Executive Summary

Thermal Load Mitigation Alternatives Evaluation

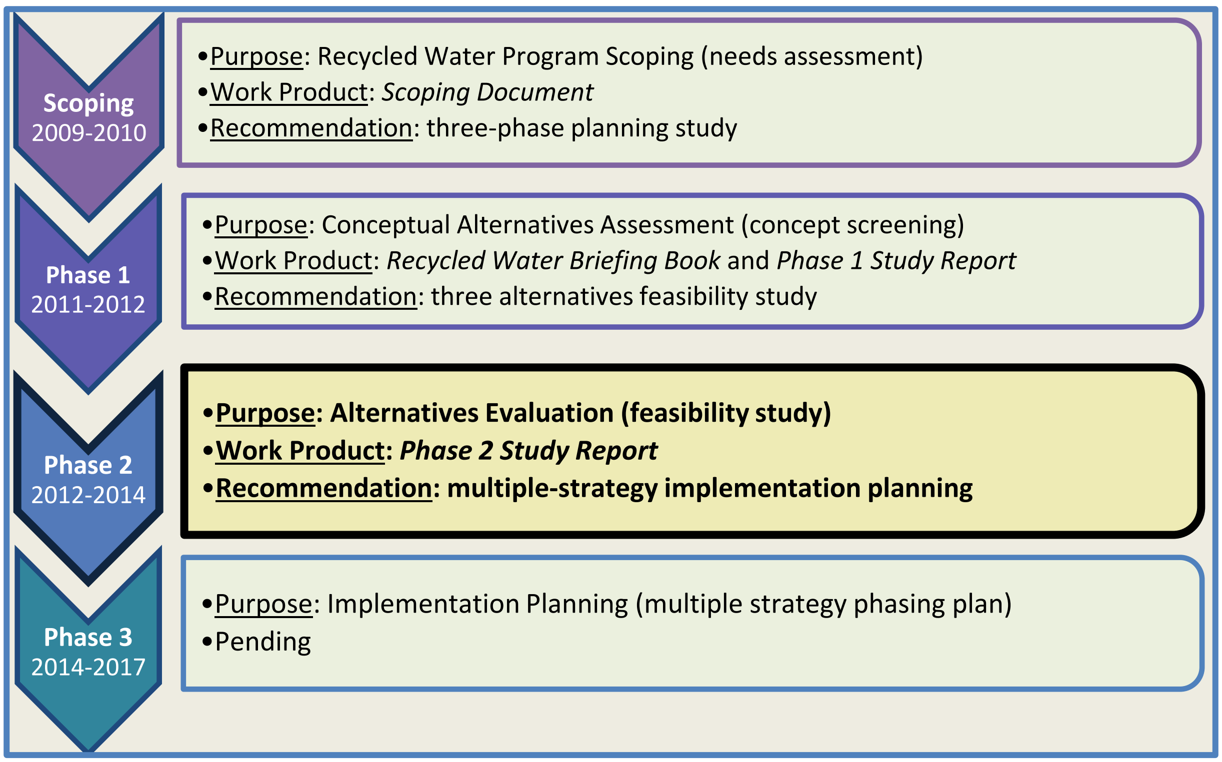
Recycled Water Program Implementation Planning, Phase 2 Study

August 2014

Study Background

The MWMC completed an Alternatives Evaluation feasibility study from 2012 – 2014 to develop better understanding of the cost-effectiveness of implementing a recycled water use program as a thermal load mitigation strategy. The Alternatives Evaluation study was the second phase of recycled water program implementation planning, following initial program scoping and an alternatives screening assessment process. **Figure ES-1** highlights Phase 2 in the timeline of study phases.

