Overview of Evidence

I will be speaking to three core items:

1. **The Hill (Waihora):** Property boundary encroachment and structural reliance regarding the entry point of the stopbank into the Wi Pere Trust side.
2. **The Silt:** The inevitable sedimentation and deposition that will end up on our whenua during flood events.
3. **Groundwater and Aquifers:** The subsurface hydrological impacts under our land.

Item 1: The Hill, the actual historical name of our hill is called: Waihora

- **The Council's Claim:** GDC representatives I spoke with stated that the stopbank alignment *"goes into the Wi Pere side of the hill", and their documentation seems to support this.*

A. The Engineering Reality: Geotechnical and Hydrological Reliance

GDC representatives stated to me that the stopbank alignment *"goes into the Wi Pere side of the hill."* When I directly challenged them, stating, *"Your stopbank is going into our hill,"* their response was, *"No, we are entering from the Wi Pere Trust side".*

But here is the engineering reality:

While the physical asset may sit on that boundary line, hydrologically and structurally, the proposed stopbank relies entirely on the structural integrity of **our** whānau hill.

- **The "But-For" Argument:** If our ancestral hill were to be removed, the council's stopbank would significantly fail. The slither of hill on Wi Pere Trust side of the property cannot hold back a flood on its own; it is merely the outer skin of the larger landform. [Photos 1 & 2]
- **The Tie-In Principle:** Because the stopbank integrates into the landform to form a continuous flood barrier, *the council is utilising the entire hill as a functional piece of public infrastructure*. Therefore, our whenua our land is functionally part of the scheme. [Photos 3 & 4]

B. The Cultural Reality: Statutory Obligations Under the RMA 1991

This whenua was gifted to my parents, Robert and Huinga Cookson, and passed down to their tamariki and mokopuna through my maternal side: from my grandmother Tarere Katipa (née Kewa), from her father Whareherehere Kewa, and his father Hone Kewa.

Under the Resource Management Act 1991 (RMA), ancestral land cannot be parsed out by standard geometric property lines when assessing cultural impacts:

- **Section 6(e):** Recognises and provides for "the relationship of Māori and our culture and traditions with our **ancestral lands, water, sites, wāhi tapu [a sacred place], and other taonga**" as a matter of national importance. The court has repeatedly established that ancestral connection matters even if the exact legal title has been altered or borders adjacent properties.
- **Section 7(a):** Requires decision-makers to have particular regard to **Kaitiakitanga** (guardianship). By modifying the foot of the hill, the council is altering the integrity of a landform we are kaitiaki over. Our whenua is tūturu [original, authentic] it holds profound historical, cultural, and spiritual value to our whānau. We hold an unbroken connection to this whenua [land] as *kaitiaki* (guardians).
- **Section 8:** Requires all persons exercising functions under the RMA to take into account the **principles of the Te Tiriti o Waitangi** (The Treaty of Waitangi), which fundamentally includes the principle of partnership and robust, good-faith consultation. Council has not consulted with our whānau and in fact declined on the grounds that the physical "tie-in" point of the stopbank touches a minor slither of the hill that sits on the adjacent, neighbouring property boundary.
- The Council has a duty to act reasonably and in good faith. Slicing into or placing structural reliance on an ancestral landform using a boundary technicality to bypass the affected whānau is a clear breach of the principle of partnership.
- The landform known as **Waihora**, situated on the whenua of **Te Karaka 16A**, is an irreplaceable anchor of identity and history for the whānau of **Te Aitanga a Māhaki**. It is not a generic landform or a commercial property asset; it is a living cultural landscape that holds the *mauri* (life force) of our people and carries the unbroken memory of our *tūpuna* (ancestors).
- To treat a landscape of this historical and cultural magnitude as a set of disconnected, geometric lines on a cadastral map is fundamentally flawed and culturally offensive. The council's argument—that they can modify a "sliver" of the hill on a neighbouring boundary line without consulting us—ignores the indivisible nature of *te ao Māori* (the Māori worldview). You cannot cut into, place engineering weight upon, or alter the toe of Waihora without degrading the spiritual integrity (*mana*) and physical safety of the entire ancestral

landform. The Council is attempting to use this very hill for public flood protection infrastructure without showing the same respect or partnership to the people who have looked after it for generations.

- As the rightful *kaitiaki* (guardians) of Te Karaka 16A, we hold the cultural memory and the ultimate responsibility for the protection of Waihora. Bypassing our whānau on a property-line technicality directly breaches the council's obligations to recognise our relationship to our ancestral *taonga* under Section 6(e) of the RMA, and completely undermines our role as kaitiaki under Section 7(a).
- The council is now trying to use that very same hill for public flood protection infrastructure *without* showing the same respect or partnership to the people who have looked after it for generations

C. The Risk of Flanking and Scour

- From a physical perspective, the connection point (the tie-in) where a man-made stopbank meets a natural hill is the highest-stress area during a major flood. Swirling floodwaters (**turbulent eddy currents**) press directly against that exact junction. If that boundary "sliver" of hill erodes or shifts, it directly threatens the stability of the rest of the landform (our whānau hill) through structural destabilisation or landslips. Because the physical risk spills onto our property, we are an **affected party**, the **council's failure to recognise us as an affected party**.

D. The Economics of Natural Topography

Building an entirely artificial stopbank requires heavy excavation, transporting thousands of tonnes of specific structural clay, compacting soil in engineered layers, and paying for decades of ongoing maintenance, mowing, and erosion repairs.

By running the stopbank directly into our natural hill, the Council achieves significant financial savings. They are using the natural height and mass of Waihora to do the heavy lifting of flood mitigation for free. It is unacceptable that the Council reaps the financial and structural benefits of our natural topography while simultaneously ignoring our legal, cultural, and environmental rights as its kaitiaki.

In civil engineering and hydraulic methodology, ***using a natural hill or high ground in conjunction with a man-made stopbank (levee) is a fundamental practice*** known as a "tie-in" or "levee termination."

The core reason a hill is used with a stopbank is to securely anchor the engineered flood barrier into a stable, natural geological structure, completely closing the flood defense perimeter so water cannot wrap around the end of the artificial wall.

Key Engineering & Financial Advantages of the Waihora Tie-In

By using our natural hill instead of extending a man-made structure, the Council gains several immense advantages:

- **Prevents Flood Bypassing:** The natural high ground blocks floodwaters from wrapping around and flowing behind the end of the artificial wall.
- **Structural Strength:** Natural, un-excavated landforms are made of dense, deeply consolidated earth and rock that resist fast-moving water far better than engineered loose-fill dirt.
- **Capital Cost Savings:** The Council avoids the significant capital expenditure required to extend the physical length of a man-made stopbank.
- **Reduced Long-Term Maintenance:** Well-established, natural slopes suffer less scouring and erosion from heavy river currents, heavily reducing ongoing maintenance costs.
- **Secure Geotechnical Endpoint:** Anchoring the scheme into solid, natural terrain drastically lowers the risk of structural cracking, piping, or a catastrophic wash-away during a major storm event.

Summary Savings Estimate

When factoring in heavy earthworks, material haulage, land acquisition, and 50 years of avoided operational maintenance, hydraulic engineers routinely find that utilising a single strategic hill tie-in saves a regional flood protection scheme anywhere from **hundreds of thousands to several million dollars**. The Council is reaping this massive financial benefit directly off the back of our landform.

The Reality of Ownership and the Lack of Consent

The portion of the hill the Council refers to as the "Wi Pere side" is merely a slender edge. The true main body, structural core, and crest of that hill landform belong to, and are controlled by, the whakapapa line of the Kewa, Katipa, and Cookson whānau (**81 and 81A Kanakanaia Road / Te Karaka 16A**).

The applicant's current design assumes free, uncompensated integration into a landform that is a Māori Reservation whenua. This land was passed down from my grandmother Tarere Kewa, who married Rāwiri Katipa, and was subsequently bequeathed to my parents, Robert and Huinga Cookson.

To date, the applicant has failed to provide a precise boundary survey to this panel or to us. Furthermore, we have **not granted Affected Party Approval**, nor have we granted an easement for this public infrastructure to anchor into, rely upon, or alter our land. Because our whenua constitutes the main body and structural foundation of the hill this stopbank relies upon, the Council is legally and physically encroaching on our ancestral estate without consent.

