Johnson Creek Cold Water Restoration Strategy

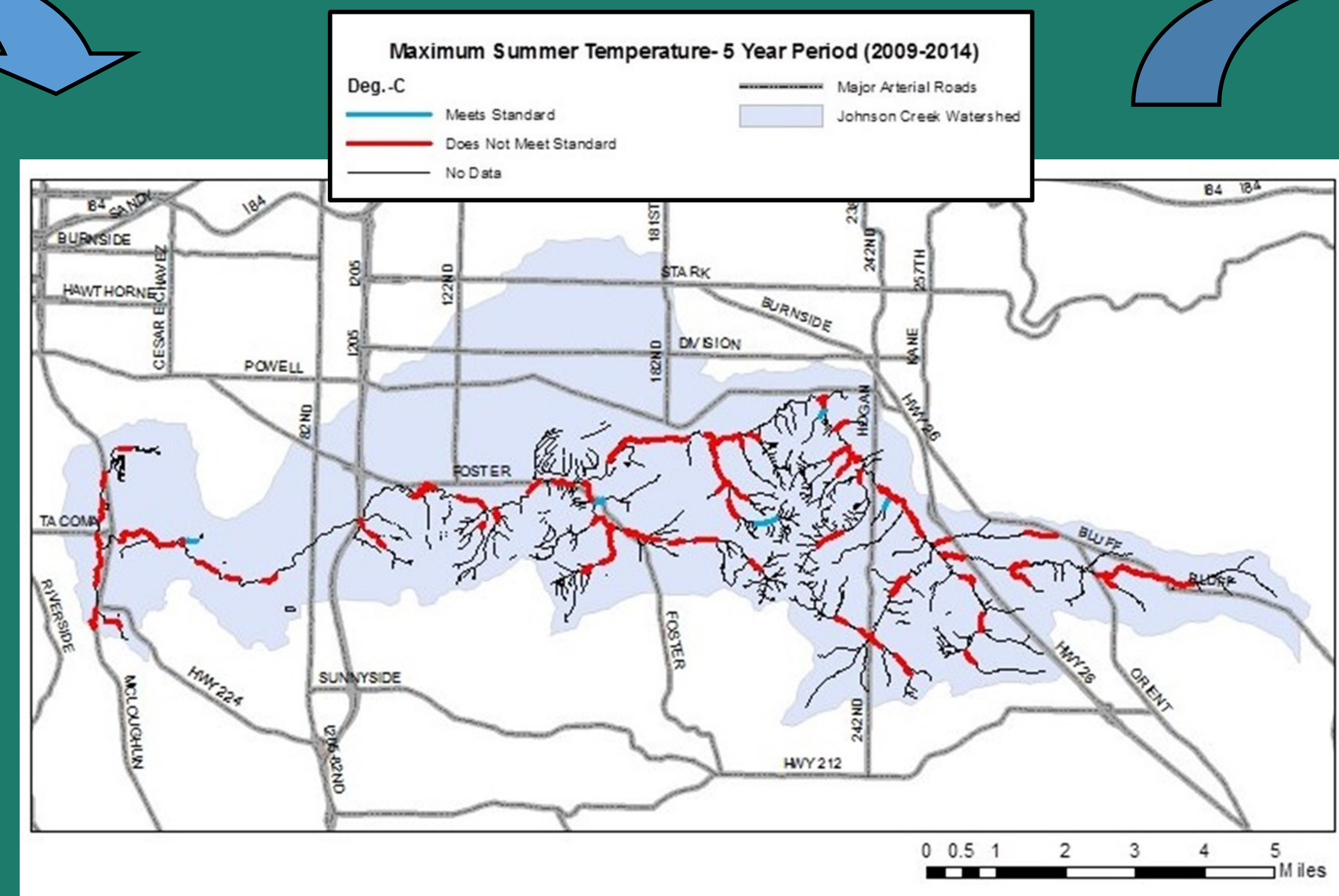
UERC 2021

The importance of cold water

Johnson Creek and its tributaries retain small runs of chinook and coho salmon, and also steelhead trout. These species are confronted with a variety of stressors. According to Oregon Dept. of Environmental Quality (2018/2020 Integrated Report), 44% of all Oregon stream miles are impaired. This impairment most frequently takes the form of "Fish and Aquatic Use," and stream temperature is the most common form of this biological impairment. High stream temperature holds less oxygen and causes an increase in dangerous aquatic pathogens. Salmon do not regulate their body temperature, so if the stream is too hot, they will die.