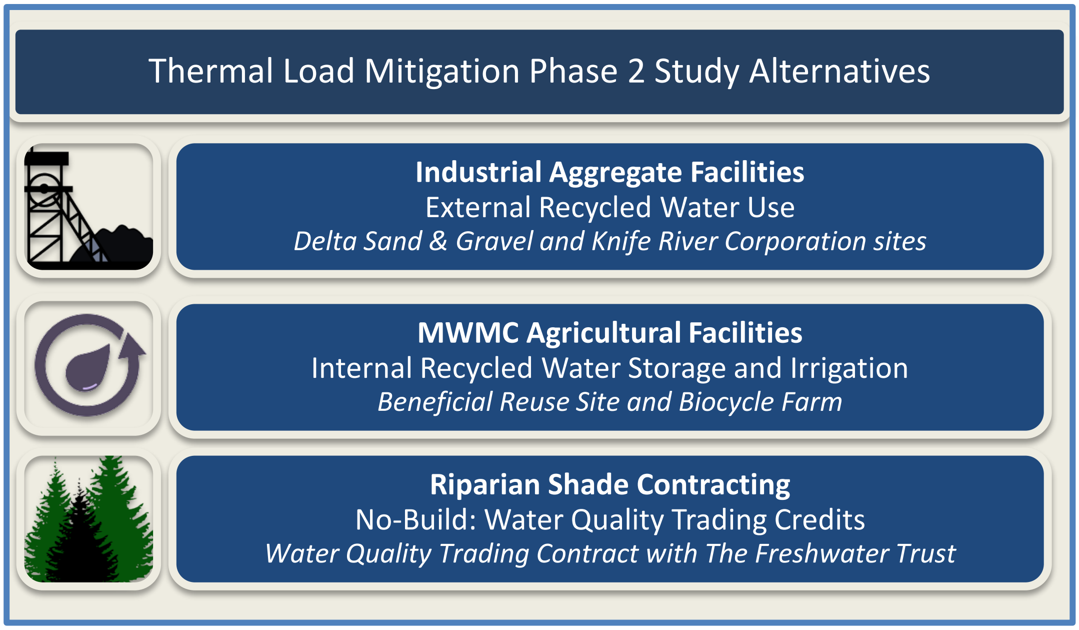
FIGURE ES-1: RECYCLED WATER PLANNING / THERMAL LOAD MITIGATION STUDY TIMELINE



Conceptual Project Alternatives Studied

Figure ES-2 depicts the three conceptual alternatives identified for evaluation through Phase 2 study. These alternatives represent (1) an external use of recycled water outside the fenceline of MWMC facilities, (2) an internal use of recycled water within the fenceline of MWMC facilities, and (3) a "no-build," non-recycled water use strategy for thermal load mitigation.

FIGURE ES-2: PHASE 2 STUDY ALTERNATIVES FOR THERMAL LOAD MITIGATION



Thermal Load Mitigation Planning Goal

The MWMC's future regulatory compliance requirements for Willamette River temperature impacts remained uncertain throughout the Phase 2 study. To evaluate the thermal load mitigation benefit of the study alternatives, the mitigation requirement presented by the 2006 TMDL was used as the key benchmark for regulatory compliance effectiveness (**Figure ES-3**). However, the study also evaluated other potential temperature mitigation compliance scenarios to assess each alternative's adaptability and flexibility to meet changing temperature reduction needs.

