

----- Forwarded message -----

From: Peter Blackwood <Peter.Blackwood@boprc.govt.nz>
To: Ken Tarboton <Ken.Tarboton@boprc.govt.nz>
Cc: Peter West <Peter.West@boprc.govt.nz>, Martin Butler <Martin.Butler@boprc.govt.nz>, Mark Townsend <Mark.Townsend@boprc.govt.nz>
Bcc:
Date: Tue, 20 Jun 2017 05:04:59 +0000
Subject: FW: Information Request 20170616 1701

Hi Ken,

Another one.

Pete

[Peter Blackwood](#)
Principal Environmental Engineer
Bay of Plenty Regional Council Toi Moana

P: [0800 884 880](tel:0800884880) **DD:** [0800 884 881 x9527](tel:0800884881x9527)
E: Peter.Blackwood@boprc.govt.nz
W: www.boprc.govt.nz
A: PO Box 364, Whakatāne 3158, New Zealand

Thriving together – mō te taiao, mō ngā tāngata

From: Peter West
Sent: Tuesday, 20 June 2017 3:11 p.m.
To: Peter Blackwood
Cc: Martin Butler; Mark Townsend
Subject: RE: Information Request 20170616 1701

Peter,

Attached results from DHI this morning for the information request below (5:01pm 16 June 2017). The attached workbook includes our Te Teko model

inflow hydrograph (sent to DHI yesterday) and a chart showing the dam management outputs.

Our work on this yesterday found that an increase to 550m³/s at 6:15pm on the 5th (phone request confirmed by email at 6:13pm) instead of at about 8:15pm (what actually happened) would have caused the lake level to reach a minimum of 71.19mRL at 9:45pm, instead of 71.57mRL (0.383m lower; all other actions held constant). This scenario leads to a 12am on the 6th April dam management tool result for optimum peak discharge at of 677m³/s (8m³/s less than the actual (archived) tool result). The inflow hydrograph sent to DHI therefore has been scaled down at the peak by 8m³/s from our earlier estimate of what actually flowed past Te Teko.

Workbook notes:

The second modified scenario hydrograph is scaled at the request (5:01pm 16/6/2017) of Kyle Christensen to represent an alternative dam management scenario: Likely dam management decision if BOPRC's 6:13pm 5th April phone and email request for 550m³/s had been actioned promptly. Dam management analysis finds a lake level difference of 0.383m leading to an effective 8m³/s reduction in the 12am 6th April dam management decision.

A -8m³/s peak scaling has been applied to the proportion of the hydrograph above 400m³/s.

Peter

[Peter West](#)

Bay of Plenty Regional Council Toi Moana

P: [0800 884 880](tel:0800884880) DD: [0800 884 880](tel:0800884880)

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A: PO Box 364, Whakatāne 3158, New Zealand

Thriving together – mō te taiao, mō ngā tāngata

From: Martin Butler

Sent: Friday, 16 June 2017 5:19 p.m.

To: Kyle Christensen

Cc: Frances Skilton; charlie.price@stantec.com; Michael Cullen; Mark Townsend;

Peter West; Peter Blackwood
Subject: RE: Information Request

Request received and transmitted onwards; I can't offer a response delivery time yet.

Kind regards

[Martin Butler](#) Information Liaison
Regional Planner
Bay of Plenty Regional Council Toi Moana

P: [0800 884 880](tel:0800884880) **DD:** [0800 884 881 x9320](tel:0800884881x9320) **Office:** Whakatāne
E: Martin.Butler@boprc.govt.nz
M: [021 289 5042](tel:0212895042) **W:** www.boprc.govt.nz
A: PO Box 364, Whakatāne 3158, New Zealand

Thriving together – mō te taiao, mō ngā tāngata

From: Kyle Christensen [<mailto:kyle@christensenconsulting.co.nz>]
Sent: Friday, 16 June 2017 5:01 p.m.
To: Martin Butler
Cc: Frances Skilton; charlie.price@stantec.com; Michael Cullen; Mark Townsend; Peter West; Peter Blackwood
Subject: Re: Information Request

Thank you Martin.

I also have one further request.

Can you please run a scenario where the dam discharge is increased to 550m³/s at 1800 on 5 April. I would like to know what dam reservoir level could have been achieved with this outflow and then on that basis what the optimised peak dam outflow would then have been. I would also like the modelled water level time series for MIKE 11 model chainage RANGITAIKI 13868 for this scenario.

