



FAST TRACK APPROVALS Act 2024 (FTAA 2024)

TECHNICAL ADVICE

File No	FTAA-2606-1253
Date	6 October 2026
Memo To	Waimakariri District Council
From	DHI Water & Environment
Subject	Independent technical review of flooding information, 531 and 535 Mill Road, Ōhoka

Carter Group Ōhoka Substantive Application

1 INTRODUCTION

1.1 Purpose of the memo

This memo provides an independent technical review of the flooding material submitted for the Carter Group proposal at 531 and 535 Mill Road, Ōhoka. It first considers the earlier review findings and evidence, then assesses the new information, with particular weight given to the Pattle Delamore Partners (PDP) Flood Effects report issued 9 September 2026, which supersedes the May 2026 report.

The review is structured to distinguish between matters that have been closed out, matters that are partly addressed, and matters that remain outstanding. Its focus is flooding, including off-site and downstream flood effects, runoff volume and timing, the representation and condition of downstream waterways and drains, model fitness for purpose, uncertainty, and the adequacy of proposed controls. Internal stormwater components, including stormwater management areas (SMAs), outlets and the primary network, are considered only where they influence those flooding outcomes.

This is a document-based review. The underlying TUFLOW model files, run logs and check files were not independently interrogated as part of this review. Conclusions about the model therefore remain subject to that limitation.

1.2 Documents reviewed

Category	Document
Primary current information	PDP, Flood Effects – 531 and 535 Mill Road, Ōhoka, job C045180001, Revision E, 9 September 2026, including appendices and the downstream effects memorandum.
Superseded flooding report	PDP, Flood Effects – 531 and 535 Mill Road, Ōhoka, Revision C, 29 May 2026.
Current application material	RC255196 / FTAA-2606-1253 Flood Assessment material for 531 Mill Road, Ōhoka.
Previous independent review	DHI, Review of Flooding – Ōhoka – Carter Group Proposal, 31 October 2024.

Category	Document
Expert conferencing	Joint Witness Statement, Stormwater, Groundwater, Sewer and Flooding Issues, 18 August 2023.
Expert conferencing	Joint Witness Statement – Engineering, Hearing Stream 12D: Ōhoka, 6 August 2024.
Applicant evidence	Evidence of Ben Throssell, flooding, 6 July 2023.
Council evidence	Evidence in Chief of Christopher Bacon on natural hazards (flooding), 22 June 2023.
Supplementary evidence	Further supplementary statement of evidence of Ben Throssell, 17 October 2024, contained in 0029_001.pdf.
Template	WDC Comments on Substantive Application Technical Advice Template.

1.3 Key areas addressed

1. Changes since the earlier reviews and whether previous concerns have been closed out.
2. Calibration, validation, hydrology, model extent and post-development representation.
3. Effects on neighbouring dwellings, roads, access and egress, and downstream floodplain areas.
4. Peak flow, runoff volume, timing, duration and cumulative downstream storage effects.
5. Physical condition, ownership, maintenance status and hydraulic reliability of downstream waterways and drains.
6. Appropriate national, regional and local statutory and technical framework.
7. Decision-critical information required before the Panel determines the substantive application, together with conditions and post-approval controls that would be required if approval is granted.

2 QUALIFICATIONS

My name is Gregory Mark Whyte. I hold a Bachelor of Civil Engineering degree from the University of Canterbury, which I gained in 1996. I am also a Chartered Professional Engineer with Engineering New Zealand, which I have held since 2003. I am Managing Director at DHI Water & Environment (DHI). I have been in this position since February 2020 and with DHI since March 2008.

I have over 30 years of experience in urban water and water resources engineering and modelling. I have experience within both local government and consulting environments. I have led studies and contributed to hydrological and hydraulic modelling across New Zealand, Australia, and the United Kingdom. In my current role, I manage and run DHI New Zealand, along with a small team in Australia, covering roles including project director, project manager, modelling technical expert, hydrological and hydraulic investigations, peer review, and strategic advice on modelling and modelling training.