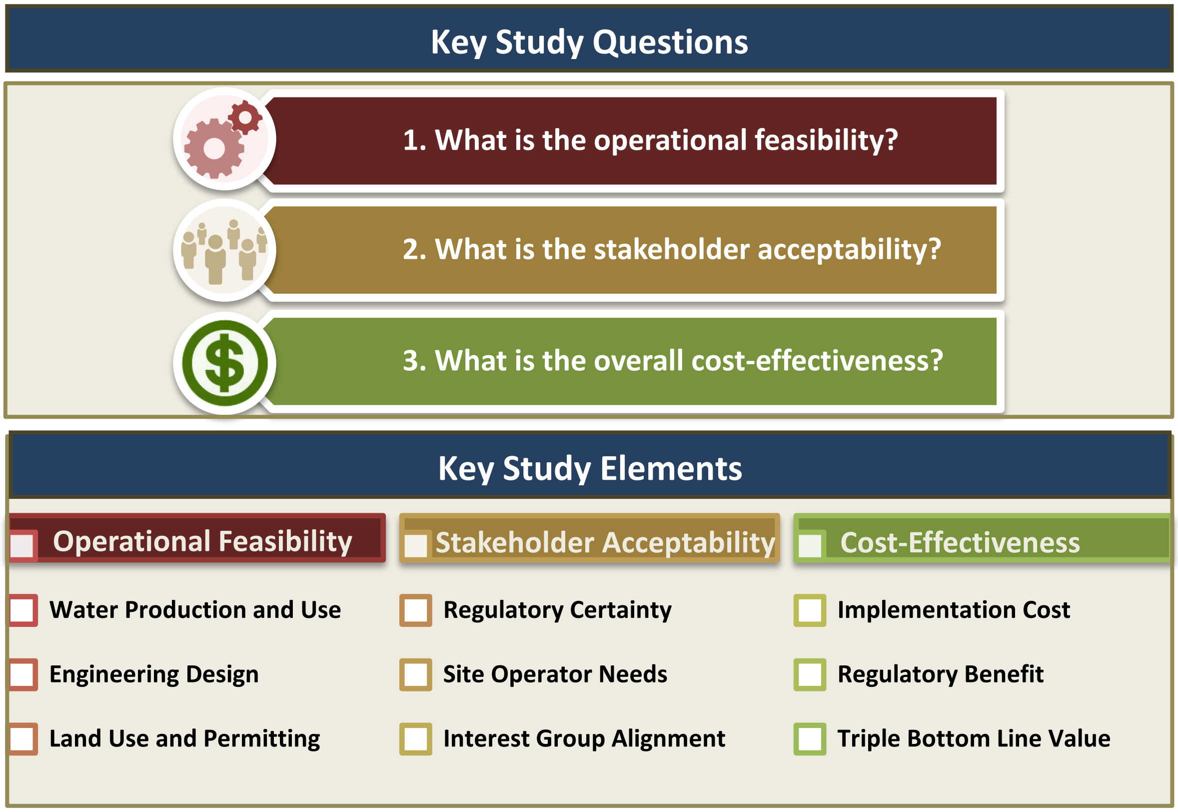
FIGURE ES-3: TARGET FOR THERMAL LOAD MITIGATION NEED BASED ON 2006 TMDL FRAMEWORK

Compliance Period at Risk	Thermal Load Mitigation Need	Equivalent Effluent Diversion Need
Late October (Oct. 21 -31)	**93 MKcal/day** (million kilocalories per day)	**3.1 MGD** (million gallons per day)

Alternatives Evaluation Methodology

The Alternatives Evaluation answers three key questions to assess the feasibility of the conceptual alternatives. **Figure ES-4** presents the key study questions and the elements comprising the study methodology.

FIGURE ES-4: ALTERNATIVES EVALUATION STUDY APPROACH



Alternatives Evaluation Findings

The Phase 2 study findings include evaluation of the operational feasibility, stakeholder acceptability, and cost-effectiveness questions outlined above.

Operational Feasibility

Figure ES-5 describes the study alternatives as defined for the study and presents the operational feasibility attributes identified through Phase 2 assessments. The information provided through this analysis provided the context to evaluate and compare the overall constructability, assets, and drawbacks of each alternative.

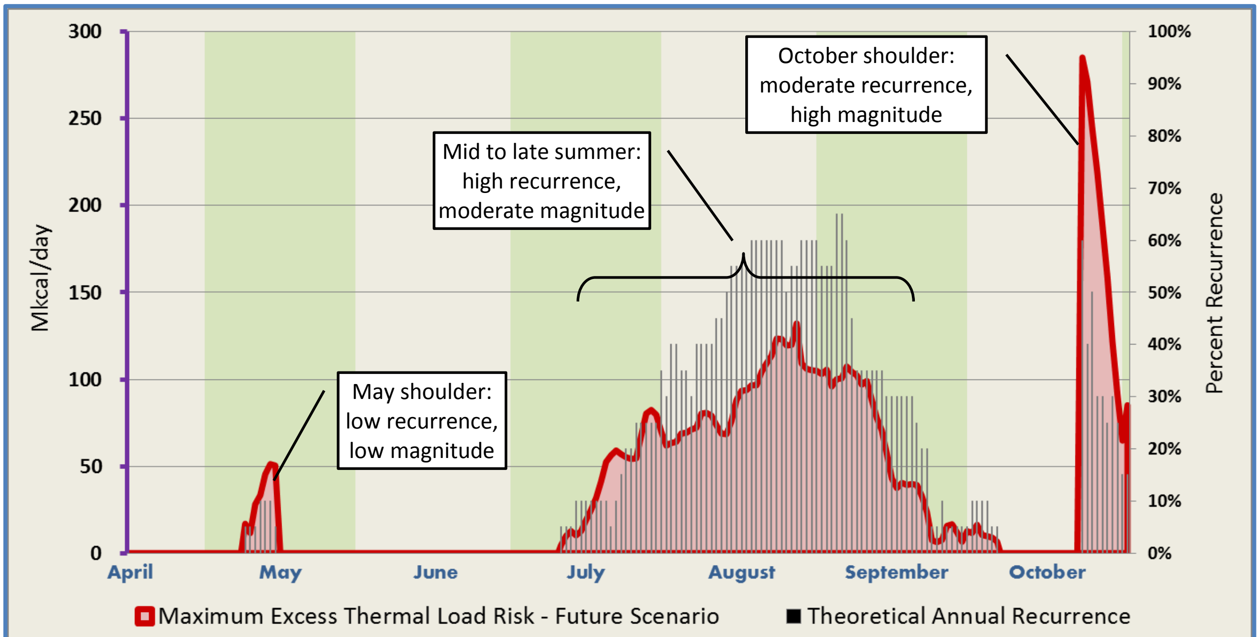
Figure ES-5: Conceptual Alternatives Operational Feasibility

