



DRAFT Slope Analysis and Natural Hazards

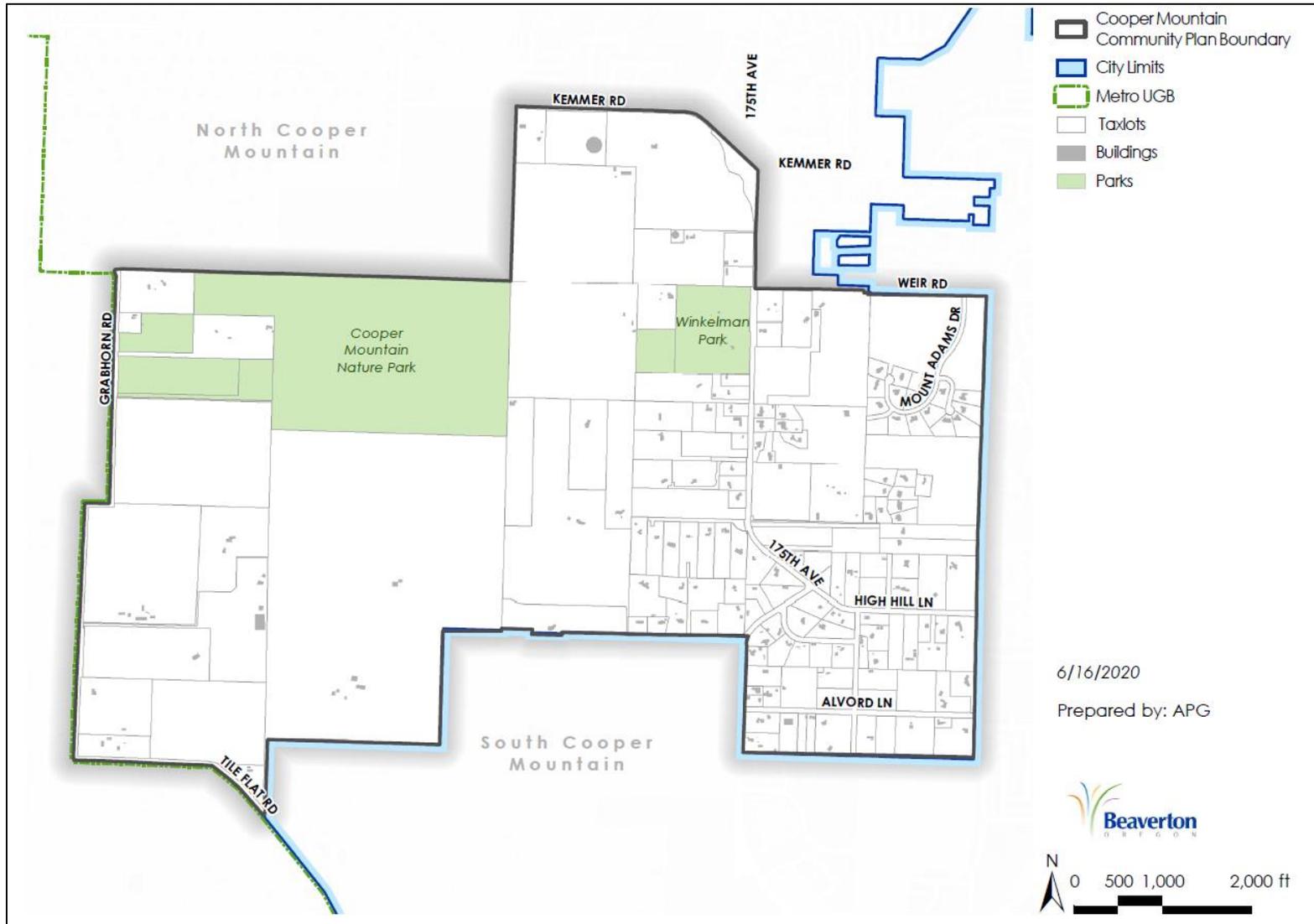
Introduction

Purpose

The purpose of this memorandum is to describe slope and potential natural hazard conditions within the Cooper Mountain Community Plan study area (shown in Figure 1). This memorandum relies primarily on publicly available data sources, which are described in greater detail at the end of the memorandum. This analysis and accompanying dataset will be used as general planning guidance for the Community Plan, including the assessment of buildable lands, documentation of existing conditions, future research on best practices for hillside development, and land use/transportation scenario creation and evaluation. The information in this memorandum is not a substitute for site-specific information regarding geological conditions or other natural hazards.