3 CODE OF CONDUCT

I confirm that I have read and agree to comply with the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023. I prepared this technical review in accordance with that Code. In particular, unless stated otherwise, the opinions expressed are within my area of expertise, and I have not omitted to consider material facts that might alter or detract from those opinions.

4 STATUS OF PREVIOUS REVIEW MATTERS

Previous matter	Status	Current review finding
Model calibration and validation	Partly closed	New calibration against 2014, 2022 and 2023 events, plus photographic site validation, materially improves the evidence. The 2022 hydrograph match is reported as closed. Spatial validation remains qualitative, and photograph timing/levels are uncertain.
50-year event	Closed for broad flood comparison	The 50-year event is now modelled pre- and post-development. This closes the earlier absence of a 50-year comparison, but not the smaller-event concern.
100-year event / updated Code of Practice	Closed	A 100-year event is now included, together with 50- and 200-year events and RCP8.5 to 2130.

Previous matter	Status	Current review finding
Lower return period events	Outstanding	The report states that events smaller than 50 years are not assessed because the primary network and SMAs) would have greater influence and the current model lacks suitable detail. This leaves the previous 10- to 20-year / frequent-event concern unresolved.
Updated development surface	Closed for current concept	The post-development model uses the Inovo surface dated 19 August 2026 and updated culvert/network data. Any material design change must trigger remodelling.
Effects at existing dwellings	Partly closed	No assessed existing dwelling has a modelled peak-flood-level increase greater than 20 mm for the 50-, 100- or 200-year events. However, surveyed floor levels were not used, and the model is expressly not property-specific.
Runoff volume and downstream effects	Partly closed	Catchment-scale modelling extends downstream to about SH1, and total site outflow hydrographs are presented. The Silverstream area is also checked. However, the SMAs are not dynamically modelled, and the volume assessment remains simplified.
Explicit SMA operation	Outstanding	SMAs are represented as full to freeboard from the start. The report itself notes that early-event increase effects should be removed when SMAs are incorporated at detailed design.
Drain and waterway condition / maintenance	Outstanding	The report identifies existing watercourses, tributaries and unnamed drains but does not establish ownership, maintenance responsibility, inspection condition, blockage susceptibility, design standard or assured conveyance.
Groundwater / resurgence	Partly closed	Horton losses and poorly drained soil classes are included, and the report discusses stormwater/groundwater interactions. Operational reliability of basins, raingardens and drains under high groundwater remains a detailed-design risk.
Independent model audit	Outstanding	The report and figures were reviewed, but this review did not independently audit the model build, checks, mass balance, control files, or result datasets.

5 TECHNICAL REVIEW OF NEW INFORMATION

5.1 Model build, calibration and validation

The updated report uses a direct-rainfall TUFLOW HPC model, variable grid resolution, LiDAR-derived topography, Horton infiltration, calibrated roughness, surveyed key culverts and a downstream boundary near State Highway 1. Calibration against three recorded events and separate comparison with site photographs are meaningful improvements. The updated work is therefore better suited to assessing relative pre- and post-development changes at catchment scale than the information available to the earlier reviewers.

It is also noted that, during discussions with PDP at the applicant meeting on 14 August 2026, PDP stated that the drainage network representation was based on LiDAR, with some manual adjustments to provide sensible hydraulic connectivity. This is a reasonable modelling approach for a catchment-scale assessment, but it reinforces that the drainage network should not be treated as a surveyed, condition-verified or asset-confirmed drainage system.

Residual concerns are that calibration relies heavily on one downstream flow gauge, the 2014 and 2023 hydrograph shapes differ from observations, photographic validation is qualitative, and calibration parameters were varied over a wide range. The model should not be treated as independently verified or as supporting precise property-level predictions.

5.2 Post-development flood representation and SMA operation

The proposed 19 August 2026 landform, development roughness, and culvert arrangement are represented in the model. This is an important close-out item. However, the proposed SMAs are not represented as operating storage. They are assumed full to freeboard at the start of each event. This gives a deliberately conservative representation of available flood storage, but it does not test the actual sequence of inflow, detention, outlet control, and outflow that will determine downstream hydrograph timing and volume.

