ATTACHMENT K: PRELIMINARY HYDROLOGY REPORT

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Westwood

Preliminary Hydrology Report

Badger Mountain Solar Project

Douglas County, Washington

February 2020, Revised September 2020

Prepared For:

AVANGRID RENEWABLES

Westwood

Preliminary Hydrology Report for

Badger Mountain Solar Project

Douglas County, Washington

Prepared for:

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Project Number: 0025965.00
Date: 02/21/2020, Updated 09/02/2020

CONTENTS

EXHIBITS

APPENDICES

OVERVIEW

The purpose of the study is to analyze and review the existing hydrology of the proposed Badger Mountain Solar Project ("the project") and any impacts that the hydrology may play in the design of the proposed solar array. This report was prepared to be used by the project team in the design and layout of the project and not intended for submittal to reviewing agencies for stormwater permitting.

The project site is proposed on approximately 1,865 acres and is located roughly 4 miles northeast of East Wenatchee in Douglas County, Washington. The site is located on sloped terrain of generally greater than 3% sloping to the east. The modeled watershed area encompasses approximately 18 square miles with the eastern portion generally sloping to the east and the western portion generally sloping to the west. An additional 6.5 square miles was modeled to the west and northwest to account for drainage to the existing and proposed portions of the transmission line to the site. This watershed primarily drains to the west.

FEMA has completed a study to determine flood hazards for portions of the selected location; the project area does not contain FEMA Zone A or AE Flood hazards; however, the project is located within a FEMA Zone C. No preliminary or pending FEMA data was located that will affect the project area.

The majority of the proposed solar facility will consist of above ground mounted solar modules. A meadow grass will be planted below the modules and will make up a majority of the site's land cover. A small amount of impervious surface will also be added from the gravel access roads and electrical equipment pads, but typically only makes up approximately 3-5% of the total project area. The project should be designed to minimize grading and maintain existing drainage patterns.

The project should utilize low-impact development techniques to provide post-construction stormwater management. The proposed meadow grass beneath the solar modules will act as a vegetated filter providing both runoff treatment and reduction when compared to existing conditions.

The hydrologic modeling in this report was created using FLO-2D modeling software. FLO-2D was used to review the overall watershed drainage to and through the project to determine if any overland runoff causes flooding, high velocity, or scour impacts to the site.

The analysis shows low water depths and low velocities (Exhibits 6 and 7) across the majority of the site. Higher flood depths occur in existing flowpaths on site. High velocities and scour are also expected in the existing flow paths on site.

Based on experience with similar projects, the majority of the site is suitable for the planned development by avoiding or designing to areas of high flood depths.

DATA SOURCES

The models and methods for this project utilize a combination of public and private data as shown in Table 1.

Table 1: Data Sources

Data Type	Format	Source	Use
Elevation	1-meter LiDAR	NOAA	FLO-2D Model Elevations
Crop Data	Shapefile	USDA 2013 Crop Data Layer	Landcover
Soils	Shapefile	USGS SSURGO Dataset	Curve Numbers
Precipitation	PDF File	NOAA Atlas 2	Design storms
HUC-12 Drainage Boundary	Shapefile	USGS	Define Model Extents
Site Boundary	Badger Mt. Solar_20191206.kmz	Avangrid Renewables	Define Model Extents
2014 Aerial Photography	ArcGIS Map Service	USDA FSA	Reference

EXISTING CONDITIONS

The project area is located approximately 4 miles northeast of East Wenatchee in Douglas County, Washington. The project site is approximately 1,865 acres and is located on relatively sloped terrain of generally greater than 3% sloping to the east.

Watershed Hydrology

The modeled watershed for the project area encompasses approximately 18 square miles with the eastern portion sloping to the east and the western portion sloping to the west. The modeled watershed for the transmission line encompasses approximately 6.5 square miles and slopes primarily to the west.

Onsite Conditions

In general the slopes throughout the project area are mild with a grade of greater than 3%. The project area is primarily fallow/idle cropland or used for agricultural row crops (Exhibit 4) with soils generally belong to Hydrologic Soil Groups B and C (Exhibit 3). The main potential hydrologic issue on site is flooding and erosive velocities.

FEMA Flood Zone

FEMA has completed a study to determine flood hazards for the selected location; the project area is covered by FEMA Firm Panel 5300360555A. The project area is located in a FEMA Zone C flood area (Appendix C). A FEMA Zone C is an area of minimal flooding. No preliminary or pending FEMA changes are proposed within the project area.

PROPOSED CONDITIONS

The majority of the proposed solar facility will consist of above ground mounted solar modules. A transmission line will extend to the site. Meadow grass will be planted below the modules and will make up a majority of the land cover. A small amount of impervious surface will be added from the gravel access roads and electrical equipment pads. The project should be designed to minimize grading and maintain existing drainage patterns.

Post- Construction Stormwater Management

The typical solar project's low-impact development technique of converting the land cover from a row crop field to a meadow grass will provide post-construction stormwater management to meet most agency requirements. The proposed meadow grass will act as a vegetated filter providing both runoff treatment and reduction when compared to existing conditions. A stormwater management report will be prepared summarizing the county and state requirements. As the project design advances the post-construction stormwater management should be reviewed in further detail with the County Engineer.

FLO-2D MODELING

FLO-2D is a physical process model that routes rainfall runoff and flood hydrographs over flow surfaces or in channels using the dynamic wave approximation to the momentum equation. FLO-2D offers advantages over 1-D models and unit hydrograph methods by allowing for breakout flows and visualization of flows across a potential site. The primary inputs are a DTM (elevation data), curve numbers and precipitation. Culverts were not modeled and roads were allowed to overtop.

Because of the complex and distributary nature of flow paths upstream and through the project site, a FLO-2D model with 40' grid cells was utilized to determine flow depths and velocities throughout the site.

Elevation Data

The elevation data input into the FLO-2D model was 1-meter DEM data from NOAA (Exhibit 5), which was incorporated into the DTM using the export to xyz function in Global Mapper. These XYZ files are read directly into FLO-2D.

Watershed Soils and Land Cover

USDA-NRCS SSURGO soil data provides soil types within the project boundary and full coverage of the contributing watershed. Soils in the area are primarily classified as Hydrologic Soil Groups B and C (Exhibit 3). Land cover was obtained from the USDA 2013 Crop Data Layer. Exhibit 4 displays the land cover classes for the entire watershed. Curve numbers were applied to each grid cell in the FLO-2D model based on intersecting the grid with the curve numbers (Exhibit 5).

Precipitation

Precipitation data was obtained from the NOAA Atlas 2 (Appendix A) and used for the FLO-2D analysis for the 100-year, 24-hour storm. Using the 100-year rainfall event of 3.2 inches for this location allows for the best initial analysis in order to determine the worst areas of flooding and erosion. Rainfall is distributed in a nested distribution pattern.

FLOOD ANALYSIS RESULTS

Existing Conditions Flood Analysis

The analysis shows low water depths and velocities (Exhibits 6 through 7B) across the majority of the site. During a 100-year storm, the flood depths across the majority of the project area are less than 0.5 feet with velocities less than 1 foot/second. Higher flood depths and velocities occur in the existing flowpaths throughout the site and watershed. See Exhibits 6 through 7B for areas within the project with higher flood depths and velocities. In general, large scour depths are contained within the existing flowpaths (Exhibits 8A and 2B).

RECOMMENDATIONS

Based on experience on similar projects, the bulk of the site is suitable for the planned development and hydrologic concerns can be addressed by either avoiding areas of high flood depths or through detailed engineering design.

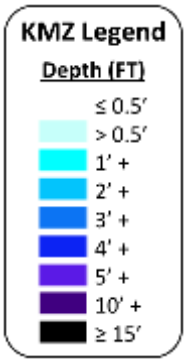
NEXT STEPS

1. Final engineering design should account for the flood depths and velocities presented in Exhibits 6-7.

2. Facilities to be elevated 1' above the 100-year, 24-hour peak flood elevations.

3. Stormwater management should be revisited to ensure the final design meets the local and state requirements.

INCLUDED OUTPUT FILES



1. Shapefile of Existing Flow Depth, Project Watershed
   2020-02-21_Badger_Prelim_Flow_Depth_at_Cell.shp
   Attribute "ID" = Grid Cell Number
   Attribute "VAR" = Max Flow Depth (Feet)

2. KMZ of Existing Flow Depth, Project Watershed
   2020-02-21_Badger_Flow_Depth_Preliminary.kmz
   Overlay in Google Earth for graphical representation.

