IN THE MATTER of the Resource Management Act 1991 (the **Act**)

A N D

IN THE MATTER of proposed Plan Change 94 (Washer Road Business Park)

A N D submissions received on the Plan Change

STATEMENT OF EVIDENCE OF PETER DONALD MOODIE - ENGINEERING

DATED 23 JUNE 2022

Introduction

1. My name is Peter Donald Moodie. I hold a Bachelor of Engineering (with Honours) in Natural Resources. I am a Chartered Engineer and am a member of the Institution of Professional Engineers New Zealand. I have 19 years of civil and environmental engineering experience in New Zealand and Australia and I am a Director of Lysaght Consultants Limited.

2. My experience includes investigations, options assessments and the design and implementation of stormwater management systems, including flood assessments to determine flood level impacts. I have been the lead design engineer/certifier and construction supervisor of residential, retirement, infrastructure and commercial projects locally and overseas. I believe the evidence I have prepared is within the extents of my normal professional practice.

Code of Conduct for Expert Witnesses

3. I confirm that I have read the Environment Court's Code of Conduct for Expert Witnesses, as contained in section 7 of the Environment Court's Practice Note 2014, and I agree to comply with it.

4. The data, information, facts and assumptions that I have considered in forming my opinions are set out in my evidence that follows. The reasons for the opinions expressed are also set out in the evidence that follows.

5. I confirm that the matters addressed in this brief of evidence are within my area of expertise, with the exception of where I confirm that I am relying on the evidence of another person. I have not omitted to consider material facts known to me that might alter or detract from my opinions expressed in this brief of evidence. I have specified where my opinion is based on limited or partial information and I have identified any assumptions I have made in forming my opinions.

Scope of Evidence

6. I have been engaged by David Washer to provide engineering advice in relation to the Bay of Plenty Regional Council's (BOPRC's) submissions opposing the proposed Plan Change 94 with respect to stormwater. In my evidence, I will respond directly to the submission questions as numbered in Appendix 1 of BOPRC's submission.

7. I have read and am familiar with the submissions and the section 42A report and

Evidence

Flood Model

8. Submission PC94 (2)(b): *Full details of the background flood model and associated maps used to inform flood risk including clarification of which climate change scenarios have been used. Of note, any flood modelling should consider the impermeable surface coverages expected in the proposed industrial zone and take into account the changes in levels resulting from proposed fill shown.*

9. I utilised the flood model provided by BOPRC to MPAD on the 15/03/2022 to undertake flood impact analysis for the plan change.

10. I understand from BOPRC's communication that the mapping is from the latest Kaituna Model for the 100yr - 2130 climate change adjusted flood scenario.

Figure 1- BOPRC Kaituna Flood Model Results- Flood Depth Q100-2130CCA

11. I understand that the BOPRC model utilises existing ground levels and impervious area coverage (pasture).

12. I utilised the Tauranga City Council (TCC) 100yr - 2130 climate change adjusted rainfall data for calculations since Western Bay of Plenty District Council (WBOPDC) does not provide this information in their Development Code. I understand that BOPRC accept TCC's values.

Table C: Climate-Adjusted Design Rainfall Depth Estimate (RCP 8.5 for 2130) in mm

Table 3. RCP 8.5 2130 IDC rainfall depths (mm)												
ARI (y)	aep	10m	20m	30m	60m	2h	3h	4h	6h	12h	24h	48h
2.33	42.9%	17	26	33	43	59	72	81	90	112	135	151
5	20.0%	24	35	47	66	92	108	118	130	158	179	202
10	10.0%	28	44	59	87	120	140	153	168	197	219	250
20	5.0%	33	54	70	109	150	175	190	206	236	263	302
50	2.0%	40	66	87	136	191	219	236	255	288	329	380
100	1.0%	45	77	98	158	221	255	275	293	326	387	449

Table D: Climate-Adjusted Design Rainfall Intensity Estimates (RCP 8.5 for 2130) in mm/hour

Table 2. RCP 8.5 2130 IDC rainfall intensities (mm/hr)												
ARI (y)	aep	10m	20m	30m	60m	2h	3h	4h	6h	12h	24h	48h
2.33	42.9%	104	78	67	30	29	24	20	15	9	6	3
5	20.0%	141	106	94	45	46	36	29	22	13	7	4
10	10.0%	169	133	119	59	60	47	38	28	16	9	5
20	5.0%	197	161	140	73	75	58	48	34	20	11	6
50	2.0%	242	198	174	91	95	73	59	42	24	14	8
100	1.0%	270	230	195	105	110	85	69	49	27	16	9

