

Middle Snake Watershed (WRIA 35)

Tucannon River Temperature Investigation – Model Results

June 13, 2006



Modeling Steps

- Temperature model was developed and calibrated to monitoring data to demonstrate that the model is reliable
- Temperature model scenarios run to evaluate effects of riparian shading:
 1. **Current Shade** - “Current conditions” riparian shading
 2. **No Shade** - No riparian shading, topography only
 3. **Full Shade** - Full improvement of riparian shading = “natural conditions” for many TMDL studies
- Modeling follows similar procedures and scenarios used in temperature TMDLs

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Summary of Model Results

- Current shading is effective at cooling water temperature
- Improved riparian shading could lower water temperature by 3 to 4 °C (about 7 °F)
- Water temperature would still be above criteria with full riparian shading for most of river
- Current temperatures in the river are more than the allowed amount above natural conditions temperatures
- Full shade temperatures represent temperature criteria and achievable temperatures for the river

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Model Results

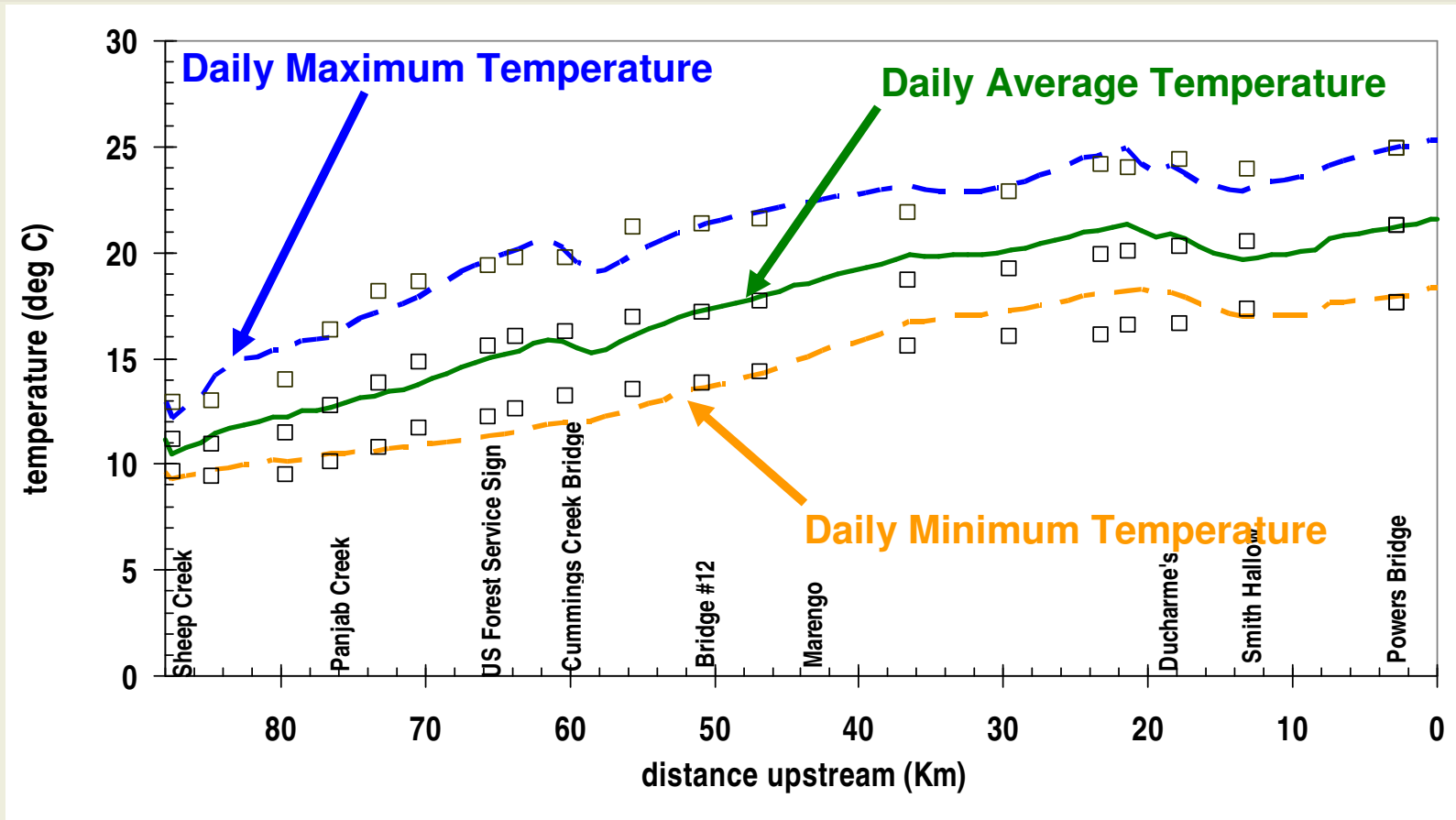
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Tucannon River Model

- **Model Extent:** Sheep Creek confluence to mouth
- **Model Output:** Daily minimum, average, and maximum temperatures
- **Model Simulation Condition:** High summer temperatures and low flow to represent “critical conditions” used in TMDL studies

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Current Tucannon Temperature Conditions



