RESPONDING TO ACTS OF GOD

I. McComb, S. Jellyman, M. Doyle, L. Pigott, M. Croxford, S. Markham, A. Humphries: All authors from Tasman District Council

ABSTRACT

The adjacent urban areas of Richmond and Stoke within the adjoining Tasman and Nelson Districts suffered from an extreme rainfall event on 21 April 2013 causing approximately $35 million damage within a few hours.

The rainfall event was calculated to have a 1 in 500 year Average Recurrence Interval (ARI) and thus was far rarer than the 50 or 100 year ARI (2% or 1% Average Exceedance Probability) storms currently considered by most local authority standards and most likely way beyond the reticulated stormwater capacity of any urban area worldwide. Thus this event, while predictable, is beyond human control and often legally considered as "an act of God". This event followed other recent significant storm events within the region.

Tasman District Council's (Council's) response is discussed from multiple perspectives:

- the engineering physical works programme required to restore operational capacity;
- the consenting framework needed to minimise the impact of and on future development;
- the building control safe & sanitary inspections and consenting response;
- the strategic planning response reviewing the questions of hazard and risk posed by future similar events and how Council could improve protection for the community; and
- overarching whole-of-Council considerations.

This event has required a cross-departmental response from Council and has facilitated consideration of a whole-of-Council policy position.

KEYWORDS

stormwater, rainfall, flooding, Tasman District, Civil Defence, consenting

PRESENTER PROFILES

Ian McComb is currently an Activity Planning Advisor for Tasman District Council and has been involved in engineering infrastructure planning for over 20 years with a special interest in stormwater.

Shane Jellyman is a Water Quality Officer for the Tasman District Council and has been involved in the operations and maintenance of stormwater networks throughout the Tasman region for over six years.

1 INTRODUCTION

A rainstorm which occurred on 21 April 2013 in the Tasman District was one of the most intense ever measured in New Zealand. It caused considerable flood damage to urban areas on the Richmond and Stoke foothills. This event followed a similar damaging storm of longer duration in December 2011.

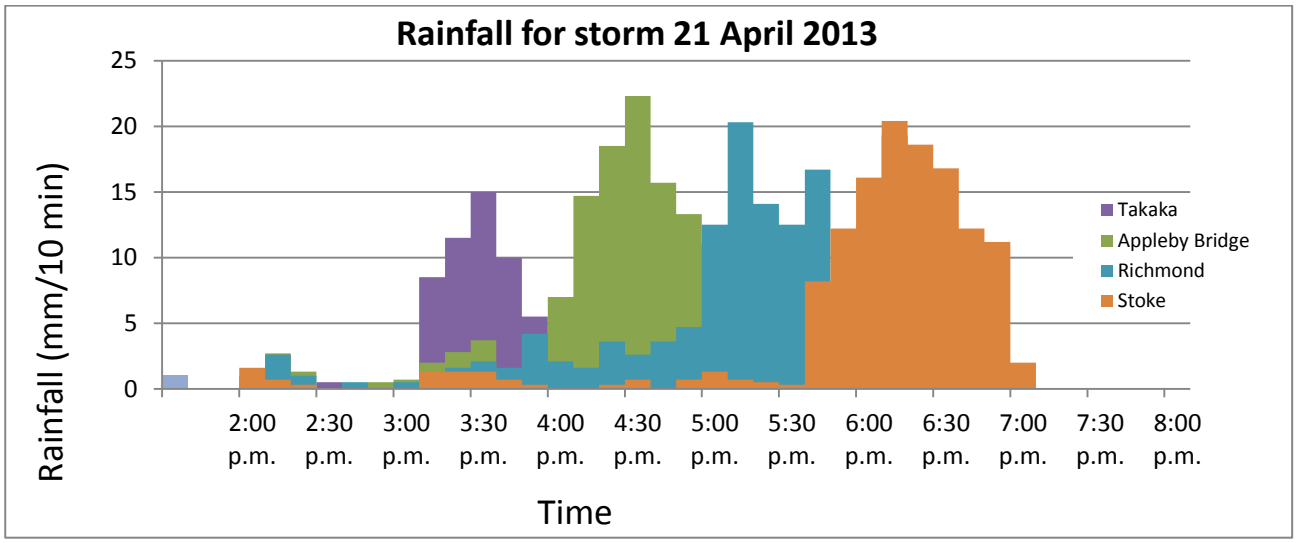
The April 2013 storm was well documented because of the density of rain gauges available in the urban area, with rainfall totals exceeding 100mm over a one hour period. The probability of this intensity of rain occurring in this location is about 0.2% in any given year i.e. rainfall only expected to be seen on average every 500 years. The flood flows of this event are likely to have a similar average recurrence interval. The stormwater flows from the Richmond and Stoke foothills onto the coastal plains of the Nelson-Richmond urban area, exceeded the capacity of reticulation and open waterways designed to cope with likely events rather than all possible storm events. Once flow left these waterways it travelled downhill over the alluvial fans in a number of directions following paths of least resistance.

The cost to build structures to cope with all possible storms in all locations across New Zealand would be astronomical, and so in practice the approach is taken to design for likely events and set this as the level of service (LOS).

2 DESCRIPTION OF EVENT AND LOCAL ENVIRONMENT

About 4pm, heavy rain commenced in the Hope area just south of Richmond. Waves of intense rain and thunderstorms tracked down a narrow band from the north east to this area. The heavy rain band slowly shifted north to lie over central Richmond, with the worst rain occurring there from 5:00pm until 6:15pm. As the rain band continued north, the Stoke area was battered by similar intensities over the period 5:40pm – 7:00pm. The progression of rain from Hope (Appleby Bridge) to Stoke can be seen in figure 2. The Takaka rainfall recorded earlier in the day is also shown on the graph for interest. Each step on the horizontal time axis is 10 minutes.

