From:	Heather Richards
To:	Sarah Sullivan
Subject:	FW: Meeting - Oak Ridge Subdivision
Date:	Thursday, June 27, 2019 1:59:57 PM

Heather Richards, PCED
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From: Heather Richards
Sent: Tuesday, June 18, 2019 4:05 PM
To: Jeff Towery <Jeff.Towery@mcminnvilleoregon.gov>
Subject: Re: Meeting - Oak Ridge Subdivision

Thank you.

Heather Richards
Sent from my Iphone

On Jun 18, 2019, at 2:54 PM, Jeff Towery <Jeff.Towery@mcminnvilleoregon.gov> wrote:

> FYI
>
> Jeff
>
> **From:** Jeff Towery
> **Sent:** Tuesday, June 18, 2019 2:54 PM
> **To:** 'Mike Colvin' <mikecolvin49@gmail.com>
> **Subject:** Meeting - Oak Ridge Subdivision
>
> Mike,
>
> Thank you for coming to meet with me today. I appreciate the time you took to lay out

your concerns. As promised, the City Attorney and I did discuss your request to add the information you left with me to the record for the City Council to consider. Because the Planning Commission closed the record, as it stands right now, I am not able to share the items you provided with the Council. As I said, the Council does have the ability to schedule their own public hearing on this matter. If they do so, the information you shared with me will become part of the record. Thank you for understanding. Take care.

Jeff Towery – City Manager
503-434-7302

www.mcminnvilleoregon.gov

May 24, 2019

Catherine Olsen
Friends of Baker Creek
2650 NW Pinot Noir Drive
McMinnville, OR 97128

Via email: cdolsen@earthlink.net

Regarding: Baker Creek Hydrologic Analysis
McMinnville, OR
PBS Project 71440.000

Dear Catherine:

As you know, in May of this year, PBS prepared a Hydrologic Analysis of Baker Creek (PBS Report) for your organization. On May 15, 2019, PBS was made aware of a response to the PBS Report by the Kellington Law Group (Kellington), on behalf of the Oak Ridge Development applicant, Premier Development, LLC. This letter discusses responds, point by point, to the assertions in the Kellington letter and explains why PBS' conclusions in the PBS Report are valid and PBS stands by its Report.

Kellington first indicates that the "consultant report would not support a FEMA LOMR…" This comment ignores the intent of the PBS Report; the PBS Report was never intended to support a FEMA LOMR –the PBS report is pointedly a "Hydrology Study" and not an "MT-2 Narrative" that would support a LOMR. as explained in the Executive Summary of the PBS Report, PBS was asked to "perform a hydrologic analysis of Baker Creek and evaluate potential floodplain impacts of recent and future development." That is what the PBS Report did and, as explained in the Report, the conclusion that it reached is that the City's current flood insurance rate maps are outdated and in need of revision.

Kellington then goes on to claim that the mathematic calculations presented in the report are inaccurate for several reasons. Those reasons are each addressed below.

1. **The response states that the PBS report "*vastly...overestimates the peak flow rates of water in Baker Creek.*" Kellington asserts that PBS "*jiggered*" the numbers so that the concentration of peak flow happens earlier than it does.**

PBS acknowledges that the Report contained a typographical error, but the analysis was performed correctly, notwithstanding the typo. The tyop mistakenly discusses and provides the definition for time of concentration. This section should have described the calculated parameters as lag time. This section should, therefore read as follows:

> **3.4 Lag Time**
> Curve number methodology in the HEC-HMS model requires that a lag time be estimated for each watershed in order to apply the unit hydrograph and calculate runoff. The SCS method prescribes a watershed lag method for calculating time of concentration as follows:
>
> $$L = \frac{l^{0.8}(S+1)^{0.7}}{1{,}900 * Y^{0.5}}$$
>
> Where: L = Lag Time (hours)
> l = Longest Flow Path (LFP) length (feet)
> $S = \frac{1{,}000}{CN} - 10 =$ Maximum potential retention (inches)
> Y = Average watershed land slope (%)
>
> Calculation of the maximum potential retention parameter requires the CN value for the watershed, estimated as described in Section 3.3. This equation has been developed to represent the lag time for watersheds of varying type and size.