Johnson Creek Watershed Council's (JCWC) stream temperature monitoring found that in the years 2009-2014, almost all watershed streams experienced streams temperatures in excess of the Oregon state standard of 18C/64.4F for rearing for juvenile salmonid during the summer months (JCWC, 2015). Mainstem Johnson Creek west of I-205 and selected areas East of I-205 had daily high temperatures that annually exceeded this standard for 80 to 113 days.

Increases in air temperature are highly correlated with increased stream temperature, though other factors such as lack or low levels of riparian shade, as well as impoundment of water in shallow in-line ponds and high amounts of impervious surface area on which summer rain falls, all contribute to high stream temperatures. Air temperature is beyond the control of stream restoration, but these other factors are not.



How restoration can mitigate the impacts of high stream temperature

Stream temperature in all watersheds is unevenly distributed. As a general rule, watersheds in the Pacific Northwest have cooler water in the smaller headwater streams where riparian shade is especially effective at blocking direct sunlight and human development is relatively low. Development has historically occurred closer to larger streams and lower in watersheds where land is flatter. The Johnson Creek Watershed is relatively flat and development has been extensive, so these regional trends do not describe it well.

Increasing riparian shade through tree planting is a common long-term strategy for reducing stream temperature and one that JCWC has pursued annually since its founding in 1995. This strategy takes more than a decade to have measurable impacts because it is limited by tree growth. Slope, aspect, and the width of a tributary stream all determine the likely effectiveness of tree planting for shade n a given location. Prioritizing planting on a taxlot basis by the likely benefit to stream temperature can speed up those impacts and make the best use of limited funds.

Impounding water on streams creates "inline ponds" that often have a more severe impact on stream temperature than an equivalent length of unvegetated stream. Water in these ponds has a much slower velocity than in flowing streams, so there is a longer residence time during which water can heat. The hotter water tends to stratify in an inline pond, with the hotter water often flowing over the top of the impoundment.

