



GEOLOGIC REPORT FOR THE 2409 REMNANT HARVEST UNIT AND ROADS

May 13, 2024

Prepared for: Jacob Eaton, Forest Engineering Specialist
Weyerhaeuser, Longview Forest Area
Castle Rock, Washington

Harvest Unit Name: 2409 Remnant
HPU Number: 122112
Watersheds: North Fork of the Toutle River
Location: Cowlitz County, Washington
Sections 15, 21, & 22
T10N R2E, W.M.

OBJECTIVE

The objective of this report is to document the geologic review we conducted on the 2409 Remnant Harvest Unit in accordance with Weyerhaeuser policies and State of Washington regulations addressing slope stability, erosion, and forest practices. Our review was specifically conducted in accordance with Section 16 of the Forest Practices Board Manual, Guidelines for Evaluating Potentially Unstable Slopes and Landforms (Division of Forest Practices, 2016).

INTRODUCTION

The 2409 Remnant Harvest Unit is planned for clearcut timber harvest. The harvest unit is located near the mouth of Stitz Creek, a tributary to the North Fork of the Toutle River, on the south side of the river about a mile up from the sediment dam. The harvest unit is located in the North Fork Toutle Watershed. We looked at LiDAR-generated topographic data, geologic maps, soil maps, existing landslide inventories, and available photos to conduct a thorough office review. We conducted our geologic field review on April 15, 2024. We covered much of the unit and focused on the areas with the most potential for landslide hazard and risk. This report has been prepared to support a Class IV Special application due to possible yarding corridors through UNS buffers and reconstruction of the 2409 Road across a cutslope failure deposited on the road.

BACKGROUND INFORMATION – OFFICE REVIEW

Stand Description

The harvest unit consists of several stand types dominated by 45 year old second-growth Douglas fir with western hemlock and other species in places (Figure 1).

Geomorphology

The unit is dominated by moderate to steep (>60%) slopes above Stitz Creek (Figure 2). Elevation in the unit ranges from 1040 feet to over 1480 feet above mean sea level.

Geology

I reviewed the harvest unit using the WDNR interactive geologic map (Division of Geology and Earth Resources, 2024). Rocks in the harvest unit are mapped as Ova(1), Oligocene andesite flows. There are numerous northwest and northeast trending faults mapped in the area, but none mapped near the unit. Rocks in the area are generally dipping 5 to 7 degrees to the southwest.

Soils

I reviewed the harvest unit using the NRCS interactive soil map (Soil Survey Staff, 2024). Soils in the harvest unit are mapped as Schneider-rock outcrop complex, silt loams of the Baumgard Series, and silt loams of the Cinebar Series. The soils are classified as GM to ML to MH soils using the Unified Soil Classification System. The upper portion of the Baumgard Series is classified as a CL soil. They are all well-drained soils.

Landslide History

I reviewed the harvest unit using the landslide maps available on the WDNR interactive geologic map (Division of Geology and Earth Resources, 2024). The WDNR inventory does not identify any landslides in the harvest unit.

OBSERVATIONS – FIELD REVIEW

We made the following observations during our field review:

- Inner gorge – Section of inner gorge along stream forming southern unit boundary; Feature buffered; Note other sections of inner gorge observed along both sides of stream.
- Slide – Shallow failure associated with seep along stream forming southern unit boundary; Feature buffered.
- Old cutslope failure – Not significantly affecting road grade; Feature buffered.
- Old sidecast failure – Not significantly affecting road grade; Feature buffered.
- Cutslope failure – Scarp in old catroad grade above cutslope in 2409 Road; Slide deposited on 2409 Road; 50-60% slopes on slide mass; 65-70% catroad cutslope; 55-60% slopes above catroad; Conifer and old growth stumps present; Wet site conditions observed in ditch along 2409 Road; No signs of surface water above slide; No other signs of recent slide activity.
- Area excluded from unit – Area of moderate to steep slopes and broadly convergent swales with wet site conditions and rock outcrops in places.

INTERPRETATION and RECOMMENDATIONS

Timber Harvest

The harvest unit has been laid out to avoid harvesting the areas with the highest landslide hazard and risk of sediment delivery to streams. Slope stability protection measures are summarized below:

- The sections of inner gorge and the slide along the stream forming the southern boundary of the harvest unit will be protected with a combination of UNS and RMZ buffers.
- The old cutslope failure above the road will be protected with a UNS buffer.
- The sidecast failure below the road will be protected within an RMZ buffer.
- The northern wedge of moderate to steep, broadly convergent swales and slopes with wet site conditions and rock outcrops will be excluded from the unit.

