

From: **Michael Law** Michael.Law@beca.com  
Subject: RE: Pinehaven Stream hydrology - Existing and Future Development  
Date: 11 June 2015 at 5:05 PM  
To: Kristin Stokes Kristin.Stokes@mwhglobal.com  
Cc: Mike Harkness Mike.Harkness@gw.govt.nz, Mark Hooker Mark.Hooker@gw.govt.nz

ML

Hi Kristin

Thnaks for getting back to me. If the initial and continuing losses are the same in both models, then the flood volumes will be the same (so long as there isn't another % impermeable area parameter that negates the losses). So that could explain the volumes. Other parameters within the model could possibly speed up the runoff response to reflect that aspect of development.

As you can see, I have copied **Mike H** in on the email. It might be worth the two of you having a chat to confirm our understanding.

Regards

**MIKE LAW**

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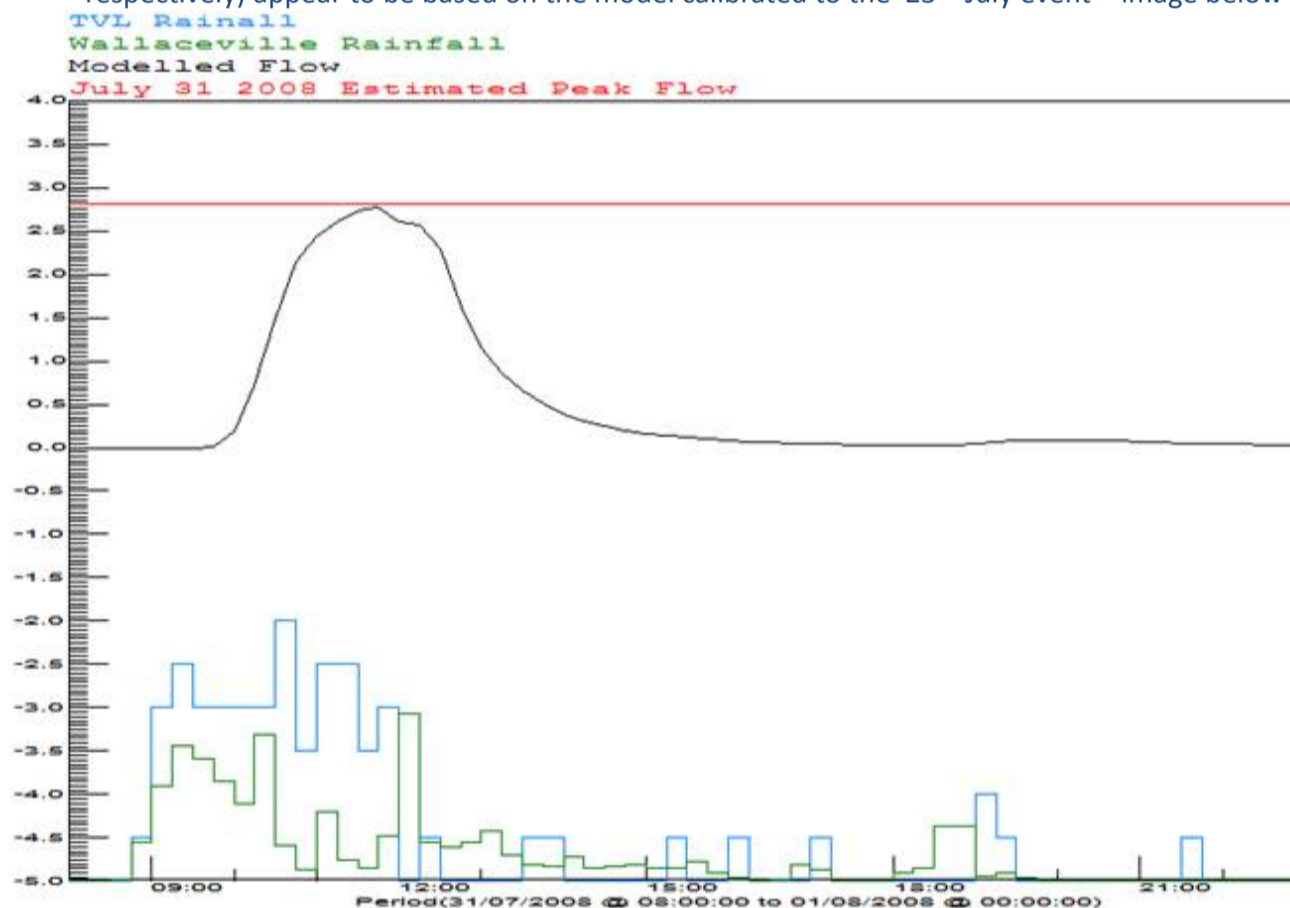
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**From:** Kristin Stokes [mailto:Kristin.Stokes@mwhglobal.com]  
**Sent:** Thursday, 11 June 2015 4:15 p.m.  
**To:** Michael Law  
**Subject:** RE: Pinehaven Stream hydrology - Existing and Future Development

Hi Mike,

Both Tom and I have looked at the model, but the approach that Mike has used for the development model is a bit difficult to tell, and we don't have time in the next few days to try and unravel them fully.