Figure 1 - Timing of rainfall across the Tasman District



2.1 SUMMARY OF THE MOST INTENSE RAINFALL

The following table shows the greatest rainfall totals measured on 21 April 2013. These totals have been verified in calibrated rain gauges. The three Richmond totals are remarkably consistent.

Table 1: Summary of most intense rainfall

Location	30 min total (mm)	60 min total (mm)	24 hour total (mm)
Stoke at Orphanage Creek	55.7	98.2	194.8
Richmond at Council Office	46.9	82.8	216.1
Richmond at Racecourse	45.1	79.4	214.9
Richmond at Kingsley Place	46.5	82.7	192.6
Roding at Caretakers	60.3	101.1	197.7

2.2 COMPARATIVE RAINFALLS

For the Nelson-Tasman region there have been 19 previous events greater than 50mm/hr since 1972. The highest was 72mm/hr and the average 56mm/hr.

The most extreme rainfall measured in New Zealand over one hour was 134mm which occurred high in the Southern Alps in the Cropp Valley in the Hokitika catchment. The next highest one hour rainfall occurred in Leigh, north of Auckland in May 2001, when 109mm fell over one hour.

2.3 FLOOD FLOWS AND SYSTEM CAPACITY

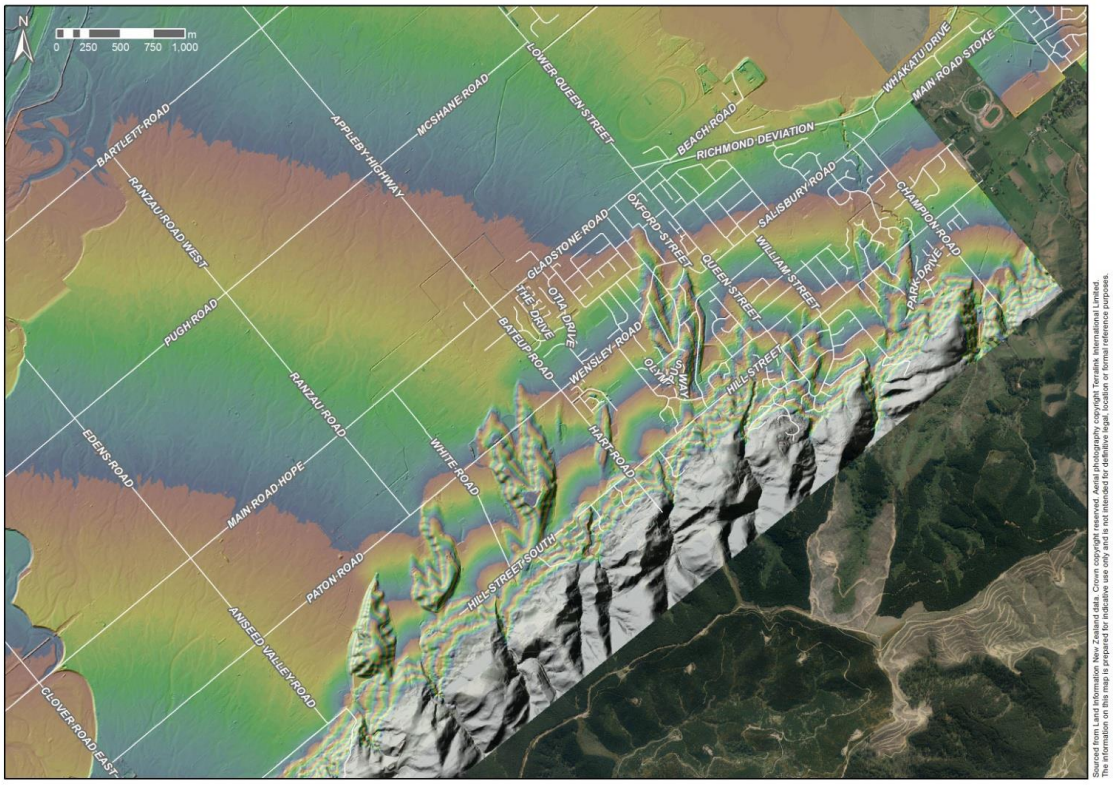
The rainfall duration and size (time of concentration) of the catchments in the Richmond-Stoke foothills were well matched. Hence, it is very likely that flow from the upper parts of the catchment had time to travel down to the lower catchment whilst the heavy rain was still falling. This ensured that all of the catchment was contributing to the flows seen at the lower levels. Effectively this was the maximum flow that could result from this land area for a storm of this intensity.

As shown in Figure 2, the Richmond-Stoke area is built upon geologically recent, low relief outwash fans which are prone to flooding as they do not have adequate well defined permanent flow paths. The capacity of the open drainage network is variable but would rarely exceed a 50 year storm rainfall intensity (49mm/hr). In addition, the installed primary stormwater drainage system in Richmond can generally cater for a five year storm (32mm/hr). Thus on 21 April 2013, the sheer volume of water greatly exceeded the primary drainage system capacity. Once free of the usual flow paths water travelled downhill in a number of directions, often in areas difficult to predict.

2.4 KEY POINTS

- 1 in 500 year Average Recurrence Interval (ARI) rainfall and flood event
- Nationally significant rainfall event
- Short duration, high intensity rainfall

Figure 2: Elevation contours for the Richmond foothills



3 THE ENGINEERING RESPONSE

3.1 BEFORE AND DURING THE EVENT

Council's engineering staff, contractor and consultants were all involved in the event response both on the day and in the follow-up. The crews were not especially prepared. Although weather forecasts indicated heavy rain, the volume of rain that fell within a short period of time was not forecast, especially not the 1:500 year ARI storm event that occurred.

