Water Quality Trading

WATER QUALITY & TEMPERATURE TRADING IN THE TUALATIN BASIN

TEN YEARS OF COMMUNITY-DRIVEN WATERSHED HEALTH EFFORTS

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INTRODUCTION

NPDES Temperature Requirements

Nearly ten years into its trading program, Clean Water Services (the District), a public utility district that serves more than 536,000 customers in the urban portion of Washington County in northwest Oregon, has met the temperature requirements of its National Pollutant Discharge Elimination System (NPDES) permit in part by planting trees instead of installing chillers to cool effluent from its wastewater treatment plants. This "watershed" approach — involving "temperature trading" — has kept utility rates low, saved over $100 million in avoided costs, and improved the health of the watershed far beyond simply meeting narrowly defined regulatory temperature requirements. The program has catalyzed extensive coordination among diverse partners now working together towards a shared vision of a healthier watershed. This collective effort is having beneficial impacts well beyond just those required for meeting NPDES permit requirements including: partners planting over four million trees and shrubs; enhancing and conserving 15,000 acres of land; and planting native vegetation along more than 60 stream miles.

Watershed Approach Benefits

In addition to addressing regulatory requirements, temperature trading has been a key driver for leveraging multiple water quality and ecological benefits. This community-driven approach has: helped build a green economy; leveraged funding from multiple sources; improved habitat for fish, birds and other wildlife; increased climate change resilience and carbon sequestration; and developed the social capital needed to ensure long term stewardship of restored areas.

Multiple Benefits

This article summarizes the last ten years of temperature trading and as such is one of the first case studies chronicling ten years of full-scale community-based trading. The article discusses the benefits of community-based trading and the many opportunities available for leveraging local, state, and federal dollars to expand the breadth and depth of large watershed-scale restoration. It concludes with an overview of some of the challenges the watershed approach will face as it continues to evolve.

This article also serves as an update to "*Water Quality & Temperature Trading: Regulatory Innovation in the Tualatin Basin*" (Bruce Cordon, *TWR* #24, February 2006).

BACKGROUND

"End-of-Pipe" Approach

Water quality regulation for wastewater treatment has long emphasized an "end-of-pipe" approach traditionally typified by regulatory limits on piped effluent outfalls to surface waters. Despite its successes, the traditional approach has struggled to address non-point source pollution and often forces utilities to invest in costly treatment technology to meet discharge requirements. In addition, this approach was not designed to meet the many diverse ecological needs required for a healthy watershed. To address these issues the District helped create a new model for meeting regulatory compliance. In 2004, the District was issued a watershed-based permit that allowed for "water quality trading" to accomplish water quality goals primarily through targeted improvements to the watershed, as opposed to technological fixes at District facilities. In this article the ideas and processes used to develop the watershed-based permit are collectively called "the watershed approach." The intent of this approach is to provide a positive outcome for both the environment and the economy.

NPDES Permit Adaptation

The watershed approach includes:

Watershed Approach Components

- Using a watershed scale as a geographic frame of reference
- Recognizing the relationships between the various organisms and activities, both human and natural, that occur within a watershed
- Acknowledging the contribution of natural resources to human well-being
- Emphasizing incentives, rather than mandates, as inducements for desired behavior
- Recognizing the role markets can play in bringing about environmental improvements
- Emphasizing public/private and regulated/non-regulated entity partnerships
- Being flexible concerning the ways regulated entities can meet regulatory goals

Point & Nonpoint Targets

In this manner, the watershed approach targets both point and nonpoint pollution sources to accomplish and enhance multiple water quality and ecological benefits. It also improves the economic efficiency of regulatory compliance as it improves opportunities for restoration throughout the watershed.

Water Quality Trading

TMDL Thermal Allocations

Technology Options

Thermal Trading Development

Permit Compliance

Shade Effect Modeling

Economic Efficiency

Trading Factors

THE WATERSHED-BASED PERMIT

The District owns and operates four wastewater treatment plants in the Tualatin River watershed, and — along with its 12 member cities and Washington County — implements the **m**unicipal **s**eparate **s**torm **s**ewer **s**ystem (MS4) NPDES permit program in urban Washington County.

