mps limited
29 Chamberlain Street
Grey Lynn,
Auckland 1021
www.mps.net.nz

6 December 2023

Trevor Canty
Neil Construction Limited
Via email
Cc: Matt Ashworth

Whenuapai Business Park – Stormwater Peer Review

Dear Trevor

1. Background

Neil Construction Limited is seeking to rezone approximately 47.57 hectares of land from Future Urban to Business – Light Industry through a private plan change application. The plan change seeks to apply precinct provisions to facilitate the transition from semi-rural land use to the development of a light industrial business area in an integrated and comprehensive manner as shown in Figure 1 below.

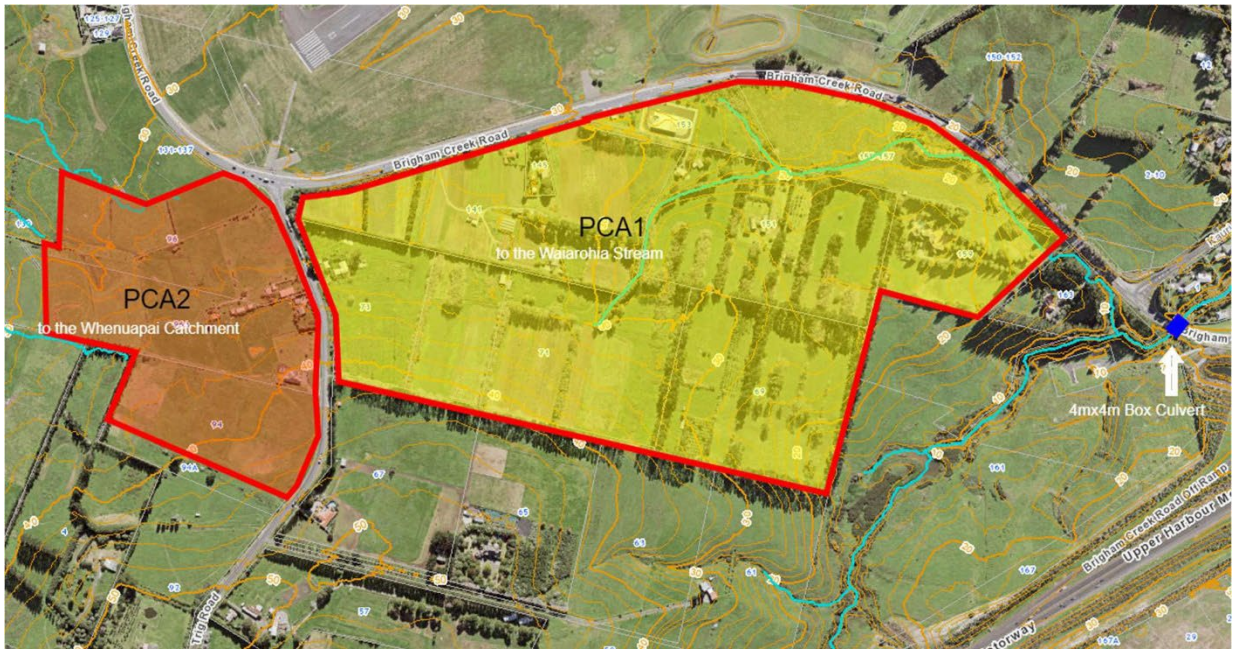

Figure 1: Plan Change Area (PCA)

A key issue in zoning, consenting, and developing the site is ensuring the stormwater services and the management of overland flow paths and flood hazards can be accommodated. This includes identifying any restrictions or constraints on proposed development that will need to be considered for mitigation as the design progresses.

MPS has been commissioned by Neil Construction Limtied to undertake a peer review of the stormwater management approach outlined in the Cato Bolam reports prepared to support the Plan Change process.

2. Scope of Work

The scope of this peer review work is limited to the relevant stormwater and flood hazard reports prepared by Cato Bolam as follows:

1. Review the draft Stormwater Management Plan, Infrastructure Report, Flooding and Flood Hazard Risk Report prepared by Cato Bolam consultants.
2. High-level review the HEC-RAS 2D outputs prepared to support the stormwater servicing solution outlined in the above report.
3. Seek further details and/or clarifications from Cato Bolam, as required.
4. Prepare a Stormwater and Flood Hazard Peer Review Memo on the proposed servicing solution outlined in the report and submit to Client for review. Suggested edits to the Cato Bolam reports will be included in this memo.
5. Meet with Client and Cato Bolam to discuss outcomes of the review.
6. Finalise Peer Review Memo following feedback from the Client.
7. Prepare and finalise a Peer Review Letter that can be submitted with the Plan Change application.

