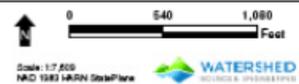
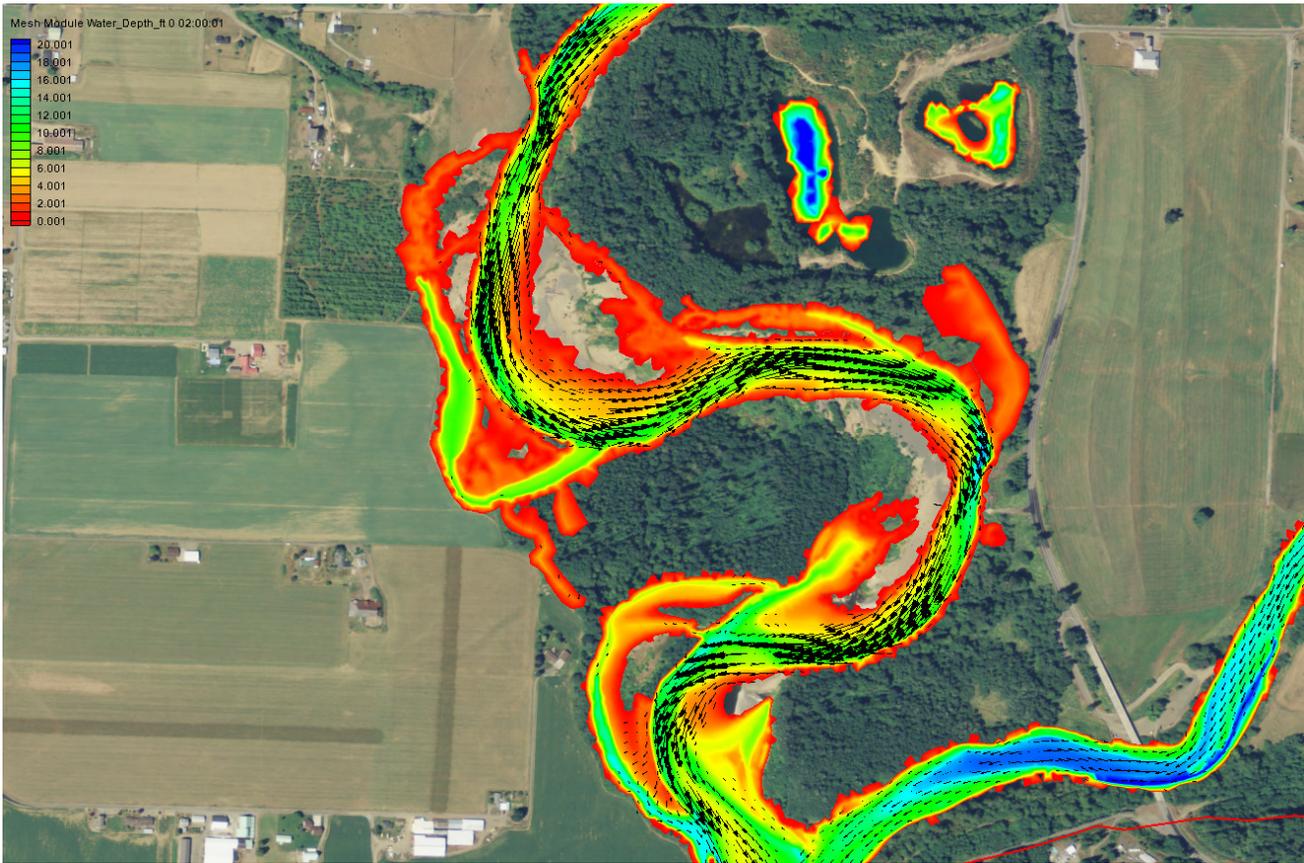