Yarding Corridors

Due to the rugged terrain and relative inaccessibility of the unit, we discussed the necessity of yarding corridors that may need to cross unstable slopes buffers (Figure 3). The forest practices application will be filed as a Class IV Special accordingly.

Corridors #1, #2, and #3 should be able to avoid crossing unstable slopes buffers. Corridor #4 will likely have to cross an inner gorge buffer (Figure 4). Corridor #5 will only require hanging lines through/over an inner gorge buffer, but no yarding through/over the buffer will be necessary. We discussed utilizing the following options to mitigate and/or minimize any impacts to the slopes and leave trees in the buffers:

- Avoid crossing buffers as much as feasible.
- Utilize natural openings in the canopy to avoid impacts to leave trees.
- Maximize lift in the yarding system as safe to do so.
- Buck logs on the slope to minimize the yarded log length (only as necessary and safe to do so). Logs may not necessarily be bucked in this situation. Whole trees allow for greater reach with less yarding corridors necessary.
- Operate the carriage slowly as it passes through the canopy in the buffers.
- Maintain full suspension as much as feasible during yarding to avoid ground disturbance.
- Trees will likely need to be felled to maintain a safe corridor at Corridor #4. Full suspension may not be possible in this corridor either. There will be full suspension across the stream and most of the inner gorge, but possibly not all of it. There may only be one-end suspension as logs come across the defining slope break at the top of the inner gorge. Any cut trees will be left within the buffer and will be felled across the corridor, parallel to the stream to provide a buffer or slash mat for the trees being yarded across to rub against instead of being yarded across the ground surface, especially at the defining slope break at the top of the inner gorge.
- Landing #2 has been moved back on the 2416 spur from the end of the spur to reduce the impact to stream shading from cutting corridors #3 and #4. By moving the landing back, the corridors will be more spread out at the RMZ to resemble something more like a thinning strip through the RMZ rather than a larger continuous block of trees removed from the top of the RMZ where the corridors converge towards the landing.

Given that the yarding corridors will minimize impacts to unstable slopes, will avoid and/or minimize ground disturbance, and will minimize impacts to the leave trees, I do not have any serious concerns with the proposed yarding corridors.

Roads

The 2409 Road will need to be reconstructed to access the north end of the unit. Most of the old grade is intact and only needs clearing, reestablished ditch-lines and cross-drains, and surfacing. However, the recent cutslope failure has made the road impassable at that location. This will also dictate the need for the forest practices application to be filed as a Class IV Special. The repair should be simple and straightforward. The slide deposit on the road will be excavated and hauled to a stable location. The slope will be laid back and then buttressed with a large rock fill as shown in the engineering notes (Figures 5 and 6). The ditch-line will be reconstructed across the site, reestablishing proper road drainage at the site.

CONCLUSIONS

We conducted a thorough office review of existing information and followed up with a field review covering those areas with the highest risk of sediment delivery to streams. I recommended adjustments to the unit layout where we identified areas of concern with the potential for sediment delivery. Leave tree areas were added or existing buffers were expanded accordingly.

We discussed yarding corridors that may need to cross buffers in the unit. We identified key mitigation strategies to avoid impacts to the slopes and leave trees in the buffers.

We also discussed reconstruction of the 2409 Road to provide access to the north end of the unit. We discussed options for reconstruction of the old grade across the cutslope failure and I offered recommendations to avoid and/or minimize impacts to the stability of the site.

I have attached an evaluation of the proposed harvest unit directly addressing Washington Department of Natural Resources requirements outlined in WAC 222-10-030 (1). This evaluation can be found in Appendix B.

Contact me if you have any questions or concerns.

LIMITATIONS

We have conducted our geologic review to the standard of care for such reviews of forest practices in Washington, consistent with work conducted by other qualified experts, and in accordance with the requirements of the Washington Department of Natural Resources and the Geologist Licensing Board. Our review was specifically conducted in accordance with Section 16 of the Forest Practices Board Manual, Guidelines for Evaluating Potentially Unstable Slopes and Landforms (Division of Forest Practices, 2016).

We utilized available information for our office review and conducted a reconnaissance-level field review. Our investigation was limited to observations of surface conditions and we did not conduct a sub-surface investigation.

Landslides are a natural hazard inherent to the slopes of the Pacific Northwest and are part of the geologic process. Forest practices may exacerbate that hazard. We have conducted our review

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with the intent of reducing potential adverse impacts that the planned forest practices may have on slope stability.

