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RCP031 - Submission by J Docherty

08/08/23

INTRODUCTION

I am a qualified mechanical engineer with over 50 years experience. I have a B.Sc (Physics & Mathematics) and a B.E.(1st Hons) and have worked as a consultant, owned a mechanical services contracting company and was also involved with research and testing while employed at the Ministry of Works, Central Laboratories from 1976-1985 (During this time I was appointed as the Aerodynamics Engineer.) While at Central Laboratories I setup the computerised data acquisition and analysis system for the boundary layer wind tunnel and carried out numerous full scale measurements of air flows and pressures. The latter included four weeks of full scale testing in the Kaimai Rail tunnel and also testing of the ventilation system in the Terrace Tunnel in Wellington. (Those measurements showed that one of the crucial factors in the design of the ventilation system was incorrect, resulting in the flow rate through the tunnel being only 52% of the design figure.)

I continue to work as a consultant, and as mentioned in my submission I spend a considerable amount of my time reviewing designs and, unfortunately, rectifying those that are faulty. In all cases these designs were carried out by engineers employed by the 'well known' consultants who presumably believed that their designs were correct and of the highest standard. Unfortunately they were not. (The buildings I have been involved with recently are 'high profile', and of considerable importance to the community, one being part of vital infrastructure.) I also carry out extensive monitoring of the operation of buildings to identify and resolve issues, develop software and have extensive experience in data acquisition, processing and analysis.

I wish to make two points in this regard:-

1. Irrespective of the profiles and claims made by people regarding their experience and the quality of designs produced by engineers, they are certainly not always correct, and in some of the cases I have dealt with they have been grossly negligent. That these designs have been 'signed off' by other more senior engineers in those practices is also of concern.

2. There is no substitute for practical 'hands on' experience and measuring what happens in practice to validate a theory or model. While it is all very well to carry out designs and produce models based on 'theory', if one does not take the time to validate that against what actually happens, the design or the model cannot be relied upon with any degree of confidence.

My comments in regard to my submission are primarily in regard to flooding which is a key issue to most residents of Ohoka. In particular I am concerned about the accuracy of the model which the WDC are relying on, the lack of calibration of the model and the apparent lack of notice being taken in regard to the ever worsening situation regarding the climate which will inevitably increase both the risk of flooding and the magnitude of the flooding.

FLOODING

In my submission I analysed the rainfall data from the Cust Main Drain station run by ECAN, showing both the 24hr and 48hr totals. (Graphs are attached again as appendix A.) I showed the extent of flooding that occurred on our property during the two highest rainfall events in June 2014 and July 2022. As noted in my submission the maximum rainfall recorded during the rainfall events in July 2022 was 81.5mm on the 26/07/22 with the 48 hour total being 97.5mm on the 25 & 26/07/2022. 71.5mm was recorded on the 12/07/2022 and 20.5mm on the 21/07/2022. The total rainfall recorded for July 2022 was 235.5mm.

Thus, while both of these events were significant, the comparison with the model data is as follows:-

EVENT	24hr rainfall (mm)	48 hr rainfall (mm)
NIWA 5 year return event	82.5	104
NIWA 50 year return event	143	177
February 2018 (24hr max)	95	
9 & 10th June 2014 (48hr max)		132.5
July 2022	81.5	97.5

The extent of flooding that occurred in July 2022 was in line with the model predictions in some parts of our property for a 50 year event although the 24hr rainfall was only 57% of the 50 year return event, and the 48hr total was only 55% of the same event.

Even more extensive flooding occurred in June 2014 when the 48hr total was 75% of the 50 year return event total.

Thus it would appear that the modeling is inaccurate and cannot be relied upon.

It is also noted that the updated submission by Ben Throssell (PDP), included the following statements:-

25. *Rainfall has been added to the internal PDP Model area, the previous PDP Model only considered external flow into the area of interest and the effects of floodplain displacement due to filling to meet minimum floor level requirements. The updated PDP Model now incorporates both the effects of floodplain displacement and the effects of increased run-off due to an increase in impervious cover.* I take it from this statement that the previous model did not include any rainfall in the area of the proposed subdivision. How can such a model be plausible and used for decision making when it apparently failed to take into account the runoff from 800+ houses and other impervious surfaces - buildings, roadways, carparks etc.? This raises further significant issues regarding the accuracy of the model.

