



Dunedin is facing some big challenges – one of them is to do with climate change



South Dunedin background



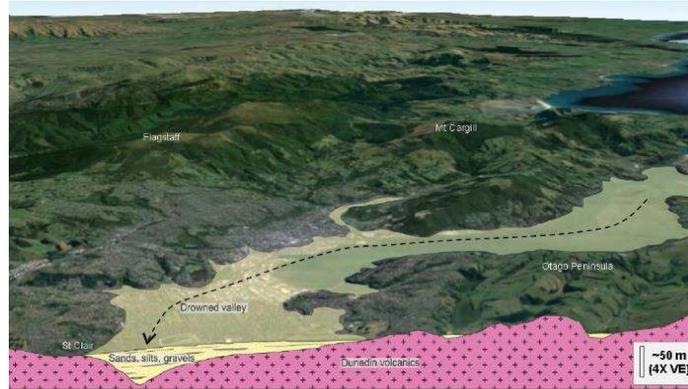
South Dunedin was a coastal estuary in the early days of pakeha settlement (circa 1864, Hocken Collection)



South Dunedin is built on land that used to be a coastal wetland. This means that groundwater is already close to the surface and makes it hard for water to drain away when it rains.



South Dunedin background



South Dunedin sits on a variety of natural and man-made substrates, on top of volcanic rock



Much of the rain that falls on the hills surrounding South Dunedin must flow through this 'flat' area to reach the sea. This means that when it rains South Dunedin has to cope with extra surface water running off the streets and through the stormwater pipes from a much wider area.

Normally, rainfall is drained through the stormwater pipes and out to the sea/harbour. Once these pipes fill up, water starts soaking slowly into the ground and floods in low-lying areas because there nowhere for it to drain away.



South Dunedin background



South Dunedin has experienced some significant flood events in the past (this photo is from 1923)



Wastewater flooding also happens in South Dunedin during heavy rain, particularly in the Surrey Street/Hillside Road area. This is because all the wastewater from the hill suburbs in Kaikorai Valley etc. is piped under South Dunedin to the Tahuna Treatment Plant.

Again, in heavy rain, there is more wastewater flowing through these pipes than the system can handle, and manhole covers are forced up by this excess wastewater, particularly in the Surrey Street/Hillside Road area.

The DCC is well aware of these issues. We have made improvements to make sure the current systems work as well as they can and we have plans to invest much, much more – we'll talk more about this shortly.



Climate change impacts for South Dunedin



Major floods in June 2015



All over the world, communities are facing challenges due to a changing climate – storms with larger amounts of rain, big tides on the coast and rising sea levels.

In the short term, storms with large amounts of rain are the biggest challenge for Dunedin, including South Dunedin.

In the longer term, rising sea levels will further increase the risk and potential impact here in South Dunedin. That's because rising sea levels will further push up that groundwater over time and will eventually mean there will be some ponding of water in low lying areas even without any rain.



What we're doing about it – the SDF project



The DCC, ORC and others began working some years ago on responding to the threat of climate change and increased flooding.

We've replaced some parts of, and improved, infrastructure in the area; we've improved maintenance of things like mud tanks; and we've made improvements to how we support the community during flooding – with things like more door-knocking, sandbags and information centres.

Planning some really big bits of work to further improve the situation.



What we're doing about it – the SDF project



Tahuna wastewater treatment plant

A new \$7M pipe to divert wastewater from Kaikorai Valley (now piped through South Dunedin to Tahuna) to Green Island



Firstly, we are looking at building a new pipe to take all the wastewater from the hill suburbs around Kaikorai Valley to Green Island for treatment, instead of to Tahuna. To do this, we also have to upgrade the Green Island treatment plant so it can cope with the extra amount of wastewater. This will lessen the wastewater flooding in South Dunedin during times of heavy rain.

The combined cost of these projects is about \$51 million. So given the scale of the work, these improvements will take time – about 7 years – to plan, design and construct.



What we're doing about it – the SDF project



Investigating short-term alternative Kaikorai wastewater diversions



In the meantime, we are looking at a temporary measure so that a large amount of wastewater can be diverted away from South Dunedin during heavy rain via the Kaikorai Stream.

We have also budgeted \$35 million on flood reduction within South Dunedin over the next 10 years.

