RIGHT-OF-WAY AND DISPLACEMENTS

Any of the proposed build alternatives would require the acquisition of right-of-way and likely residential displacements. Table 5 shows the estimated range of the number of parcels affected by the alternatives and the estimated number of residential displacements for each alternative.

Table 5. Summary of Project Footprint, Potential Right-of-Way, and Displacements

	Acres of Right-of-Way	Parcels Affected	Potential Displacements
Modify Existing Lolo Pass Road Alternative	5	10-18	4-5
Zigzag Mountain West Alternative	23	12-22	1-2
Zigzag Mountain East Alternative	25	25-26	1-2

ENVIRONMENTAL RESOURCES

This section presents reconnaissance and high-level field information regarding streams and wetlands, threatened and endangered species, geological hazards, floodplains, cultural resources and hazardous materials. The analysis relied heavily on existing databases and information; field work was limited, but included walking the river in the vicinity of the proposed new crossing, observations from Lolo Pass Road and other roadways in the study area, and a wetland determination conducted on a large wooded parcel in the vicinity of the Zigzag Mountain Alternatives. The information provided below is intended to provide an overview of potential opportunities and constraints, and was used to modify the alternatives to avoid critical resources. Appendices E, F and G provide additional information on the biological and wetlands, geological hazards, and cultural resource investigations completed for this study.

STREAMS AND WETLANDS

This section describes the results of database and field-level reconnaissance completed for the project. A Water Resources Report is attached as Appendix E. Lolo Pass Road parallels the Sandy River. Clear Creek parallels the Sandy River and is separated from it by Lolo Pass Road. The Powerline Corridor is adjacent to the Sandy River at its west end, and tributaries in the western tip of the Powerline Corridor drain to North Boulder Creek, a tributary of the Sandy River. The Powerline Corridor extends upstream along the Sandy River valley slope above Hackett Creek to cross seven streams: three unnamed Hackett Creek tributaries, Minikahda Creek and three other unnamed tributaries to Clear Creek.

Almost all of the wetlands shown on the National Wetlands Inventory (NWI) maps (see Figure 13) coincide with or adjoin the Sandy River channel, and are likely to be included as part of the Sandy River for jurisdictional purposes. The three exceptions in the Sandy River study area are a

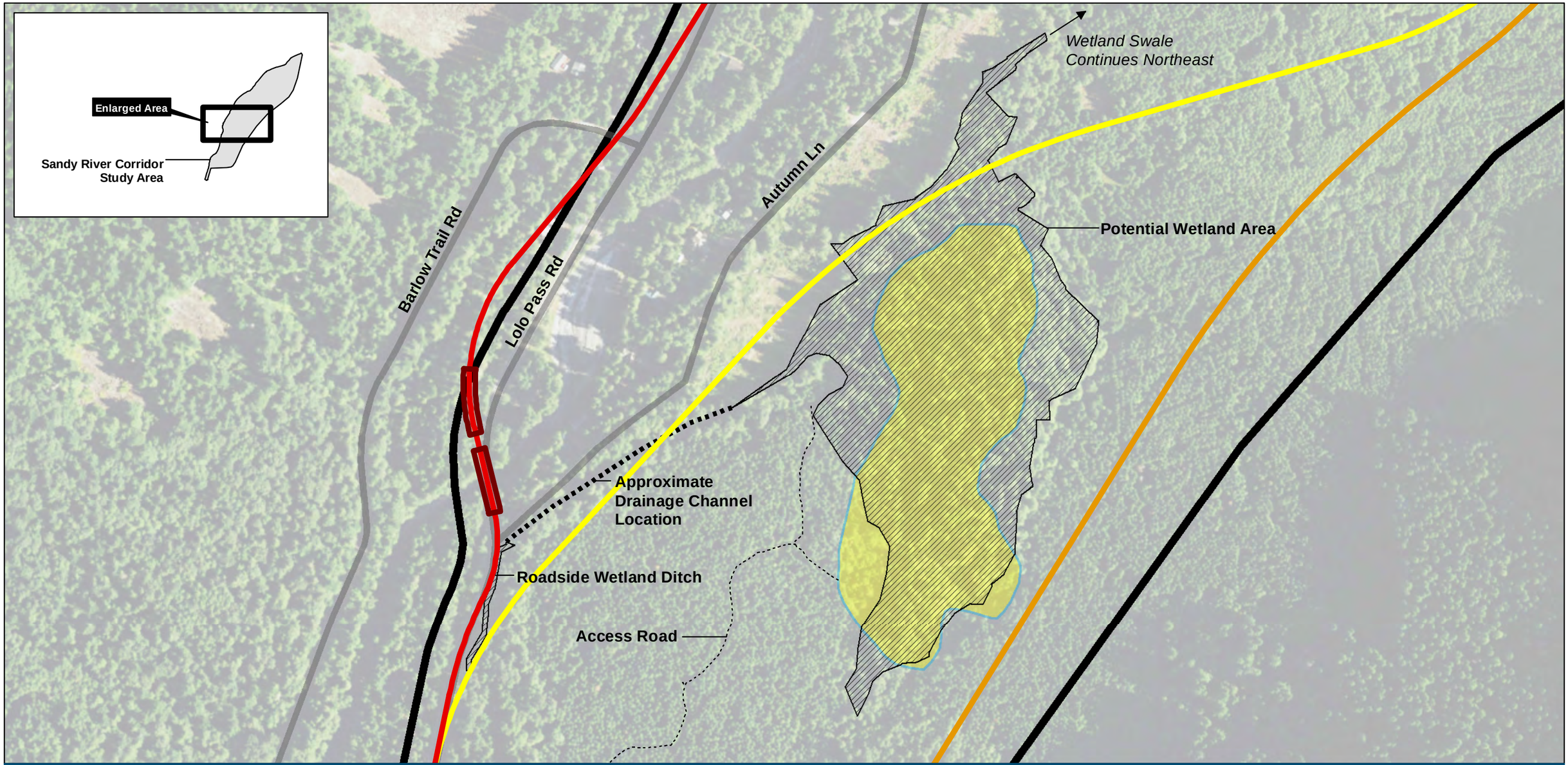
large forested wetland to the east of Autumn Lane, and two small ponds west (uphill) of Lolo Pass Road. No wetlands are shown in the powerline corridor.