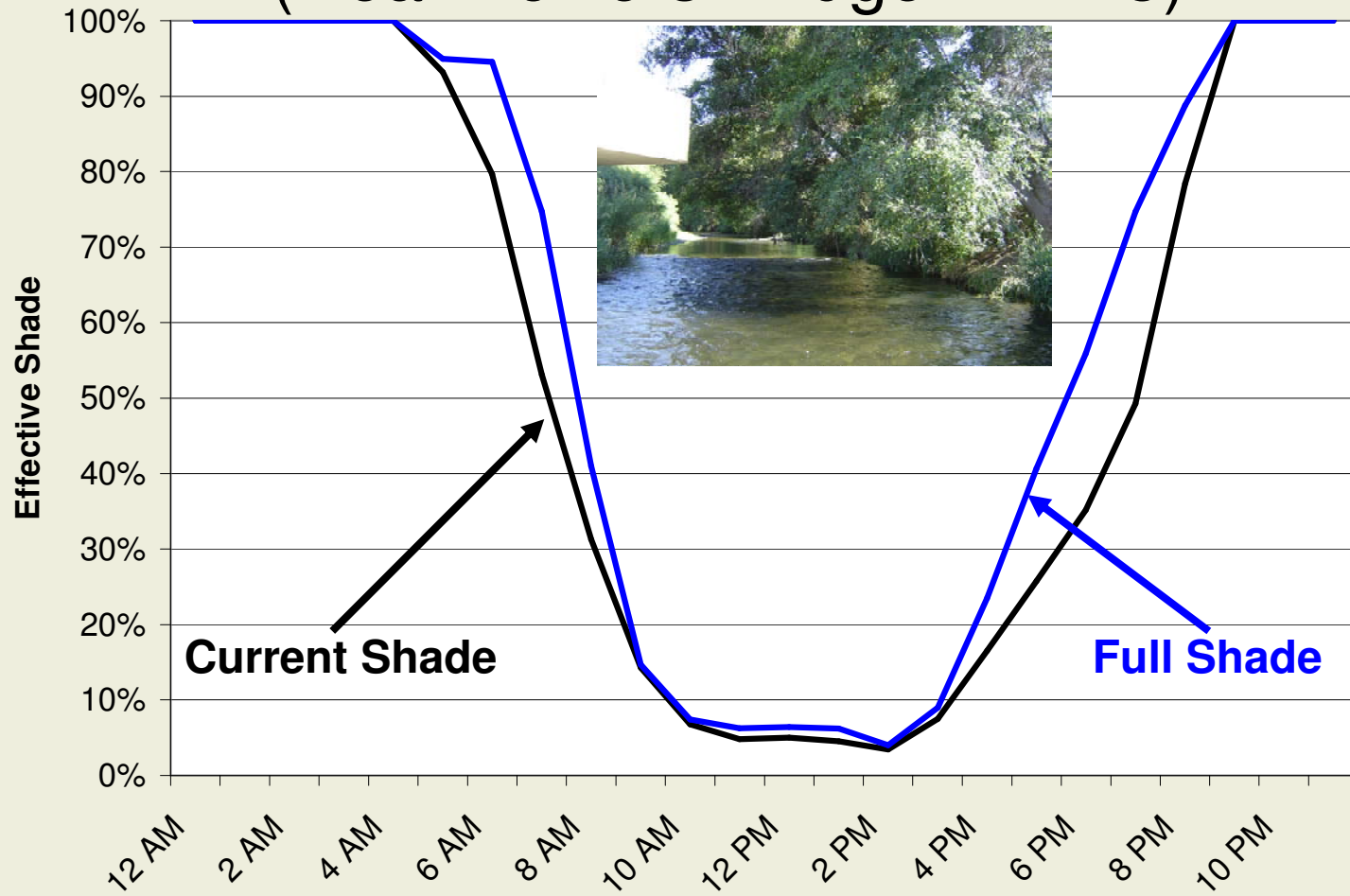
Daily temperature difference, about 3 - 4 °C (7 °F) in headwaters to about 7 °C (12 °F) through the lower 60 km

How is shade* represented for current and full shade conditions?

