

Councillor Advice

Conceptual Stormwater Management System

**14 Claret Ash Avenue,
South Bowenfels NSW 2790**

AUTHOR: Director Infrastructure and Project Delivery

TO: All Councillors

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Claret Ash Avenue Subdivision – Conceptual Stormwater Management Plan

1. Summary

Council's Director Infrastructure and Economy and other Council staff have reviewed the Conceptual Stormwater Management Plan for the future residential subdivision located at 14 Claret Ash Avenue, South Bowenfels NSW 2790 (Lot 1, DP 933666), authored by Calare Civil P/L for Ledger Enterprises P/L.

The report suggests that there will be a marked reduction in stormwater flow rates at the outlet of the western catchment detention basin, post development. This will result in reduced ponding at the inlet of the existing pipe that carries stormwater under the Great Western Highway.

The report is based on good data, industry best practice methodology and sound assumptions. It is recommended that Council accept the findings of the report.

2. Purpose of a Stormwater Management Plan

A stormwater management plan (SWMP) is a comprehensive plan that outlines strategies for managing, treating, and directing stormwater runoff in an urban area. The goal of an SWMP is to minimise the adverse impacts of stormwater on the environment and local communities, while also protecting public health and safety. An effective stormwater management plan can help to maintain or improve water quality, reduce erosion and sedimentation, protect public health, and enhance the overall health of aquatic ecosystems.

The Stormwater Management Plan typically includes measures such as:

- Best management practices (BMPs) for reducing pollutants in stormwater runoff
- Techniques for capturing and treating stormwater runoff before it enters local water bodies
- Measures for reducing the risk of flooding and minimizing flood damage
- Strategies for preserving and restoring natural drainage patterns and ecosystems
- Efforts to promote public awareness and involvement in stormwater management.

A key component of a SWMP is a Flood Analysis Report. A Flood Analysis Report identifies:

- Identifies the site to be subject to analysis
- Explains the methodology used to measure stormwater impact, and the documents referenced to achieve this outcome
- Determines stormwater velocity in a range of storm events
- Explains the impact of stormwater flow with respect to detention infrastructure on the site and surrounding area, usually both pre- and post-development.
- Provides recommendations for mitigating the impact of stormwater across all catchments.
- Services as a decision-making tool for Local Government in determining development proposals.

3. Document References

The SWMP has obtained and utilised the data from Council's Flood Study Reviews, undertaken in May 2017, in the development of their pre- and post-development stormwater quantity assessments.

The author has also consolidated the results of two previous reports completed by Calare Civil which considers both the western and eastern sides of the catchment separately. These reports are dated 2020 and would still be considered contemporary.

The author has also relied on the Australian Rainfall and Runoff (AR&R) 2019 guidelines for Regional Flood Frequency and Estimation Modelling, alongside other key data sources offered by AR&R, to develop their models.

Both documents reflect the most relevant data available to inform flood impact assessments in a Lithgow context. The AR&R manuals are the industry standard which define leading practice in Australian rainfall impact assessments.

There is no cause to pursue an alternative methodology or other improvements regarding the chosen methodology to assess site specific stormwater impacts.

4. Key Assumptions

The author has made the following assumptions which has fed into the creation of their pre- and post-development flood model.

1. The pre-development model assumes a total impervious (hardstand) area of 0%.
2. The post-development model assumes a total impervious (hardstand) area of 19%, noting that most of the site will be left undeveloped due to terrain constraints.
3. For each of the building envelopes, a total imperviousness rating of 40% is assumed.
4. For the road formation, a total imperviousness rating of 100% is assumed.
5. A conservative soil type of 'light clay' has been adopted, which is a conservative assumption that assumes moderate storage.

These are reasonable assumptions.

5. Discharge Analysis

Based on the selected methodology, data and key assumptions, a model has been created to measure flow at the discharge points for both the western and eastern catchments respectively. Those discharge points are located as follows.

