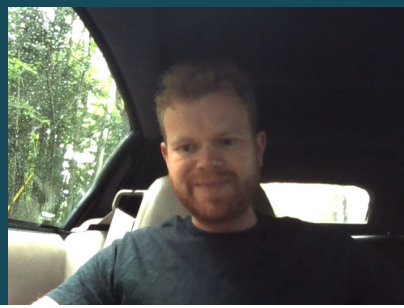
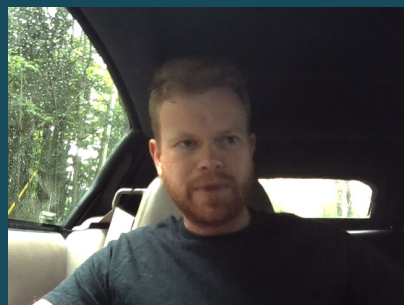
Greater Wellington Flood Forecasting – Past, Present and Future



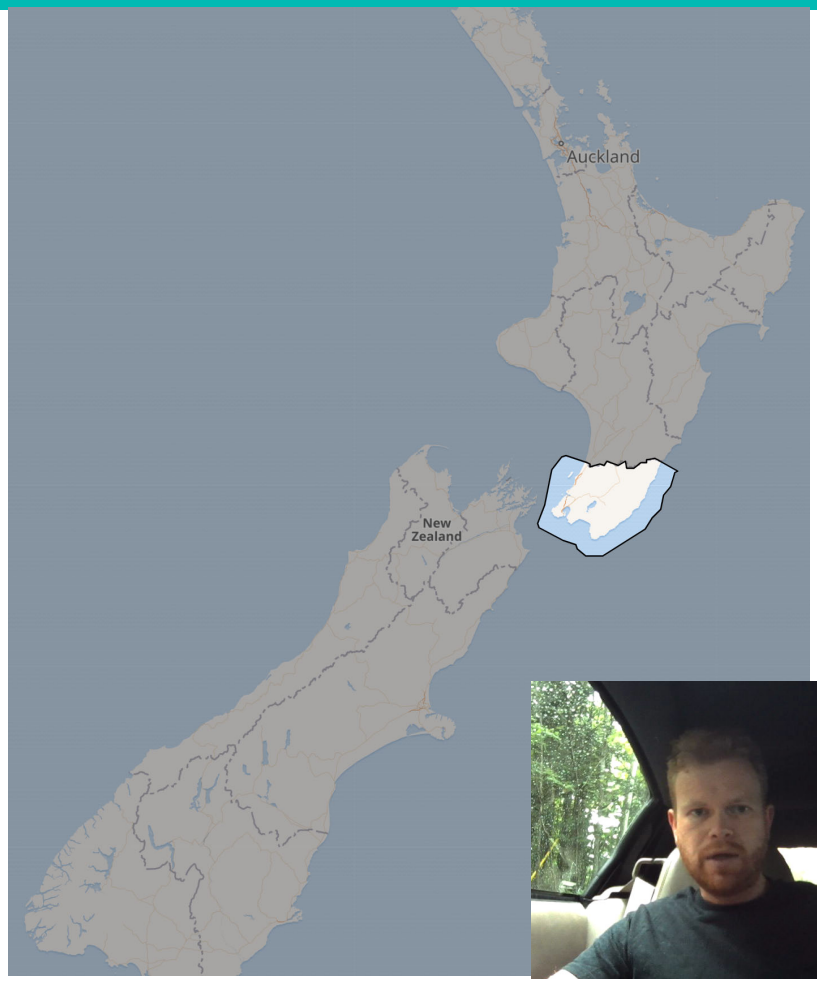
Kaipūkaha | Senior Flood Engineer

GWRC Flood Protection



Te Pane Matua Taiao – Greater Wellington Regional Council

- We do flood risk management, public transport, strategic resource management, land management, and environmental protection
- Greater Wellington manages 320 km of river channels and 280 km of flood banks
- We work with our 6 major mana whenua (indigenous groups) partners under the Treaty of Waitangi. Ngā Hapū ō Ōtaki, Ātiawa ki Whakarongotai Charitable Trust, Te Rūnanga o Toa Rangatira Inc, Port Nicholson Block Settlement Trust, Rangitāne ō Wairarapa Inc, Ngāti Kahungunu ki Wairarapa Charitable Trust
- We cover a land area of 813,500 hectares
- Around 35 million passenger journeys are made on our public transport system every year
- We manage 50,000 hectares of regional parks and forests