The focus of the peer review will be on the engineering, technical and flooding elements of the proposed servicing solution in conjunction with input into the regulatory context.

3. Summary of Information reviewed

The following information has been received and reviewed in relation to preparation of this review:

1. Auckland Council GIS information.
2. Stormwater Management Plan (21/11/2023 - Draft), prepared by Cato Bolam.
3. Infrastructure Report (22/11/2023 - Draft), prepared by Cato Bolam.
4. Flooding and Flood Hazard Risk Report (23/11/2023 – Draft), prepared by Cato Bolam.
5. No results or model files have been provided.

4. Relevant Regulatory, Design and Guidance Documents

The relevant regulatory, design and guidance documents are set out below:

- Operative in Part Auckland Unitary Plan (AUPOIP).
- Stormwater Code of Practice v3 2022 (SWCoP).
- Auckland Council Regional Stormwater Network Discharge Consent (NDC).
- Whenuapai Stormwater Management Plan.
- Stormwater Management Devices in the Auckland Region Guideline Document 2017/001 (GD01).
- Water Sensitive Design for Stormwater Guideline Document 2015/004 (GD04).

The NDC is typically the preferred pathway for “greenfield developments” such as this one to be approved, subject to a Stormwater Management Plan (SMP) being adopted by Healthy Waters in accordance with Schedule 4 of the NDC. The SMP needs to address the requirements set out in Figure 2 below or be assessed as being the Best Practical Option (BPO).

