June 2009

Final Proposed

Appendix

Shoreline Inventory for the Cities of Lacey, Olympia, and Tumwater and their Urban Growth Areas

Thurston Regional Planning Council

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TRPC

Thurston Regional Planning Council

THURSTON REGIONAL PLANNING COUNCIL (TRPC) is a 22-member intergovernmental board made up of local governmental jurisdictions within Thurston County, plus the Confederated Tribes of the Chehalis Reservation and the Nisqually Indian Tribe. The Council was established in 1967 under RCW 36.70.060, which authorized creation of regional planning councils.

TRPC's mission is to **"Provide Visionary Leadership on Regional Plans, Policies, and Issues."** The primary functions of TRPC are to develop regional plans and policies for **transportation** [as the federally recognized Metropolitan Planning Organization (MPO) and state recognized Regional Transportation Planning Organization (RTPO)], **growth management, environmental quality**, and other topics determined by the Council; provide **data and analysis to support local and regional decision making;** act as a "**convener**" to build **community consensus** on regional issues through information and citizen involvement; build **intergovernmental consensus** on regional plans, policies, and issues, and advocate local implementation; and provide **planning, historic preservation, and technical services** on a contractual basis.

2009 MEMBERSHIP OF THURSTON REGIONAL PLANNING COUNCIL

Governmental Jurisdiction	Name of 2009 Representative
City of Lacey	**Virgil Clarkson,** Councilmember
City of Olympia	**Joan Machlis,** Councilmember
City of Rainier	**Dennis McVey,** Councilmember
City of Tenino	**Ken Jones,** Mayor
City of Tumwater	**Ed Stanley,** Councilmember
City of Yelm	**Robert Isom,** Councilmember
Town of Bucoda	**Kathy Martin,** Mayor
Thurston County	**Cathy Wolfe,** County Commissioner
Intercity Transit	**Sandra Romero,** Transit Authority Board Member
LOTT Alliance	**Graeme Sackrison,** Board Member
Thurston PUD	**Paul Pickett,** PUD Commissioner
North Thurston Public Schools	**Chuck Namit,** School Board Member
Olympia School District	**Frank Wilson,** School Board Member
Confederated Tribes of the Chehalis Reservation	**Lennea Magnus,** Planning Director
Nisqually Indian Tribe	**Francine Lester,** Tribal Councilmember
Associate Members	
CAPCOM	**Jeff Kingsbury,** Board Chairman
Economic Development Council of Thurston County	**Joseph Beaulieu,** EDC President
Lacey Fire District #3	**Frank Kirkbride,** Commissioner
Olympic Region Clean Air Agency	**Ann Burgman,** Board Member
Puget Sound Regional Council	**Norman Abbott,** Director
Timberland Regional Library	**Dick Nichols,** Library Board Member
The Evergreen State College	**Paul Smith,** Director of Facilities Services

Chair	Vice Chair	Secretary
Ed Stanley	**Dennis McVey**	**Cathy Wolfe**
City of Tumwater	City of Rainier	Thurston County

Lon D. Wyrick, Executive Director

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About This Report

Consistent with Governor Gregoire's Plain Talk Executive Order 05-03 (2005), this report is written in a manner that is brief and to-the-point, uses non-bureaucratic language and features a clean design that promotes fast scanning and reading.

Scientific and legal references are kept to a minimum, replaced by a full list of sources in the report appendix.

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I. Notes and Explanations

A. Water Quality Explanations

Water quality information comes from several sources, including federal, state and local agencies.

State Water Quality Information

The Washington State Department of Ecology measures water quality standards in surface waters, including rivers, lakes, and marine waters. Under the federal Clean Water Act, water quality standards must be adequate for the protection of beneficial uses of water bodies, including recreation, habitat for aquatic and marine life, and water supplies for agriculture and the general public.

The State Department of Ecology measures waterbodies and evaluates how observed measurements of water quality parameter affect each water body. Measurements of each water quality parameter are taken from water, sediment and tissue samples. Water bodies are then divided into categories, separated by varying degrees of degradation. The categories, as defined in Washington State's Water Quality Assessment for 2004 are as follows:

A. Category 5: Polluted waters requiring a TMDL[1].

   Data has shown that water quality standards have been violated for at least one pollutant, and that there is no TMDL or pollution control plan in place. TMDLs must be created for waterbodies in this category.

B. Category 4: Polluted waters not requiring a TMDL.

   Water bodies in this category have pollution problems that are being addressed by one of three methods:

   1. Category 4a: Water bodies that already have an approved TMDL.
   2. Category 4b: Water bodies that have another pollution control plan in place. They are required to exhibit many features of TMDL plans and must include legal or financial guarantees that the plans will be implemented.

[1] A TMDL or Total Maximum Daily Load is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources. Water quality standards are set by States, Territories, and Tribes. TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The calculation must include a margin of safety to ensure that the waterbody can be used for the purposes the State has designated. The calculation must also account for seasonal variation in water quality. The Clean Water Act, section 303, establishes the water quality standards and TMDL programs.

3. Category 4c: Water bodies impaired by a non-pollutant, including low water flow, stream channelization and dams.

C. Category 2: Waters of concern.

Water bodies are placed in this category for several reasons. Pollution levels may not be high enough to violate water quality standards, or there may have been too few violations to characterize the water body as impaired under Ecology's policies. There could be data that indicates water quality violations, but the data may have been collected improperly.

D. Category 1[2]: Meets tested standards for clean waters.

This designation does not mean that a water body is free of pollutants, only that it met standards for the pollutants for which it was tested. Specific monitoring results can be found in each water body's individual listing.

The "State Information" in this report includes evaluations made by the Department of Ecology, based on water, sediment and tissue samples. Information is provided for Shoreline-regulated waterbodies within WRIA 13, and is separated into categories as defined by Ecology. A comprehensive listing of all water bodies in violation of water quality standards in the State of Washington is available from the Washington State Department of Ecology.

Local Water Quality Information

Thurston County also conducts its own water quality testing. In 2006, Thurston County Public Health and Social Services Department, Thurston County Water and Waste Management Department and the Storm and Surface Water Program in conjunction with the Public Works and Water Resources Programs of the cities of Olympia and Lacey, the City of Tumwater's Public Works Department and the Washington State Department of Ecology collectively published the Thurston County Water Resources Monitoring Report for the 2003-2004 and 2004-2005 Water Years. It includes water quality information on streams and lakes in Thurston County. This study separated water quality parameters into two sets of criteria: water contact recreation and freshwater aquatic life uses.

In addition to reporting on the status of various water quality parameters found during the study, water bodies were rated on a scale from "Excellent" to "Poor". The guidelines below, taken from the Water Resources Monitoring Report, show what considerations were used to rate water bodies in the study.

[2] Category 1 listings were not included in this report.

Stream Water Quality Categories

"Excellent" - No water quality standard violations, and very low fecal coliform and nutrient concentrations.

"Good" - Usually meets water quality standards; OR violates only one part of the two part fecal coliform standard; OR the violation is most likely the result of natural conditions rather than pollution.

"Fair" - Frequently fails one or more water quality standards and other parameters such as nutrients indicate water quality is being impacted by pollution.

"Poor" - Routinely fails water quality standards by a large margin; other parameters such as nutrients are at elevated concentrations.

Lake Water Quality Categories

"Excellent" - Very low nutrient and chlorophyll *a* concentrations, and very high water clarity; Classified as Oligotrophic; Uses not impaired.

"Good" - Low to moderate nutrient and chlorophyll *a* concentrations, and moderate to high water clarity; Classified as Mesotrophic; Uses not impaired.

"Fair" - Moderate to high nutrient and chlorophyll *a* concentrations, and low to moderate water clarity; Classified as Eutrophic; Uses sometimes impaired.

"Poor" - High nutrient and chlorophyll *a* concentrations, and low water clarity; Classified as Eutrophic; Uses impaired during most of the summer season by excess algae and/or aquatic macrophyte (plant) growth.

B. Critical Areas

Wetlands

Wetland Indicator maps were prepared for the cities of Lacey, Olympia, Tumwater, and their urban growth areas during the early 1990s. Wetland consultants were used as described in Keany and Rozenbaum (1992), and on the TRPC web site - Wetland Mapping for the Thurston Region.

Landslide Hazard Areas

Each jurisdiction has identified steep slopes while developing their Critical Areas Ordinances. For local jurisdictions they are defined as follows:

- Lacey – not applicable (no steep slopes or landslide hazard areas)
- Olympia – 40 percent or greater slopes
- Tumwater – 40 percent or greater slopes
- Thurston County – 50 percent or greater slopes

Habitat Conservation Areas

Habitat conservation areas are the riparian buffer around streams protected under local Critical Area Ordinances by a riparian buffer. Buffers have been generalized for mapping purposes, and are shown in the table below:

TABLE A - 5: RIPARIAN BUFFER WIDTHS BY STREAM TYPE FOR LACEY, OLYMPIA, TUMWATER AND THURSTON COUNTY.

Streams	Lacey	Olympia	Tumwater	Thurston County
Current Washington State Department of Natural Resources Stream Typing System				
Type S	n/a	250 ft	n/a	n/a
Type F	n/a	200 ft	n/a	n/a
Type N	n/a	150 ft	n/a	n/a
Type U (unknown)	n/a	100 ft	n/a	n/a
Previous Washington State Department of Natural Resources Stream Typing System				
Type I	200 ft	n/a	200 ft	100 ft
Type II	200 ft	n/a	200 ft	100 ft
Type III	200 ft	n/a	100 ft	100 ft
Type IV	150 ft	n/a	50 ft	50 ft
Type V	150 ft	n/a	50 ft	25 ft

In addition to the stream buffers listed above, habitat conservation areas also include Important Riparian Areas identified within only the City of Olympia. They are located on marine or lake shorelines with high riparian quality. These areas are designated along three marine shorelines segments in southern Budd Inlet, and three shoreline segments along Capitol Lake.

100 Year Floodplains

Floodplains with a one in one hundred chance of flooding (hereafter know as *100 Year Floodplains*) were mapped by FEMA within the three cities and Thurston County during the late 1970s and early 1980s. Field data collection and surveying was accomplished along the major rivers within Thurston County, including the Deschutes River. The results of the studies were published by FEMA in a report for each local jurisdiction City of Lacey (FEMA, 1981), City of Olympia (FEMA, 1981), City of Tumwater (FEMA 1984) and Thurston County (1982).

FEMA undertook a hydrologic study of Capitol Lake following the 2001 Nisqually earthquake. The recommendation of that report (URS & Dewberry, 2003) was to raise the elevation of the 100 Year Floodplain of Capitol Lake from 11.0 feet NVGD to 11.5 feet NVGD. FEMA then changed the FIRM panels for Capitol Lake. In response a slight berm was designed into the landscaping of Heritage Park which surrounds the eastern shore of the North Basin. (Schilperoot and Morrison, 2002) Improvements to the park and this landscaping to prevent flooding of downtown Olympia from the lake during a 100 year flood event were completed in 2006.

Channel Migration Zone

A “channel migration zones” (CMZ) is the area where a stream or river is susceptible to channel erosion. (Rapp & Abbe, 2003).

Delineation of the Deschutes River channel migration zone from historic aerial photography was completed from Tumwater Falls (RM 2) upstream to Deschutes Falls (RM 42) by TRPC staff in 1996. Historic river channels from 1941 and 1955 were plotted on the 1996 base map (Morrison, 1999). The portion of the channel migration zone within the urban areas was updated in 2008 based on LiDAR-derived elevation and 2006 air photos.

II. Minimum and Optional Jurisdiction along the Deschutes River

A. Overview

The Deschutes River is a dynamic river subject to natural flooding events and channel migration. While the goal of the SMA is to regulate development activities along the shoreline of the Deschutes River, the dynamic nature of the river makes the shoreline difficult to predict in the future. This is compounded by the lack of accurate mapped data on floodplains and floodways along the river, data sets that were developed before detailed aerial photography and topography were available.

The following pages document the development of an updated Ordinary High Water Mark and Channel Migration Zone delineation for the SMA update, as steps in establishing minimum jurisdiction. All data were developed for planning level purposes only.

The second section shows the updated channel migration zone in relation to the FEMA 100-year flood plain, as a basis for discussion for the policy choice of what to include in Optional Jurisdiction.

Minimum Jurisdiction:

Those shorelines along the Deschutes River that fall under Minimum Jurisdiction include:

- Ordinary High Water Mark plus 200 feet of upland areas
- Associated Wetlands
- Floodways
- Floodplains (100 year) if they are within 200 feet of the floodway.

Optional Jurisdiction:

SMA Minimum Jurisdiction may be extended by the use of Optional Jurisdiction, which can include critical areas and their buffers. Local policy makers determine Optional Jurisdiction. Channel Migration Zones must be addressed under the SMP, but do not change Minimum Jurisdiction. They could be considered part of Optional Jurisdiction.

B. Data Layers for Minimum Jurisdiction

Delineation of Ordinary High Water Mark (OHWM)

The existing HYDRO layer provides an approximation of the Ordinary High Water Mark for the Deschutes River, and includes obvious gravel bars and other areas inundated during high water events. This layer was modified in the following ways:

- The data layer was slightly out of date, and due to channel migration along the Deschutes River did not accurately reflect current conditions. It was modified to reflect 2006 conditions.

- In some areas side-channels (with open water) were discernable that were not originally included in the HYDRO layer. Usually these are in places where the river channel had undergone an abrupt change or shifted to a new location in the last ten years. Both the old channel and new channel were included in the updated layer.

This data layer is adequate for general planning purposes. To accurately delineate the OHWM on a site specific development will require field delineations.

Figures 1 (a-d) show examples of how the OHWM data set was updated.

FIGURE A - 2(A): RIVER CHANNEL (SHOWN IN BLUE) WAS LAST UPDATED AROUND 2000, AND IS OVERLAIN ON A 2000 AIR PHOTO.

THIS EXAMPLE IS IN REACH 3 OF THE DESCHUTES RIVER – JUST SOUTH OF THE CONFLUENCE WITH CHAMBERS CREEK.

FIGURE A – 1(B): BY 2006 SIGNIFICANT MIGRATION OF THE RIVER CHANNEL HAD OCCURRED, REQUIRING AN UPDATE OF THE DATA SET. ORIGINAL MAPPING IS OVERLAIN IN BLUE.

THIS EXAMPLE IS IN REACH 3 OF THE DESCHUTES RIVER – JUST SOUTH OF THE CONFLUENCE WITH CHAMBERS CREEK.

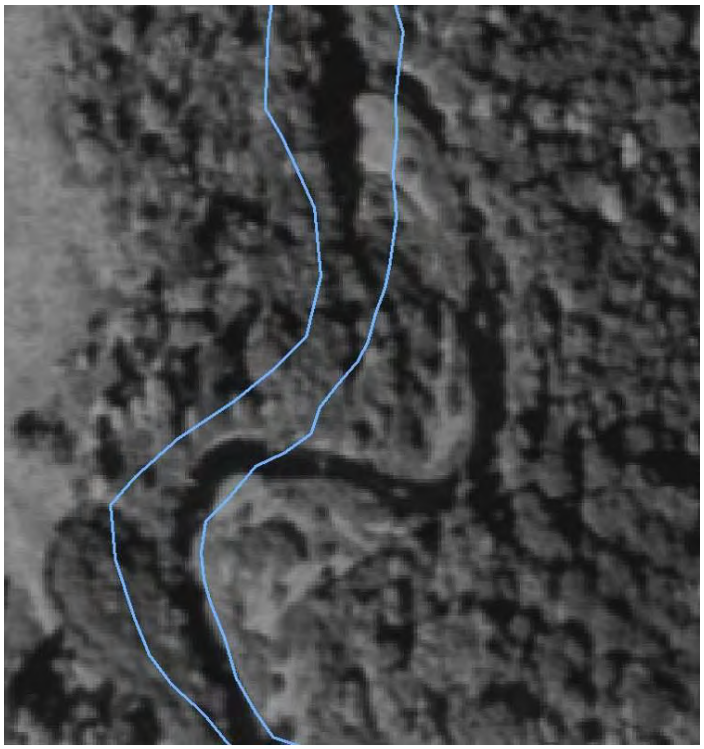

FIGURE A - 1(C): OLD RIVER CHANNEL (TO THE RIGHT) IS CLEARLY VISIBLE IN A 1993 AIR PHOTO.

THIS EXAMPLE IS IN REACH 3 OF THE DESCHUTES RIVER – JUST SOUTH OF THE CONFLUENCE WITH CHAMBERS CREEK.

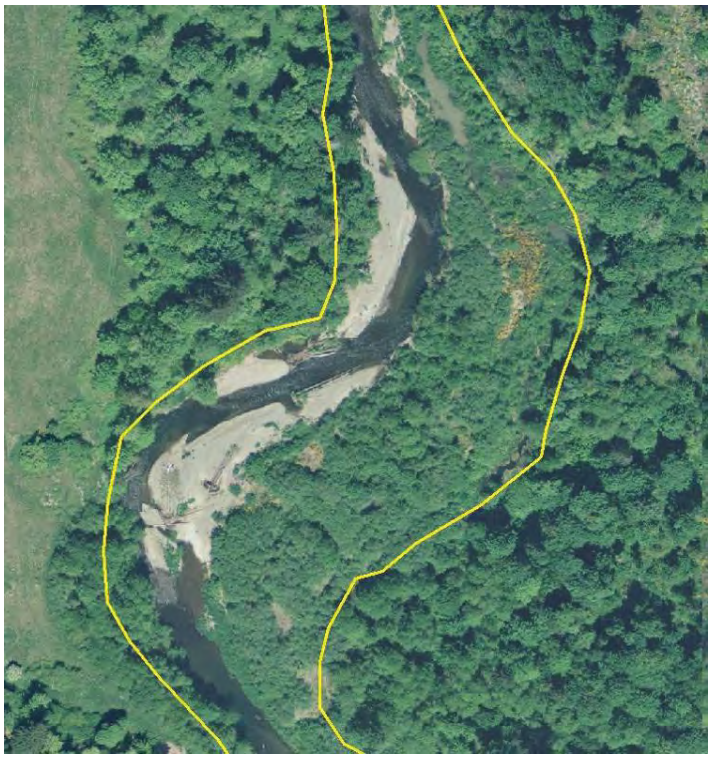

FIGURE A - 1(D): ADJUSTED DATA LAYER USED FOR OHWM MAPPING (IN YELLOW) OVERLAIN ON A 2006 AIR PHOTO.

