Woodson Debris Flow
December 2007

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Photo: KGW website, 2007
What is a Debris Flow?

A mixture of water and soil-rock-woody debris that have become a liquefied slurry in a channel and commonly move very rapidly down slope (>10m/s~25miles/hour).

Example: The Dodson Debris Flow, Columbia River Gorge, OR 1996
How do Debris Flows Start?

Three common ways that debris flows initiate:

1. A small landslide fails into a channel & grows into a debris flow on the way down the channel.
2. Erosion of material in a channel by severe runoff grows into a debris flow.
3. A dam (usually from a separate landslide or an existing fill) in the channel fails & grows into a debris flow on the way down the channel.

* Woodson debris flow was a combination of 1 & 3.
What Happened in Early December?

A large storm hit NW Oregon December 1-4, 2007

Data and image credits: NOAA – NWS website, 2007
Where Did It Happen?

Pre-Event maps from Woodson/Highway 30 up to the ridge top (roughly 1.5 miles)

Maps created with assistance from Jason Hinkle, 2007
December 2nd or 3rd Map

It is likely that one or more small landslides triggered a debris flow that traveled ~1 mile to the old RR trestle-fill embankment and blocked the drainage.

Maps created with assistance from Jason Hinkle, 2007

Burns, December 2007
December 2\textsuperscript{nd} or 3\textsuperscript{rd} Details

- Likely during the heavy rains on December 2\textsuperscript{nd} or 3\textsuperscript{rd}, one or two landslides roughly 1.5 miles up slope of Woodson and roughly 1/4 mile up slope of the RR trestle-fill embankment failed into Eilertsen Creek and formed debris flows that traveled down to the old RR trestle-fill embankment.
- These debris flows likely blocked the drainage under the RR crossing.

Photo by Josh Thule, 2007

Photo of one of the two small landslides (eastern small landslide on previous map)
With the drainage under the old RR trestle-fill embankment blocked, a temporary lake formed behind the embankment December 4-11.
December 4\textsuperscript{th} through 11\textsuperscript{th} Details

- After the drainage under the old RR trestle-fill embankment was blocked, a temporary lake roughly 30-40 feet deep and 200 feet long formed behind the embankment.
- The land owner noticed this lake and called the Oregon Department of Forestry (ODF).
- After study of the old RR trestle-fill embankment and lake, ODF notified the residents in Woodson and the Oregon Department of Transportation that a debris flow was eminent.
- The residents in Woodson were evacuated and Highway 30 closed during the morning of December 11\textsuperscript{th}. 

Photo by: Bill Burns, 2007
The temporary lake was too deep for the old RR trestle-fill embankment to hold, and the embankment failed catastrophically, initiating a debris flow that engulfed the town of Woodson and Highway 30.
December 11th Details

- Around noon on December 11th the old RR trestle-fill embankment failed catastrophically and a debris flow engulfed the town of Woodson and Highway 30.
- There were no fatalities.

Image credits: MSNBC website, 2007; KGW website, 2007; and Scott Burns, 2007
The bedrock in the slopes above Woodson is relatively loose sandstone, which weathers to a sand. There are NO igneous rocks, which tend to weather to boulders. This is why the debris flow deposit at Woodson did not have big boulders like some other debris flow deposits in Oregon. The Woodson debris flow was composed of mostly water, sand, and woody debris.
Prior to Intense Storm Events

1) Be familiar with the land around you
   – Learn if you are in a debris flow prone area

2) Support your local government to develop regulations or ordinances related to development in hazardous areas

3) Watch the weather
   – Heavy rainfall
   – Quick snowmelt

4) Contact local emergency-response authorities for evacuation plans in your area and develop emergency plans for your family or business
During Intense Storm Events

1) Stay awake and alert
   - Listen for unusual sounds (cracking trees, boulders knocking together)
   - Watch for sudden increase or decrease in water flow in a channel
   - Watch for buildup of water in abnormal places

2) If you are in a debris flow prone area, consider leaving the area

3) If driving, be alert
Conclusions

- Excessive rainfall can trigger landslides
- The entire length of a drainage may be effected, especially in the drainage mouth area
- At Woodson, the hazard was increased by the water damming behind the old RR trestle-fill embankment
- Property owners and state agencies worked together to warn those at risk
- Systematic landslide hazard analysis in Oregon will lead to:
  - Effective mitigation strategies
  - Improved warning systems
  - Increased life safety and reduced property damage