The duration of the deluge, combined with the danger presented by water surging through streets meant that a response to the event became one of assessing damage where possible as it happened and getting involved following the event, rather than preparing for the deluge and attempting to prevent damage.

The following factors contributed to the type of response that the majority of the Council Engineering Services staff took in reaction to the event:

- The first weather warning was issued by the MetService on the afternoon of Saturday 20 April 2013. The Council offices were closed being a weekend and first observations of the impending weather for On Call staff did not cause alarm. The predicted rainfall, while substantial, was not uncommon in this part of the country, particularly for Golden Bay. Subsequent warnings on the Saturday afternoon and Sunday morning also caused no great concern. The magnitude of the storm and the resulting rainfall accumulations over such a short duration of time were not predicted.

- Although steady rain fell throughout Saturday and Sunday, the first indication of extreme intensity rainfall was recorded in Takaka between 3:00 and 4:00pm,

where 53mm of rain fell. By this stage high intensity rain was already falling over parts of the Waimea Plains. By 7:00pm and within a period of three hours, the storm had delivered between 130-160mm of rain to parts of the Waimea Plains, Richmond and Stoke.

- A number of staff were personally affected by the storm. For some, a duty to the community and the Council's infrastructure was overshadowed by trying to prevent water coming through their own homes!

- Many Council staff lived in areas which were not affected by heavy rainfall and therefore were not aware of the damage occurring around Richmond.

- The volume of rain, the impending darkness (sunset was at 5:47pm) and rivers of storm run-off on many streets presented significant danger for anyone prepared to venture out to witness the carnage. Many people adopted a mentality of "there is little I can do now without putting myself in danger, I will respond when the weather and danger has subsided".

So what does 130-160mm of rain on the ground within a short period of time look like? The following photographs 1-3 show locations under normal conditions and during the event.

Photograph 1 A & B: Gladstone and Queen intersection in Richmond dry and wet

Photograph 2 A & B: PAK'nSAVE Carpark in Richmond dry and wet

Photograph 3 A & B: Queen Street in Richmond dry and wet

3.2 ENGINEERING RESPONSE SUMMARY

It quickly became obvious to Engineering Services staff who resided in the Richmond area that this event was extreme and flooding was imminent. Civil Defence operations were set up in the Richmond office during the early part of the evening. With the aid of consultants and contractors, Council staff worked until the early hours of the following morning assessing issues and arranging for clean up when flows and danger had subsided.

The method for determining the highest priority issues was through:

- assessing calls from the public,
- receiving feedback from the Council's maintenance contractors,
- Council staff inspections; and

- using knowledge of assets susceptible to flooding.

This process allowed targeted inspections to assess asset damage in areas where the extreme rain fell. The good relationship between the Council and its maintenance contractors, Downer and Fulton Hogan, and the ownership they take for the Council's assets ensured that the most critical issues were attended to as soon as possible. It became clear from field inspections that the storm event tracked along a very narrow band, only really affecting the Richmond and Stoke areas.

Examples of key actions include:

- inspection of Reservoir Creek Dam that sits above the urban area as it had previously shown signs of fatigue;
- checks on other key Council-owned detention dams;
- assessing private dams in response to public concerns; and
- inspecting known areas of gravel accumulation that threaten asset performance.

Storm damage that caused a potential risk to life and a risk to private property and Council assets was generally tidied up/repaired within a few days of the event. Some larger scale repairs and less urgent issues took longer, and in some instances a long term solution to resolve damage is still being sought.

A notable response involved clearing huge volumes of gravel from within creeks, in front of stormwater intakes and below outlets; examples are:

- Champion Road Culvert 1000m^3 / 500 tonne
- Bill Wilkes Reserve 900m^3 / 450 tonne
- Easby Park Inlet 150m^3 / 75 tonne
- Bramley Estate (Hart Creek) 120m^3 / 60 tonne

In addition, Lodestone Detention Dam has an estimated 1500m^3 of infill that has yet to be removed.

It is worth noting that the previous flooding event of December 2011 highlighted a number of areas throughout Richmond where flooding issues could be predicted in a similar long duration event. This resulted in the Council implementing further proactive measures and maintenance in these areas to reduce the susceptibility to flooding. Unfortunately, these measures to reduce the effects of heavy rain and flooding in vulnerable areas had little effect during a short duration, 1:500 year ARI flood event. Historical knowledge did however assist staff to prioritise checks of the most vulnerable areas and arrange for clean up immediately where it was needed most.

3.3 LONG TERM RESPONSE

It is acknowledged by the Council (and was before the April 2013 flooding) that there are various parts of the Richmond and Hope stormwater network that are under-capacity for flooding events of much smaller magnitude than that experienced in April 2013. There is considerable planning work going on in the background for future upgrades to ameliorate flooding issues in these areas. It must be recognised however, that the existing stormwater network throughout the entire region is not designed to cope with events of such magnitude, and it would be cost-prohibitive to design to meet this standard.

It is therefore important to convey to the public that events such as April 2013 are "freak" events and flooding is highly likely to occur under such circumstances. It can become public perception that the Council is not doing enough to prevent flooding. Rather, we suggest there is little more that can be done to prevent flooding in such

events with the previous level of funding. The community's willingness to pay for greater stormwater management will be testing in the upcoming Long Term Plan 2015-2025 process.

What has transpired from the recent events is that there are areas which are far more vulnerable to flooding than others, and the Council can continue to improve the public perception that efforts are being made to prevent, or at least manage the issue. One such example is that of Champion Road where the blocking of culverts under the road resulted in the flooding of many properties in 2011 and again in April 2013.

