

**Before the Independent Hearing Panel appointed by
the Canterbury Regional Council**

IN THE MATTER OF The Resource Management Act
1991

AND

IN THE MATTER OF Application **CRC242267**
CRC242268 CRC242269 – Christchurch City Council -
Coastal erosion and protection works - construction
phase stormwater - works within 100m of wetland

Addendum to Section 42A Officer's Report

Report of

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Introduction

Background

1. This report forms part of the Canterbury Regional Council's (**CRC**) audit of the assessment of environmental effects (AEE) provided by The Christchurch City Council (the **Applicant** or **CCC**) in support of resource consent applications for Coastal erosion and protection works - construction phase stormwater - works within 100m of wetland
2. This report will provide the decision-maker with information and advice related to:
 - a. The actual and potential effects of the proposed activities on groundwater quality and quantity.
 - b. The interactions between the groundwater in the area with the surrounding environment.
3. While not required for a Council hearing for a resource consent application, I have read the Code of Conduct for Expert Witnesses in giving evidence to the Environment Court. I agree to comply with that code when giving evidence to the Hearing Panel in this matter. All my evidence is within my expertise and I have considered and stated all material facts known to me which might alter or qualify the opinions I express.

Qualifications

4. My name is Mitchell James Green, and I have been employed by CRC as a Groundwater Scientist since 22 August 2022. I hold a degree of Master of Science from the University of Canterbury, and I have over 8 years' experience in groundwater science at Regional Councils in both Canterbury and the Bay of Plenty, New Zealand.
5. My work at CRC includes investigating, monitoring, data analysis and reporting on both groundwater quality and quantity. I also provide technical advice for a range consents such as those relating to groundwater occurrence, flow direction and where discharges can lead to contaminants entering groundwater.

Scope of Report

6. This report is prepared under the provisions of section 42A of the Resource Management Act 1991 (RMA). This section allows a council officer or consultant to provide a report to the decision-maker(s) on a resource consent application made to the council and allows the decision-maker(s) to consider the report at the hearing. Section 41(4) of the RMA allows the decision-maker(s) to request and receive from any person who makes a report under Section 42A *"any information or advice that is relevant and reasonably necessary to determine the application"*.
7. This report is supplementary to the Section 42A Report prepared by the CRC officer, Olivia Murray, for the above resource consent applications. Full details of the consent applications are provided in that report.
8. To carry out this audit of the consent applications, I have:
 - a. Considered the relevant sections of the assessment of effects on the environment (AEE) submitted by the applicant, including its technical appendices. I have also reviewed further information that was provided by the applicant:
 - i. A memorandum titled S92 *ECan RFI Response*. Dated 23/10/2024 from CCC.
 - ii. A report titled Application s92 Response to Questions 2 and 4a November 2024 Assessment of future levels attachment B N.

- iii. A memorandum titled - *Application s92 partial Response to questions 1 3 and 5* email dated October 2024 (C25C/87134).
- iv. The revised proposed conditions (C25C/255443).
- b. Attended a site visit to the area of proposed the works on 16 July 2025.
- c. Taken into account relevant issues raised by submitters in relation to the effects I have considered in this report.

