



WHYCHUS CREEK:
PROGRESS IN RESTORATION





Acknowledgements

PREPARED BY:

The Deschutes Partnership

WRITTEN AND EDITED BY:

Upper Deschutes Watershed Council

FUNDED BY:

Bonneville Environmental Foundation

Laird Norton Family Foundation

Oregon Watershed Enhancement Board

The information presented in this publication is based on the following technical reports available at www.RestoreTheDeschutes.org:

2012 WHYCHUS CREEK MONITORING REPORT

2011 WHYCHUS CREEK MONITORING REPORT

Compiled and edited by the Upper Deschutes Watershed Council and Deschutes River Conservancy.

The following entities provided information, data or support used in the development of this publication:

Confederated Tribes of Warm Springs

Oregon Department of Environmental Quality

Oregon Department of Fish and Wildlife

Oregon Department of Water Resources

Portland General Electric

The Xerces Society

U.S. Forest Service

U.S. Fish and Wildlife Service

The reintroduction of salmon and steelhead in Whychus Creek is led by Portland General Electric, the Confederated Tribes of Warm Springs and Oregon Department of Fish and Wildlife. Please see www.DeschutesPassage.com for information.

Introduction

IN THE SPRING OF 2007, THE HISTORIC REINTRODUCTION OF STEELHEAD trout in Whychus Creek began with the release of 250,000 fry into the creek. These small fish, barely two inches in length, were the first steelhead trout to swim in Whychus Creek for more than 50 years since dams on the Deschutes River blocked the historic migrations. Two years later, in 2009, annual steelhead releases were complemented by the first reintroduction of chinook salmon fry and smolts. Hundreds of thousands of young fish representing both seagoing species have been released each year since, and will continue to be placed in Whychus Creek for years to come.

The salmon and steelhead reintroduction, led by Portland General Electric, Confederated Tribes of Warm Springs and Oregon Department of Fish and Wildlife, has catalyzed a tremendous community investment in Whychus Creek. Landowners, farmers, community organizations, public officials, students, and many others have come together to help make Whychus Creek healthy. Collectively, these community partners are engaged and invested in many types of watershed restoration, including stream restoration, water conservation, fish passage projects and community involvement.

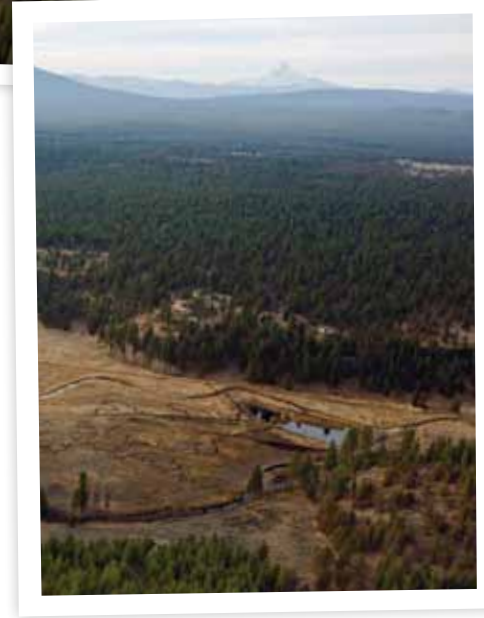
The reintroduction that began in 2007 will continue for decades as biologists work to rebuild the historic salmon and steelhead runs in Whychus Creek. As millions of dollars continue to be invested in Whychus Creek it is important to track progress: Is restoration making a difference? Is the creek healthier? Do the fish have access to better habitat?

These questions of effectiveness are some of the most challenging questions in watershed restoration because so many factors can affect the health of a watershed. Changing

climate, wildfire, land development patterns, natural variability and many other factors can all make it very difficult to understand how an individual restoration project contributes to the overall health of a creek.

While acknowledging the complexity of the many factors that affect watershed health, local restoration partners are closely tracking certain components of conditions in Whychus Creek. Each indicator, such as water temperature, streamflow or fish passage, can provide a window into the health of the creek. While each indicator provides varying degrees of information, together they can help paint a picture of how the creek is changing over time.

Watershed monitoring has highlighted temperature and macroinvertebrate communities as the leading indicators of changes in stream conditions. As streamflows have increased each year and reaches of channel have been reconstructed to restore hydrological function, temperatures have become consistently lower and macroinvertebrate species characteristic of poor stream conditions have been replaced by more selective species found only in streams with good water quality.



ABOVE: Stream restoration at Camp Polk Meadow will restore more than 1.7 miles of high quality fish habitat.

This report provides an overview of the current state of seven key indicators in Whychus Creek as of 2012. The purpose of this report is to provide a condensed overview of what these indicators say about the health of Whychus Creek while summarizing local efforts to restore a healthy watershed. All of the information presented here has been distilled from a series of technical reports published by the Upper Deschutes Watershed Council, available at www.RestoreTheDeschutes.org.

Restoration Activities

ALTHOUGH THIS REPORT FOCUSES ON TRACKING INDICATORS OF WATERSHED health in Whychus Creek, improvements in the watershed are largely the result of successful restoration projects. These projects, ranging from one-day volunteer planting efforts to multi-year restoration programs, collectively result in improved water quality, fish habitat and overall watershed health.

Whychus Creek stands out as a place where individuals, organizations, businesses and government agencies have all come together for a common cause. The projects that result are designed to meet the ecological needs of the creek while simultaneously serving community interests, such as continued farming, improved energy conservation and recreational access.

Although the projects here appear as individual dots on a map, they are part of a holistic, integrated restoration strategy that seeks to restore the critical elements of a healthy watershed. This restoration strategy recognizes that no single restoration action can improve the watershed, but multiple projects can collectively achieve long term restoration goals. For example, stream restoration can be successful only when there is sufficient year-round instream flow. And, over the long term, stream restoration projects will meet their full potential only when adequate land conservation and management programs are in place.

The restoration efforts in Whychus Creek would not be possible without significant, long-term investments from key funders, partners and collaborators, all of whom share a common interest in successful reintroduction and watershed management (see below).