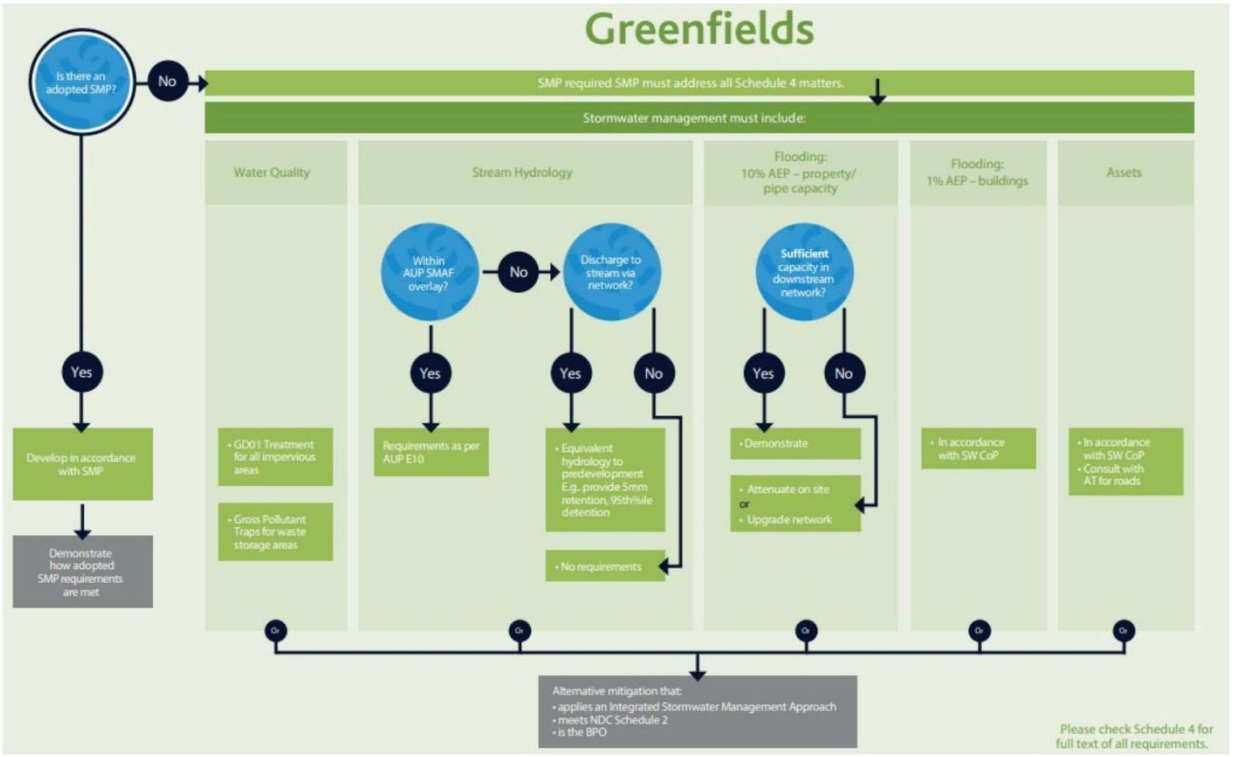

Figure 2: NDC Schedule 4 Requirements for Greenfields

Alternatively, applications for stormwater discharges and diversion can be lodged under the Operative in Part Auckland Unitary Plan (AUPOIP).

5. Stormwater Management Review

The purpose of the review is to focus on the potential effects of the proposed works as they impact on surrounding properties, environment, infrastructure, and other stakeholders.

This report has been prepared to support a plan change application, noting that additional works are required to complete the detailed design for the project. This review focuses on the stormwater management approach and does not constitute a full technical peer review of the proposed design, as the detailed design will occur after the plan change being approved.

As part of this review process, matters that required clarification were sent to Cato Bolam and several suggested amendments to the final reports were made to provide greater clarity. This report summarises the review of the works presented and responses to questions and clarifications.

5.1 Stormwater Strategy Summary Review

The following is a summary of the proposed stormwater management strategy:

- New stormwater infrastructure will be designed to account for:
  - Climate Change.
  - Maximum Probable Development (MPD) scenario.
  - In line with the Auckland Council SWCoP.
- Primary stormwater networks (e.g. network pipes) will provide for the runoff from the 10% AEP + Climate change (CC) storm event.
- Secondary flow paths will provide for the runoff from the 1% AEP + CC storm event.
- Hydrological mitigation (retention/detention) is proposed to manage flows.

- Treatment systems shall be provided to treat the runoff from impervious surfaces (excluding inert roofing) in accordance with GD01 for the relevant contaminants.
- Existing and proposed overland flow paths shall be managed or re-routed to avoid any detrimental effects to the neighbouring properties and downstream environment.
- The locations of the overland flow path entry and exit points from the PCA shall not be altered without resource consent.
- Removal of existing culverts and reinstating the stream bed within the development area to restore the waterways are proposed to promote ecological and biodiversity values.
- Future development will be set back at least 10m from the top of bank of the stream and natural wetlands.
- Riparian planting is to be established 10m either side of the stream and natural wetlands.

6. Water Quality

The following diagram describes the proposed stormwater treatment train:

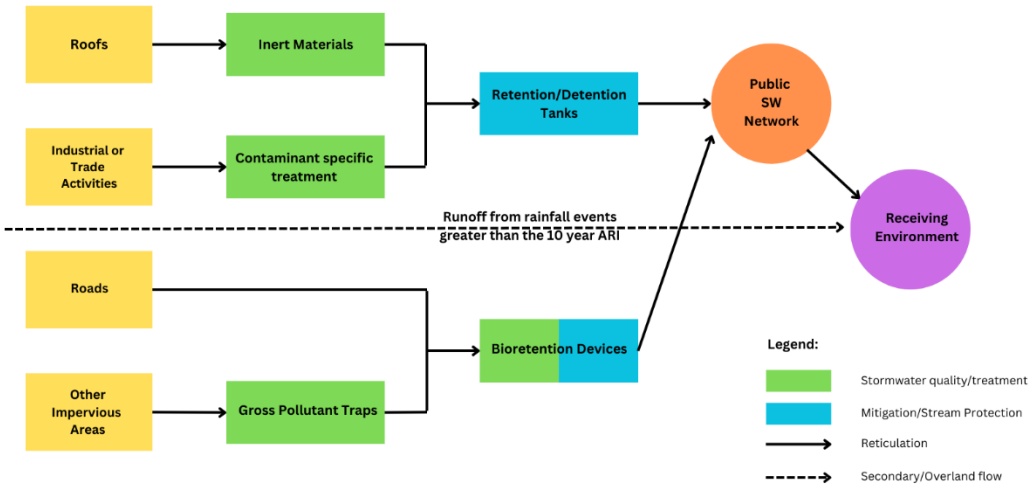

Figure 3: Proposed Stormwater Management Treatment Chain

To comply with Schedule 4 of the regionwide NDC (which is understood to be more stringent than the Whenuapai Stormwater Management Plan), treatment of all impervious surfaces (or best practical option, as relates to provision of mitigation only to clean roof runoff) is proposed.

