Water Solutions
Certainty in Water

Report to

GRANTHAM FLOODS COMMISSION OF INQUIRY

on

EXPERT HYDROLOGY REPORT 10 JANUARY 2011 FLOOD

CIRCUMSTANCES AND CONTRIBUTING FACTORS

SUPPLEMENTARY MATERIAL

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Water Solutions
Certainty in Water

Grantham Floods Commission of Inquiry
Expert Hydrology Report 10 January 2011 Flood Circumstances and Contributing Factors (Supplementary Material)

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Engineering Excellence Award 2003 WINNER Queensland Division

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1 Scope of Additional Material

1. This document should be read as an addendum to my main report, Document Number WS150262 Rev 0, dated 11 August 2015.

2. I have prepared additional GFCOI model simulation analyses for the following scenarios:

   - Most Likely (greatest delay): Most Likely scenario, but with Western Levee failure initiation when flood levels at Trigger D reach 126.4mAHD (that is, the same failure initiation trigger as for the Worst Case (greatest delay) scenario, or at a simulated time of 3:59pm), plus a fast failure duration (5 seconds);
   - Most Likely (worst case delay): Most Likely scenario, but with Western Levee failure initiation at time 4:16pm (that is, the time of Western Levee failure initiation for the Worst Case (greatest delay) scenario), plus a fast failure duration (5 seconds);
   - No Levee: Most Likely scenario, but with all bunds and spoil piles associated with the Grantham Quarry removed (that is, the pre-quarry surface topography but with the quarry pit remaining exactly as per the August 2010 LIDAR survey);
   - 1996 With Quarry: Most Likely scenario with the Lockyer Creek flood hydrograph replaced with the May 1996 hydrograph recorded at the DNRM Helidon Gauging Station (please note this scenario is indicative only as other hydrology inputs, such as Monkey Water Holes, Flagstone Creek, Ma Ma Creek and Sandy Creek, have not been changed from those inflows for the 10th January 2011 flood); and
   - 1996 No Quarry: No Quarry scenario with the Lockyer Creek flood hydrograph replaced with the May 1996 hydrograph recorded at the DNRM Helidon Gauging Station (please note this scenario is indicative only as other hydrology inputs, such as Monkey Water Holes, Flagstone Creek, Ma Ma Creek and Sandy Creek, have not been changed from those inflows for the 10th January 2011 flood).

3. In conjunction with this report I have provided separately, movie files that present animation of complete simulation outputs for:

   - the extent of inundation;
   - flow intensity;
   - velocity direction; and
   - velocity magnitude.

4. These simulation sequences cover:

   - 2011 Flood: the period 12pm to 8 pm on the 10th January 2011 (8 hours); and
   - 1996 Flood: the period 12pm 2nd May 1996 to 4pm 3rd May 1996 (28 hours).

5. The movie files have been produced with a time-step of 1 minute. The file names and descriptions are listed in Table 1.1 below.

Table 1.1 – Simulation Movie Files

File Name	Contents
GFCOI_ML_Delay359_FF_Jan_2011.avi	Most Likely (greatest delay) case, levee failure at 3:59pm
GFCOI_ML_Delay416_FF_Jan_2011.avi	Most Likely (worst case delay) case, levee failure at 4:16pm
GFCOI_No_Levee_Jan_2011.avi	Most Likely case, with all bunds and spoil removed (pit remains)
GFCOI_With_Quarry_May_1996.mov	Most Likely case for an approximated May 1996 flood
GFCOI_No_Quarry_May_1996.mov	Pre-quarry case for an approximated May 1996 flood

1.1 Reference Locations

6. I have established the likely effects on flooding in Grantham using two indicator methods:

- comparison of time-series of simulated flood flow rates, at the downstream locations marked in Figure 1.1; and
- comparison of depth and flow intensity hydrographs, at the locations marked in Figure 1.2.

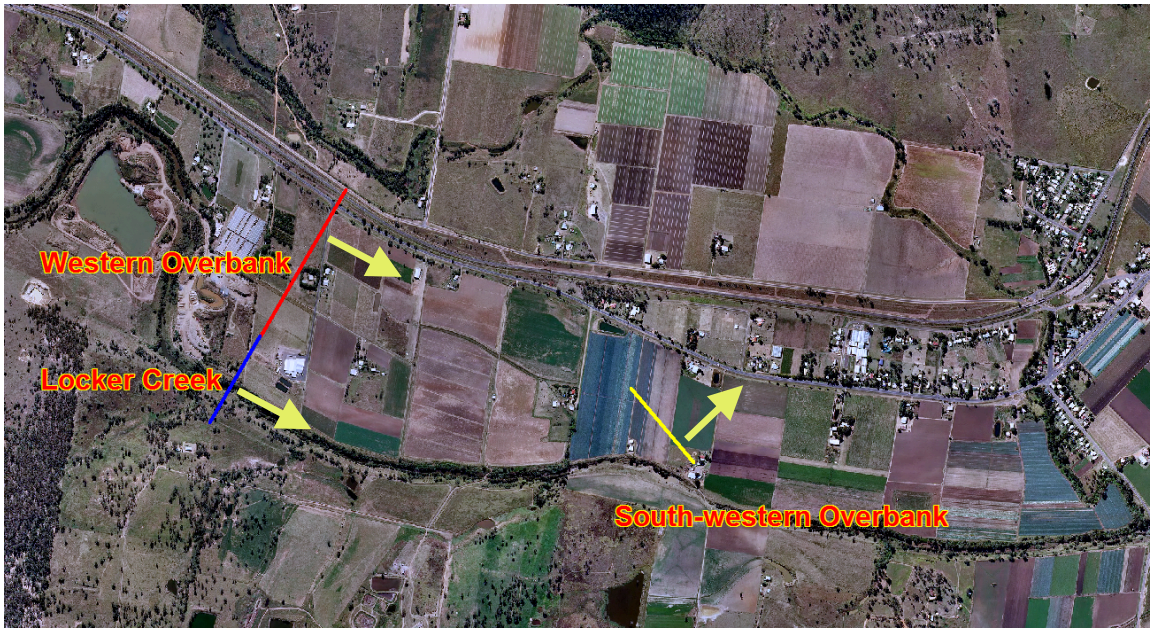


Figure 1.1 – Downstream Reporting Locations

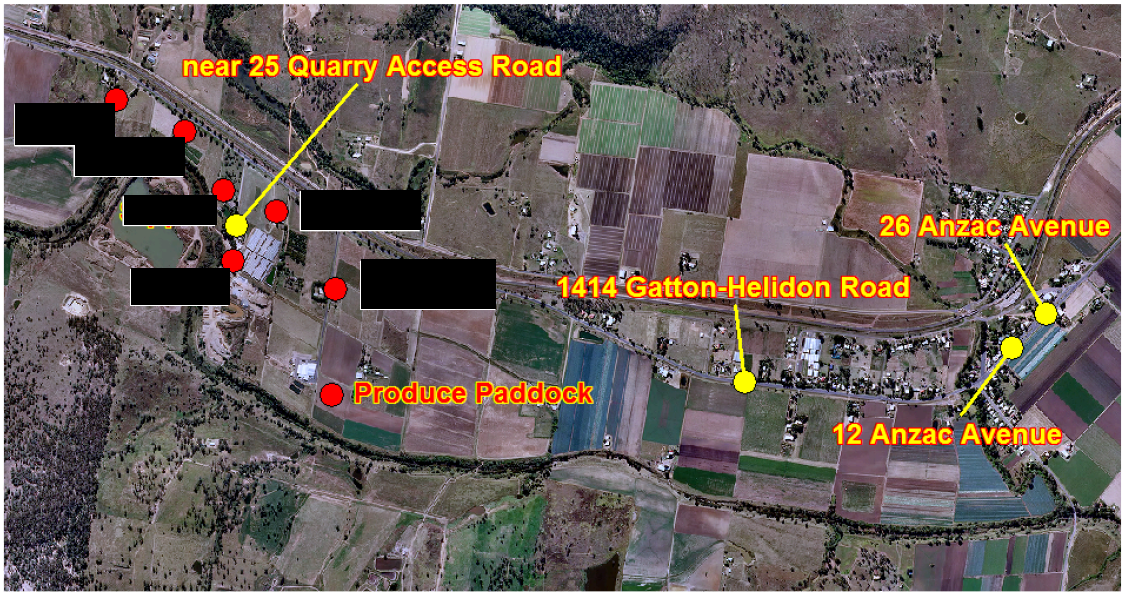


Figure 1.2 – Flow Depth and Intensity Hydrograph Locations

7. I have selected the downstream reporting locations marked in Figure 1.1 for the same reasons I gave in my main report.

8. I have selected the flow hydrograph reporting locations indicated in Figure 1.2 because they give representative coverage of depth and flow intensity measurements within and around the Grantham Quarry. Depth and flow intensity measurements are good indicators for the quantification of flood hazard.

1.2 Downstream Flow Reporting

9. Following are outcomes of the simulated flood hydrographs from the GFCOI model for:

- Most Likely (greatest delay) scenario, Figure 1.3;
- Most Likely (worst case delay) scenario, Figure 1.4;
- No Levee scenario, Figure 1.5; and
- 1996 With and Without Quarry Scenarios, Figure 1.6.