Also, with the unpredictable effects of climate change the modeling of the expected precipitation is also not 'certain'. The frequency of events which give rise to increased rainfall in New Zealand is increasing, particularly due to warm moist systems moving south from the tropical area to the north of New Zealand, as occurred with Cyclone Gabrielle.

The frequency of catastrophic rainfall events resulting in extensive flooding throughout the world has also increased markedly, and even more so in the last 12 months, where these events that are occurring across the world are often described as being **'unprecedented'.** It should be readily apparent that we are in a

period of increasing temperatures resulting in an alarming increase in the frequency and intensity of rainfall events. As all should be aware this has resulted in extensive and often catastrophic flooding on the East Coast of the North Island, Coromandel, Auckland, Mangawhai, Italy, Bejing and Korea to name but a few.

This increase in rainfall intensity, accompanied with the recently observed record decrease in the Antarctic sea ice[1], glaciers collapsing in Alaska and similar loss of snow cover throughout the alpine regions in the world, will result in increased rates of sea level rise which cannot be ignored.

To ignore the possibility that such unprecedented events will occur in Canterbury, and to rely on a model, which demonstrably underestimates flooding, has not been 'calibrated' against what actually occurs, ignores the fact that the natural drainage is part of an overall interconnected system from the source to the sea, would in my view be extremely irresponsible.

I also included in my submission extracts from a paper by Professor Matthew Wilson of the University of Canterbury, (available on NIWA's website), in which he stated the following:-

> *Yet, even if we use the best possible data and model representations, uncertainty will still result from a complex combination of errors associated with source data, sampling and model representation. These uncertainties "cascade" through the risk assessment system (Figure 1a), reducing our confidence in any individual prediction and leading to variability in predicted depths and extents across multiple predictions which account for these errors. These uncertainties, here represented as variability in predicted depths and flows, further cascade through to the analysis of flood impacts (Figure 1b). Uncertainty in predicted depths and flows combine with errors from data such as those for buildings and infrastructure, and the statistical models used to quantify damage (e.g., via depth-damage curves). The end result is uncertainty in quantified damage for a flood scenario, creating issues for the decision-making processes such as determining whether to invest in improved mitigation measures.*
>
> (The full document is included in my original submission.)

Comments on PDPs Updated Submission by Ben Throssell (dated 6th July and 6th August)

In addition to the comment regarding point 25, (referred to above), I make the following comments:-

1. PDP relies on the District Wide Model and make the following comments:-

   40 *Turning to the validation of the District Wide Model, DHI (2020) report there is limited opportunity for validation or calibration of this District Wide Model. DHI report:*
   "The MIKE 21 model results for a 1 in 100 year event give a peak flow of 910m^3/s at the Fox Creek Okuku gauge, Figure 3-6. This is around double the flow estimated using frequency analysis, indicating that the infiltration rates may be too conservative in the hillside areas. However, given the uncertainties involved in the flood frequency analysis, it is difficult to determine by how much"

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[1] After reaching a record-low summer minimum earlier this year, Antarctic sea ice continues to break records. In the midst of its winter growth phase, it has reached a record-low extent, far below the previous record, for this time of year.

Data archived by the National Snow and Ice Data Center (NSIDC) record Antarctic sea ice extent at 4.5 million square miles (11.7 million square kilometers) as of June 27, 2023. That's nearly a million square miles (2.6 million square kilometers) below the 1981–2010 average, and approaching a half a million square miles (1.2 million square kilometers) below the previous lowest extent for the day, observed in 2022.

Further:

"Despite the potential overestimation of flow, it is believed that the model is still performing better in this area than in the earlier modelling".

42 As no model validation information specific to Ohoka is presented for the District Wide Model, I have compared the flow predictions made by the District Wide Model with design flood estimates provided by Tonkin and Taylor (2017)[4].

I note that there has been ample opportunity for PDP to compare the model's predictions to actual flooding in Ohoka; i.e. to calibrate the model so that it bears some relation to what actually happens in Ohoka. (PDP note that the model is not calibrated, stating *"However, the purpose of the PDP Model is to investigate the effects of flooding rather than determine an absolute water level."* How can any credibility be given to the results and the flooding shown on the various maps presented which state that they show the '*Maximum Flooding Depth*' ? (PDP Figures B2 & B3 in the Appendix E of the novo group report dated 15/06/22.) What is the point of modeling if the absolute water level cannot be determined from it ? It would appear that all that PDP are trying to 'prove' is that, except in a few instances, the effect of the subdivision is 'less than minor'', while ignoring the extent of the actual flooding that occurs now and will occur in the future.

