

July 14, 2022



# Wilson River Highway (OR6) MP 32 to 37 Landslide Investigations and Planning

Larry Robinson, *Project Lead, Engineering Geologist, R.G., C.E.G.*

Michael Tardif, *Senior Engineering Geologist, R.G., C.E.G.*

Tony Robinson, *Senior Geotechnical Engineer, Ph.D., R.G., C.E.G., P.E., G.E.*

Region 2, Geo/Hydro/HazMAT Unit

# Meeting Agenda

---

- **Overview of the Problem Area**
- Data from the Statewide Unstable Slopes Program
- Past Repair Efforts
- Results from the Current Investigation
- Repair Options for the Active Failures at MP 34.8
- Corridor Realignment

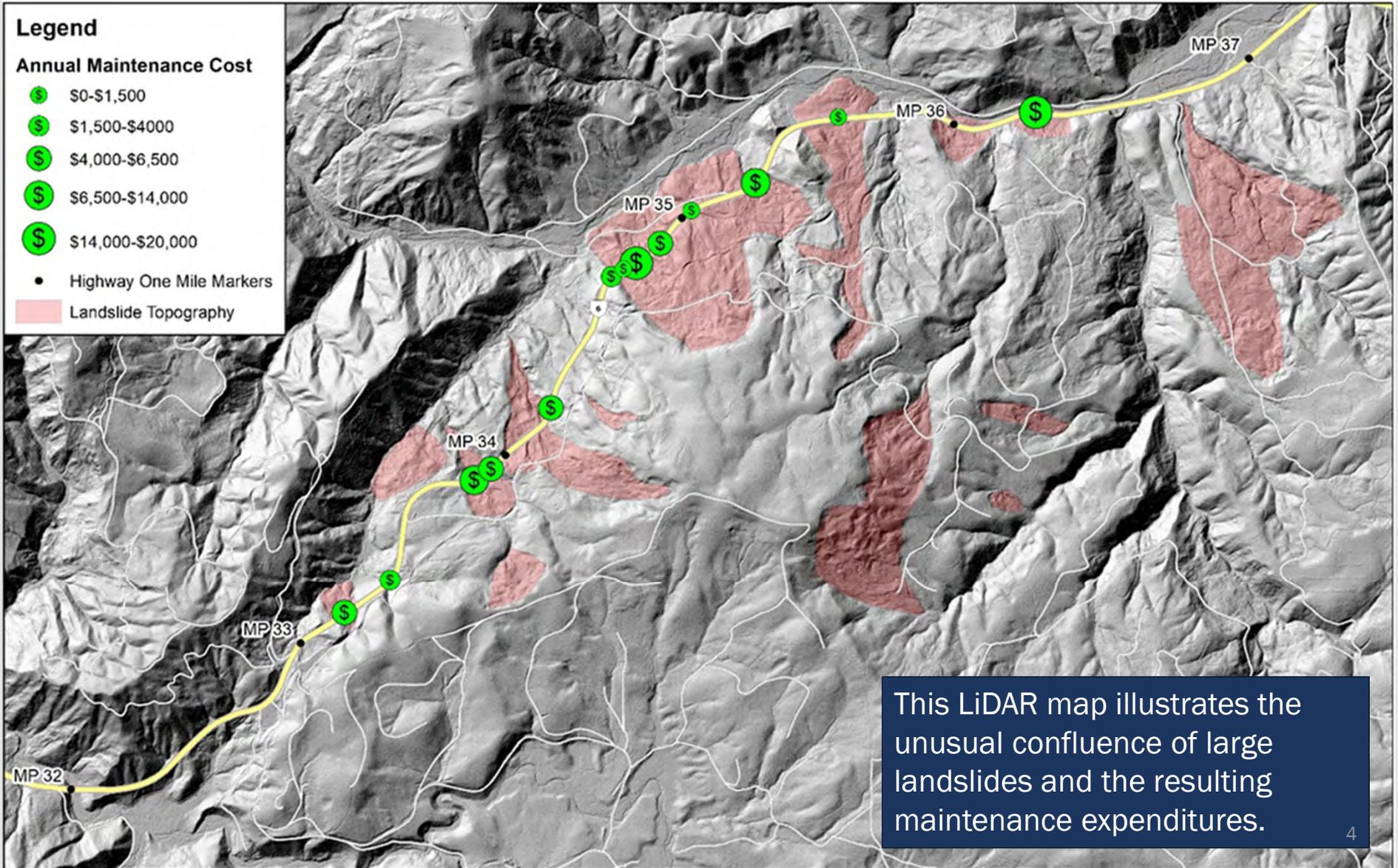
## Problem Area: Wilson River Highway (OR6) MP 32 to 37

- Wilson River Highway, major route between Tillamook and Metro Portland (73 miles).
- The alternative route is via US101 to US26 (119 miles), which adds over an hour of travel time on average.

## Legend

### Annual Maintenance Cost

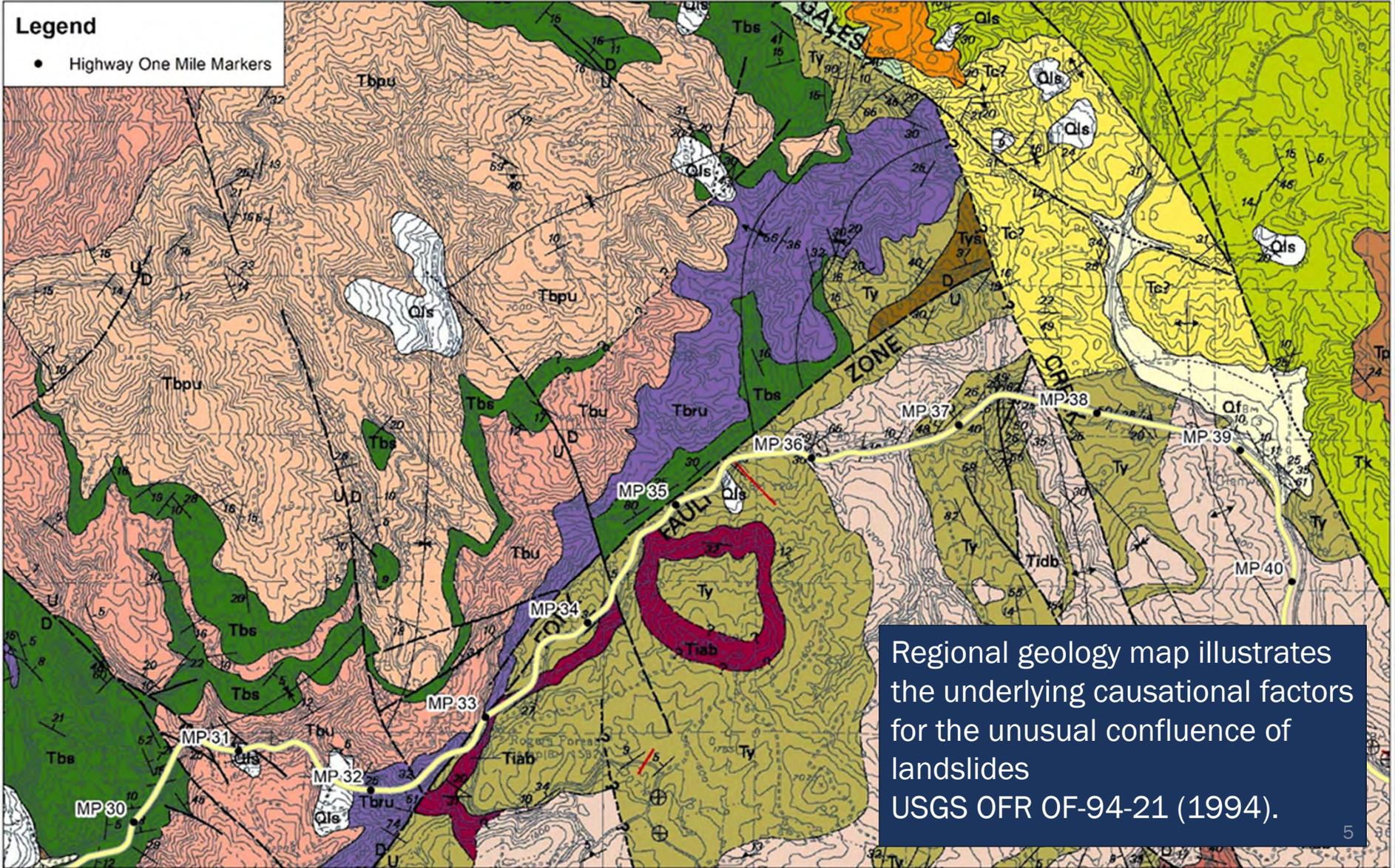
-  \$0-\$1,500
-  \$1,500-\$4,000
-  \$4,000-\$6,500
-  \$6,500-\$14,000
-  \$14,000-\$20,000
-  Highway One Mile Markers
-  Landslide Topography