This limitation matters because the report attributes remaining early-event downstream increases to the absence of explicit SMA operation and anticipates removing those increases at detailed design. That is a future expectation, not a demonstrated current flood-effect result. Before the Panel determines the substantive application, dynamic modelling should demonstrate that the proposed layout and available SMA areas can achieve acceptable flooding outcomes. If approval is granted, subsequent detailed modelling should operate as a certification hold point to verify conformity with the design before engineering approval or commencement of relevant works.

5.3 Off-site peak flood levels

The new report indicates that none of the existing dwellings assessed is shown to experience an increase in peak flood level greater than 20 mm in the 50-, 100- or 200-year events. It also identifies modelled downstream reductions over a broader area and local increases concentrated in existing watercourses, with a maximum increase of about 60 mm within a watercourse.

The conclusion should remain qualified. The dwelling assessment uses building outlines and a 2 m buffer rather than surveyed floor levels; the model is not property-specific, and it did not include velocity and duration in the downstream effects assessment. While the reported maximum increase of approximately 60 mm occurs within a watercourse rather than at assessed dwellings, this should not automatically be interpreted as hydraulically neutral. The significance of the increase depends on available channel freeboard, conveyance capacity, blockage susceptibility, maintenance condition, flood duration, velocity effects and whether the increase propagates to adjacent land, infrastructure or access routes. Before a decision is made on the Panel determines the FTAA substantive application, surveyed floor and relevant access levels should be obtained for potentially affected existing dwellings and used to confirm the consequences of the increases in flood levels.

A brief comparison was also made between maximum water-level results from the DHI South Ashley model and the PDP local model for the 1% AEP event. The PDP local model indicates maximum water levels approximately 350 to 400 mm lower than the DHI South Ashley model. The DHI model used HIRDS 4 24-hour rainfall with RCP 8.5 climate change allowance to 2100, whereas the PDP model used HIRDS 4 24-hour rainfall with RCP 8.5 climate change allowance to 2130. Because the PDP model uses a later time horizon, with higher rainfall, as a result higher flood levels would be expected, rather than a decrease. This review of the PDP work primarily compares pre- and post-development effects within the PDP model, so the absolute difference does not by itself invalidate the comparative results. Nevertheless, a difference of approximately 350 to 400 mm is significant and still worth noting, and this review has not explored its cause; it should be investigated thoroughly before the Panel's reliance is placed on the PDP modelling to determine the FTAA substantive application decision.

5.4 Downstream runoff volume, timing and storage

The principal remaining concern is not simply the peak discharge from the development boundary. Development increases impervious area and therefore runoff volume. Attenuation can reduce or delay the peak while still sending additional volume downstream. In a flood-prone receiving system, that volume may fill downstream storage earlier, extend flood duration, or coincide with other tributary peaks.

The updated report improves the position by extending the model to approximately State Highway 1, presenting whole-site outflow hydrographs, and reporting no modelled peak-flood-level increase in the Silverstream area. However, the Silverstream volume check also repeats a simplified bathtub calculation. Further, the whole-site hydrograph comparison is based on a model in which the SMAs are not dynamically represented. For this reason, the report notes higher flows at the start of the event. Accordingly, the downstream volume concern is only partly closed.

Peak-flow neutrality is not equivalent to hydraulic neutrality. A finding of limited or reduced peak flood levels does not resolve concerns about runoff volume, duration, flood timing, receiving-system capacity, blockage susceptibility, maintenance condition, or increased reliance on downstream drainage assets.

Before the Panel determines the FTAA substantive application, the applicant should provide, for each modelled event and critical duration: pre- and post-development cumulative volumes; hydrographs at each Whites Road/Mill Road outlet and at Christmas Road Bridge, Silverstream and other identified controls; time to peak; duration above selected flow and water-level thresholds; and a clear mass-balance reconciliation. Coincident catchment conditions and sensitivity to SMA initial water level and outlet blockage should also be tested. This information should be independently reviewed before the Panel makes its decision on the application.