It is proposed that open water or new bird habitats (within stormwater management devices) are to be avoided to limit an increase in bird life in the area. This approach has been undertaken due to the potential increased risk of bird- strike issues given the development location adjacent to the Whenuapai Airbase. I support this exclusion and this approach is consistent with other developments located near airports. Therefore, stormwater ponds/wetlands have been excluded from the list of possible water quality treatment solutions.

It is noted in the reporting that if large detention basins are required to support the development, that they shall be constructed as “dry basins”. It is recommended that any dry basins are designed to minimise the attraction of birds and that they have suitable sub-soil drainage to prevent the basin remaining wet for extended periods of time during the winter months.

6.1 Hydrological Mitigation

The creation of impervious surfaces in a catchment increases the flow rate and volume of stormwater runoff that can negatively affect streams by accelerating erosion and bank instability and creating hydrological conditions that do not support healthy aquatic ecosystems. To manage the change in hydrology the development proposes the following:

- Stormwater outlet structures shall set back from the stream.
- Riprap protections shall be provided to minimise the erosion.
- Multiple stormwater outlets shall be used where feasible to minimise the peak flows at discharge points while maintaining the water balance to streams.
- Roads – Retention/detention storage provided within Bioretention (raingardens or swales).
- On-lot – Retention/detention storage onsite.
- The detention and retention volumes shall be calculated in accordance with GD01 and the AUPOIP.

It is highlighted that the due to the low percolation rates (below 2mm/hr) and where the occupancy level is too low to make use of re-use tanks, any retention requirements shall be compensated within the proposed detention volume. This is a common and acceptable approach to manage retention requirements where infiltration rates or reuse potential is low. Cato Bolam have recommended additional infiltration tests be conducted throughout the PCA in consenting stage to confirm the infiltration rate and to determine the retention function of the bioretention devices.

In addition, I note that the reports identified some areas as having a high groundwater table that may preclude infiltration of stormwater.

I support the proposed hydrological mitigation approach outlined in the reports and confirm it is consistent with good practice.

6.2 Conveyance (Network capacity) - 10% AEP event

As there is no existing public stormwater reticulation within the PCA, a new public stormwater network will be designed to convey the 10% AEP flow + CC from the PCA for the Maximum Probable Development (MPD) scenario.

The new public network will be designed in accordance with the SWCoP. As the project is still within its early stages of development, limited detailed design of a network has been undertaken. However, given the natural gradient of the catchment, there is no reason to believe an appropriate stormwater system that complies with the SWCoP could not be designed and implemented as per the SMP document.

6.3 Flooding and Overland Flow Path Management - 1% AEP event

A key consideration in determining if there are any adverse effects from the development will be consideration of peak flows leaving the site but also the management of stormwater within the site and the possible impacts of any displaced flood volume and the timing of attenuating flows on-site.

A flood hazard assessment and high-level flood modelling using rain on grid HEC-RAS 2D has been prepared as part of the plan change application. The model was run using the 1% AEP storm assuming a 3.8^{o}C +CC scenario, rather than the 2.1^{o}C + CC scenario set out in the published SWCoP. The 3.8^{o}C +CC scenario, is essentially a pathway with very large greenhouse gas concentrations and associated increases in temperature and rainfall. Therefore, the results are considered conservative, as they use the worst-case climate change scenario that will occur by 2100 at the time of writing. It is noted that the SWCoP may change in the future, but it is unclear if and when this may occur.

A copy of the model and the detailed result files was not available at the time of this review and writing this report. It is understood the model will be provided to Healthy Waters for review and comment.

However, several recommendations were made to Cato Bolam to improve reporting as follows:

- Insert a table with rainfall depths and climate change scenarios.
- Provide further details on the modelling assumptions e.g. Mannings's n values applied.
- Agree the model assumptions with Healthy Waters.

It is noted that the Manning's n values ranging from 0.03 to 0.1 were assumed in the model. It is not clear from the reporting what value was applied to represent different surface types (pre and post development). It is recommended further clarification and information is provided in the report and how they compare to the recommended values. It is noted that the Council's Rapid Flood Hazard Model (RFHM) applies a Manning's roughness n value of 0.1 for the entire catchment, with resistance due to buildings modelled as roughness zones with a Manning's n value of 0.5. It is noted that Council's 2012 RFHM specifications differ from the 2011 Stormwater Modelling Specifications for 2d surfaces.