10. For comparison, I have overlaid on each figure simulation outcomes from the No Quarry and Most Likely scenarios.

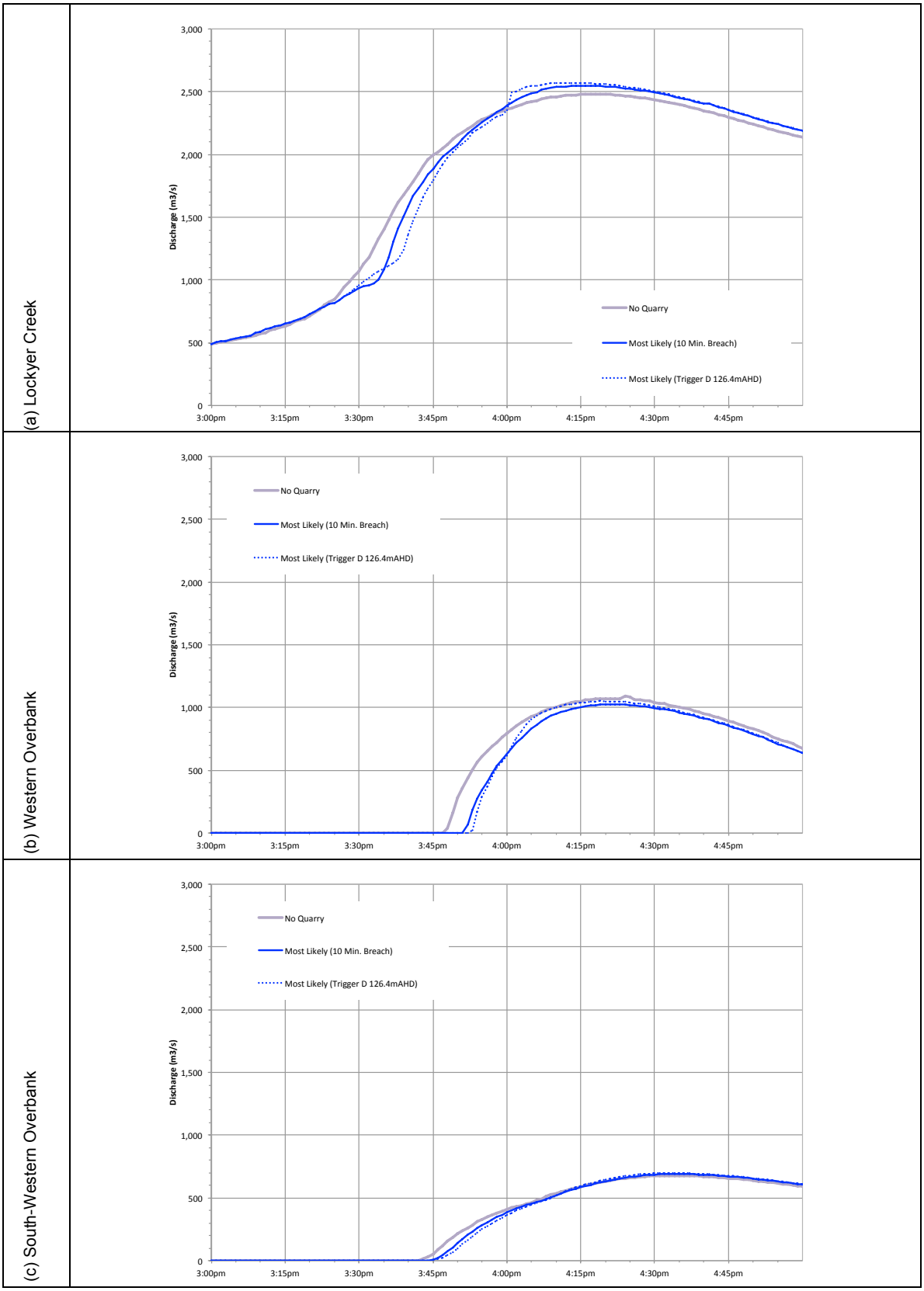


Figure 1.3 – Effect of Delayed Quarry Levee Failure (3:59pm) on Downstream Flow

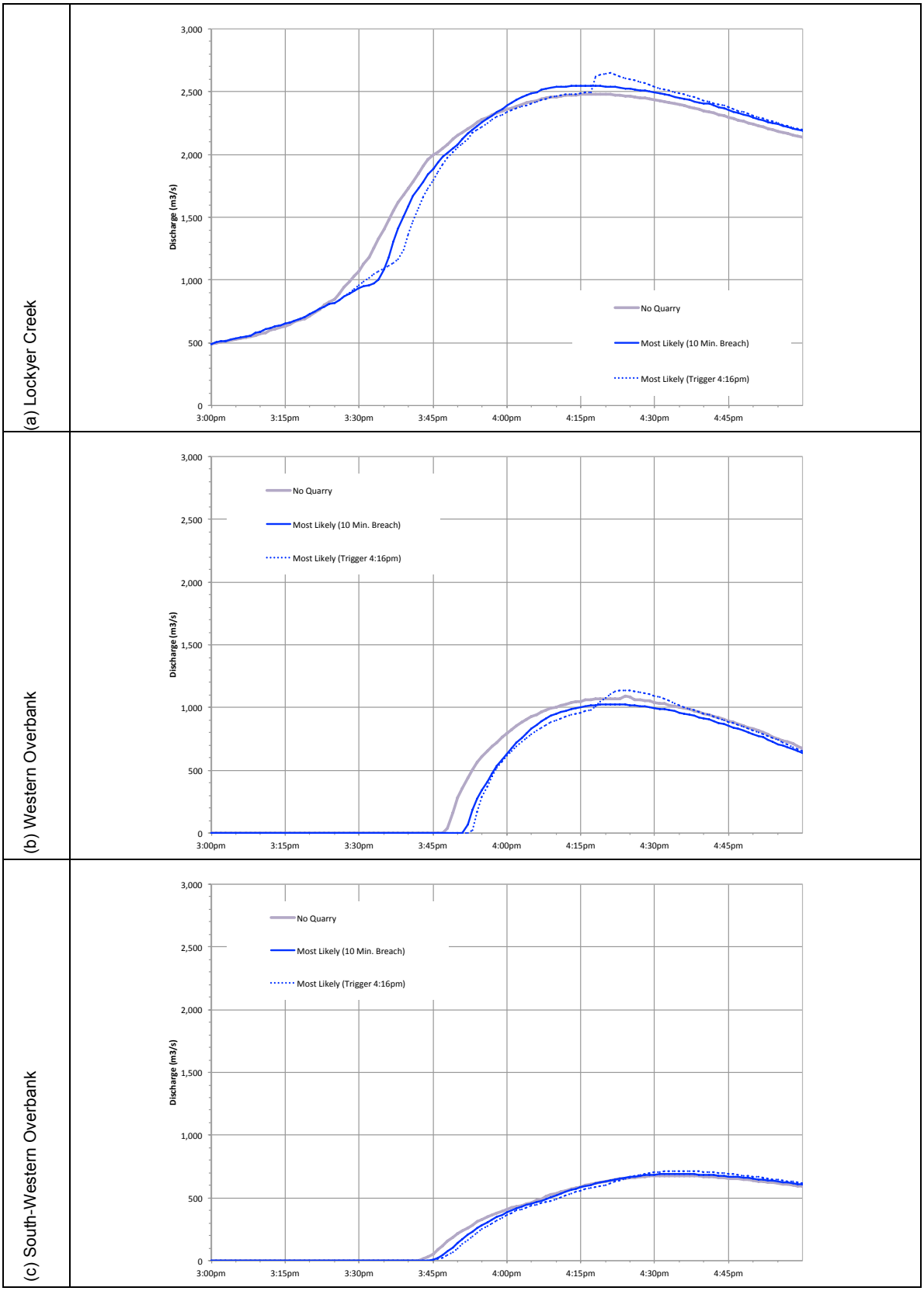


Figure 1.4 – Effect of Delayed Quarry Levee Failure (4:16pm) on Downstream Flow

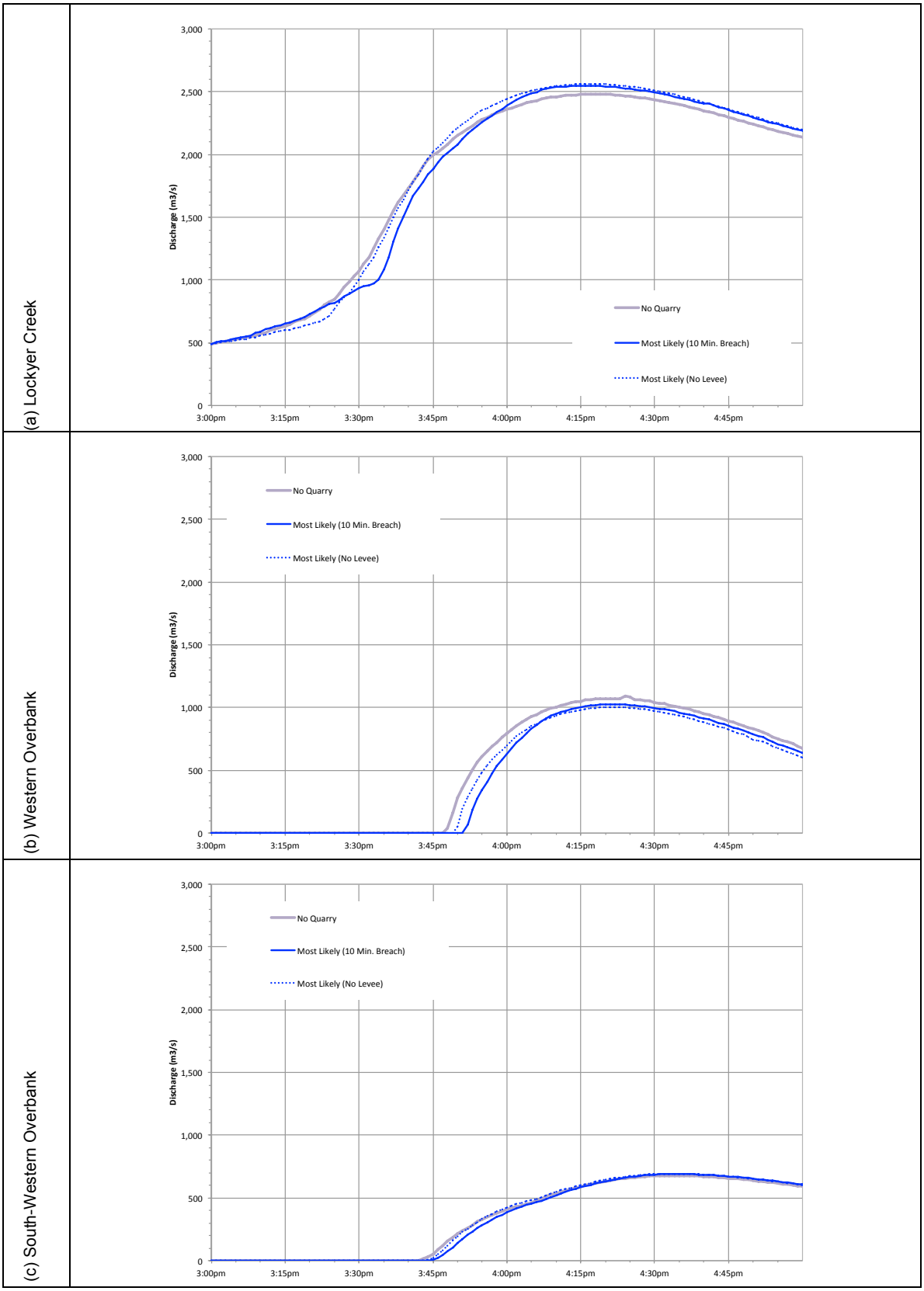
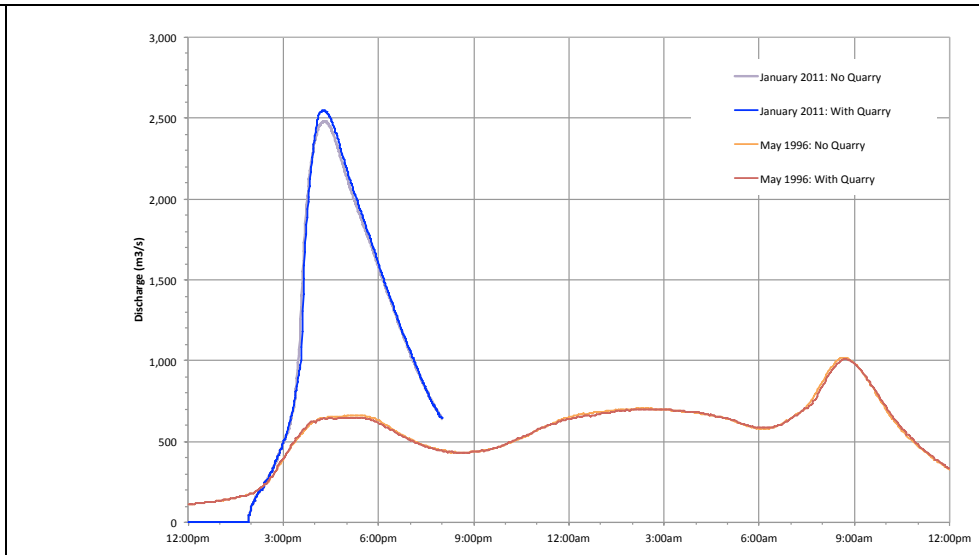
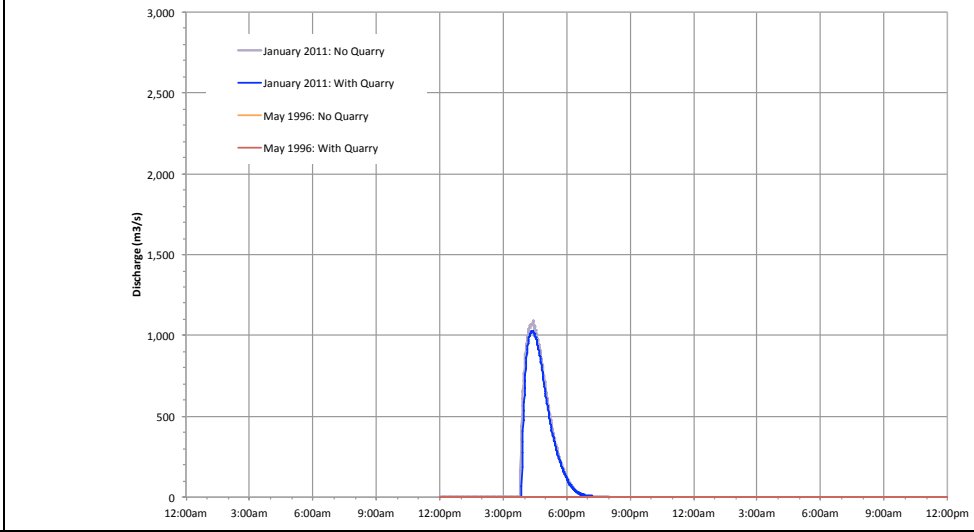


Figure 1.5 – Effect of No Quarry Levee on Downstream Flow

(a) Lockyer Creek



(b) Western Overbank



(c) South-Western Overbank

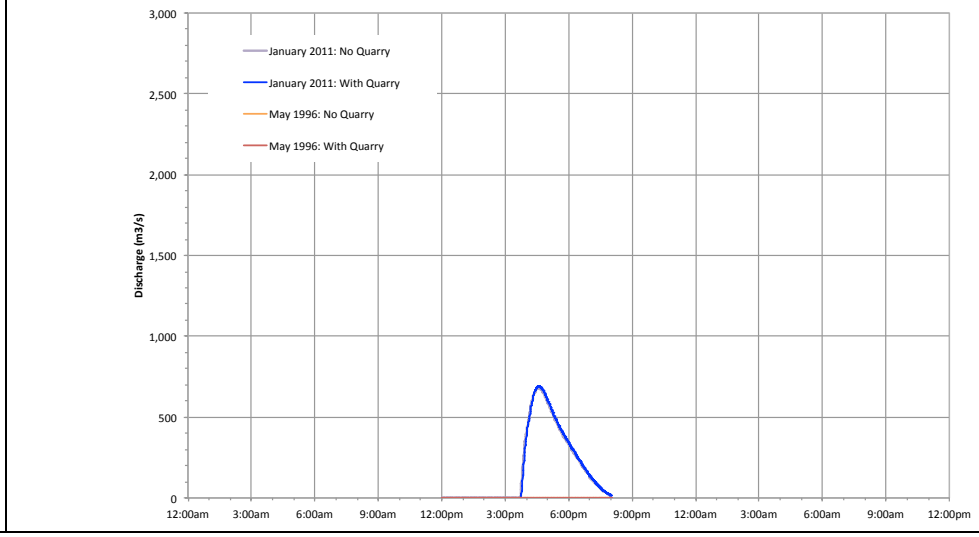


Figure 1.6 – Effect of May 1996 Flood on Downstream Flow

1.3 Flow Depth and Intensity

11. Following are outcomes of simulated flow depth and intensity from the GFCOI model at selected locations shown on Figure 1.2:

- Most Likely (greatest delay):

  Four previously used reference points:

  - (near 25) Quarry Access Road, Figure 1.7;
  - 1414 Gatton-Helidon Road, Figure 1.8;
  - 12 Anzac Avenue, Figure 1.9; and
  - 26 Anzac Avenue, Figure 1.10.

  Seven additional reference points:

  - Ryman: near the Ryman's residence, Figure 1.11;
  - Mallon: near the Mallon's residence, Figure 1.12;
  - Sippel: near the Sippel's residence, Figure 1.13;
  - Besley: to the west of the sheds near the Besley's residence, Figure 1.14;
  - Gillespie: near the Gillespie's residence, Figure 1.15;
  - Gallagher: near the Gallagher's residence, Figure 1.16; and
  - Produce Paddock: to the east of the Produce Store, in the paddock, Figure 1.17.

- Most Likely (worst case delay):

  Four previously used reference points:

  - (near 25) Quarry Access Road, Figure 1.18;
  - 1414 Gatton-Helidon Road, Figure 1.19;
  - 12 Anzac Avenue, Figure 1.20; and
  - 26 Anzac Avenue, Figure 1.21.

  Seven additional reference points:

  - Ryman: near the Ryman's residence, Figure 1.22;
  - Mallon: near the Mallon's residence, Figure 1.23;
  - Sippel: near the Sippel's residence, Figure 1.24;
  - Besley: to the west of the sheds near the Besley's residence, Figure 1.25;
  - Gillespie: near the Gillespie's residence, Figure 1.26;
  - Gallagher: near the Gallagher's residence, Figure 1.27; and
  - Produce Paddock: to the east of the Produce Store, in the paddock, Figure 1.28.

- No Levee:

  Four previously used reference points:

  - (near 25) Quarry Access Road, Figure 1.29;
  - 1414 Gatton-Helidon Road, Figure 1.30;
  - 12 Anzac Avenue, Figure 1.31; and
  - 26 Anzac Avenue, Figure 1.32.

Seven additional reference points:

- Ryman: near the Ryman's residence, Figure 1.33;
- Mallon: near the Mallon's residence, Figure 1.34;
- Sippel: near the Sippel's residence, Figure 1.35;
- Besley: to the west of the sheds near the Besley's residence, Figure 1.36;
- Gillespie: near the Gillespie's residence, Figure 1.37;
- Gallagher: near the Gallagher's residence, Figure 1.38; and
- Produce Paddock: to the east of the Produce Store, in the paddock, Figure 1.39.