Thanks and regards

Kyle Christensen
Rivers & Stormwater Engineer

m | 022 620 9047
e | kyle@christensenconsulting.co.nz
w | www.christensenconsulting.co.nz

From: Martin Butler <Martin.Butler@boprc.govt.nz>
Date: Friday, 16 June 2017 at 2:59 PM
To: Kyle Christensen <kyle@christensenconsulting.co.nz>
Cc: Frances Skilton <frances@tregaskisbrown.com>, "charlie.price@stantec.com" <charlie.price@stantec.com>, Michael Cullen <honmichaelcullen@gmail.com>, Mark Townsend <Mark.Townsend@boprc.govt.nz>, Peter West <Peter.West@boprc.govt.nz>, Peter Blackwood <Peter.Blackwood@boprc.govt.nz>
Subject: RE: Information Request

Hi Kyle

Our Engineers and consultants are working on this and hope to have your answer after the weekend.

Kind regards

Martin Butler
Regional Planner
Bay of Plenty Regional Council Toi Moana

P: [0800 884 880](tel:0800884880) **DD:** [0800 884 881 x9320](tel:0800884881x9320) **Office:** Whakatāne
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A: PO Box 364, Whakatāne 3158, New Zealand

Thriving together – mō te taiao, mō ngā tāngata

From: Kyle Christensen [<mailto:kyle@christensenconsulting.co.nz>]
Sent: Friday, 16 June 2017 2:06 p.m.
To: Martin Butler
Cc: Frances Skilton; charlie.price@stantec.com; Michael Cullen; Mark Townsend; Peter West; Peter Blackwood
Subject: Information Request

Hi Martin,

I wish to request a modelled water level time series for MIKE 11 model chainage RANGITAIKI 13868 for a dam outflow of 680 m³/s. Please use a scaled inflow hydrograph based on the analysis presented by Peter West on 8 June, reference - Retrospective analysis of dam management Scenario B Part 2 lake prep level at 70.0 mRL.

Best regards

Kyle Christensen

Rivers & Stormwater Engineer

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e | kyle@christensenconsulting.co.nz

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Cc: Martin Butler <Martin.Butler@boprc.govt.nz>, Mark Townsend <Mark.Townsend@boprc.govt.nz>
Bcc:
Date: Tue, 20 Jun 2017 05:09:45 +0000
Subject: Information Request KC 20170617 07:56
Hi Ken,

This is all for today.

Pete

[Peter Blackwood](#)

Principal Environmental Engineer
Bay of Plenty Regional Council Toi Moana

P: [0800 884 880](tel:0800884880) DD: [0800 884 881 x9527](tel:0800884881x9527)

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Thriving together – mō te taiao, mō ngā tāngata

From: Peter West

Sent: Tuesday, 20 June 2017 4:56 p.m.

To: Peter Blackwood

Cc: Martin Butler; Mark Townsend

Subject: Information Request KC 20170617 07:56

Peter,

Please find below a response to Kyle Christensen's Information Request of 7:56am on the 17th of June.

Please edit as you see fit.

-

General notes about gauges that were not fully operational:

Tauranga at Ranger Station (Ranger) rain gauge was operational throughout but not correctly connected in the model due to a recent change in site identifier code. Kokamoka rain gauge was not operational throughout. Data became available later. Both of these items (above) would also have had localised impacts on Rain Radar data inputs (known about and assessed at the time).

Rangitāiki at Aniwhenua Barrage is the water level for Lake Aniwhenua. This is used to inject or subtract river flows from dam operations there. This gauge was not operational after about 3pm on the 3rd.

In the model, each rain gauge has its “stand-in” rain gauge that automatically is used if no data is available at the actual gauge.

For Kokamoka, the stand-in gauge is Tarapounamu.

For Galatea Basin: Kokamoka

For Ranger: Kokamoka

So for model runs with these three gauges “out” Tarapounamu depths would have been used in their place.

This note does not apply to radar correction procedure. Only the gauge-rain scenario in the hydrological model.

