Proposal
Medford Regional Water Reclamation Facility
Thermal Credit Trading Program

As part of the Rogue Basin Total Maximum Daily Load (TMDL), the Oregon Department of Environmental Quality (DEQ) is implementing temperature limits on permitted dischargers. To meet these new thermal limits at the Medford Regional Water Reclamation Facility, the City of Medford is proposing to use streamside re-vegetation projects that will reduce stream warming caused by radiant heating

This document provides an explanation of the plan to offset thermal impacts and includes the solar load reduction calculation methodology, site selection and location criteria, landowner recruitment and contracting requirements, and standards for site assessment, site planning, implementation, maintenance and monitoring, remediation measures to address underperforming sites, and third party verification and registration procedures.

Temperature TMDL / Trading Requirements

The TMDL set by DEQ for Temperature in the Rogue Basin includes an allocation for the Medford RWRF of 0.1772 °C. That is, discharge from the treatment plant cannot raise the river temperature more than 0.1772 °C. For practical use in determining trading requirements, this allocation is converted to a measurement of heat utilizing average plant flow and the 7Q10 river flow (the seven-day average low flow with a ten year return frequency). Heat is measured with the unit of millions of kilo-calories per day (kCal/day).

The Medford Regional Water Reclamation Facility (RWRF) has a permitted design capacity of 20 million gallons per day. Because the thermal load that is discharged is based on the plant flow, the thermal discharge will continue to increase as growth causes flows to increase. This will increase the amount of trading that needs to be achieved to comply with the TMDL.

Based on existing conditions, the estimated projected maximum heat discharged to the river can exceed the waste load allocation by 267 million kilocalories when river flows are at or below 7Q10 conditions. As the region grows, the plant flow will increase and the amount that the excess temperature load exceeds the allocation will increase. By the year 2030, mitigation of approximately 400 million kilocalories is anticipated. Based on this projection, Table 1 shows the goals for mitigation expressed in miles of river restoration as well as estimated kilocalories of credits. The miles of restoration are an estimate and will change based on the shade potential that is available from the selected projects.

Table 1. Restoration Goals for the Temperature Offsets		
Year	No. of Miles Restored	Cumulative Kilo-Calories Offset, millions
2012	1.00	10,500,000
2013	3.00	42,100,000
2014	3.00	73,700,000
2015	3.00	105,300,000
2016	3.00	136,900,000
2017	3.00	168,500,000
2018	3.00	200,100,000
2019	3.00	231,700,000
2020	3.00	263,300,000
2021	3.00	294,900,000
2022	1.40	309,700,000
2023	1.40	324,500,000
2024	1.19	337,000,000
2025	1.00	347,500,000
2026	1.00	358,000,000
2027	1.00	368,500,000
2028	1.00	379,000,000
2029	1.00	389,500,000
2030	1.00	400,000,000

Implementation

Implementation of the TMDL will be addressed as part of the revised NPDES permit and compliance schedule. The RWRF could exceed the TMDL at any time that the Rogue River flows approach draught conditions. Consequently, interim limits will be needed as well as a compliance schedule to establish a time frame for meeting the TMDL.

Project Management / Potential Trading Partners

The City of Medford issued a Request for Proposals (RFP) to select a trading partner that will be responsible to organize and manage all restoration and trading activities and the City is currently negotiating an agreement with The Freshwater Trust for these services. The partner organization will oversee the trading program including preliminary modeling and site selection through monitoring and maintenance, third party verification and registration procedures. Medford plans to enter into an agreement with The Freshwater Trust (TFT) whereby TFT will develop, finance, certify, register and maintain the restoration projects and the City will purchase the credits for the completed project.

The basis for selecting TFT was the experience and capacity of TFT to develop credits that are registered and to maintain the restored sites. The City will work with DEQ to be consistent with the DEQ internal management directive *"Water Quality Trading in NPDES Permits, Internal Management Directive"* dated December 2009

Geographic Boundary

Projects under this permit will be completed on sites in the approved offset area: the Rogue River watershed upstream of the point of maximum impact at river mile 62 including the Bear Creek watershed. See Appendix A for a map that shows the area for potential solar load reduction.