Evidence Documentation Letter

- **Pages 1 – 3**
    - ➢ Appendix 15.1: Geotechnical Factual Assessment, GDH - Te Karaka Stopbank Upgrade Geotechnical Interpretive Report.
        - ✓ 1.4 Site Description: At the property 81 Kanakanaia Road there is a small hill with an elevation increase 40 m RL to 53 m RL. The locals call the hill, Cookson's Hill or Cookson's Knoll the proper and actual name is Waihora Hill, explained by Robert Ruru to my parents with myself present, **my apologies I wrote** somewhere between August 1967 and September 1967, it may have been 1968.
          Under the title "Site Description", 81 Kanakanaia Road property also known as Te Karaka 16A, has been tagged as part of the project for the stopbank.
        - ✓ 1.5, Figure 2, page 3 shows the stopbank from the left side of the hill, formulating "High Ground Flood Line" which also indicates 81 Kanakanaia Road/Te Karaka16A and the neighbour, as part of the Plan, to restart the floodbank at the back of the Collier's homestead.
        - ✓ 2.2, Figure 4, page 5 – shows 81 Kanakanaia Road/Te Karaka16A as part of the Plan.
        - ✓ Page 5, Fig 1:
    - ➢ Appendix 8: Consequential Flood Risk Assessment, Tonkin & Taylor – Te Karaka Consequential Flood Risk Assessment.
        - ✓ Page 5, Fig 1.1
    - ➢ Refer to photos 1, 2, 3, 4,

<u>Research Supporting Evidence</u>

In civil engineering and hydraulic research, using a natural hill or high ground in conjunction with a man-made stopbank (levee) is a fundamental practice known as a **"tie-in"** or **"levee termination."**

The core reason a hill is used with a stopbank is to securely anchor the engineered flood barrier into a stable, natural geological structure, completely closing the flood defense perimeter so water cannot wrap around the end of the artificial wall.

Core Concepts & Engineering Reasons

1. **Perimeter Closure and Preventing Flanking:** A stopbank cannot simply stop in an open field; if it does, floodwaters will just flow around the end (flank the structure) and flood the protected area from behind. Engineering manuals require stopbank to either form a complete closed ring or "tie in" to natural topography that is higher than the design flood level.
2. **Utilising Natural Topography for Cost and Scale Efficiency:** Building artificial earthen mounds is expensive and resource-intensive. If a natural ridge or hill borders a floodplain, engineers will run the stopbank up against that high ground. This drastically reduces the amount of dirt, labour, and maintenance required for the overall flood scheme. [BOPRC}
3. **Minimizing Seepage and Stability Vulnerabilities:** The boundary where an artificial earth structure meets a natural hill is a critical zone. [GWRC]

Key Research & Technical References

The following are primary authoritative sources:

1. U.S. Army Corps of Engineers (USACE) – Engineer Manuals

The USACE produces the global gold-standard literature for levee and stopbank design.

- **Reference:** *EM 1110-2-1913: Design and Construction of Levees*
- **Why it's clear:** This manual explicitly details "Levee Terminations and Tie-ins." It outlines the hydraulic criteria required when transitioning a man-made embankment into "high ground" (hills or natural bluffs) to ensure that the natural ground meets slope stability and height requirements, preventing floodwaters from bypassing the system.

2. International Commission on Large Dams (ICOLD) / NZSOLD

Research networks that study integrated flood systems heavily document how stopbanks interact with surrounding geography. [NZSOLD]

- **Reference:** *ICOLD Bulletin 177: Levees and Flood Defences* (or guidelines by the New Zealand Society on Large Dams (NZSOLD))
- **Why it's clear:** These technical papers focus on the systemic view of catchments. They highlight how utilising natural topography (like bounding high ground) alters the floodplain hydraulics, slowing down water and providing natural containment alongside man-made structures. [UC Research Repository & NZSOLD]

3. CIRIA: The International Levee Handbook (Report C731)

This is an extensive, multi-national comprehensive guide compiled by researchers from France, the UK, the US, and the Netherlands.

- **Reference:** *The International Levee Handbook (CIRIA C731)*
- **Why it's clear:** It features dedicated chapters on **"Morphological and Geotechnical Site Characterization."** It details how natural features like valley sides, terraces, and hillsides should be evaluated to serve as the definitive endpoint of a levee system, emphasizing the structural transition needed to prevent flanking erosion.

4. Regional Hydraulic Design and Flood Scheme Reports

Localised case studies often provide the clearest real-world examples of high ground bounding a stopbank.

- **Reference Example:** Reports like the *Hydraulic Design of the Awarua Drain Stopbanks* by regional councils (e.g., Bay of Plenty Regional Council).
- **Why it's clear:** These reports explicitly state design decisions such as: *"the best method of improving flood protection was to... [build] a stopbank along the right bank of the drain, the left bank being largely boundered by high ground."* This clearly shows the optimization of a hill as an automatic, free flood barrier. [BOPRC]

Item 2: Hydrodynamics, Siltation, Erosion — Refuting the "Small Corner" Claim

A. The Council's Claim vs Our Response

- **The Council's Claim:** GDC representatives told me during our discussions that the stopbank's impact on our property is minimal, stating, *"...it's just a small corner."* Their design documentation treats this location as a standard, benign termination point where the stopbank ends at a downward angle directly into the vertex where the flat land meets the base of Waihora. *[Ref: Hydrodynamics Photos 1 & 2]*
- **Our Response:** This area is **not** a minor, inactive corner. Historical evidence from Cyclone Bola and Cyclone Gabrielle proves that this exact junction is a **high-energy convergence zone**. Floodwaters do not remain static during a breach or overtopping event; they operate in a destructive, two-phase hydrodynamic sequence.

- **The Council's Documentation:** The orange design alignment shows the stopbank ending at a downward angle directly into the corner where the flat land meets our hill. The Council's application treats this as a standard termination point.
- **Our Response:** Historical evidence from Cyclone Gabrielle and Cyclone Bola proves that this area is a high-energy convergence zone. Floodwaters do not just sit still; they move in a destructive two-phase sequence:
  - **Phase A (Water Velocity):** Floodwaters hitting this massive topographical corner will bottleneck, creating severe, turbulent eddying.
  - **Phase B (Silt Dropping):** As the water violently swirls and slows in the corner, it drops massive, heavy silt deposits at the bottom of our hill.

B. The Hydrodynamic Process: Two-Phase Destructive Sequence

Phase 1: High-Velocity Bottlenecking & Turbulent Eddy Currents

As high-velocity floodwaters rush toward the scheme, the man-made stopbank will force the water directly into a topographical dead-end against the steep face of Waihora. Because the water has nowhere else to go, it will bottleneck. This restriction forces the water to sharply redirect, creating a **localised vortex (turbulent eddy currents) and a high-stress bottleneck**. Instead of a peaceful transition, these high-turbulence pockets will actively scour, strip our topsoil, and erode the vulnerable toe of the hill.

Phase 2: Deceleration and Progressive Siltation (The "Drop Zone")

As the turbulent water hits the structural face of the hill and loses momentum, it dramatically decelerates. Moving water requires velocity to keep sediment suspended; the moment it stalls, it immediately sheds its heavy sediment load. This creates a massive, rapid drop of silt and sand right at the tie-in point.

As the initial wave of silt settles directly into the vertex, it physically alters the terrain. This initial deposit forms a new mud barrier, triggering a domino effect: subsequent floodwaters are forced to stall earlier and earlier, causing the silt accumulation to expand **backward (upstream) against the direction of the river flow**.

The Progressive Silt Build-up

```
                [WAIHORA] HILL
                 \
                  \
                   \
                    \___________ [COUNCIL] STOPBANK (Flat)
                   /\
         [ Stage 3 ]  /  \ [ Stage 1 ]
         Drops here  /    \ First initial dump
                 /     \ fills the vertex
                /       \
      [ Stage 2 ]  /         \
      Piles behind /           \
      Stage 1    /             \
              /_________________\
<------------------------
 BACKWARD EXPANSION (Upstream)   <---------- HIGH-VELOCITY FLOODWATER
```

Sediment Transport: Theory and Practice by Chih Ted Yang – The definitive textbook outlining vertex filling and the upstream propagation of deposition lines when a supercritical or high-velocity subcritical flow encounters a transverse barrier.
Open-Channel Hydraulics by Ven Te Chow – The foundational textbook that models the "Backwater Curve" (specifically the **M1 or S1 backwater profiles**) which causes the velocity drop responsible for Stage 1, 2, and 3 mechanics.
Principles of River Engineering by P.Ph. Jansen – Focuses on the structural response of riverbeds to obstacles like stopbanks and the progressive upstream morphologic shift.

