Presenting: The Temperature Chapter!
Reminder: Elements & Scope

- Temperature
- Contaminants & Toxics
- Dissolved Oxygen
- Nutrients
- Sediment/Turbidity

Synthesize existing literature
Document existence of datasets/monitoring programs
Climate

Hydrology

New data analyses

Reminder: Beyond our scope
Temperature impairments are **common** and **widespread** in WRIA7.....

*year after year*....

*in small and large subbasins alike*....

*from headwaters to mouth.*
Point sources: Not an issue for thermal pollution in WRIA7

Nonpoint sources: The main culprit
EVEN DURING ‘MILD’ YEARS, HOUSTON, WE HAVE A PROBLEM
EXTREME YEARS CRANK THE PROBLEM’S VOLUME TO 11 AND GIVE US A PREVIEW OF A WARMING FUTURE

Adapted from Snohomish County, unpublished data (2016)
HEADWATERS ARE NOT OFF THE HOOK

Adapted from Kubo and leDoux (2016).
UPSTREAM CONDITIONS DEFINE WHAT HAPPENS IN THE ESTUARY DURING SUMMER

Adapted from Hall et al. (2018)
This is fine.
Yeah, it’s hot out there. But look closer. Is that a cold spot I spy with my FLIR camera?

......Thermal diversity to the rescue?
It’s important to understand groundwater.

Groundwater can help moderate temperatures **locally**, perhaps only during **baseflows**.

Adapted from Kubo and leDoux (2016).
We need to **find coldwater refugia** and work to **enhance, expand, and protect** them.

Adapted from Snohomish County (2012).
FINE SCALE: SUPPORT THERMAL DIVERSITY FOR RESILIENCE
IMPAIRMENTS TO MEET STATE STANDARDS

Are standards realistic everywhere, given challenges?

Is maximum temperature the lens through which we should view our goals?

Reorient goals to reflect thermal diversity, not just 7DADMAX standards?

Steel et al. 2017
REALITY CHECK:

- Plan targets undershoot calculated needs
- Pace of restoration doesn’t match magnitude, scale of the problem

<table>
<thead>
<tr>
<th>WADOE calculated need (2011)</th>
<th>2005 Salmon Plan targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>How much?</td>
<td></td>
</tr>
<tr>
<td>900 acres mainstem plantings on the Snoqualmie alone</td>
<td>256 acres mainstem plantings for the whole Snohomish basin</td>
</tr>
<tr>
<td>By when?</td>
<td>By when?</td>
</tr>
<tr>
<td>By 2021 → mature shade by 2071</td>
<td>By 2015</td>
</tr>
<tr>
<td>Status?</td>
<td>Status?</td>
</tr>
<tr>
<td>Unsure (some % of 332 acres)</td>
<td>332 acres as of 2018*</td>
</tr>
</tbody>
</table>

*number does not reflect net total after accounting for loss of riparian habitat elsewhere
When all you have is a hammer, everything looks like a nail.

Besides shade, we have many tools in the toolbox. Let’s use them!
Riparian restoration

Tributary confluence restoration

Removal of armoring

Large wood addition

Side-channel/Off-channel creation

Increased connectivity
Let’s use the right tool for every location- and condition-specific job.
### MONITORING AND DATA GAPS: KEY TAKEAWAYS