I provided photographic evidence of water levels in the 2014 and 2022, which clearly showed the Ohoka Stream South Branch breaching the banks, and considerable flooding on our property. Other submitters also have provided information on the flooding that occurs. It would appear that PDP have taken no notice of this information and continue to focus on 'proving' that the effects of the subdivision will be "less than minor".

I also note that there is no mention in the model as to the physical characteristics of the waterways in the area. What dimensions have been allowed for in the model and what account is taken of the 'obstructions', both temporary and permanent that exist in these waterways ? For example the Ohoka Stream South Branch is constrained where it exits our property due to the encroachment of the bank into the stream, from the root structure of a large tree that was planted many years ago. When the tree fell down two years ago I asked WDC if the restriction could now be removed to reduce the flooding that occurs, however I was told that ECAN would not permit this. I also note that immediately adjacent to this restriction our neighbour has removed the bank and created a discharge point, complete with multiple piped drains which discharge into the stream. I assume that the model does not take either the restriction, or the additional discharge into account. There are also some drains adjacent to our property which are essentially blocked by vegetation as there is no maintenance carried out by the owners or the WDC. At times of heavy rain, rather than conveying water away as part of the overall drainage system, these can overflow resulting in water running onto our property. (Reference is made to these being considered as being 'blocked' in the model.) I have included two photos showing the encroachment onto the stream and the additional drainage.

STORMWATER MANAGEMENT

The submission by Eoghan O'Neill includes the following:-

16. *Potential flooding of the site and the surrounding land is covered in detail in the evidence of Mr Ben Throssell. The stormwater management proposals for the plan change area have been developed in close collaboration with the flood modelling and flood mitigation work to ensure that the development can progress without increasing the flood risk to properties upstream or downstream of the development. As noted in Paragraph 114 of Mr Ben Throssell's evidence,*

"modelling of the 200-year event shows the flood hazard is still low for areas south of Mill Road/downstream of Whites Road and moderate for areas north of Mill Road. I note the PDP model predicts generally no effect greater than 10 mm for areas north of Mill Road and no increase greater than 20 mm for habitable dwellings elsewhere within the PDP model." He therefore concludes that the effect of the development on flooding outside of the plan change area are less than minor.

Ben Throssell states:-

113 *I conclude that Ohoka is prone to low hazard flood events, similar to those experienced in June 2014 and July 2022. I note the magnitude of these events at Ohoka was probably between a 10-year and 20-year event. The stormwater solution within the site will provide mitigation of any additional stormwater generated by the site for events of these magnitudes.*

Thus it appears that the stormwater management is based on an uncalibrated flooding model. How can any reliance then be placed on the stormwater management proposal ?

Comment on the S42A Report

It would seem that the WDC have accepted the modeling provided without seriously questioning any aspects of it, such as its fundamental accuracy and lack of calibration. The following extract is from the report and Appendix 5:-

6.5.22 Many submitters raised concerns over flooding in the area, stating the site was not suitable for new housing due to poor drainage / drains being at capacity now, existing flood risk and being concerned over the proposal worsening flooding on neighbouring properties from displacement, and reduction in the floodplain. These include: R Hill (12), T S Davison (31), P Trumic (34), R Macpherson (42), A Webb (43), A Gibbs (50), A McAllister (53), J Stapley (60), C Hall (64), N Wilkinson (65), S Stewart (66), L Hurley & C Stephen (73), M & J Williams (75), N Holland (77), M White (80), M Harvey (26), M Jongens (83), OOCB (370), E Low (377), Wilson Drive Residents (204). R Lynn (134) also states that comprehensive floodwater plans are required prior to any plan change approval, rather than at subdivision stage.

