

WRIA 9 FUNDING MECHANISM REPORT: GENERATING PAYMENTS FOR ECOSYSTEM SERVICES

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Table of Abbreviations

KC	King County
KCD	King Conservation District
KCFCD	King County Flood Control District
MBRT	Mitigation Banking Review Team
PES	Payments for ecosystem services
PSP	Puget Sound Partnership
RCW	Revised Code of Washington
TDR	Tradable Development Right
WCI	Western Climate Initiative
WRIA	Water Resource Inventory Area
WSDOT	Washington State Department of Transportation

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EXECUTIVE SUMMARY

Healthy watersheds and the salmon populations they support are essential to the health of our economy. The range of ecosystem services provided by the Green/Duwamish and Central Puget Sound Watershed benefits over 700,000 residents. Further investments in healthy ecosystems as natural capital assets within the watershed will provide tremendous value in the form of beneficial ecosystem services.

Water Resource Inventory Area 9 (WRIA 9), the management entity for the Green/Duwamish and Central Puget Sound Watershed, established a precedent for protecting and restoring the watershed and salmon habitat with the 2005 publication *Making Our Watershed Fit For a King: Salmon Habitat Plan for the Green/Duwamish and Central Puget Sound Watershed (WRIA 9)*. This natural capital investment requires dedicated funding mechanisms generating revenue that averages \$20-30 million each year over 10 years.

By providing innovative approaches to investment in natural capital, the Salmon Habitat Plan provides a lower cost solution than engineering and built-capital approaches for restoration. Natural systems provide self-maintaining benefits, such as producing salmon production, controlling floods and providing drinking water in perpetuity. This is far more efficient than replacing these self-maintaining natural systems with human-built infrastructure that depreciates and must be replaced every 30-40 years. Natural systems are unsurpassed in preserving natural and human health and economic benefit for the lowest cost.

This proposal is based on principles of ecological economics to manage the economic efficiency, social equity and environmental sustainability of the Green/Duwamish and Central Puget Sound Watershed. We propose the following funding mechanisms for consideration by the WRIA 9 Watershed Forum.

1. A **tax lid lift**, at a rate of \$.10 per \$1,000 of property value, increasing the Flood Control District levy by an estimated \$1.1 million or more per year over 3-7 years for investment in projects that will accomplish objectives both flood hazard management and salmon habitat restoration.
2. A \$25 per passenger cruise ship **impact fee**, to pay for the impact of cruise ship wastewater on Puget Sound, generating an estimated \$20 million annually that may be distributed to several jurisdictions.
3. A new \$5 per parcel **special assessment fee** generating an estimated \$866,950 for WRIA 9 subsequent to the proposed establishment of tax district status for the WRIA. Alternatively, a **new property tax** levy at a rate of \$.20 per \$1,000 property value, estimated to generate \$21.2 million for WRIA 9.
4. A **new district and tax** on marine shoreline armoring impacts, levied at a rate of \$.33 per \$1,000 of property value and estimated to generate approximately \$1 million annually. Alternatively, a **new fee** of \$45 per lineal foot on permits for new bulkhead development to raise approximately \$111,105 annually.
5. An added **fee on impervious surface impacts** on salmon habitat and ecosystem health, estimated to generate approximately \$15.4 million annually from a levy in unincorporated King County.
6. A **mitigation banking market** to provide funding and incentives for private sector investment

in protecting and restoring the watershed's habitats.

7. Further research on opportunities for inter-departmental and multi-jurisdiction collaboration on creating a **watershed investment district**, with a combined system of funding mechanisms that will provide the most cost-effective approach for integrated management of all ecosystem services.
8. Initiate planning for demonstration or pilot program status in collaboration with the Puget Sound Partnership Action Agenda to align funding mechanism development with agenda financing strategies.

The Puget Sound region will benefit extensively from investing in the ecosystem goods and services of the watershed. This investment in natural capital will both protect and restore habitat for threatened and endangered species. Total annual revenue from proposed funding mechanisms is estimated at approximately \$59 million, exceeding the target amount to provide a contingency buffer, in case all the recommended funding mechanisms cannot be implemented. Preliminary estimates conclude that as much as \$6.44 of benefit will be generated for each dollar invested (as detailed in Appendix B).

INTRODUCTION

Problem Statement

Salmon habitat is woven into the fabric of Northwest culture and economy. To many native tribes the cultural value of salmon is beyond measure, and most citizens in the region believe that the existence of salmon is intrinsically valuable. In fact, most people indicate they are willing to pay for this value from salmon, even if they derive no direct recreational or other benefit from the existence of salmon (Olsen 1991). People and communities located in and beyond the watershed benefit from healthy salmonid populations and the associated ecosystem services that a healthy watershed provides. Once restored, a healthy watershed provides vast benefits over the long term.

The WRIA 9 document *Making Our Watershed Fit For a King: Salmon Habitat Plan for the Green/Duwamish and Central Puget Sound Watershed (WRIA 9)*, hereafter referred to as the Salmon Habitat Plan, provides an action plan with projects for improving the health of the watershed. This funding mechanism project was initiated to develop proposed funding mechanisms sufficient to generate revenue for planned project budgets totaling \$200-300 million over ten years.

Restoring threatened and endangered wild Chinook salmon and other salmonid populations in the Green River Watershed is required under the Endangered Species Act and supported by popular demand from residents. Success in restoring Chinook salmon, the watersheds on which they depend, and a sustained stream of ecosystem services requires a good scientific grounding and careful project identification and implementation. The Salmon Habitat Plan includes specific projects, programs and policies for watershed management that are sufficient to avert Chinook salmon endangerment or extinction while enhancing ecosystem services.

This funding mechanism development builds on socio-economic analysis and an ecosystem service valuation included in the WRIA 9 Salmon Habitat Plan and related reports by Earth Economics (2005).

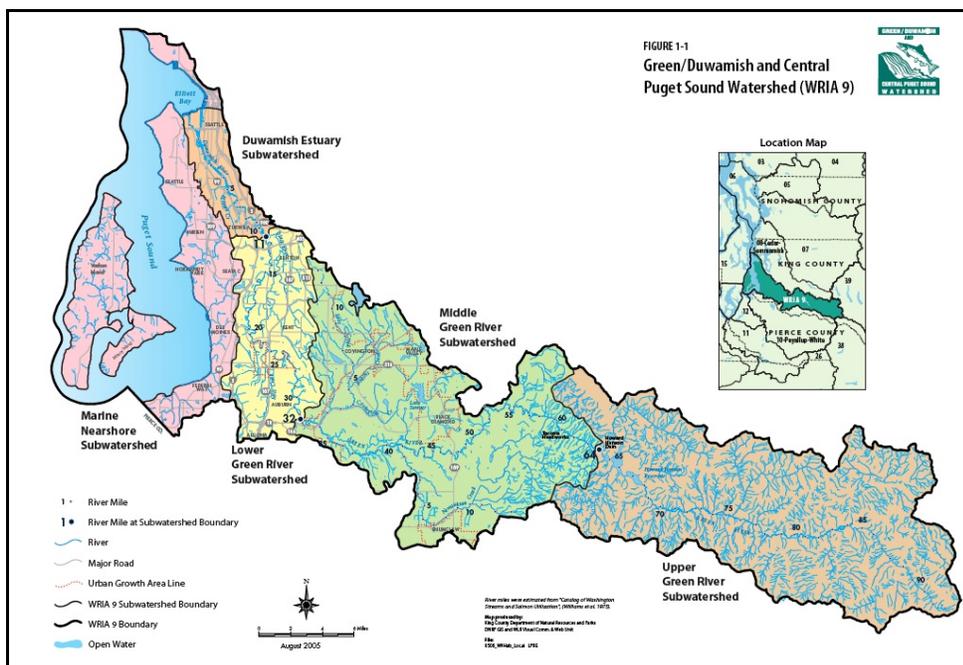


Figure 1: WRIA 9 Map

Partners in the Plan—The Salmon Habitat Plan was developed with support from scientists, economists, land managers and other experts on land and natural resources in the Green/Duwamish and Central Puget Sound Watershed. Members of the public added their perspectives to ensure the resulting recommendations were practical and realistic. Since the approval of the Salmon Habitat Plan in 2005, local partners have begun acting on its recommendations. Implementation of this Plan and its specific restoration projects requires substantial funding, however, and the lack of a dedicated funding mechanism for the Salmon Habitat Plan has slowed implementation.

Just as all citizens benefit from public services such as transportation infrastructure, police, fire protection and public education, all citizens benefit from a healthy watershed. Healthy watersheds provide salmon, flood and storm protection, clean drinking water, recreation, and other benefits that are often unrecognized. By their physical nature, these public goods and services cannot easily be privatized. Thus, watershed restoration is largely a public investment, though private land stewardship is an important complement.

Partners in Funding—Currently, funding for salmon restoration is provided through three general sources:

- state/federal grants
- local grants through the King Conservation District
- cost sharing through inter-local agreements between cities and the county within the watershed.

The current funding mechanisms are clearly insufficient as sources of revenue for accomplishing the Salmon Habitat Plan at the watershed level. Additional dedicated funding would be a wise public investment. As Chapter 6 of the WRIA 9 Salmon Habitat Plan demonstrates, the natural systems of a healthy Green/Duwamish and Central Puget Sound Watershed provide an economic value stream of \$ 1.7 - 6.3 billion each year to local residents. Restoring salmon and enhancing watershed health as an investment in natural capital assets will increase this value stream by as much as \$6 for every \$1 invested, effectively securing vast benefits in the present and future (Earth Economics 2005).

Effectiveness and Fairness—This report and proposal provides a summary of project research and analysis on independent funding mechanisms for plan implementation. In addition to raising sufficient money, the several of the proposed funding mechanisms shift economic incentives toward retaining rather than harming public watershed services. This proposal includes tax, fee, and market mechanisms. Each tool can be viewed as either payment for ecosystem services or payment for damage to ecosystem services.

This project identifies the services provided and the recipients of benefits, allowing for greater equity and fairness in paying for goods and services through investment in natural capital assets. The natural capital investments will benefit over 700,000 residents, local and national businesses at the heart of the local economy. In addition, this project will produce significant benefit for communities beyond the immediate watershed and region.

Project Objectives

The primary goal of this project is to develop multiple funding mechanisms to provide \$200-300 million of revenue over 10 years to fund projects in the WRIA 9 Salmon Habitat Plan.

The following steps were undertaken to identify and evaluate funding mechanisms:

1. Survey the literature on existing and proposed funding mechanisms relevant to WRIA 9.
2. Identify and describe 3-5 potential funding mechanisms sufficient to fund implementation of the WRIA 9 Habitat Plan.
3. Provide an overview of the economic benefits that residents, local governments, and private firms would receive from a dedicated WRIA 9 funding source.
4. Conduct a workshop with King Conservation District and WRIA 9 staff, Steering Committee members, and Forum members on these proposed funding mechanisms to identify one or two mechanisms for in-depth analysis.
5. Examine the identified funding mechanisms in-depth for economic viability, sufficiency, legal requirements, collection efficiency, and other criteria.
6. In partnership with King Conservation District and WRIA 9 staff, Steering Committee, and Forum, review, revise, and complete this final report.