Fieldwork conducted in 2015 identified the maximum extent of the NWI-identified wetland to the east of Autumn Lane. Based on field observations, Figure 13 shows the maximum potential extent of a large palustrine forested wetland in this area. Much of the wetland appears to be perennially saturated/inundated, and is fed by groundwater and by a stream channel flowing in from the north. Water discharges from the main wetland through channels at its south and west corners. Vegetation consists of a tree canopy dominated by red alder, with a dense understory including salmonberry, skunk cabbage and slough sedge. The action alternatives were adjusted to avoid this area to the extent possible based on the mapping of the maximum potential extent of this wetland. The Zigzag Mountain West Alternative passes through the western-most extent of the potential wetland area. (Note: this is a larger area than previously identified in NWI or property-owner mapping and needs to be verified in future design.)

The Clackamas Soil Survey shows seven general soil types within the study area (see the maps in Appendix A of this report; specifically, Appendix C of the reconnaissance report included there). None of the seven soil types are listed as hydric (formed under wet conditions) by the NRCS (NRCS 2014). Therefore, soils mapping does not indicate that unmapped areas may contain wetlands. However, given the high rainfall totals in the area, the position of the Powerline Corridor on a steep slope below the Bull Run Watershed, and the position of Lolo Pass Road in the study area at the base of steep forested slopes, unmapped wetlands fed by groundwater are likely to occur.

THREATENED AND ENDANGERED SPECIES

Based on existing information, federally listed and endangered fish under jurisdiction of the National Marine Fisheries Service (NMFS) are present in the study area, as summarized in Table 6. Although several of these species are present downstream of the study area in Hickman Creek, resources do not indicate any presence in any of the Hickman Creek tributaries that are within the study area. The Sandy River and Clear Creek are designated as Critical Habitat for steelhead trout and Chinook salmon. It is important to note that construction of new impervious surface anywhere as part of the project may trigger the Endangered Species Act documentation requirements because of potential downstream effects of such construction. It is likely that native resident cutthroat trout, sculpin and possibly other non-listed fish are present in all of the perennial streams within the study area.



Lolo Pass Road Access Alternatives

Sandy River Corridor Study Area

Legend

- Access Road
- Ditch
- Drainage Channel
- Potential Wetland
- NWI Wetland

Alternatives

- Modify Existing Lolo Pass Road
- Zigzag Mountain East
- Zigzag Mountain West
- Bridge Deck

Figure 13.
Approximate Maximum Extent of Potential Wetland Area

N

0 300 600 Feet

Data Sources:
ESRI, ArcGIS Online, World Imagery. Microsoft. July 11, 2010.
US Fish and Wildlife Service. 2010. National Wetlands Inventory (1977 to present). Branch of Habitat Assessment.

Document Path: P:\F\FHAX00000218\0600INFO\GIS\Maps\Alternatives Selection Figs\Fig_X_Wetlands.mxd
Date: 8/4/2015 Time: 1:32:27 PM User Name: mmf

Table 6. Summary of Threatened and Endangered NMFS Fish Species Occurrence in the Study Area

Species (Status)	Sandy River	Clear Creek	Minikahda Creek	North Boulder Creek
Lower Columbia River (LCR) winter steelhead (listed threatened)	X	X		X
LCR summer steelhead (listed threatened)	X			
LCR coho salmon (listed threatened)	X	X	X	X
LCR spring Chinook salmon (listed threatened)	X	X		X

Source: ODFW 2014.

The U.S. Fish and Wildlife Service (USFWS) Information Planning and Conservation System identifies eight USFWS listed and proposed species that may be within the study area or potentially affected areas. Information on potential occurrence of listed plants and wildlife has been obtained from Oregon Biodiversity Information Center (ORBIC) and is presented in Table 7. Portions of the Powerline Corridor study area lie within the MHNF. For these areas, the U.S. Forest Service will likely require studies to determine occurrence of additional species beyond those on the federal Threatened and Endangered Species list.

Table 7. Summary of USFWS Threatened and Endangered Species Potential Occurrence in the Study Area

Species (Status)	Actual Occurrence
Northern spotted owl (listed threatened)	None within project footprint, but four occurences within 1 mile of project areas
Marbled murrelet (listed threatened)	None, site is too far inland
Streaked horned lark (listed threatened)	None, no suitable sparse vegetation habitat in the study area
Yellow billed cuckoo (proposed threatened)	None, no suitable riparian habitat in the study area
Bull trout (listed threatened)	None, no documented occurrence
Nelson's checker-mallow (listed threatened)	None, no documented occurrence
Water howellia (listed threatened)	None, no documented occurrence
Willamette Daisy (listed endangered)	None, no suitable prairie habitat in the study area

Source: USFWS 2014.

GEOLOGICAL HAZARDS

The geotechnical consultant evaluated existing geotechnical conditions by reviewing published geologic mapping of the area, review of aerial photographs of the site from the 1960s, and topographic maps derived from publicly available airborne LIDAR (light detection and ranging) survey information from the Oregon Department of Geology and Mineral Industries (DOGAMI) and by conducting a ground-level reconnaissance on July 16, 2014. A memorandum summarizing the findings of the geological reconnaissance and preliminary geotechnical evaluation is attached as Appendix F.

Figure 14 shows the alignments overlaid on areas with alluvial fan, pyroclastic flow and debris flow, debris flow deposits and landslide debris.