What Kellington overlooked is that the proper input to the HEC-HMS model is, in fact, the lag time, and **not** the time of concentration. The lag equation was, therefore, *intentionally* applied to the basins. We recognize the typographical error contained in the PBS report but can assure that the calculated lag time was properly input into the hydrologic model. We have revised the PBS report accordingly, but correcting the typo does not change the result of our analysis.

2. **Kellington goes on to claim that the hydrologic model is undermined by the choice of calibration watersheds, providing unit discharges for two of the calibration watersheds (140 cfs per square mile and 154 cfs per square mile for Butte and Tualatin Creeks, respectively)**

Kellington has utilized unit discharge as reasoning to support the implication that a "whopping" 249 cfs per square mile is out of the realm of possibility. What Kellington selectively omits is that the gage statistics for the third calibration watershed (Scoggins Creek) indicate that its 100-year peak unit discharge for that gage is over 230 cfs per square mile, which is very similar to that estimated for the Baker Creek watershed.

Unit discharges are not a reliable way to compare watersheds in isolation. Unit discharge is ultimately influenced by a number of factors, including watershed geometry, soil types, and land cover types. One reason for higher unit discharge occurring in the Baker Creek watershed than in the Tualatin and Butte watersheds is that the calculated curve number parameter is higher than in the other watersheds, which results in a greater volume of runoff from the surfaces in the watershed. It stands out that a watershed with more similar size and calculated curve number parameter, all included in the report, has very similar unit discharge to Baker Creek.

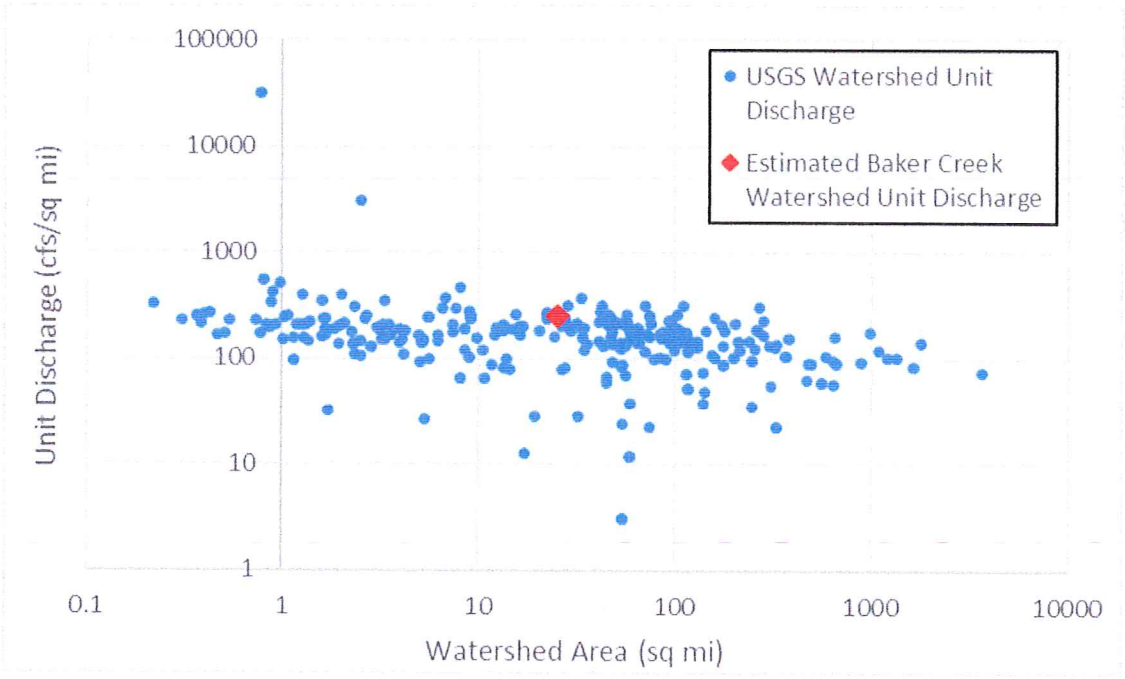
Choice of calibration watersheds is based on a number of factors, including:

