

Waitākere District Court – New Courthouse Project Flood Assessment

Ministry of Justice
14 Edmonton Road
Henderson

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Ministry of Justice

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Flood Assessment

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Henderson

Document Status

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1. Introduction

This report has been prepared to support a Substantive Application made by Ministry of Justice (on behalf of the Requiring Authority - Minister of Justice) under the Fast Track Approval Acts 2024 in accordance with the requirements of Section 42. The proposal is a Referred Project and this report has been prepared to support a Notice of Requirement Application to designate the site at 14 Edmonton Road, Henderson for 'Judicial and Court purposes' known as the Waitakere District Courthouse - New Courthouse project.

Under s42(4)(d), this substantive application is giving notice of a requirement to designate the site that would otherwise be applied for under the Resource Management Act 1991. Section 43 of the Fast Track Approval Act sets out the information to be included in a substantive application, which includes an assessment of adverse effects of the project on the environment. This report has been prepared to assess the flood hazard risk on the site, and the effects of the Waitakere District Courthouse Project.

1.1 Site Description

The subject site (Lot 1 DP 564257), located to the north of the Alderman Drive and Edmonton Road intersection, has an area of 4,435 m². The site is currently used as a parking area and recreational space, and generally slopes towards the northwestern boundary at an average gradient of approximately 1.5%. The site has a gully (low point) running through the centre of the site in a north westerly direction. The site is zoned as the following under the Auckland Unitary Plan (AUP) (Operative in Part):

- Open Space - Informal Recreation Zone
- Business - Metropolitan Centre Zone

Additionally, a public 1,500 mm stormwater culvert runs centrally through the property. The culvert captures stormwater runoff from southeast of the Edmonton Road carriageway, and discharges it to the northwest of the subject property.

A GIS Layout Plans have been included in Appendix A.



Figure 1 : Existing Site Layout

2. Proposed Development - Future Justice Facility

2.1 Development Description

The Notice of Requirement application will designate the site for the construction and operation of a Justice Facility at 14 Edmonton Road, Henderson. Whilst the exact design of the Waitākere District Courthouse is not known at this stage, a future building would be built on suspended slabs, supported by piles which would be located within the 1% AEP floodplain extent. The indicative design for a future Justice Facility, provided in the bulk and location study plans prepared by Architectus, shows most of the building slab will be located above the water surface elevation (WSE) of the existing floodplain. However, the indicative sloped vehicle access along the south-east corner of the building, which connects to level 2, and indicative vehicle crossing locations on Edmonton Road, are located within the 1% AEP floodplain. The following items have been modelled within the HEC-RAS 2D model as impediments to the floodplain:

- The sloped slab is partially located within the floodplain and would therefore block flows along the eastern end of the building. The cross-sectional area of the impediment has been modelled along with the overall volume reduction within the floodplain.
- All piles for the suspended slabs have been modelled as they are located within the flood plain and would therefore impede flows.

Layout plans of the indicative building slabs and piles for the future Justice Facility have been included in Appendix B.

2.2 Options Descriptions

This report assesses two options, referred to as the *As-Lodged* indicative plan set and the *Alternative* indicative plan set that is enabled by the NoR conditions. The primary differences between the options relate to the overall building footprint, pile layout, and proposed mitigation measures, which are discussed below.

2.2.1 As-Lodged Indicative Plan Set

The following items outline the key differences of the *As-Lodged* indicative scheme compared with the *Alternative* indicative plan set:

- A larger building footprint is proposed at the north-western corner of the building relative to the *Alternative* indicative plan set.
- Construction of a 5 m wide rectangular channel is proposed along the southeastern boundary of the site to assist in directing floodwaters around the building.
- Construction of a 8 m wide trapezoidal channel through the centre of the property, including lowering the ground level by approximately 150 mm – 200 mm. This channel increases on-site storage capacity and improves conveyance of surface runoff across the site.
- The construction of a 2 m wide channel along the western boundary which expands to 5.6 m outside of the dripline of the existing street trees to increase the cross-sectional flow area along the western most corner of the site.

Figure 2 illustrates the layout of the proposed mitigation works and the associated building pile and foundation arrangement.



Figure 2 : As-Lodged Indicative Plan Layout

2.2.2 Alternative Indicative Plan Set

The following items outline the key differences of the *Alternative* indicative scheme compared with the *As-Lodged* indicative plan set:

- A smaller building footprint is proposed at the north-western corner of the building. This reduced footprint provides a greater cross-sectional area, allowing floodwaters to pass more freely.
- Regrading of the entire site is proposed to improve channelised flow of floodwaters beneath the building. Refer to the earthworks design prepared by Holmes.

Figure 3 illustrates the layout of the proposed mitigation works and the associated building pile and foundation arrangement.

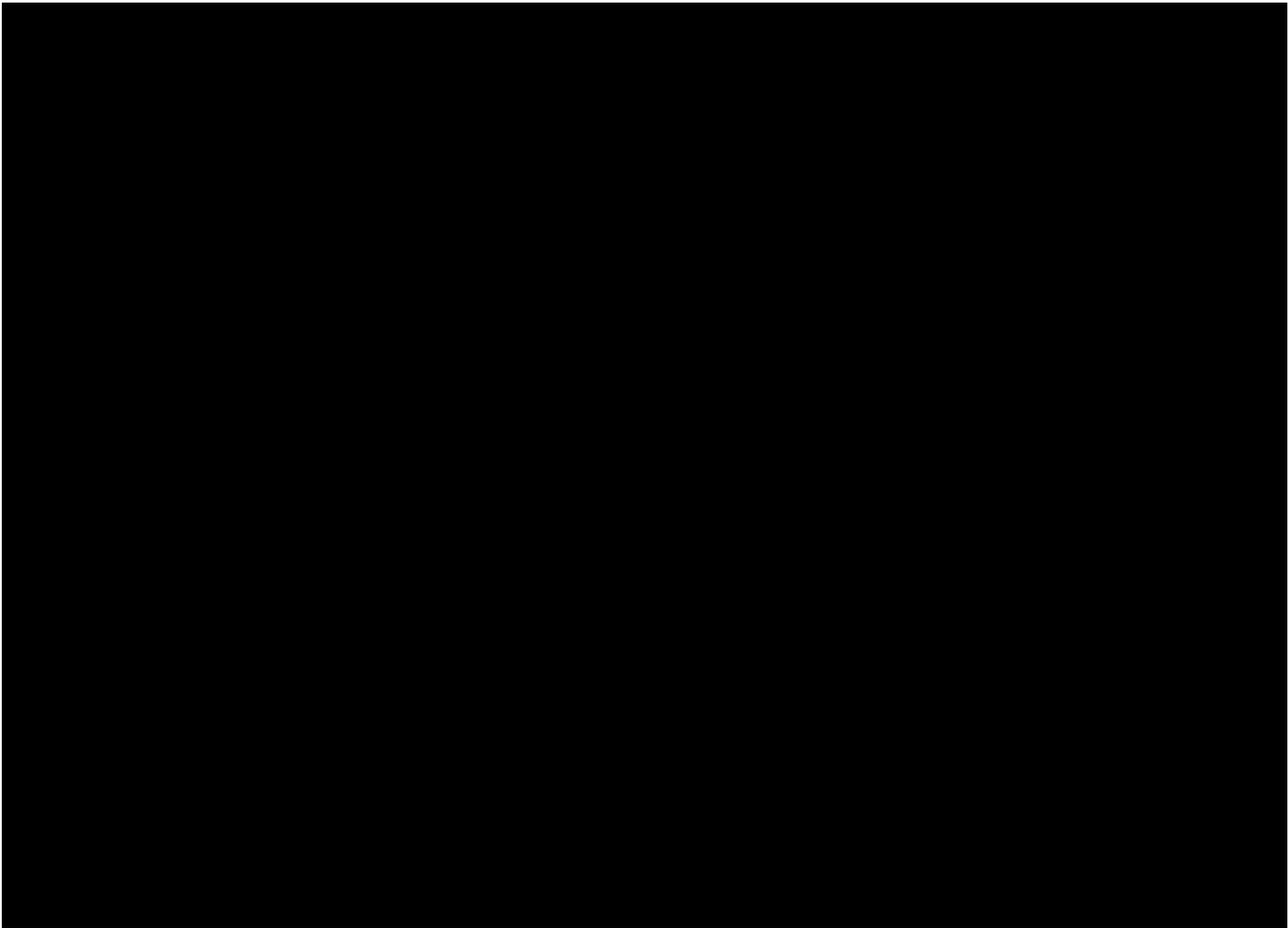


Figure 3 : Alternative Indicative Plan Layout

3. Council Requirements

3.1 Healthy Waters Flood Model Requirements

Healthy Waters (HW) have provided the MoJ and ACH Consulting with the latest flood modelling information (attached in Appendix C) as a 2D HEC-RAS model needs to be prepared to determine the impact of the proposed development on the floodplain. The following information and requirements were provided by HW to ACH to create a base flood model of the subject area:

- The model, created by ACH Consulting, is to include the main Oratia Stream from the Great North Road bridge up to the downstream pedestrian bridge located to the east of 20 Alderman Drive.
- The model must include the overland flow path (OLFP) running through 14 Edmonton Road.
- An inflow hydrograph with a peak flow of 401.2 m³/s (including 3.8-degree climate change) was provided by HW. The hydrograph was taken directly north of the Great North Road bridge.
- An inflow hydrograph with a peak flow of 9.3 m³/s (including 3.8-degree climate change) was provided by HW. The hydrograph was taken directly southeast of the Edmonton Road carriageway, inside the gully south of 15 Edmonton Road.
- A stage hydrograph with a peak elevation of 7.55 m RL (NZVD2016) was provided by HW. The stage hydrograph was taken at the downstream pedestrian bridge, east of 20 Alderman Drive.

- The existing 1,500 mm culvert passing through 14 Edmonton Road is assumed to be 100% blocked, based on observations made during the January 2023 flood event. However, it is noted that the Stormwater Code of Practice (Version 4, Section 4.3.5.6) specifies that pipelines greater than 1,050 mm in diameter are to be assumed 10% blocked.

Note that additional modelling was undertaken to establish pre- and post- flood levels with both a fully blocked culvert and a 10% blocked culvert.

Email correspondence and information provided by HW have been attached in Appendix D.

3.2 Freeboard Requirements

The Auckland Council Stormwater Code of Practice (based on the NZ Building Code E1/VM2) defines the freeboard requirements for buildings in Auckland. The Code of Practice notes the following in Table 1 below.

Table 1 : Freeboard Requirements for the 1% AEP event Flood Plain and 1% AEP Coastal Storm Inundation Including 1 m Sea-Level Rise

Scenario	Freeboard
More Vulnerable Activities* in Floodplains	500 mm
Less Vulnerable Activities* in Floodplains	300 mm
Overland Flow Paths, where Flow is Less than 2 m ³ /s	<ul style="list-style-type: none"> • 500 mm where surface water has a depth of 100 mm or more and extends from the building directly to a road or car park, other than a car park for a single dwelling. • 150 mm for all other cases.
Overland Flow Paths, where Flow is Equal to or in Excess of 2 m ³ /s	<ul style="list-style-type: none"> • 500 mm for More Vulnerable Activities.* • 300 mm for Less Vulnerable Activities.*
Coastal Storm Inundation Areas (1% AEP Including 1 m Sea-Level Rise)	<ul style="list-style-type: none"> • 500 mm for dwellings and habitable rooms which are subject to wave action from the sea. • 150 mm for all other cases.

*As defined in the AUP

In this case, the Auckland Unitary Plan requires a minimum freeboard of 300 mm for the building ground floor level, as the activity is classified as a less vulnerable community activity.

Where the vehicle crossings on Edmonton Road and the access ramp shown on the indicative bulk and location plans are unable to achieve the required freeboard, potential effects shall be managed through the implementation of a robust Flood Response Management Plan. This plan shall ensure that all vehicles are removed from the building prior to the onset of flooding and that the affected area is cordoned off to prevent vehicles from entering floodwaters at this location. Slab Layout Plans have been included in Appendix B.

4. GIS 100-Year Flood Plain

The floodplain shown on Council’s GIS was updated in late 2025. This update supersedes the 2016 Jacobs Report and is based on the latest published flood model prepared by Healthy Waters (HW), which incorporates a 3.8-degree climate change scenario. GIS mapping indicates that the subject property, Alderman Drive to the west, and Edmonton Road to the southeast are fully inundated during a 100-year rainfall event, except for the section of Edmonton Road east of the property. Figure 4 below shows the site inundation according to Council's GIS.



Figure 4 : GIS Floodplain

5. Healthy Waters Flood Model

HW has provided ACH with the latest flood model results (attached in Appendix C), which indicates WSE, velocities, flood depths, and flow directions across the floodplain over the subject site.

Figure 5 below, derived from the HW model, shows that 24.9 m³/s enters the site from the western boundary due to overtopping of the Oratia Stream embankments and the Alderman Drive carriageway. In addition, a further 10.0 m³/s enters the site from the southeastern boundary via the Edmonton Road OLFP, overtopping the Edmonton Road carriageway from the gully located at 15 Edmonton Road.

The model also indicates that flood levels across the site range from 7.71 m RL (NZVD2016) at the northern corner of the site to 8.23 m RL (NZVD2016) at the southern corner. Note that water surface elevations and terrain levels within the HW model are referenced to the AUK1946 datum and have been adjusted by –280 mm to convert to NZVD2016.

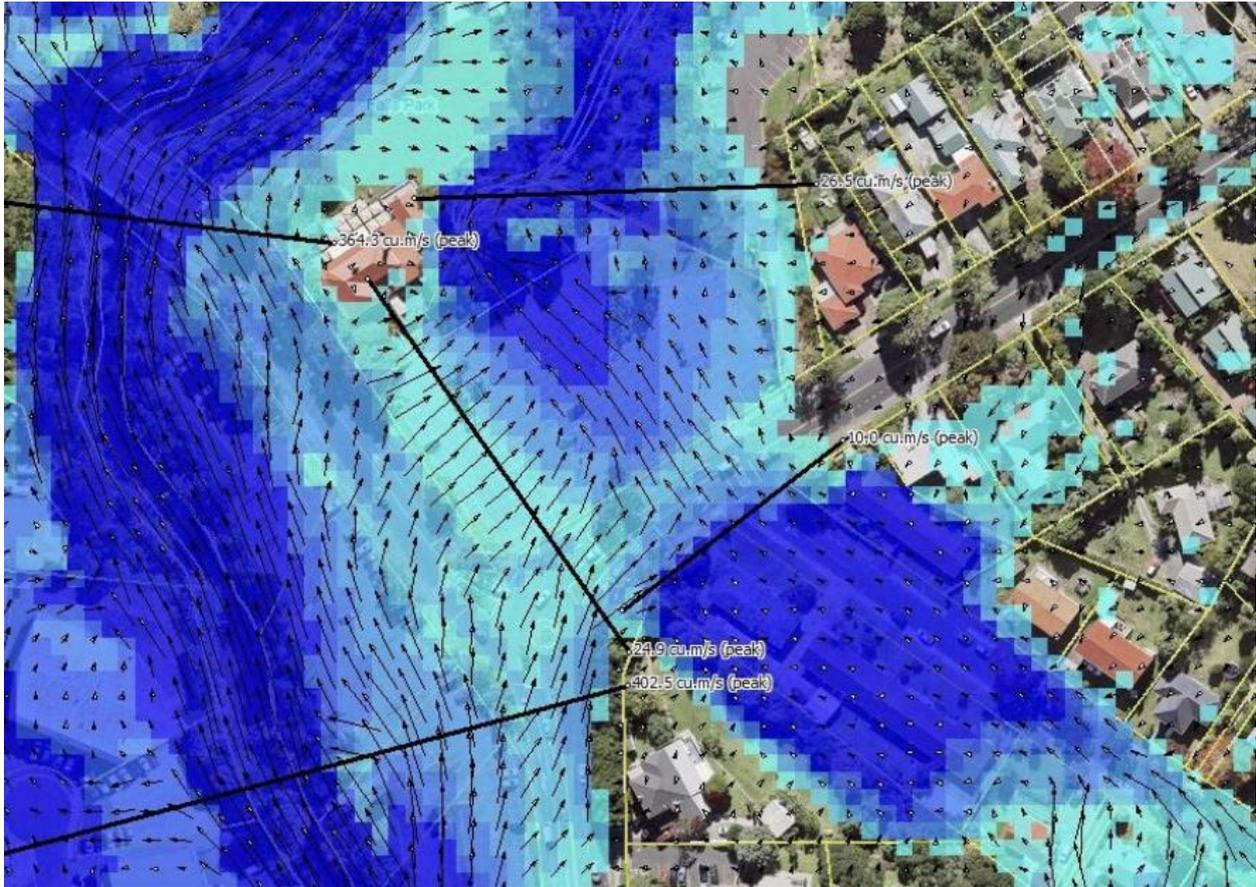


Figure 5 : HW Flood Map

6. ACH 2D HEC-RAS Models

6.1 ACH Predevelopment Flood Model

6.1.1 ACH Model Description

ACH Consulting Ltd prepared a HEC-RAS 2D base model of the existing flood conditions based on the information in Section 3.1 above. Additionally, the terrain utilised for the model is based on a CKL survey (Appendix A) of the Oratia Stream embankments and Council’s GIS LIDAR information for the wider catchment.

The pre-development model was calibrated to closely represent the water surface levels on HW’s model, with WSE on the ACH model being within a maximum of 80 mm of what is shown on the HW model. Note that the information provided by HW was based on the Lands and Survey Datum of Auckland 1946, while the model prepared by ACH Consulting Ltd was completed in NZVD2016 (-280 mm Height Difference from AUK1946 to NZVD2016). A layout plan, which has the corrected HW levels (NZVD2016) and the ACH levels, has been attached in Appendix E.

6.1.2 ACH Model Pre-Development Flood Timelines – Fully Blocked Culvert

The subject site experiences two distinct flooding events when the 1,500 mm culvert is assumed to be 100% blocked. The first occurs when the Edmonton OLFP overtops the road carriageway, resulting in minor flooding. The second, and more severe event occurs when the Oratia Stream overtops the Alderman Drive carriageway, producing peak flooding.

During the storm event, the gully located southeast of the Edmonton Road carriageway fills with water, resulting in flooding of residential properties to the north of the gully before the Edmonton Road carriageway is overtopped approximately 10 hours and 25 minutes after storm commencement. Floodwaters then enter the subject site via the southeastern boundary, flow in a north-westerly direction, and exit along the northwestern boundary. Peak flooding on the subject site associated with the Edmonton Road OLFP occurs approximately 12 hours and 20 minutes after the start of the storm event, as shown in Figure 6.

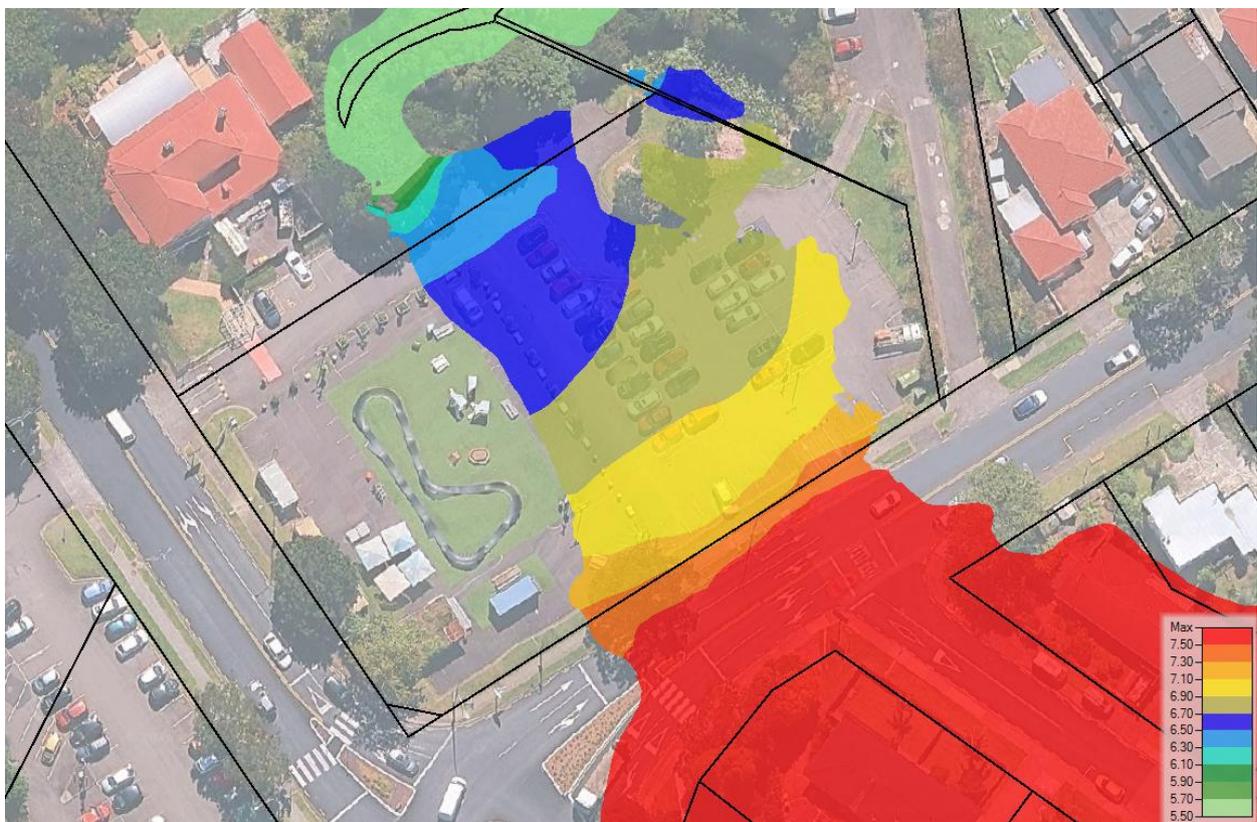


Figure 6 : Edmonton Road OLFP – Peak Flood (Storm Duration: 12 hours 20 minutes)

Flows from the Oratia Stream overtop the Alderman Drive carriageway and enter the subject site approximately 13 hours and 20 minutes after the onset of the storm event. The water then flows from the western boundary toward the site’s low point located along the northwestern boundary. Peak flooding across the subject site (Figure 7) occurs after the overtopping event, approximately 14 hours and 10 minutes after storm commencement.

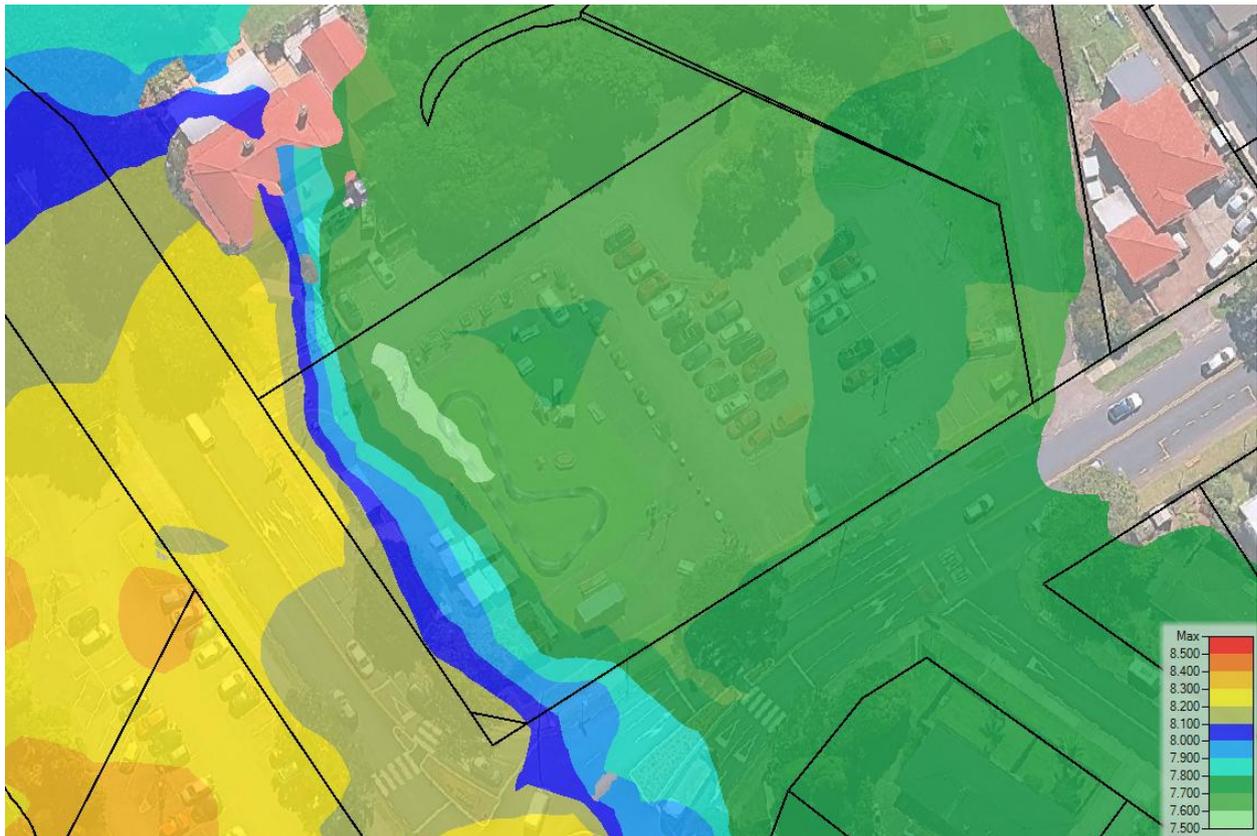


Figure 7 : Oratia Stream Overtopping – Peak Flood (Storm Duration: 14 hours and 10 minutes)

Floodwaters begin to recede from the subject site, Alderman Drive carriageway, and Edmonton Road carriageway approximately 14 hours and 45 minutes hours after storm start. The Alderman Drive and Edmonton Road carriageways become accessible approximately 15 hours and 25 minutes after storm onset, being 1 hour and 15 minutes after the peak flooding event (Figure 8 below).

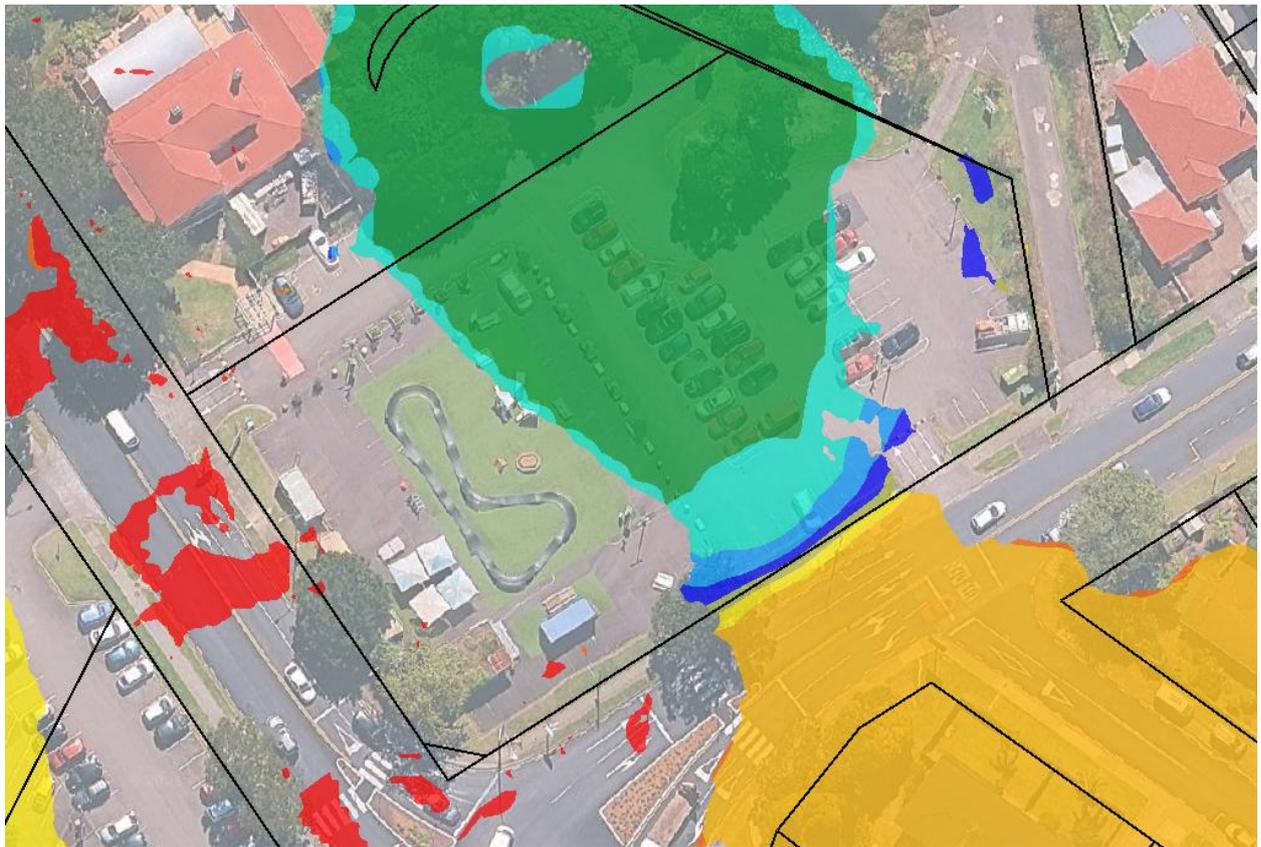


Figure 8 : Receding Floods (Storm Duration: 15 hours and 25 minutes)

HEC-RAS model results based on timestamps have been included in Appendix E.

6.1.3 ACH Model Pre-Development Flood Timelines – 10% Blocked Culvert

Unlike Section 6.1.2 above, where the culvert is assumed to be 100% blocked, the subject site experiences only a single instance of flooding during the 100-year event, occurring during overtopping of the Alderman Drive carriageway due to the availability of the 1,500 mm culvert. The model demonstrates that, with the culvert assumed to be 10% blocked, sufficient capacity exists to capture all stormwater runoff generated by the upstream Edmonton OLFP catchment, with water levels rising to the crown of the Edmonton Road carriageway, as shown in Figure 9. The gulley located southeast of the Edmonton Road carriageway reaches peak flood levels approximately 12 hours and 30 minutes after storm commencement, after which floodwaters recede toward the gulley.



Figure 9 : Edmonton Road OLFP Peak Flooding (Storm Duration: 12 hours and 30 minutes)

The 1,500 mm culvert has no impact on the flows entering the site from the western boundary, and therefore the peak flood event will remain unchanged from section 6.1.2 above.