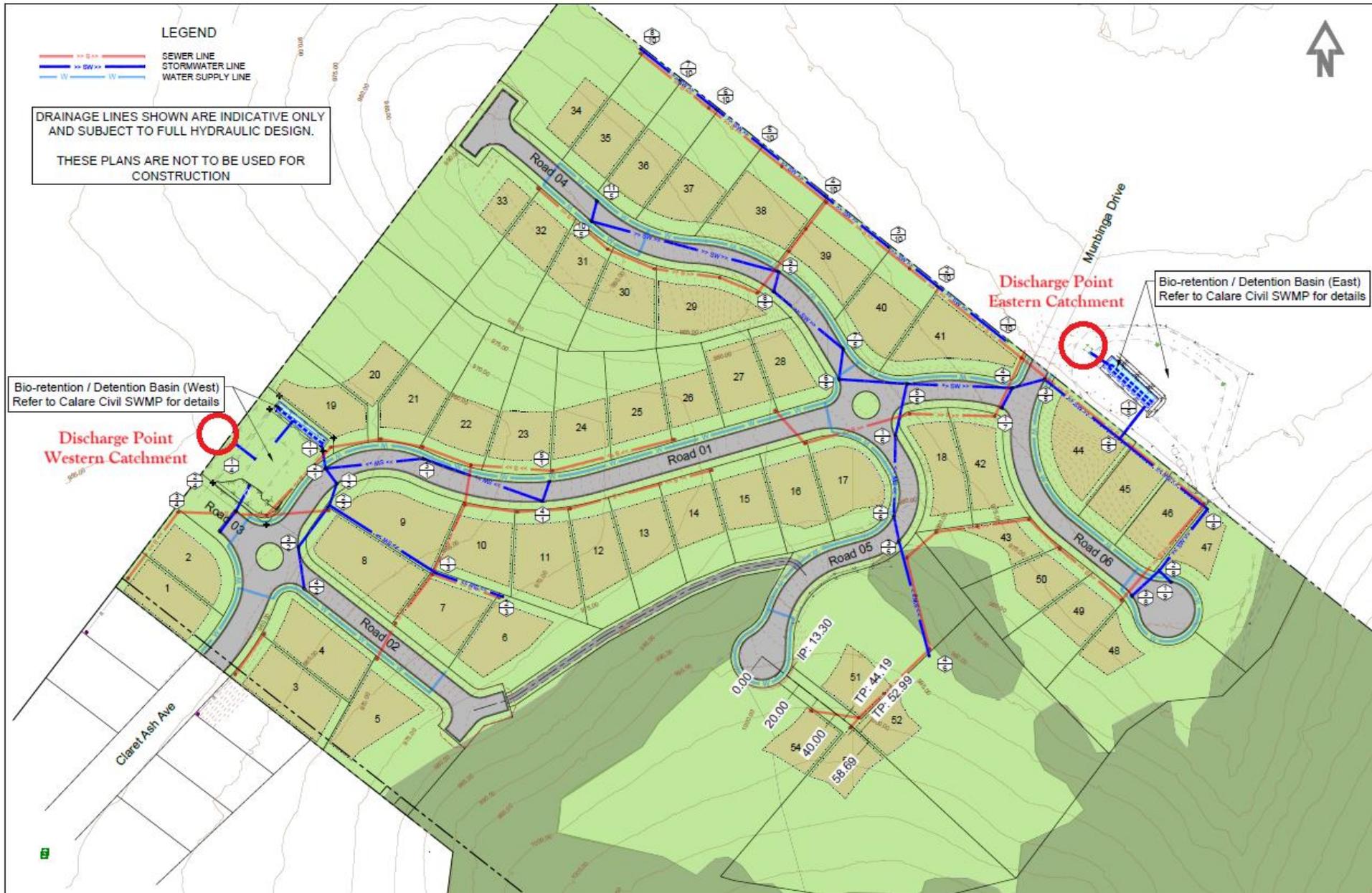


Figure 1: Discharge Point Locations

It is understood that the western discharge point is the subject of most concern by the Councillors and nearby residents. For that western discharge point, the SWMP considers flow rates for the following scenarios:

1. Pre-development, unmitigated flow (today's scenario)
2. Post-development, unmitigated flow (should the development occur with no treatment or detention mechanisms)
3. Post-development, mitigated flow (should the development occur with the treatment and detention mechanisms proposed by the development).

The model utilised has returned values for each scenario, across 1 in 5-year, 1 in 10-year, 1 in 20-year, 1 in 50-year and 1 in 100-year flood events. The model has also considered a range of rainfall durations, through to a 1 in 100-year rainfall event that occurs over a 168-hour time period. The modelling results are replicated below. All values are reported in cubic metres per second (flow rate).

Flood event	Scenario 1	Scenario 2	Scenario 3
1 in 5-year	0.189	0.338	0.074
1 in 10-year	0.271	0.420	0.077
1 in 20-year	0.321	0.506	0.082
1 in 50-year	0.344	0.627	0.090
1 in 100-year	0.401	0.715	0.095

Table 1: Comparison outlet flow rates resulting from three development scenarios.