This LiDAR map illustrates the unusual confluence of large landslides and the resulting maintenance expenditures.

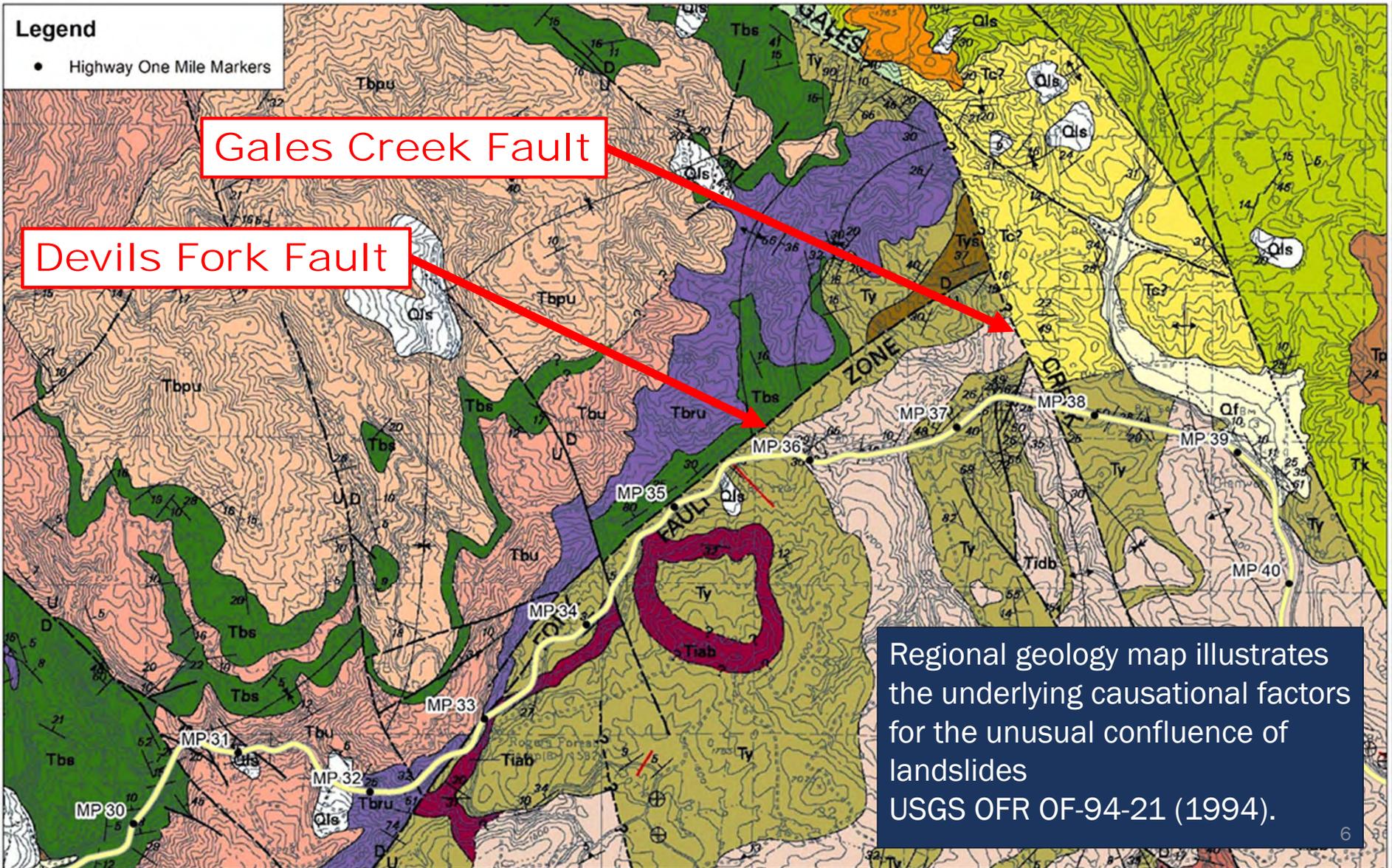
**Legend**

- Highway One Mile Markers



**Legend**

- Highway One Mile Markers



Gales Creek Fault

Devils Fork Fault

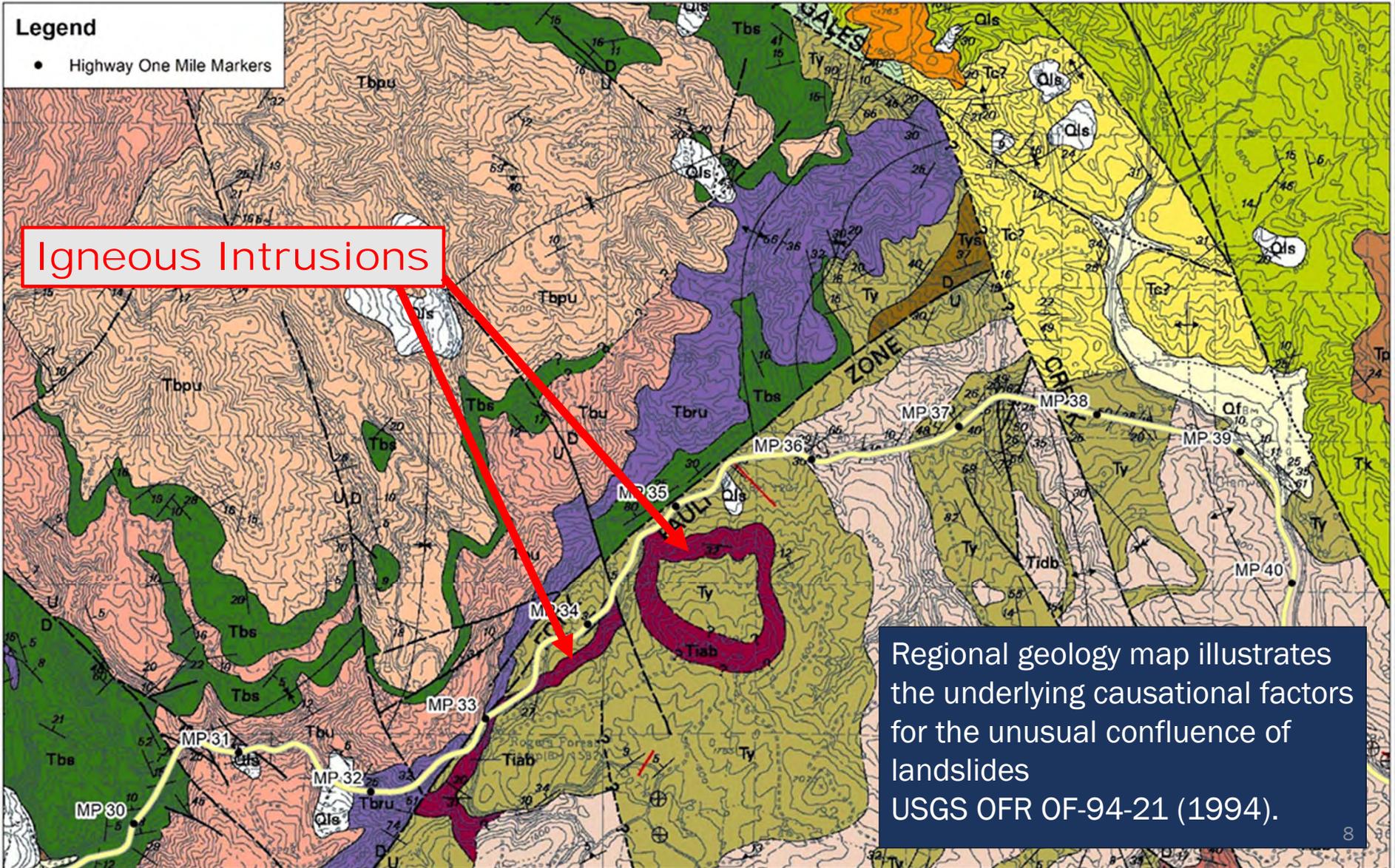
Regional geology map illustrates the underlying causal factors for the unusual confluence of landslides  
USGS OFR OF-94-21 (1994).



**Legend**

- Highway One Mile Markers

Igneous Intrusions



Regional geology map illustrates the underlying causal factors for the unusual confluence of landslides  
USGS OFR OF-94-21 (1994).



# Meeting Agenda

---

- Overview of the Problem Area
- **Data from the Statewide Unstable Slopes Program**
- Past Repair Efforts
- Results from the Current Investigation
- Repair Options for the Active Failures at MP 34.8
- Corridor Realignment

## Statistics from Statewide ODOT Unstable Slopes Program

- The Statewide Unstable Slopes Program (USP) tracts 1,847 sites in Region 2.
- Two of the top 50 ranked STIP sites along OR6.
  - STIP score of 32 at MP 33.89 (fill failure).
  - STIP score of 49 at MP 33.96 (fill failure).
- OR6 corridor annual maintenance costs reported at \$100,293.98 (2020).
- OR6 corridor geotechnical mitigation costs estimated at ~\$21 M (2020).
- Considering a 3x multiplier for all elements to construct, actual costs estimated at ~\$63 M.