Regional exposure to flooding

Buildings

Residential
73,000
31%

Commercial
4,000
69%

People

Total
197,000
31%

Transport

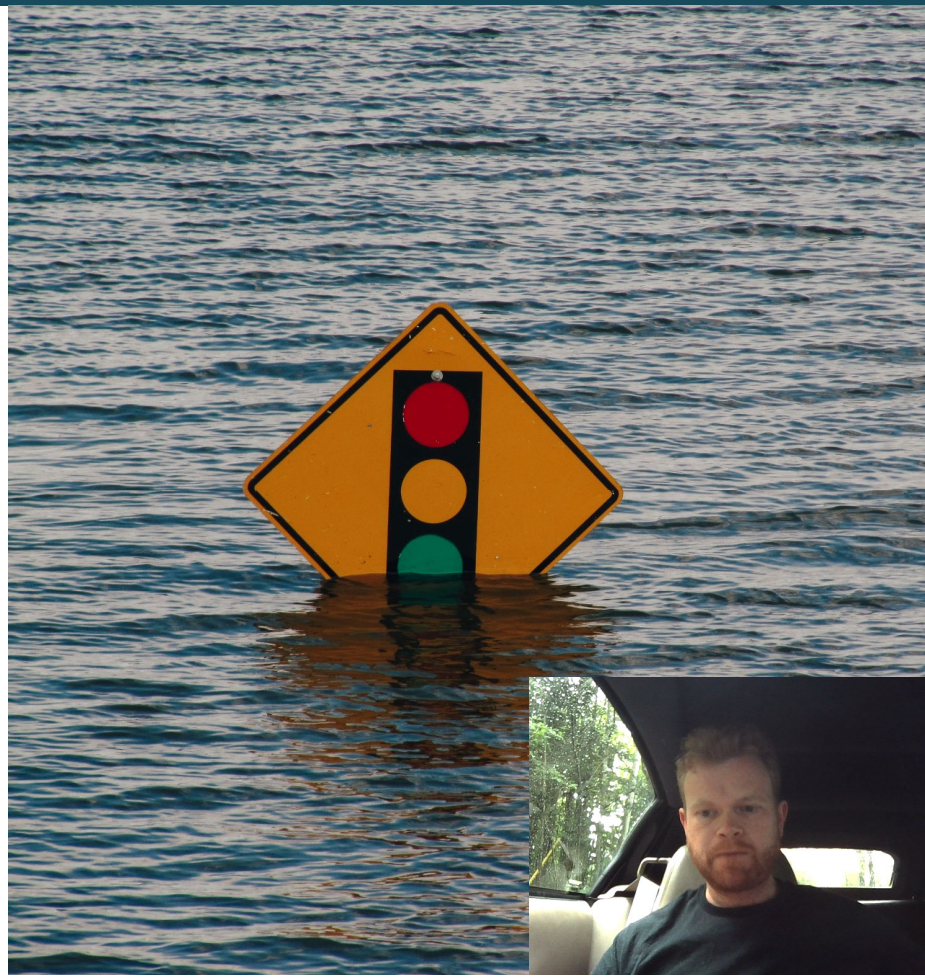
Road
1,000 km
0.02%

Rail
40 km
0.02%

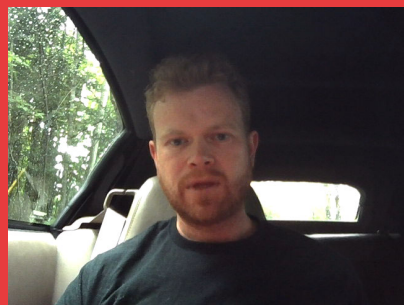
Emergency Service Sites

Total
11
24%

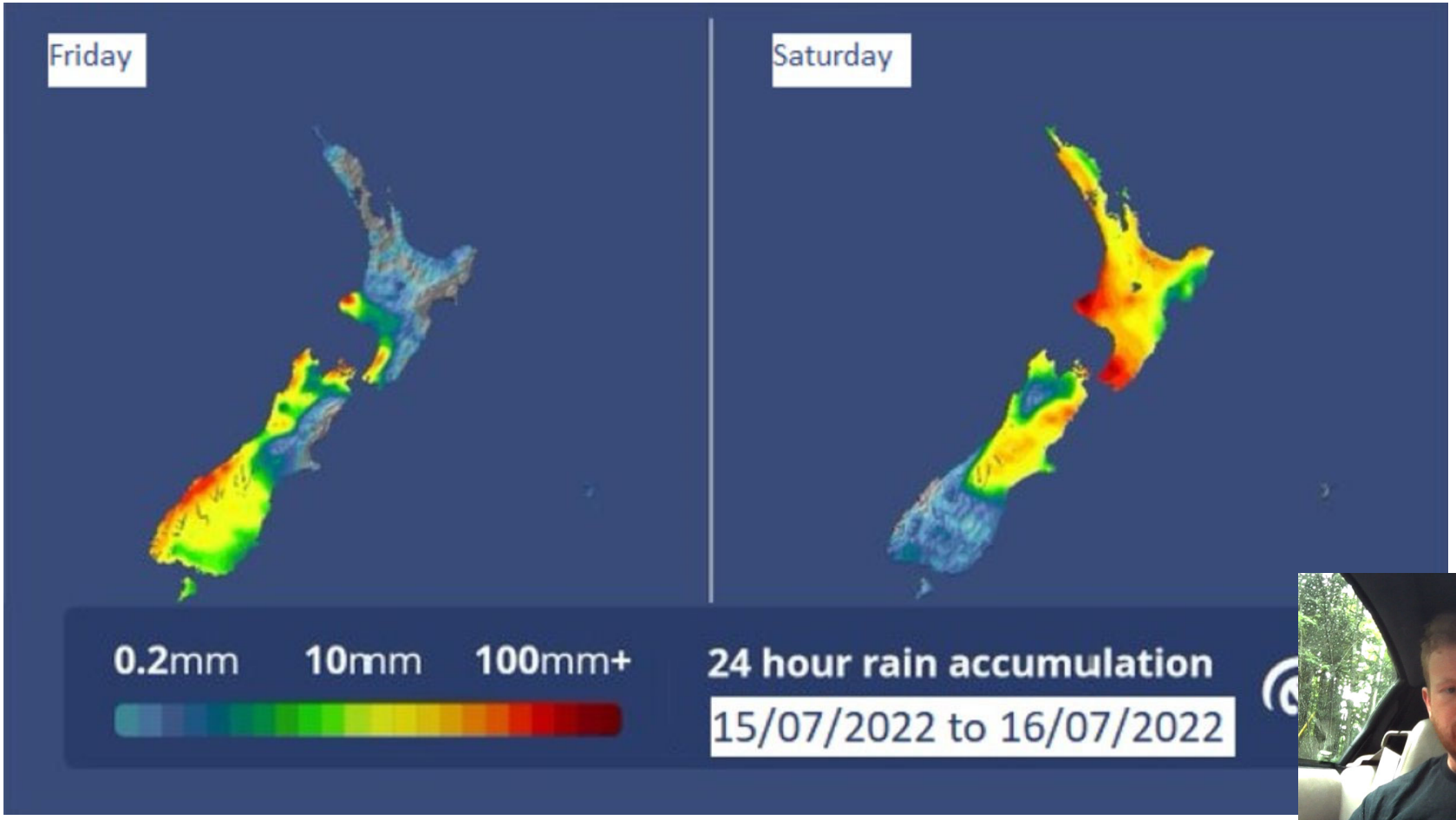
GWRC 2022 Flood Exposure Assessment

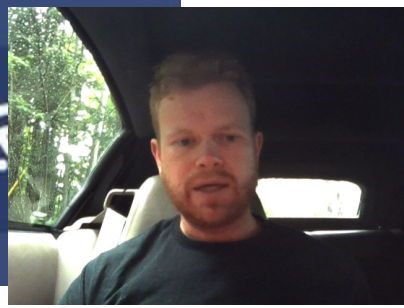


15 July 2022

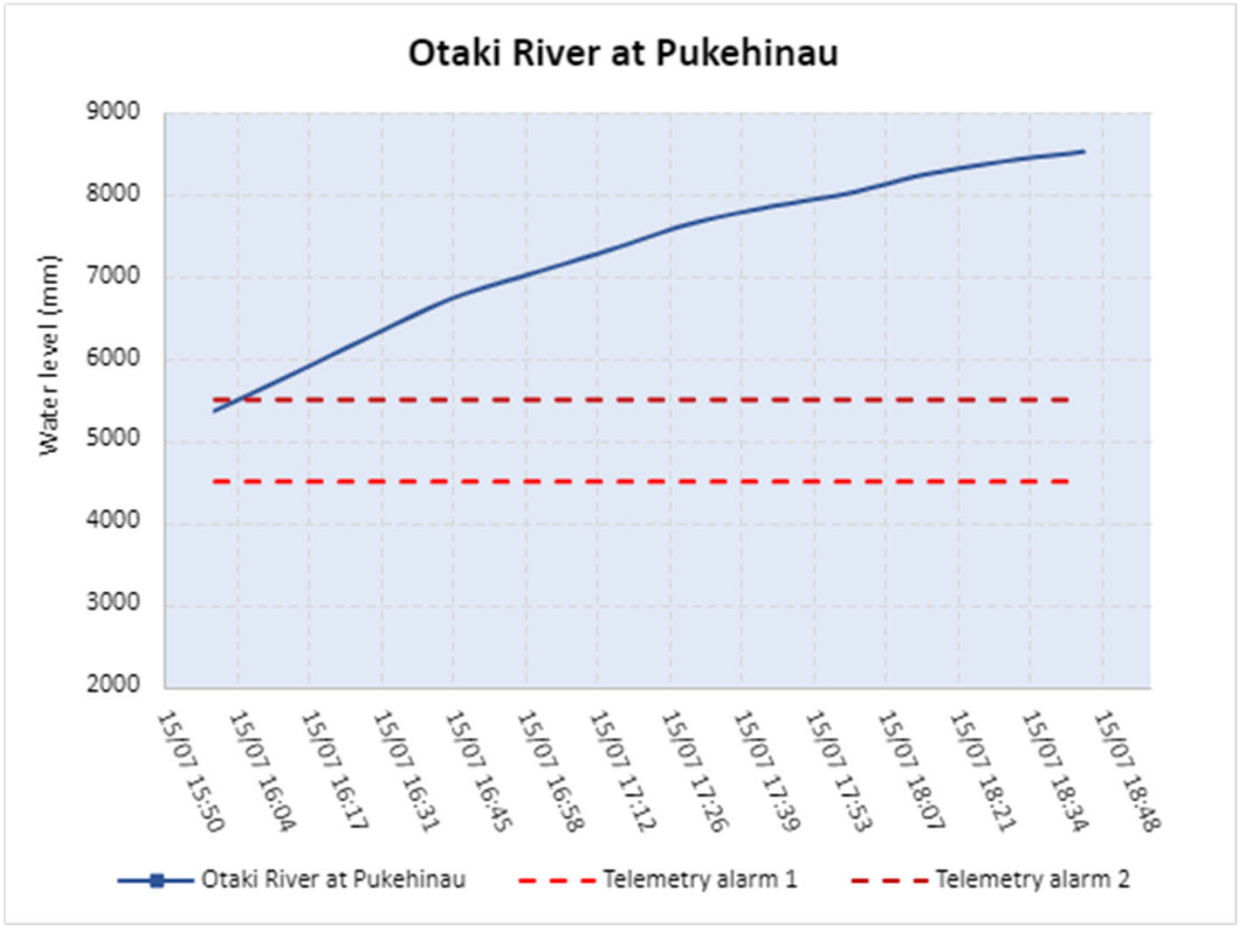


Forecast rainfall accumulation





Jumping Forward - Hydrometric Data 15 JULY 2022 18.45



TVNZ NEWS

“Today's headlines. Hundreds of households, businesses and commuters are facing disruption across Kapiti Coast from a combination of high king tides and river flooding, after almost a month’s worth of rain fell within a few hours. Some 80 properties and counting are known to have flooded, 10 persons have been rescued from vehicles