Assessment of Receiving Environment

9. CCC is applying for consents to carry out Coastal Erosion and Protection related earthworks along the western edge of the SouthShore Spit (the Spit) and South New Brighton Park (SNBP) area (the Site), along the shore of the Estuary of the Heathcote and Avon Rivers / Ihutai (the Estuary).
10. Groundwater occurrence
 - a. The site overlies the Christchurch Confined Aquifer System. The AEE (page 103 states "Aquifer 1 sits at a depth of 141 m at the nearest measuring bore log for aquifer testing on Estuary Road (BX24/1210)." I disagree with this assessment of depth to Aquifer 1. The shallowest of the named aquifers in the area are the Riccarton Gravels, and this is found approximately 32.9 m below ground level in the area (according to the bore log of M35/1971).
 - b. Shallow groundwater is also observed in the sand dune deposits and the underlying Christchurch formation silts and sands as evidenced by groundwater readings in the shallow beach-derived sand sediments underlying the area (i.e. bore logs from wells and geotechnical investigations less than 20 metres depth) (Figure 1 **Error! Reference source not found.**).
 - c. This shallow groundwater is known to and has been referenced by the CCC in a recent factsheet for the area named the *SOUTH NEW BRIGHTON AND SOUTHSORE FACT SHEET GROUNDWATER ISSUES* (CCC, 2025)
 - d. The source of this shallow groundwater is likely to be a mixture of infiltrating rainfall, estuarine and coastal origin in the area around the site along the area of works.
11. Depth to groundwater
 - a. The applicant has assessed the depth of groundwater to be 0-2 m below ground level across the site (section 3.4.7 of the AEE), and I agree with this assessment. Groundwater is observed in shallow wells and is often less than 1 metre below groundwater across the area of proposed works (Figure 2 Figure 3). The shallow CCC monitoring wells in the area show groundwater is consistently shallow and shows a tidal effect. This indicates the groundwater levels are hydraulically connected the nearby water levels in the estuary and the coast.
 - b. The AEE also states in section 3.4. 7 that water table is the coastal confined gravel aquifer. I disagree with this statement as the coastal confined gravel aquifer (Aquifer 1) is confined in the area, and water levels recorded in a confined aquifer are under pressure, with levels recorded classified as a piezometric/potentiometric level. Water tables occur in unconfined aquifers and are at atmospheric pressure, and the two aquifer levels do not typically coincide in the same location (Fetter, 2001; Freeze & Cherry, 1979).

12. The groundwater system has not been further detailed by the applicant in the AEE or supplementary documents, with little interpretation of the groundwater flow direction, quality, or the shallow groundwater system in general. This is important to understand as the groundwater in the area is dynamic, with flow direction and water level often changing with the tidal effects associated with the Avon-Heathcote Estuary and/or the coast.
13. The following is my further analysis of the groundwater in the area for these above-mentioned aspects and potential effects of the proposed activity on the underlying groundwater and its interaction with the nearby Avon Heathcote estuary.
14. Groundwater flow
 - a. There are three nearby shallow wells with consecutive water levels that can be correlated for triangulation (interpolation) of water levels (with difficulty due to the relatively linear alignment of the wells), BX24/1885 (7.49m deep), BX24/2427 (6.16m deep) and BX24/2632 (6.06 m deep). These are CCC shallow groundwater monitoring wells, all with continuous water level readings from September 2016 until August 2024 in the CRC database. The water levels in these wells show good correlation over time, with some localised variation. The water levels can be converted to the water level relative to metres above average sea level (masl) or RL (relative level).
15. Tidal Effect and groundwater level variations
 - a. The tidal effects seen in the shallow monitoring wells is varied compared to the estuary, the coast and nearby wells screened in the underlying confined Riccarton Gravels (such as M35/7753), which show a clear tidal effect of 0.8 to 1 metre in the lunar tide cycles and higher and lower levels during spring and neap tides. The shallow groundwater recorded in the triangulation wells shows mostly a spring and neap tide effect and only a minor (1-2 centimetre) potential lunar tidal effect. This is likely due to the lower hydraulic conductivity of the shallow groundwaters aquifer and higher elevation as compared to the Riccarton Gravels (Figure 4).
 - b. When plotting the water level records for the selected interpolation wells, there are consecutive low and high groundwater levels recorded in the area. Interpolating these levels is used to assess groundwater level changes across the area over time, and to show the potential shallow groundwater flow direction in the area.
 - c. Plotting the groundwater levels from the interpolation wells, the water levels of the Avon River as it enters the estuary and the nearest NIWA Virtual Climate Data Station rainfall, there appears to be several influences on groundwater level. This includes local rainfall, rainfall in the upper catchments of the Avon River and the tidal effects. Overall, the shallow groundwater levels in Southshore appear to relate to the Estuary water level, while short term spikes in water level are observed following rainfall events of sufficient magnitude for recharge (Figure 5).
 - d. Prominent low groundwater levels are seen recently in the summer of 2024, and December 2017 (Figure 6: Groundwater levels for the selected triangulation wells from 2020-2025. Note the relative correlation of the water levels, the short-term tidal effects and the potential localised level effects at certain times. The water level data used to infer the typical high and low water levels in the area and to compare with the tidal data is shaded in grey. In periods where BX24/1885 (red) are higher than BX24/2632 (blue), groundwater will likely be flowing towards the estuary. Figure 6). As for an example of the high groundwater levels in the area, sustained high groundwater levels were seen in the winter of 2019, and they're that I will use these to assess the potential variability of the groundwater depth and