THIS EXAMPLE IS IN REACH 3 OF THE DESCHUTES RIVER – JUST SOUTH OF THE CONFLUENCE WITH CHAMBERS CREEK.

Associated Wetlands

Wetlands with a hydrologic connection to the Deschutes River also fall under SMA Minimum Jurisdiction. Associated wetlands were identified through refinement of the existing TRPC and NWI wetlands data layers of wetlands within the Deschutes River floodplain.

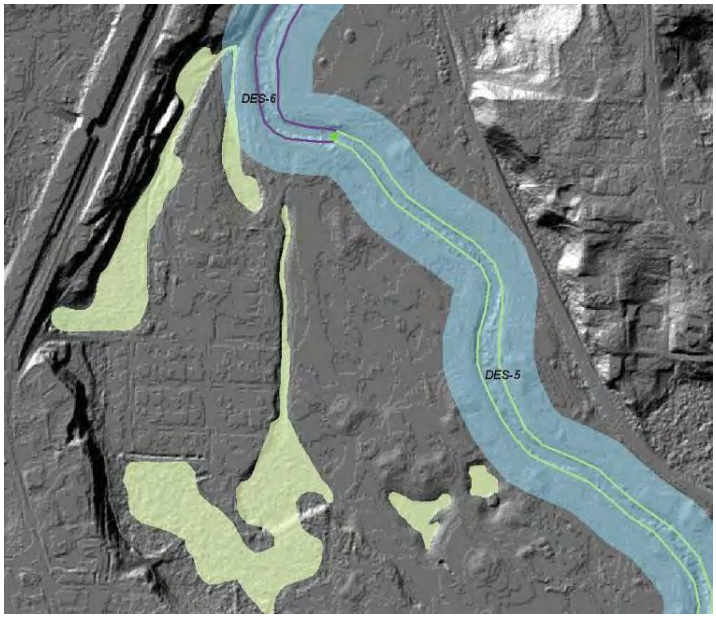

FIGURE A - 2: ASSOCIATED WETLANDS ARE ALSO INCLUDED IN MINIMUM SHORELINE JURISDICTION. IN THIS CASE THE CONNECTION TO THE RIVER IS LIKELY THROUGH A CULVERT.

WETLANDS ARE SHOWN IN LIGHT GREEN; THE ORDINARY HIGH WATER MARK AND 200 FOOT BUFFER ARE SHOWN IN LIGHT BLUE. BOTH ARE OVERLAIN ON 2002-LIDAR DERIVED ELEVATION DATA.

THIS EXAMPLE IS IN DESCHUTES RIVER REACHES 5 AND 6.

Floodway

For the Deschutes River most of the floodway is fairly well mapped, given the age and scale from which it was derived. It is usually larger than the adjusted Ordinary High Water Mark, but within a 200 feet of its edge. There are some areas where the river channel has migrated significantly where the floodway is outside of the river channel, but this is rare within the urban area.

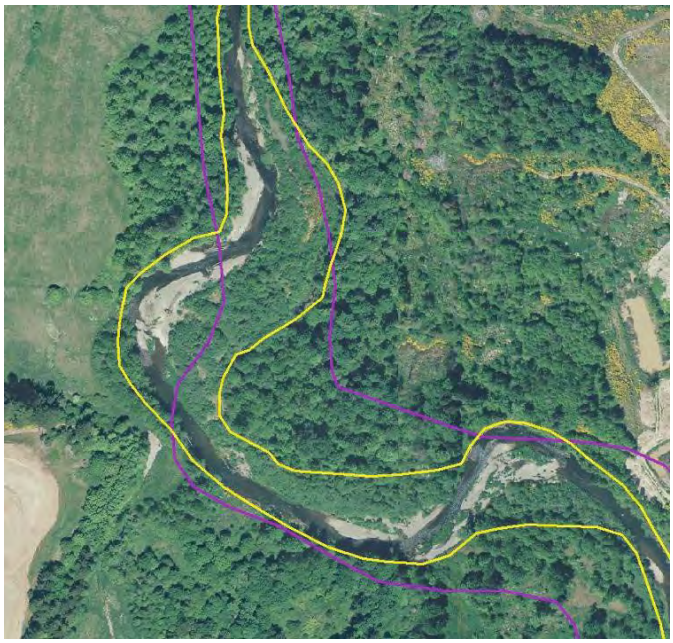

FIGURE A - 3: OHWM DATA LAYER (IN YELLOW) COMPARED TO FLOODWAY (IN MAGENTA) OVERLAIN ON A 2006 AIR PHOTO.

THIS EXAMPLE IS IN REACH 3, JUST SOUTH OF THE CONFLUENCE OF CHAMBERS CREEK.

Floodplain within 200 Feet of Floodway

Portions of the floodplain that fall within 200 feet of the edge of the floodway also fall under Minimum Jurisdiction.

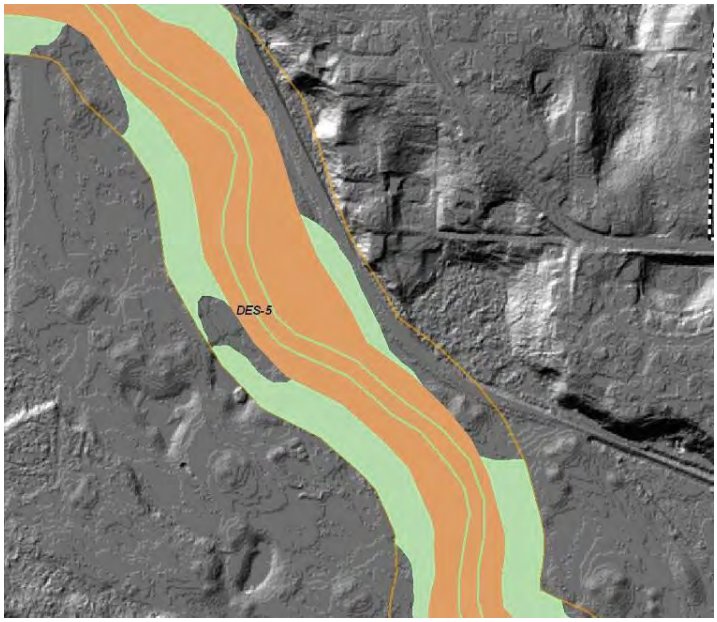

FIGURE A - 4: MINIMUM JURISDICTION IS EXTENDED BEYOND THE FLOODWAY BY 200 FEET IF THE AREA FALLS WITHIN THE 100-YEAR FLOODPLAIN.

DESCHUTES RIVER REACH 5 – ORANGE IS MAPPED FLOODWAY; ORANGE LINE IS 200 FEET OUTSIDE OF MAPPED FLOODWAY. GREEN IS PORTIONS OF THE 100 YEAR FLOODPLAIN THAT ARE WITHIN 200 FEET OF THE FLOODWAY.

Channel Migration Zone

Channel migration zones are not part of Minimum Jurisdiction, but they can be included as part of Optional Jurisdiction under the SMA.

Channel migration zones are defined in the SMA as "the area along a river within which the channel(s) can be reasonably predicted to migrate over time as a result of natural and normally occurring hydrological and related processes when considered with the characteristics of the river and its surrounding areas."

The available meander belt or CMZ data layer for the Deschutes River was developed prior to LiDAR derived elevation data being available for the region. It was developed using aerial photos from 1944, 1956, and 1996.
The CMZ data layer was updated using:

- 2002 LiDAR-derived topography (Figure A - 5)
- Color air photos from 2000, 2002, 2004 and 2006

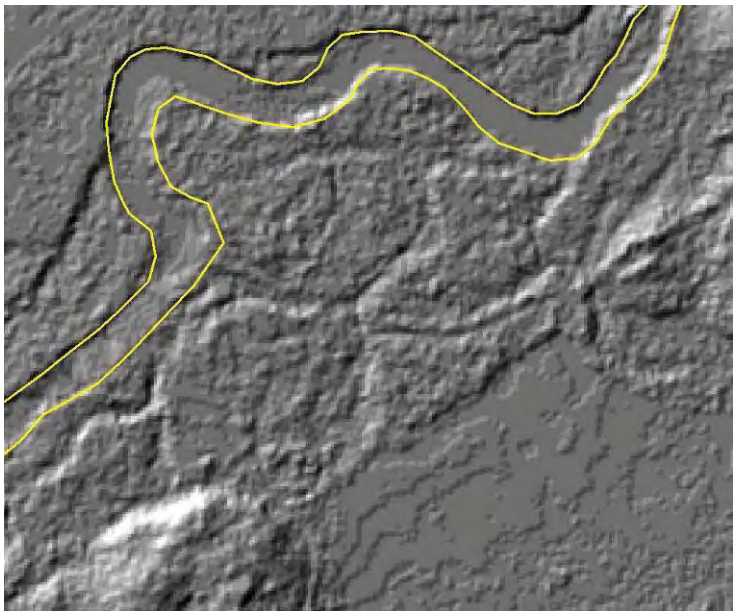

FIGURE A - 5: LIDAR DERIVED ELEVATION DATA WAS USEFUL IN IDENTIFYING ABANDONED RIVER CHANNELS. THESE HELPED DEFINE THE OUTER LIMIT OF THE CHANNEL MIGRATION ZONE.

YELLOW IS OHWM. THIS EXAMPLE OF LIDAR IMAGERY IS FROM DESCHUTES RIVER REACH 2.

Overall, the updated data layer captures a larger meander zone than identified in the original data layer. Figures A - 6(a) and (b) show the difference between the existing available data layer, and the updated data layer.

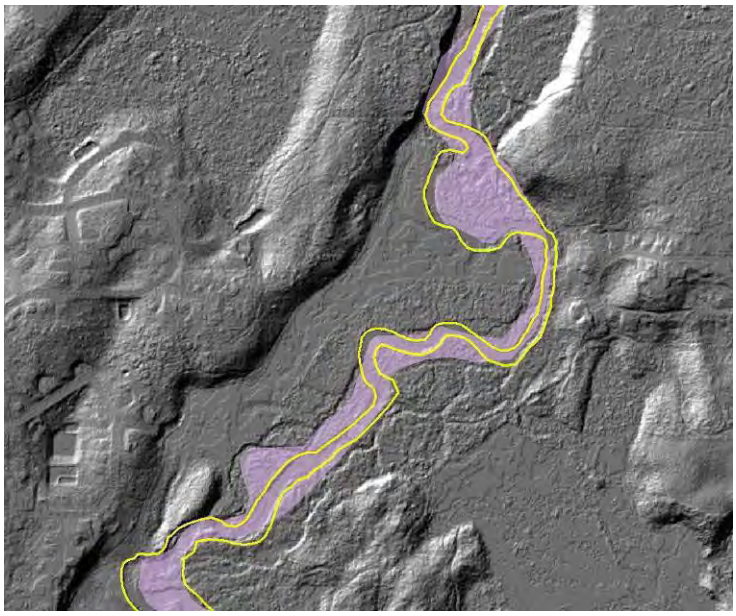

FIGURE A - 6(A): UPDATED OHWM DATA LAYER (YELLOW) SHOWN WITH EXISTING MEANDER BELT DATA LAYER (PINK). BOTH ARE OVERLAIN ON 2002 LIDAR-DERIVED ELEVATION DATA WHERE REMNANT CHANNELS ARE IDENTIFIABLE.

THIS EXAMPLE IS IN DESCHUTES RIVER REACH 2.

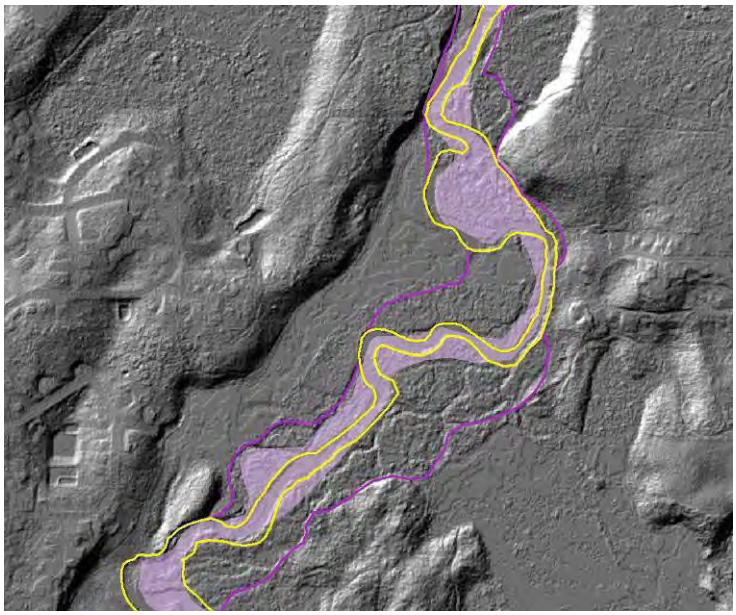

FIGURE A - 6(B): UPDATED CMZ DATA LAYER (PURPLE) SHOWN WITH UPDATED OHWM DATA LAYER (YELLOW) AND EXISTING MEANDER BELT DATA LAYER. OVERLAIN ON 2002 LIDAR-DERIVED ELEVATION DATA.

The figures on the following pages show the adjusted channel migration zone for the Deschutes River, along with reach delineations of the OHWM. The figures are arranged north to south.

Figures A - 7(a) through (h) show the channel migration zone.

Figures A - 8(a) through (h) show the channel migration zone in comparison to Minimum Jurisdiction.

Figures A - 9(a) through (h) show the channel migration zone in comparison to Minimum Jurisdiction and the 100-year floodplain.

Deschutes River Channel Migration Zone by Reach

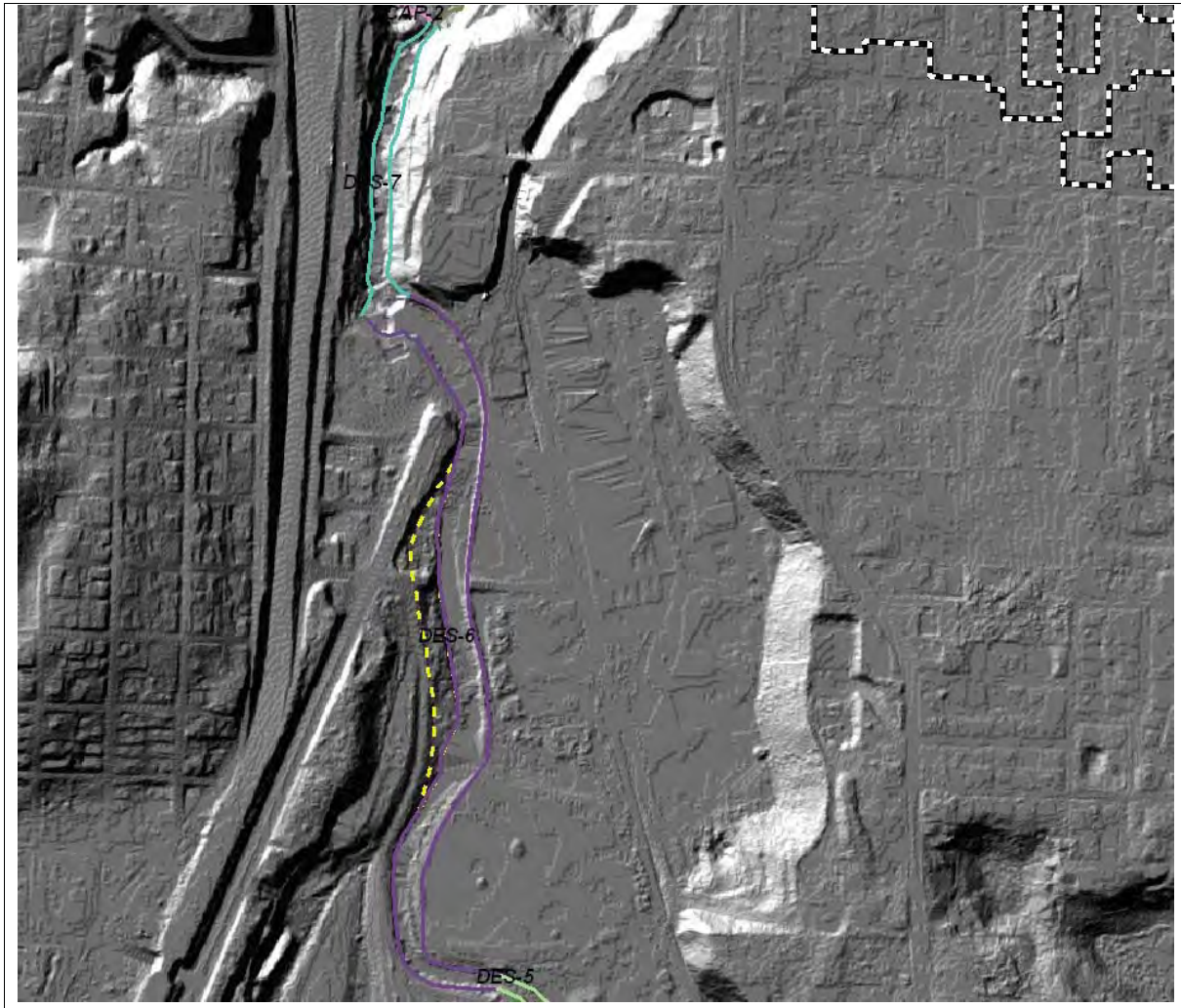

FIGURE A - 7(A): CMZ - DESCHUTES RIVER REACHES 6-7

CMZ OUTER LINE SHOWN IN DASHED YELLOW.

REACH BREAKS SHOWN ON OHWM IN BLUE (DES-7) AND PURPLE (DES-6).