Figure 2- TCC 2130 CCA Rainfall Depths and Intensity

13. Calculations are presented below.

Flood Displacement

14. Submission PC94 (2)(c): *Full details Feasibility reporting to demonstrate the requirements for stormwater detention measures based on the updated modelling and, in accordance with BOPRC's Hydrological and Hydraulic Guidelines 2012/02 can be achieved for the development site outside of the 1% AEP floodplain*

15. A revised servicing plan is provided attached and denoted as Revision C.

16. The LIDAR data in the location of the proposed wetland/ED pond indicates an existing ground level of approximately RL 7.3m (Moturiki Datum). The latest flood modelling provided by BOPRC indicates generally less than 50 mm of ponding across the site, equating to a flood level of approximately RL 7.35m in this location. The modelling indicates the highest flood level on the site at the southern extent of flooded area, is approximately RL 9.3m. It was originally proposed, prior to receiving

the updated modelling, to raise the site to a platform level of RL 10.5m however the modelling indicates this could be reduced to RL 7.65 at the north end to RL 9.6 at the southern end of the flooding to comply with BOPRC Hydraulic Guidelines and WBOPDC Development Code 300mm freeboard to platform requirements for a commercial development.

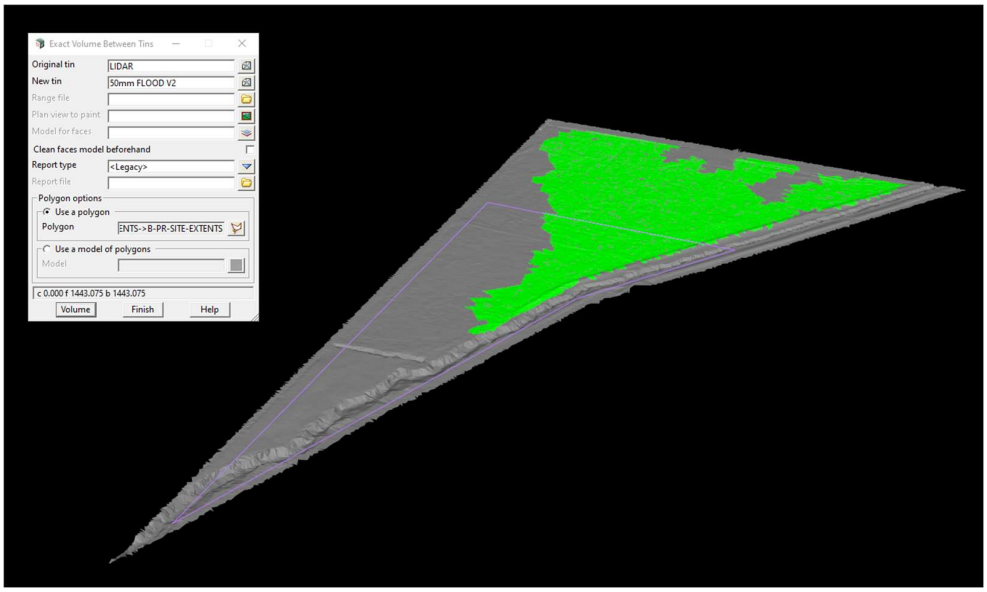

Figure 3- 12D Flood Displacement Model – Flooded Area Shown Green

17. I determined from the 12D surface model that the volume of flooding displaced by filling the site to at least RL 9.6m is 1443m³ as described in Figure 3.

18. I adopted a 100-yr runoff coefficient of 0.36 for the existing site, and 1.0 for the proposed development. The predevelopment scenario was considered pervious whilst the post development scenario was considered 90% impervious.

19. A DRAINS software model was utilised to calculate the runoff volume for the pre and post development scenarios using the TCC 100-year – 2130, 6-hour nested rainfall pattern. The resulting runoff hydrographs are provided in Figure 4