6.2 As-Lodged Post-Development Flood Model

The post-development flood models incorporate all the features of the pre-development model, with the inclusion of post-development flood mitigation options and foundation layouts as listed in Section 2.2.1 above.

6.2.1 ACH Model Results – Fully Blocked Culvert

The *As-Lodged* post-development flood model indicates increases in WSE of between 20 mm and 150 mm with the highest increase occurring at the eastern most corner of the site. The highest WSE experienced at the boundaries is 8.31 m, with the highest WSE adjacent to the building being 8.28 m (NZVD2016). Based on these flood levels, a minimum finished floor level of 8.58 m RL is required to comply with the Stormwater Code of Practice (Version 4). These increases in WSE are primarily attributable to the impervious walls along the western and southern façades of the proposed Justice Facility building.

Flows entering the site from the Edmonton Road carriageway are directed toward a 19.5 m wide opening along the southeastern façade of the building, where water is conveyed beneath the structure in a north-westerly direction, as well as eastward around the proposed building before continuing in a northerly direction. The resulting reduction in cross-sectional flow area along the southeastern façade increases WSE along the southeastern boundary by approximately 90 mm to 150 mm.

Most flows entering the site from the western boundary are directed northward, while some flows at the southwestern corner are deflected eastward due to the fully impervious southwestern façade of the proposed building. This associated reduction in cross-sectional flow area increases flood depths along the western boundary by approximately 20 mm to 90 mm. Figure 10 illustrates the flow paths into and out of the subject site and the interaction of floodwaters with the proposed building foundations and walls.



Figure 10 : As-Lodged - 1% AEP Floodplain Flow Paths

6.2.2 ACH Model Results – 10% Blocked Culvert

All levels surrounding the site, measured at the site boundaries, are consistent with the model assuming a 100% blocked culvert, with the exception of the upstream catchment southeast of the Edmonton Road carriageway. Allowing flow through the culvert results in a reduction in WSE of approximately 20 mm across the Takapu floodplain, thereby producing a lower WSE that may reduce predicted impacts on properties within this floodplain.

6.2.3 Neighbouring Property Impacts

The proposed development is predicted to increase flood depths upstream of the subject property along Takapu Street by approximately 120 mm (10% blocked culvert) to 140 mm (fully blocked culvert). This increase is attributed to the reduction in cross-sectional flow area along the southeastern boundary and the redirection of flood waters into the opening and around the east portion of the proposed building.

As a result, the floodplain footprint is expected to expand horizontally by up to 3.7 m across the Edmonton Road carriageway and by up to 2.6 m within the residential properties at 23 Edmonton Road. In addition, the floodplain extent will encroach an additional 2.7 m over the existing driveway serving

22–24 Edmonton Road. Figure 11 illustrates the upstream floodplain expansion associated with the proposed development.

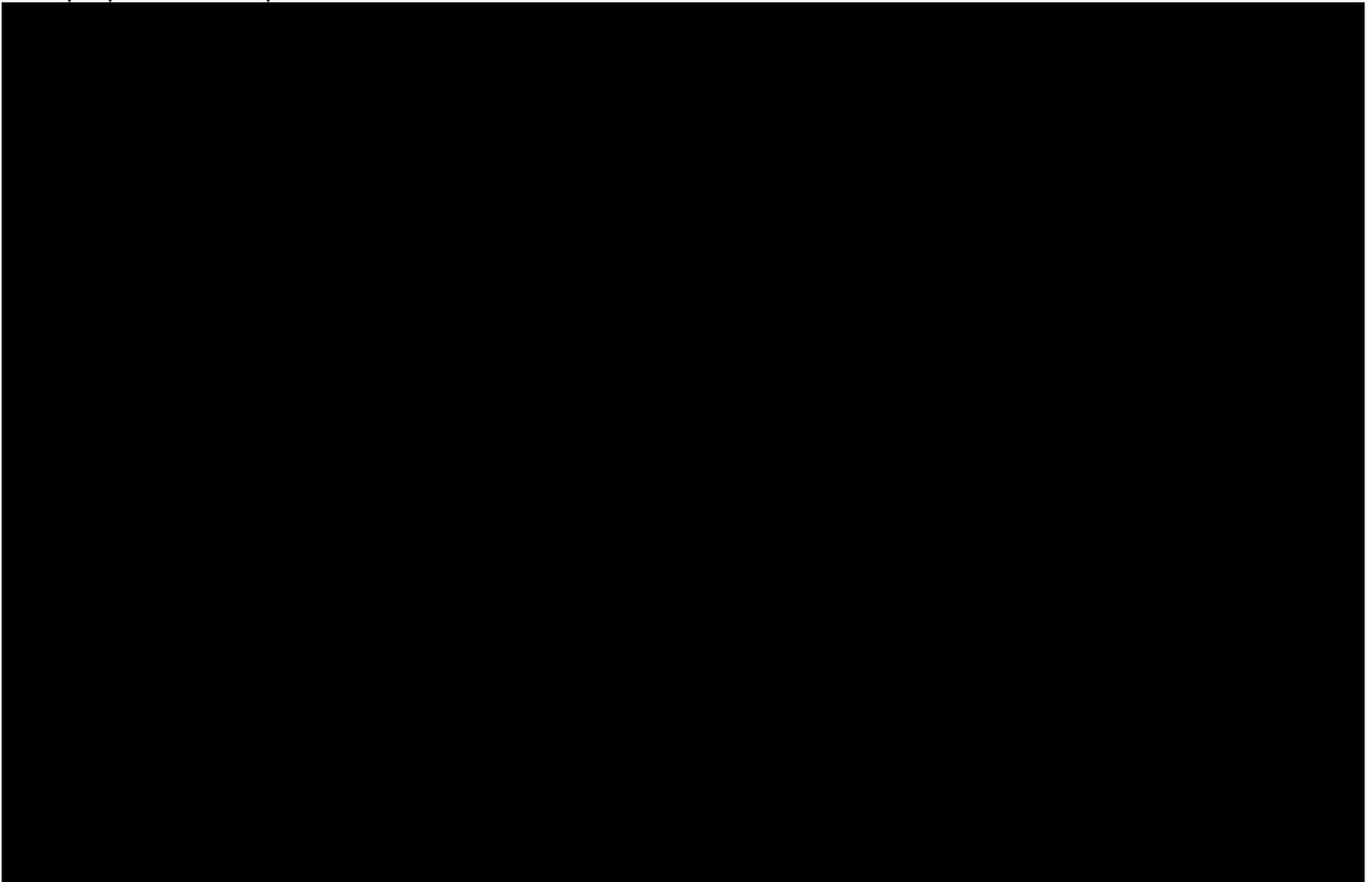


Figure 11 : As-Lodged Upstream Floodplain Impact (Blue: Post-Dev; Green: Pre-Dev)

Downstream of the proposed development, the only location experiencing an increase in floodplain horizontal expansion is the property at 22 Alderman Drive (Falls Park). The impervious wall along the western boundary redirects a greater proportion of flow toward the north of the site, resulting in increased flood depths at the northwestern corner. This increase in flow through the corner is predicted to raise flood depths across 22 Alderman Drive by approximately 50 mm, thereby reducing the extent of unflooded area on the site, as shown in Figure 12.

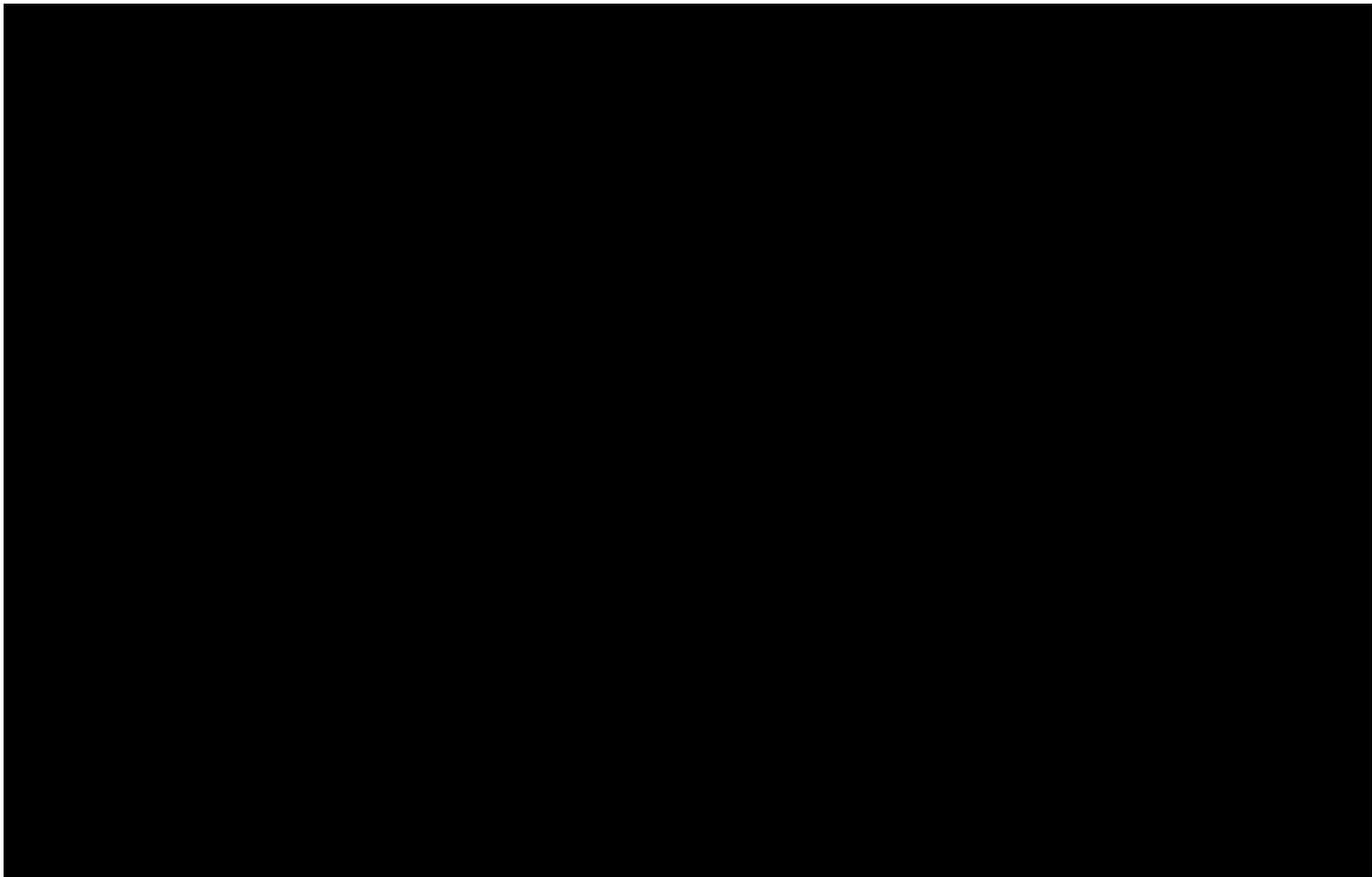


Figure 12 : As-Lodged Downstream Floodplain Impact (Blue: Post-Dev; Green: Pre-Dev)

6.2.4 Neighbouring Finished Floor Level Assessment

The WSE of the Takapu Street Floodplain for the respective models have been summarised in Table 2 below.

Table 2 : As-Lodged – Takapu Street Floodplain WSE

Model	Takapu Street Floodplain WSE
Healthy Waters	7.78 m
Pre-Development (Fully Blocked Culvert)	7.74 m
Pre-Development (10% Blocked Culvert)	
As-Lodged (Fully Blocked Culvert)	7.88 m
As-Lodged (10% Blocked Culvert)	7.86 m

The finished floor levels of the properties within the Takapu floodplain have been surveyed on the 21st of January 2026. Their levels, freeboards, and inundation have been summarised in Table 3 below.

Table 3 : As-Lodged – Takapu Street Finished Floor Level Assessment

Address	Finished Floor Level (NZVD2016)	Freeboard
21 Edmonton Road	House: 9.08 m Garage: 8.47 m	HW _(house) : 1.30 m HW _(garage) : 0.69 m Pre-Dev _(house) : 1.34 m Pre-Dev _(garage) : 0.73 m As-Lodged - No Culvert _(house) : 1.20 m As-Lodged - No Culvert _(garage) : 0.59 m As-Lodged - 10% Culvert _(house) : 1.22 m As-Lodged - 10% Culvert _(garage) : 0.61 m
23 Edmonton Road	House: 9.60 m Rear House: 8.33 m Garage: 8.60 m	HW _(house) : 1.82 m HW _(rear house) : 0.55 m HW _(garage) : 0.82 m Pre-Dev _(house) : 1.86 m Pre-Dev _(rear house) : 0.59 m Pre-Dev _(garage) : 0.86 m As-Lodged - No Culvert _(house) : 1.72 m As-Lodged - No Culvert _(rear house) : 0.45 m As-Lodged - No Culvert _(garage) : 0.72 m As-Lodged - 10% Culvert _(house) : 1.74 m As-Lodged - 10% Culvert _(rear house) : 0.47 m As-Lodged - 10% Culvert _(garage) : 0.74 m
1/2A Takapu Street	House: 6.64 m	HW: -1.14 m Pre-Dev: -1.1 m As-Lodged - No Culvert: -1.24 m As-Lodged - 10% Culvert: -1.22 m
2/2A Takapu Street	House: 6.64 m	HW: -1.14 m Pre-Dev: -1.1 m As-Lodged - No Culvert: -1.24 m As-Lodged - 10% Culvert: -1.22 m
2 Takapu Street	House: 7.70 m	HW: -0.08 m Pre-Dev: -0.04 m As-Lodged - No Culvert: -0.18 m As-Lodged - 10% Culvert: -0.16 m

3-3B Takapu Street	Houses: 8.05 m	HW: 0.27 m Pre-Dev: 0.31 m As-Lodged - No Culvert: 0.17 m As-Lodged - 10% Culvert: 0.19 m
3C-3D Takapu Street	Houses: 8.15 m	HW: 0.37 m Pre-Dev: 0.41 m As-Lodged - No Culvert: 0.27 m As-Lodged - 10% Culvert: 0.29 m
3E Takapu Street	House: 8.69 m	HW: 0.91 m Pre-Dev: 0.95 m As-Lodged - No Culvert: 0.81 m As-Lodged - 10% Culvert: 0.83 m
4 Takapu Street	House: 8.69 m Garage: 8.42 m	HW _(house) : 0.91 m HW _(garage) : 0.64 m Pre-Dev _(house) : 0.95 m Pre-Dev _(garage) : 0.68 m As-Lodged - No Culvert _(house) : 0.81 m As-Lodged - No Culvert _(garage) : 0.54 m As-Lodged - 10% Culvert _(house) : 0.83 m As-Lodged - 10% Culvert _(garage) : 0.56 m
6 Takapu Street	House: 8.14 m	HW: 0.36 m Pre-Dev: 0.40 m As-Lodged - No Culvert: 0.26 m As-Lodged - 10% Culvert: 0.28 m

* **Red Text** indicate freeboards less than 500 mm for more vulnerable activities. Assessments for wave action have not been completed.

The table above shows that all properties, except the rear house at 23 Edmonton Road, 1/2A Takapu Street, 2/2A Takapu Street, 2 Takapu Street, 3-3B Takapu Street, 3C-3D Takapu Street, and 6 Takapu Street have a pre-development freeboard greater than 500 mm and continue to maintain a freeboard exceeding 500 mm post-development. It should be noted that 1/2A Takapu Street, 2/2A Takapu Street and 2 Takapu Street are all inundated under pre-development conditions. We understand that some of these properties have been purchased by Auckland Council as part of a buyout scheme due to flooding concerns.

6.3 Alternative Indicative Layout Post-Development Flood Model

6.3.1 ACH Model Description

The post-development flood model incorporates all the features of the pre-development model, with the inclusion of post-development flood mitigation options and foundation layouts as listed in Section 2.2.2 above.

6.3.2 ACH Model Results – Fully Blocked Culvert

The *Alternative* indicative layout post-development flood model indicates increases in WSE between 50 mm and 190 mm with the highest increase occurring at the eastern most corner of the site. The highest WSE experienced at the boundaries is 8.29 m, with the highest WSE adjacent to the building being 8.24 m (NZVD2016). Based on these flood levels, a minimum finished floor level of 8.54 m RL is required to comply with the Stormwater Code of Practice (Version 4). These increases in WSE are primarily attributable to the impervious walls along the western and southern façades of the proposed Justice Facility building.

Flows entering the site from the Edmonton Road carriageway are directed toward a 20.0 m wide opening along the southeastern façade of the building, where water is conveyed beneath the structure in a north-westerly direction, as well as eastward around the proposed building before continuing in a northerly direction. The resulting reduction in cross-sectional flow area along the southeastern façade increases WSE along the southeastern boundary by approximately 60 mm to 190 mm.

Most flows entering the site from the western boundary are directed northward, while some flows at the southwestern corner are deflected eastward due to the fully impervious southwestern façade of the proposed building. The associated reduction in cross-sectional flow area increases flood depths along the western boundary by approximately 50 mm to 90 mm, with a decrease in WSE of 30 mm at the western most corner. Figure 13 illustrates the flow paths into and out of the subject site and the interaction of floodwaters with the proposed building foundations and walls.

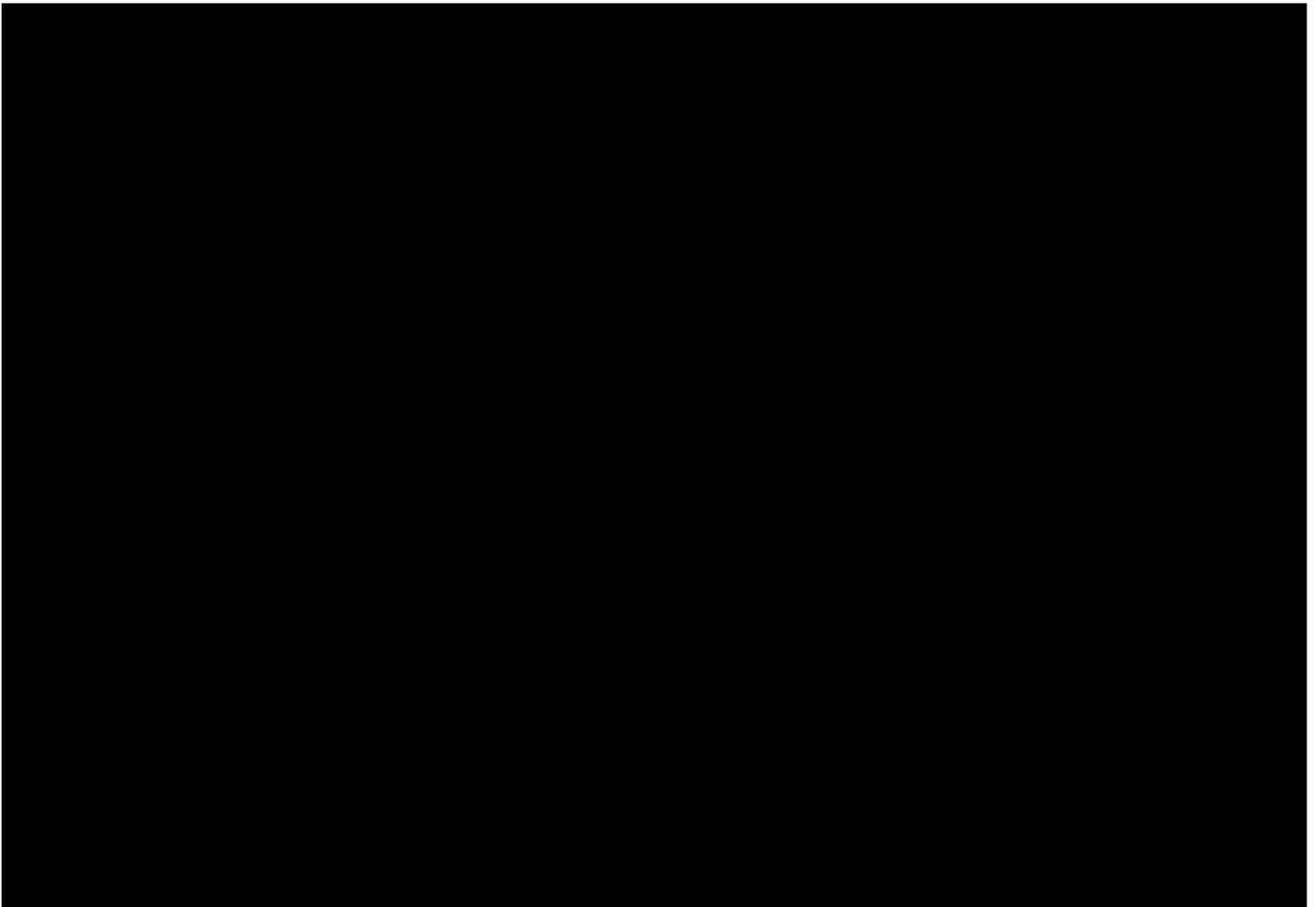


Figure 13 : Alternative Indicative Plan Layout - 1% AEP Floodplain Flow Paths

6.3.3 ACH Model Results – 10% Blocked Culvert

All levels surrounding the site, measured at the site boundaries, are consistent with the model assuming a 100% blocked culvert, with the exception of the upstream catchment southeast of the Edmonton Road carriageway. Allowing flow through the culvert results in a reduction in WSE of approximately 20 mm across the Takapu floodplain, thereby producing a lower WSE that may reduce predicted impacts on properties within this floodplain.

6.3.4 Neighbouring Property Impacts

The proposed development is predicted to increase flood depths upstream of the subject property along Takapu Street by approximately 140 mm (10% blocked culvert) to 160 mm (fully blocked culvert). This increase is attributed to the reduction in cross-sectional flow area along the southeastern boundary and the redirection of water into the opening and around the east portion of the proposed building. Additionally, the foundations and walls running perpendicular to the flow path also prohibit flows from leaving the site effectively, thereby further increasing flows upstream of the Edmonton Road carriageway.

As a result, the floodplain footprint is expected to expand horizontally by up to 3.8 m across the Edmonton Road carriageway and by up to 2.7 m within the residential properties at 23 Edmonton Road. In addition, the floodplain extent will encroach approximately 2.7 m over the existing driveway serving 22–24 Edmonton Road. Figure 14 illustrates the upstream floodplain expansion associated with the proposed development.

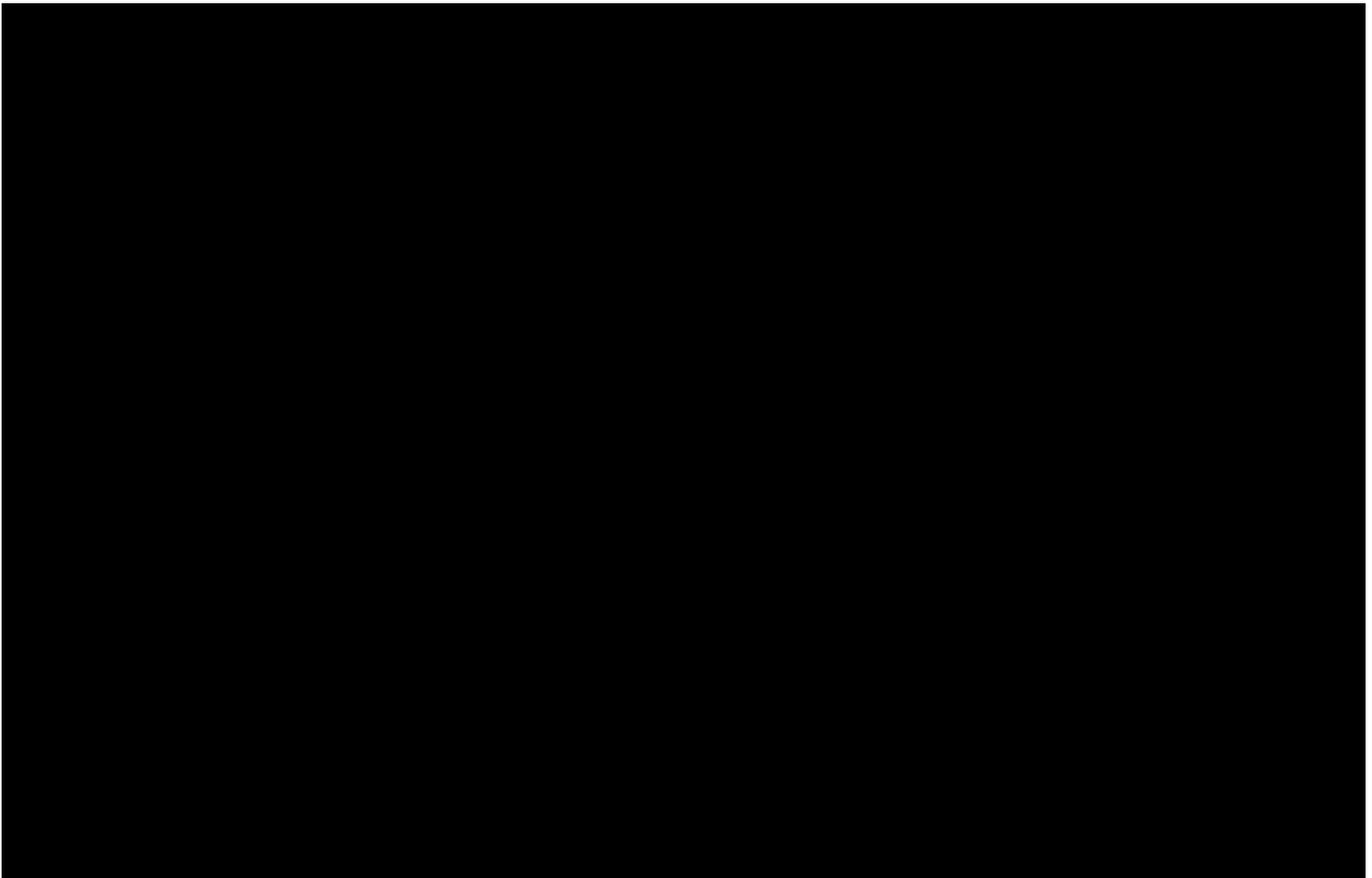


Figure 14 : Alternative Upstream Floodplain Impact (Blue: Post-Dev; Green: Pre-Dev)

Downstream of the proposed development, the only location experiencing a slight increase in flood inundation is the property at 22 Alderman Drive (Falls Park). The impervious wall along the western boundary redirects a greater proportion of flow toward the north of the site, resulting in increased flood depths at the northwestern corner. This increase in flow through the corner is predicted to raise flood depths across 22 Alderman Drive by approximately 20 mm, thereby reducing the extent of unflooded area on the site, as shown in Figure 15.

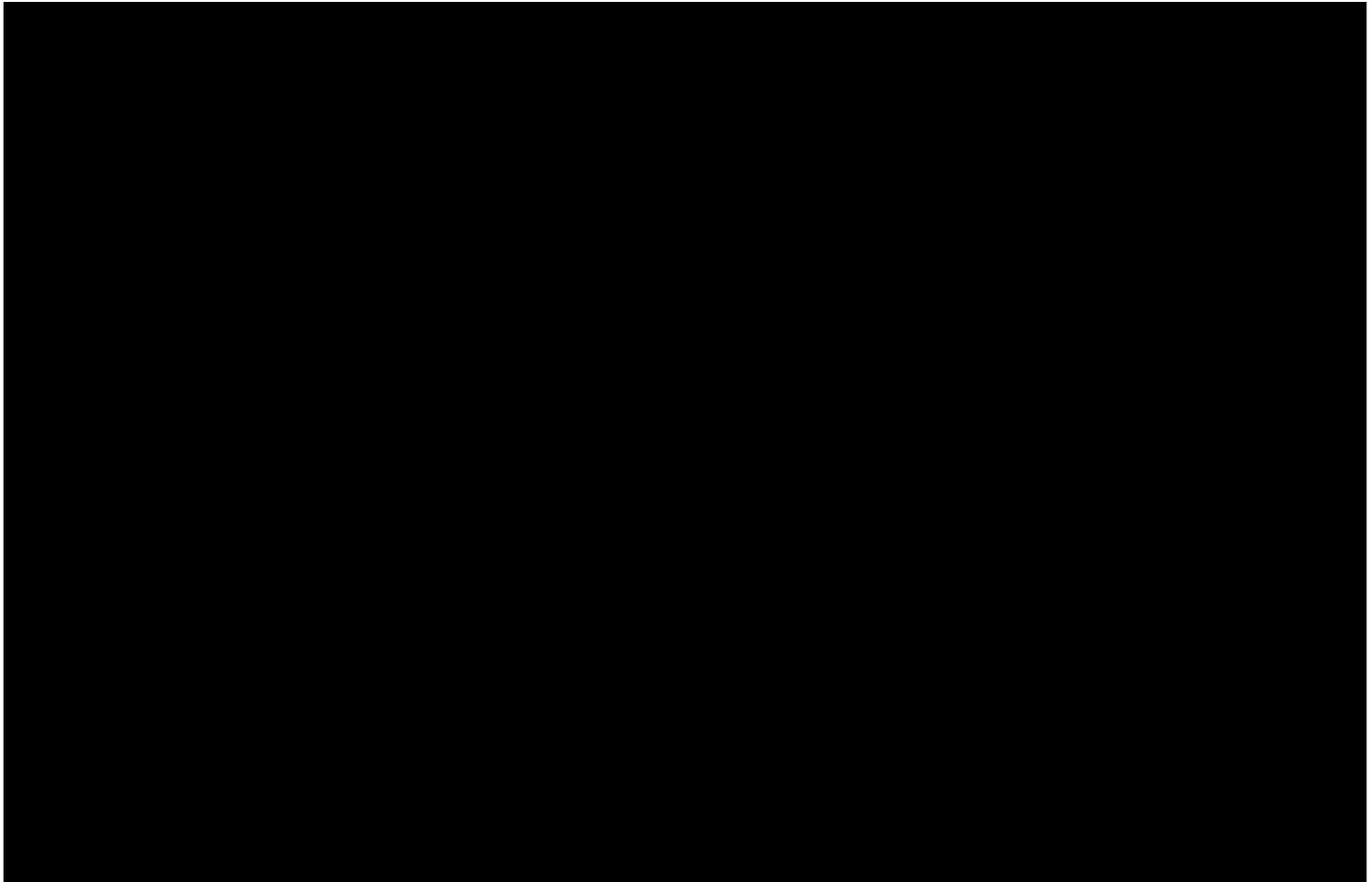


Figure 15 : Alternative Downstream Floodplain Impact (Blue: Post-Dev; Green: Pre-Dev)

6.3.5 Neighbouring Finished Floor Level Assessment

The WSE of the Takapu Street Floodplain for the respective models have been summarised in Table 4 below.