The new alpha and N values given in the appendix B, Revision of our report ( 2 and 1.7 respectively) appear to be based on the model calibrated to the 23<sup>rd</sup> July event – image below



As far as we can tell the initial Loss and continuing losses used are the same in both models (5mm and 2mm).

The Hydrol model doesn't take any further excess out apart from the initial and continuing losses so that could explain why the volume is the same.

The model that gives the future results I have located the output file and it matches your graph. But I cannot find the model file to be sure of the inputs used.

Would sending the model files to Mike Harkness to interpret be helpful? Otherwise if you give me a call tomorrow maybe we can discuss further

Cheers,  
Kristin



Kristin Stokes  
Hydrologist

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**From:** Michael Law [<mailto:Michael.Law@beca.com>]  
**Sent:** Thursday, 11 June 2015 8:36 a.m.  
**To:** Kristin Stokes  
**Subject:** FW: Pinehaven Stream hydrology - Existing and Future Development

Hi Kristin

I need to get my draft report to GWRC over the weekend, so please let me know whether or you and Tom have found an answer to my query about the future development hydrology.

I look forward to hearing from you.

Regards

**MIKE LAW**

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**From:** Michael Law  
**Sent:** Thursday, 4 June 2015 9:20 a.m.  
**To:** 'Kristin Stokes'  
**Cc:** Mark Hooker ([Mark.Hooker@gw.govt.nz](mailto:Mark.Hooker@gw.govt.nz))  
**Subject:** RE: Pinehaven Stream hydrology - Existing and Future Development

Kristin

Thanks. I look forward to hearing from you.

Regards

**MIKE**

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**From:** Kristin Stokes [<mailto:Kristin.Stokes@mwhglobal.com>]  
**Sent:** Thursday, 4 June 2015 9:16 a.m.  
**To:** Michael Law  
**Cc:** Mark Hooker ([Mark.Hooker@gw.govt.nz](mailto:Mark.Hooker@gw.govt.nz))  
**Subject:** RE: Pinehaven Stream hydrology - Existing and Future Development

Hi Mike,

Sorry for the delay in replying to your email. I have been away this week and forgot to set up an out of office email.

I located the files and looked at them last week, although I am not familiar enough with the software to identify why there is no difference in the flood volumes. I will discuss with my colleague Tom who still uses Hydstra to find out if he can shed any light on it today (he was away last week) and get back to you today.

Kind Regards,  
Kristin



**Kristin Stokes**  
**Hydrologist**

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**From:** Michael Law [<mailto:Michael.Law@beca.com>]  
**Sent:** Tuesday, 2 June 2015 12:46 p.m.  
**To:** Kristin Stokes  
**Cc:** Mark Hooker ([Mark.Hooker@gw.govt.nz](mailto:Mark.Hooker@gw.govt.nz))  
**Subject:** FW: Pinehaven Stream hydrology - Existing and Future Development

Hi Kristin

I was wondering whether or not you had been able to look at this issue regarding Pinehaven Stream, or whether MWH are still able to access the model files to be able to do the checks?

If you could let me know how things are going, I'd appreciate it.

Thanks

**MIKE LAW**

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**From:** Michael Law  
**Sent:** Wednesday, 27 May 2015 12:29 p.m.  
**To:** [Kristin.stokes@mwhglobal.com](mailto:Kristin.stokes@mwhglobal.com)  
**Cc:** Mark Hooker ([Mark.Hooker@gw.govt.nz](mailto:Mark.Hooker@gw.govt.nz))  
**Subject:** Pinehaven Stream hydrology - Existing and Future Development

Hi Kristin

Following on from our meeting last month (regarding the audit that I am doing for GWRC on their flood hazard maps of the Pinehaven Stream catchment), I have reviewed the hydrology and hydraulic modelling, and met with Mike Harkness.

I'm putting the finishing touches to the audit report, but came across one issue quite late in the day relating to the hydrology used for modelling future development. As you will see from the draft report text below, peak flows are higher for Future development but there is no corresponding increase in flood volume.

I had extracted the flood hydrographs from SKM Jacobs MIKE FLOOD model, and so first checked with Ben Fountain that he had used the correct hydrographs. He assured me that they were the hydrographs provided by MWH. Mike Harkness confirmed that they were the outputs from his modelling when he was with MWH, but he doesn't have the hydrological model input/parameters to allow him to understand why there wasn't an increase in flood volume.