***Effective Shade = the proportion of potential solar radiation blocked by topography and riparian vegetation**

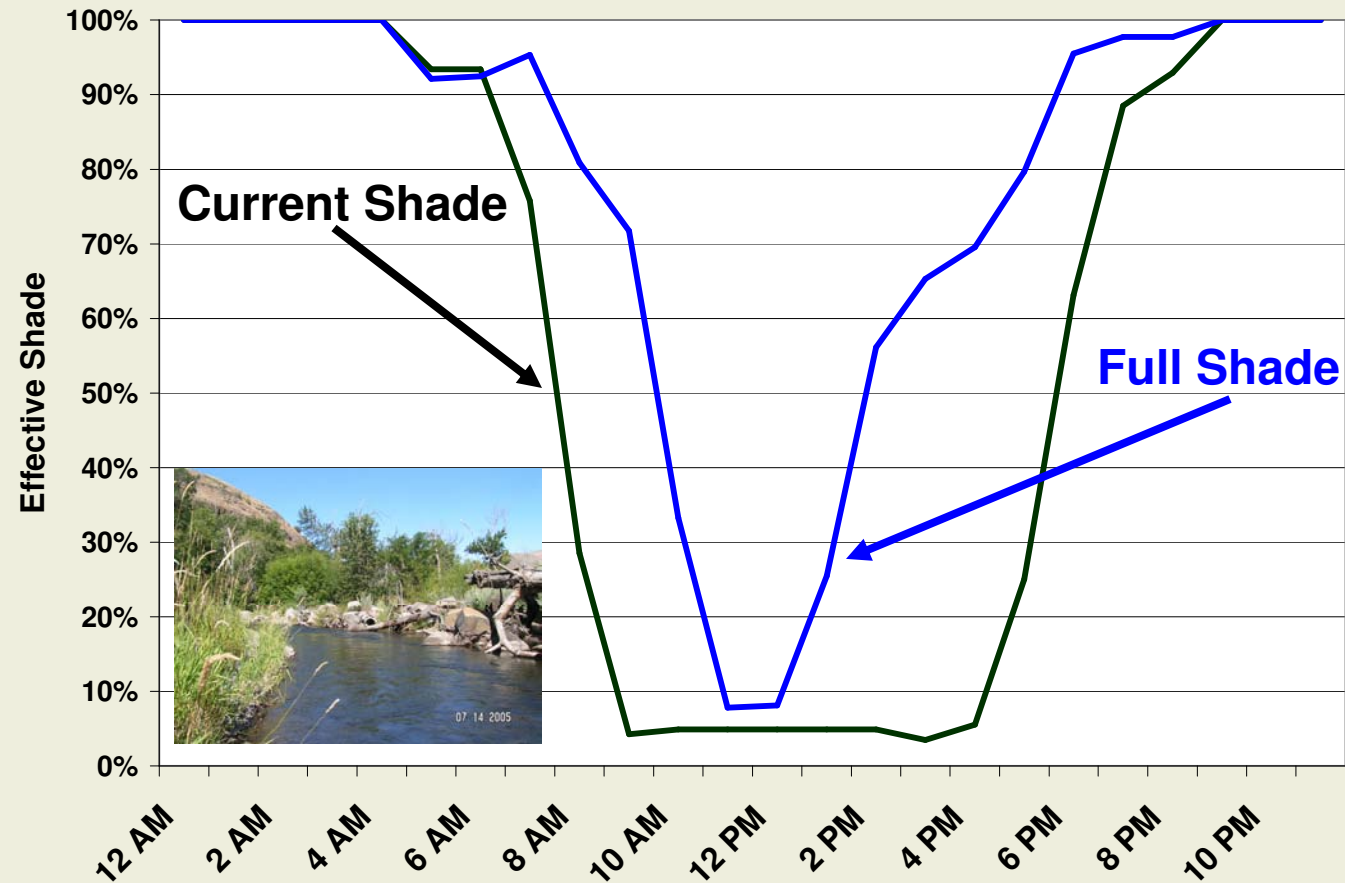
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Lower Tucannon River Shade (Near Powers Bridge – RK 3)



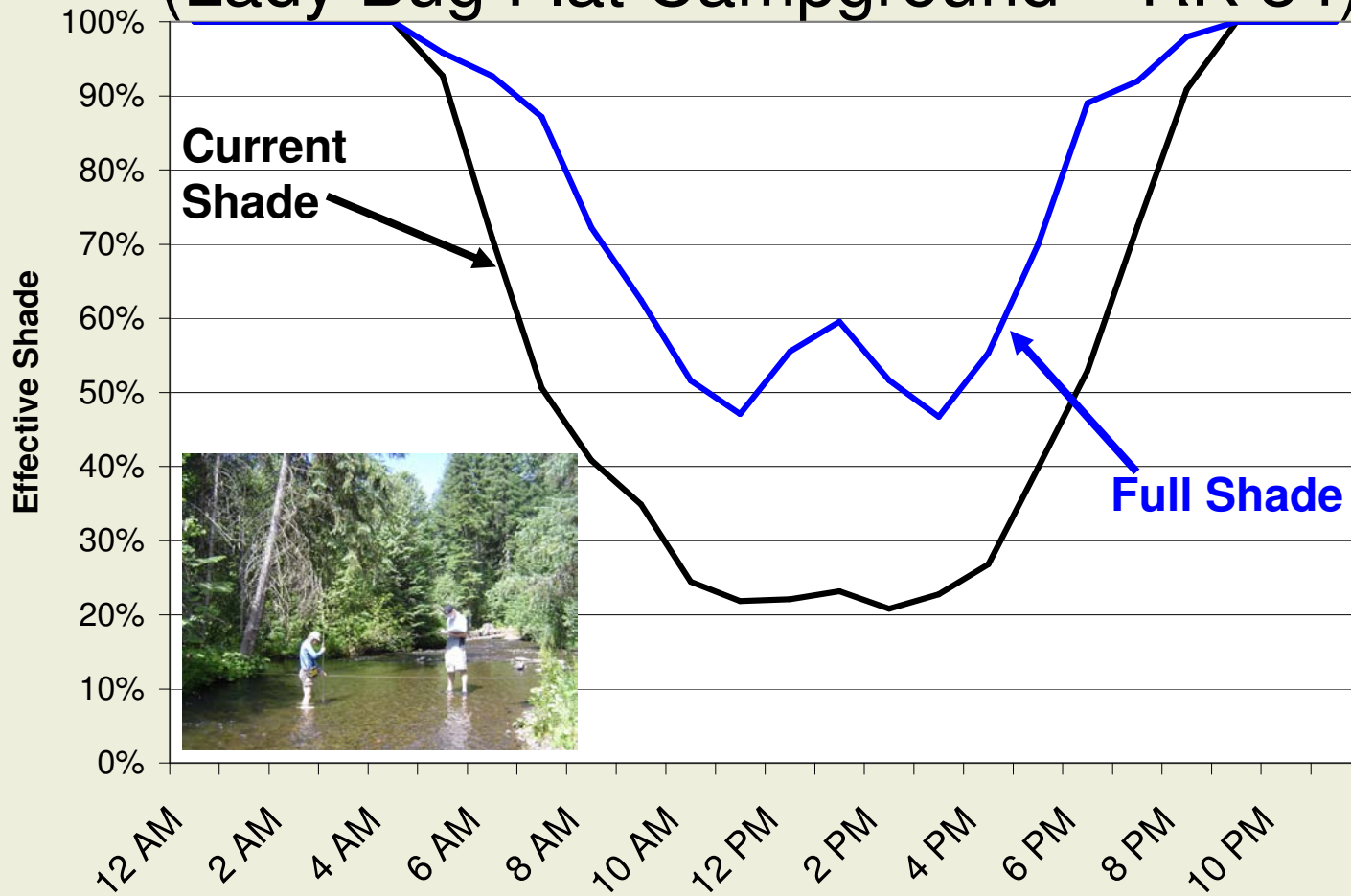
Current and full shade levels are similar for the lower 14 miles.