ALTERNATIVE	OPERATIONAL FEASIBILITY ATTRIBUTES
 **Industrial Aggregate Use**	**Description**: Class A (filtered and ultra-disinfected) recycled water produced at the MWMC wastewater treatment plant is pumped via the West Bank Trail Pipeline to Delta Sand & Gravel and Knife River facilities. A dedicated recycled water distribution loop delivers water to each point of use for gravel washing, concrete mixing, asphalt batching, equipment cleaning, and dust control. A pressure tank and redundant pumps ensure consistent delivery of water to meet industrial demand. **Pros**: Conserves river water currently pumped to the industrial facilities. Long season of recycled water demand maintained from spring through fall. Up to 3 or 4 million gallons of use daily aligns with near-term thermal reduction need. Potentially expandable to transition to utilize water storage and indirect discharge via gravel pits. **Cons**: Relies on industry demand for water to meet regulatory compliance need. Industrial water demand is subject to seasonal reduction concurrent with the MWMC's greatest need for effluent diversion in late October. Non-operating days (such as weekends) would not provide a mitigation benefit. Concrete quality, worker impacts, and discharge permitting requirements are disincentives to implementation. Short lifespan of remaining gravel reserves for processing could limit long-term effectiveness.
 **MWMC Facilities Use**	**Description**: Class D (current level of effluent treatment and disinfection) recycled water produced at the MWMC wastewater treatment plant is pumped via the W2 Recycled Water Conveyance Pipeline to the Beneficial Reuse Site (BRS) lagoon. The W2 Pipeline is upsized to a continuous 16-inch diameter to enhance total capacity to 5 MGD. Stored recycled water is subsequently used to irrigate BRS crops through rehabilitated pivot irrigators and Biocycle Farm poplar trees via a new dedicated drip irrigation system. **Pros**: Fully controlled by the MWMC. BRS lagoon storage facilitates peak diversion of effluent in late October compliance period. Enhanced irrigation can be economically beneficial to BRS farm use and Biocycle Farm poplar production. Potentially expandable to onsite discharge wetlands or for external agricultural irrigation use. **Cons**: Proposed design requires upsizing 2.5 miles of W2 pipeline and investment in relining and rehabilitating the BRS lagoon. Use for prolonged summer diversion is limited by lagoon total holding capacity of 57 million gallons.
 **Riparian Shade**	**Description**: 20-year contract with The Freshwater Trust to restore native riparian vegetation to provide shade on the lower McKenzie River or its larger tributaries. Assumed initial contract is for 93 million kilocalories per day of late October shading benefit. **Pros**: 100% third party responsibility for implementation. Highest credit value is generated in October concurrent with the MWMC's greatest mitigation need period. Provides ancillary ecosystem benefits. Supports water quality protection in the key drinking water supply area for Eugene/Springfield. Highly scalable to increase total project area and shade credits. **Cons**: No additional operational or water quality benefits to the MWMC. Regulatory uncertainty related to water quality trading and application for temperature mitigation. Not as effective during summer. Requires sufficient landowner participation to yield desired quantity of shading. Relies on long-term contractor longevity to ensure project stewardship and reporting.