12. For comparison, I have overlaid on each figure simulation outcomes from the No Quarry and Most Likely scenarios.

Most Likely (greatest delay)

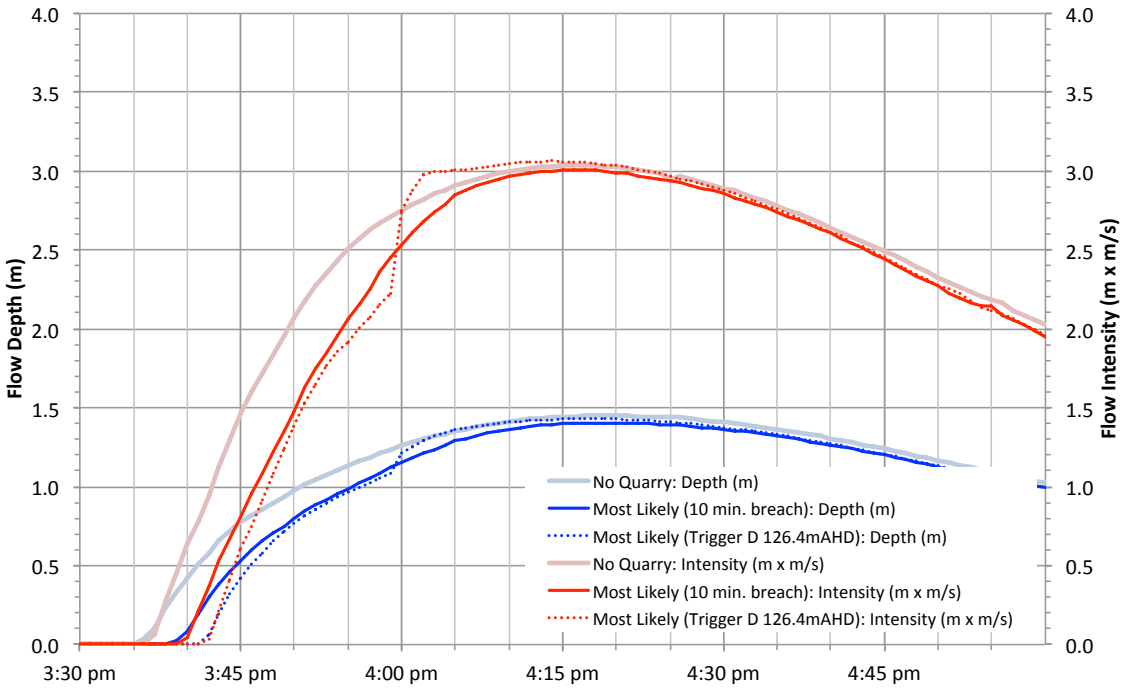


Figure 1.7 – Most Likely (greatest delay): Flow Depth and Intensity at near 25 Quarry Access Road

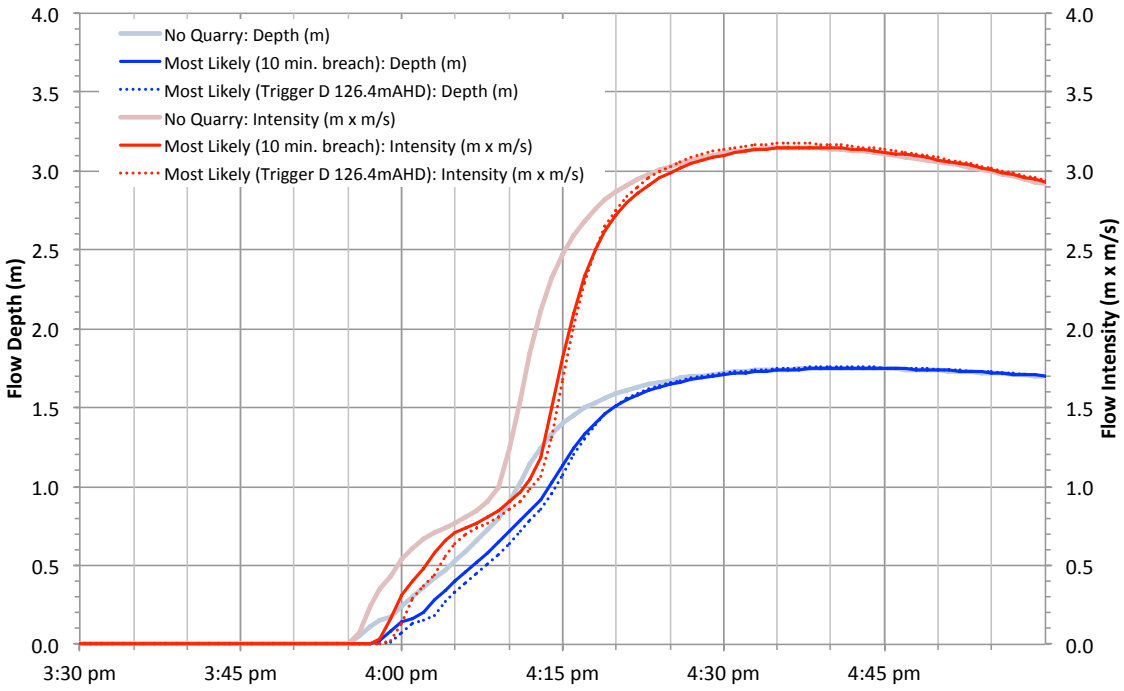


Figure 1.8 – Most Likely (greatest delay): Flow Depth and Intensity at 1414 Gatton-Helidon Road

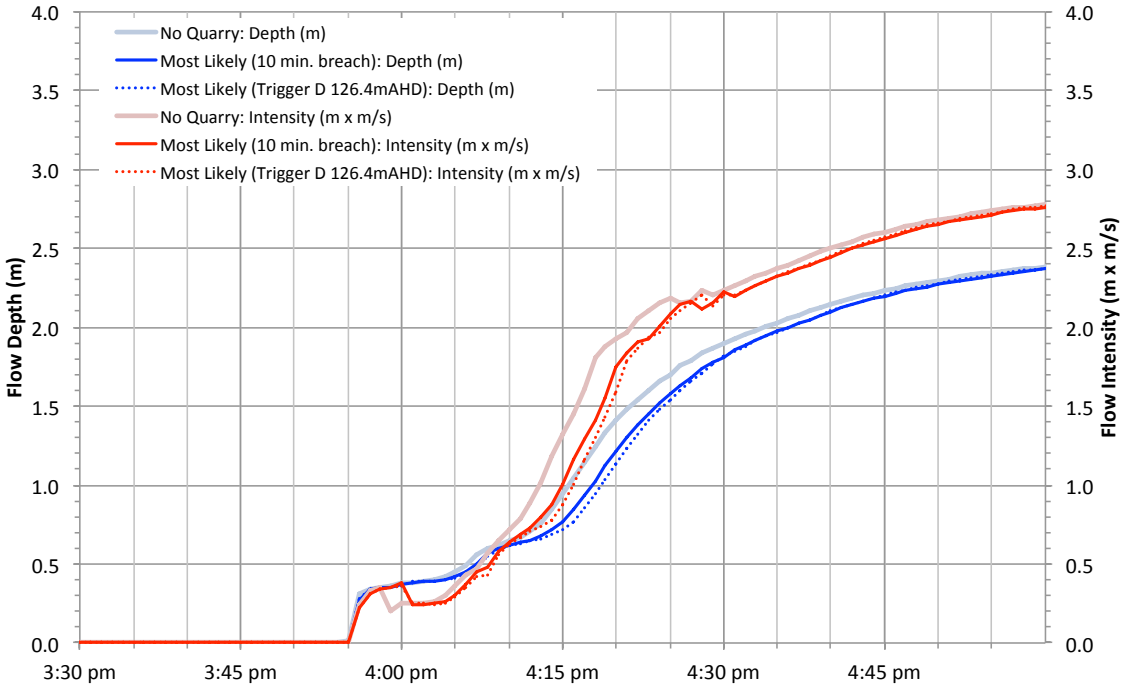


Figure 1.9 – Most Likely (greatest delay): Flow Depth and Intensity at 12 Anzac Avenue

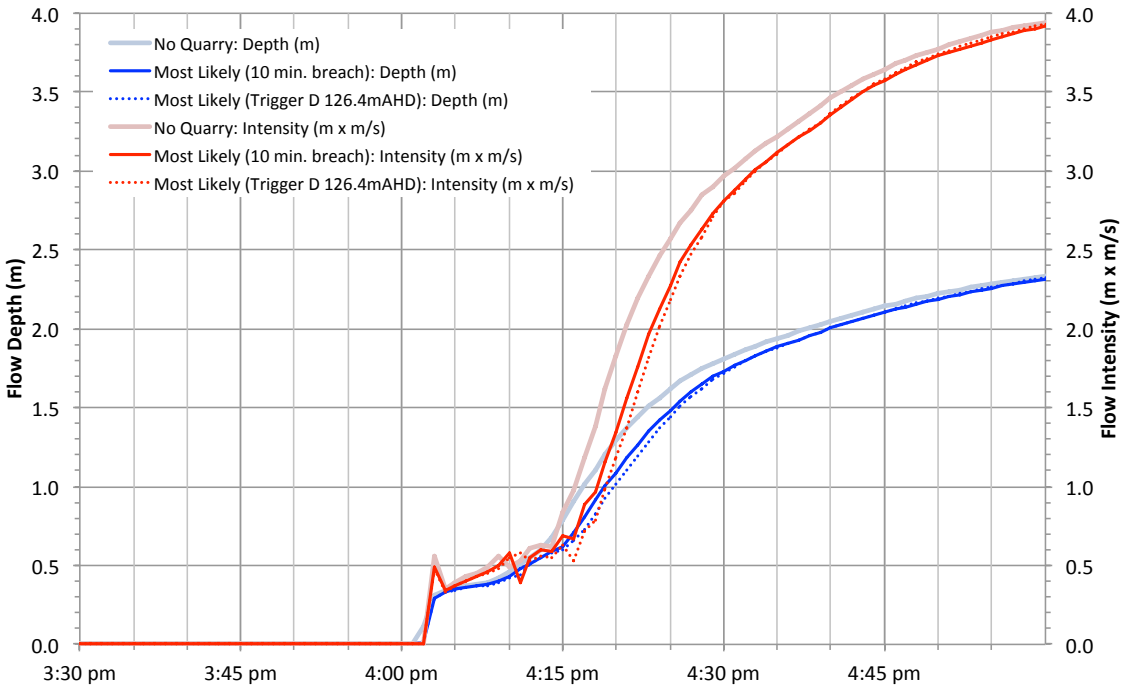


Figure 1.10 – Most Likely (greatest delay): Flow Depth and Intensity at 26 Anzac Avenue