In 2001, a Temperature Total Maximum Daily Load (TMDL) for the Tualatin River was published by the Oregon Department of Environmental Quality (ODEQ). The TMDL includes thermal load allocations for two of the District's Advanced Wastewater Treatment Facilities — the Rock Creek and Durham plants. As such, the District knew that thermal load allocation would become a requirement of its 2004 NPDES permit.

Faced with the enormous task of cooling fifty million gallons of effluent per day, the District pondered the available traditional options: either install refrigeration equipment at the treatment facilities or build a new pipeline to transfer the effluent to the much larger Willamette and Columbia Rivers. The cost of either approach — both in excess of a hundred million dollars — was prohibitive. In addition, either approach would require enormous amounts of electricity. Ultimately, the District concluded that the technology-based approach, which would require mechanical cooling, was resource intensive and cost prohibitive, and would do little to improve watershed health.

Fortunately, ODEQ and the District were willing to consider nontraditional options, and were assisted in this respect by a grant from the US Environmental Protection Agency (EPA). The grant helped fund the development of the 2004 watershed-based permit, which was initially issued on February 26, 2004, and reissued on July 27, 2005. The permit included innovative provisions that allowed "water quality trading" for temperature. Specifically, it allowed the District to offset excess thermal loads of its wastewater treatment facilities by establishing a thermal trading program which includes: 1) planting trees, to increase the amount of shade along streams; and 2) flow restoration, which increases the amount of water available in the river. Shade reduces the extent to which the sun heats the stream. Additional flow spreads that thermal energy gain over more water, thereby decreasing a temperature change, and also increases flow speed, which reduces the time available for solar radiation to increase the temperature of the river.

As predicted, water quality trading has proven to be very cost-effective when compared to technology-based options in addition to providing an opportunity to substantially improve overall watershed health.

THE TEMPERATURE MANAGEMENT PLAN

The details of how the District would use shade and flow restoration to meet permit requirements were worked out in an ODEQ-approved Temperature Management Plan. From the outset, it was recognized that the plan would need to contain several departures from the traditional approach. First, given the nature of shade and its creation, permit compliance could not be expected immediately; nor could it be determined by simply measuring stream or treatment facility effluent temperature. It would take time to plant enough trees to provide the needed shade, and it would take even longer for the trees to grow high enough to produce shade-effects — much longer than the five-year period for which an NPDES permit is issued. Recognizing this, the plan gives the District five years to plant enough trees to meet permit requirements. The plan gives the District shade credit as soon as the trees are planted, based on an estimate of how much shade the trees will be producing twenty years later. The shade estimates are calculated using the "Shade-a-Lator" module of a "Heat Source Model" developed by ODEQ (www.deq.state.or.us/wq/tmdls/tools.htm). To compensate for the time lag between tree planting and the amount of shade created in 20 years, the plan also requires the District to create twice as much shade as the ODEQ model indicates is necessary to offset the excess thermal load.

WATER QUALITY TRADING

According to EPA:

> Water quality trading is an innovative approach to achieve water quality goals more efficiently. Trading programs allow facilities facing higher pollution control costs to meet their regulatory obligations by purchasing environmentally equivalent (or superior) pollution reductions from another source at lower cost, thus achieving the same water quality improvement at lower overall cost.
>
> Where watershed circumstances favor trading, it can be a powerful tool for achieving pollutant reductions faster and at lower cost. Trading works best when there is a driver that motivates facilities to seek pollutant reductions; sources within the watershed have significantly different costs to control the pollutant of concern; and watershed stakeholders and the state regulatory agency are willing to try an innovative approach and engage in trading design and implementation issues.
>
> (EPA website, http://water.epa.gov/type/watersheds/trading.cfm, accessed March 25, 2014).