TOP: Before restoration, the Three Sisters Irrigation Diversion dam blocked upstream passage for fish.
BOTTOM: With the stream channel built up to meet the height of the dam, fish are able to use habitat upstream.



Working Together

Successful restoration work in Whychus Creek requires that many local, state and federal partners and funders come together for a common cause. The Deschutes Partnership is a consortium of groups, including Upper Deschutes Watershed Council, Deschutes River Conservancy, and Deschutes Land Trust, working to restore stream conditions to support the successful reintroduction of salmon and steelhead. Additional partners and funders in Whychus Creek include:

LOCAL, STATE & FEDERAL AGENCIES/TRIBES

- City of Sisters
- Confederated Tribes of Warm Springs
- Oregon Watershed Enhancement Board
- Oregon Department of Environmental Quality
- Oregon Department of Fish and Wildlife
- Oregon Department of Water Resources
- National Marine Fisheries Service
- U.S. Bureau of Reclamation
- U.S. Forest Service
- U.S. Fish and Wildlife Service

FOUNDATIONS & ORGANIZATIONS

- Bella Vista Foundation
- Bonneville Environmental Foundation
- Clabough Foundation
- Laird Norton Family Foundation
- National Forest Foundation
- Portland General Electric / Pelton Fund
- Roundhouse Foundation
- The Freshwater Trust
- The Nature Conservancy
- Trout Unlimited

STREAM & RIPARIAN RESTORATION

Stream restoration projects come in many shapes and sizes, from small-scale planting projects to large-scale stream channel reconstruction. Despite these variations, all of the projects are intended to improve the health of the creek by enhancing habitat, improving water quality and restoring a naturally functioning creek system. Stream and riparian restoration projects occur throughout the watershed and often involve local volunteers, students and landowners.

LAND CONSERVATION

Over the long term, land development patterns can significantly affect the health of Whychus Creek. Land conservation projects permanently protect the ecological integrity of key properties in addition to providing good sites for community education, student learning and stream restoration. Nearly seven miles of creek have already been preserved and an additional several miles are in the planning phases.

FISH PASSAGE

For the redband and steelhead trout that live in Whychus Creek, fish passage barriers at dams, diversions and other manmade structures can block access to historic spawning, foraging and rearing habitat. Fish passage restoration projects seek to eliminate these barriers by constructing fish ladders, modifying the barriers, or removing the barriers altogether. Since 2009, fish passage has been restored at two of the five barriers in Whychus Creek. Current efforts are focused on fixing the remaining three.

WHYCHUS CREEK

Restoration Activities

INDIAN FORD MEADOW

CAMP POLK

DISCOVERY OUTPOST

RIMROCK RANCH

WHYCHUS CANYON

ALDER SPRINGS

Sisters

N

W

E

S

< Headwaters

STUDENT STEWARDSHIP PROJECTS

Community involvement is critical to most of the restoration efforts in Whychus Creek. For some projects, students from local schools have take leadership roles in developing, implementing and maintaining restoration sites. These "student stewardship projects" provide lasting benefits for hundreds of students each year by connecting them to their local environment while simultaneously improving the health of the creek.

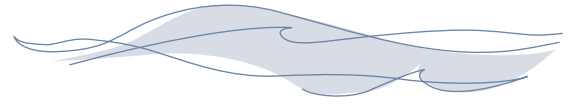
STREAMFLOW RESTORATION

Like many of the rivers and streams of the arid west, Whychus Creek has played a significant role in providing irrigation water to farms and local communities over the last century. During the summer months, streamflow in the creek can consequently drop to very low levels. Streamflow restoration efforts, most of which are concentrated upstream of Sisters, have resulted in approximately 33 cubic feet per second of water being restored to the creek during the hot summer months. This instream flow provides the foundation for cleaner, cooler water and healthier fish populations.

FISH SCREENING

Fish in Whychus Creek can inadvertently become trapped in unscreened irrigation diversions that draw water from the creek. Fish screening projects focus on retrofitting these diversions with specially designed screens that allow water - but not fish - to be diverted from the creek. Of the 12 unscreened diversions on the creek identified in the UDWC's 2009 inventory, five diversions have been upgraded to meet screening criteria, and retrofits are in the planning stages for one more.

Streamflow



FISH HABITAT, WATER TEMPERATURE AND MANY OTHER CRITICAL ASPECTS OF stream health are closely linked to streamflow. With sufficient flows in Whychus Creek, the water remains cool, pools provide deep cover for hiding fish and streamside vegetation has sufficient moisture to survive the hot Central Oregon summers. When streamflow is depleted, however, water temperatures can quickly rise, vegetation may be dewatered and lost, and the entire aquatic ecosystem can suffer from the cascading effects of a dry creek.

In Whychus Creek, streamflow is an excellent indicator of restoration progress because flows are critically important for water quality, habitat, spawning and many other ecological functions. In addition, streamflow can be readily measured over time to track long-term progress.

Soon after the first irrigation diversions were developed along Whychus Creek in 1871, the creek began to run dry during the summer months when irrigation demands were at their peak. By 1912, the creek routinely ran dry. Between 1960 and

1999, a period for which there are reliable streamflow data, the creek ran dry, on average, two out of every three years.

Starting in 1999, Whychus Creek began to come back to life when irrigators, conservation organizations and government agencies began working collaboratively to bring streamflow back to Whychus Creek. For the first time in almost 100 years, the creek was allowed to flow through the hot summer months. Now, conservation practices and creative water deals allow for flows of 33 cubic feet per second. While

ABOVE: Increased flows maintain cooler temperatures for fish and support riparian vegetation through the hot summer months. **RIGHT:** High flows at Camp Polk spill out over the new floodplain, leaving behind rich sediment that nourishes riparian plants. **FAR RIGHT:** Local students have worked with the Watershed Council to study Whychus Creek. Through streamside learning activities, writing and art projects, youth have developed strong connections to the creek.