Figure 1. Cooper Mountain Community Plan Area



Source: City of Beaverton, Metro RLIS



Summary

Elevation and Slopes

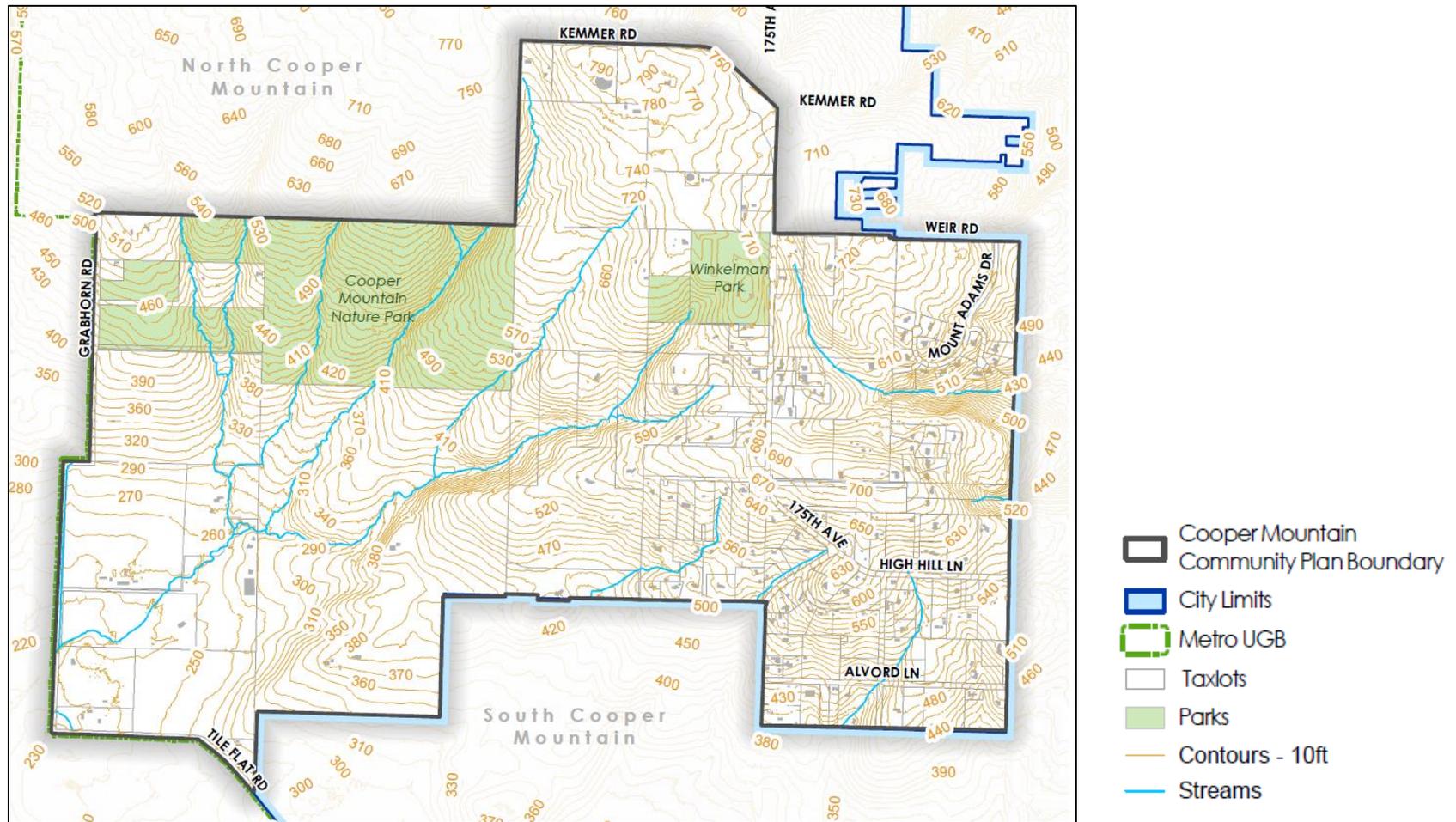
The study area is characterized by its varied, hilly terrain and steep slopes. Land in the southwestern portion of the study area is roughly 230 feet in elevation, while land along Kemmer Road at the north end of the study area reaches 790 feet in elevation (see Figure 2). Overall, the study area is most gently sloped in the "hilltop" area south of Kemmer Road and where McKernan Creek approaches Grabhorn Road near the intersection of Tile Flat Road and Grabhorn Road. Slopes exceed 25% in areas associated with stream corridors, the historic landslide near Summer Creek, and in a dispersed pattern of steep slopes in the southeast portion of the study area near Alvord and High Hill Lanes. A slope analysis is illustrated on Figure 4 and historic landslide data is mapped on Figure 5. Landslide Susceptibility Matrix .

Table 1. Slope Categories in the Cooper Mountain Community Plan Area

Slope Category	Acres	Percentage of study area
0-5%	180.3	14.5%
5-10%	320.1	25.8%
10-15%	304.8	24.6%
15-20%	189.8	15.3%
20-25%	102.0	8.2%
25+%	143.6	11.6%