WRIA 9 Salmon Habitat Plan

Scaling Up from Fish—In March of 1999, the National Marine Fisheries Service recognized Chinook salmon (*Onchorhynchus tshawytscha*) as threatened; subsequently, the US Fish and Wildlife Service listed bull trout (*Salvelinus confluentus*) as threatened in November of that year. As people throughout Puget Sound learn about the importance of salmon as indicators of watershed functions, we are finding new ways to manage our watersheds for the health of all local species. This was part of the intention that led the Washington Department Ecology to establish the Water Resource Inventory Areas (WRIAs) in which decision-makers manage habitat and natural resources at a watershed scale.

Management practices resulting in the protection and restoration of salmon habitat broadly improve watershed health, in many cases also directly improving flood control, water quality, recreation, stormwater management, biodiversity and climate stability. Salmon restoration is in fact an investment in the natural capital that supports the broader economy and provides benefit both locally and globally across generations.

Focus on the Watershed—The WRIAs in Washington State were designed as a multi-jurisdictional structure capable of addressing the complex issues of habitat management. WRIA 9 has been a leader in salmon habitat protection and restoration, with the publication of *Making Our Watershed Fit For a King: Salmon Habitat Plan for the Green/Duwamish and Central Puget Sound Watershed (WRIA 9)*.¹ One of its most significant recommendations is to allocate 40% of available funding to the Lower Duwamish, where the habitat is most degraded. Specific recommendations focus on the impacts of shoreline armoring and impervious surfaces. Impervious surfaces typically support vehicle loads that contribute largely to non-point source pollutants. Other pollutant sources are runoffs from suburban lawn maintenance chemicals; agricultural fertilizers, pesticides and manures; and industrial wastes. King County is currently involved in 64 projects along the length of

¹ Additional information including the full plan document are available at the following web site:
<http://www.govlink.org/watersheds/9/plan-implementation/HabitatPlan.aspx>

the watershed. Management solutions for ecosystem services, particularly those related to natural processes and functions involving water cycles, are most effectively applied at the watershed scale of the challenges, and WRIA 9 represents this scale of focus.

UNDERSTANDING ECOSYSTEM SERVICES

Economic development and social well-being are both sustained by healthy natural ecosystems (forests, grasslands, wetlands, rivers, etc.). The benefits that ecosystems provide to people are called ecosystem goods and services, which can be grouped into four functional categories:

- **Regulation functions** maintain climate stability, water filtration, storm and flood protection, natural pest control.
- **Supporting functions** maintain the habitat, material and nutrient cycles that are fundamental to sustaining life.
- **Production functions** provide goods such as water, food and raw materials.
- **Information or cultural functions** provide benefits that include medicines, genetic resources, recreation, and spiritual, cultural, and aesthetic benefits.

The WRIA 9 funding mechanisms project focused primarily on the salmon habitat ecosystem service. Yet, it is difficult to discuss any ecosystem service in isolation, so this report also discusses dynamics connected to flood protection, climate regulation and many other ecosystem services. Appendix A provides an overview of the wide range of ecosystem services.²

INVESTING IN NATURAL CAPITAL ASSETS

Natural Infrastructure—The WRIA 9 Salmon Habitat Plan represents an investment plan for natural infrastructure. Often natural systems provide goods and services that markets cannot, or provide them more efficiently than markets. The Puget Sound region is at the forefront of innovative new strategies for investment in natural capital and green infrastructure in development of nature's economy.

At scales ranging from local to global, decision makers are initiating a new economic recognition of the importance of investment in natural capital. The central goal of this effort is to mobilize and refocus the global economy towards investments in clean technologies and natural infrastructure such as forests and soils as the first best option for stimulating real economic development, combating climate change and triggering an employment boom in the 21st century. The Puget Sound region is already leading the way to such success.

Natural and Built Capital—Historically, natural capital assets—such as forests, clean water, wetlands, and salmon—have been abundant and seemed inexhaustible. As a result, economic activity was focused on creating what was scarce: manufacturing capacity, transportation, manufactured goods and other built capital. In the modern world, it is increasingly clear that natural capital is increasingly scarce relative to demand. Indications come from constraints in the abundance of resources and the diminished capacity for nature to process societal wastes.

² Additional information is available in Chapter 6 of the habitat plan linked above and a full analysis of ecosystem services in the Green/Duwamish and Central Puget Sound Watershed can be downloaded from the following link: http://www.eartheconomics.org/resources/publication_documents/WRIA_9_Ecosystem_Service_Analysis.pdf

In the past, solutions to watershed problems meant replacing natural capital assets, such as forests and wetlands, with built capital solutions such as dams and levees—the design of our tax jurisdictions reflects this. As we developed floodplains and replaced the trees and riparian areas with buildings and pavement, we directly contributed to habitat loss and increased flooding. Levees were constructed as an engineered built capital solution to replace the ecosystem services previously provided by natural capital assets. Scientific knowledge at the time was not yet adequate for recognizing the placement and value of healthy ecosystems for providing natural flood protection and other ecosystem services. Overall, this trend has tended to replace free, natural, and effective services with relatively expensive, uncertain and continually depreciating engineered solutions.

Watershed Capital Planning—King County, WRIA 9 and the King Conservation District are demonstrated leaders in regional, national and international efforts to develop new solutions in response to these issues. Both the WRIA 9 Salmon Habitat Plan and the King County Flood Hazard Management Plan represent significant steps towards recognizing the importance of watershed scale planning for investment in natural capital, and further integration of these approaches and plans is needed. This same advancement in thinking points the way to a more sensible, sustainable, effective and affordable means of investing in natural capital to ensure the ongoing stream of value and benefit from ecosystem services at the scale of the river watershed.

FUNDING MECHANISM OVERVIEW

Types of Incentive and Funding Mechanisms

This report includes details on nine proposed funding mechanisms, in order to provide the WRIA 9 Watershed Management Forum with options for final selection and implementation. To support the rationale for these recommendations, this report will detail general information on fee, tax and market structures as well as strategies for selecting appropriate funding mechanisms from the recommended options.

Tax Funding Mechanisms

Tax for Funding—Tax funding mechanisms provide a means to collect funds based on any party's stake in real estate property value or market value of transactions (utility usage, services received, purchases, etc.). Washington State uses property tax, retail sales tax, business taxes, fuel tax and RTA tax (combines a vehicle tax and sales tax) to fund government activities. Another example is the King County Flood Control District (KCFCD) tax levy, at a rate of \$.10 per \$1,000 of assessed property valuation to generate \$32 million a year for flood protection management activities.

Tax for Incentive—In addition to generating revenue, taxes can serve as an incentive to change behavior, adjusting incentives to discourage activities that force impacts or external costs on others. For example, taxes on cigarettes have been shown to reduce cigarette smoking and lung cancer rates, which in turn reduces both private and public health costs.

Several tax options have been researched for this project, including:

- An increased general property tax,
- New property taxes focused explicitly on properties with impervious surfaces,
- New property taxes on near-shore properties with bulkheads and/or shoreline armoring.

The general tax options would be structured similar to currently existing tax options, while the latter two options would take a green tax approach, generating revenue while also providing an incentive to decrease negative impacts on ecosystem health.

Tax by Code—Development of tax mechanisms may in some cases require establishment of a new district under legislative direction detailed in the Revised Code of Washington State. New tax mechanisms may also be subject to constitutional or statutory limits. These details will be explored in more detail in subsequent sections of this report.

Fee Funding Mechanisms

Application of fee-based funding mechanisms provides an alternative to tax-based mechanisms. Fees are charged to parties based on a particular benefit provided. Fees are levied, collected and allocated to fund projects or programs that address a problem or alleviate negative impacts. For example, local stormwater management fees are designed to provide funding for engineered stormwater management systems to mitigate the impacts in areas that have a high concentration of impervious surfaces. The fee amount is related to the cost of the stormwater management required. Other fees in Washington State include title and registration fees for land and vehicles, permitting fees, and environmental impact fees.

Development of fee-based mechanisms may in some cases require establishment of a new district under legislative direction detailed in the Revised Code of Washington State. Such districts include a special purpose district, benefit assessment district, or local improvement district; these details will be explored in more detail in subsequent sections of this report.

From Impact to Benefit—The fee discussed in the early stages of this project is a per parcel assessment fee, similar to but in addition to the current \$10 per parcel special assessment fee collected by the King Conservation District. This funding mechanism would operate identically to the current assessment fee, which funds WRIAs as well as King Conservation District programs and activities. A new fee provides an opportunity to raise additional funds for WRIA projects and programs. Collection at the county level could fund WRIAs 8 and 9 and parts of 7 within King County; an alternative collection option specific to WRIA 9 could occur through establishing a benefit assessment district.

Other specific fee funding mechanisms considered in research and analysis for this report include fees on bulkheads and shoreline armoring, water usage, impervious surface development, public road use, fishing licenses, recreational use permits, and pet license registrations.

Market Funding Mechanisms

Market funding mechanisms apply innovative approaches to banking and trading of benefits or impacts. Credits corresponding to actions with negative impact are transferred to projects with a corresponding positive impact. In wetlands mitigation banking, any projects that harm a healthy, intact wetland must be offset by other projects providing comparable wetland restoration in another location. Existing protocols, requirements and standards for such market-based mechanisms are used in a wider range of contexts including carbon trading, water quality trading, and other areas.

Banking on Ecosystems—Development of market-based mechanisms will require establishing a regulatory precedent and protocol as well as a formal system for banking or market exchange.

Various issues may affect the overall feasibility of market-based funding mechanisms. For example, market-based approaches require systems for third-party verification or certification for project quality assurance. These details will be explored in more detail in subsequent sections of this report.

Discussion on market-based banking or trading system in this report focuses on mitigation banking for wetlands conservation, due to the fact that Washington State has an existing policy precedent for wetlands mitigation banking. Other market mechanisms being developed in Washington State include conservation banking, water quality (temperature) trading, tradable development rights (TDRs) and carbon markets.

Watershed Investment District

The watershed investment district concept takes a multi-jurisdiction approach, similar to a public utility, which would include management systems for a range of ecosystem services. Such a mechanism could be structured on the Vermont Common Asset Trust model or the Alaska Permanent Fund and implemented at the scale of an individual watershed or by King County. A watershed provides a suite of inseparable goods and services related to the health of the watershed. If the watershed is considered the unit of production, then a watershed investment district would be a jurisdiction at the same scale as the productive asset, encompassing the full suite of benefits the watershed provides.

Sharing the Wealth as the Watershed Does—Washington State has previously created new tax districts to fund and manage individual ecosystem services. In nearly all of these cases, the boundaries of these districts do not correspond to the geographic area in which the ecosystem services are generated or benefits received. For example, shellfish districts do not include the areas where water quality is degraded, causing damage to shellfish. Also, flood districts have traditionally been at the base of the watershed, when most of the flood protection is provided further up the watershed. In many cases, effective management of natural flood protection services of upland ecosystems prior to damage can be more cost-effective than engineered management solutions or solutions designed after damage has occurred and flooding has increased. The challenge is how to tax and manage on this scale.

It is inefficient for management of flooding, stormwater, water quality, biodiversity (including both salmon habitat restoration and shellfish protection) and other ecosystem services to be individually districted. Moreover, there is unnecessary complexity and potential for conflict when these services are funded through separate jurisdictions, with separate legal precedents and jurisdictions overlapping in mission and geography, in some cases competing for limited funding. This complex piecemeal structure contains potentially redundant administrative functions. A more efficient solution would be to integrate all into one comprehensive system for funding, planning and management.