C. The Long-Term Consequences of the "Topographical Trap"

The Council's design turns our whenua into a localized retention basin for hazardous sediment. This creates four distinct long-term impacts:

1. **Formation of an Alluvial Splay:** The uneven, rapid accumulation of coarse material (sand and heavy silt) will create an artificial mini-delta at the base of our hill, permanently altering natural surface drainage and directing future floodwaters directly into the hillside interface.

2. **Post-Flood Packing and Hardening:** Once floodwaters recede, these thick layers of silt dry out, forming a dense, concrete-like, cake-like layer that suffocates the underlying soil structure and destroys its agricultural or ecological viability.

3. **The Environmental Health Threat (The Stench):** Silt deposited by regional flood events is not clean river sand; it is a thick, toxic, contaminated sludge. The overwhelming volume and profound stench of the mud left in Te Karaka after Cyclone Gabrielle are well-recognized. As Tahi Hiroki, a local volunteer coordinator, documented during the clean-up:

"...the main job in Te Karaka today is going around the houses and scooping soot [silt/sludge] off the properties... to pick them up and remove them, that'll help get rid of the stench."

https://www.youtube.com/watch?v=TSR6R0ze4rg

4. **Permanent Land Damage:** Because the proposed stopbank ties directly into Waihora—an area that has already borne the brunt of two major historical disasters—the current engineering design will systematically channel and trap future floodwaters, toxic silt, and heavy debris directly onto our property.

Other important facts:

- **"Altered Hydraulics":** By tying it into the hill, the council/applicant has concentrated the river's energy and created a sediment trap right at that junction.
- **Maintenance Burden:** Heavy silt accumulation (especially depths over 15mm) ruins pasture, damages land use permanently, and requires expensive mechanical removal.
- **The "Scour" Risk:** The tie-in creates a bottleneck. If the stopbank wasn't designed with a smooth transition, the water creates a vortex against the hill, causing localized erosion (scouring) that can threaten the stability of the natural hillside itself.

https://www.mpi.govt.nz/funding-rural-support/adverse-events/dealing-with-floods
https://www.hastingsdc.govt.nz/assets/Links/Removal-of-silt-deposited-during-flooding.pdf

New Zealand Engineering & Design Guidelines

To establish how a "tie-in" is supposed to be managed and why it creates a hazard, you can reference regional stopbank design standards:

- **Reference:** *Stopbank Design and Construction Guidelines (Guideline 2021/01)*, Prepared by Britton Consultants for Regional Councils.
  - **How to use it:** This standard outlines that the interface where an earth embankment meets a natural landform (the tie-in) is a **high-risk boundary**. Guidelines mandate a strict "benched tie-in cut batter" to blend the two. If the engineering fails to properly manage the transition, it alters the natural flow paths, creating localized high-velocity zones or artificial "flow shadows" where massive sediment drop occurs.
- **Reference:** *Pōrangahau Stopbanks Design Report* & *Lower Rees River Assessment of Floodplain Intervention Options (2024)*.
  - **The How:** These regional council resource consent frameworks explicitly state that terminating or tying-in flood protection structures requires extensive mitigation because it creates **"end effects erosion"** and blocks or "backs up" water levels upstream.

2. The Hydraulic Reference: "The Hjulström-Sundborg Curve"

To prove *why* the silt drops rapidly when floodwater hits the hill/stopbank junction, rely on a foundational principle of physics taught to all civil and environmental engineers:

- **The Principle: The Hjulström Curve** (or Sundborg Modification) for sediment transport.

https://www.youtube.com/watch?v=g3uftZ9ySpI&t=13s

https://www.geological-digressions.com/the-hydraulics-of-sedimentation-flow-regime/

- **The How:** Silt particles (defined in NZ as ranging between 0.002mm and 0.063mm) require continuous water velocity to remain as a **"suspended load"**. https://www.fondriest.com/environmental-measurements/parameters/hydrology/sediment-transport-deposition/
- **The Argument:** When floodwater hits the pocket where the stopbank meets the hill, it experiences an **abrupt drop in hydraulic radius and velocity** due to the physical barrier. According to the Hjulström Curve, the moment velocity drops below a critical threshold, the water can no longer sustain a suspended load, forcing immediate, heavy sediment deposition. https://www.kapiticoast.govt.nz/media/oaclcqvf/caa-discounted-long-list-options-and-actions-june-2023.pdf

3. Geomorphic Reference: "Flow Shadows" and "Crevasse Splays"

- **Reference:** *Connecting Fluvial Levee Deposition to Flood Inundation Dynamics*, (e.g., studies featured in *CAB Direct / Earth Surface Processes*).
- **The How:** Scientific text establishes that when a stopbank or tall levee structure obstructs natural floodplain flow, it creates a **"flow shadow"** on the protected/corner side. Sediment is preferentially deposited in these low-energy flow shadows, shifting the point of maximum deposition right to the toe (base) of the structure and hill. This process physically reshapes the land, causing rapid silt accumulation.

D. Long-Term Maintenance and Environmental Burden

The Council is effectively designing a system that dumps the regional maintenance burden directly onto private Māori land.

According to guidelines from the Ministry for Primary Industries (MPI) and the Ministry of Business, Innovation and Employment (MBIE) on dealing with flood impacts, heavy silt deposition is profoundly destructive. Accumulated silt suffocates pastures, strips the land of its agricultural viability, permanent alters local surface drainage, and severely damages subfloor building elements.

By creating a localised retention basin at the base of Waihora, the Council's design guarantees that future flood debris and toxic silt will be systematically channelled onto our property. Remediating this requires incredibly expensive, heavy mechanical removal—a financial and operational burden the Council has completely failed to account for, model, or offer to mitigate.

Conclusion for Item 2

This is not a small, benign corner—it is a textbook **topographical trap**. Funnelling high-velocity floodwaters directly into the base of our ancestral hill will strip our topsoil, trigger severe localized erosion, and leave catastrophic silt build-ups. The Council cannot use a property-line technicality to build a high-risk engineering interface that relies on our landform while leaving our whānau to deal with the permanent environmental and financial fallout.

Questions for the Applicant (Gisborne District Council)

To assist the Commission Panel in evaluating the technical soundness and cultural safety of this proposal, I formally request that the applicant provide clear, data-backed answers to the following four questions:

1. **Regarding Asset Integration and Encroachment:**
   Is the applicant explicitly operating under the assumption that our whānau is required to provide uncompensated structural reliance, structural tie-ins, and permanent storage for regional floodwaters, toxic silt, and debris on our private, Māori Reservation whenua?

2. **Regarding Sedimentation Mechanics and Upstream Impacts:**
   Once the initial vertex saturation occurs at the boundary interface (Stage 1 of the flow shadow), where exactly does the applicant's hydraulic model show subsequent upstream sediment dropping? Given that standard fluid mechanics dictating the Hjulström Curve require a progressive backward expansion, has this upstream deposition footprint on our land been quantified?

3. **Regarding the Lack of Hydrodynamic Simulations:**
   The applicant has asserted that the physical impact of the stopbank termination is strictly confined to a "small corner." Can the applicant produce a localized, high-resolution hydrodynamic model simulation to visually demonstrate and prove this claim to our whānau and the Panel?

4. **Regarding Structural Inundation and Property Risk:**
   If the applicant denies that silt, hazardous debris, and turbulent vortexes will physically expand across a wide, destructive footprint of our private property, what empirical engineering data or simulation modelling is being relied upon to support that denial?

Evidence Documentation Letter

- **Pages 3 – 8**

  - Appendix 8: Consequential Flood Risk Assessment, Tonkin & Taylor – Te Karaka Consequential Flood Risk Assessment.

