

**Technical Memorandum:  
River Bank Erosion at SR 7, Milepost 4.75,  
Tilton River, Lewis County, WA**



**Work Order MT0265**

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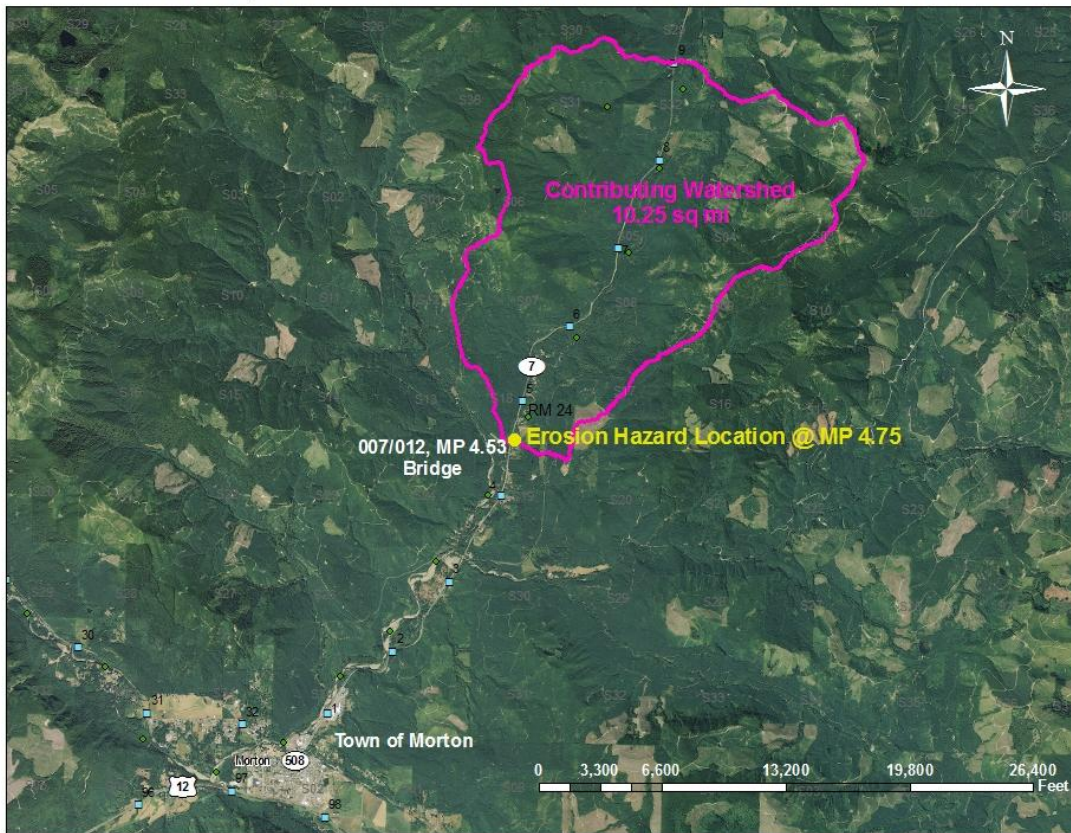
## Overview:

This technical memorandum analyzes hydrologic and geomorphic conditions that contribute to an erosional scour problem at milepost 4.75 on SR 7. At this location, a riprap blanket formerly covered the right embankment of the Tilton River next to the northbound lanes of SR 7. This protective blanket has been eroded to the point where the pavement and guard rail are nearly undermined. A utility line, likely for fiber optics, has also been exposed by the erosional scarp. At this location, the Tilton River's thalweg transitions from left bank to the right bank, creating cross flows that collide with the right bank at an angle of approximately 55 degrees. The cross flows impart shear stresses on the bank during high flows and flood flows. The shear stress contributes to undermining the road prism and subsequent failure of the road prism and stream embankment.

There is little documentation of the history of erosion problems at this location. However, the previous erosion problems and repairs are visually apparent. Evidence of previous erosion at this site includes the remnants of a rock blanket that still exists directly downstream of the current erosional scarp and two vertical wood piles that were apparently used to anchor some type of retaining or crib wall. Within the approximately 420 feet between the MP 4.75 erosion site and the (functionally obsolete) 007/012 bridge there are three other erosional scarps that have formed on the right bank, although none currently threaten the highway.

The Tilton River at the project site is a 3<sup>rd</sup> order stream. Its upper reaches are mid-elevation commercial forest lands that have been actively and repeatedly logged for decades. Residential development exists only in the floodplains and adjacent terraces. Commercial and industrial development is nonexistent except for a few open timber storage facilities. The contributing watershed is quite steep outside of the floodplain, with a main basin slope of 35 percent and a relief of 3620 feet.

### SR 7, MP 4.75 Erosion Hazard Site Location



**Figure 1. Location of Bridge 07/012 and the erosion hazard area along the Tilton River.**

#### **Geomorphic and Hydrologic Conditions:**

The FEMA jurisdictional floodplain in the project reach varies from 210 to 630 feet wide, with an average of 350 feet. SR 7 at MP 4.75 demarcates the western extent of the FEMA floodplain in the project reach. SR 7 has not been prone to flooding because of the large active floodplain that exists to the east of the Tilton that can accommodate flood flows. The floodplain riparian areas are relatively intact in the project reach and contribute significant amounts of large woody debris to the Tilton.

**Table 1. Basin and peak flow statistics for the Tilton River at RM 23.4.**

Statistic	Value
Drainage Area	10.25 mi <sup>2</sup>
Mean Annual Precipitation	83.5 in
Maximum Basin Elevation	4730 ft
Minimum Basin Elevation	1120 ft
Mean Basin Slope	35%
Sinuosity	1.8
Project Site River Gradient	0.007
2-Year Flow	569 cfs
10-Year Flow	1010 cfs
25-Year Flow	1240 cfs
50-Year Flow	1430 cfs
100-Year Flow	1620 cfs
500-Year Flow	2100 cfs

**Recommendations:**

Any effective long-term solution for the erosion hazard at MP 4.75 will have to address three elements:

- 1) Heavy loose riprap has previously been used to protect the bank and failed. Larger rock is needed.
- 2) The embankment is currently over-steepened with a slope greater than 1:1.
- 3) The thalweg of the Tilton River is currently directed at the toe of the erosional scarp and will continue to facilitate erosion at the site.

The recommended fix also consists of three elements:

- 1) Very large 4 to 5-man rock revetment, stacked from the toe of the slope up to (at least) the ordinary high water mark.
- 2) Several root wads anchored by the 4 to 5-man rock, projecting three to six feet into the bed of the river at an angle of approximately 55 degrees from perpendicular. The root wads will deflect the river's thalweg away from the bank.
- 3) Quarry spall backfill from the top of the revetment up to the pavement and guardrail.

## SR 7, MP 4.75 Erosion Hazard Site

The revetment should not project into the river beyond the previous bank line. The only features that should project into the river bed should be the root wads.

A prime example of this type of bank repair was constructed in 2009 by Wahkiakum County Public Works on Nelson Creek. Photos of the completed bank repair are shown in Figures 2, 3, and 4.



**Figure 2. Bank repair on Nelson Creek, Wahkiakum County, looking north.**



**Figure 3. Bank repair on Nelson Creek, Wahkiakum County, looking south.**



**Figure 4. Bank repair on Nelson Creek, Wahkiakum County, people for scale.**

## **References**

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