Site Selection and Assessment

Recruitment and Site Selection

Sites will be selected that meet geographic criteria, thermal reduction potential, and pertinent biological priorities (i.e. all projects will be completed in salmon bearing streams subject to the same cold water quality criteria of the facility). Sites with the highest potential for generating credits will be preferred.

Timeline: Recruitment activities will begin upon signed contract between TFT and the City of Medford and continue until obligations are met.

Site-specific Solar Load Reduction Calculation

Potential project sites will be evaluated using the Shade-a-lator model 6.2 (DEQ 2009a) for Bear Creek and Version 8 for the Rogue River. The model will be used to calculate baseline solar radiation flux and associated effective shade based on the geographic and vegetative characteristics of the stream channel. The model will also be used to calculate the post-restoration heat load, which is the basis for establishing kcal reduction values.

While excess thermal load can be encountered in September through the end of October, the largest excess has historically occurred on October 16 and will continue to be on that date. Wastewater temperatures drop during October so the most critical conditions occur on the first day of the compliance period when river flows and the applicable temperature criterion are at their lowest level. Solar radiation conditions for October 16 will be used to compute the temperature credits.

A trading ratio of 2:1 will be employed unless otherwise approved by DEQ.

Timeline: Ongoing, concurrent with recruitment activities.

Re-vegetation Project Standards

Each project site is unique, but planning, implementation, maintenance and monitoring specifications will be governed by the Re-vegetation Standards (described below). These standards are required to ensure consistent project quality and performance over time.

Site Assessment & Baseline Monitoring

Field visits are required for eligible sites in order to develop a baseline credit estimate and develop a restoration plan appropriate for the current site conditions. Site assessment and baseline reports will include:

- **Map of restoration site**: A map in a standardized format that includes documentation of invasive plant coverage, evidence of flooding regime, and site conditions relevant to plant selection.
- **Current site conditions assessment**: A standardized database must be used to record, in detail, current site conditions and any relevant baseline condition observations that may influence performance of the site (i.e. adjacent property use, evidence ungulate browsing or livestock damage, etc.).
- **Photo-point establishment and baseline photos**: Photo-point monitoring locations will be established to document baseline conditions. These same photo points will be used annually to track site conditions and monitor changes in vegetation and structure. A minimum of one point will be selected to accurately showcase the features of the site. A minimum of four, high quality, digital photos (one from each cardinal direction from the established photo-point) must be taken that clearly and visibly depicts vegetation cover and structure in order to document a 360 degree view of the site. The pictures, as well as their corresponding longitude and latitude, must be stored in an accessible electronic database that will be updated annually to record and register site conditions and ongoing performance.

Timeline: Site assessments and monitoring will continue for the contracted life of the project.

Re-vegetation Project Design

Project designs must be customized for each site using the following standard components:

- **Planting area:** Plantings will be focused on land outside of active channel and above bankfull height, unless site conditions and ecological need demands otherwise (e.g. willow plantings to stabilize banks or reduce width to depth ratios, or plantings on point bars, islands, etc.).
- **Stem density:** Tree stem density and shrub stem density (stems per acre) targets will be established with using a reference site for a specific habitat type. The average density may vary depending on site-specific issues or reference site conditions. Sites will be designed to meet the stem density and structural characteristics of reference sites in the watershed (sites chosen to represent the least human impaired areas). Reference sites will be identified within the project's 5th field Hydrologic Unit Code (HUC). A target density of 1,600 stems per acre at project year 5 is the current standard.

- **Plant composition:** Species diversity targets will help to ensure a project's sustainability over the long term. A mix of Oregon native trees and shrubs will be selected that replicate the natural variability of reference sites in the watershed (sites chosen to represent the least human impaired areas. Reference sites will be identified within the project's 5th field Hydrologic Unit Code (HUC). Planting areas may be divided into hydrologic zones based on elevation; species composition will be determined accordingly. No more than 20% non-native woody vegetation cover will be allowed.
  - Current standard: At least five woody species, no single species representing more than 50% of the woody plants, trees should account for at least 20% of the total stems per acre target, and shrubs should account for at least 20% of the total stems per acres target.
- **Plant procurement:** Proper plant materials are necessary to ensure plantings will survive under local conditions over the long term. The following guidelines will be followed when selecting plant materials:
  - Transplanted material must come from outside the bankfull width.
  - Indigenous-derived plant material will be utilized, unless unavailable or otherwise impossible.
  - One to two-year old bare root seedlings will be utilized wherever possible.
- **Buffer width:** Projects intended for temperature reductions will be designed with an average buffer width of 60 feet, measured from the edge of the stream bank. Actual buffer widths may vary depending on site characteristics.

