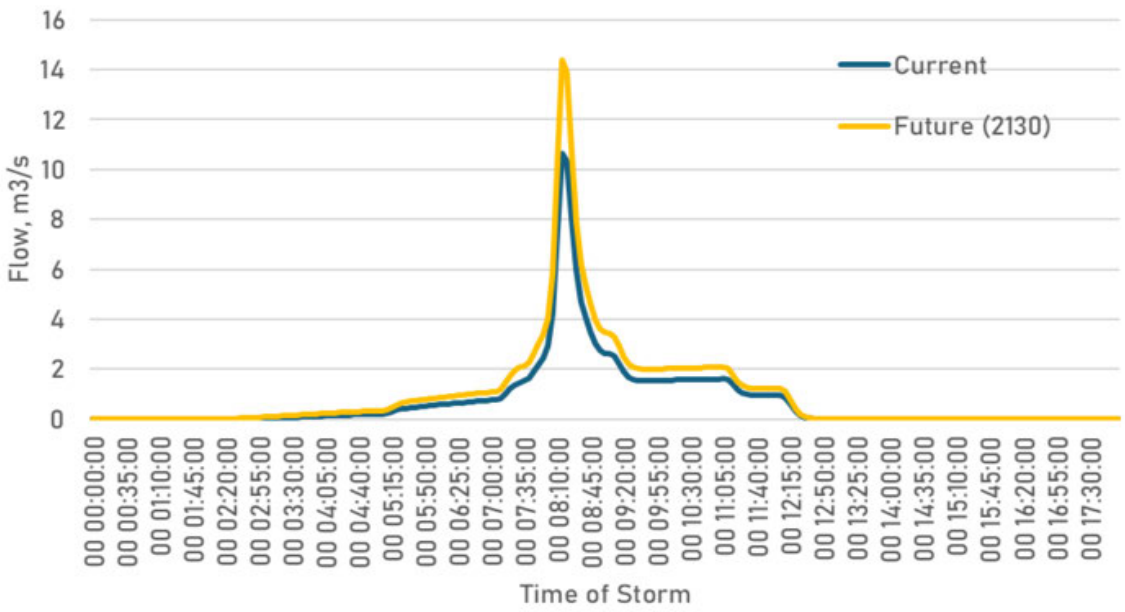


Figure 3: Hydrograph for the catchment 1 of the Firth Block

2.3. Dry Creek

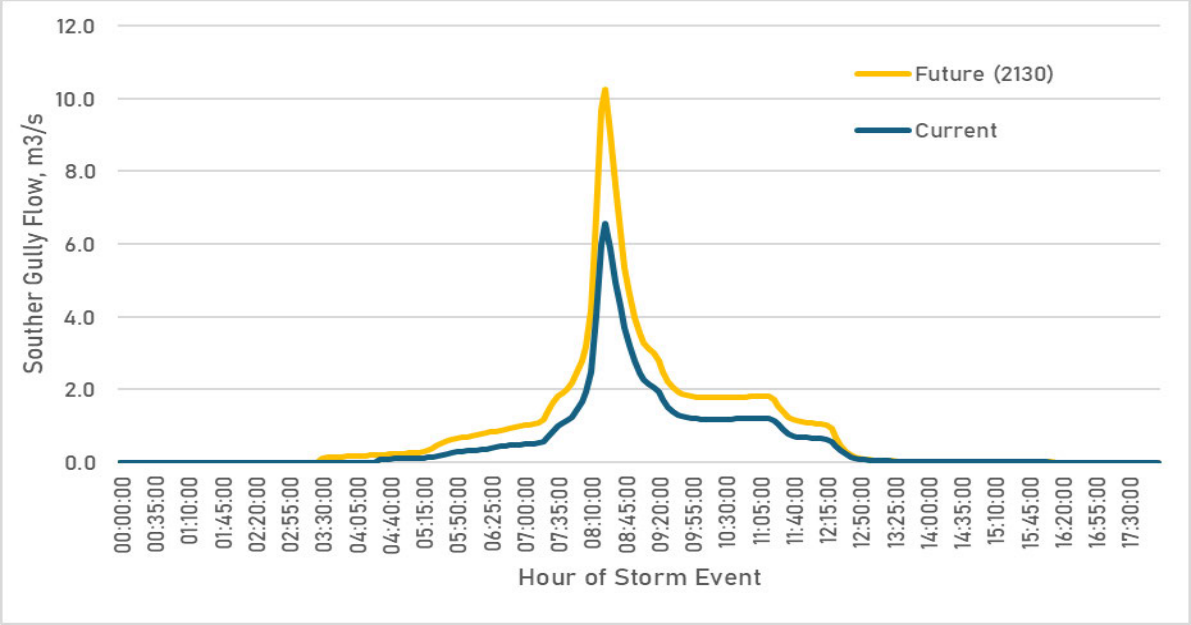
Dry Creek parcel sits across catchment 5 and 6. The portion of the land parcel in catchment 5 is on a ridge and is deemed to have negligible flood risks. The portion within catchment 6 is mostly bush clad hillside. There is a small segment of the parcel that includes the stream that drains into a culvert that passes through the old quarry. At the culvert intake there is a well-formed overland flow path that passes through the quarry. This overland flow path is almost entirely on the old quarry land. During the 1 in 100-year flood events that were modelled the overland flow path means there is little impact on the depth of flows in the stream through the proposed exchange land. Therefore, the flood depths and velocities are similar to what would be expected in streams across the Belmont Regional Park.