flow direction across the site. The dates and times used for representative low and high groundwater levels will be:

- i. Summer 2017 = 2017-12-01 12:00:00
- ii. Winter 2019 = 2019-08-01 11:55:00

- e. Using the lowest groundwater levels in this period (Summer 2017), triangulating the water levels from these three wells shows the groundwater is likely flowing from the estuary to the coastal side off the spit (Figure 7).
- f. Alternatively, plotting the high groundwater levels from the winter 2019 groundwater levels, we see a reversal of flow, with higher readings at well BX24/1885 than BX24/2632, the groundwater is flowing in a north westerly direction, from near the middle of the spit to towards the estuary (Figure 8).

16. Groundwater quality

- a. The shallow groundwater quality in the proposed area of works is likely to be influenced by the coastal environment, leading it be brackish and non-potable in relation to the drinking water standards. This is supported by nearby shallow wells near the coast such as M36/5385 (6m deep, Ferrymead), and M35/5890 (5m deep, Burwood) which show elevated chloride and conductivity values in water samples over their sampling history (Figure 9Figure 10).
- b. During times of high rainfall, the groundwater is recharged by the infiltrating rainwater, which will be significantly lower salinity compared to the brackish waters of the estuary.

17. Groundwater users

- a. There are six active drinking water wells in the area, with known depths ranging from 49 to 147 metres deep, with three of the wells having no depth values associated with them. Additionally, the wider area is supplied by reticulated drinking water, so the purpose of these wells with unknown depth and other details is not known and are likely not being used. But if the wells are potable and productive, then they are most likely deeper than 30m and screened within the deeper aquifer units in the area. Therefore, due to the depth of these wells and the confining layers above them, I have no concern for the potential effects of this application to affect the drinking water quality in the area.

Assessment of Effects on the Environment

- 18. The shallow groundwater may be a pathway of contamination to the estuary and could transport sediments and/or other contaminants if they infiltrate to it. Therefore, appropriate erosion and sediment control methods and procedures for working with contaminated land should be followed in a way to mitigate against groundwater contamination.
- 19. This effect may be more prevalent at the estuary edge, with estuary water flowing under the area of proposed works towards the centre of the spit during high tides and/or low groundwater level or flowing from the centre of the spit towards the estuary in times of higher groundwater levels and/or lower tide heights.
- 20. The effects of the proposed earthworks such as excavation and deposition that lead to disturbance of the land surface could mobilise contaminants to the shallow underlying

groundwater such as the observed heavy metals and likely hydrocarbons such as coal tar (as discussed in C25C/87134). I have concern regarding the proposal to drain construction related stormwater to land, as any potential contaminants either pre-existing in the soil to be disturbed or spilled onto the land during the earthworks could flow to the groundwater via this drainage. As seen in the shallow groundwater level readings, rainfall induced recharge to the groundwater occurs in the area, and when this occurs, the groundwater tends to flow towards the estuary. This means that the groundwater will be shallower during and following significant rainfall and likely act as a pathway from the area of earthworks to the estuary. However, if these are identified and suitably removed as per the revised conditions (condition 23), then I have low concern here.

21. Groundwater levels are also likely elevated following rainfall events in the area, and this may lead to issues for drainage capabilities as the groundwater can be within 1 metre of the land surface, in relatively low permeability soils and sediments (fine to medium sands). It is unclear with the provided evidence that this will not lead to mounding or ponding in the area. This may lead to increased potential localised flooding during high rainfall events.