Mr Bacon also makes the following statements in Appendix 5 (highlighting added):-

13. *Overall the modelling work done by PDP is reasonable, but the results do raise some concerns and anecdotal evidence from submitters should be assessed by the Applicant.*

15. *Multiple submissions raise concerns about the impacts of the proposed development on stormwater run-off and flood risk. This is understandable given the community's experience with high groundwater and flooding in the Ohoka area.*

18. *From my evidence, I offer the following summarising statements:*
    i. *The Applicant has appropriately considered the potential increase in flooding within the site, however, has not proposed rules to mitigate against flood risk within the development site (e.g. freeboard requirements; earthworks to raise building platforms).*

ii. *The Applicant has appropriately considered the potential increase in offsite flooding and has identified an increase in flooding at several dwellings offsite.* ***The implications of the predicted increase at these dwellings have not been fully addressed. There is a risk there is not a practical mitigation that will be able to be identified at resource consent stage which can be implemented to protect the affected properties.***

It is difficult to understand how the WDC are apparently willing to accept an uncalibrated model while seemingly ignoring the 'anecdotal' evidence which has been presented by numerous submitters, including myself. What does clause 18 (ii) actually mean. Are WDC accepting that the application should be approved inspite of the clearly identified risks and that the flooding can be 'sorted out' later on ? To do this is, in my view, irresponsible.

Mr Willis in the Section 42A report states:-

6.5.25 Mr Bacon considers that the Applicant has appropriately considered the potential increase in offsite flooding and has identified an increase in flooding at several dwellings offsite. In particular, he notes that the modelling shows some existing dwellings have an increase in flood depth in the 0.5% event of 45mm and that the report does not state whether or not this effect is reasonable; at this stage it has simply identified the problem. Mr Bacon considers that the increase in flood depth needs to be further assessed to demonstrate there are no adverse off-site effects, and all effects of the development in the 0.5% AEP event can be fully mitigated, and any remaining effects demonstrated to be less than minor to ensure existing dwellings are not adversely impacted by the development. He considers that there is a risk there is no practical mitigation able to be identified at resource consent stage which can be implemented to protect the affected properties and that it would be helpful to understand the types of mitigation measure the Applicant could put forward to manage increased flood effects on offsite dwellings.

6.5.26 Based on the evidence presented and Mr Bacon's opinion, I consider that the proposal does not adequately demonstrate that off-site flood risk can be appropriately managed. ***Ideally*** *evidence on mitigation measures will be provided as part of the Applicant's evidence to the Hearing Panel.*

Surely 'Ideally' is not the correct word to use. This information MUST be provided to the Hearing Panel.

CONCLUSIONS

1. My view is that the modeling of the actual flooding ~~that occurs now and will occur in the future~~ fails to accurately predict the flood levels that occur now and will occur in the future. As PDP state *" the purpose of the PDP Model is to investigate the effects of flooding rather than determine an absolute water level."* It is incumbent on both the applicant and the WDC to ensure that accurate data is presented to the hearing which can be relied upon to assess the impacts of flooding. That would appear not to be the case at present.

2. The rapidly worsening of the effects of climate change, with increased rainfall, 'atmospheric rivers' and rising sea levels means that the predictions provided for modeling future scenarios are no longer relevant. We are experiencing unprecedented climate events throughout the world. Canterbury and Ohoka are not immune from these. As noted above advice on NIWA's website from Professor Wilson draws attention to the uncertainty in using available data to predict future events. In my view any increase in the flooding risk is completely unacceptable.

3. Proceeding with any development which increases the risk of flooding puts both the WDC and the applicant at risk of future claims in regard to damage. As a ratepayer I do not believe that the WDC should be accepting any additional liability.