Water Quality Trading

Credit Exchange

Community Based Model

Incentives & Benefits

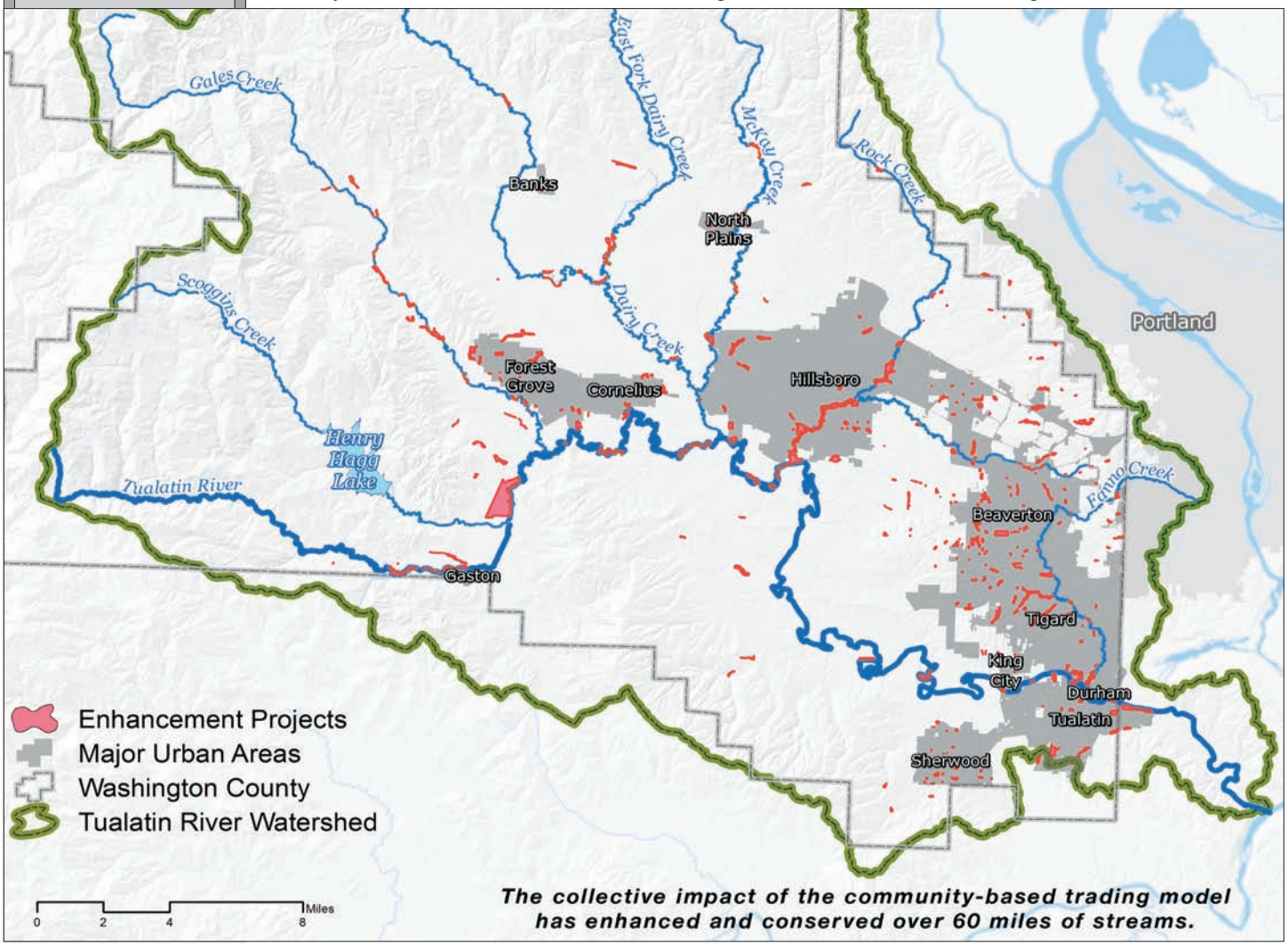
EPA also states that trading can occur directly between two or more point sources or through an exchange. Trading can also occur between a point source and a nonpoint source, either directly or through an exchange. A credit exchange is where a third party — such as a person, organization, or website — facilitates trading. A credit exchange can also include a reserve of credits held in case of failed trades. These are the basic trading scenarios; others may exist. (*see* EPA's *Frequently Asked Questions About Water Quality Trading* at: http://water.epa.gov/type/watersheds/trading/tradingfaq.cfm#10).