CLOSING

Thank you for the opportunity to review this harvest unit and roads project. Please let me know if you have any questions or concerns.

Sincerely,



Jason Hinkle, LEG, QE



APPENDIX A

REFERENCES

Division of Forest Practices, Washington State Department of Natural Resources, Forest Practices Board Manual Section 16 Guidelines for Evaluating Potentially Unstable Slopes and Landforms. Available online at http://www.dnr.wa.gov/Publications/fp_board_manual_section16.pdf . 2016.

Division of Geology and Earth Resources, Washington State Department of Natural Resources, Washington Interactive Geologic Map. Available online at <https://fortress.wa.gov/dnr/geology/?Site=wigm> . Accessed 2024.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Soil Survey Geographic (SSURGO) Database for Lewis County, Washington. Available online at <http://soildatamart.nrcs.usda.gov> . Accessed 2024.

APPENDIX B

WASHINGTON DEPARTMENT OF NATURAL RESOURCES
WAC 222 10-030 REQUIREMENTS

The following are responses addressing WAC 222-10-030 (1) (a, b, c).

(1) In order to determine whether such forest practices are likely to have a probable significant adverse impact, and therefore require an environmental impact statement, the applicant must submit the following additional information, prepared by a qualified expert. The expert must describe the potentially unstable landforms in and around the application site and analyze:

(a) The likelihood that the proposed forest practices will cause movement of the potentially unstable slopes or landforms, or contribute to further movement of a potentially unstable slope or landforms;

The likelihood that timber harvest will cause movement of potentially unstable slopes is low because areas of concern have been identified and flagged as leave tree areas or posted out of the harvest unit.

The likelihood that the road project will cause movement of potentially unstable slopes is low because the road will be reconstructed to modern BMP standards,

(b) The likelihood of delivery of sediment or debris to any public resources or in a manner that would threaten public safety; and

The likelihood of sediment delivery to streams resulting from the proposed timber harvest is low. The areas of concern, where the likelihood would have been high, have been flagged as leave tree areas or posted out of the harvest unit.

The likelihood of sediment delivery to streams resulting from the proposed road project is low because the road will be reconstructed to modern BMP standards designed to minimize/avoid sediment delivery.

The risk to public safety is low because there are no high traffic volume roads, homes, or other structures in the runout zone if a landslide were to initiate within the harvest unit.

(c) Any possible mitigation for the identified hazards and risks.

The areas of concern have been flagged as leave tree areas or posted out of the harvest unit. I recommended adjustments to the harvest layout and those adjustments were made accordingly.

Due to the rugged terrain and relative inaccessibility of the unit, we discussed the necessity of yarding corridors that may need to cross unstable slopes buffers (Figure 3). The forest practices application will be filed as a Class IV Special accordingly.

Corridors #1, #2, and #3 should be able to avoid crossing unstable slopes buffers. Corridor #4 will likely have to cross an inner gorge buffer (Figure 4). Corridor #5 will only require hanging lines through/over an inner gorge buffer, but no yarding through/over the buffer will be necessary. We discussed utilizing the following options to mitigate and/or minimize any impacts to the slopes and leave trees in the buffers:

- *Avoid crossing buffers as much as feasible.*
- *Utilize natural openings in the canopy to avoid impacts to leave trees.*
- *Maximize lift in the yarding system as safe to do so.*
- *Buck logs on the slope to minimize the yarded log length (only as necessary and safe to do so). Logs may not necessarily be bucked in this situation. Whole trees allow for greater reach with less yarding corridors necessary.*
- *Operate the carriage slowly as it passes through the canopy in the buffers.*
- *Maintain full suspension during yarding to avoid ground disturbance.*
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APPENDIX C