Following the flooding of the Champion Road area, the Council has taken a far more rigorous approach to preventative action to reduce flooding in that area. This includes stationing an excavator on site in reaction to weather warnings, thus allowing immediate action to clear the creek and culverts of gravel during events to ensure free passage for flow. This precaution will continue until the culvert is upgraded in 2014/2015. This initiative prevented further flooding at Champion Road in May 2013, when a short sharp rain event resulted in the blocking of the culverts. Other initiatives include small upgrades to infrastructure and regular communication with the public on major upgrades that will be occurring in the area.

Apart from Lodestone Dam there are 20 other Richmond flood damage related projects in the draft Stormwater Activity Management Plan (AMP) for Long Term Plan 2015 - 2025 consideration.

Follow up actions so far:

- Removal of an aesthetic island at Bramley Estate to discourage gravel accumulation immediately above a culvert;
- Hardening of a private property boundary at Washbourne Gardens to encourage secondary flow to remain in public spaces;
- Fast tracking of Champion Road culvert replacement, improvement of roadside drainage and small cut off drain installed on private property to redirect overflow back to Champion Road.

3.4 KEY POINTS

- Prior knowledge of the stormwater system vulnerabilities and good working relationships with contractors and consultants facilitates efficient responses.
- Public input can facilitate efficient Council's responses and should be catered for.
- Consideration of plant needs e.g. excavators and trucks should be part of the response planning.
- Long duration ponding-focussed events and short duration flowpath-focussed events need consideration.

4 THE CONSENTING RESPONSE

Three recent significant storm events in the Tasman District have each provided a set of lessons for planners involved in consenting land development applications. Those events are the December 2011 flooding and debris flows in Richmond and Pohara areas, the April 2013 flooding in Richmond and the June 2013 debris flows in the Marahau area. The Council's consenting practices have responded to the need to better understand natural hazards and manage risks to the downstream community and other issues associated with development.

4.1 RESOURCE CONSENT STAFF RESPONSE

The Council's Engineering Standards and Policies have traditionally been the benchmark for setting design standards for infrastructure. However, these recent events are of a greater return period than specified in the Standards and pose a different set of questions in terms of development. In essence, during the assessment Council's Consent staff are turning their mind to probable maximum impact and thinking about the potential upstream failures and downstream risks to achieve precautionary land planning results.

The meaning of "effect" in section 3 of the RMA includes any potential effect of high probability and of low probability which has a high potential impact. While the stormwater infrastructure may not be required to be designed to cope with such events there is an expectation that the risk of such events is managed mostly by ensuring development is set back from areas at risk. Risk assessment tools such as NZS9401:2008 and/or Saunders et al (2013) are being investigated as to how they can be incorporated in the consent auditing process.

The Council experience is that many of the development proposals are led by people who are not well versed in stormwater management. Often they appear not to understand that while land may be zoned for an activity this does not guarantee that all of that land is fit for purpose. Therefore, there may be significant constraints placed on a development from the natural and/or existing environment that requires large areas to be set aside from development or for significant works to be completed in order to make the land suitable. Overland flow paths for stormwater and setting minimum ground levels or building floor levels are other options. Contributing to the challenge is the reality that most of the simpler subdivision opportunities in the District have already been developed. In addition, most sites available for current development have limited downstream capacity in the stormwater networks.

Furthermore, much of the undeveloped residentially zoned land is in fragmented ownership. The Council is now seeking catchment-wide planning to minimise *ad hoc* solutions and thus avoid elevated ongoing maintenance costs to ratepayers. Coordination of funding is a challenge as a large central structure can be unaffordable to individual developers and this is further complicated when the works are not anticipated by the Council's own Annual Plan process.

Often potential lot yield is determined by a developer at the time of land acquisition and the financial bottom line set prior to designing the subdivision. In many ways it would be preferable to be in a position to assist developers in approaching the problem backwards. Starting with the question "what areas do the natural and/or existing environments allow to be developed?" Hence developers and Council need to undertake more and broader pre-development thinking. Unfortunately, there is a real potential for such sound planning to be seen as restricting the land owners development "rights" and this can result in legal and political consequences.

In a related vein, it is also evident that some people in the land development business have a general lack of appreciation of the potential risk of certain natural hazards. Including one saying recently that "stormwater management is just engineering, that can be sorted out at the engineering plan approval stage". While much of the specifics can be deferred to this post-consenting stage, the main issue for the Council is ensuring that there is sufficient space for natural systems and secondary flows can be safely passed, (i.e., that adverse effects can in fact be mitigated or avoided) prior to issuing consent. This includes evidence to justify the amount of space set aside for these purposes. As

developers utilise a range of consultants, the lack of national rainfall and runoff guidelines reduces the consistency of the design process and reliability of outcomes.

The information and infrastructure requirements for development should be as clear as possible prior to developers purchasing land. There can often be a knowledge gap prior to the design process for most developments. In Tasman's case, the absence of catchment management and structure plans or the information not being readily accessible within the territorial authority can create issues for providing timely advice. This is compounded by developers frequently not obtaining LIMs prior to purchase. Establishing a common clear understanding of the upstream controls and downstream constraints can be time consuming and ideally resolved as part of the pre-application process.

A key lesson learnt from the recent events includes a greater focus on secondary flow paths. Generally public infrastructure is resilient; it is the location of dwellings in relation to the risk which is of primary concern to the Council – such as avoiding secondary flow paths on private land where relatively minor features can move large volumes of water into unanticipated locations. For example a locked gate at a local retirement village caused the diversion of flow and significant flooding and associated damage. Keeping secondary flood flows from entering private property in the first place is preferable as the Council has limited control or desire to impose control over features that can divert flow.