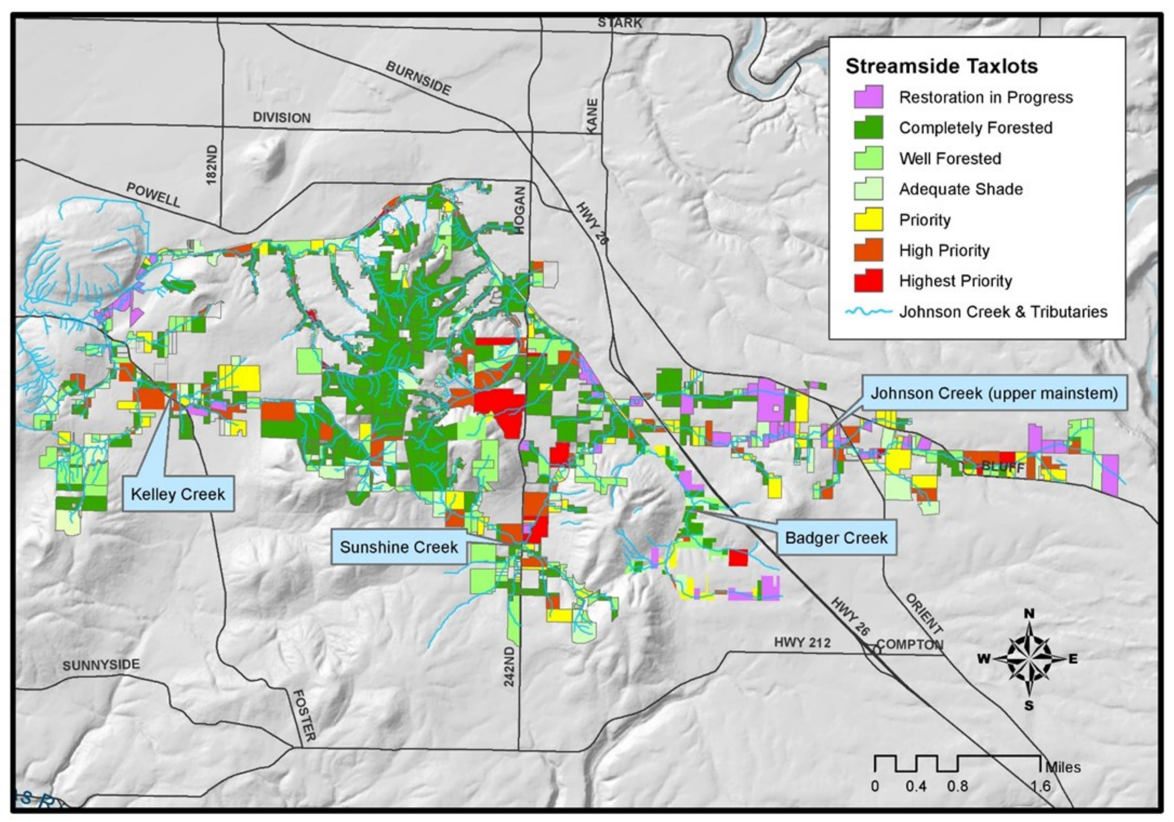
Temperature records show that many tributary streams in the Johnson Creek Watershed are natural cold water refugia, most likely because of localized hyporheic flow. These natural cold water tributaries are areas where salmonids can survive the summers. Unfortunately, many of these tributary streams are inaccessible to salmonids because of impassible road culverts and other passage barriers.

By increasing prioritized strategic riparian planting, removing or otherwise mitigating the temperature impacts of inline ponds, and opening up natural cold water tributaries to salmonids are three ways that restoration can mitigate the impacts of high stream temperature in the Johnson Creek Watershed. These are the three cornerstones of the Johnson Creek Cold Water Restoration Strategy.

1

Using a heat source model, JCWC prioritized all riparian taxlots according to shade deficit. We continually reach out to landowners, beginning with the higher priority taxlots. Since 2012, we have begun planting native trees & shrubs on many of these higher priority taxlots. Each year, JCWC installs 20,000+ native plants, mostly in riparian areas.

Riparian Restoration Priorities by Taxlot in Target Johnson Creek Subwatersheds



2

132 inline ponds impound water in Johnson Creek, ranging in size from 1/10th acre to over 1 acre. This is a lot of heat trapped! In 2019, the Council removed a 0.7 acre pond on Mitchell Creek. We had previously recorded a rise of 14C in stream temperature because of the pond on a particularly hot day. The photos below show the pond before and after construction. Removing the culverts that impounded the water also opened salmonid passage through this reach.

The picture on the left show the large, shallow 0.7 acre pond prior to restoration. The photo on the right shows an emerging wetland complex with added large wood structures. A seasonal wetland remains, which hosts amphibians and dragonflies. Riparian reforestation and blackberry removal is an ongoing component of this restoration.