Truly Public Goods—The rationale for a comprehensive approach to watershed-scale integration of funding is that public and private entities within the watershed receive benefits from the watershed. Truly public goods, like flood control, storm protection, and biodiversity, are best provided through a public utility model, since a private owner cannot exclude beneficiaries from these public goods and services.

Strategies for Choosing Appropriate Mechanisms

Ecological economics offers a strategic approach for making decisions between various standards, taxes or markets, recognizing both incentives and funding needs in resource management decisions. The strategic goals of economics and ecology together guide the decision making: determinations on estimated costs of preventing, abating or mitigating any social or environmental impacts as compared to the estimated costs—or foregone benefit—that these impacts impose on society and the environment. These latter costs are also known as “externalities”, representing social or environmental impacts and loss of value that are not considered in market dynamics.

Ecology and Economy—Analyzing the ecological economic efficiency, effectiveness and sustainability of watershed and salmon habitat restoration involves appraisal of all associated costs: costs for programs preventing habitat damage or costs for projects mitigating habitat damage and restoring viable habitat. The benefits, or foregone benefits representing a socio-ecological cost, are via ecosystem service valuation (ESV). ESV entails a dollar-based economic valuation of the extensive benefits provided by ecosystem services. This dollar valuation allows social and environmental externalities to be considered in management decisions.

Precautionary Principle and Regulatory Standards

General principles for choosing management mechanisms begin with the precautionary principle, which carries a responsibility to anticipate harm and obligation to minimize it. This principle advises that socio-ecological damage should be reduced or avoided and areas of critical natural capital protected in any cases where negative impacts cannot be reversed. The precautionary principle is also applied in cases where there is uncertainty about the extent, severity or reversibility of any impact.

Precaution Prevents Problems—Management systems structured around a precautionary principle are designed to prevent or mitigate risks prior to the impact and otherwise seek to avoid the most severe results of environmental or social impact. In technical economic terms, each individual unit of marginal change in the level of pollution or damage has a greater impact on the costs, or foregone benefits, to society than to the costs of prevention or damage mitigation. In simple terms, the rigor of a management system to avoid risks of habitat loss or damage and reverse any negative impacts is tremendously important. Thus, ecological economics advises that firm regulatory standards are appropriate to preserve economic efficiency, social equity and environmental sustainability.

Protect and Restore—Standards and fees are recommended before taxes or markets to protect and restore critical natural capital. This specifically applies to restoration of or mitigation of impacts to habitat for species protected under the Endangered Species Act. Similarly, the precautionary principle is the foundation of other resource management systems, such as those in the precedent-setting legislation of the Federal Clean Water Act and Clean Air Acts. A rigorous management system is essential in these cases to prevent irreversible species loss or damage and to protect processes integral to the stability and biodiversity of ecosystems.

Green Taxes and Mitigation or Offset Markets

The strategic choice of incentive and funding mechanisms is more challenging in cases that may not present a clear application of the precautionary principle. In cases of reversing past damage, there is no legal precedent for the precautionary principle, nor in cases where there is uncertainty about

either extent or severity of socio-ecological impacts or the costs of prevention, mitigation and restoration. The principle is not required in decisions to prevent loss of ecosystems that are not protected and do not contain endangered species, as well as cases where further research is needed to determine the precise extent of impacts imposed by activities subject to management via a tax or market system. Tax or market system funding mechanisms to reduce impacts of impervious surfaces or marine shoreline armoring are non-precautionary cases.

Importance of Location—Humans have flexibility in decisions on the placement or development location of built capital; this is not the case with natural capital assets such as salmon habitat. For example, a parking lot could be built in a variety of locations and with a variety of structures (asphalt lot to multi-story). However, the transition zone for salmon can only occur where salt and fresh water meet in a river, which allows juvenile salmon to adjust from fresh to salt water before entering Puget Sound. The transition zone cannot be moved. Thus, in choices that may permanently damage natural capital, or that involve adjustments to built capital, the precautionary approach and prudent economics support adjustments to built capital. If there was a choice between a parking lot or protecting the transition zone for salmon, the transition zone should be protected.

Clearly there is a tremendous amount of inherent uncertainty in these decisions, given the complexity of data collection to determine the precise costs involved and the extent to which an impact will affect endangered species or society. One or more of these situations may apply where marine shoreline armoring, impervious surfaces, anthropogenic changes in water quality, or habitat degradation, fragmentation and loss impose negative impacts on Chinook salmon habitat.

Making Good Choices—Tax mechanisms are generally most appropriate where there is greater uncertainty in the marginal costs of habitat protection, damage mitigation or restoration. Tax mechanisms are also appropriate where there is greater change in these marginal costs than in the marginal socio-ecological benefit.

Market mechanisms can be most appropriate in cases where there is relatively greater uncertainty in the protection or mitigation costs and relatively greater change in the marginal socio-ecological benefit. In many cases, such as carbon credit markets or habitat mitigation markets, the functioning of a market mechanism merely offsets pollution or damage rather than preventing or mitigating the impact.

Popularity and Risks of Market Mechanisms

In recent years, markets have become the most popular mechanism to structure payments for ecosystem services. It is not clear that this popular movement towards market-based approaches is founded in economic analysis, either as the most efficient and cost-effective approach or with respect to social equity and environmental sustainability.

Precaution and Market Approaches—For this reason, a thorough analysis of the comparative efficiency of regulatory and market governance structures is necessary to determine the most appropriate mechanism for a given ecosystem service. Any market mechanisms will require appropriate levels of regulatory oversight and governance. The full efficiency of ecosystem service markets requires further experimentation and information. From a precautionary stance, we need to know the risks that market structures would fail to adequately protect or promote environmental sustainability and social equity.

The popular advocacy for market mechanisms to manage ecosystem services tends to overlook this widespread need for deeper analysis on a case-by-case basis to determine appropriate management systems. Interdisciplinary scientific research is needed to consider the economic efficiency, social equity and environmental sustainability of proposed incentive and funding mechanisms for ecosystem service management.

Learning from Carbon—The emerging carbon markets have provided good experience for lessons learned in the application of market mechanisms. The cap-and-trade system established by carbon markets represents a hybrid mechanism including both a regulatory standard (the cap on carbon emissions), as well as a market structure (the trade in carbon credits). The cap establishes a regulatory standard for maximum levels of greenhouse gas emissions at the industry, sector and national scales in accordance with global benchmark targets.

Emerging carbon market mechanisms have precedent in proposed federal and state legislation as well as regional initiatives, indicating that this hybrid approach is the most appropriate mechanism for managing climate regulation ecosystem services. In opposition to this trend, a recent Congressional Budget Office report (CBO, 2008) provides analysis concluding that a tax mechanism is more appropriate than the popular hybrid cap-and-trade mechanism for regulating carbon emissions to protect climate stability.

This concern about the popular support of carbon markets is echoed by environmental organizations such as the World Wildlife Fund (WWF, 2008). WWF has historically been a carbon market advocate and has raised serious questions about market mechanisms based on concerns that the early stages of the European Union emissions trading scheme have resulted in windfall profit generation more effectively than intended emissions reductions.

No Market is Truly Free—The current economic crisis stemming from insufficiently regulated financial markets for new security backed mortgages and credit-default swaps provides clear evidence of the inherent risks in developing new markets which are insufficiently understood or regulated. These markets were subject to risks of failure given a lack of adequate analysis in market design as well as a lack of regulatory oversight in implementation. Ecosystem services are complex and vitally important; thus they require a careful and clear understanding of ecological goals, market development, property rights delineation, risk and uncertainty, needed regulatory structures and enforcement mechanisms. The principles, strategies and methodologies proposed in this report only begin to address the growing need for deeper analysis into appropriate funding mechanisms. Ecosystem service science and economics will continue to provide new tools for designing incentive and funding mechanisms based on empirical assessment of costs and benefits, uncertainty, resilience and critical thresholds in the stability of ecosystem processes and functions.

Strategic Mechanism Decisions for Salmon Habitat

Salmon habitat protection and restoration—with costs and benefits related to mitigation of past, present or future damage impacts—present a challenging context for deciding which funding mechanism to use to raise revenue and alter incentives.

Reducing the Threat—First and foremost, the designation of Chinook salmon as a threatened species under the federal Endangered Species Act suggests that a case can be made for the precautionary principle to apply—yet this may still be contested given that the species are not yet designated as endangered. Firm standards can well be justified to prevent all future pollution or damage impacts that would affect Chinook salmon habitat. The most appropriate incentive or

funding mechanisms in this case would be fee-based mechanisms. This case would be stronger if Chinook salmon or any other salmonid species reached an endangered designation, but at that point it may be too late to restore a viable population. The precautionary principle provides guidance in choosing fee-based incentive and funding mechanisms.

The proposed funding mechanisms in this report rely primarily on taxes and fees, with market mechanisms as a complement, since the Salmon Habitat Plan contains estimates of project implementation costs with more certainty and precision than the damage cost estimates available to date. To reach a definitive conclusion on the relative efficiency of funding mechanisms, it will be essential to conduct further analysis of marginal changes in costs and benefits for each proposed project on a case-by-case basis, as outlined in Appendix B of this report.

In this hybrid approach, market mechanisms complement regulatory standards and green taxes/fees by providing incentives for private landowner activities with similar goals to the public sector projects. Robust green taxes and fees stand as the primary funding mechanism in this proposal, with market mechanisms such as mitigation banking playing a supporting role.

FUNDING MECHANISM PROPOSAL OVERVIEW

Rationale of Payments for Ecosystem Services

The WRIA 9 Salmon Habitat Plan is designed to have clear economic and ecological benefits to residents of the watershed. These benefits begin with the basic existence value and cultural importance of salmon, priceless in monetary terms. The planned restoration projects will provide other key ecosystem services: flood protection to properties in the floodplain; carbon sequestration in the upper and middle watershed regions; soil regulation, water provisioning and purification, as well as a range of other services.

Flood protection provides measurable benefits to specific properties by preventing costly flood damage, but many other services will benefit all residents equally (Earth Economics, 2007). For example, carbon sequestration and air purification are benefits that have local as well as global impacts. Increased recreational opportunities benefit residents of WRIA 9, neighboring watersheds, and local businesses who rely on recreational tourists (Green/Duwamish and Central Puget Sound Watershed WRIA 9 2005).

Damage, Benefit, Work and Pay—To determine who should pay for the projects outlined in the WRIA 9 Salmon Habitat Plan, we began with a simple analysis of what parties have a stake in the restoration efforts, including where damage has originated from, who stands to gain from the co-benefits of restoration, and who will be directly involved with the process. Figure 2 shows the chain of actions that the Salmon Habitat Plan addresses.

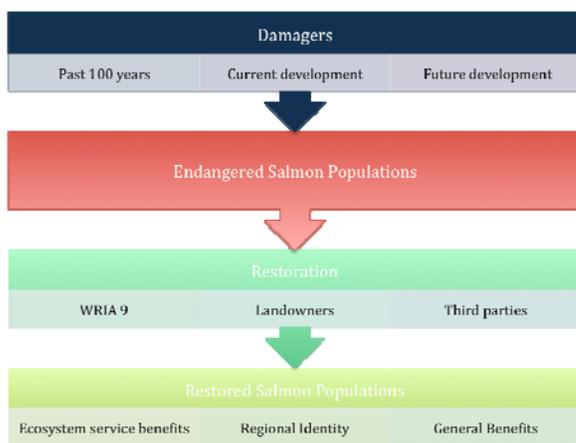


Figure 2: Salmon Restoration Process

As the lifecycle of salmon has become better understood, the factors affecting their decline have been increasingly incorporated into local, state, and national policies.