Conclusions and Recommendations

22. As construction phase stormwater is proposed to be drained to land, this poses a risk of mounding and flooding, as well as adding concentrated drainage water to a particular area, which would exacerbate the potential for contaminants to be carried to the groundwater, which could then be a pathway for these contaminants to enter the estuary.
23. Therefore, proper adherence to effective and robust erosion and stormwater management plans should be followed. Including containment of any spills and the effective removal of any potential contaminants in the soils in the area of the proposed works, as per the revised proposed condition 23.

References

24. CCC. (2025). *SOUTH NEW BRIGHTON AND SOUTHSORE FACT SHEET
GROUNDWATER ISSUES.*
<https://ccc.govt.nz/assets/Documents/Environment/Coast/Factsheets/FACT-SHEET-Groundwater.pdf>
25. Fetter, C. W. (2001). *Applied hydrogeology* (4th ed.). Pearson Education.
26. Freeze, R. A., & Cherry, J. A. (1979). *Groundwater*. Prentice-Hall.

Attachments

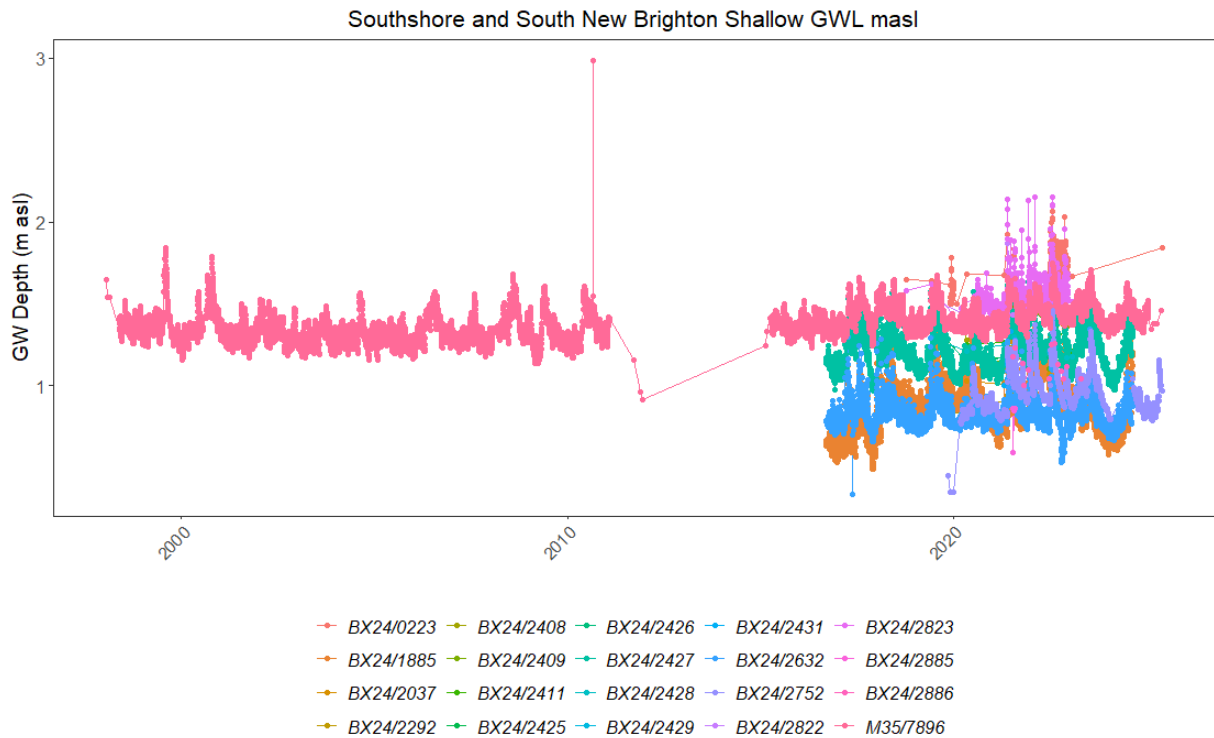


Figure 1 Plot of all shallow (less the 20m) groundwater level readings in the SNBP and Southbridge area in metres above sea level.