WATER QUALITY TRADING: THE DISTRICT'S APPROACH

To create enough shade to offset the excess temperature load, the District developed new programs that utilize water quality trading.

The District chose to focus on a community-based trading model instead of a market-based model for several reasons. The community-based model targets partnerships with similar restoration goals and develops shared programs that amplify additional ecological benefits. This approach leverages existing local, state, and federal resources and then applies these resources in a coordinated, focused restoration strategy. In rural settings, the District is primarily focused on agricultural land along streams and partnerships are developed through the local Tualatin Soil and Water Conservation District (TSWCD). In urban settings, this approach utilizes a network of cities and non-profit organizations to implement restoration programs along urban streams.

The District was able to help fund landowner incentive programs aimed at creating stream shade in rural areas while still substantially lowering its permit compliance costs. Moreover, the trees have produced many additional environmental benefits, such as: increased species habitat; removing pollutants from runoff; helping to control erosion; carbon sequestration; and increased resiliency to climate change. This could not be said for the technology-based solutions, which, in addition to being expensive and narrowly focused, would have caused increased pollution due to their substantial power needs.



Water Quality Trading

Tools Development

Riparian Restoration

Per Acre Payments

Buffer Maintenance

Ag Community Involvement

Stream Buffers

Restoration Contracts

Rural Planting Programs

Two tools were developed to address water quality needs in agricultural areas: 1) Enhanced Conservation Reserve Enhancement Program (ECREP); and 2) Vegetated Buffer Areas for Conservation Program (VEGBAC). As explained below, these tools were developed by partnering with agencies well-trusted by the agricultural community — TSWCD, US Department of Agriculture's (USDA's) Natural Resource Conservation Service, and USDA's Farm Service Agency — and by listening to the needs of the agricultural community. The local landowners and agency staff were invaluable in building these programs and continue to be important in program implementation.

ECREP

In order to address water quality needs in agricultural areas, the District partnered with the TSWCD to develop voluntary incentive-based tools for riparian restoration. Working with a Local Committee composed of farmers, foresters, and various stakeholder groups, the first tool developed by this partnership was "ECREP" — which was a modified version of USDA's Conservation Reserve Enhancement Program (CREP).

Before discussing the changes to the program, some background is in order. CREP had been available to farmers in the Tualatin Basin since the late 1990's, but no landowners had signed up for the program. Although the program had achieved some popularity in other parts of Oregon, it did not provide the kind of incentives needed for it to be successful in the Tualatin watershed. Two studies were then conducted to determine what was needed to increase its popularity (Viatella, Kathy, and Rhee, Donna, "*The Oregon Conservation Reserve Enhancement Program: An Opportunity for Achieving Healthy Watersheds*" (2002); Oregon Department of Agriculture and Oregon Association of Conservation Districts, "*Evaluation of the Conservation Reserve Enhancement Program*" (2002)).

The Local Committee reviewed these studies and looked at how CREP had been modified in other states to make it more successful. On the basis of this information, four things became clear. First, the annual per acre payments to farmers for farmland converted to buffer areas were too low, especially in areas like the Tualatin Basin, with highly productive land. Second, farmers were not compensated enough to maintain buffer areas after the site clearing and planting work was completed. Most farmers received less than ten dollars per acre per year for maintenance, but the actual cost, especially during the first five years, could be several hundred dollars per acre. Third, there was insufficient agency staff available to market the program and process enrollment applications. Finally, additional tools were needed to provide for the various needs of a diverse agricultural community.

In designing ECREP, the Local Committee made changes that reflected the information it had collected. ECREP increased annual payments, and TSWCD hired staff to market and manage the program. The TSWCD board of directors is composed of farmers and small woodland owners, and its staff work closely with landowner groups on a daily basis. TSWCD also shared office space with local USDA staff. Under ECREP, USDA retained many of the responsibilities it had under CREP. The shared office promoted coordination between all those involved in operating the program. Finally, while the District supported the program financially and performed a general oversight function, most of the program was implemented by the agricultural community.