3. Shapefile of Existing Flow Depth, T-Line Watershed
   2020-08-31_Badger_TLine_Prelim_Flow_Depth_at_Cell.shp
   Attribute "ID" = Grid Cell Number
   Attribute "VAR" = Max Flow Depth (Feet)

4. KMZ of Existing Flow Depth, T-Line Watershed
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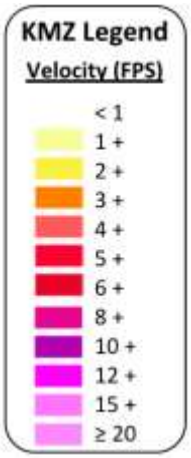

5. Shapefile of Existing Velocity, Project Watershed
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   Attribute "VAR" = Velocity (FPS)

6. KMZ of Existing Velocity, Project Watershed
   2020-02-21_Badger_Velocity_Preliminary.kmz
   Overlay in Google Earth for graphical representation.

7. Shapefile of Existing Velocity, T-Line Watershed
   2020-08-31_Badger_TLine_Prelim_Velocity_at_Cell.shp
   Attribute "ID" = Grid Cell Number
   Attribute "VAR" = Velocity (FPS)

8. KMZ of Existing Velocity, T-Line watershed
   2020-08-31_Badger_Velocity_TLine_Preliminary.kmz
   Overlay in Google Earth for graphical representation.

REFERENCES

National Engineering Handbook, Part 630 Hydrology. Chapter 9 Hydrologic Soil-Cover Complexes. USDA. NRCS. 210-VI-NEH, July 2004

2009 PSLC Lidar: Douglas 1-meter LiDAR, Accessed February 2020, https://coast.noaa.gov/dataviewer/#/lidar/search/

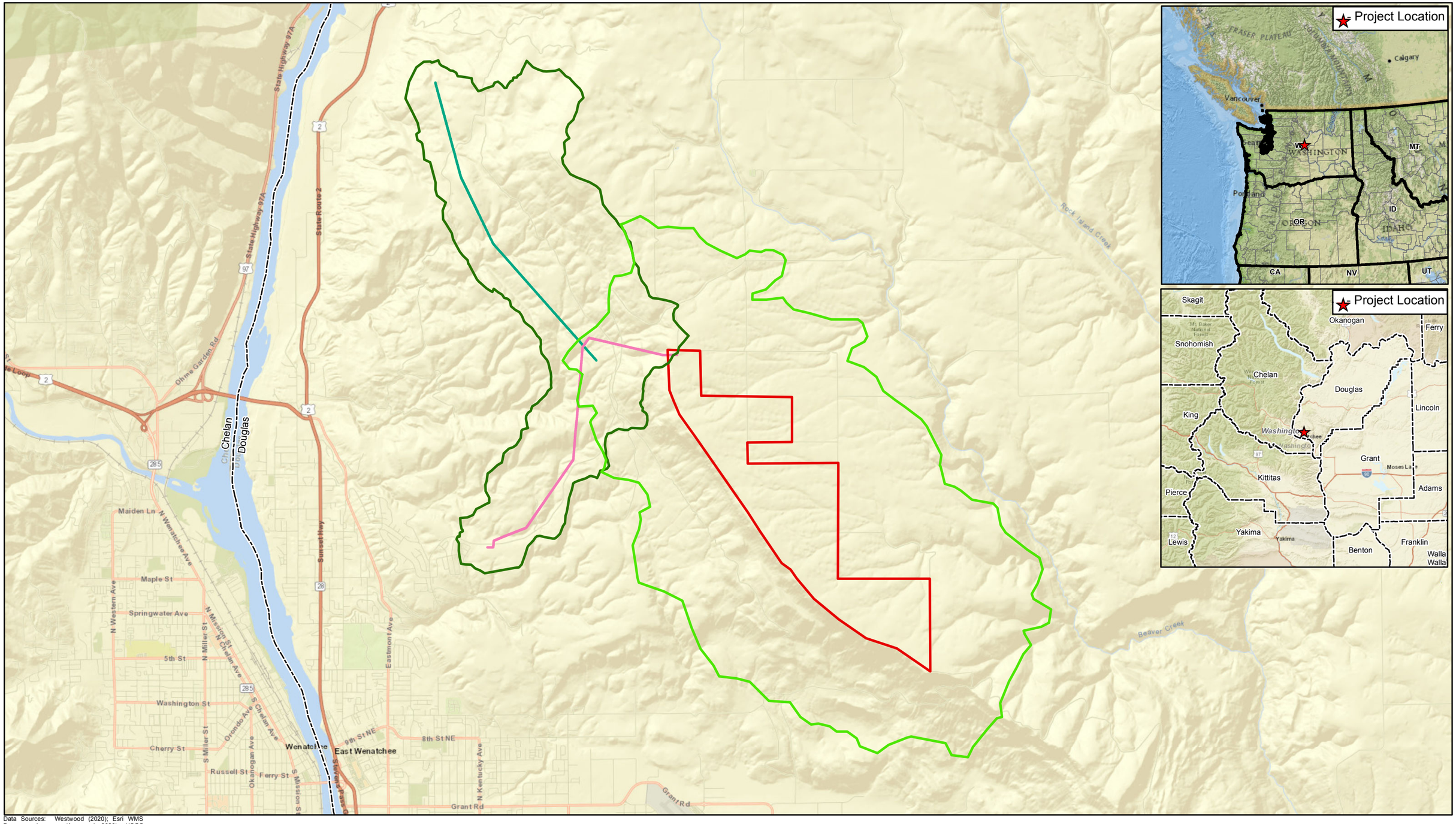
Web soil survey. Retrieved February 2020, from https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

NOAA, & Service, N. W. AHPS Precipitation analysis. Retrieved February 2020, from http://water.weather.gov/precip/download.php

USGS. USGS water resources: About USGS water resources. Retrieved February 2020, from https://water.usgs.gov/GIS/huc.html

USDA 2013 Crop Data Layer, Landcover data, retrieved February 2020, from https://www.nass.usda.gov/Research_and_Science/Cropland/SARS1a.php

Exhibits



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- FLO-2D T-line Model Boundary
- County Boundary
- Proposed T-Line
- Existing T-Line