trapped by rising flood water and 2 farms have reported a loss of livestock. Commuters are stranded as road and rail are severely disrupted by flood water.

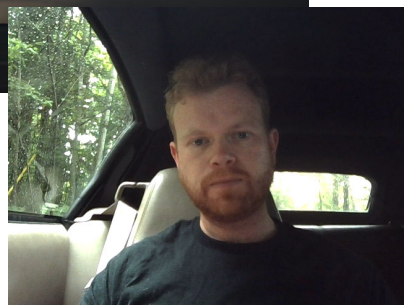
Local representatives of the National Party have been critical of Labour and asked whether enough was being done and to make sure infrastructure in the district was robust enough when extreme weather struck, and why warnings were not issued earlier. Labour has said it is not the time for finger pointing and the focus should be on helping the community through this flood emergency at this time.“

Flood Response Duty Officers – Top Opportunities

Flood Forecasting - State of Play

2019

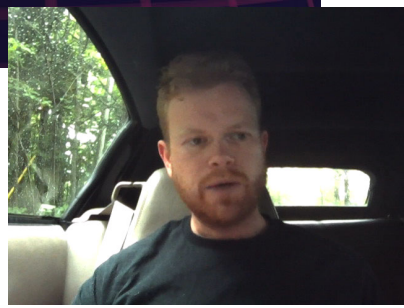
- GW's flood forecasting capability is limited, some older operational models in some catchments
- Without a sufficient flood forecasting capacity GW will be unable to provide adequate early warnings