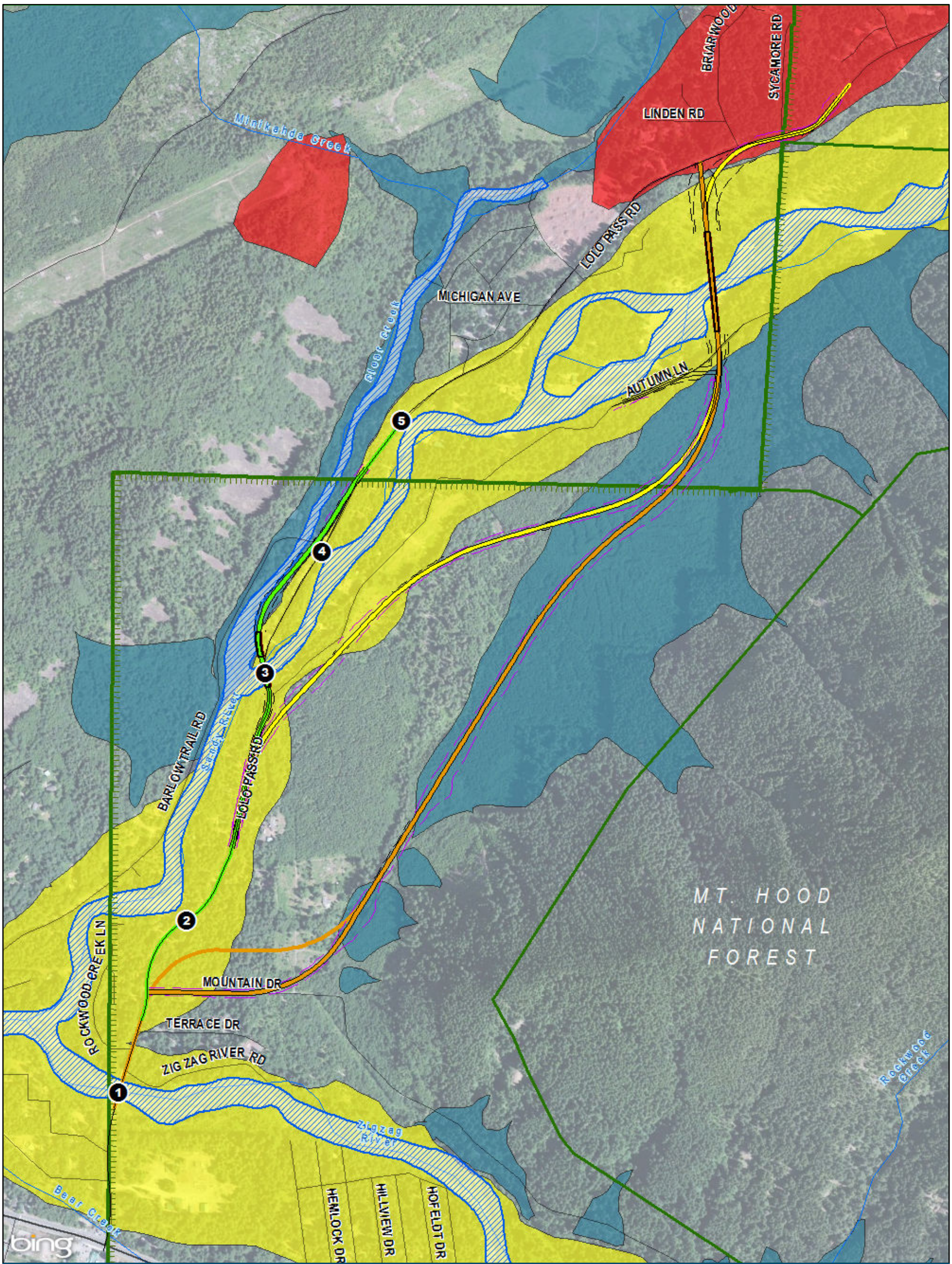
MODIFY EXISTING LOLO PASS ROAD

The alternative to modify Lolo Pass Road will include construction of two 200-foot-long bridges separated by an "island" of roadway embankment about 50 feet long. The primary geotechnical considerations for design of bridge foundations will be the characteristics of alluvial and debris flow sediments underlying the site and the depth and quality of the underlying rock. We anticipate that large cobbles and boulders are present within the sediments. Considering the constructability of foundations in this material and the possibility that the foundations would extend into the rock, we recommend considering small diameter drilled shaft foundations that can be drilled using down-hole hammer equipment, typically limited to diameters of about 30 inches.

The bridge approach embankment, "island" embankment, and portion of Lolo Pass road adjacent the existing river channel would be susceptible to river erosion, especially during floods. Near the north end of the alignment for this option, the road would remain susceptible to flooding and erosion occurring along the outside of a meander bend along a section of river about 1,900 to 2,500 feet eastbound of the existing bridge over the Sandy River.

ZIGZAG MOUNTAIN ALTERNATIVES

The Zigzag Mountain Alternatives (West and East) include cut slopes traversing alluvial fan deposits, a bridge over the active and dynamic river channel, large fills over river sediment and debris flow deposits for the bridge approaches, and an area of landslide debris identified at the north end of the alignment.



Legend

- Modify Existing Lolo Pass Road
- Zigzag Mountain East
- Zigzag Mountain West
- Mt. Hood Wilderness Boundary
- Mt. Hood National Forest
- Street
- River
- Vulnerable Areas
- FEMA Floodway

Geologic Hazard

- Alluvial Fan
- Landslide
- Debris Flow

Figure 14
Sandy River Corridor Geologic Hazards

N

0 1,000 2,000 Feet

Data Sources:
ESRI, ArcGIS Online, World Imagery. 2010. Microsoft.

About 5,500 ft of the East alternative and about 1,400 ft of the West alternative would traverse alluvial fans. Considering the relatively small drainage basins collected by the streams that form the alluvial fan deposits, large-span culverts would likely be appropriate. However, a significant portion of the roadway would be established in cuts up to about 35 feet below existing grades and additional cut and channel reconstruction would be needed for streams that cross the alignment. Stormwater management and accumulation of debris deposited by the streams will be considerations for these alternatives, especially the East alternative. The actively meandering Sandy River channel could relocate to any portion of the area mapped as pyroclastic flow and debris flow deposits within the design life of a proposed new bridge across the Sandy River (see Figure 14). Therefore, a bridge that is long enough to allow river meander within this area would need to be considered. The proposed 800-foot bridge presented in this report has sufficient length to span both the current river channel location and a historic channel to the west described in the geomorphology report (Appendix C). For the most part, this also spans the area impacted by a 100-year flood event with up to 8 feet of potential aggradation.