What we're doing about it – the SDF project

\$35 million for flood alleviation in South Dunedin over 10 years

DUNEDIN CITY COUNCIL Te Kaitiaki Take Kōwhiri **Te Kaitiaki Take Kōwhiri** Te Kaitiaki Take Kōwhiri

We have also budgeted \$35 million on flood reduction within South Dunedin over the next 10 years.

The DCC, ORC and GNS Science and others are currently investigating the interaction of stormwater and groundwater in South Dunedin. Results of these investigations will help us develop a detailed plan for exactly how to spend that \$35 million and improve how we manage stormwater flows and high groundwater in the area – Jean-Luc Payan (ORC) & Phil Glassey (GNS Science) will talk more about this in a moment.

We've identified some opportunities to remove bottlenecks from our stormwater network at Forbury Road and Portobello Road. Addressing these has the potential to significantly improve the stormwater system in South Dunedin. We're in the process of further investigation of these.

We want to make sure we're talking with you, the community, as well as central government and other key stakeholders so that we can all understand the environmental and other changes taking place; help identify opportunities and options; and decide how best to adapt in a careful and considered way.

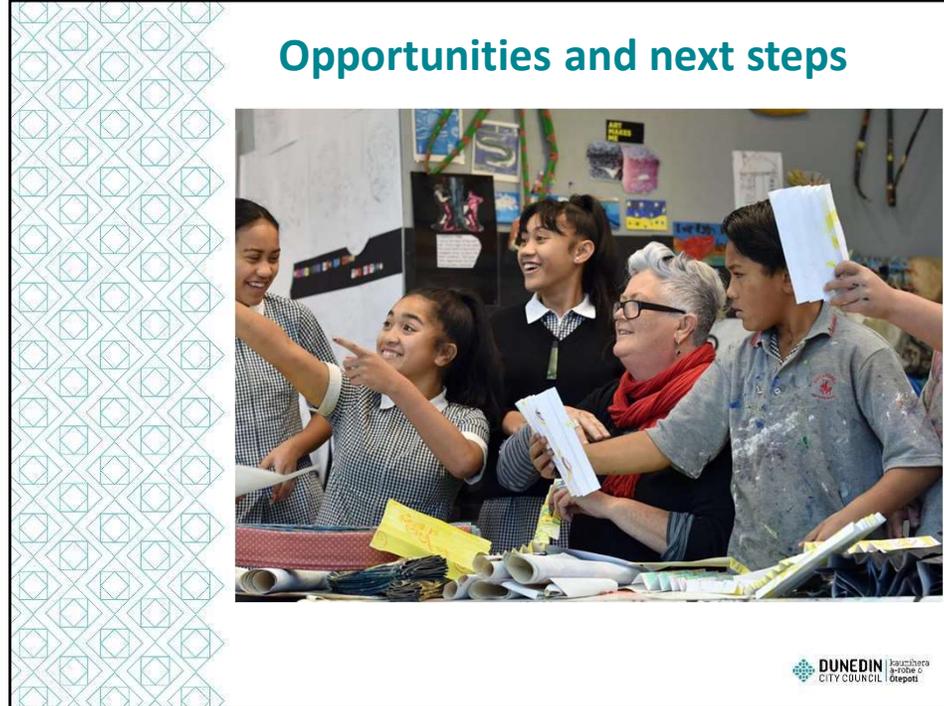
I will now **hand briefly to Tom Simons-Smith** to talk briefly on Ocean Beach.



Ocean Beach



Tom Simons-Smith, DCC



Sue Bidrose, DCC

While responding to climate change presents some challenges, it also creates some real opportunities such as creating a long-term vision for the greater South Dunedin community

We're currently gearing up to start individually approaching all known community groups, sports clubs etc. in South Dunedin to start a long-term conversation with them on all of the issues we've talked about this evening.

We want to let as many people as possible know, face to face: what climate change impacts are expected and what this means for South Dunedin; what we are doing about it in the short, medium and long term; and what individuals, households and communities can do themselves.

We're keen to hear from you about the things that are important to you; where you think the information gaps are; and how you would like us to keep you informed.

While tonight and the upcoming community meetings are a good first opportunity to talk about these issues, it certainly won't be the last.