- GW's Flood Protection and Hydrology have the remit to provide flood predictions
- Our understanding of catchment and infrastructure are needed to turn flood forecasts into effective flood warnings
- We have internal capacity but limited internal capability to build a new system



2020-21 – Searching for the best option for GWRC

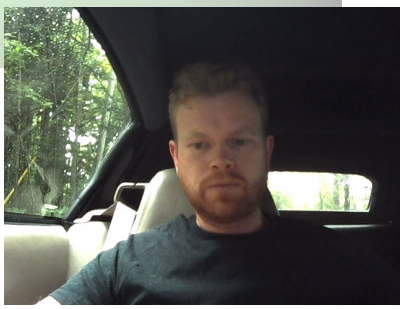
2020

- The **Stage 1 Flood Warning Project** conducted internal workshops to **assess requirements**, and **international market sounding** to assess modern products and trends in flood forecast and that would suit GW's needs and fit with our mission and capabilities
- The tool would need to be robust and proven, fit with our existing systems and people, and also lay the foundation for future technologies to be integrated
- Delft FEWS was the **forecast platform** identified best suited for this purpose. Wflow was the **modern hydrological model** that can make use of **new weather forecast products** that was selected to run on this platform



2022/23 – The road to an operational flood forecast system

- The Stage 1 work made it clear that Delft FEWS and wflow are the best choices for GWRC to adopt.
- We are now seeking to implement a **Pilot** of **Delft FEWS** and **wflow**. The purpose of the pilot is to set up a simplified system, train our staff, and lay the foundations for a region wide system integrated into our existing processes.
- **Delft FEWS and wflow** will be set up with a modern **cloud architecture**. This means that we don't need to worry about hardware and operating system updates, so easier to maintain and scale in the long term, and easy to set up back up systems and take advantage of reduced upkeep costs increasingly cheap cloud computational power over time.