2.4. Southern Gully

The southern gully parcel sits within catchment 3. The Southern Gully section encompasses the middle section of an unnamed stream runs from north to south. The section of the stream covered by the southern gully DOC-get land is the section encompassing the wetland area. Downstream of the DOC-get land the unnamed stream flows through a steeper gorge-like section before falling down a series of waterfalls, after which it joins Te Awa Kairangi.

The hydrograph for the combined flow at the point the stream crosses the Southern Gully DOC-get land, with and without climate change, are presented below. The flood flows within the parcel proposed for exchange were found to be similar to what would be expected in streams across the Belmont Regional Park. The risk to the surrounding buildings that are elevated above the stream was found to be negligible during a 1 in 100 year flood event including during under and SSP5-8.5M climate change projection through to 2130s.



2.5. Climate Change Impacts

In accordance with the Ministry for the Environment's climate change risk assessment framework this report adopts a climate change projection through to the year 2130. The projections are based on the RCP5-8.5M scenario. 1 in 100-year flood event has been modified to assess the impact of climate change on the properties proposed to be acquired by DOC as part of the land exchange.

2.5.1. Rainfall

A nested rainfall approach has been used to calculate rainfall. This is a conservative approach that is consistent with best practice. The modelled rainfall is based on historic rainfall events that have then been adjusted for climate change using NIWA HIRDS v4 based on a RCP 8.5 M scenario. This modelling equates to a 35% increase in rainfall compared with present day by 2130.

As the projected 35% increase in rainfall by 2130 is a Wellington region-based increase it would apply to both the land being given and received by DOC as part of the exchange. This means that the climate change risk profile for DOC within the Belmont regional park would remain unchanged as a result of land exchange.

2.5.2. Sea Level Rise

An assessment of the impacts of sea level rise on the site was conducted. The lowest elevation of the three proposed land swaps is on the Firth Block which at its lowest elevation is 35 m RL (Wellington 1953). Under an RCP 8.5 M scenario sea levels would increase 1.59 m

by 2130. Given this the risk of inundation due to sea level risk is expected to be negligible and the modelling confirms inundation is not an issue for this site due to its topography.

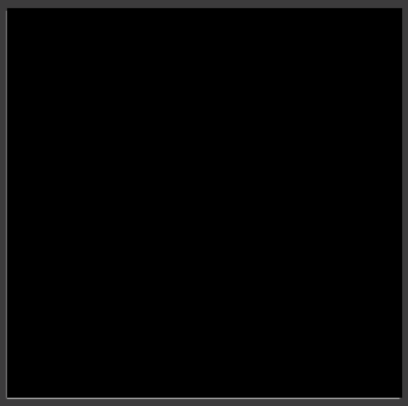
Potential impacts of sea level rise for the properties are therefore limited to that of worsened tail water conditions in the Hutt River to which the catchments discharge. An assessment of sea level rise was conducted on the Hutt River using the sea level risk modelling produced by GWRC.