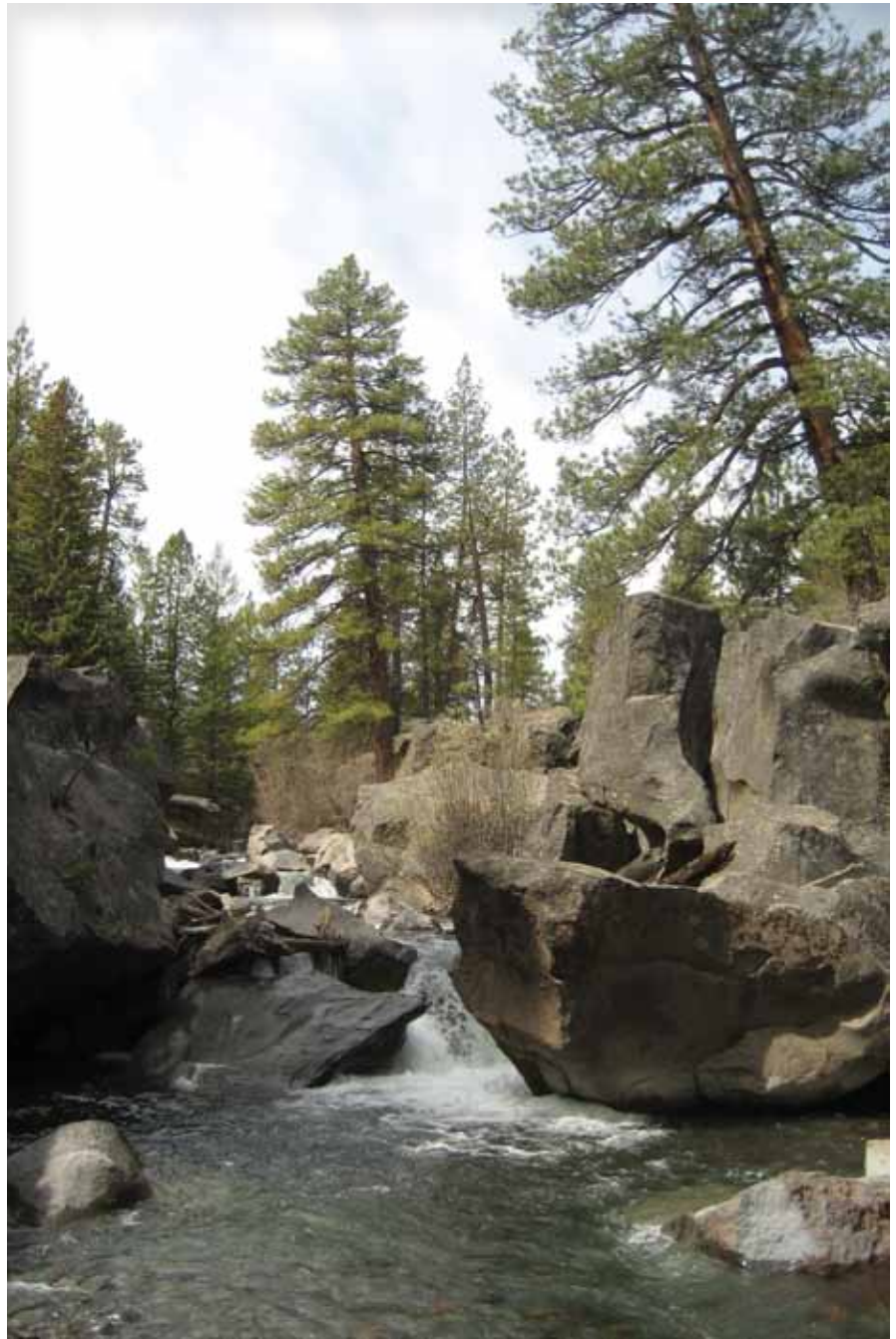





this may appear to be a modest change, it is a significant step toward restoring a healthy creek.

With water now flowing in Whychus Creek during the summer months, the focus has shifted from restoring any flow to restoring the right amount of flow during the right season. Streamflow and temperature monitoring results have provided preliminary benchmarks for what flows, during which months, are needed to support a healthy creek. With this information, UDWC and restoration partners can continue to engage in efforts targeted to achieve these flows.

The Deschutes River Conservancy, Three Sisters Irrigation District and other partners have worked tirelessly since the 1990s to bring streamflow back to Whychus Creek during the summer months. The progress made to date illustrates how collaborative efforts can result in significant improvements in Whychus Creek.

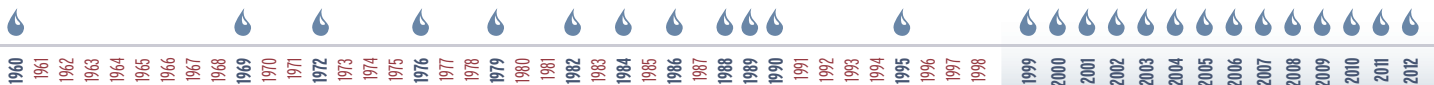


Whychus Creek Streamflow Timeline

 Years when Whychus Creek did not run completely dry

Between 1960 and 1999, Whychus Creek ran dry an average of two out of every three years.

Beginning in 1999, however, irrigators, non-profits, agencies and funders have successfully maintained year-round flows.