URBAN GROWTH AREA LINE SHOWN IN DASHED BLACK AND WHITE.

OVERLAIN ON 2002 LIDAR-DERIVED ELEVATION.

SCALE APPROX 1:6,215

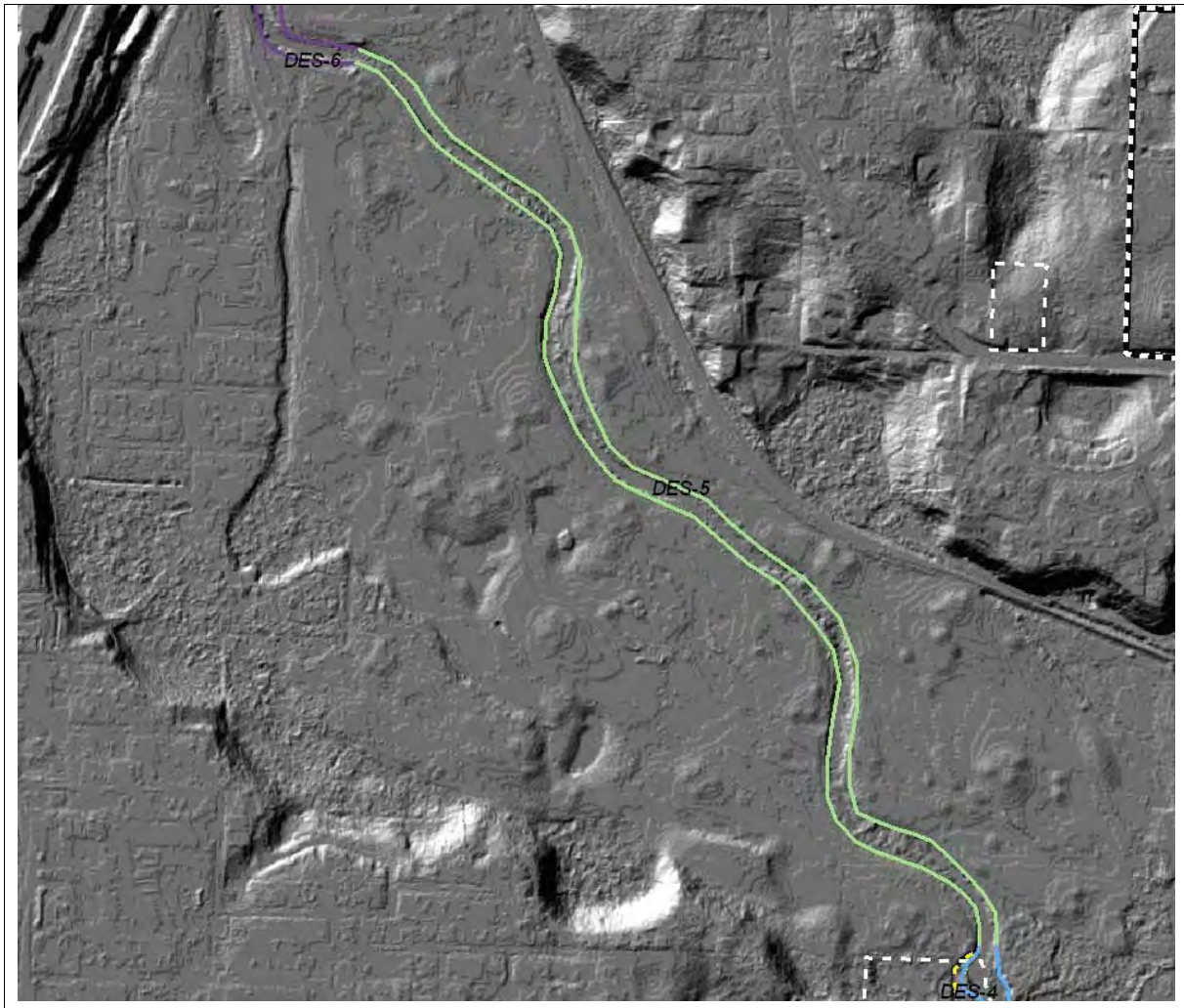

FIGURE A - 7(B): CMZ - DESCHUTES RIVER REACH 5

CMZ OUTER LINE SHOWN IN DASHED YELLOW. (NOTE: NONE MAPPED FOR THIS REACH BREAK THROUGH THE TUMWATER GOLF COURSE.)

REACH BREAKS SHOWN ON OHWM IN GREEN (DES-5).

URBAN GROWTH AREA LINE SHOWN IN DASHED BLACK AND WHITE. CITY LIMITS ARE SHOWN IN DASHED WHITE LINE.

OVERLAIN ON 2002 LIDAR-DERIVED ELEVATION.

SCALE APPROX 1:6,215

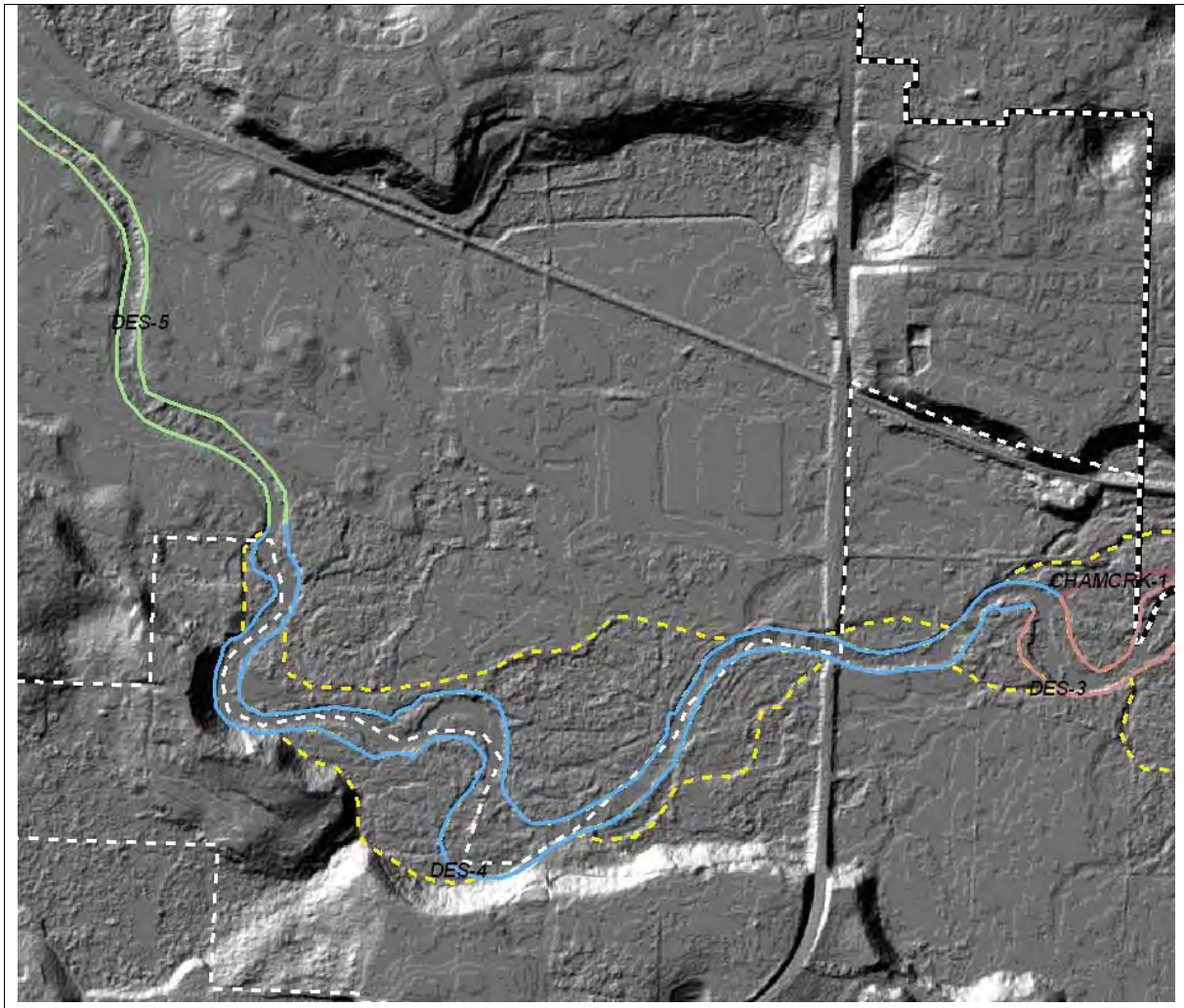

FIGURE A - 7(C): CMZ - DESCHUTES RIVER REACH 4

CMZ OUTER LINE SHOWN IN DASHED YELLOW.

REACH BREAKS SHOWN ON OHWM IN GREEN (DES-5), BLUE (DES-4), AND SALMON (DES-3).

URBAN GROWTH AREA LINE SHOWN IN DASHED BLACK AND WHITE. CITY LIMITS ARE SHOWN IN DASHED WHITE LINE.

OVERLAIN ON 2002 LIDAR-DERIVED ELEVATION.

SCALE APPROX 1:6,215

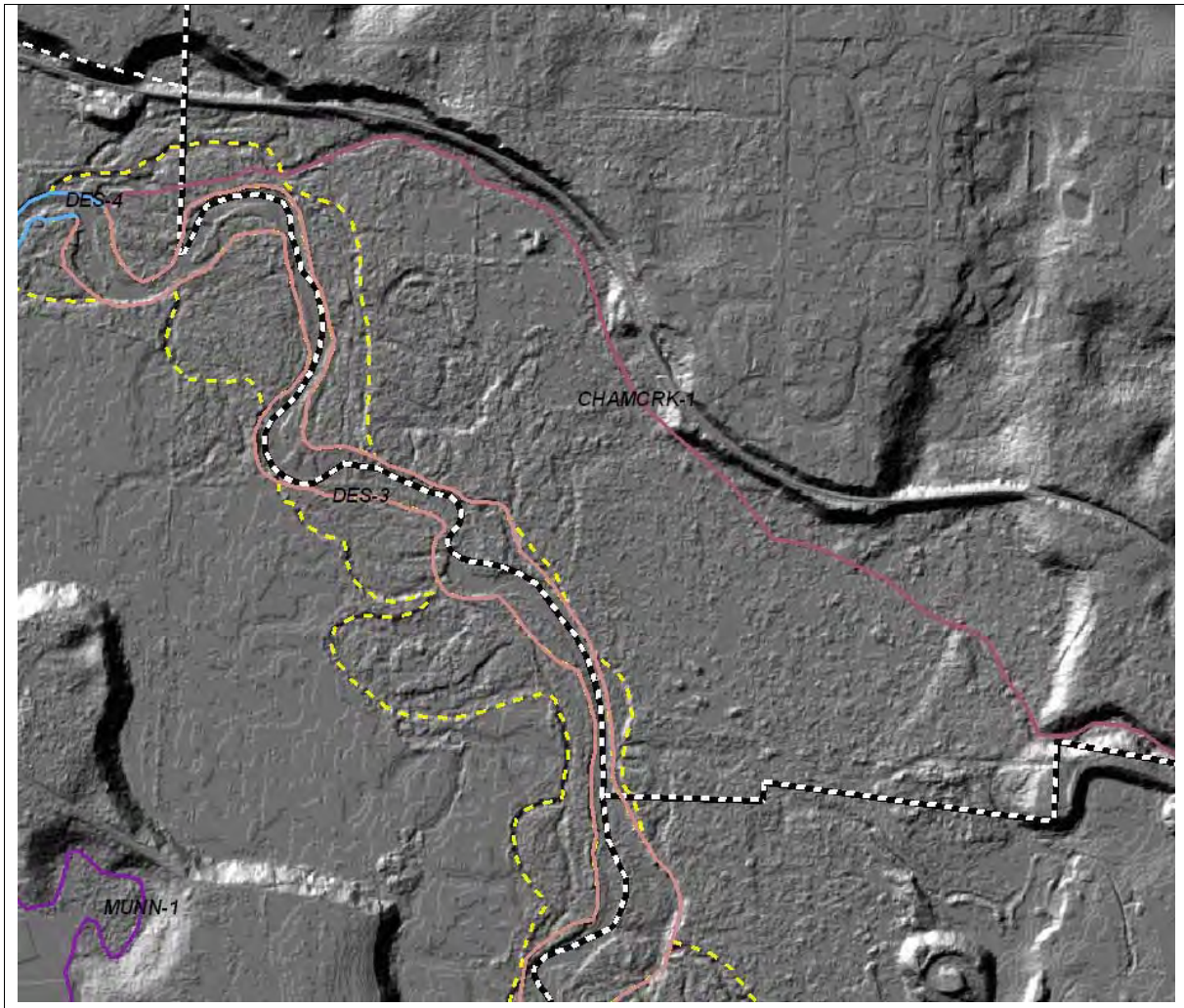

FIGURE A - 7(D): CMZ - DESCHUTES RIVER REACH 3 NORTH

CMZ OUTER LINE SHOWN IN DASHED YELLOW.

REACH BREAKS SHOWN ON OHWM IN SALMON (DES-3) AND PURPLE (CHAMBERS CREEK – 1).

URBAN GROWTH AREA LINE SHOWN IN DASHED BLACK AND WHITE. TUMWATER UGA IS TO THE WEST; OLYMPIA UGA IS TO THE EAST. RURAL COUNTY IS TO THE SOUTHEAST AND OUTSIDE OF STUDY AREA.

OVERLAIN ON 2002 LIDAR-DERIVED ELEVATION.

SCALE APPROX 1:6,215

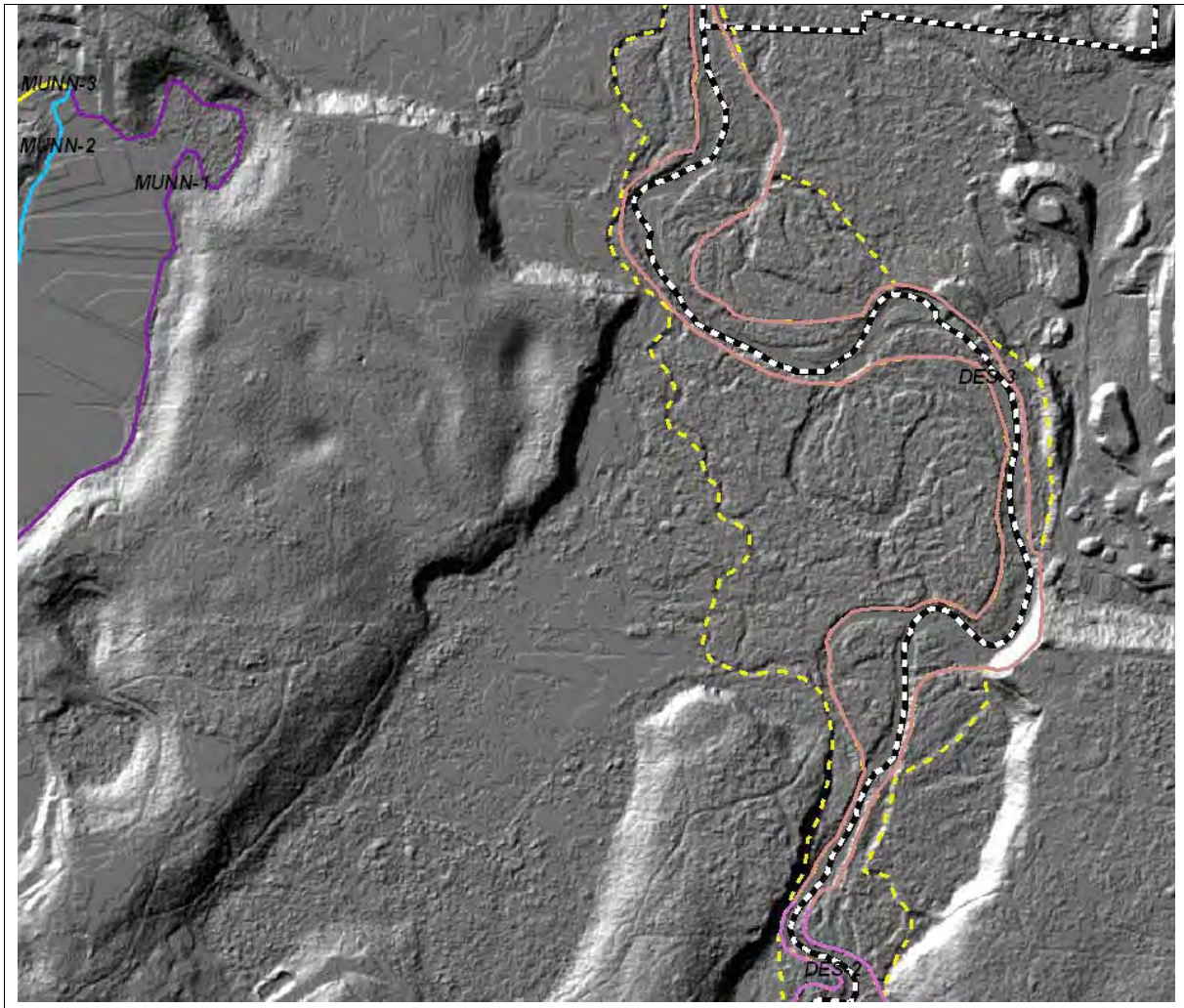

FIGURE A - 7(E): CMZ - DESCHUTES RIVER REACH 3 SOUTH

CMZ OUTER LINE SHOWN IN DASHED YELLOW.

REACH BREAKS SHOWN ON OHWM IN SALMON (DES-3).

URBAN GROWTH AREA LINE SHOWN IN DASHED BLACK AND WHITE. TO THE EAST IS RURAL COUNTY AND OUTSIDE OF STUDY AREA.

OVERLAIN ON 2002 LIDAR-DERIVED ELEVATION.