VEGBAC

The next program the Local Committee developed was called Vegetated Buffer Areas for Conservation and Commerce. In 2014, the program is being slightly modified and the name is changing to Vegetated Buffer Areas for Conservation Program. VEGBAC provides incentives for rural landowners to plant native trees and shrubs in stream buffer areas. The program, which is also administered by the TSWCD, aims to provide shade to streams and cool water temperatures. VEGBAC offers a restoration alternative to landowners who either do not qualify for ECREP or prefer more flexibility over higher benefits. Moreover, when temperature trading began, no one in the local area had signed up for CREP in the past and there were no guarantees that ECREP would fare much better. VEGBAC was developed to provide a simpler, no-strings-attached alternative.

Under VEGBAC, a landowner enters into a restoration contract with TSWCD. TWSCD provides all necessary conservation planning, specifications, and planting material at no charge to the landowner. With landowner input, TSWCD, in conjunction with USDA's Natural Resource Conservation Service (NRCS), develops a conservation plan for the site. All restoration activities, including site preparation, seeding, planting, and maintenance is implemented by TSWCD. The landowner is required to pay for a portion of these activities for the first five years of the contract and TSWCD maintains the project area for the duration of the contract. Before work begins, TSWCD and the landowner develop a schedule and access plan indicating how and when TSWCD and its contractors can enter the landowner's property.

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Water Rights Leasing

Unlike ECREP, VEGBAC is a strictly local program — the federal and state governments have no role in its funding or management — and the landowner does not receive annual payments for the riparian restoration activities. However, landowners can qualify for a one-time bonus payment if 50% or more of the stream bank within a two-mile segment of stream is enrolled in VEGBAC or ECREP. Also, landowners can qualify for additional lump sum payments by electing a longer 15 or 30-year agreement. In addition, landowners who lease water rights to the State of Oregon for instream use may be eligible for payment through The Freshwater Trust, a nonprofit organization and VEGBAC partner. The Freshwater Trust works with the local Watermaster to determine if a landowner's water right qualifies for the lease.

Program Improvements

Program Enhancements

Several changes are underway in 2014 that enhance these programs. These changes: streamline the programs; reflect users' interests; provide a longer protection of investment; and are expected to increase enrollment, project connectivity, and landowner interest and attachment to projects.

Program enhancements include:

- Minimum buffer width increased from 10 feet to a minimum of 30 feet
- Contract terms increased, discontinuing the previous five-year duration and now providing 10-, 15-, and 30-year options
- All site preparation, planting, and maintenance is performed by TSWCD and its partners
- Easement options replaced with Restoration Partnership Agreement and lump sum payments
- Landowners receive results of vegetation monitoring

Landowner Interest

Since ECREP and VEGBAC were implemented in January of 2005, the programs have received significant interest from landowners. By the end of 2014, nearly 70 landowners will be enrolled in ECREP and VEGBAC programs. Given the level of interest in the programs, along with the progress made on its own buffer re-vegetation projects within its service area, the District has met the shade benchmark established in its temperature management plan. ECREP and VEGBAC have made agricultural restoration a reality in the watershed. As noted above, prior to these programs the CREP program in the Tualatin basin hadn't any enrollment.

Public Property Partners

Urban Planting Program

The District has also partnered with its member cities and Washington County to plant trees and shrubs on public property within urban areas. More recently, the District has partnered with Metro (an elected regional government serving three counties and 25 cities in the Portland metropolitan area) and Tualatin Hills Park and Recreation District to plant a diversity of trees and shrubs on their properties. Through these local government partnerships, the District is able to access property for planting and restoration. In return, the property owner receives planning, planting materials, and long-term stewardship of their sites.

The District has developed strong partnerships with local nonprofits, including: Friends of Trees; SOLVE; Raindrops to Refuge; The Wetlands Conservancy; and others. Nonprofit organizations have been very successful at planning and facilitating large volunteer work parties, often planting thousands of trees in a single morning. Not only does this stretch the rate-payer dollar, it also gets the community involved in planting events which translates into local site ownership and long-term stewardship.

Volunteers Planting: At a recent community event nearly 100 volunteers planted several hundred trees and shrubs to improve watershed health. Volunteers have fun, stretch rate-payer dollars,and develop local site buy-in.