RIVER HEALTH INDICATOR NO. 2

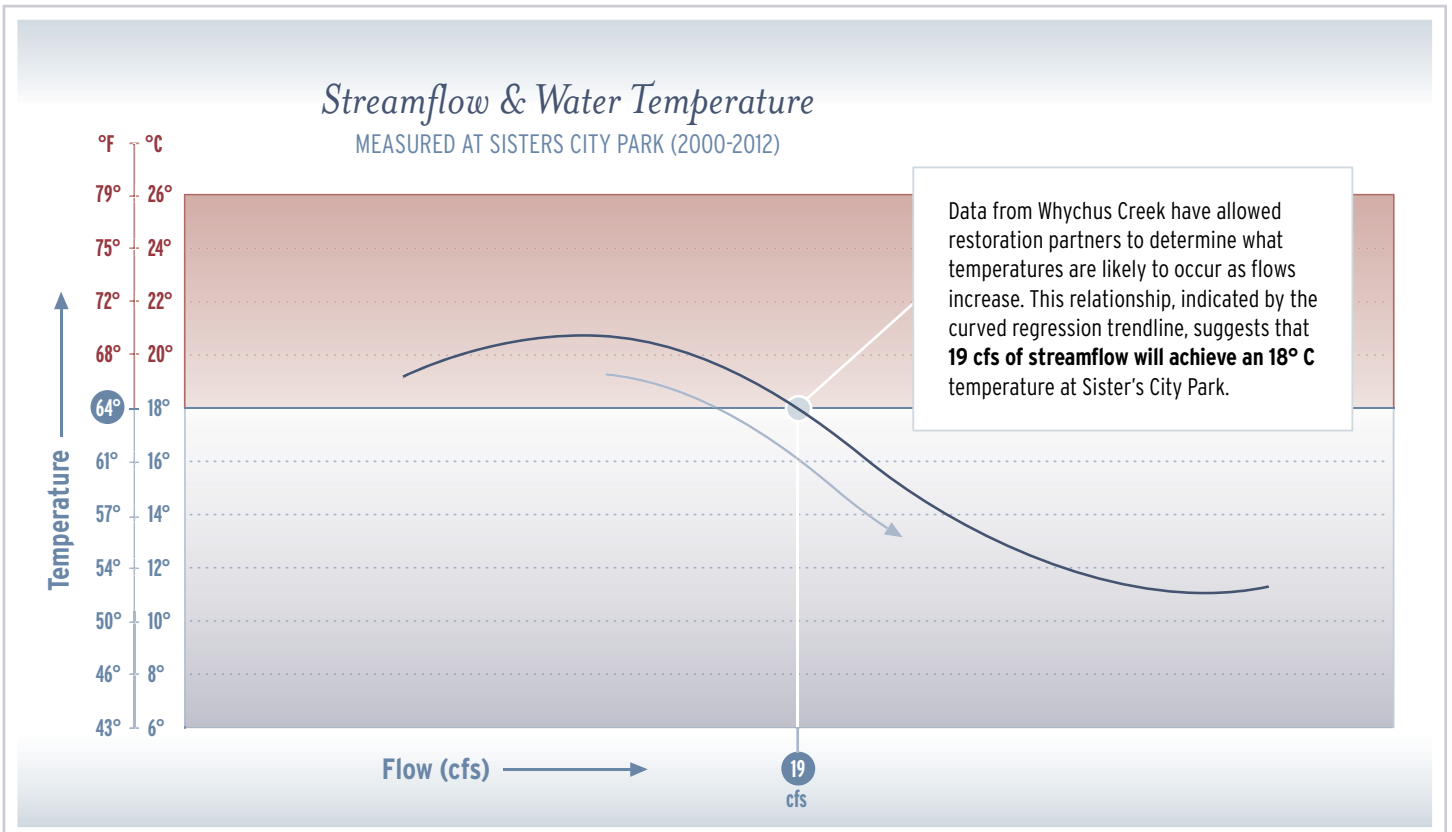
Stream Temperature

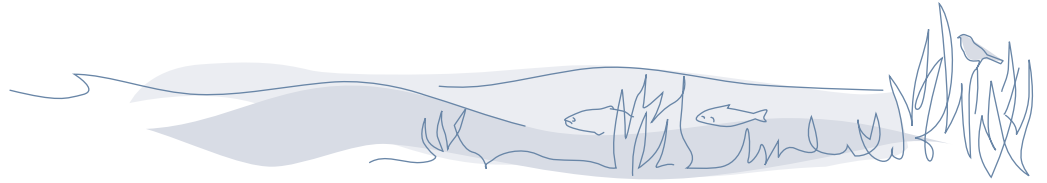
THE GLACIAL HEADWATERS OF WHYCHUS CREEK THAT SIT HIGH IN THE THREE Sisters Wilderness begin with an abundance of cold, clean water ideal for redband and steelhead trout. Fifteen miles downstream, where Whychus Creek flows through urban and agricultural land, the water temperature begins to rise during the summer months as diversions pull more than 90% of the streamflow out of Whychus Creek. With less water instream, the remaining water warms rapidly, quickly changing the character of the creek.

While redband and steelhead trout are very hardy fish, they require relatively cool water. The State of Oregon has identified 18°C / 64°F as a maximum temperature standard to protect these fish. When diversions on Whychus Creek are at their maximum and the summer's heat is at its peak, tempera-

tures in the creek can reach or exceed 24°C / 75°F, conditions that are lethal for fish and are well above the state identified limit.

The relationship between water temperature and streamflow has been very well documented over years of study. This relationship shows that as more water is





restored to Whychus Creek, average water temperatures will be reduced (bottom left graphic). However, as streamflow varies with climate, snowpack and diversions, temperatures will rise and fall.

Despite this variability, each year since 1999, more and more water has been left instream through water conservation projects championed by irrigators, agencies and conservation organizations. With consistent increases in summer flows, temperatures in Whychus Creek through Sisters have met the standard in almost every year since 2006 (graphic below). Temperatures downstream continue to exceed the 18°C / 64°F standard,

but monitoring results indicate that higher flows yet will achieve temperatures that are suitable for fish. The continued progress in flow restoration is an important trend that will ultimately bring valuable benefits for the water temperature in Whychus Creek.



Whychus Creek July Temperatures
MEASURED AT SISTERS CITY PARK (2000-2012)



Fish Populations



ONE OF THE MOST COMMONLY ASKED QUESTIONS ABOUT RESTORATION IN Whychus Creek is:

“How are the fish populations responding to all the restoration work?”