Debris flows have recently become evident as a significant natural hazard risk. The December 2011 storm in the Pohara area and the April 2013 storm in the Marahau area resulted in a debris flows affecting some settlements and a number of isolated rural houses. Sadly in the latter storm a landslide resulted in a death. Staff have learnt what a debris flow looks like and the marks it leaves in the catchments which feature granite geology. The potential for debris flows is an area requiring further investigation and is a site specific consideration for subdivisions in certain areas.

From within the organisation communication with developers has become a key issue. Ensuring that everyone is giving the same message with a single point of contact has been a difficult process to establish. Tasman District Council has also had to acknowledge that the different roles within a unitary Council need to be understood and respected, as these can create in-house challenges. Council staff have carried out an in-depth cross-Council review of stormwater management processes under the banner of "Project Stormwater" and this resulted in a set of guiding principles for decision-making. For example, the circumstances when piping of an open waterway through the urban area may be acceptable. Further work is ongoing to embed these principles in-house and establish protocols for resolving conflict to assist delivering a consistent message to customers.

4.2 GENERAL CONSENTING THOUGHTS

There can also be an inherent conflict between the need to maintain urban watercourses for flood capacity and maintaining or enhancing ecological issues. Just how often will the diggers be in the stream scooping out gravel?

Recent events in Tasman have forced a paradigm shift in the way staff consider urban development. However, there does seem to be a gap in recently published standards and guides as to how to create resilient communities, in that the 'what if' question needs to be asked early in the process.

The need to protect people by setting a high Finished Floor Level for buildings is leading to pressure to build on piles rather than slab on ground and this presents a change for the building industry which seems to prefer concrete slab-on-ground construction.

4.3 KEY POINTS

- Consent planning consideration of probable maximum impact.
- Ongoing consideration of risk and internal protocols to generate an across Council (Building, Engineering, Environment, Resource Consents) consistent approach to consenting.
- Secondary flow path management has an elevated status.
- Earlier and more robust consideration of natural hazards.
- Pre-application education of developers.

5 THE BUILDING CONTROL RESPONSE

5.1 BUILDING CONTROL BACKGROUND

Minimum Finished Ground Levels (FGL) and Finished Floor Levels (FFL) can be imposed under the Building Code. However even these can be inadequate when dealing with the infrequent events (>Q100) or where poor communication historically between hazard scientists and building staff has led to buildings being constructed at inadequate levels; or something has changed (e.g. climate change driven rainfall increases).

When a building consent is granted in areas where the land to be built on is subject to such hazards, a notice will be added to the title identifying the risk. Understandably developers and homeowners do not want hazard notices on their properties as it can affect property values, the availability of insurance premiums and EQC cover. A related issue which has recently occurred is where resource consent has been granted at some time in the past, however, new information available on hazards such as sea level rise has led to suitability of the land for development being questioned. In such cases the powers in the Building Act are used to ensure that any buildings constructed will be fit for purpose.

5.2 BUILDING CONTROL INITIAL REACTION

Having suffered a huge flooding and slipping event in December 2011 the Tasman District Council's Building Department staff were pretty well positioned to respond to this event. Suitable equipment, procedures and forms were available for use by staff. The initial response revolved around identifying if a building is dangerous or insanitary due to the flooding. If appropriate, a notice was issued which meant further use of the building becomes an offence. These inspections assisted property owners with their insurance claims. A copy of the *Flooding Inspection Form* is attached in Appendix A and an *Insanitary Notice* is enclosed in Appendix B. The initial visit is also an opportunity to provide home owners with information to allow them to cleanse their properties effectively. A copy is enclosed in Appendix C.

To date 80 building consents have been requested for remedial works specifically related to the April 2013 flooding, with an estimated value of $1.28 million (range $1000-$100,000, average $16,183, median $10,000).

Since the April 2013 floods the Council has been working with the Ministry of Business Innovation & Employment to produce the "*Post Disaster Building Assessment Field Guide*

– *Flooding"* and this information incorporates much of the information originally produced by the Council.

5.3 ONGOING BUILDING CONTROLS

Further controls on the development of individual sites exist after resource consent has been granted in the form of the building consenting process. Under the Building Act a building consent cannot be granted if the Council believes that there is an unreasonable risk of a hazard (such as flooding or other inundation) causing serious injury or death to any future occupants. This assessment is done by taking into account factors additional to the location e.g. the likely frequency of such events, any mitigating land features and the way in which the building will be constructed. There is some leeway in that consent can be granted if the building will not become dangerous under such circumstances and will not increase the effect of the hazard on other properties, however, this is often a difficult call to make.

While the 2013 event created widespread flooding and presented a risk to people/vehicles on the roads, within the context of buildings, it was not an *unreasonable risk*, especially given the extreme nature of the rainfall. Therefore, generally speaking, the event has not changed the way Building Control deals with new consents; however, scrutiny of projects on old titles that do not have clear secondary flow paths or flood related floor or ground level controls has increased.

5.4 KEY POINTS

- Be administratively prepared for Post Event response inspections and advice.
- Across Council (Building, Engineering, Environment, Resource Consents) consistent approach to consenting.
- Building staff are closely reviewing old subdivision consent levels vs new hazard data.

6 THE FORWARD PLANNING RESPONSE

There are many related threads of work that have a bearing on the planned response to big storm events beyond the standard Level of Service including:

- Catchment Management Plans.
- Improved catchment and stormwater system mapping.
- Updated stormwater modelling.
- Review of proposed growth areas, land use and drainage capacity to reduce vulnerability.
- Review of the Urban Drainage Area rating system.
- Impacts of climate change on sea level and rainfall.
- Adopting Council-wide stormwater management principles and acceptable solutions.
- Reviewing definitions and control of stormwater systems.
- Mapping, assessing capacity and protecting secondary flow paths.
- Review of hazards related material in the Tasman Resource Management Plan (TRMP) for current application and consideration of stronger precautionary measures.