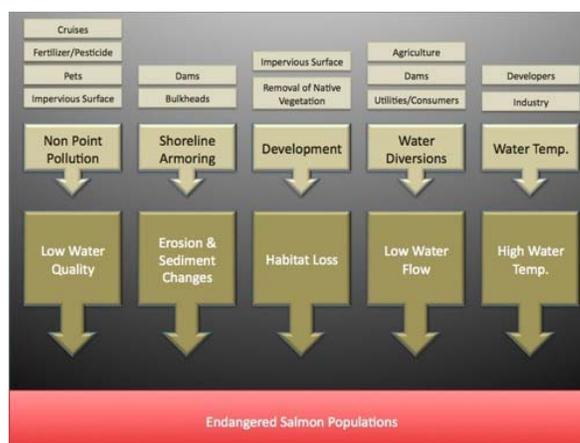
The critical importance of feeder bluffs to salmon habitat, for example, has led some jurisdictions in the Puget Sound to adopt strict regulations of marine shoreline management (Johannessen & MacLennan, 2007).

For salmon restoration to be a sound investment, the sources of the damage must be controlled to prevent further habitat destruction. The day-to-day lifestyles of all residents of WRIA 9 have impacts that contribute to declining salmon populations. Driving, walking the dog, or maintaining the yard—many residents may not realize they can have serious consequences for the health of the Puget Sound and species that depend on it. Other damages were done by past generations but still need to be mitigated. On the other end, it is important to educate the public on the value of benefits they receive from restoration projects.

Changes Accessible to Funding Mechanisms—The primary human-caused sources of salmonid population decline are “hydropower operations, fishing, poor hatchery practices, and degradation of habitat through land use and water use practices” (Green/Duwamish and Central Puget Sound Watershed WRIA 9 2005). We chose to focus on water and land management aspects of these problems, as fishing and take allowances are regulated by a complex web of jurisdictions that include tribal and international agreements. Hatchery practices—though certainly an important part of salmon management—may be best improved through policy and regulatory solutions; they do not offer much funding potential. Those that we determined to be potential opportunities for funding mechanisms are listed in Figure 3 below.

After preliminary research on the components identified in Figure 3, we selected those with the highest revenue potential, feasibility, and fairness for further investigation.

A general charge to all residents was also evaluated, since such a charge has high revenue potential and addresses the roles that all citizens have as both



damagers and beneficiaries of the Salmon Habitat Plan.

Figure 3: Sources of Damage to Salmonid Populations

Shorelines and Swales—As far as impact categories are considered, marine shoreline armoring is an immediate issue. Though many species such as smelt, Dungeness crabs, and herring are affected by bulkheads, there is substantial evidence that salmon habitat is most dramatically affected (Department of Ecology 2008). Though already managed by various jurisdictions, impervious surfaces are a clear choice, based on feedback from the WRIA 9 Ad-hoc Funding Committee.

Recommendations of the Salmon Habitat Plan include promoting low-impact development (porous pavement, bioswales, etc), and focusing on “nonpoint” pollution from stormwater runoff. Other categories include cruise ships, flood protection benefits, and possible integration of market mechanisms such as wetlands mitigation banking.

FUNDING FROM GENERAL TAX AND FEE LEVIES

Salmon habitat restoration benefits all residents and landowners in the watershed. Watershed residents are the primary beneficiaries of salmon, flood protection and other benefits. These citizens who are the beneficiaries can appropriately invest in implementing the WRIA 9 Salmon Habitat Plan. To preserve economic efficiency, social equity and environmental sustainability, costs can be distributed among those individuals or entities deriving benefit from or causing damage to ecosystems that provide salmon habitat. A wide variety of potential benefits from salmon habitat restoration are outlined below in Figure 4.

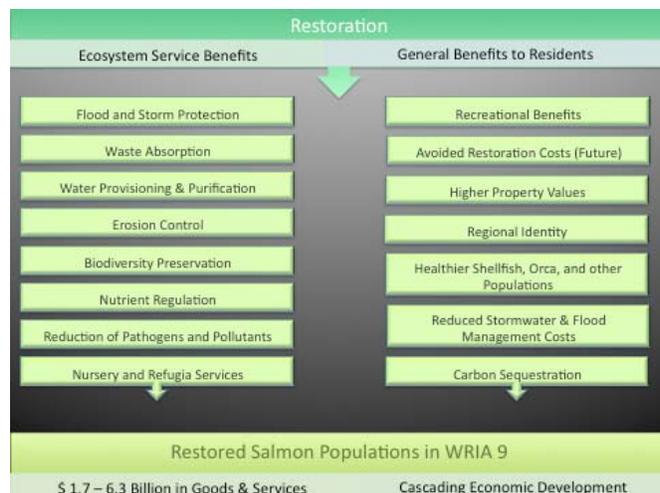


Figure 4: Benefits from WRIA 9 Salmon Habitat Plan

Funding on Target—The following funding mechanisms were specifically designed so that each proposed mechanisms would correspond to a specific beneficiary or damager to those ecosystem services identified as being improved through salmon habitat restoration. These proposed mechanisms also offer the advantage of aligning with Policy ES4: “Develop, continue, expand, and improve programs to encourage positive personal action in daily life,” as outlined in the WRIA 9 Salmon Habitat Plan. This Policy includes programs to raise awareness about natural yard care, good car maintenance, septic system maintenance, minimizing paving, toxic free products, salmon-

friendly car washing, pet waste cleanup, beach use etiquette, and other ecologically sound behavior. (Green/Duwamish and Central Puget Sound Watershed WRIA 9 2005).

In 1989, RCW 89.08.400 authorized a special assessment fee charged in King County on a per parcel basis to finance the activities of a conservation district. To establish the most recent levy rate, the King County Council approved KC Ordinance No. 15661 on December 11, 2006, authorizing a King Conservation District (KCD) special assessment for three years, effective January 1, 2007 through December 31, 2009. The District developed a Program of Work (KCD, 2008b), outlining the proposal for fee expenditures for KCD activities as well as WRIA and local jurisdiction allocations in an Interlocal Agreement between King County and the KCD.

The current special assessment levy generates funding for the King Conservation District, local jurisdictions, and WRIsAs 8, 9 and a portion of 7 within King County. Established by King County Ordinance 10981 at a rate of \$1.89, this levy has been amended by Ordinances 12095, 12959, and 14016. The most recent update to the special assessment levy rate in 2007 was set at \$9.98 per parcel on all King County parcels, except those classified forestry or parcels in exempted jurisdictions of Enumclaw, Federal Way, Milton, Pacific, and Skykomish. The special assessment also includes an additional \$0.01 annual rate for parcels between one and five acres, and \$0.02 annual rate for parcels greater than five acres.

This fee of approximately \$10 per parcel is divided into	Of the amount granted to WRIsAs,	In 2007, these special assessment fee allocations distributed approximately
<ul style="list-style-type: none">• \$5 awarded as grants to local watershed forums (WRIsAs),• \$2 granted to local jurisdictions,• \$3 to fund conservation district programs and activities.	<ul style="list-style-type: none">• 40% is awarded to WRIA 9, the Green/Duwamish and Central Puget Sound Watershed,• 40% to portions of WRIA 8, the Lake Washington / Cedar / Sammamish Watershed within King County,• 20% to portions of WRIA 7, the Snoqualmie Watershed within King County.	<ul style="list-style-type: none">• \$593,000 to WRIA 7,• \$1.2 million each to WRIsAs 8 and 9,• \$1.9 million to the King Conservation District, and• \$1.2 million to local jurisdictions for a total revenue generation of \$6 million (King Conservation District 2008a).

Proposed Mechanism: Special assessment fee

To fund the WRIA 9 Salmon Habitat Plan, we recommend applying a new and additional \$5 per parcel special assessment fee to be levied directly by WRIA 9. Based on the former distribution applied to 173,390 parcels in WRIA 9, excluding exempt jurisdictions, (King County GIS Center 2008b), this funding mechanism is estimated to generate approximately \$866,950 in directly revenue to WRIA 9 based on a \$5 per parcel special assessment fee.

WRIA 9 as a jurisdiction is not currently authorized to levy a fee of any kind under the current legislation. In order for WRIA 9 to directly levy a special assessment fee, it would first be necessary to establish the legislative precedent for WRIA 9 as a taxing district. To fund the Salmon Habitat Plan effectively, the levy should be structured to continue for a period of 5-10 years without the need for renewal.

The per parcel property assessment fee would draw revenue equally from all landowners in the District, whether rural or urban, regardless of property value or the extent of direct benefit from or damage to ecosystem services. Although this evenly distributed fee may cause some resistance, it provides consistent revenue, unlike a tax on property value. Consistent funding from year to year despite changing economic circumstances will help secure the success of the Salmon Habitat Plan.

Alternate Mechanism: Property Tax

As an alternate proposal to the special assessment fee, a new property tax would generate funding for the Salmon Habitat Plan. This is a less feasible option given that it requires a new district formed at the state or the county level to define the area to tax. A district could also be established at the WRIA level, but the current legal precedent for property taxation does not extend to WRIA jurisdictions.

The 2008 Annual Report of the King County Office of the Assessor lists the total assessed value of parcels in King County as approximately \$341 billion. King County property taxes, levied at a rate of \$1.2077 per \$1,000 of assessed value, resulted in estimated total tax revenue of \$409.8 million for 2008. The portion of this tax levy generated within WRIA 9 is estimated at \$127 million (King County GIS Center, 2008b). WRIA 9 as a jurisdiction is not currently authorized to levy a tax of any kind under the current legislation. In order for WRIA 9 to directly levy a property tax, it would first be necessary to establish the legislative precedent for WRIA 9 as a taxing district.

To generate over \$21.2 million in funding for WRIA 9, it would be necessary to set a new property tax levy at the rate of \$.20 per \$1,000 of property value applied to \$106 billion in estimated property value within WRIA 9 (King County GIS Center 2008b). This proposed rate is less than 20% of the existing county level property tax. The feasibility of this funding mechanism is directly related to the rate, due to the challenges of public buy-in on new taxes. These rates are provided for discussion only, since the County Assessor encourages proposal of tax levies based on desired revenue generation rather than on tax rate.

This mechanism depends on creation of a new property tax to generate funding for the Salmon Habitat Restoration Plan. A new district could be formed at the state or the county level; it is also possible to establish a district at the WRIA level but this may be more difficult given that the current legal precedent for property taxation does not exist for WRIA jurisdictions.

In light of the relatively low rate of revenue generation, the property tax funding mechanism is of limited feasibility; thus it is proposed as an alternate funding mechanism to the per parcel property assessment. A per parcel property assessment yields more consistent funding, while a property tax levy results in a more equitable distribution of the funding burden between urban and rural communities based on relative wealth—higher property values pay more. While any increase in taxes triggers resistance, the public is likely to offer significant resistance to an increased property tax levy.

Any new property tax would appropriately be levied at the county level, since there is no legal precedent for WRIA authority to tax. Application of this funding mechanism at the county level would result in revenue generation that can also be applied to WRIA 8 and a portion of WRIA 7 within King County.