Table 4 : Alternative Layout – Takapu Street Floodplain WSE

Model	Takapu Street Floodplain WSE
Healthy Waters	7.78 m
Pre-Development (Fully Blocked Culvert)	7.74 m
Pre-Development (10% Blocked Culvert)	
Alternative Layout (Fully Blocked Culvert)	7.88 m
Alternative Layout (10% Blocked Culvert)	7.86 m

The finished floor levels of the properties within the Takapu floodplain have been surveyed on the 21st of January 2026. Their levels, freeboards, and inundation have been summarised in Table 5 below.

Table 5 : Alternative Layout – Takapu Street Finished Floor Level Assessment

Address	Finished Floor Level (NZVD2016)	Freeboard
21 Edmonton Road	House: 9.08 m Garage: 8.47 m	HW _(house) : 1.30 m HW _(garage) : 0.69 m Pre-Dev _(house) : 1.34 m Pre-Dev _(garage) : 0.73 m Alternative - No Culvert _(house) : 1.18 m Alternative - No Culvert _(garage) : 0.57 m Alternative - 10% Culvert _(house) : 1.20 m Alternative - 10% Culvert _(garage) : 0.59 m
23 Edmonton Road	House: 9.60 m Rear House: 8.33 m Garage: 8.60 m	HW _(house) : 1.82 m HW _(rear house) : 0.55 m HW _(garage) : 0.82 m Pre-Dev _(house) : 1.86 m Pre-Dev _(rear house) : 0.59 m Pre-Dev _(garage) : 0.86 m Alternative - No Culvert _(house) : 1.70 m Alternative - No Culvert _(rear house) : 0.43 m Alternative - No Culvert _(garage) : 0.70 m Alternative - 10% Culvert _(house) : 1.72 m Alternative - 10% Culvert _(rear house) : 0.45 m Alternative - 10% Culvert _(garage) : 0.72 m
1/2A Takapu Street	House: 6.64 m	HW: -1.14 m Pre-Dev: -1.1 m Alternative - No Culvert: -1.26 m Alternative 10% Culvert: -1.24 m
2/2A Takapu Street	House: 6.64 m	HW: -1.14 m Pre-Dev: -1.1 m Alternative - No Culvert: -1.26 m Alternative 10% Culvert: -1.24 m
2 Takapu Street	House: 7.70 m	HW: -0.08 m Pre-Dev: -0.04 m Alternative - No Culvert: -0.20 m Alternative - 10% Culvert: -0.18 m

3-3B Takapu Street	Houses: 8.05 m	HW: 0.27 m Pre-Dev: 0.31 m Alternative - No Culvert: 0.15 m Alternative - 10% Culvert: 0.17 m
3C-3D Takapu Street	Houses: 8.15 m	HW: 0.37 m Pre-Dev: 0.41 m Alternative - No Culvert: 0.25 m Alternative - 10% Culvert: 0.27 m
3E Takapu Street	House: 8.69 m	HW: 0.91 m Pre-Dev: 0.95 m Alternative - No Culvert: 0.79 m Alternative - 10% Culvert: 0.81 m
4 Takapu Street	House: 8.69 m Garage: 8.42 m	HW _(house) : 0.91 m HW _(garage) : 0.64 m Pre-Dev _(house) : 0.95 m Pre-Dev _(garage) : 0.68 m Alternative - No Culvert _(house) : 0.79 m Alternative - No Culvert _(garage) : 0.52 m Alternative - 10% Culvert _(house) : 0.81 m Alternative - 10% Culvert _(garage) : 0.54 m
6 Takapu Street	House: 8.14 m	HW: 0.36 m Pre-Dev: 0.40 m Alternative - No Culvert: 0.24 m Alternative - 10% Culvert: 0.26 m

* **Red Text** indicate freeboards less than 500 mm for more vulnerable activities. Assessments for wave action have not been completed.

The table above shows that all properties, except the rear house at 23 Edmonton Road, 1/2A Takapu Street, 2/2A Takapu Street, 2 Takapu Street, 3-3B Takapu Street, 3C-3D Takapu Street, and 6 Takapu Street have a pre-development freeboard greater than 500 mm and continue to maintain a freeboard exceeding 500 mm post-development. It should be noted that 1/2A Takapu Street, 2/2A Takapu Street and 2 Takapu Street are all inundated under pre-development conditions. We understand that some of these properties have been purchased by Auckland Council as part of a buyout scheme due to flooding concerns.

6.4 Assessment in Accordance with Vulnerability Curves and Fragility Curves

Hazard Vulnerability Curves (Australian Rainfall and Runoff Guidelines, 2019) have been used to assess flood risk within this reach of the catchment. Properties with ground elevations ≥ 0.5 m are classified as Hazard Vulnerability H3, indicating conditions that are unsafe for vehicles, children, and the elderly. This classification currently applies to 1/2A, 2/2A, and 3–3E Takapu Street. The remaining properties fall within Hazard Vulnerability categories H1 and H2. None of the proposed development scenarios result in an increase in hazard vulnerability for any property.

Flood Fragility Curves (NIWA, 2010) illustrate the relationship between flood depth and the extent of building damage. When flood levels exceed the finished floor level of residential dwellings, damage to

the building and its contents occurs, with the severity represented by a defined Damage State. Increases in water depth within the same Damage State do not significantly affect repair costs (Simran Bassan et al., 2023). The residential dwellings at 1/2A and 2/2A Takapu Street are currently assessed as Damage State DS3, under which approximately 50% of the building is expected to be damaged and occupants may require alternative accommodation for more than one year (Tonkin and Taylor, 2024). The proposed development does not increase the Damage State for these properties.

At 2 Takapu Street, the Damage State increases from a high-level DS1 to DS2. However, both pre-development and post-development conditions correspond to an estimated 8–10% building damage (NIWA, 2010) and an occupant displacement period of approximately 20 days (Tonkin and Taylor, 2024).

6.5 Flood Results Discussion

Table 6 below provides a comparison of the impact on the floodplain for the *As-Lodged* indicative plan set and the *Alternative* indicative plan set.

Table 6 : WSE Comparison for As-Lodged and Alternative Indicative Layout

	As-Lodged	Alternative
Upstream of proposed development (east / southeast of development)	WSE increases by 20 mm to 150 mm along boundaries. Overall increase of 120 mm (10% blocked culvert) to 140 mm (fully blocked culvert) throughout Takapu floodplain and 150 mm increase over 22 Edmonton Road driveway.	WSE increases by 50 mm to 190 mm along boundaries. Overall increase of 140 mm (10% blocked culvert) to 160 mm (fully blocked culvert) throughout Takapu floodplain and 170 mm (10% blocked culvert) to 190 mm (fully blocked culvert) increase over 22 Edmonton Road driveway.
Upstream of proposed development (west / southwest of development)	WSE changes by 20 mm to 90 mm along boundary.	WSE increases by -30 mm to 90 mm along boundary.
Downstream of proposed development.	22 Alderman Drive (Falls Park) experiences a WSE increase of 50 mm.	22 Alderman Drive (Falls Park) experiences a WSE increase of 20 mm.
Finished Floor Level (300 mm Freeboard)	8.58 m RL	8.54 m RL
Post-Development Neighbour Impact	The table above shows that all properties, except the rear house at 23 Edmonton Road, 1/2A, 2/2A, 2, 3-3B, 3C-3D, and 6 Takapu Street have a pre-development freeboard greater than 500 mm and continue to maintain a freeboard exceeding 500 mm post-development.	The table above shows that all properties, except the rear house at 23 Edmonton Road, 1/2A, 2/2A, 2, 3-3B, 3C-3D, and 6 Takapu Street have a pre-development freeboard greater than 500 mm and continue to maintain a freeboard exceeding 500 mm post-development.

The post-development flood modelling for the *As-Lodged* indicative plan set and the *Alternative* indicative plan set results have similar impacts to the floodplain with the following key differences:

- Edmonton OLFP upstream catchment (southeast of proposed development) – The *Alternative* indicative layout has a minor increase in WSE compared to the *As-Lodged* indicative plan set due to the following items:
 - Staircase along the southwestern corner of the site obstructs flows from the Alderman Drive carriageway. Therefore, reducing cross sectional area and forces flows to run into the Edmonton Road carriageway prior to entering the opening along the southeastern façade of the development.
 - The foundation layout underneath the building for the *Alternative* indicative layout has more obstructions compared to the *As-Lodged* indicative plan set.
- The Alderman Drive WSE (west of proposed development) is lower for the *Alternative* when compared to the *As-Lodged* due to the following Key differences:
 - The *Alternative* indicative plan set provides a greater cross-sectional area along the northwestern corner of the site for waters to pass by the building. This further reduces the impact of the WSE along 22 Alderman Drive (Falls Park).

7. Recommendations

The following items are recommended as part of this assessment:

- A minimum freeboard of 300 mm must be provided to the water surface level. This results in a recommended FFL of 8.58 m RL for both indicative plan sets.
- The flood mitigation design measures outlined in this report must be implemented into the future building design of the Justice Facility on the site. Some additional earthworks modelling, which includes smoother transitions between channels and additional retaining walls along boundaries to provide greater cross-sectional flow area may slightly reduce post development WSE by up to 50 mm.
- A Flood Management Plan (FMP) must be prepared and implemented for the operation of the activity. The FMP will outline measures and protocols to manage safe access and egress to the site, including details of early warning systems to be implemented for the operation of the activity.

8. Conclusions

The following conclusions were made as part of this assessment:

- A pre-development two-dimensional HEC-RAS model has been prepared and calibrated to align with Healthy Waters modelling outputs which assumes 100% blockage of the 1.5m diameter culvert (note stormwater code of practice would typically assume 10% blockage). This provides a conservative baseline for assessing flood risk and potential effects.
- Based on the compliant Finished Floor Level and the rapid onset of peak flooding within the Oratia Stream catchment, occurring approximately 14 hours into the design storm, a Shelter in Place approach is considered appropriate and safe. This measure has been formalised within the Flood Management Plan for the development.
- The finished floor level (FFL) is recommended to be at least 300 mm above the 1% AEP flood level to achieve compliance with the Auckland Council Stormwater Code of Practice (V4). This results in a FFL of 8.58 m RL for the *As-Lodged* indicative layouts and 8.54 m RL for the *Alternative* indicative layouts.

- The proposed development results in increases to upstream floodplain water surface levels due to the required impervious security walls. However, the affected properties along Takapu Street and Edmonton Road are already subject to significant inundation under pre-development conditions. Several properties do not currently achieve compliant freeboard and are understood to form part of an Auckland Council managed buyout programme, reducing the sensitivity of these areas to minor additional flood level increases.
- Some of the properties within the Takapu Street floodplain have a non-compliant freeboard to the 100-year flood level at pre-development conditions, with some properties being inundated.
- A Flood Management Plan must be prepared for the proposed development.
- Further design changes can be implemented within the earthworks of the proposed development to increase flow conveyance throughout the site.
- A change in damage state is noted for 2 Takapu Street. No additional properties experience a change in damage classification as a result of the proposed development.
- The inundation time for the site is predicted to be 2.5 hours and occurs approximately 13hrs and 20 mins after the commencement of the storm. This timeline provides a sufficient window for the activation of the FEMP and evacuation protocols.

9. Limitations

This report has been prepared for the Ministry of Justice in support of a Notice of Requirement application to designate the site at 14 Edmonton Road, to enable construction and operation of a Justice Facility on the site. The information provided in this report is for the Ministry of Justice, Waitakere Project Design Team, Ministry for Environment fast track review panel, environmental Protection Authority, and Associated Stakeholders. Although this application is not before the Environment Court, this report has been prepared in accordance with the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023. A Copy of the qualifications and experience of the authors is provided with this assessment.

All design information used to prepare the flood risk assessment, and to understand the impacts on the floodplain, have been based on Civil plans provided by Holmes and flooding information provided by Healthy Waters. The design information provided by Holmes will address all relevant clauses within the Auckland Unitary Plan relating to the subject development. This report is not to be used by other persons or for any other purpose without first contacting ACH Consulting Ltd.

Appendix A

Existing GIS and Survey Information

Appendix B

Proposed Development Drawings

Appendix C

Healthy Waters Model Information

Appendix D

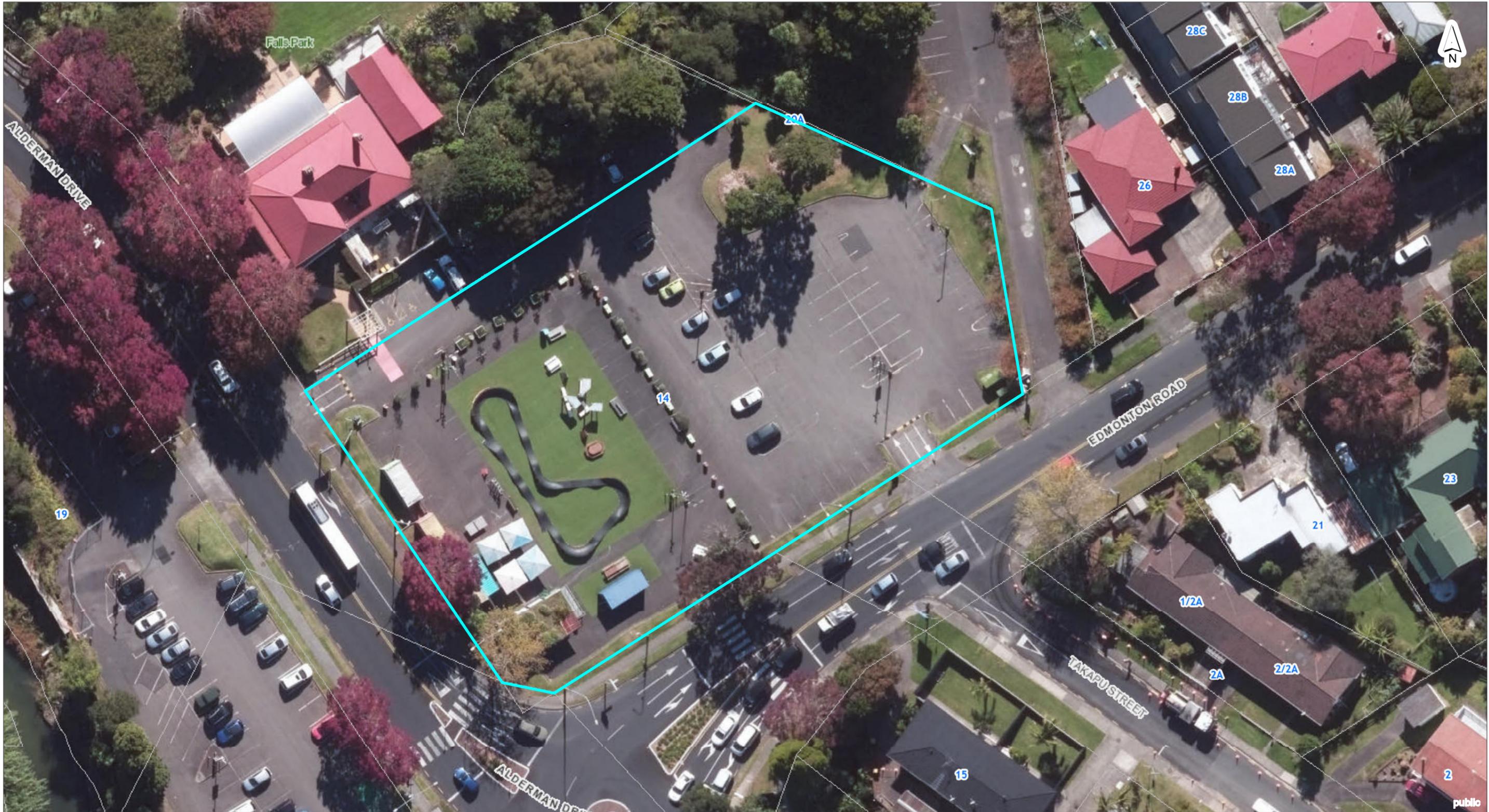
Healthy Waters Correspondence

Appendix E

Model Results

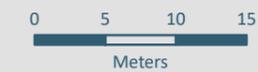
Appendix A

Existing GIS and Survey Information



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GIS Layout - Sheet 1 of 3



Scale @ A3
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Date Printed:
 16/01/2026





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GIS Layout - Sheet 2 of 3



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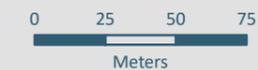
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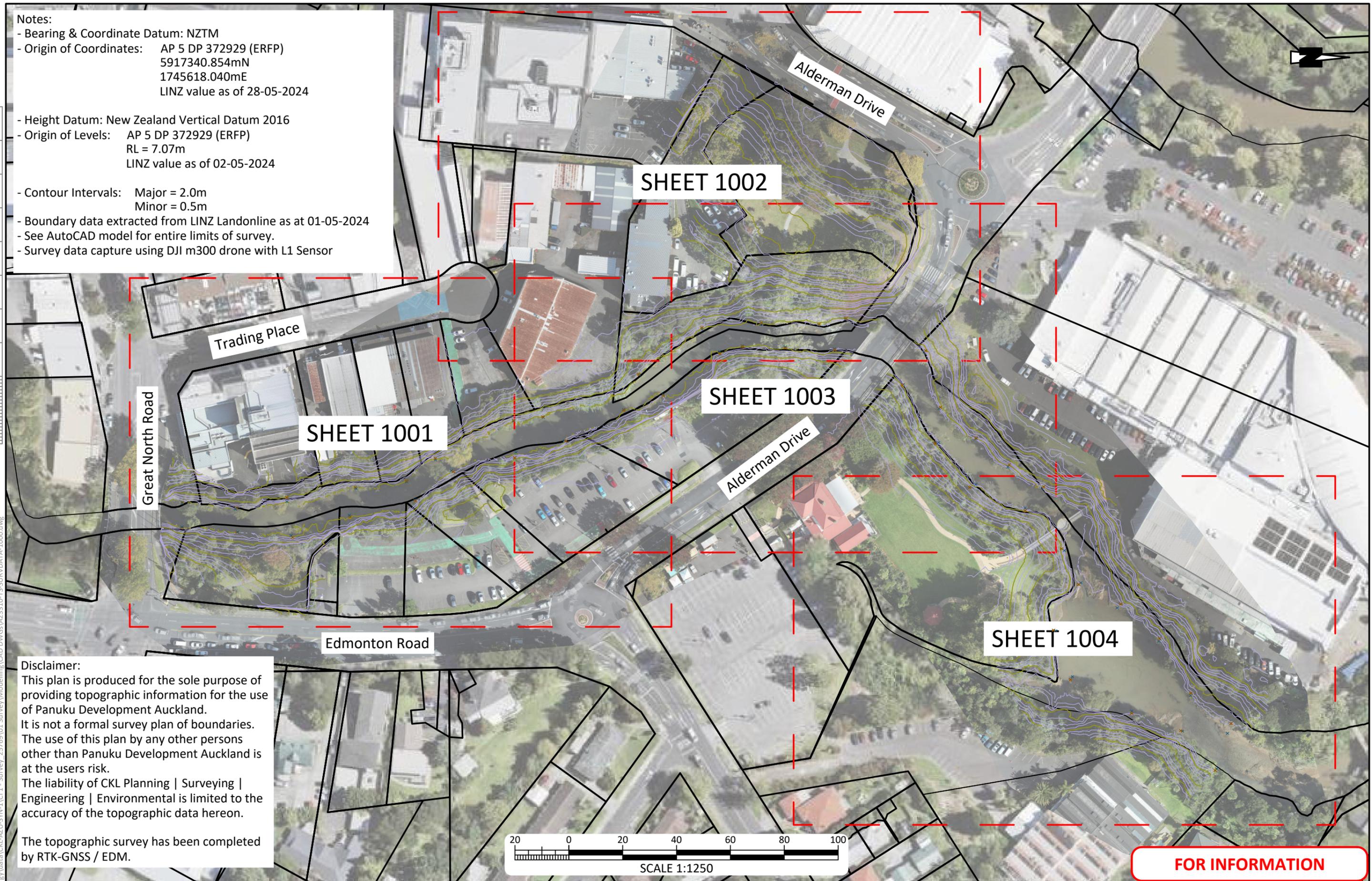


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 1745618.040mE
 LINZ value as of 28-05-2024

- Height Datum: New Zealand Vertical Datum 2016
 - Origin of Levels: AP 5 DP 372929 (ERFP)
 RL = 7.07m
 LINZ value as of 02-05-2024

- Contour Intervals: Major = 2.0m
 Minor = 0.5m
 - Boundary data extracted from LINZ Landonline as at 01-05-2024
 - See AutoCAD model for entire limits of survey.
 - Survey data capture using DJI m300 drone with L1 Sensor

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Disclaimer:
 This plan is produced for the sole purpose of providing topographic information for the use of Panuku Development Auckland. It is not a formal survey plan of boundaries. The use of this plan by any other persons other than Panuku Development Auckland is at the users risk. The liability of CKL Planning | Surveying | Engineering | Environmental is limited to the accuracy of the topographic data hereon.

The topographic survey has been completed by RTK-GNSS / EDM.



FOR INFORMATION



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 E: Auckland@ckl.co.nz

**ORATIA STREAM
 PANUKU DEVELOPMENT AUCKLAND
 9 ALDERMAN DRIVE, HENDERSON**

**SITE TOPOGRAPHIC SURVEY
 PLAN**

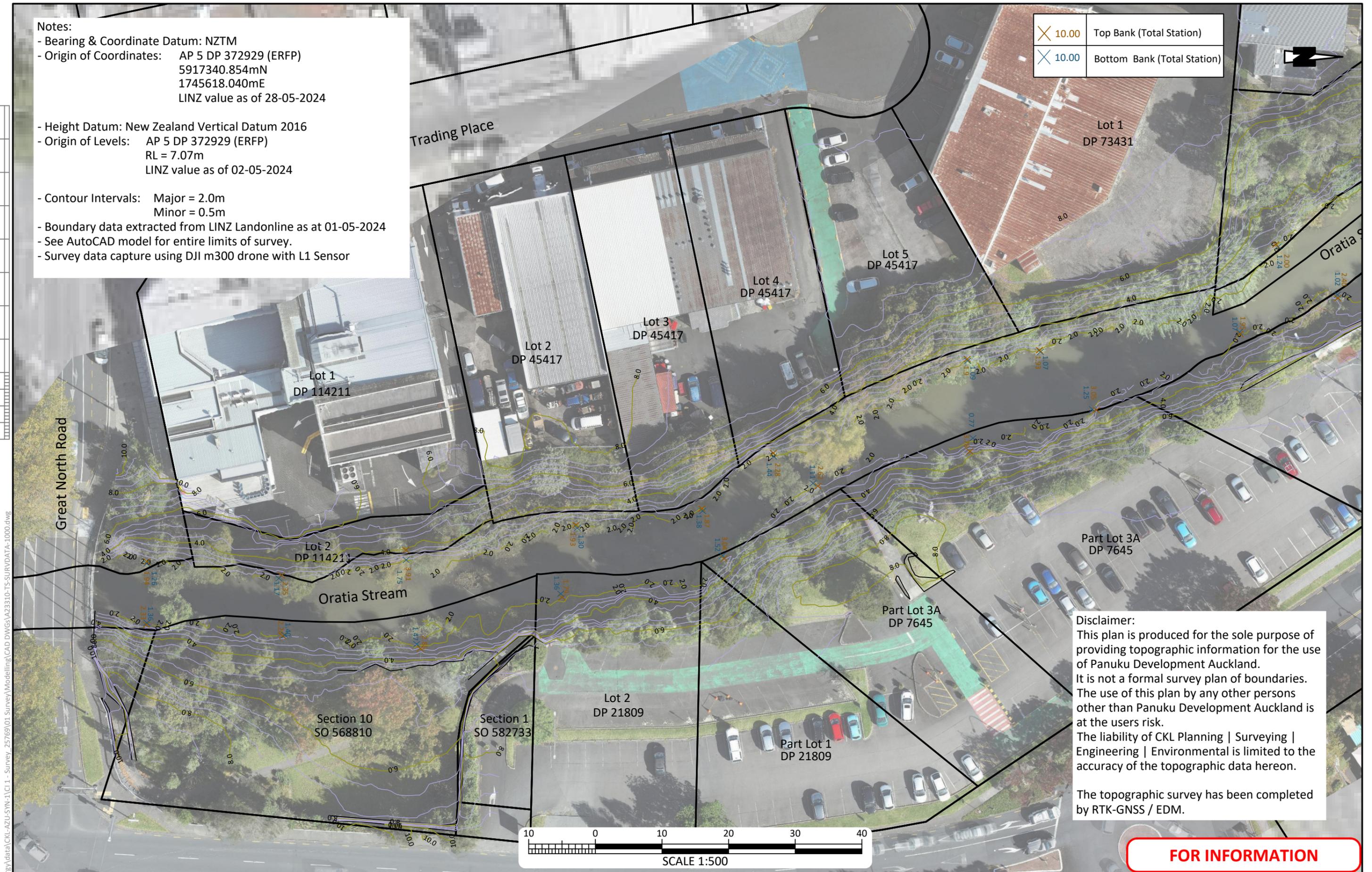
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				Checked: MRD	28.05.24	
				Job No:	Dwg No:	Rev:
				A23310	1000	0

Notes:
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 - Origin of Coordinates: AP 5 DP 372929 (ERFP)
 5917340.854mN
 1745618.040mE
 LINZ value as of 28-05-2024

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 RL = 7.07m
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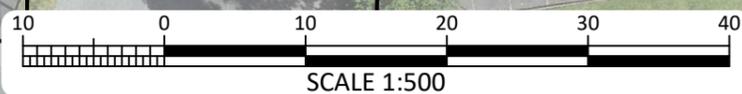
- Contour Intervals: Major = 2.0m
 Minor = 0.5m
 - Boundary data extracted from LINZ Landonline as at 01-05-2024
 - See AutoCAD model for entire limits of survey.
 - Survey data capture using DJI m300 drone with L1 Sensor

	10.00	Top Bank (Total Station)
	10.00	Bottom Bank (Total Station)



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FOR INFORMATION



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				Job No:	Dwg No:	Rev:
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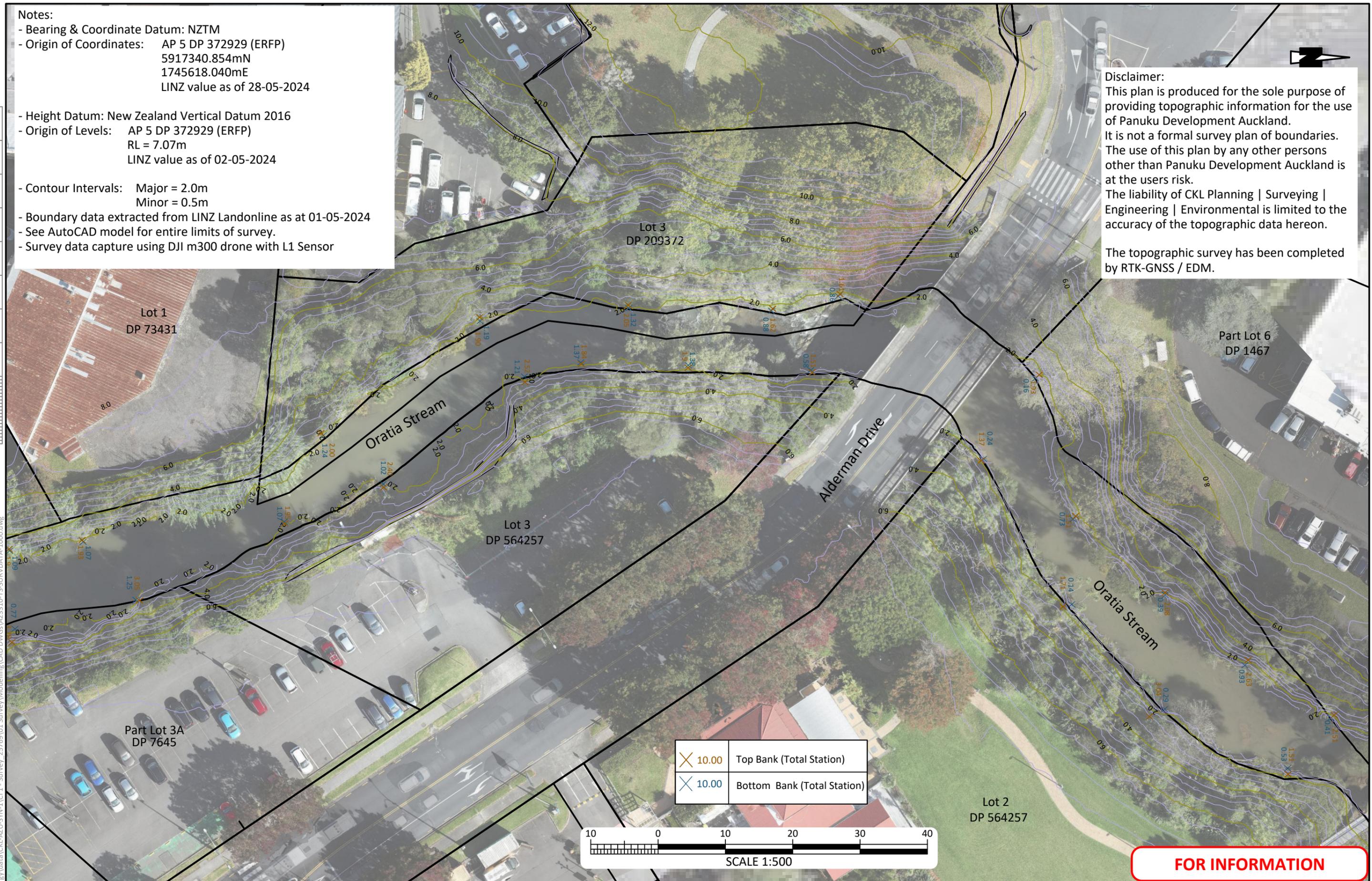
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- Height Datum: New Zealand Vertical Datum 2016
 - Origin of Levels: AP 5 DP 372929 (ERFP)
 RL = 7.07m
 LINZ value as of 02-05-2024

- Contour Intervals: Major = 2.0m
 Minor = 0.5m
 - Boundary data extracted from LINZ Landonline as at 01-05-2024
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The topographic survey has been completed by RTK-GNSS / EDM.