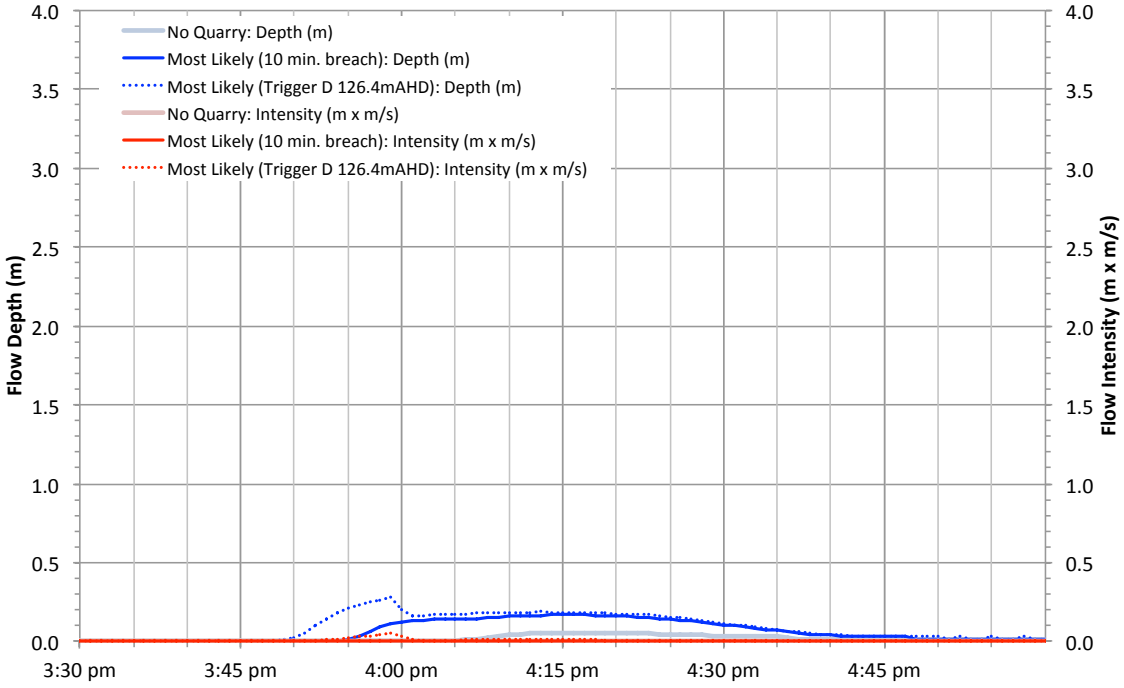


Figure 1.11 – Most Likely (greatest delay): Flow Depth and Intensity at Ryman

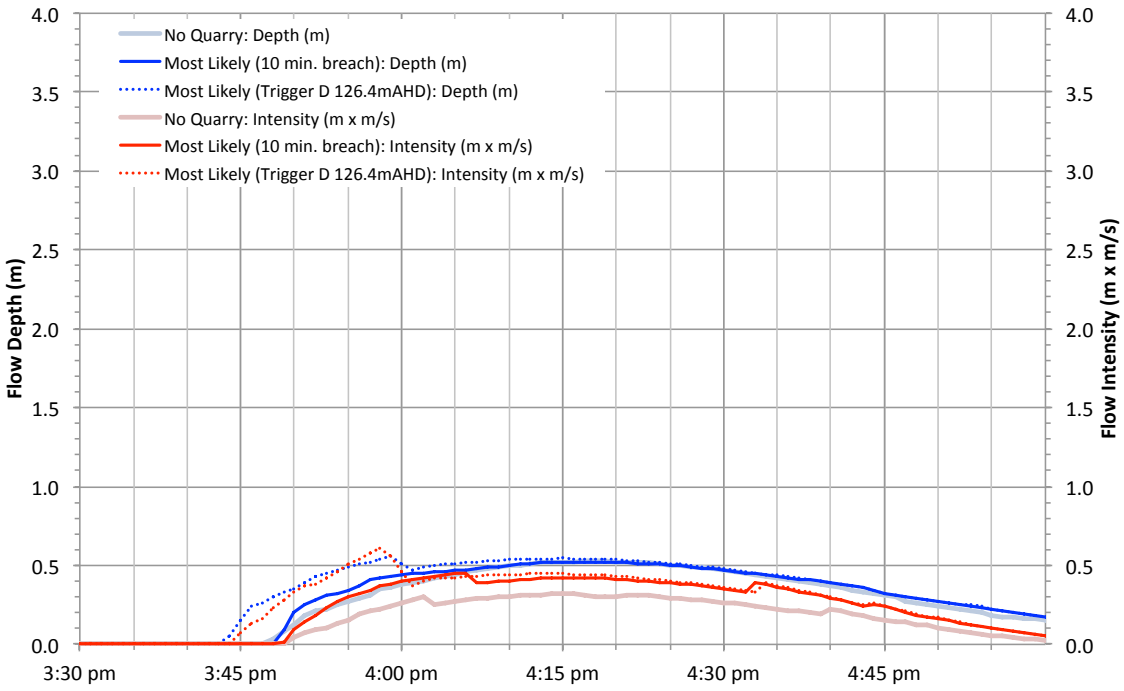


Figure 1.12 – Most Likely (greatest delay): Flow Depth and Intensity at Mallon

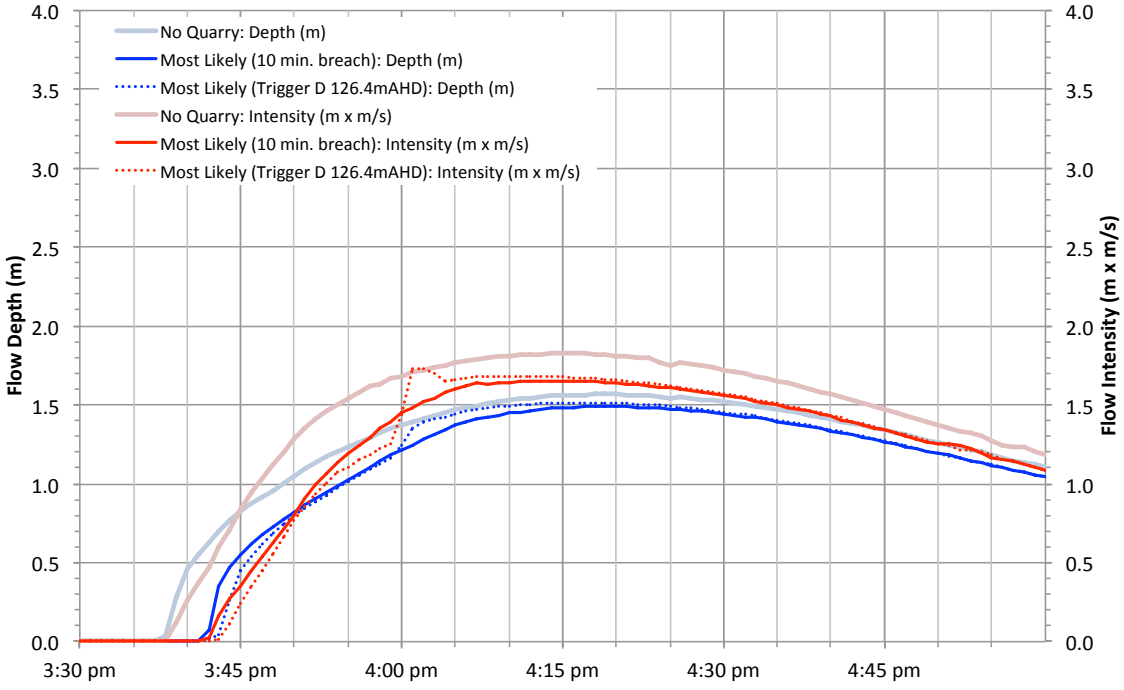


Figure 1.13 – Most Likely (greatest delay): Flow Depth and Intensity at Sippel

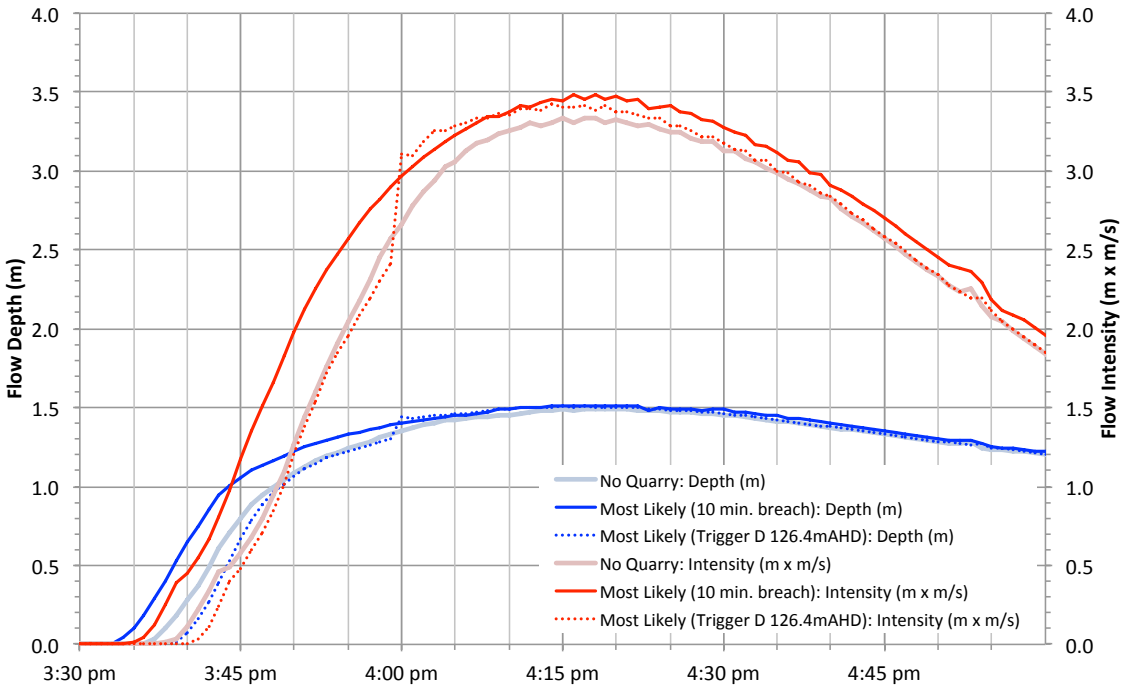


Figure 1.14 – Most Likely (greatest delay): Flow Depth and Intensity at Besley

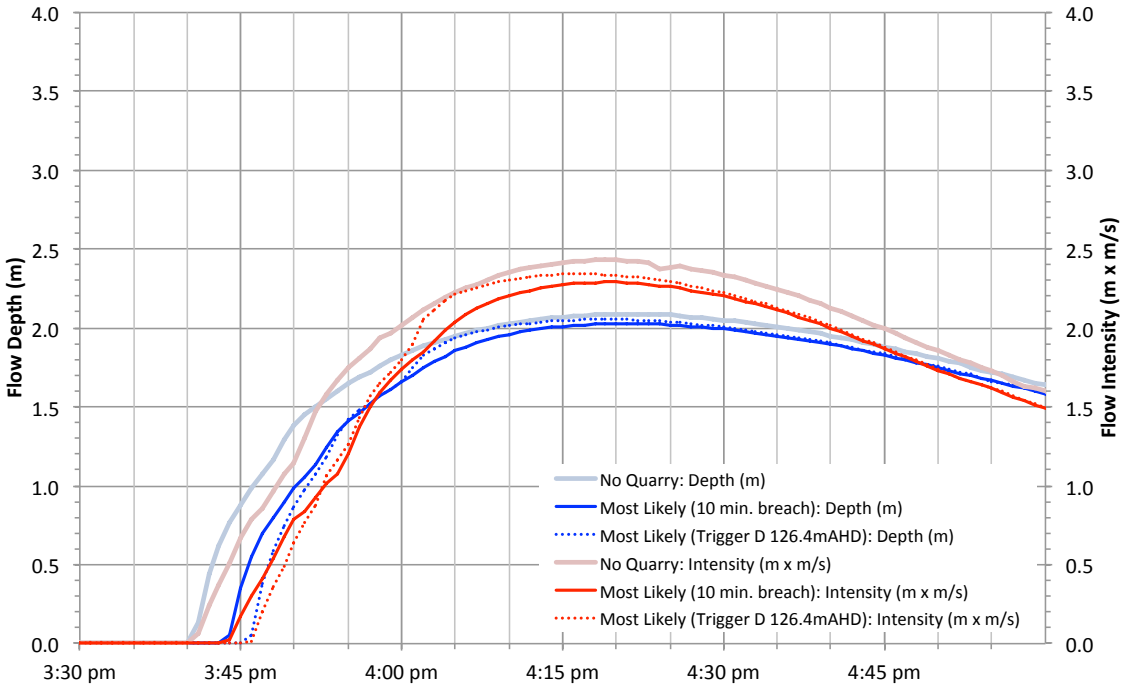


Figure 1.15 – Most Likely (greatest delay): Flow Depth and Intensity at Gillespie

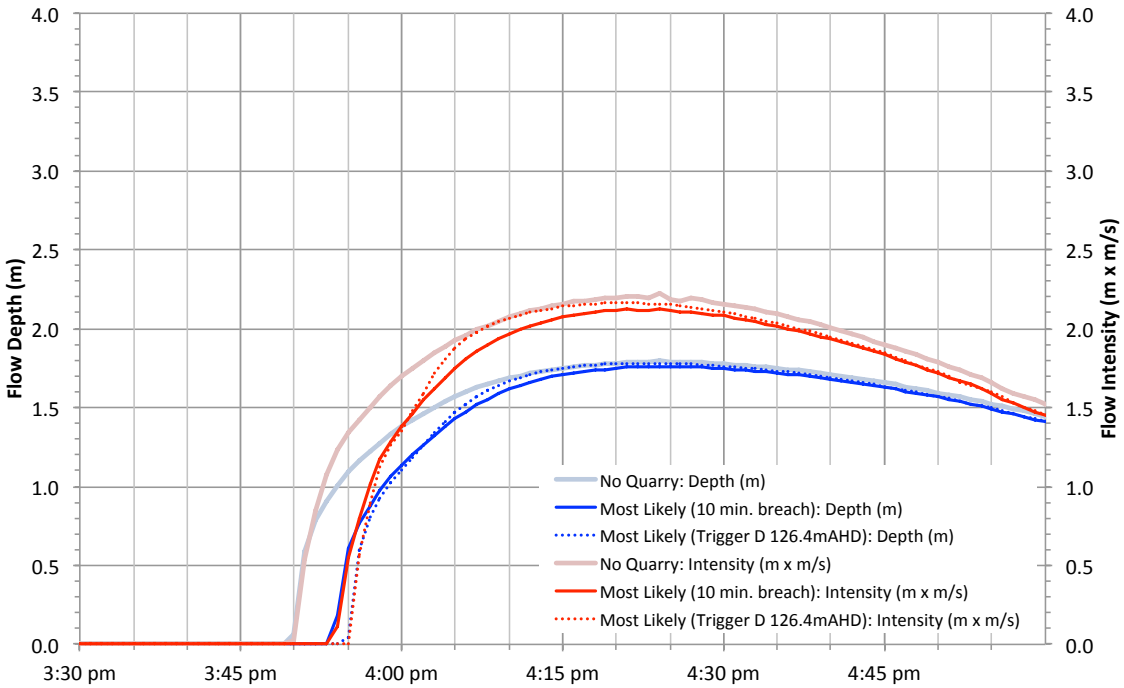


Figure 1.16 – Most Likely (greatest delay): Flow Depth and Intensity at Gallagher

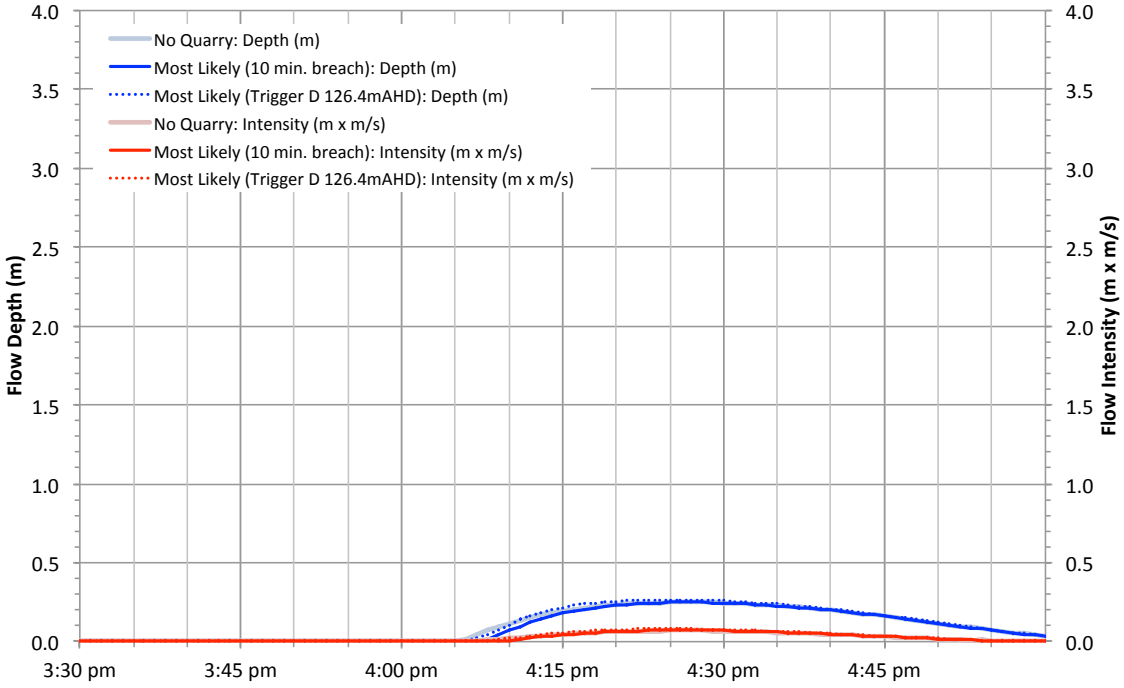


Figure 1.17 – Most Likely (greatest delay): Flow Depth and Intensity at Produce Paddock