This represents a flow rate reduction between the scenario on-site today, and the scenario that will exist once the subdivision has been completed, including all bio-retention basins. The percentage reduction at the catchment outlet (highlighted on Figure 1 above) is expected to be:

Flood event	Scenario 1	Scenario 3	Reduction
1 in 5-year	0.189	0.074	60.8%
1 in 10-year	0.271	0.077	71.6%
1 in 20-year	0.321	0.082	74.5%
1 in 50-year	0.344	0.090	73.8%
1 in 100-year	0.401	0.095	76.3%

Table 2: Percentage reduction in stormwater flow rates post-development

In summary, during the most frequent rainfall event (1 in 5-year event), flow rates at the outlet of the detention basin will be reduced by 60% compared to a pre-development scenario. During the most irregular, but highest intensity event (1 in 100-year event), flow rates at the outlet will be reduced by 76%.

It is important that this analysis consider flow rate as it is the rate of flow over a given time that determines whether the pipe that runs under the Great Western Highway will reach capacity, and the extent to which any water will pond at the inlet of the existing highway pipe before discharging towards Col Drewe Drive.

Noting that discharge flow rates are expected to dramatically decrease, so will the ponding that occurs today at the inlet of the existing 400mm stormwater pipe under the Great Western Highway.

6. Other matters relating to the Stormwater Management Plan

- The stormwater discharge model developed considers the entirety of the site, including the vegetated portions of the property upon which there is no proposed development.
- The report considers eastern catchment discharge flow rates from the eastern discharge point, demonstrating compliance with Council's Engineering Standards
- The report appropriately responds to stormwater quality concerns.
- The report considers asset maintenance responsibilities and provides a guide on an expected maintenance regime once the developer's period of responsibility lapses (12 months post-completion).

7. Proposed modifications to stormwater infrastructure to assist nearby residents

On Friday 25 July, Council's Director Infrastructure and Project Delivery met with the developer and all nearby residents to discuss their perspectives and issues as they see them. This occurred over the course of approximately two hours, commencing at 10am.

Outcomes and findings from the conversation with the developer:

- He is confident that the stormwater report accurately depicts the post-development stormwater behaviour, resulting in a reduction in peak stormwater flow rates, and thereby reduced flooding in front of the residences adjacent to the highway.
- He believes that the pipework installed by Council in the early 2000s (adjacent to the highway) isn't adequate.
- He removed the dams on his property in the early 2000s, with Council's approval.
- He notes that they Taylor's property has been saturated since at least the commencement of the period of heavy rainfall, around 2021. Since that time, the stormwater half-pipe channel has run continuously.
- He is happy to pipe stormwater flow, and install a perforated pipe, within the Taylor's property.

Outcomes and findings from conversations with the nearby residents:

- They have never felt heard regarding the issues that they face regarding stormwater.
- The pipes running under driveways, and the half-pipe channel installed by Council, is only sufficient for the smallest of flood events. They require amplification.
- The pipe under the highway is insufficient.
- We ran through the stormwater management designs produced by the developer. They are now aware that the land is being split into two catchment areas, each with their own bio-filtration and detention basins. They felt more comfortable once we worked through those plans.
- I also proposed both some short and long term initiatives which, combined with the improvements agreed with the developer, would help alleviate the impact of stormwater on all properties in the precinct.