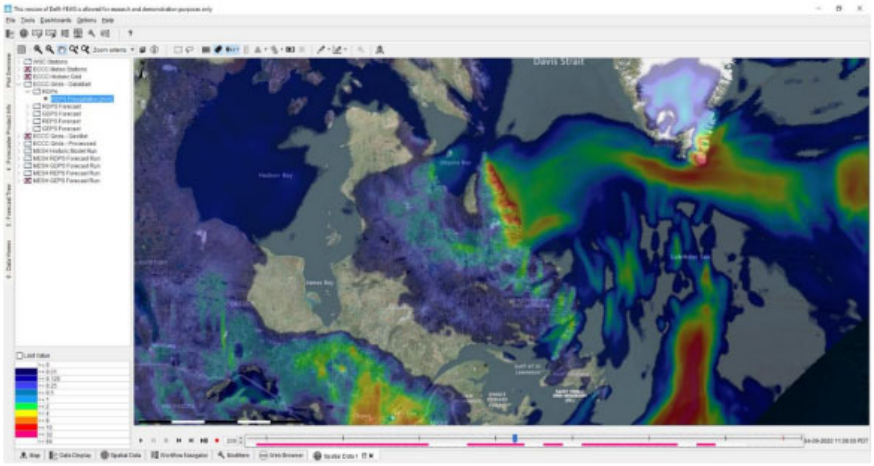
Desired future state for flood risk management

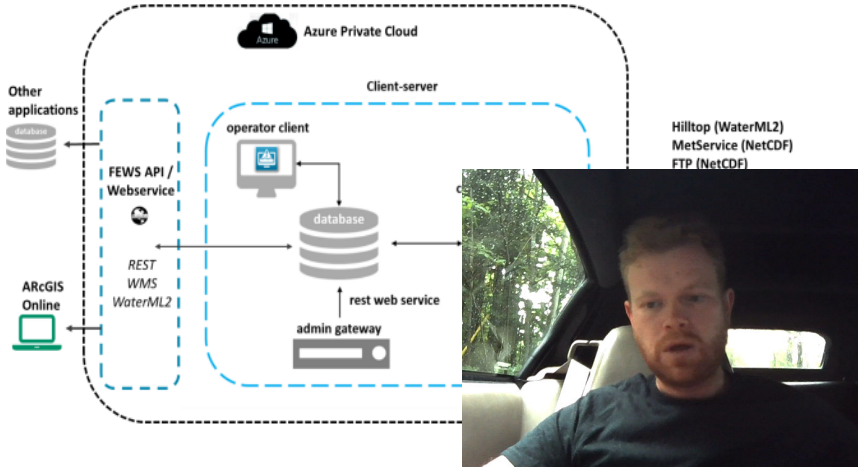
Together with the working group, we defined our desired future state. These are represented by a set of strategic themes and milestone outcomes.

Strategic themes	Milestone outcomes
Flood readiness, warning, response & recovery	We reduce the risk to life and damage to property from flooding through proactive emergency management.
Flood model sharing, access and collaboration	We consistently apply best practice in flood modelling and deliberately evolve our approaches, capabilities and toolkits to continually deliver optimal value.
Flood data management	We trust and effectively access, manage and process the quality data we need to produce flood information for different audiences.
Flood advisory information sharing & request management	The information we provide meets the unique needs of our different audiences. We have a deep understanding of what information they need and when and how to provide it effectively. Our services and user experiences are highly valued by our community and supporting stakeholders.
Integrated and adaptive flood risk management	We proactively safeguard communities from major flooding through integrated and adaptive p risk management.
Flood asset management	We manage flood assets and solutions that protect people and property from floods in harmo sensitive ecosystems.