Westwood
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N

0 1 Miles

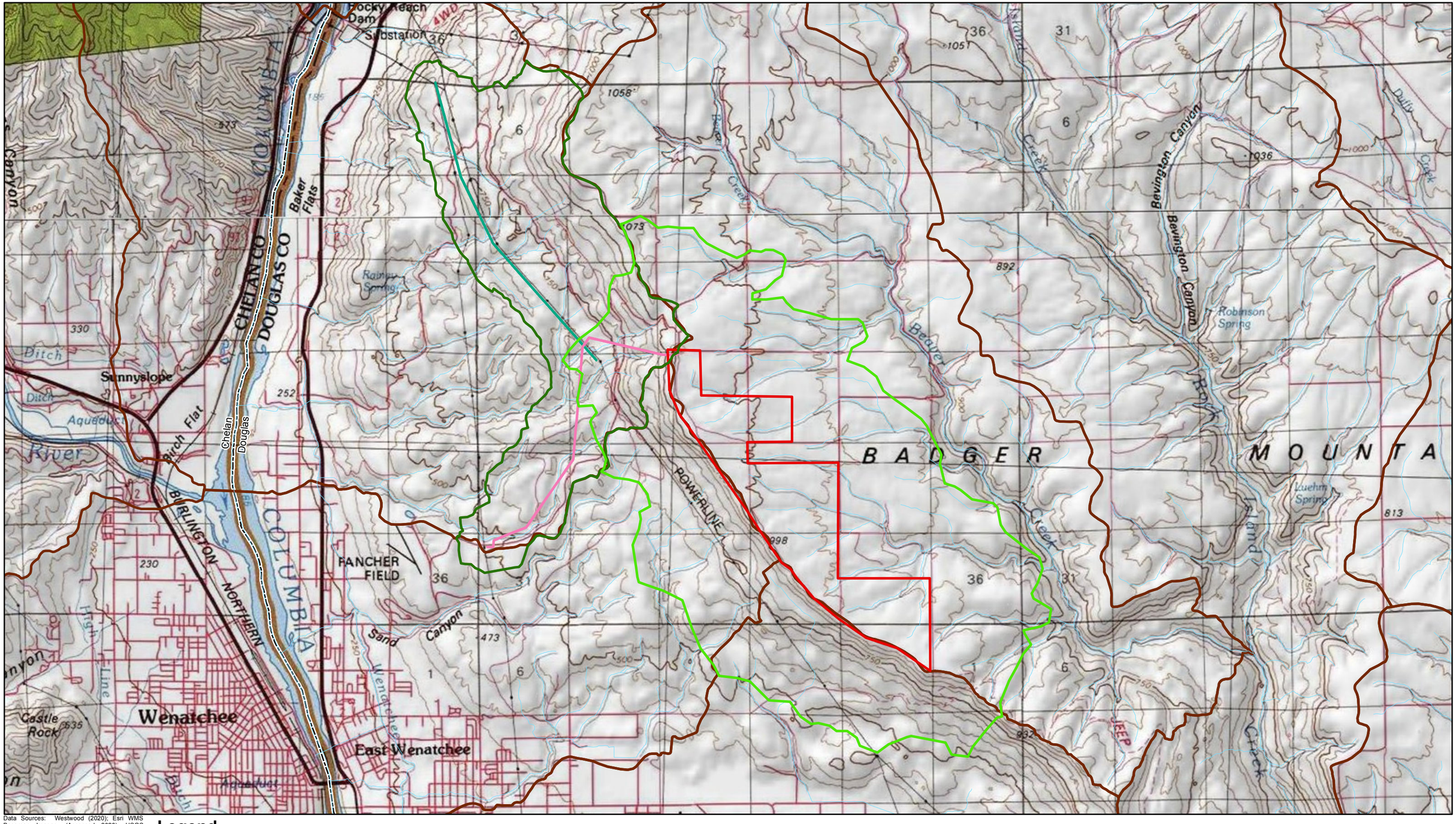
Badger Mountain Solar Project

Douglas County, Washington

Exhibit 1: Location Map

September 02, 2020

Map Document: \\westwoodps.local\GFS\Global Projects\00259665.00\GIS\Hydro Exhibits\2020-08-31_Badger_Ex1_LocationMap.mxd TPGlaza 9/2/2020 10:24:49 AM



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- FLO-2D T-line Model Boundary
- County Boundary
- NHD Flowline
- HU-12 Boundary
- Existing T-Line
- Proposed T-Line

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N

0 0.75 Miles

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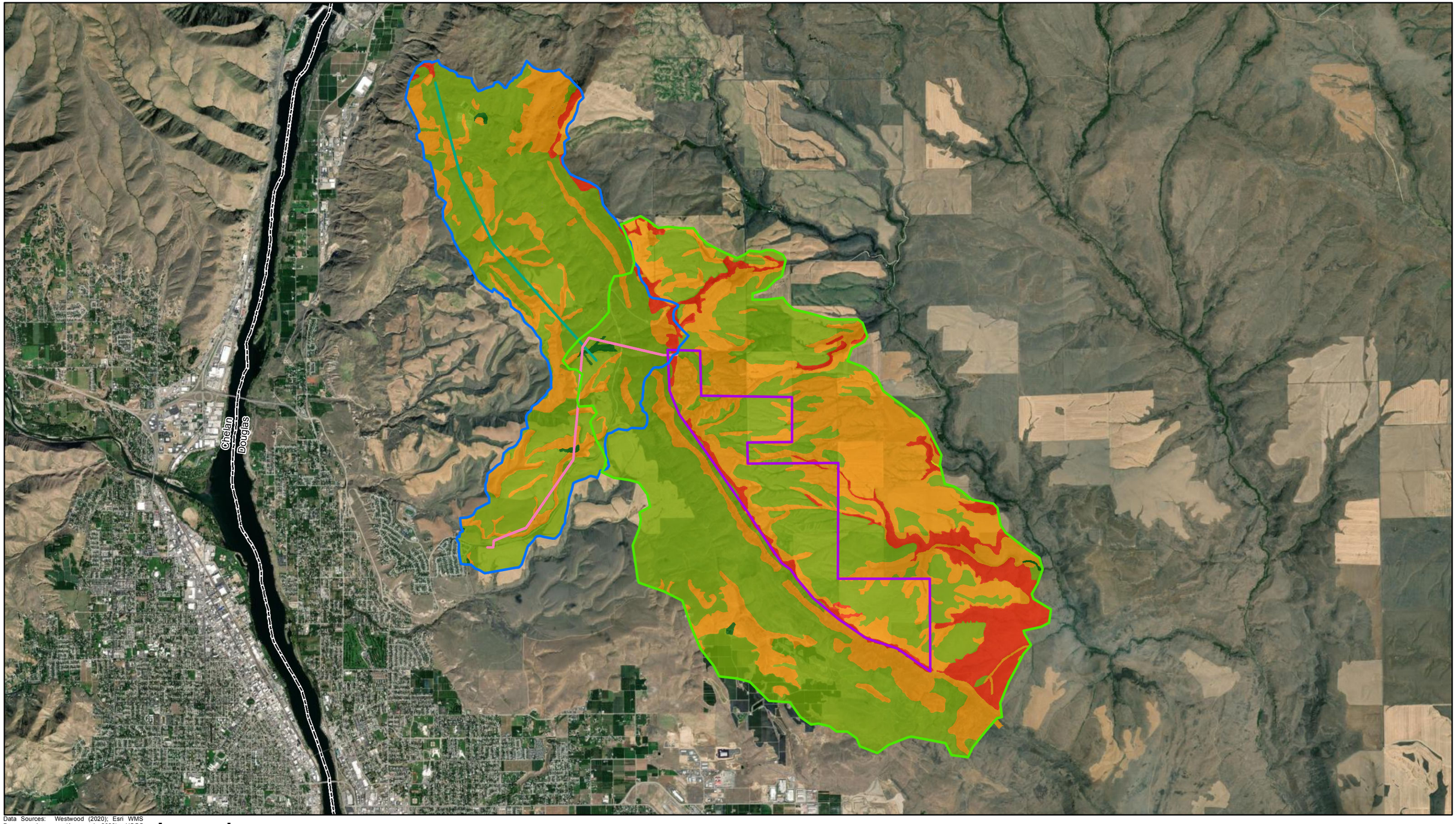
Exhibit 2: Base Map

September 02, 2020

Map Document: \\westwoodps.local\GFS\Global Projects\0025965.00\GIS\Hydro Exhibits\2020-08-31_Badger_E-X2_BaseMap.mxd TPGlaza 9/2/2020 10:26:47 AM



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- FLO-2D T-line Model Boundary
- County Boundary
- Existing T-Line
- Proposed T-Line

Hydrologic Soils Group

- A
- B
- B/D
- C
- D

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N

0 1 Miles

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Exhibit 3: Soils Map

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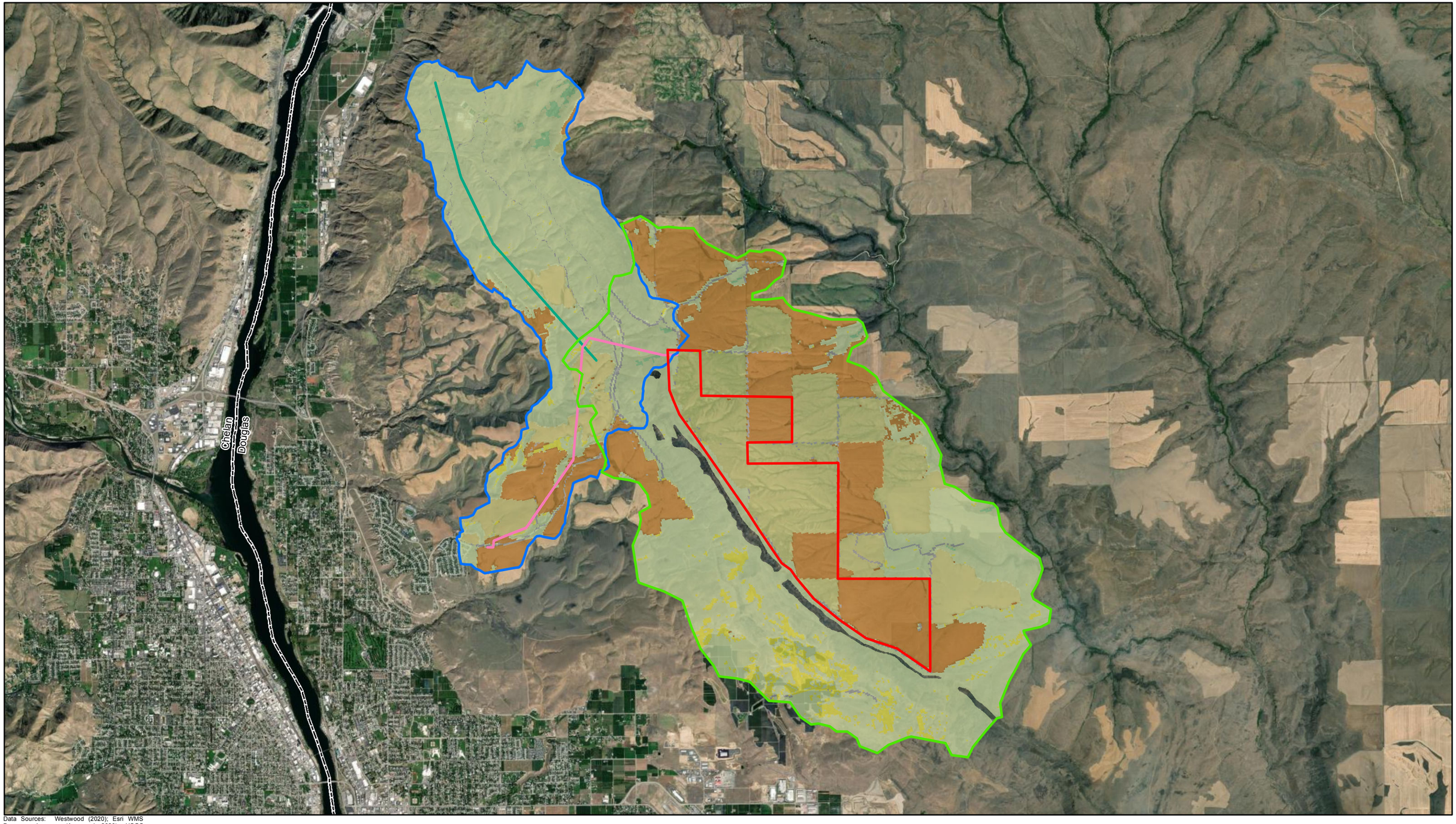
Map Document: \\westwoodps.local\GFS\Global Projects\00259\65.00\GIS\Hydro Exhibits\2020-08-31_Badger_Ex3_SoilsMap.mxd TPGlaza 9/2/2020 10:28:30 AM