Timeline: Project designs will be created as project sites are selected.

Site Preparation

Timing of site preparation is vital to the success of a riparian re-vegetation project. Many riparian areas have been degraded by past land use or infestation by invasive species, such as Himalayan blackberry. Site preparation will include steps to address continued degradation and the removal of existing non-native woody vegetation and preparation of the soil surface.

Invasive plant removal: Invasive plants are defined as those plants included on the Oregon State Noxious Weed list[1] compiled by the Oregon Department of Agriculture. Invasive plant infestations will be treated using manual and mechanical methods and chemical herbicides appropriate for riparian work. Treatments may involve a combination of methods.

Manual and mechanical methods include: hand pulling, seed clipping, stabbing, girdling, cutting, solarization[2], scarification[3], chopping, and mowing. Equipment may include hand-held tools, power tools, and heavy equipment including tractors and bulldozers.

[1] http://www.oregon.gov/ODA/PLANT/WEEDS/statelist2.shtml

[2] Solarization is the technique of covering the ground surface with plastic sheeting to increase solar radiation and raise ground temperatures to kill plants, seeds, and other undesirable organisms (Tu et al. 2001). Opaque plastic can be used to block sunlight and kill existing plants.
(Katan et al. 1987 in Tu et al. 2001).

Herbicide treatments include the following: stem injection, cut-stump, wicking and wiping, spot application, and hack and squirt. Broadcast aerial spraying will not be permitted. Herbicides are limited to chlorsulfuron, clopyralid, aquatic labeled glyphosate, imazapyr (aquatic and non-aquatic labeled), metsulfuron methyl, and sethoxydim, sulfometuron methyl. Only surfactants or adjuvants that do not contain any ingredient on EPA's List 1 or 2[4] may be used. No herbicide will be applied if precipitation is forecasted within 24 hours. All herbicide treatments will comply with label instructions. A certified/licensed herbicide applicator will oversee all herbicide application projects.

Soil improvement: On compacted, agricultural soil, improving soil structure will improve plant survivorship. Loosening the upper portion of the soil profile effectively reduces compaction, increases water infiltration, aerates the soil, and makes planting in the soil easier. It will also be important for the disruption of invasive weed root systems that would inhibit new plant growth and foster rapid regeneration of the non-native vegetation if left intact.

Site soil will be prepared by auguring each planting site to a depth of 12 inches or, for larger sites, soil can be disked. Soil disking should not occur within 10 feet of the top of the stream bank to reduce the risk of bank failure or erosion. It should also not occur within 10 feet of existing native trees to reduce the risk of root damage. If the soil is disked, an erosion control seed mix will be sprayed to reduce soil erosion and invasive plant growth.

Disked or sprayed areas will be seeded with a native erosion control seed mix containing native grasses that establish quickly and aid in controlling erosion with little competing nutrient uptake. The mixture should be applied at 30lbs of pure live seed (PLS) per acre.

Timeline: May occur annually - April through September

Plant Installation

Riparian plant installation will occur in the late winter or early spring after the threat of winter flood events has passed. In cases where it is advantageous, potted material may be planted in the late fall months. A restoration professional will obtain the appropriate number of bare-root trees and shrubs. Care will be taken to ensure plant material is free of weeds and compatible with the project site (e.g., plant material from outside the site is sown from indigenous seed which will survive well at the site's elevation and climate). Cuttings from native *Salix*, *Cornus*, *Spiraea* and *Lonicera* shrubs may be used to supplement bare root plantings, especially on steep streambanks and in the active channel. Transplanted material must come from outside the bankfull width, typically in abandoned floodplains, and where such native plant material is often abundant.