Forecast specific notes about which gauges were not operational:

Forecast of 4pm on 4 April;

Kokamoka

Ranger

Aniwhenua Barrage

6am on 5 April;

Galatea Basin

Kokamoka

Ranger

Aniwhenua Barrage

9am on 5 April;

Kokamoka

Ranger

Aniwhenua Barrage

12pm on 5 April;

Kokamoka

Ranger

Aniwhenua Barrage

3pm on 5 April;
Galatea Basin
Kokamoka
Ranger
Aniwhenua Barrage

6pm on 5 April.
Galatea Basin
Kokamoka
Ranger
Aniwhenua Barrage WL
Murupara WL

The information request asked which gauges were available for use. The above information provides which were-not available. The list below shows what is normally used in the forecasting system.

As described, gauge rainfall depths are applied to each model subcatchment based on an inverse-distance-squared weighting factor (distance from gauge to area centroid of the subcatchment).

The following list indicates the relative influence on flood estimation of each of the 13 raingauges used in the model (sum of weighting x subcatchment area as a percentage).

This list is for the model area not including the Murupara subcatchment. The Murupara subcatchment is the single largest catchment and is 79% influenced by the Kokamoka raingauge (which was not sending). The Murupara subcatchment has a very small specific flood response due to its flatness and its deep pumice soils covered largely in pine forest. Including it in the list below would unhelpfully skew the indication. The influence of the lack of the Kokamoka gauge input has not been fully analysed but it is not thought to be large.

Gal

Galatea Basin		17%
Huiarau at Huiarau Summit		4%
Kaituna at Whakarewarewa		2%
Okaro Meteorology at Birchalls		6%

Rangitaiki at Kokomoka	4%
Rangitaiki at Te Teko	8%
Tarapounamu at Summit	13%
Tarawera at Awakaponga	2%
Waihua at Waihua Rain Gauge	15%
Waimana at Ranger Stn	3%
Whakatane at Huitieke Link	5%
Whakatane at Kopeopeo	2%
Whirinaki at Galatea	19%

river flow gauges are used to indicate observed flows on the report sheet. They do not contribute to the actual model result.

The lake level gauges at Aniwhenua Barrage and at Lake Matahina are used to add/subtract flows from the river routing (net storage) in the model.

The flood forecast derived from radar rain data is usually the primary output (considered the most reliable) and is not meant to be strongly impacted by missing raingauge data, however (as described) a bug was identified in the raingauge correction system that would have locally impacted rain radar data near Kokamoka and Ranger; and for part of the time, near Galatea Basin.

Peter

[Peter West](#)

Bay of Plenty Regional Council Toi Moana

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Thriving together – mō te taiao, mō ngā tāngata

From: Kyle Christensen [<mailto:kyle@christensenconsulting.co.nz>]

Sent: Saturday, 17 June 2017 2:06 p.m.

To: Martin Butler

Cc: Frances Skilton; charlie.price@stantec.com; Michael Cullen; Mark Townsend; Peter West; Peter Blackwood

Subject: Re: Information Request

Hi Martin,

I have located the forecast information in Objective Connect but would still like clarification on what actual (rainfall & riverflow) data was available and used for each forecast.

Thanks

Kyle Christensen

Rivers & Stormwater Engineer

m | 022 620 9047
e | kyle@christensenconsulting.co.nz
w | www.christensenconsulting.co.nz

From: Kyle Christensen <kyle@christensenconsulting.co.nz>
Date: Saturday, 17 June 2017 at 7:56 AM
To: Martin Butler <Martin.Butler@boprc.govt.nz>
Cc: Frances Skilton <frances@tregaskisbrown.com>, "charlie.price@stantec.com" <charlie.price@stantec.com>, Michael Cullen <honmichaelcullen@gmail.com>, Mark Townsend <Mark.Townsend@boprc.govt.nz>, Peter West <Peter.West@boprc.govt.nz>, Peter Blackwood <Peter.Blackwood@boprc.govt.nz>
Subject: Re: Information Request

Hi Martin,

I have a further request regarding the flood forecasting during the event -

The information provided by Peter West in the presentation on 8 June provides flood forecasts made at 6pm on 3 April and 12am on 6 April.

Can I please have additional forecast information (I only require Matahina peak inflow and time of peak) for the following forecast times -

4pm on 4 April;
6am on 5 April;
9am on 5 April;
12pm on 5 April;
3pm on 5 April;
6pm on 5 April.