    - ✓ Page 5, Fig 1.1 – the orange line shows a downward slant as the stopbank connects into the Wi Pere Trust side of the hill, therefore making it a triangular corner for the silt to pool and lie at the bottom of our whenua hill on the leeward side. When Gabrielle hit, it is well documented of the large silt deposits that inundated the Te Karaka residents, hence the reason for the stopbank. With the stopbank being positioned into the side of the hill, and our whenua hill Cookson's Knoll is the main body to that position, will receive the dumping and huge deposits of silt during the next cyclone and flooding.
    - ✓ The kōrero explained to me by GDC representatives that it will affect a small corner of our property Te Karaka 16A, this will not be a small corner, it the silt that once impacted on the residents of Te Karaka will have nowhere else to go other than the extremely large portion of a corner.

Item 3: The Subsurface Hydrological Flaw & Multi-Generational Bore Data

A. The Council's Geotechnical Claim vs. Empirical Reality

- **The Council's Documentation:** Section 2.2 of GDC's geotechnical report explicitly states: *"...Groundwater was not encountered within the investigations."*
- **Our Evidence:** This statement is factually incorrect and represents a severe administrative and technical blind spot. The applicant's limited, shallow auger testing completely missed a prominent, highly active shallow aquifer system running directly beneath 81 Kanakanaia Road.

Our whānau holds an unbroken history on this whenua, and we submit the following verifiable, multi-generational history of four separate operational bores on our property:

1. **The Ancestral Bore:** Originally drilled and successfully utilised for **30–35 years** to run our tipuna's historical Coaching Inn, providing a constant water supply for travellers and horses. [Bores: Photo 1 & 2]

    Page 1: The Cultural Reality: Statutory Obligations Under the RMA 1991

    Page 2: 'an unbroken history of our tūpuna'

2. **Bore 1 (Driveway Base):** at the base of the hill where the driveway curves toward the Lodge, successfully utilised for **13–15 years.** [Photo 1 & 4]

3. **Bore 2 (Rear Shed):** Installed by our parents highly active and successfully utilised for **8–10 years** in the vicinity of the current Katipa Whānau shed, Mahanga Katipa is the contact person. [Photo 6]

4. **Bore 3 (Te Karaka 16A Centre):** Successfully utilised for **8–10 years** across the drainage ditch toward the middle of the block. [Photo 7]

- **Photos of bore markings**

It is scientifically unacceptable that a commercial engineering assessment can claim groundwater was "not encountered" when our whānau has successfully pumped water from four distinct locations across this whenua over a span of decades. Because the Council has completely ignored this shallow aquifer, their design fundamentally fails to account for **subsurface hydrostatic pressure**.

B. Subsurface Hydrology: Aquifer Overpressure (The Hydraulic Jack Effect)

An aquifer has a finite natural capacity. During a major flood event, the weight of massive surface floodwaters forces immense downward infiltration into the ground. When this unmapped, high water table is subjected to extreme river pressure, it triggers a destructive phenomenon known as the **Hydraulic Jack Effect**:

```
FLOODWATER & RUSHING RAIN LOADING

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~


      |  |  |

      V  V  V  (Massive downward infiltration)

______________________________

[   IMPERMEABLE SOIL    ]

---------------------------

      ^  ^  ^


      |  |  |  (Extreme upward hydrostatic pressure)

============================

OVER-SATURATED AQUIFER

============================
```

Soil Mechanics and Foundations by Muni Budhu: This textbook contains explicit diagrams showing exactly what happens when heavy surface ponding occurs over an impermeable soil layer while an underground confined layer experiences a massive spike in *pore water pressure*.

Groundwater by R. Allan Freeze and John A. Cherry: The absolute Bible of hydrogeology. Look up their chapters on **"Confined Aquifers and Artesian Systems."** They diagram exactly how regional recharge zones fill an aquifer until the piezometric head exceeds the ground elevation, causing severe upward hydrostatic pressure against an upper confining bed (the impermeable layer).

Artesian Spouting: The immense surface weight of the floodwaters compresses the aquifer. If this extreme internal pressure finds a geological weak point—such as a natural bedrock fracture or an unsealed historical borehole—the groundwater will erupt violently to the surface like an artesian geyser.

- **Ground Heaving:** The upward pressure exerted by the overfilled aquifer acts exactly like a hydraulic jack. It presses against the underside of the overlying soil layers and concrete structures, causing the ground to crack, tilt, and buckle upward.

C. Structural Foundation and Geotechnical Failure Mechanics

Subjecting an ignored, unmapped aquifer to these extreme pressures risks a catastrophic failure of the stopbank itself through three distinct mechanisms:

1. **Liquefaction-Like Weakening:** When the aquifer becomes over-pressurised, water forces its way between individual soil particles above it. This spikes the **pore water pressure**, causing the soil to lose all internal friction and shear strength. The ground liquefies, causing heavy engineering structures or earth stopbanks built above it to instantly sink, shift, or wash away.
2. **Buoyancy Uplift:** Underground structures, storage tanks, and large public drainage pipes act like boats in water. When the aquifer rises rapidly and completely saturates the surrounding soil matrix, the resulting buoyant force can literally pop heavy concrete infrastructure straight out of the ground.
3. **Accelerated Subsurface Piping and Sinkholes:** If this over-pressurised groundwater finds an escape path toward a lower-elevation surface point (such as the dry side/toe of the stopbank or a nearby drainage channel), it moves rapidly. This continuous internal washing carves out massive underground tunnels (**internal piping**). Once these subsurface voids grow too large, the ground above suddenly drops, creating severe sinkholes and triggering the **catastrophic internal collapse of the flood defences**.

Under **Section 8 of the RMA**, the Council has a statutory obligation to take into account the principles of **Te Tiriti o Waitangi**, fundamentally including the principles of partnership and robust, good-faith consultation. Proceeding with an engineering design that ignores decades of localized mātauranga and multi-generational bore data is a clear breach of that partnership.

4. Accelerated Piping and Sinkholes

If the over-pressurised aquifer water finds a path to escape toward a lower-elevation surface point (like the base of a stopbank or a nearby river channel), it moves rapidly.

- **Internal Erosion:** The escaping groundwater washes fine sand and soil particles along with it.
- **Underground Voids:** Over hours or days, this continuous internal washing carves out massive underground tunnels (piping). Once the tunnel grows too large, the ground above it suddenly drops, creating ***severe sinkholes*** or triggering the catastrophic internal collapse of flood defenses.

Evidence Documentation Letter:

- **Pages 8 – 9**

Item 4. DECISIONS AND RELIEF SOUGHT FROM THE PANEL

I am presenting to the Panel today because the Council's current stopbank proposal utilises a design that forces catastrophic sedimentation onto our land, relies on factually flawed groundwater baselines, and results in the ***uncompensated, non-consensual use of our private ancestral hill as public infrastructure.***

To restore the integrity of the resource consent process, protect our whenua, and honor the role of our whānau as its rightful kaitiaki, **I am formally seeking the following relief and directives from the Commission Panel:**

1. **Halt the proposal**: Issue a directive to halt the current proposal in its current form until the Council has undertaken formal, documented, and meaningful consultation with our whānau.
2. **Affected Party Status:** Formally recognise our whānau as an Affected Party under the RMA, given the undeniable physical, hydrological, and cultural impacts on our ancestral landform, Te Karaka 16A.
3. **Direct the Council to** co-design a solution alongside our whānau that respects the *mauri* and integrity of the main body of Waihora Hill and Te Karaka 16A.