Water Balance and Thermal Load Evaluation

To further explore operational feasibility, the Phase 2 study included a spreadsheet-based evaluation of modeled water demands and resulting thermal load mitigation values of the recycled water use and riparian shading. Hypothetical future environmental conditions were modeled to assess potential future risk periods using the 2006 TMDL waste load allocation calculations. **Figure ES-6** depicts the maximum calculated thermal load excess risk posed under this scenario (red line, in MKcal/day by day of year). The vertical lines on the graph represent theoretical recurrence risk (percent chance of occurrence of any excess thermal load, by day of year). **While the month of August indicates the highest probability for excess thermal load conditions under this scenario, late October continues to present the period of greatest thermal load mitigation offset need. Figure ES-7** presents the theoretical mitigation performance of the study alternatives against the thermal load risk presented in **Figure ES-6**.

FIGURE ES-6: HYPOTHETICAL THERMAL LOAD RISK PROFILE



*The Phase 2 thermal load risk analysis was performed in an initial stage of the study. The result compares with the result of another temperature limitation analysis in which theoretical excess effluent temperature is based on maximum allowable temperature impact at the point of discharge (as opposed to total thermal load of the river). **The alternative scenario shown to the right illustrates a similar seasonal risk of temperature exceedance during the May and October shoulder periods as well as a mid- to late-summer exceedance risk (again of a lower magnitude than appears in October).***

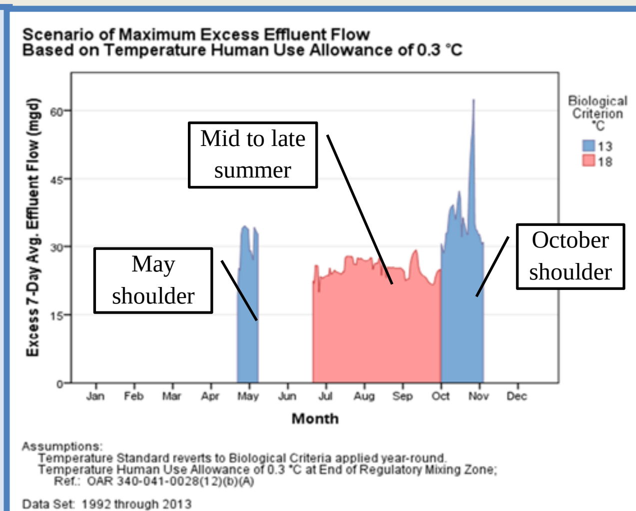
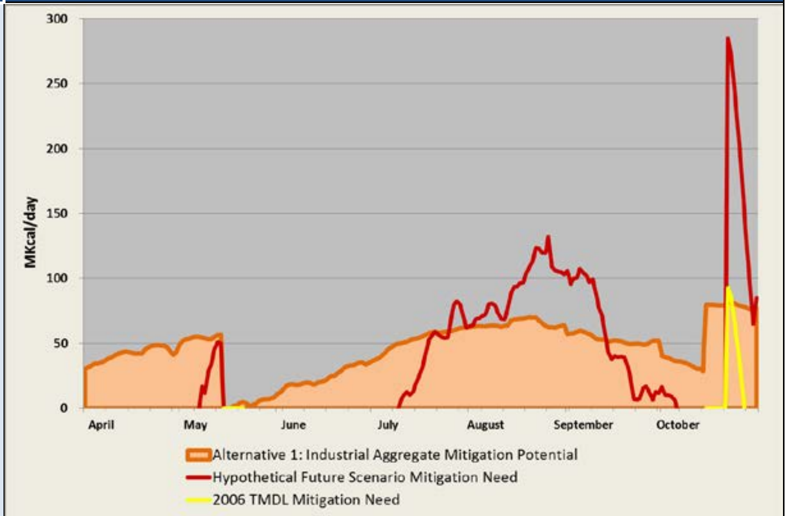
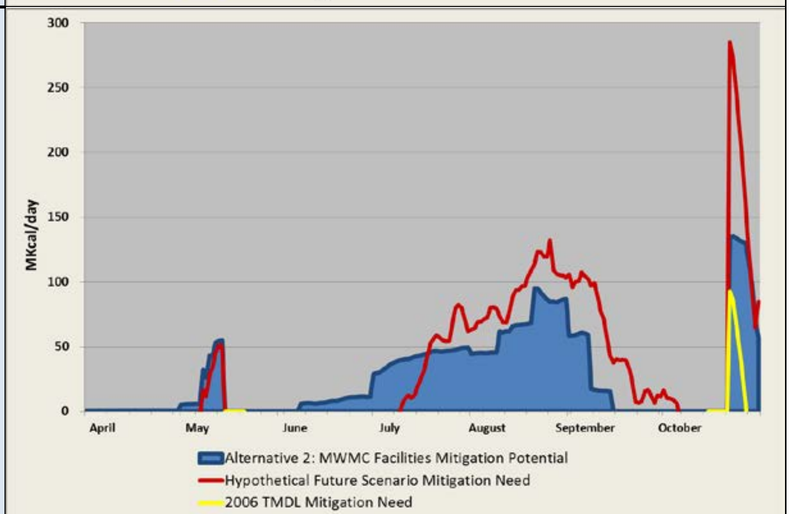
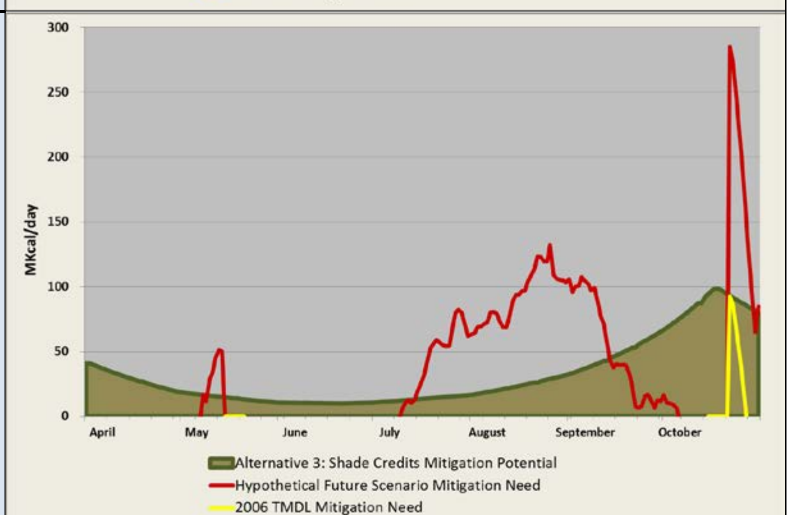