Fills up to about 50 ft tall will be needed to construct the approach embankments for the bridge over the Sandy River. The fill will be constructed on materials that are relatively loose. Ground improvement methods to reduce the risk of seismically induced liquefaction may be needed to densify the subgrade materials prior to constructing the embankment fill.

SUMMARY

Regarding the two alternatives in this corridor, there may be landslide debris at the east connection point with Lolo Pass Road. For the Zigzag Mountain East Alternative, the primary concern is the distance the alternative traverses alluvial fan deposits, which increases the risk of cut slope instability and would require significant stormwater controls or stream channel reconstruction. A geotechnical investigation will be needed to evaluate the subsurface conditions for design of bridge foundations, cut slopes and embankments.

The primary geotechnical considerations for design of bridge foundations would be the characteristics of alluvial and debris flow sediments underlying the site, and the depth and quality of the underlying rock. Large cobbles and boulders are likely present within the sediments. Considering the constructability of foundations in this material and the possibility that the foundations would extend into the rock, the geotechnical team would recommend considering small diameter drilled shaft foundations that can be drilled using down-hole hammer equipment, typically limited to diameters of about 30 inches.

FLOODPLAINS

DOGAMI was contracted to remap the Sandy River basin for a multi-agency team. DOGAMI has completed the channel migration hazard data and mapping project (English et al. 2013). Figure 15 shows the current (2015) FEMA floodplains for the area. These maps have not yet been adopted by Clackamas County in the project area; however, the differences are not substantial enough to affect the project analysis.

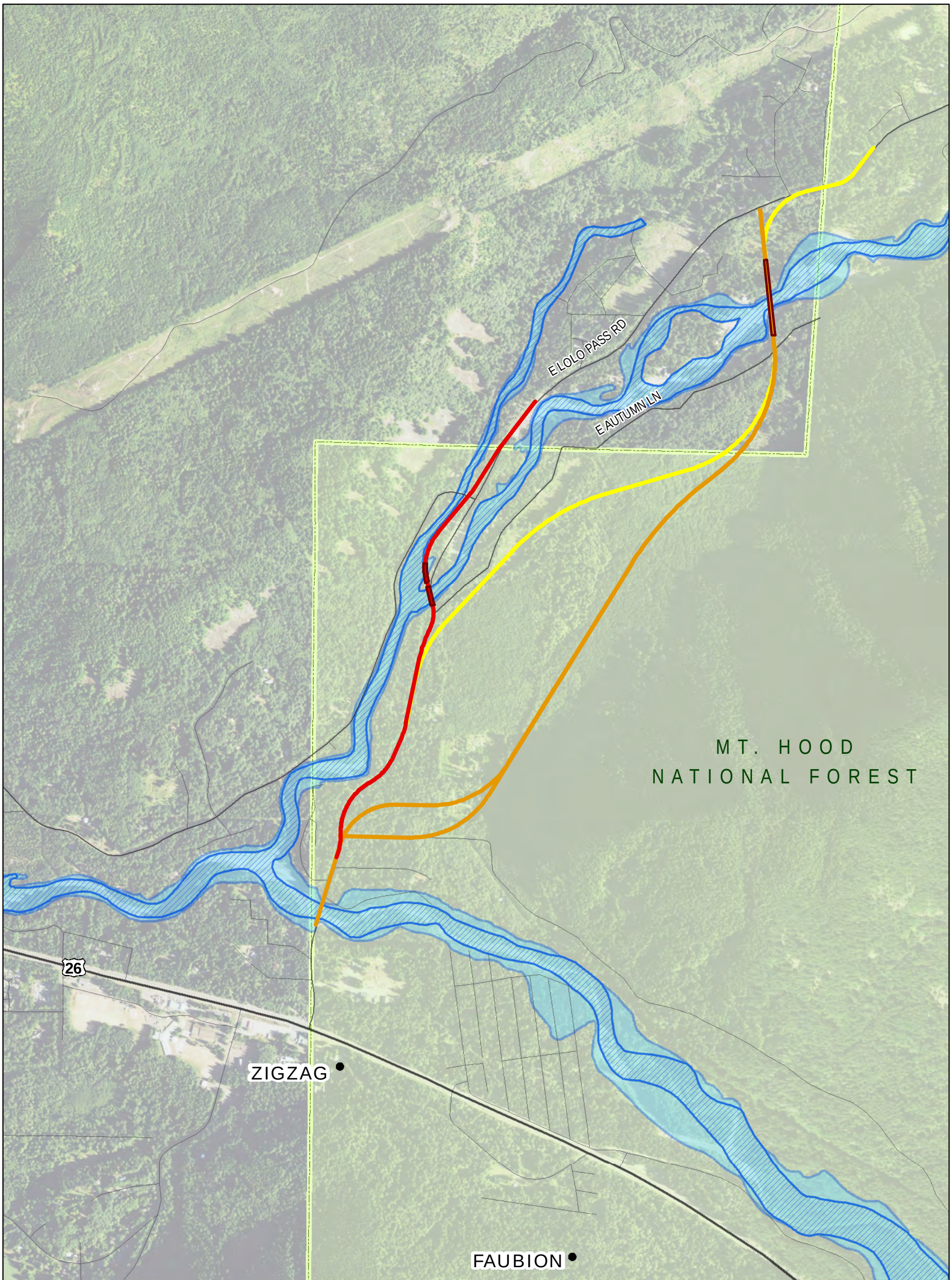
CULTURAL RESOURCES

CULTURAL RESOURCES REVIEW

AINW reviewed cultural resource records for the study to meet the requirements of Section 106 of the National Historic Preservation Act, as amended, and its implementing regulations under 36 CFR 800. The cultural resource records review was completed by AINW staff who meet the professional qualifications of the Secretary of Interior's Standards and Guidelines for Archaeology and Historic Preservation. The study was performed following the standards and guidelines of the Oregon State Historic Preservation Office (SHPO). The memorandum produced for this project is attached as Appendix G.