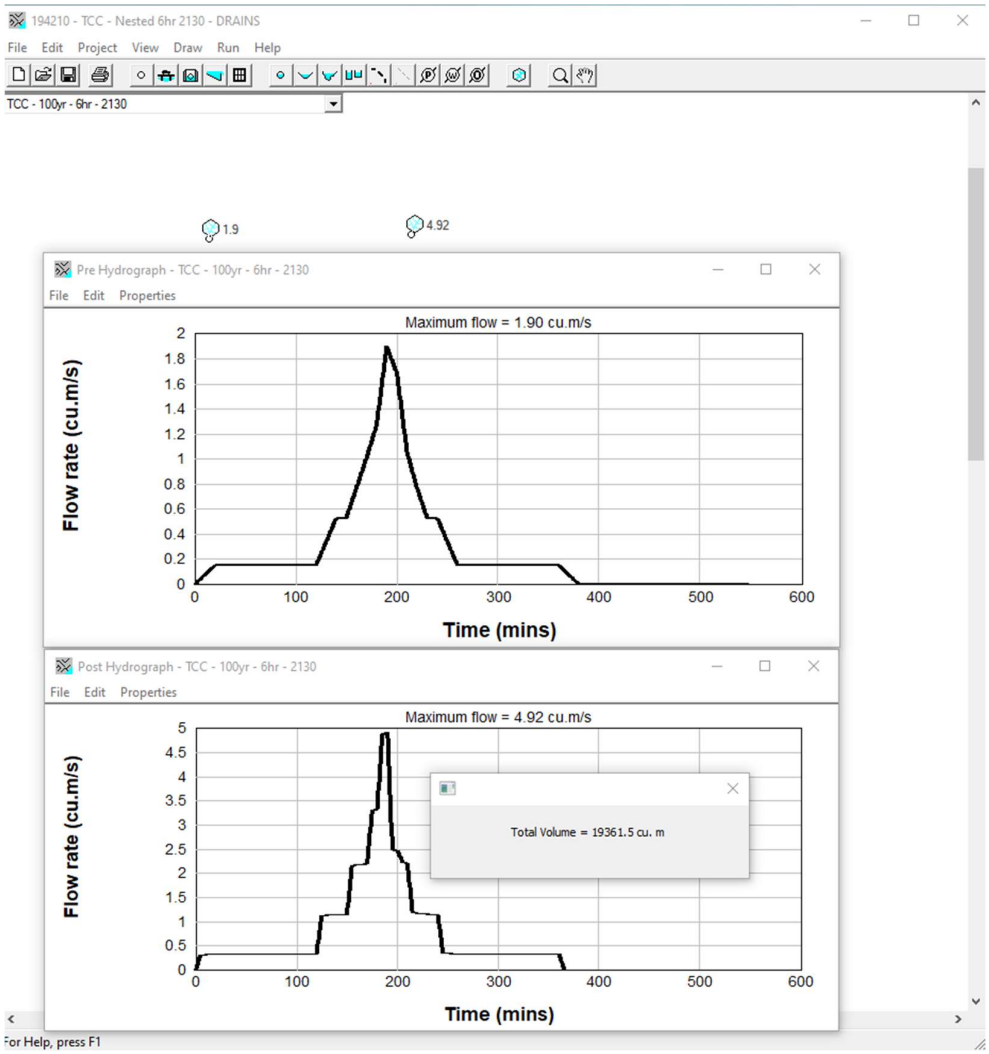

Figure 4- DRAINS Runoff Volumes

20. The modeling confirms 8,868m³ of predevelopment runoff compared to 19,362m³ post development runoff, equating to 10,494m³ of increased runoff volume post development.

21. I confirmed in my servicing report (dated 25/03/21), that the downstream flood plain area is approximately 43 km² in area. Hence, the increase in downstream flooding due to the combined 1,443m³ of displaced volume and 10,494m³ increased runoff volume equates to a 0.24mm rise in downstream flood depths. I consider this effectively unmeasurable and therefore a "no more than minor" effect. A summary of the calculation is presented in Figure 5

Flood Plain Area	43	km²
Displaced Volume	1,443	m³
DRAINS Runoff Volume Pre	8,868	m³
DRAINS Runoff Volume Post	19,362	m³
Difference	10,494	
Increased Flood Depth	0.24	mm

Figure 5- Downstream Flood Impacts

22. Section 7.1.3 of the BOPRC Stormwater Management Guidelines (SMG) for the Bay of Plenty Region (Guideline 2012/01) states that peak discharge control should only be undertaken in the top half of a catchment where potential coincidence of peaks cannot occur. Lysaght's report noted that the site is located in the lower portion of the catchment therefore detention is not required by the guidelines. It is also noted that the downstream flood plain is likely to have a significantly long draw down period, probably measured in days. As such, any detention volume provided in a pond is likely to have been discharged into the flood plain before it has been drawn down and thus the benefits of detention are greatly diminished.