SCALE APPROX 1:6,215

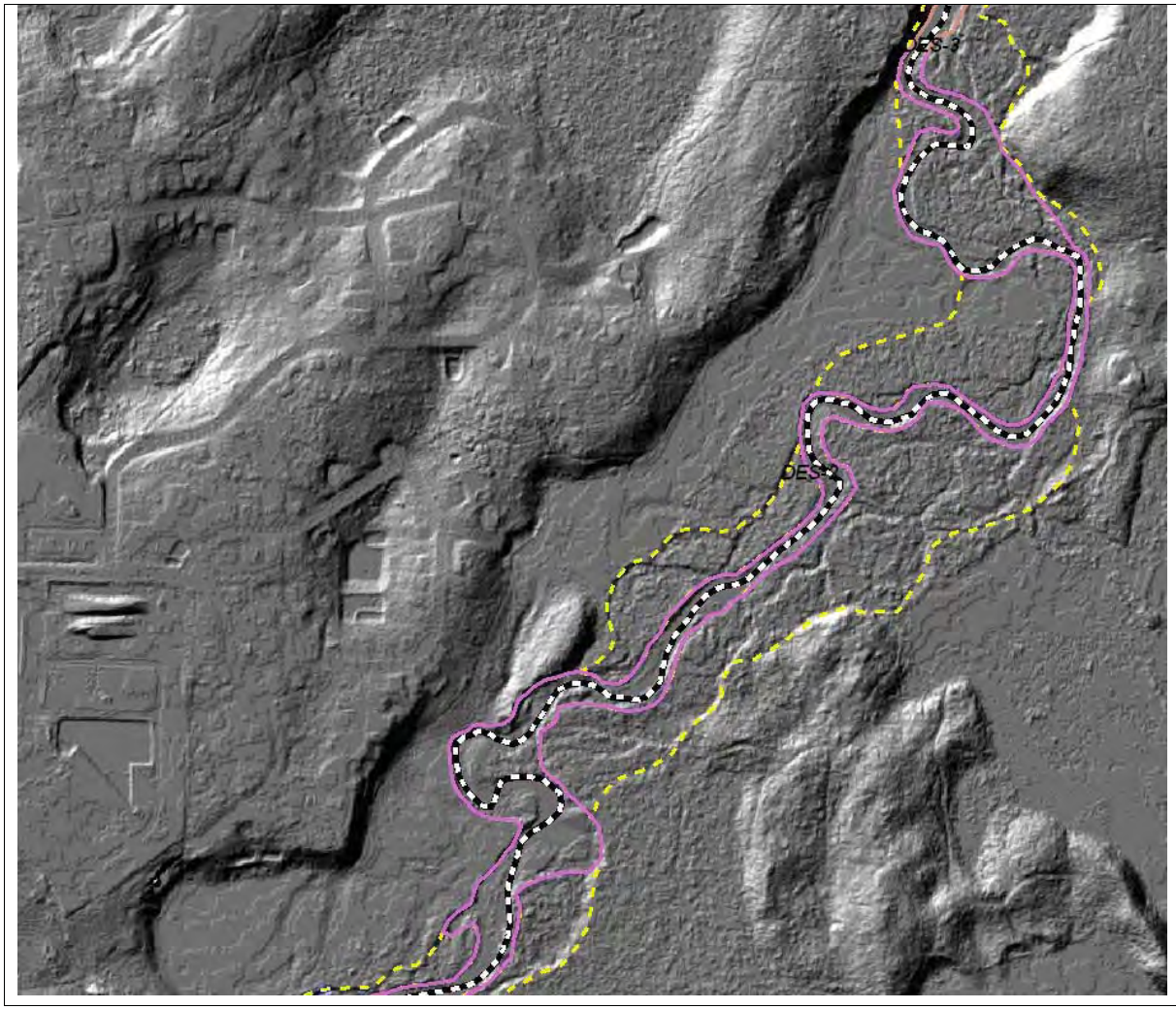

FIGURE A - 7(F): CMZ - DESCHUTES RIVER REACH 2 NORTH

CMZ OUTER LINE SHOWN IN DASHED YELLOW.

REACH BREAKS SHOWN ON OHWM IN PURPLE (DES-2).

URBAN GROWTH AREA LINE SHOWN IN DASHED BLACK AND WHITE. TO THE EAST IS RURAL COUNTY AND OUTSIDE OF STUDY AREA.

OVERLAIN ON 2002 LIDAR-DERIVED ELEVATION.

SCALE APPROX 1:6,215

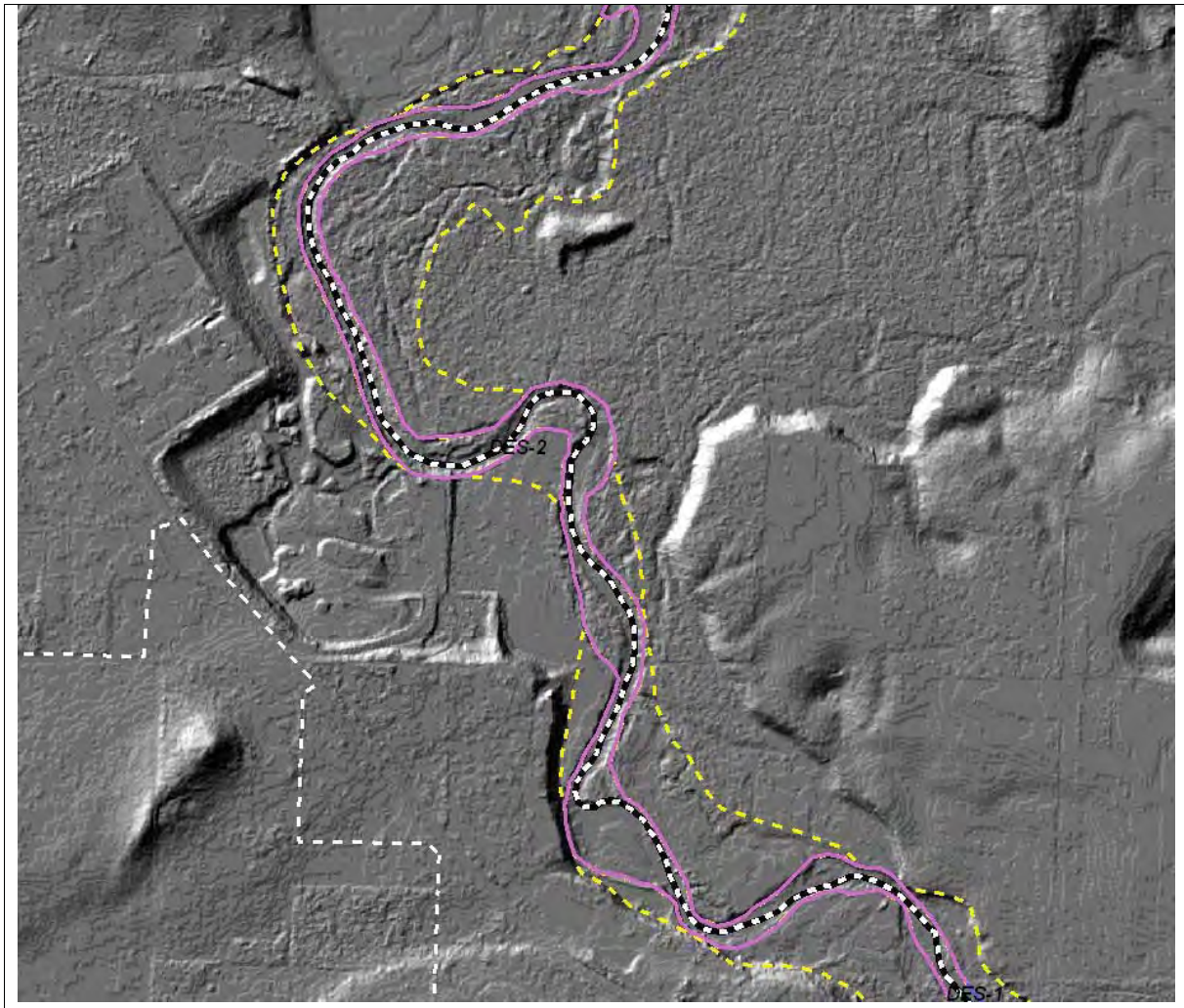

FIGURE A - 7(G): CMZ - DESCHUTES RIVER REACH 2 SOUTH

CMZ OUTER LINE SHOWN IN DASHED YELLOW.

REACH BREAKS SHOWN ON OHWM IN PURPLE (DES-2).

URBAN GROWTH AREA LINE SHOWN IN DASHED BLACK AND WHITE. TO THE EAST IS RURAL COUNTY AND OUTSIDE OF STUDY AREA.

OVERLAIN ON 2002 LIDAR-DERIVED ELEVATION.

SCALE APPROX 1:6,215

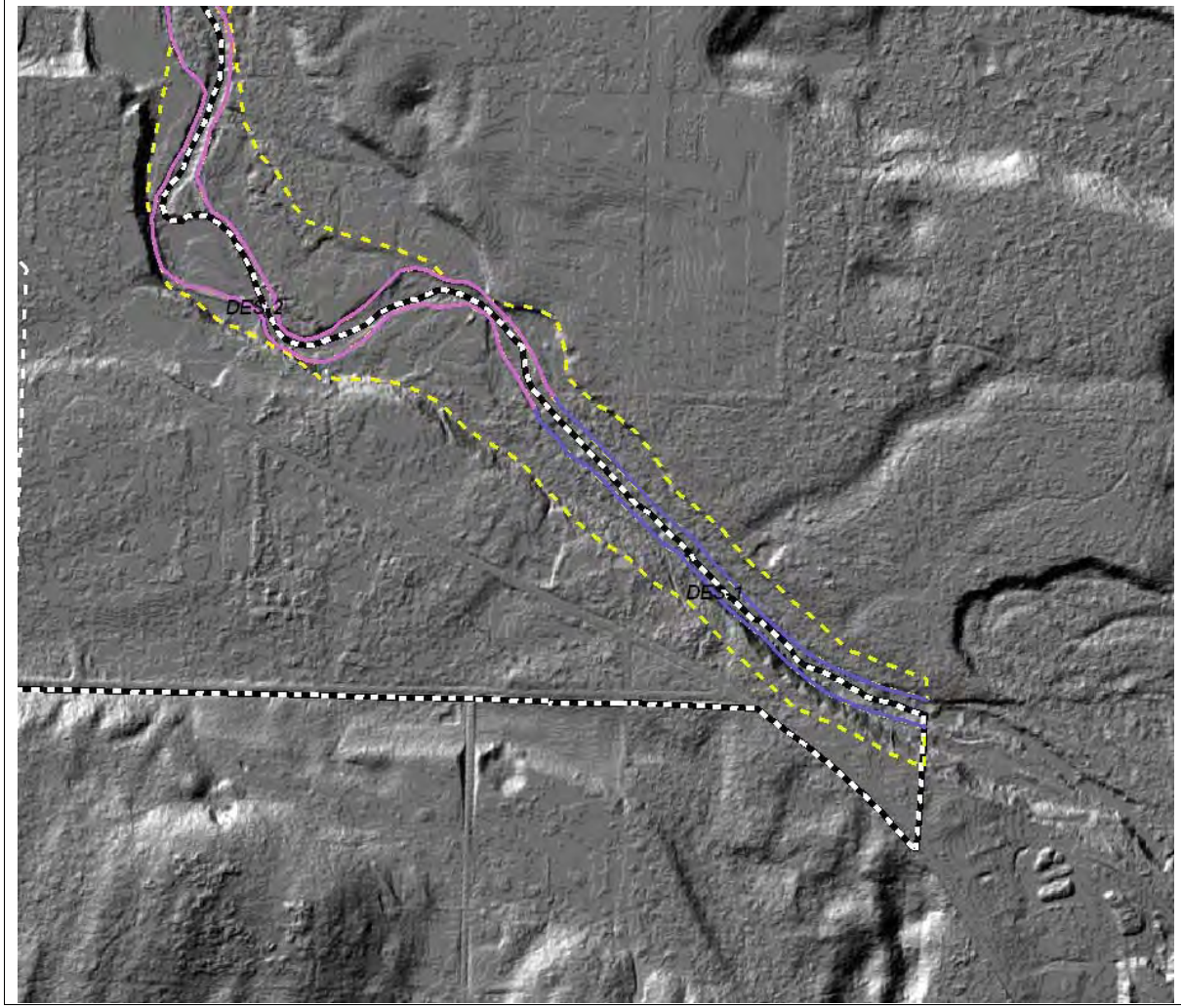

FIGURE A - 7(H): CMZ - DESCHUTES RIVER REACH 1

CMZ OUTER LINE SHOWN IN DASHED YELLOW.

REACH BREAKS SHOWN ON OHWM IN PURPLE (DES-2) AND DARKER PURPLE (DES-1).

URBAN GROWTH AREA LINE SHOWN IN DASHED BLACK AND WHITE. TO THE EAST IS RURAL COUNTY AND OUTSIDE OF STUDY AREA.

OVERLAIN ON 2002 LIDAR-DERIVED ELEVATION.

SCALE APPROX 1:6,215

Minimum Jurisdiction Compared to Channel Migration Zone by Reach

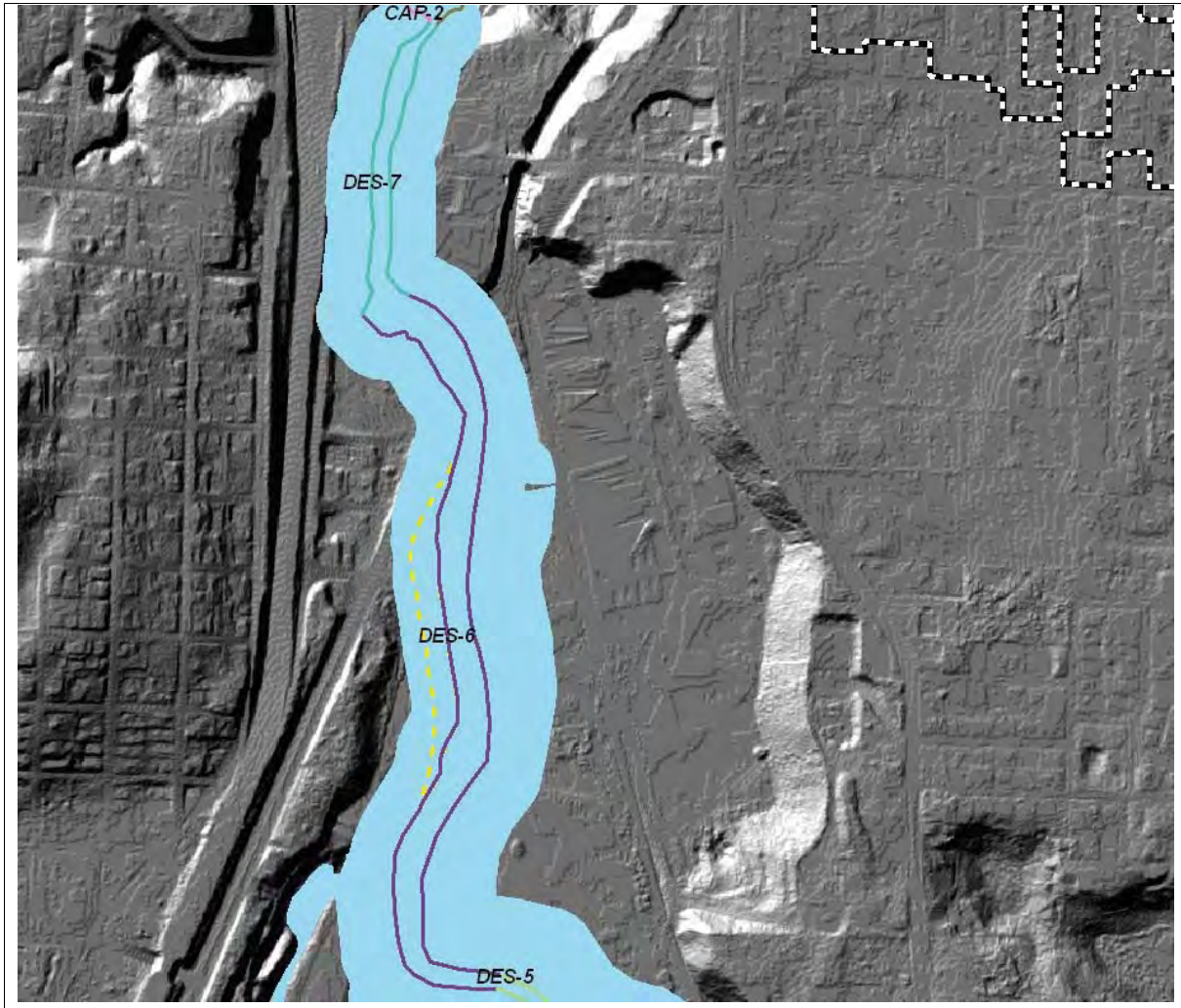

FIGURE A - 8(A): MINIMUM JURISDICTION COMPARED TO CMZ - DESCHUTES RIVER REACHES 6 AND 7

THE CHANNEL MIGRATION ZONE (CMZ) (BRIGHT YELLOW) IS WITHIN MINIMUM JURISDICTION (SHOWN IN BLUE).

URBAN GROWTH AREA LINE SHOWN IN DASHED BLACK AND WHITE.

OVERLAIN ON 2002 LIDAR-DERIVED ELEVATION.