AINW reviewed multiple written and electronic records, completed a reconnaissance-level survey in February 2015, and developed recommendations for future work to assess potential impacts to cultural resources in the study area. AINW used databases available through the Oregon SHPO, as well as materials in the AINW library and on file at the United States Forest Service Zigzag Ranger District. This research found that two cultural resource surveys have been previously conducted within the study area, neither of which resulted in the identification of cultural resources. A 2004 study concluded that due to the regular flooding of the area, "people were probably less likely to use this area with much frequency, thus less likely to leave behind cultural materials, and regular flooding would likely damage or remove any cultural deposits." (Oetting (2004:5-6))

An 1884 General Land Office (GLO) map shows the "Old Toll Road Across Cascade Mountains" generally following the present-day East Mountain Road and crossing East Lolo Pass Road through the project study area (Figure 16). The Old Toll Road may be the original alignment of the Barlow Trail, but further investigations will be needed to confirm its location. Another alignment, "Old Barlow Trail Road," is depicted on the 1884 GLO map on the south side of the Zigzag and Sandy Rivers, outside the study area, roughly following the present-day alignment of US 26 (see Figure 16).



Lolo Pass Road Access Alternatives

Legend

- Study Area
- FEMA Floodway
- FEMA 100-Year Floodplain
- Mt. Hood National Forest

Alternatives

- Modify Existing Lolo Pass Road
- Zigzag Mountain East
- Zigzag Mountain West
- Bridge Deck

Sandy River Corridor Study Area

Figure 15
Floodplain

Data Sources:
ESRI, ArcGIS Online, World Imagery. 2010. Microsoft.
FEMA. 2015.

N

0 1,000 2,000 Feet

Document Path: P:\F\FHAX00000218\0600\INFO\GIS\Maps\Alternatives Selection Figs\Fig_X_Floodplain.mxd
Date: 8/5/2015 Time: 11:31:40 AM User Name: m

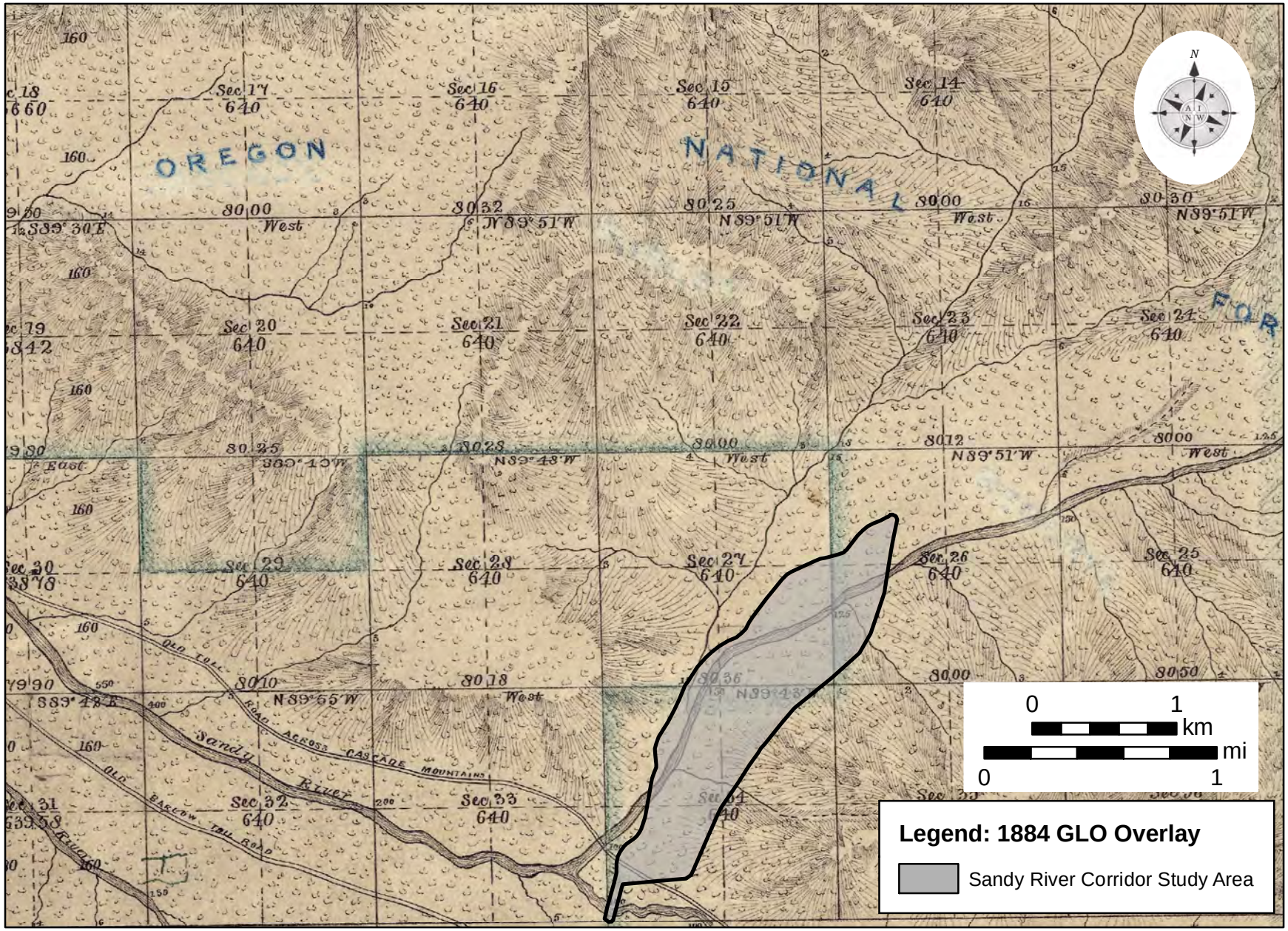


Figure 16. Overlay of the Sandy River Corridor study area on the 1884 General Land Office (GLO) map. Pioneer-era roads passed in and near the southern part of the study area.

The Harry Morton House is a previously recorded historic resource located along the Zigzag Mountain East Alternative (Resource No. 20) (see Figure 17). It was built in 1909 and is a good example of the Vernacular style in the Zigzag vicinity. Morton was an early resident of the area who farmed the land and worked as a woodcutter (Koler/Morrison Planning Consultants 1991b).