Are you able to shed any light on this from the files in your archive. I would value any comments that you have.

The attached spreadsheet has the hydrographs for sub-catchments B and E, as examples.

Regards

**MIKE LAW**

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Extract from draft report prior to review

As part of the flood hazard study carried out by SKM, a future case scenario was carried out to determine the impact of a future development scenario for the Pinehaven Hills. In undertaking this modelling, assumptions were made about the runoff changes that would occur as a result of future development, based on:

- 1665 lots
- Average lot size of 750m<sup>2</sup>
- 40% increase in impermeable area across the affected sub-catchments

Figure 8.1 shows the change in flood hydrographs for existing development (*E4\_Q100CC\_2hr\_HB.bnd11*) and future development (*E4\_Q100CC\_FP\_2hr\_HB.bnd11*) for sub-catchment B, which is in the southwest of the catchment and drains to the top of Pinehaven Road.

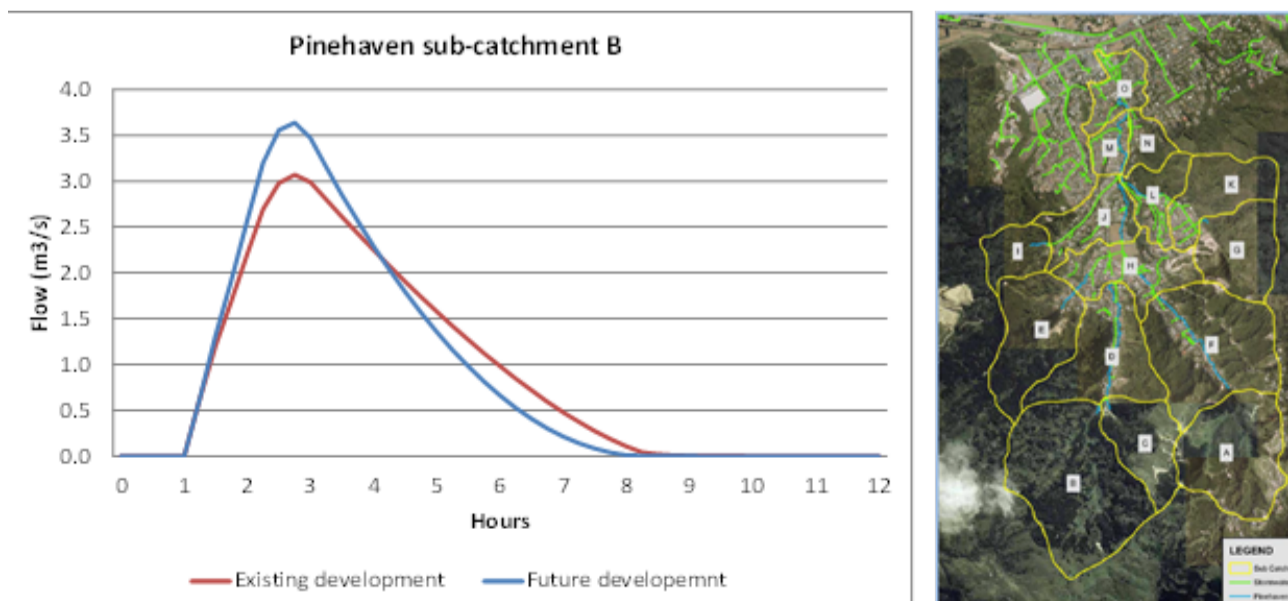


Figure 8.1 – Existing and maximum probable development hydrographs

Future development increases the peak flow by 18% (from 307m<sup>3</sup>/s to 3.64m<sup>3</sup>/s), and the flow recession is steeper than for the existing land use. However, the flood volume does not increase. This

is unexpected, as increasing the impervious area of sub-catchment by 40% to reflect the development would be expected to reduce rainfall losses and increase runoff volume. Similar results were found for sub-catchment E, which drains to Wyndham Road.

Assuming a 100-year ARI plus climate change rainfall depth of 87.1mm for the 3-hour storm, an Initial Loss of 5mm, Ongoing Loss of 2mm, and 40% impermeable area for the affected post-development sub-catchments, then the effective rainfall depths would be;

- 76.7mm (88%) for existing land use
- 80.8mm (93%) for post-development land use

The difference between existing and post-development flood volumes would be expected to be to a similar ratio. The existing ground cover of bush and pine forest on sloping catchments generated relatively high runoff, when compared to natural vegetation on flatter ground. This is reflected in the 88% effective rainfall for the existing situation and only 5.6% increase in effective rainfall post-development.

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