Middle Tucannon River Shade (Marengo – RK 43)



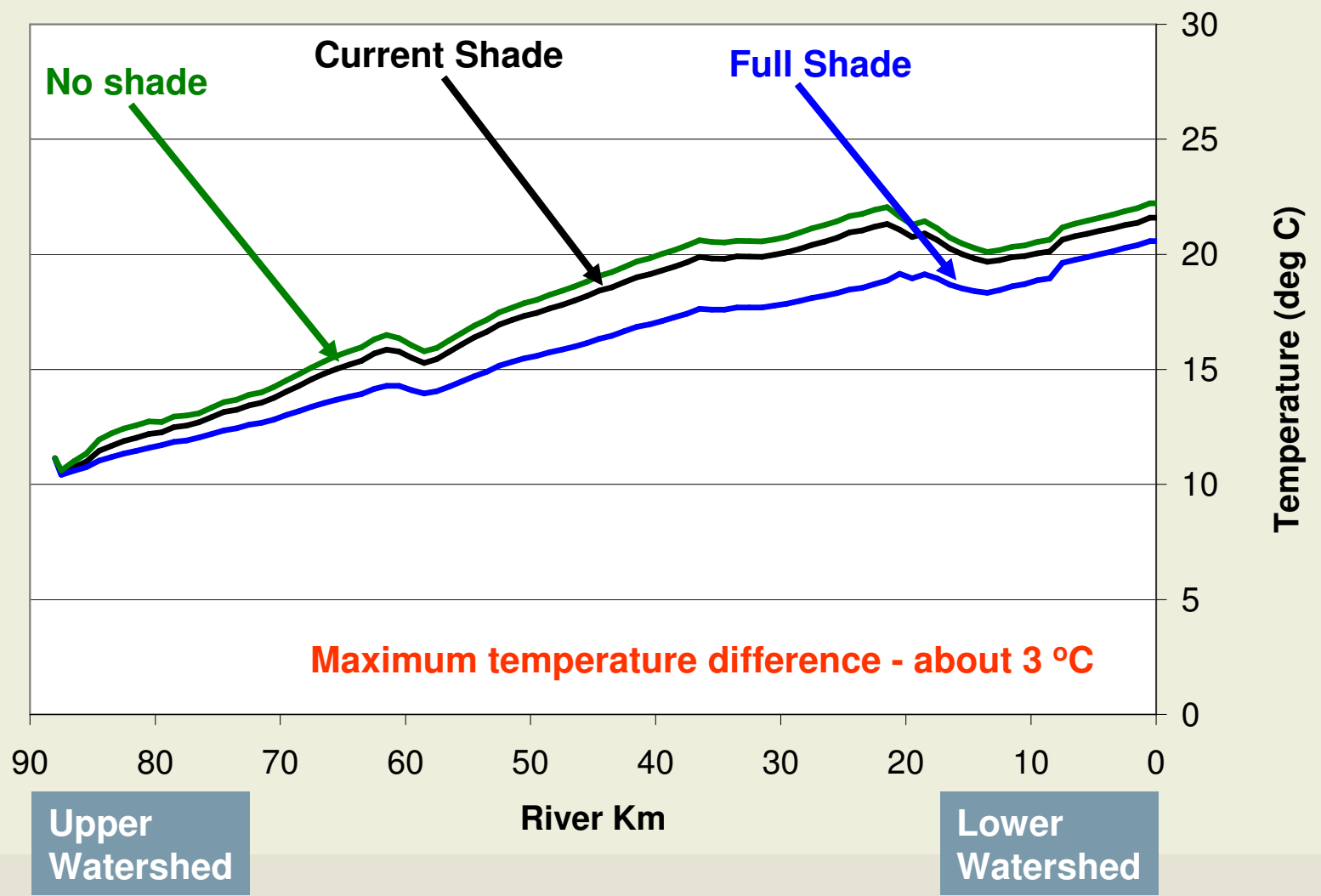
Current Riparian Shade < 20 % shade between 9 am and 5 pm (8 hours)
Full Riparian Shade < 20 % shade between 11 am and 2 pm (3 hours)