Satsop River Topography

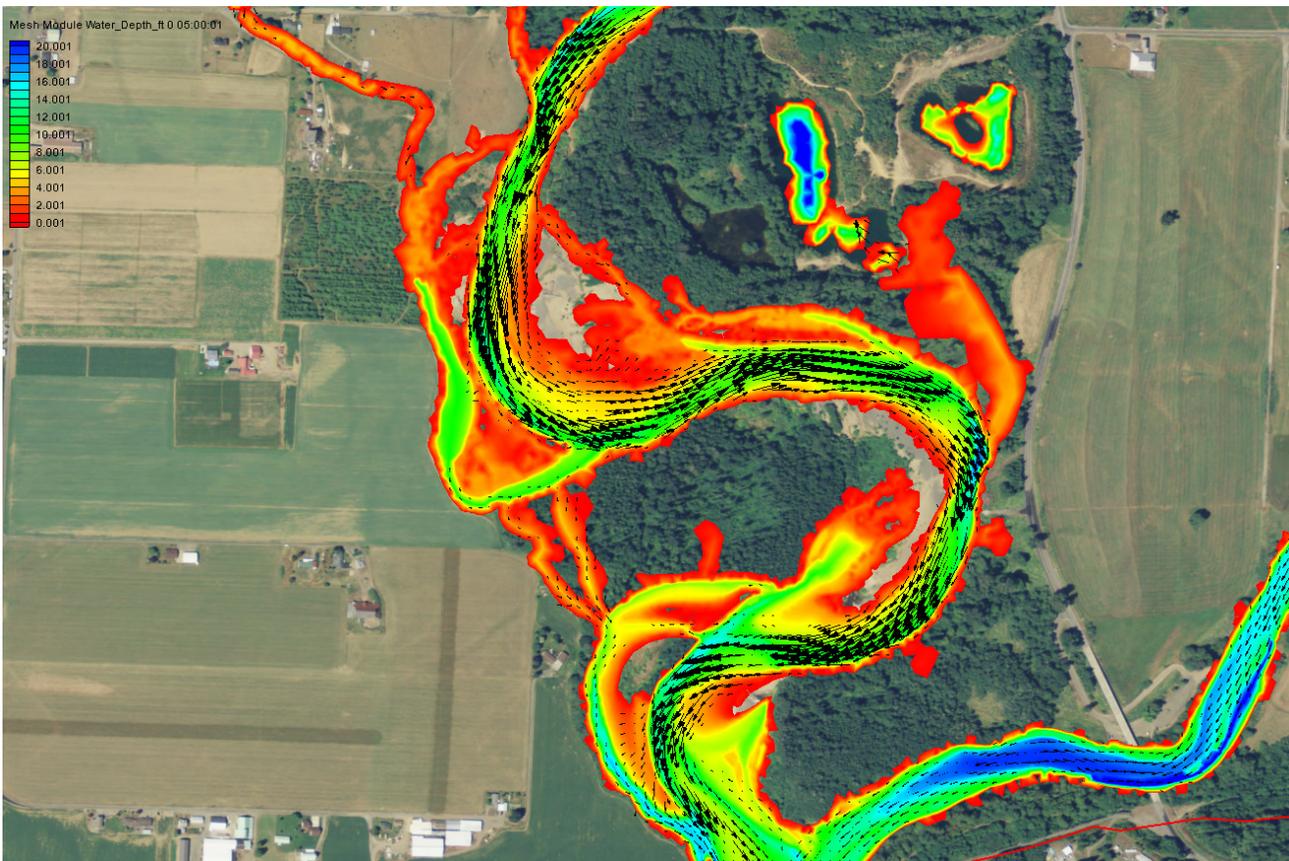


Topographic (LiDAR) Data for the lower Satsop River floodplain. Note the prominent alluvial fan (red color midway between SR 12 and the Chehalis River), the WDFW pits and spoils piles (white and red colors between Satsop and Keyes Road) and the many remnant channels of the Satsop and Chehalis Rivers.

Nov. 2012 Flood: Water depth and velocity vectors at hour 2 (10,800 cfs)

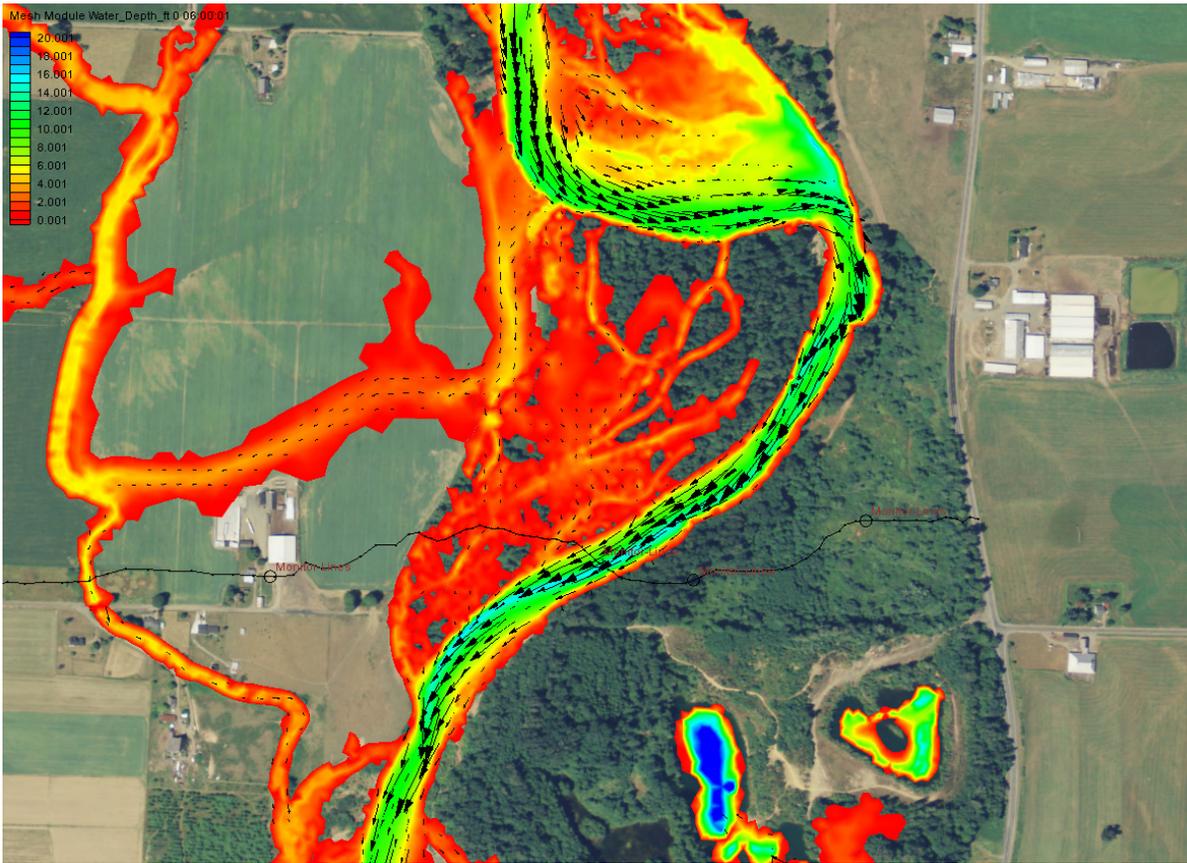


Nov. 2012 Flood: Water depth and velocity vectors at hour 5 (13,200 cfs)