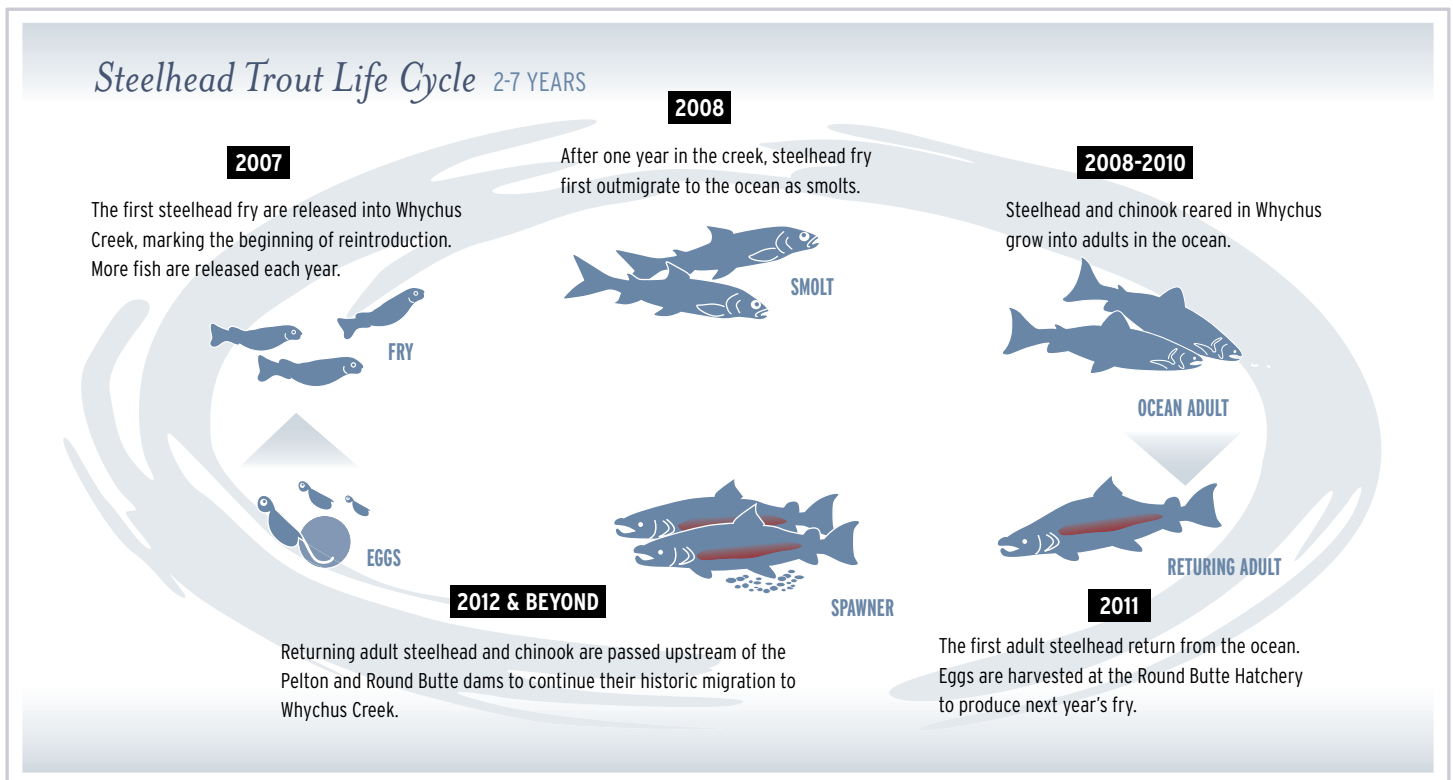
Although fish counts can often be used as meaningful indicators of watershed restoration success, the current numbers of fish in Whychus Creek are unnaturally high. More than 1.3 million steelhead fry, 14,000 steelhead smolts, 200,000 chinook salmon fry and 16,000 chinook smolts have been reintroduced into Whychus Creek since 2007, resulting in artificially increased population sizes. While counting fish provides very meaningful information for biologists managing fish reintroduction efforts, the ongoing reintroduction means that population counts actually tell us very little about

whether any specific restoration project has led to improved fish populations.

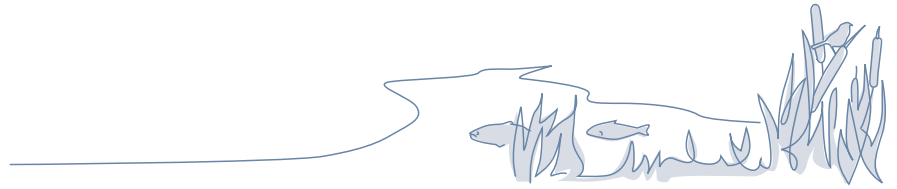
Until changes in fish populations can be better linked to habitat improvements, it is more instructive to examine the lifecycle of steelhead trout and ask: To what extent are the key stages of the steelhead trout lifecycle being supported in Whychus Creek? Are all of the stages of the lifecycle represented? As each stage becomes naturally supported in Whychus Creek, steelhead trout will be one step closer to being self-sustaining in the watershed.

Beginning in 2012, steelhead and chinook salmon adults reared in Whychus Creek

have been released upstream of the Pelton dams. With spawning resuming in Whychus Creek, the life cycles of these iconic fish are being completed in the creek for the first time in over fifty years. Eventually, the only fish in the creek will be those that result from natural spawning. At that time, perhaps five or ten years in the future, the freshwater stages of the salmonid lifecycle occurring within Whychus Creek will be a direct reflection of conditions in the creek and restoration partners can better understand how habitat improvements are affecting fish populations during each stage of their lifecycles.