WHAT WE'RE DOING ABOUT IT



- Building safe and resilient communities in the face of climate change: a priority
- Supporting DCC in the South Dunedin Future
- Monitoring and technical work
- Multi-hazard approach for South Dunedin
- Climate change risk assessment for the whole of the Otago region



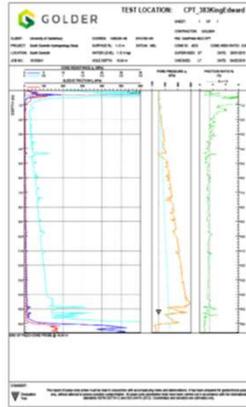
DUNEDIN GROUNDWATER MONITORING

Caveat: Any results presented here are provisional



SOUTH DUNEDIN: NEW DRILLING & MONITORING NETWORK

Cone Penetrometer Tests and piezometers - Feb 2019



Consortium:



16 CPTs, with shallow piezometers installed at 8 locations

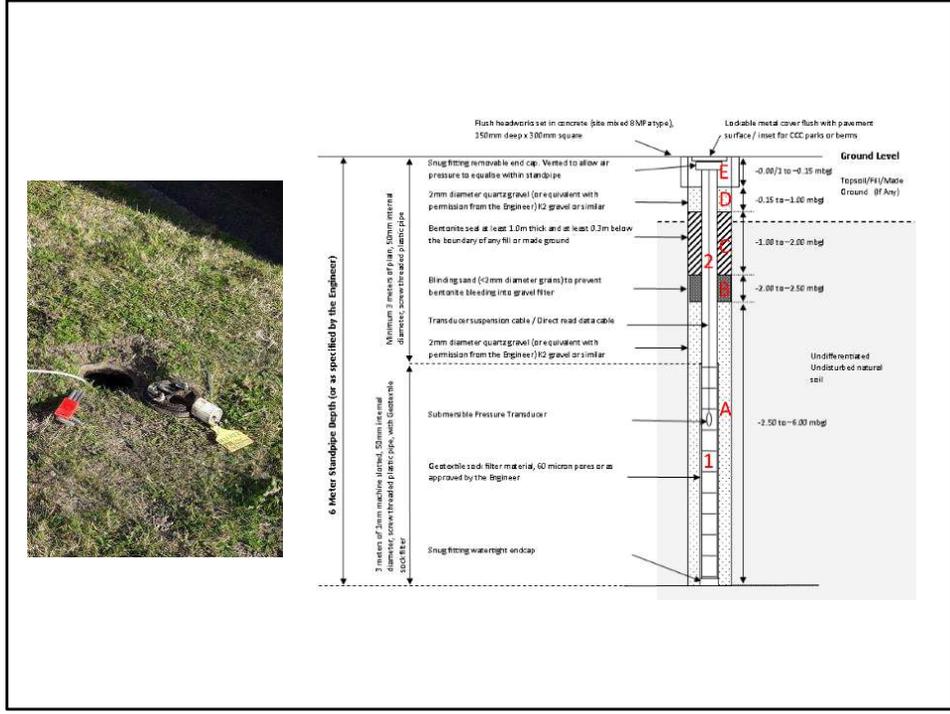


Diagram of a typical piezometer installation in a drillhole

SOUTH DUNEDIN: NEW DRILLING & MONITORING NETWORK