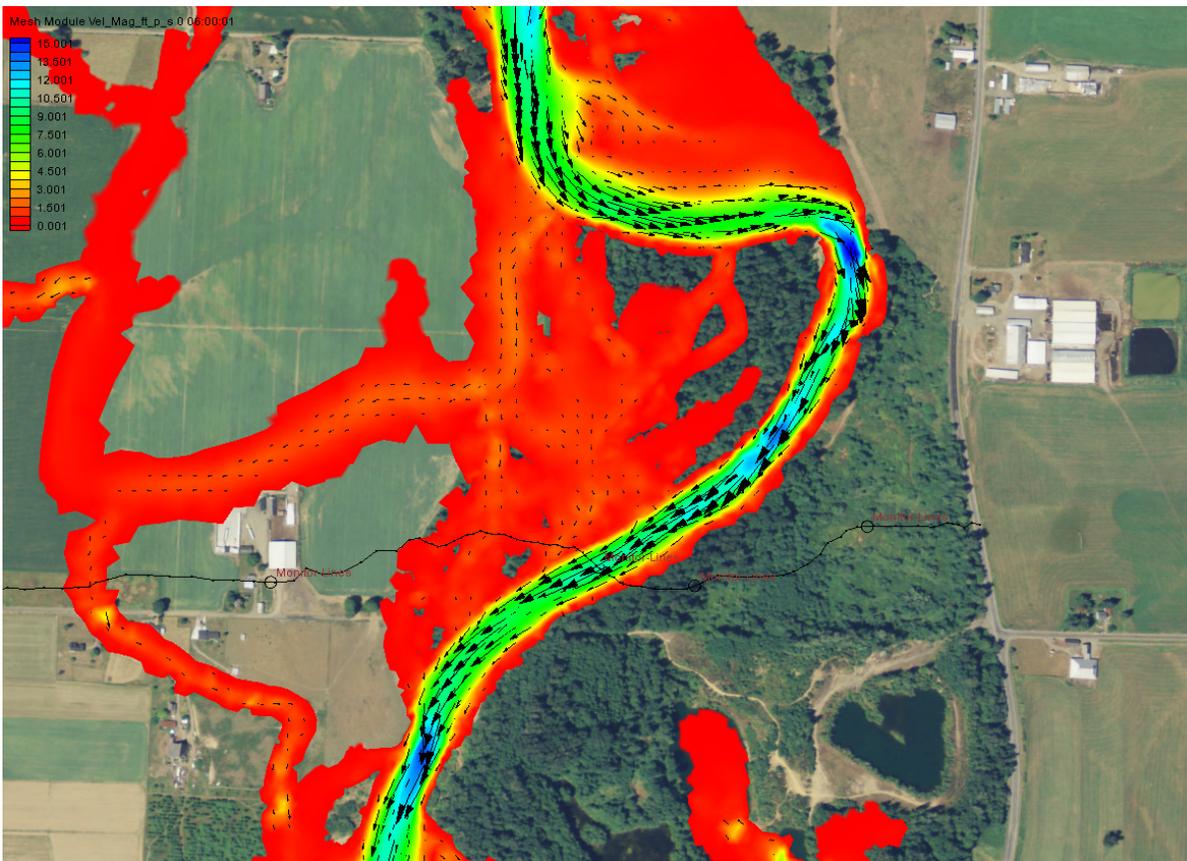


Figures showing the flow patterns near the start of the event. Note that the Fish and Wildlife ponds actually receive river flow initially from the south, from the Satsop River near the PDA wellhead site.

Nov 2012 Flood: Water depth and velocity vectors at hour 6 (14,200 cfs)