# Meeting Agenda

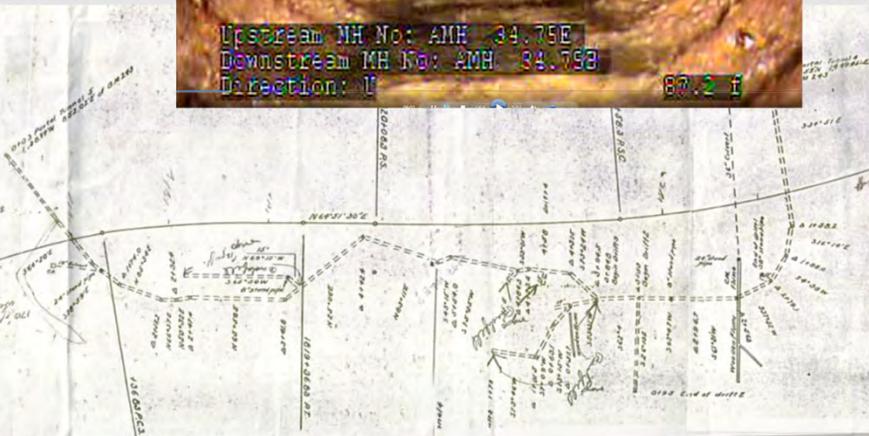
---

- Overview of the Problem Area
- Data from the Statewide Unstable Slopes Program
- **Past Repair Efforts**
- Results from the Current Investigation
- Repair Options for the Active Failures at MP 34.8
- Corridor Realignment

## Past Repair Efforts in this Area

- Failures mapped as far back as 1939. Tillamook Burn 1933 to 1951. Highway developed during this time.
- Hand-excavated drainage tunnels at MP 34.8 circa 1956, now collapsing.
- Historic 1996 Floods caused extensive damage along the corridor (side image).
- Soldier Pile Walls installed at MP 33.25, 33.75 and 34.25 circa 2010 (total cost est. \$4.1 M).
- Light weight fill (i.e. sawdust) used to reduce soil loading in several locations. Sawdust fills now decomposing causing widespread settlement.





## 1956 Drainage Tunnels

- Drainage tunnels installed by specialty mining crews to facilitate drainage around the active landslides at MP 34.8.
- Tunnels lined with concrete and corrugated pipes.
- Tunnels now collapsing forming sink holes at the surface.
- Effectiveness of these drainage tunnels is now reduced.



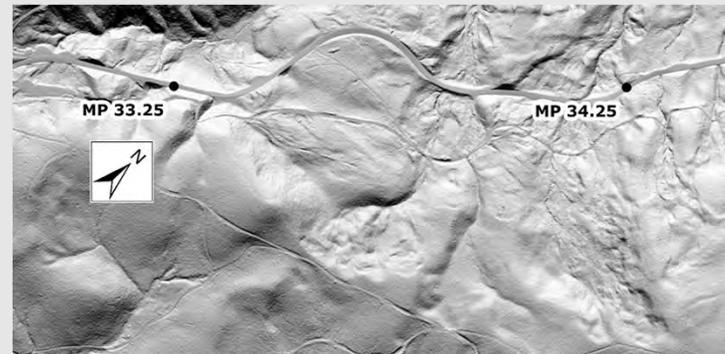
## 1996 Flood Damage

- 1996 associated rain events caused widespread damage along the OR6 corridor.
- Several partial roadway collapses occurred.
- Example images from MP 33.3.