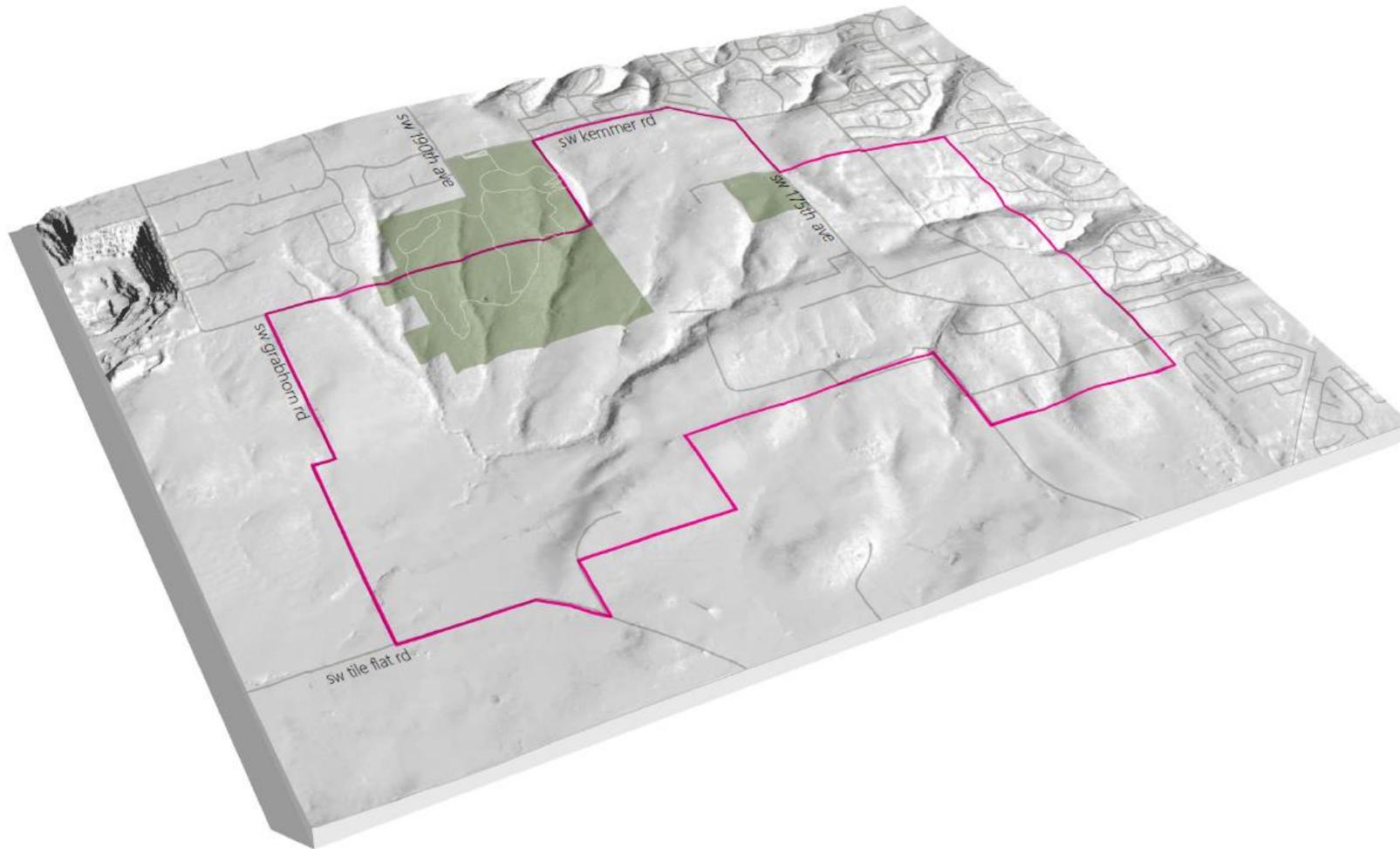
Figure 2. Study Area Elevation Contours



Source: City of Beaverton, Metro RLIS, DEA Stream Lines (2020 Local Wetland Inventroy)



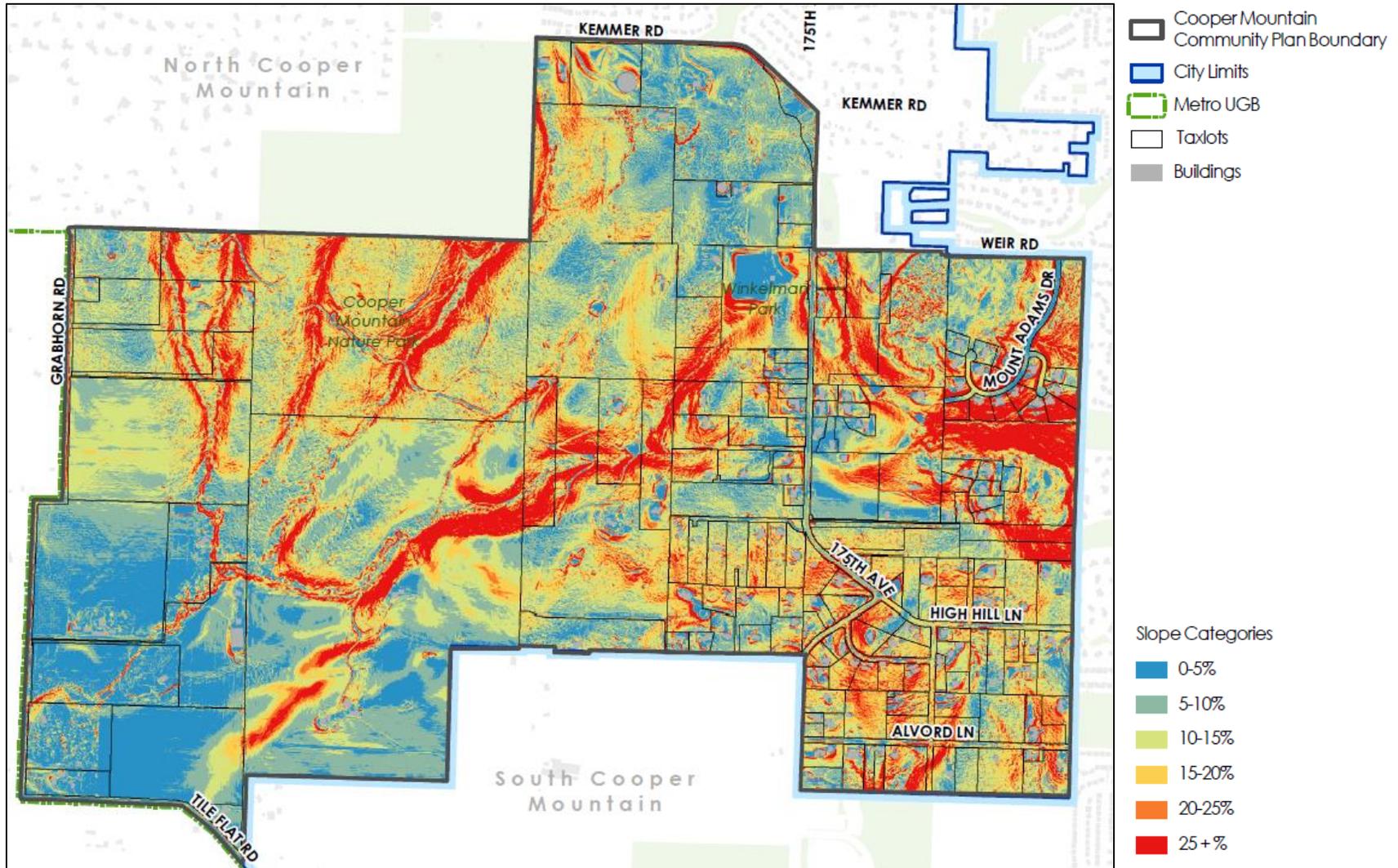
Figure 3. 3D Model of Study Area, Parks Shown



Source: City of Beaverton, Walker Macy



Figure 4. City of Beaverton Slope Categories



Source: City of Beaverton, Metro RLIS



Hazards

This section describes existing conditions and summarizes information about potential geologic hazards. Future research will determine how this information will be considered in land use, transportation, utilities, and other planning choices. The Oregon Department of Geology and Mineral Industries (DOGAMI) provides landslide and geologic-related data for land use planning. Please see the data sources section at the end of this memorandum for the data used in this hazards summary.