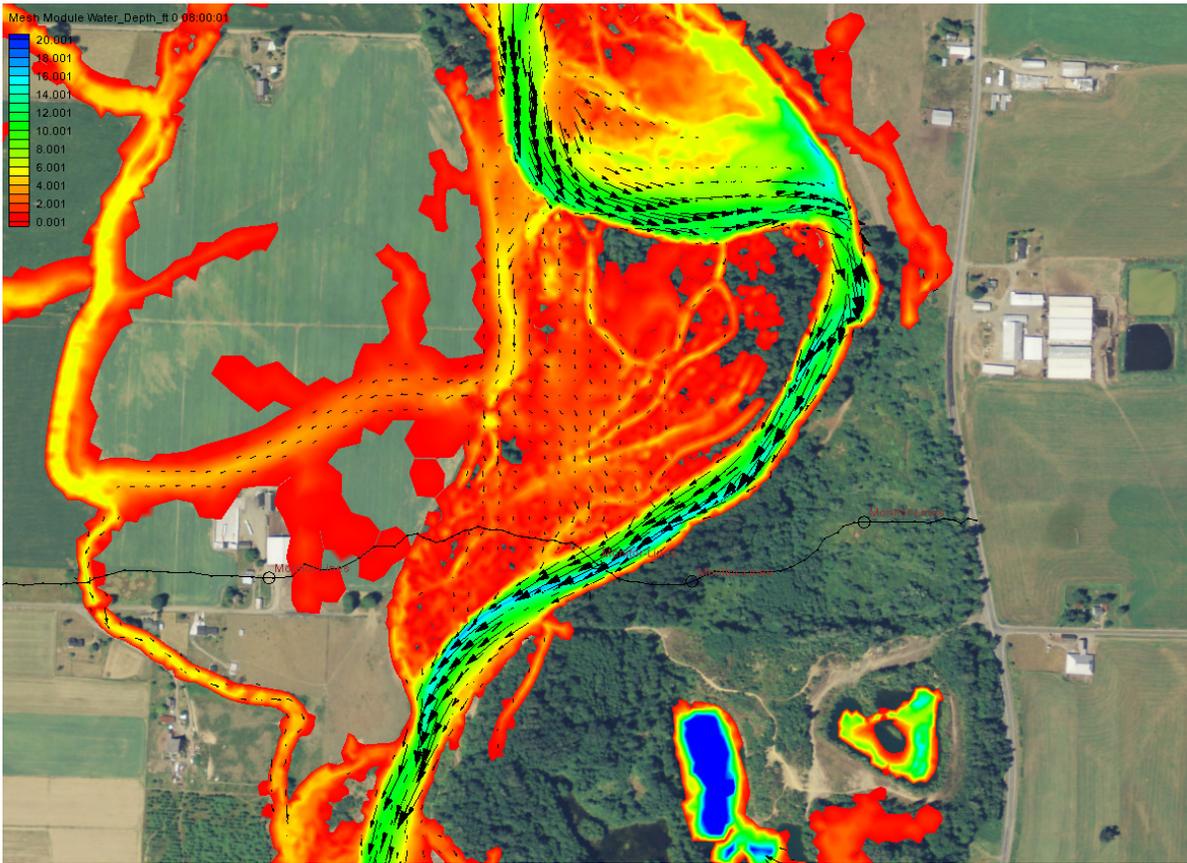


Nov 2012 Flood: Flow velocity magnitude and velocity vectors at hour 6 (14,200 cfs)

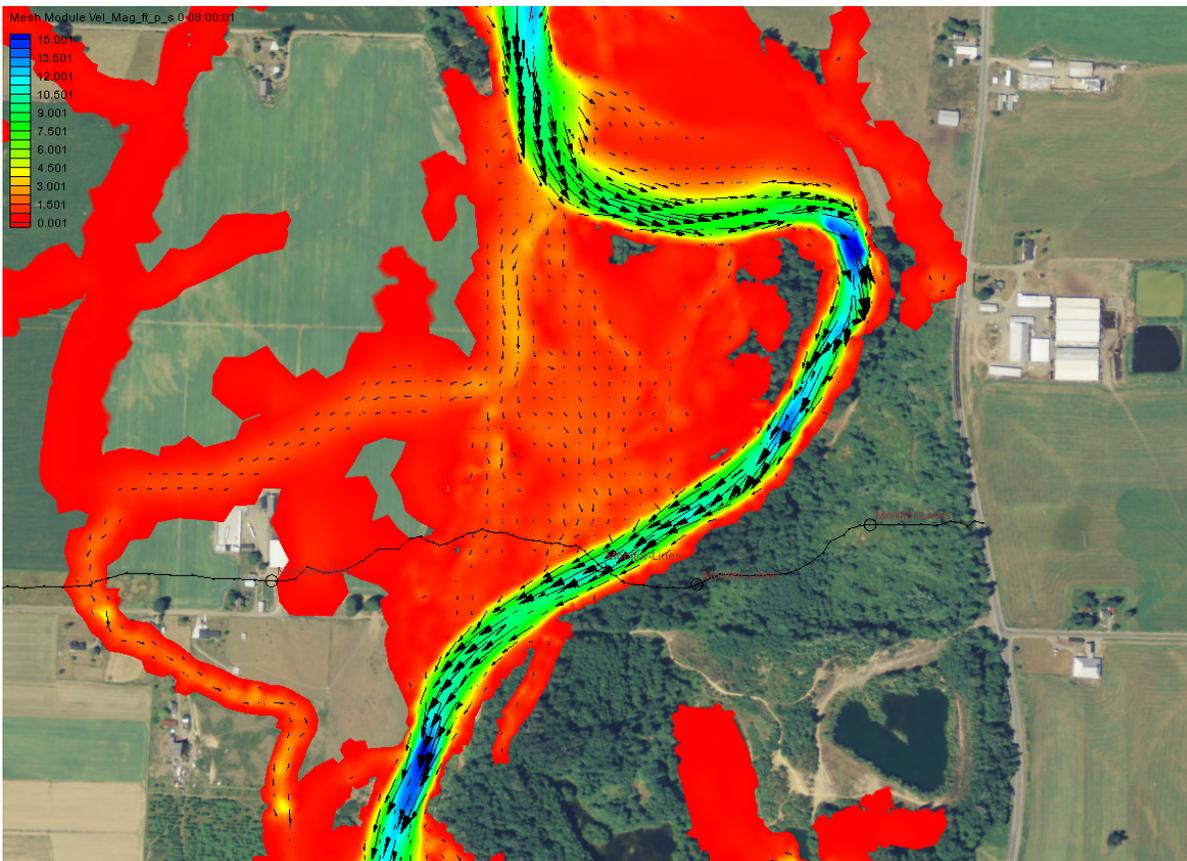


Figures showing the flow patterns in study reach early in the flood event. Water breaks out of the Satsop River channel upstream of SR12 at a flow of about 14,000 cfs. Overbank flow through the right bank floodplain and side channels is evident in these figures.

Nov 2012 Flood: Water depth and velocity vectors at hour 8 (16,800 cfs)

