



May 5, 2008

TO: E. Pierson, North Central Region PEO, NCR

FROM: T.M. Allen / M.P. Mulhern  
OSC Materials Laboratory MS: 47365  
Geotechnical Services Division  
Fax (360) 709-5585

SUBJECT: SR 2 Vicinity MP 146.29 to 146.37, XL-3204 (Phase 5)  
State-Wide Risk Reduction Rock Slope Scaling Program  
Geotechnical Recommendations

## **INTRODUCTION**

A state-wide risk reduction scaling program was implemented by WSDOT in 2006. The program is meant to reduce rockfall until a permanent slope stabilization project under the P3 Unstable Slope Program can be programmed and constructed. This memorandum details our findings and mitigation recommendations for the unstable rock slope located on SR 2 between MP 146.29 and 146.37, approximately 4 miles west of Waterville, Washington (Figure 1).

## **GEOTECHNICAL ASSESSMENT**

Our geotechnical site assessment consisted of taking photographs of the slope, conducting Maintenance interviews, measuring slope heights, lengths, orientations, and detailing risk reduction work which includes slope scaling, debris removal, and determining estimated quantities. Project stationing was field located with cloth tape and spray paint.

## **SITE CONDITIONS**

This unstable slope is within a through-cut. The left unstable slope is approximately 400-feet long and about 50-feet high with the existing cutslope angle near-vertical (Figure 2). The right unstable slope is approximately 300-feet long and about 60-feet high with the existing cutslope angle also near-vertical (Figure 2). The ditch on both sides of the highway is about 10-feet wide, 2-feet deep, and contains much of the smaller rockfall; however, Maintenance indicates that rockfall is so frequent that the ditch is unable to contain the amount of rockfall produced year-round. Rockfall reaches both lanes of the highway at this location.

Both slopes are primarily composed of highly fractured, hackly jointed, slightly weathered, strong basalt. The bedrock is mapped as basalt flows of the Grande Ronde

Formation of the Columbia River Basalt Group. Block sizes range from a few inches to 4-feet in dimension. The highly fractured basalt results in raveling and toppling-type failures.

No seepage was observed on the slope during our site assessment on March 7, 2007.

### **MITIGATION RECOMMENDATIONS**

Mitigation measures to reduce rockfall at this location consist of scaling and debris removal.

#### **Scaling and Debris Removal**

Slope scaling limits and areas of intensive scaling are shown in Figures 4, 5, and 6. Within the slope scaling limits, typical rock scaling operations should be performed. The locations of intense scaling should consist of removing unstable blocks that we observed during our site visits.

We have estimated that 200 crew hours will be required for slope scaling. Special Provisions for Slope Scaling are provided in Appendix B. Scaling will likely damage the highway surfacing, so provisions for its repair should be included in the contract.

We also estimate that approximately 1000 cubic yards of debris will be generated during scaling operations. A Special Provision for Debris Removal Including Haul is provided in Appendix B.

### **CONSTRUCTION CONSIDERATIONS**

#### **Traffic**

Full roadway closures will be required to perform scaling operations. We anticipate that these closures will be accomplished with short-duration work windows on the order of 20 to 30 minutes in length.

#### **Geotechnical Inspection**

We request that a geotechnical specialist from our office be contacted to assess the slope prior to the completion of scaling to help the engineer determine whether or not additional scaling is required.

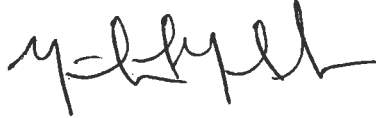
If you have questions regarding the information presented in this memorandum, then please contact Mike Mulhern at (360) 709-5583 or Doug Anderson at (360) 709-5427.