Figure 2: Map of the South New Brighton Park and Southshore area showing shallow (less than 10m) deep wells highest groundwater levels (from ground level) and the approximated area of proposed works. Note the very shallow groundwater levels across the area especially in the low-lying areas near the shoreline of the Avon-Heathcote Estuary, and the lack of shallow groundwater readings near the SNBP.



Figure 3. Map of the South Brighton Park area showing groundwater wells and wells classed by reading count. Note the lack of shallow continuous groundwater level wells around the park site, with most readings limited to periodic or the initial (Static) water level in the well when drilled (SWL). Many of the shallow SWL readings show the groundwater as less than 1m below ground level, with the shallowest showing 0.13m below ground level at well BX24/2292 towards the south of the map.

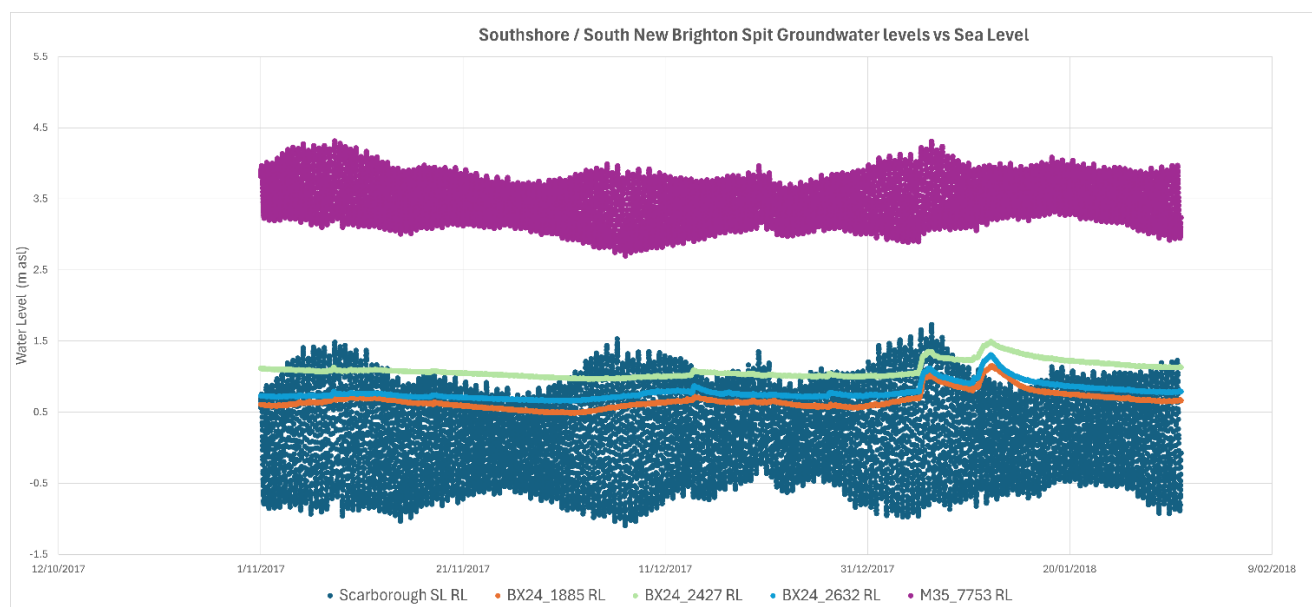


Figure 4: Plot of the three triangulation wells, a nearby monitoring well in the Riccarton Gravels Aquifer (M35/7753), and the nearest sea level monitoring site (Scarborough) displaying short and long term tidal effects on the groundwater, as shown in metres above mean sea level.