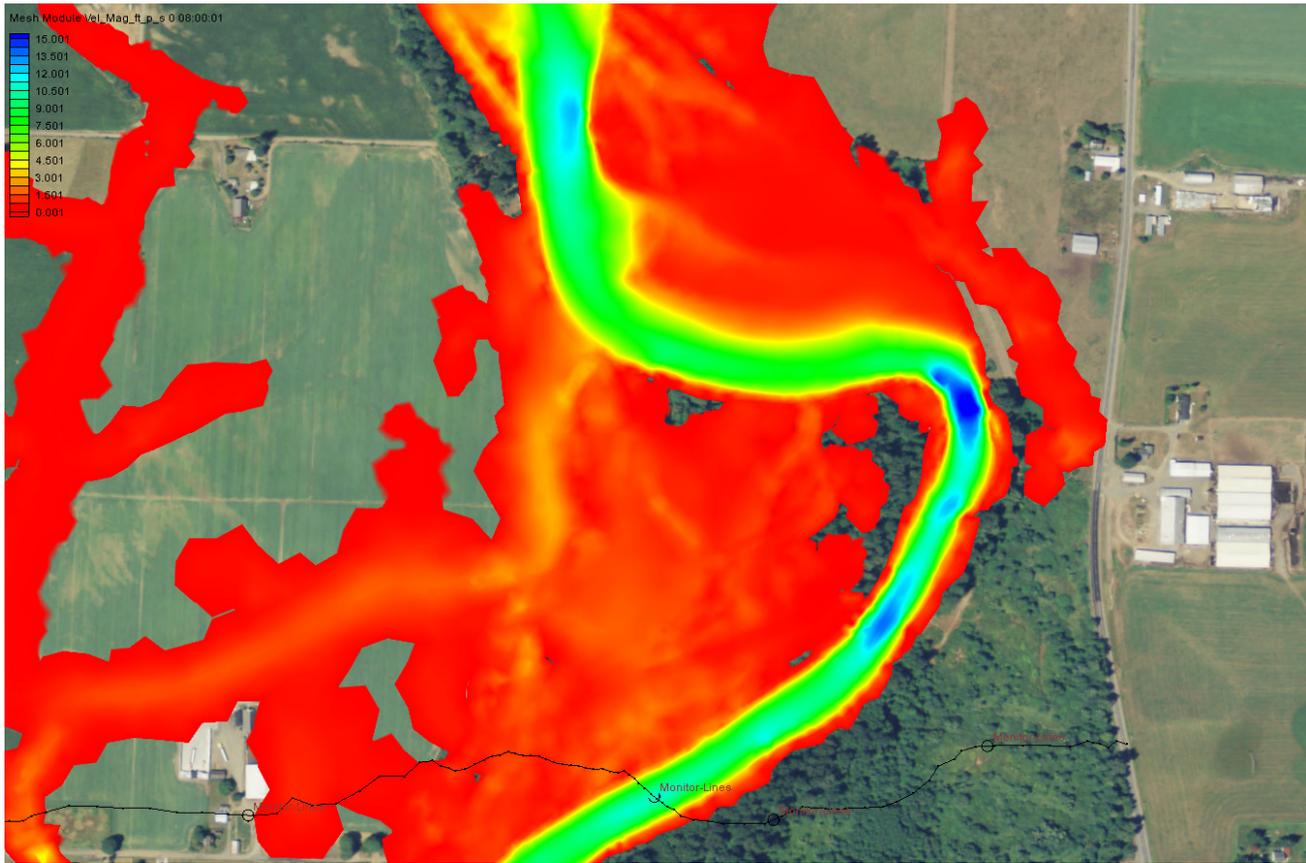


Nov 2012 Flood: Flow velocity magnitude and velocity vectors at hour 8 (16,800 cfs)