#### WATER TEMPERATURE MONITORING IN THE SNOHOMISH BASIN

<table>
<thead>
<tr>
<th>Agency</th>
<th>Project / Unit</th>
<th>Data Type</th>
<th>Start of Data</th>
<th>End of Data</th>
<th>Number of Sites</th>
<th>General location description</th>
<th>Public Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>King County</td>
<td>Ambient Water Monitoring</td>
<td>Continuous time-series</td>
<td>2017 *</td>
<td>ongoing</td>
<td>20</td>
<td>small to moderate sized tributaries in the Snoqualmie basin, e.g., unnamed tributaries to the Middle Fork Snoqualmie</td>
<td><a href="https://wsa.epe.gov/wma/climate/?">coming soon</a></td>
</tr>
<tr>
<td>King County</td>
<td>Field Hydrology Unit</td>
<td>Continuous time-series</td>
<td>1990 *</td>
<td>ongoing</td>
<td>12</td>
<td>small to moderate sized tributaries primarily in lower basin, e.g., Jones, Cherry, Patten</td>
<td><a href="https://wsa.epe.gov/wma/climate/?">yes</a></td>
</tr>
<tr>
<td>King County</td>
<td>Special Study: Upper Snoqualmie Temperature</td>
<td>Continuous time-series</td>
<td>2018</td>
<td>ongoing</td>
<td>25</td>
<td>The upper Snoqualmie basin above the fork, primarily the Middle Fork</td>
<td><a href="https://wsa.epe.gov/wma/climate/?">yes</a></td>
</tr>
<tr>
<td>King County</td>
<td>Special Study: Summer of 2012 in the Snoqualmie River Watershed</td>
<td>Continuous time-series</td>
<td>June 2015 - September 2015</td>
<td>27</td>
<td>17 mainstem Snoqualmie River sites, 10 major tributaries</td>
<td><a href="https://wsa.epe.gov/wma/climate/?">repost available</a></td>
<td></td>
</tr>
<tr>
<td>King County</td>
<td>Special Study: Fall City to Carnation Reach of Snoqualmie River</td>
<td>Continuous time-series</td>
<td>June 2016 - September 2016</td>
<td>13</td>
<td>14 mainstem Snoqualmie River sites between Fall City and Carnation, 1 at Patterson Creek mouth</td>
<td><a href="https://wsa.epe.gov/wma/climate/?">repost available</a></td>
<td></td>
</tr>
<tr>
<td>King County</td>
<td>Streams Ambient Water Quality</td>
<td>Monthly observation</td>
<td>2011</td>
<td>ongoing</td>
<td>12</td>
<td>One on the mainstem Snoqualmie at Duvall, all others are in tributaries including 3 forks above the Falls</td>
<td><a href="https://wsa.epe.gov/wma/climate/?">yes</a></td>
</tr>
<tr>
<td>King County</td>
<td>ADMP</td>
<td>Continuous time-series</td>
<td>2018</td>
<td>ongoing</td>
<td>varies</td>
<td>Location and timing vary by year but mostly small channels during low drainage during mid-summer</td>
<td><a href="https://wsa.epe.gov/wma/climate/?">upper request</a> Email Amanda Miller at <a href="mailto:amanda.miller@kingcounty.gov">amanda.miller@kingcounty.gov</a></td>
</tr>
<tr>
<td>King County</td>
<td>King County Science and Technical Support Center</td>
<td>Monthly observation</td>
<td>2003 - 2004</td>
<td>3</td>
<td>Toll River - Snoqualmie River upstream/downtown of Toll</td>
<td><a href="https://wsa.epe.gov/wma/climate/?">repost available</a></td>
<td></td>
</tr>
<tr>
<td>NOAA / USGS</td>
<td>Upper Snoqualmie River Water Quality Enhancement</td>
<td>Continuous time-series</td>
<td>2011</td>
<td>ongoing</td>
<td>40</td>
<td>5 stations Snoqualmie, others on moderate to large tributaries</td>
<td><a href="https://wsa.epe.gov/wma/climate/?">coming soon</a></td>
</tr>
<tr>
<td>WA DNR</td>
<td>Plan</td>
<td>Continuous time-series</td>
<td>2008</td>
<td>2010</td>
<td>11</td>
<td>5 stations mainstem Snoqualmie, others on moderate to large tributaries</td>
<td><a href="https://wsa.epe.gov/wma/climate/?">repost available</a></td>
</tr>
<tr>
<td>USFS</td>
<td>Skykomish and Snoqualmie Ranger District</td>
<td>Continuous time-series</td>
<td>Installation summer 2020</td>
<td>NA</td>
<td>5</td>
<td>Skykomish basin, exact locations TBD</td>
<td>No</td>
</tr>
<tr>
<td>USGS / ADEP</td>
<td></td>
<td>Continuous time-series</td>
<td>2007 *</td>
<td>ongoing</td>
<td>3</td>
<td>Lower Decker River, lower Skykomish R, and upper NF Skykomish R</td>
<td><a href="https://wsa.epe.gov/wma/climate/?">repost available</a></td>
</tr>
<tr>
<td>USGS</td>
<td>Washington Water Science Center</td>
<td>Continuous time-series</td>
<td>2007</td>
<td>ongoing</td>
<td>7</td>
<td>Toll basin - NF, SP, and mainstem, Sultan basin</td>
<td><a href="https://wsa.epe.gov/wma/climate/?">repost available</a></td>
</tr>
<tr>
<td>City of Seattle</td>
<td></td>
<td>Continuous time-series</td>
<td>2013</td>
<td>ongoing</td>
<td>23</td>
<td>Toll basin - NF, SP, and mainstem</td>
<td><a href="https://wsa.epe.gov/wma/climate/?">repost available</a></td>
</tr>
<tr>
<td>USGS / Tulalip Tribes</td>
<td></td>
<td>Thermal Infrared Survey</td>
<td>August 2020</td>
<td>NA</td>
<td>NA</td>
<td>On Snoqualmie (upper NF to Chumash Bend and Skykomish (inlet to confederny) mouth)</td>
<td><a href="https://wsa.epe.gov/wma/climate/?">coming soon</a> TED</td>
</tr>
</tbody>
</table>

**Data gap #1: What data is even out there?**
The missing link: Connecting temperature data with fish use data
Monitoring itself is a strategy— one of the most important ones we can deploy.
Temperature impairments are common and widespread in WRIA7.

Because they’re driven by complex nonpoint sources, they’re much harder to fix and take longer to fix too.

Climate change is making it worse.

Let’s re-orient goals to include thermal diversity.

Reality check: we need to drastically increase restoration to match scale and magnitude of the problem.

Shade is important, but we have more tools in the toolbox, too. Let’s use them.

Use the right tool for the job.

Let’s leverage data we already have.

Fund monitoring. It is one of the most important strategies we have.
REVIEWING THE CHAPTER: HOW CAN YOU HELP?

• Are we missing information about a particular geographic area or dataset?

• Did we mischaracterize results from a particular body of work?

• Did we miss any major strategies?

• Did we miss any of your monitoring datasets in the Monitoring Table?

DEADLINE FOR FEEDBACK: OCTOBER 6TH
(OCTOBER TECH COMM MEETING)
QUESTIONS?

If you have a question during your review, please contact
Emily Davis: emdavis@kingcounty.gov,
Josh Kubo: josh.kubo@kingcounty.gov or
Andrew Miller: Andrew.miller@kingcounty.gov

Photo courtesy Andrew Miller.
Status of Sections

Temperature: Currently in fourth iteration
Contaminants & Toxics: Being drafted
Dissolved Oxygen: Currently in second iteration
Nutrients: Currently in second iteration
Sediment/Turbidity: Out for internal review
Timeline for Completion

Section Drafts (Spring-Summer 2020)

Internal Review and Rewrites (May-December 2020)

Technical Committee and WRIA 7 Subject Matter Expert Review (Sept-Dec 2020)

Integrate Comments and Input (Sept-Jan 2020)

Updated/Final Drafts (Jan 2020)