5.5 Condition and status of downstream waterways and drains

The three principal channels through the site discharge to WDC-maintained drains: Ōhoka Stream, the Ōhoka Stream South Branch and Johnsons Creek. These waterways are maintained to provide functional drainage of the surrounding land; they are not understood to have been sized or designed to provide a specified return-period capacity. The current report also describes flows entering an unnamed drain and the Mill Road drain, but does not establish the ownership, maintenance responsibility or service standard for every receiving feature. Nor does it document current cross-sections, vegetation, sediment, bank condition, culvert condition, blockage history, maintenance standard or legal access for maintenance.

The existing rural land is understood to rely on a mixed land-drainage system comprising Council-maintained drains, informal drains and private or semi-formal drainage routes. Some reaches may be regularly maintained while others may not be maintained to a defined service standard. Even if the development does not materially increase peak flows

through these drains, the reliance on their continued conveyance performance is likely to increase markedly once runoff is collected, attenuated and routed through the proposed development system.

The WDC-maintained status of Ōhoka Stream, the Ōhoka Stream South Branch and Johnsons Creek does not establish a defined flood-capacity standard. The assessment should therefore confirm their existing condition, practical conveyance, maintenance regime, downstream continuity and ability to accommodate the development's proposed discharge regime before those drainage routes are relied on for the FTAA substantive application decision.

Even if those outlet channels are confirmed as WDC-maintained drains, the proposed development would still route substantially more runoff through them than occurs under the present rural land use. That increased flow volume and potentially altered timing would place an unknown additional strain on the downstream drainage system, which has not yet been demonstrated to have adequate capacity, resilience or maintenance provision for the increased reliance.

The 14 August 2026 applicant-meeting explanation is relevant to this gap. A LiDAR-based drainage-network representation, even with manual connectivity adjustments, may provide a practical representation of flow routes for broad-scale modelling, but it does not confirm drain invert levels, cross-section capacity, culvert dimensions, maintenance condition, ownership or legal responsibility.

This is a material gap. Modelled conveyance based on terrain and assigned roughness may overstate real-world reliability if an informal or privately maintained drain is vegetated, silted, undersized, inaccessible or intermittently blocked. Conversely, assuming a poor condition without evidence may be overly conservative. The correct response is an asset and condition survey, not an assumption.

5.6 Smaller and more frequent events

The 2024 DHI review and expert conferencing identified concern about more frequent local flooding. The updated report models no event smaller than the 50-year ARI and states that the current model is not sufficiently detailed because the primary system and SMAs become more influential. That explanation is technically understandable, but it confirms that the earlier concern remains open.

As a minimum, events representative of the primary and secondary system service levels should be assessed with the detailed stormwater network and operational SMAs. The assessment should include access and egress, nuisance flooding, duration, road drainage and effects on the vulnerable low-lying downstream areas.

5.7 Sensitivity, uncertainty and robustness

The 72-hour rainfall sensitivity and alternative temporal profile testing are useful. Further robustness testing should cover drain/culvert blockage, downstream maintenance condition, SMA initial water level, outlet performance, future design changes, and combinations of high groundwater with rainfall. A formal uncertainty register should distinguish uncertainties likely to affect relative changes from those affecting absolute flood levels.

6 AREAS OF AGREEMENT

The following matters are accepted as areas of agreement or substantial technical progress based on the September 2026 report, which supersedes the May 2026 flooding report and is the appropriate current basis for this review.

- The updated model build, calibration and site validation are materially more robust than the information available to the earlier reviews
- The 50-, 100- and 200-year event comparisons provide useful catchment-scale evidence, but they do not yet demonstrate hydraulic neutrality because SMA operation, runoff volume and duration, and receiving-system reliability remain unresolved
- The proposed development must preserve the principal overland flow paths and must not rely on future correction of unacceptable off-site effects
- Detailed design is an appropriate stage to finalise the primary network and treatment system, but only if enforceable performance outcomes and hold points are set now
- Further modelling of the SMAs, outlets and final drainage network is required before the Panel determines the FTAA substantive application decision consent, because an approval would establish a layout that may be difficult to amend if additional stormwater-management area is subsequently required.