Drill holes and piezometers - Jun 2019

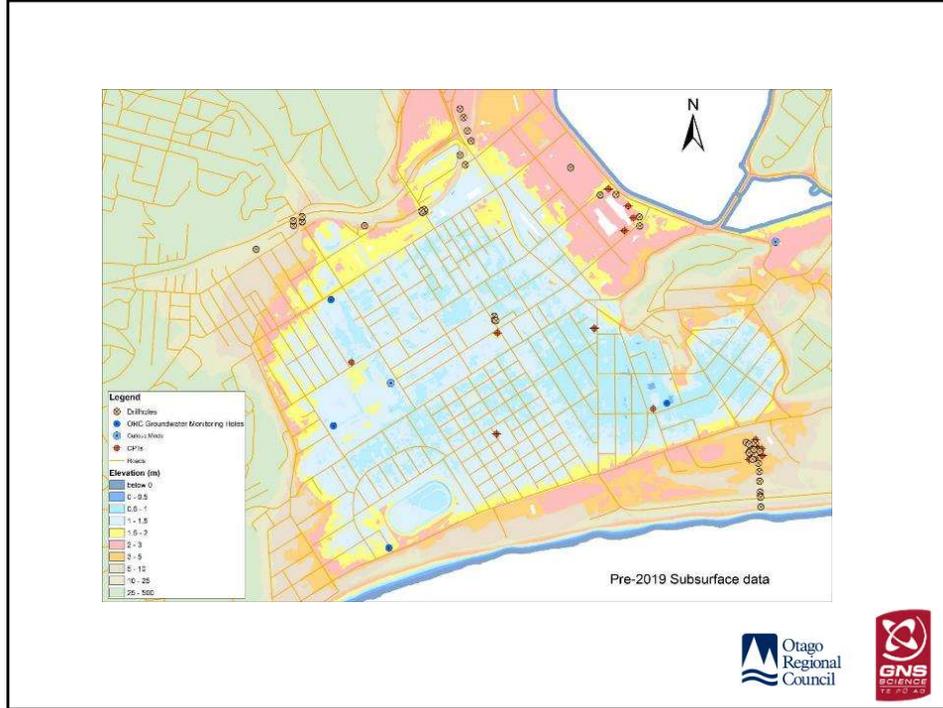


Log of Drill Hole		DATE	DRILLER
DEPTH (m)	DIAGNOSTIC	15/06/19	DAVID H. SMITH
1.0	0.0 - 1.0	0.0 - 1.0	0.0 - 1.0
2.0	1.0 - 2.0	1.0 - 2.0	1.0 - 2.0
3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
4.0	3.0 - 4.0	3.0 - 4.0	3.0 - 4.0
5.0	4.0 - 5.0	4.0 - 5.0	4.0 - 5.0
6.0	5.0 - 6.0	5.0 - 6.0	5.0 - 6.0
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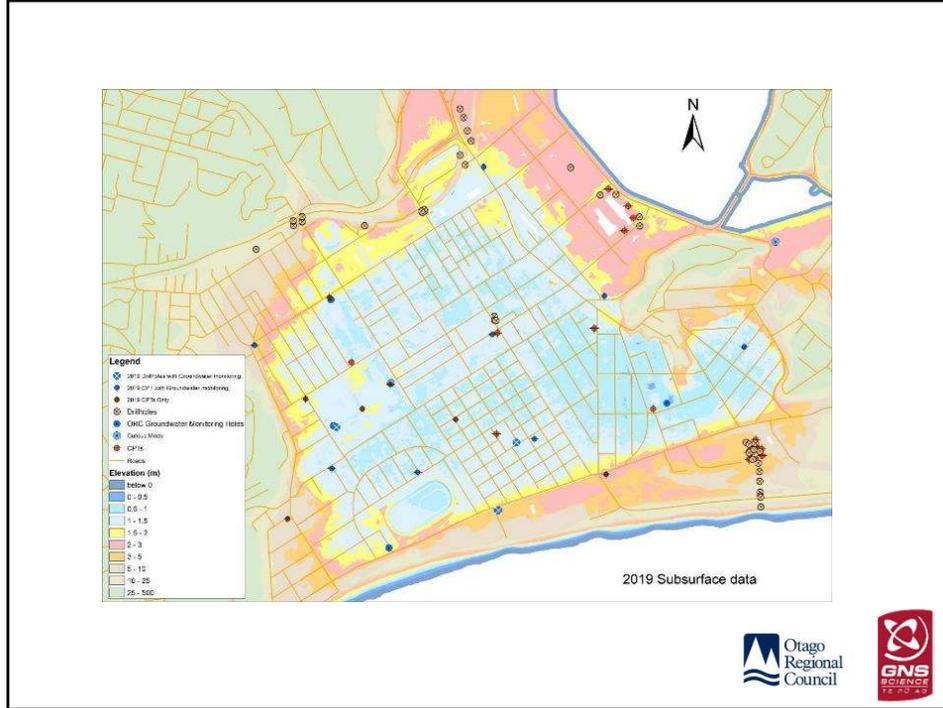
Core recovered from the subsurface in 3 holes, giving an indication of the sediment below South Dunedin

4 new piezometers installed



Prior to 2019 there were 6 shallow (< 6 m deep) piezometers (blue dots) monitoring groundwater in South Dunedin