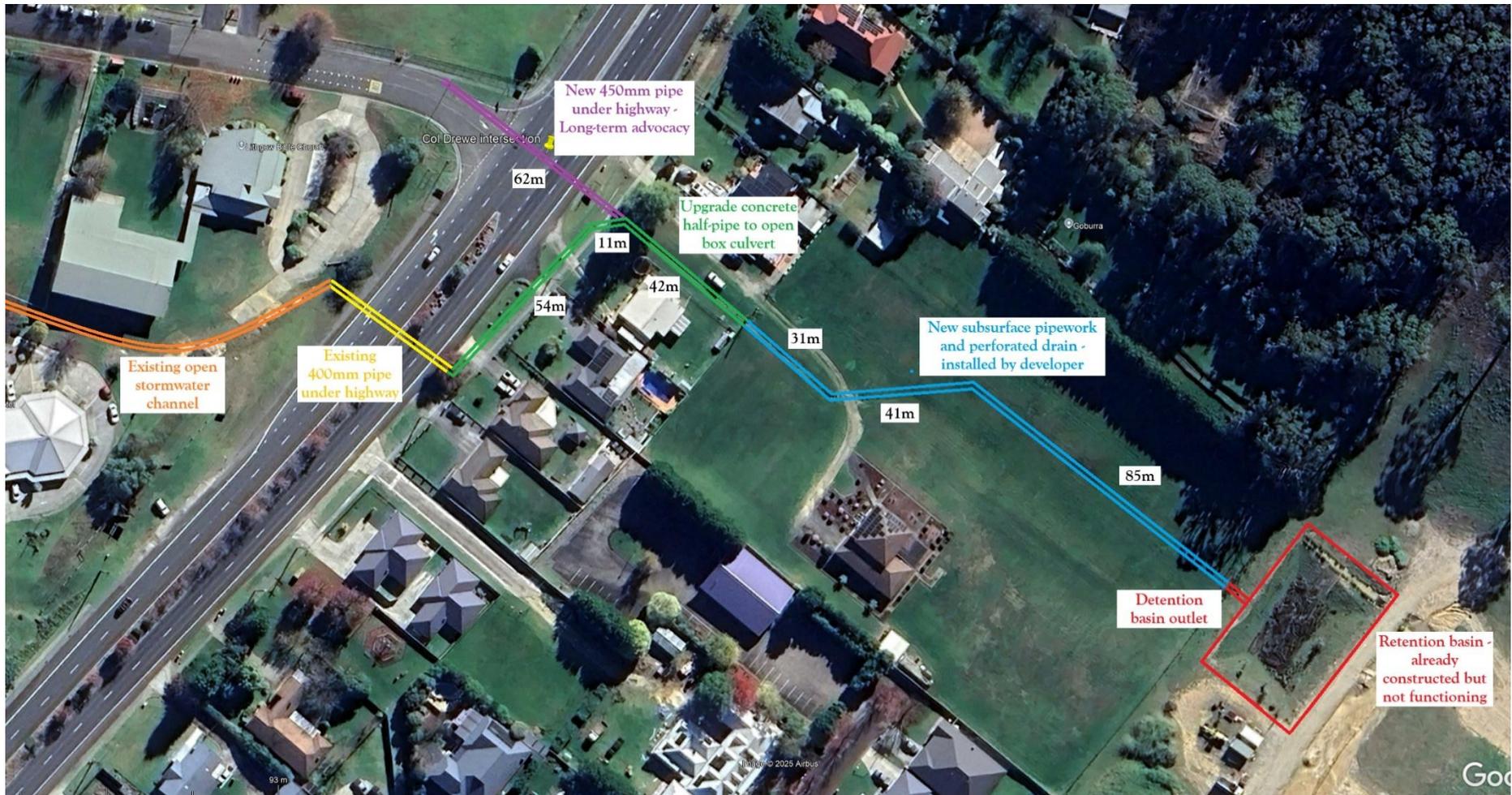


Figure 2: Proposed modifications to nearby infrastructure

The proposed modifications to nearby stormwater infrastructure is depicted in Figure 2 above, but explained below.

Blue lines

The developer has agreed to the installation of approximately 157 lineal metres of 250mm pipe (matching the outlet of the detention basin) to the northwestern boundary of the Taylor's property.

The alignment of the blue line is the wettest part of the Taylor's property. Hence, alongside the 250mm pipe, a smaller 100mm perforated pipe to be installed to catch groundwater and assist with the drying of the resident's property.

Green lines

An upgrade of the concrete half-pipes in these locations require upgrade/amplification for the full length of approximately 107 metres. They are approximately 300mm in size, a cross-sectional area of about 0.14m². It is proposed to upgrade these to something like a 1500mm x 300mm culvert, increasing the cross-sectional area to 0.45m² (3x the capacity of the current half-pipes).

It is proposed to keep these as open top culverts to ensure that we don't create capacity issues upstream. Lengths that carry stormwater underneath driveways will have an enclosed top. There are three driveways impacted.

These will then deposit into the 400mm pipe (yellow lines) that runs underneath the highway (approx. 0.5m² cross sectional area).

Purple lines

Previously, it has been suggested that the pipes under the highway (marked in yellow) require amplification. This would only serve to increase the risk of flooding around the church, Medical Centre and motel. Instead, it is proposed that Council commence advocacy to install a new pipeline under the highway as shown in purple on the map above, over a length of 62 metres.

Installation of these pipes would carry the following benefits:

- Stormwater doesn't need to change direction. The current stormwater flows quickly and creates problems at this junction.
- There is existing subsurface stormwater infrastructure underneath the northern side of Col Drewe Drive which can be connected to.
- Reduces the volume of stormwater running through the open channel shown in orange on the attached map, reducing risk of flooding and stormwater impacts to adjacent businesses.

Each of the residents of 977, 979, 981, 983 and 985 Great Western Highway have been consulted onsite and are comfortable with the proposed solution.