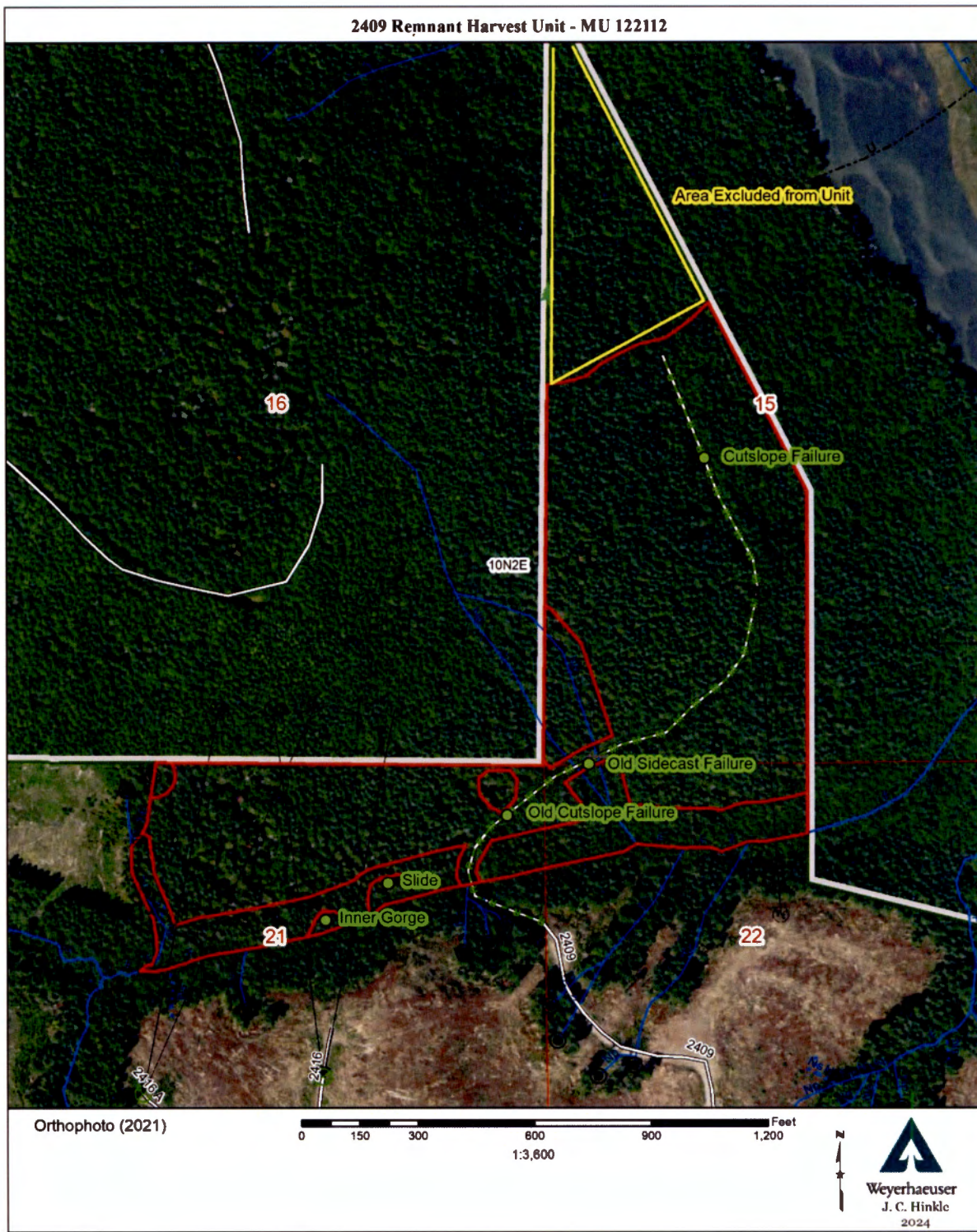


Figure 1: 2021 Orthophoto.