Before


After restoration

Partners & Funders with JCWC in Fish Passage Projects

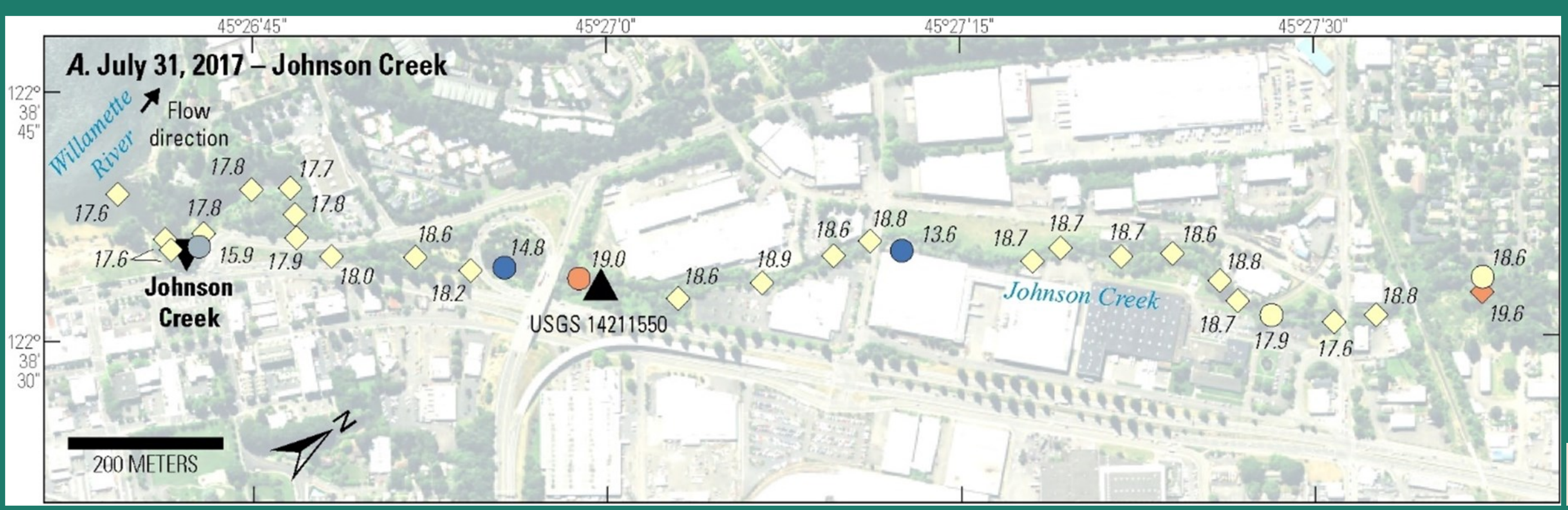
Metro
East Multnomah SWCD
Multnomah County Roads Dept.
Oregon Watershed Enhancement Board
Paul Allen Foundation & American Rivers
PGE & The Nature Conservancy
National Fish & Wildlife Foundation
Oregon Dept. of Environmental Quality
Oregon Dept. of Transportation
Portland Parks & Recreation
Johnson Creek Interjurisdictional Committee

Partners & Funders with JCWC in Riparian Planting:

East Multnomah SWCD
Clackamas SWCD
City of Gresham
City of Milwaukie
Portland Bureau of Environmental Services
Friends Of Trees
Oregon Watershed Enhancement Board
Freeway Lands II
Bonneville Environmental Foundation
& many volunteers!