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- FLO-2D T-line Model Boundary
- County Boundary
- Existing T-Line
- Proposed T-Line

Landcover

- Cultivated
- Developed
- Fallow
- Forested
- Prairie/Pasture
- Shrubland

N

0 Miles 1

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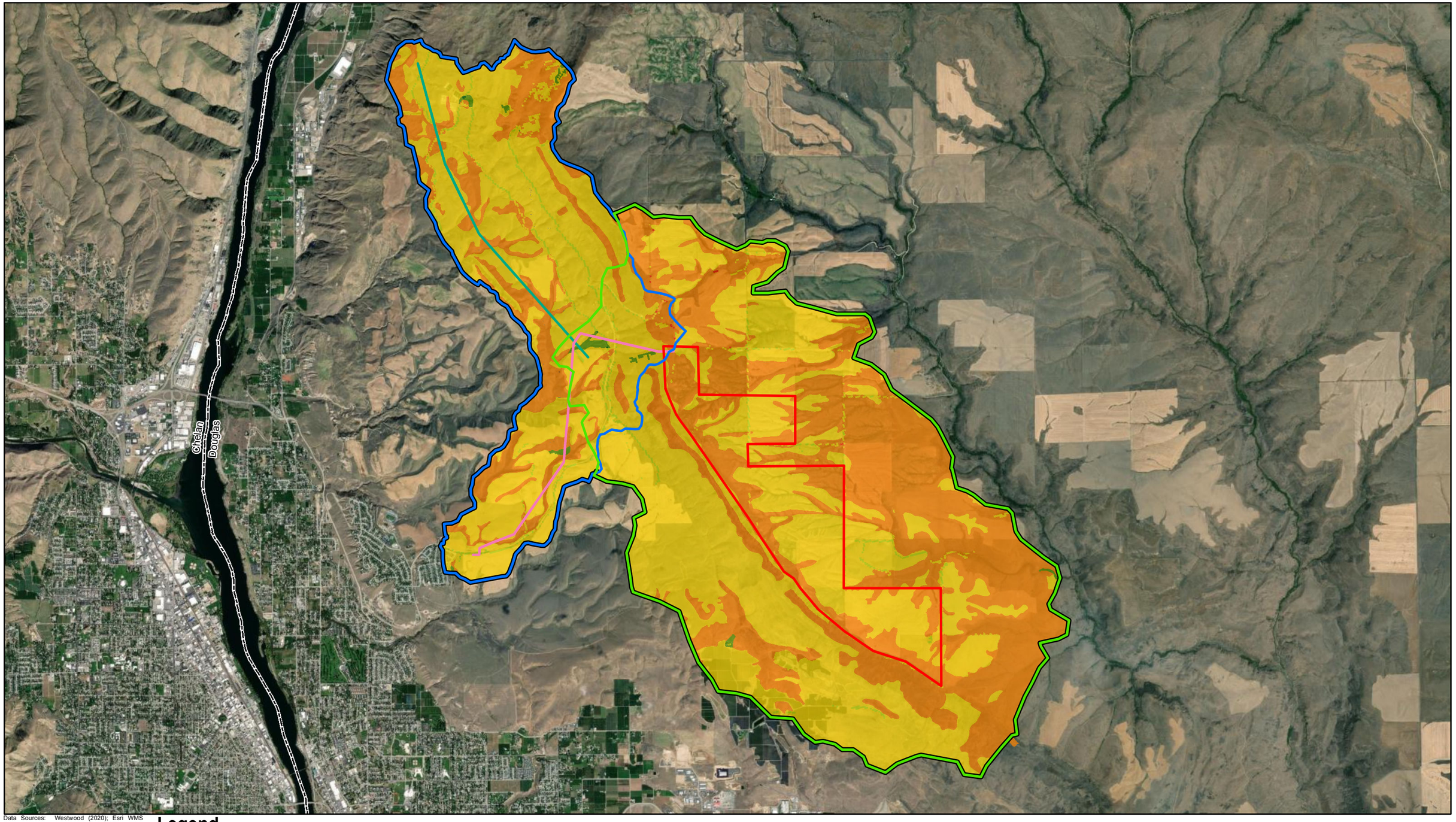
Exhibit 4: Soils Map

September 02, 2020

Map Document: \\westwoodps.local\GFS\Global Projects\00259\65.00\GIS\Hydro Exhibits\2020-08-31_Badger_Ex4_LandcoverMap.mxd TPGlaza 9/2/2020 10:30:08 AM



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- FLO-2D T-line Model Boundary
- 1-meter Elevation Extents
- County Boundary
- Proposed T-Line
- Existing T-Line

Curve Number

- 46
- 55
- 60 - 69
- 70 - 79
- 80 - 89
- 90 - 99

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N

Miles
0 0.75

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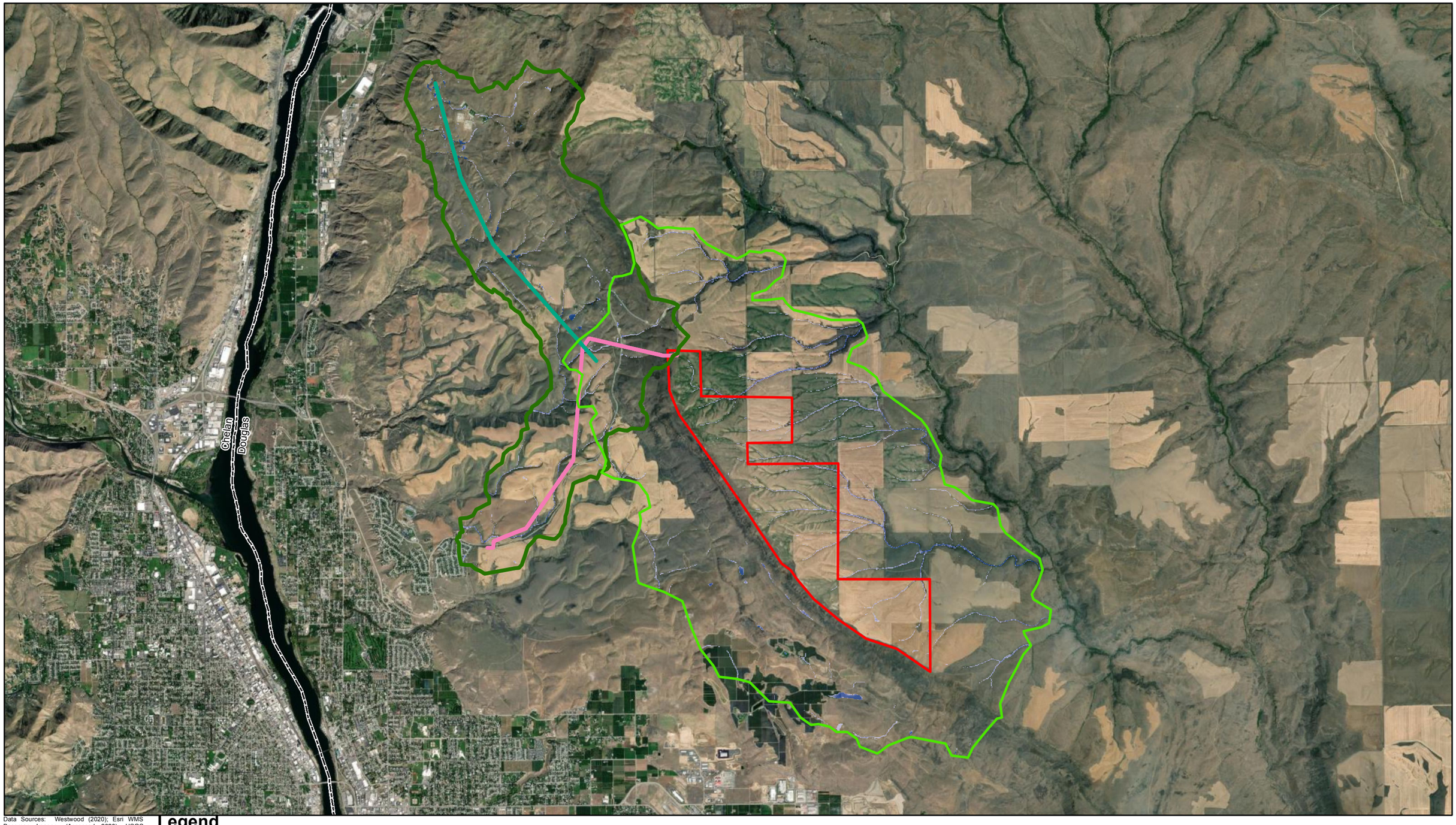
Exhibit 5: Curve Number and Topographic Source Map

