

# TECHNICAL MEMORANDUM

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Date: July 22, 2020  
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Project Name: Kittitas County CAO Update  
Project Number: 181229

## Subject: Recommendations for Riparian Management Zones Widths

The purpose of this memorandum is to provide Kittitas County with The Watershed Company's recommended widths for Riparian Management Zones (RMZs) along streams protected by the County's Critical Areas Regulations (Kittitas County Code Title 17A). The Watershed Company has evaluated peer review literature and guidelines by the Washington Department of Fish and Wildlife (WDFW) to provide the County with up-to-date and regionally specific recommendations. The following discussion is primarily guided by WDFW's most recent guidance on RMZ science and recommendations outlined in Riparian Ecosystems, Volume 1 (Quinn et al. 2018) and Volume 2 (Windrope et al. 2018).

### Riparian Management Zone Widths Based on Ecoregion

The guidance published by WDFW heavily emphasizes a shift in terminology from referencing protected riparian areas as "stream buffers" to "riparian management zones (RMZs)." An RMZ is defined as "...a scientifically based description of the area adjacent to rivers and streams that has the potential to provide full function based on the SPTH [site potential tree height] conceptual framework." This differs from the use of "buffer(s)," as an RMZ is by definition wide enough to potentially provide full riparian function, while "buffers" are established through policy decisions designed with the intention of protecting streams, and not necessarily providing full riparian function.

The guidance published by WDFW relies on a synthesis of science related to the site potential tree height (SPTH) concept. The SPTH of an area is defined as "...the average maximum height of the tallest dominant trees (200 years or more) for a given site class." In areas that are not

forested or very sparsely forested, using SPTH to determine RMZ widths is not applicable. Volume 2 (Windrope et al. 2018) of the WDFW's guidance recommends determining RMZ widths in non-forested landscapes like the Columbia Plateau by determining the widest area necessary that provides the following three riparian functions: shade, wood recruitment (large and small), or pollutant removal.

Kittitas County has a wide-ranging landscape that includes forested mountains and foothills in the west and the semi-arid Columbia Plateau characterized by its shrubs and grasses, also referred to as a shrub steppe ecosystem, in the east. Therefore, the county can be divided into two general ecoregions: the forested Cascade Ecoregion – includes parts of the North Cascades, Cascades, and Eastern Cascade Slopes and Foothills; and the Columbia Plateau Ecoregion. We recommend designating and managing RMZs within these two ecoregions separately due to their differing plant communities and ecology.

## Cascade Ecoregion

As previously outlined, the Cascade Ecoregion covers the western portion of Kittitas County and is characterized by its coniferous forests. Volume 2 (Windrope et al. 2018) of the WDFW's guidance recommends two pathways for determining SPTH in forested areas. The first method uses the Washington Department of Natural Resources (WDNR) interactive maps of site productivity classes for all nonfederal and nontribal forestlands in Washington to determine the site class for a given area. The second method uses an interactive map of the Web Soil Survey (WSS) provided by the Natural Resources Conservation Service determines the site index for a given area. Both methods relate either the site class or site index to the SPTH of Douglas firs to determine the RMZ width of an area. We chose to use the WSS data provided by the Natural Resources Conservation Service to determine SPTH for Douglas-fir because it incorporates data from Eastern Washington (Cochran 1979), and the data can be extracted for analysis.

Table 1. Site-potential tree heights in feet by site index for interior (east side) Douglas-fir (Cochran 1979). Height equations in Cochran (1979) are only valid for stand ages less than 180-190 years because of growth patterns.

Site Index	Height at Age 180 to 190 Years
50	88
60	104
70	120
80	135

Site Index	Height at Age 180 to 190 Years
90	151
100	167
110	182

Figure 1 shows an example of the web soil surveys output with distinct soil types distinguished by their numbers and associated colors. The soil types determine the productivity or site index of the area. As shown in Figure 1, the data is very detailed and it can be hard to determine site indexes for large areas. We extracted the data from the WSS website into an Excel file and determined what percentage of the county fell within each site index category (Table 1).