FUNDING FROM FLOOD PROTECTION SERVICES

Flooding in King County is a significant concern to a wide variety of stakeholders—for salmon restoration as well as for businesses, residents, and all parties tied to the local economy. The 100-year floodplain spans over 25,000 acres, with a total assessed valuation of over \$7 billion (King County Ordinance 15728). If flooding were to shut down economic activity in this area for even one day, the County would lose over \$46 million in foregone economic output (ECONorthwest).

The threat of such losses is quite real, as King County was declared a federal flood disaster area eight times between 1990 and 2006. In 2006, King County experienced extremely heavy rains and some of the worst flooding ever recorded. Several main highway routes, including Interstate 5 and Interstate 405, were shut down, billions of dollars in damages occurred, and several lives were lost. Recently in 2009, flooding occurred again at severe levels, particularly in the town of Pacific.³

Largely in response to the 2006 flooding, King County Ordinance 15728 was passed in April 2007, ordering the formation of a countywide flood control district. This ordinance united what had previously been a wide variety of disconnected flood protection districts. The ordinance officially recognized that flood control must to be undertaken through an integrated and coordinated approach that would include upland ecosystem management strategies, as proposed in the watershed investment district strategy discussed later in this report. This conclusion is important in light of recent discoveries that sink holes in portions of the Howard Hansen dam are reducing the effectiveness of this engineered structure as a flood protection solution for several years, a problem which may recur in the future.⁴

Flood Districting—The King County Flood Control District (KCFCD) is an independent special purpose district of the State of Washington, authorized by Chapter 86.15 of the Revised Code of Washington (RCW). RCW 86.15 authorizes the King County Council to be the District's board of supervisors; thus the KCC is the governing body for the KCFCD. KCFCD was established in April, 2007 by Ordinance 15728 of the Metropolitan King County Council to protect public health and safety, regional economic centers, public and private properties and transportation corridors.

To guide implementation for district activities, King County developed its Flood Hazard Management Plan, which includes a flood prevention project list with itemized implementation costs totaling an estimated \$335 million over 10 years. Funding for this project list was established with a property tax assessment of \$.10 per \$1,000 of assessed valuation, raising approximately \$32 million per year for plan implementation.

Under RCW 86.15, flood control levy revenues are primarily intended to support flood and stormwater projects. RCW 86.15.035 allows 10% portion of the revenue to be used to support cooperative watershed projects, approximately \$3.2 million per year, providing there is approval from the Flood District Board of Supervisors. The Advisory Committee unanimously recommended disseminating this revenue via a Sub-regional Opportunity Fund. Further specifications include the following:

³ Recent news reports indicate that there is significant concern about use and viability of dams for flood protection: http://seattletimes.nwsourc.com/html/localnews/2008627490_apwapacificflooding.html
http://seattletimes.nwsourc.com/html/localnews/2008650646_apwahowardhansondam.html

⁴ For more information on the King County Flood Control District, please visit the following link: http://www.kingcounty.gov/council/flood_district.aspx

- 1) The 10-Percent Subregional Opportunity Fund should be allocated to jurisdictions on a pro-rated basis.
- 2) Jurisdictions should have flexibility to determine which types of activities they wish to finance with these funds, so long as those activities are consistent with RCW 86.15.
- 3) Jurisdictions should have flexibility to determine where these funded projects should be located.

Habitat Funding Agreement—While much attention has been given to the formation of this new district, the philosophy of increased coordination has not been carried to the extent that would truly make watershed management most effective. Traditionally, salmon restoration and other ESA compliance-driven activities have had highly specific, science-based approaches to protecting a given species. This funding source may provide a substantial complement to funding mechanisms in this report, but it has not been included as a proposed mechanism, as it would not provide a stable, dedicated source of revenue for WRIA 9.

In the fall of 2008, the Flood District Board of Supervisors decided to narrowly define the allowable uses of the flood district money, to specifically exclude habitat work unless specifically connected to a flood project. Specifications of this resolution include the following:

District funds may be expended for cooperative watershed management actions, including watershed management partnerships and other intergovernmental agreements, for the purposes of water supply, water quality, and water resource and habitat protection and management, provided that Opportunity Funds expended for salmon habitat protection shall be linked to the construction of a flood or stormwater project, and provided further that all such funds shall be used for the implementation of watershed management plans.

Since the Board must approve the levy annually, any continuation of this decision would need to be confirmed by a vote of the Board each year.

Collaboration on Similar Goals—This series of decisions affects the context of funding mechanisms for WRIA 9, since a number of projects in this plan are consistent with the King County Flood Hazard Management Plan. Such projects involve channel rehabilitation, levee setbacks, bank restoration, upgrade to roads with associated fish passages or riparian restoration. At least 5 major projects in the Salmon Habitat Plan are quite similar in scope and location (see Appendix C for a detailed analysis of overlap between the two plans). Several of the projects in these two plans may in fact produce identical outcomes depending on negotiation between decision makers.

Given these overlaps, many of the Flood Hazard Management Plan projects located in the Lower Green River between Tukwila and Auburn have the potential to greatly improve salmonid habitat. Overlap between projects in the Salmon Habitat Plan and the Flood Hazard Management Plan includes \$38.4–72.1 million in total estimated costs of the Salmon Habitat Plan. In the scope of WRIA 9 funding mechanisms, this represents a large percentage of the entire \$200-300 million to be generated over a 10-year period.

The significant overlap may also provide sufficient justification for applying a portion of the estimated \$3.2 million annual Sub-regional Opportunity Fund to projects in the Salmon Habitat Plan that can also improve flood control and hazard management. This is a temporary funding opportunity and has not been included among the proposed funding mechanisms below. Further analysis is warranted to comprehensively identify projects with outcomes that will improve both salmon habitat and flood control.

Proposed Mechanism: Lid lift on existing flood control tax levy

This mechanism would expand the rate at which the Flood Control District is allowed to levy, directing the increased revenue towards the Salmon Habitat Plan. This lid lift would require prior agreement with the existing district. Lid lifts can last up to 20 years, though according to the King County Assessor, the majority of lid lifts tend to be approved for a much shorter term, averaging approximately 6 years.

A temporary lid lift is proposed as an appropriate funding mechanism due to the connection between salmon habitat restoration and improvement of flood control ecosystem services. In fact, a number of projects in the Salmon Habitat Plan are identical, similar or complementary to projects proposed in the King County Flood Hazard Management plan and other proposed flood control. One solution may be to integrate a salmon representative into the flood district's planning, so that the district could coordinate project work with WRIA 9 to ensure that each salmon project also provides maximum flood benefits.

The Flood Control District levy in 2008 was set at a regular rate of \$.10, with a maximum of \$.50 authorized for each increment of \$1,000 in assessed parcel value. This rate is subject to limits constraining the levy from exceeding the following:

- 1% of the market value of a property (Washington State Constitution);
- (b) \$5.90 per \$1,000 of assessed parcel value in aggregate with all other levies (RCW 84.52.043); and
- (c) a maximum of 101% of the highest regular levy since 1986 (RCW 84.55).

Total assessed value for King County in 2008 was approximately \$341 billion, resulting in a total tax of approximately \$32 million for the county flood control district. The total assessed value of parcels within WRIA 9 in 2008 is estimated to be \$106.2 billion (King County GIS Center 2008b). The proposed lid lift could generate an estimated \$10.6 million, at a rate of \$.10 per \$1,000 in assessed value from parcels within WRIA 9. Since this funding mechanism is applied at the county level, additional revenue will also be generated for other WRIAs within King County.

It is not clear at this time whether this funding mechanism would be subject to the 10% limit for funding of projects for salmon habitat restoration. If any projects to date with positive impacts on salmon habitat have received funding outside of this 10% portion of flood hazard management revenue, then it is recommended that discussions begin with a similar strategy. Alternatively, if no such projects exist then it will be necessary to limit this funding mechanism to an amount no greater than 10% of the total flood control district tax revenue. This would limit the proposed funding mechanism to \$1.6 million of revenue per year generated from parcels within WRIA 9.

The lid lift funding mechanism is the best one for paying for projects that are in both plans, improving both salmon habitat and flood control without a new levy. With common goals, including avoiding a new levy, WRIA 9 and the KCFCD may be able to reach agreement at least for coordinated funding of projects that meet overlapping goals for flood protection and habitat restoration (see Appendix C).

The lid lift funding mechanism is proposed as an additional tax, above and beyond the existing tax levy for the King County Flood Control District. At the estimated rate, the lid lift could fund as much as half of the \$20 million in the annual project budget for the WRIA 9 Salmon Habitat Plan. There are also applicable funding constraints and sequential defunding protocols in the event of a revenue

shortfall. Under these protocols, flood control districts are relatively low on the priority hierarchy and among the first to be defunded in such an event. Therefore, other funding mechanisms to provide steady revenue are suggested as part of the overall approach, but the immediacy of opportunities for a lid lift and the combined benefits for flood control and habitat make a lid lift a very important component of these funding mechanism recommendations.

FUNDING FROM MARINE SHORELINE ARMORING IMPACTS

Marine shoreline armoring presents one of the most significant impacts of land-use development affecting natural shoreline protection. There are already 805 miles of armoring, primarily through bulkhead development, along the Puget Sound and Northern Straits, covering 34% of the coastline (Johannessen & MacLennan 2007). Well over half the marine shorelines in WRIA 9 have some form of armoring on them. In 1972, Washington State established legislative protections for natural marine shorelines by passing the Shoreline Management Act (RCW 90.58).

This precedent setting law was established to “prevent the inherent harm in an uncoordinated and piecemeal development of the state’s shorelines” based on conclusions that “shorelines of the state are among the most valuable and fragile of its natural resources.”

This legislation contains three broad policies:

- to encourage water-dependent uses,
- protect shoreline natural resources,
- and to promote public access.

Despite this imperative for limiting the impact from bulkheads and other forms of marine shoreline armoring, there is little to no indication that the current regulatory approach actually protects nearshore ecosystems.

Effects on Natural Processes—The Green/Duwamish and Central Puget Sound Watershed has experienced ecological impacts from development that are much more concentrated and significant than almost any other watershed in the state. Nearshore ecosystems in particular have been altered by the addition of seawalls, bulkheads, and other forms of marine shoreline armoring intended to protect the adjacent properties from natural erosion. Even on Vashon/Maury Island, which is considered relatively undeveloped and is outside the Urban Growth Area, 50% of the shoreline is armored.

The health of Chinook salmon and other salmon species depends on nearshore natural ecosystem processes and functions that include erosion and deposition along marine shorelines. Bulkheads and other armoring devices degrade the nearshore habitats that provide habitat for many salmon prey species, including surf smelt, sand lance, and herring. For salmon, shoreline armoring causes habitat shifts; loss of shoreline vegetation, wetland vegetation, and large wood, and changes in food resources (Department of Ecology 2008). In addition, salmon need nearshore habitat with healthy

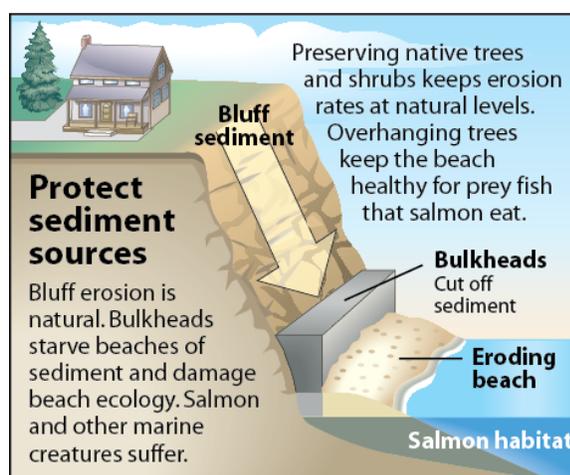


Figure 5: Bulkhead impacts on habitat.

eelgrass beds for food and shelter from predators along their migratory path. Habitat impacts are also imposed by docks and chemical changes due to human activity along the shoreline (Mumford 2007).