TMA:mpm

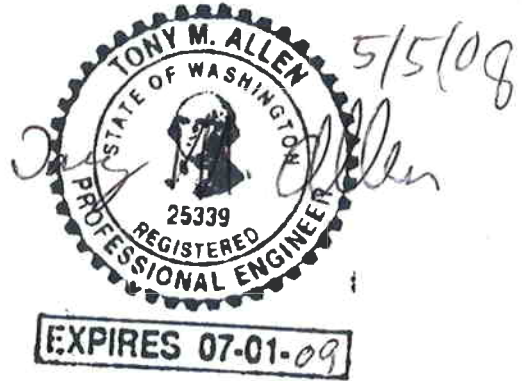
M. Fleming  
May 5, 2008  
Page 3

cc: J. Burnell, North Central Region, NCR  
J. Roseburg, North Central Region Materials Engineer, NCR  
D. Bierschbach, Assistant Region Administrator for Maintenance, NCR  
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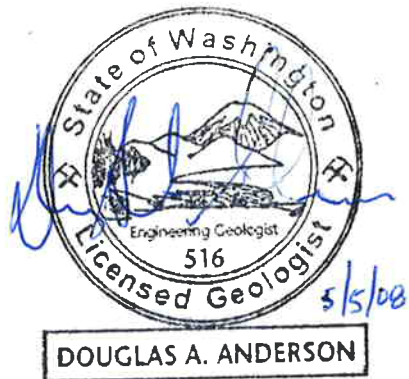
Prepared by:  
Michael P. Mulhern  
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Agency Approving Authority:  
TONY M. ALLEN, P.E.  
State Geotechnical Engineer



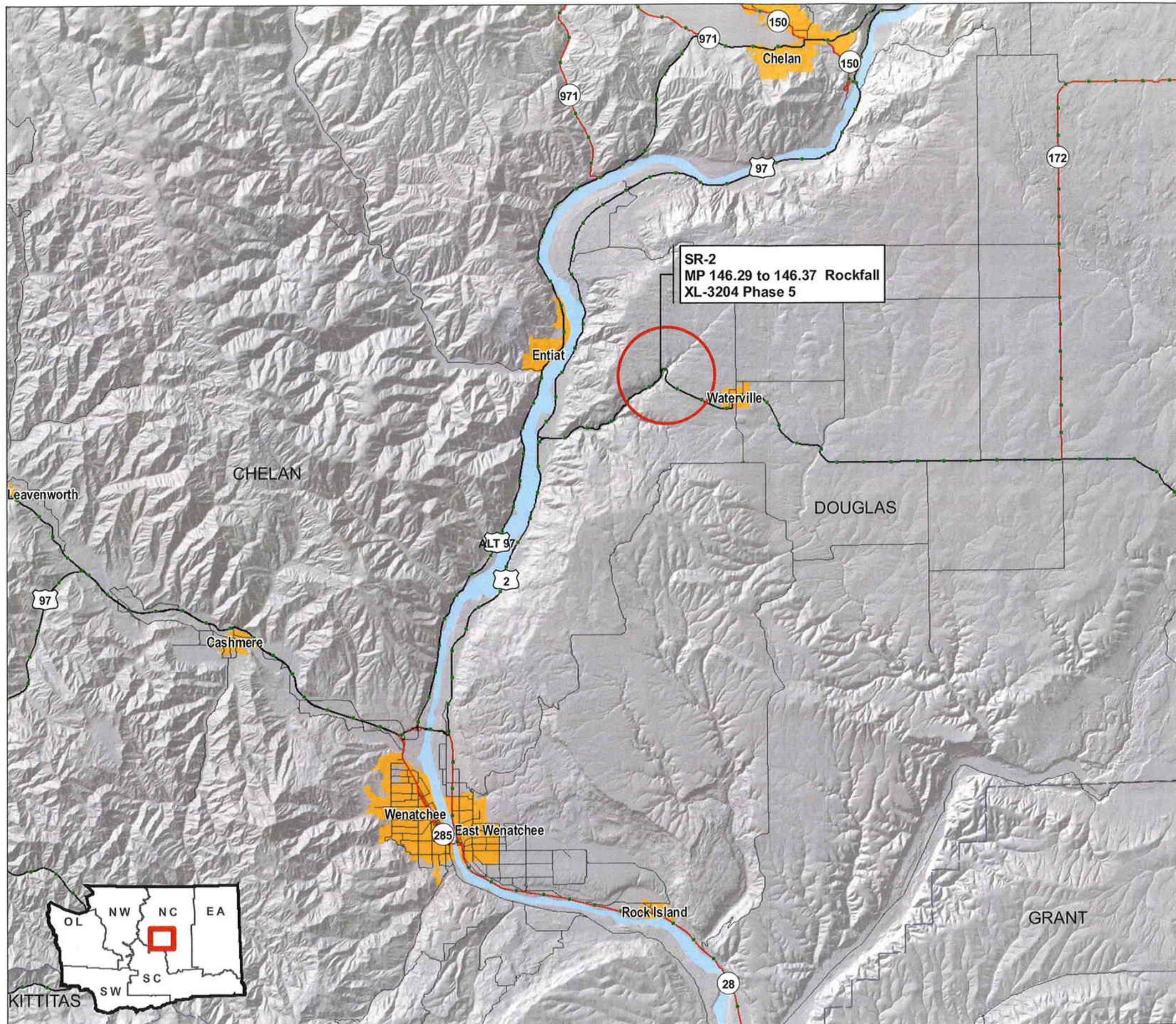
Technical Review By:  
Douglas A. Anderson, L.E.G.  
Assistant Chief Engineering Geologist