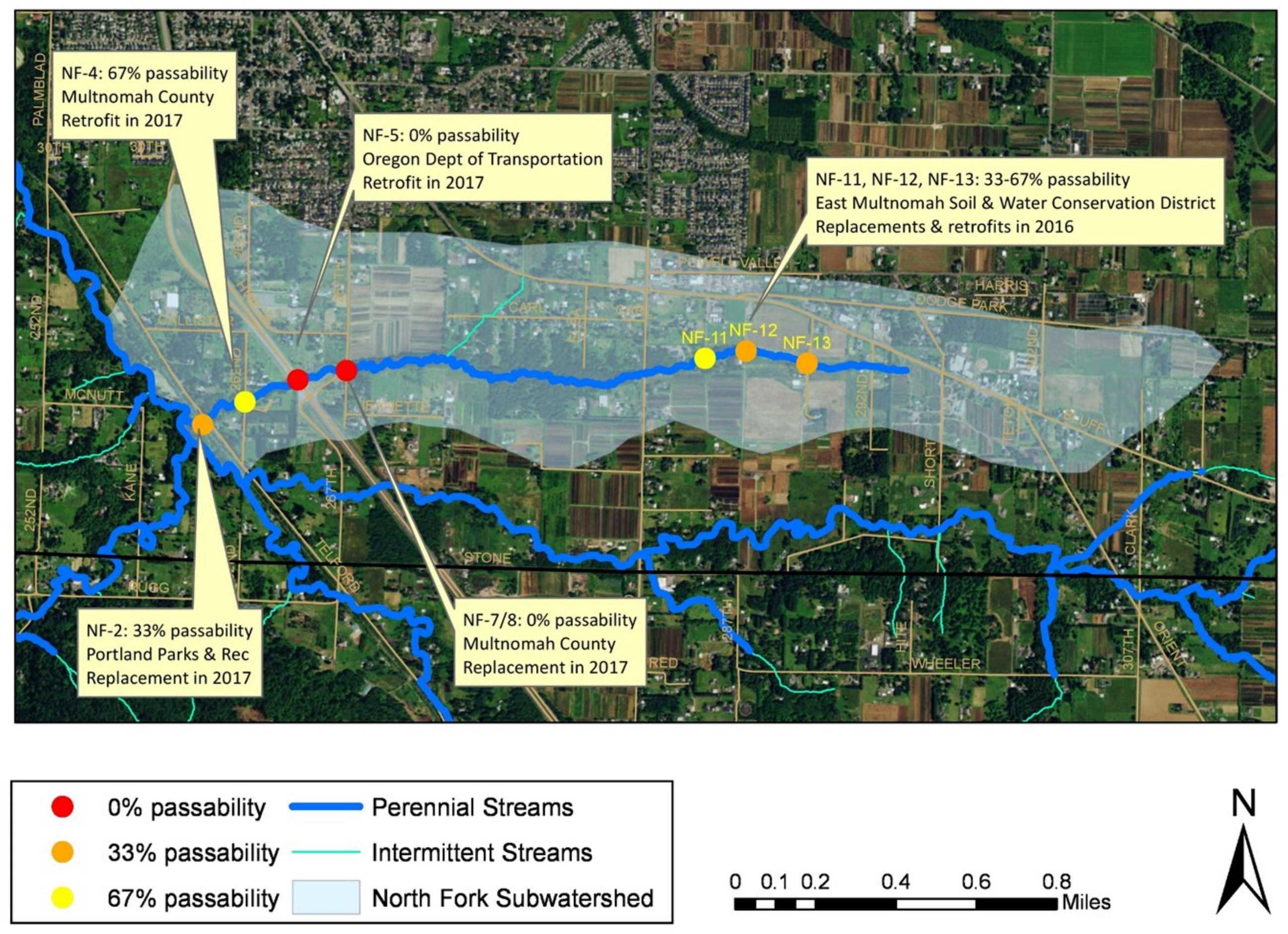
3

Between 2016 & 2020, JCWC removed, replaced, or retrofitted 6 culverts and removed a dam, all in cold water tributaries. Two more are planned for 2021. JCWC has also begun adding large wood for habitat in these cold water tributaries, and at areas in the mainstem where detectable, measurable cold water enters. In the USGS diagram below, three cold water inputs to the first mile of mainstem Johnson Creek are identified. Spawning adults en route to the upper Willamette River tributaries, can sense this cold water, making lower Johnson Creek a thermal refuge for many anadromous fish stocks. In 2020, JCWC installed large wood structures at one of these cold water inputs (14.8, blue dot on the map below).



North Fork Johnson Creek is a cold water tributary where JCWC & partners are attempting to provide complete fish passage. The 7 barriers, shown in the map on the right will all have been removed, replaced, or retrofitted by summer, 2021. The Council is using flexibaffles—a new low-cost retrofit technology to provide passage—at 3 of these sites. These projects are the first uses of this technology in the Western US. Through a similar project on Kelley and Mitchell Creeks, beginning in 2018, the Council and partners are also addressing 7 barriers. Environmental DNA testing is being used to evaluate if anadromous fish have made it past the sites of the former barriers.

North Fork Johnson Creek Culvert Projects



Above: **Flexibaffles** being installed at a culvert on North Fork Johnson Creek. These flexible baffles bend during high flows, slowing the velocity, and stay upright in low flows, creating resting pools.

Johnson Creek Watershed Council 1995 25 2020

Poster by Daniel Newberry