Invariably, altering the shoreline has measurable physical effects to any neighbors. A bulkhead will stop land loss where it exists but can accelerate erosion on unarmored properties on either side. Such shoreline modifications have clear and measureable physical and economic externalities.

Continuing Trend—The Washington State Department of Fish and Wildlife is authorized as the permitting agency for development of new marine shoreline armoring. While the rate of permits issued for new bulkhead development was steadily decreasing in the 1980s into the 1990s, from over 200 permits issued per year to slightly more than 100, this rate has remained steady since the mid-1990s (Cornwall and Mayo 2008). Research indicates that none of the hundreds of permit applications received in recent years have been rejected. It is not clear whether the permitting agency has been authorized to deny applications. If not, this permitting process cannot be used to control the rate of development. Furthermore, anecdotal evidence indicates minimal review of bulkhead development permits. Investigative research by the Seattle Times uses relatively conservative methods to conclude that the rate of new bulkhead development across all of Puget Sound has been at least 5 miles over the past 2 years—approximately 13,200 feet or more per year. A preliminary estimate of permits granted in 2008 for marine shoreline armoring development just within WRIA 9 shows approximately 2,469 lineal feet of new development.⁵

This stable rate of bulkhead development has occurred despite shoreline development restrictions and the protection of Chinook salmon under the Endangered Species Act. The steady rate of armoring and apparent minimal oversight presents a clear concern, given that bulkheads and other forms of marine shoreline armoring are a significant cause of damage to salmon habitat and other shoreline natural resources.

As residents have altered their shorelines, salmon have lost critical habitat. The WRIA 9 Salmon Habitat Plan attempts to undo some of this damage, and includes numerous projects that target specific locations for bulkhead removal and shoreline restoration. Even as these projects are completed, shoreline armoring elsewhere in the Puget Sound will continue to damage salmon populations.

Reversing the Impact—One way that landowners can mitigate the damage caused by armoring would be to pay a damage tax or fee corresponding to the amount of shoreline that they or previous owners of their property have altered. These funds would then pay for restoration projects in the Habitat Plan that will partly compensate for the previous damage. Landowners choosing alternative management strategies such as “soft” armoring could receive an exemption. Such an exemption would align well with many of the goals, programs, and policies outlined in the Salmon Habitat Plan as described below.

To assist landowners with the transition, the Salmon Habitat Plan includes Program goal N-3: Create an Incentive Program to Encourage Multiple Family/Neighborhood Use of Docks and Boat Ramps. Two policy goals from the Salmon Habitat Plan are also relevant—Policy IN2: Support shorelines exemption for properties affected by salmon habitat restoration projects that would

⁵ Based on data on permits granted in 2008 (Department of Fish and Wildlife 2009). Data presented number of permits within each permit range (<101 feet, 101-200 feet, 201-300 feet, 300-500 feet, >500 feet) and averages for each range were applied for preliminary estimates. More detailed analysis will provide greater precision in estimates.

relocate the location of the ordinary high water mark, and Policy IN3: Support bioengineering alternatives for shoreline bank stabilization and flood control facilities where feasible. To change landowner behavior, proposed funding mechanisms focused on marine shoreline armoring would be most effective if coupled with a program to educate landowners on salmon-safe alternatives for natural shoreline protection.⁶

Proposed Mechanism: Property Tax on marine shoreline armoring

A property tax on marine shoreline armoring would directly connect the watershed restoration revenue stream with one of the most significant causes of damage to healthy salmon habitat. The proposed funding mechanism is analyzed at a tax levy rate of \$.33 per \$1,000 of property value. At this rate for the 2008 estimate of \$3.1 billion in property value (King County GIS Center 2008a, 2008b), the revenue generation potential is approximately \$1 million.

A new district to levy a fee on these properties would be created through a statutory resolution of legislative authority or petition to county legislative authority. Thus, this particular funding mechanism requires a greater degree of legislative action than other funding tools in this report. Legislation would also outline the formation of these new marine shoreline armoring districts and delineate their powers and authority. This process was undertaken in the formation of the Shellfish Conservation Districts formed under Chapter 90.72 of the Revised Code of Washington (RCW).

The process of establishing a new district may be time-consuming and meet political resistance from property owners. The simplest district boundary would include all waterfront properties; parcels without any shoreline armoring would be eligible for exemption. In addition to Program goal N-3, this program would help landowners implement alternative management techniques to protect their property.

If established, this mechanism would be relatively fair and also encourage behavioral change to improve the nearshore ecosystem and benefit salmon populations. Setting the tax high enough to affect behavior acts in concert with the high level of assessed values for most shoreline properties to generate revenue. In the scale of needed revenue, this mechanism is small, but the rate may be scaled for a greater revenue generation. This proposal will also provide an strong incentive to change development strategies and best practices, reducing the extent of damage to ecosystem health over time.

Alternative Mechanism: Permitting fee on marine shoreline armoring

This proposed funding mechanism would introduce a flat or per lineal foot fee for permits for any future armoring of marine shoreline properties or changes to existing armoring. As a means to implement the Shoreline Management Act, a permit fee would help to improve the current permit system by providing an added financial disincentive to property owners.

A proposed permit fee levied at \$25 per lineal foot of new development (one-time fee) is estimated to generate approximately \$111,105 in revenue, based on the estimate of 2,469 feet in new permits each year. This is a relatively small amount of revenue for the fee; hence the proposal of this funding mechanism as an alternative option. It is possible that the fee would encounter less

⁶ A report providing information on and evaluation of alternative methods for shoreline stabilization has been prepared for the Puget Sound Action Team in 2006 (Gerstel and Brown 2006).

political resistance than a property tax, since only those landowners making changes to the armoring on their property would be affected. The downside of this mechanism is that damage already done is not mitigated.

As observed in the introductory paragraphs, the amount of marine shoreline already armored is significant, so a charge that does not address existing armoring will have lower revenue potential and less impact on behavior. In addition, it is likely the permitting agency would want to receive all or part of such a fee, as there would be some additional overhead involved with managing the payments. Another potential negative is that introducing a fee provides an incentive for landowners to avoid the permitting process by illegally undertaking their desired actions. Assuming the fee is set high enough to alter behavior, this mechanism would decline over time.

FUNDING FROM IMPERVIOUS SURFACE IMPACTS

The Green/Duwamish and Central Puget Sound Watershed urban areas are among the most densely populated and developed in the state, resulting in the area having a relatively high concentration of impervious surfaces. The detrimental effect that water runoff from impervious surfaces has on salmon habitat is well documented; this non-point source pollution is among the least regulated. Salmonid populations are adversely affected by the contaminants carried by water running across impervious surfaces, as well as by sedimentation and habitat loss due to surface water discharges. Salmon survival is critically linked to management of surface water and stormwater runoff. Stormwater discharges from impervious surfaces also are the primary way in which pollutants are conveyed to the marine waters of Puget Sound.

A study of impervious surface in the Snohomish WRIA 7 reveals a 255% increase in impervious surface from 1972 to 2006 (Powell, Cohen, Yang, Pierce and Alberti 2007). Specific data on the rate of increase in WRIA 9 are not available, but the rate of increase has likely been significant.

In Washington, surface water management is defined as a fee for service, which allows each jurisdiction to determine its own payment system. As a fee, it is designed to represent the contribution to the problem as opposed to charges based on income or value such as taxes. Some districts have opted to designate each property in Equivalent Surface Units (ESU)—an estimate of the average amount of impervious surface on residential properties. Commercial and industrial properties are charged in terms of the number of ESUs on each property.

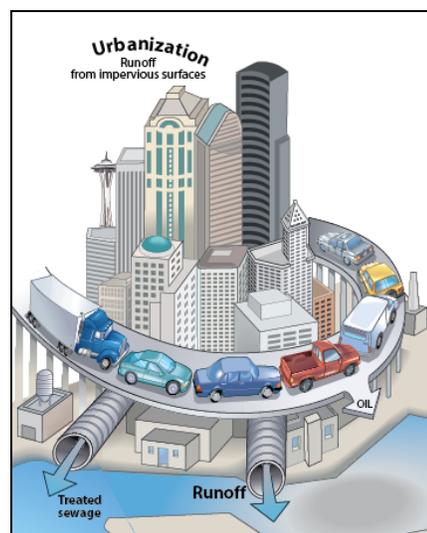


Figure 6: Impervious surface impacts.

Rainfall to Runoff—These charges on impervious surfaces relies on hydrological modeling to determine the fraction of rainfall that becomes runoff from a parcel. These runoff coefficients vary depending on how pervious (permeable) a surface is, based on the fact that more stormwater will

run off of hard or impervious surfaces while pervious or permeable surfaces will absorb more water.

King County currently assesses a flat charge of \$111 per residential property, while commercial properties pay rates that vary depending on the amount of impervious surface per property. Rates for other jurisdictions within the county vary from \$83 (Seatac) to \$183 (Kirkland). In Minneapolis, this system has been developed a bit further through delineation of three categories of residential property size—high, medium, or low (City of Minneapolis 2008).

In 1974, Bellevue was one of the first cities to introduce a surface water management fee and now has one of the most advanced payment systems. All properties, including residences, are charged based on the amount of impervious surface divided by the total square footage, with credits for additional management tools or wetlands on the property (NRDC 1999). Damon Diessner, the former Assistant Director of the Bellevue Utilities' Environment Department, has observed that "areas that are nearly fully developed need to focus on retrofits, restoration, and reversal of the impacts of existing development, whereas areas that are sparsely developed can focus on protecting, preserving, and enhancing high quality water resources" (Water Environment Research Foundation 2008).

In King County, addressing the environmental impacts of surface water through salmon restoration and other projects is considered to be the responsibility of the WRIAs, though a small portion of the surface water management fees they collect is directed towards salmon restoration. Generally, revenues from surface water management fees are strictly limited in use by state statutes and King County code to ensure that money is spent only on surface water management (King County Surface Water Management 2008).

Fee Exemptions—Any new or increased fee should reasonably include these existing exemptions for practices that reduce runoff:

1. **Stormwater Facility Discount** for landowners with onsite water quality treatment facilities meeting County standards.
2. **Sixty-Five-Ten Discount** for landowners with at least 65% of land forested, no more than 10% impervious surface and applying Best Management Practices.
3. **Pervious Surface Absorption Discount** for non-residential landowners with at least 10% of land served by flow control Best Management Practices.
4. **Impervious Surface Cost Share and Credit Program** for commercial landowners with a plan for converting impervious surface to (1) native-vegetated landscape, (2) compost-amended lawn or (3) grassed, modular-grid pavement.
5. **Open Space Discount** for landowners with property classified as "open space", "agriculture" or "timber" and enrolled in the Current Use Taxation Program.