In 2016, DOGAMI produced a landslide susceptibility overview map of Oregon using (1) generalized geologic data, (2) a statewide inventory of past landslides, and (3) slope information. Spatial statistics were calculated to determine the percentage of landslide area and slope categories for each of the 148 generalized geologic units in Oregon. DOGAMI notes that this map is suitable for regional and community-scale purposes, not to answer site-specific questions. The susceptibility ratings are listed below and shown in Figure 5:

- **Low:** Landsliding unlikely. Areas with low landslide density and with few slopes prone to landsliding.
- **Moderate:** Landsliding Possible. Areas with low to moderate landslide density and moderate slopes prone to landsliding; OR areas with moderate landsliding density and low slopes prone to landsliding.
- **High:** Landsliding Likely. Areas with high landslide density and low or moderate slopes prone to landsliding; or areas with low landslide density and with high slopes prone to landsliding.
- **Very high:** Existing landslides. (Note: quality of landslide inventory varies across the state)



Figure 5. Landslide Susceptibility Matrix

<i>Graphic display of how data sets are combined to create the final landslide susceptibility zones.</i>		Landslide Density			Landslides
		Combine: ① Generalized Geologic Map + ② Landslide Inventory	Low (less than 7%)	Moderate (between 7% and 17%)	High (greater than 17%)
Slope Prone to Landsliding Combine: ② Landslide Inventory + ③ Slope Map	Low (less than 1 STD)	Low	Moderate	High	Very High
	Moderate (between the mean and 1 STD)	Moderate	Moderate	High	Very High
	High (equal to or greater than mean)	High	High	High	Very High

Source: DOGAMI (2016)

A majority of the Community Plan study area has a landslide susceptibility rating of “moderate” or higher, as shown in Figure 7. Areas of particularly steep slopes (generally greater than 25%) have a landslide susceptibility rating of “high.” There are several historic landslides within the study area (shown on Figure 6), including two large landslides east of 175th Avenue and south of Weir Road. These areas have a very high level of landslide risk, as shown on Figure 7.

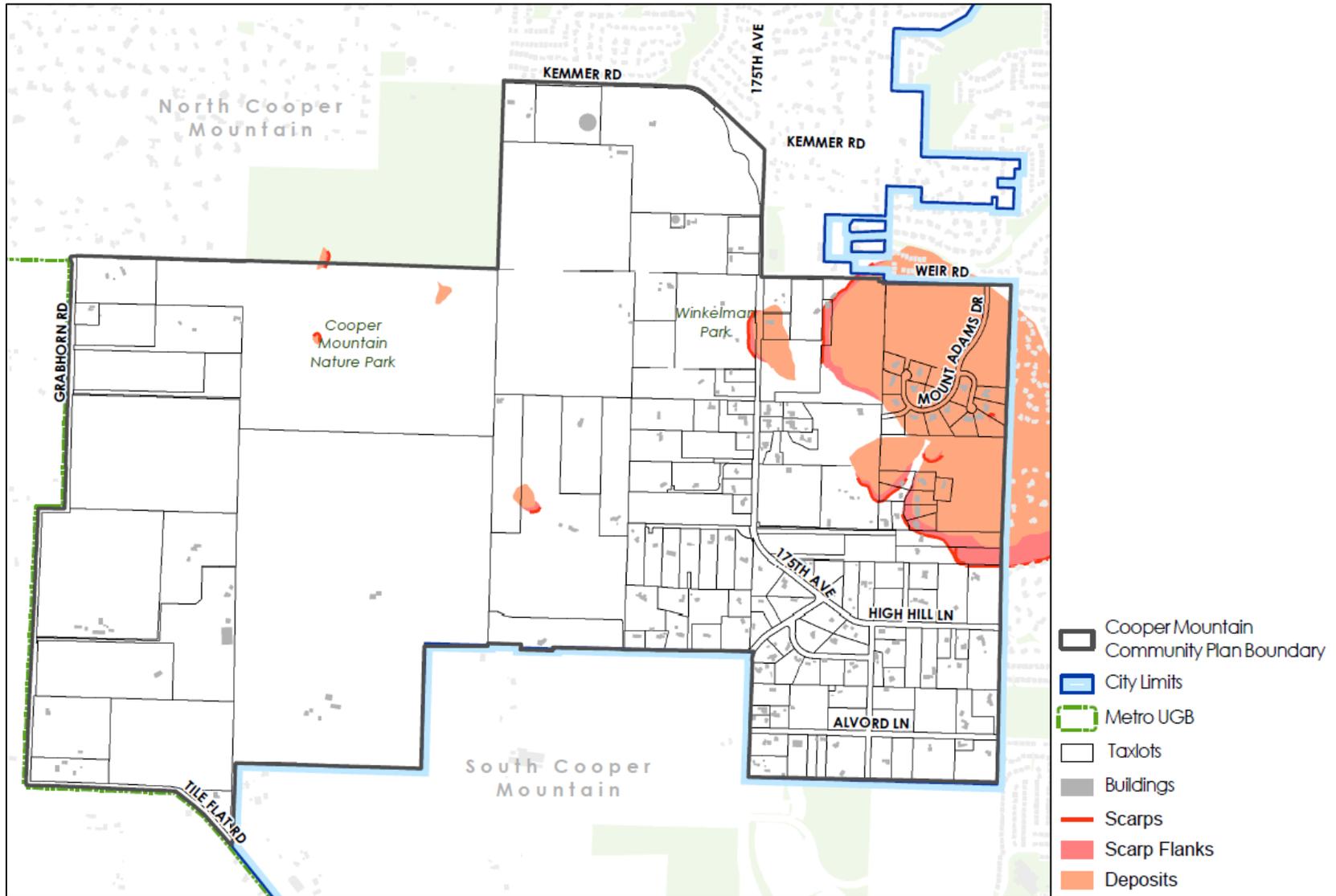
Some areas are mapped in greater detail for shallow (less than 15 feet) landslide susceptibility and deep (greater than 15 feet) landslide susceptibility, shown on Figure 8 and Figure 9, respectively. DOGAMI’s detailed landslide susceptibility maps can be produced only in areas where detailed LiDAR-based landslide inventory maps have been completed; these maps do not provide data for the majority of the study area.

Earthquake hazard is also mapped by DOGAMI and available through the Statewide Geohazards Viewer (HazVu - <https://www.oregongeology.org/hazvu/>). Figure 10 shows hazard due to liquefaction of soft soil during an earthquake, which is present in the low-lying areas to the southwest. Figure 11 shows expected earthquake shaking, which is high throughout the study area.

There are no identified Federal Emergency Management Agency (FEMA) floodplains in the study area.