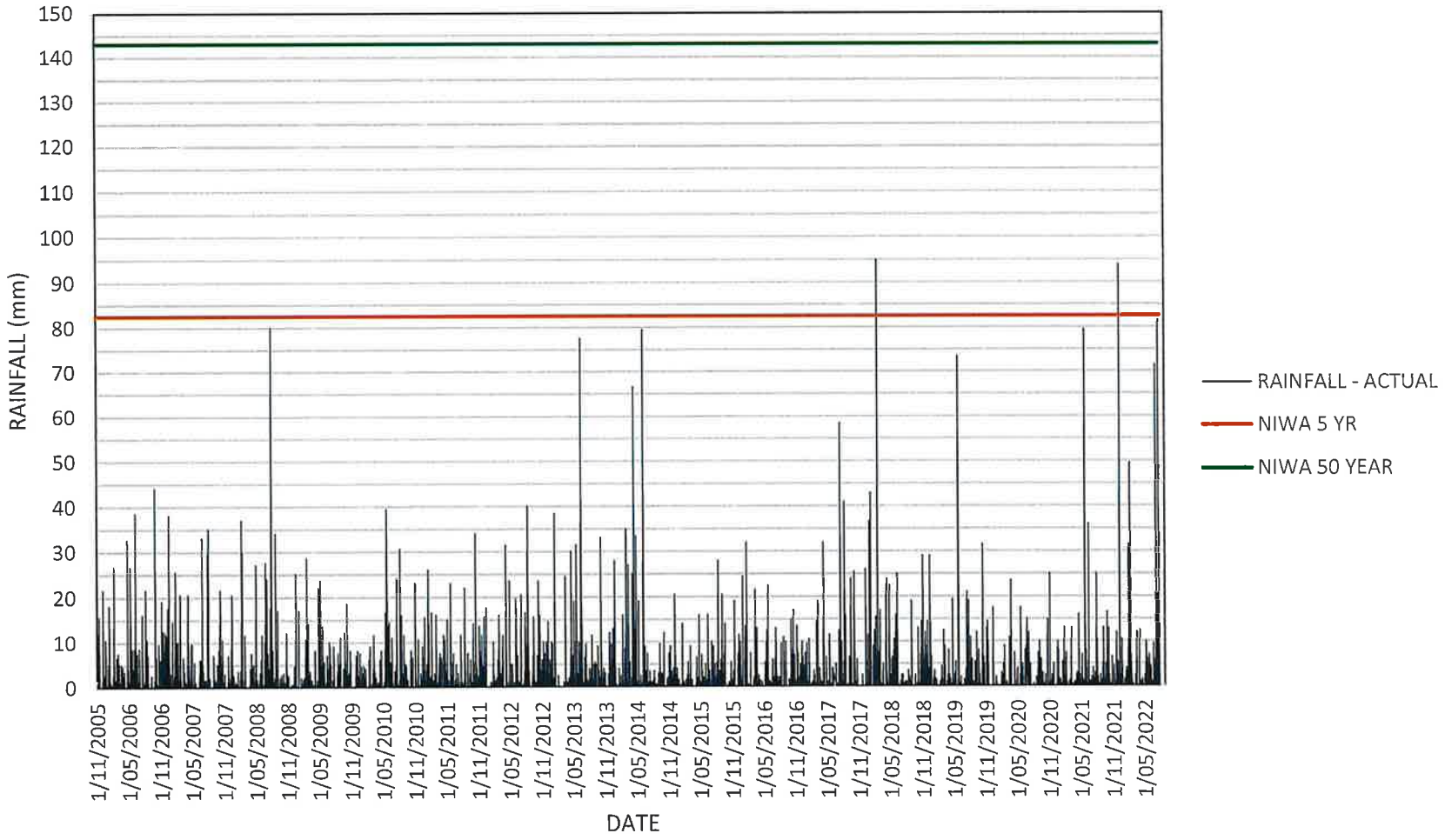
4. While today I have concentrated on the flooding issue I have also drawn attention in my original submission to issues with the width of Whites Road and the significant difference between the information provided in the original application and the actual road 'shoulder' dimensions.