The City of Seattle has a more complex system for determining this fee, in comparison with King County. New rate specifications take effect in 2009, establishing that single-family residential and duplex parcels smaller than 10,000 square feet are now divided into four categories, each associated with a range of parcel sizes (e.g., 3,000 to 4,999 square feet). Each rate category is assigned a flat fee that increases as the parcel size range increases. However, all properties

assigned to the same rate category will be charged the same fee, regardless of variances in lot size. Large single-family residential/duplex parcels (10,000 square feet or greater) are no longer charged a flat fee. Rather, these properties are charged in the same manner as commercial properties.

Starting in 2009, there will be a rate credit assigned to qualifying parcels with fully functioning, well-maintained stormwater management system providing that these systems meet City Stormwater, Drainage, and Erosion Code requirements. Another potential rate credit will be available to parcels with low-impact development facilities, such as rain gardens and swales or detention vaults. The level of these rate credits are variable, depending on the degree of stormwater management effectiveness. Starting in 2009, properties with significant amounts of highly pervious surfaces on their properties may qualify for new low impact drainage rates: unit rates will be charged per 1,000 square feet and not per acre.

Shared Management Strategies—Though many of the municipalities within King County have taken steps to control the source causes of surface water runoff, there is abundant opportunity for greater collaboration and a coordinated approach, given that the damaging impacts extend beyond jurisdictional boundaries. Since reducing the source of the problem is a top priority, those who continue to contribute to the problem, which is any landowner with impervious surface on their property or anyone who utilizes impervious surface elsewhere (roads, parking lots, shopping malls, etc.), should help pay the costs of mitigating that impact.

The combined strategy of a funding mechanism that also offers an impact reduction incentive will strengthen salmon restoration efforts and prevent the need for such measures in the future. Ongoing collaboration between local, County and WRIA representatives will support these efforts to create salmon-friendly, natural solutions to surface water management. Increasing use of permeable surfaces for roadways and driveways, development of bioswales and infiltration ponds, as well as other sustainable urban drainage systems will support many shared water management goals.

The WRIA 9 Salmon Habitat Plan includes these goals throughout their policy and program recommendations. For example, Policy IN4 recommends a “surface water fee reduction for landowners with properties that are at least 65% forested and have no more than 10% impervious surface”. Policies WQ2, WQ3, and WQ4 also address surface water management.

Proposed Mechanism: Fee on existing impervious surface

This mechanism would annually charge all landowners based on the amount of impervious surface within the parcel, similar to the existing impervious surface fee described above. This particular fee-based funding mechanism is limited in feasibility, since King County and most cities in WRIA 9 already assess a similar fee for stormwater management programs. Levying this fee may also require amendment of the Revised Code of Washington to authorize use of surface water management fees for salmon habitat restoration, unless the fee can be established as an impervious surface fee outside of the existing authorization for stormwater management fees. This proposed funding mechanism would not require establishing a new tax district, unlike the other mechanisms.

The recommendation in this report represents only one option among many possibilities for structuring such a fee mechanism, in this case with focus on achieving a standard level between county and municipal rates. This rate proposal may be modified to raise the rates higher or lower

across the entire county or at a smaller scale as negotiated through further discussion among the relevant parties. This negotiation may also include discussion of fee distributions that would modify existing inter-local agreements to allocate additional funding from impervious surface fees.

Existing stormwater management fees at the county level are levied at one basic rate, and many municipalities set rates individually. Residential properties in King County are charged a flat fee, as the GIS work required to determine the amount of impervious surface on individual properties would be quite involved. Commercial and industrial properties are charged according to the amount of impervious surface. The table below provides details on surface water fee rates for non-residential properties in King County.

Table 1. King County Surface Water Fee Rates

<u>Classification</u>	<u>Percent impervious</u>	<u>Rate</u>	<u>Unit</u>
Very light	< 10%	\$111.00	per parcel
Light	10.1-20%	\$277.39	per acre
Moderate	20.1-45%	\$597.85	per acre
Moderately heavy	45.1-65%	\$1,005.67	per acre
Heavy	65.1-85%	\$1,363.76	per acre
Very heavy	85.1-100%	\$1,737.74	per acre

We propose a fee on impervious surfaces in addition to the current King County and city surface water fee. Seattle fee rates were chosen for this comparison because the fees are scaled by percent of impervious surface. Using any other municipal fees for this comparison would result in potential inequity from fees not scaled to the concentration of impervious surface within a parcel.

The proposed impervious surface fees have been scaled to establish uniform rates at both city and county levels. Other jurisdictions could match this rate level. In another discussion, we recommend revising the jurisdictional divisions between these systems for a coordinated surface water management and investment system at the watershed scale.

The proposed impervious surface fee increase applies to residential and commercial parcels within unincorporated King County only. Parcels with less than 10% impervious surface can be designated as exempt from this increase, which effectively includes a majority of residential parcels. These parcels would still be subject to the existing per parcel fee. Further exemptions may also be warranted for parcels with pervious surfaces or other strategies for mitigating the impact of impervious surfaces, based on existing exemption information discussed previously. Proposed impervious surface fee rates and estimated revenue from parcels in unincorporated King County are presented in the table below.⁷

Table 2. Proposal for Additional Fees on Impervious Surfaces

<u>Percent impervious</u>	<u>Parcels</u>	<u>Proposed fee increase per acre</u>	<u>Estimated revenue</u>
Less than 10 %	9502	0	\$-
10–20%	4310	\$456	\$1,965,360
20–45%	9033	\$500	\$4,516,500
45–65%	8659	\$590	\$5,108,810

⁷ Estimates were generated using parcel and value data from King County GIS Center (2008c)

65–85%	4149	\$698	\$2,896,002
Greater than 85%	1418	\$711	\$1,008,198
Total			\$15,494,870

Applying this fee only to unincorporated King County creates an impervious surface funding mechanism with greater parity to municipal fees. Since other municipalities levy fees on impervious surfaces at a rate lower than either the King County or Seattle rates, these municipalities can adjust fees in relation to current or proposed county rates. A more complex impervious surface fee could be structured on aggregate calculation of rates from multiple jurisdictions, which process is beyond the projections in this report.

This fee increase represents a potential inequity due to increasing fees charged to rural landowners in order to establish uniformity of fees scaled to impacts. Exempting residential parcels with less than 10% impervious surface would reduce this inequity. The revenue generated from this funding mechanism would be dedicated to mitigating the overall impact on critical habitat for threatened salmon species as well as funding stormwater management activities.

FUNDING FROM CRUISE SHIP IMPACTS

The Port of Seattle, central to the shoreline of the Green/Duwamish and Central Puget Sound Watershed, is now the main Northwest point of departure for Alaskan-bound cruise ships, receiving valuable economic benefits from the additional passenger traffic. However, cruise ships also bring with them a number of damages that are less frequently discussed. Each week, a typical ship generates

- 150,000 gallons of sewage,
- 1 million gallons of greywater,
- Over 130 gallons of hazardous waste,
- 8 tons of solid waste, and
- 25,000 gallons of oily bilge water.

Moreover, it has been estimated that each week a ship dumps 6,000 gallons of untreated sewage sludge. Current law allows this material to be dumped 3 miles offshore, but cruise lines claim to do so at 12 miles (Felleman 2008).

Incidents of Dumping—There are documented incidents of cruise ships illegally dumping waste in Puget Sound, despite a legal restriction that prohibits such dumping in any location that is less than 3 miles from the coast. In 2005, Celebrity Cruise Lines was fined \$100,000 by the Washington State Department of Ecology for dumping by the vessel Mercury of over 500,000 gallons of wastewater in Puget Sound over multiple incidents (Stiffler and Millares Bolt 2006), this being one of the largest environmental damage penalties in history; the previous year Norwegian Cruise Lines was fined for dumping 16,000 gallons of wastewater into Puget Sound (Environmental News Network 2002).

Certainly, more dumping occurs than those instances that caught and fined but beyond anecdotal evidence it is not possible to generate an accurate estimate for the extent of this problem. This represents a significant source of damage to water quality and marine ecosystem health, and the impact is distributed throughout Puget Sound as a result of tide and current circulation.

This damage affects the entire Puget Sound, so a fee would need to be divided among several jurisdictions. Still, this would be an important step towards connecting cruise ship passengers with

their environmental impacts. Devoting the money to environmental restoration will ensure that the natural beauty that spurs cruise ships in the first place will be protected and maintained.

Proposed Mechanism: Cruise ship impact fee per passenger

This mechanism would assess a fee of \$25 for every passenger on cruise ships departing from the Port of Seattle. A similar program has been implemented in Alaska, where the state charges a \$50 fee for all passengers, and municipalities add their own surcharges. It may be of limited feasibility for this funding to go solely to WRIA 9 without some distribution among other jurisdictions and entities, yet this mechanism still has the potential to raise a large sum of money.

The total number of cruise ship passengers visiting Seattle is estimated to be over 800,000 in 2009 (Port of Seattle 2008). At the level of money individuals spend on a cruise, \$25 is relatively small. Setting the fee at \$25 fee per passenger would generate approximately \$20 million in revenue. This fee may present a small disincentive to passengers; also, the revenue from this funding mechanism would vary with cruise ship market fluctuations. This fee is also subject to fluctuations resulting from changes in cruise passenger levels.

This fee will clearly be subject to fluctuations resulting from changes in cruise passenger levels. Also, it would be appropriate to conduct some analysis on the impact to market demand as a result of this fee increasing costs of cruises: while the fee is relatively small compared to the total cost of a cruise ship ticket, it may encourage consideration of other nearby ports as alternatives to avoid the fee.

MARKET MECHANISMS

In the past decade, interest in using market-based mechanisms to fund environmental preservation, restoration, or improvements has expanded enormously. Some of the current international leaders of this field include Costa Rica, Australia, and China. In Washington state, a number of efforts to launch ecosystem service markets have emerged, only the first of which is discussed in detail in this report:

- **wetland mitigation banking** programs initiated by the Department of Transportation and by the Department of Ecology, as discussed below,
- a **conservation banking market** pilot initiative by the Washington Conservation Commission,
- a **regional market for tradable development credits** initiated by the Department of Community, Trade & Economic Development,
- the **mandatory carbon market** initiated by Washington State and other states in the Western Climate Initiative (WCI).

Market mechanisms are proposed as a complementary strategy for WRIA 9 funding but not as a primary funding mechanism. The most applicable market mechanism with potential to advance the WRIA 9 Salmon Habitat Plan is wetlands mitigation banking. This is due to the fact that wetlands mitigation banking systems have been established in Washington State. Other market mechanisms under development may also offer further opportunities once established. These market mechanisms are not recommended as a primary proposal in light of the fact that the banking systems result in a one to one ratio of habitat loss to habitat restoration with no net increase.

Wetlands mitigation banking is based on a policy of “no net wetlands loss”. This means that any development that will cause unavoidable damage to wetlands must offset its impact through the restoration, creation, or in some cases, preservation of wetlands loss elsewhere. Until recently, strong preference has been given to on-site mitigation efforts—mitigation that occurs elsewhere on the property itself. However, on-site efforts may not be most effective in ensuring real mitigation. Generally, wetlands restoration efforts are more effective at a larger scale. This shift in thinking has led to the creation of wetlands mitigation banks, where many project offsets can be consolidated in one geographic area that has a higher likelihood of achieving ecological success.