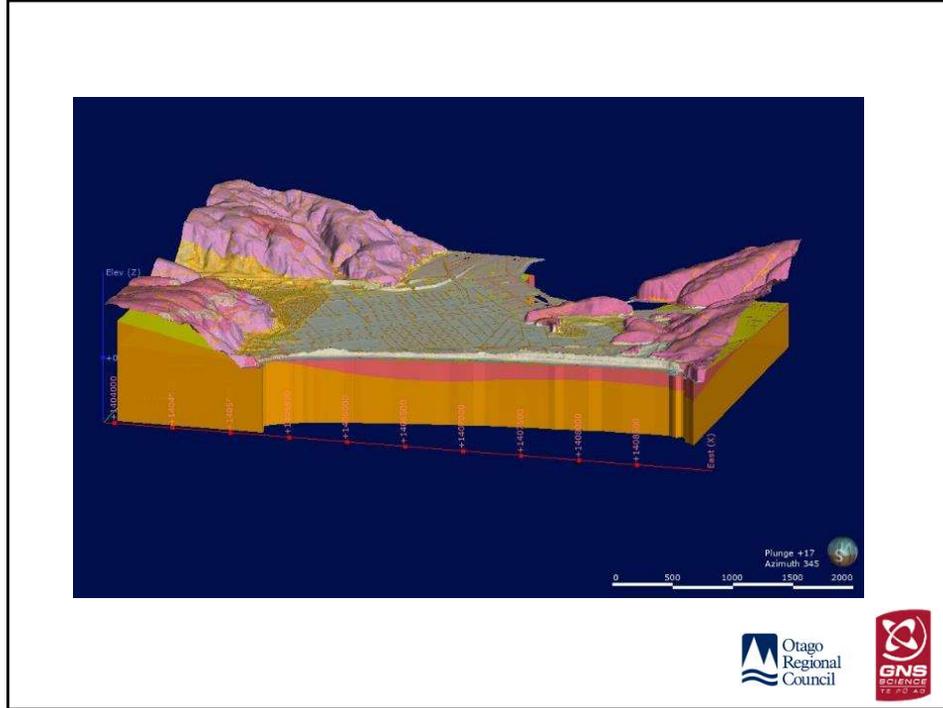
Also very little drillhole or Cone Penetrometer Test (CPT) data



As at June 2019 there are now 20 piezometers monitoring groundwater levels in South Dunedin

and

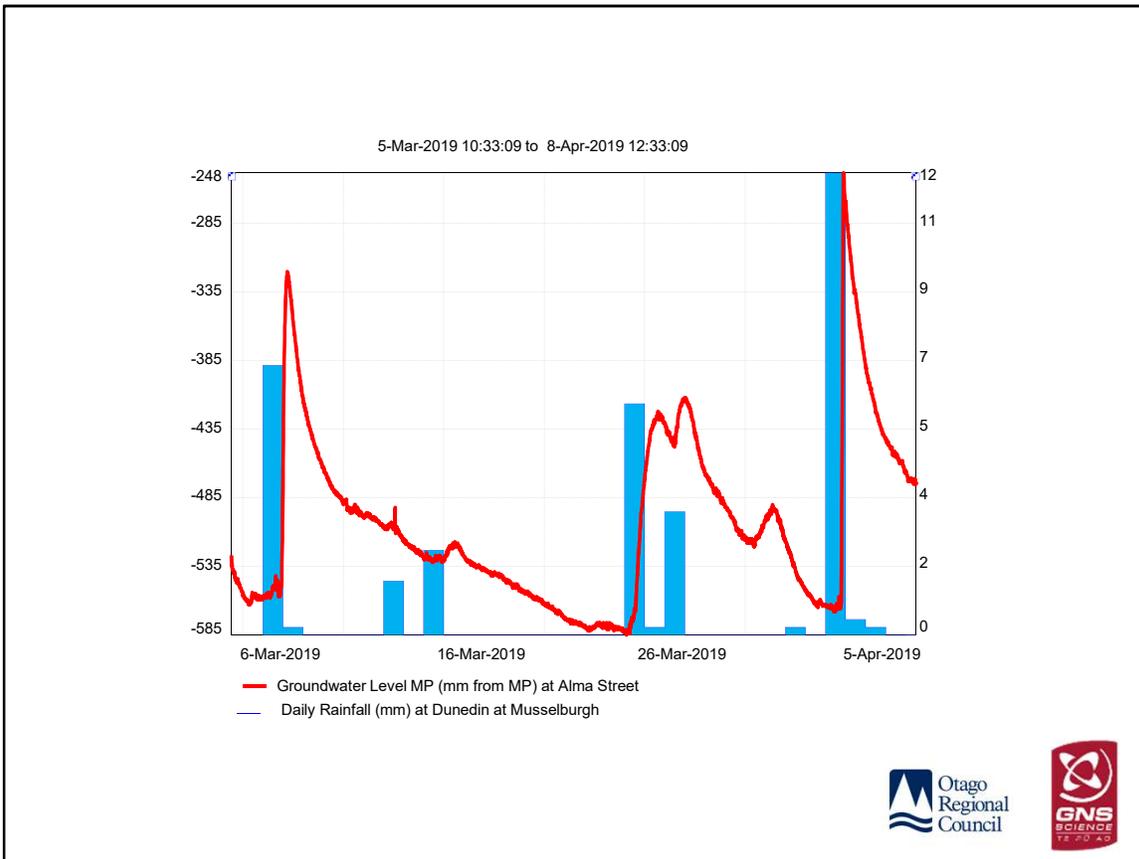
19 additional subsurface investigation (CPT and drillhole) sites