Upper Tucannon River Shade (Lady Bug Flat Campground – RK 84)

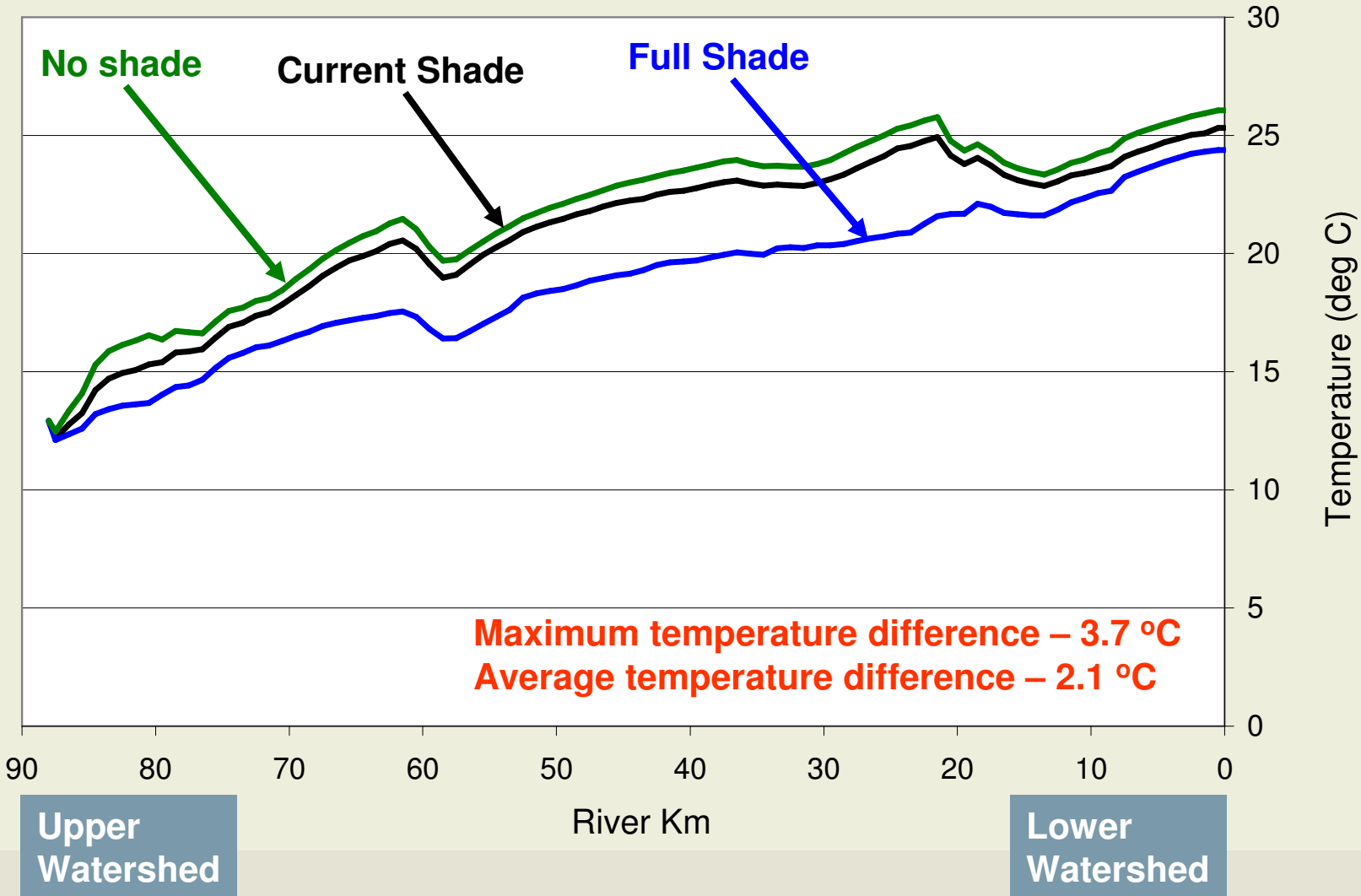


Current Riparian Shade: < 40 % shade between 10 am and 5 pm (7 hours)
Full Riparian Shade: not less than 40 % shade