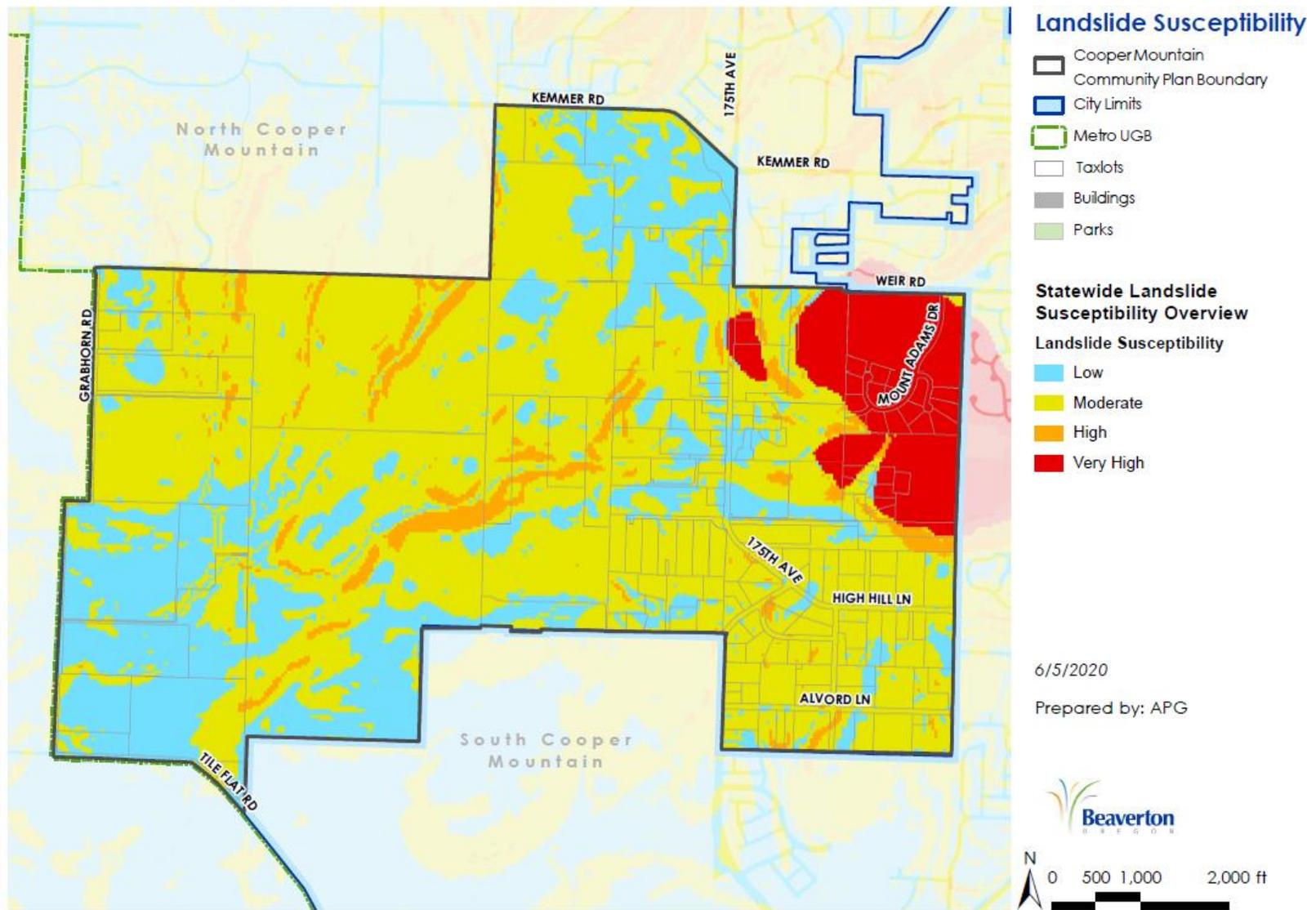
Figure 6. DOGAMI Historic Landslide Data – Scarps, Scarp Flanks, and Deposits



Source: City of Beaverton, DOGAMI, Metro RLIS



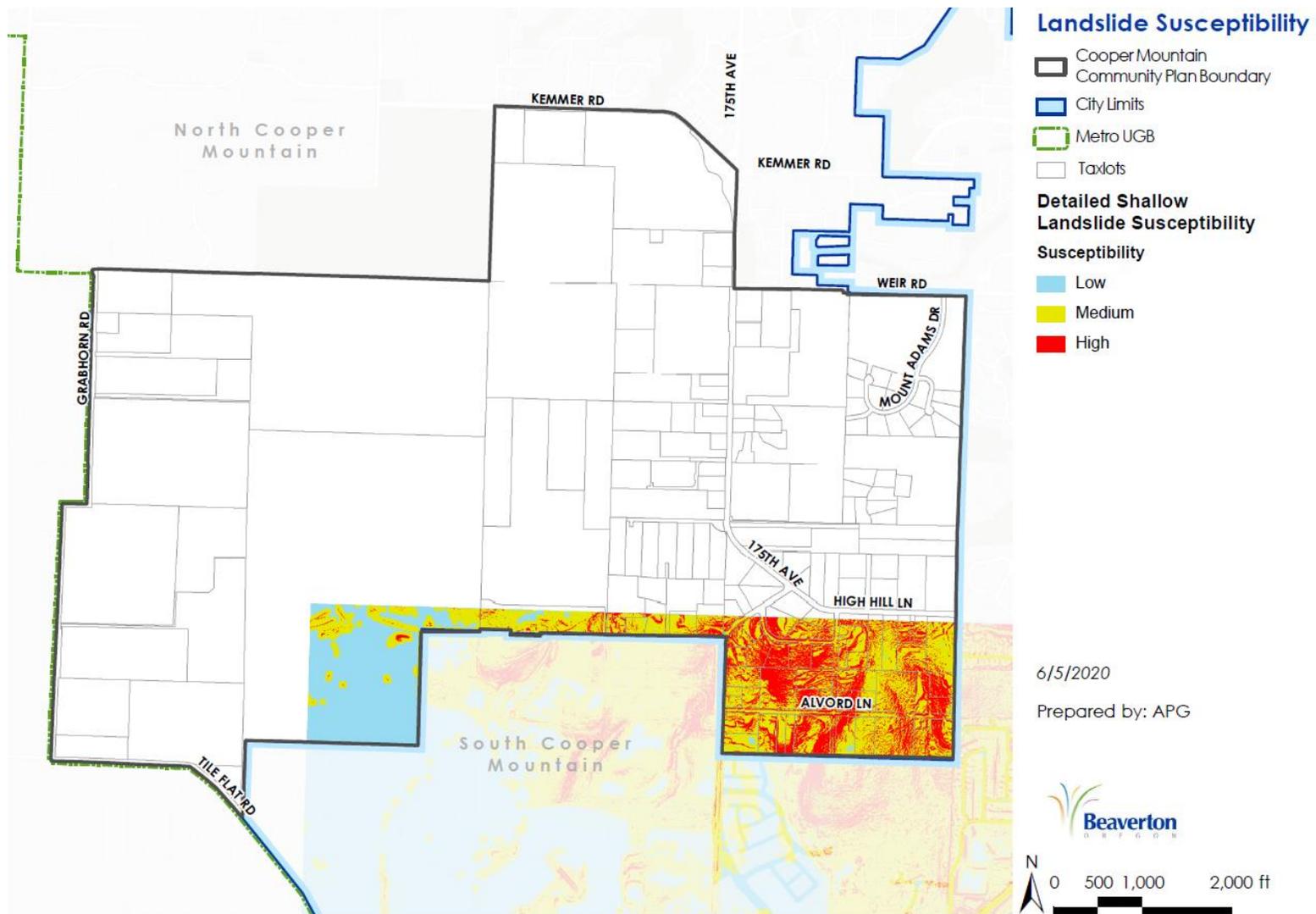
Figure 7. DOGAMI Statewide Landslide Susceptibility



