Section 1
Method for Determination of Adequate Shade Requirements on Streams

PART 1. STEPS

1. **Is any harvest planned within the inner zone of a riparian management zone** on a flowing Type 1, 2, or 3 water which is also within 75 feet of the bankfull width (BFW) or channel migration zone (CMZ) of the stream, whichever is greater? (See **WAC 222-30-040**). (Note: "flowing" refers to waters which are not seasonal, or dry from July - September.) (Note: In the case of exempt 20-acre parcels, the maximum width Riparian Management Zone as described under **WAC 222-30-023** is to be substituted for the inner zone within 75 feet of the bankfull width or CMZ in this and subsequent paragraphs). If the answer is no, the temperature method does not apply. If the answer is yes, proceed to step two.

2. **Determine whether harvest unit is in Eastern or Western Washington** relative to the Cascade divide.

   See map 1.1: Eastside/Westside (pg. M1-3)

   If harvest unit is in western Washington, apply the Temperature Screens beginning with step 4.

   If harvest unit is in eastern Washington, is it within the bull trout habitat overlay?

   If yes . . . proceed to step 3.

   If no . . . proceed to the Temperature Screens beginning with step 4.

3. **Bull Trout Habitat Overlay**: When the harvest unit is within the bull trout habitat overlay (eastside only), all available shade must be retained within 75 feet of the bankfull width or CMZ, whichever is greater. All available shade would be equivalent to the existing pre-harvest canopy closure, which is measured with the densiometer using the method described below. Proceed to steps 5 through 8.

   See map 1.2: Eastern Washington Bull Trout Overlay (pg. M1-4)

4. **Temperature Screens**: Determine the water quality stream temperature classification, 16 degrees C or 18 degrees C (**WAC 173-201A**). A map displaying this information is available from the Department of Natural Resources (DNR). Determine the elevation at the midpoint of the stream reach within the proposed harvest area. Apply this information to the following

nomographs (pgs. M1-4 and M1-5) to derive the minimum canopy (shade) required after harvest (see **WAC 222-30-040(2)**).

5. **To determine the average pre-harvest canopy closure** for the stream reach or CMZ, take evenly spaced plots every 75 feet. Begin 75 feet in from unit boundary. The minimum number of plots required is five. Average canopy closure for all plots taken to obtain average reach pre-harvest canopy closure.

6. **Determine the percent of canopy closure** at each plot while standing at the appropriate location described below:

   If there is a CMZ, stand at the edge of the CMZ.

   If there is no CMZ and the flows are low enough, stand in the middle of the channel. If flows are too high, stand at the edge of the BFW.

7. **How to use a densiometer for measuring canopy closure**: Hold the instrument level 12" - 18" in front of your body at elbow height. You should see the reflection of your head just outside of grid in the mirror. Assume four equal spaced dots in each square and systematically count dots equivalent to quarter-square canopy openings. Repeat this procedure four times per plot taking measurements while facing upstream, downstream, and at the right and left banks. Average the four dot counts per plot to get the percent canopy opening for the plot. Multiply the average number of dots by 1.04 and subtract the results from 100 to obtain the percent of area occupied by canopy. (For canopy openings greater than 50%, it may be easier to directly count the area covered by canopy.) Leaf-out must be estimated when leaves are not present.

8. **To estimate post-harvest canopy closure**, repeat the canopy closure calculations for all plots and take the average for the reach, this time estimating the effect of the proposed canopy removal. The crowns of individual trees must be identified visually by standing at one of the locations described in Step 6, and the effect of their removal on the percent canopy closure must be calculated. (It may be easier to flag the RMZ line and/or the desired post-harvest leave trees, at least at each plot, prior to estimating post-harvest canopy closure.)

9. **When outside the bull trout overlay**, harvesting within the inner zone on a flowing Type 1, 2, or 3 water, which is also within 75 feet of the bankfull width or CMZ of the stream, whichever is greater, cannot reduce canopy closure below the minimum derived from the nomograph in Step 4. Leave trees may be selected in different combinations to meet canopy closure requirements, provided the RMZ leave tree requirements are also met (**WAC 222-30-021 and 022**).

10. **Where the existing pre-harvest canopy closure is less than the amount required from the nomograph**, all available shade must be retained within 75 feet of the bankfull width or CMZ, whichever is greater. (See definition for “all available shade” in Step 3.) Where the projected post-harvest canopy closure is less than the nomograph requires, proposed canopy removal must be reduced accordingly until the required canopy closure is met.