	10.00	Top Bank (Total Station)
	10.00	Bottom Bank (Total Station)



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**ORATIA STREAM
 PANUKU DEVELOPMENT AUCKLAND
 9 ALDERMAN DRIVE, HENDERSON**

**SITE TOPOGRAPHIC SURVEY
 PLAN**

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ACH Consultants Ltd

Wednesday, 21 January 2026

Takapu Street FFL Survey (ACH Ref: 250061)

Address	FFL
21 Edmonton Road, Henderson	House 9.08, Garage 8.47
23 Edmonton Road, Henderson	House 9.60, Rear Dwelling 8.33, Garage 8.60
26 Edmonton Road, Henderson	House 10.28, Garage 9.12
1/2A Takapu Street, Henderson	6.64
2/2A Takapu Street, Henderson	6.64
2 Takapu Street, Henderson	7.7
3-3B Takapu Street, Henderson	8.05
3C-3D Takapu Street, Henderson	8.15
3E Takapu Street, Henderson	8.69
4 Takapu Street, Henderson	House 8.43, Garage 8.42
6 Takapu Street, Henderson	Upstairs 11.58, Downstairs 8.14

Note:

All levels are to LINZ New Zealand Vertical Height Datum 2016

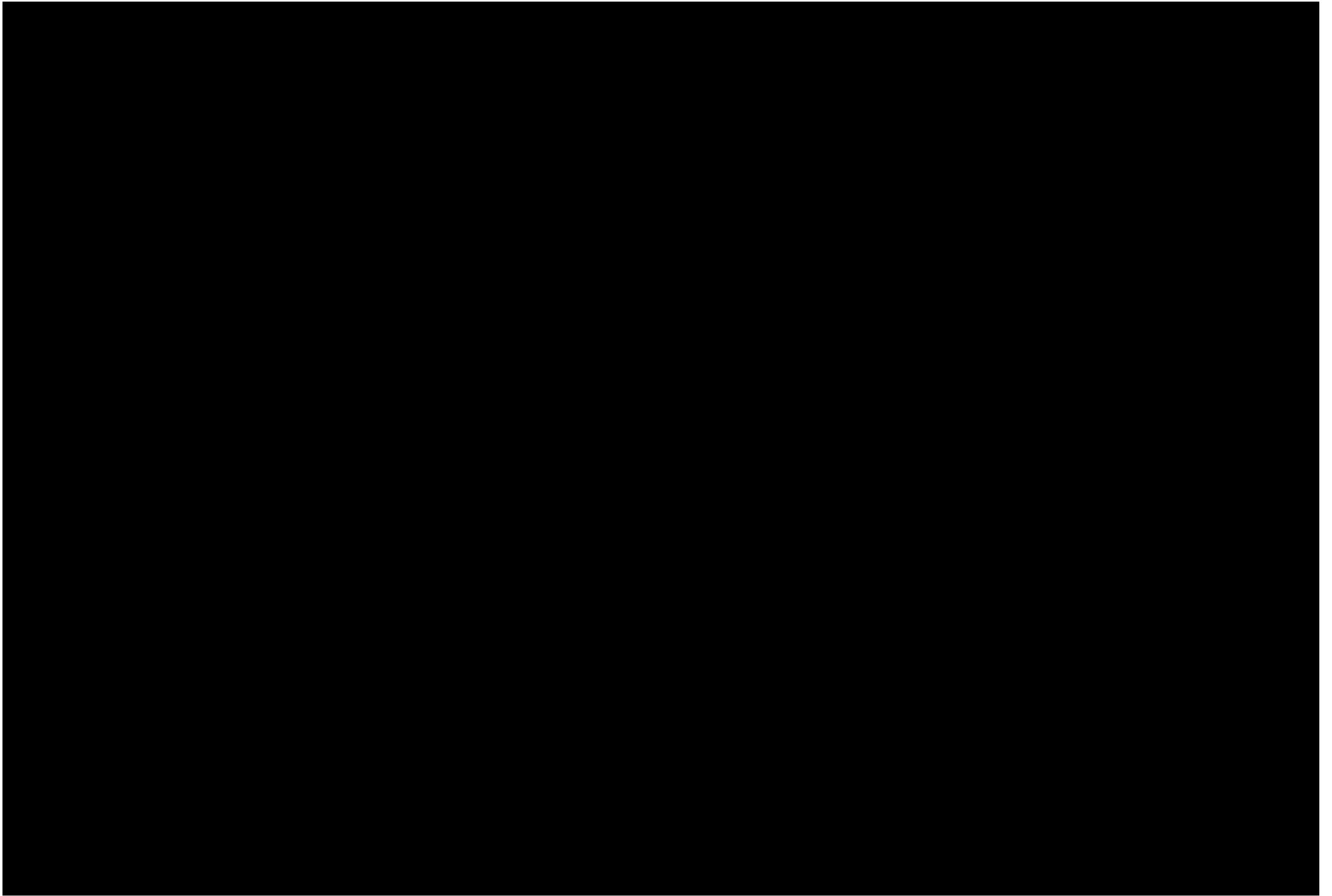
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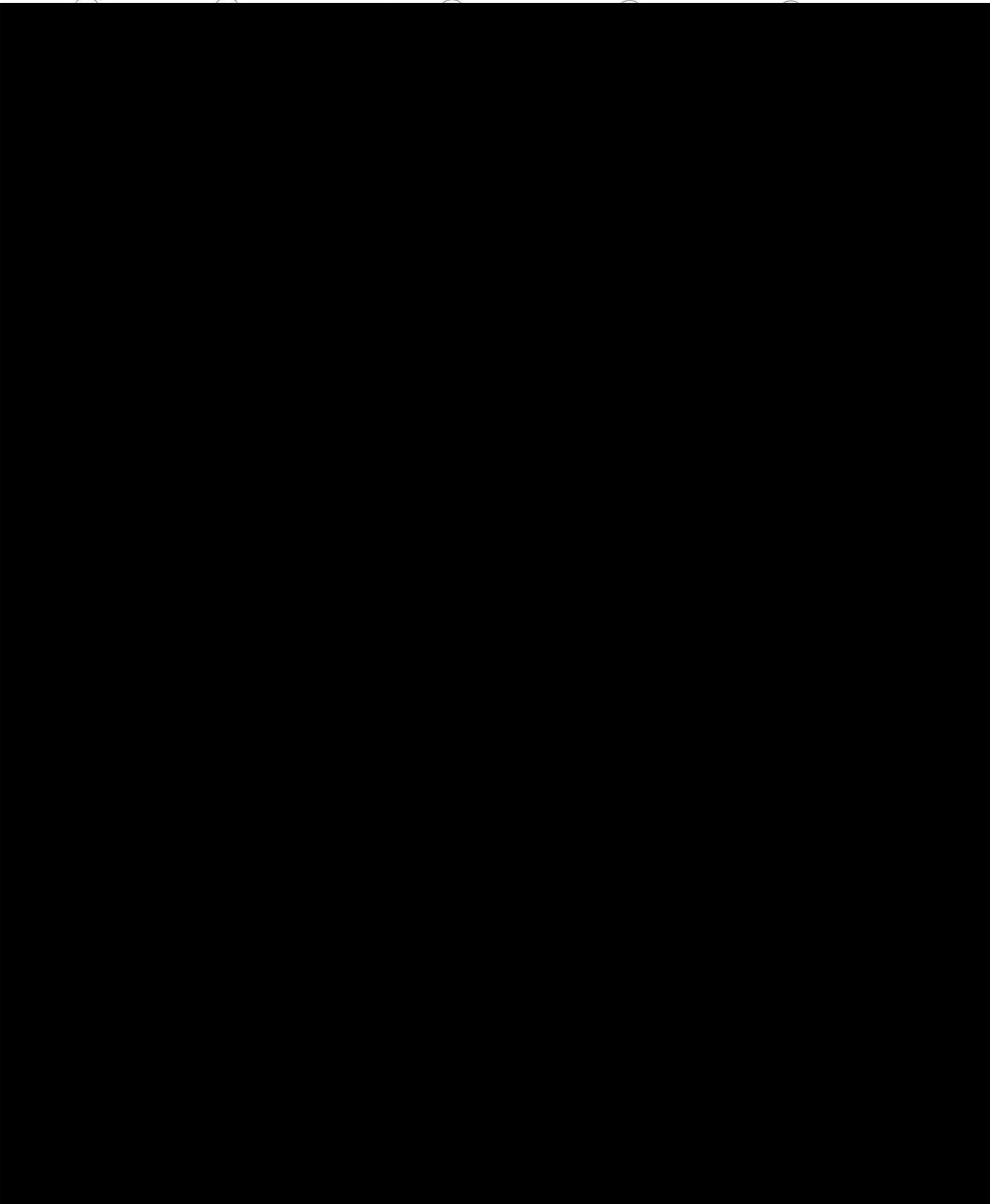
Property Surveyed FFLs

Appendix B

Proposed Development Drawings







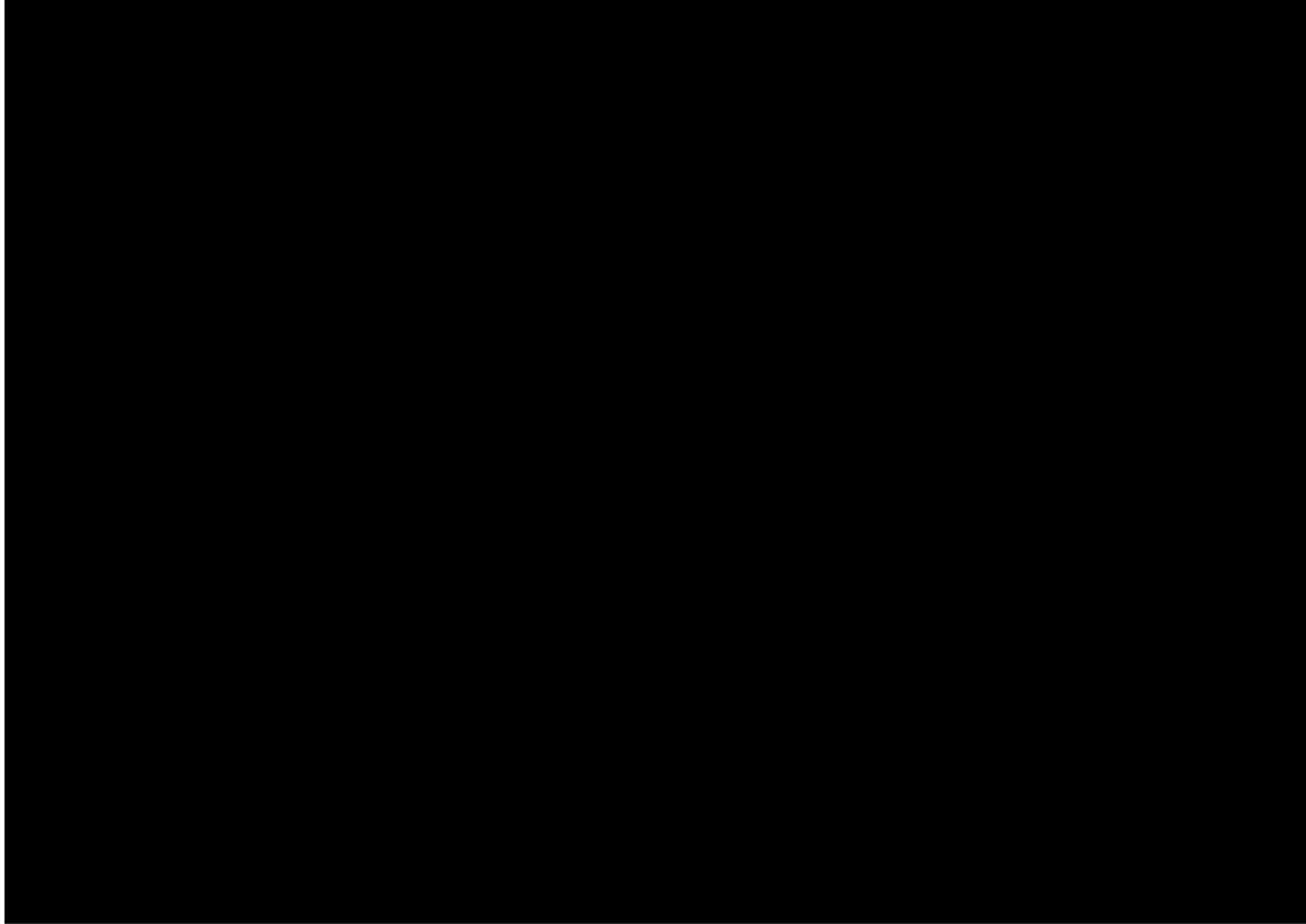
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⊕

RL +7.385
⊕

RL +7.579
⊕

architectus™ Waitākere Court House

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Issue:
Date: 02/04/25
Job no: 2440.01



Appendix C

Healthy Waters Model Information

AUCKLAND COUNCIL HEALTHY WATERS

RESPONSE TO REQUEST FOR FLOODING INFORMATION



Ref: 8704080434

Requestor details	Name	Business Name	Email
	Jéan Petherbridge	Holmes	jean.petherbridge@holmesgroup.com

Site Address	Catchment / Model
14 Edmonton Road, Henderson	Regionwide Rural Rapid Flood Model 2022 Unit D

INFORMATION TO APPLICANT

This Document provides current information held by Auckland Council relating to predicted flooding levels and extent within the catchment that includes the property noted above.

The information is extracted from a catchment wide modelling study. The study does not consider effects of built structures or potential blockage of piped infrastructure and should not be assumed to be a detailed representation of potential flooding impact that will occur within a particular site.

Disclaimer

Auckland Council gives no warranty as to the accuracy and completeness of any information given and accepts no liability for any error, omission or use of the information. The information provided does not preclude the need for an appropriate site-specific assessment and cannot be construed as endorsement, or approval, by Auckland Council. of any development

Special information requirements Auckland Unitary Plan Chapter E36 Section E36.9.2

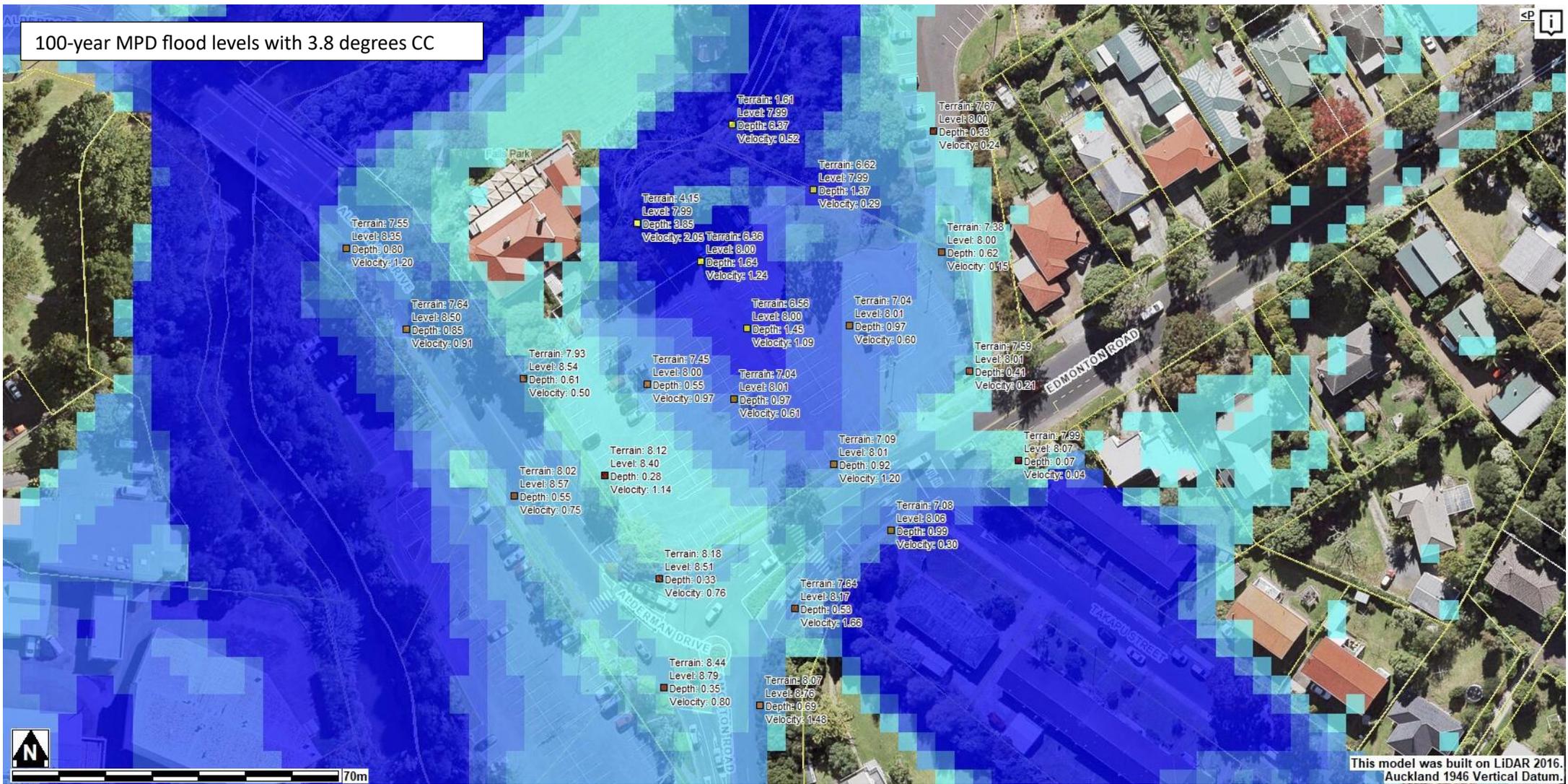
A hazard risk assessment must be undertaken when subdivision, use or development requiring resource consent is proposed to be undertaken on land which may be subject to the 1 per cent annual exceedance probability (AEP) floodplain or overland flow paths.

A hazard risk assessment report must accompany a resource consent application for the subdivision, use or development referenced above. The flooding hazard risk should be assessed for all rainfall event frequencies where flooding of the site occurs.

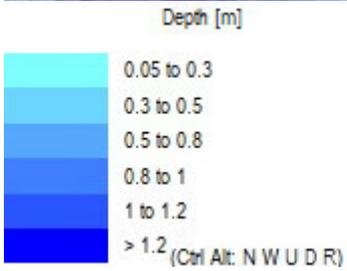
FLOODING INFORMATION

1% AEP Flooding Information		
Overland Flow: Q_{max}	402.5 m ³ /sec	Please refer to the attached figures for flow rates and velocities for the 1% AEP event.
Maximum Flooding Level	RL 8.54 (AUK1946)	Refer to the attached figure for a variety of flood levels and depths for the 1% AEP event across the wider site area. Note that the site is near a flood prone area.

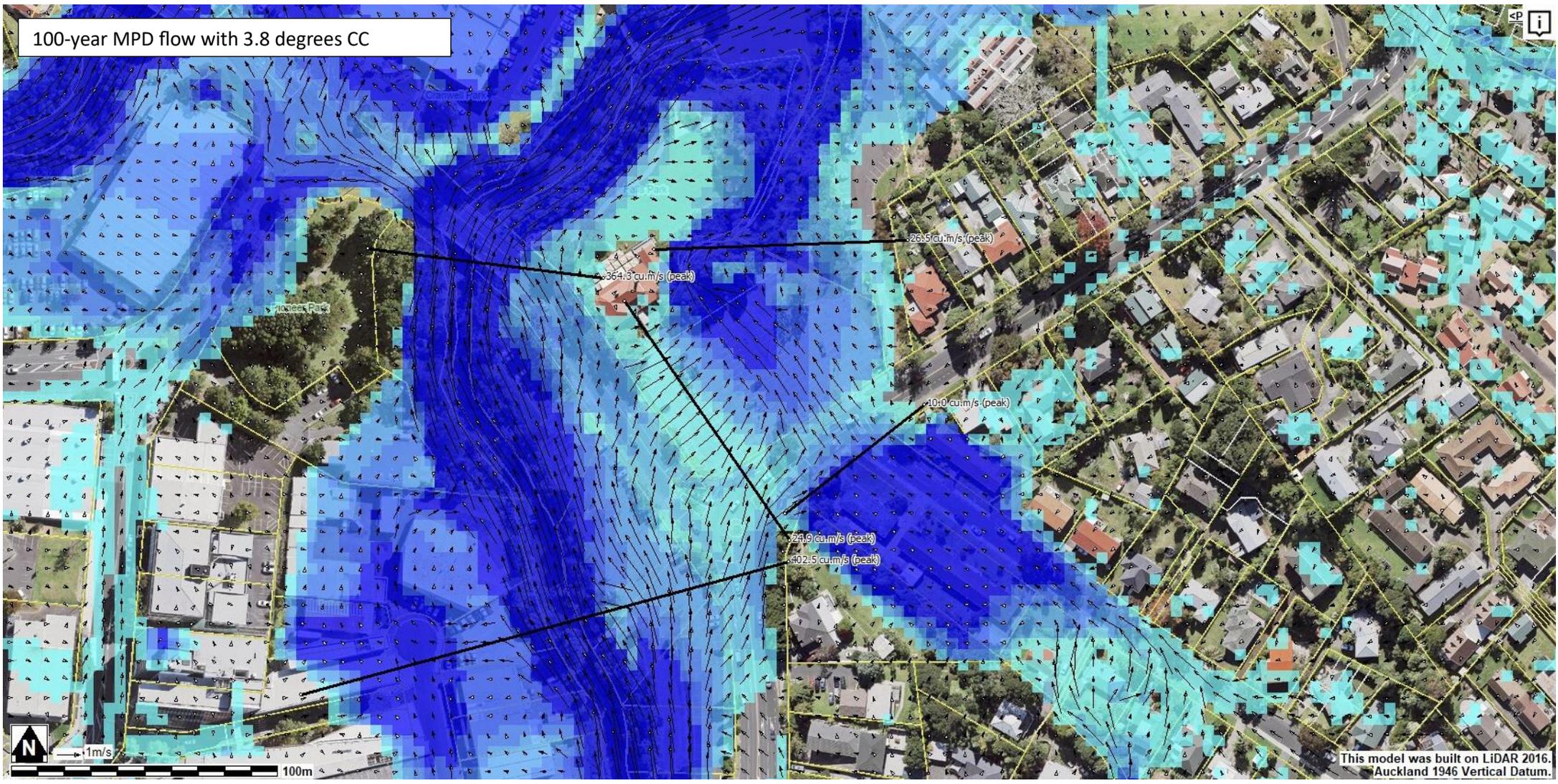
100-year MPD flood levels with 3.8 degrees CC



This model was built on LiDAR 2016, Auckland 1946 Vertical Datum.



100-year MPD flow with 3.8 degrees CC



Flood prone area information for 100-year MPD with 2.1 degrees CC

Info	Legend	Results
Flood Prone Area		
Attribute	Value	
Flood prone area ID	30502357	
Can fill in a 100yr ARI rainfall event	Yes	
Catchment Area (m2)	264572	
Minimum elevation (m RL AUK1946)	3.88	
Minimum elevation (m RL NZVD2016)	3.6	
Spill elevation (m RL AUK1946)	7.58	
Spill elevation (m RL NZVD2016)	7.3	
Spill ponding depth (m)	3.7	
Volume to spill elevation (m3)	6543	
Rainfall required to fill flood prone area (mm)	49	
Rainfall depth 100yr ARI future scenario (mm)	234	
Flood prone elevation in 100yr ARI event (m RL)	Spills – specific calculation is required	
Flood prone elevation in 100yr ARI event (m RL NZVD_2016)	Spills – specific calculation is required	
Flood prone depth in 100yr ARI event (m)	Spills – specific calculation is required	
Flood prone volume stored in 100yr ARI event (m3)	Spills – specific calculation is required	



100Yr ARI MPD 3.8 degree Climate change adjusted scenario

Time(hrs)	Flow at		Water Level at	
	Flow at Great North Road Bridge (m3/s)	Takapu Street (m3/s)	downstream (mRL) - 1946 Vertical Datum	NZVD2016 Δ-280mm
0	0	0	2.7	2.42
0.17	0.182	0.0014	2.701317	2.421317
0.33	0.1576	0.0005	2.700843	2.420843
0.5	0.1475	0.002	2.699788	2.419788
0.67	0.1248	0.0005	2.700996	2.420996
0.83	0.1296	0.0023	2.700574	2.420574
1	0.1401	0.0007	2.699357	2.419357
1.17	0.116	0.0025	2.699074	2.419074
1.33	0.1235	-0.002	2.699626	2.419626
1.5	0.1119	-0.0002	2.699555	2.419555
1.67	0.1353	0.0005	2.700138	2.420138
1.83	0.0961	0.0005	2.701821	2.421821
2	0.1392	0.0048	2.700825	2.420825
2.17	0.1495	0.0037	2.699837	2.419837
2.33	0.1243	-0.0015	2.700055	2.420055
2.5	0.1833	0.0033	2.700997	2.420997
2.67	0.1842	0.0037	2.699659	2.419659
2.83	0.1917	0.006	2.698452	2.418452
3	0.2202	0.0071	2.699902	2.419902
3.17	0.2535	0.0084	2.700981	2.420981
3.33	0.2572	0.0099	2.701144	2.421144
3.5	0.3009	0.0127	2.70113	2.42113
3.67	0.3848	0.0164	2.701803	2.421803
3.83	0.4437	0.0204	2.701203	2.421203
4	0.547	0.0256	2.700722	2.420722
4.17	0.5913	0.032	2.701623	2.421623
4.33	0.7659	0.0391	2.70043	2.42043
4.5	0.9128	0.0468	2.700308	2.420308
4.67	1.016	0.0542	2.701187	2.421187
4.83	1.159	0.061	2.703178	2.423178
5	1.288	0.0678	2.702778	2.422778
5.17	1.414	0.074	2.702033	2.422033
5.33	1.577	0.0798	2.70256	2.42256
5.5	1.694	0.0851	2.702585	2.422585
5.67	1.818	0.0897	2.702526	2.422526
5.83	1.992	0.0944	2.701983	2.421983
6	2.188	0.0982	2.703145	2.423145
6.17	2.477	0.1073	2.704245	2.424245
6.33	2.793	0.1214	2.70621	2.42621
6.5	3.115	0.1402	2.709832	2.429832
6.67	3.413	0.1327	2.710154	2.430154

6.83	3.733	0.1892	2.709262	2.429262
7	4.166	0.2189	2.710635	2.430635
7.17	4.704	0.2493	2.712264	2.432264
7.33	5.355	0.2782	2.714109	2.434109
7.5	5.947	0.3027	2.716852	2.436852
7.67	6.542	0.3228	2.718956	2.438956
7.83	7.41	0.3389	2.724097	2.444097
8	8.493	0.3518	2.729054	2.449054
8.17	9.171	0.3628	2.731826	2.451826
8.33	10.06	0.3721	2.735454	2.455454
8.5	10.96	0.3799	2.739822	2.459822
8.67	11.97	0.3863	2.744433	2.464433
8.83	13.05	0.3922	2.750223	2.470223
9	14.22	0.3975	2.755753	2.475753
9.17	15.57	0.4131	2.764225	2.484225
9.33	17.3	0.4379	2.77763	2.49763
9.5	19.28	0.4672	2.793394	2.513394
9.67	21.39	0.5024	2.812294	2.532294
9.83	22.98	0.5304	2.830255	2.550255
10	25.05	0.5558	2.853517	2.573517
10.17	27	0.6045	2.88283	2.60283
10.33	29.13	0.6748	2.917062	2.637062
10.5	31.24	0.7517	2.954126	2.674126
10.67	34.17	0.8347	2.997907	2.717907
10.83	37.34	0.901	3.052982	2.772982
11	40.3	0.9482	3.107199	2.827199
11.17	43.59	1.054	3.165421	2.885421
11.33	47.82	1.212	3.23869	2.95869
11.5	51.81	1.399	3.319933	3.039933
11.67	60.88	1.819	3.430454	3.150454
11.83	69.48	2.456	3.589706	3.309706
12	85.21	4.145	3.84019	3.56019
12.17	111.49	8.595	4.27879	3.99879
12.33	146.85	9.315	4.828167	4.548167
12.5	176.71	6.52	5.238454	4.958454
12.67	195.78	4.491	5.514441	5.234441
12.83	211.68	3.334	5.713975	5.433975
13	236.05	2.794	5.934576	5.654576
13.17	274.48	2.377	6.22383	5.94383
13.33	329.56	1.977	6.570397	6.290397
13.5	374.99	0.377	6.930629	6.650629
13.67	399.5	0.7965	7.264499	6.984499
13.83	401.2	0.9669	7.513452	7.233452
14	387.34	1.054	7.676386	7.396386
14.17	362.27	1.309	7.769277	7.489277
14.33	333.65	1.535	7.794282	7.514282
14.5	302.76	1.785	7.76034	7.48034
14.67	274.47	1.864	7.680562	7.400562

14.83	248.89	1.459	7.564112	7.284112
15	225.9	1.098	7.421731	7.141731
15.17	203.91	0.9334	7.255143	6.975143
15.33	182.3	0.8343	7.060624	6.780624
15.5	162.84	0.7511	6.845224	6.565224
15.67	146.17	0.6879	6.607584	6.327584
15.83	133.88	0.6358	6.367216	6.087216
16	123.71	0.6002	6.127775	5.847775
16.17	113.52	0.5765	5.885397	5.605397
16.33	105.24	0.5627	5.653642	5.373642
16.5	97.63	0.5546	5.440874	5.160874
16.67	92.86	0.55	5.241053	4.961053
16.83	87.07	0.5472	5.058056	4.778056
17	81.99	0.5456	4.884566	4.604566
17.17	77.59	0.5453	4.720656	4.440656
17.33	73.86	0.5446	4.558476	4.278476
17.5	70.94	0.5445	4.41136	4.13136
17.67	67.69	0.5444	4.276498	3.996498
17.83	64.55	0.5444	4.15351	3.87351
18	62.84	0.5442	4.048599	3.768599
18.17	61.01	0.5224	3.95969	3.67969
18.33	59.32	0.4872	3.881695	3.601695
18.5	58.64	0.447	3.814379	3.534379
18.67	58.78	0.3945	3.753741	3.473741
18.83	57.36	0.3707	3.699703	3.419703
19	53.83	0.3438	3.650812	3.370812
19.17	52.46	0.3213	3.603826	3.323826
19.33	50.96	0.3048	3.559077	3.279077
19.5	49.82	0.2925	3.517949	3.237949
19.67	48.3	0.2836	3.479232	3.199232
19.83	47.08	0.2774	3.443263	3.163263
20	45.6	0.2729	3.408731	3.128731
20.17	43.4	0.2699	3.370629	3.090629
20.33	41.52	0.2679	3.330892	3.050892
20.5	39.98	0.2666	3.289514	3.009514
20.67	38.46	0.2659	3.248239	2.968239
20.83	36.48	0.2653	3.212331	2.932331
21	35.46	0.2649	3.181501	2.901501
21.17	34	0.2647	3.149623	2.869623
21.33	32.53	0.2647	3.117655	2.837655
21.5	31.47	0.2646	3.088348	2.808348
21.67	30.87	0.2647	3.062281	2.782281
21.83	30.39	0.2646	3.041361	2.761361
22	29.68	0.2647	3.021802	2.741802
22.17	29.36	0.2646	3.006354	2.726354
22.33	28.91	0.2646	2.993192	2.713192
22.5	28.64	0.2646	2.983568	2.703568
22.67	28.14	0.2645	2.974442	2.694442