The key sticking point in most cases is that while the Council could do more, can the community afford it? The balance point of willingness to pay is traditionally resolved

through the Long Term Plan process and this is the appropriate final step that Tasman is currently preparing for. Leading to this is the robust staff process of technical versus financial tradeoff thinking that leads to the recommendations to Councillors. Key issues are:

- The state of knowledge of the stormwater system, its weaknesses and resulting effects.
- The level of damage that has (or could have) occurred (value at risk).
- The ability to instigate change based on any existing TRMP and Bylaw provisions.
- What is a financially achievable level of service?
- What are the best vehicles to achieve change; bylaws, education, internal communication?

At this stage Tasman is still pursuing all these matters with the goal being:
"formulating an organisation-wide approach to this scope of planning steps in terms of trans-disciplinary collaboration, data and information systems integrated development, strategy and policy codings under CMPs in context of companion planning instruments, management and governance socialisation and legitimisation for successful delivery."

So far we have concluded that the best way to deal with such large events is to manage as much water as the infrastructure will allow *and* also the community expectations of how much the Council can reasonably do. It may be tempting to set a higher level of service for stormwater management in the aftermath of an event or a series of events as Tasman District has experienced over the last three years or a season as Southern England suffered this (northern) winter. However, the reality is that the increased cost of a higher level of service can quickly exceed the willingness of the community to pay or the Council to fund, even through loans.

6.1 KEY POINTS

- Greater emphasis on secondary flow and ponding areas within catchment-wide planning.
- Integrated whole-of-council planning.
- Intention to ensure bylaws or planning rules support flood risk management.
- Balancing stormwater level of service with community willingness to pay.

7 COUNCIL WIDE PERSPECTIVE

No single data system has captured the total number of properties or buildings impacted by the flood.

The Fire Service data indicates that over 200 properties were flooded, Council's Service Centre logs cover over 140 flooded properties and 80 building consents were requested for flood related remedial works. However, the Council is aware that many owners did not report flooding that occurred on their properties. During the event clean up the Council instigated a new "Emergency Event" category for the service requests to capture all the logged data in the first instance as the roading and utilities related data are routinely stored in different databases (RAMM and Confirm).

There is a significant amount of post-event discussion to be had with the public and key staff and the elected members were heavily involved in this time consuming and sometimes emotionally challenging activity. A key message delivered was that whilst devastating weather events are hideously expensive and impossible to predict, Mayor Kempthorne believes that the recent storms have had benefits in that it has taught local

authorities how to deal with them better and hence they are now more capable and the community is "in a more resilient space" (Arnold 2014).

Whilst it is not affordable for the Council to design and construct infrastructure to cope with a 1:500 year ARI weather event, it is possible to communicate to the public that Council is doing what can be done within budget to manage or prevent the most extreme effects of flooding. Being seen to prioritise the most vulnerable areas with regard to a clean-up response, and attendance during an event is at least recognition that the Council is monitoring the issue and will ensure a swift response to flooding in these areas.

7.1 KEY POINTS

- Emergency preparedness needs to include streamlined data gathering systems to facilitate complete capture.
- Such events potentially cause a high time commitment from elected members and key staff to discuss the outcomes with ratepayers.
- Longer term the level of service that the public is expecting to be provided needs to be discussed and the cost implications worked through. What the Council can and will do then needs communication.

8 CONCLUSIONS

The central conclusion for responding to large storm events is that it will take a sustained and wide-ranging effort across Council departments to initially react and then plan to minimise future risk and damage. With the threat of climate change, this is not a static situation.

Additional learnings from Tasman District Council's experience are summarised below.

Before the event:

- Gather knowledge of the stormwater system vulnerabilities
- Establish good working relationships with contractors and consultants to facilitate efficient responses.
- Public input can help efficient Council's responses and should be catered for by developing streamlined data gathering systems to facilitate complete capture as part of emergency preparedness.
- Consider of plant needs e.g. excavators and trucks as part of the response planning.
- Building, engineering and customer service staff need to be administratively prepared for post event response calls, inspections and advice.
- The impact of both long duration ponding-focussed events and short duration flowpath-focussed events need consideration.

Planning and consenting:

- Building staff should closely scrutinise old subdivision consent levels vs new hazard data.
- Consent Planning to consider probable maximum impact of hazards.
- Pursue ongoing consideration of risk and internal protocols to generate an across Council (Building, Engineering, Environment, Resource Consents) consistent approach to planning and consenting.
- Ensure bylaws or planning rules support flood risk management
- Pursue earlier and more robust consideration of natural hazards in the consent process.

- Facilitate pre-application education of developers to reduce consent delays and arguments.
- Support greater emphasis on secondary flow and ponding areas within catchment-wide planning, consenting and ongoing management.

Communications:

- Such events potentially cause a high time commitment from elected members and key staff to discuss the outcomes with ratepayers.
- Longer term, the level of service that the public is expecting to be provided needs to be discussed and the cost implications worked through.
- What the Council can and will do needs communication to all stakeholders.

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APPENDICES

A. Building Flooding Inspection Forms

B. Insanitary Building Notice

C. Resident Information Sheet

APPENDIX A: BUILDING FLOODING INSPECTION FORM

Flooding Assessment

		Valuation Number:	
Inspector		Date of Inspection _____	*Areas Inspected* Exterior Only
Authority	**TASMAN DISTRICT COUNCIL**	Time AM/PM	Exterior and Interior

Building / Owner Name:	
Site Address:	
Postal Address:	
Phone / Cell Numbers:	
Water height inside building	***Note:*** *All wall linings should be removed to 300mm above highest flood height so debris & silt can be cleaned from cavities, & framing exposed to the air for drying before relining & decorating.*

Note that if flood waters have inundated:

- food in fridges/freezers, the food is deemed to be spoiled and should be discarded.
- electrical mechanics of white ware, the white ware is deemed to be electrically dangerous and should be discarded.