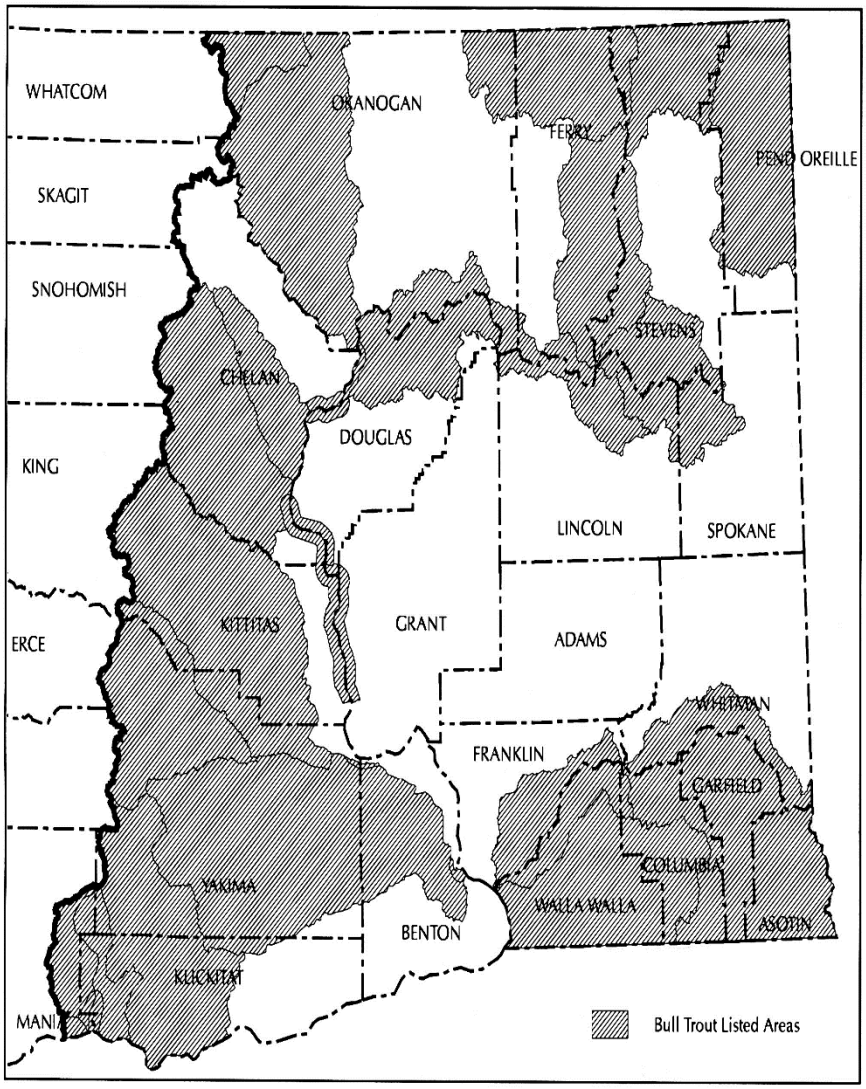
11. **Water Quality Standards:** If natural conditions exceed water quality temperature standards (16 or 18 degrees C, according to class of water), then no management-related temperature increases over 0.3 degrees C will be allowed. If water quality temperature standards are being met, then no management-related temperature increase can exceed 2.8 degrees C; however, in no case, can the temperature go above either 16 or 18 degrees accordingly. Determine if the harvest will remove more than 25% canopy cover. If so, the "TFWTEMP" computer model (current version approved by the Board) should be run to determine if the maximum allowable water temperature increase will be exceeded. To use the TFWTEMP computer model contact the Washington Department of Ecology or DNR.