FIGURE ES-7: ESTIMATED SEASONAL THERMAL LOAD MITIGATION CAPACITY BY ALTERNATIVE

Alternatives Evaluation Summary	Estimated Seasonal Thermal Load Mitigation
Industrial Aggregate Use Recycled water demand at Delta Sand & Gravel and Knife River peaks seasonally in summer. Modeled effluent diversion is potentially short of the 2006 TMDL calculated mitigation need (yellow line). Effluent diversion throughout the year potentially would meet future scenario mitigation in May and a significant portion of the planning scenario summer offset need. **The alternative may not fully meet some later summer and late October need (red line).**	
MWMC Facilities Use Recycled water diverted for storage and irrigation uses at the MWMC facilities could fully meet the 2006 TMDL mitigation need (93 MKcal/day in late October; yellow line). Managed storage and irrigation use presents high potential to meet a significant portion of hypothetical future thermal load mitigation need (red line). **This alternative alone may not be enough to fully mitigate theoretical late summer and late October compliance need**.	
Riparian Shade The riparian shade alternative is designed to fully meet the 2006 TMDL mitigation need (93 MKcal/day; yellow line). **However, this amount of shade may fall significantly short of hypothetical future mitigation need in May and throughout the summer, as well as increased future need in late October (red line).**	

Stakeholder Acceptability

Stakeholders internal to the MWMC and directly involved with the study alternatives provided input that factored into the design and the cost-benefit evaluations for each alternative. External stakeholders were also engaged to provide input on the potential acceptability of the projects from three key interest group perspectives:

- Water Resources Protection, Infrastructure, and Sustainability
- Watershed Stewardship and Ecosystem Services
- Public and Environmental Health

Key findings are summarized below. **Figure ES-8** summarizes areas of primary support and leading concerns for recycled water use by interest group. These findings should be considered as any project planning moves forward.