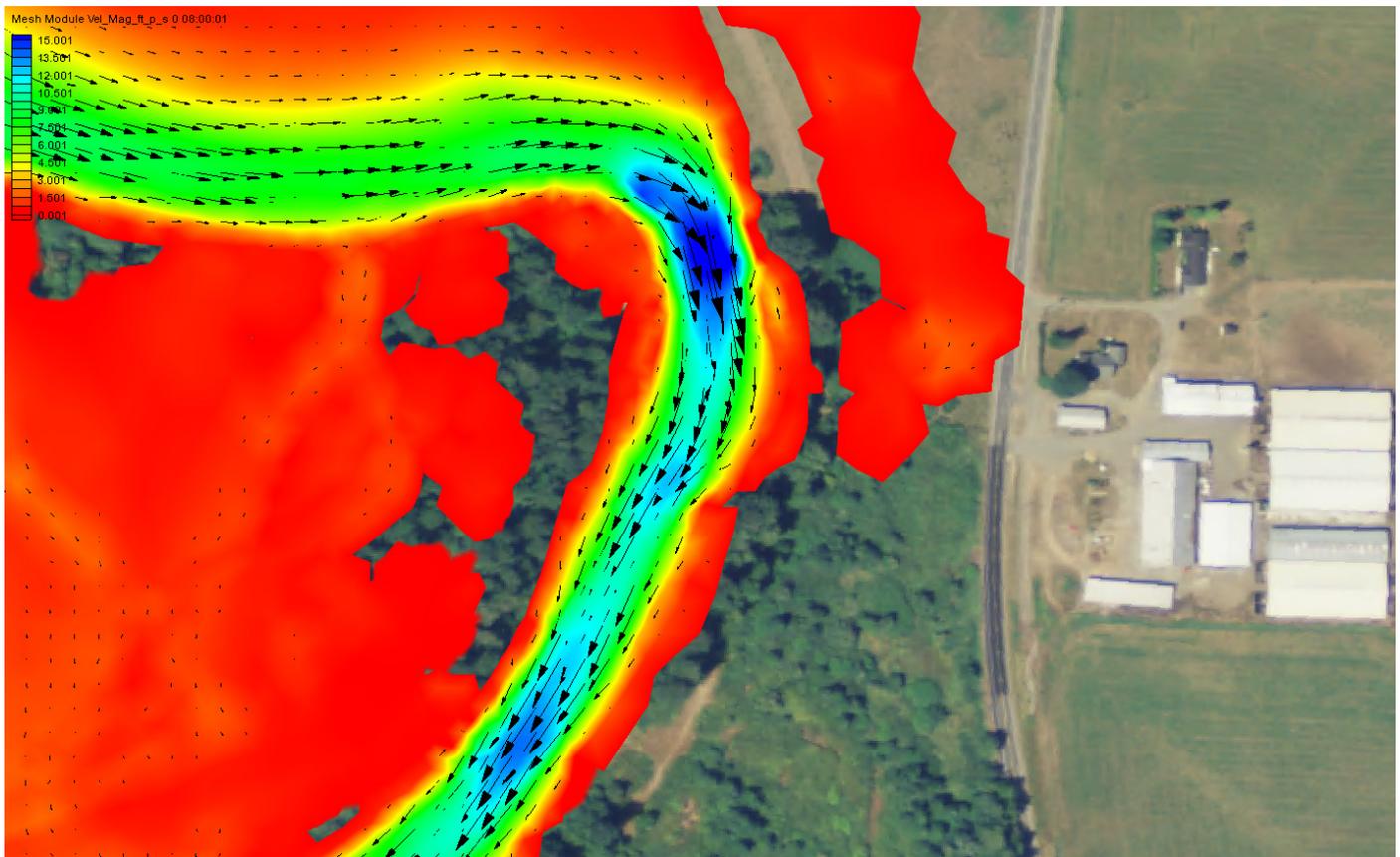


Figures showing the flow patterns between SR 12 and the rip rap revetment early in the flood event. Water first breaks out of the Satsop River channel upstream of 55 Keyes Road at a river flow of about 16,800 cfs.

Nov 2012 Flood: Water velocity magnitude at failed revetment – hour 8 (16,800 cfs)

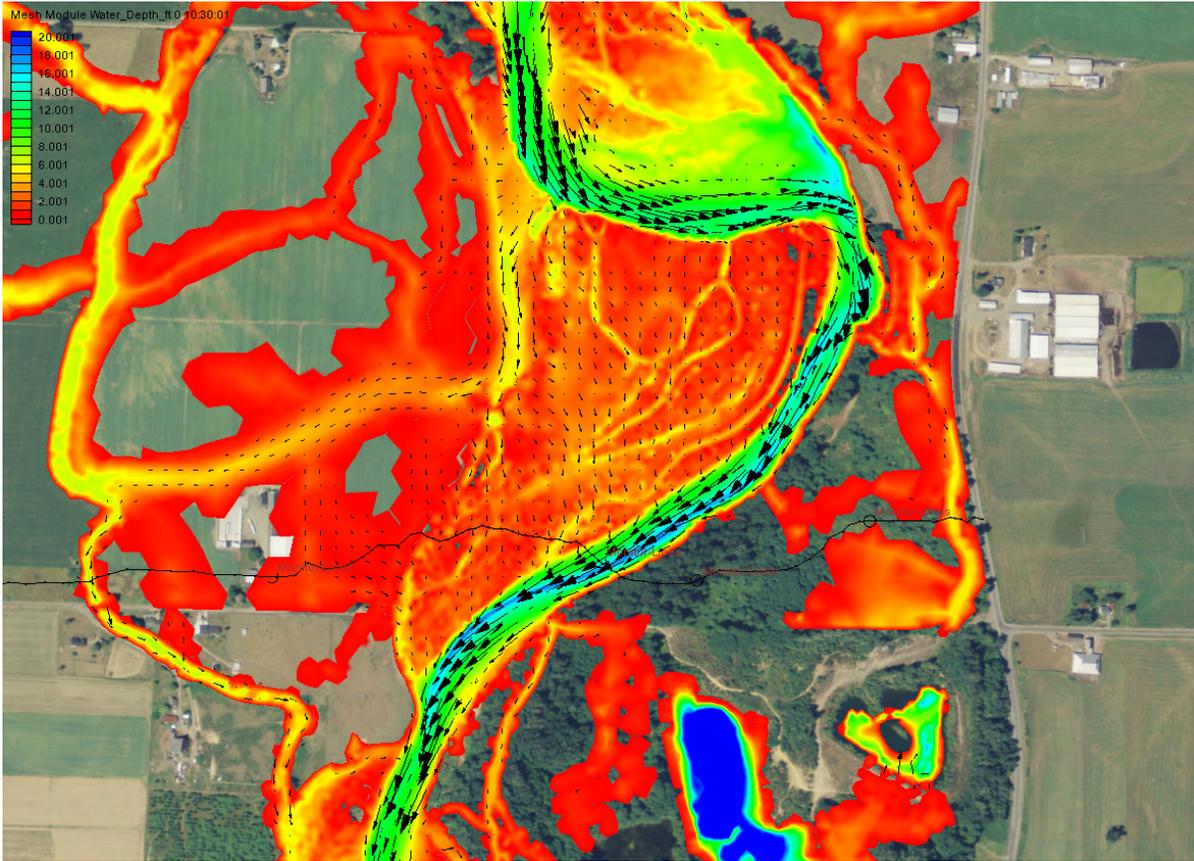


Nov. 2012 Flood: Velocity magnitude at failed revetment – hour 8 (16,800 cfs)