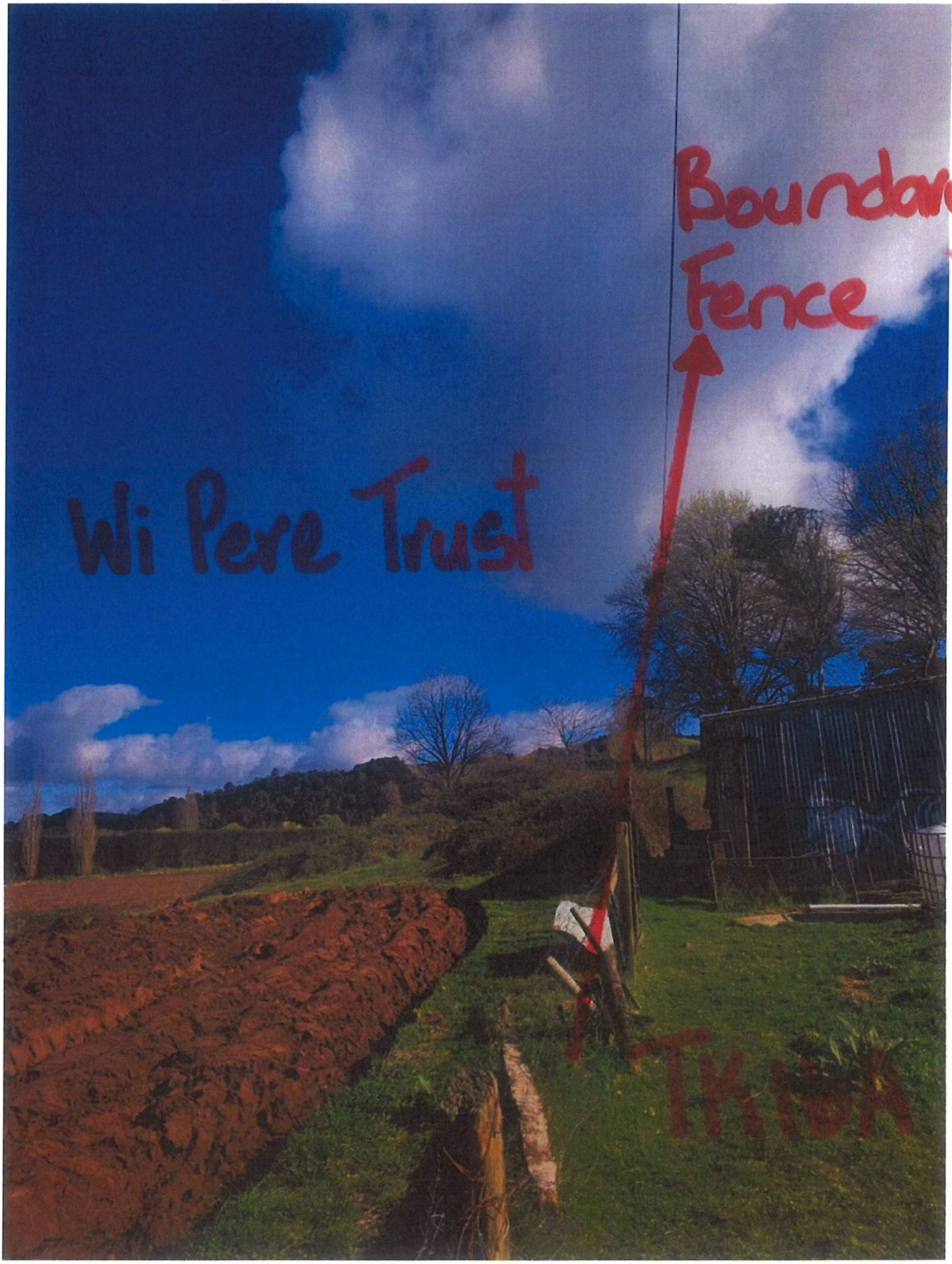
4. **Full Operational Accountability for Silt Clearance:** That the Council accept full financial and operational responsibility for the immediate and ongoing mechanical clearing of all flood-deposited silt, mud, and hazardous debris from our property during and after severe weather events. Where council-managed infrastructure and inadequate hydrological planning directly contribute to localized deposition, the Council must be held fully accountable for remediation.
5. Fair **Financial Compensation:** Direct the Council to provide fair financial recompense and formal easements for both the initial integration and ongoing structural reliance upon our private land as part of the regional flood mitigation scheme.

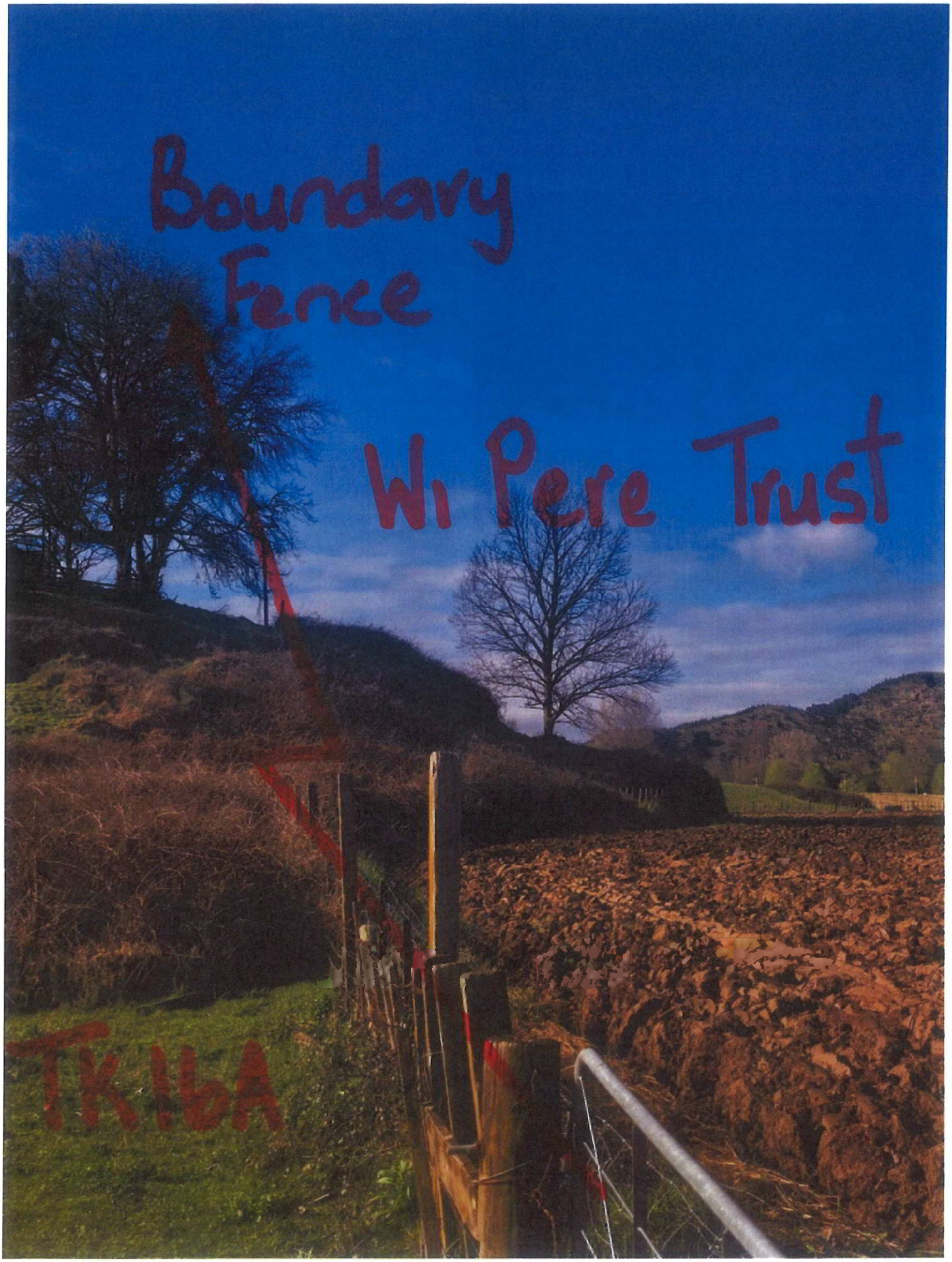
Closing Question for the Applicant

I wish to leave the applicant with one final, fundamental question to answer for the record:

"If the Council refuses to accept operational responsibility for clearing the catastrophic siltation generated by this design, is the Council explicitly stating that our whānau is expected to provide free, permanent storage for public floodwater debris, toxic mud, and contaminated silt on our private ancestral land?"

Ngā mihi, ngā mihi, ngā mihi nui ki a koutou


Boundary
Fence
Wi Pere Trust
TKIDA


Boundary Fence
Wi Pere Trust
TKIbA

3

Photo 3 – Photo taken of the front of the hill, approx. three quarters of the hill, on Te Karaka 16A/81 Kanakanaia Road, with Wi Pere Trust on the left-side. The hill could not fit into one photo.