Modeled Daily Average Tucannon River Temperatures



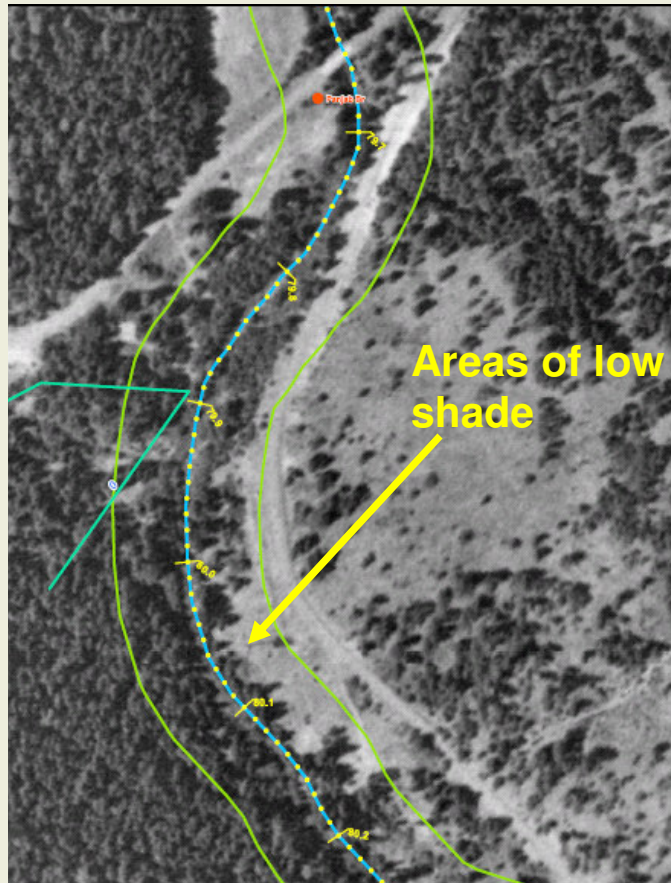
Modeled Daily Maximum Tucannon River Temperatures



Why is full shade scenario cooler than current forested conditions in the upper watershed?

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Current vs. Full Shade Conditions



Panjab Bridge – RK 80

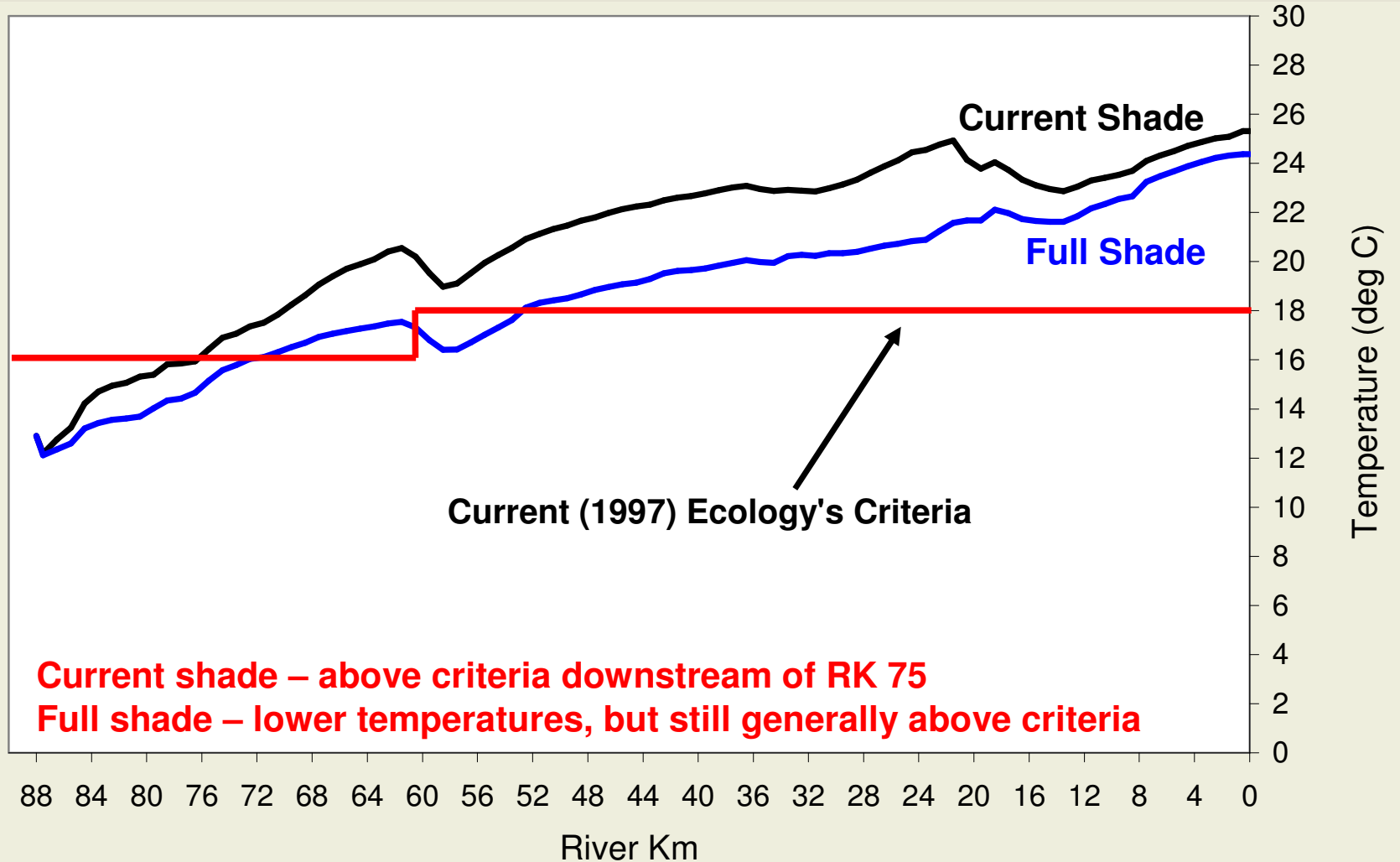
- Areas in upper watershed are not completely covered by shade trees
- For full shade scenario in the model and TMDL analysis, it is assumed that the entire buffer area is covered by tall trees at a high density