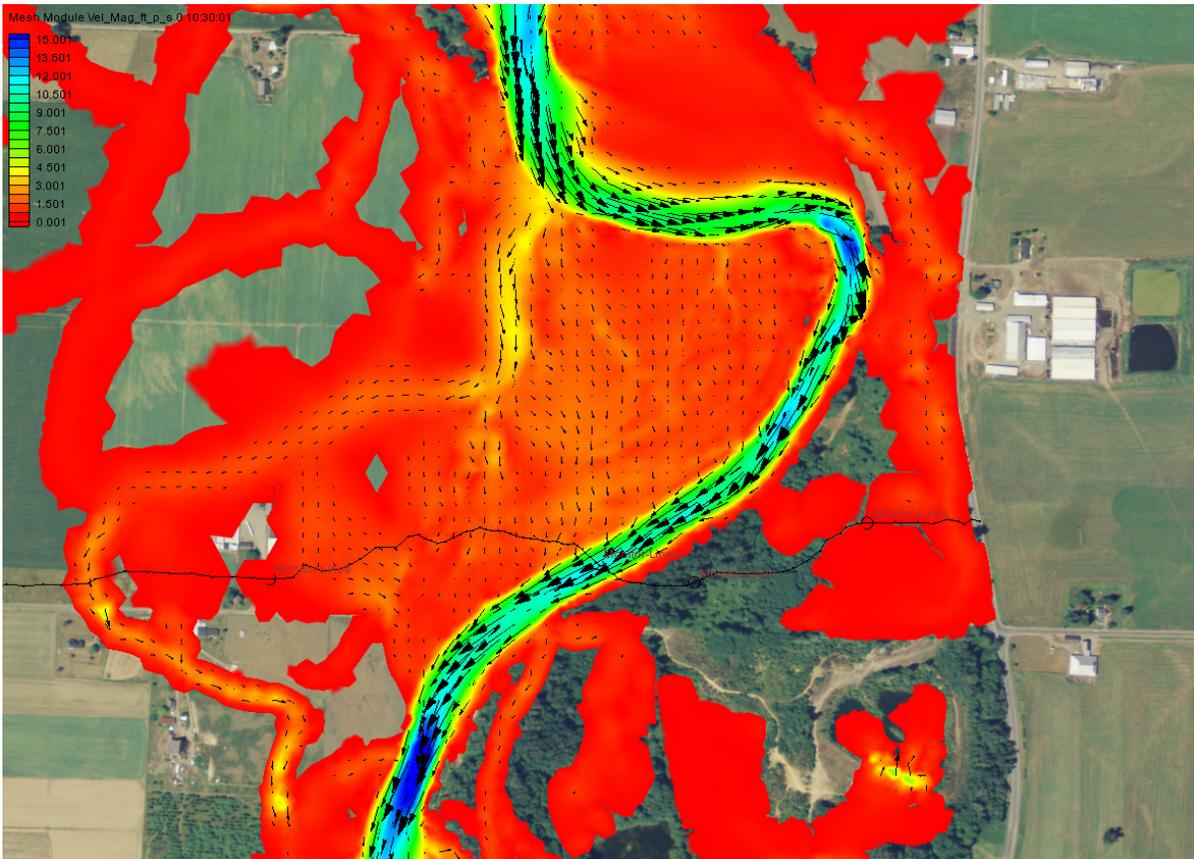


Zoomed in view showing the velocities magnitudes and patterns near the location of the revetment failure near Keyes Road. Note the high velocities (greater than 14 feet per second) and angle of attack towards the west (east) bank of the river. This location is a concern for additional bank erosion.

Nov 2012 Flood: Water depth and velocity vectors at hour 10.5 (20,600 cfs)