Temperature Trading - Flow Restoration

Another component of the District's temperature trading program is restoring flow in the Tualatin River using its stored water in Hagg Lake (Scoggins Reservoir) and Barney Reservoir. As currently implemented, flow restoration primarily benefits the mainstem Tualatin River. Many of the tributaries of the Tualatin River lack sufficient flow during the dry season to provide good water quality and support aquatic habitat. Over the last few years, the District has conducted pilot studies which restored flows in some Tualatin River tributaries. The pilot studies have shown that enhancing flow in the tributaries results in improved water quality — lower temperatures and higher dissolved oxygen levels — improvements which are reasonably expected to provide broader ecological benefits. The District plans to work cooperatively with the Oregon Water Resources Department, Tualatin Valley Irrigation District, and local farmers to continue implementing the tributary flow restoration program.

Water Quality Trading

Leverage Programs

Observations & Lessons Learned

The District has learned that many landowners want to manage their land in a way that provides good economic benefits but also enhances watershed health. By providing expertise and financial incentives to landowners, long-term partnerships have been forged. In rural areas, TSCWD is the lead agency, while in urban areas there is a mix of inter-governmental coordination and nonprofit organizations providing volunteer manpower to build community support of projects.

ECREP and VEGBAC have also helped open the door for landowners to leverage additional resources and benefits through other state and federal voluntary incentive programs, including: the Environmental Quality Incentive Program; Agricultural Water Enhancement Program; Wildlife Habitat Incentive Program; Oregon Watershed Enhancement Board Small Grant Program; Oregon Riparian Tax Incentive Program; Oregon Wildlife Habitat Conservation and Management Program; and Nonpoint Source Pollution Control Facilities Tax Credit. These additional funding sources have made it possible to expand the program faster and into larger areas — thereby improving watershed health at a faster rate than would have occurred under regulatory requirements alone.

By implementing a watershed approach and partnering with diverse stakeholders, the District and its partners have collectively enhanced and conserved 15,000 acres of land and over 60 miles of streams — thereby accomplishing a profoundly positive impact on the basin's natural resources. This effort represents a great example of the beneficial collective impact — a diverse group of stakeholders from different sectors working together to solve a challenging social problem using a common agenda, aligned efforts, and common measures of success (*see* www.fsg.org/OurApproach/CollectiveImpact.aspx). By partnering with cities, farmers, other governmental organizations, nonprofits, volunteers, industry, and others, project sites are linking together — which improves river and watershed health and provides lower management costs, higher water quality and habitat values, and more system resilience.

Moving forward all these planting programs is now collectively called the "Tree For All" program — which brings together both urban and rural partners. More information can be found at www.JoinTreeForAll.org.

"Tree For All" brings together urban & rural partners www.JoinTreeForAll

Thermal Load Offset

Flow Release

Added Benefits

Beaver Colonization

RESULTS

The District is meeting its permit requirements and more.

Watershed-Based Permit Requirements

The District's Temperature Management Plan established a five-year schedule to offset the excess thermal load from the Advanced Wastewater Treatment Facilities. During the initial five-year period (February 2004 through January 2009), the District conducted over 30 miles of riparian plantings which over time will result in 590 million kilocalories per day of thermal load being blocked (i.e., by shade) and which translates into 295 million kilocalories per day of thermal credits using the 2:1 trading ratio specified in the Temperature Management Plan. The District also released an average of 35 **c**ubic **f**eet per **s**econd (cfs) of stored water throughout July and August during each year of the five-year period — this flow restoration generated 508 million kilocalories per day of credits at the Rock Creek Advanced Wastewater Treatment Facility and 347 million kilocalories per day of credits at the Durham Advanced Wastewater Treatment Facility. Using a combination of flow restoration and riparian planting projects, the District has offset the excess thermal loads from the Rock Creek and Durham facilities. Since the permit has been administratively extended, the District continues flow restoration activities and is banking additional riparian planting projects for when the permit is renewed.