The property boundary is here this is the same in photo 1.

This is Wi Pere Trust part of the hill.

4

Photo 4 - Photo taken of the front of the hill approx. the last quarter of the hill, on Te Karaka 16A/81 Kanakanaia Road. The boundary of the property is here

Evidence

Kia Ora Commission Panel,

Re: Te Karaka Stopbank - LR-2026-113441-00

This is the evidence I am providing on behalf of the Kewa/Katipa/Cookson for Te Karaka 16A/81 Kanakanaia Road.

Evidence Item 1: Property Boundary Encroachment

- **The Council's Claim:** GDC documentation states that the stopbank alignment *"goes into the Wi Pere side of the hill."*
- **Our Evidence:** The portion of the hill the Council refers to is merely a slender edge. The main body and crest of that hill landform belong to and are controlled by the Kewa/Katipa/Cookson Whānau (81 & 81A Kanakanaia Road/Te Karaka 16A). Our whenua is mentioned in the Te Karaka Stopbank documentation which is part of my evidence:
    - ➢ Appendix 15.1: Geotechnical Factual Assessment, GDH - Te Karaka Stopbank Upgrade Geotechnical Interpretive Report.
        - ✓ 1.4 Site Description: At the property 81 Kanakanaia Road there is a small hill with an elevation increase 40 m RL to 53 m RL. The locals call the hill, Cookson's Hill or Cookson's Knoll the proper and actual name is Waihora Hill, explained by Robert Ruru to my parents with myself present somewhere between August 1967 to September 1967.
          Under the title "Site Description", 81 Kanakanaia Road property also known as Te Karaka 16A, has been tagged as part of the project for the stopbank.
        - ✓ 1.5, Figure 2, page 3 shows the stopbank from the left side of the hill, formulating "High Ground Flood Line" which also indicates 81 Kanakanaia Road/Te Karaka16A and the neighbour, as part of the Plan, to restart the floodbank at the back of the Collier's homestead.
        - ✓ 2.2, Figure 4, page 5 – shows 81 Kanakanaia Road/Te Karaka16A as part of the Plan.
        - ✓ Page 5, Fig 1:
    - ➢ Appendix 8: Consequential Flood Risk Assessment, Tonkin & Taylor – Te Karaka Consequential Flood Risk Assessment.
        - ✓ Page 5, Fig 1.1
    - ➢ Refer to photos 1, 2, 3, 4,

Research Supporting Evidence

In civil engineering and hydraulic research, using a natural hill or high ground in conjunction with a man-made stopbank (levee) is a fundamental practice known as a **"tie-in"** or **"levee termination." The core reason a hill is used with a stopbank is to securely anchor the engineered flood barrier into a stable, natural geological structure, completely closing the flood defense perimeter so water cannot wrap around the end of the artificial wall.**

Core Concepts & Engineering Reasons

1. **Perimeter Closure and Preventing Flanking:** A stopbank cannot simply stop in an open field; if it does, floodwaters will just flow around the end (flank the structure) and flood the protected area from behind. Engineering manuals require stopbank to either form a complete closed ring or "tie in" to natural topography that is higher than the design flood level.
2. **Utilizing Natural Topography for Cost and Scale Efficiency:** Building artificial earthen mounds is expensive and resource-intensive. If a natural ridge or hill borders a floodplain, engineers will run the stopbank up against that high ground. This drastically reduces the amount of dirt, labor, and maintenance required for the overall flood scheme. [BOPRC}
3. **Minimizing Seepage and Stability Vulnerabilities:** The boundary where an artificial earth structure meets a natural hill is a critical zone.

[GWRC – Greater Wellington Regional Council]

Key Research & Technical References

The following are primary authoritative sources:

1. U.S. Army Corps of Engineers (USACE) – Engineer Manuals

The USACE produces the global gold-standard literature for levee and stopbank design.

- **Reference:** *EM 1110-2-1913: Design and Construction of Levees*
- **Why it's clear:** This manual explicitly details "Levee Terminations and Tie-ins." It outlines the hydraulic criteria required when transitioning a man-made embankment into "high ground" (hills or natural bluffs) to ensure that the natural ground meets slope stability and height requirements, preventing floodwaters from bypassing the system.

2. International Commission on Large Dams (ICOLD) / NZSOLD

Research networks that study integrated flood systems heavily document how stopbanks interact with surrounding geography. [NZSOLD]

- **Reference:** *ICOLD Bulletin 177: Levees and Flood Defences* (or guidelines by the New Zealand Society on Large Dams (NZSOLD))

- **Why it's clear:** These technical papers focus on the systemic view of catchments. They highlight how utilising natural topography (like bounding high ground) alters the floodplain hydraulics, slowing down water and providing natural containment alongside man-made structures. [UC Research Repository & NZSOLD]

3. CIRIA: The International Levee Handbook (Report C731)

This is an extensive, multi-national comprehensive guide compiled by researchers from France, the UK, the US, and the Netherlands.

- **Reference:** *The International Levee Handbook (CIRIA C731)*
- **Why it's clear:** It features dedicated chapters on **"Morphological and Geotechnical Site Characterization."** It details how natural features like valley sides, terraces, and hillsides should be evaluated to serve as the definitive endpoint of a levee system, emphasizing the structural transition needed to prevent flanking erosion.

4. Regional Hydraulic Design and Flood Scheme Reports

Localised case studies often provide the clearest real-world examples of high ground bounding a stopbank.

- **Reference Example:** Reports like the *Hydraulic Design of the Awarua Drain Stopbanks* by regional councils (e.g., Bay of Plenty Regional Council).
- **Why it's clear:** These reports explicitly state design decisions such as: *"the best method of improving flood protection was to... [build] a stopbank along the right bank of the drain, the left bank being largely boundered by high ground."* This clearly shows the optimization of a hill as an automatic, free flood barrier. [BOPRC]

Evidence Item 2: Hydrodynamics & "The Corner Effect" (Silt and Erosion)

- **The Council's Claim:** The orange design alignment shows the stopbank ending at a downward angle directly into the corner where the flat land meets our hill. The Council's application treats this as a standard termination point.
- **Our Evidence:** Historical evidence from Cyclone Gabrielle and Cyclone Bola proves that this area is a high-energy convergence zone. Floodwaters do not just sit still; they move in a destructive two-phase sequence:
    - **Phase A (Water Velocity):** Floodwaters hitting this massive topographical corner will bottleneck, creating severe, turbulent eddying.

- **Phase B (Silt Dropping):** As the water violently swirls and slows in the corner, it drops massive, heavy silt deposits at the bottom of our hill.

Our whenua is mentioned in the Te Karaka Stopbank documentation, which is part of my evidence:

- Appendix 8: Consequential Flood Risk Assessment, Tonkin & Taylor – Te Karaka Consequential Flood Risk Assessment.

  - ✓ Page 5, Fig 1.1 – the orange line shows a downward slant as the stopbank connects into the Wi Pere Trust side of the hill, therefore making it a triangular corner for the silt to pool and lie at the bottom of our whenua hill on the leeward side. When Gabrielle hit, it is well documented of the large silt deposits that inundated the Te Karaka residents, hence the reason for the stopbank. With the stopbank being positioned into the side of the hill, and our whenua hill Cookson's Knoll is the main body to that position, will receive the dumping and huge deposits of silt during the next cyclone and flooding.

  - ✓ The kōrero explained to me by GDC representatives that it will affect a small corner of our property Te Karaka 16A, is incorrect, this will not be a small corner. The silt that once impacted on the residents of Te Karaka during Gabrielle, will have nowhere else to go other than into the extremely large portion of a corner of our whenua. And a high probability will settle on the flat part of our land at the back of the hill.

Research Supporting Evidence:

[1] Flooding Waters

Because two completely different structures are joined at this boundary—a highly compacted, uniform earth fill and an irregular, multi-layered natural hillside—it behaves as a complex structural junction. The primary phenomena that occur at this specific point during high-water events include: [Pile Buck Magazine]

1. Hydraulic "Pinch Point" and Velocity Surges

When a river swells, water flows downstream until it hits the hillside obstruction. The hill acts as a hard boundary, forcing the moving water to pivot and squeeze tightly along the face of the stopbank. [Wairoa Flood Mitigation Project]

- This constriction creates a **hydraulic pinch point**, dramatically increasing local water velocity and turbulence right at the intersection.