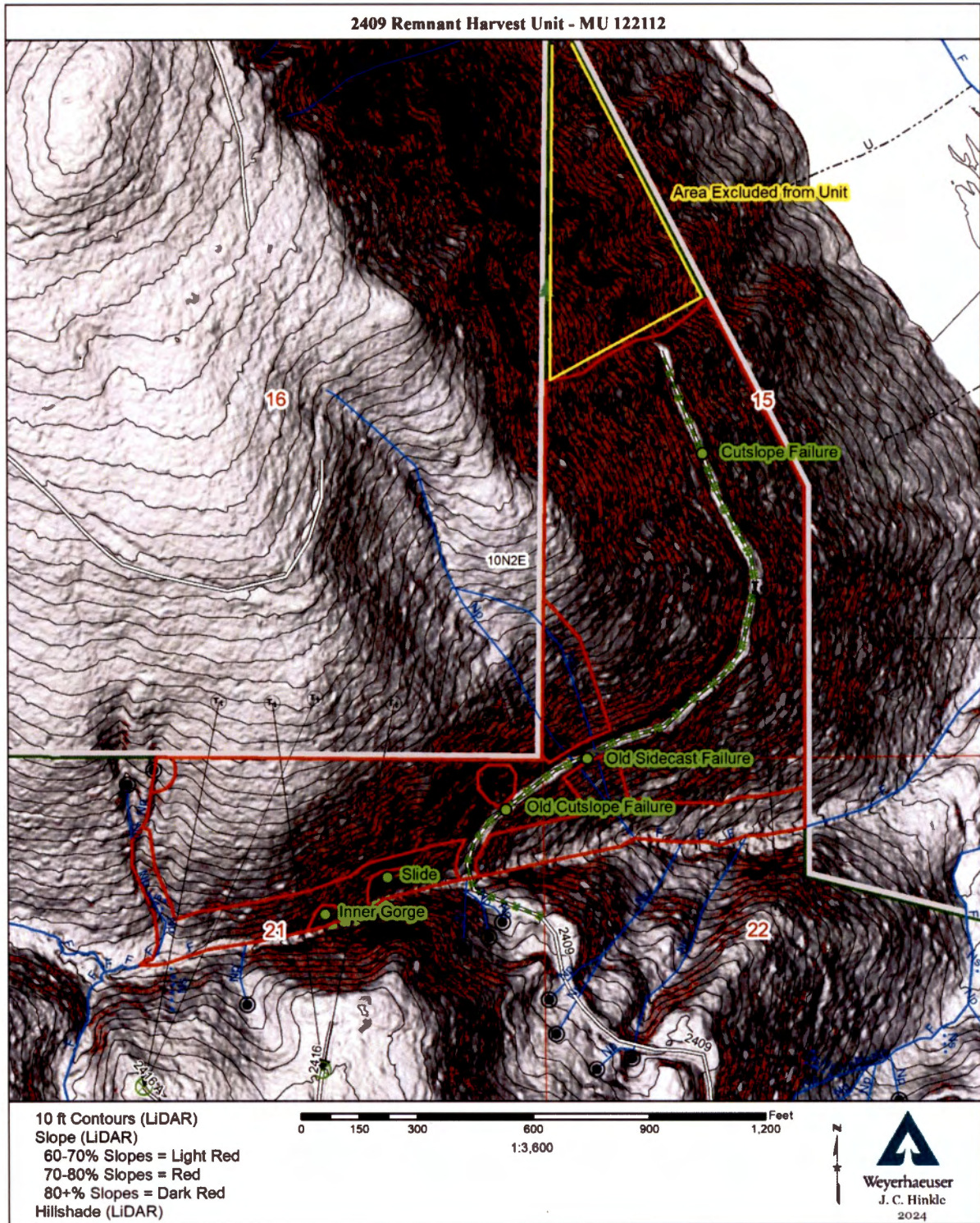


Figure 2: LiDAR 10 ft contours, slopes, and hillshade.