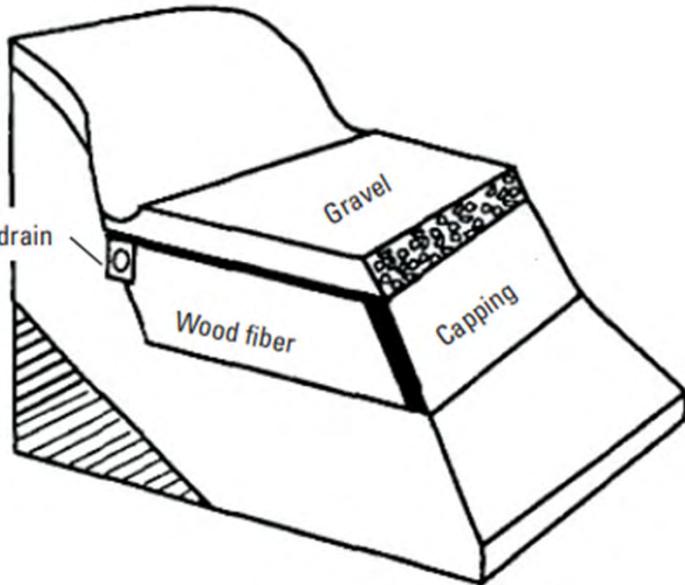
## 2010 Soldier Pile Walls

- Soldier Pile Walls installed circa 2010 for a total cost of ~\$4.1 M.
- MP 33.25 – 250 feet of wall.
- MP 33.75 – 230 feet of wall.
- MP 34.25 – 200 feet of wall.

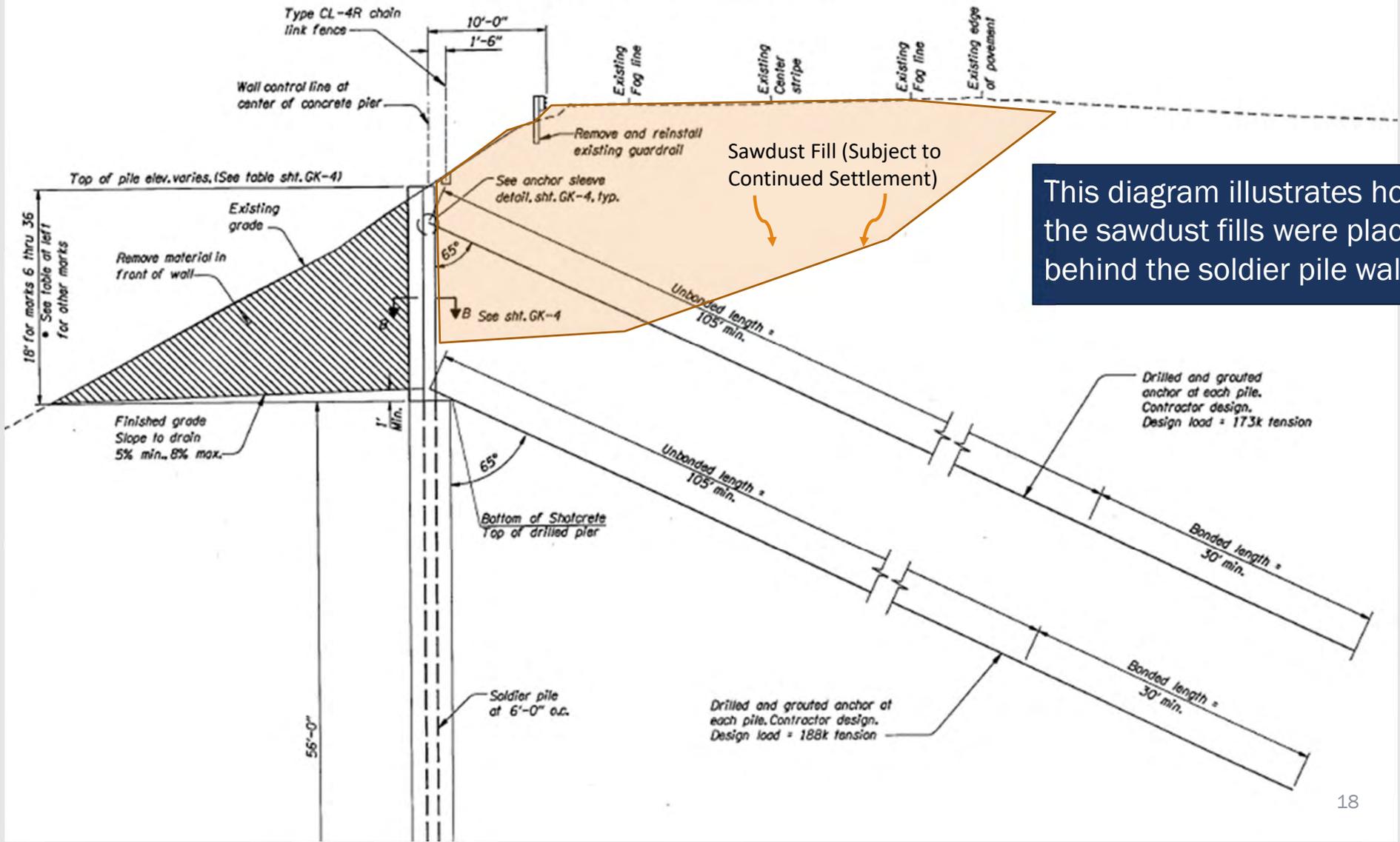


## Lightweight Fill Repairs

- Lightweight fill materials used to reduce loading on these landslide features during repair efforts circa 1996 and 2010.
- In accordance with standard practice of the time, lightweight fill composed of wood fiber or sawdust was used.
- This material is now decomposing causing continued settlement of the pavement.



# ANCHORED SOLDIER PILE WALL



This diagram illustrates how the sawdust fills were placed behind the soldier pile walls.

# Meeting Agenda

---

- Overview of the Problem Area
- Data from the Statewide Unstable Slopes Program
- Past Repair Efforts
- **Results from the Current Investigation**
- Repair Options for the Active Failures at MP 34.8
- Corridor Realignment