- As the fast-moving water shears against the junction, it triggers aggressive **scour (surface erosion)**, which can rapidly peel away the protective grass cover and wash out the soil if the junction is not armored with heavy rocks or riprap. [GWRC]

2. Differential Seepage and "Contact Piping"

Water always seeks the path of least resistance. Earthen stopbanks are meticulously engineered with uniform soil layers to limit water flow. Hillsides, conversely, have chaotic structures full of tree roots, animal burrows, fractured rock, and variable topsoil. [Environment Canterbury]

- During a flood, high water pressure pushes water directly into the seam where the stopbank meets the hill.
- Because the two soil profiles have different densities and pore spaces, water tends to flow aggressively *along the contact plane*.
- If unchecked, this causes **contact piping** (internal erosion). Water washes out fine silt along the boundary seam, carving out hidden, internal microscopic tunnels ("pipes") that weaken the structural integrity from within. [Taylor Francis Engineering, UK]

3. Concentration of Wave Action (Run-up)

As floodwaters surge against a hillside, waves generated by wind or river currents cannot gently dissipate over a flat floodplain. Instead, they are channelled directly toward the corner where the bank meets the slope. The energy hits this pocket, causing localised **wave run-up**. The concentrated sloshing and swirling at the intersection subject the top edge of the stopbank's tie-in to much higher structural fatigue than the straight sections running parallel to the river.

4. Shear Stress from Differential Settlement

Even before the floodwater arrives, an artificial stopbank settles and compacts downward over time under its own weight. The hill is a pre-existing, ancient, and highly consolidated landmass.

- At the exact interface where they meet, a zone of **differential settlement** forms.
- When a flood saturates the stopbank, the earth expands and becomes heavy with absorbed water. The saturated stopbank pushes against the unyielding hillside, generating intense subterranean **shear stress**. This structural tension can create microscopic cracks or physical gaps along the seam, providing a ready-made pathway for floodwaters to tear the structure open. [MDPI – engineering journals]

[2] Silt

During a flood, the silt suspended in the water behaves in highly dynamic, polarizing ways at the exact point where a stopbank meets a hill. [farmersweekly.co.nz; Science Media Centre]

Because this zone marks a sharp transition in topography and water behaviour, the silt undergoes either **extreme deposition (pooling and choking)** or **severe erosive scouring (migration and piping)**. [Science Media Centre; Coleman Moore Company - specializes in supplying geosynthetics, erosion control products, stormwater management materials, and soil stabilization solutions.

The exact behaviour of the silt shifts depending on the side of the junction and the water's local velocity:

1. The "Dead Zone" Effect: Massive Silt Deposition

On the upstream side of the hill-stopbank pocket, the hill acts as a massive physical block. When fast-moving, silt-heavy floodwater hits this boundary, its forward momentum is stopped dead.

- **The Velocity Drop:** According to hydraulic laws, the moment water velocity drops, its energy to carry suspended material plummets.
- **Silt Smothering:** The water forms a calm "flow shadow" or eddy pocket right in the junction angle. Silt rapidly drops out of suspension, settling in dense, thick layers. Once the flood recedes, this junction is typically buried under massive, feet-deep deposits of heavy, suffocating alluvial silt. [RNZ; Science Media Centre; Research Gate]

The silt accumulation will build up and continuously fall behind the initial dump, expanding backward against the direction of the river flow.

As the first wave of silt settles right into the vertex, it physically changes the shape of the terrain. The initial dump creates a new mud barrier, causing a domino effect that forces incoming floodwater to stall earlier and earlier.

Here is how the accumulation spreads over time:

The Progressive Silt Build-up

```
                    HILL
                      \
                       \
                        \
                         \___________ STOPBANK (Flat)
                         /\
           [ Stage 3 ]  /  \ [ Stage 1 ]
           Drops here  /    \ First initial dump
                      /      \ fills the vertex
                     /        \
        [ Stage 2 ] /          \
        Piles behind /          \
        Stage 1    /             \
                  /_______________\
<-------------------------
  BACKWARD EXPANSION (Upstream)  <---------- HIGH-VELOCITY FLOODWATER
```

The Three Stages of Accumulation

1. **Stage 1: The Initial Vertex Fill (The Wedge)**
   The very first silt-laden water slams into the sharp corner, loses all energy, and drops its heavy load directly into the vertex. This quickly forms a dense, wedge-shaped ramp of mud.

2. **Stage 2: The Upstream Push (Falling Behind)**
   Because the vertex is now filled with a ramp of mud, the next wave of incoming floodwater hits this new mud barrier *before* it can reach the actual hill. This forces the water to slow down prematurely, dumping its silt directly on top of and behind the initial pile.

3. **Stage 3: Delta Formation (Continuous Growth)**
   As the flood continues, this pile grows outward and backward against the current, creating an artificial "delta" or slope. The water is forced to drop its silt further and further back from the original corner, progressively burying a much wider area of the stopbank approach.

2. High-Velocity Scouring: Silt Stripping

Conversely, if the floodwater is forced to *squeeze around* the point where the bank wraps into the hillside, a hydraulic pinch point is created.

- **Stripping Earthen Fills:** The water accelerates sharply here. Instead of dropping silt, the water gains enough shear energy to aggressively pick up and tear away the existing silt and fine sand that make up the stopbank's face. [BOPRC]
- **Erosion Gaps:** This stripping action (scouring) can erode the very foundation of the tie-in, leaving a physical gap between the engineered wall and the bedrock of the hill. [BOPRC]

3. Subterranean Silt Migration (Contact Piping)

The most dangerous action involving silt occurs underground along the contact plane where the stopbank's clay/soil mix physically touches the irregular hillside rock and topsoil.

- **Silt Liquefaction and Washing:** Under intense hydrostatic pressure from the high floodwaters, water forces its way into the tiny microscopic gaps between the hill and the stopbank.
- **Internal Tunneling:** Because silt particles are incredibly fine (between 0.002mm and 0.063mm), they are easily detached and liquefied by internal water pressure. The water washes the silt out from *inside* the seam, carrying it through to the dry (landward) side. [BOPRC]
- **Boils:** On the safe side of the stopbank, this looks like muddy, silty water bubbling out of the ground (known as a "sand boil" or "silt boil"). This internal migration of silt leaves behind hollow void pipes that can cause the stopbank to instantly collapse into itself. [BOPRC]

4. Hillside Wash-In (Collateral Siltation)

At the same time the river is flooding, heavy rainfall is usually saturating the adjacent hill.

- The steep slope of the hill experiences sheet erosion, rilling, or small landslides.
- This forces a secondary stream of landslide silt to wash *downward* directly into the V-notch where the hill meets the stopbank. This builds up external weight and pressure on the back or top of the stopbank junction, trapping water and mud in the corner. [Science Direct – www.sciencedirect.com/topics/agricultural-and-biological-sciences/bank-erosion]

Evidence Item 3: The Groundwater Flaw & Multi-Generational Bore Data

- **The Council's Claim:** Section 2.2 of GDC's geotechnical report explicitly states: *"...Groundwater was not encountered within the investigations."*

- **Our Evidence:** This statement is factually incorrect. The applicant's limited auger testing completely missed a prominent, highly active shallow aquifer system directly beneath 81 Kanakanaia Road. We submit the following verifiable history of operational bores on our property:

  1. **The Ancestral Bore:** Originally drilled and successfully utilised for **30–35 years** to run our tipuna's historical Coaching Inn, providing a constant water supply for travellers and horses.

  2. **Bore 1 (Rear Shed):** Installed by our parents and successfully utilised for **8–10 years** in the vicinity of the current Katipa Whānau shed [Mahanga Katipa – contact person for that parcel of whenua.

3. **Bore 2 (Te Karaka 16A Centre):** Successfully utilised for **8–10 years** across the drainage ditch toward the middle of the block.
4. **Bore 3 (Driveway Base):** A highly active domestic bore utilised for **13–15 years** at the base of the hill where the driveway curves toward the Lodge.