September 02, 2020

Map Document: \\westwoodps.local\GFS\Global Projects\0025965.00\GIS\Hydro Exhibits\2020-08-31_Badger_Ex5_CNMap.mxd TPGlaza 9/2/2020 10:38:58 AM



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- FLO-2D T-line Model Boundary
- County Boundary
- Existing T-Line
- Proposed T-Line

Peak Flow Depth (ft)

0.50 - 1.00 | 1.01 - 1.50 | 1.51 - 2.00 | 2.01 - 2.50 | 2.51 - 3.00 | 3.01 - 4.00 | 4.01 - 6.00 | 6.01+

N

0 Miles 1

Badger Mountain Solar Project

Douglas County, Washington

Exhibit 6: 100-Year Max Flood Depth Map

August 31, 2020

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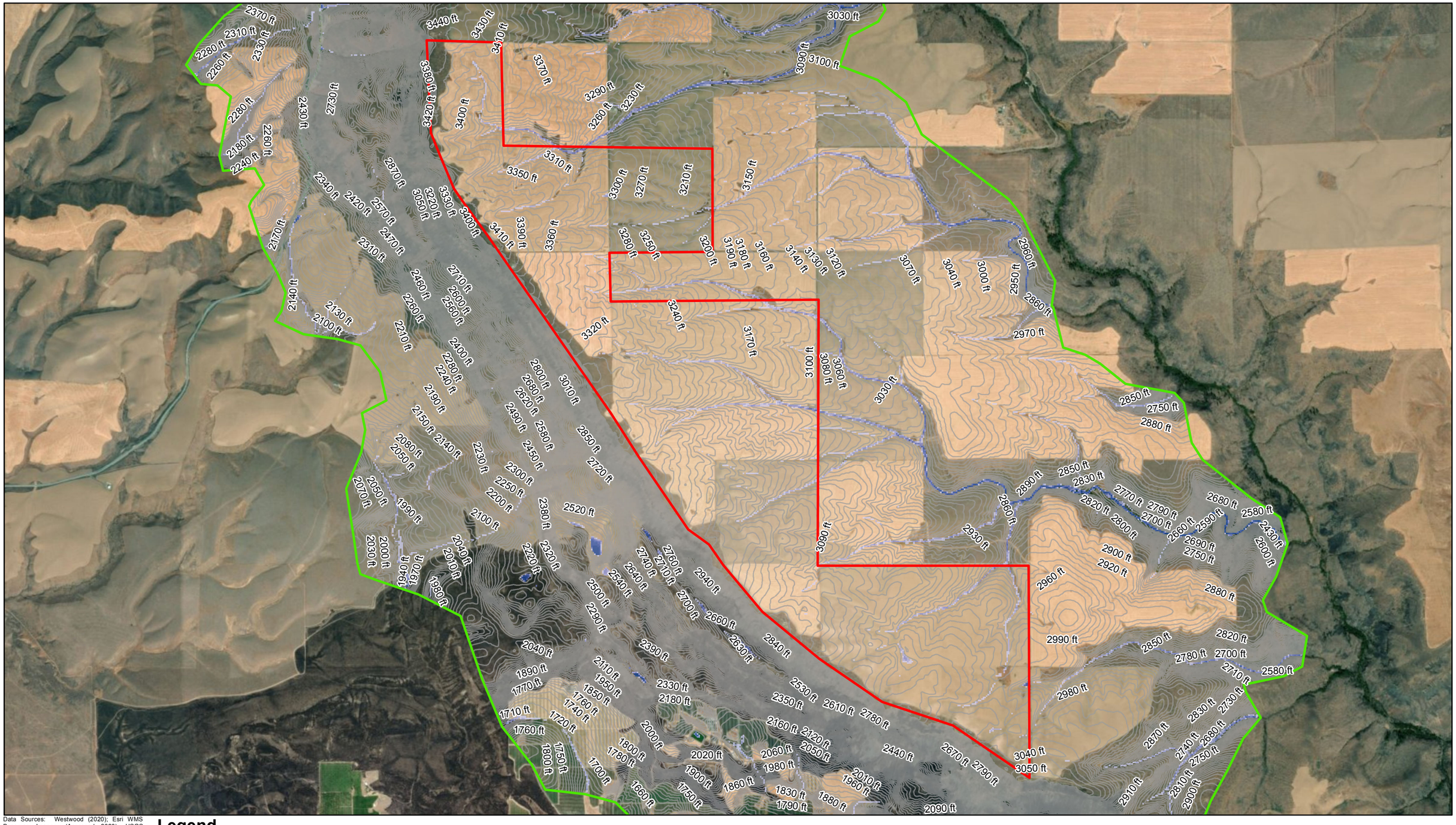

Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- FLO-2D Model Boundary
- Project Boundary
- 10-foot Contours
- County Boundary

Peak Flow Depth (ft)

0.50 - 1.00 | 1.01 - 1.50 | 1.51 - 2.00 | 2.01 - 2.50 | 2.51 - 3.00 | 3.01 - 4.00 | 4.01 - 6.00 | 6.01+

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N

0 Feet 2,300

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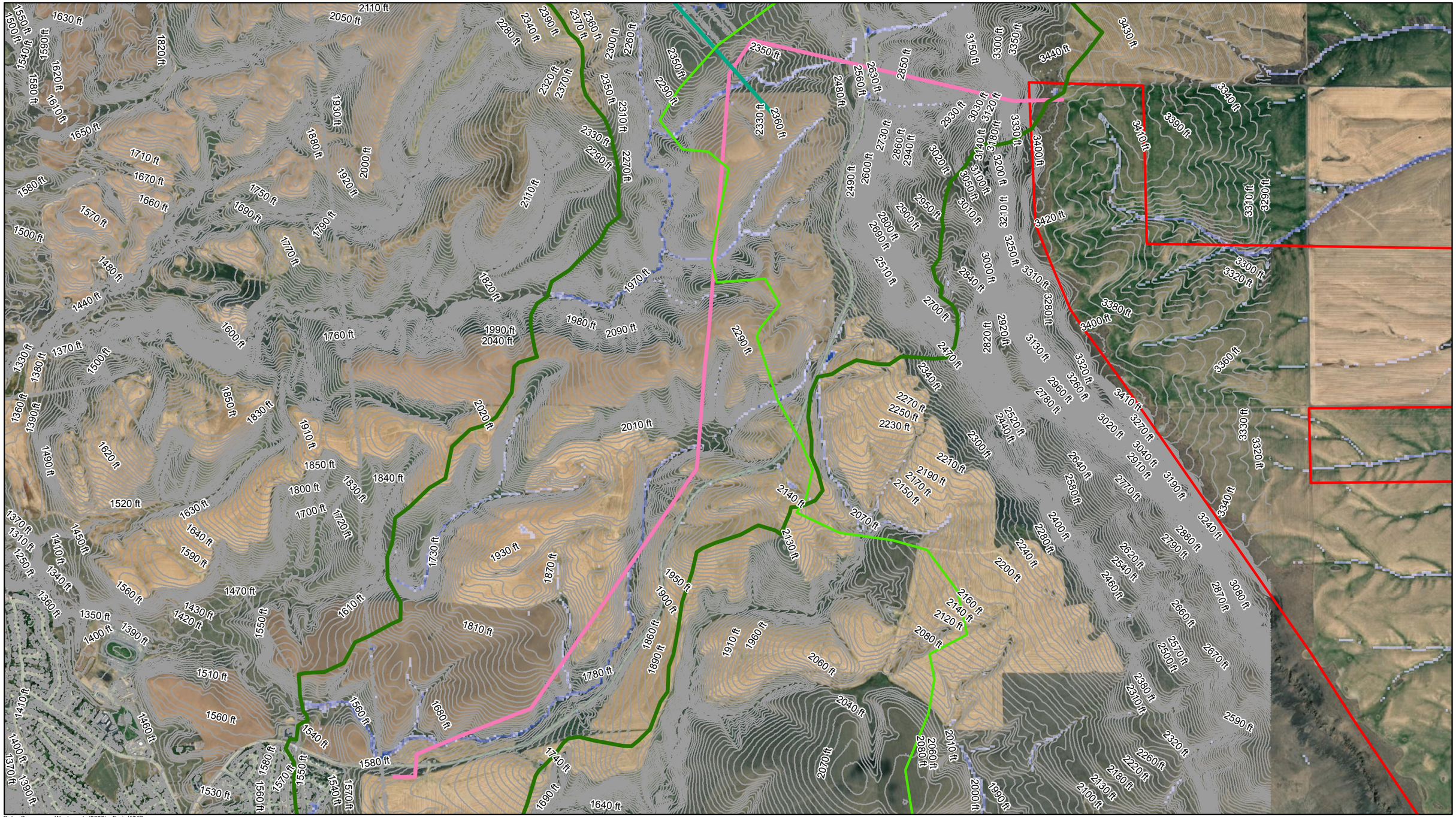
Douglas County, Washington