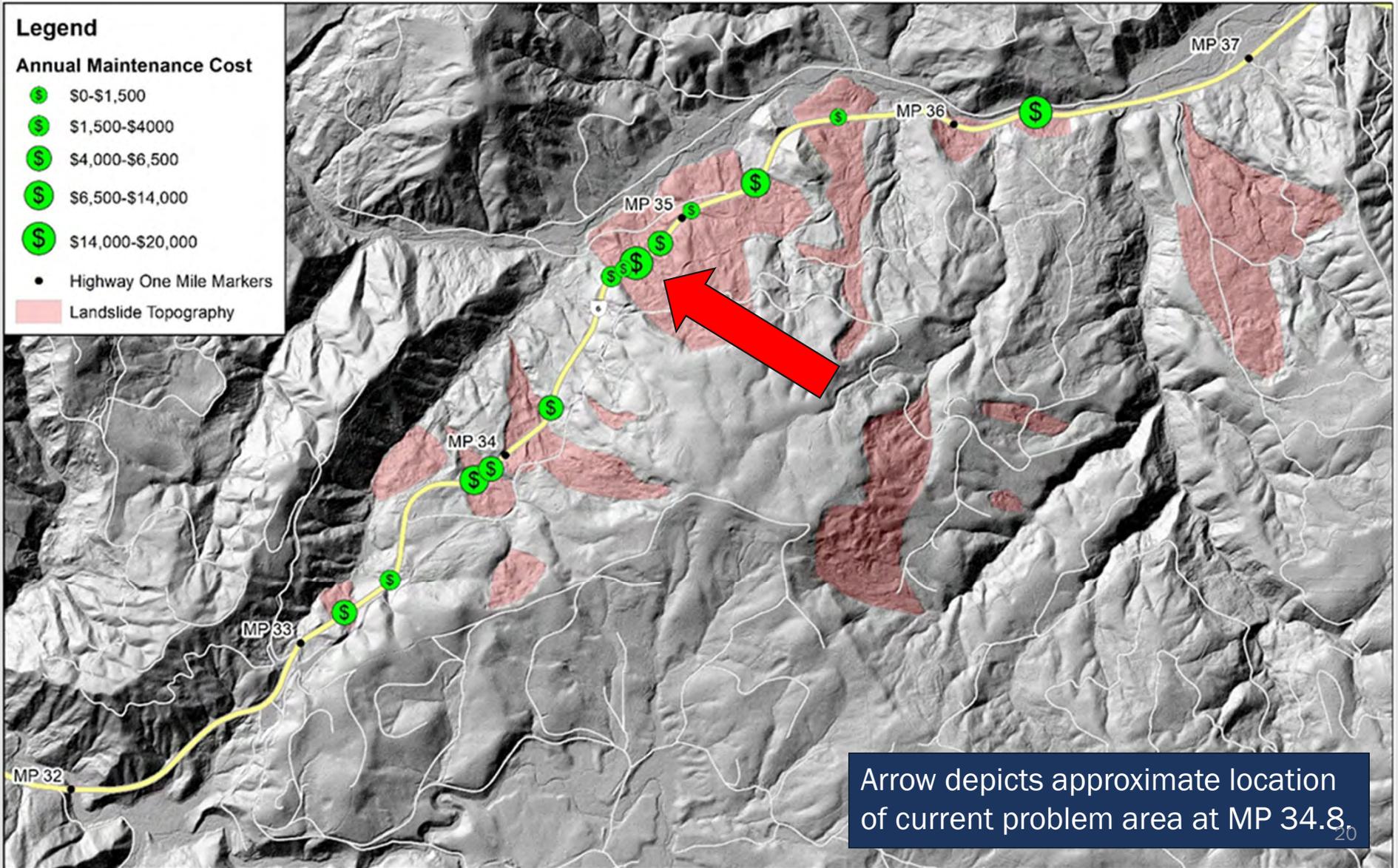
### Legend

#### Annual Maintenance Cost

-  \$0-\$1,500
-  \$1,500-\$4,000
-  \$4,000-\$6,500
-  \$6,500-\$14,000
-  \$14,000-\$20,000