Most Likely (worst case delay)

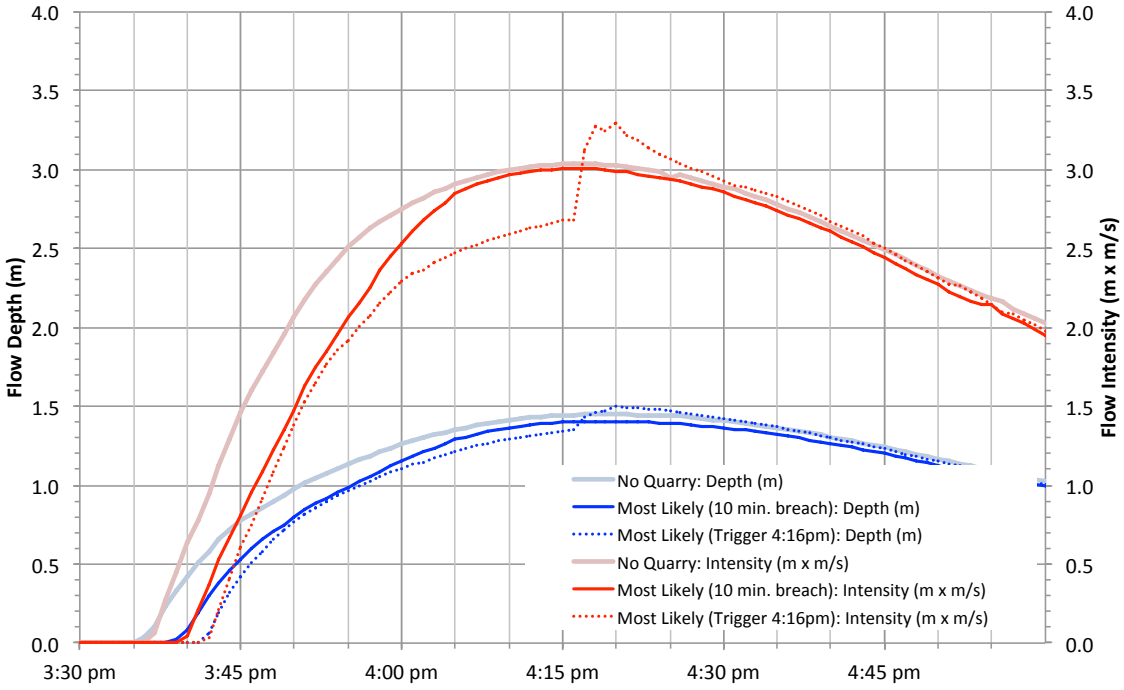


Figure 1.18 – Most Likely (worst case delay): Flow Depth and Intensity at near 25 Quarry Access Road

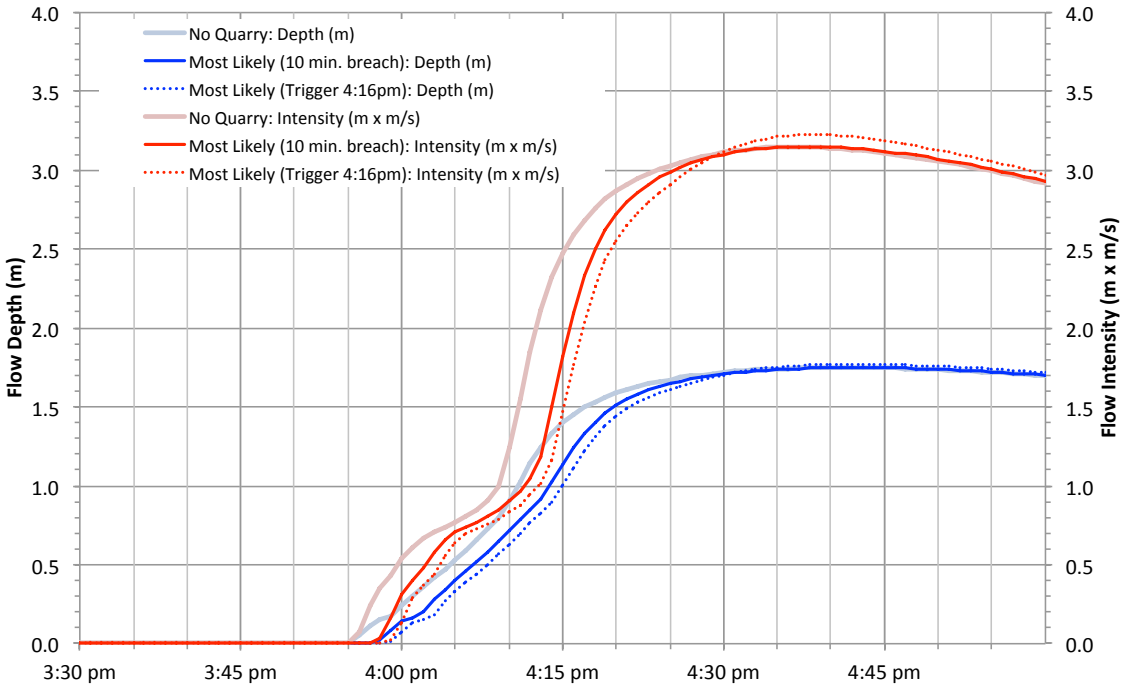


Figure 1.19 – Most Likely (worst case delay): Flow Depth and Intensity at 1414 Gatton-Helidon Road

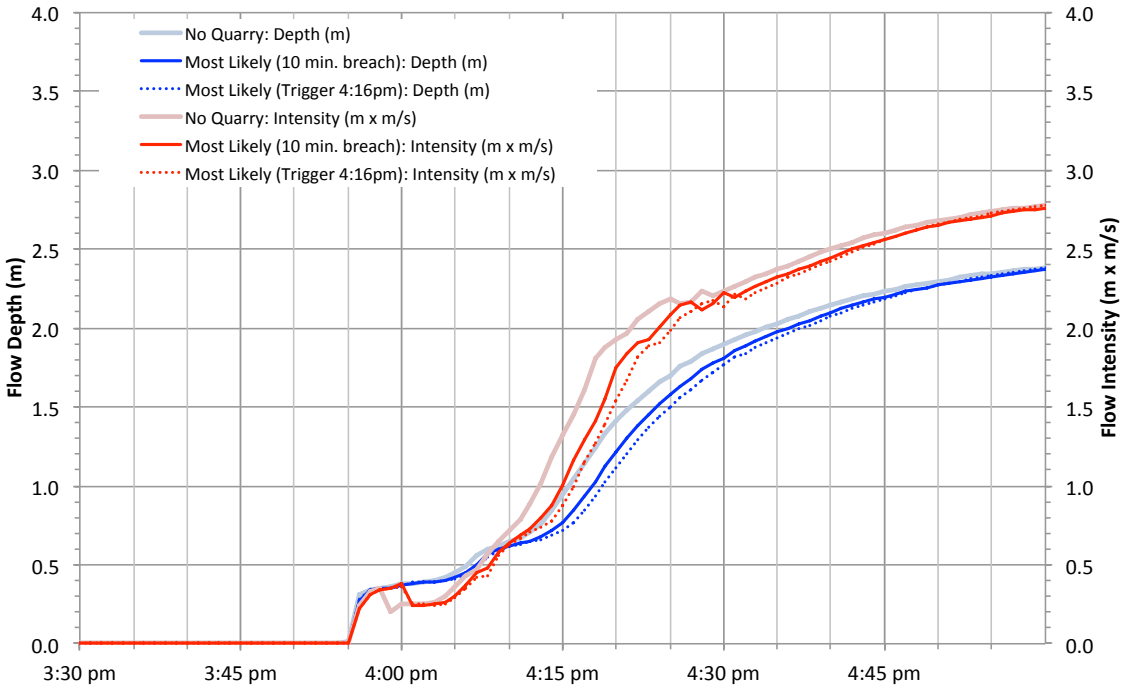


Figure 1.20 – Most Likely (worst case delay): Flow Depth and Intensity at 12 Anzac Avenue

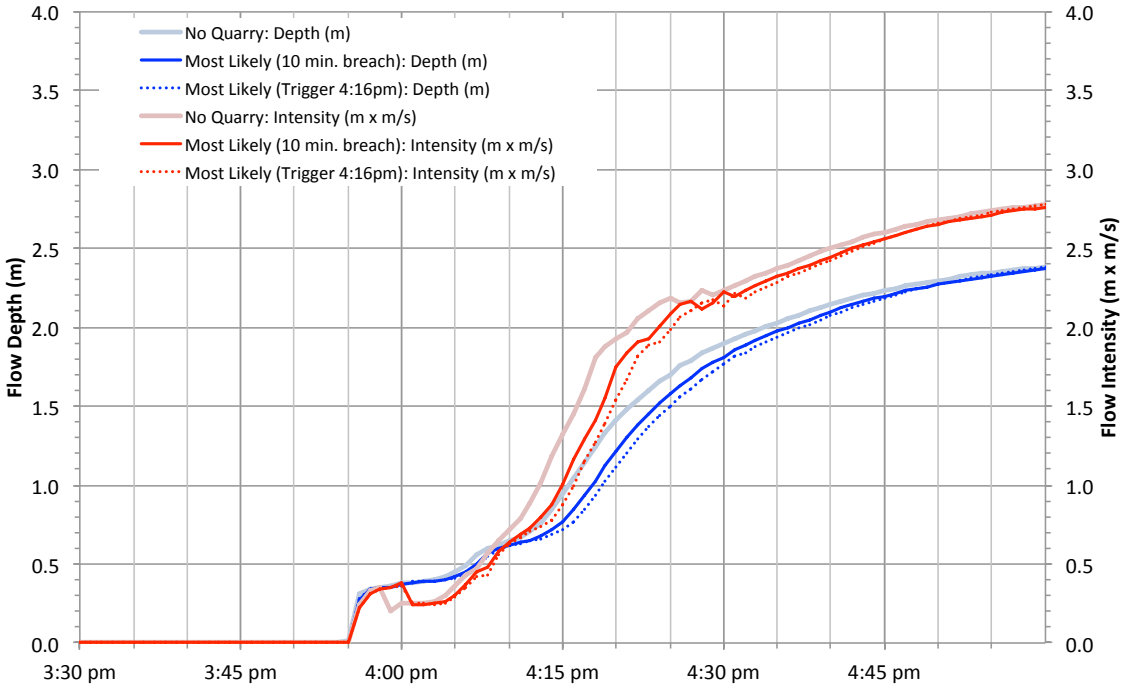


Figure 1.21 – Most Likely (worst case delay): Flow Depth and Intensity at 26 Anzac Avenue