Fish Habitat



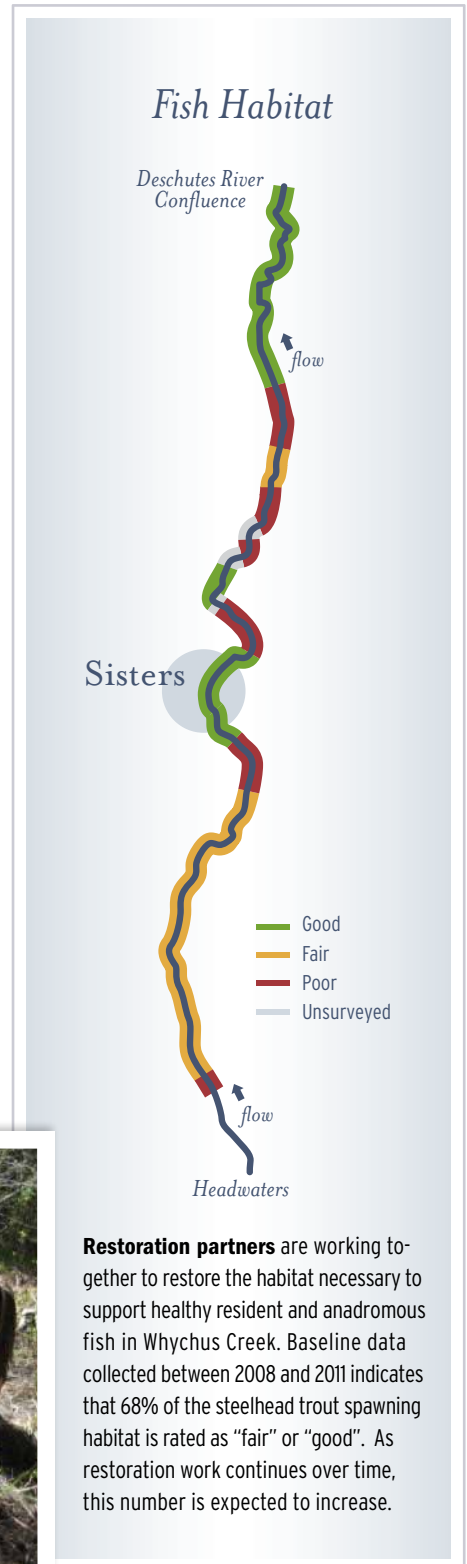
A FUTURE STEELHEAD TROUT SPAWNING IN WHYCHUS CREEK WILL LIKELY have traveled thousands of miles on its journey down the Deschutes and Columbia Rivers, to the Pacific Ocean and back again. Along the way, a myriad of factors - fishing, predation, dams, ocean conditions and others - will ultimately affect the long term growth and stability of the population.

While many of the large scale factors affecting steelhead trout are outside the control of restoration partners working in Whychus Creek, the quality of the habitat within Whychus Creek can be improved through carefully planned restoration projects. The cumulative benefit of improved habitat along more than 30 miles of creek can ultimately have significant impacts on fish populations and, along with sustained stream stewardship practices, restoration projects play an important role in supporting healthy conditions for the fish in Whychus Creek.

Biologists leading the salmon and steelhead reintroduction effort have been evaluating the quality of habitat in Whychus Creek by collecting data on substrate, cover, pools, and other attributes. These data are then analyzed using HabRate, a habitat model developed by the Oregon Department of Fish and Wildlife, to rate habitat quality as “poor,” “fair,” or “good” for the different life stages of steelhead trout and Chinook salmon. A “fair” or “good” rating indicates that habitat conditions will successfully support fish survival.

Baseline fish habitat data collected between 2008 and 2011 indicated that physical habitat was suitable for summer rearing and overwintering life stages of

steelhead trout and chinook salmon in all 33.2 stream miles surveyed. There was less suitable habitat for steelhead and chinook spawning: approximately one-third of surveyed miles (10.5 miles) were rated “poor”, with the remaining two-thirds of miles (22.7 miles) rated “good” or “fair”. Most of the reaches rated as “poor” are in areas where historic channelization, reductions in streamflow, or other disturbances have significantly changed the creek. Over time, as habitat restoration projects are implemented and the creek is re-surveyed, these ratings are likely to improve. By continuing to track these changes in stream conditions and habitat ratings, local restoration partners can monitor and better understand their progress in restoring fish habitat in Whychus Creek.



Fish Passage



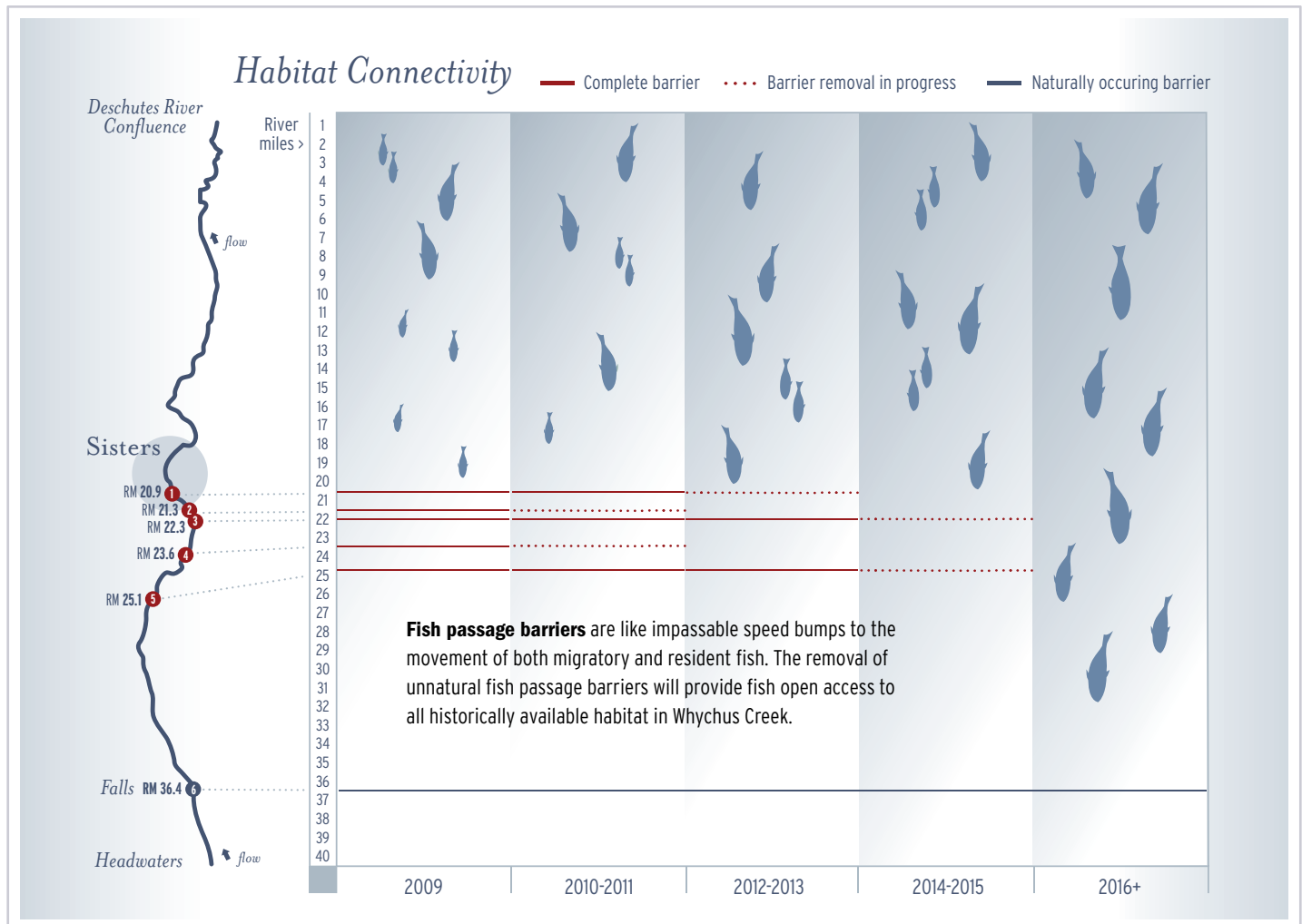
AS REDBAND AND STEELHEAD TROUT move throughout Whychus Creek, fish passage barriers at dams, diversions and other manmade structures can block access to historic spawning, foraging and rearing habitat. Because the removal of these barriers can significantly increase the available habitat, and therefore increase the strength of local fish populations, barrier removal is a very important component of collaborative restoration efforts in Whychus Creek. Tracking the increase in habitat connectivity achieved by removing barriers can be a valuable indicator