a. Watershed Area
b. Watershed Geometry

c. Soil and Land Use Make-up
d. Location in relation to the study watershed

Ideally, these factors are all the same in the calibration watershed as in the study watershed. However, each watershed is unique and this is almost never the case – there simply aren't enough stream gages present to support an ideal analysis. These factors must be balanced by a qualified Engineer when such analysis is performed.[1] Adjustments in the PBS report to curve numbers were based on the watersheds sharing the greatest similarity balanced with proximity to Baker Creek; however, no two watersheds are completely alike.

This is most easily observed using a study of Western Oregon watersheds by the USGS, in which the regression equations for flow estimates in ungaged watersheds are based. 100-year flows and watershed areas extracted from that study, placed on a log-log plot show that the estimated Baker Creek unit discharge is not an obvious outlier from watersheds of similar size:

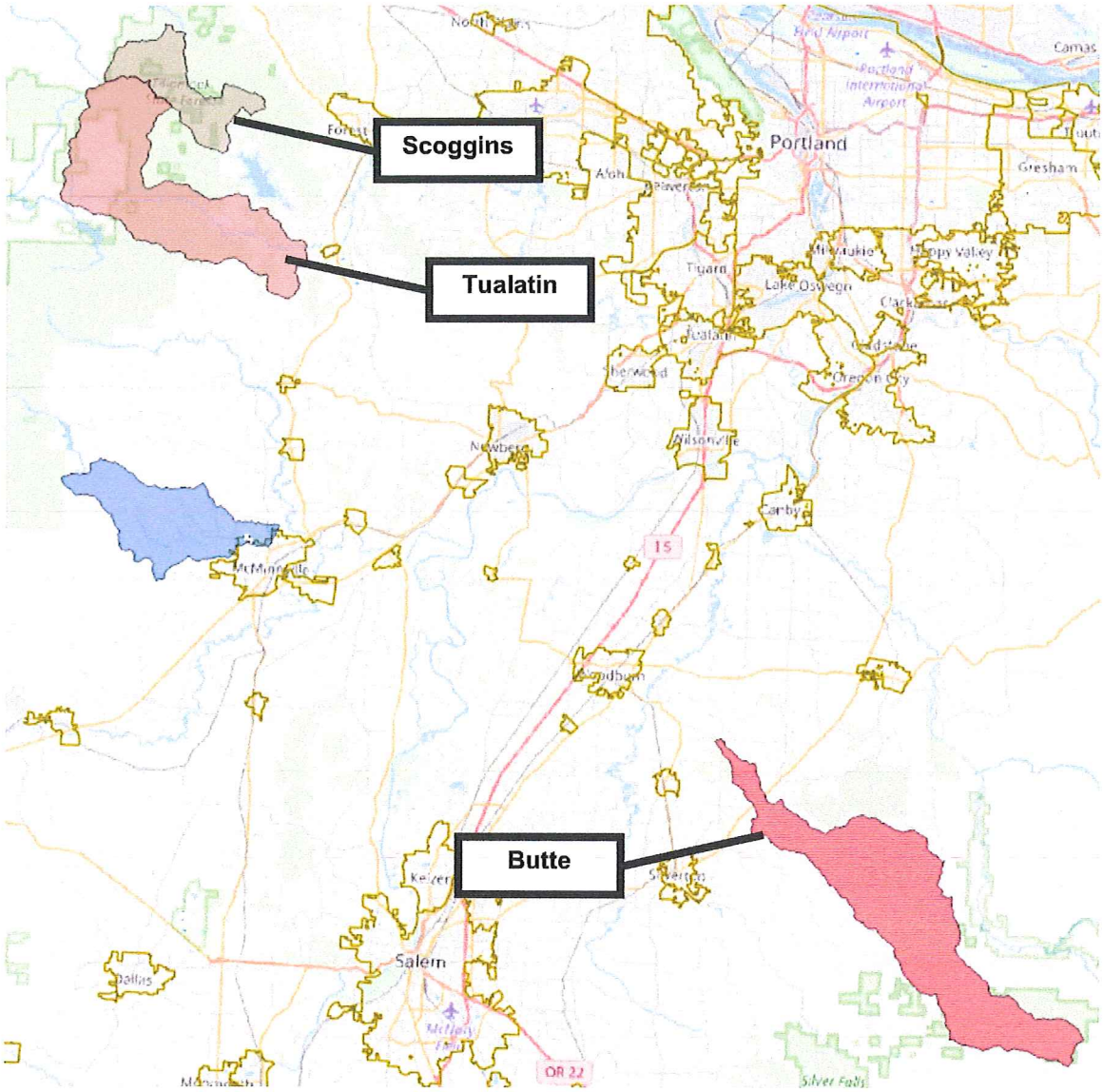


The calibration is founded on adjustment of the Curve Number according to the soil conditions and land uses present in the watershed. Curve number adjustment is therefore primarily based on the watershed with the closest physical properties (reference Table 10 and 11) and proximity. Even for a watershed with similar unit discharge (Scoggins), the curve number adjustment required to achieve a match to the 100-year gage statistic for peak flow is greater than that required for the other two watersheds.

If curve number adjustment were performed based on similar unit discharge alone, the result would actually have been higher peak discharge for Baker Creek. However, greater weight was given to the watersheds with more similar soil properties. This is an exercise of engineering judgment, based on experience calibrating Curve Number methodology.