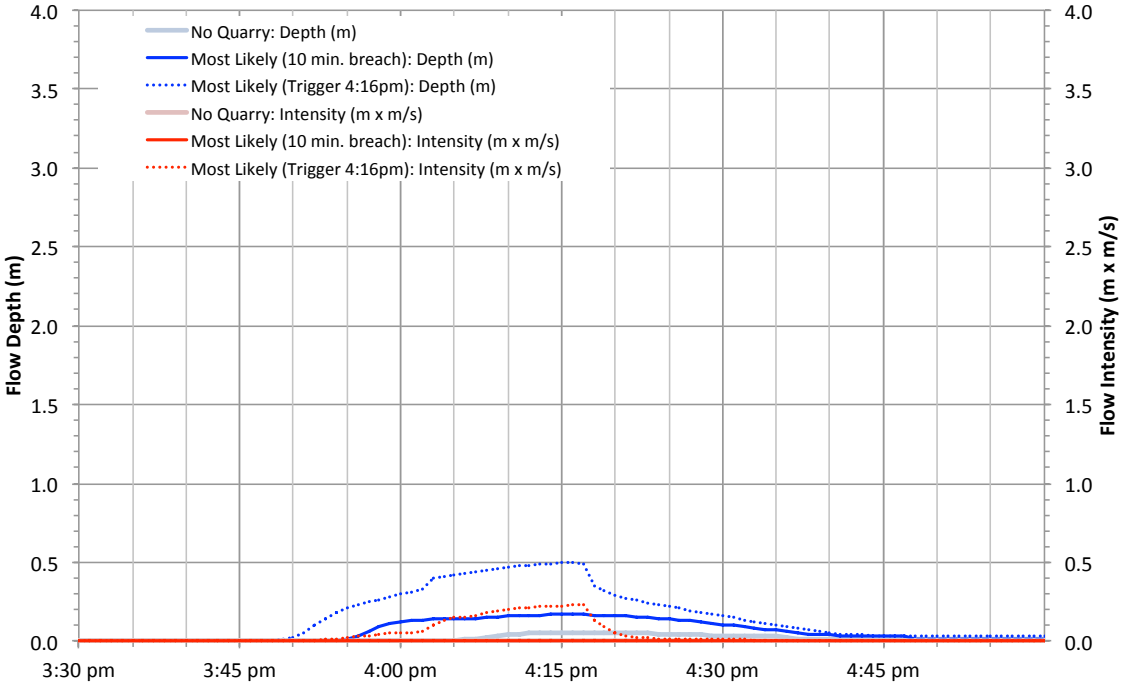


Figure 1.22 – Most Likely (worst case delay): Flow Depth and Intensity at Ryman

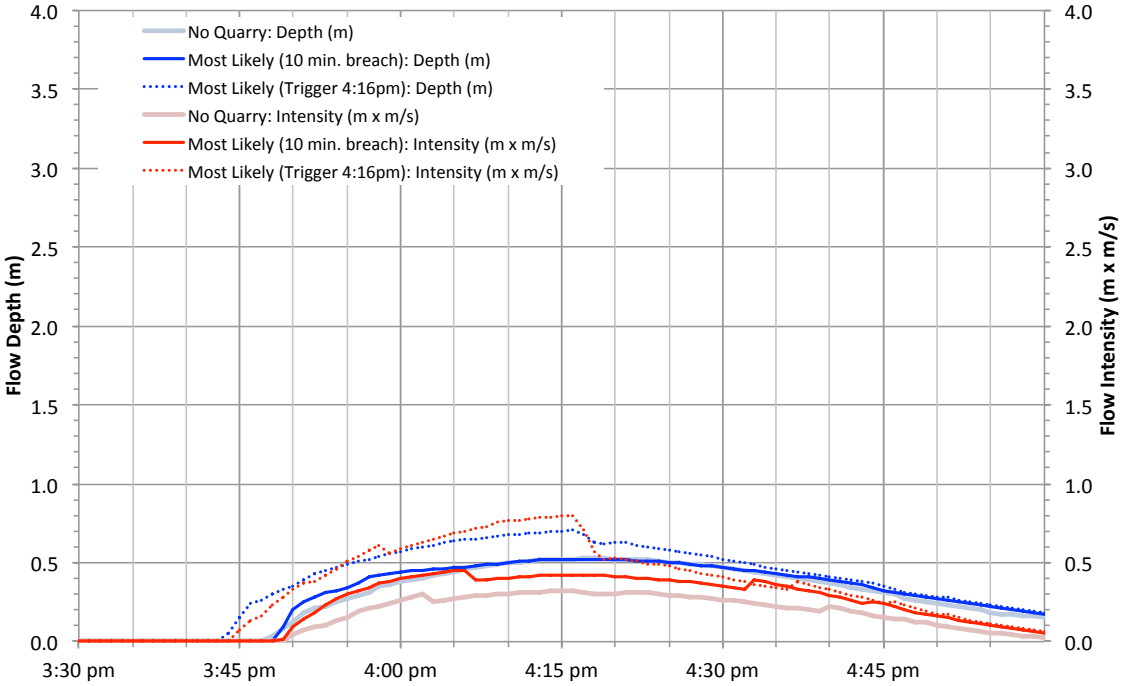


Figure 1.23 – Most Likely (worst case delay): Flow Depth and Intensity at Mallon

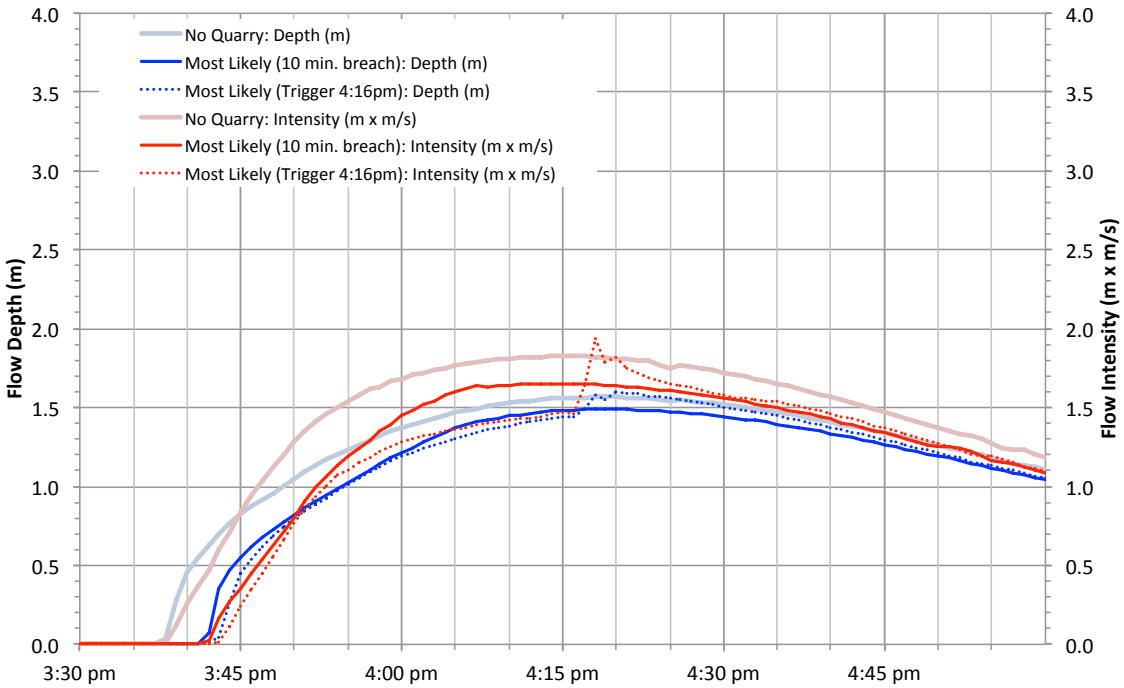


Figure 1.24 – Most Likely (worst case delay): Flow Depth and Intensity at Sippel

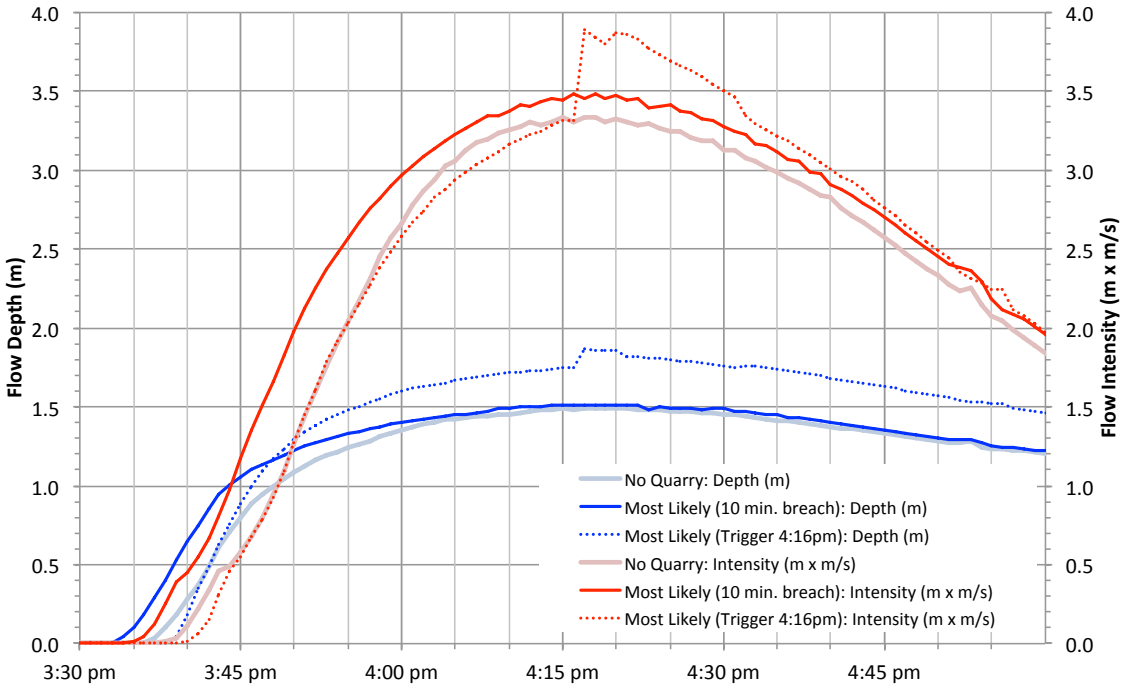


Figure 1.25 – Most Likely (worst case delay): Flow Depth and Intensity at Besley

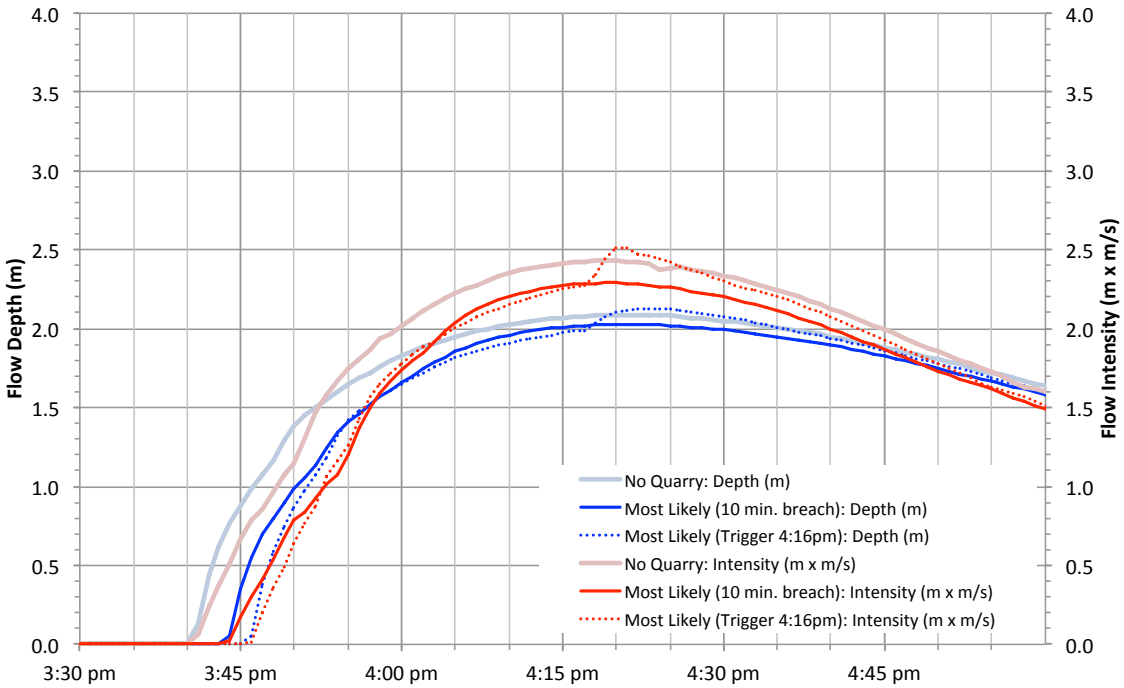


Figure 1.26 – Most Likely (worst case delay): Flow Depth and Intensity at Gillespie

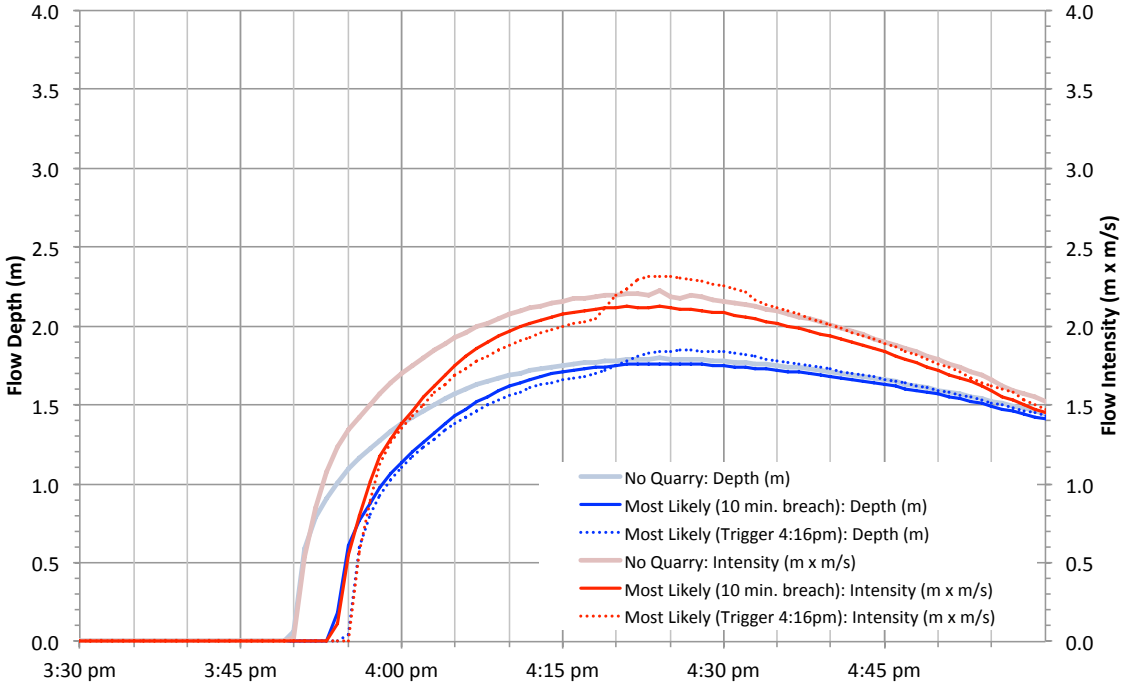


Figure 1.27 – Most Likely (worst case delay): Flow Depth and Intensity at Gallagher

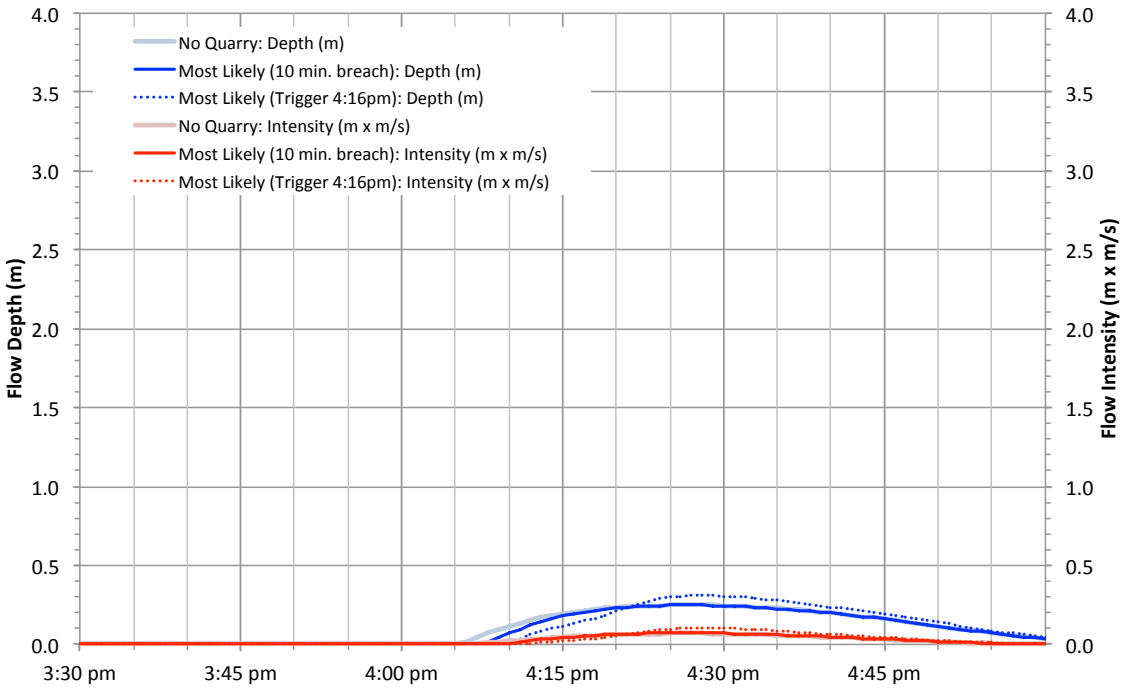


Figure 1.28 – Most Likely (worst case delay): Flow Depth and Intensity at Produce Paddock