8. Next steps

Should the Council accept the logic of the proposed solution, staff will:

- a) Obtain quotes from local companies to construct the new culvert/channel indicated in green within Figure 2.
- b) Commence negotiation with the developer to reach an agreement regarding cost-sharing.
- c) Depending on the outcome of those negotiations, consider a funding source from the 2025/26 operational plan.
- d) Once complete, call an extra-ordinary meeting of the Infrastructure Committee to discuss and agree on a solution and funding proposal, for consideration at an Ordinary Meeting of Council.

9. Current stormwater impacts before development

To aid with Councillor understanding, the following seven figures outline Council's flood modelling data for the precinct, as it stands today in its undeveloped state. As it stands today, it is clear that 981 and 983 Great Western Highway currently suffer significant stormwater impact across a variety of flood events.

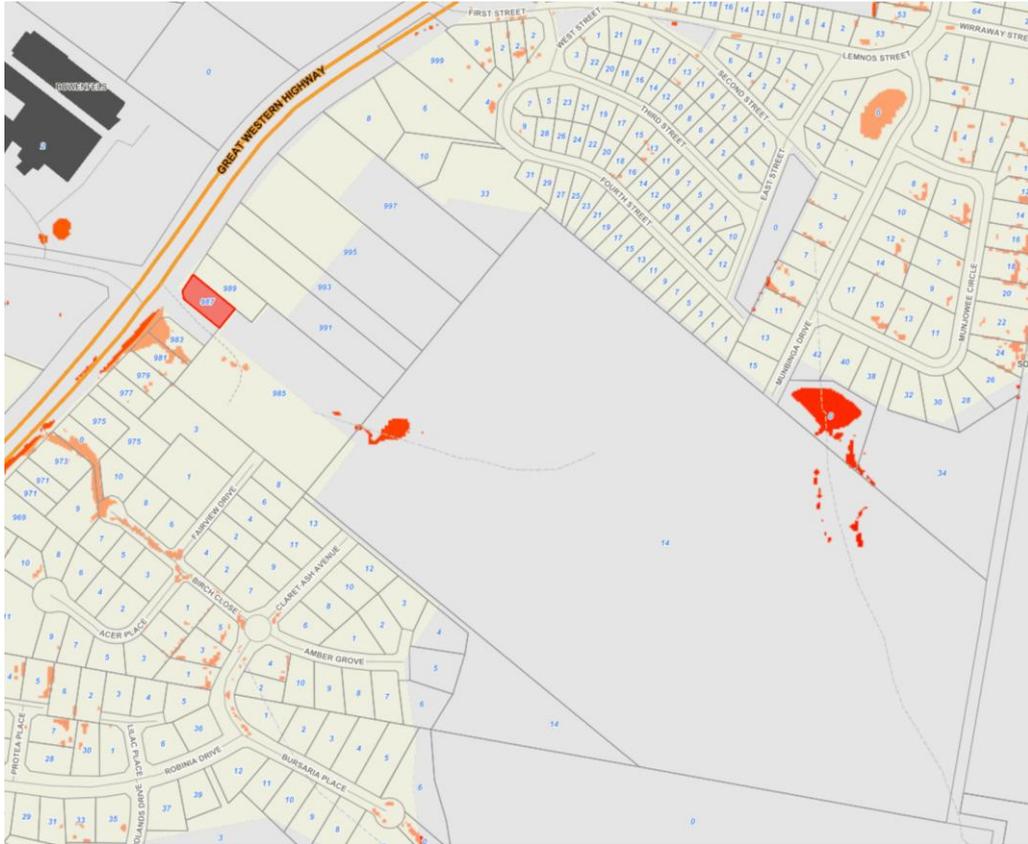


Figure 3: 1 in 5-year flood event

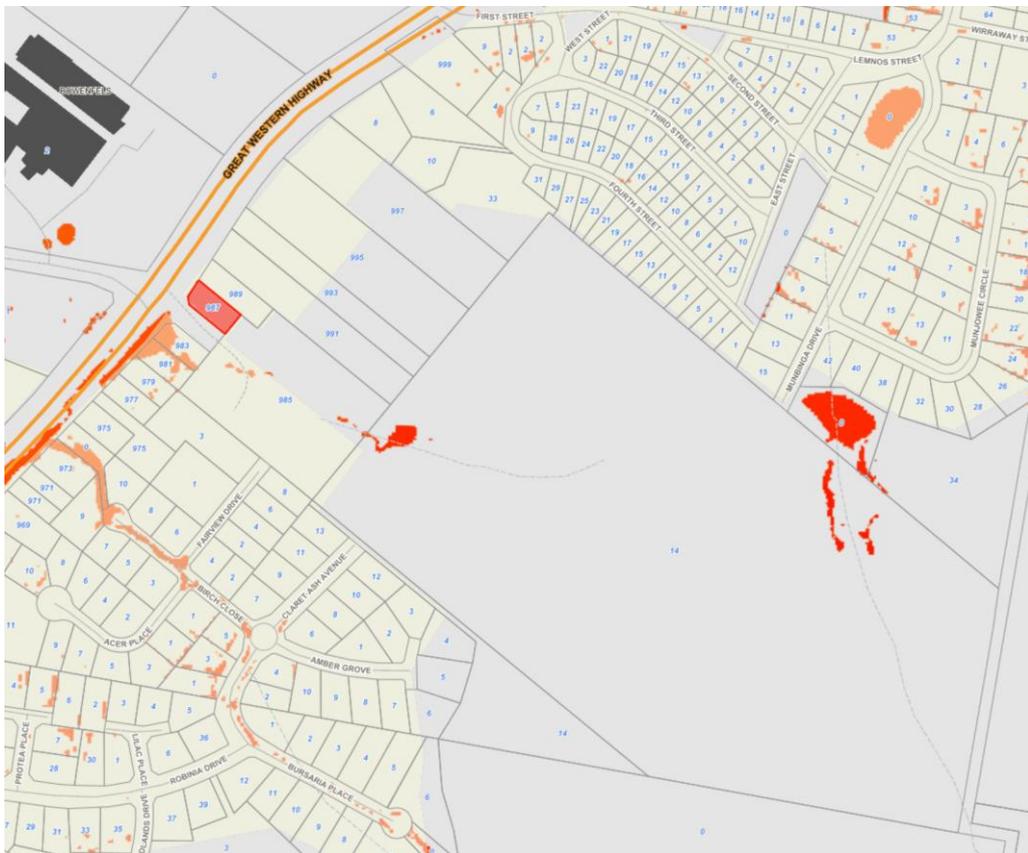