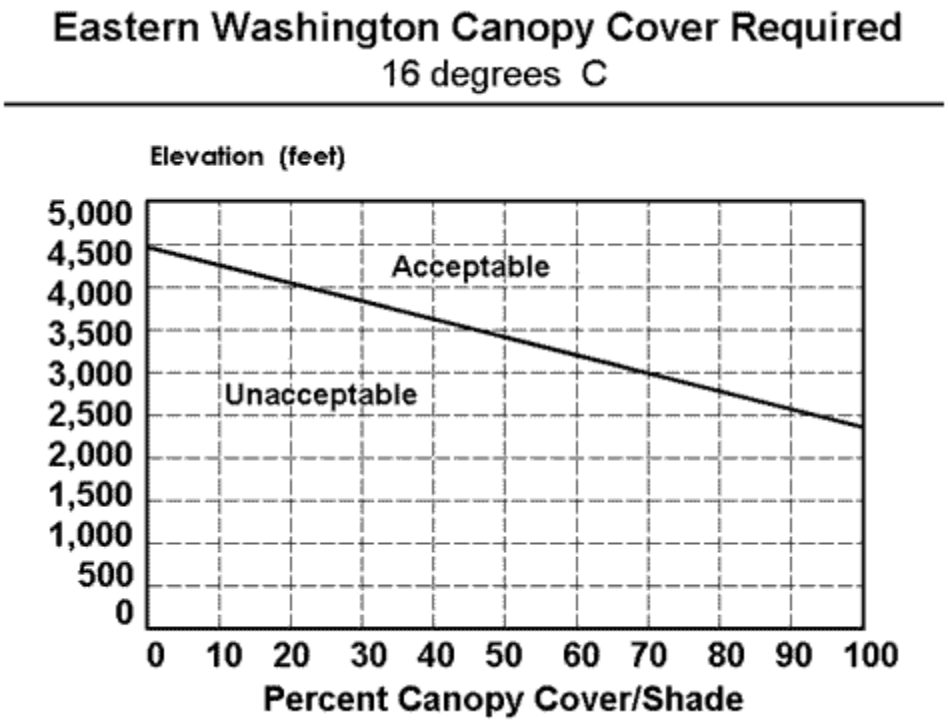
12. **The nomograph and model used in this method are empirically based tools**. As new data becomes available and is reviewed by CMER, or water quality standards change, these tools may be updated and modified by the Board.

Map 1.1: Eastside/Westside

Map 1.2: Eastern Washington Bull Trout Overlay

Bull Trout Overlay Map





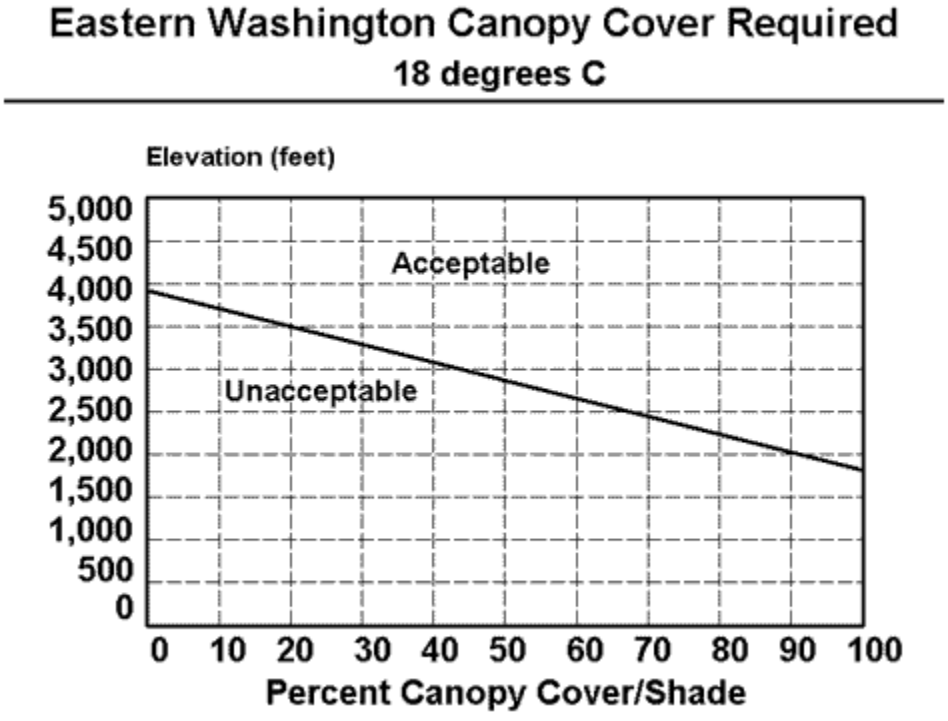
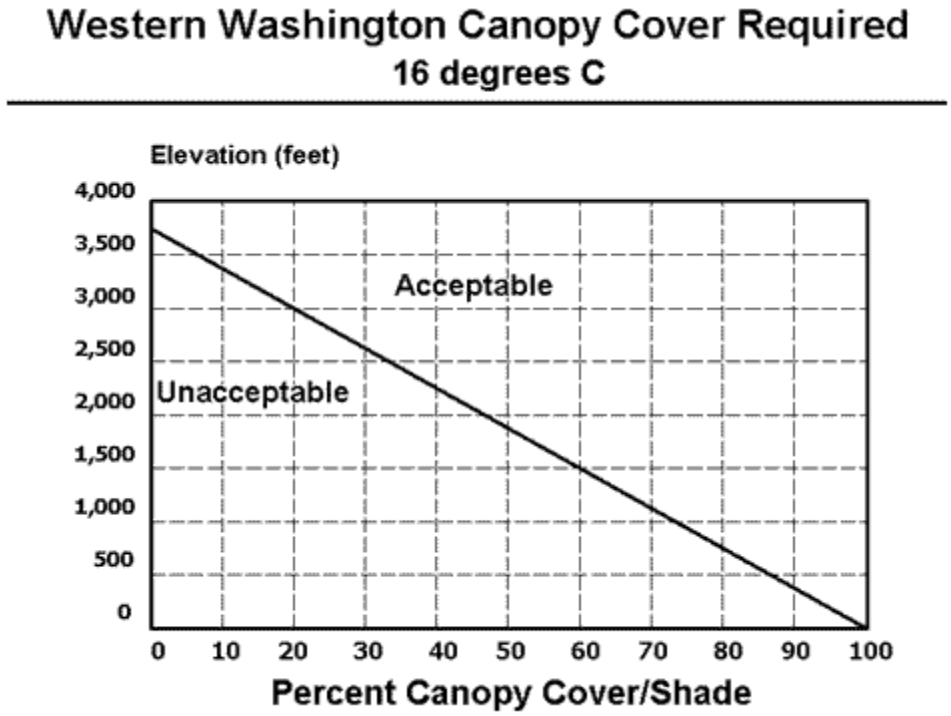