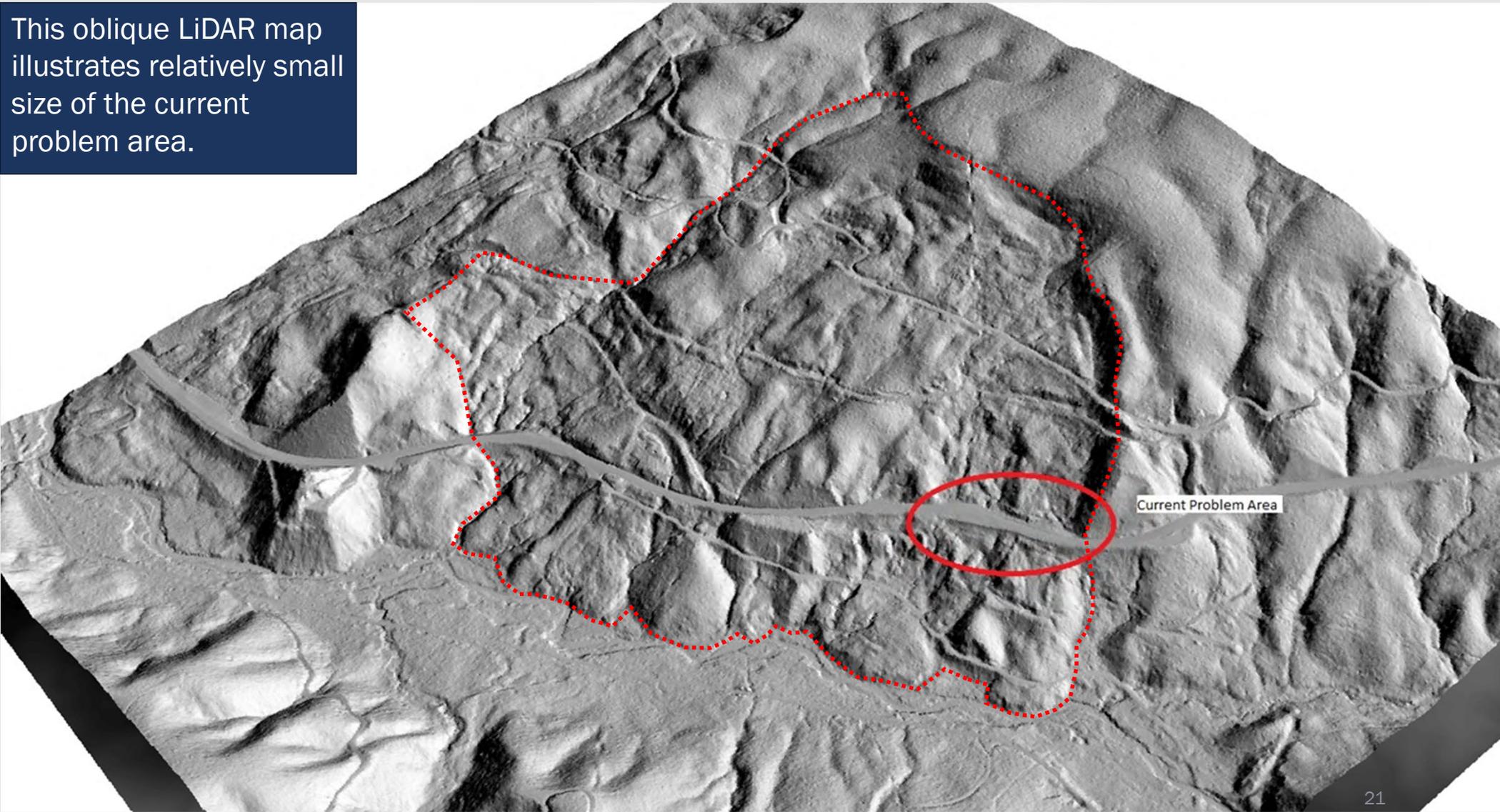
 Highway One Mile Markers

 Landslide Topography

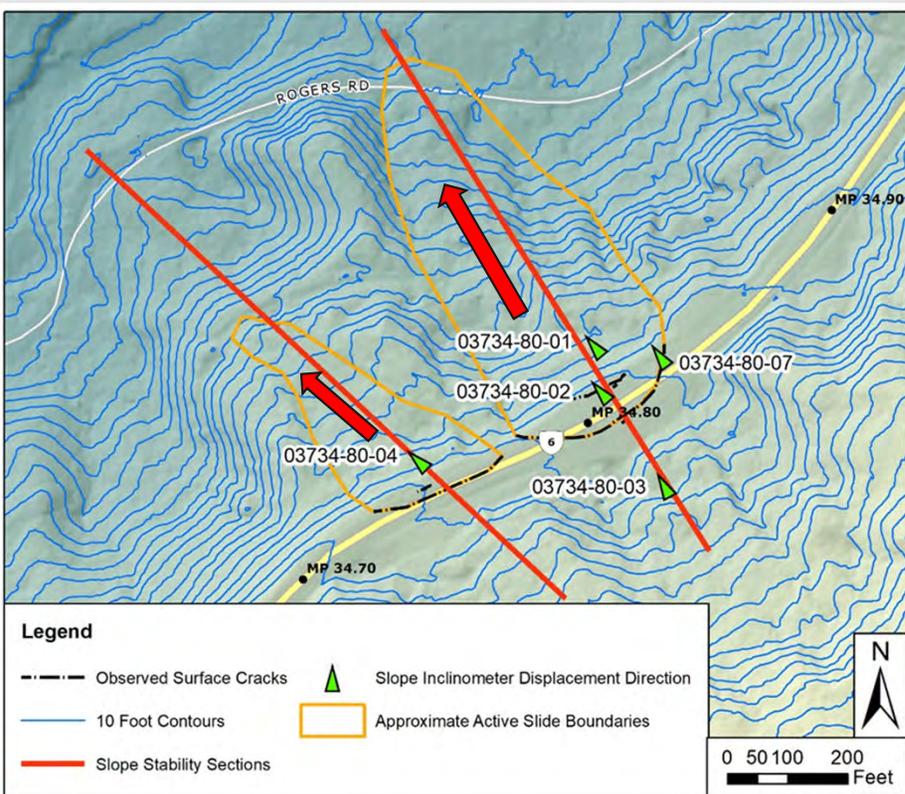


Arrow depicts approximate location of current problem area at MP 34.8

This oblique LiDAR map illustrates relatively small size of the current problem area.



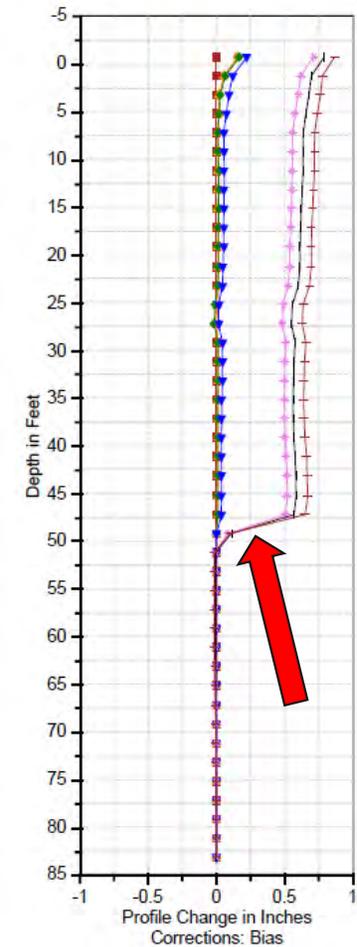
## Results from the Current (2021) Investigation (MP 34.8)



- Slide comprised of two active lobes.
- West lobe is about 275 feet wide.
- East lobe is about 310 feet wide.
- West slide instrumentation indicates depth of movement at 32 feet bgs, just above contact with landslide debris and bedrock.
- East slide instrumentation indicates depth of movement at 37 feet bgs, and 48 feet bgs, just above contact with landslide debris and bedrock.
- Deep basal shear zone (i.e. >30 ft.) dramatically increases repair costs.

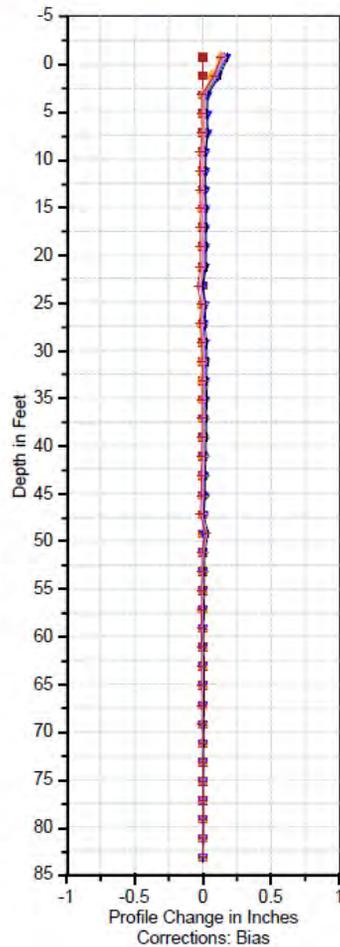
OR6 03734-80-02 A

9/23/2021 9/29/2021 10/1/2021  
 10/14/2021 11/1/2021 11/17/2021  
 12/1/2021 12/16/2021