How do model results compare with
temperature standards?



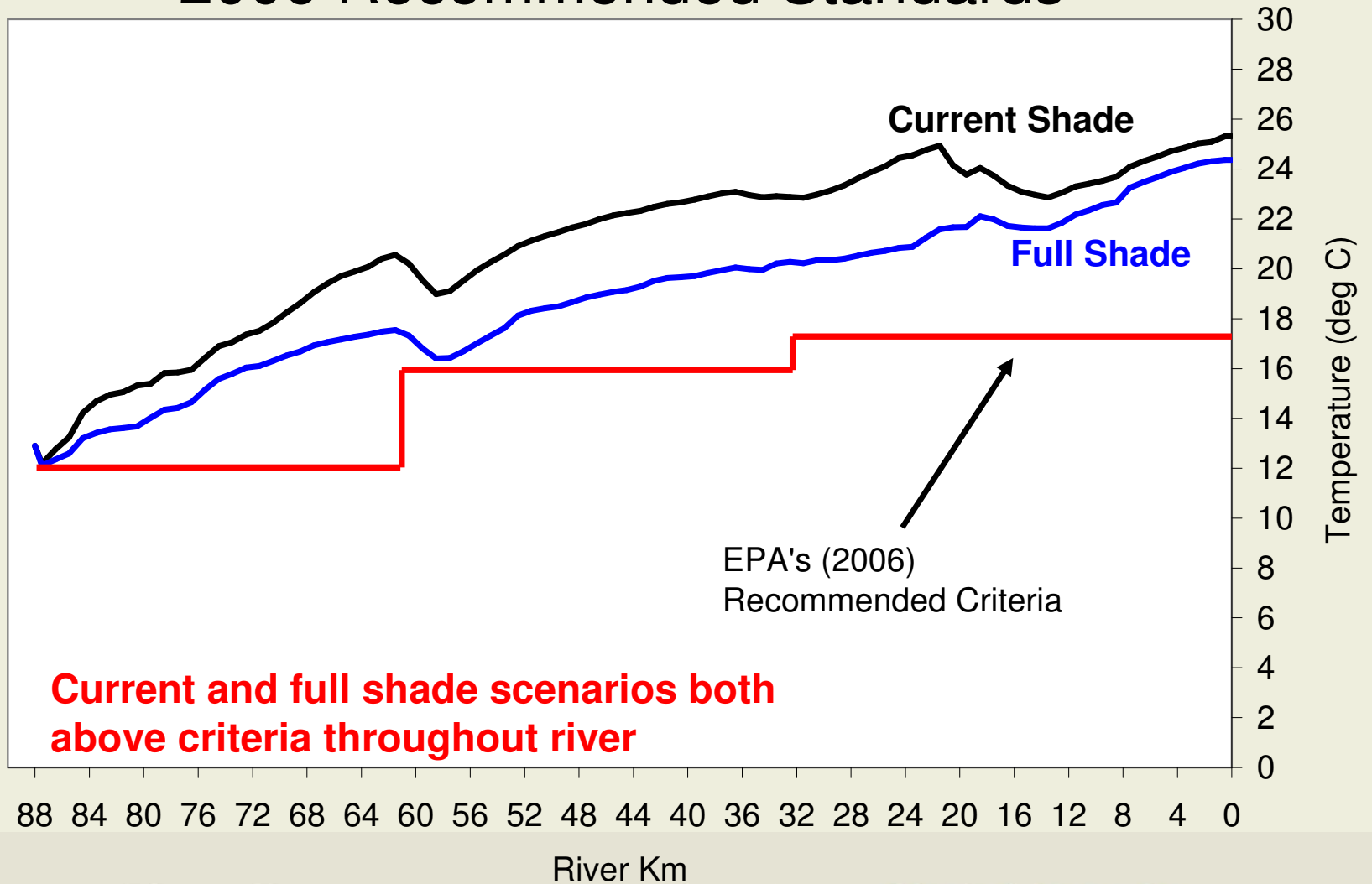
Comparison with Current Temperature Standards



