

# 1 Problem

What	Problem(s)	Landslide
When	Date	March 22, 2014
	Time	~10:40 a.m.
	Different, unusual, unique	Many previous landslides in area; outdated boundaries for logging
Where	Facility, site	Oso, Washington
	Unit, area, equipment	Residential neighborhood
	Task being performed	Reactivation of existing landslide

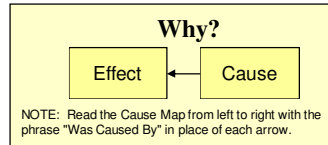
## Impact to the Goals

Safety	27 known deaths; 22 missing (could overlap)	
Environmental	Landslide	
Customer Service	30 families displaced	
Regulatory	Logging in area that should have been protected	
Property/ Equipment	Estimated losses	\$10 M
Labor/ Time	Massive search, recovery efforts	

Frequency	Similar slide in area on January 25, 2006; other slides in 1949, 1951, 1967	This incident \$10 M
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# Risks of Future Landslides - and Actual Past Landslides - Ignored in Tragedy

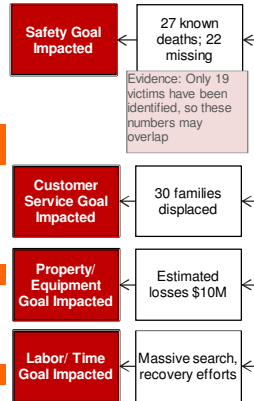
Oso, Washington  
March 22, 2014



## Timeline

Date	Description
1949	Nearly 1,000' landslide (no injuries or structural damages)
1951	Mudflow partially dams river
Fall 1960	Report warning of slide area expansion
1961	Berm constructed at upstream end of slide
1962	High water results in loss of most of berm
1964	Installation of rock barrier
1964	Mud overtops rock barrier
January 1967	Landslide buries barrier, damages dozens of homes
1969	Report warning of hazardous area
1980s	Report of expanded landslide activity
May 1988	Landowner receives approval to begin logging above slope
August 1988	DNR issues stop-work order on logging
November 1988	Landslide moves river south again
1997	Report of landslide conditions
1999	Report warning of catastrophic failures
2000s	Officials plan to move river 430 feet to the south
June 2004	Modified tree removal application accepted
January 25, 2006	Landslide moves river 730'
January 28, 2006	Construction resumes on 5 new houses in area
Summer 2006	Installation of log wall anchored with concrete
2009	Another home is built in the area
	Approval of more logging on plateau
2010	Landslide area ranked as one of the highest risk areas
2011	Approval of more logging on plateau
2013	DNR decided area should be reanalyzed for landslide risks
March 22, 2014	Landslide kills at least 27, destroys 30 houses in area

## 2 Analysis



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Cause Mapping is a Root Cause Analysis method that captures basic cause-and-effect relationships supported with evidence.

## CAUSE MAPPING

Problem Solving • Incident Investigation • Root Cause Analysis

- Step 1 **Problem** - What's the Problem?
- Step 2 **Analysis** - Why did it happen?
- Step 3 **Solutions** - What will be done?

## 3 Solutions