The Oregon Historic Sites Database, which was accessed through the Oregon SHPO, was reviewed for previously recorded historic resources within the study area. Two historic resources were identified in or near the study area and were recorded during the 1989–1992 Clackamas County Historic Resources Inventory. The first is the Barlow Trail Stage Stop Chimneys, which is located immediately outside the study area (Koler/Morrison Planning Consultants 1991a), and the second is the Harry Morton House (Resource No. 20) (Koler/Morrison Planning Consultants 1991b). The Oregon Historic Sites Database notes that both of these resources are eligible for listing in the National Register of Historic Places (NRHP).

CULTURAL RESOURCES SUMMARY

There are no previously recorded archaeological resources or previously documented Traditional Cultural Properties within the study area; however, much of the study area has not been surveyed for cultural resources. Portions of the study area within the Sandy River floodplain are unlikely to retain archaeological resources as a result of regular flooding and channel migration, which likely would have obliterated any material evidence of human activity along the river. Based on topographic maps and the reconnaissance survey, it appears that a large portion of the study area located east of the Sandy River is undeveloped and retains terraced landforms. Terraced landforms are considered to have high probability for containing both historic-period and prehistoric archaeological resources. There may also be potential for historic-period archaeological sites where the Barlow Road once crossed the study area (see Figure 16).

Potential historic resources built in or before 1970, meeting age criteria requirements for consideration for listing in the NRHP, were researched and identified using Clackamas County tax assessor records to determine construction dates. A total of 51 historic resources were found to meet the age criteria within the study area. One historic resource was found in Zigzag Mountain East Alternative and six historic resources were found in Zigzag Mountain West Alternative. There are three anticipated displacements of potential historic homes along the Modify Existing Lolo Pass Road Alternative (Resource Nos. 26-28, constructed between 1948 and 1955) and more resources along the existing roadway. The remaining 44 historic resources are scattered throughout the study area, including along East Lolo Pass Road. These resources

are summarized in Table 1 of Appendix F, and their locations are shown on Figure 17 through Figure 19.

Several clusters of circa 1920s to 1950s recreational cabins and houses situated along East Lolo Pass Road were identified by accessing Clackamas County tax assessor data, and some were field checked during the reconnaissance survey. The clusters of historic resources are located in subdivisions created in the 1920s following the construction of the Mt. Hood Loop Highway, which was completed from Zigzag to Government Camp in 1924 (Chapman and Hadlow 2003). The subdivisions are located near East Terrace Drive and East Mountain Road; there is also a small cluster of residences north of East Mountain Drive, and another cluster of residences near East Minikahda Avenue. One cluster of residences, located near the Sandy River and north of East Mountain Drive, appears to be a former auto camp/auto court (Resource No. 13) (see Figure 17; Photo 3 in Appendix F). Auto camps/auto courts were usually a small collection of cabins or tents that were the forerunner of motels, and were typically found on highways and in recreational areas.

Both Zigzag Mountain Alternatives cross a land parcel that may contain a 1950s building (Resource No. 25) (see Figure 19). However, this building doesn't appear on current parcel maps and may have been removed from the property. Further investigations will be needed to verify whether the structure is extant.

The Zigzag Mountain East Alternative has a total of six historic resources and crosses the land parcel containing the NRHP-eligible 1909 Harry Morton House (Resource No. 20) (see Figure 17). Clackamas County tax assessor data shows a house built in 1965 on the parcel. However, the 1989–1992 Clackamas County Historic Resources Inventory records note both a 1965 house and the 1909 Harry Morton House on the parcel, and that they were still within the family at the time (Koler/Morrison Planning Consultants 1991b). Further investigations will be needed to verify whether the Harry Morton House is extant.

AINW recommends a cultural resource survey on a preferred road alignment if one is eventually selected to be developed into more detailed design. Additional studies may include a pedestrian survey along the alignment and shovel testing in areas with low ground surface visibility and high probability for containing archaeological resources, including terraced landforms and areas where the Barlow Road may cross the alignment. AINW also recommends that a historic resource survey be conducted for the preferred alignment to record and evaluate the resources for their eligibility for listing in the NRHP. Any resources found to be eligible for listing in the NRHP would need to be evaluated for potential direct and indirect project effects that may cause alterations to the character and use of the historic building or structure.