SCALE APPROX 1:6,215

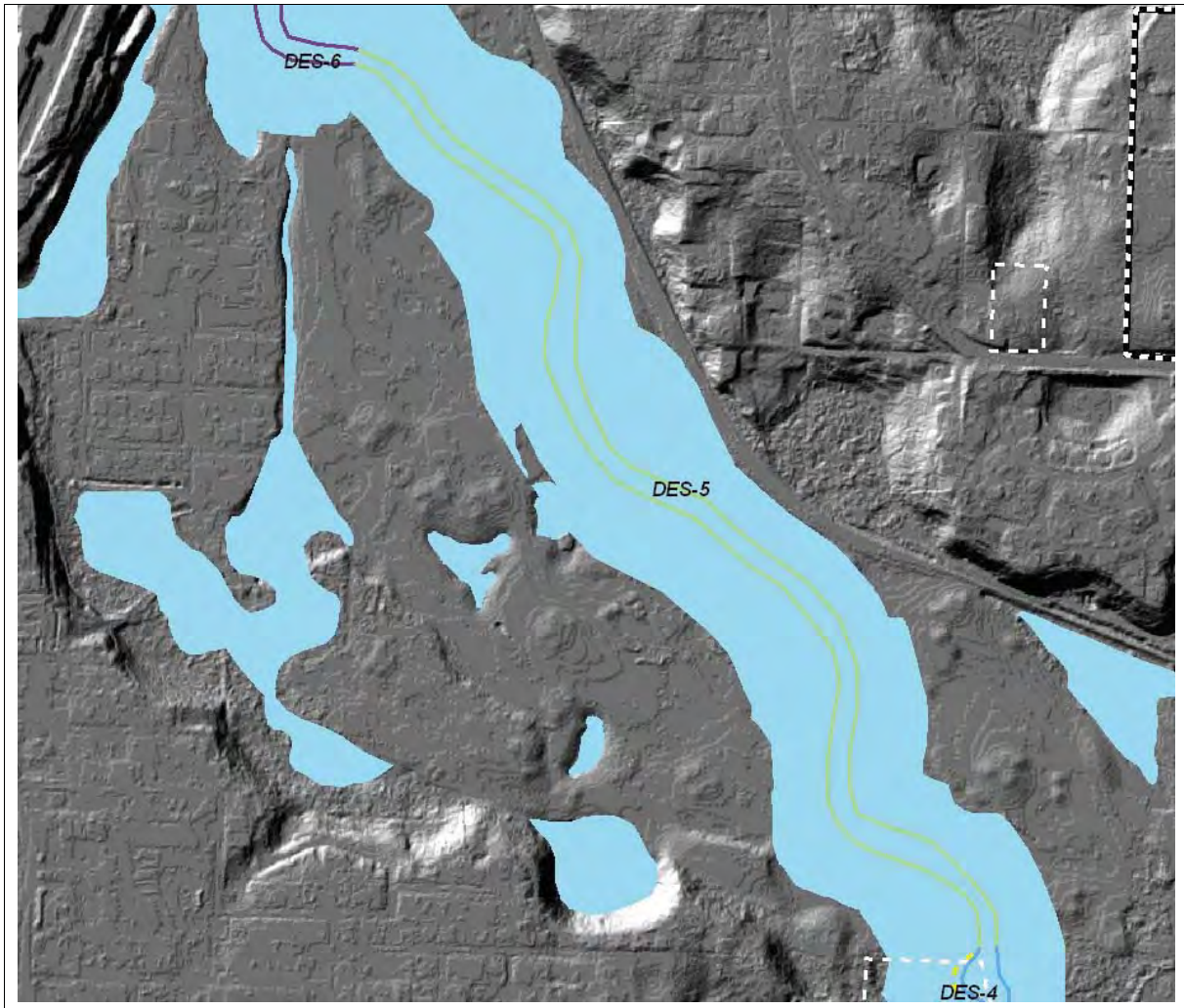

FIGURE A - 8(B): MINIMUM JURISDICTION COMPARED TO CMZ - DESCHUTES RIVER REACH 5

THE CHANNEL MIGRATION ZONE (CMZ) (BRIGHT YELLOW) IS WITHIN MINIMUM JURISDICTION (SHOWN IN BLUE). (NOTE: NONE MAPPED FOR THIS REACH BREAK THROUGH THE TUMWATER GOLF COURSE.)

URBAN GROWTH AREA LINE SHOWN IN DASHED BLACK AND WHITE. CITY LIMITS SHOWN IN DASHED WHITE LINE.

OVERLAIN ON 2002 LIDAR-DERIVED ELEVATION.

SCALE APPROX 1:6,215

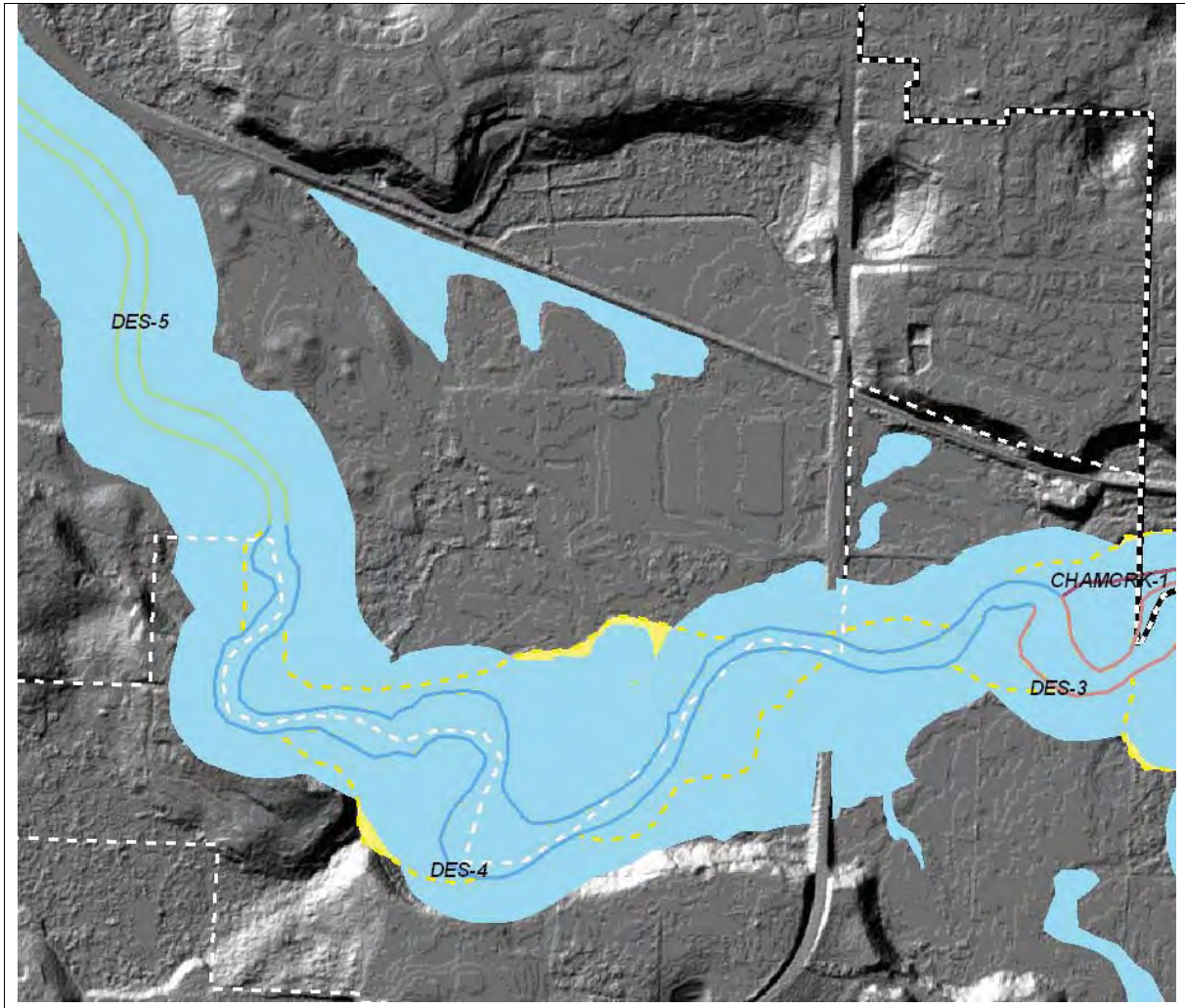

FIGURE A - 8(C): MINIMUM JURISDICTION COMPARED TO CMZ - DESCHUTES RIVER REACH 4

PARTS OF THE CHANNEL MIGRATION ZONE (CMZ) (BRIGHT YELLOW) MAY BE OUTSIDE OF MINIMUM JURISDICTION (SHOWN IN BLUE).

URBAN GROWTH AREA LINE SHOWN IN DASHED BLACK AND WHITE. CITY LIMITS SHOWN IN DASHED WHITE LINE.

OVERLAIN ON 2002 LIDAR-DERIVED ELEVATION.

SCALE APPROX 1:6,215

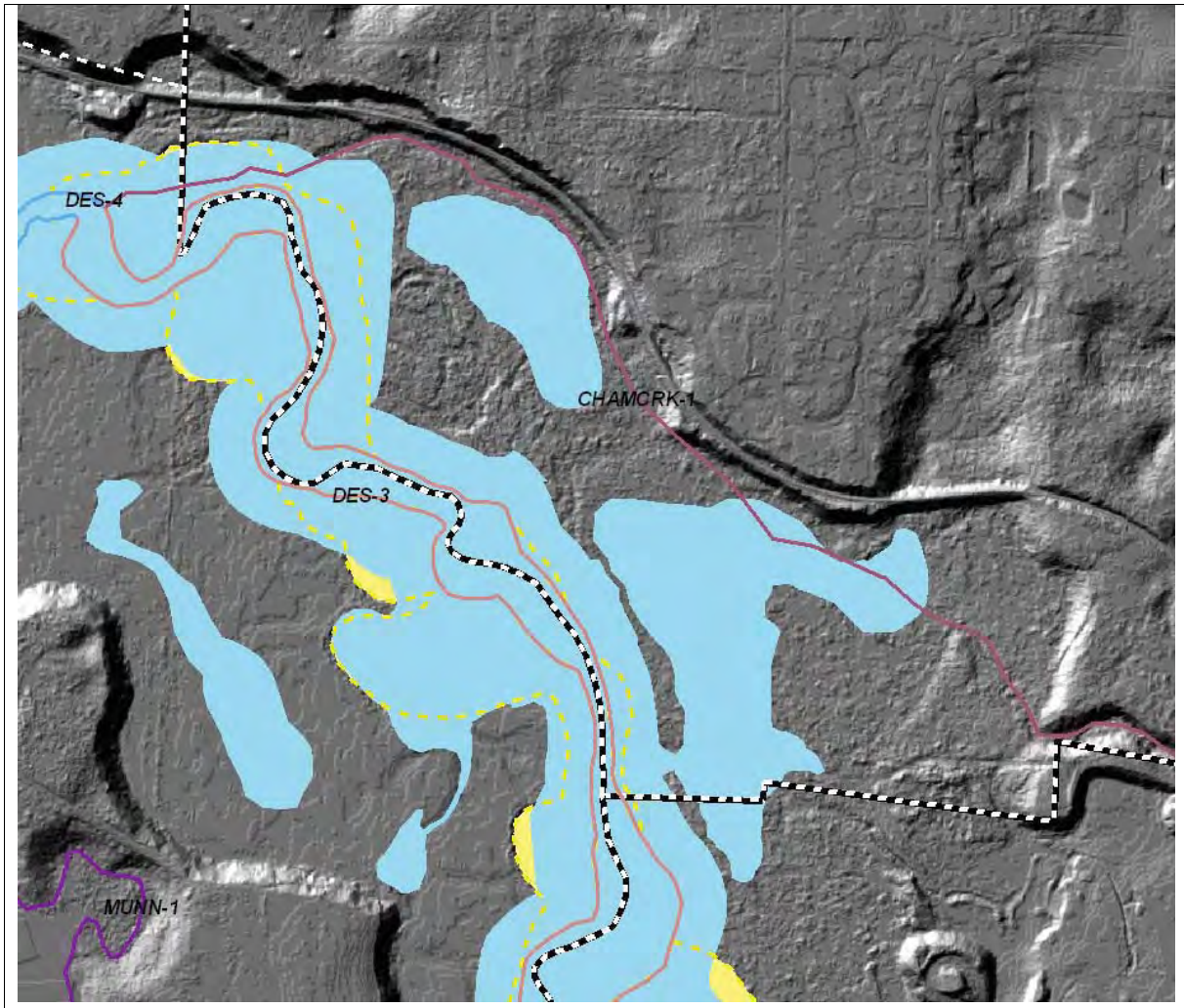

FIGURE A - 8(D): MINIMUM JURISDICTION COMPARED TO CMZ - DESCHUTES RIVER REACH 3 NORTH

PARTS OF THE CHANNEL MIGRATION ZONE (CMZ) (BRIGHT YELLOW) MAY BE OUTSIDE OF MINIMUM JURISDICTION (SHOWN IN BLUE).

URBAN GROWTH AREA LINE SHOWN IN DASHED BLACK AND WHITE. CITY LIMITS SHOWN IN DASHED WHITE LINE.

TO THE SOUTHEAST IS RURAL COUNTY AND OUTSIDE OF STUDY AREA.

OVERLAIN ON 2002 LIDAR-DERIVED ELEVATION.

SCALE APPROX 1:6,215

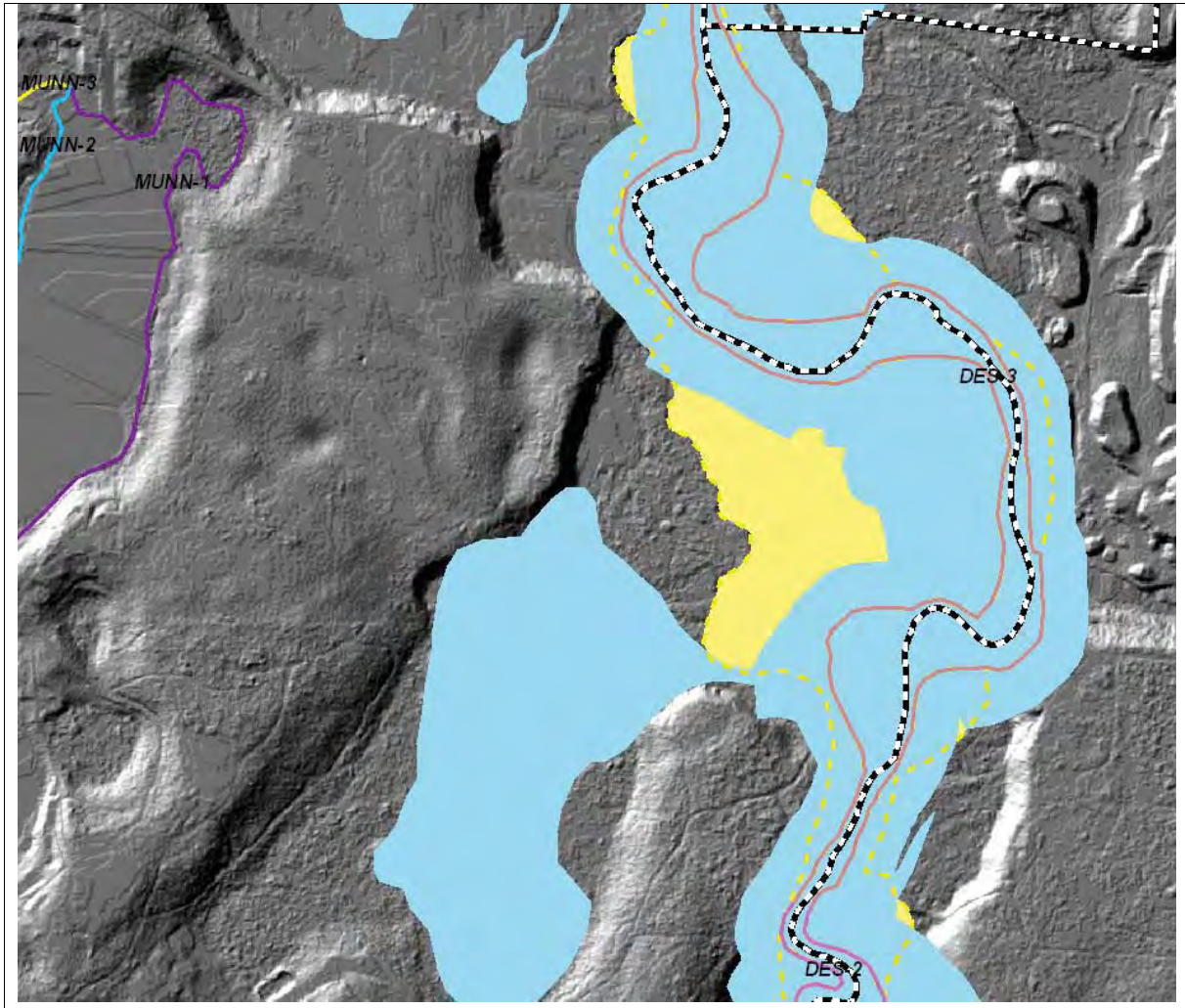

FIGURE A - 8(E): MINIMUM JURISDICTION COMPARED TO CMZ - DESCHUTES RIVER REACH 3 SOUTH

PARTS OF THE CHANNEL MIGRATION ZONE (CMZ) (BRIGHT YELLOW) MAY BE OUTSIDE OF MINIMUM JURISDICTION (SHOWN IN BLUE).

URBAN GROWTH AREA LINE SHOWN IN DASHED BLACK AND WHITE. TO THE EAST IS RURAL COUNTY AND OUTSIDE OF STUDY AREA.

OVERLAIN ON 2002 LIDAR-DERIVED ELEVATION.