The information is being used to create a 3D geological model of South Dunedin which is a major input into a groundwater model.

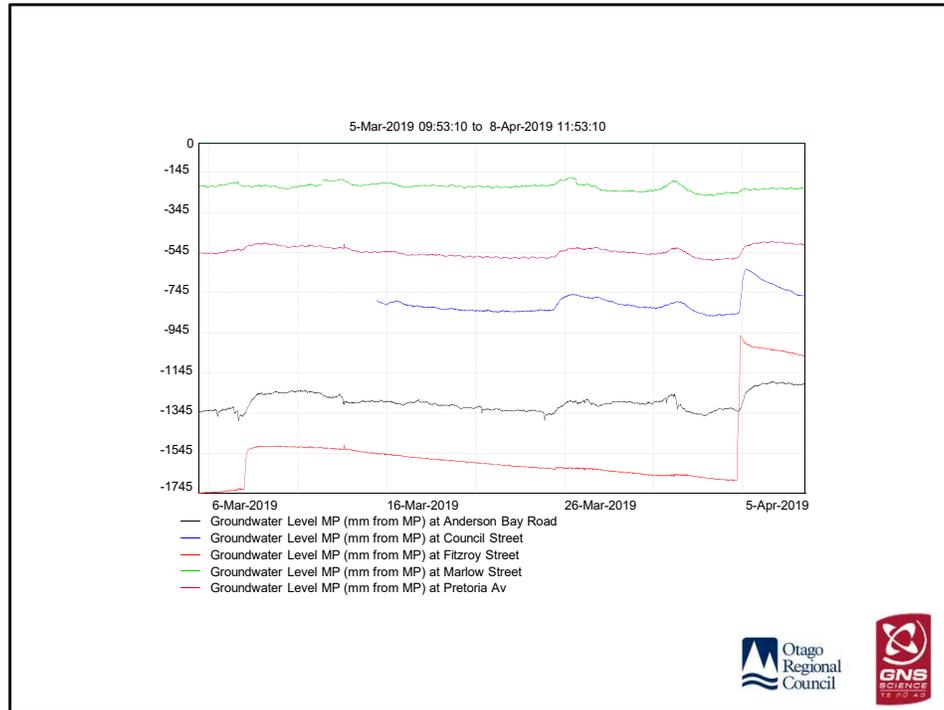
The groundwater model will be used to simulate the affect of a number of future sea- level rise scenarios on Groundwater levels.

The response of groundwater to sea level rise is not simple and not likely to be linear. i.e. it will vary across South Dunedin, and may not necessarily be the same amplitude as the sea-level rise itself.



The groundwater levels are being monitored by instruments installed in the piezometers by the Otago Regional Council.

The Graph shows how the groundwater level (red) for this piezometer at Alma St responds to daily rainfall blue bars.