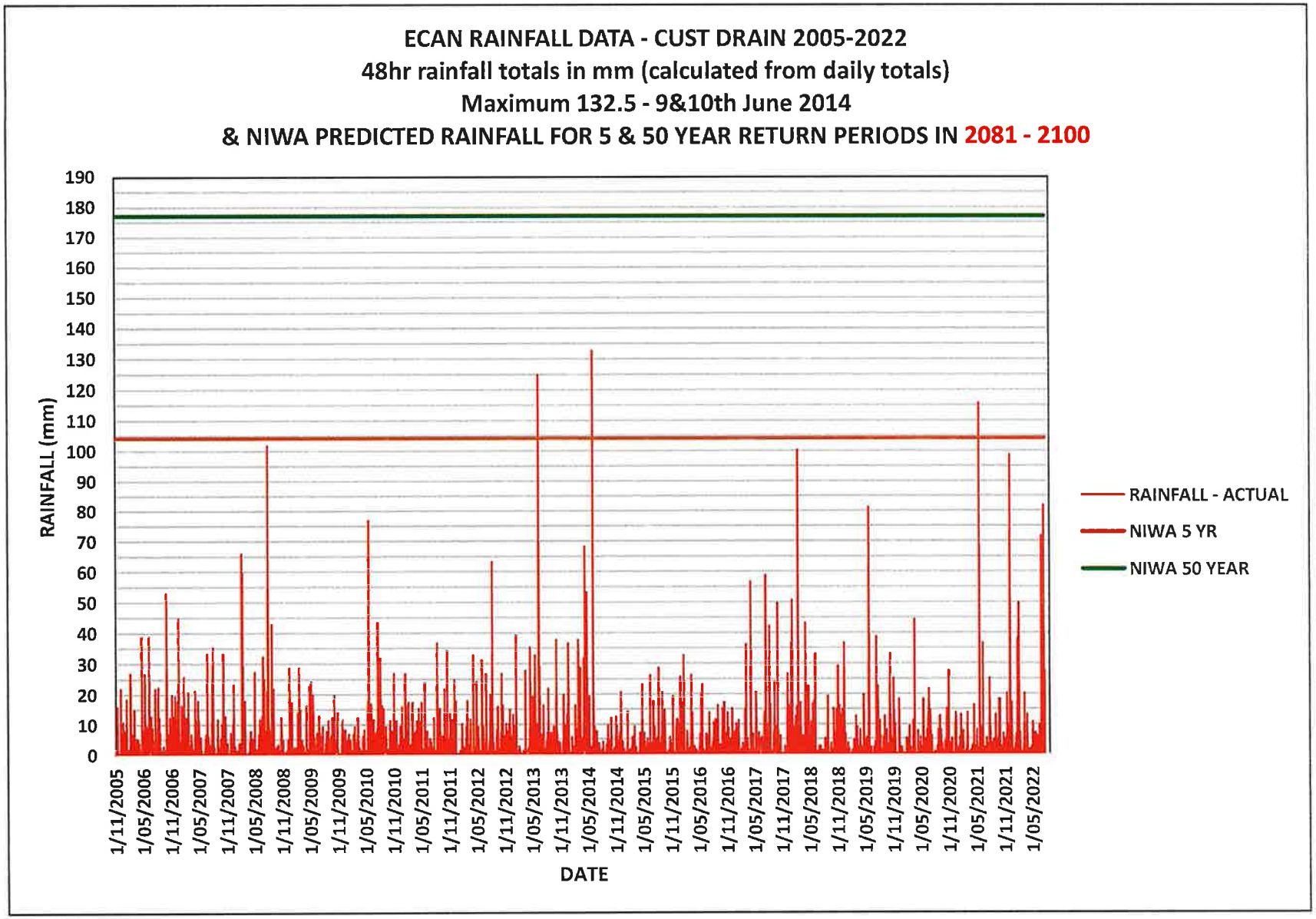
J W Docherty

APPENDIX A - ECAN RAINFALL DATA - CUST MAIN DRAIN

The following graphs were prepared using data downloaded from the ECAN website for the Cust Main Drain station. This data was imported into a database and processed to calculate the 48 hour totals. Two sets of 48 hour data were calculated in order to ascertain the maximum values which typically occurred either side of a peak 24 hour rainfall event. This data was then exported to an Excel spreadsheet and plotted.

ECAN RAINFALL DATA - CUST DRAIN 2005-2022
24hr rainfall in mm
Maximum 95mm - 20/02/2018
& NIWA PREDICTED RAINFALL FOR 5 & 50 YEAR RETURN PERIODS IN 2081-2100




ECAN RAINFALL DATA - CUST DRAIN 2005-2022
48hr rainfall totals in mm (calculated from daily totals)
Maximum 132.5 - 9&10th June 2014
& NIWA PREDICTED RAINFALL FOR 5 & 50 YEAR RETURN PERIODS IN 2081 - 2100
RAINFALL (mm)
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1/11/2005
1/05/2006
1/11/2006
1/05/2007
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1/05/2019
1/11/2019
1/05/2020
1/11/2020
1/05/2021
1/11/2021
1/05/2022
DATE
RAINFALL - ACTUAL
NIWA 5 YR
NIWA 50 YEAR

Figure 1 THIS PHOTO SHOWS WHERE THE OHOKA STREAM SOUTH BRANCH IS RESTRICTED BY THE ENCROACHMENT OF A NOW FALLEN TREE ROOT SYSTEM INTO THE STREAM. (THE TRUNK IS VISIBLE ON THE LEFT.) HOW DOES FACTORS SUCH AS THIS GET TAKEN INTO ACCOUNT IN THE MODELING ?