Current shade – above criteria downstream of RK 75

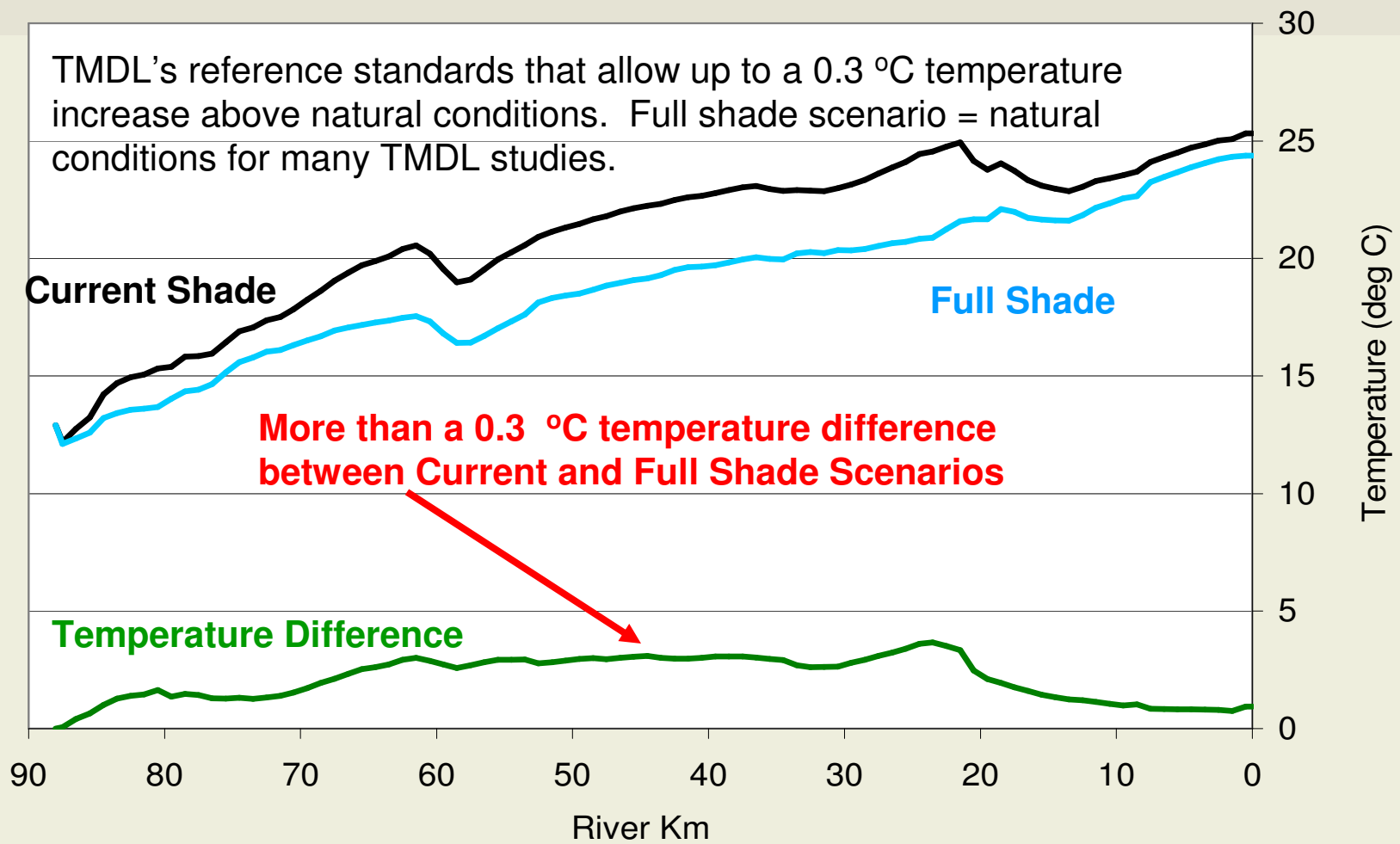
Full shade – lower temperatures, but still generally above criteria

Comparison with EPA's 2006 Recommended Standards



**Current and full shade scenarios both
above criteria throughout river**

Current vs. Full Shade – Natural Conditions



More than a 0.3 °C temperature difference between Current and Full Shade Scenarios

Temperature Difference

Maximum temperature difference: 3.7 °C

Average temperature difference: 2.1 °C

Summary of Comparisons with Temperature Standards

- Both current and improved shade scenarios above temperatures criteria
- Improved shade conditions represent temperature criteria for TMDL studies
- Current temperatures in the river are more than the allowed amount (0.3 °C) above full shade (natural conditions) temperatures
- Current temperatures about 2 to 3 °C above full shade, rather than 6 to 7 °C above the criteria

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Conclusions of Model Results

- Current shading is effective at cooling water temperature
- Improved riparian shading could lower water temperature by 3 to 4 °C (about 7 °F)
- Water temperature would still be above criteria with full riparian shading for most of river
 - 66 km still exceeded criteria with full riparian shading out of 88 km total river reach
- Full shade temperatures represent temperature criteria and achievable temperatures for the river

Potential Next Steps

- Submit study results to Ecology for 2006 303(d) list of data and TMDL scoping
- Use full shade scenario results to represent temperature criteria
- Use calibrated model to assess benefits of management improvements or other scenarios, such as riparian shading in select areas or instream flow conditions
- Focus efforts on riparian improvement projects that would bring temperature closer to full shade conditions. Current and previous modeling have shown the approximate “natural conditions” temperatures and the achievable temperature targets for the river.

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