For each forecast can you please state which rain gauges and river flow gauges were operational and able to be used for the forecast.

Thanks and regards

Kyle Christensen

Rivers & Stormwater Engineer

m | 022 620 9047
e | kyle@christensenconsulting.co.nz
w | www.christensenconsulting.co.nz

From: Martin Butler <Martin.Butler@boprc.govt.nz>
Date: Friday, 16 June 2017 at 5:19 PM
To: Kyle Christensen <kyle@christensenconsulting.co.nz>
Cc: Frances Skilton <frances@tregaskisbrown.com>, "charlie.price@stantec.com" <charlie.price@stantec.com>, Michael Cullen <honmichaelcullen@gmail.com>, Mark Townsend <Mark.Townsend@boprc.govt.nz>, Peter West <Peter.West@boprc.govt.nz>, Peter Blackwood <Peter.Blackwood@boprc.govt.nz>
Subject: RE: Information Request

Request received and transmitted onwards; I can't offer a response delivery time yet.

Kind regards

Martin Butler Information Liaison
Regional Planner
Bay of Plenty Regional Council Toi Moana

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Thriving together – mō te taiao, mō ngā tāngata

From: Kyle Christensen [<mailto:kyle@christensenconsulting.co.nz>]

Sent: Friday, 16 June 2017 5:01 p.m.

To: Martin Butler

Cc: Frances Skilton; charlie.price@stantec.com; Michael Cullen; Mark Townsend; Peter West; Peter Blackwood

Subject: Re: Information Request

Thank you Martin.

I also have one further request.

Can you please run a scenario where the dam discharge is increased to 550m³/s at 1800 on 5 April. I would like to know what dam reservoir level could have been achieved with this outflow and then on that basis what the optimised peak dam outflow would then have been. I would also like the modelled water level time series for MIKE 11 model chainage RANGITAIKI 13868 for this scenario.

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Kyle Christensen

Rivers & Stormwater Engineer

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From: Martin Butler <Martin.Butler@boprc.govt.nz>

Date: Friday, 16 June 2017 at 2:59 PM

To: Kyle Christensen <kyle@christensenconsulting.co.nz>

Cc: Frances Skilton <frances@tregaskisbrown.com>, "charlie.price@stantec.com" <charlie.price@stantec.com>, Michael Cullen <honmichaelcullen@gmail.com>, Mark Townsend <Mark.Townsend@boprc.govt.nz>, Peter West <Peter.West@boprc.govt.nz>, Peter Blackwood <Peter.Blackwood@boprc.govt.nz>

Subject: RE: Information Request

Hi Kyle

Our Engineers and consultants are working on this and hope to have your answer after the weekend.

Kind regards

Martin Butler

Regional Planner

Bay of Plenty Regional Council Toi Moana

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Thriving together – mō te taiao, mō ngā tāngata

From: Kyle Christensen [<mailto:kyle@christensenconsulting.co.nz>]

Sent: Friday, 16 June 2017 2:06 p.m.

To: Martin Butler

Cc: Frances Skilton; charlie.price@stantec.com; Michael Cullen; Mark Townsend; Peter West; Peter Blackwood

Subject: Information Request

Hi Martin,

I wish to request a modelled water level time series for MIKE 11 model chainage RANGITAIKI 13868 for a dam outflow of 680 m³/s. Please use a scaled inflow hydrograph based on the analysis presented by Peter West on 8 June, reference - Retrospective analysis of dam management Scenario B Part 2 lake prep level at 70.0 mRL.

Best regards

Kyle Christensen

Rivers & Stormwater Engineer

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...

[Message clipped] [View entire message](#)

9 Attachments

S O C
I A L
I Z E

Steve A

	1:05 PM (1 hour ago)	

they are all good...

i can make each one a PDF?

and what about the attachments, where do they fit in?

Steve

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From: Peter Blackwood <Peter.Blackwood@boprc.govt.nz>

To: Peter West <Peter.West@boprc.govt.nz>, Ken Tarboton <Ken.Tarboton@boprc.govt.nz>

Cc: Martin Butler <Martin.Butler@boprc.govt.nz>, Mark Townsend
<Mark.Townsend@boprc.govt.nz>

Bcc:

Date: Tue, 20 Jun 2017 04:05:58 +0000

Subject: Information Request; 9:24pm 19 June

Hi Ken,

I'm coordinating Mark Townsend's receipt of these requests and then forwarding then to yourself to load into the external objective link to the Review Panel. Please can you forward thiws one.