The model meshes is reported at being set to 2.5 or 5m within the proposed plan change and the area of interest; and 50m for the rest of the catchment. This provides further refinement and detail than the Council's RFHM whereby a maximum triangle area of 100m^2 and minimum element area of 50m^2 was applied. Therefore, the model mesh applied is considered to be within an acceptable range for this analysis. It is recommended that the consultant provide the model to Healthy Waters for review and comment.

The key areas of flood risk identified are as follows:

- Buildings.
- Brigham Creek Road - Existing Box Culvert Crossing.
- Spark Infrastructure buildings - 153 Brigham Creek Road.

6.4 Buildings

To extend the buildable area, the 1% AEP overland flow within the PCA and the existing and new roads shall be diverted to the nearest stream. Earthworks will recontour the land to form channels, future public roads, and private accessways which will be utilised to convey the overland flow paths and address areas currently shown as flood prone.

The HEC-RAS model results demonstrate that the extent of the 1% AEP floodplains for the post development situation can be mostly contained within the stream banks or riparian margin area, road reserves and the proposed flow path channels. No building platforms within the PCA are anticipated to be located within the final flood plain or overland flow paths once design has been completed. It is noted development of the PCA will include a new stormwater system that will convey the 10% AEP + climate change (CC) storm event. This is not included in the existing model, so the flooding shown within the PCA can be considered to be conservative.

Downstream of PCA1, there are two buildings located at 162 Brigham Creek Road identified as being within at risk of flood waters identified in Figure 4 below. No habitable building floors have been identified to be affected further downstream of PCA2 as the flow will be contained within the stream channel or riparian margin.