of long-term restoration success.

As of 2009, five barriers limited fish passage and migratory movement in Whychus Creek between river mile 15.5 and river mile 26.8. The graphic below illustrates how barriers affect the number of miles of contiguous stream habitat. As barriers are removed, fish have increased access to healthy, contiguous habitat in Whychus Creek, particularly when barrier removal is coupled with habitat restoration, installation of fish screens, and streamflow restoration.

Restoration partners have completed

projects that restored fish passage at two of the original five fish passage barriers. Twenty-two miles of fish habitat are now accessible from the mouth of Whychus Creek. Current efforts will address the remaining three barriers, providing many more miles of contiguous connectivity for fish. As habitat, or stream connectivity, increases with each barrier to fish passage removed, the capacity of Whychus to support the freshwater life stages of steelhead and salmon will move closer to the conditions that historically supported abundant populations of these species.



Irrigation Diversion Screening

FOR THE FISH THAT INHABIT WHYCHUS CREEK, UNSCREENED IRRIGATION DIVERSIONS may be potentially dangerous detours. Fish moving upstream or down can inadvertently swim or be drawn directly into an irrigation canal. Once in a canal, they may be more vulnerable to predators or become stranded within a complex system of canals. Juvenile fish are particularly vulnerable as they may seek shelter in a canal, mistaking it for a naturally occurring side channel.

While the expensive studies required to quantify how many fish may be lost in Whychus Creek's diversions have not been completed, anecdotal reports from a 2006 fish salvage effort estimated that 5,000 fish were rescued from one large irrigation diversion. In addition, published scientific research has repeatedly documented the negative effects of unscreened diversions

on fish populations throughout the Pacific Northwest. With this information in hand and steelhead trout reintroduction underway, efforts to install protective fish screens were launched in 2008.

Of the twelve irrigation diversions spread along 15 miles of Whychus Creek, none were equipped with fish screens until the first protective screen was installed



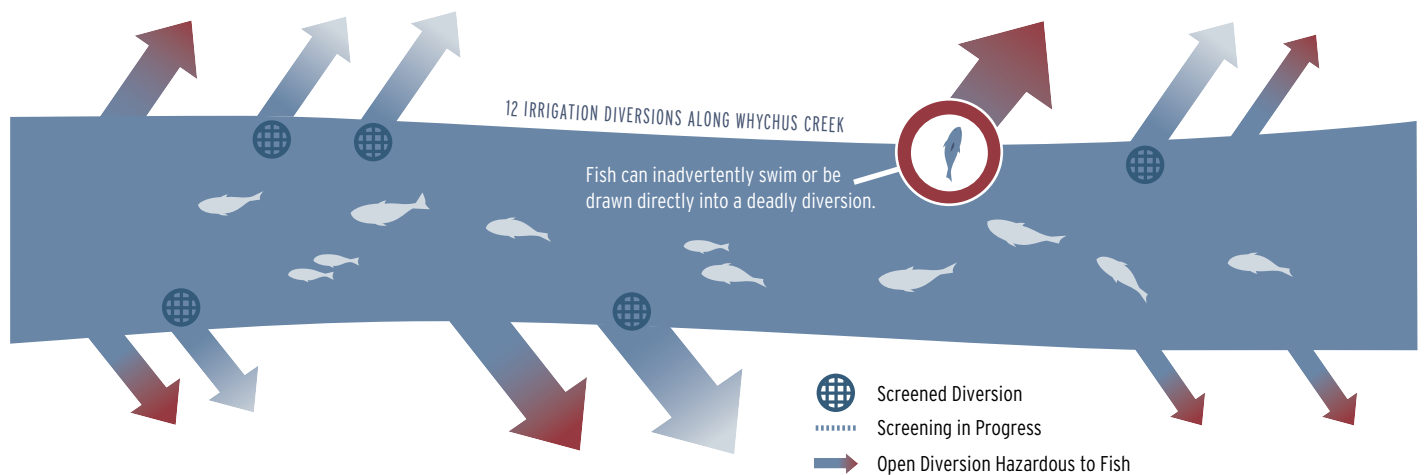
in 2009. Between 2009 and 2012, restoration partners screened an additional four diversions, reducing the amount of flows diverted through unscreened diversions by more than 82%. Through continued collaboration, all of the diversions on Whychus Creek will likely be screened or decommissioned by 2020.