22.83	28.01	0.2647	2.967726	2.687726
23	27.84	0.2646	2.963191	2.683191
23.17	27.57	0.2646	2.959693	2.679693
23.33	27.51	0.2646	2.956676	2.676676
23.5	27.47	0.2646	2.955348	2.675348
23.67	27.44	0.2646	2.954526	2.674526
23.83	27.42	0.2646	2.953435	2.673435
24	27.41	0.2645	2.952677	2.672677
24.17	24.48	0.2532	2.951832	2.671832
24.33	25.48	0.2321	2.956465	2.676465
24.5	26.47	0.2074	2.961341	2.681341
24.67	26.08	0.1833	2.963815	2.683815
24.83	25.46	0.16	2.957952	2.677952
25	24.58	0.1389	2.94689	2.66689
25.17	23.85	0.1187	2.935924	2.655924
25.33	23.31	0.1022	2.923623	2.643623
25.5	22.11	0.0889	2.907124	2.627124
25.67	21.53	0.0759	2.896496	2.616496
25.83	20.08	0.0668	2.879856	2.599856
26	19.54	0.06	2.865962	2.585962
26.17	17.84	0.0525	2.848412	2.568412
26.33	16.29	0.0475	2.829123	2.549123
26.5	15.37	0.0426	2.811558	2.531558
26.67	14.34	0.0378	2.797272	2.517272
26.83	13.37	0.0335	2.787778	2.507778
27	12	0.031	2.772903	2.492903
27.17	10.69	0.0281	2.757922	2.477922
27.33	9.47	0.0249	2.744528	2.464528
27.5	9.09	0.0233	2.739089	2.459089
27.67	7.914	0.0213	2.731849	2.451849
27.83	7.106	0.0202	2.724168	2.444168
28	6.405	0.0195	2.717748	2.437748
28.17	5.659	0.0167	2.713033	2.433033
28.33	5.084	0.0157	2.709675	2.429675
28.5	4.371	0.0155	2.707942	2.427942
28.67	3.581	0.0137	2.705591	2.425591
28.83	3.034	0.0122	2.702602	2.422602
29	2.586	0.0119	2.702055	2.422055
29.17	2.262	0.0109	2.703822	2.423822
29.33	1.976	0.0104	2.703341	2.423341
29.5	1.836	0.0099	2.700448	2.420448
29.67	1.565	0.0094	2.69812	2.41812
29.83	1.289	0.0092	2.69814	2.41814
30	1.304	0.0077	2.699911	2.419911
30.17	1.268	0.0082	2.700493	2.420493
30.33	1.125	0.0075	2.699057	2.419057
30.5	1.087	0.0067	2.697323	2.417323
30.67	0.993	0.0068	2.69734	2.41734

30.83	0.8963	0.0066	2.69922	2.41922
31	0.8388	0.0058	2.698651	2.418651
31.17	0.7961	0.0057	2.698085	2.418085
31.33	0.7454	0.0061	2.698722	2.418722
31.5	0.7263	0.0052	2.699355	2.419355
31.67	0.6652	0.0054	2.70041	2.42041
31.83	0.6579	0.0052	2.700772	2.420772
32	0.6077	0.0048	2.700831	2.420831

2D: Oraita Perimeter BCLine: Oratia Inflow

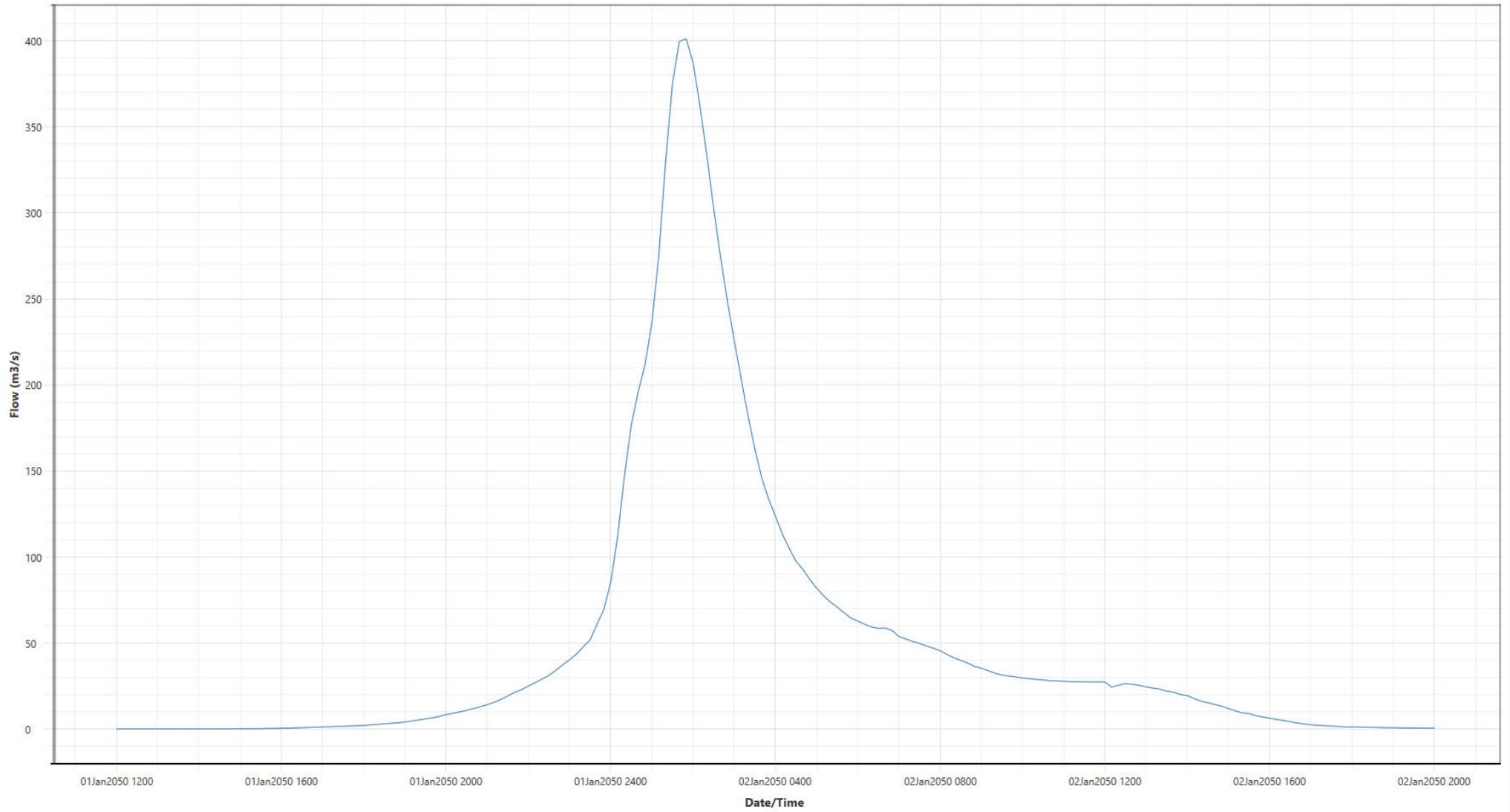


Figure 1: Oratia Stream Inflow Hydrograph

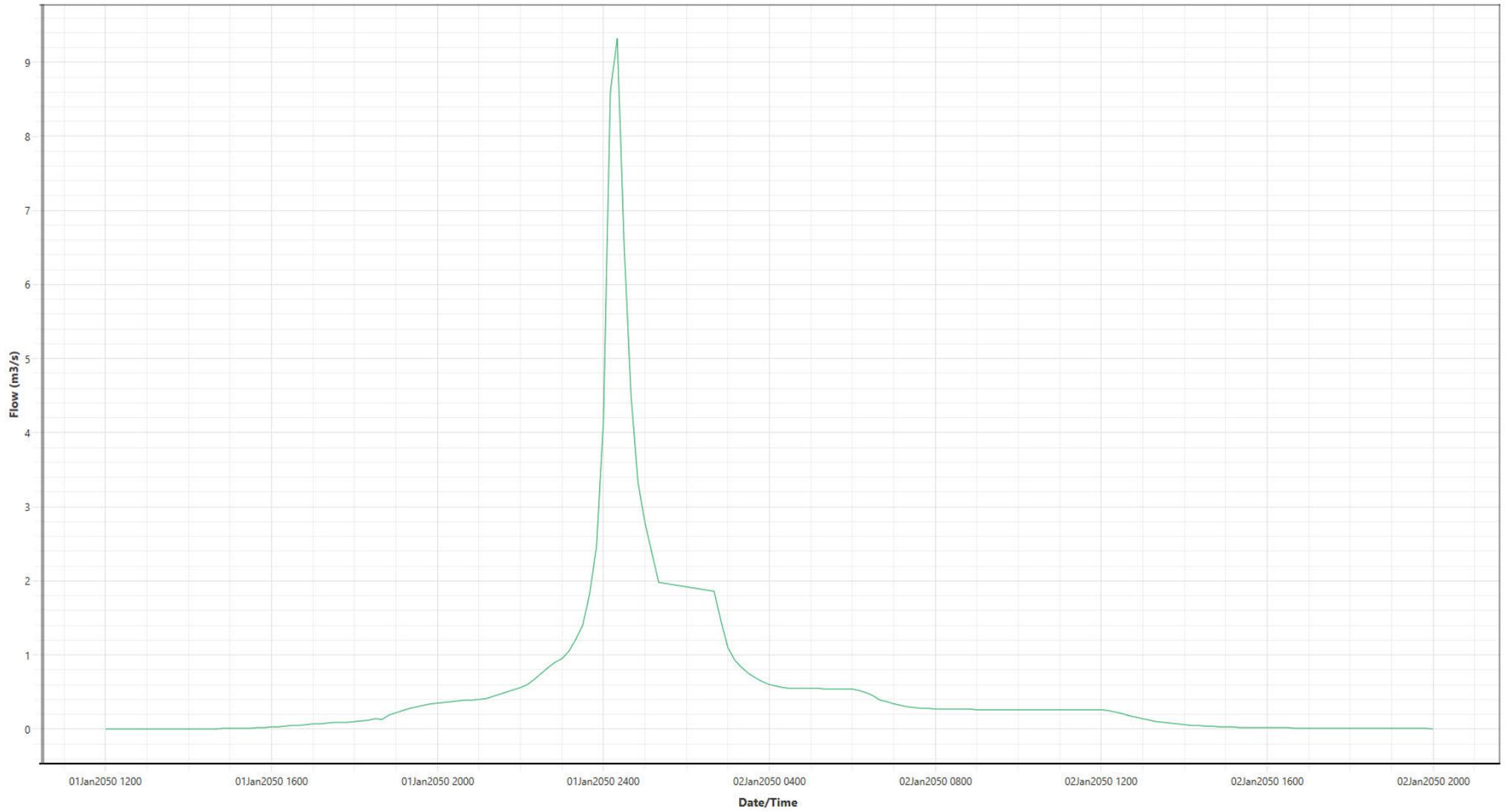


Figure 2: Edmonton Road OLFP Inflow Hydrograph

2D: Oraita Perimeter BCLine: Oratia Outflow

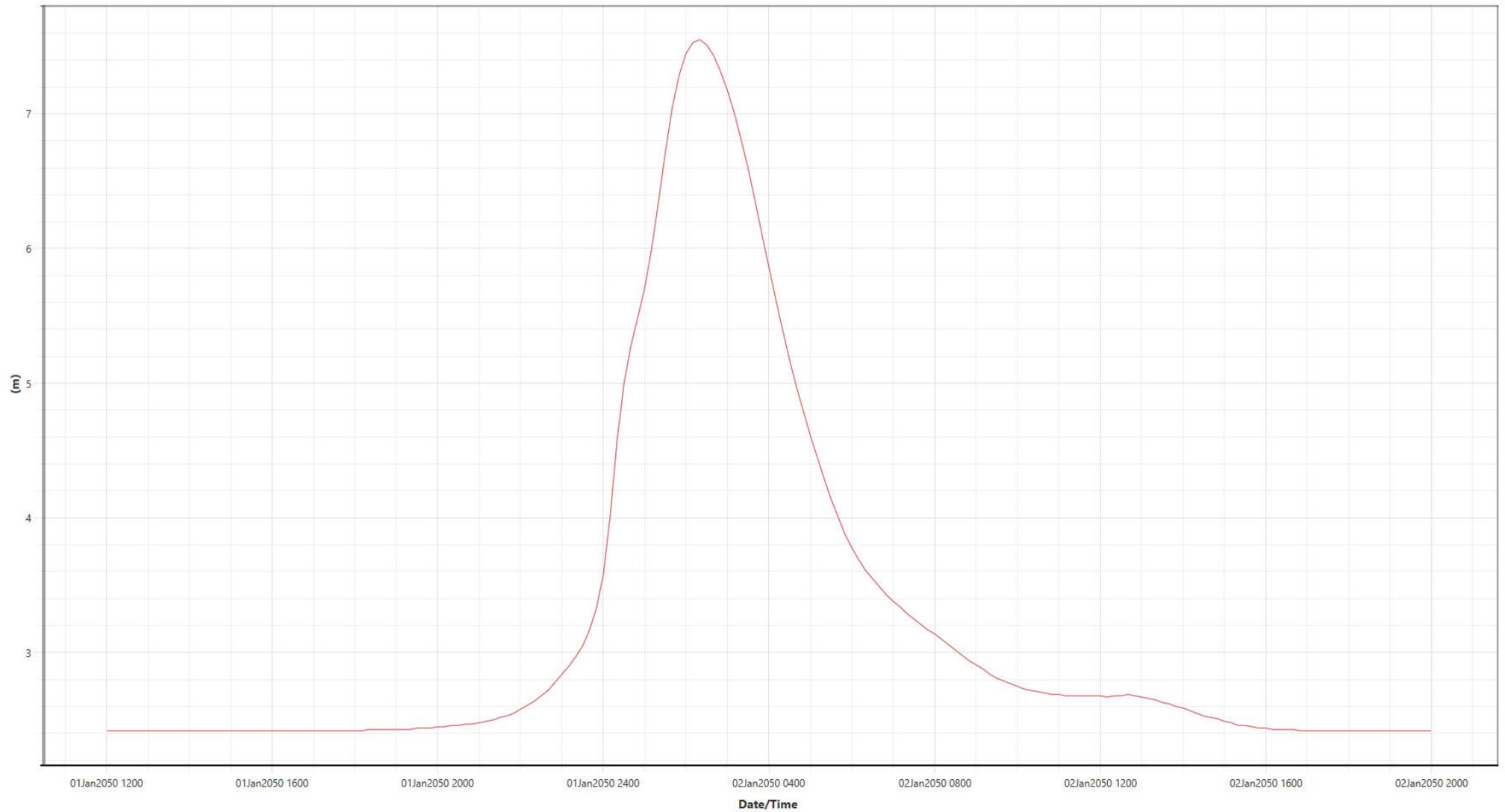


Figure 3: Oratia Stream Outflow Stage Hydrograph

Appendix D

Healthy Waters Correspondence

Marnu Strydom

From: Kevin Fan <Kevin.Fan@aucklandcouncil.govt.nz>
Sent: Friday, 14 February 2025 5:34 pm
To: Marnu Strydom
Cc: Lakshmi Nair; Tom McLean
Subject: RE: JPPP - Waitākere Courthouse development - 14 Edmonton Road, Henderson
Attachments: waterRIDE Export.xlsx

Follow Up Flag: Follow up
Flag Status: Completed

You don't often get email from kevin.fan@aucklandcouncil.govt.nz. [Learn why this is important](#)

Hi Marnu

Please find the attached Inflow hydrographs for the Waikumete Stream and overland flow path and downstream water levels from modelled 1% AEP MPD event with a 3.8-degree climate change scenario.

The following tables show the changes in the rainfall depth and rainfall intensity due to climate change.

Table A1 – 1: Percentage Increase in 24-hour Design Rainfall Depth

Annual Exceedance Probability (AEP)	Percentage Increase in 24-hour Design Rainfall Depth due to Future Climate Change (2.1°C Increase in Temperature)	Percentage Increase in 24-hour Design Rainfall Depth due to Future Climate Change (3.8°C Increase in Temperature)
50%AEP	15.1%	27.4%
20%AEP	16.4%	29.6%
10%AEP	17.0%	30.8%
5%AEP	17.2%	31.2%
2%AEP	17.6%	31.9%
1%AEP	18.1%	32.7%

Table A1 – 2: TP108 Normalised 24-hour Temporal Rainfall Intensity Profile

Time (hrs:mins)	Time Interval (min)	TP108 Normalised Rainfall Intensity (I/I24)		
		Historic Climate	Future Climate change (2.1°C Increase in Temperature)	Future Climate (3.8°C Increase in Temperature)
0:00 – 6:00	360	0.34	0.29	0.27
6:00 – 9:00	180	0.74	0.69	0.66
9:00 – 10:00	60	0.96	0.93	0.91
10:00 – 11:00	60	1.40	1.42	1.43
11:00 – 11:30	30	2.20	2.30	2.36
11:30 – 11:40	10	3.80	4.14	4.35
11:40 – 11:50	10	4.80	5.23	5.50
11:50 – 12:00	10	8.70	9.49	9.97
12:00 – 12:10	10	16.20	17.66	18.56
12:10 – 12:20	10	5.90	6.43	6.76
12:20 – 12:30	10	4.20	4.58	4.81
12:30 – 13:00	30	2.90	3.08	3.20
13:00 – 14:00	60	1.70	1.65	1.62
14:00 – 15:00	60	1.20	1.20	1.19
15:00 – 18:00	180	0.75	0.72	0.70
18:00 – 24:00	360	0.40	0.36	0.34

Kind regards
Kevin Fan

From: Tom McLean <t.mclean@tbig.co.nz>
Sent: Tuesday, February 11, 2025 2:27 PM
To: Kevin Fan <Kevin.Fan@aucklandcouncil.govt.nz>; Hannah Pettengell <HannahP@barker.co.nz>
Cc: Alisa Neal <AlisaN@barker.co.nz>; Tess Browne <t.browne@tbig.co.nz>; Jo Hart <Jo.Hart@aucklandcouncil.govt.nz>;
 Lakshmi Nair <Lakshmi.Nair@aucklandcouncil.govt.nz>
Subject: RE: JPPP - Waitākere Courthouse development - 14 Edmonton Road, Henderson

Hi Kevin,

Our Hydrology consultant is Marnu Strydom from ACH Consulting, their details are below:

Marnu Strydom
Senior Civil Engineer

P 09 839 7050
M 027 700 9158
E marnu.strydom@achconsulting.co.nz

Regards,

Tom

Tom McLean

Senior Project Manager

M 027 577 6051 E t.mclean@tbig.co.nz W tbig.co.nz

Level 13, Grant Thornton House, 215 Lambton Quay, Wellington 6011 | PO Box 830, Wellington, 6140



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From: Kevin Fan <Kevin.Fan@aucklandcouncil.govt.nz>

Sent: Tuesday, 11 February 2025 2:18 pm

To: Hannah Pettengell <HannahP@barker.co.nz>

Cc: Alisa Neal <AlisaN@barker.co.nz>; Tess Browne <t.browne@tbig.co.nz>; Tom McLean <t.mclean@tbig.co.nz>; Jo Hart <Jo.Hart@aucklandcouncil.govt.nz>; Lakshmi Nair <Lakshmi.Nair@aucklandcouncil.govt.nz>

Subject: RE: JPPP - Waitākere Courthouse development - 14 Edmonton Road, Henderson

Hi Hannah

Could you please provide contact details of ACH modeller's? I will contact him directly

Kind regards

Kevin Fan

From: Hannah Pettengell <HannahP@barker.co.nz>

Sent: Tuesday, 11 February 2025 12:08 PM

To: Kevin Fan <Kevin.Fan@aucklandcouncil.govt.nz>

Cc: Alisa Neal <AlisaN@barker.co.nz>; Tess Browne <t.browne@tbig.co.nz>; Tom McLean <t.mclean@tbig.co.nz>; Jo Hart <Jo.Hart@aucklandcouncil.govt.nz>; Lakshmi Nair <Lakshmi.Nair@aucklandcouncil.govt.nz>

Subject: FW: JPPP - Waitākere Courthouse development - 14 Edmonton Road, Henderson

Hi Kevin,

Hope all is well.

Just touching base regarding Tom's email below. Are you able to advise a timeframe to provide this information?

Thanks in advance.

Ngā mihi | Kind regards,

HANNAH PETTENGELL
Senior Planner
027 350 0754
HannahP@barker.co.nz



barker.co.nz 

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From: Tom McLean <t.mclean@tbig.co.nz>
Sent: Friday, 7 February 2025 11:41 am
To: Kevin Fan <Kevin.Fan@aucklandcouncil.govt.nz>
Cc: Tess Browne <t.browne@tbig.co.nz>; Alisa Neal <AlisaN@barker.co.nz>; Hannah Pettengell <HannahP@barker.co.nz>; Jo Hart <Jo.Hart@aucklandcouncil.govt.nz>; Lakshmi.Nair@aucklandcouncil.govt.nz
Subject: JPPP - Waitākere Courthouse development - 14 Edmonton Road, Henderson

Hi Kevin,

Following on from our catch up on the 30th of January, please find below a summary of what we will require from Healthy Water to be able to generate our site-specific flooding calculations for the site.

- *Confirmation of the extent of the Waikumete and surrounding streams which will need to be included in the model, including upstream and downstream points.*
- *Inflow hydrographs for the Waikumete Stream and overland flow paths, for the events that need to be modelled (1% AEP with climate change of 3.8°)*
- *GIS information on the culvert under Edmonton Rd (Diameter, invert, location) and any other existing features which will need to be included in model.*
- *Confirmation on how the culvert under Edmonton Road is to be treated in the model. i.e. partially or fully blocked during a 100-year event.*
- *The engineer will be looking to download the GIS contour for the ground profile and will calculate the top water level as part of their assessment.*
- *Roughness information/land use information from the detailed model. If this is not available, the engineer will use their own roughness coefficients based on accepted engineering standards.*

Please noted that due to the timeframe we need this modelling completed for our project, we have changed our Hydrology Modelling Engineers from Stantec to ACH Consulting. We understand ACH Consulting recently complete flood modelling for the Eke Panuku sites located at 19 Alderman Drive, 10 Edmonton Road & 8 Edmonton Road so already have a good understanding of the flooding risk in this area.

Looking forward to hearing from you.

Kind regards,

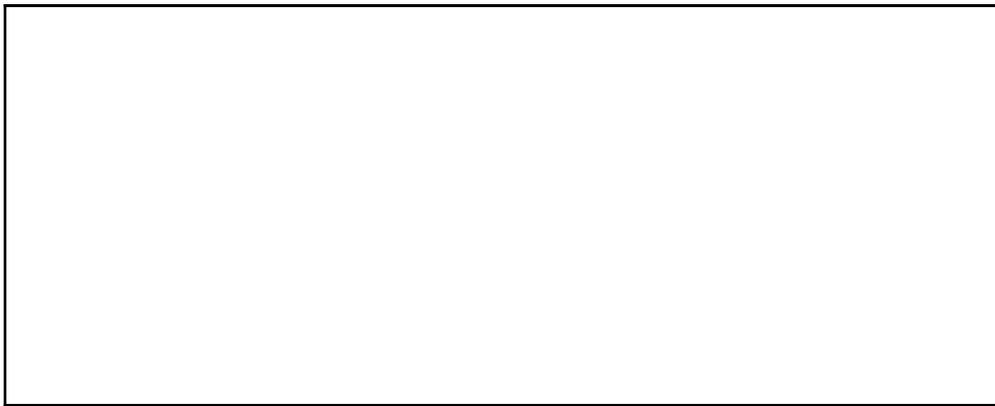
Tom

Tom McLean
Senior Project Manager

M 027 577 6051 E t.mclean@tbig.co.nz W tbig.co.nz



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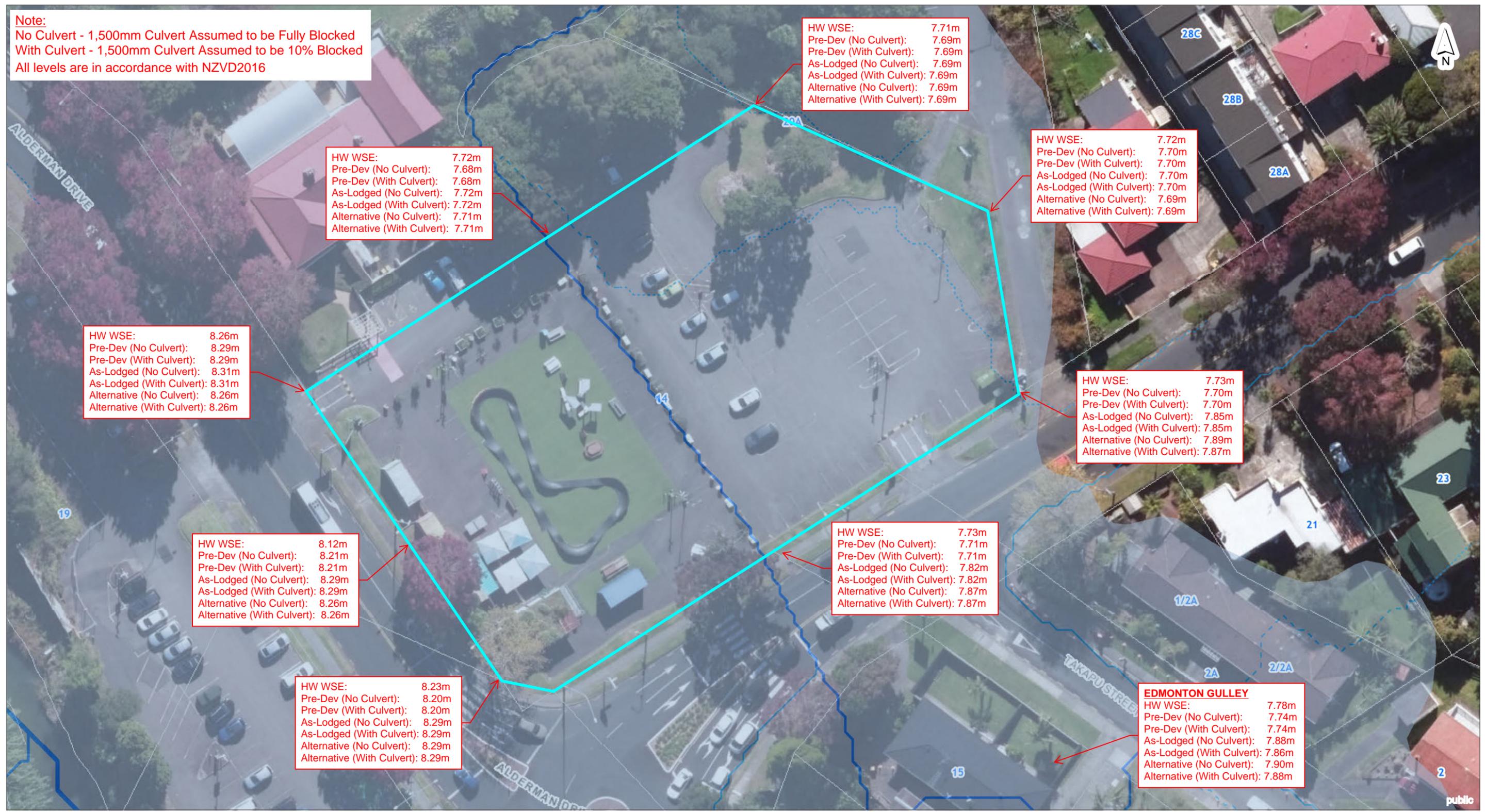


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Appendix E

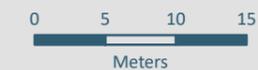
Model Results

Note:
 No Culvert - 1,500mm Culvert Assumed to be Fully Blocked
 With Culvert - 1,500mm Culvert Assumed to be 10% Blocked
 All levels are in accordance with NZVD2016



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GIS Layout - Sheet 2 of 3



Scale @ A3
 = 1:500

Date Printed:
 16/01/2026



Pre-Development 100-Year Floodplain (1,500mm Culvert 100% Blocked)



Figure 1: Edmonton OLFP Overtops Road Carriageway (10 hrs 25 min after storm start)

Pre-Development 100-Year Floodplain (1,500mm Culvert 100% Blocked)



Figure 2: Edmonton OLFP Peak Flood (12 hrs 20 min after storm start)

Pre-Development 100-Year Floodplain (1,500mm Culvert 100% Blocked)