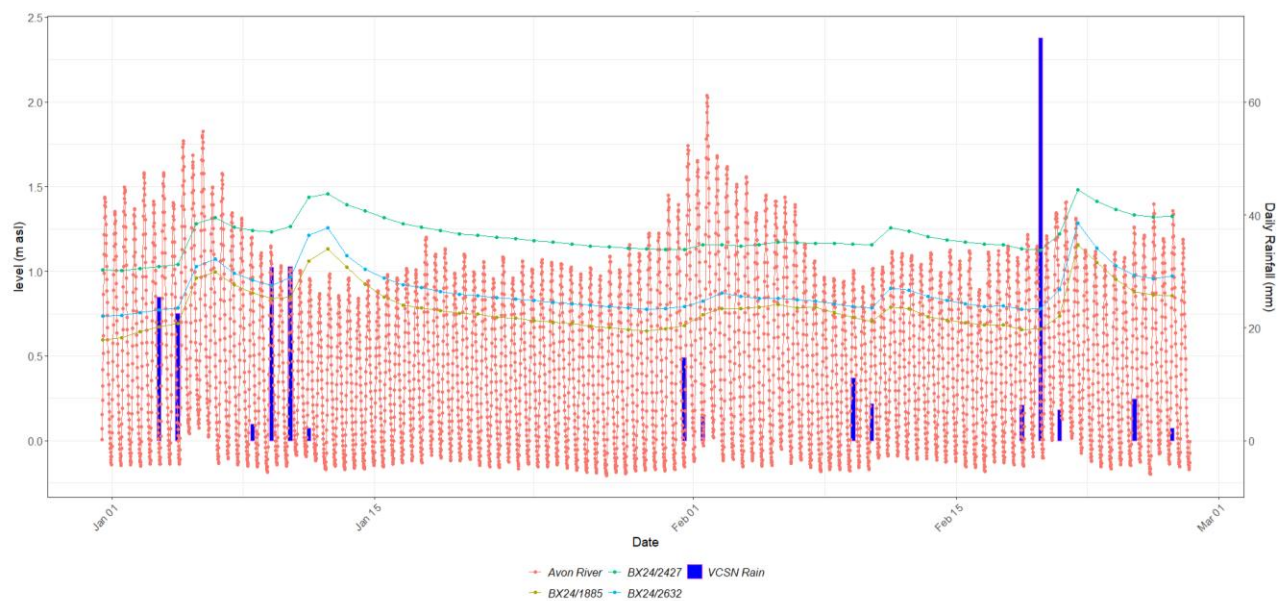


Figure 5: The Summer 2018 Southshore groundwater levels compared with the estuary water levels (at Avon River @ Bridge St site) and rainfall levels. The groundwater levels appear to be influenced by both the estuary levels and the larger rainfall events.