Screening Irrigation Diversions

TWO MEASURES OF PROGRESS to track the improvements to fish screening over time:

1 Total number of screened diversions:
Five out of 12 diversions (42%) are currently screened.

2 Total volume of water diverted through screened diversions:
Of the total of 178 cubic feet per second (cfs) of water rights for diversions from Whychus Creek, 146 cfs (82%) now flow through protective screens.



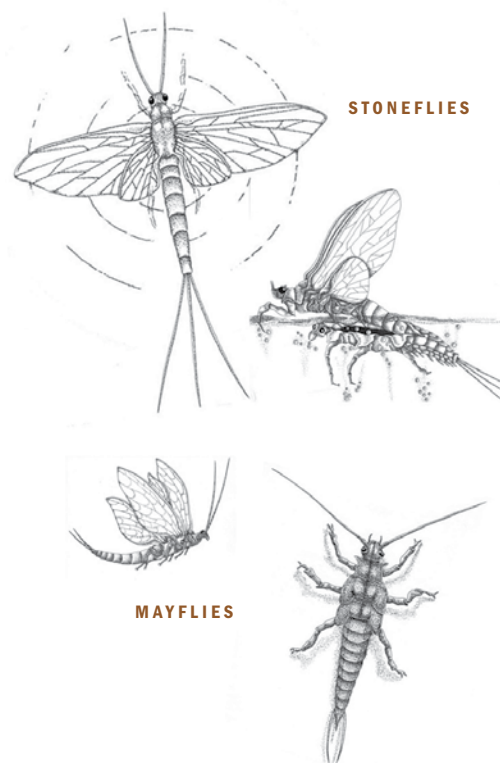
Macroinvertebrates

MACROINVERTEBRATES – STONEFLIES, MAYFLIES AND OTHER AQUATIC “BUGS” that live in the creek—can tell us a lot about the health of Whychus Creek because they are extremely sensitive to changes in water temperature, sediment, habitat conditions and other stream conditions. Much like the “canary in the coal mine,” the macroinvertebrates in Whychus Creek are being used as important biological indicators to track long-term restoration effectiveness.

Macroinvertebrate studies typically examine the relative distribution, abundance, diversity and richness of species throughout the creek. Because some species live in only pristine conditions with cold, clean, well-oxygenated water and others are more tolerant of poor conditions such as warm, nutrient rich water with high sedimentation, surveys provide important clues about overall conditions. As these data can be tracked over the long term through repeated surveys, macroinvertebrates provide one of the most useful biological indicators for restoration practitioners.

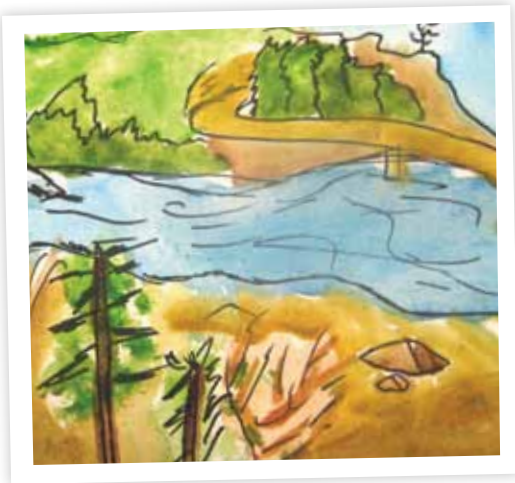
In 2005, the Xerces Society and others collected macroinvertebrate samples from 10 sites along Whychus Creek from river mile 30.25 to river mile 0.5. This initial sampling was conducted prior to large scale habitat restoration or significant stream flow restoration and, therefore, provides a good baseline from which to track long-term changes. Recognizing that macroinvertebrates are one of our best indicators of stream conditions, restoration partners conducted monitoring at the same sites in 2009, 2011 and 2012 and plan to continue monitoring over the next several years.

Macroinvertebrate data indicated different responses in different sections of the creek over time, demonstrating the complexity that characterizes ecological systems. However, in downstream reaches where streamflows have consistently improved over the last decade, changes in macroinvertebrate populations suggest that there have been steady improvements in habitat conditions. Continued monitoring throughout the watershed will help restoration partners develop an increasingly clear picture of the responses of the macroinvertebrate community as stream habitat and stream flow restoration work continues.



TOP: Stoneflies and mayflies are among the species most sensitive to changes in stream conditions.
BOTTOM: Volunteers collect macroinvertebrates on Whychus Creek to track the macroinvertebrate community response to changes in stream conditions.





WHYCHUS CREEK

Monitoring Partners

THE MONITORING DISCUSSED IN THIS REPORT IS conducted as part of the Bonneville Environmental Foundation's Model Watershed Program in Whychus Creek. This program provides dedicated funding to conduct ten years of watershed monitoring that evaluates the long-term effectiveness of watershed restoration projects.

THE PROGRAM IS IMPLEMENTED IN WHYCHUS CREEK BY:

Bonneville Environmental Foundation
The Deschutes Partnership*

* The Deschutes Partnership includes the Upper Deschutes Watershed Council, Deschutes River Conservancy, and Deschutes Land Trust. These groups are working together to restore conditions to support successful reintroduction of salmon and steelhead on Whychus Creek.

To learn more about the restoration and monitoring discussed in this report:

UPPER DESCHUTES WATERSHED COUNCIL

VISIT www.RestoreTheDeschutes.org

WRITE PO Box 1812 Bend, OR 97709

CALL 541 382 6103

DESCHUTES RIVER CONSERVANCY

VISIT www.DeschutesRiver.org

WRITE 700 NW Hill St. Bend, OR 97701

CALL 541 382 4077

DESCHUTES LAND TRUST

VISIT www.DeschutesLandTrust.org

WRITE 210 NW Irving Ave. Suite 102 Bend, OR 97701

CALL 541 330 0017

To learn more about the work of The Deschutes Partnership, **visit:** www.deschutespartnership.org