STRUCTURAL DAMAGE – INUNDATION

- ☐ Piles & Foundations
- ☐ Baseboards
- ☐ Claddings
- ☐ Subfloor foil
- ☐ Disturbed or slumped ground to compromise foundations
- ☐ Other _____

WATER SUPPLY

- ☐ Public Supply
- ☐ Roof collection
- ☐ Bore
- ☐ Other _____
- ☐ Tank storage ABOVE ground
- ☐ Tank storage BELOW ground

Remedial work required to ensure water supply is still potable:_____

PLUMBING AND DRAINAGE

- ☐ Gully traps blocked?
- ☐ Sewerage nuisance?
- ☐ Plumbing operational?
- ☐ Obvious damage to system/septic tank?
- ☐ Other _____

OUTBUILDINGS

Comments / Remedial Action_____

Note: *Water supply bores that do not have a sealed cap to prevent flood waters directly contaminating the bore water, will need to be flushed out and retested (usually by EHO) for potability*

Note: *All septic tanks that were covered with flood waters will require pumping out. Silt infiltration may create displacement in the tank, which may cause solids to float, and block soakage pits or soakage systems.*

Placards for assessed building: Choose a posting based on the evaluation and team judgement.

INSPECTED (Green) ☐ G1 ☐ G2 **RESTRICTED USE** (Yellow) ☐ Y1 ☐ Y2 **UNSAFE** (Red) ☐ R1 ☐ R2 ☐ R3

Damage	Risk level	Posting	Useability Category		Remarks
Light	Low	INSPECTED	**G1**	Occupiable, no immediate further investigation required	
		INSPECTED	**G2**	Occupiable, repairs required	
Medium	Medium	RESTRICTED USE	**Y1**	Short term entry	
		RESTRICTED USE	**Y2**	No entry to parts until repaired or demolished	
Heavy	High	UNSAFE	**R1**	Significant damage; repairs, strengthening possible	
		UNSAFE	**R2**	Severe damage; demolition likely	
		UNSAFE	**R3**	At risk from adjacent premises or from ground failure	

☐ Yes ☐ No IMMEDIATE Re-occupation?

☐ Yes ☐ No BRANZ Bulletin "Restoring a House After Flood Damage" information given to occupier

Record any restriction on use or entry:

Signature on Completion _____

APPENDIX B: INSANITARY BUILDING NOTICE

DO NOT ENTER

Pursuant to s128 of the Building Act 2004

THIS BUILDING IS CONSIDERED TO BE A INSANITARY BUILDING UNDER SECTION 123 OF THE BUILDING ACT, 2004

NO OCCUPATION IS PERMITTED WITHOUT AUTHORISATION OF THE TASMAN DISTRICT COUNCIL

No work can take place without first obtaining a Building Consent

Do not remove this notice

Placed by order of the Tasman District Council

Call 03 543 8400 for further information.

APPENDIX C: RESIDENT INFORMATION SHEET

TASMAN DISTRICT: GENERAL GUIDANCE FOR CLEANING UP AFTER A FLOOD

If in doubt please speak to a qualified health professional or tradesperson.

A Description of Typical House Flood Damages and Cleanup Requirements:

When your house floods, the water can wreak havoc on the structure of the house, your personal belongings, and the health of the inside environment. Flood waters contain many contaminants and lots of mud. High dollar items can get ruined all at once, even with just an inch of water, for example: carpeting, wallboard, appliances, and furniture. A more severe storm or deeper flood may add damage to even more expensive systems, like: ducts, the heater and air conditioner, roofing, private sewage and well systems, utilities, and the foundation.

First things first: call your insurance agent. If your insurance covers the damage, your agent will tell you when an adjuster will contact you. List damage and take photos or videotape as you clean. You'll need complete records for insurance claims, applications for disaster assistance and income tax deductions.

After a flood, cleaning up is a long and hard process. Here is a list of common techniques for sanitizing and cleaning flooded items:

PERSONAL PROTECTIVE EQUIPMENT

It is possible that any deposits in or around your property may be contaminated with sewerage, chemicals and sharp objects. It is strongly recommended that you wear suitable protective equipment such as heavy duty waterproof gloves, boots and where necessary face masks.

Contaminated mud Shovel out as much mud as possible, then use a garden sprayer or hose to wash away mud from hard surfaces.

Clean and disinfect every surface. Scrub surfaces with hot water and a heavy-duty cleaner. Then disinfect with a solution of 1/4 (50ml) cup chlorine bleach per gallon(5 Litres) of water or a product that is labelled as a disinfectant to kill germs.

IN THE KITCHEN

Immerse glass, porcelain, china, plastic dinnerware and enamelware for 10 minutes in a disinfecting solution of 2 tablespoons of chlorine bleach per gallon of hot water. Air-dry dishes. Do not use a towel.

Disinfect silverware, metal utensils, and pots and pans by boiling in water for 10 minutes. Chlorine bleach should not be used in this case because it reacts with many metals and causes them to darken.

Cupboards and counters need to be cleaned and rinsed with a chlorine bleach solution before storing dishes.