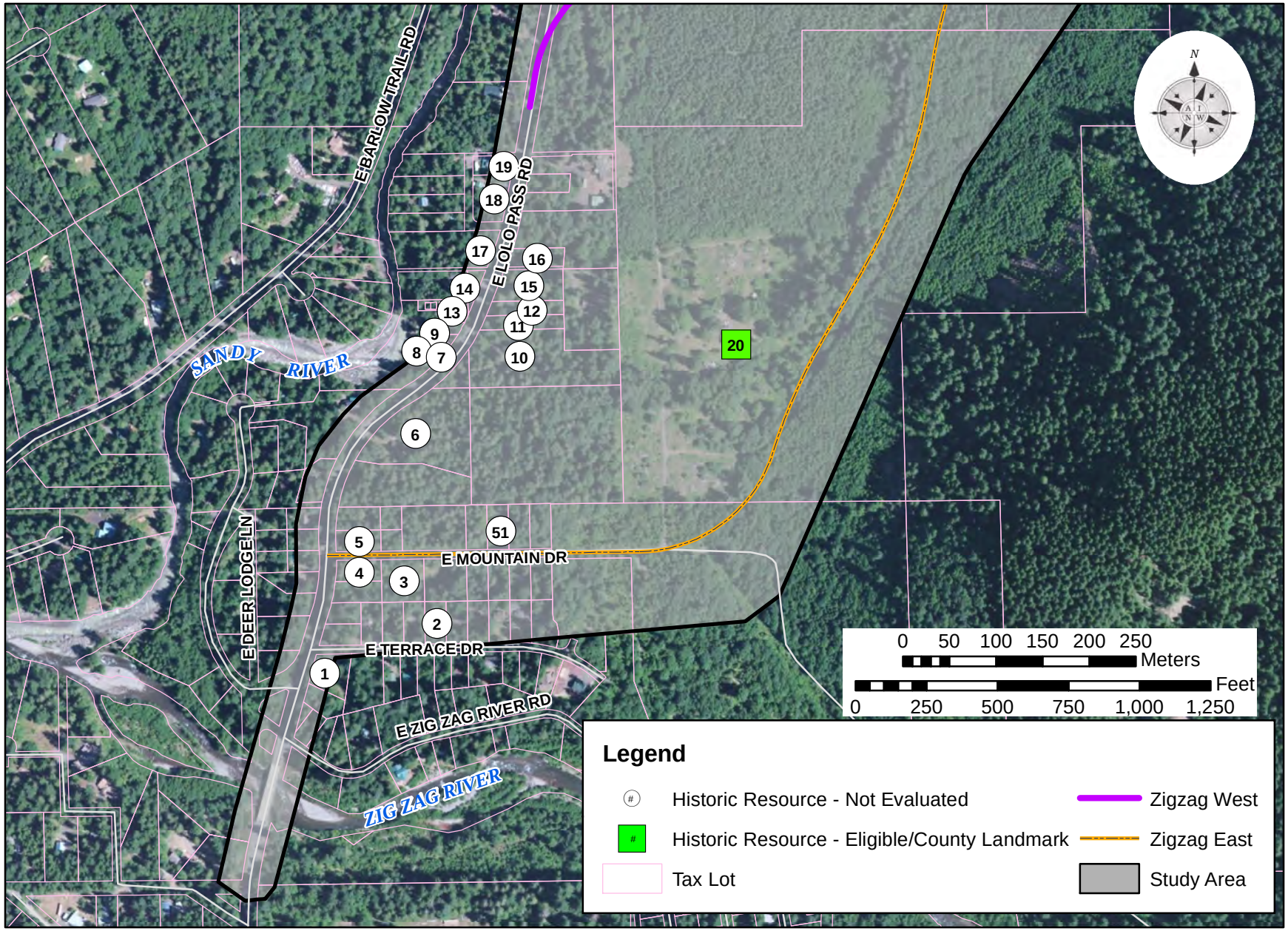


Figure 17. Sandy River Corridor study area showing the parcels containing historic resources and the two alignments in the southern end of the study area.

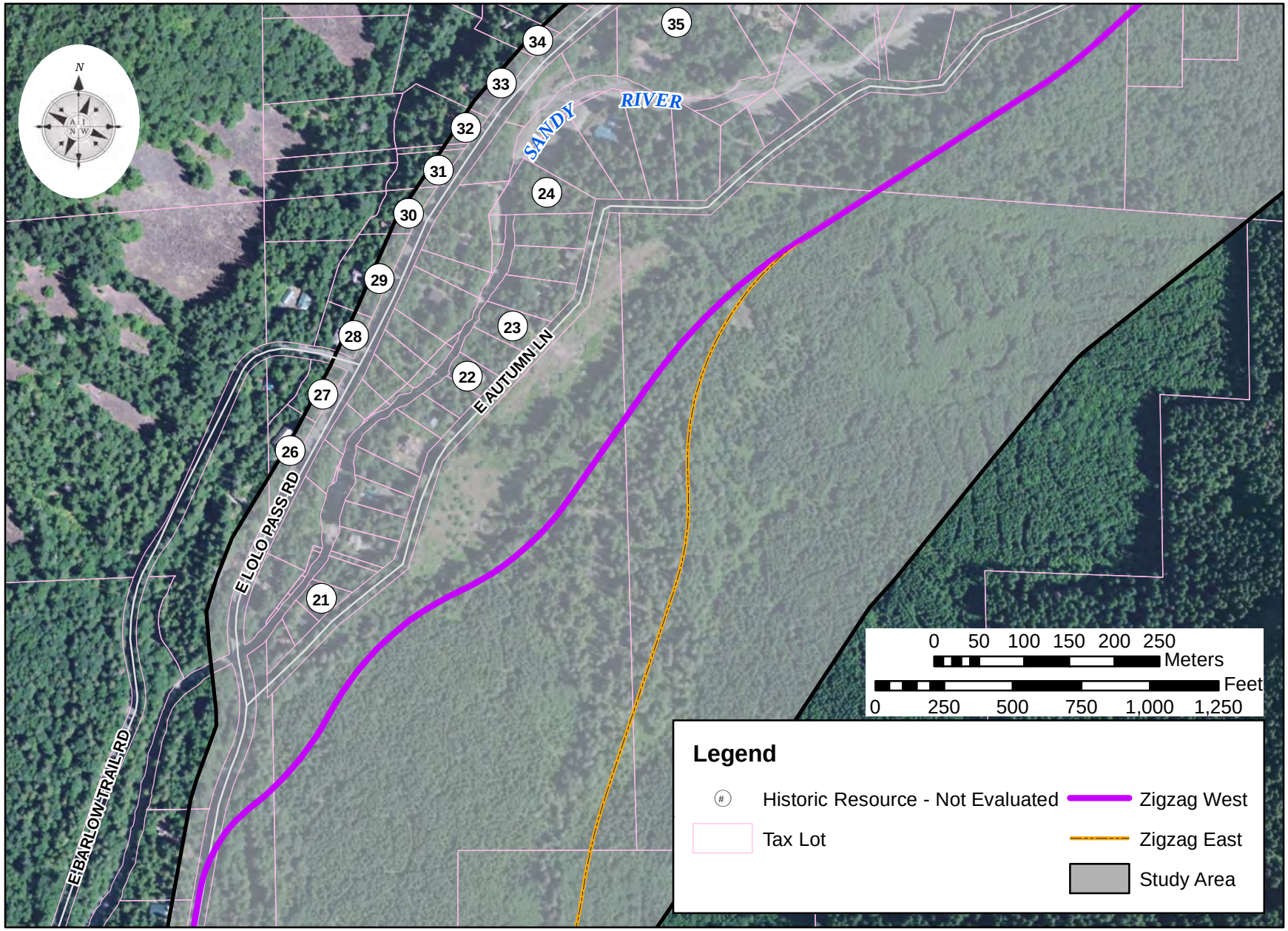


Figure 18. Sandy River Corridor study area showing the parcels containing historic resources and the two alignments in the central portion of the study area.