The lowest culverts from all three sites discharge under State Highway 2 to the Hutt River. The culvert from the Northern Gully and Firth Block discharges at 19m RL (NZ Wellington Datum 1953). Under an RCP 8.5 M scenario sea levels would increase 1.59 m by 2130. Whilst this has tail water effects on the Hutt River in its lower reaches, it does not affect the river above 5 m RL. Therefore, we conclude that the impact sea level rise on the catchments is negligible and not an issue due to the location of the land to be exchanged being significantly higher than this.

3. Conclusions

The flood risk and climate risk assessments have concluded that on the proposed Winstone Aggregates land exchange parcels the flood risk is similar to streams throughout the Belmont Regional Park. There was found to be no flooding risk or coastal inundation risk presently or under modelled climate change scenarios that would prevent the land being used for conservation purposes.

Appendix A



QUALIFICATIONS

Bachelor of Engineering – Natural Resources (Honours), University of Canterbury

PRINCE2 Practitioner

CURRENT POSITION

Principal Stormwater

MEMBERSHIPS AND AFFILIATIONS

CPEng (Chartered Professional Engineer)

IntPE (NZ)

SPECIALIST FIELDS

- Simplifying complexity
- Stormwater management and planning
- Hydraulic Modelling
- Natural hazards management
- Business development
- Water quality
- Coalition building
- Risk management
- People and programme coordination
- Contract management
- Strategy
- Organisational alignment

SUMMARY OF COMPETENCIES

I bring to my work the character, energy and skill sets to simplify complexity, build partnerships, and get things done. These strengths have served me well in my varied career. I am a Chartered Professional Engineer with 25 years' experience in delivering projects, building teams, shaping strategy, managing risk, organisational alignment and delivery. I understand the commercial, contractual and regulatory environment in which infrastructure projects are undertaken in the New Zealand context. My experience in stormwater, hydraulic modelling, flood risk management and water quality is recognised nationally. I have consulted and worked with central government, territorial authorities and regional councils and communities across the country to help shape policy and implement work programmes to address the many water related challenges our nation is facing. A core area of strength is my ability to build relationships and to communicate across a wide range of stakeholders and partners including government, the private sector and iwi. These attributes complement my strategic thinking, leadership and people management skill sets. I consider myself values driven and bring these values to both what I do and how I do it.

PROJECT EXPERIENCE

Wellington Region Stormwater Modelling Programme

Client: Wellington Water Ltd (as employee)

Role: Modelling Manager

Wellington Water Ltd employed me to manage their multimillion-dollar hydraulic modelling programme. This included developing the first comprehensive flood hazard mapping programme across the metro councils. I developed the specification to deliver some of the most detailed flood models in the country. I established the panel of consultants to deliver on this programme and created the environment of innovation to push the boundaries of how models can be built and used. The true test of the success of this programme has been the streamlined adoption of flood hazard maps in the district plans in the region and the ongoing development of catchment management plans to plan network upgrades and maintenance.

Puhoi to Warkworth: Roads of National Significance

Client: NZTA, Waka Kotahi

Role: Stormwater and Coastal Coordinator

Working in the alliance I coordinated the assessment of water quality and flooding effects. This required me to work with some of the country's leading coastal and freshwater ecologists, modelers and scientists. I planned and coordinated the coastal impacts assessments to quantify and manage the impacts of the project on sedimentation in the Mahurangi and Puhoi Estuaries. This role included shaping the consenting evidence strategy, cross disciplinary coordination and delivering hearing's evidence. I demonstrated the management of water quality impacts linking the area of open earthworks to erosion and sediment control to sediment distribution modelling in the estuaries to ecological impacts.