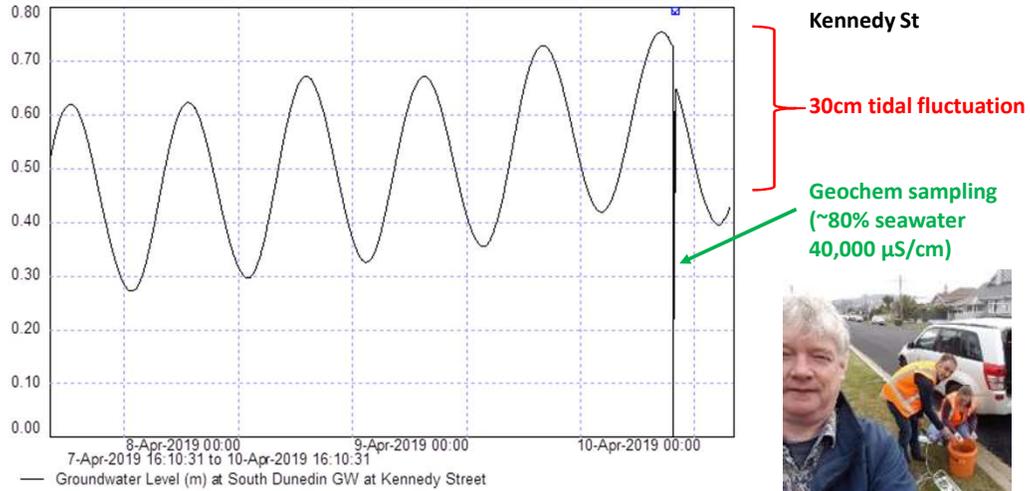
The groundwater level response to rain is not the same across South Dunedin

The above graph shows the groundwater levels of 5 piezometers across South Dunedin

The variation is due to the different material that the piezometer is installed in (i.e. Sand or Clay)

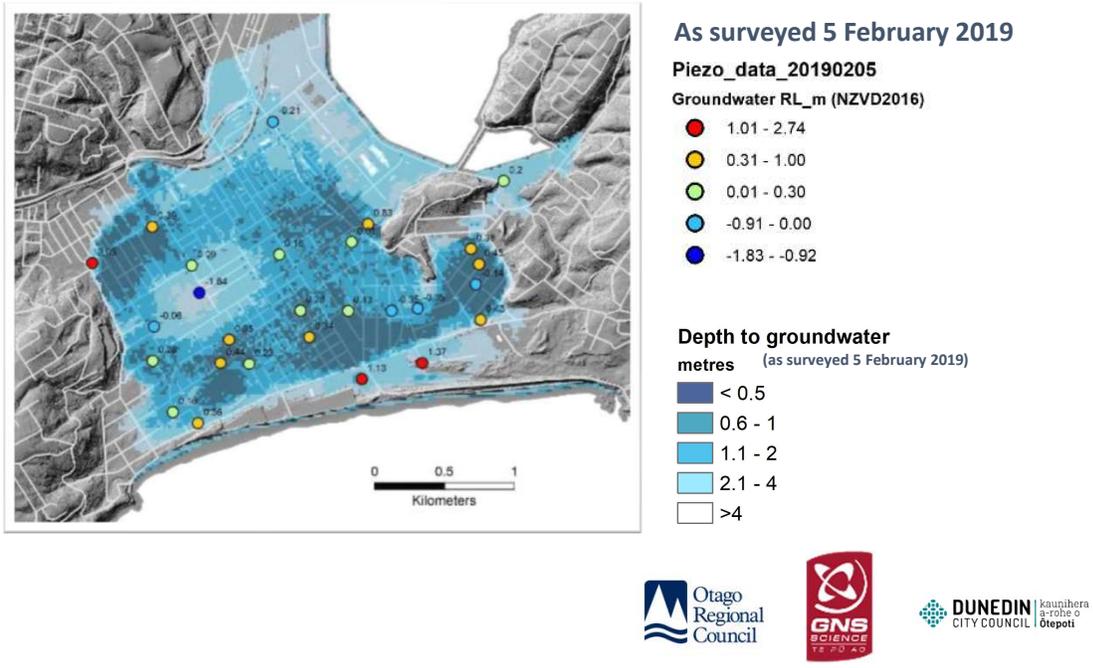
Pumping of stormwater and waste water also has an influence on groundwater level variation

South Dunedin: Groundwater Monitoring



The Kennedy Street piezometer, groundwater level is directly affected by the tides as shown by the oscillation in the above graph

South Dunedin: New drilling & monitoring network



The map above shows a snapshot of the depth to groundwater on the 5 February 2019.

Dark blue indicates that groundwater is less than 0.5 m below the surface and lighter colours indicate greater depth to groundwater below the surface.

The depth to groundwater level will change with rainfall and seasonally