[1] It is worht noting that Ms. Kellington is an attorney – not an engineer – and provides no basis to believe that she had the training or qualifications to undertake any such judgments or analysis. It is worth noting that the applicant has retained an engineer, but that engineer either did not perform the analysis, or was unwilling to put his name on the arguments made by Ms. Kellington.

For reference, a figure of the watersheds is provided below.



This leaves a multitude of reasons that the Baker Creek unit discharge is higher than the calibration watersheds, none of which have anything to do with improper calibration of curve number values. The most obvious reason is a higher curve number due to the presence of larger concentrations of Type C/D soils and somewhat more urbanization and agricultural uses, as well as a far more complex geometry. Baker Creek also has a relatively large northern branch (drainage area 3) coming to a confluence with flows from drainage areas 1 and 2. This lends itself to a somewhat different aspect ratio from the calibration watersheds, which do not have a significant tributary branch.

If every gaged watershed were eliminated from consideration in a calibration on the foundation of Kellington's assertions of dissimilarity of unit discharge, no calibration would be possible. Again, the arguments in Kellington's letter provides no reason for PBS to change the conclusions in its report.

3. **Kellington notes that the hydraulic model relies exclusively upon LiDAR data and that the "*Date of the LiDAR data used is not revealed – it could have been from spring or winter when the stream channel was full of water.*" Kellington also indicates that the report's "*point of beginning – the capacity of the channel to handle storm water – is faulty.*" The response further notes that the channel survey result came in May 15, 2019. Kellington makes the assertion that the "*discharge capacity within the channel could be as much as 500 to 1,000 cfs greater than what the...hydraulic model indicates*".**