Exhibit 6A: 100-Year Max Flood Depth Project Area Map

February 20, 2020

Map Document: N:\00259\65.00\GIS\Hydro Exhibits\2020-02-20_Badger_Ex6A_100yrMaxFloodDepthMapZOOM.mxd mmhealy 2/20/2020 12:30:58 PM



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- FLO-2D T-line Model Boundary
- County Boundary
- 10-foot Contours
- Existing T-Line
- Proposed T-Line

Peak Flow Depth (ft)

0.50 - 1.00 | 1.01 - 1.50 | 1.51 - 2.00 | 2.01 - 2.50 | 2.51 - 3.00 | 3.01 - 4.00 | 4.01 - 6.00 | 6.01+

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N

0 Feet 1,500

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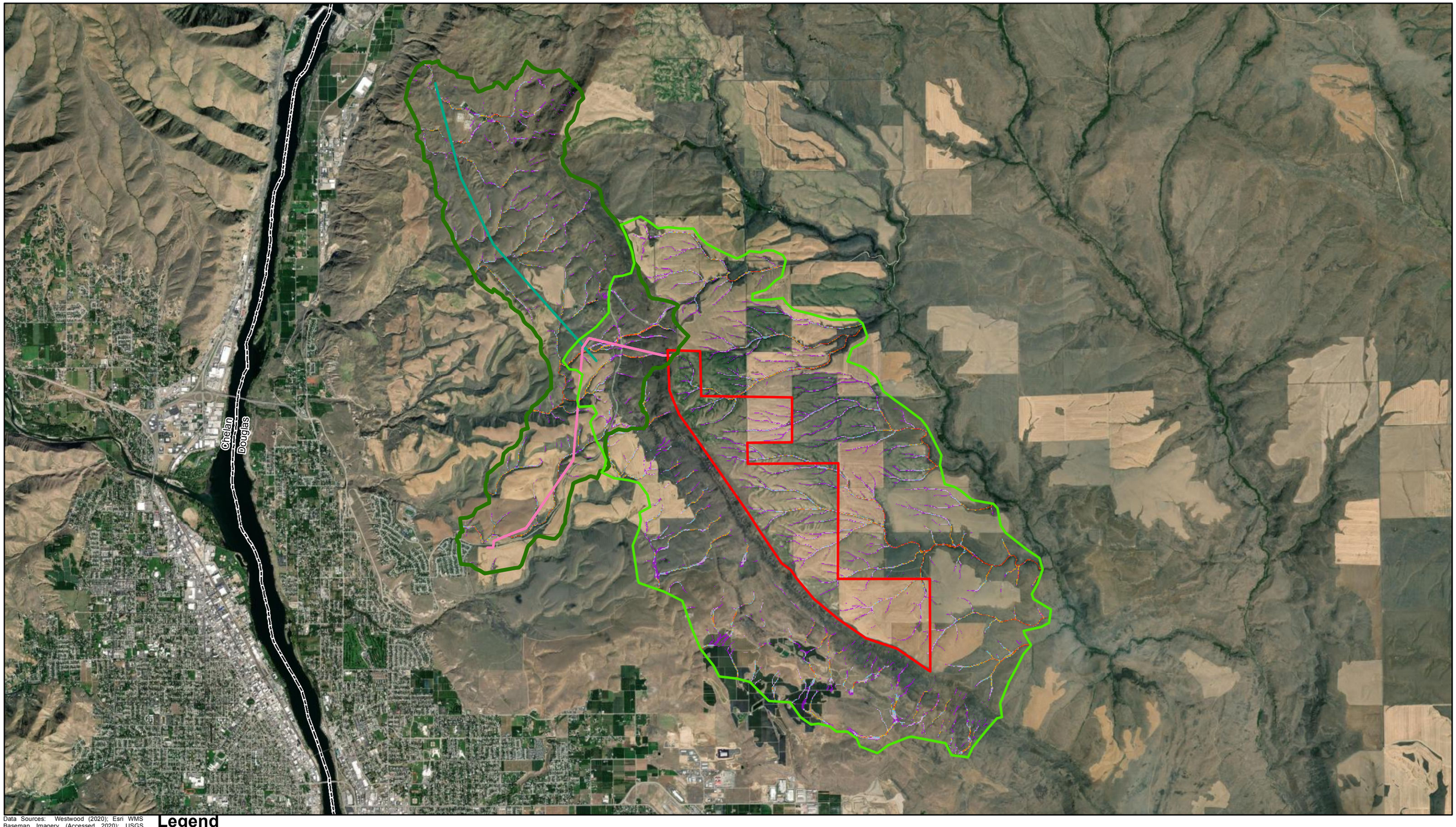
Exhibit 6B: 100-Year Max Flood Depth Proposed T-Line Zoom Map

September 02, 2020

Map Document: \\westwoodps.local\GFS\Global Projects\00259\65.00\GIS\Hydro Exhibits\2020-08-31_Badger_Ex6B_100yrMaxFloodDepthMap.mxd TPGlaza 9/2/2020 10:38:30 AM



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- FLO-2D Model Boundary
- FLO-2D T-line Model Boundary
- Project Boundary
- County Boundary
- Existing T-Line
- Proposed T-Line

Peak Velocity (fps)

1.00 - 1.50 | 1.51 - 2.00 | 2.01 - 2.50 | 2.51 - 3.00 | 3.01 - 4.00 | 4.01+

N

0 1 Miles

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Exhibit 7: 100-Year Peak Velocity Map

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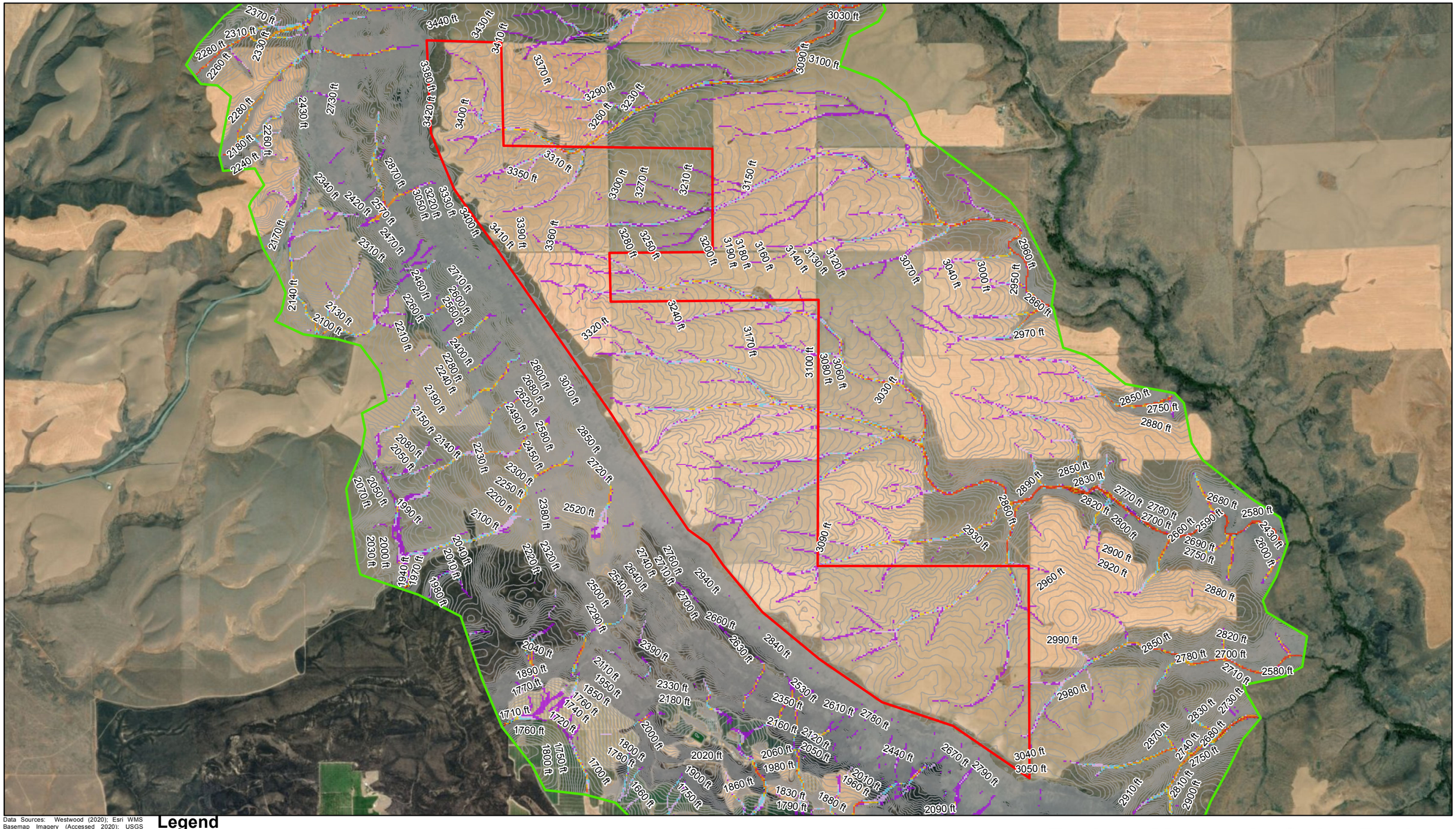
Map Document: N:\0025965.00\GIS\Hydro Exhibits\2020-08-31_Badger_Ex7_100yrPeakVelocityMap.mxd TPGlaza 8/31/2020 1:18:55 PM