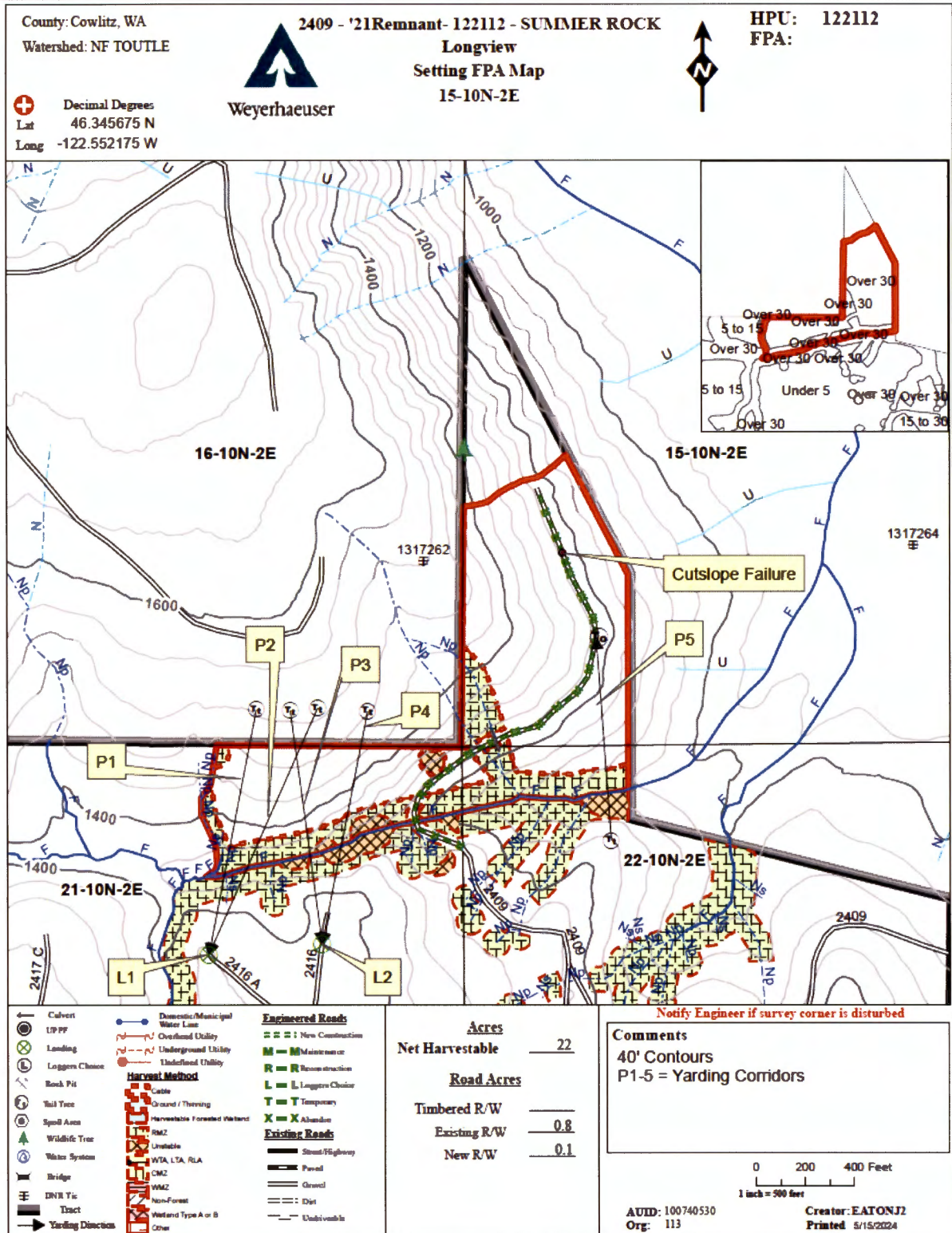
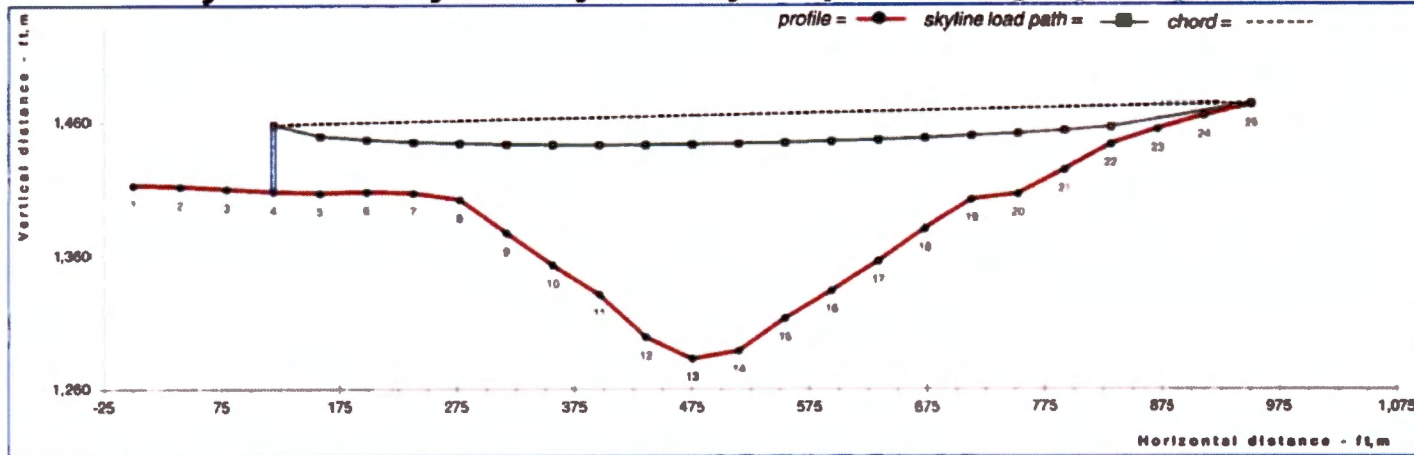


Figure 3: Final unit layout with yarding corridors.