# **APPENDIX A**

## **Figures**

**FIGURE 1: SITE VICINITY**  
**SR-2 VICINITY MP 146.29 TO 146.37 ROCKFALL**  
 JOB# XL-3204 PHASE 5



**LEGEND**

- Risk Reduction Scaling Program Slopes
- Milepost Markers
- State Routes**
  - Interstate
  - US Route
  - State Route
  - Ramps
  - Proposed Route
  - Local Road
- County Boundary Lines
- Incorporated Cities



1:240,000

1 INCH EQUALS 20,000 FEET

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DATE	MARCH 17, 2008

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JOB XL-3204 S.R. 2

SR 2 vicinity MP 146.29 to 146.37 Rockfall



WASHINGTON STATE  
DEPARTMENT OF TRANSPORTATION  
GEOTECHNICAL DIVISION

DATE 4/2008  
SCALE N.T.S. VERT. HORZ.  
SHEET      OF       
DRAWN BY WM

Figure 2 - A photograph showing the unstable through-cut on SR 2 vicinity MP 146.29 to 146.37.

BEGIN ROCK  
SCALING LIMITS  
~STATION  
0+00  
↓

~STATION  
1+50  
↓

~STATION  
2+75  
↓



**LEGEND**

- - - Areas of Intense Scaling
- - - Slope Scaling Limits



**WASHINGTON STATE  
DEPARTMENT OF TRANSPORTATION  
GEOTECHNICAL DIVISION**

**FIGURE 3 (LEFT): RISK REDUCTION MITIGATION DESIGN**

SR 2 MITIGATION MEASURES

SR-2 SRMP 146.29 - 146.37 JOB # XL-3205

**NOT TO SCALE**

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~STATION  
2+75  
↓

END ROCK  
SCALING LIMITS  
~STATION  
4+00  
↓



LEGEND

- - - Areas of Intense Scaling
- - - Slope Scaling Limits



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GEOTECHNICAL DIVISION

FIGURE 4 (LEFT): RISK REDUCTION MITIGATION DESIGN

SR 2 MITIGATION MEASURES

SR-2 SRMP 146.29 - 146.37 JOB # XL-3205

NOT TO SCALE

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END ROCK  
SCALING LIMITS  
~STATION  
3+25  
↓