A restoration professional will be onsite to lay plants out in their proper hydrologic zone and at the spacing dictated by the planting plan. Techniques such as tree protection tubes, or similar practices or technology will be used to minimize plant losses due to herbivory or damage from routine maintenance tasks (mowing/weed-whacking).

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[3] Scarification is the cutting of the top layer of soil.

[4] EPA listing indicates a chemical is of toxicological concern or is potentially toxic with a high priority for testing. See EPA's website for more information: http://www.epa.gov/opprd001/inerts/fr52.htm

Timeline: Planting will occur in the winter and early spring months when bareroot nursery stock is available. In cases where it is advantageous, potted material may be planted in the late fall months

Monitoring

All planting sites will be monitored to confirm success of the planting project and guide remediation actions if needed. Success of the riparian establishment plan will result in the restoration of several riparian habitat functions; however, this plan will specifically measure success relative to vegetation growth, cover, and diversity. Third party verification will occur on the schedule outlined below.

Monitoring schedule: Monitoring will be more robust during the establishment period. It is expected re-vegetation projects will reach a free-to-grow state in five years. 'Free-to–grow' is defined as a project with healthy trees, taller than competing vegetation and well distributed across the area[5]. Monitoring will be conducted at least once a year for the first five years and in response to any events, such as floods or fires, that may cause damage at a project site. Monitoring reports will be developed as follows:

Years 1-4 monitoring reports will include the following components:

- Updated map of restoration site, clearly demarcating areas of plant mortality or damage and other issues, such as erosion, as well as areas where plants are thriving.
- Census of planted species, including survival and mortality. Transect surveys will be completed for large areas.
- A summary of needed corrective measures or future maintenance needs and a schedule of when those actions will take place.
- Photo-point monitoring

Year 5 monitoring report will include the above components. In addition, an assessment will be completed to determine that each site is meeting the following requirements:

- The site has reached a free-to-grow state.
- The site will have no more than 20 percent non-native woody vegetation cover (average) at project Year 5.
- The site will have no fewer than five woody species and no single species may represent more than 50 percent of the woody plants at project year five.
- Neither trees nor shrubs will represent less than 20 percent of the total stems per acre at project Year 5.

Years 10, 15, and 20, monitoring reports will include the following or when floods, fires or other acts of God may indicate the need for monitoring:

- Updated map
- Summary of site conditions

[5] Oregon State University. *The Care and Planting of Tree Seedlings on your Woodland.* 2006.

- Summary of maintenance needs, including a schedule of tasks to be completed.
- Photo-point monitoring

Remediation

If the site is not performing to standards at Year 5, action will be taken to correct any problems, including replanting the site, excluding circumstances in which the loss or damage is due to acts of God. Loss due to flood, fire, or other events beyond the reasonable control of the City will not be cause for automatic replacement or repair of the damaged portion of a site. Maintenance will be continued and restoration of the site function will be assessed.

Timeline: Monitoring will be completed each fall. Remediation activities will occur as necessary throughout the project period.

Maintenance

Maintenance will include invasive plant control and replacement of failed plantings when needed. Scheduled maintenance tasks will occur on the timeline outlined below. Additional maintenance may take place as prescribed by routine monitoring reports.

Year 1

- Newly installed plantings will be irrigated as needed, dependent on soil moisture conditions. Irrigation will be completed by a trained contractor either from an onsite spring, rain catchment system, or directly from the stream.

Years 1 – 5

- Invasive plant control: Invasive plants will be managed by mowing the project site as needed annually. On severely infested sites, additional herbicide treatment may be required according to standards in the invasive plant removal section above.
- In-fill planting: Plant mortality between 10-20% is common. The original planting plan will be used as a guide for in-fill planting to replace failed plants, as well as an assessment on the success/failure of the on-site plants.
- Any materials used to minimize maintenance or herbivore damage (i.e. tree tubes or similar technology) will be removed during the fourth year after plant installation, unless there is a demonstrated need for continued use.

Years 5 – 20

Maintenance will be reduced after sites have achieved free-to-grow conditions. However, if a site sustains damage, corrective actions, including in-fill planting to replace failed plants will be completed as needed.

Timeline: Invasive control will occur in summer; in-fill planting will occur in spring.