Master Planning Eastern Porirua Regeneration

Client: Wellington Water (as employee)

Role: Chief Advisor Stormwater

I was energised through my involvement in assisting with the catchment planning for the 1.5 billion dollar social housing and regeneration project in Eastern Porirua. Through Wellington Water Ltd I scoped, developed and coordinated the three waters master planning for this project. While my focus has been on infrastructure this has a strong interaction with environmental and community outcomes. As this project transitioned from concept to action, I worked with the planners, architects and engineers to shape and consent the initial phases of this development.

Earthquake Impacts on Flood Risk, Christchurch

Client: Christchurch City Council

Role: Principal Engineer

As part of the post-earthquake recovery in Christchurch I found myself central to the shaping of Christchurch City Councils initial response to the emerging flooding problems. A series of severe and damaging rainfall events that exposed the impact of land settlement and the damaged infrastructure left by the earthquakes quickly elevated flooding risk to a crisis response. I worked closely with Christchurch City Council as part of the Mayoral Task Force and trusted advisor to quantify, prioritise and plan the action needed. This pressured work was not just technically challenging it also was highly relational requiring community engagement, political briefings, emergency coordination and cross disciplinary alignment. The actions taken over this time that directly impacted on the desperate situation of hundreds of Christchurch residents are some of the most rewarding experiences of my career.

Oratia Flood Hazard Modelling and Mapping, Auckland Council

Client: Auckland Council

Role: Technical Lead

Technical lead for a flood hazard modelling and mapping project in Henderson. The project involves assessment of existing model data availability, identifying additional data gathering requirements, Rapid Flood hazard Assessment, and development of a combined 1D/2D flood model.

Matatua Bridge Construction

Client: Kapiti Coast District Council

Role: Engineers Representative

I undertook the site supervision of the construction of a $2.6m bridge upgrade on the Kapiti coast. This project included extensive work within the bed of the stream requiring careful control of sediment and management for the risk of flooding.

Climate Change Manager

Client: Porirua City Council (as employee)

I was given the opportunity to build the new climate change team at Porirua City Council. I developed the work programme, identified the internal and external skill sets needed, employed my staff and managed the team. The work included developing an emissions reduction plan and a city-wide adaptation plan.

Chief Advisor Stormwater

Client: Wellington Water Ltd (as employee)

This cross functional role seeks to shape and align the business around its strategy and priorities. This role requires me to work with the full breadth of the organisation from the front-line operational staff in the trucks to the senior leadership. This role also required me to interface with all the councils in the region particularly their planning and building consent teams. I also frequently presented and hosted workshops with the elected officials supporting their decision making. One of the highlights of my time at Wellington Water was my role in securing the construction of a 15,000m2 wetland to enhance water quality and flood protection

[redacted]

in the heart of Porirua. I built support around the opportunity, developed the business case and successfully applied for a multi-million dollar grant from the MfE Freshwater Improvement Fund. This project is an example of nature-based adaptation.

NZDF Base Infrastructure Mapping and Management

Client: NZDF

Role: Project Manager

I coordinated the collection and mapping of underground asset infrastructure at NZDF Camps and Bases across the country. As part of this work I planned and delivered the condition assessment of the underground services.

Catchment Management and Water Quality Innovation

I have a history of innovation that has improved outcomes and advanced the stormwater sector in New Zealand. I recently deployed a real time enterococci monitor into Porirua Harbour to improve our understanding of wastewater contamination, public health risks and our ability to tell better, data driven stories with the community, mana whenua and decision makers. I pioneered the use of dynamic freeboard in flood modelling to support building consenting teams across the Wellington Region. Some of my innovation has been built on groundbreaking work started by others such as deploying in Wellington the Nowcast system pioneered in Auckland. Building on the framework we adapted this to the operational needs of the local context.

RECENT WORK HISTORY

Awa Environmental	*Principal Waters Engineer*	2025 – Present
Porirua City Council	*Chief Advisor, Climate Manager*	2021-2025
Wellington Water Ltd	*Modelling Manager, Chief Advisor*	2015-2021
Sinclair Knight Merz/Jacobs Wellington	*Client Manager, Senior Environmental Engineer*	2004-2015
Wellington City Council (Drainage and Water Supply Unit)	*Site Engineer*	2000-2004
Environment Canterbury	*Graduate Engineer*	1999

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