   Although there is no requirement to include the date of the LiDAR data, the LiDAR dataset utilized in the study is the 2012 Tillmaook-Yamhill Bare Earth returns, collected between September 23rd and October 5th, 2012 (Full LiDAR metadata is available on the DOGAMI website). The assertion that the report's "point of beginning" is an analysis of the capacity of the channel is, once again, a misrepresentation of the purpose of this report. The report is, after all, a *Hydrology Study,* with an ancillary Hydraulics element to it. Kellington's assertion that the conclusions of this impact analysis are "fallacious" is unwarranted and incorrect, constituting a misrepresentation of the purpose of the hydraulic modeling, and demonstrating that these analyses should be left to qualified engineers. The LiDAR data was used primarily as an impact analysis tool in this report and was found to be the best available information at the time that the study was performed. Regardless of the water surface elevations present in the channel, if an activity is going to have an impact on this hydraulic model, the nature of that impact (increase or decrease) will remain the same regardless of the ground surface inputs.

   PBS understands that LiDAR accuracy is susceptible to water surface elevations; however, no better elevation data was available at the time of the study that might have improved accuracy.[2] Without survey data, one could also assume that geomorphological processes have had an impact on the creek in the 40 years since the FIS was published. Contrary to the assertion in the Kellington letter, observation of the LiDAR cross sections did not show an unnaturally flat channel bottom that would indicate water surface interference. The channel centerline utilized in this study does not match the FEMA channel centerline, so morphological change couldn't be placed out of the realm of possibility.

   Kellington also provides testimony of ground surface difference that provides neither reference to locations nor figures to support their evaluation of the LiDAR data. The Kellington letter further never provides the datum of the elevations to which they are comparing the LiDAR.

   In any case, PBS would not, and did not, base a LOMR application on unverified topographical data. LiDAR, for the purposes of this study, was used merely to illustrate the potential differences in water surface elevations from the published BFEs due to development and agricultural activity in the watershed, and to identify the potential for flood risk outside of the effective floodplains. This report does not claim to support a LOMR, and it does not propose new flood hazard areas. The report explicitly notes that, if a LOMR application were performed, hydraulic structures should also be added to the modeling to ensure compliance with FEMA's modeling requirements (reference to Section 4.1.3).

   Setting aside the accuracy of the topography, Kellington has provided testimony on channel capacity, stating that "*the discharge capacity within the channel could be as much as 500 to 1,000 cfs more than what the opponents' hydraulic model indicates.*" No numerical support has been provided for this estimate, nor are any documents or credentials cited that back Kellington's assertion regarding the channel capacity.

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[2] Frankly, this only highlights to the PBS Report's ultimate conclusion that the City's current flood insurance maps are outdated and are in desparate need of revision.

Looking at the FIS independent of any ground surface data, the estimated 500-year flow is 2,400 cfs, which is only 370 cfs greater than the published 100-year flow rate. Zone X areas noted as areas of 0.2% chance (500-year) flood risk have clearly extended beyond the channel's banks. Based on this information, it is reasonable to state that the peak 100-year flow rate estimated by the PBS Report would extend flood hazard areas beyond the banks of the Creek. Such a vast increase in flow from the effective FIS, which clearly didn't take into account the complexity of the watershed geometry in its blind use of regression statistics, supports the conclusion of the PBS Report that the FEMA effective mapping is not reflective of current watershed conditions and the City's flood insurance maps are in need of updating.

4. **Kellington notes that Lake Oswego rain gage data was used to provide an evaluation of the hydraulic model's performance.**

   Kellington notes that the report relies for verification on anecdotal photographs that are undated and could have been taken at any time. Kellington states that this *"can't be accurate"* on the grounds that the *"largest 24-hour storm event in November 2015 had a total rainfall for McMinnville airport of 1.53 inches, which is unlikely to be enough rainfall to cause [this] kind of flooding."*

   The Lake Oswego Gage was originally used in the analysis because at the time, data downloads from the CDO website were not working due to server errors. The cause of these errors is not known. Since the report was issued, PBS has been able to download data from the NOAA CDO website.

   Since the report was issued, residents have also clarified what dates their photos were taken and provided metadata for the photo files supporting clarification to the model verifications. The year of the photos in the PBS report were reversed, Figure 16 in the report was an observation of flooding during a December 7, 2015 rainfall event, while Figure 17 was taken during a December 18, 2018 rainfall event. These dates have been clarified in the attached revised report.