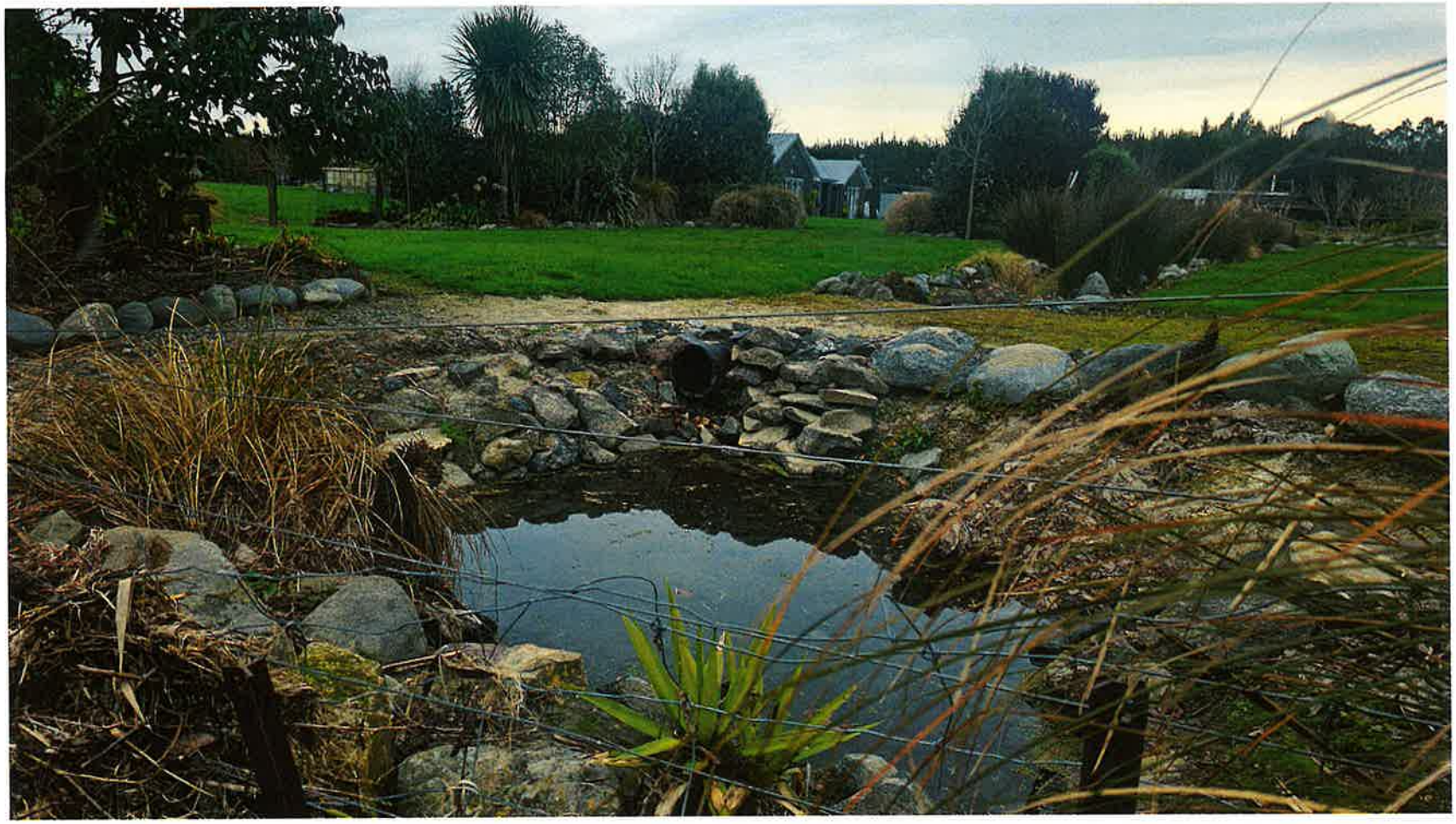

Figure 2 - ONE OF TWO DRAINS INTO THE OHOKA SOUTH BRANCH FROM AN ADJOINING PROPERTY. NOT PART OF ORIGINAL DRAINAGE. IS THIS INCLUDED IN THE MODEL. (RUNOFF IS FROM STORMWATER & HARD SURFACES.)