Figure 4: 1 in 10-year flood event

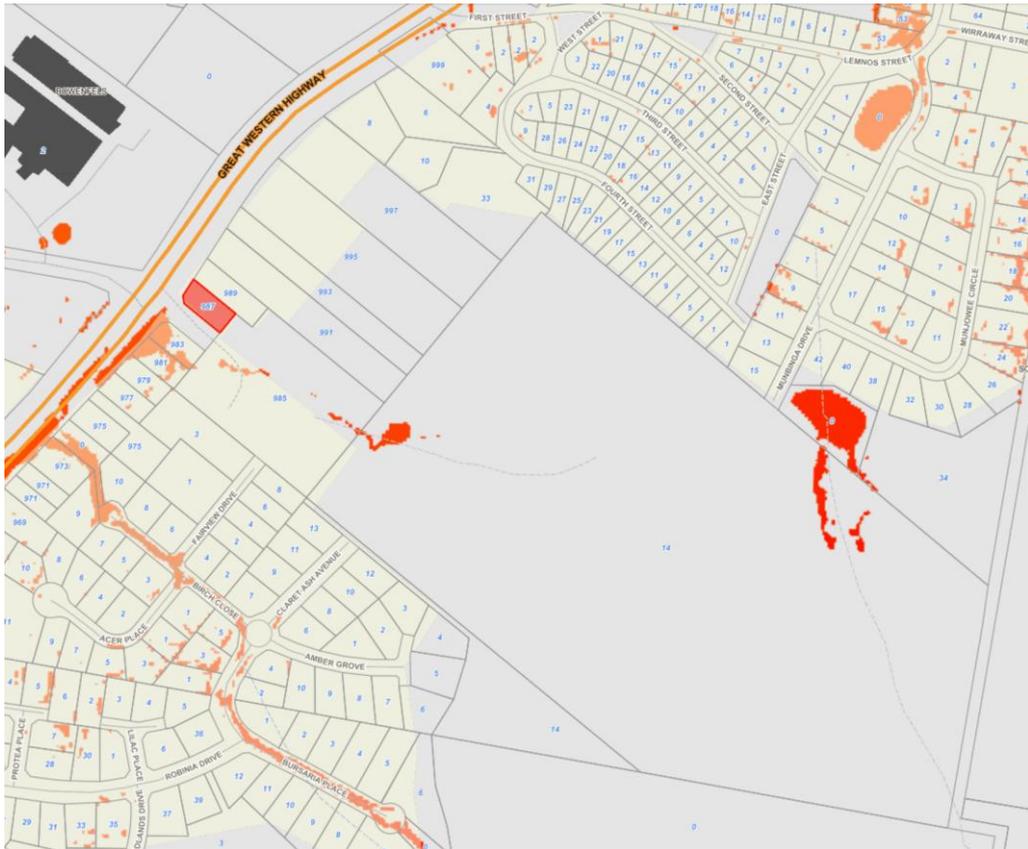


Figure 5: 1 in 50-year flood event

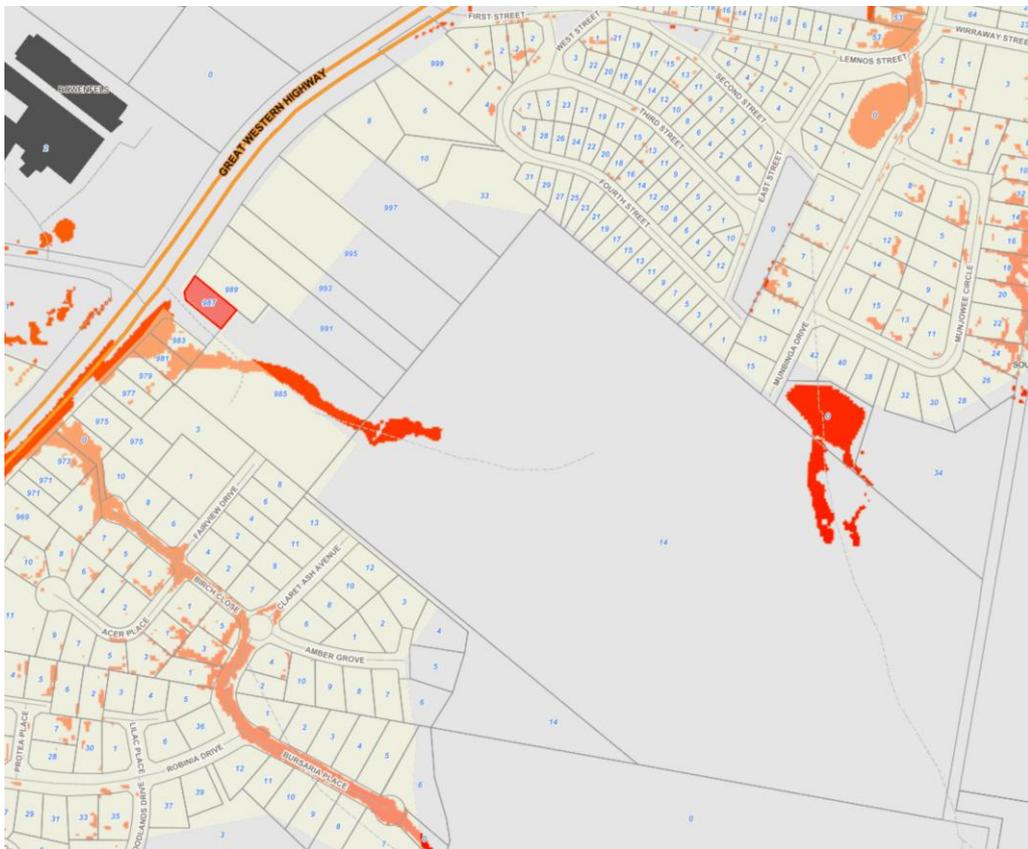


Figure 6: 1 in 100-year flood event

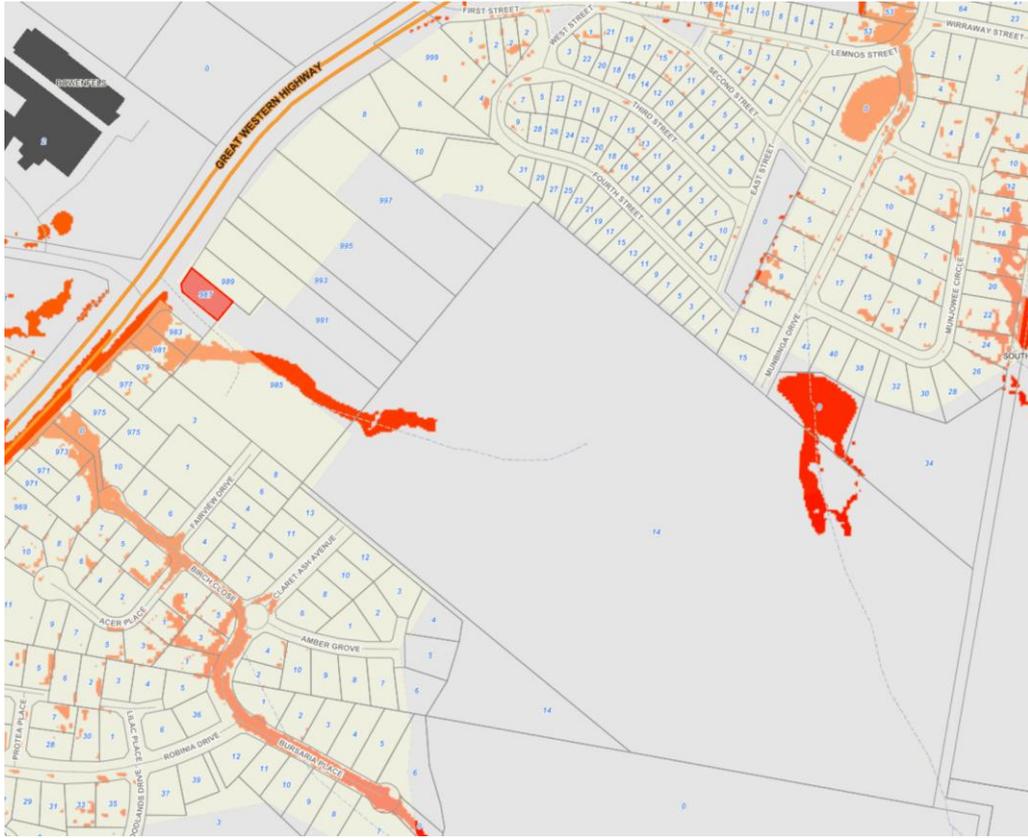


Figure 7: 1 in 200-year flood event

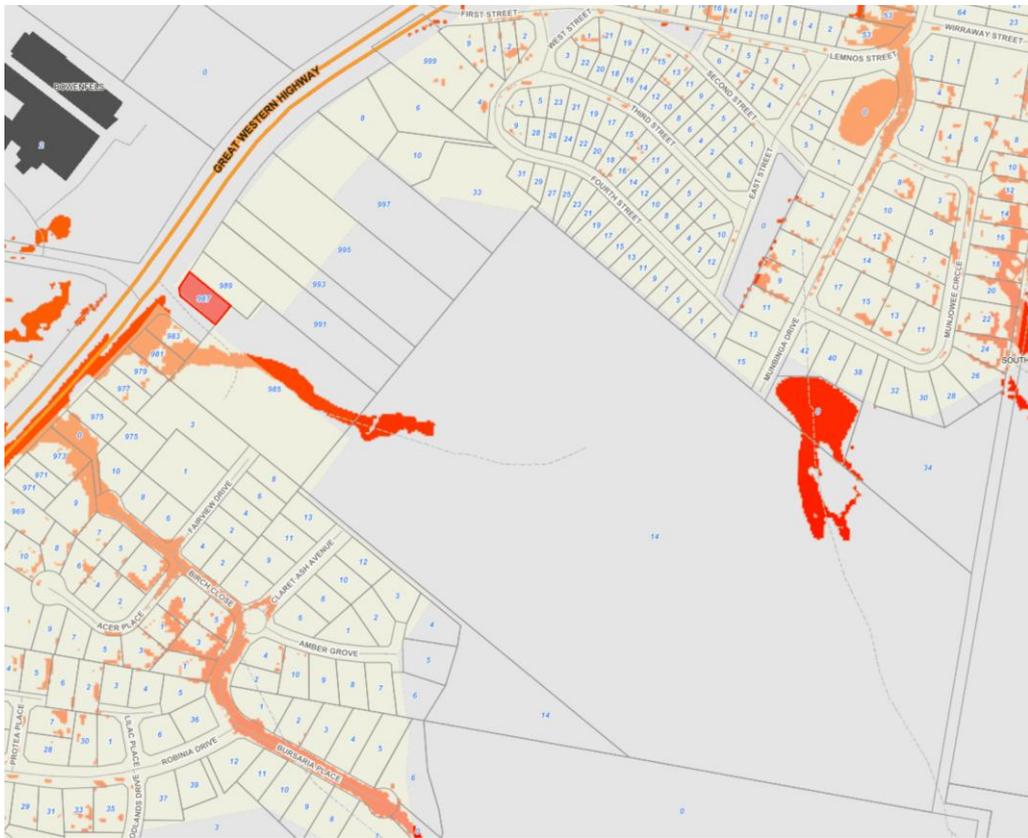


Figure 8: 1 in 500-year flood event