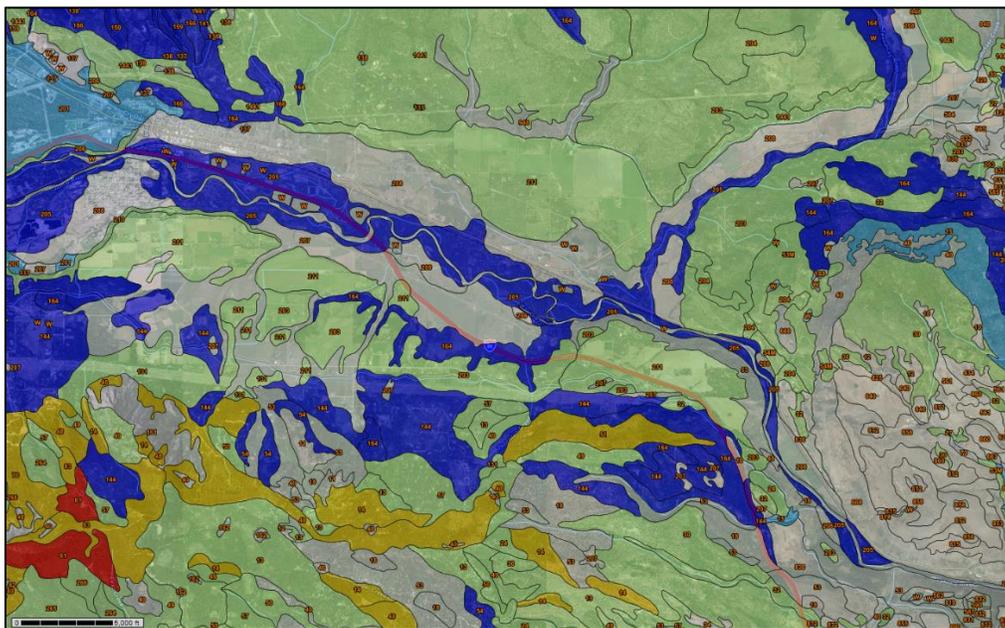


Figure 1. Screen shot of the WSS along the Yakima River from the east side of Cle Elum past Teanaway.

Table 2. Synthesized WSS data of Kittitas County, it does not add up to 100% as 43.4% of County's area does not have a site index (i.e., semi-arid areas).

Site Index	Height at Age 180 to 190 Years	Percent of County
50	88	2.90%
60	104	18.40%
70	120	7.40%
80	135	10.10%

Site Index	Height at Age 180 to 190 Years	Percent of County
90	151	2.40%
100	167	0%
110	110	0%
<b>Total</b>		<b>56.6%</b>

Based on the WSS data and using site class categories on WDNR's interactive map to verify the approximate numbers, a RMZ width of 150 feet would be sufficient to protect riparian functions along Type F streams in the Cascade Ecoregion of Kittitas County.

## Columbia Plateau Ecoregion

The Columbia Plateau Ecoregion is within the eastern half of Kittitas County and represents the semi-arid shrub-steppe ecosystem abundant along the Columbia River. As forested areas are rather sparse in this region, RMZs based on SPTH are not recommended. Volume 2 (Windrope et al. 2018) of the WDFW's guidance recommends using the widest necessary width to obtain adequate shade, wood recruitment (large and small), and pollutant removal to determine the appropriate width of the RMZ. Because shade and wood recruitment are reliant on vegetative height, they will have a narrower zone of influence than that of pollutant removal due to the general lack of forested areas in the Columbia Plateau.

Scientific literature is widely varied in regard to the width necessary for a vegetated buffer area to remove all or most of the pollutants contained in runoff. This variation is due to many factors including soil characteristics, vegetation type and composition, surrounding land use, rainfall, topography, and type of pollutant to name a few. The best available science review document prepared for Kittitas County in June of 2014 by Environmental Science Associates states,

*"Buffer widths reported for removal of pollutants, nutrients and chemicals can vary widely based on vegetation type, soil type, and slope. Knutson and Naef (1997) report that buffer widths ranging from 13 feet to more than 850 feet are adequate for nutrient reduction or removal depending on site conditions... Though there is a wide range of effective buffer widths reported in the literature, widths of 100 feet are generally sufficient for removing nutrient or bacterial pollution (Lynch et al., 1985; Terrell and Perfetti, 1989)."*