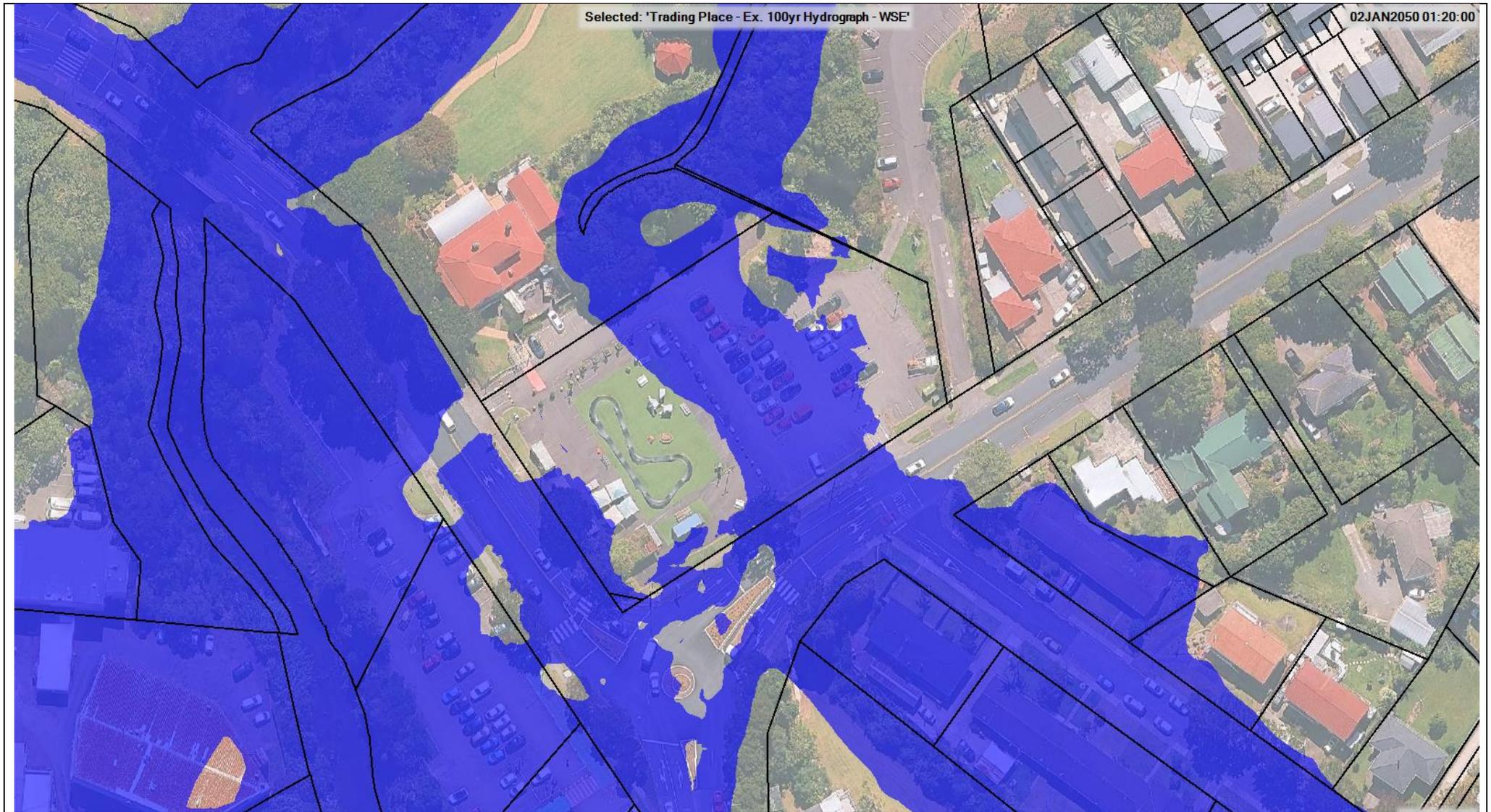


Figure 3: Oratia Stream Overtops Alderman Drive Carriageway (13 hrs 20 min after storm start)

Pre-Development 100-Year Floodplain (1,500mm Culvert 100% Blocked)

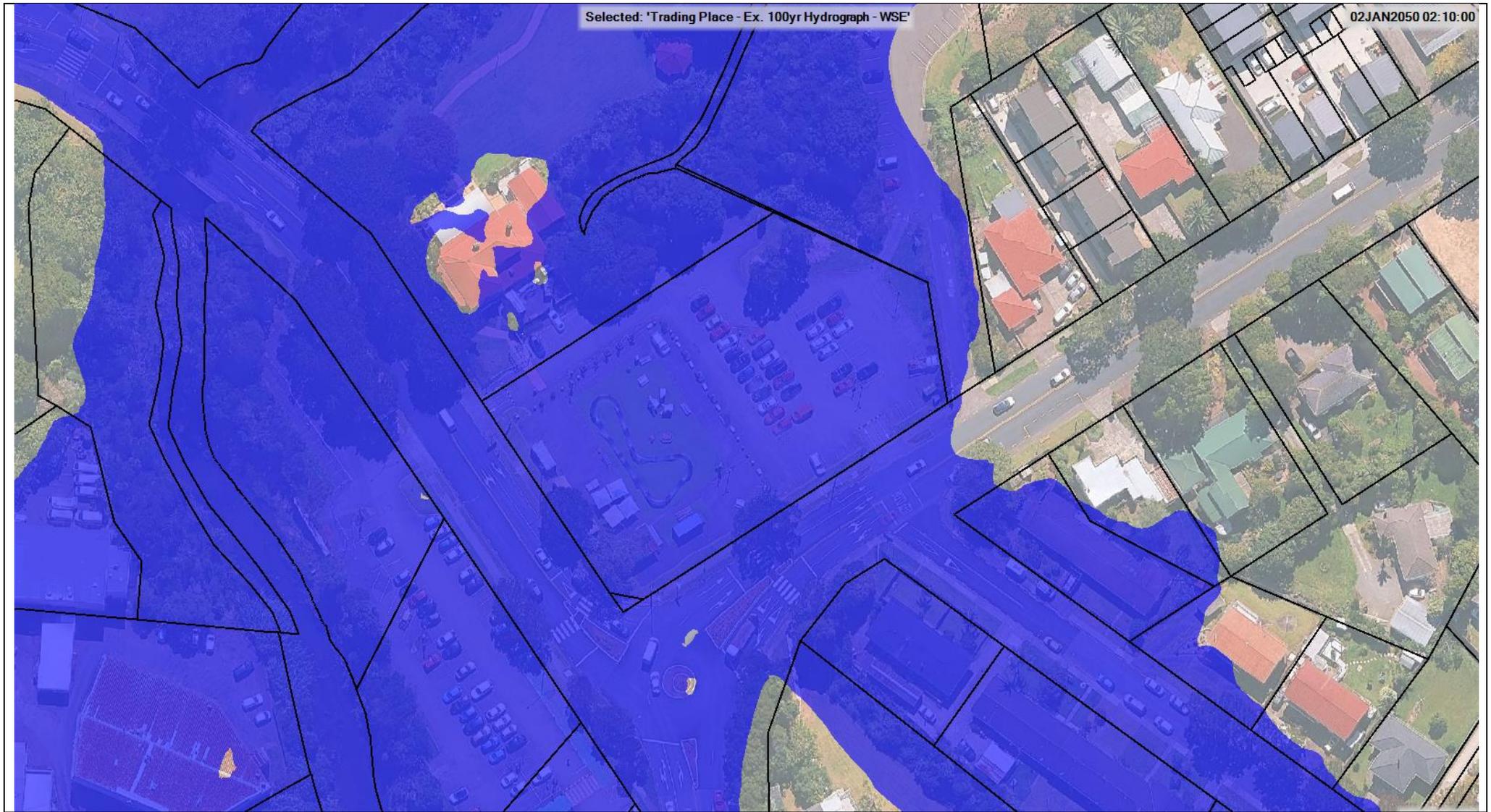


Figure 4: Peak Flooding (14 hrs 10 min after storm start)

Pre-Development 100-Year Floodplain (1,500mm Culvert 10% Blocked)

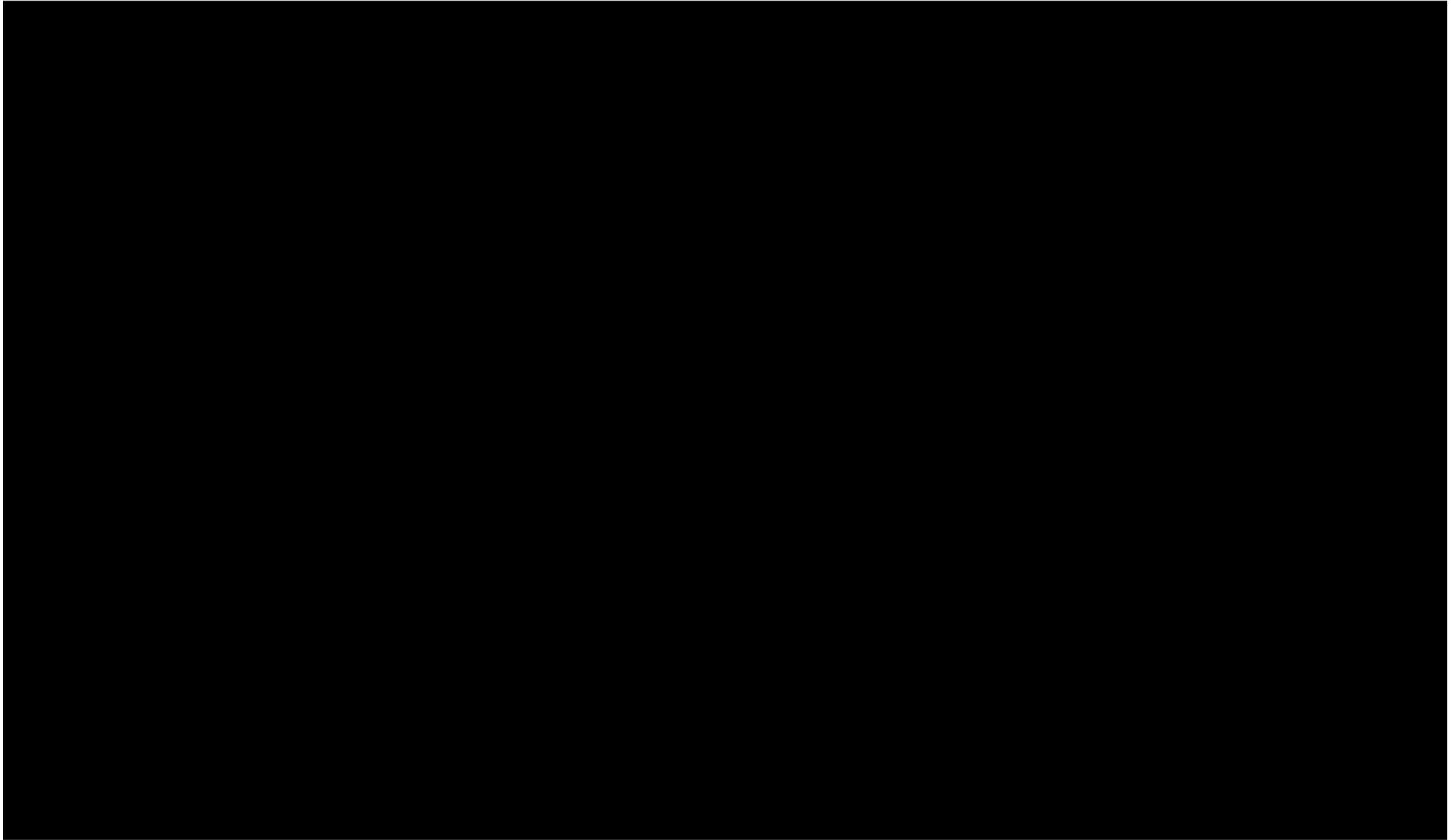


Figure 5: Edmonton OLFP Peak – No Carriageway Overtopping (12 hrs 30 min after storm start)

As-Lodged Post-Development 100-Year Floodplain (1,500mm Culvert 100% Blocked)



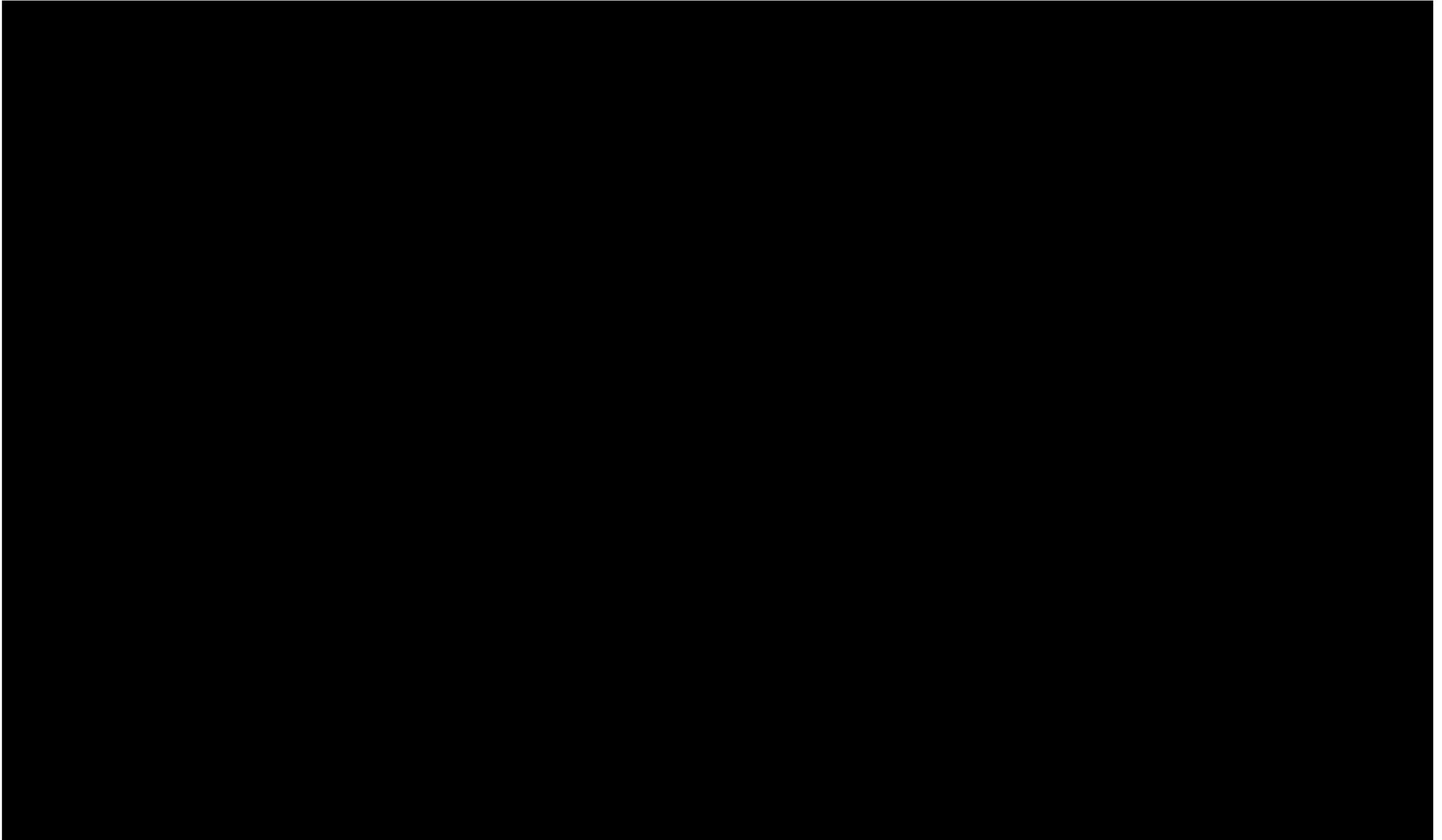
As-Lodged Post-Development 100-Year Floodplain (1,500mm Culvert 100% Blocked)



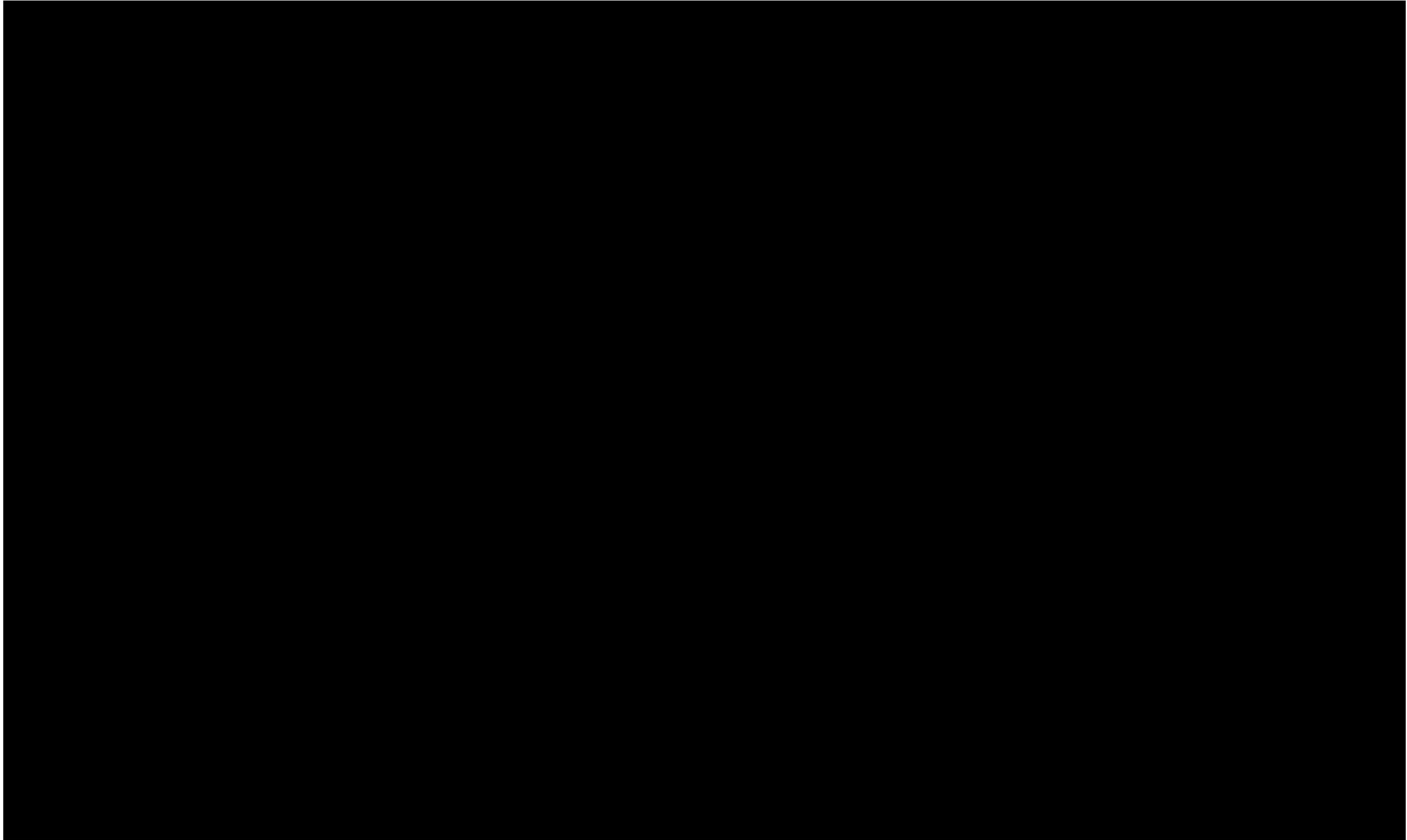
As-Lodged Solution Post-Development 100-Year Floodplain (1,500mm Culvert 10% Blocked)



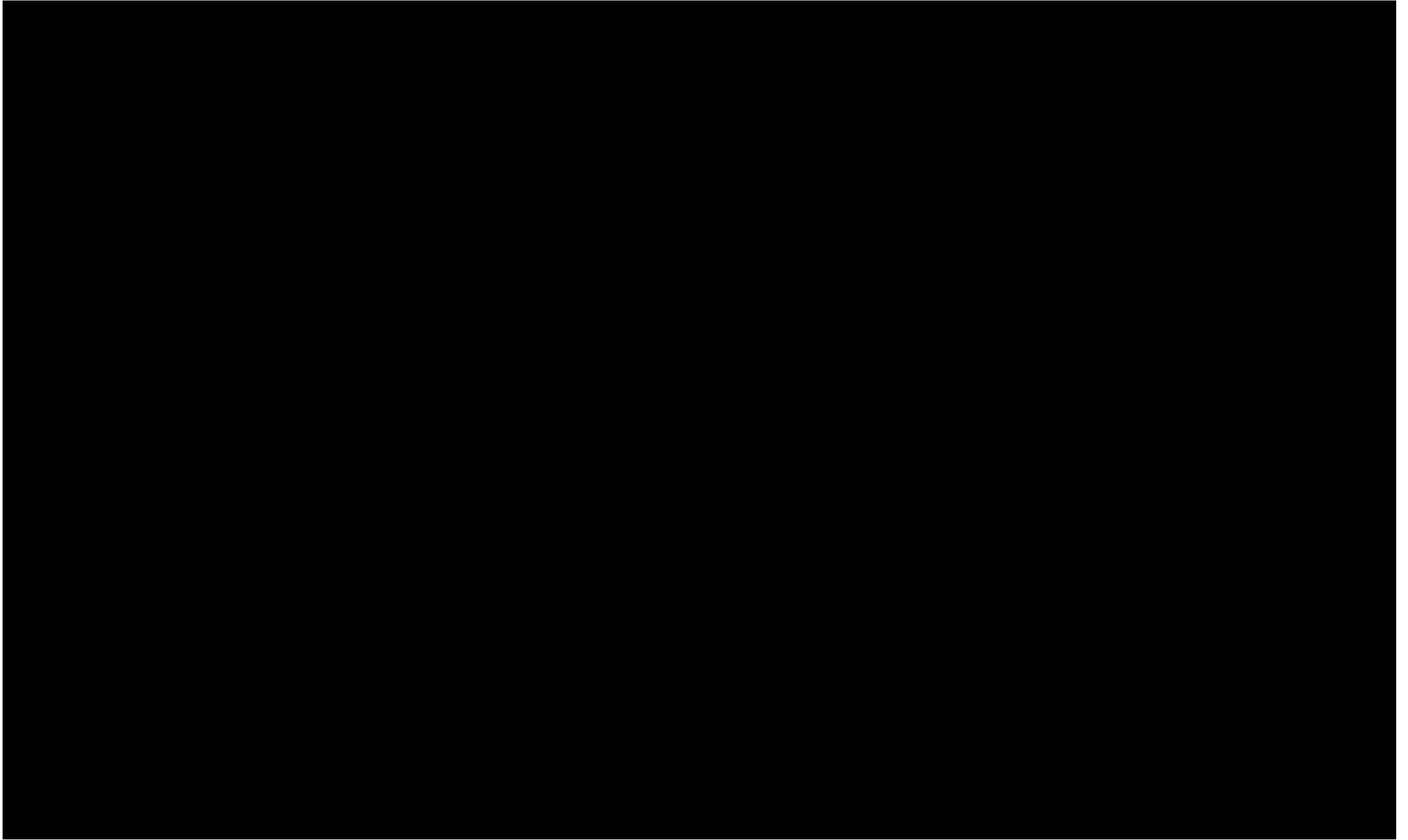
As-Lodged Solution Post-Development 100-Year Floodplain (1,500mm Culvert 10% Blocked)



Alternative Solution Post-Development 100-Year Floodplain (1,500mm Culvert 100% Blocked)

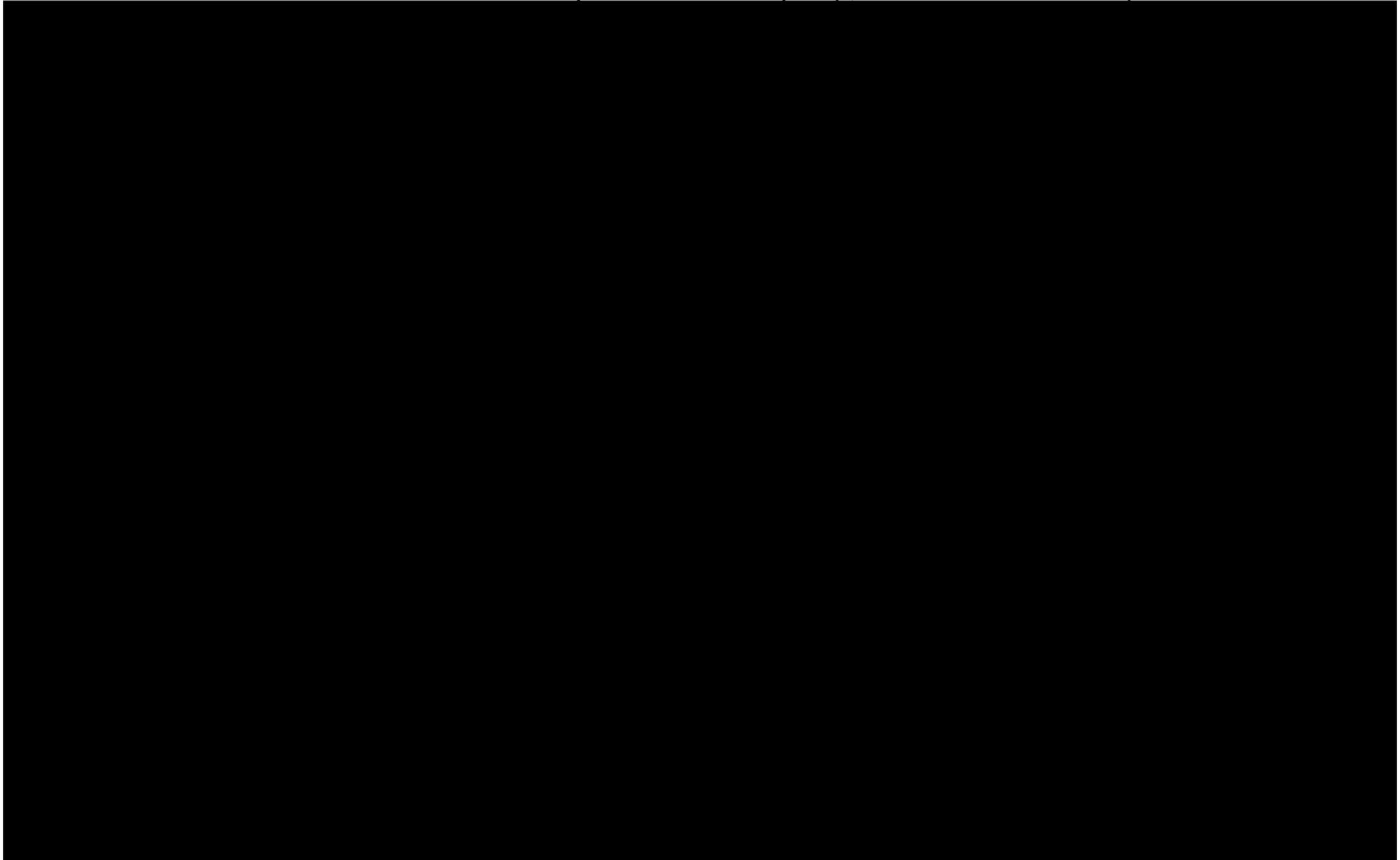


Alternative Solution Post-Development 100-Year Floodplain (1,500mm Culvert 100% Blocked)





Alternative Solution Post-Development 100-Year Floodplain (1,500mm Culvert 10% Blocked)



Pre-Development 100-Year Flood Levels

Selected: 'Trading Place - Ex. 100yr Hydrograph - WSE'

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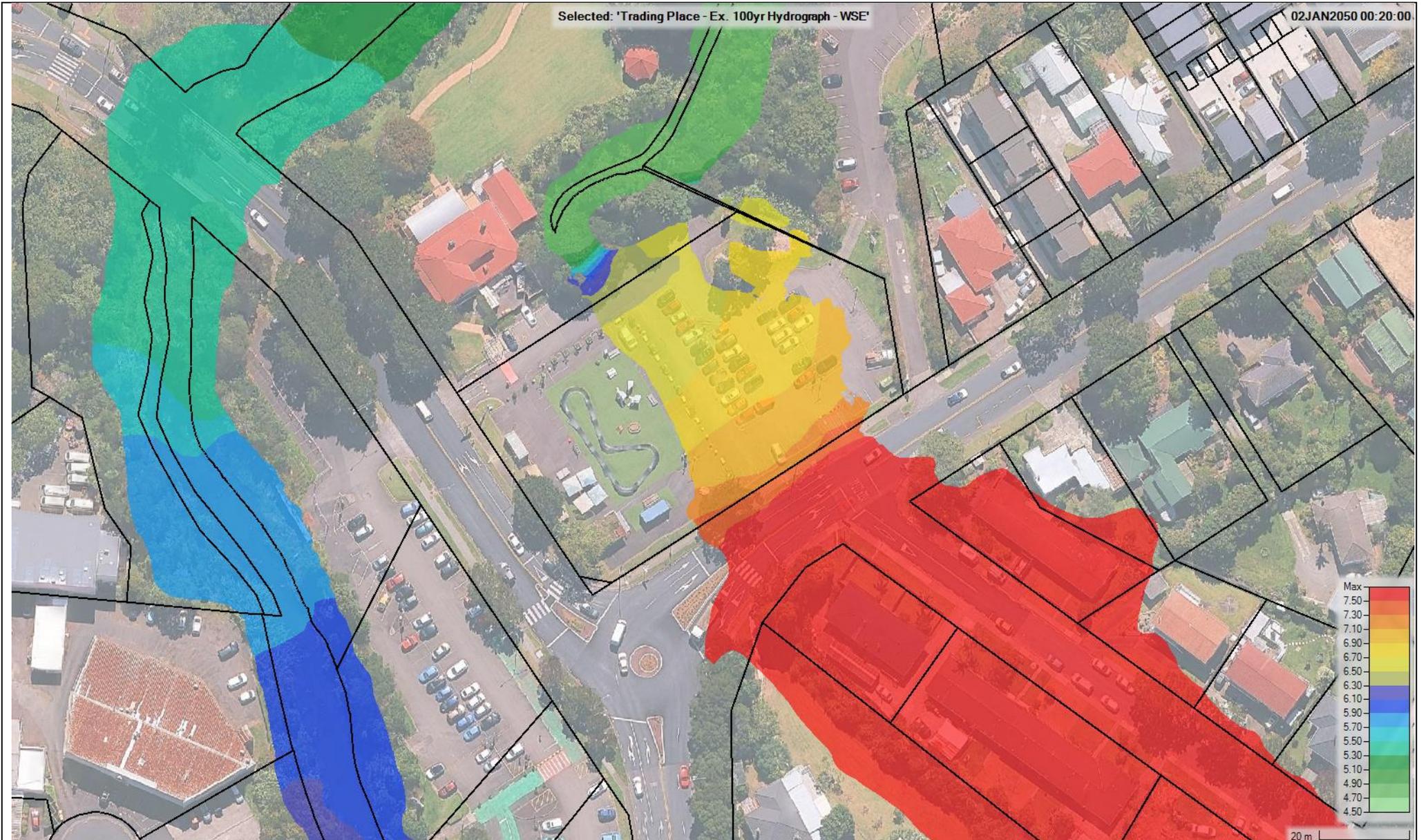


Figure 14: Pre-Development 100-Year Flood Levels – Edmonton OLFP Peak (100% Blocked Culvert)