FIGURE ES-8: EXPRESSED SUPPORT AND KEY CONCERNS RELATED TO RECYCLED WATER USES BY INTEREST GROUP

Interest Group	Key Support	Key Concerns
Water Resources Protection, Infrastructure, and Sustainability	• Sustainability and climate resiliency • Secondary water supply	• Cost-effectiveness • Distribution infrastructure requirements
Watershed Stewardship and Ecosystem Services	• Reduction in river temperature • Improved habitat conditions	• Reduced stream flow • Demonstrable temperature benefits
Public and Environmental Health	• Soil infiltration and root zone interactions improve water quality	• Unmanaged releases can impact soil and groundwater quality

Interest group stakeholders:

☑ **Generally support recycled water use alternatives**

☑ **Recognize recycled water planning can integrate with timely local infrastructure upgrade needs**

☑ **Support taking a watershed approach and pursuing natural wastewater treatment alternatives**

☑ **Recommend that the MWMC clearly demonstrate water quality to gain community acceptance**

☑ **Recognize the right water reuse strategy will be complementary to other local planning goals**

Cost Effectiveness

Based on the assessed thermal load mitigation potential, estimated project cost, and operational aspects of the three study alternatives, overall cost-effectiveness is compared in **Figure ES-9**.

FIGURE ES-9: COMPARISON OF ALTERNATIVES COST-EFFECTIVENESS

Measures of Cost, Capacity, and Implementation Timeline		Phase 2 Study Alternative Evaluated		
		Industrial Aggregate	MWMC Facilities	Riparian Shade
20-Year Project Cost (estimated net present value)		$6,801,000	$11,924,000	$4,650,000
Late October	**Thermal Load Mitigation Capacity** (estimated maximum)	81 MKcal/day	135 MKcal/day	93 MKcal/day
Late October	**Regulatory Cost-Benefit**	8.4¢ per Kcal/day	8.8¢ per Kcal/day	5.0¢ per Kcal/day
Mid-August	**Thermal Load Mitigation Capacity** (estimated maximum)	50 MKcal/day	75 MKcal/day	25 MKcal/day
Mid-August	**Regulatory Cost-Benefit**	13.6¢ per Kcal/day	15.9¢ per Kcal/day	18.6¢ per Kcal/day
Implementation Readiness (design-to-operational timeline)		2 to 3 years	2 to 3 years	5 to 7 years
Recycled Water Flow (Maximum)		7.2 MGD	5.0 MGD	~ 3.1 mgd equivalent