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- FLO-2D Model Boundary
- Project Boundary
- 10-foot Contours
- County Boundary

Peak Velocity (fps)

1.00 - 1.50	1.51 - 2.00	2.01 - 2.50	2.51 - 3.00	3.01 - 4.00	4.01+

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N

0 Feet 2,300

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Exhibit 7A: 100-Year Peak Velocity Project Area Map

February 20, 2020

Map Document: N:\0025965.00\GIS\Hydro Exhibits\2020-02-20_Badger_Ex7A_100yrPeakVelocityMapzOOM.mxd mmhealy 2/20/2020 3:25:09 PM

Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- FLO-2D Model Boundary
- FLO-2D T-line Model Boundary
- Project Boundary
- County Boundary
- 10-foot Contours
- Existing T-Line
- Proposed T-Line

Peak Velocity (fps)

1.00 - 1.50	1.51 - 2.00	2.01 - 2.50	2.51 - 3.00	3.01 - 4.00	4.01+

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N

0 Feet 1,500

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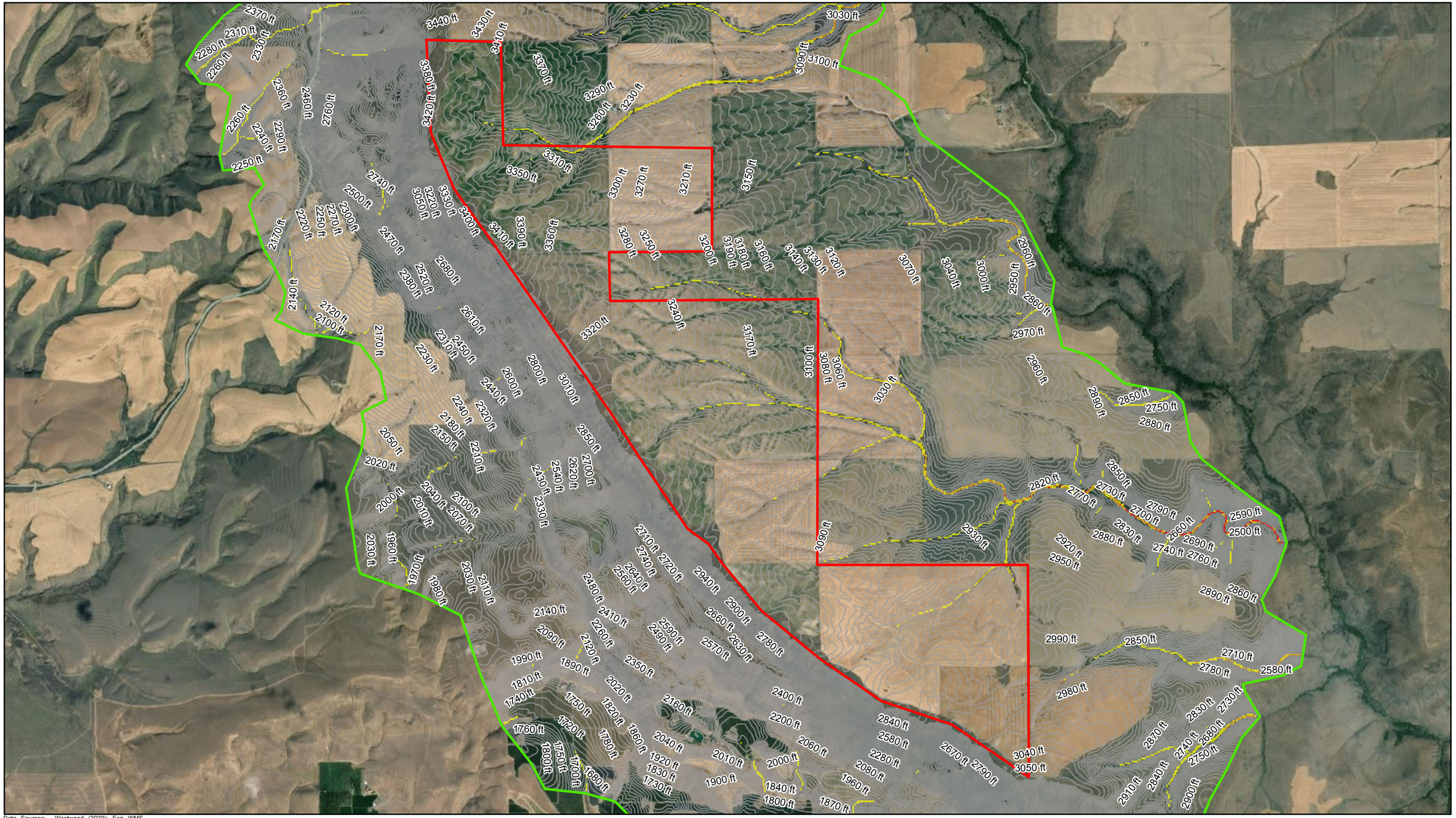
Douglas County, Washington

Exhibit 7B: 100-Year Peak Velocity Proposed T-Line Zoom Map

September 02, 2020

Map Document: \\westwoodps.local\GFS\Global Projects\00259965.00\GIS\Hydro Exhibits\2020-08-31_Badger_ExB_100yrPeakVelocityMap.mxd TPGlaza 9/2/2020 10:27:06 AM



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- FLO-2D Model Boundary
- Project Boundary
- 10-foot Contours
- County Boundary

Scour (ft)

- 1.00 - 1.50
- 1.51 - 2.00
- 2.01+

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N

0 Feet 2,300

Badger Mountain Solar Project

Douglas County, Washington

Exhibit 8A: Scour Project Area Map

August 31, 2020

Map Document: N:\0025965.00\GIS\Hydro Exhibits\2020-08-31_Badger_Ex8_ScourMap.mxd TPGlaza 8/31/2020 3:26:52 PM

Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D T-line Model Boundary
- County Boundary
- 10-foot Contours
- Existing T-Line
- Proposed T-Line

Scour (ft)

- 1.00 - 1.50
- 1.51 - 2.00
- 2.01+

N

0 Feet 1,500

Badger Mountain Solar Project

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Exhibit 8B: Scour Proposed T-Line Zoom Map

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Map Document: \\westwoodps.local\GFS\Global Projects\00259\65.00\GIS\Hydro Exhibits\2020-08-31_Badger_Ex8B_ScourMap.mxd TPGlaza 9/2/2020 10:45:54 AM