   Kellington's evaluation far oversimplifies the complexity of both storm events and watershed response, citing 24-hour rainfall totals and making the claim solely based on those values that flooding is unlikely. The rainfall depth cited must be taken at face value in that it was taken at a single point in a 25 square mile watershed and does not provide a sub-24-hour duration analysis. A real storm event that brings 1.53 inches of precipitation over 24 hours at McMinnville airport can include a single hour that includes the vast majority of that 24-hour total. A single one-hour precipitation total can also bring "10-year" rainfall at one point in a watershed and "25-year" rainfall totals in another.

   Hydrologic analyses such as that presented in the PBS Report are based on balanced, synthetic storm events that assume that a storm is not varying in its return period throughout its duration. While these are referred to as "24-hour storm events", that synthetic storm event includes a 2-year, 1-hour rainfall total, a 2-year, 6-hour rainfall total, and so on. In reality, a single hour of that event in isolation, due to its high intensity, could be capable of causing flooding regardless of the surrounding hourly rainfall.

   Observation of the McMinnville Airport gage data on December 18, 2018 shows a single hour from approximately 11 AM to 12 PM that recorded 0.68 inches of rainfall. A 2-year, 1-hour rainfall total based on the ODOT precipitation GIS grid and a NOAA Type 1A storm distribution is about 0.70 inches in depth.

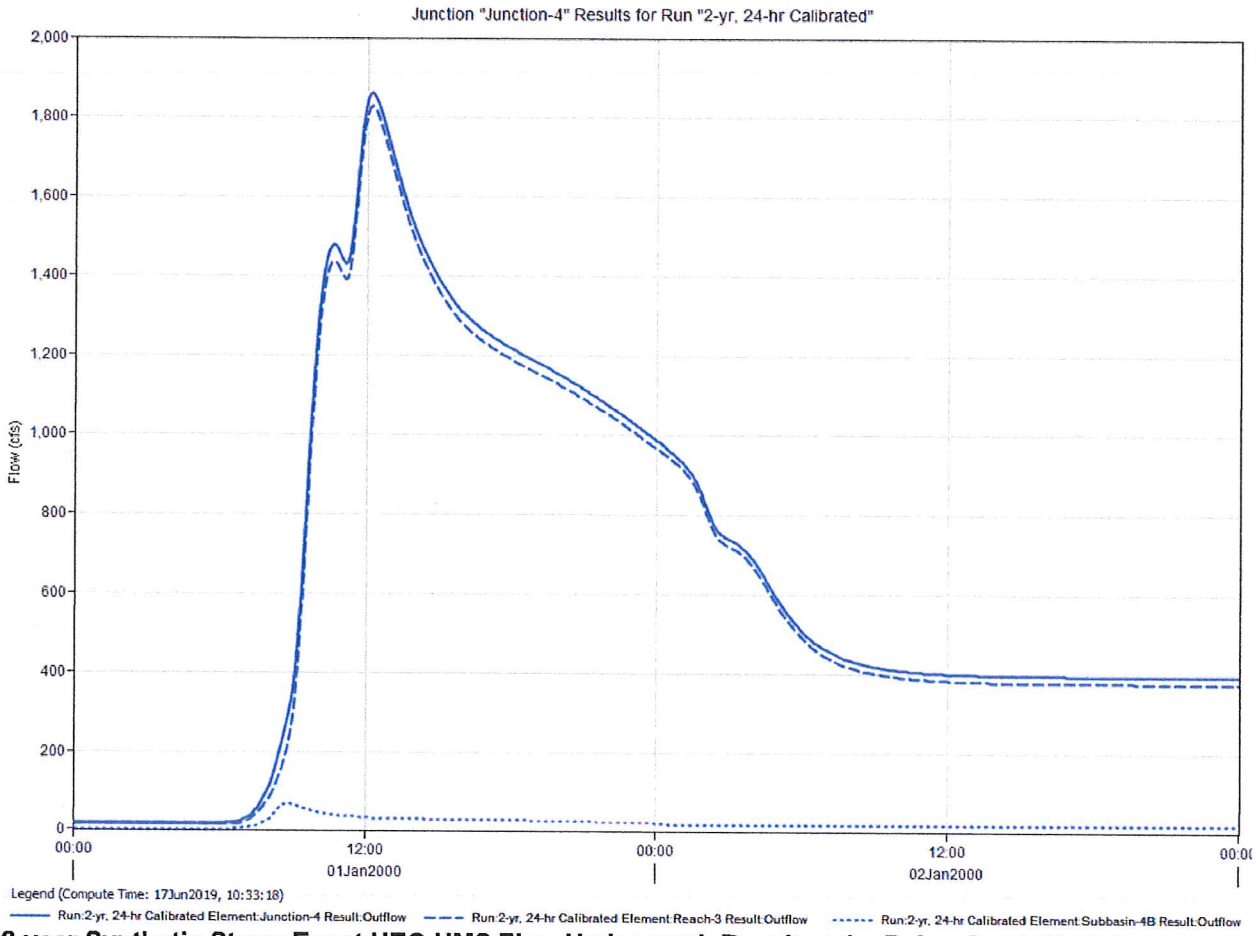
   On December 7, 2015, 6- and 12-hour rainfall totals at the Airport gage registered 1.11 inches and 1.99 inches, respectively. Based on the same ODOT data, 2-year, 6-hour and 2-year, 12-hour