Ecosystem Benefits

The District's temperature trading program supports numerous ecosystem benefits beyond meeting the requirements of the watershed-based NPDES permit. The ecosystem benefits of riparian shading activities include: improved stream functions (bank stabilization, peak flow attenuation, habitat creation); increased diversity of aquatic and terrestrial plant and animal species; filtering of stormwater runoff; and improved water quality.

Increased complexity of structure and diversity of restored riparian forests and forested and scrub shrub wetlands (i.e., areas dominated by woody vegetation less than twenty feet tall) support many important ecosystem functions. One example of this is colonization of some stream reaches by beavers, a keystone species for stream function in the basin. By raising the water table, beavers promote floodplain wetlands with enhanced plant, animal, and geomorphic diversity in comparison to the original simplified and degraded stream. These features and resultant geomorphic diversity may also provide cool water refuges for cold-water fish, including steelhead listed under the federal Endangered Species Act. Furthermore, the enhancement of riparian areas within and outside the District's service area improves the overall health of the Tualatin River watershed and creates partnerships with positive outcomes for water quality.

Water Quality Trading

Departing from Tradition

Reforestation Goals

Additional Options

One Million Trees

The District's release of stored water also provides multiple ecosystem benefits. Flow restoration: provides cooling effects; buffers against temperature changes; and results in higher dissolved oxygen levels to support aquatic life. Flow restoration, along with the release of the highly treated discharges from the District's Rock Creek and Durham AWTFs, provides a sustainable base flow to the mainstem Tualatin River during the dry season.

CONCLUSION

LOOKING TO THE FUTURE: CHALLENGES & OPPORTUNITIES

It is clear that the District's 2004 NPDES permit and the landowner incentive programs it spawned are a departure from traditional regulation. The overall effort contains many of the elements of the watershed approach, including: water quality trading; public-private partnerships; economic incentives; regulatory flexibility; and a watershed perspective on water quality management. ECREP, VEGBACC, and our community planting programs have been successful in helping the District meet its permit obligations and demonstrate that the watershed approach can be more economically efficient than the traditional approach.

To address the thermal load associated with the projected growth in its service area, the District continues to implement a strategy that includes creating shading for thermal load reduction activities to reduce the thermal load discharged from the wastewater treatment facilities, and a thermal load trading program to offset the remaining thermal load from the wastewater treatment facilities.

In 2004, the infrastructure was nascent for an extensive reforestation program that would improve not only the health of the Tualatin River but that of the entire county. It took time for the plant nurseries to build up to current production capacities, contractors to find and fill the native plant installation niche, and our communities to rise to the challenge. In 2005, the cities were challenged to plant one million trees in twenty years. They met that challenge in less than ten years because of the collective impact of diverse partnerships toward the common goal of reforestation.

The District is strengthening partnerships with the Tualatin Soil and Water Conservation District and developing collaborative projects with Metro, Tualatin Hills Park and Recreation District, US Fish and Wildlife Service, and others to enhance riparian corridors, floodplain wetlands, and adjacent natural areas to improve overall watershed health. These partnerships result in large-scale restoration projects that will have a considerable landscape level impact on the ecological health of the Tualatin River watershed. As projects evolve over time, the District is exploring approaches to increase resiliency of the natural system, such as introduction of shady herbaceous plants or increased shrub diversity. In regards to emerging scientific understanding of ecological processes, the District is interested in potential cooling effects of restored wetlands and braided channels, which have more accounting complexity than typical sites. The District is also working to identify core cold water habitat areas in the Tualatin River watershed and will include this information in the screening criteria for riparian project selection. Recognizing the ecological benefit of beavers, the District is also exploring the impacts beavers have on temperature regimes and the ecological health of the watershed.

The District will continue developing its rural and urban tree planting programs and continue to explore flow restoration opportunities. Also, the District and its partners — through the collective impact — now have the capacity to plant one million native trees and shrubs in one year. This was not possible when the program began in 2004. Now, due to the efforts of everyone involved, one million trees will be planted over the course of ten months. Starting in September 2014, the District kicks off a Tree For All campaign that will plant "One Million, in One Year, for One Water" (www.JoinTreeForAll.org).

The collective impact, the watershed approach, and temperature trading have made the impossible possible.

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