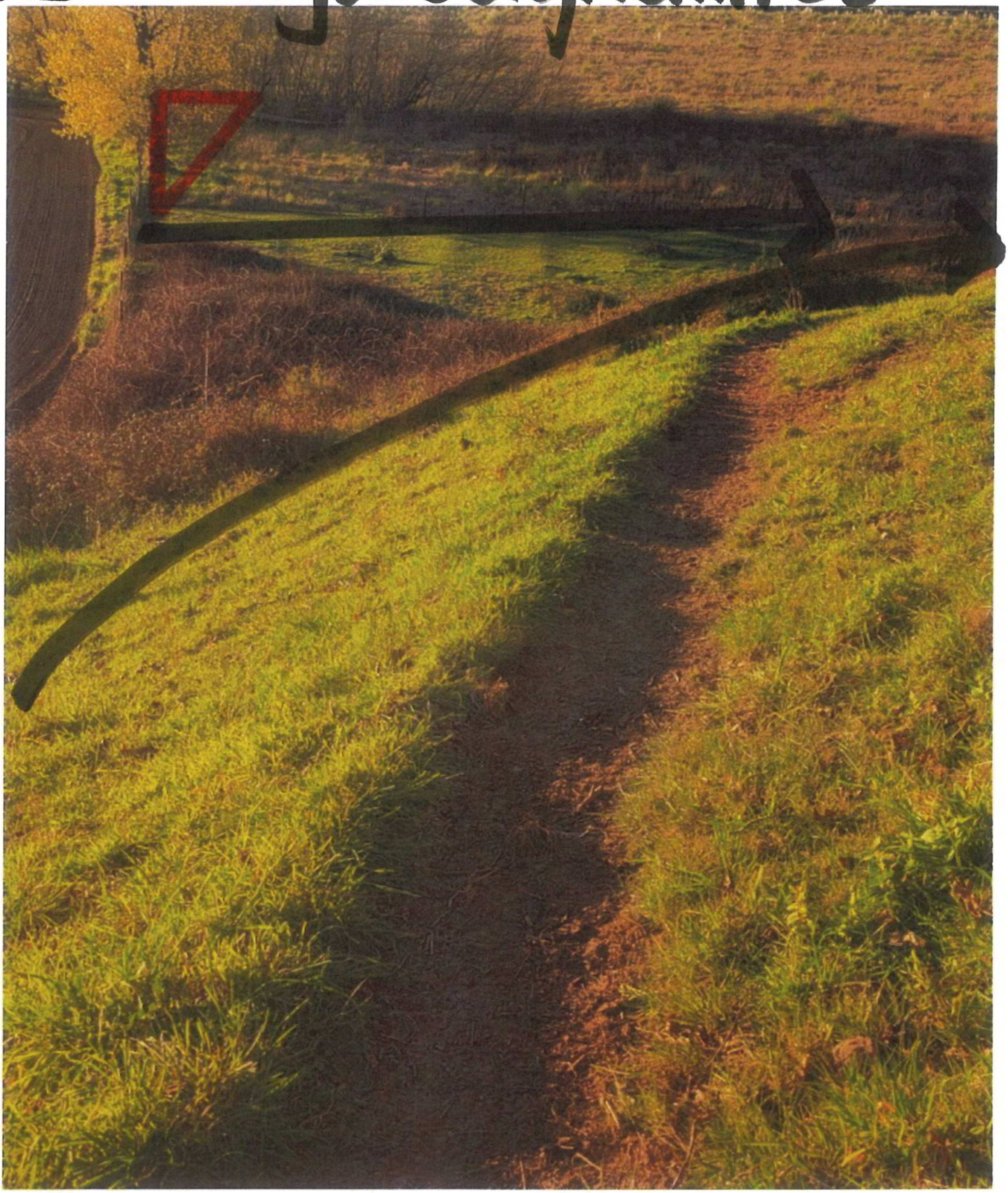
- Refer to Photo 5

Thank you for your time.

Ngā mihi nui

Maraea Cookson
0226914465

1 Hydrodynamics



The small corner

Our belief where the mud + silt will move to + dump/deposit

1 Hydrodynamics

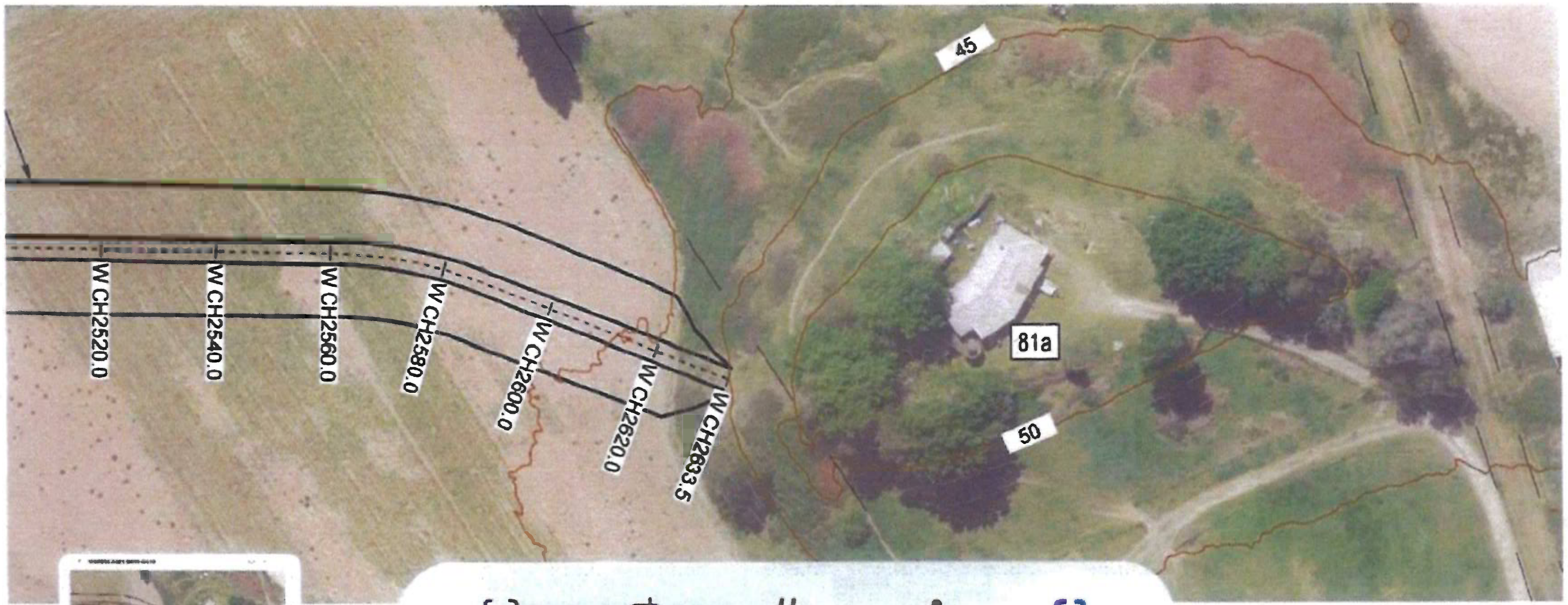
2

Extensively documented mud and silt through both Bola and Gabrielle Cyclone

Our belief this is where the mud + silt will extend to + dump/deposit

APPENDIX-8-SUPERSEDED-IN-PART-Consequential-Flood-
PDF reader

1092556.0021-SK10-SK10



Bores

Original bore from my tipuna

1st bore my parents put down

1 [redacted]

The black cross near the bottom on the right is where the first bore my tipuna put down, the burnt house is where the original Coaching Inn was standing. My parents decided to build a lodge house on the original site, which is the burnt house in the photo. That bore was investigated to reopen it, the conclusion was the bore would be better placed at the site on page 3.

Original bore of my tipuna

Bores

Photo 5 The black cross in the right side of the picture is approx. where the 2nd bore had been placed.

3 [redacted]

The black cross is approx. where the 2nd bore was placed and is the same as picture on page 1.

4 [redacted]

4 -

Behind the yellow line across the ditch, it was originally Te Karaka 16A up to the shed.

2 —

Approx position of the 3rd bore

6 [redacted]

Approx. place of 4th bore, this bore was originally part of Te Karaka 16A, which now sits behind the yellow line on page 5 photo.

4

1