What's Coming Out of Tile Drains?

Six months of monitoring complete

Six months of tile drain monitoring throughout spring and summer is now complete in the SFFF "What's Coming Out of Tile Drains?" project, led by AgFirst. As to be expected, our results have brought up as many questions as answers. Despite being too early for specific nutrient analysis, we have been working on understanding tile flows and their relationship with rainfall, during an uncharacteristically wet spring and summer.

During this six- month period we have completed 15 fortnightly base runs. Nine event runs have also been completed, triggered by a 15mm rainfall event. Tile flow rates are recorded, and water samples undergo field and lab testing to record water quality factors and nutrient data.

As was highlighted in a previous article, we continue to find that no two tiles are equal. Often, there is a difference in flow behaviour between the two tiles at a single site. At some sites we have not recorded any flow to date. This leads to further questions, around the hydrology of the subsurface water system, and the timing and rate of drainage following rainfall events.

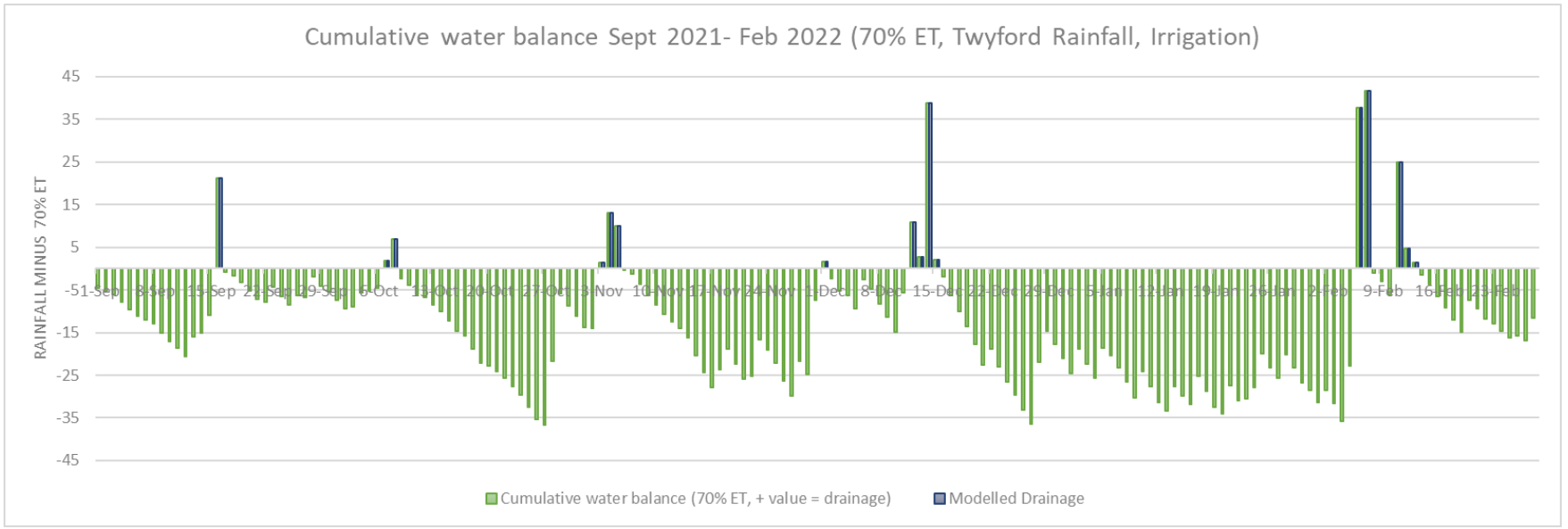
Rainfall and water balance

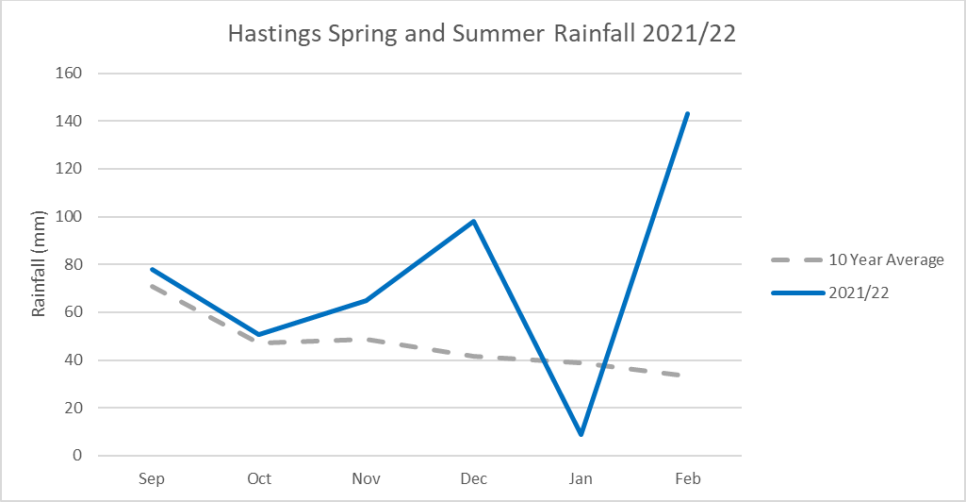
Monitoring began on 1st September 2021, following two particularly dry summers. Rainfall in 2021 from January to September had been lower than average.

However, a wet spring followed, with an average total rainfall across sites of 193mm (1st September to 30th November). This is compared to the 10 year average of 166mm of spring rainfall. Summer was also rather wet, with an average total summer rainfall being 250mm to the 28th February, over double the 10 year average of 103mm. This higher than average rainfall has presented a challenge, creating unreadable submerged tiles. In high flow events where the receiving water submerges the tile exit, no tile flow can be sampled. We are in the process of working to improve our current sampling methodology so that in these events, tile flow data can be captured. The proposed year two sampling method will help to alleviate this. Tiles will be fitted with flow meters and proportional samplers, above the tile exit into the receiving water. In this way, high flow events will not affect the ability to take a sample.

The cumulative water balance using daily rainfall, irrigation applied and 70% evapotranspiration of an individual site, shows there were seven modelled drainage events during the six-month monitoring period. All of these were captured by sampling runs, and some of the larger ones occurred over multiple days. The rainfall event over Waitangi weekend resulted in the soil moisture at this site to get topped up from the cumulative water balance deficit of -35.73mm on 4th February, back up to 41.75mm on 7th February. This resulted in the largest modelled drainage event at this site since monitoring began.