events produce approximately 1.39 and 1.83 inches of rainfall, respectively, on the Type 1A distribution used in the analysis.

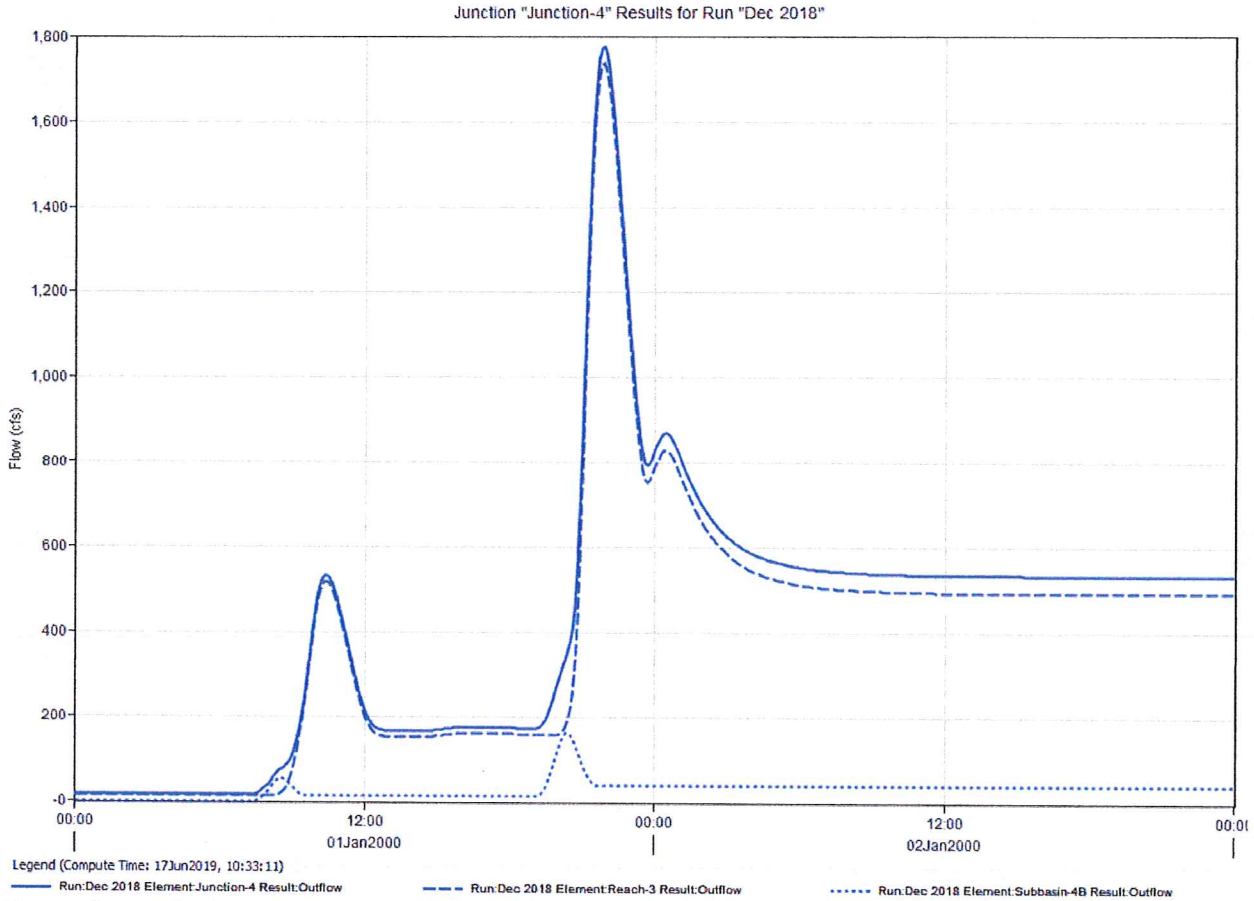
While the 24-hour rainfall totals for both flooding events may not have registered as a 2-year return period, sub-durations that would produce the bulk of a balanced 24-hour storm used in modeling did reach that level.