SCALE APPROX 1:6,215

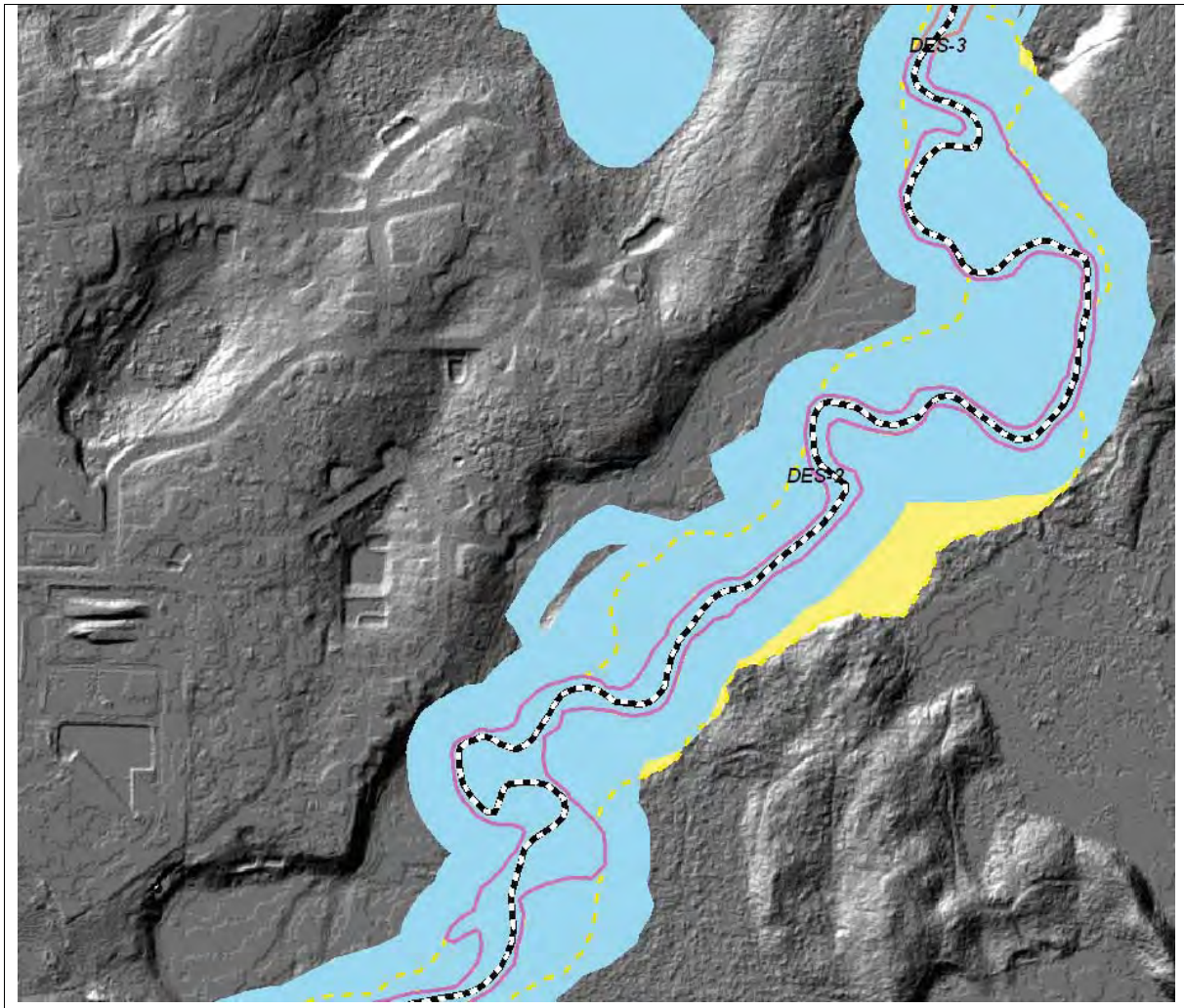

FIGURE A - 8(F): MINIMUM JURISDICTION COMPARED TO CMZ - DESCHUTES RIVER REACH 2 NORTH

THE CHANNEL MIGRATION ZONE (CMZ) (BRIGHT YELLOW) IS WITHIN MINIMUM JURISDICTION (SHOWN IN BLUE) WITHIN THE UGA; THE EAST SIDE OF THE RIVER IS THE RURAL COUNTY AND OUTSIDE OF THE STUDY AREA.

URBAN GROWTH AREA LINE SHOWN IN DASHED BLACK AND WHITE.

OVERLAIN ON 2002 LIDAR-DERIVED ELEVATION.

SCALE APPROX 1:6,215

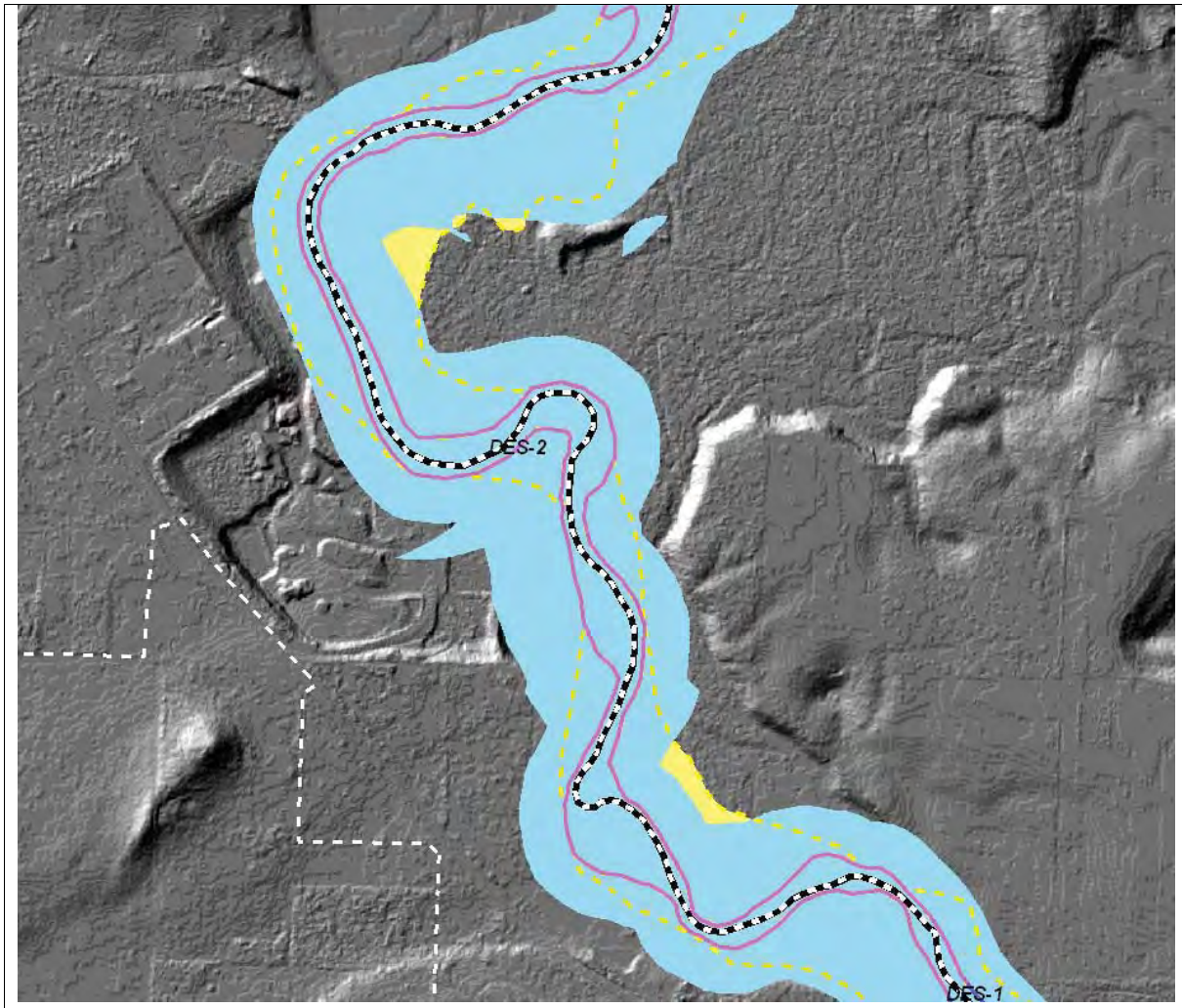

FIGURE A - 8(G): MINIMUM JURISDICTION COMPARED TO CMZ - DESCHUTES RIVER REACH 2 SOUTH

THE CHANNEL MIGRATION ZONE (CMZ) (BRIGHT YELLOW) IS WITHIN MINIMUM JURISDICTION (SHOWN IN BLUE) WITHIN THE UGA; THE EAST SIDE OF THE RIVER IS THE RURAL COUNTY AND OUTSIDE OF THE STUDY AREA.

URBAN GROWTH AREA LINE SHOWN IN DASHED BLACK AND WHITE.

OVERLAIN ON 2002 LIDAR-DERIVED ELEVATION.

SCALE APPROX 1:6,215

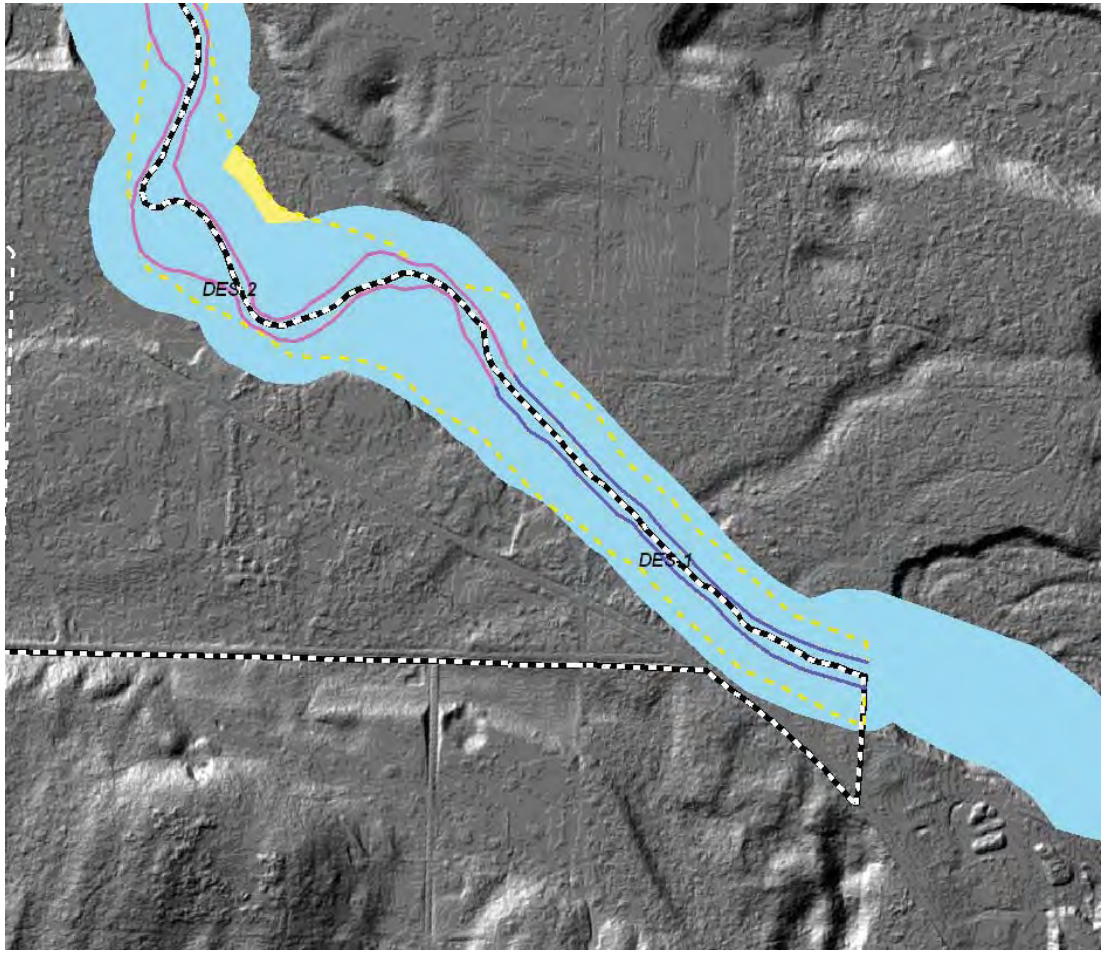

FIGURE A - 8(H): MINIMUM JURISDICTION COMPARED TO CMZ - DESCHUTES RIVER REACH 1

THE CHANNEL MIGRATION ZONE (CMZ) (BRIGHT YELLOW) IS WITHIN MINIMUM JURISDICTION (SHOWN IN BLUE) WITHIN THE UGA; THE EAST SIDE OF THE RIVER IS THE RURAL COUNTY AND OUTSIDE OF THE STUDY AREA.

URBAN GROWTH AREA LINE SHOWN IN DASHED BLACK AND WHITE.

OVERLAIN ON 2002 LIDAR-DERIVED ELEVATION.

SCALE APPROX 1:6,215

100-Year Floodplain Compared to Minimum Jurisdiction and Channel Migration Zone

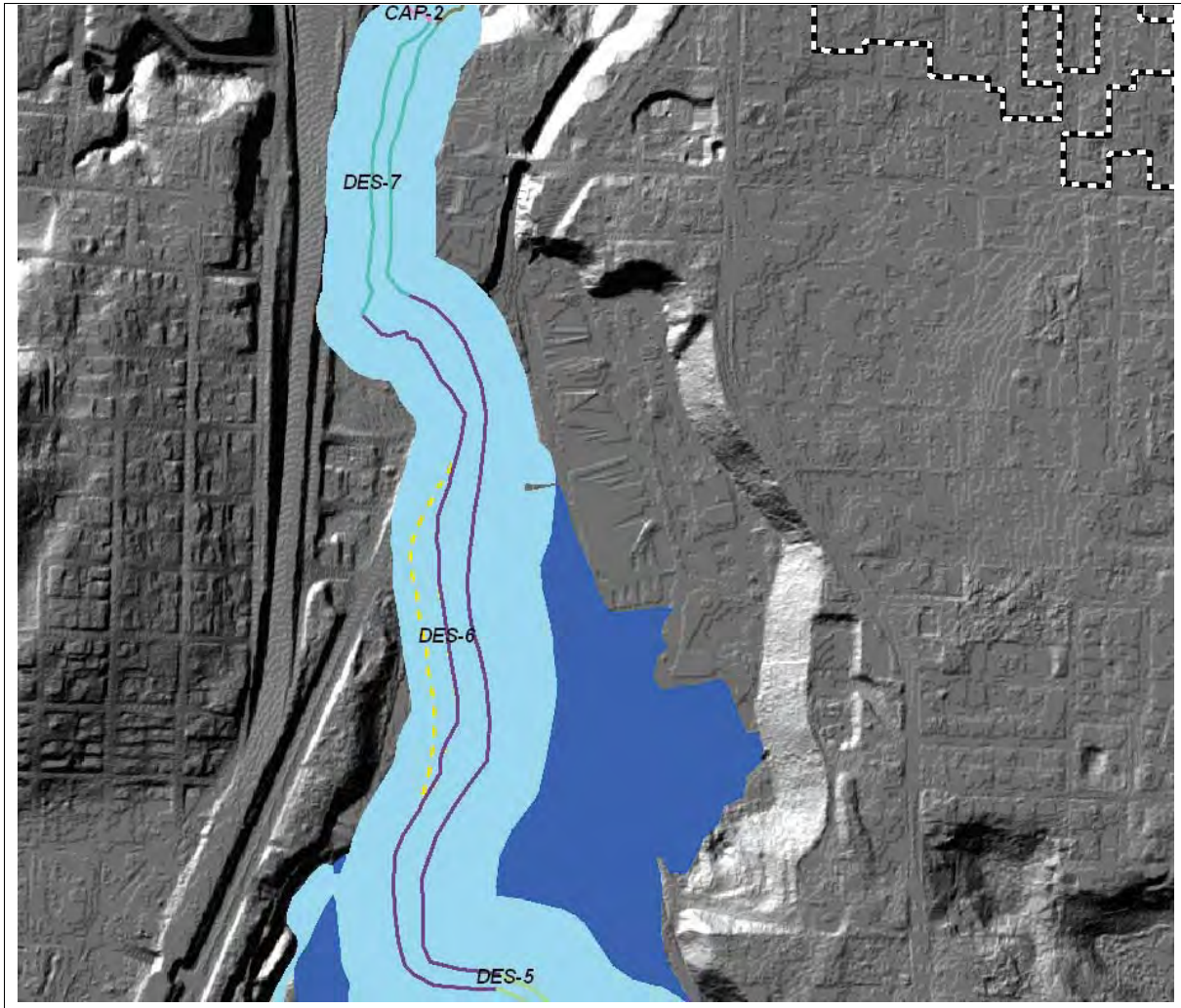

FIGURE A - 9(A) : 100 YEAR FLOODPLAIN COMPARED TO MINIMUM JURISDICTION AND CHANNEL MIGRATION ZONE – REACHES 6 AND 7

100-YEAR FLOODPLAIN IS DARK BLUE
MINIMUM JURISDICTION IS LIGHT BLUE
CMZ IS BRIGHT YELLOW

URBAN GROWTH AREA LINE SHOWN IN DASHED BLACK AND WHITE.

OVERLAIN ON 2002 LIDAR-DERIVED ELEVATION.