Across the project, this Waitangi weekend rainfall resulted in three more monitored tiles flowing than had been earlier in the summer. The rainfall on the 11th February, resulted in a further modelled drainage event of 25.5mm at this site, as well as triggering one extra monitored tile to flow.





Figures: (1) cumulative water balance at an individual monitoring site, and (2) 2021/22 spring and summer rainfall for Hastings

Tile Behaviours to date

Despite the high rainfall during spring and summer, of the 34 tiles across 17 sites monitored,

- 13 tiles have been dry or recorded only one flow event during our sampling run (38%)
- 10 tiles can be characterised by spring flow but summer dry (29%)
- and 5 tiles are only showing flow following a rainfall event of over 15mm (15%)
- During the last six months, 6 tiles have regular continuous flow recorded (18%)

Recording dry tile occurrences is important data collection, as if there is no flow, those tiles are not contributing any nutrient load to the receiving water body at that point in time.

Nutrient Measurement Results

Conclusive comments around the nutrient analysis at this stage would be premature, as we need to identify and understand results through time and over multiple years.

We do not have reference base levels for nutrients at any given time, to compare our grab sample data too. We also do not know how the contribution of natural nutrient sources may affect levels found in samples.

Additionally, the background story of each tile is also important to understand any output results.

- What is the current land use?
- How long the site has had that land use?
- What are the specific soil types that feed the tile?
- What is the water source that feeds the tile (rainfall / ground water / spring fed)?
- If the water source is not just rainfall, where is the water coming from and what is the status of it as it enters the tile?
- Does the source water vary throughout the season?
- What grower management practices influence the output results? Do these align with times of heightened environmental risk?

The ongoing autumn and winter monitoring periods will provide valuable insights into our monitored tile behaviours during a period where continual drainage events are common and expected.

Take home messages to date

- Tile drainage systems within horticultural production systems are highly varied in their output of water into receiving water ways and should not all be treated as equals.
- Of our monitored tiles, 38% have run only once in the first six months, and 18% of tiles have had regular continuous flow over the same time period.
- Another year of monitoring is needed to understand what happens through seasonal time changes and during specific rainfall events.