7 INFORMATION GAPS AND CLARIFICATION REQUIRED

The Critical and High priority items in the table below are necessary to determine whether off-site and downstream flooding effects have been adequately mitigated and are acceptable. They should be provided and independently

reviewed before the Panel determines the FTAA substantive application decision. Deferring these matters until detailed design would risk locking in a layout, including the extent of the SMAs, that may not be capable of accommodating the measures ultimately required. Medium priority items may be resolved through later design controls only where they do not affect that pre-decision finding.

Priority	Gap	Required response
Critical	Dynamic SMA modelling for flood-effect assessment	Represent basin stage-storage, inlets, outlets, spillways, initial water levels, groundwater constraints and routing for the final design. Demonstrate that SMA operation does not create unacceptable off-site or downstream flood effects for relevant events and durations.
Critical	Downstream volume and duration	Provide cumulative volumes, hydrographs, timing and threshold durations at each site outlet and downstream controls, with mass balance.
Critical	Receiving drain and waterway condition	Provide asset/ownership classification, survey, condition inspection, maintenance responsibility and blockage sensitivity for all relied-on downstream reaches, including Council drains, informal drains and private/semi-formal drainage routes. Reconcile the LiDAR-based drainage-network representation, including any manual connectivity adjustments described by PDP at the 14 August 2026 applicant meeting, with surveyed invert, culvert, cross-section and asset information. Confirm whether any increased reliance is acceptable where maintenance is not assured.
High	Smaller events	Model events below 50-year ARI with primary network and operational SMAs, including nuisance flooding and access/egress.
High	Model audit material	Provide model package, control files, check files, logs, GIS layers, result grids and QA documentation for independent review.
High	Final design change control	Define material-change triggers requiring remodelling, including earthworks, lot yield/imperviousness, road levels, culverts, SMA geometry/outlets and drainage routes.
High	Building and access consequence	Use surveyed floor/access levels for identified sensitive properties and confirm emergency access criteria.
High	Groundwater and operations	Confirm how high groundwater affects basin availability, rain gardens, outlet control, baseflow and maintenance.
Medium	Climate and temporal pattern sensitivity	Confirm adopted climate allowances and test alternative temporal/spatial storm patterns where they may control downstream coincidence.
Medium	Governance and maintenance	Document vesting, inspection frequency, maintenance standards, funding and enforcement for all stormwater/flood-management assets.

8 CONDITIONS AND CONTROLS IF THE PANEL IS MINDED TO APPROVE

The conditions and controls below are not a substitute for resolving the decision-critical information gaps identified in Section 7. They would apply only if the Panel is satisfied, before determining the substantive application, that the proposed layout and available SMA areas can achieve acceptable off-site and downstream flooding outcomes.

Recommended condition / control	Purpose and minimum requirement
Model certification hold point	If approval is granted, require an independently peer-reviewed integrated flood model before engineering approval or commencement of relevant works. The model should incorporate the final landform, primary network, operational SMAs and downstream conveyance system and verify conformity with the flooding outcomes and design envelope demonstrated before the Panel's decision; it should not be used to defer establishment of those outcomes until detailed design.
Performance outcome	Require the approved development to avoid any material worsening of flood level, hazard, velocity, duration, frequency, access risk or reliance on unverified downstream conveyance at existing dwellings, access routes, roads, infrastructure and downstream land for the specified design events and durations. Compliance criteria and assessment locations should be defined in the approval conditions and be consistent with the evidence accepted by the Panel.
Volume neutrality / downstream effects	Require the final design to remain within the downstream runoff-volume, timing and duration envelope demonstrated before the Panel's decision, verified through hydrograph and cumulative-volume assessment at the accepted downstream control locations.