Source: City of Beaverton, DOGAMI, Metro RLIS



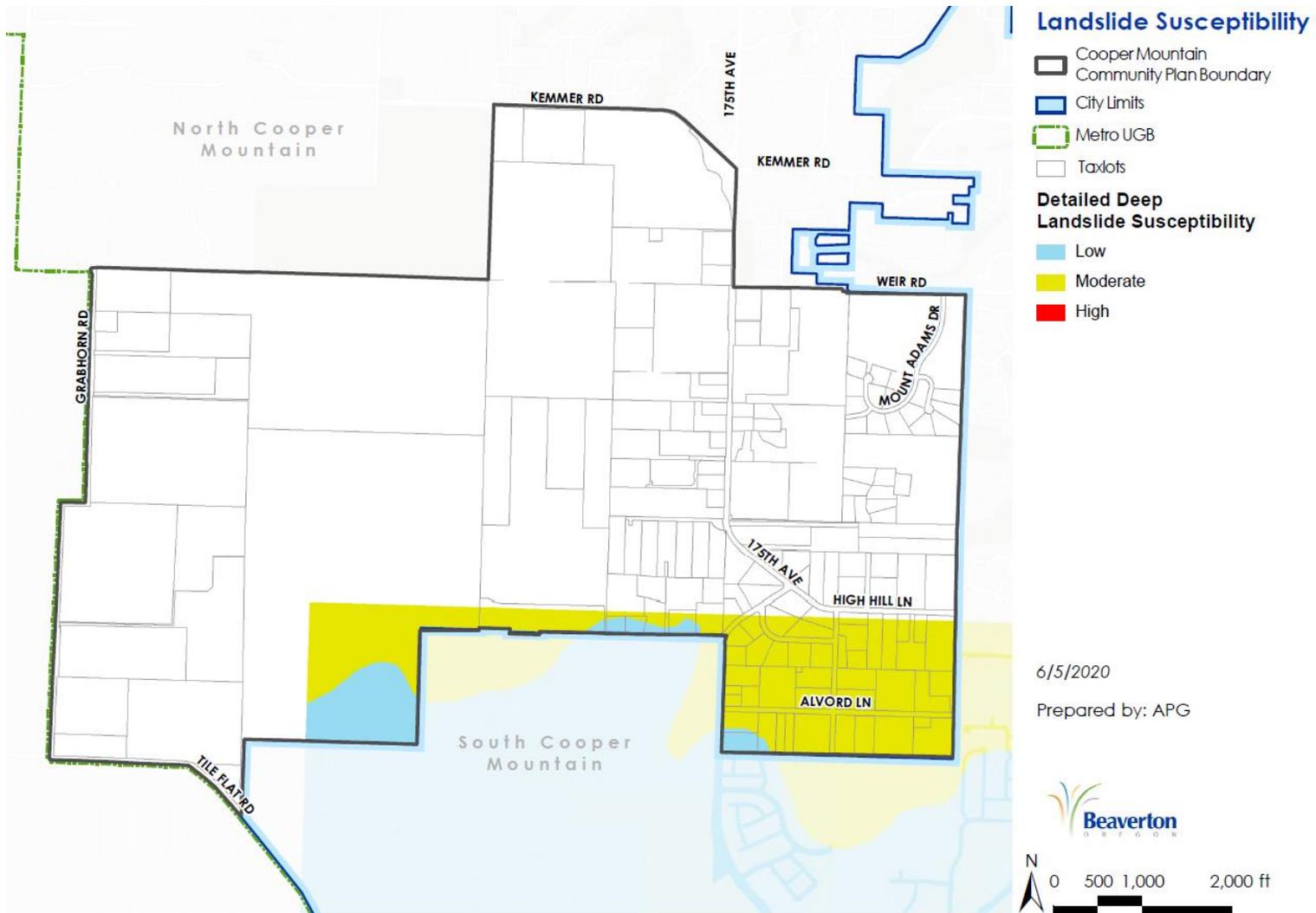
Figure 8. DOGAMI Detailed Shallow Landslide Susceptibility