Thank you

Pete

[Peter Blackwood](#)

Principal Environmental Engineer
Bay of Plenty Regional Council Toi Moana

P: [0800 884 880](tel:0800884880) **DD:** [0800 884 881 x9527](tel:0800884881x9527)

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Thriving together – mō te taiao, mō ngā tāngata

From: Peter West

Sent: Tuesday, 20 June 2017 9:55 a.m.

To: Peter Blackwood

Cc: Martin Butler; Mark Townsend

Subject: FW: Information Request; 9:24pm 19 June

Good morning Peter,

A response to the first part of Kyle's information request (*italics text is from Kyle's email below*):

My understanding of what actually occurred was a dam outflow instruction of 710 m³/s at 00:40 which was then increased to 780 m³/s at 09:50.

[Correct. These times and discharge values are confirmed by the email record].

Based on Scenario B Part 2 (as presented on 8 June) the optimised peak outflow would have been a constant 655 m³/s from 00:00 6 April with no subsequent increases. This would have required a lake level of 70.0 mRL prior to filling and a perfect inflow forecast (no factor of safety) to reach the maximum operating level of 76.2 mRL.

[Mostly correct: Scenario B Part 2 attempts to recreate the information available to the flood manager leading up to the decision at 00:40 6th April with only one change from what actually occurred: that the lake had been lowered to 70.0mRL. So the inflow forecast is as-estimated-at-the-time; – not perfectly-known or found-later. The 655m³/s value referred to is what the modelling tools would then have estimated as the optimum peak outflow. The archived report from this time shows that the optimisation tool estimated 685m³/s. Therefore 25m³/s contingency was effectively included in the 710m³/s dam discharge request. The magnitude of this contingency has been conserved in the subsequent modelling of this scenario (for example in the hydraulic results provided in response to the 2:06pm 16 June info request).

Correct that at this time (00:40 6th April) the expectation was that the estimated optimum peak outflow would be applied as a constant, actioned immediately, with no subsequent increases.

Correct about the tool's target level being 76.2mRL. Correct that no other safety factors are included in the modelling tool's estimate (other than the use of Max Operating Level as the tool's target instead of Max Flood Level) .

My understanding is that allowing for some contingency the likely attenuation flow decision would have been 680 m³/s at 00:40 which would have then been increased to 755 m³/s at 09:50 and that this is the basis for the flow and water level information that has been provided at the breach site.

[Correct. BOPRC estimates that, all other factors being conserved, the impact of a lake preparation level of 70.0mRL would have led to a discharge request at 00:40 6th April of 680m³/s instead of 710m³/s. Further analysis of the impact of this single change on the 09:50 6th April decision indicates a discharge request of 755m³/s at that time instead of 780m³/s. This is the basis for the hydraulic model results of water levels at the breach site provided 19 June in response to the 2:06pm 16 June request for information. For this scenario, the hydraulic model inflow hydrograph (at Te Teko) was scaled down by 30m³/s, proportionally over 400m³/s. (i.e. flows below 400m³/s unchanged; flows between 400m³/s and the peak discharge are scaled proportionally so that the peak discharge is 30m³/s less). It might be helpful to note (if not already noted) that hydraulic modelling is not available between the Dam and Te Teko – hence the scaling method].

Peter

From: Kyle Christensen [<mailto:kyle@christensenconsulting.co.nz>]

Sent: Monday, 19 June 2017 9:24 p.m.

To: Martin Butler

Cc: Frances Skilton; charlie.price@stantec.com; Michael Cullen; Mark Townsend; Peter West; Peter Blackwood

Subject: Re: Information Request

Hi Martin,

I wish to seek clarification relating to the alternative flow scenarios that are being run on the basis that a lake level of 70.0 mRL had been achieved prior to lake filling.

My understanding of what actually occurred was a dam outflow instruction of 710 m³/s at 00:40 which was then increased to 780 m³/s at 09:50.