~STATION  
2+50  
↓

~STATION  
2+00  
↓

~STATION  
1+50  
↓



LEGEND

- - - Areas of Intense Scaling
- - - Slope Scaling Limits



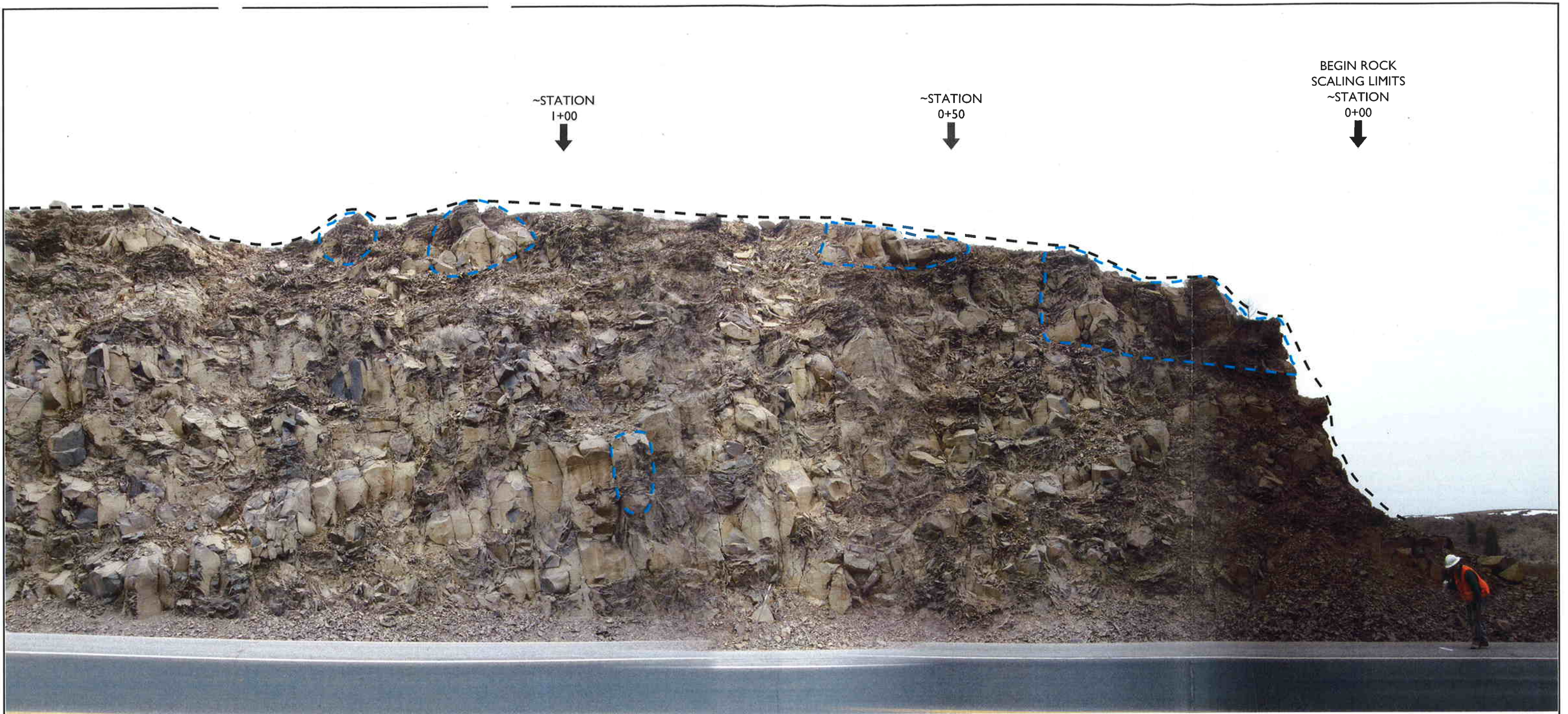
FIGURE 5 (RIGHT): RISK REDUCTION MITIGATION DESIGN

SR 2 MITIGATION MEASURES

SR-2 SRMP 146.29 - 146.37 JOB # XL-3205

NOT TO SCALE

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**LEGEND**

- - - Areas of Intense Scaling
- - - Rock Scaling Limits



**FIGURE 6 (RIGHT): MITIGATION DESIGN**

SR 2 MITIGATION MEASURES

SR-2 SRMP 146.29 - 146.37 JOB # XL-3205

**NOT TO SCALE**

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**APPENDIX B**

**Special Provisions**

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## **SLOPE SCALING**

### **Description**

This work shall consist of the manual removal of vegetation and loose rock and soil on the slope at the locations shown in the Plans or as directed by the Engineer. The Contractor shall provide all materials, equipment, and labor necessary to perform this work.