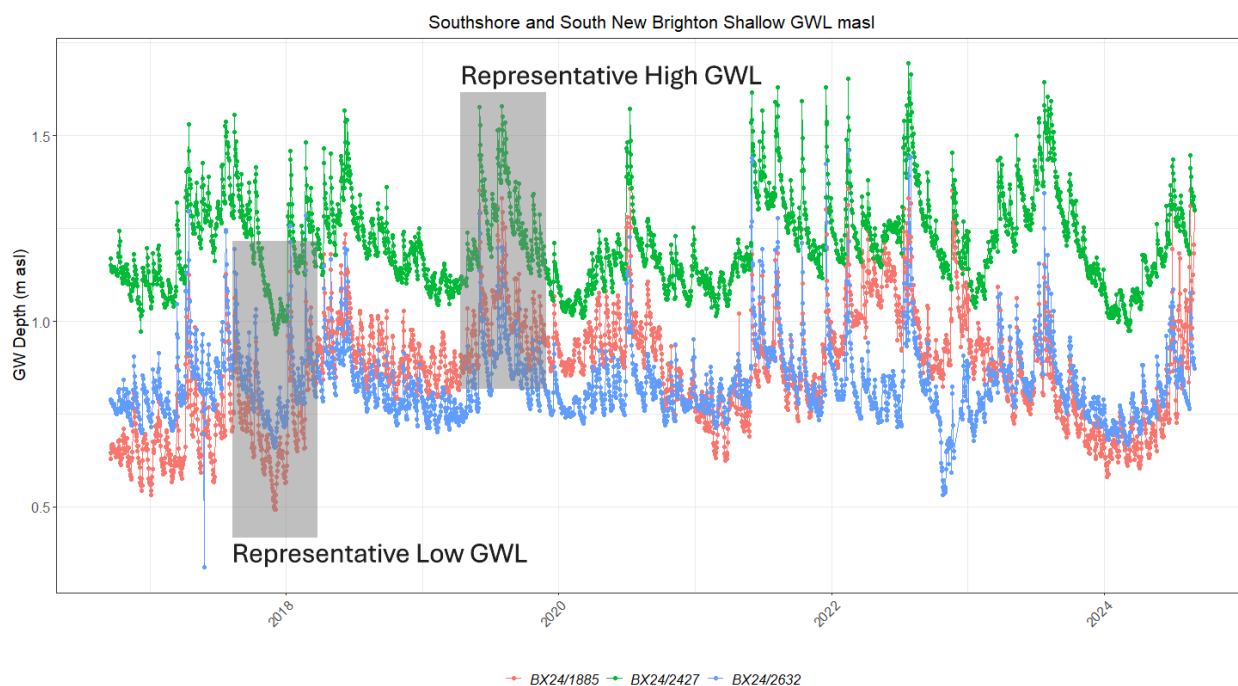


Figure 6: Groundwater levels for the selected triangulation wells from 2020-2025. Note the relative correlation of the water levels, the short-term tidal effects and the potential localised level effects at certain times. The water level data used to infer the typical high and low water levels in the area and to compare with the tidal data is shaded in grey. In periods where BX24/1885 (red) are higher than BX24/2632 (blue), groundwater will likely be flowing towards the estuary.



Figure 7: Map of the interpolated lowest groundwater levels (masl) during the representative low groundwater period in summer 2017-18. Note the groundwater flow direction being to the east, moving away from the estuary, which is likely contributing to the groundwater. The steeper gradient of the water levels shows a higher flow rate for the shallow groundwater.



Figure 8: Map of the interpolated highest groundwater level (masl) from the selected shallow triangulating wells, during the representative high groundwater period in the winter of 2019. Note that the flow direction differs from the low groundwater period, with the groundwater flowing to Northwest and likely flowing to the estuary.