SCALE APPROX 1:6,215

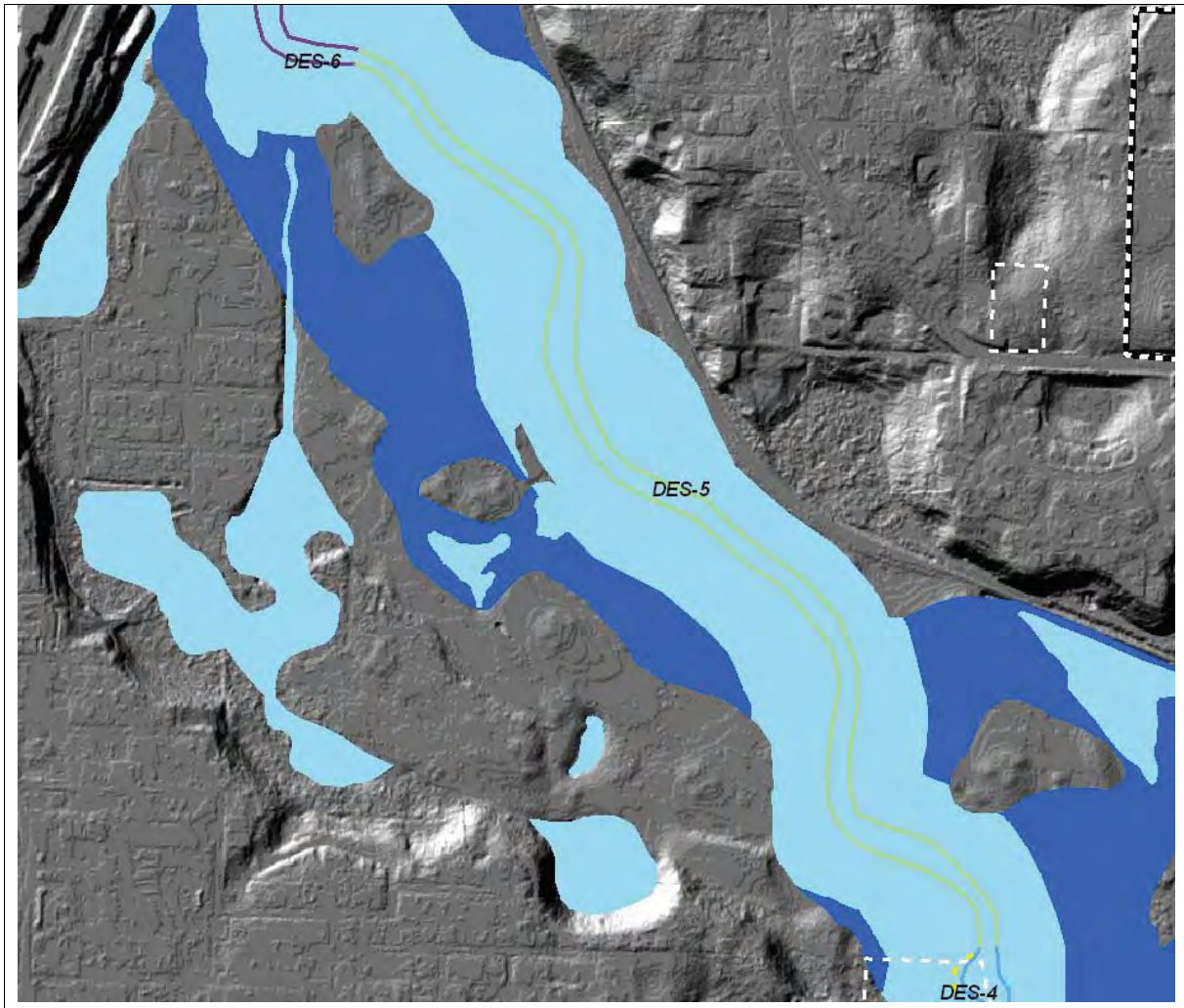

FIGURE A - 9(B): 100 YEAR FLOODPLAIN COMPARED TO MINIMUM JURISDICTION AND CHANNEL MIGRATION ZONE – REACH 5

100-YEAR FLOODPLAIN IS DARK BLUE
MINIMUM JURISDICTION IS LIGHT BLUE
CMZ IS BRIGHT YELLOW

URBAN GROWTH AREA LINE SHOWN IN DASHED BLACK AND WHITE. CITY LIMITS SHOWN IN DASHED WHITE LINE.

OVERLAIN ON 2002 LIDAR-DERIVED ELEVATION.

SCALE APPROX 1:6,215

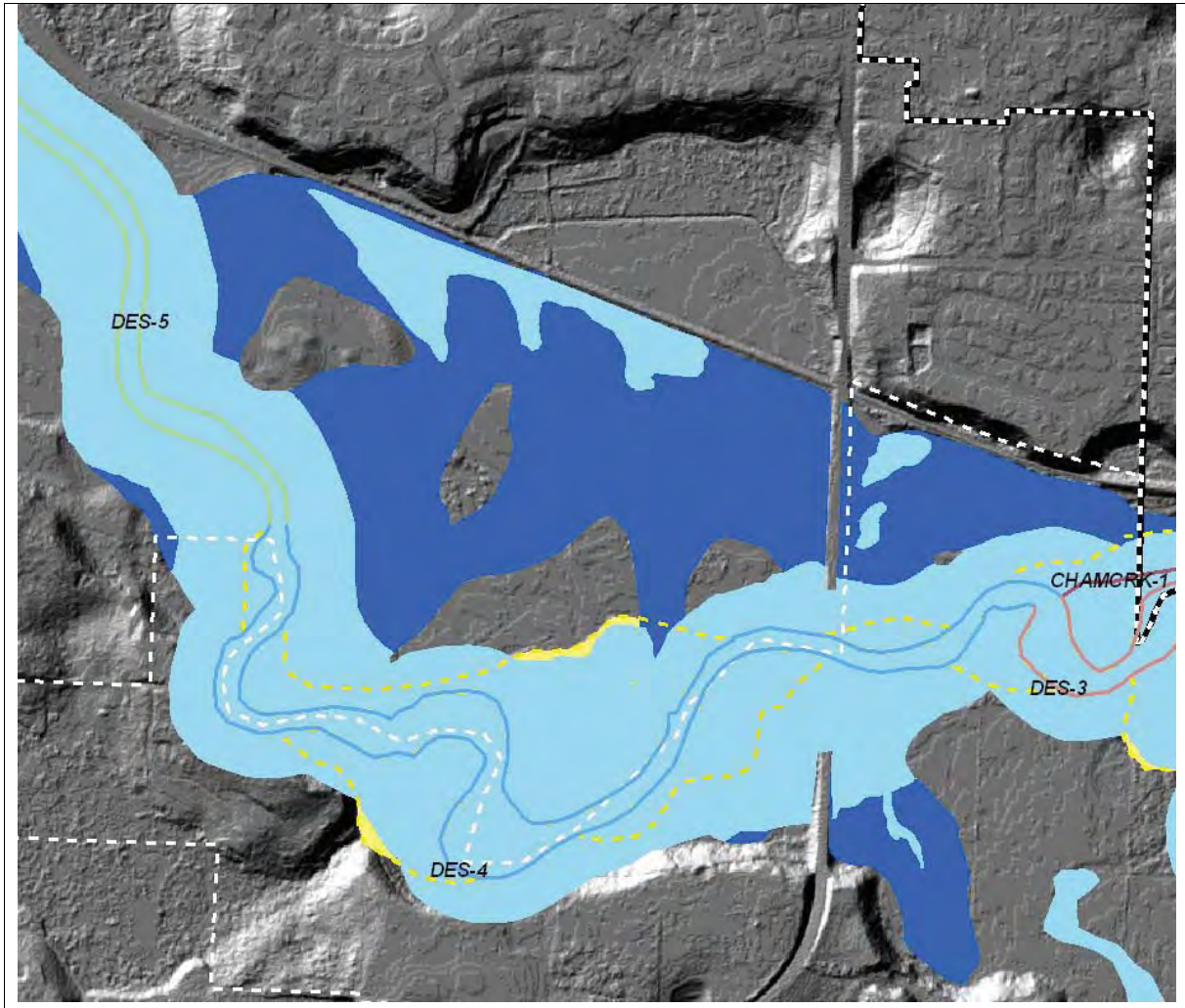

FIGURE A - 9(C): 100 YEAR FLOODPLAIN COMPARED TO MINIMUM JURISDICTION AND CHANNEL MIGRATION ZONE – REACH 4

100-YEAR FLOODPLAIN IS DARK BLUE
MINIMUM JURISDICTION IS LIGHT BLUE
CMZ IS BRIGHT YELLOW

URBAN GROWTH AREA LINE SHOWN IN DASHED BLACK AND WHITE. CITY LIMITS SHOWN IN DASHED WHITE LINE.

OVERLAIN ON 2002 LIDAR-DERIVED ELEVATION.

SCALE APPROX 1:6,215

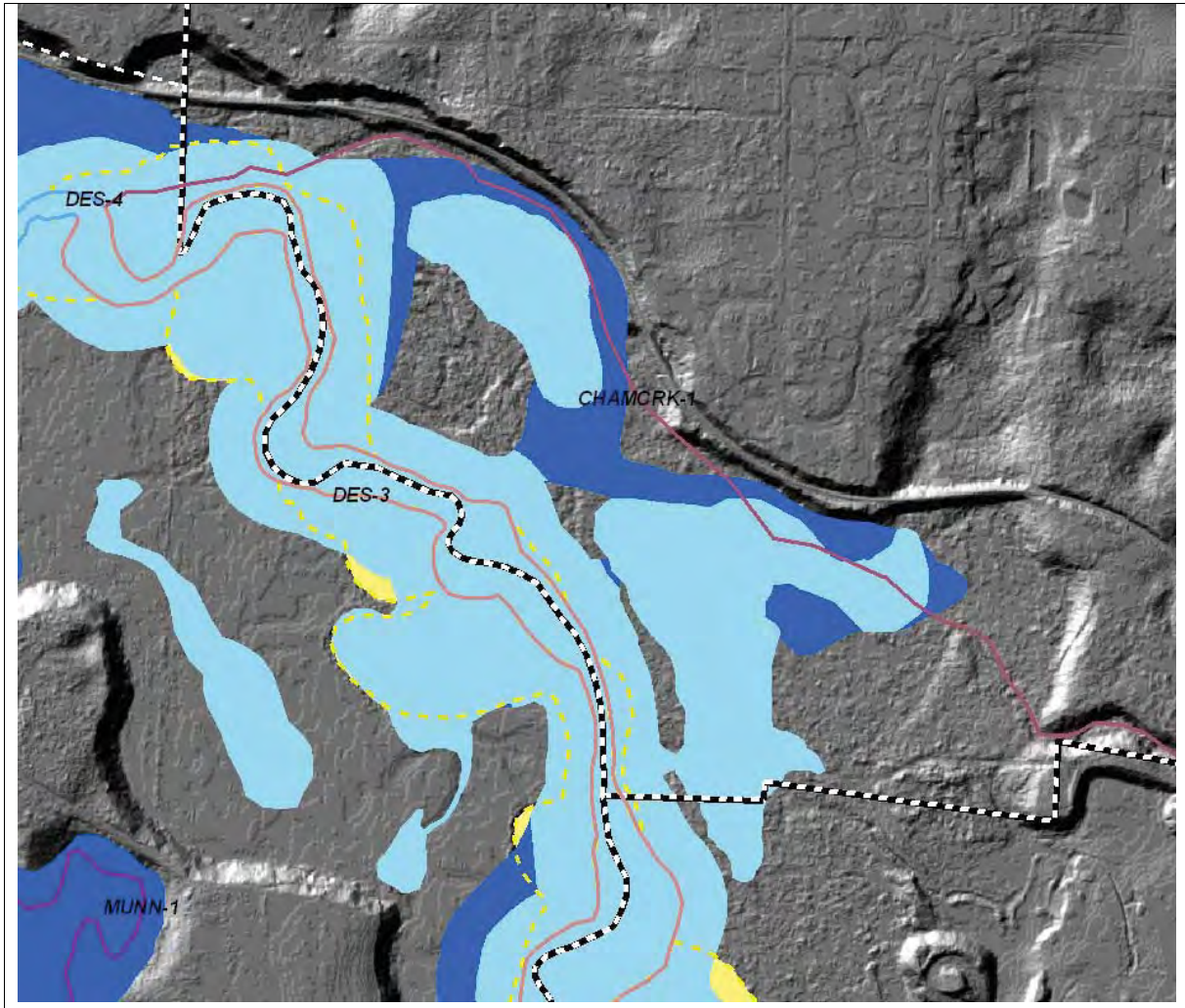

FIGURE A - 9(D) : 100 YEAR FLOODPLAIN COMPARED TO MINIMUM JURISDICTION AND CHANNEL MIGRATION ZONE – REACH 3 NORTH

100-YEAR FLOODPLAIN IS DARK BLUE
MINIMUM JURISDICTION IS LIGHT BLUE
CMZ IS BRIGHT YELLOW

URBAN GROWTH AREA LINE SHOWN IN DASHED BLACK AND WHITE. CITY LIMITS SHOWN IN DASHED WHITE LINE.

RURAL COUNTY IS TO THE SOUTHEAST OF THE RIVER AND OUTSIDE OF THE STUDY AREA.

OVERLAIN ON 2002 LIDAR-DERIVED ELEVATION.

SCALE APPROX 1:6,215

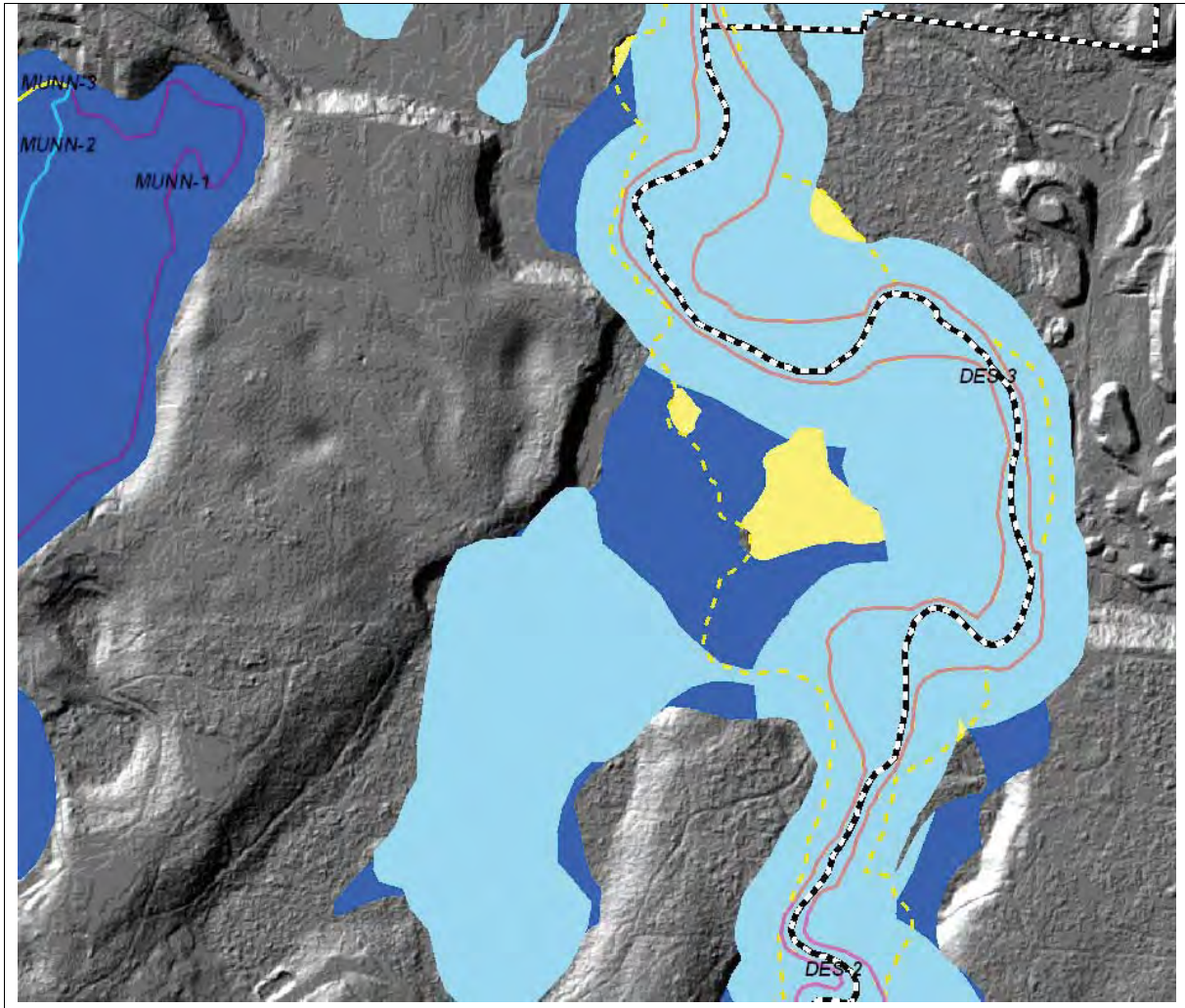

FIGURE A - 9(E): 100 YEAR FLOODPLAIN COMPARED TO MINIMUM JURISDICTION AND CHANNEL MIGRATION ZONE – REACH 3 SOUTH

100-YEAR FLOODPLAIN IS DARK BLUE
MINIMUM JURISDICTION IS LIGHT BLUE
CMZ IS BRIGHT YELLOW

URBAN GROWTH AREA LINE SHOWN IN DASHED BLACK AND WHITE. RURAL COUNTY IS TO THE EAST OF THE RIVER AND OUTSIDE OF THE STUDY AREA.

OVERLAIN ON 2002 LIDAR-DERIVED ELEVATION.