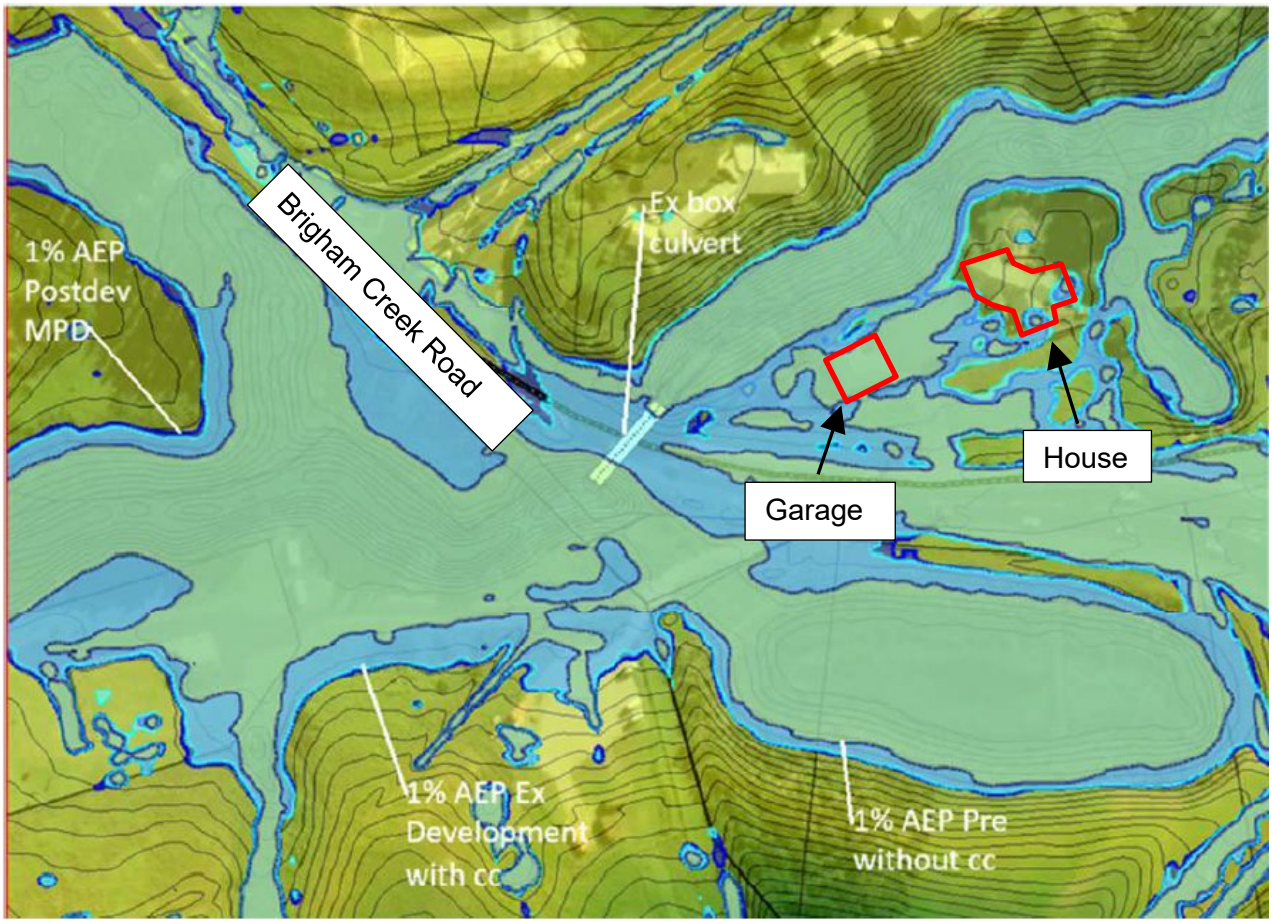

Figure 4: 162 Brigham Creek Road – Flood Extents downstream of PCA1

Figure 4 above shows the relative extents of the 1%AEP storm event as follows:

- Pre-development without climate change.
- Pre-development with climate change.
- Post-development with climate change.

The results show that the greatest change in flood risk is the result of climate change with negligible change in extents between the pre and post development climate change scenarios. The existing house is predominately outside the flood plain, with minor ponding located to the east and south of the building.

Information from Cato Bolam indicates that the change in flood depth (RL9.03) at 162 Brigham Creek Road from the development of the PCA remains below the habitable floor (FFL of RL9.13m) of the house, and does not change between the pre and post development scenarios as shown in Table 1 on the next page. Therefore, the flood level of the habitable floor is unaffected by the proposed development.

Table 1: Flood Depth adjacent to House at 162 Brigham Creek Road

Model Scenario	Existing House – Flood level (m)
1% AEP Predev 100% Culvert Cap 3.8degree climate change	9.08
1% AEP Predev 50% Culvert Cap 3.8degree climate change	9.08
1% AEP Postdev (PCA only) 100% Culvert Cap 3.8degree climate change	9.08
1% AEP Postdev (PCA only) 50% Culvert Cap 3.8degree climate change	9.08

The garage at 162 Brigham Creek Road is understood to be below the fully within the flood plain with FFL of RL8.54m but is not deemed a habitable floor. However, Auckland Transport has lodged a Notice of Requirement (NoR) over this portion of the property that includes the garage, refer Figure 5 below. Auckland Transport propose to use this area to batter the widened road, so the garage will be removed.