Figure 1.1 Eastern Washington



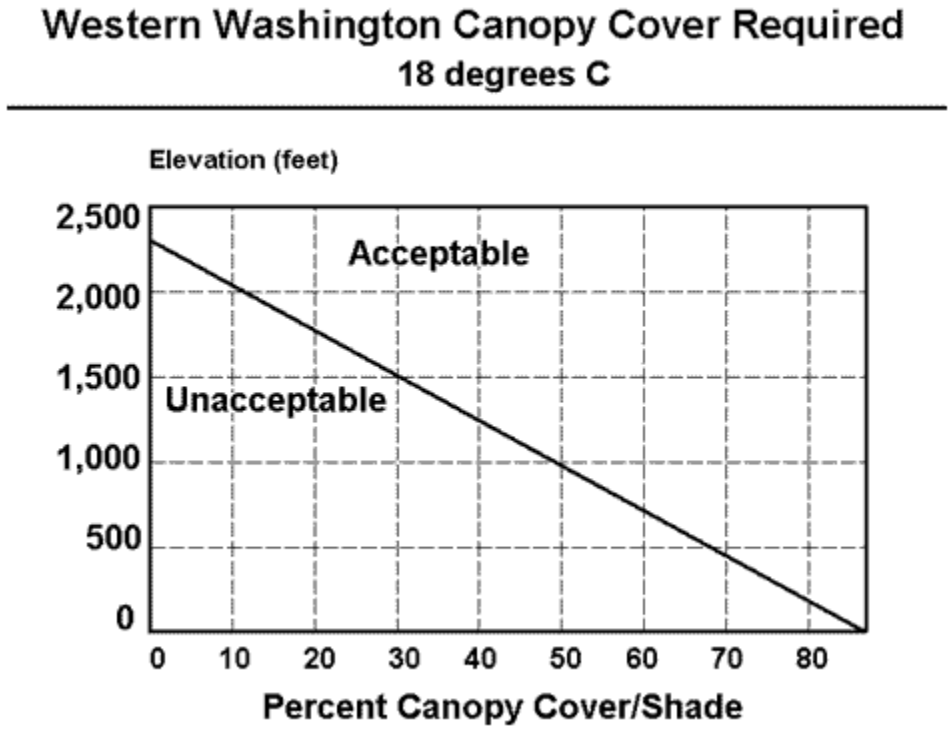


Figure 1.2 Western Washington