### **Submittals**

Not less than 2 weeks prior to commencing rock scaling, the Contractor shall provide to the Engineer:

- A. The Contractor shall provide written evidence that the rock slope scaling foreman and scalers have performed satisfactory work in similar capabilities for sufficient length of time to be fully qualified to perform their duties. The foreman shall have not less than 1500 hours of demonstrated experience as a scaler. The scalers shall have not less than 1000 hours of demonstrated experience on similar projects.
- B. The Contractor shall submit a detailed work plan for each rock slope to be scaled. The plan shall include:
  1. The proposed construction sequence and schedule.
  2. The type of equipment and tools to be used.
  3. The number of scaling crews to be employed on the project. (A scaling crew is defined as one qualified foreman and two qualified scalers.)
  4. Debris removal and disposal plan generated from the scaling work.
  5. Provisions to protect adjacent facilities.

Work shall not begin until the Engineer has approved the appropriate submittals in writing.

### **Materials**

Slope scaling will be done with the use of scaling bar, portable hydraulic wedges, air pillows, hand drills, splitters, Boulder Buster™ or other mechanical means. Other hand tools in addition to scaling bars may be used provided they have demonstrated effectiveness to perform the required work by approval of the Engineer.

### **Construction Requirements**

All trees and brush within 20 feet of the slope crest shall be flush cut and the root wad left intact.

Work shall proceed according to the work plan and schedule submitted by the Contractor prior to commencement of work. The size of the crew, defined as a foreman and two qualified scalers, shall be maintained at all times.

3/12/08

Slope scaling shall start at the top of the slope and work shall proceed down slope, removing loose rock and soil as the work progresses. Tree and brush removal shall be included as Slope Scaling. Unless otherwise directed by the Engineer, all trees within 20 feet of the slope crest shall be flush cut and the root wad left intact. Tree falling shall be completed prior to performing other scaling work.

The extent of the slope scaling will be determined by the Engineer and/or be specified in the Plans.

All rock, debris, and vegetive material produced by the scaling operation shall be removed by the Contractor and hauled to a site specified in the contract. See Special Provision **DEBRIS REMOVAL INCLUDING HAUL**.

### **Measurement**

Slope scaling will be measured by the crew hour.

Debris removal will be by the cubic yard in the hauling conveyance at the point of removal from the roadway. See Special Provision **DEBRIS REMOVAL INCLUDING HAUL**.

### **Payment**

Payment will be made in accordance with Section 1-04.1, for the following Bid item included in the proposal:

"Slope Scaling", per crew hour.

The unit contract price per crew hour for "Slope Scaling" shall be full pay for performing the work as specified.

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## **DEBRIS REMOVAL INCLUDING HAUL**

### **Description**

This work consists of removing existing debris from the roadway or material generated from slope scaling, mechanical scaling, and/or trim blasting operations.

### **Construction Requirements**

The Contractor shall remove all existing and slope scaling-, mechanical scaling -, and/or trim blasting-related debris within the project limits and as directed by the Engineer. The Contractor shall also haul and place debris at a specified location.

### **Measurement**

Debris removal will be measured by the cubic yard in the hauling conveyance at the point of removal from the roadway.

### **Payment**

Payment will be made in accordance with Section 1-04.1 for the following bid item that is included in the proposal:

“Debris Removal Including Haul”, per cubic yard.

The unit contract price per cubic yard for “Debris Removal Including Haul” shall be full pay for performing the work described including furnishing the equipment, materials, and labor required to load, haul, and place the debris at the specified location.