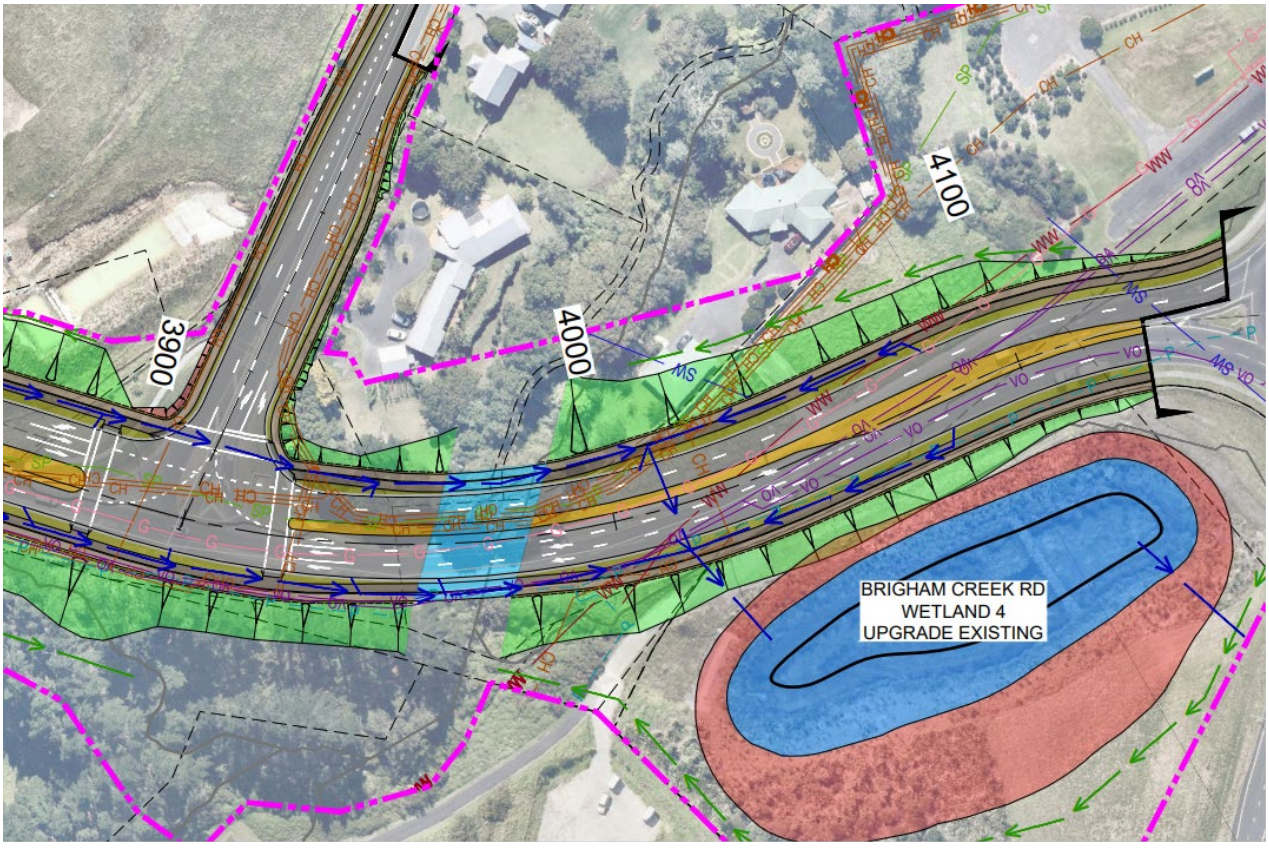

Figure 5: Auckland Transport – Notice of Requirement – Brigham Creek Road

Anecdotal evidence from the selling agent of the house indicates that the house or garage did not flood during the 27 January 2023 storm event where 229mm of rain was recorded at the Whenuapai Rain Gauge. In addition, anecdotal evidence indicates that the culvert under Brigham Creek Road did not block. It was recommended that Cato Bolam include a summary of information gathered on the 27 January storm event within the report.

It has been assumed that the levels reported in the report is based on a 50% blockage of the Brigham Creek culvert. However, the AUPOIP definition of a flood plain (https://unitaryplan.aucklandcouncil.govt.nz/Images/Auckland Unitary Plan Operative/Chapter J Definitions/Chapter J - Definitions.pdf) and the 2011 Auckland Council Flood Modelling Specifications (refer Section 5.3.2.1) assumes no blockage when assessing freeboard and habitable floor requirements. However, it is noted that the design of new culverts (>1500mm in

diameter) requires that secondary flow paths be designed assuming that the culvert is 50% Blocked. Therefore, the flood analysis undertaken is considered conservative as assumes a worst-case scenario for assessing the flood risk to the buildings, as blockage has been assumed. It is suggested both levels are tabled in the report, noting the definition of a flood plain in the AUPOIP.

6.5 Brigham Creek Road

The modelling scenario assuming no blockage shows that the Brigham Creek Road is not overtopped upon the development of the PCA. Assuming a 50% blockage of the 4m x 4m culvert underneath the road, shows a marginal increase of 0.05m flood depth, occurring for an additional 5 minutes than the predevelopment scenario. In my opinion this change is within acceptable limits and is comparable to standards established by Auckland Transport in the delivery of other roading projects. It is recommended that a flood hazard classification assessment using the Australian Rainfall-Runoff (ARR) 2019 guidelines should be undertaken during the resource consent stage.

It is understood that this section of Brigham's Creek Road will be upgraded as part of Auckland Transports Road infrastructure programme. Therefore, it is likely that the effects of any blockage or climate change will not occur, and any existing risks associated with these can be addressed by the Auckland Transport project.

It is noted in the Stormwater Management Plan (Section 6.2.5) that any delay of the peak discharge from the PCA1 may have a negative effect on the wider catchment peak flow in relation to the existing box culvert due to the aligning peak flows with that of the upstream catchment. It is reported that the potential benefits of implementing mitigation measures in the 1% AEP scenario were investigated and determined that such measures would yield minimal improvements (a decrease in the maximum flood level above the culvert of under 0.01m).