Recommended condition / control	Purpose and minimum requirement
Receiving-system verification	If approval is granted, require completion of the downstream waterway and drain asset and condition assessment, together with any maintenance commitments or upgrades relied on by the accepted assessment, before engineering approval, occupation or the relevant stage release. These requirements should verify, rather than replace, the pre-decision evidence that the receiving system can accommodate the proposed discharge regime.
Blockage and degraded-condition sensitivity	Test credible blockage and poor-maintenance scenarios for critical culverts, drains and outlets and incorporate resilient design or contingency measures.
Smaller-event assessment	Assess agreed smaller design events with the final primary system and demonstrate no worsening of frequent nuisance flooding or access/egress conditions.
Design consistency	Set maximum imperviousness, minimum storage, maximum controlled discharge, overland-flow corridor levels and culvert/outlet requirements consistent with the accepted model.
Change management	Require remodelling and approval for any material departure from the accepted surface, drainage layout, development intensity, imperviousness or staging.
Monitoring and maintenance plan	Provide inspection, sediment/vegetation management, outlet testing, blockage response, ownership, funding and reporting requirements for vested and private assets.
As-built verification	Before occupation of each stage, confirm by survey and certification that landform, culverts, waterways, SMAs, outlets and overland flow paths match the accepted design model.

9 OVERALL POSITION / CONCLUSIONS

The 9 September 2026 PDP report substantially advances the flooding assessment and closes several previous matters, particularly by providing a recalibrated catchment-scale model, an updated development surface, 50-, 100- and 200-year comparisons, a wider downstream model extent, building-effect screening and an updated natural-hazard assessment. However, those improvements provide useful comparative evidence; they do not establish that the nature, magnitude and acceptability of all off-site and downstream flooding effects have been adequately demonstrated.

The main earlier concern, downstream effects from increased runoff volume, is not fully closed. The reported results are encouraging in some respects, including no peak-level increase at Silverstream and generally lower post-development peak outflows, but the applicant has not demonstrated that downstream effects will be adequately mitigated or that hydraulic neutrality will be achieved. The assessment remains peak-focused; actual SMA operation is not represented; the reported early-event increases are attributed to that omission; and the Silverstream check remains partly based on a simplified volume-to-area approach.

A second material gap is the absence of adequate evidence on the real condition and institutional status of all downstream waterways and drains. Ōhoka Stream, the Ōhoka Stream South Branch and Johnsons Creek are identified as WDC-maintained drains, but that status does not establish a defined flood-capacity standard. The ownership, maintenance responsibility, condition and practical conveyance of the other unnamed, private or informal receiving features also remain unverified. These matters require an asset, ownership and condition survey and appropriate sensitivity modelling.

This is particularly important because the proposal may shift the site from a rural drainage context, where local ponding and informal conveyance are part of the existing condition, to a developed catchment that depends more explicitly on defined downstream drains continuing to function. A finding of no material peak-flow increase is therefore not, by itself, sufficient to demonstrate that the receiving drainage system can be relied on without confirming its condition, maintenance status and responsibility.

Accordingly, from a flooding and hydraulic-effects perspective, the information provided with the current FTAA substantive application is insufficient to support approval. The outstanding matters are fundamental to determining whether the proposed development can be accommodated without unacceptable effects beyond the site and cannot be deferred entirely to detailed design or addressed solely through conditions. Further independent review is required before a robust conclusion can be reached on the acceptability of the proposed flood-management approach.

10 REFERENCES

Pattle Delamore Partners Ltd (2026), Flood Effects – 531 and 535 Mill Road, Ōhoka, Revision E, 9 September 2026.

Pattle Delamore Partners Ltd (2026), Flood Effects – 531 and 535 Mill Road, Ōhoka, Revision C, 29 May 2026.

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Joint Witness Statement – Engineering, Hearing Stream 12D: Ōhoka, 6 August 2024.

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Throssell, B. (2023), Evidence on flooding for Proposed Private Plan Change RCP31, 6 July 2023.

Bacon, C. (2023), Evidence on Natural Hazards (Flooding) Relating to Private Plan Change Request RCP031, 22 June 2023.

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Waimakariri District Council, Engineering Code of Practice 2025; Stormwater Drainage and Watercourse Protection Bylaw 2024; Stormwater and Drainage guidance.

Water New Zealand (2024), National Stormwater Modelling Guide.

Christchurch City Council, Waterways, Wetlands and Drainage Guide.

Environment Court Practice Note 2023.