This seems to hold true throughout the literature, 33m or approximately 100 feet seems to be a common width known to remove a significant portion of pollutants from runoff (Mayer et al. 2007, Sweeney & Newbold 2014, and Zhang et al. 2010). A width of 100 feet is also a good median as the land uses within the eastern portion of the County are highly variable. It is important to mention that all existing farmland is subject to the County's Voluntary

Stewardship Program (VSP) and not these critical area regulations, resulting in most lands regulated under the critical areas ordinance being non-agricultural land uses. This is important because agriculture is the main intensive land use in the area and would provide the largest inputs of pollutants in the forms of manure, fertilizer, and pesticides, for example. Although fertilizers and pesticides are often used on rural residential properties, they are generally not at the levels associated with conventional farming practices and would be filtered by the proposed RMZ. When considering the literature and the land uses to be regulated by this code, it is our recommendation that an RMZ width of 100 feet be used for Type F streams within the Columbia Plateau Ecoregion.

## Summary of Final Recommendations

Due to the highly contrasting nature of the western and eastern halves of Kittitas County, the County is proposing to regulate stream riparian management zones (RMZs) within these two areas separately. The western forested region (comprised of the North Cascades, Cascades, and Eastern Cascade Slopes and Foothills Ecoregions) will be referred to hereafter as the Cascade Ecoregion with the eastern shrub-steppe region referred to as the Columbia Plateau Ecoregion. The County is able to do this based on maps containing the necessary information on local watersheds (subbasins) and ecoregions (Figures 2 & 3).

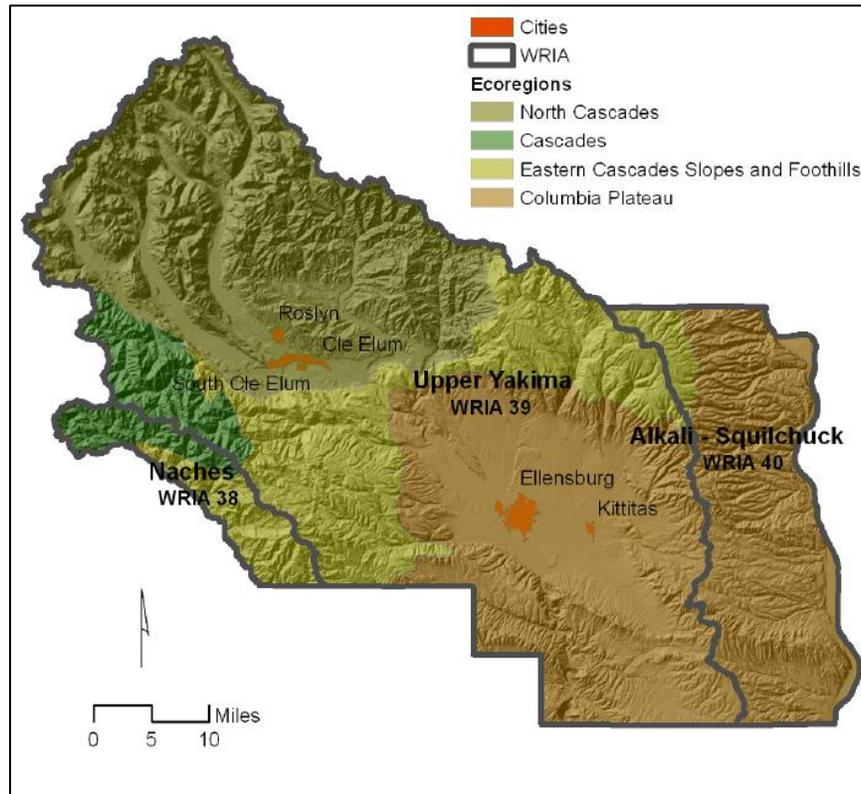


Figure 2. WRIA boundaries and ecoregions in Kittitas County (ESA, 2013).