6.6 Spark Infrastructure Buildings

The existing Spark Infrastructure buildings within 153 Brigham Creek Road are not affected by flooding in the existing situation and shall remain as such for the future development.

6.7 Flood Modelling Conclusion

The reports concludes that based on the modelling results that mitigation and attenuation of the additional 1% AEP +CC storm event from the development is not required. I support this conclusion at this stage of the development's design process as the effects are less than minor and are comparable to approved changes to flood depths of other projects, such as Auckland Transport Road upgrades.

Therefore, I can concur that the effects to neighbouring properties, infrastructure or the downstream environment are less than minor. The report also notes that any isolated flood plains outside the proposed overland flow paths can be eliminated or adjusted during resource consent and building consent stages. This is an acceptable approach to managing isolated effects given the stage of the design process.

7. Conclusions

Cato Bolam have taken an inter-disciplinary approach to the development of the stormwater management solution for the proposed PCA. This has included specialised input from land surveyors, ecologists, geotechnical and contamination specialist so that one may inform the other, and to identify risks at the earliest opportunity.

The stormwater management approach and design principles adopted for the subject site have been developed with consideration of the requirements or guidelines set out in the AUPOIP, GD01, NDC (Schedule 4 – Greenfields), Whenuapai Stormwater Management Plan, and GD04.

The stormwater management approach seeks to protect and enhance the values and functions of natural ecosystems by:

- Proposed use of riparian margins e.g., 10m setback from the top of bank of the stream and natural wetlands.
- Manage stormwater effects as close to source as practical.
- Treating stormwater runoff from impervious areas (excluding inert roof water) prior to discharging to the receiving environment.
- Mimic natural systems and processes with approved stormwater management techniques.
- Restoration of the existing stream integrated with the proposed treatment of impervious surfaces and roads will promote the ecological values.

I am confident that the stormwater management as outlined in the reports can be implemented. The proposed approach will ensure that stormwater from the PCA is managed and, where appropriate, treated, to ensure the health and ecological value of streams are maintained and where practicable, enhanced. In addition, the effects of flooding on adjacent properties and infrastructure can be managed and predicted effects are considered to be less than minor.

Based upon the findings of this peer review, the proposed solution is sufficiently robust from an engineering and environmental management perspective for the Plan Change application to be approved. There is no reason at this stage of the process to expect that the stormwater engineering solution developed cannot be successfully designed and implemented allowing the development to proceed.

Yours sincerely

Phil Jaggard
Director, MPS Limited

mps limited
29 Chamberlain Street
Grey Lynn,
Auckland 1021
www.mps.net.nz

2 May 2024

Trevor Canty
Neil Construction Limited
Via email
Cc: Matt Ashworth

Whenuapai Business Park Plan Change - Request for Further Information (RFI) Peer Review

Dear Trevor

I, Phil Jaggard have reviewed the Cato Bolam response to Auckland Council's request for more information regarding the Whenuapai Business Park Plan Change. I hereby confirm my support for the statements and information provided within the titled " Request for Further Information – Brigham's Creek Road (1/05/2024)" document.

In conducting this review, I have examined the content and findings presented and provided feedback to Cato Bolam through the development of their response. Based on my expertise and experience in Stormwater, I find that the responses are well-founded and substantiated by the evidence provided and sufficiently detailed for a Plan Change application. In addition, it should be recognised by Council that the proposed solution will be subject to further detailed design and modelling upon successful approval of the Plan Change application, whereby the proposed solutions will be refined and improved where practical.

I make additional comments regarding the hydrology mitigation request (RFI - HW5) by Council. The purpose of the "*Auckland Unitary Plan stormwater management provisions: Technical basis of contaminant and volume management requirements (TR2013/035)"* report was to provide the technical and scientific evidence base and requirements to support the provisions that have been developed in relation to land use controls that manage stormwater contaminants and stormwater volume/flow.

In addition, the proposed hydrological controls are consistent with Healthy Waters Network Discharge Consent, Schedule 4 for Greenfield areas. Therefore, I support the application of SMAF1 provisions to the development area, as they represent current best practice for hydrological controls in Greenfield areas of Auckland.

Should you require any further clarification or assistance regarding my review, please do not hesitate to contact me.

Yours sincerely

Phil Jaggard
Director, MPS Limited