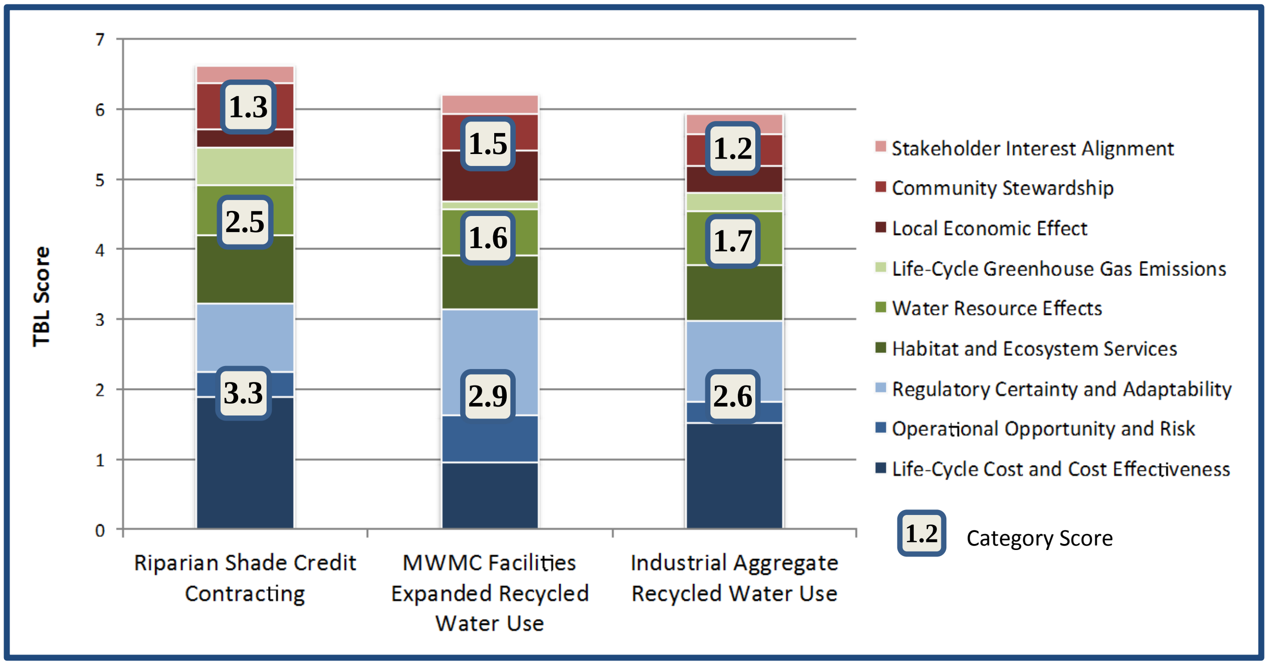
Triple Bottom Line Assessment

Alternatives were further evaluated through a triple bottom line assessment process to compare the overall economic, environmental, and societal cost-benefit. The triple bottom line process supports the MWMC's purpose statement (a balance of environmental, economic, and social benefits in delivering high-quality wastewater treatment performance) in this planning and decision-making process. The assessed score of each alternative is a product of technical merit across the triple bottom line categories and the weighted value of each criterion to the total project merit.

Technical Merit × Criteria Weighting = Triple Bottom Line Score

The chart in **Figure ES-10** depicts the total scoring of each alternative as they stack up against each other by nine criteria across the three triple bottom line categories. The Riparian Shade Contracting fared the best under this assessment, primarily due to its low costs and ancillary environmental benefits. However, each alternative compared fairly closely in total triple bottom line score.

FIGURE ES-10: TRIPLE BOTTOM LINE COMPARISON OF ALTERNATIVES



Color Key:
- Social Criteria Scores: Reds
- Environmental Criteria Scores: Greens
- Economic Criteria Scores: Blues

Recommendations

The Phase 3 study recommendations are presented in **Figure ES-11**. The Phase 2 study provided valuable information on the potential for riparian shade credits to be a leading thermal load mitigation strategy for late October compliance. However, the regulatory certainty of a shade credit strategy remains subject to ongoing legal considerations and rule making. Recycled water use has also shown to be a favorable asset for community water planning in the long term. In the short term, the MWMC's water storage and irrigable lands are a valuable asset for thermal load mitigation flexibility and responsiveness. Additionally, indirect discharge opportunities may serve multiple beneficial purposes in the long term for effluent management and water quality benefits, as well as habitat assets. More information about the technical and regulatory feasibility of indirect discharge needs to be gained. Funding and implementation partnerships should be further assessed for enhanced cost-effectiveness of project development.

FIGURE ES-11: RECOMMENDED PHASE 3 THERMAL LOAD MITIGATION PLANNING EFFORTS

Objectives	Thermal Load Mitigation Strategy			
				
	Riparian Shade	**Recycled Water**	**Storage**	**Indirect Discharge**
Assess Near-Term Mitigation Strategies	• McKenzie Watershed shading partnership with EWEB	• Demonstration Project Implementation • Biocycle Farm Hose Reel Irrigation • W2 Pipeline upgrade	• Facultative Sludge Lagoon (FSL) Temporary Storage Management • BRS Lagoon Rehabilitation	• none
Assess Long-Term Mitigation Opportunities	• CWSRF Sponsorship Projects for additional shade credits	• BRS crop irrigation • Community greenspace irrigation demands • Industrial and commercial water demands	• Gravel pit detention	• MWMC discharge wetlands • Gravel pond discharge cells

The Phase 3 study objectives are based on the potentially feasible near-term and long-term temperature mitigation strategies identified in Phase 2. The key attributes of the recommended implementation study are:

- A McKenzie watershed protection and restoration program in partnership with EWEB and The Freshwater Trust could provide multiple benefits to the community as well as leverage for lower-cost shade credit project implementation.
- Low-interest funding via the Clean Water State Revolving Fund (CWSRF) sponsorship option could couple financing of capital projects (such as recycled water uses) with riparian restoration.
- The MWMC can benefit from use of existing infrastructure and equipment to store water in the FSLs and to enhance irrigation of the Biocycle Farm using hose reels rather than installation of a drip irrigation system.
- Upgrading the W2 pipeline enhances daily capacity of recycled water flow to 5 MGD, which coupled with the BRS lagoon's storage capacity could achieve peak effluent diversion for 11 straight days.
- Demonstration of recycled water through partner-identified projects could provide a valuable community asset while building public trust and support for recycled water.