FURNITURE AND HOUSEHOLD ITEMS

Take furniture, rugs, bedding and clothing outside to dry as soon as possible. Use an air conditioner or dehumidifier to remove moisture or open at least two windows to ventilate with outdoor air. Use fans to circulate air in the house. If mold and mildew have already

developed, brush off items outdoors to prevent scattering spores in the house. Vacuum floors, ceilings and walls to remove mildew, then wash with disinfectant. Wear a two-strap protective mask to prevent breathing mold spores.

- Mattresses should be thrown away.
- Upholstered furniture soaks up contaminants from floodwaters and should be cleaned only by a professional.
- Wood veneered furniture is usually not worth the cost and effort of repair. Solid wood furniture can usually be restored, unless damage is severe.
- Toys and stuffed animals may have to be thrown away if they've been contaminated by floodwaters.

Photographs, books and important papers can be frozen and cleaned later. They should be dried carefully and slowly. Wash the mud off and store the articles in plastic bags and put them in a frost-free freezer to protect from mildew and further damage until you have time to thaw and clean them or take them to a professional.

CEILINGS AND WALLS

Wallboard can act like a sponge when wet. Remove damaged wallboard, plaster and panelling to at least the flood level. If soaked by contaminated floodwater, it can be a permanent health hazard and should be removed. If most of the wallboard was soaked by clean rainwater, consider cutting a 10 to 30cm high section from the bottom and top of walls. This creates a "chimney effect" of air movement for faster drying. A reciprocating saw with a metal cutting blade works well, but use only the tip of the blade and watch out for pipes, ductwork and wiring. Plaster and panelling can often be saved, but air must be circulated in the wall cavities to dry the studs and sills.

The three kinds of insulation must be treated differently. Styrofoam might only need to be hosed off. Fibreglass batts should be thrown out if muddy but may be reused if dried thoroughly. Loose or blown-in cellulose should be replaced since it holds water for a long time and can lose its antifungal and fire retardant abilities.

Electrical system- The system must be shut off and repaired and inspected by an electrician before it can be turned back on. Wiring must be completely dried out- even behind walls. Switches, convenience outlets, light outlets, entrance panel, and junction boxes that have been under water may be filled with mud.

Heating and cooling systems and ducts- Will need inspection and cleaning. Flood-soaked insulation should be replaced.

Appliances- Appliances will get stains, odours, silt deposits, and gritty deposits and need to be serviced, cleaned and sanitized. Running equipment before it is properly cleaned could seriously damage it and/or shock you. Professional cleaning is recommended for electronics, TVs and radios, washing machines, dryers, dishwashers, and vacuum cleaners. The hard exterior can be hand cleaned. All metallic appliances that have been flooded should be properly grounded to prevent electric shock. Mud or dirt in a grounded outlet or adapter may prevent the grounding system from working, and you could be electrocuted.

Pump out the basement- If your basement is full or nearly full of water, pump out just 60 or 100cm of water each day. If you drain the basement too quickly, the pressure outside the walls may be greater than the pressure inside the walls. That may make the walls and floor crack and collapse.

Floors- With wood subflooring, the floor covering (vinyl, linoleum, carpet) must be removed so the subflooring can dry thoroughly which may take several months. Open windows and doors to expose the boards to as much air as possible.

Carpeting- Clean and dry carpets and rugs as quickly as possible. If sewage-contaminated floodwater covered your carpeting, discard it for health safety reasons. Also discard if the carpet was under water for 24 hours or more. To clean, drape carpets and rugs outdoors and hose them down. Work a disinfecting carpet cleaner into soiled spots with a broom. To discourage mildew and odours, rinse with a solution of 2 tablespoons bleach to 1 gallon water, but don't use this solution on wool or nylon carpets. Dry the carpet and floor thoroughly before replacing the carpet. Padding is nearly impossible to clean so should be replaced. If the carpet can't be removed, dry it as quickly as possible using a wet/dry vacuum and dehumidifier. Use a fan to circulate air above the carpet, and if possible, lift the carpet and ventilate with fans underneath.

Vinyl flooring and floor tile may need to be removed to allow drying of subfloor.

Wood floors- Wooden floors should be dried gradually. Sudden drying could cause cracking or splitting. Some restoration companies can accelerate drying time by forcing air through the fluted underside of hardwood floorboards. Remove hardwood floor boards to prevent buckling. Remove a board every few feet to reduce buckling caused by swelling. Clean and dry wood before attempting repairs.

ROOF DAMAGE AND LEAKS

Defective flashing- Flashing is the sheet metal used in waterproofing roof valleys, hips and the angle between a chimney and a roof. Wet spots near a chimney or outside wall may mean the leak is caused by defective flashing, narrow flashing or loose mortar joints. Look for corroded, loose or displaced flashing on sloping roof valleys and at junctions of dormers and roof.

Clogged downspouts or eaves- Check for choked downspouts. Accumulated water or snow on the roof above the flashing may cause a leak. Ice accumulations on eaves sometimes form ridges, which cause melting snow to back up under the shingles.

Cracks and deterioration- Roofing (especially wood or composition shingles) usually deteriorates first on southern exposures. Check southern slopes for cracking or deterioration.

Holes- Missing shingles or holes in the roofing may be causing wet spots. To find holes, check for a drip trail or spot of light coming through in the attic. Stick a nail, straw or wire through the hole to mark the spot on the outside.

Private sewage systems-Flooding of a private sewage system can be a hazardous situation for homeowners. It may lead to a back-up of sewage in the home, contaminated drinking water and lack of sanitation until the system is fixed. When flooding or saturated soil conditions persist, a private sewage system cannot function properly. Soil treatment systems for wastewater rely on aerobic (with oxygen) regions to reduce the amounts of chemicals and living organisms (viruses, bacteria and protozoa). When the soil is saturated or flooded, those hazardous materials can enter the groundwater and your drinking water supply. A suitably trained individual should be employed to assess the system.