Based on Scenario B Part 2 (as presented on 8 June) the optimised peak outflow would have been a constant 655 m³/s from 00:00 6 April with no subsequent increases. This would have required a lake level of 70.0 mRL prior to filling and a perfect inflow forecast (no factor of safety) to reach the maximum operating level of 76.2 mRL.

My understanding is that allowing for some contingency the likely attenuation flow decision would have been 680 m³/s at 00:40 which would have then been increased to 755 m³/s at 09:50 and that this is the basis for the flow and water level information that has been provided at the breach site.

Can you please confirm the above to be correct.

I also have one further question relating to the forecasting/dam management during the event -

The flood forecasts produced at 6am, 8am and 12pm on 5 April all predicted Matahina inflows of around 800 m³/s indicating a very significant flood (similar to 2004). Can you please comment on why approval to go to 70.0 mRL wasn't given earlier in the day. I have of course taken into account the lack of lake lowering that occurred between midnight and 11am on the 5th as well as between 6pm and 8:30pm.

Thanks and regards

Kyle Christensen

Rivers & Stormwater Engineer

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From: Peter West
Sent: Tuesday, 20 June 2017 3:11 p.m.
To: Peter Blackwood

Cc: Martin Butler; Mark Townsend

Subject: RE: Information Request 20170616 1701

Peter,

Attached results from DHI this morning for the information request below (5:01pm 16 June 2017). The attached workbook includes our Te Teko model inflow hydrograph (sent to DHI yesterday) and a chart showing the dam management outputs.

Our work on this yesterday found that an increase to 550m³/s at 6:15pm on the 5th (phone request confirmed by email at 6:13pm) instead of at about 8:15pm (what actually happened) would have caused the lake level to reach a minimum of 71.19mRL at 9:45pm, instead of 71.57mRL (0.383m lower; all other actions held constant). This scenario leads to a 12am on the 6th April dam management tool result for optimum peak discharge at of 677m³/s (8m³/s less than the actual (archived) tool result). The inflow hydrograph sent to DHI therefore has been scaled down at the peak by 8m³/s from our earlier estimate of what actually flowed past Te Teko.

Workbook notes:

The second modified scenario hydrograph is scaled at the request (5:01pm 16/6/2017) of Kyle Christensen to represent an alternative dam management scenario: Likely dam management decision if BOPRC's 6:13pm 5th April phone and email request for 550m³/s had been actioned promptly. Dam management analysis finds a lake level difference of 0.383m leading to an effective 8m³/s reduction in the 12am 6th April dam management decision.

A -8m³/s peak scaling has been applied to the proportion of the hydrograph above 400m³/s.

Peter

[Peter West](#)

Bay of Plenty Regional Council Toi Moana

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From: Martin Butler

Sent: Friday, 16 June 2017 5:19 p.m.

To: Kyle Christensen

Cc: Frances Skilton; charlie.price@stantec.com; Michael Cullen; Mark Townsend; Peter West; Peter Blackwood

Subject: RE: Information Request

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Kind regards

Martin Butler Information Liaison
Regional Planner
Bay of Plenty Regional Council Toi Moana

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Sent: Friday, 16 June 2017 5:01 p.m.

To: Martin Butler

Cc: Frances Skilton; charlie.price@stantec.com; Michael Cullen; Mark Townsend; Peter West; Peter Blackwood

Subject: Re: Information Request

Thank you Martin.

I also have one further request.

Can you please run a scenario where the dam discharge is increased to 550m³/s at 1800 on 5 April. I would like to know what dam reservoir level could have been achieved with this outflow and then on that basis what the optimised peak dam outflow would then have been. I would also like the modelled water level time series for MIKE 11 model chainage RANGITAIKI 13868 for this scenario.

Thanks and regards

Kyle Christensen

Rivers & Stormwater Engineer

m | 022 620 9047
e | kyle@christensenconsulting.co.nz
w | www.christensenconsulting.co.nz

From: Martin Butler <Martin.Butler@boprc.govt.nz>
Date: Friday, 16 June 2017 at 2:59 PM
To: Kyle Christensen <kyle@christensenconsulting.co.nz>
Cc: Frances Skilton <frances@tregaskisbrown.com>, "charlie.price@stantec.com" <charlie.price@stantec.com>, Michael Cullen <honmichaelcullen@gmail.com>, Mark Townsend <Mark.Townsend@boprc.govt.nz>, Peter West <Peter.West@boprc.govt.nz>, Peter Blackwood <Peter.Blackwood@boprc.govt.nz>
Subject: RE: Information Request

Hi Kyle

Our Engineers and consultants are working on this and hope to have your answer after the weekend.