OR6 03734-80-02 B

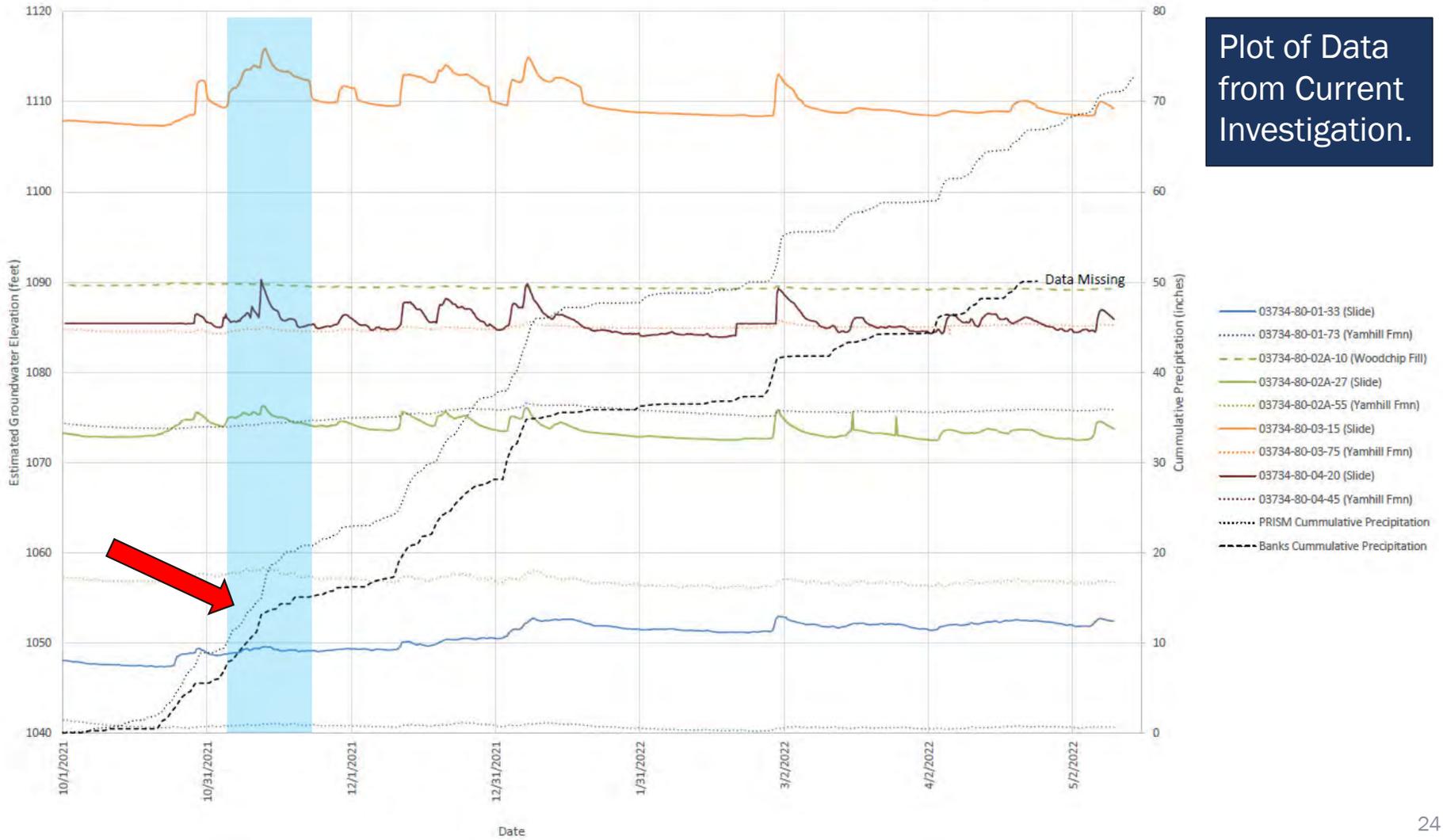
9/23/2021 9/29/2021 10/1/2021  
 10/14/2021 11/1/2021 11/17/2021  
 12/1/2021 12/16/2021



## Results from the Current Investigation

- Rates of movement indicate pulses or surges on the order of 0.04 to as much as 0.28 inches per week (winter 2021 / 2022).
- Some instruments abandoned due to excessive movement.
- Example plot shows little movement from 09-23-2021 to 11-01-2021, movement increased by 11-17-2021, and then slowed thereafter.

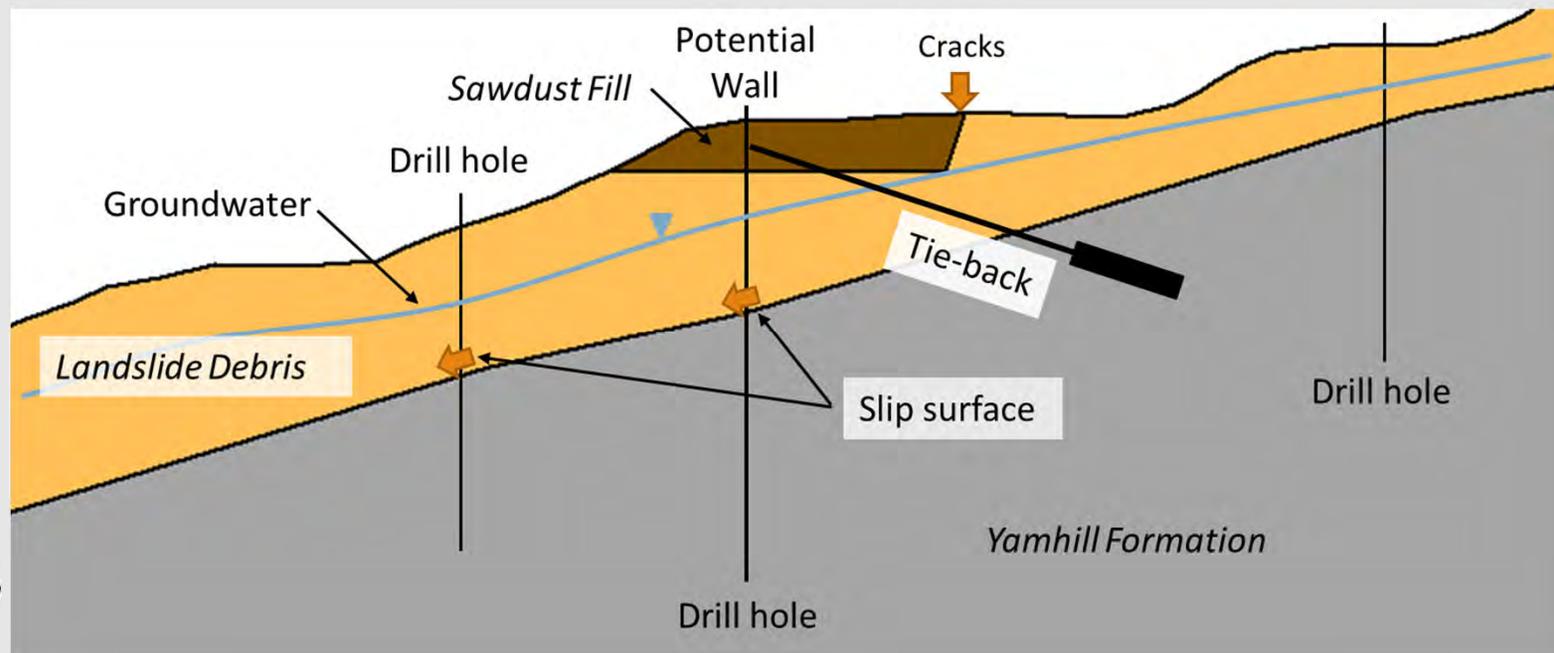
### OR6 MP34.8 Groundwater Elevations and Cummulative Precipitation



Plot of Data from Current Investigation.

# Results from the Current Investigation

- Preliminary landslide slope stability modeling performed to evaluate feasibility of mitigation alternatives.