In order to illustrate this possibility, 1-hour precipitation readings from the McMinnville Airport gage for December 18, 2018 were input into the HEC-HMS hydrology model in order to roughly estimate peak flow produced by the watershed. The figures below provide the 2-year result first for a synthetic, Type 1A storm event, then for the December 18, 2018 event. This result indicates that peak flow values at the watershed's point of concentration from the two models fall within approximately 5% of one another.

While PBS recognizes that running precipitation data from a single point through the model may not represent the spatial distribution of the actual storm event, this exemplifies the reason that one cannot discount the possibility that these two events could cause overtopping of Baker Creek's banks.



2-year Synthetic Storm Event HEC-HMS Flow Hydrograph Result at the Baker Creek Model's Point of Concentration (Peak Flow ~1,860 cfs).



December 2018 Rainfall Event HEC-HMS Model Result (Peak Flow ~1,780 cfs).

What Kellington further does not acknowledge is that these photos, regardless of their exact dates, provide clear and specific evidence that flood waters encroached into areas beyond the 100-year FEMA-defined special flood hazard areas.

In sum, the Kellington's testimony does not impact the conclusions of the PBS Report, as the comments on the analysis were based on a typographical error that did not affect the accuracy of the model and the omission of data presented in the report to support their claims. Kellington's evaluation of the Hydraulic model as if it was intended to provide anything but an illustration of potential floodplain impacts is a misrepresentation of the intent of this report, which is to show that the currently effective FEMA study does not accurately depict the current extent of the floodplain.

We acknowledge that the typographical error in the report may have been the cause of some confusion in the interpretation of the Hydrologic analysis; accordingly, we have provided with this letter a revised copy of the report correcting this error, as well as providing a citation of the LiDAR dataset used and more specific photo dates and local rainfall data. Most importantly, our conclusions have not changed – it appears possible that a portion of the development proposed could lie within the 100-year floodplain based on modern modelling methods and statistics, and the effective flood insurance maps need to be updated.

Please feel free to contact me at 360.567.2105 or justin.maynard@pbsusa.com with any questions or comments.

Sincerely,

Justin Maynard
Civil/Water Resources Engineer

Attachments:
Kellington Law Group Testimony
Revised Hydrology Report