Pre-Development 100-Year Flood Levels

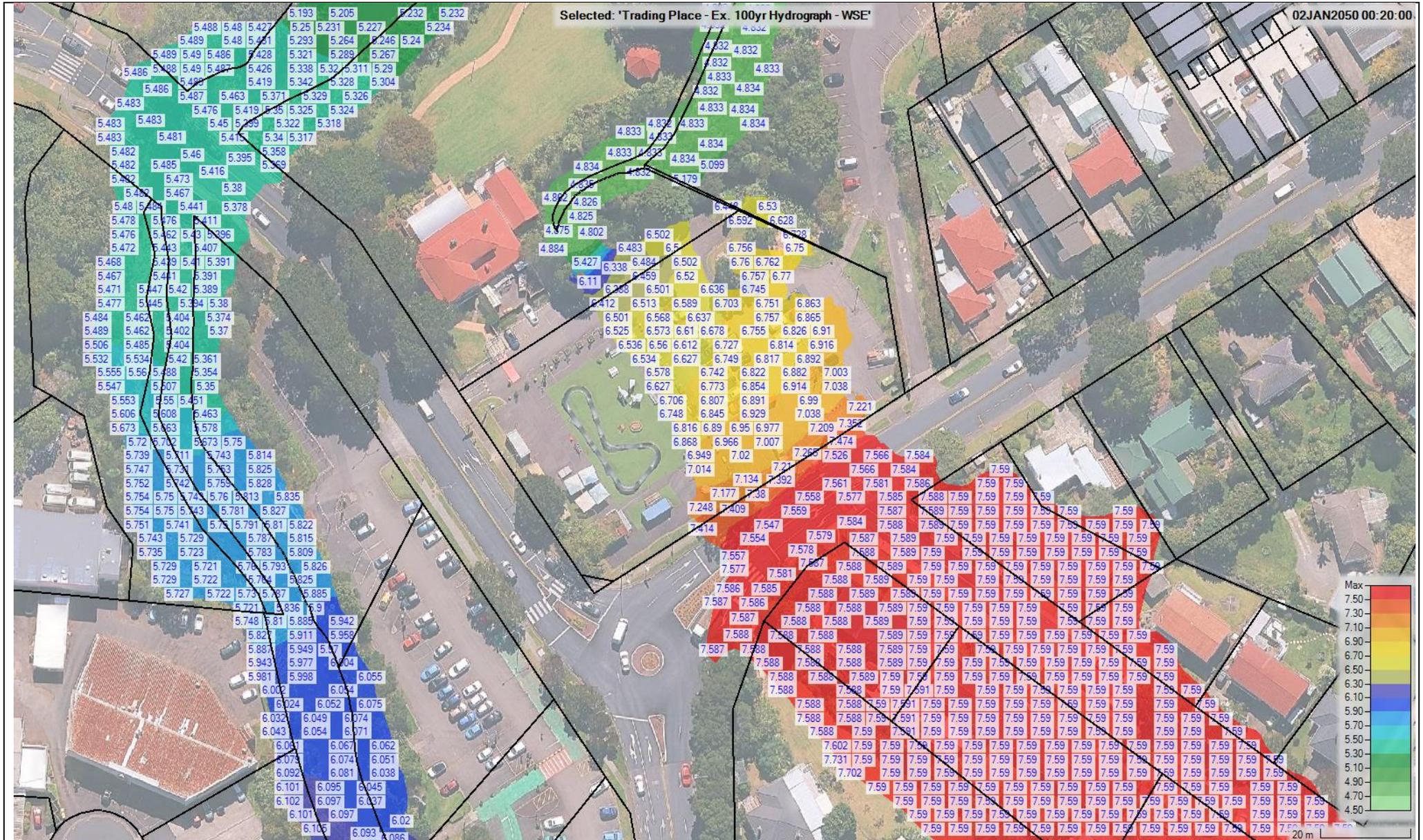


Figure 15: Pre-Development 100-Year Flood Levels – Edmonton OLFP Peak (100% Blocked Culvert) - Annotated

Pre-Development 100-Year Flood Levels



Figure 16: Pre-Development 100-Year Flood Levels – Peak Flooding (100% Blocked Culvert)

Pre-Development 100-Year Flood Levels



Figure 17: Pre-Development 100-Year Flood Levels – Peak Flooding (100% Blocked Culvert) - Annotated

Pre-Development 100-Year Flood Levels

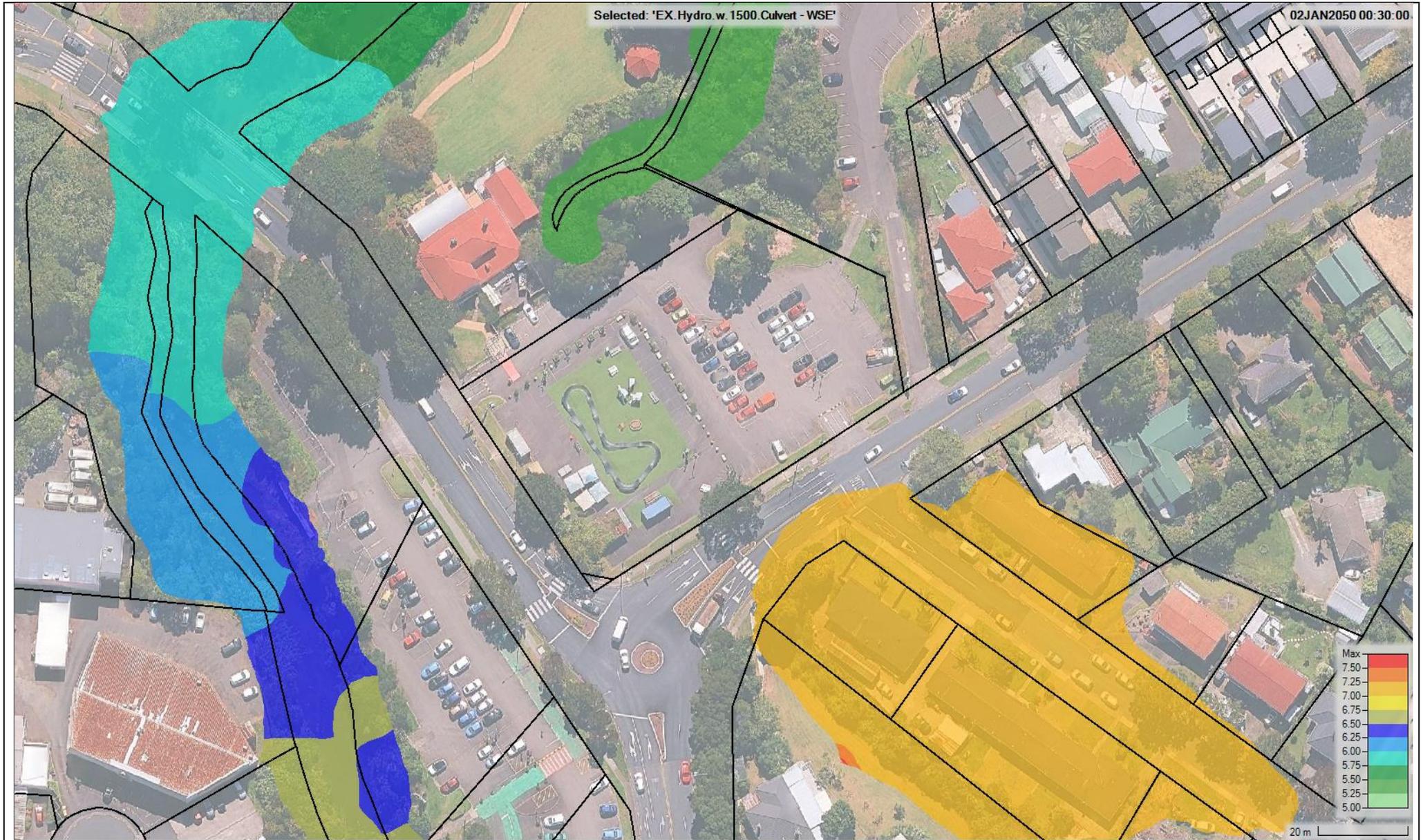


Figure 18: Pre-Development 100-Year Flood Levels – Edmonton OLFP Peak (10% Blocked Culvert)

Pre-Development 100-Year Flood Levels

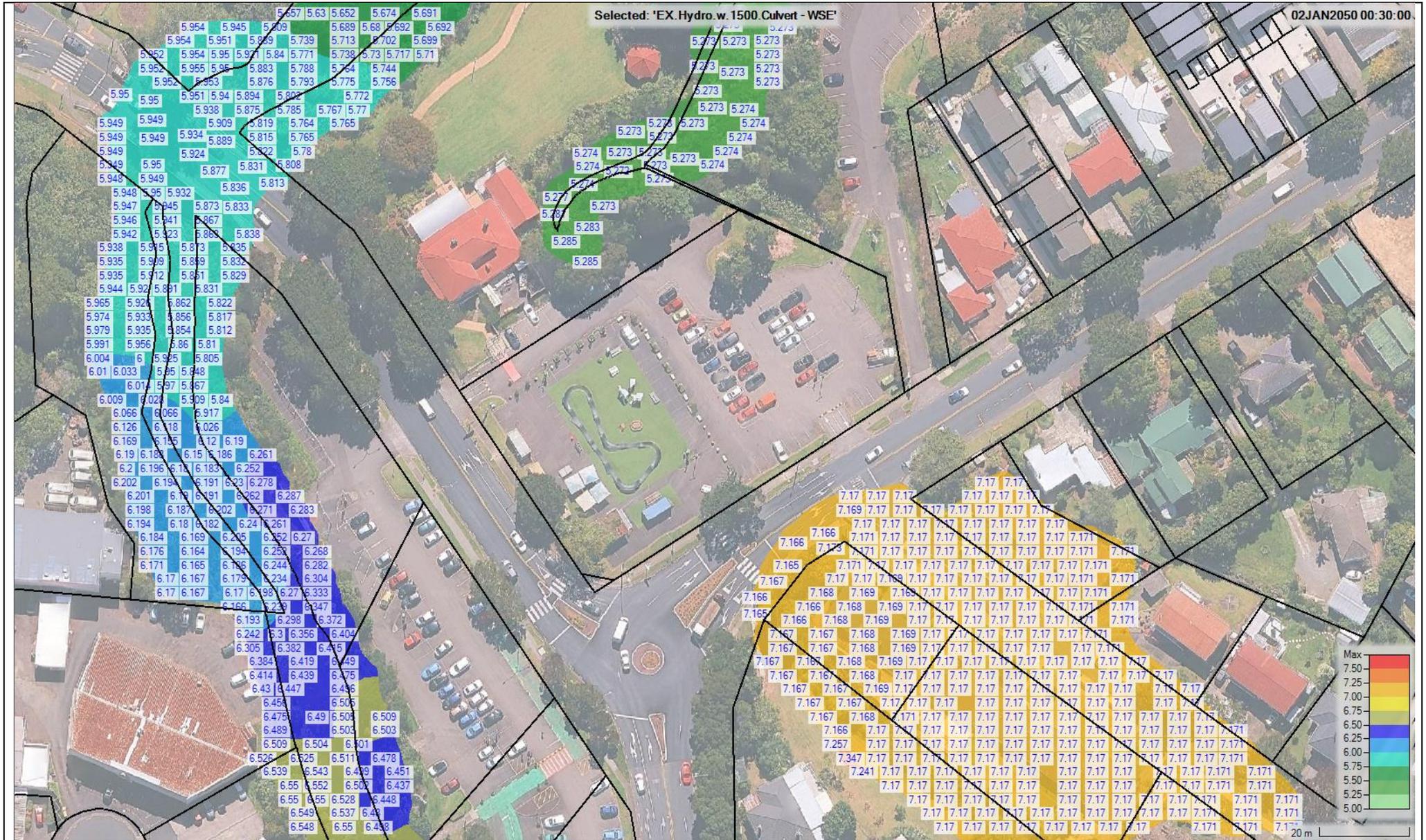


Figure 19: Pre-Development 100-Year Flood Levels – Edmonton OLFP Peak (10% Blocked Culvert) - Annotated

Pre-Development 100-Year Flood Levels

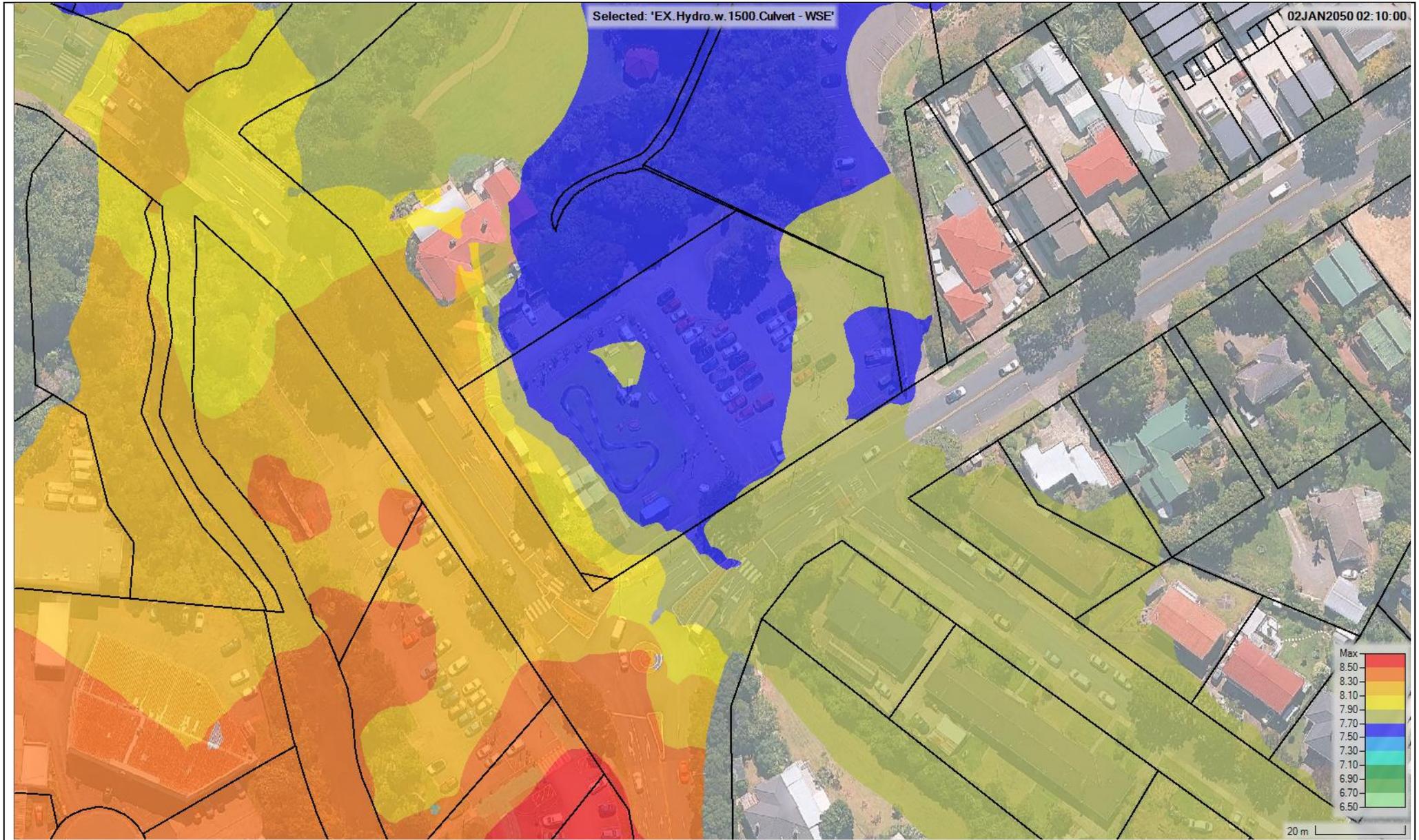


Figure 20: Pre-Development 100-Year Flood Levels – Peak Flooding (10% Blocked Culvert)

Pre-Development 100-Year Flood Levels

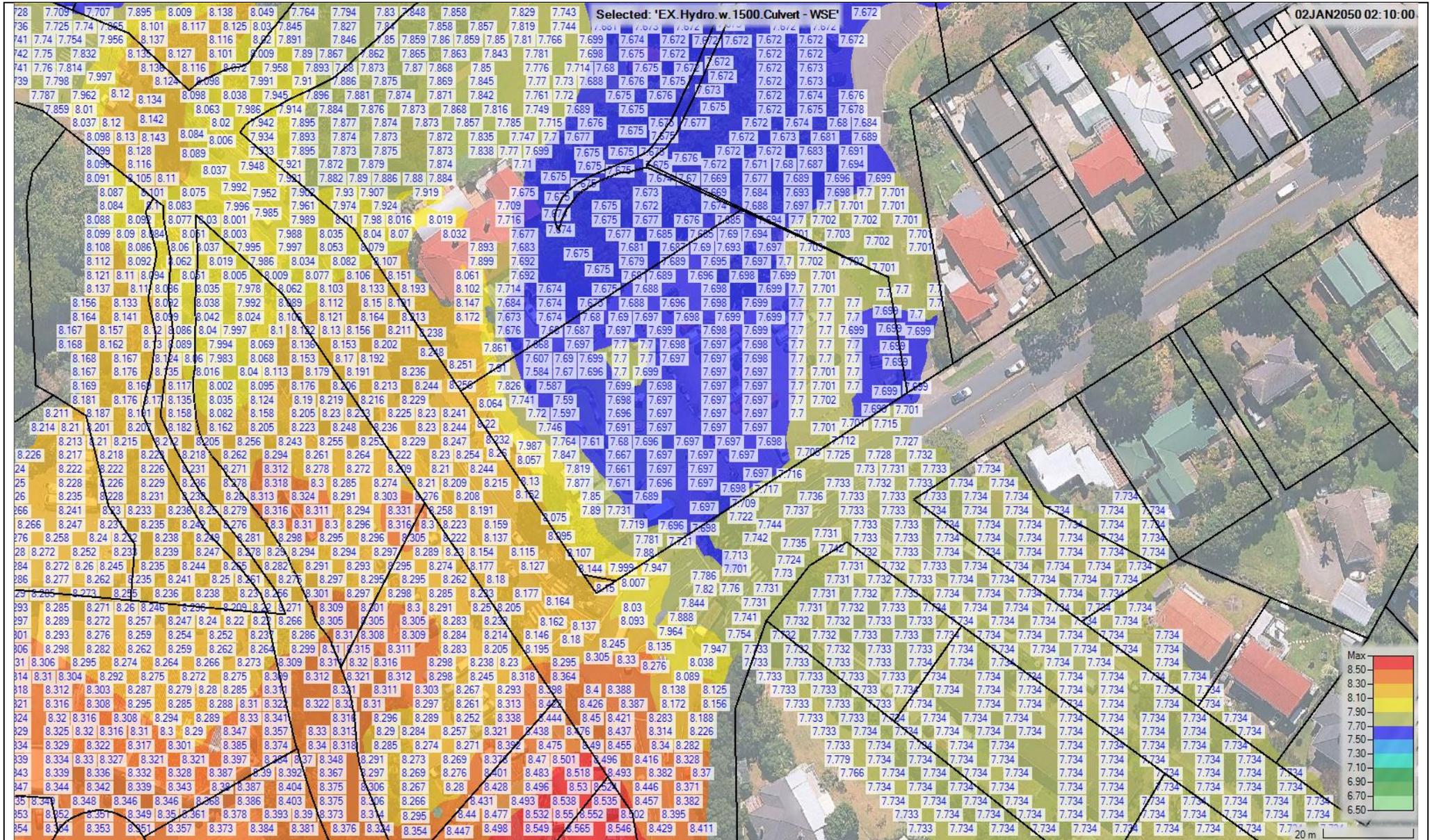
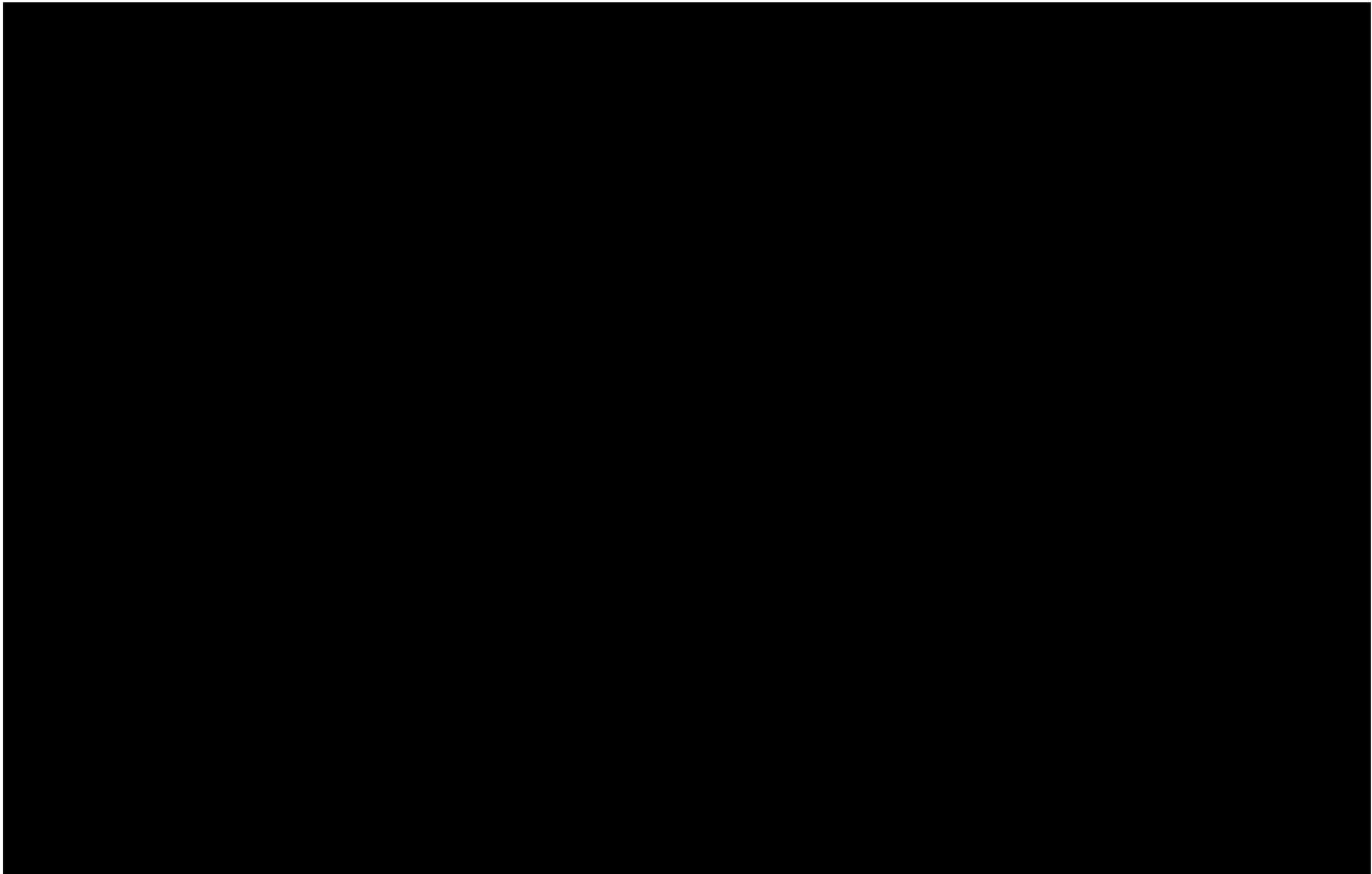


Figure 21: Pre-Development 100-Year Flood Levels – Peak Flooding (10% Blocked Culvert) - Annotated



As-Lodged Solution 100-Year Flood Levels

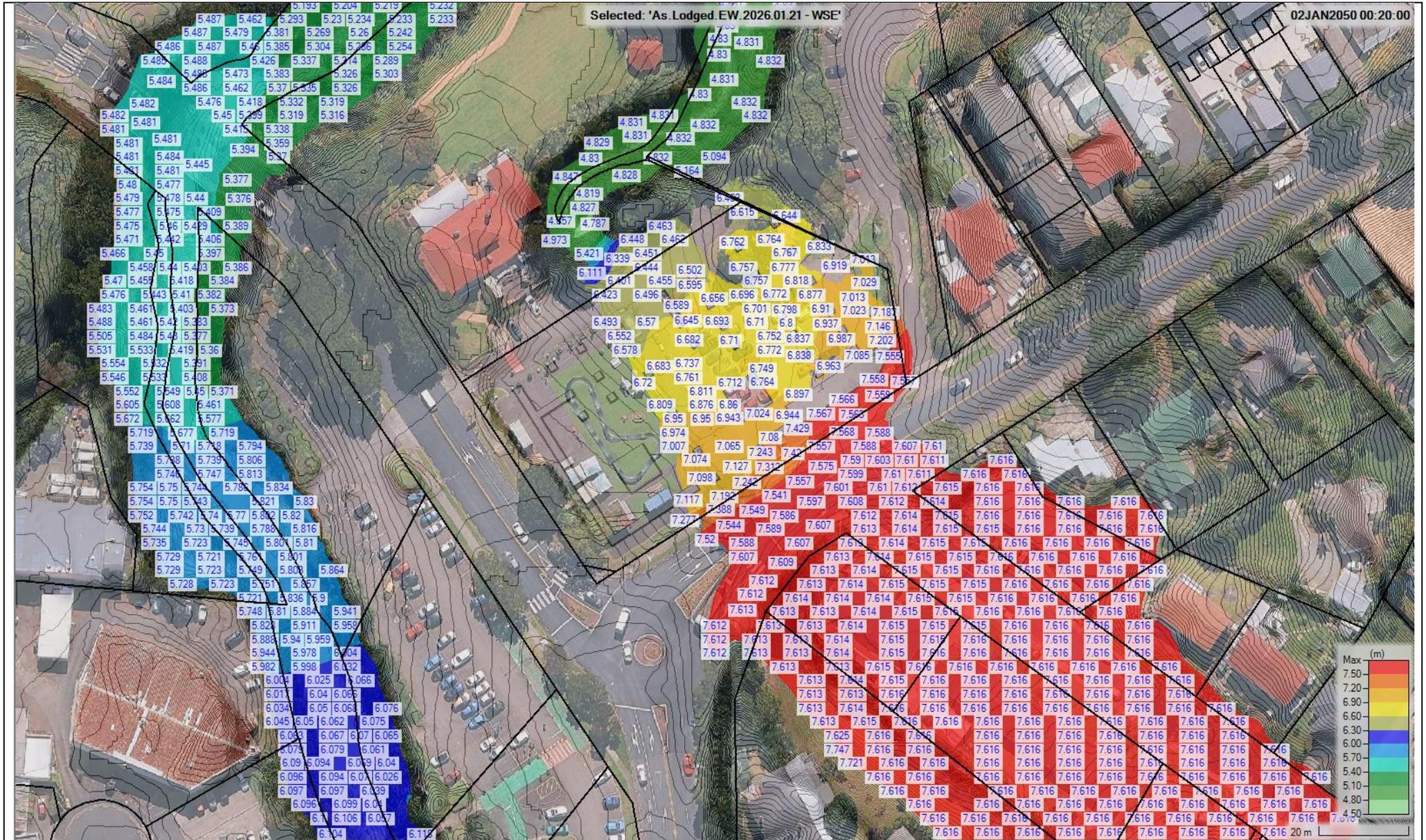
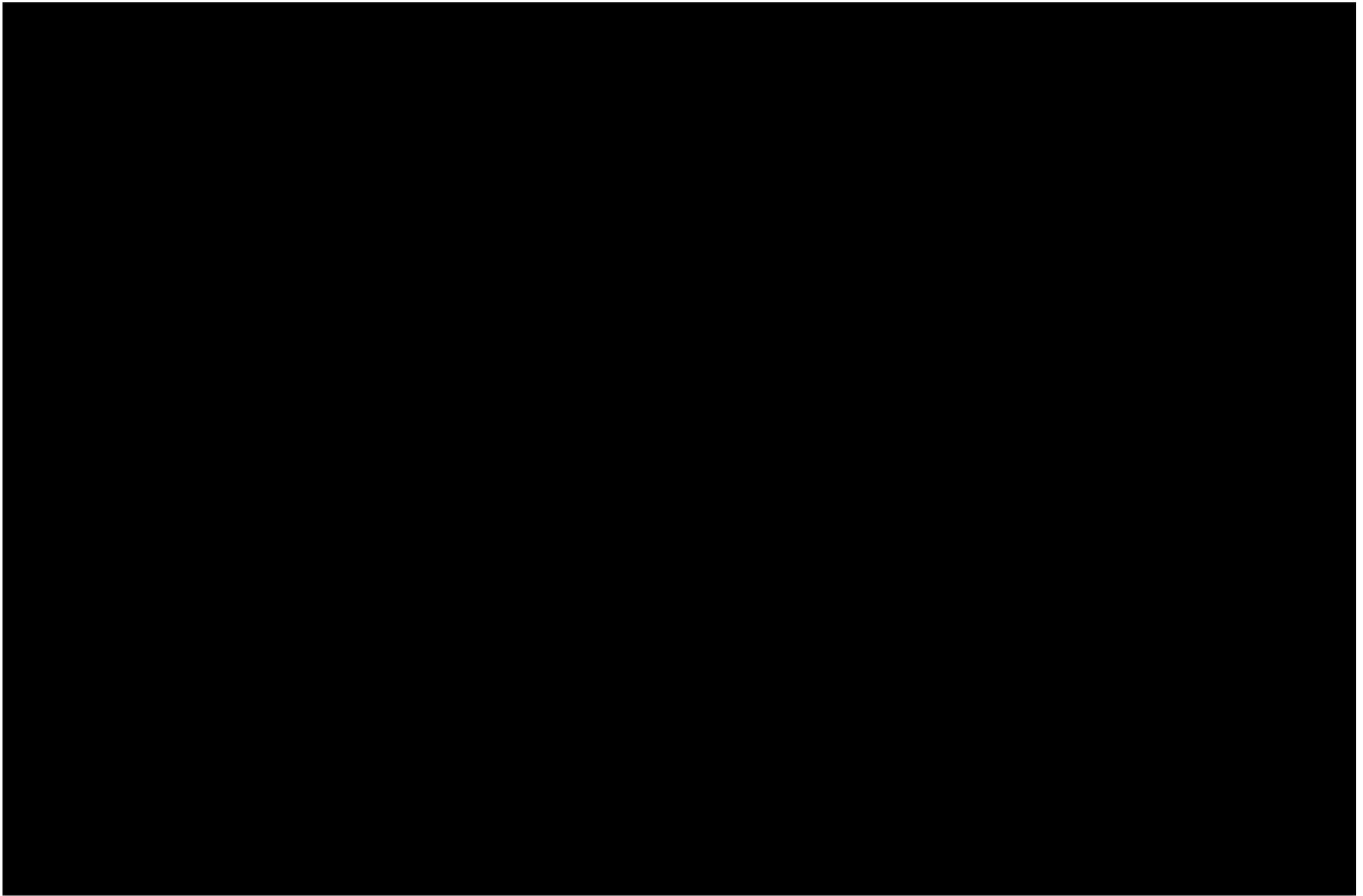


Figure 23: As-Lodged 100-Year Flood Levels – Edmonton OLFP Peak (100% Blocked Culvert) - Annotated