Source: City of Beaverton, DOGAMI, Metro RLIS



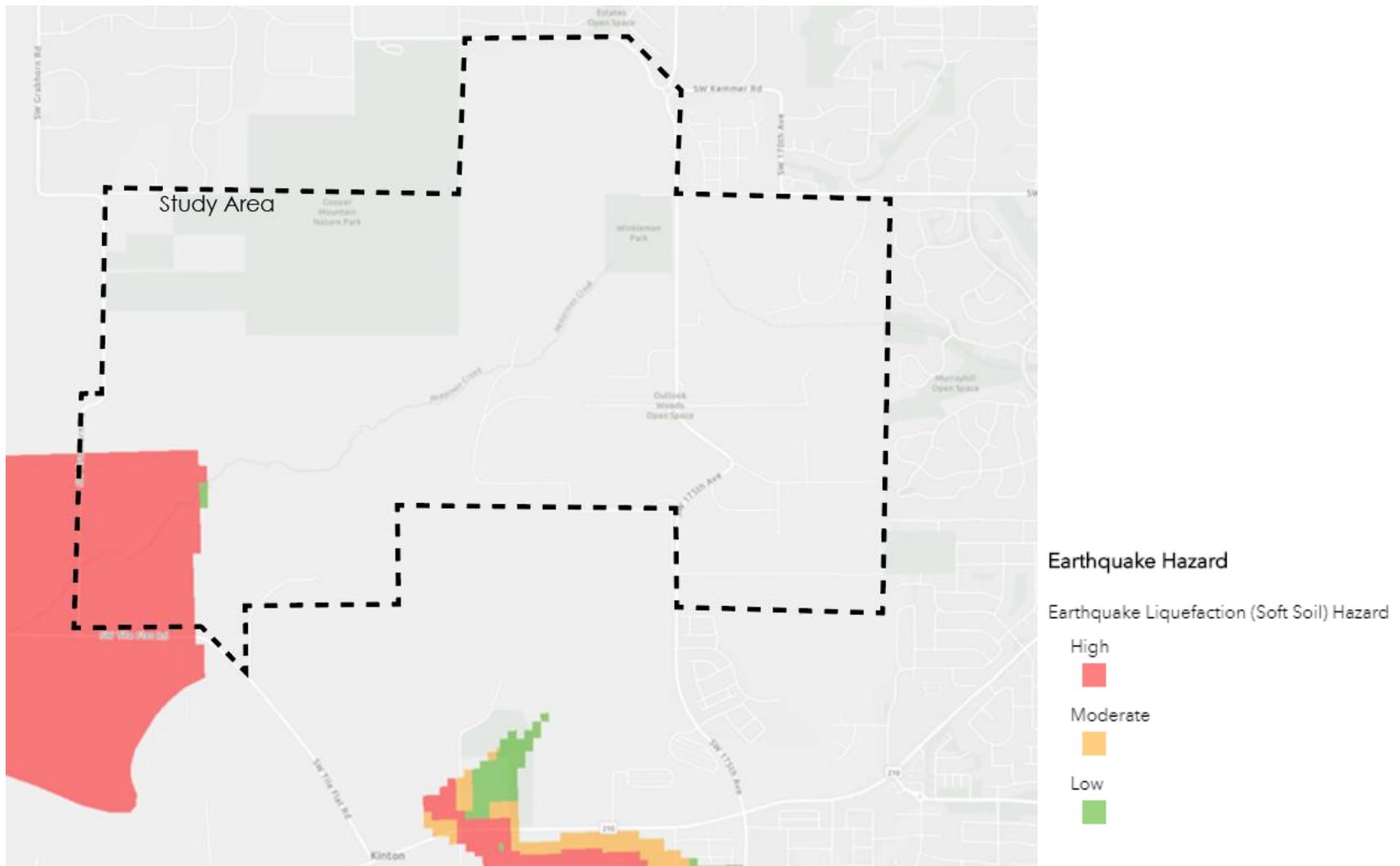
Figure 9. DOGAMI Detailed Deep Landslide Susceptibility



Source: City of Beaverton, DOGAMI, Metro RLIS



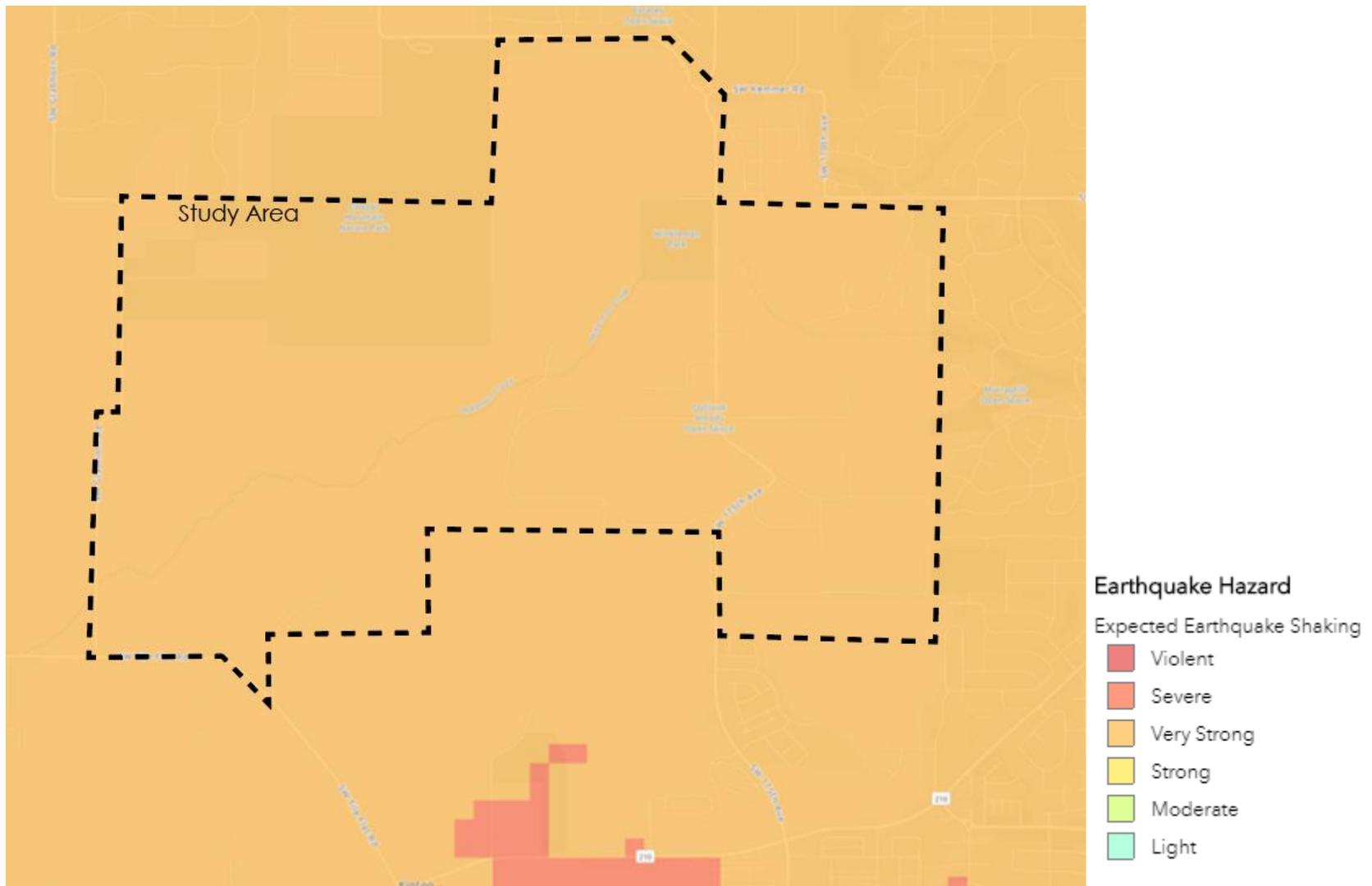
Figure 10. Earthquake Liquefaction (Soft Soil) Hazard, Screenshot from DOGAMI HazVu