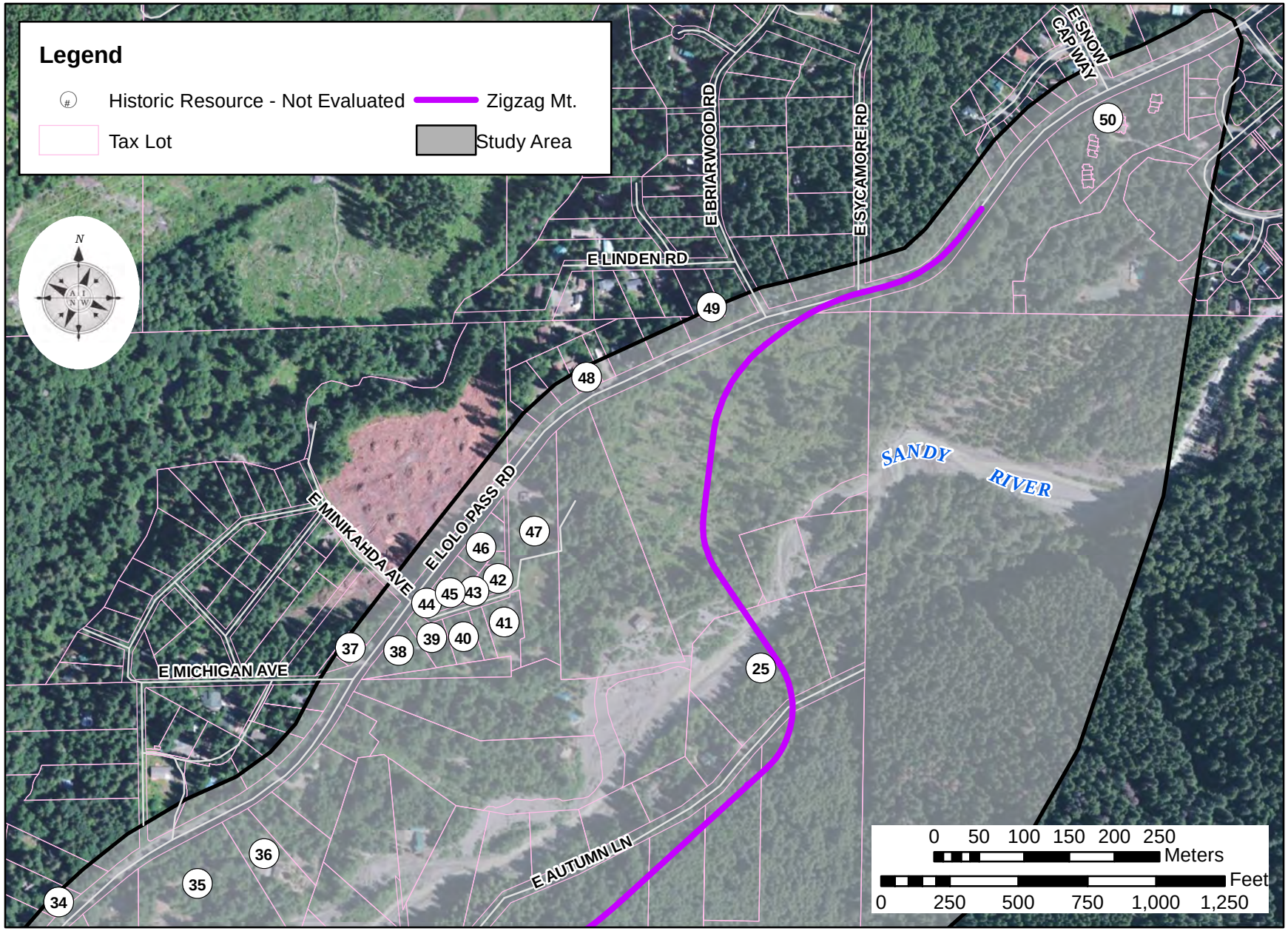


Figure 19. Sandy River Corridor study area showing the parcels containing historic resources and Alignment 1 in the northern portion of the study area.

HAZARDOUS MATERIALS

Federal and state databases were searched on August 14 and 15, 2014, for identified hazardous waste sites. The U.S. Environmental Protection Agency (EPA) keeps detailed information on all businesses dealing with hazardous materials, water discharge, Superfund sites, toxic releases and air emissions. According to the EPA Facility Register Service website, which includes Resource Conservation and Recovery Act (RCRA) sites, there are no National Priorities List (Superfund) sites within 5 miles of the study area (EPA 2014). There is one RCRA site with 0.25 mile of the study area. The RCRA site is a Conditionally Exempt Small Quantity hazardous waste generator for the United States Forest Service, MHNF Zigzag Ranger District, that supports activities for forestry.

The Oregon Department of Environmental Quality (DEQ) regulates or permits facilities and sites in the state. The DEQ Facilitator website identifies the following hazardous material sites in or within 0.25 mile of the study area (DEQ 2014):

- 4 Leaking Underground Storage Tanks: three with documented cleanup completed and one with cleanup started.
- 2 Water Quality Permits: one individual (Zig Zag Village Homeowners Association) and one industrial (Mt. Hood Asphalt Products, Inc.).

Background data files for each identified site are in Appendix A (specifically, Appendix D in the reconnaissance report). The hazardous materials sites listed above include only those which have been identified through online database review. Further ground-level survey and more detailed site reconnaissance could identify additional hazardous materials locations.

COST ANALYSIS

This section presents planning-level construction cost estimates for each alternative. It also presents potential maintenance and emergency maintenance costs for the different alternatives, including the estimated costs of the no action alternative (maintaining the existing road). The cost estimates were developed for the following three build alternatives:

- Modify Existing Lolo Pass Road
- Zigzag Mountain West, originating near Autumn Lane
- Zigzag Mountain East, originating near Mountain Drive

Costs were not developed for the Powerline Corridor alignment or the No Action alternative. The Powerline Corridor is described in the alternatives section at the beginning of the report and was not developed further.