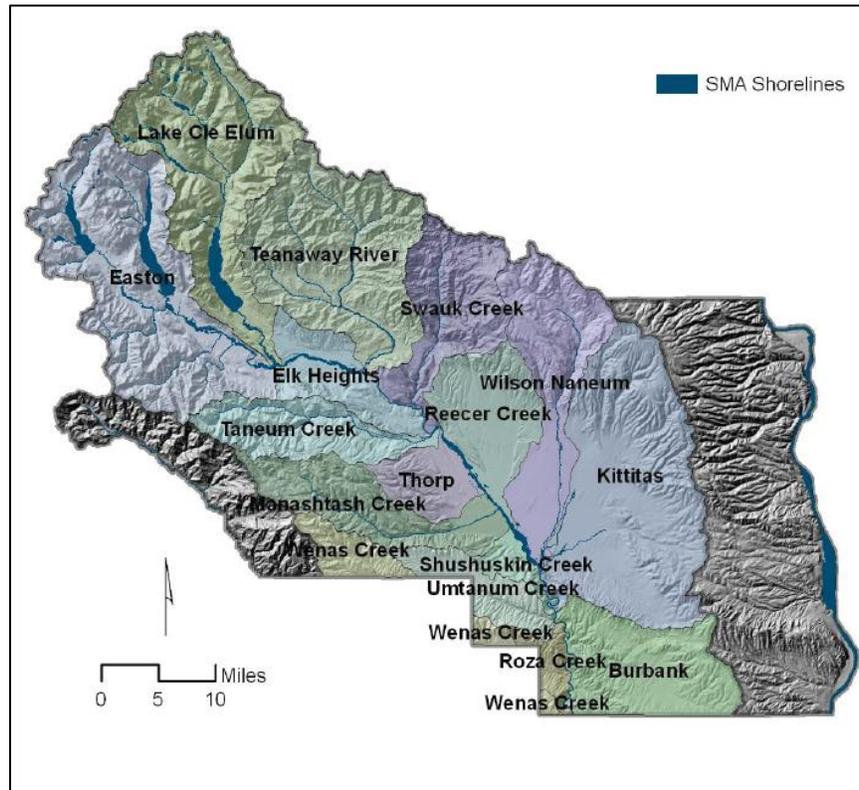


Figure 3. Subbasins of the upper Yakima basin (ESA, 2013).

The RMZ width for Type F streams for the Cascade Ecoregion were formulated using site potential tree height (SPTH) data from two databases, Washington Department of Natural Resources (WDNR) database for forestlands in Washington and the Web Soil Survey (WSS) provided by the Natural Resources Conservation Service (NRCS). The RMZ width for Type F streams in the Columbia Plateau Ecoregion is based on guidance provided by the Washington Department of Fish and Wildlife (WDFW) described in Volume 2 (Windrope et al. 2018) of their RMZ guidance and other best available science obtained from peer reviewed literature.

The RMZ widths for Type Np and Ns streams were derived from BAS pertaining to the protection of bank stability, riparian diversity, and stream health. WDFW (2018b) suggests RMZs at least 60% of SPTH (presumably where SPTH is applicable, i.e. in Cascade Ecoregion areas) to be protective of riparian ecosystems along non-fish bearing perennial and seasonal streams and recommends consultation with the appropriate regional habitat biologist when generating RMZ widths for these stream types. RMZs will be measured from the ordinary high water mark, as the county does not currently have the data to accurately establish channel migration zone areas. With the information obtained from peer reviewed literature and the

principles outlined in WDFW’s guidance on RMZs, we recommend the following RMZ widths to be implemented within Kittitas County’s critical areas regulations:

Table 3. Riparian Management Zone width recommendations for each ecoregion.

<i>Cascade Ecoregion RMZs</i>		<i>Columbia Plateau Ecoregion RMZs</i>	
<b>Stream Type</b>	<b>RMZ Width (ft)</b>	<b>Stream Type</b>	<b>RMZ Width (ft)</b>
Type S	See SMP	Type S	See SMP
Type F	150	Type F	100
Type Np	100	Type Np	65
Type Ns	50	Type Ns	40

## References

- Cochran, P. H. (1979). *Site index and height growth curves for managed, even-aged stands of Douglas-fir east of the Cascades in Oregon and Washington* (Vol. 251). Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station.
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