23. It is therefore proposed that no additional detention storage is provided for the development.

24. The proposed development ground level is to be raised to at least 1m higher than the 100-year – 2130 CCA flood level. The proposed wetland/extended detention pond will be located on this platform and will therefore be raised well above the 1% AEP flood level and will not be subject to resuspension of sediment or inundation from the stream.

25. It is also noted that the wetland is proposed to be offline, providing treatment only to the design treatment flow rate, reducing the risk of resuspension of sediments by diverting larger events around the wetland.

Building Floor Levels

26. Submission PC94 (2)(d)(ii): *Provisions to be included in the structure plan to ensure a low level of risk for the various hazards can be achieved within the plan change area without increasing risk outside of the development site; and Provisions to ensure risk is not increased outside of the plan change area. In the case of flooding, provisions should consider, but not be limited to, the following: (ii) Controls to ensure that buildings are not functionally compromised in the event of 1% AEP flood event (RCP 8.5-2130 climate change allowance*

27. A minimum finished floor level shall be set at the 1% AEP 2130 RCP 8.5 flood level plus 300mm freeboard allowance. We note that the finished platform will be at least 1m higher than flood levels.

28. Submission PC94 (2)(d)(iii): *Management of subdivision earthworks and development in overland flow paths to ensure that the conveyance and storage function is protected as determined by an assessment of depth and velocity for a 1% AEP flood event (RCP 8.5-2130 climate change allowance)*

29. Velocity/depth maps were requested from BOPRC but had not been received at the time of evidence preparation. Based on the data available to date, overbank conveyance does not appear to be a significant issue on the BOPRC model for the southern section of the stream. All of the proposed earthworks have been setback at least 10m from the edge of the stream as required by the geotechnical investigation. As such I don't anticipate that the infilling will significantly affect conveyance capacity. Storage has already been addressed in the first sections of my evidence.

30. Overland flows within the development are proposed to be directed over internal roads and are expected to be shallow with low velocities and will be considered a low hazard risk to human life and property. No significant

overland flows are understood to cross the site from other offsite sources.

Extended Detention and Treatment

31. Submission PC94 (2)(d)(iv): *On-site methods to manage run-off within the plan change area such as water sensitive urban design;*

32. It is proposed to manage runoff by providing extended detention and stormwater treatment in a treatment train consisting of pretreatment devices and a wetland sized in accordance with the Low Impact Design principles specified in BOPRC's SMG.

33. Submission PC94 (3): *The proposed plan change does not include provisions to give effect to NPS-FM (2020) and would be inconsistent the relevant provisions of the RNRP and the RPS to manage incremental degradation of water quality on receiving environments arising from urban stormwater*

34. The following treatment train approach is proposed to be built into the plan change provisions:

a) All roof, cladding, gutters, downpipes and external plant and fixtures on buildings to be colourbond/non-leach materials to ensure dissolved metals are minimised.

b) All high pollution activities (e.g. wreckers, galvanising etc) shall have site specific plans and treatment systems and operate under cover to minimise runoff of pollutants into the reticulated system.

c) Stormwater shall be collected from all hardstand areas and reticulated to trunk drainage mains and directed to the stormwater treatment system.

d) The water quality flow shall be directed through a gross pollutant trap (e.g. VortCapture) for removal the bulk of pollutants/sediments > 5mm in

size. The system will also remove free-floating grease and oil and litter. This pre-filter system will provide significant reductions in maintenance costs and extend the periods between maintenance of the downstream treatment devices.

e) Water quality flows will then be directed through a finer mechanical filtration system e.g Jellyfish or Stormfilter for removal of particles down to 2 microns, which will remove a high percentage of particle bound pollutants, including phosphorus, nitrogen, metals and hydrocarbons.

f) Finally, the stormwater will be directed through a planted wetland or other approved biological/chemical device to provide polishing, particularly for the removal of nutrients in plant uptake and aerobic/anaerobic processes.

g) The stormwater would discharge from the wetland directly into the stream via a pipe, swale or spillway.

h) Higher flows up to and including the extended detention flowrate will bypass the gross pollutant trap into the wetland where it will be stored and detained, releasing slowly over 24 hours into the stream to reduce velocity erosion of the stream.

Conclusion

35. I believe on reasonable grounds, based on the available evidence utilised in my servicing review, that the proposed industrial plan change area can be adequately serviced through either existing or upgraded stormwater, wastewater and water reticulation and, protected from flood inundation with less than minor impacts with respect to the matters addressed in my review

Peter Moodie
23/06/2022