SCALE APPROX 1:6,215

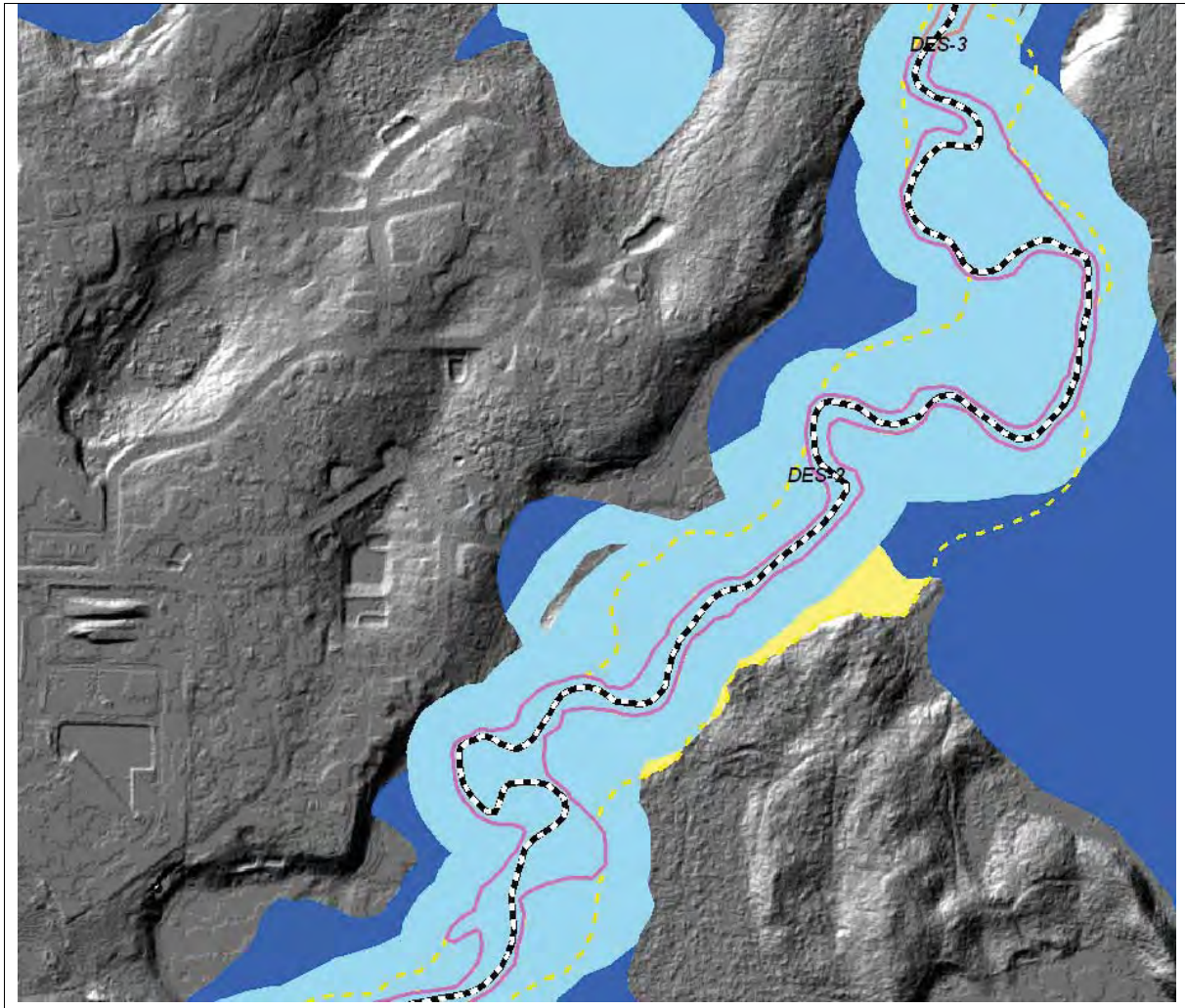

FIGURE A - 9(F) : 100 YEAR FLOODPLAIN COMPARED TO MINIMUM JURISDICTION AND CHANNEL MIGRATION ZONE – REACH 2 NORTH

100-YEAR FLOODPLAIN IS DARK BLUE
MINIMUM JURISDICTION IS LIGHT BLUE
CMZ IS BRIGHT YELLOW

URBAN GROWTH AREA LINE SHOWN IN DASHED BLACK AND WHITE. RURAL COUNTY IS TO THE EAST OF THE RIVER AND OUTSIDE OF THE STUDY AREA.

OVERLAIN ON 2002 LIDAR-DERIVED ELEVATION.

SCALE APPROX 1:6,215

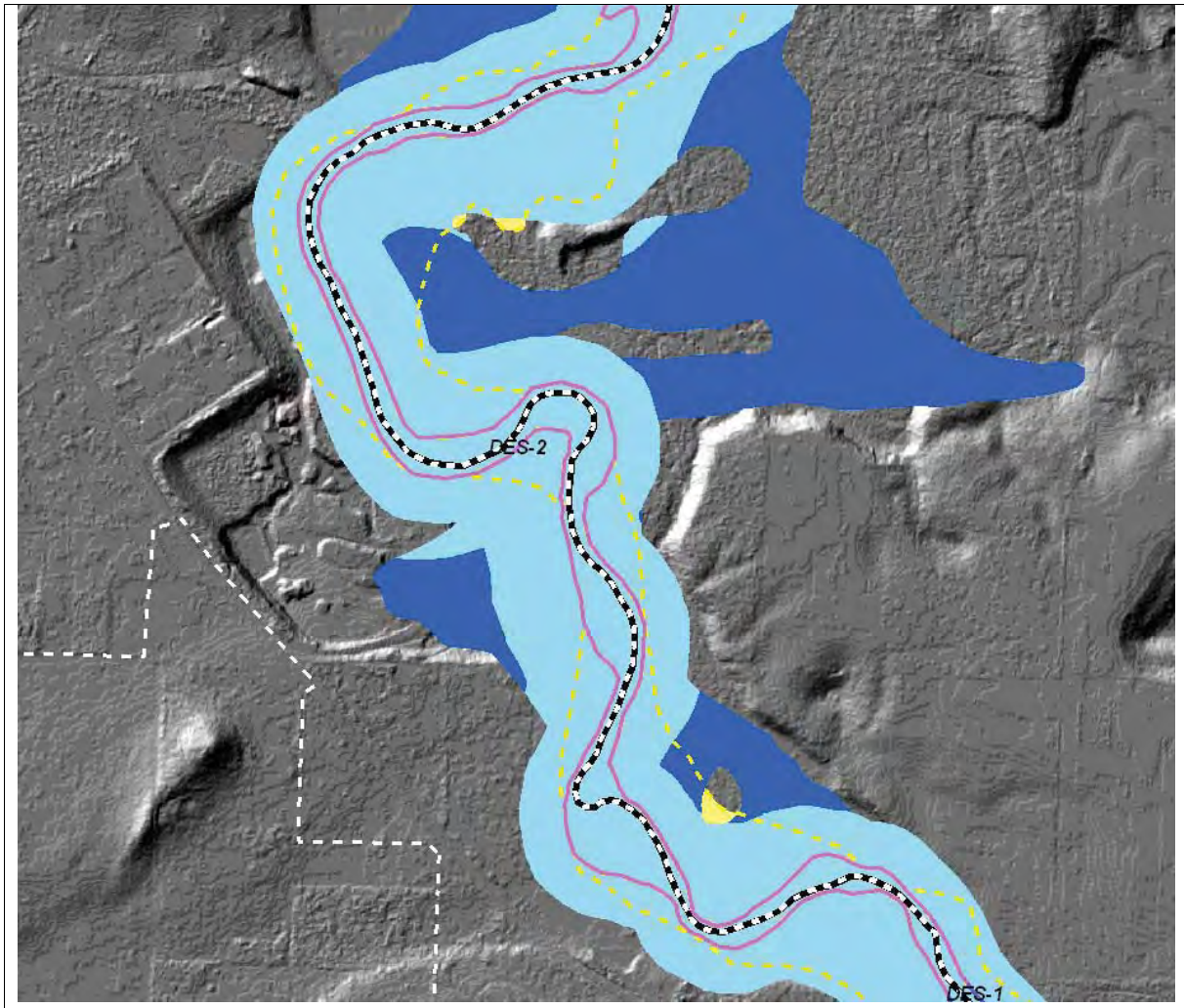

FIGURE A - 9(G): 100 YEAR FLOODPLAIN COMPARED TO MINIMUM JURISDICTION AND CHANNEL MIGRATION ZONE – REACH 2 SOUTH

100-YEAR FLOODPLAIN IS DARK BLUE
MINIMUM JURISDICTION IS LIGHT BLUE
CMZ IS BRIGHT YELLOW

URBAN GROWTH AREA LINE SHOWN IN DASHED BLACK AND WHITE. RURAL COUNTY IS TO THE EAST OF THE RIVER, AND OUTSIDE OF THE STUDY AREA.

OVERLAIN ON 2002 LIDAR-DERIVED ELEVATION.

SCALE APPROX 1:6,215

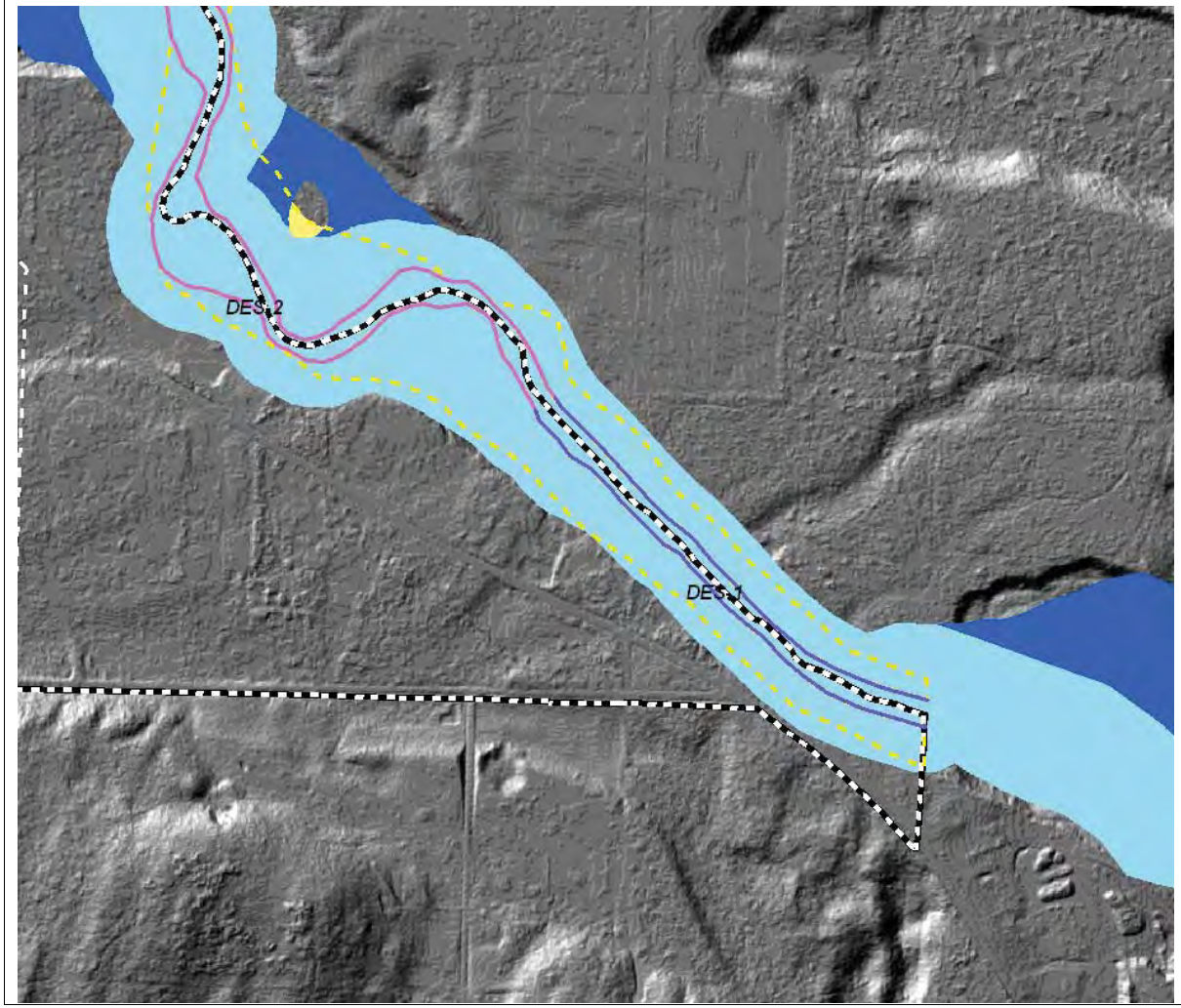

FIGURE A - 9(H): FLOOD PLAIN - DESCHUTES RIVER REACH 1

THE 100 YEAR FLOOD PLAIN (SHOWN IN DARK BLUE) IS COMPLETELY WITHIN MINIMUM JURISDICTION FOR REACH 1.

CMZ OUTER LINE SHOWN IN DASHED YELLOW.

URBAN GROWTH AREA LINE SHOWN IN DASHED BLACK AND WHITE. RURAL COUNTY IS TO THE EAST OF THE RIVER, AND OUTSIDE OF THE STUDY AREA.

OVERLAIN ON 2002 LIDAR-DERIVED ELEVATION.

SCALE APPROX 1:6,215

III. Reach Break Methodology and Results

A. Overview

Reach breaks were developed by ESA Adolphson working in conjunction with TRPC staff, and with the Scientific and Technical Advisory Group review.

Main data sources used to develop the reach breaks included:

- Draft minimum SMA jurisdiction map developed by the TRPC;
- WA DNR shorezone mapping (2000);
- Recent (2006) NAIP aerial photography;
- WA DNR hydro streams GIS layer;
- The Draft Shoreline Inventory (TRPC, 2008); and
- The Capitol Lake Sediment Transport Study (USGS, 2006).

Lakes

In general, shoreline lakes in Lacey, Olympia and Tumwater area were considered to be each one reach. Most of the lakes within the study area have relatively consistent surrounding land uses, and generally homogenous morphologies. Reach breaks were assigned for lakes if:

1. There was a mapped inlet and outlet channel;
2. A city boundary ran along or through the lake (e.g., Chambers Lake);
3. Distinct land use and/or critical areas (e.g., wetlands or floodplains)

Capitol Lake was treated differently, and was broken into several segments (south, middle, north, and Percival Cove) to be consistent with past work. These breaks also constitute constructions in the lake.

TABLE A - 6: LAKE REACHES IN WITHIN LACEY, OLYMPIA AND TUMWATER URBAN AREAS

Lake	Reach ID	Reach Description
Capitol	CAP-1	East side of southern basin
	CAP-2	West side of southern basin
	CAP-3	East side of middle basin
	CAP-4	West side of middle basin
	CAP-5	Percival Cove
	CAP-6	East side of northern basin
	CAP-7	West side of northern basin
Long Lake	LONG-1	Residential area in north basin
	LONG-2	Residential area in south basin
	LONG-3	Residential, wetland area, and inlet channel/ditch in south basin
	LONG-4	Residential area in south basin
	LONG-5	Residential area in north basin
	LONG-6	Wetland and outlet channel in north basin.
Chambers Lake	CHAM-1	Eastern basin
	CHAM-2	Less developed portion, generally within Olympia
	CHAM-3	Developed portion, generally within Lacey.
Black	BLK-1	Less developed portion in southeast portion of lake
	BLK-2	Residential portion of northeast portion of lake.
Trosper	TROS-1	
Barnes	BARNES-1	
Ken	KEN-1	
Grass	GRASS-1	
Munn/Susan	MUNN-1	East side of Munn Lake
	MUNN-2	West side of Munn Lake
	MUNN-3	Susan Lake
Ward	WARD-1	
Hewitt	HEW-1	
Bigelow	BIG-1	
Southwick	SOU-1	
Hicks	HICKS-1	Wetland along south rim
	HICKS-2	Residential area
Pattison	PAT-1	Residential area north of road crossing
	PAT-2	Residential area in southwest portion
	PAT-3	Less developed and wetland area
	PAT-4	Mix of residential and wetland area, including outlet.

B. Rivers

Reach breaks were typically assigned along river shorelines at:

1. Confluences of major tributaries;
2. City or UGA boundaries; and/or
3. Major morphologic breaks (e.g., Tumwater Falls on the Deschutes).

Reach breaks along the Deschutes River have been developed as part of several past reports (e.g., McNichols 1984, Collins 1994, Anchor 2008, etc.) These reach breaks were reviewed for applicability to the SMP process, and some were used, but in general it was found that they were either (1) not resolved enough in the case of Collins and Anchor, or (2) resulted in too many reaches to allow for meaningful comparisons along the portion of the channels within the study area (as was the case for the McNichols reach breaks.) The purpose of the McNichols reach breaks was to group together areas with "relatively homogenous physical characteristics ranging in length from a quarter mile to three miles." (McNichols, 1984 page 19). The McNichols study identified 12 breaks within the study area, ranging in distance between 1,300 feet and 10,000 feet long. The McNichols study was geared toward an overall assessment of channel condition, sediment sources, and resulting in overall estimate of sediment production throughout the watershed.

Seven reach breaks were assigned along the Deschutes to capture either (1) significant shifts in morphology, most often using sinuosity or belt width, or (2) land use (e.g., golf course), or (3) major profile breaks (e.g., Tumwater Falls).

TABLE A - 7: RIVER REACHES IN THE OLYMPIA, LACEY, AND TUMWATER URBAN AREAS.

Waterbody	Reach	Rationale
Deschutes	DES-1	UGA boundary to end of straight reach
	DES-2	Meandering reach to tributary confluence
	DES-3	Tributary confluence to Chambers Creek Confluence
	DES-4	Meandering reach between Chambers Creek confluence to the golf course
	DES-5	Golf Course
	DES-6	Golf Course to Tumwater Falls
	DES-7	Falls to South Basin of Capitol Lake
Woodland Creek	WOOD-1	I-5 to confluence with tributary
	WOOD-2	Tributary to UGA boundary
Black Lake Drainage Ditch	BLDD-1	Black Lake Drainage Ditch in wetland from Black Lake to Mottman Road
	BLDD-2	Black Lake Drainage Ditch in ravine from Mottman Road to Percival Creek confluence
Percival Creek	PC-1	Downstream of confluence with Black Lake Drainage Ditch to Percival Cove
Chambers Creek	CHAM-1	Extent of SMA jurisdiction to Deschutes River

C. Marine

Reach breaks were assigned along the marine shoreline at:

1. Major shorezone unit boundaries as mapped by WA DNR; and/or
2. Major land use shifts.

Not all shoreline units were used to break our reaches, but all of our reach breaks occurred at or very close to a shoreline unit break. Examples where we did not assign a reach break on a shoreline unit boundary included: shoreline unit boundaries that appeared to be based on a similar British Columbia coastal class unit (e.g., "sand beach" to "sand flat").

TABLE A - 8: MARINE REACHES IN THE LACEY AND OLYMPIA URBAN AREAS.

Waterbody	Reach	Rationale
Budd Inlet	BUDD-1	UGA boundary to shorezone unit boundary
	BUDD-2	Shorezone unit boundary to unit boundary at marina
	BUDD-3	Marina to Capitol Lake
	BUDD-4	Capitol Lake mouth, including the existing dam
	BUDD-5	Capitol Lake to shorezone unit (Port Peninsula
	BUDD-6	Head of East Bay
	BUDD-7	Residential Area along east side of East Bay
	BUDD-8	Ellis Cove and Priest Point
Nisqually	NIS-1	UGA/City boundary to Drift cell, near Shorezone unit break, and land use break at Mallard Cove
	NIS-2	Mallard Cove to UGA boundary, lumps one shorezone boundary