# Meeting Agenda

---

- Overview of the Problem Area
- Data from the Statewide Unstable Slopes Program
- Past Repair Efforts
- Results from the Current Investigation
- **Repair Options for the Active Failures at MP 34.8**
- Corridor Realignment

# MP 34.8 Preliminary Mitigation Options

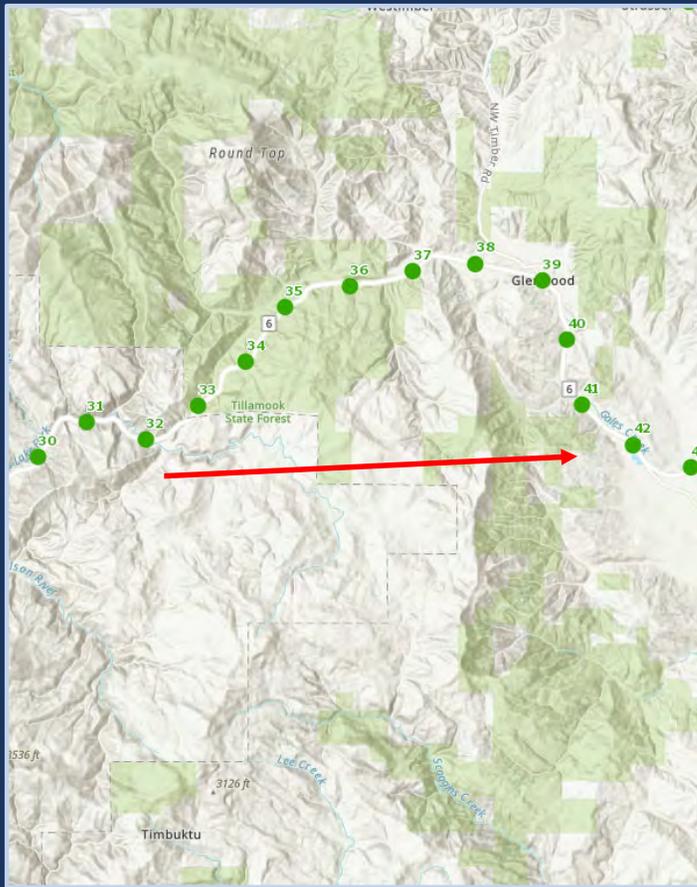
Option	Risks	Benefits	Est. Cost <sup>(1)</sup>
Tie-back Soldier pile wall	More investigation, one continuous wall for both slides, may need two wall lines and multiple rows of tie-backs	Removes sawdust fill, maintains current alignment, less impact to traffic / mobility	Estimated ~\$20 M
Local Highway Realignment	More investigation, reactivation of surrounding landslide(s), alignment alteration, impacts to traffic / mobility	Avoids existing landslide / sawdust fill	Estimated ~\$6 to \$10 M Shift Roadway Upslope and off Active Portion of Slide
Excavate and Replace Highway	More investigation, may still need tie-back soldier pile wall, impacts to traffic / mobility	Removes sawdust fill, maintains current alignment	Estimated ~\$9 to \$15 M Place Large SEM Fill

# Meeting Agenda

---

- Overview of the Problem Area
- Data from the Statewide Unstable Slopes Program
- Past Repair Efforts
- Results from the Current Investigation
- Repair Options for the Active Failures at MP 34.8
- **Corridor Realignment**

## OR6 MP 32 to 37 Corridor Realignment



- A study is needed to find a suitable alignment, which balances environmental, geological, land acquisition, and external stakeholder interests.
- Substantial planning involvement.
- Substantial property acquisition.
- Significant investigation needs, potentially along multiple alignment alternatives.
- Realignment of OR6 corridor assumes that highway will increase in overall length relative to that existing.
- Estimated cost in the \$100's M.

## Legend

### Annual Maintenance Cost

● \$0-\$1,500

● \$1,500-\$4,000

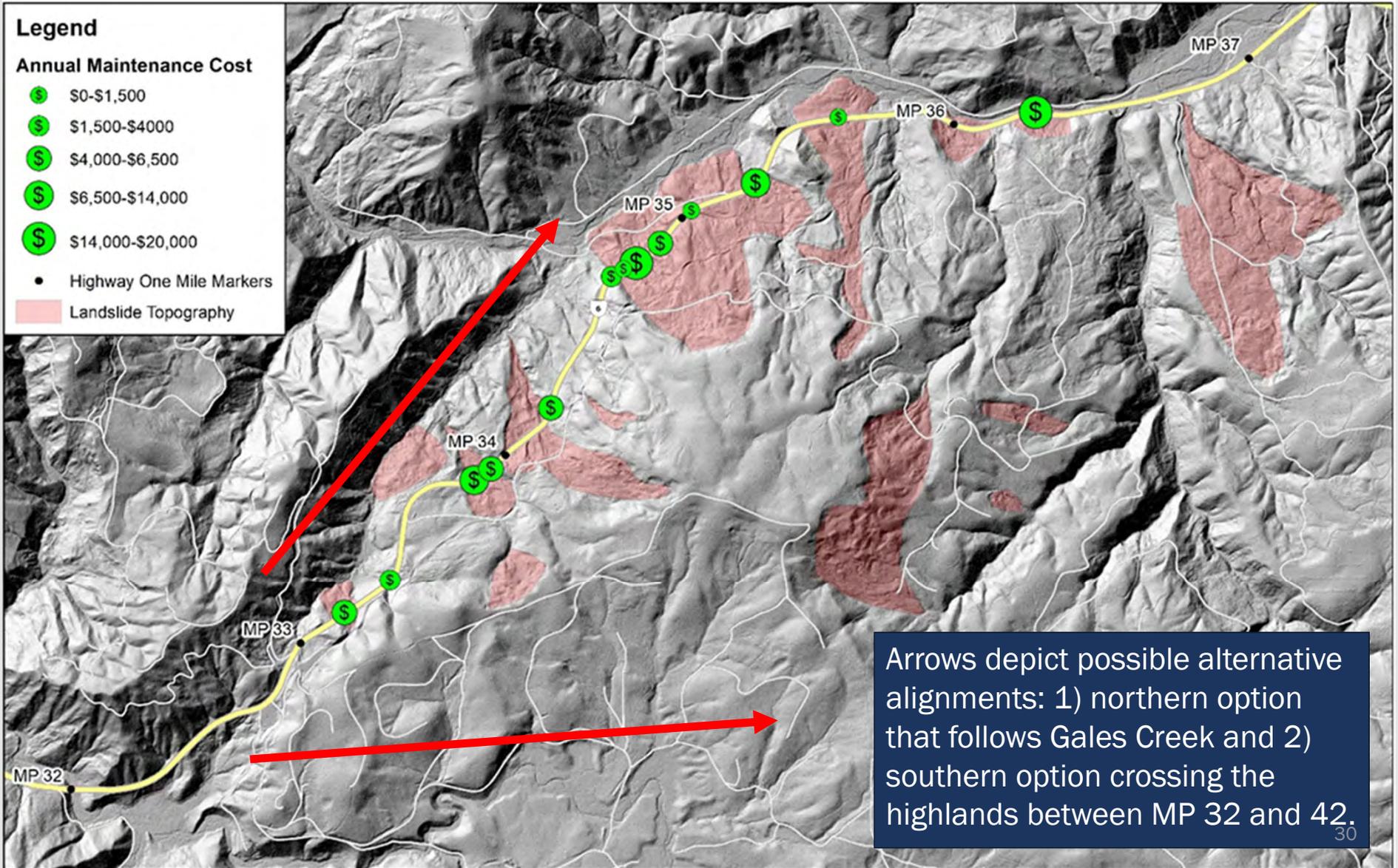
● \$4,000-\$6,500

● \$6,500-\$14,000

● \$14,000-\$20,000

● Highway One Mile Markers

■ Landslide Topography



Arrows depict possible alternative alignments: 1) northern option that follows Gales Creek and 2) southern option crossing the highlands between MP 32 and 42.

**Thank you for your time,  
Questions?**