Delft FEWS Pilot Project

- **GW ICT** have accepted the project and are supporting the Pilot, and will build the cloud infrastructure to hand over to Deltares.
- **Deltares** to provide the integration & configuration support, training, and ongoing support to build our in-house capability to maintain the software, configure it for our catchments, and improve models over time.
- ICT have limited Azure IaaS / PaaS experience, but we have decided to accepted the Pilot as a chance for them to learn too.
- We have also contracted **Bapon Fakhruddin** from T+T, an internationally renowned Flood Early Warning Systems expert to provide technical assistance and guidance (to ensure we are getting long term value for money and meeting our flood forecasting objectives.





LinkedIn TOP VOICES

Bapon Shm Fakhruddin, PhD (He/Him) · 1st

Technical Director, DRR and Climate Resilience at Tonkin + Taylor

Talks about #earlywarning, #climatechange, #emergencymanagement, #disasterriskreduction, and #climatechangeadaptation

Auckland, Auckland, New Zealand · Contact info

22,076 followers · 500+ connections

183 mutual connections: Jasmin Callosa-Tarr, Andy Brown, and 181 others

Message More

ADB Asian Development Bank (ADB)

Politecnico di Milano

Options (Provide information below for each option assessed. Include only information that is relevant or required. Expand pages as required.)

Question	Option 1: On-premises @ CCL (Do nothing)	Option 2: Azure IaaS/PaaS	Option 3 : On-Prem / Azure PaaS
Why this option was selected or considered? If this is a tactical solution to address an immediate problem be sure to state this.	Traditional infrastructure approach. Utilises existing infrastructure hosted in CCL's datacentre and the learning curve is very low as ICT staff currently support this environment. This option will also use the locally hosted RDS farm to publish the Delft-FEWS client. It would also allow for clients to be locally installed on end user devices as latency should be lower.	This option combines Azure IaaS for the Delft-FEWS front-end services and uses Azure SQL database (PaaS) to host the central database. The client app in this option would be presented as a published app via Azure Virtual Desktop (AVD). This provides centralised user and application management. **This is the recommended option.**	This option would be designed using Azure PaaS and would utilise modern architecture, infrastructure, and DevOps practices (e.g., Azure DevOps, Terraform, containers). Examples of design patterns for this solution are: • Containers / microservices using Docker, K8s and overlaying commonly used open-source tools such as Rancher or Portainer. • Full Azure PaaS using Azure web services, storage accounts, SQL DBaaS, and Azure functions / logic apps for integration. The client will be published as an app in the same way as option 2, or if it was supported the client could be converted to a web app.
Pros and cons	**Pros**: • Lowest OPEX • Medium risk • Low level of training for ICT staff **Cons**: • Does not support a move to cloud • Utilises legacy infrastructure / RDS farm • Highest level of management required • No DR in place for the infrastructure hosted at CCL	**Pros**: • Full cloud deployment, supports cloud DoT • HA built into the Azure platform and DR is simple to implement • Scalability is easier to implement through Azure scale sets • Lower management overhead using Azure SQL DB and AVD PaaS. • Futureproof: Supports Flood Protections future digital plans **Cons**: • Some upskilling / training required with the use of Azure SQL DB and AVD • Highest operating cost due to running VM's in Azure	**Pros**: • High level of automation due to modern approach to deployments • Low cost, highly scalable (inherent) • Takes advantage of as-a-service model • Futureproof: Supports Flood Protections future digital plans **Cons**: • Completely r and upskillin • Potentially lo • Vendor has r
Cost of the option (deployment and operational). How will it be funded?	The Flood Protection team is funding this pilot, once in production ICT will own the operational cost.		

“Within the next five years, everyone on Earth should be protected by early warning systems against increasingly extreme weather and climate change. “

- UN Secretary-General António Guterres - UN Climate Change Press Release.

23 March 2022