P4

SkylineXL 15.1 Skyline Analysis - Analysis Input - Standing Skyline System



Analysis type	Selected yarder	Selected carriage
Standing	Thunderbird 6150, spcm	Bowman Mark V Super

Log Geometry Table	
tag length - (ft)	10.0
log length - (ft)	120.0
log diameter - (in)	16.00

Min payload-(lbs)	At terrain point
0	0

Supports Table	At terrain point	Rigging height (ft)
head spar	4	50
tail spar	25	1
int support 1		
int support 2		
int support 3		

Yarding Parameters Table	Inner dist terrain pt.	Outer dist terrain pt.
yarding limits	5	22

landing cut (-) or fill (+) - (ft)

Susp. type	Log Susp. and Clearance Table	Log clearance (ft)
partial		1.5

Analysis name:
 Units: English Pro date:
 Data source: Pro name: 1
 Analysis phase: 1 Analyst:

LIVE sky selections

Specified clearance

Lift only

Drop only

Lift-drop location at terrain point...

1

2

3

4

5

The above options for LIVE skyline analysis only

Print date: 5/1/2024

Skyline Analysis - Phase 1

Profile_P4

Figure 4: Engineering notes for corridor profile P4.

2409 STA 17+00

Cutslope Failure

Jacob Eaton
04/24/24

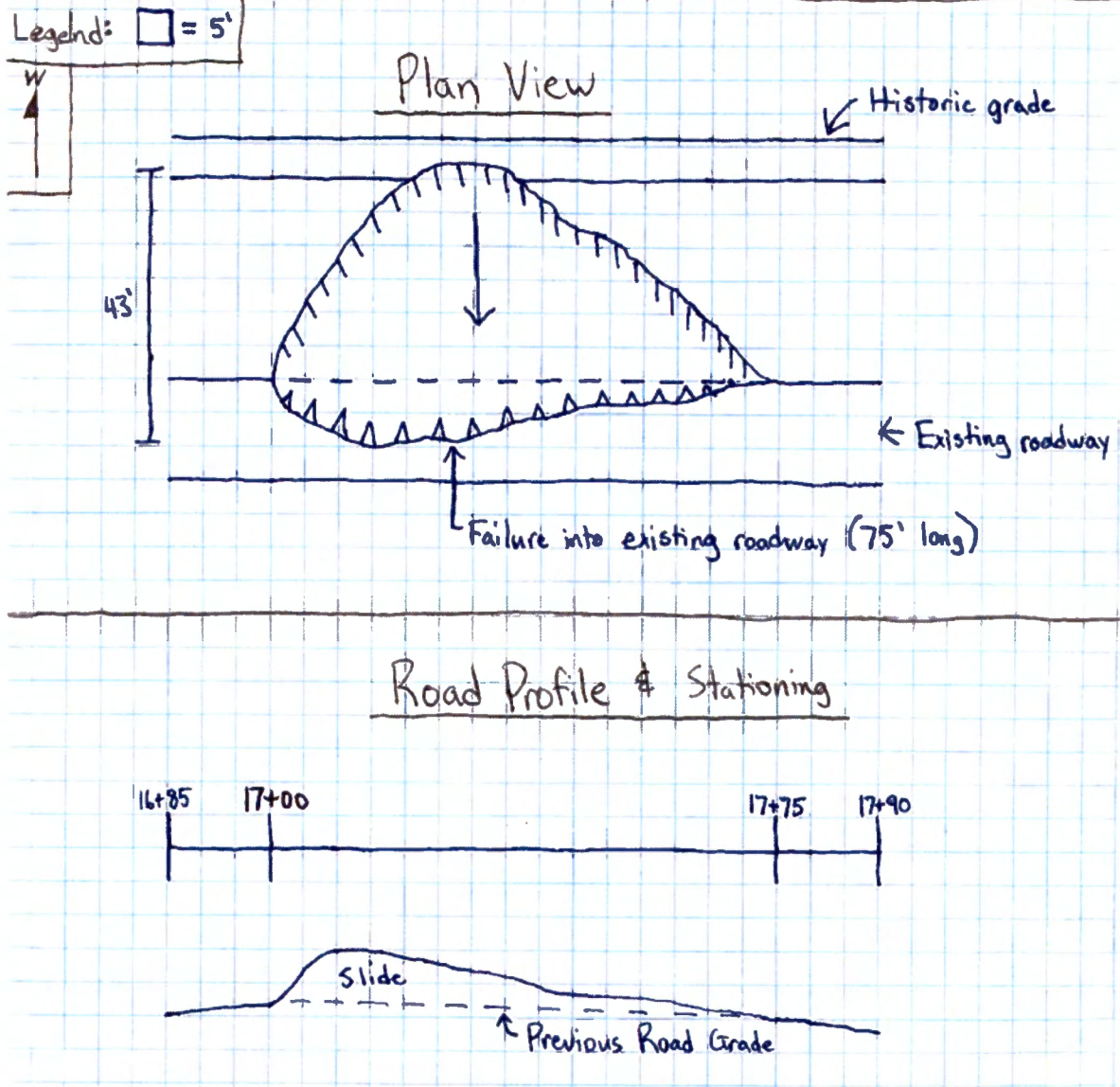


Figure 5. Plan view and profile of reconstruction at cutslope failure.