No Levee

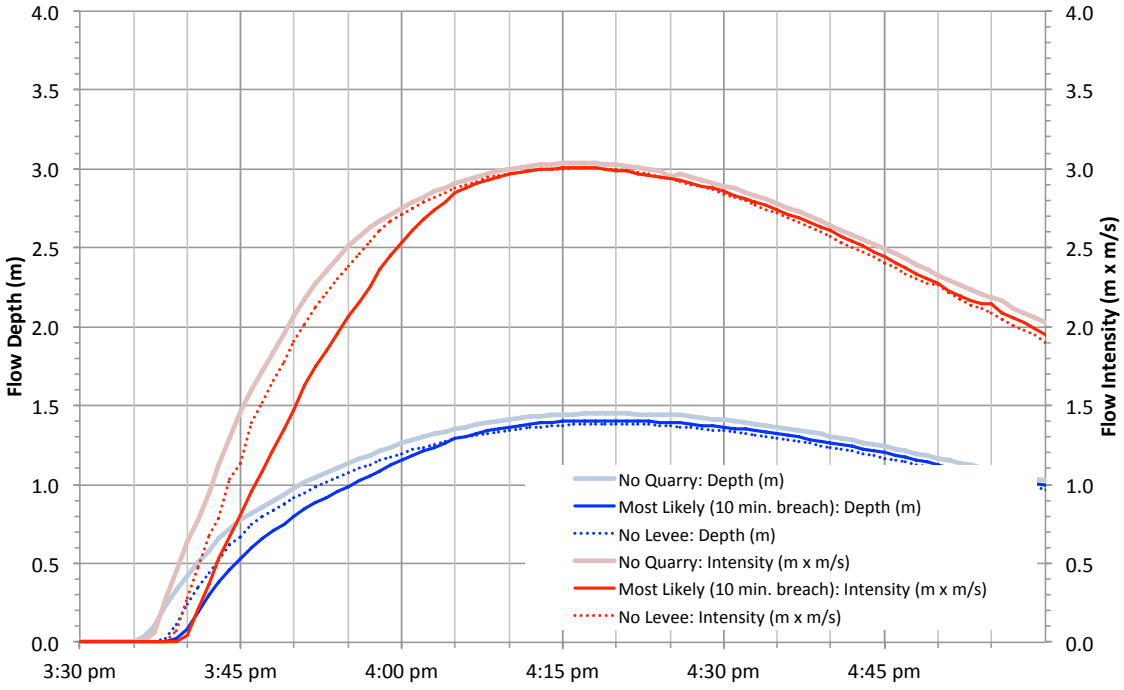


Figure 1.29 – No Levee: Flow Depth and Intensity at near 25 Quarry Access Road

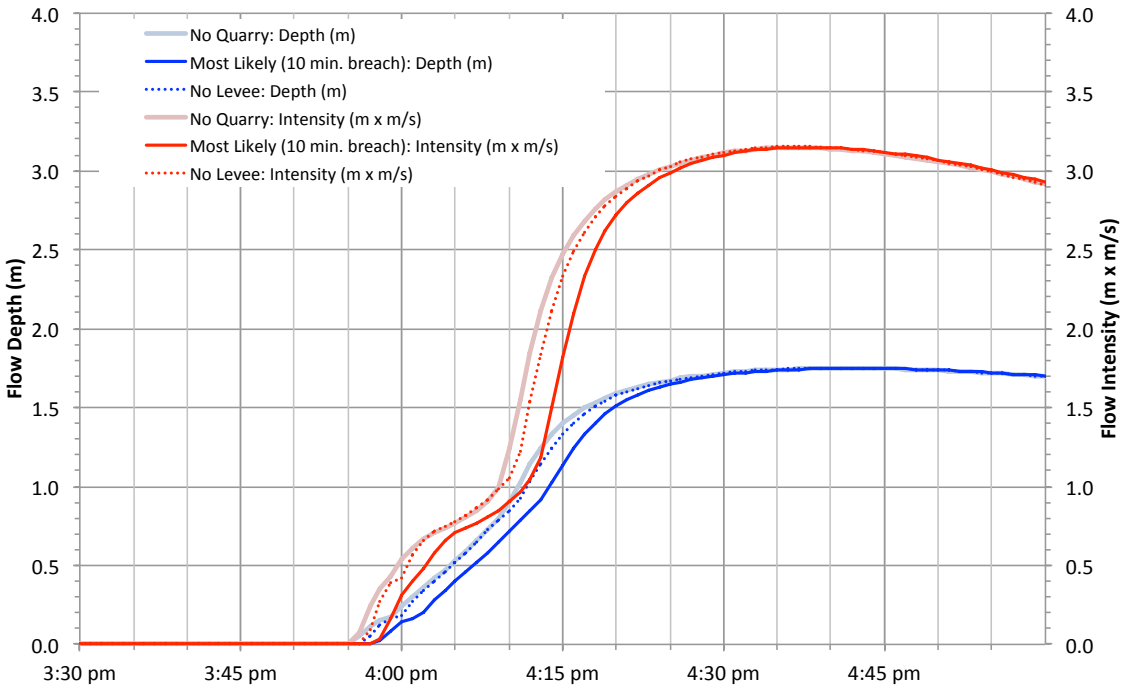


Figure 1.30 – No Levee: Flow Depth and Intensity at 1414 Gatton-Helidon Road

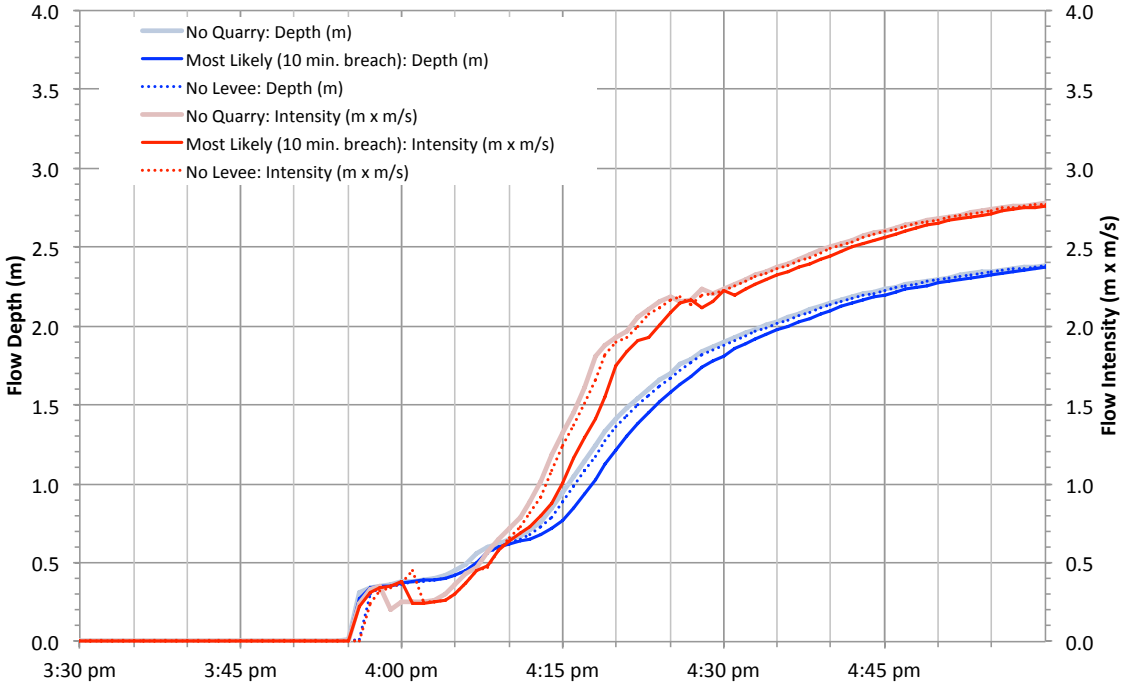


Figure 1.31 – No Levee: Flow Depth and Intensity at 12 Anzac Avenue

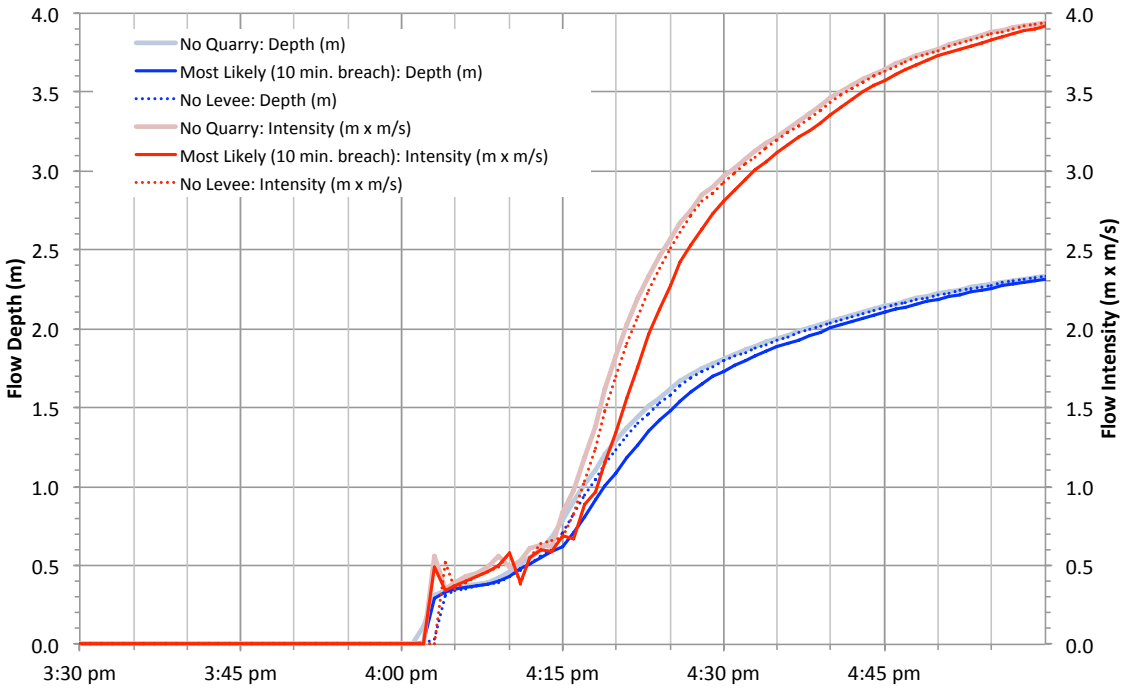


Figure 1.32 – No Levee: Flow Depth and Intensity at 26 Anzac Avenue

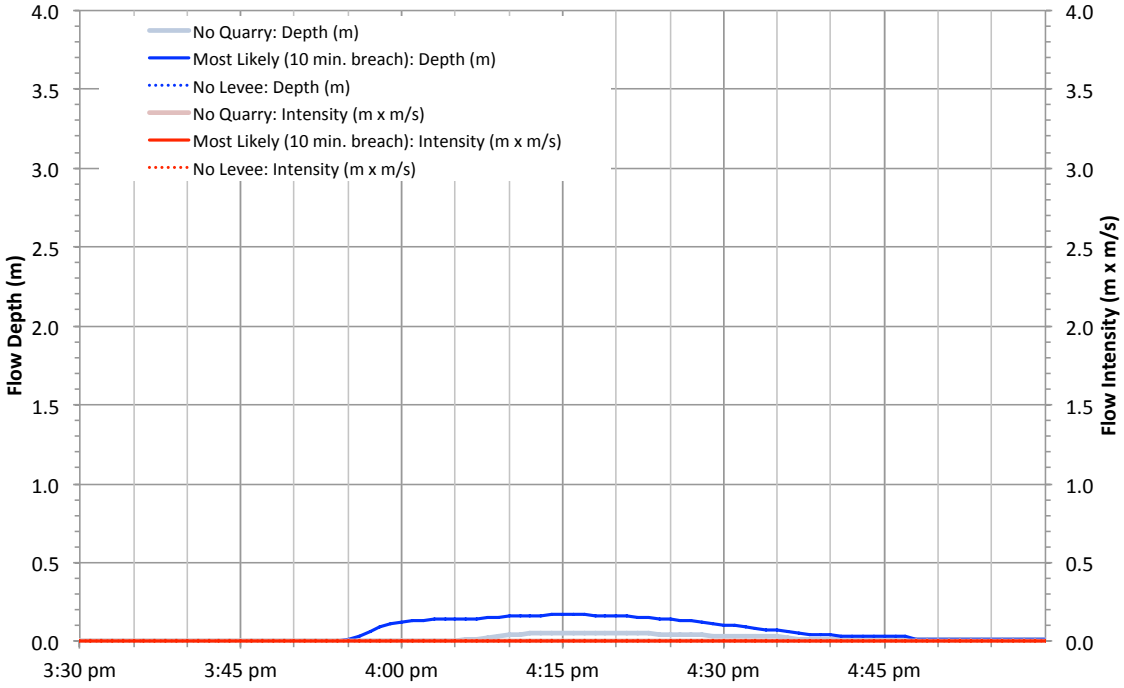


Figure 1.33 – No Levee: Flow Depth and Intensity at Ryman

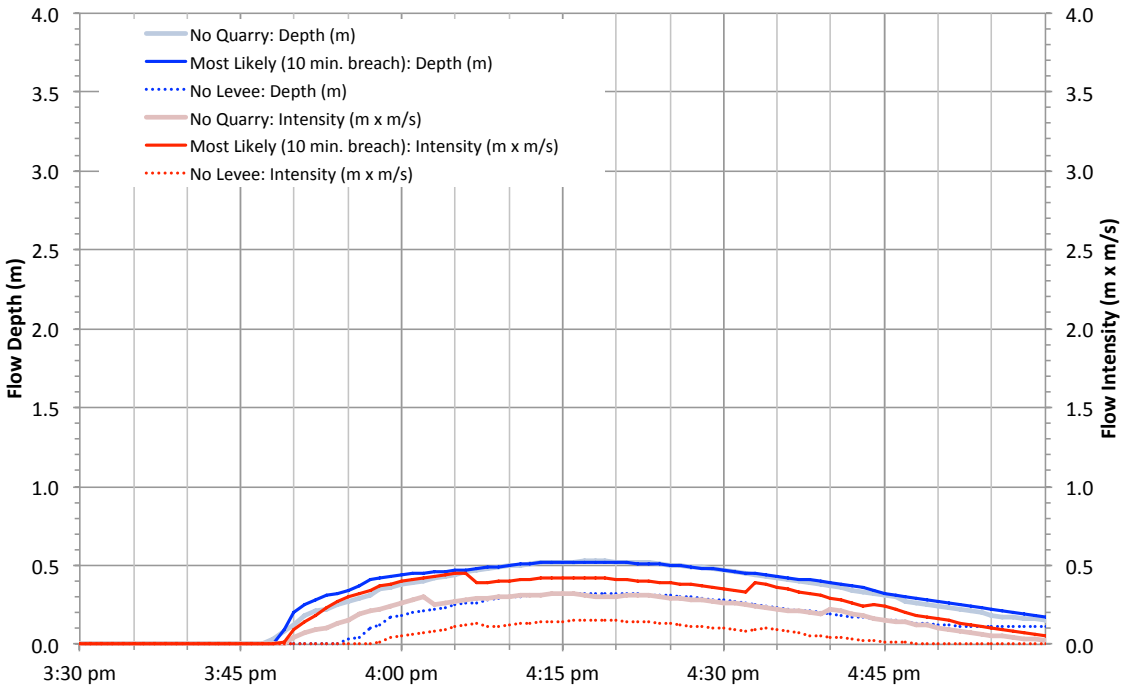