As-Lodged Solution 100-Year Flood Levels

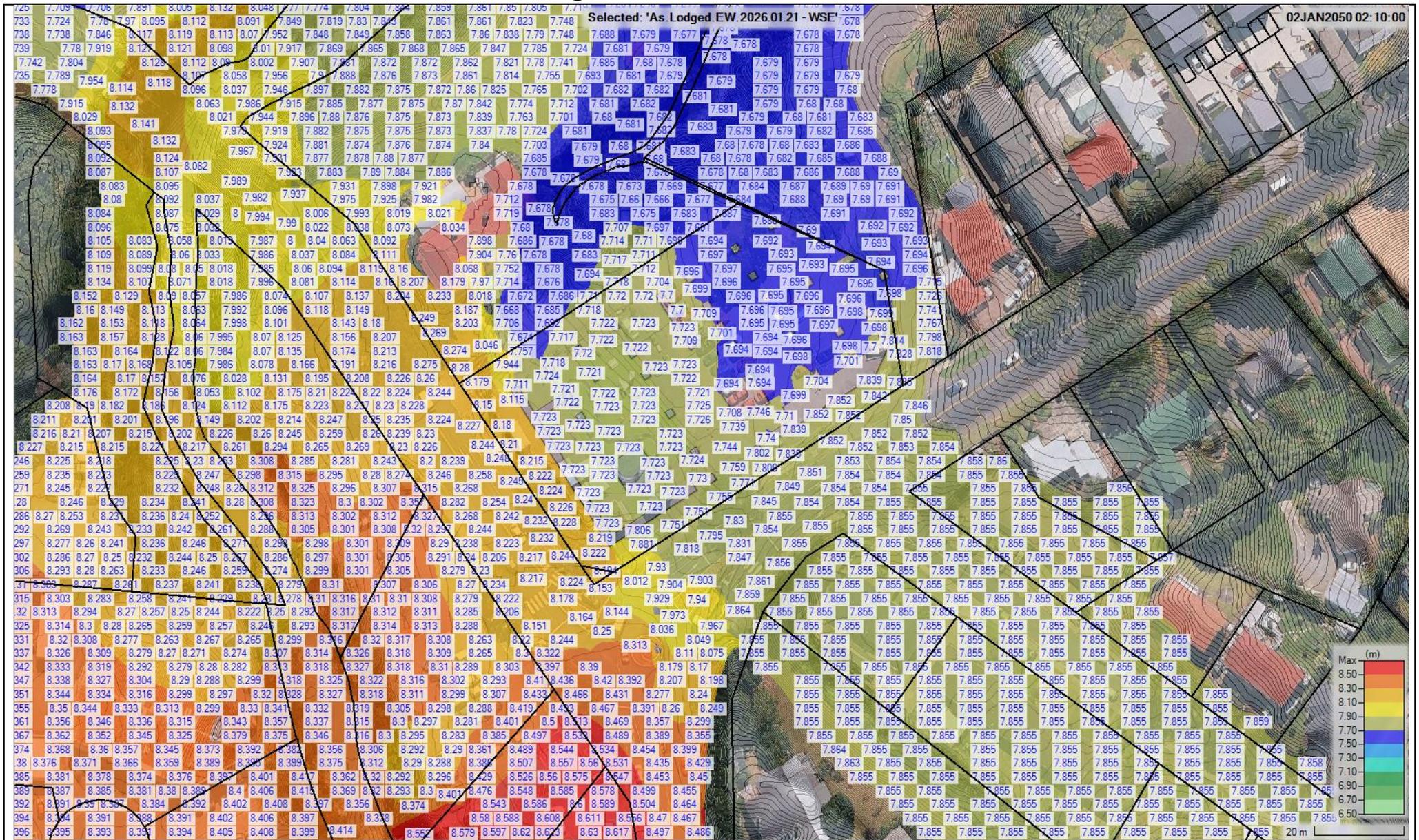


Figure 25: As-Lodged 100-Year Flood Levels – Peak Flooding (100% Blocked Culvert) - Annotated



As-Lodged Solution 100-Year Flood Levels

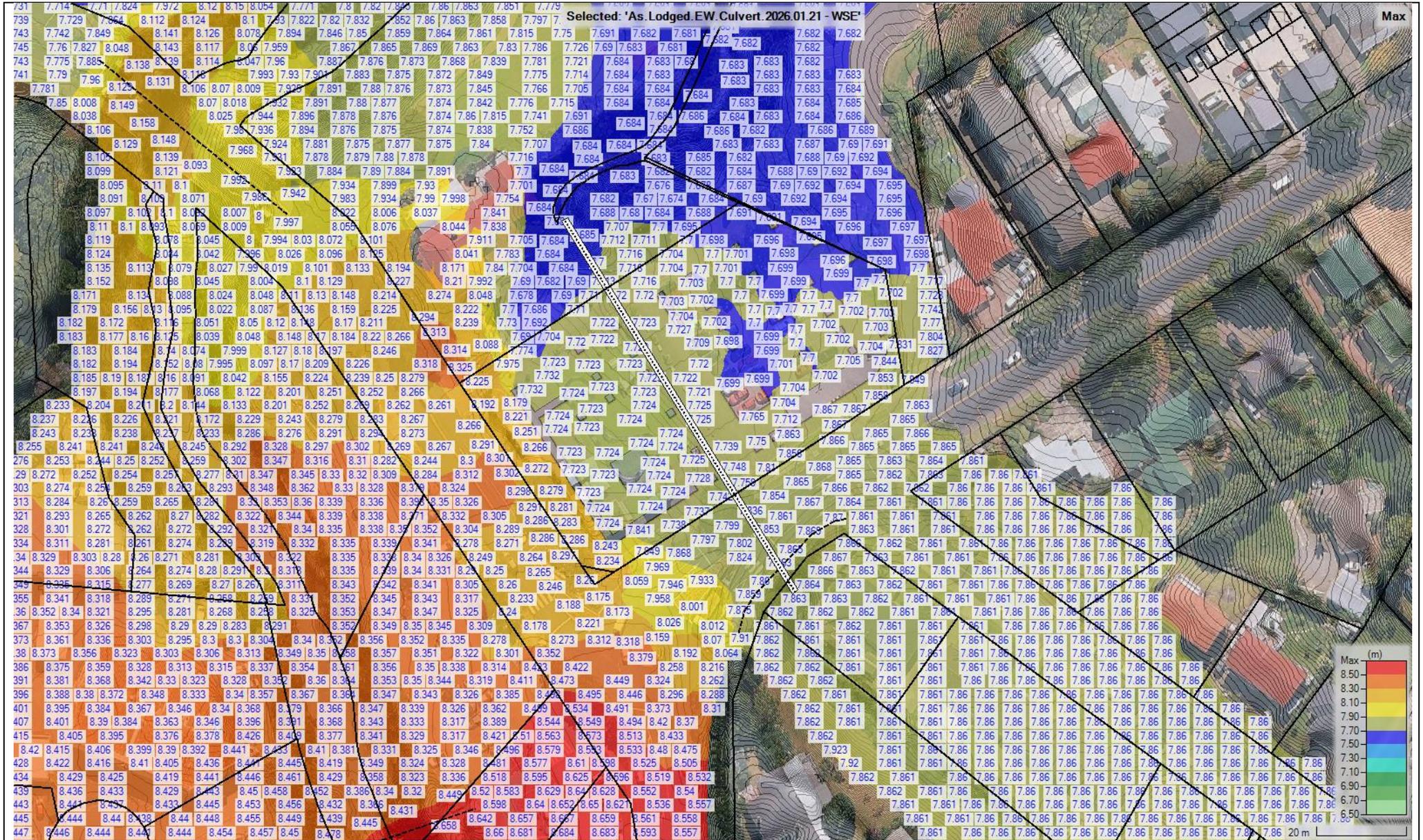
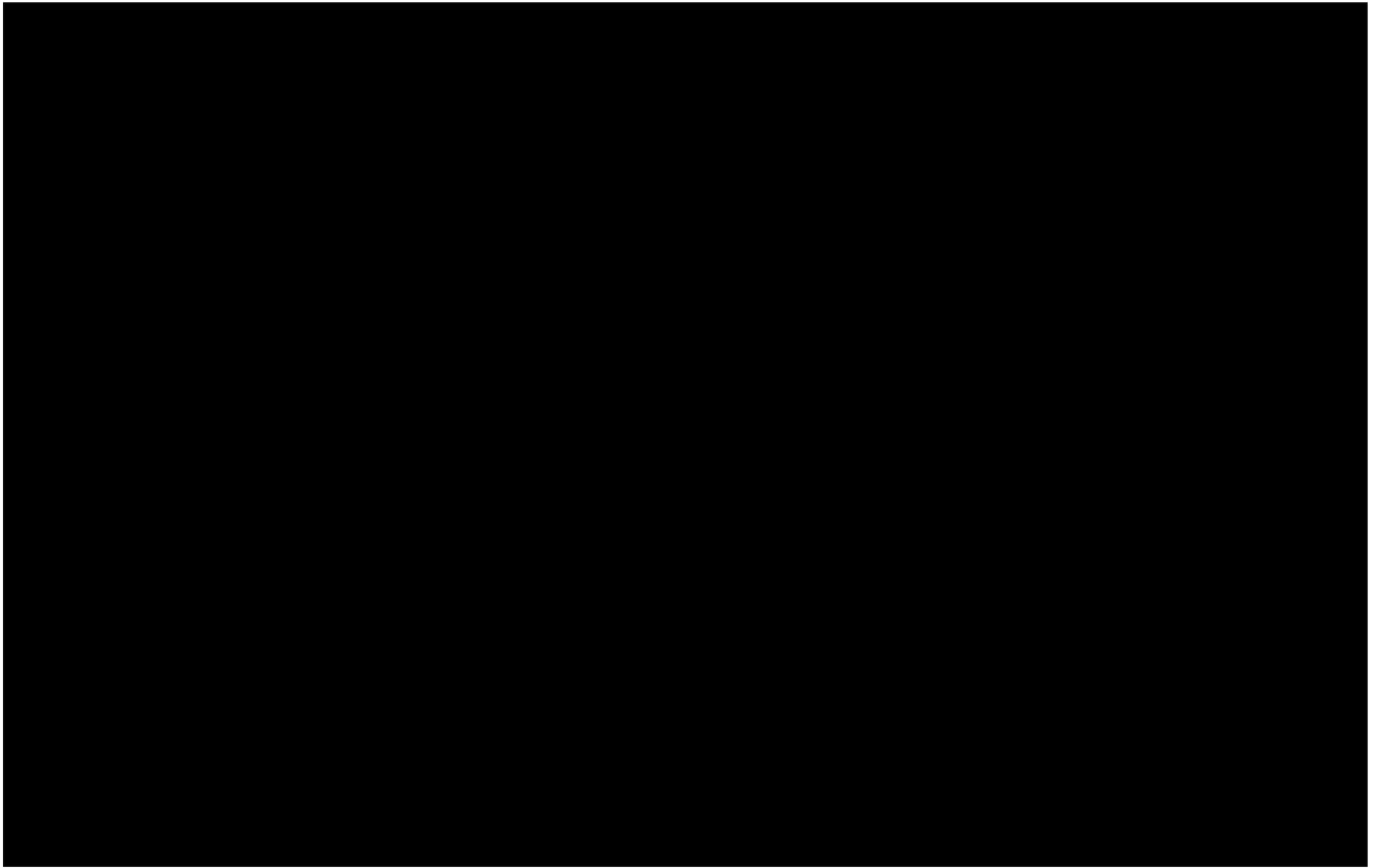


Figure 27: As-Lodged 100-Year Flood Levels – Peak Flooding (10% Blocked Culvert) - Annotated



Alternative Solution 100-Year Flood Levels

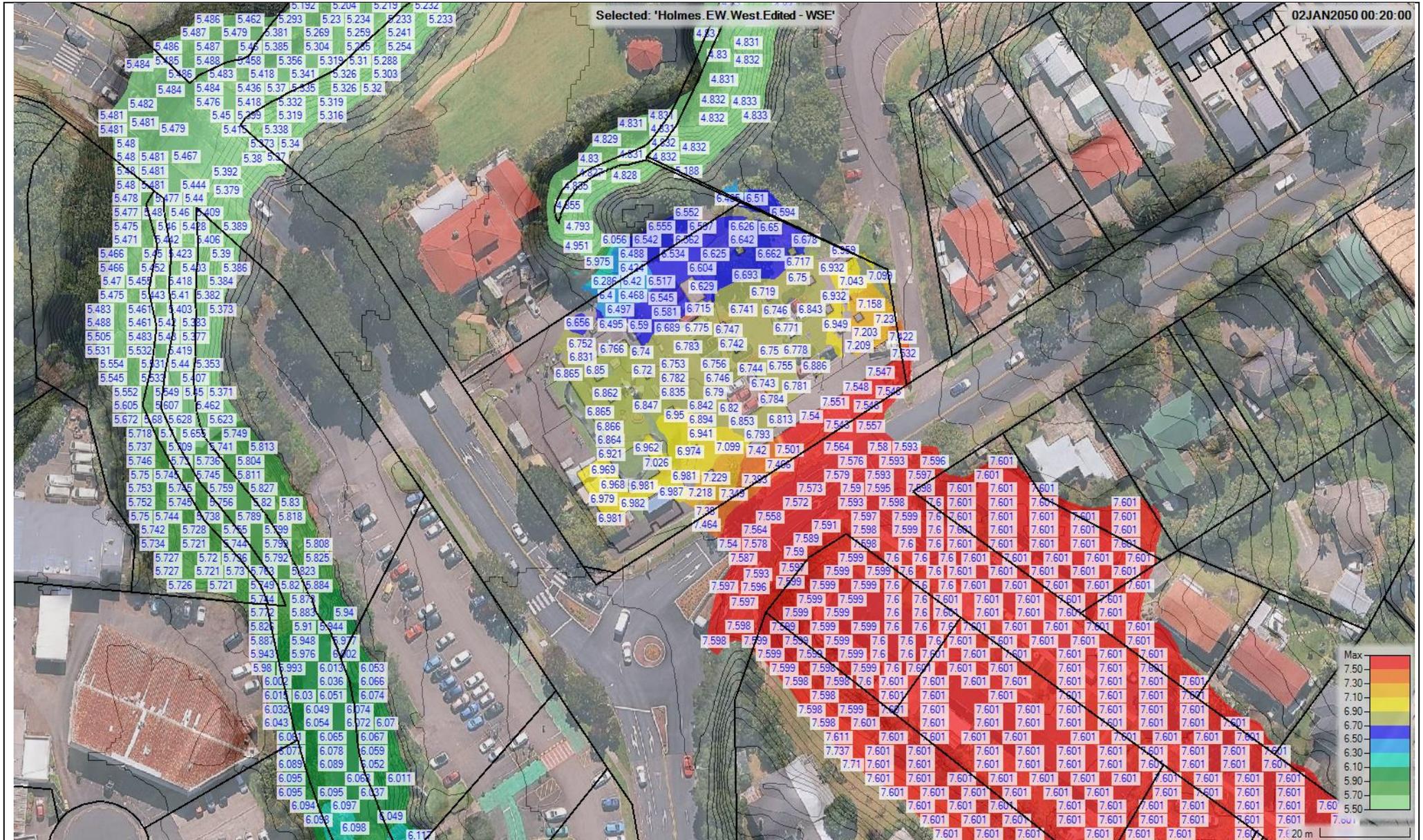


Figure 29: Alternative Solution 100-Year Flood Levels – Edmonton OLFP Peak (100% Blocked Culvert) - Annotated



Alternative Solution 100-Year Flood Levels

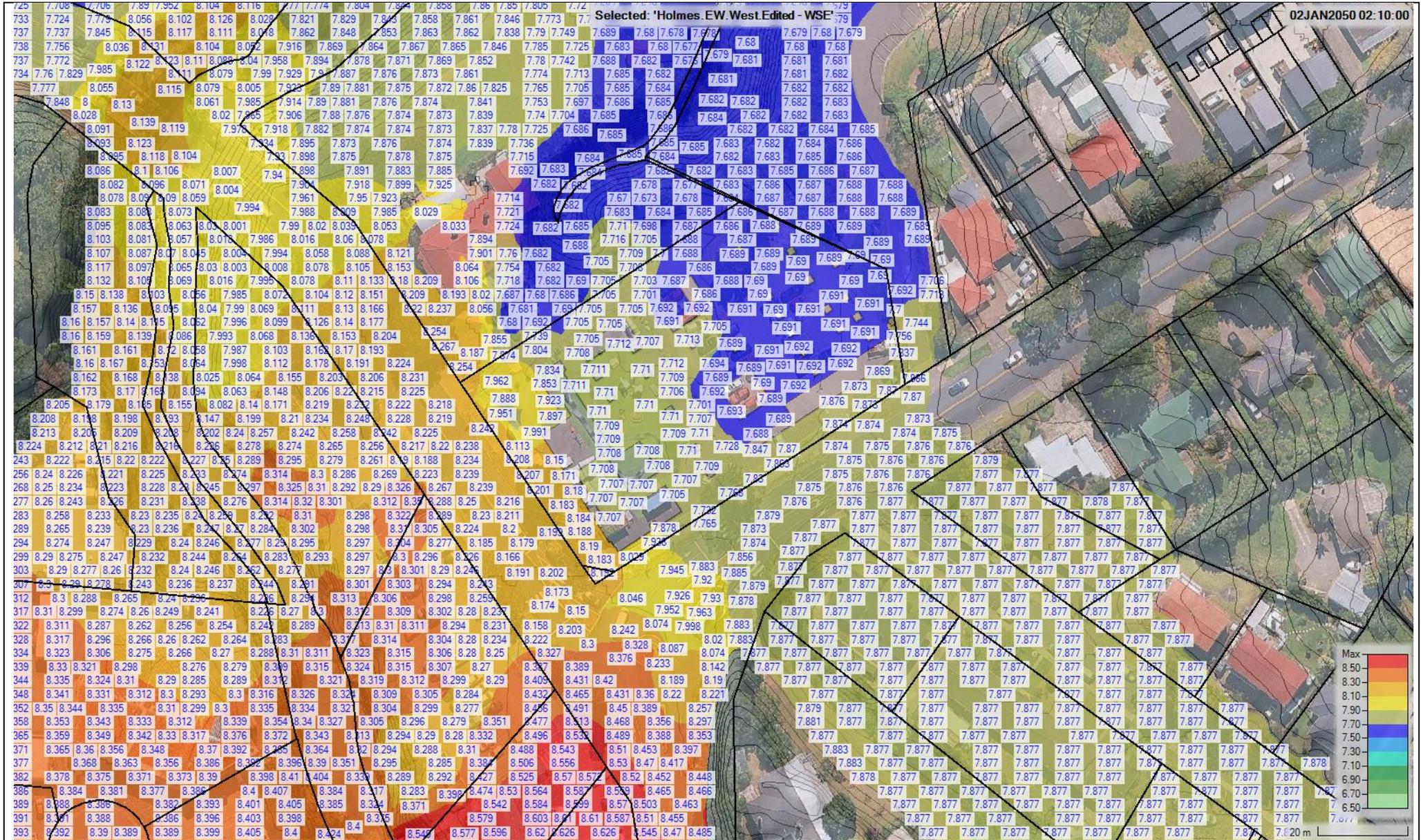
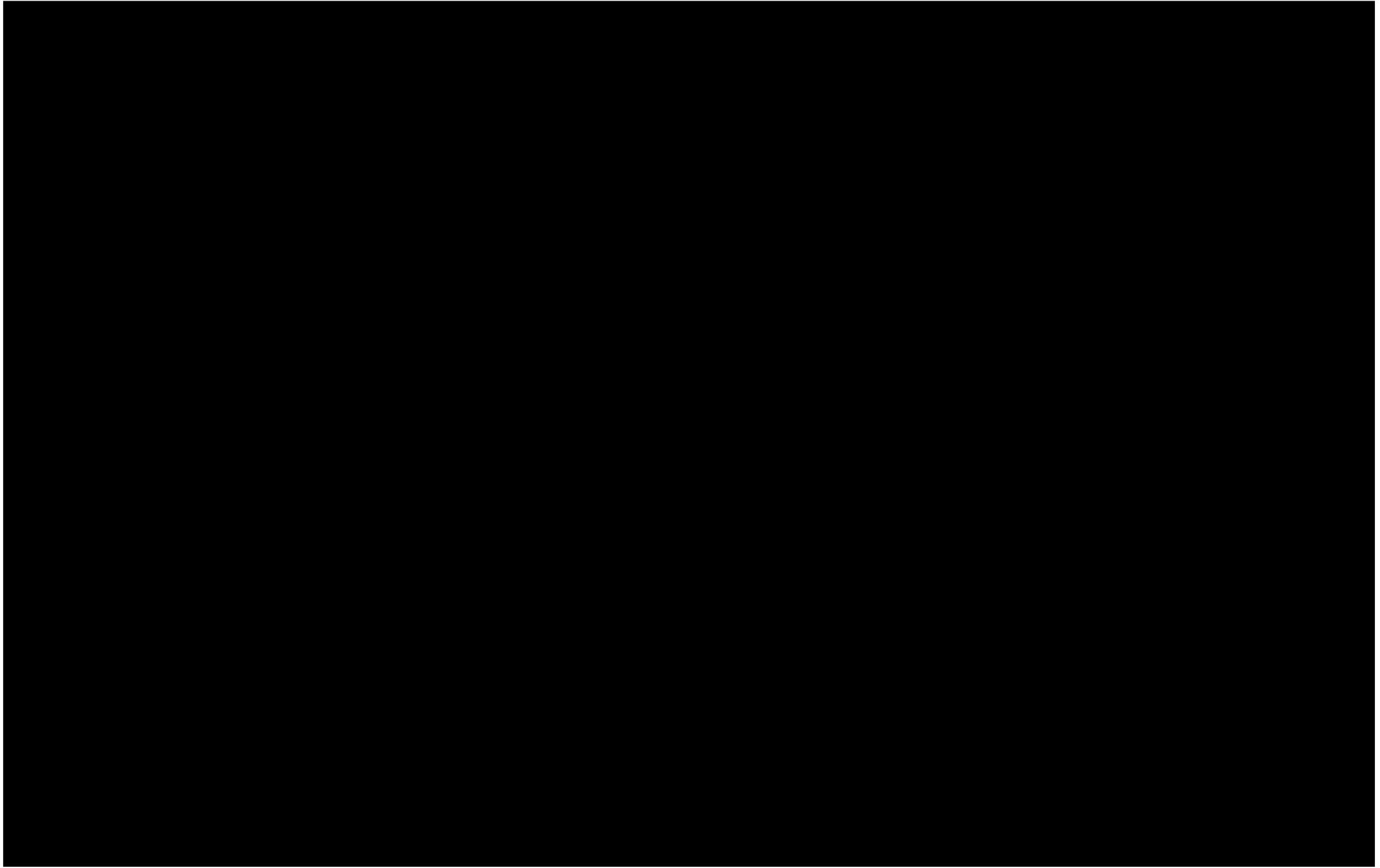


Figure 31: Alternative Solution 100-Year Flood Levels – Peak Flooding (100% Blocked Culvert) - Annotated



Alternative Solution 100-Year Flood Levels

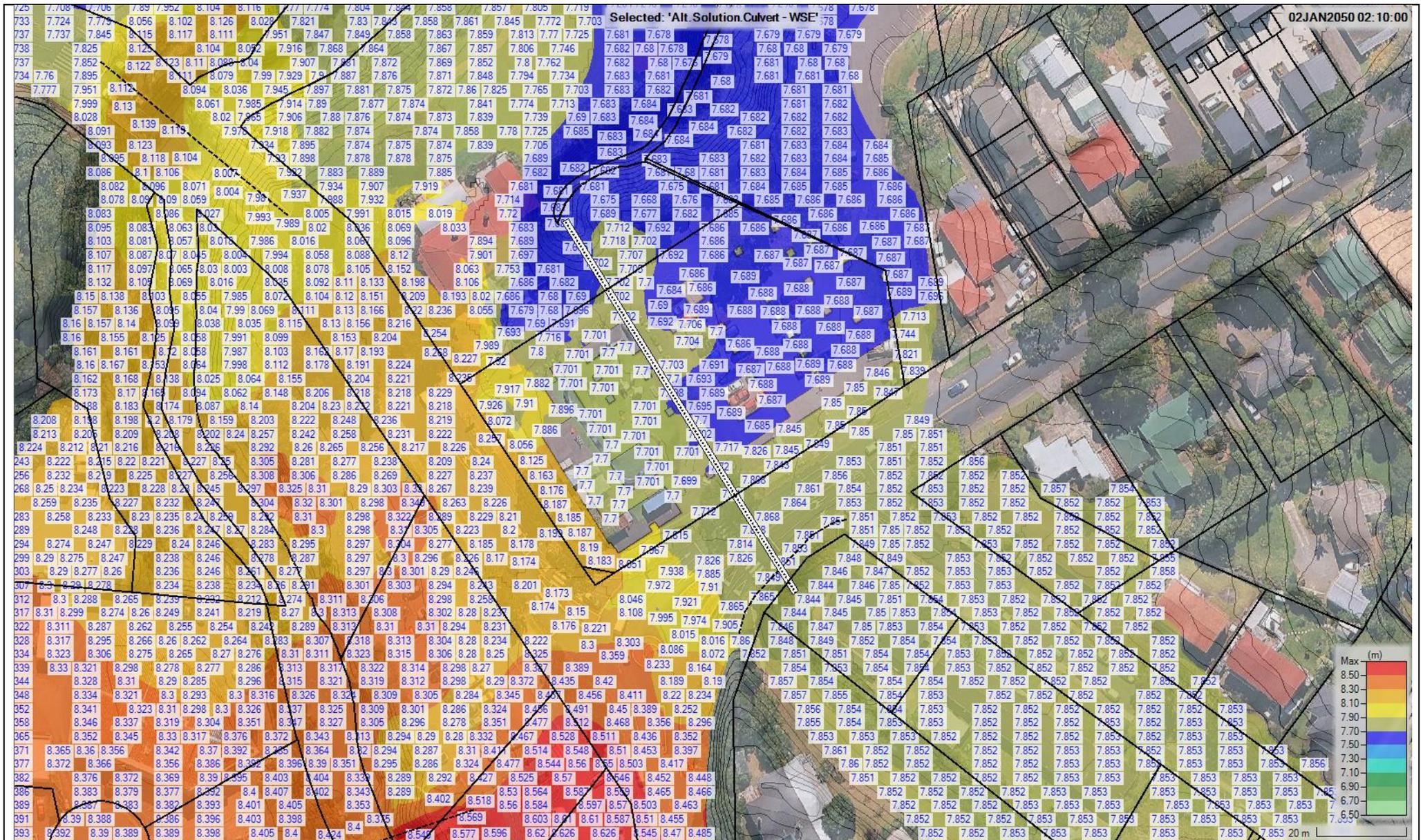


Figure 33: Alternative Solution 100-Year Flood Levels – Peak Flooding (10% Blocked Culvert) - Annotated

100-Year Flood – Flow Paths

Selected: 'Trading Place - Ex. 100yr Hydrograph - WSE'

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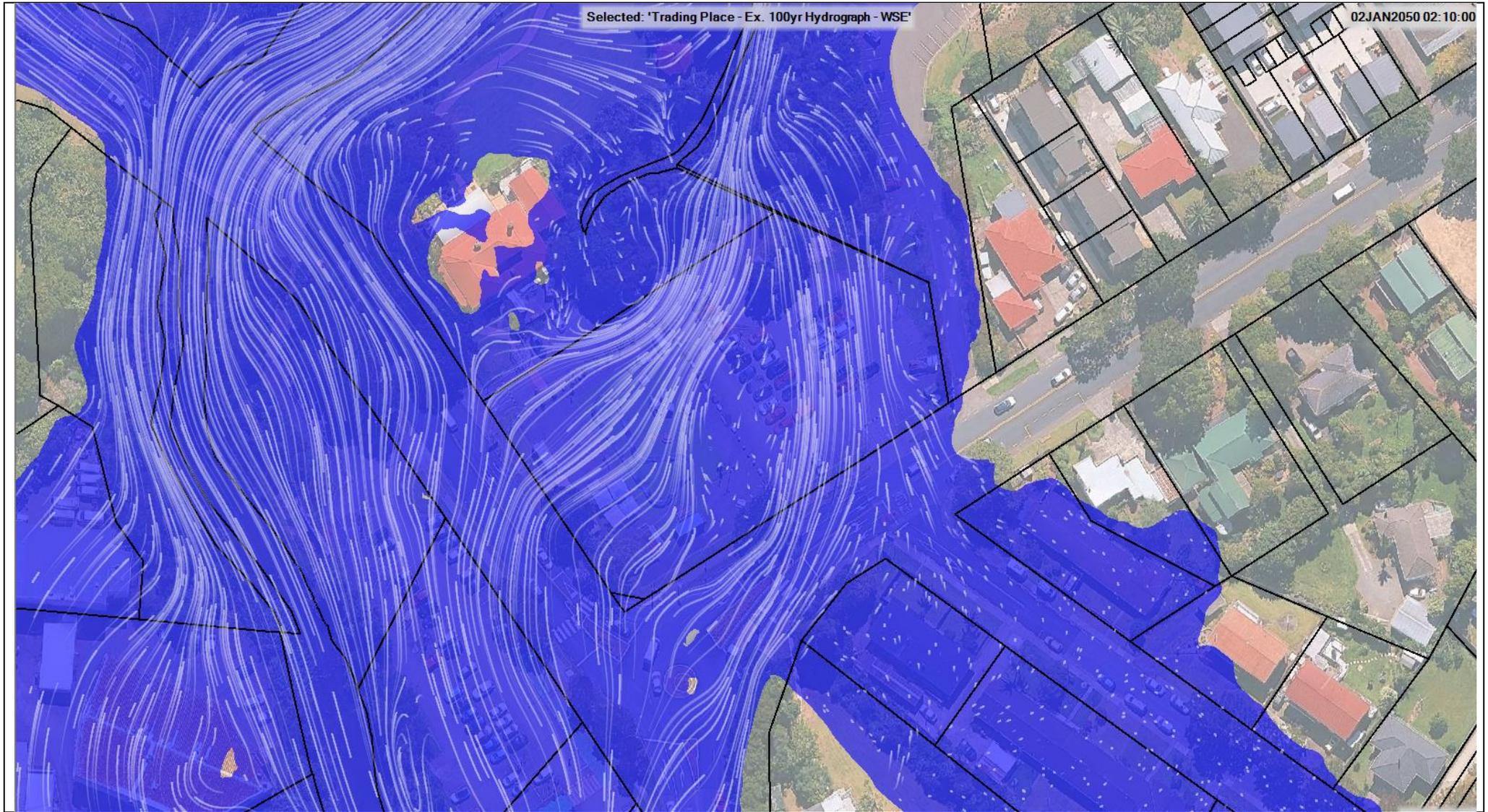


Figure 34: Pre-Development 100-Year Peak Flow Paths