Kind regards

Martin Butler

Regional Planner

Bay of Plenty Regional Council Toi Moana

P: [0800 884 880](tel:0800884880) DD: [0800 884 881 x9320](tel:0800884881x9320) Office: Whakatāne

E: Martin.Butler@boprc.govt.nz

M: [021 289 5042](tel:0212895042) W: www.boprc.govt.nz

A: PO Box 364, Whakatāne 3158, New Zealand

Thriving together – mō te taiao, mō ngā tāngata

From: Kyle Christensen [<mailto:kyle@christensenconsulting.co.nz>]

Sent: Friday, 16 June 2017 2:06 p.m.

To: Martin Butler

Cc: Frances Skilton; charlie.price@stantec.com; Michael Cullen; Mark Townsend; Peter West; Peter Blackwood

Subject: Information Request

Hi Martin,

I wish to request a modelled water level time series for MIKE 11 model chainage RANGITAIKI 13868 for a dam outflow of 680 m³/s. Please use a scaled inflow hydrograph based on the analysis presented by Peter West on 8 June, reference - Retrospective analysis of dam management Scenario B Part 2 lake prep level at 70.0 mRL.

Best regards

Kyle Christensen

Rivers & Stormwater Engineer

m | 022 620 9047

e | kyle@christensenconsulting.co.nz

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----- Forwarded message -----

From: Peter Blackwood <Peter.Blackwood@boprc.govt.nz>

To: Peter West <Peter.West@boprc.govt.nz>, Ken Tarboton <Ken.Tarboton@boprc.govt.nz>

Cc: Martin Butler <Martin.Butler@boprc.govt.nz>, Mark Townsend <Mark.Townsend@boprc.govt.nz>

Bcc:

Date: Tue, 20 Jun 2017 05:09:45 +0000

Subject: Information Request KC 20170617 07:56

Hi Ken,

This is all for today.

Pete

[Peter Blackwood](#)

Principal Environmental Engineer
Bay of Plenty Regional Council Toi Moana

P: [0800 884 880](tel:0800884880) **DD:** [0800 884 881 x9527](tel:0800884881x9527)

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A: PO Box 364, Whakatāne 3158, New Zealand

Thriving together – mō te taiao, mō ngā tāngata

From: Peter West

Sent: Tuesday, 20 June 2017 4:56 p.m.

To: Peter Blackwood

Cc: Martin Butler; Mark Townsend

Subject: Information Request KC 20170617 07:56

Peter,

Please find below a response to Kyle Christensen's Information Request of 7:56am on the 17th of June.

Please edit as you see fit.

-

General notes about gauges that were not fully operational:

Tauranga at Ranger Station (Ranger) rain gauge was operational throughout but not correctly connected in the model due to a recent change in site identifier code.

Kokamoka rain gauge was not operational throughout. Data became available later.

Both of these items (above) would also have had localised impacts on Rain Radar data inputs (known about and assessed at the time).

Rangitāiki at Aniwhenua Barrage is the water level for Lake Aniwhenua. This is used to inject or subtract river flows from dam operations there. This gauge was not operational after about 3pm on the 3rd.

In the model, each rain gauge has its "stand-in" rain gauge that automatically is used if no data is available at the actual gauge.

For Kokamoka, the stand-in gauge is Tarapounamu.

For Galatea Basin: Kokamoka

For Ranger: Kokamoka

So for model runs with these three gauges “out” Tarapounamu depths would have been used in their place.

This note does not apply to radar correction procedure. Only the gauge-rain scenario in the hydrological model.

Forecast specific notes about which gauges were not operational:

Forecast of 4pm on 4 April;

Kokamoka

Ranger

Aniwhenua Barrage

6am on 5 April;

Galatea Basin

Kokamoka

Ranger

Aniwhenua Barrage

9am on 5 April;

Kokamoka

Ranger

Aniwhenua Barrage

12pm on 5 April;

Kokamoka

Ranger

Aniwhenua Barrage

3pm on 5 April;

Galatea Basin

Kokamoka

Ranger

Aniwhenua Barrage

6pm on 5 April.