Figure 1.34 – No Levee: Flow Depth and Intensity at Mallon

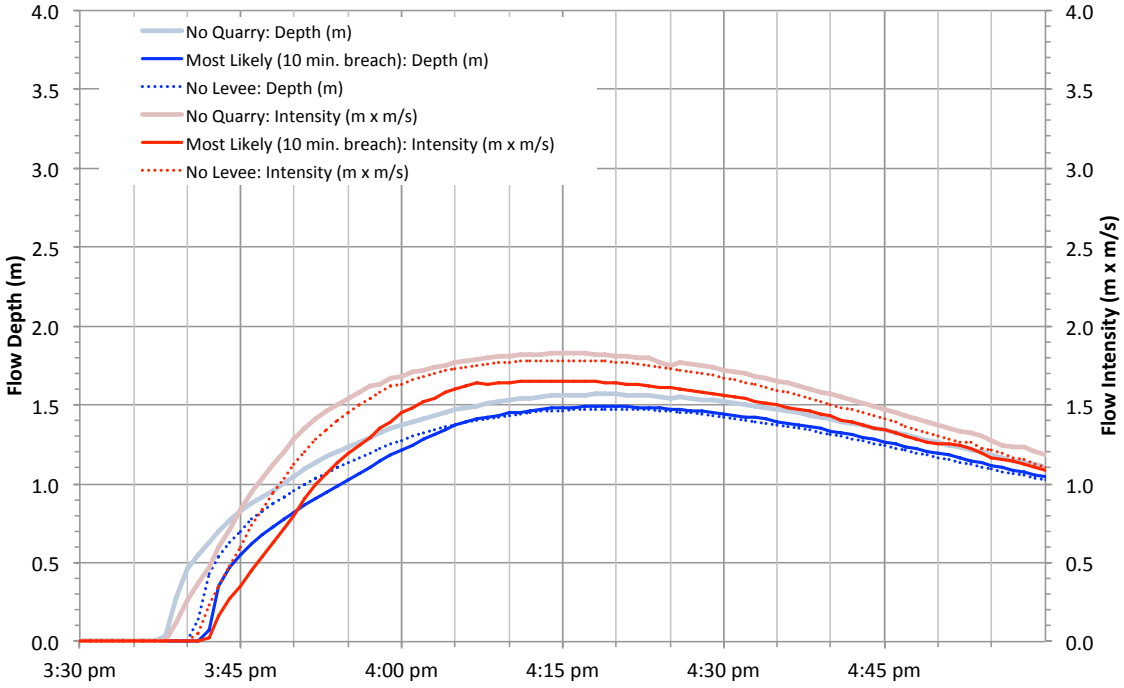


Figure 1.35 – No Levee: Flow Depth and Intensity at Sippel

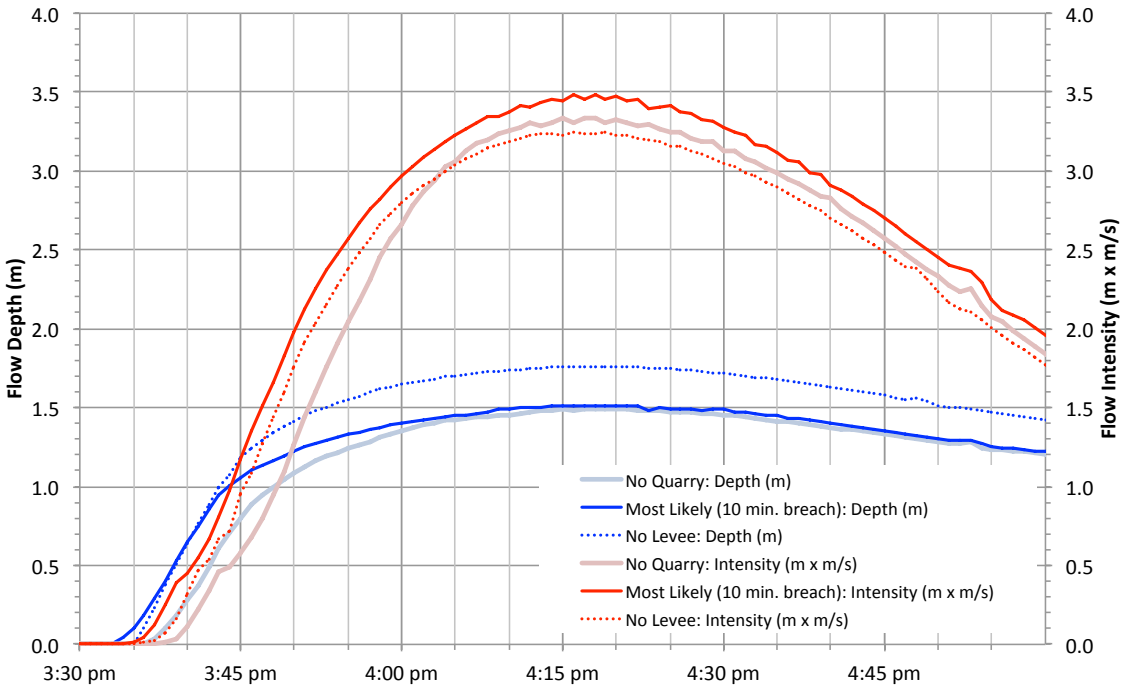


Figure 1.36 – No Levee: Flow Depth and Intensity at Besley

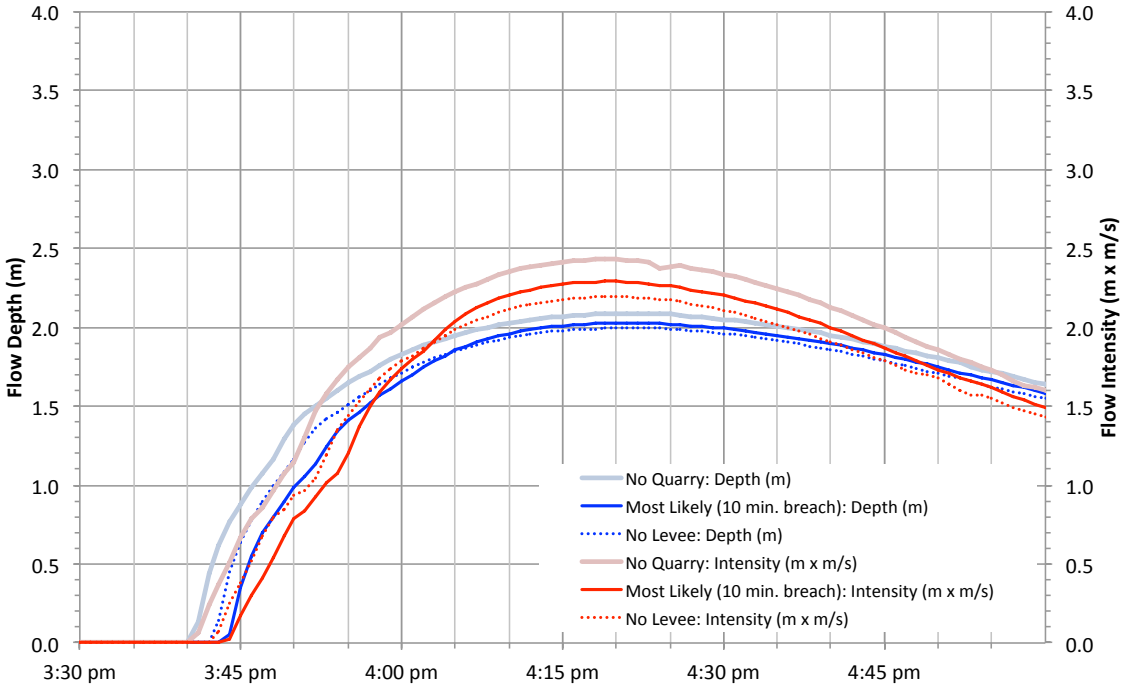


Figure 1.37 – No Levee: Flow Depth and Intensity at Gillespie

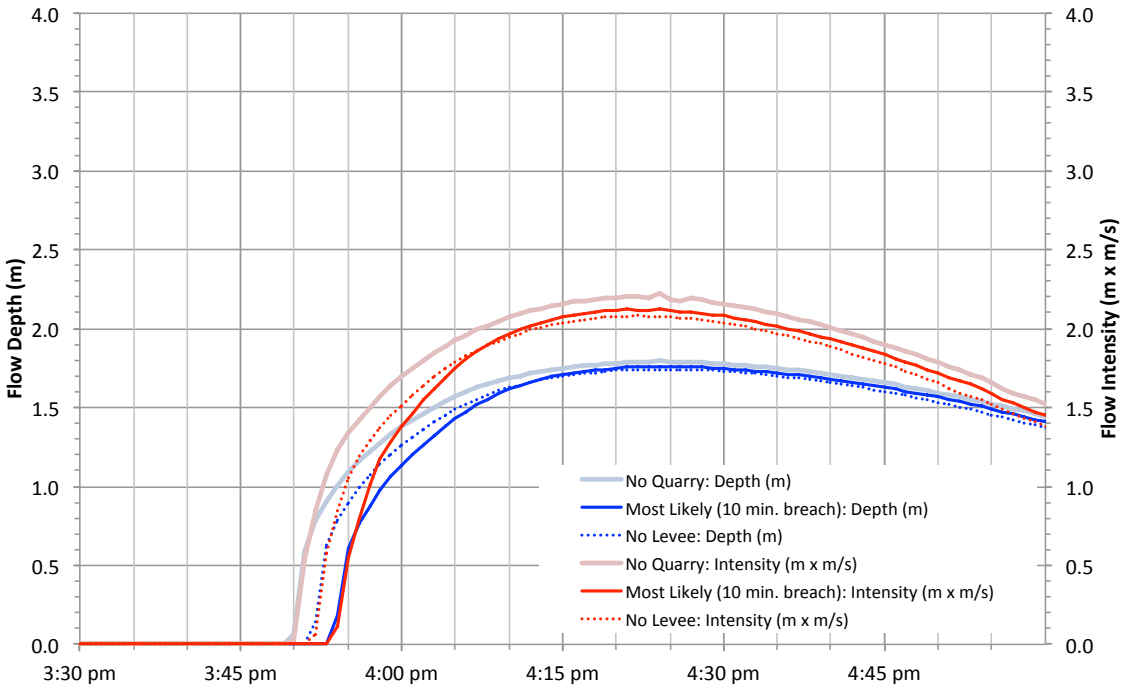


Figure 1.38 – No Levee: Flow Depth and Intensity at Gallagher

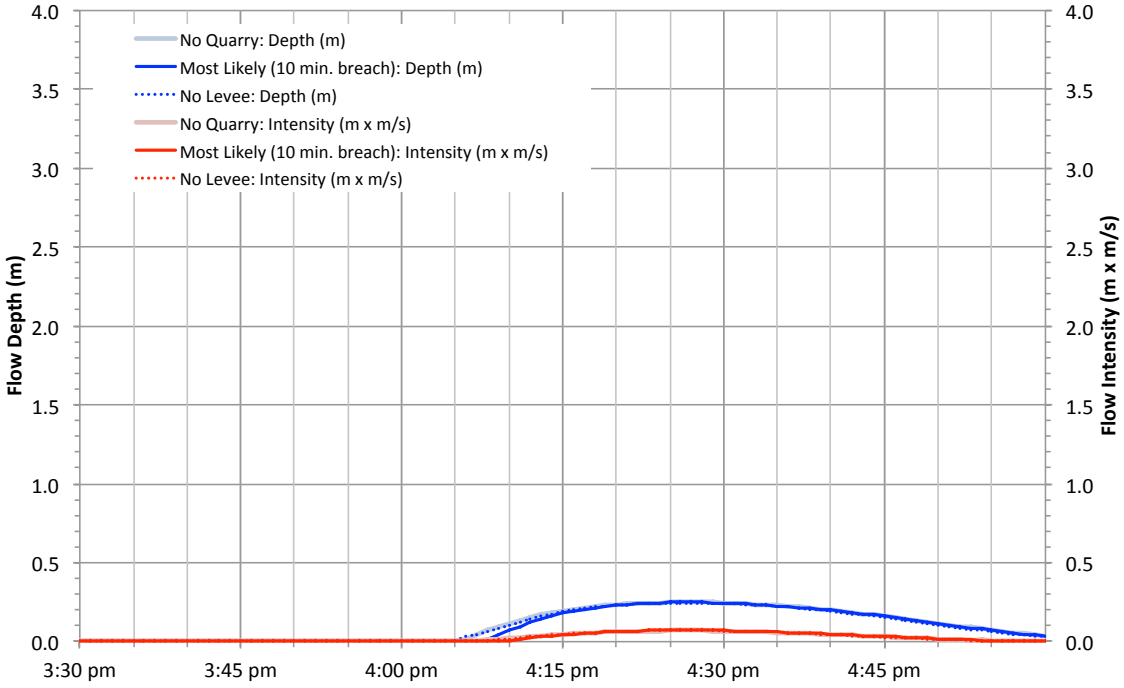


Figure 1.39 – No Levee: Flow Depth and Intensity at Produce Paddock

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