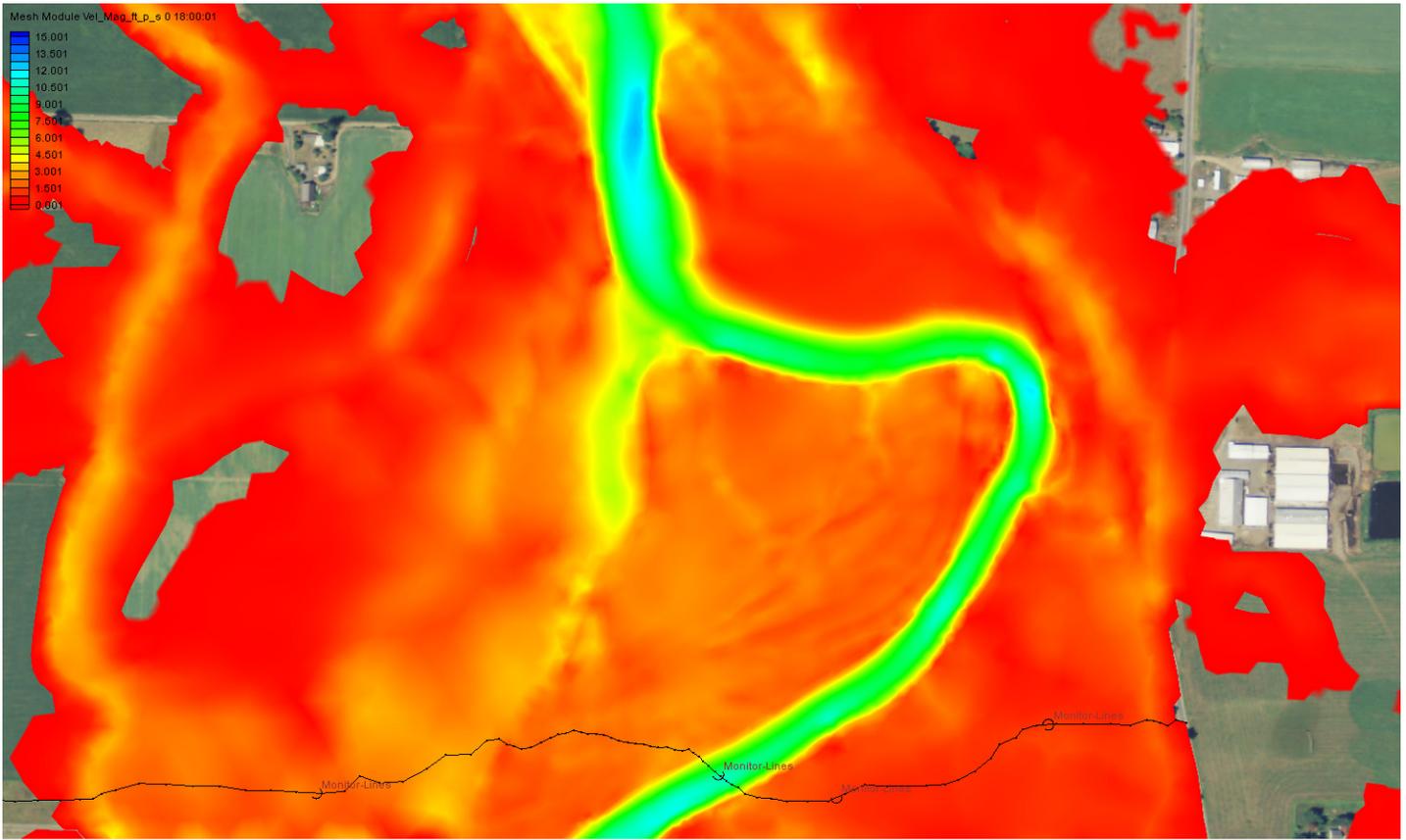


Nov 2012 Flood: Flow velocity magnitude and velocity vectors at hour 10.5 (20,600 cfs)

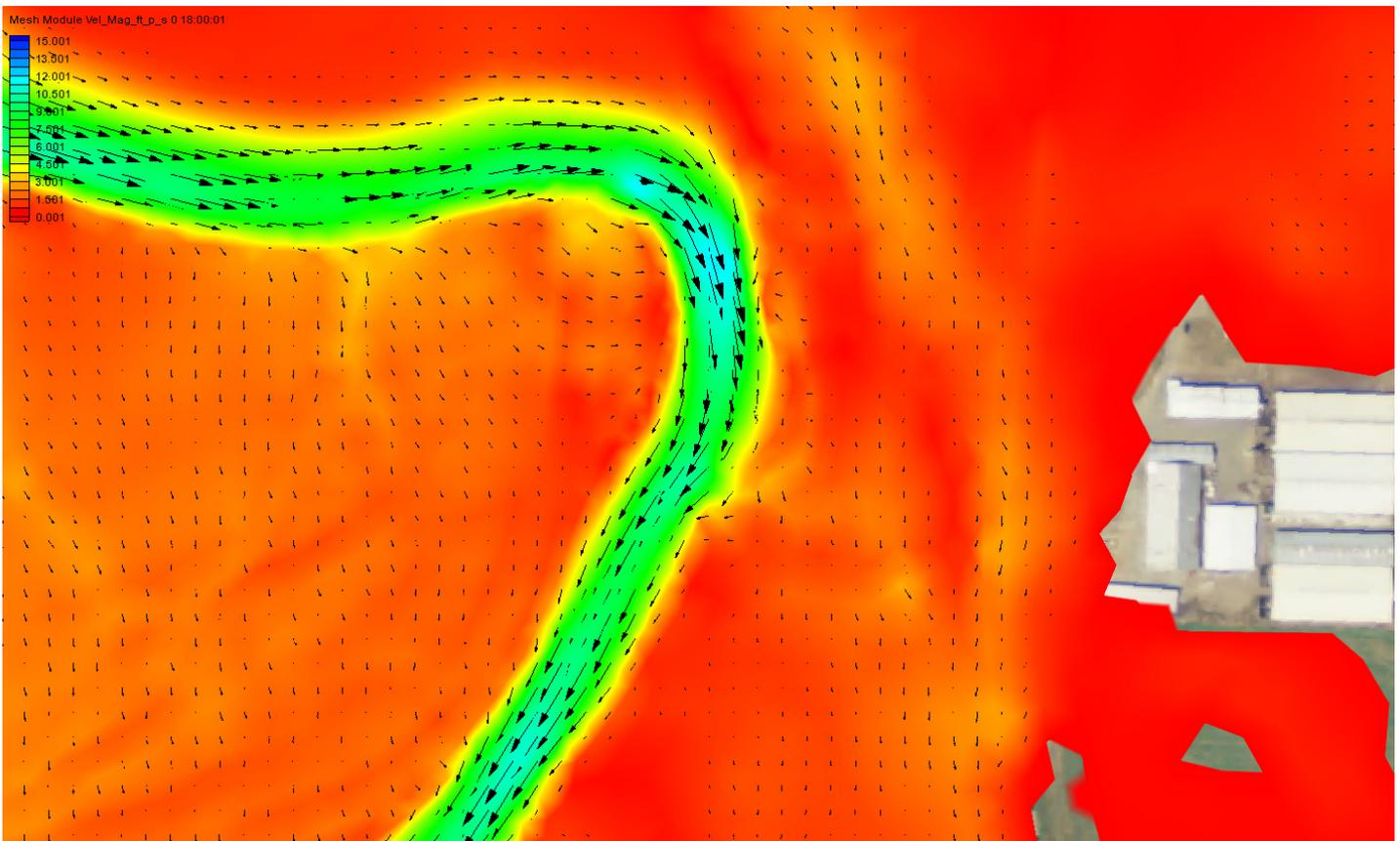


When Satsop River flow reaches about 20,000 cfs there is significant flow in the swale near Keyes Road and which reaches the dike along the north side of the WDFW pits and is directed back towards the west, towards the Satsop River. The WDFW ponds are still only receiving water from the south at this point in the flood event.

Nov 2012 Flood: Water velocity magnitude at failed revetment – hour 18 (Peak of event) (28,900 cfs)



Nov. 2012 Flood: Velocity magnitude at failed revetment – hour 18 (Peak of event) (28,900 cfs)



Zoomed in view showing the velocity magnitudes and patterns near the location of the revetment failure near Keys Road at the peak of the November 2012 event. Note that the velocities are significantly lower than earlier in the event as overbank flows tend to backwater the site and reduce overall flow velocities and attack of the left bank.