Landowner Agreements

Signed landowner agreements or easements are required for each credit producing site. The agreement or easement must include the exclusive right to use the riparian area covered under the agreement for silvicultural activities required to meet and maintain vegetation standards. The agreement or easement must include the right to access the project site for the purposes of project implementation, maintenance and monitoring. The agreement or easement must also bar any activities in the project area detrimental to the goals of the project. Where required, agreements or easements will be recorded with the county land office.

Third Party Credit Verification

Third party verification will be required by the City. An organization that provides accredited professionals will be sought to independently verify that project land rights are secured for the duration of the credit life, site implementation standards are met, and that credit calculations are correct. Specific activities will include:

On-site inspection immediately following implementation of each project. To validate that credits can be used for compliance, riparian shade projects will have an accredited verifier attest that each project meets minimum design standards, has documented secure land access rights, and that credit calculations are accurate and free from material misstatements. The accredited verifier will use rapid visual assessment methods which were developed by The Willamette Partnership in coordination with DEQ to verify that credit calculations are within a 15-percent margin of error. Initially, the City intends to use accredited professionals trained by The Willamette Partnership.

Annual review of monitoring reports. Accredited verifiers will verify annually that monitoring reports reflect fulfillment of obligations and standards are met for 4 years after initial site visit.

Five year cycle on-site inspection of project performance. Every 5 years, accredited third-party verifiers will conduct on-site inspections. Over an average 20 year credit cycle, each project will receive inspection and attestation from at least four accredited professionals, assuring quality and demonstrating independent professional consensus that projects meet compliance standards.

Projects tracked on an online database. Project information will be available to agencies through a transparent, web-accessible, and credible registration system. This system will enable DEQ to demonstrate that compliance standards are met and will also address EPA's water quality trading requirement of "timely public access to information on trades."

Ancillary Benefits of a Temperature Trading Program

In addition to effectively lowering temperatures in the Rogue River, adoption of a temperature trading program has many ancillary benefits for the public and the environment. Economic analysis conducted as part of Medford RWRF facility plan (*West Yost Associates, 2011*) has shown that the cost of a temperature trading program is significantly less than the available alternatives. Evaluated alternatives included effluent chillers and effluent storage. These alternatives are not only more costly, but also more energy intensive; particularly effluent

chillers. The adoption of a lower cost solution will produce lower costs to rate payers and thus presents a public benefit.

The alternative temperature management options also do not provide any ancillary environmental benefits. The streamside rehabilitation and planting efforts conducted as part of this trading plan will improve habitat for wildlife and reduce silting be decreasing bank erosion.

Financing

The City of Medford has financed capital improvements on a pay as you go basis using rates to fund capital projects. Rates are adjusted to meet both operation and maintenance costs of the RWRF as well as the projected capital costs. The draft Facilities Plan includes a capital improvement plan (CIP) for the next ten years including the annual expenditures for the temperature trading program as shown in Table 2.

Based on the proposed CIP, the City will meet with the Regional Rate Commission to rate requirement to support the CIP. Development of the financing plan will be completed concurrently with the development of the pilot project.

Table 2. Estimated Cost for Restoration

Year	No. of Miles Restored	Annual Capital Costs, $1,000	O&M Costs, $1,000	Total Cost, $,1000
2012	1.00	135,000	3,000	137,000
2013	3.00	407,000	23,000	429,000
2014	3.00	415,000	64,000	480,000
2015	3.00	423,000	101,000	524,000
2016	3.00	428,000	119,000	547,000
2017	3.00	432,000	155,000	587,000
2018	3.00	434,000	168,000	602,000
2019	3.00	435,000	181,000	616,000
2020	3.00	435,000	194,000	629,000
2021	3.00	436,000	197,000	633,000
2022	1.40	222,000	209,000	431,000
2023	1.40	218,000	194,000	412,000
2024	1.19	186,000	178,000	364,000
2025	1.00	159,000	167,000	326,000
2026	1.00	156,000	155,000	310,000
2027	1.00	154,000	160,000	315,000
2028	1.00	155,000	158,000	313,000
2029	1.00	155,000	156,000	311,000
2030	1.00	154,000	156,000	310,000

Appendix A. Area Eligible for Trading