Appendix A

Rainfall Data

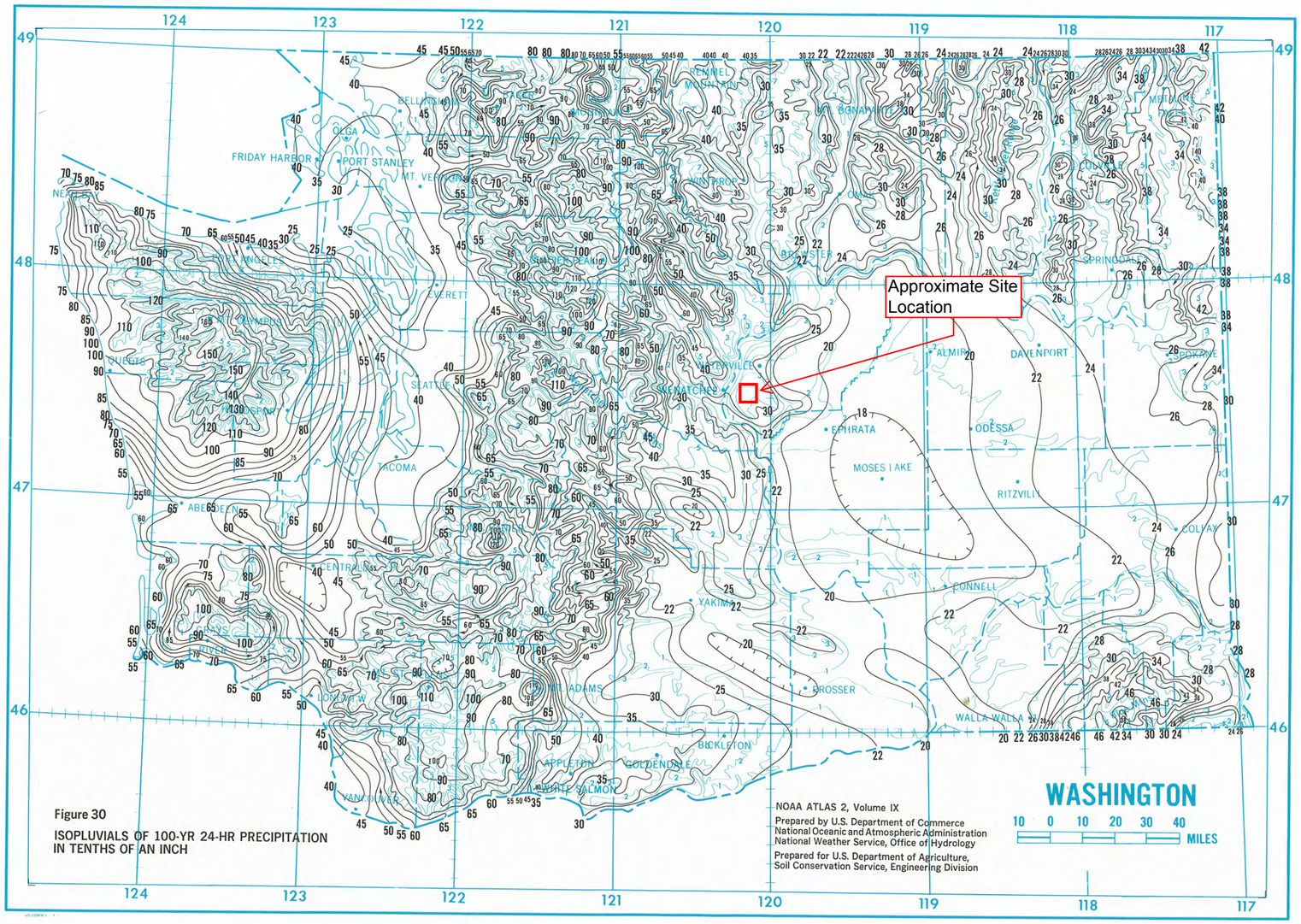

Figure 30

ISOPLUVIALS OF 100-YR 24-HR PRECIPITATION IN TENTHS OF AN INCH

☆ U.S. GOVERNMENT PRINTING OFFICE : 1974 O—507-860

Appendix B

Curve Number Table

Table 2. Semi-Arid Curve Numbers (adapted from NEH 630)

Class	Value	Classification Description	Curve Number				
			Soil Type*				
			A	B	C	D	W
Water	11	Open Water - areas of open water, generally with less than 25% cover of vegetation or soil.	98	98	98	98	100
	12	Perennial Ice/Snow - areas characterized by a perennial cover of ice and/or snow, generally greater than 25% of total cover.	98	98	98	98	100
Developed	21	Developed, Open Space - areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20% of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.	46	65	77	82	100
	22	Developed, Low Intensity - areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20% to 49% percent of total cover. These areas most commonly include single-family housing units.	61	75	83	87	100
	23	Developed, Medium Intensity – areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50% to 79% of the total cover. These areas most commonly include single-family housing units.	77	85	90	95	100
	24	Developed High Intensity -highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80% to 100% of the total cover.	89	92	94	95	100
Barren	31	Barren Land (Rock/Sand/Clay) - areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.	77	86	91	94	100
Forest	41	Deciduous Forest - areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species shed foliage simultaneously in response to seasonal change.	43	55	70	77	100
	42	Evergreen Forest - areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species maintain their leaves all year. Canopy is never without green foliage.	43	55	70	77	100
	43	Mixed Forest - areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75% of total tree cover.	43	55	70	77	100
Shrubland	51	Dwarf Scrub - Alaska only areas dominated by shrubs less than 20 centimeters tall with shrub canopy typically greater than 20% of total vegetation. This type is often co-associated with grasses, sedges, herbs, and non-vascular vegetation.	55	71	81	89	100
	52	Shrub/Scrub - areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.	55	71	81	89	100
Herbaceous	71	Grassland/Herbaceous - areas dominated by gramanoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.	55	71	81	89	100
	72	Sedge/Herbaceous - Alaska only areas dominated by sedges and forbs, generally greater than 80% of total vegetation. This type can occur with significant other grasses or other grass like plants, and includes sedge tundra, and sedge tussock tundra.	55	71	81	89	100
	73	Lichens - Alaska only areas dominated by fruticose or foliose lichens generally greater than 80% of total vegetation.	55	71	81	89	100
	74	Moss - Alaska only areas dominated by mosses, generally greater than 80% of total vegetation.	55	71	81	89	100
Planted/Cultivated	81	Pasture/Hay – areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20% of total vegetation.	55	71	81	89	100
	82	Cultivated Crops – areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20% of total vegetation. This class also includes all land being actively tilled.	67	78	85	89	100
	83	Small Grains	63	75	83	87	100
Wetlands	91	Woody Wetlands - areas where forest or shrubland vegetation accounts for greater than 20% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.	45	66	77	83	100
	92	Emergent Herbaceous Wetlands - Areas where perennial herbaceous vegetation accounts for greater than 80% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.	45	66	77	83	100

*A/D, B/D and C/D soils lumped as D soils, W denotes water

**Curve Numbers for NLCD Codes 41-43 have been increased from 30 to 43 as many of these areas are partially grazed Woods-grass combination.

Appendix C

FEMA Firm Panels

Approximate Project Boundary

ZONE B

ZONE C

ZONE AO

MOUNTAIN

BADGER

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

DOUGLAS COUNTY, WASHINGTON (UNINCORPORATED AREAS)

COMMUNITY-PANEL NUMBER 530036 0555 A

PAGE 555 OF 650

(SEE MAP INDEX FOR PAGES NOT PRINTED)

EFFECTIVE JULY 17, 1978

To determine if flood insurance is available in this community, contact your insurance agent, or call the National Flood Insurance Program, at (800) 638-6620, or (800) 424-8872.

APPROXIMATE SCALE 0 1000 FEET

EXPLANATION OF ZONE DESIGNATIONS#

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
A0	Areas of 100-year sheet flow flooding with depth from 1 to 3 feet; product of flood depth (feet) and velocity (feet per second) less than 15.
A1 - A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by a flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of 100-year flood and 500-year flood; or areas of 100-year shallow flooding with depth less than 1 foot. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V0	Areas of 100-year shallow flooding with velocity; depth from 1 to 3 feet; product of depth (feet) and velocity (feet per second) more than 15.
V1 - V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.

NOTES TO USER

Certain areas not in the special flood hazard areas (zones A and V) may be protected by flood control structures.

This map is for flood insurance purposes only; it does not necessarily show all areas subject to flooding in the community or all plainimetric features outside special flood hazard areas.

For adjoining map panels, see separately printed Index To Map Panels.

INITIAL IDENTIFICATION JANUARY 17, 1975

CONVERSION TO REGULAR PROGRAM JULY 17, 1978

Base Flood Elevation Line With Elevation in Feet** — 513

Base Flood Elevation in Feet Where Uniform Within Zone** — (EL 987)

River Mile — • M1.5

Elevation Reference Mark — RM7×

**Referenced to the National Geodetic Vertical Datum of 1929

100-Year Flood Boundary

Zone Designations* With Date of Identification e.g., 12/2/74 — ZONE A1 DATE / ZONE A6 DATE / ZONE B

500-Year Flood Boundary