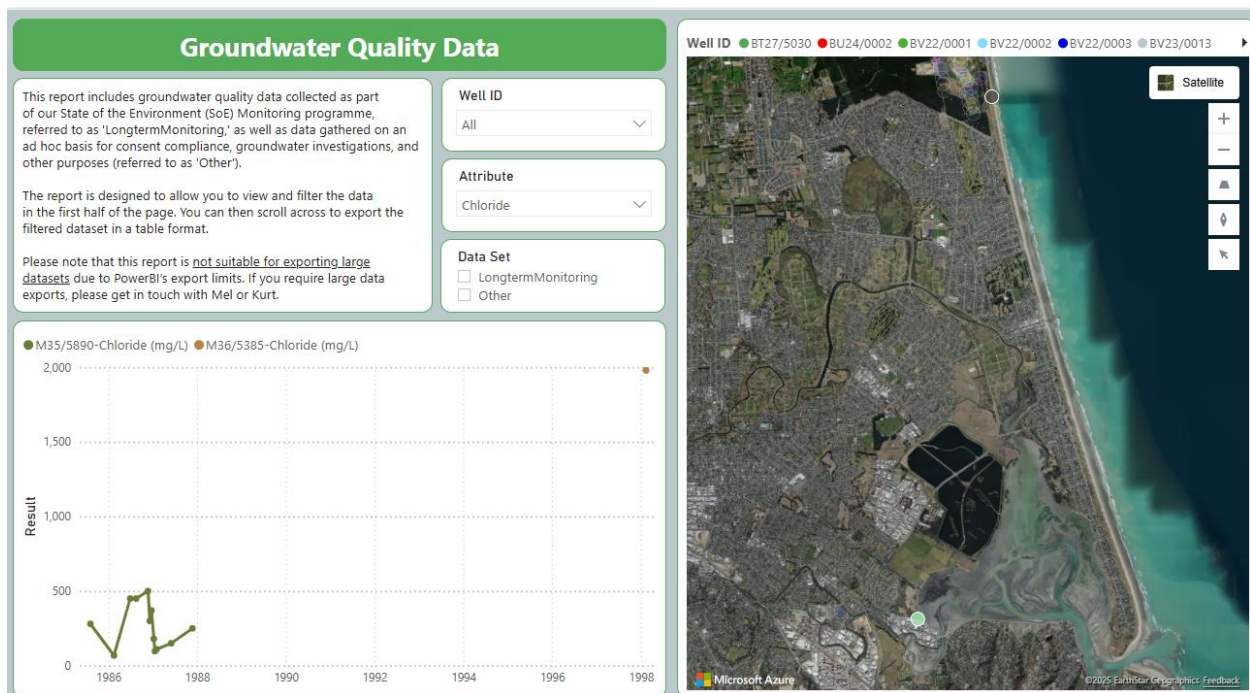


Figure 9: Shallow groundwater Chloride (mg/L) values at wells M35/5890 and M36/5385.

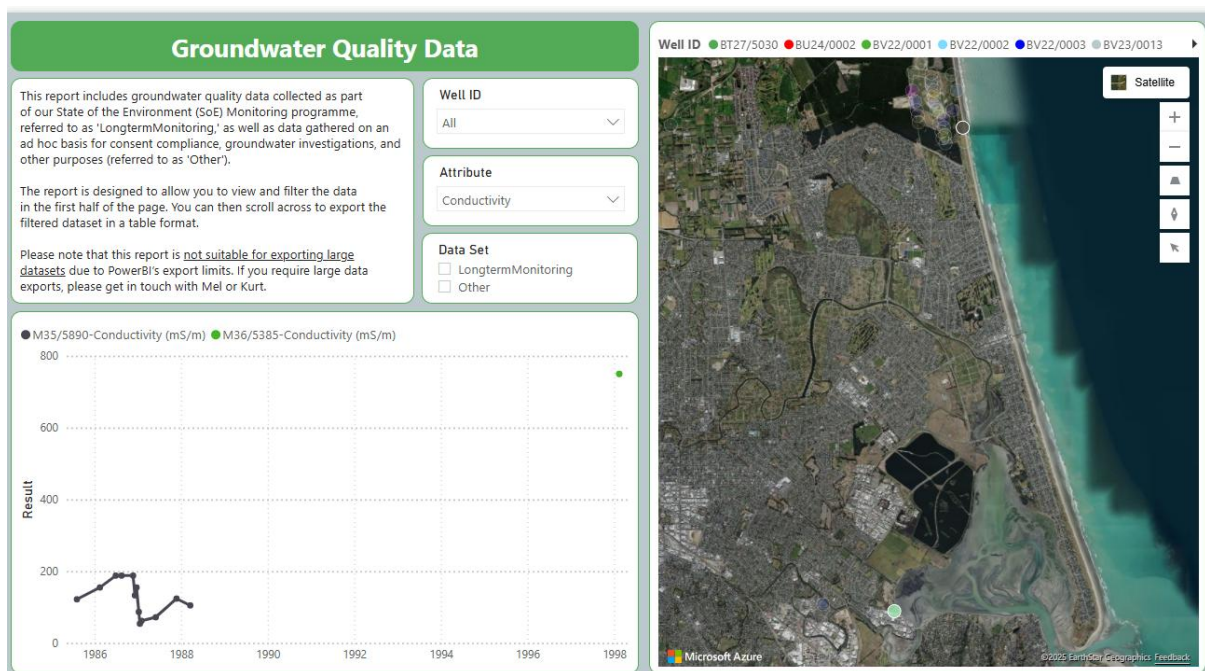


Figure 10: Shallow groundwater Conductivity (MS/m) values at wells M35/5890 and M36/5385.