Source: DOGAMI HazVu



Figure 11. Expected Earthquake Shaking, Screenshot from DOGAMI HazVu



Source: DOGAMI HazVu



Data Sources and Additional Detail

The Geographic Information System (GIS) data used in this memorandum are as follows.

- **City of Beaverton**
 - Slope categories
 - Contours
- **DOGAMI**
 - Historic Landslide Inventory
 - Landslide Susceptibility*
 - Soil Liquefaction Hazard
 - Expected Earthquake Shaking
- **David Evans & Associates**
 - 2020 Local Wetland Inventory (see separate Natural Resources Inventory Memorandum)

*Detailed deep and shallow landslide susceptibility data is based on previous LiDAR imagery and only available for the southern portion of the study area.

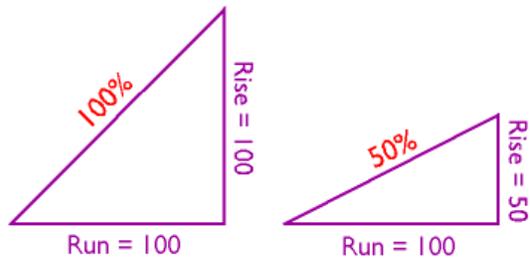
City of Beaverton Slope Contours

Detailed slope contours for the study area were provided by the City of Beaverton. Contours are available in 10 ft, 5 ft, 2 ft, and 1 ft intervals.

Contours are also available regionwide through Metro's Regional Land Information System (RLIS), however the data from the City of Beaverton used here is more recent and accurate.

City of Beaverton Slope Categories

Detailed slope categories were derived from LiDAR data provided by the City of Beaverton. Slopes are identified in percentages, where a rise:run of 1:1 is 100%. Slopes greater than 25% are generally considered to be unbuildable, while slopes in the 15%-25% range can be challenging to develop.



DOGAMI Historic Landslide Inventory

Source: SLIDO 4.0 Geodatabase (<https://www.oregongeology.org/slido/data.htm>)

DOGAMI provides a statewide inventory of mapped landslide deposits compiled from numerous studies. The original studies vary widely in scale, scope, and focus, which is reflected in the wide range of accuracy, detail, and completeness with which landslides are mapped. The landslide inventory is intended to provide users with basic information regarding landslides. The geologic, terrain, and climatic conditions that led to landslides in the past may provide clues to the locations and conditions of future landslides, and it is intended that this data will provide useful information to develop regional landslide susceptibility maps, to guide site-specific investigations for future developments, and to assist in regional planning and mitigation of existing landslides. The dataset includes scarp lines, flanks, and deposit areas from historic landslides. The diagram below provides a generalized description of these landslide elements.

DOGAMI Statewide Landslide Susceptibility Overview Data

Source: SLIDO 4.0 Geodatabase (<https://www.oregongeology.org/slido/data.htm>)

This raster image depicts the landslide susceptibility through the State of Oregon. The landslide susceptibility is categorized by a low, moderate, high, and very high designation. The intended use of this overview map is to help identify regions (cities, counties, communities, portions of lifelines, watersheds, etc.) that may be at risk for future landslides. It is designed to provide landslide hazard information for regional planning and specifically to identify areas where more detailed landslide mapping is needed. The data in this raster depicts landslide susceptibility at a 10-meter resolution, across the state of Oregon. The data was created using Oregon LiDAR Consortium (OLC) data, and USGS National Elevation Dataset (NED) data where OLC data was not present. This elevation data was converted into slopes, and a multi-



pronged analysis process used these slopes, geology and mapped existing landslides to create this 10-meter resolution raster.

DOGAMI Detailed Landslide Susceptibility Data

Source: SLIDO 4.0 Geodatabase (<https://www.oregongeology.org/slido/data.htm>)

This layer is a shallow landslide susceptibility raster dataset. It was created to increase resilience of Oregon communities to the impacts of landslide hazards through identification of susceptible areas. The symbology on this map includes low, moderate and high susceptibility. Using a LiDAR-based landslide inventory and several other data sets, a shallow landslide (failure depth less than 15 feet) susceptibility map and deep landslide (failure depth greater than 15 feet) map were created.

The final shallow-landslide susceptibility zones were established from locations of shallow-landslide deposits and their associated head scarps, factor of safety calculations, and buffers.

Deep-landslide susceptibility zones were established from locations and proximity to deep-landslide deposits and head scarps, head scarp buffers, susceptible geologic units, slope angles, and mapper judgment.

This map cannot serve as a substitute for site-specific investigations by qualified practitioners. Site-specific data may give results that differ from those shown on this map.

Detailed data is not currently available for the entirety of the CMCP study area.

FEMA Floodplain

FEMA Floodplain data is available through Metro RLIS. There are no FEMA floodplains within the study area.

DOGAMI Earthquake Hazard

<https://www.oregongeology.org/hazvu/>

DOGAMI data identifies Expected Earthquake Shaking and Liquefaction (Soft Soil) Hazard in its HazVu web viewer. Screenshots of the study area are provided in Figure 10 and Figure 11.