Galatea Basin

Kokamoka

Ranger

Aniwhenua Barrage WL

Murupara WL

The information request asked which gauges were available for use. The above information provides which were-not available. The list below shows what is normally used in the forecasting system.

As described, gauge rainfall depths are applied to each model subcatchment based on an inverse-distance-squared weighting factor (distance from gauge to area centroid of the subcatchment).

The following list indicates the relative influence on flood estimation of each of the 13 raingauges used in the model (sum of weighting x subcatchment area as a percentage).

This list is for the model area not including the Murupara subcatchment. The Murupara subcatchment is the single largest catchment and is 79% influenced by the Kokamoka raingauge (which was not sending). The Murupara subcatchment has a very small specific flood response due to its flatness and its deep pumice soils covered largely in pine forest. Including it in the list below would unhelpfully skew the indication. The influence of the lack of the Kokamoka gauge input has not been fully analysed but it is not thought to be large.

Galatea Ba

Galatea Basin	17%
Huiarau at Huiarau Summit	4%
Kaituna at Whakarewarewa	2%
Okaro Meteorology at Birchalls	6%
Rangitaiki at Kokomoka	4%
Rangitaiki at Te Teko	8%
Tarapounamu at Summit	13%
Tarawera at Awakaponga	2%
Waihua at Waihua Rain Gauge	15%
Waimana at Ranger Stn	3%
Whakatane at Huitieke Link	5%
Whakatane at Kopeopeo	2%
Whirinaki at Galatea	19%

ow gauges are used to indicate observed flows on the report sheet. They do not contribute to the actual model result.

The lake level gauges at Aniwhenua Barrage and at Lake Matahina are used to add/subtract flows from the river routing (net storage) in the model.

The flood forecast derived from radar rain data is usually the primary output (considered the most reliable) and is not meant to be strongly impacted by missing raingauge data, however (as described) a bug was identified in the raingauge correction system that would have locally impacted rain radar data near Kokamoka and Ranger; and for part of the time, near Galatea Basin.

Peter

[Peter West](#)

Bay of Plenty Regional Council Toi Moana

P: [0800 884 880](tel:0800884880) **DD:** [0800 884 880](tel:0800884880)

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A: PO Box 364, Whakatāne 3158, New Zealand

Thriving together – mō te taiao, mō ngā tāngata

From: Kyle Christensen [<mailto:kyle@christensenconsulting.co.nz>]

Sent: Saturday, 17 June 2017 2:06 p.m.

To: Martin Butler

Cc: Frances Skilton; charlie.price@stantec.com; Michael Cullen; Mark Townsend; Peter West; Peter Blackwood

Subject: Re: Information Request

Hi Martin,

I have located the forecast information in Objective Connect but would still like clarification on what actual (rainfall & riverflow) data was available and used for each forecast.

Thanks

[Kyle Christensen](#)

Rivers & Stormwater Engineer

m | 022 620 9047
e | kyle@christensenconsulting.co.nz
w | www.christensenconsulting.co.nz

From: Kyle Christensen <kyle@christensenconsulting.co.nz>
Date: Saturday, 17 June 2017 at 7:56 AM
To: Martin Butler <Martin.Butler@boprc.govt.nz>
Cc: Frances Skilton <frances@tregaskisbrown.com>, "charlie.price@stantec.com" <charlie.price@stantec.com>, Michael Cullen <honmichaelcullen@gmail.com>, Mark Townsend <Mark.Townsend@boprc.govt.nz>, Peter West <Peter.West@boprc.govt.nz>, Peter Blackwood <Peter.Blackwood@boprc.govt.nz>
Subject: Re: Information Request

Hi Martin,

I have a further request regarding the flood forecasting during the event -

The information provided by Peter West in the presentation on 8 June provides flood forecasts made at 6pm on 3 April and 12am on 6 April.

Can I please have additional forecast information (I only require Matahina peak inflow and time of peak) for the following forecast times -

4pm on 4 April;
6am on 5 April;
9am on 5 April;
12pm on 5 April;
3pm on 5 April;
6pm on 5 April.

For each forecast can you please state which rain gauges and river flow gauges were operational and able to be used for the forecast.

Thanks and regards

Kyle Christensen

Rivers & Stormwater Engineer

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