2409 S1A 17+00

Cutslope Failure

Jacob Eaton
04/24/24

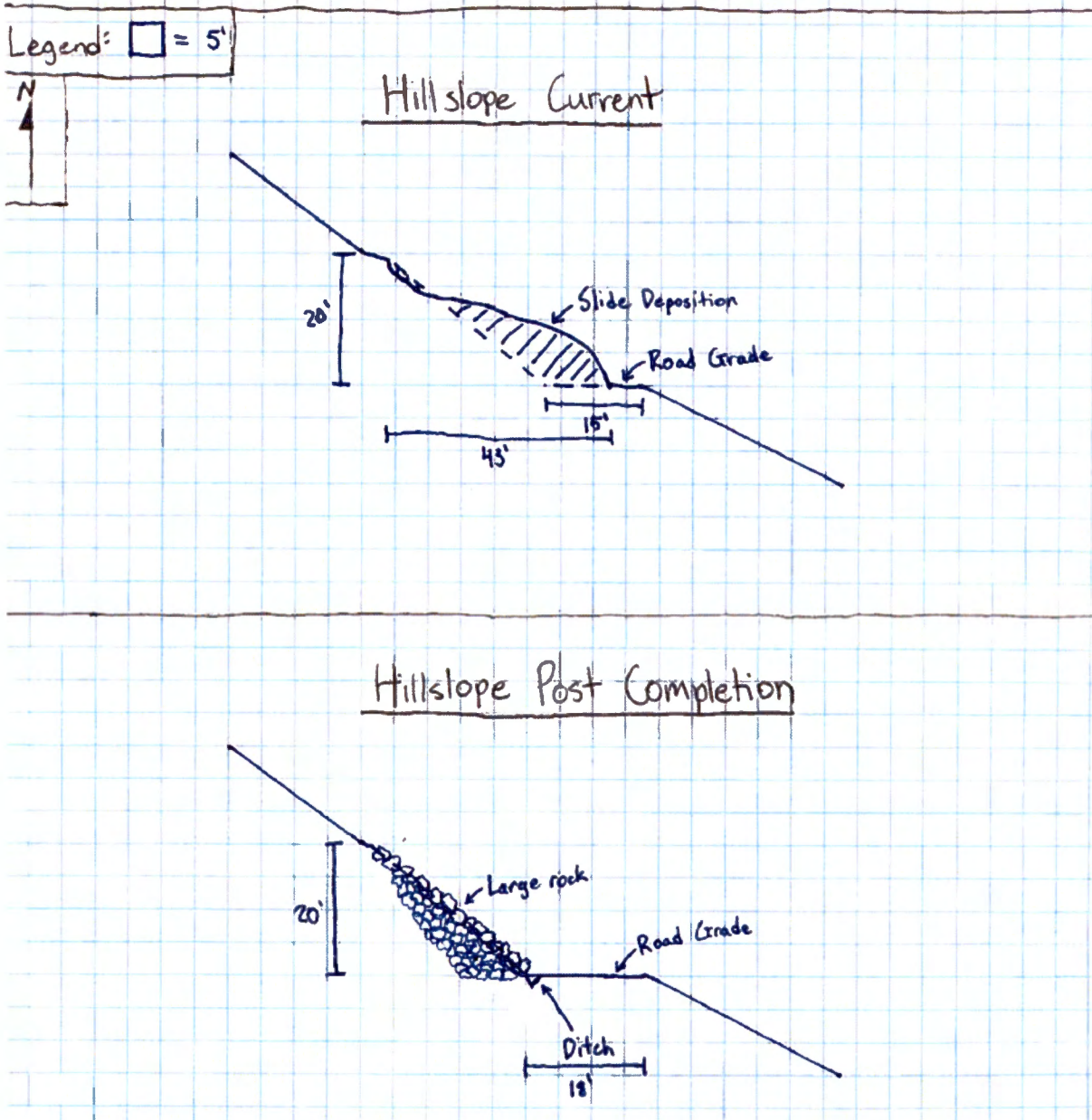


Figure 6. Profiles before and after reconstruction at cutslope failure.