Chapter 90.84 of the Revised Code of Washington State, “Wetlands Mitigation Banking,” outlines the state’s wetlands policy, which adopts the federal sequence for wetlands management under CWA Section 404. In 2004, the state legislature appropriated \$120,000 for a pilot program for wetland banking during fiscal year 2005, which was later extended to last through 2007. Mitigation banks can be formed by private entrepreneurs or public entities (e.g. ports, transportation departments, public works agencies).

The process for forming banks is as follows:

1. Bank proponent submits a prospectus.
2. Interagency Mitigation Bank Review Team (MBRT) reviews the prospectus.
3. Bank proponent responds to feedback from the MBRT.
4. Prospectus is sent out for public comment.
5. Bank proponent submits draft Mitigation Banking Instrument.
6. Federal and state agencies and local jurisdiction give final approval.

Once formed, a wetland mitigation bank should provide a number of valuable wetland functions, such as flood control, improved water quality, groundwater recharge, and fish and wildlife habitat. Regulatory agencies charged with certifying the bank then determine the number of credits available at the bank, which can then be sold to developers or public agencies who bear compensation or mitigation obligations.

Forming a Mitigation Bank—The Washington State Department of Transportation (WSDOT), is currently the largest mitigation banker in the State of Washington. The first project, the Springbrook Creek Wetland & Habitat Mitigation Bank Project located in the Renton area, will ultimately restore or enhance 130 acres of wetlands. The bank will serve WSDOT’s mitigation needs once completed in 2009. Funding has come from a 2003 transportation fund, the City of Renton, and several other sources. Construction has been underway since the spring of 2007, and as of January 2009 crews had installed a drainage system and parts of the boardwalk, with a spring 2009 final completion goal. The project will provide a number of valuable ecosystem enhancements, such as habitat diversity, improved water quality and hydrologic function, and improved riparian functions. This type of mitigation approach offers a greater ecological value than mitigating through more, smaller projects, and allows for mitigation in advance of project development.⁸

King County has one of several wetlands mitigation banks planned for implementation in the State of Washington.⁹ The Lake Washington-Sammamish Watershed Mitigation Bank is to be located in Redmond, Washington. Proposed by Habitat Bank NW, LLC., this bank would service all of WRIA 8

⁸ For more information on the WDOT mitigation banking program, please see the following web site:

<http://www.wsdot.wa.gov/Environment/Biology/alternativemitigation.htm>

⁹ For more general information on mitigation banks in Washington State, please see the following web site:

<http://www.ecy.wa.gov/programs/sea/wetlands/mitigation/banking/index.html>

below 2,500 feet in elevation (U.S. Army Corps of Engineers 2008). The prospectus for this wetlands mitigation bank was submitted in January of 2008 (Habitat Bank LCC 2008), and the draft proposal in April 2008. This proposal is now being evaluated by the Mitigation Bank Review Team, and credits should be available in 2009 (Habitat Bank LCC 2009).

Although often the most significant ecological and economic benefits of wetlands mitigation banking arise from the geographic continuity of projects, there are also a number of “umbrella banks” in the United States. Umbrella banks developed multiple compensation sites under a single instrument. This is likely to be the most relevant approach for WRIA 9, which plans a variety of projects sited at locations most likely to improve the overall health of the watershed. Clark County Mitigation Bank is proposing three umbrella banks. Additional bank sites may be added later as amendments (U.S. Army Corps of Engineers 2007).

Tradable development rights (TDRs) offer another market-based mechanism worthy of note, though it is of less relevance to developing WRIA 9 funding mechanisms. TDRs allow property owners who want to develop their land to pay for that right in trade with a property owner who agrees not to develop land somewhere else. The stated purpose of the program in King County Code (Chapter 21A.37) is “to transfer residential density from eligible sending sites to eligible receiving sites through a voluntary process for permanently preserving rural resource and urban separator lands that provide a public benefit”.

The benefit of TDR is to channel development away from the more healthy rural areas of the watershed to the already urbanized portions of the watershed where the marginal impacts on the ecosystem should be less. Sending sites can be rural lands, resource lands, or urban separator areas with R-1 zoning as designated by the King County Comprehensive Plan. Public lands are not eligible. Receiving sites are strictly delineated as well, but generally must be in urban areas appropriate or planned for increased development. WRIA 9 may be able to encourage TDR exchanges on pieces of private property especially important for conservation and restoration.

Conservation banking is another market-based approach to ecosystem service management that is focused on endangered species populations and habitat. Precedents for conservation banking can be found in legislation such as the Endangered Species Act, for which the focus of banking is on conservation of listed species populations and habitat. Similar to other market mechanisms, conservation banking provides a trading mechanism by which development and conservation are balanced in order to ensure no net loss of critical ecosystems. There are also potential opportunities for establishing conservation banking systems as market mechanisms for supporting protection of state priority habitats and species, lands protected under critical area ordinances, fragile shoreline ecosystems or specific ecosystem services. This report and proposal for funding mechanisms does not include detail on conservation banking options due to the fact that conservation banking systems have not yet been established in Washington State. However, pilot projects to implement conservation banking have been undertaken by the Washington Biodiversity Council (WBC 2008).

WATERSHED INVESTMENT DISTRICT

The creation of a Watershed Investment District is based on a conceptual shift that existing tax districts relating to natural capital should be merged and set at the scale of the watershed. Such an approach would require state legislative action to establish WRIA 9 as an independent taxing district and to expand the jurisdictional mandate beyond salmon restoration. Given that ecosystem

services provided in a watershed tend to conform to natural boundaries such as those of a water drainage basin, at least more consistently than by ecologically arbitrary jurisdictions, this level of tax district is the most appropriate means for integrating planning, funding and management of services such as flood control, stormwater management, carbon sequestration and other. Such an integrated approach is consistent with RCW 865.15.035 specifications for involving flood control districts cooperative watershed management actions and with RCW 39.34.200, which establishes a general precedent for watershed management partnerships.

Scale of Management—A watershed is a productive unit providing a variety of benefits. The watershed level provides the best rationale for efficiently allocating resources by investing in the watershed’s natural assets and the goods and services they provide. Because watersheds provide a variety of closely connected benefits, the existing system of providing these benefits through a variety of single purpose tax districts is more complicated and inefficient than necessary, allowing jurisdictions to work at cross purposes instead of fostering the suite of ecosystem services as a whole.

Other than cities, counties and the State, tax districts are established for a single purpose. For example a stormwater district provides built infrastructure for handling stormwater. A flood district builds levees or opens floodways by acquiring land to provide additional flood protection. Seattle and Tacoma public utilities provide drinking water and stormwater services. Though a tax district or utility may have a single purpose and invest in various actions within a watershed, the watershed as a whole provides all of these goods and services when healthy or stops providing them if impaired.

Management Integration—Washington State has established a great number of different independent tax districts, from ports and school districts to park districts and cities. King County alone has over 100 tax districts. This is largely a product of the State’s populist history. In the early years, Washington State citizens did not want any government agency to have too much control or too large of a jurisdiction. Thus, from ports to parks, separate tax districts were established.

Ecosystem services such as salmon habitat and flood control are physically inseparable; thus managing these services requires an integrated approach. Inherently, the funding mechanisms for the various ecosystem services overlap, since the payments for services are designed to correspond with benefits or damages to the same underlying processes and functions.

The final proposal, and the most important long-term vision, as a result of this WRIA 9 funding mechanisms project is to develop a single, integrated watershed-scale investment district and management structure that combines all ecosystem services.

A **Watershed Investment District** would be responsible for the health of the watershed, provisioning and distributing a suite of ecosystem services based on detailed mapping of areas in which each service is generated and areas where beneficiaries are located. Examples include the following:

- **Flood protection** is provided by upper watershed forests and also by ponding structures such as dams, wetland and levees. The beneficiaries of flood protection are in the lower flood prone areas of the watershed.
- **Drinking water** is provided by groundwater and above watershed drinking water intake areas. The beneficiaries are mapped in the utility distribution maps. Tacoma Public

Utilities provides water diverted from the Green River to parts of Renton and King County as well as to Tacoma and Pierce County.

- **Carbon sequestration**, for example is primarily provided by forests of the upper watershed and in deltas of the lower watershed, while the beneficiaries are global: everyone benefits no matter where carbon is sequestered. Local watershed scale management would be aligned with global goals.

Additional ecosystem services to be coordinated in a Watershed Investment District include salmon habitat functions, biodiversity conservation, carbon sequestration, flood protection, and stormwater conveyance.

Combined Funding—The district or utility would bill out according to benefits provided. Those in flood prone areas would pay a fee for flood protection, as would residents for stormwater conveyance. The District would invest to gain the greatest suite of public benefits. For example, it is likely that greater flood prevention could be gained with less cost by increasing wetlands and forest coverage, which also assists with carbon sequestration, salmon restoration, groundwater recharging and stormwater conveyance.

The district could mark a more cost effective balance between natural and built capital investments. Currently, natural systems still accept most stormwater, though these systems are not mapped as part of our green stormwater infrastructure. Thus we are slowly replacing free stormwater conveyance in natural systems with built systems that fall apart and require maintenance and new capital expenditures. While 15 cities and the County may have separate stormwater systems, they are invariably linked by water flows and may not provide the greatest benefits for the investment.

Mapping Service Areas—A watershed district would allow solutions at the scale of the problem, the watershed, which is particularly important for the many ecosystem services related to water cycles. All stormwater within a watershed is either transpired by plants, soaks into groundwater or moves with surface waters to Puget Sound. A full watershed plan for stormwater management, including both the built and natural capital infrastructure that provides it, would likely provide greater benefits at less cost to all the cities and jurisdictions within the watershed. In addition, a watershed district plan could integrate drinking water, ground water recharging, flood control and salmon restoration in a single planning process for both built and natural infrastructure. Thus a watershed district planning process could eliminate many of the cross-purpose actions that have frustrated competing tax districts.

Mapping the provisioning of these services in a spatially explicit systems model, can help planners reduce the total cost of providing this suite of services, increase the benefits, and help secure a more sustainable system comprised of both built and natural infrastructure. By mapping and estimating the economic benefits provided to different beneficiaries across the landscape, billing for these services can be made more fair than the current hodge-podge of tax districts.

This vision of an integrated watershed investment mechanism helps to justify a more rational, fair and efficient system to the existing districts. Although it requires significant legislation, an integrated watershed scale approach to managing ecosystem services ultimately presents the most economically efficient, socially equitable and environmentally sustainable proposal as a WRIA 9 funding mechanism.

REVENUE POTENTIAL OF PROPOSED MECHANISMS

The following table shows estimated revenue generation potential from each individual funding mechanism proposed in this report. One exception not included is mitigation banking as a market-based funding mechanism: feasibility information and financial data for this mechanism are insufficient. Rates listed are presumptive, with preliminary estimates based on data collection and analysis to date. We recommend further data collection and analysis updates as additional research reveals additional details of funding mechanism feasibility and scalability. Presumptive rates may be adjusted based on additional information.

Table 4. Estimated Revenue Generated from Proposed Funding Mechanisms

Funding Mechanism	Type	Basis of measure	Unit	Rate	Estimated Revenue
Flood district lid lift	Tax	\$106,166,524,590	Assessed value of parcels	\$0.10*	\$1,061,665
Cruise ship	Fee	800,000	Passengers per year	\$25.00	\$20,000,000
Special assessment	Fee	173,390	Parcels	\$5.00	\$866,950
Property tax	Tax	\$106,167,497,980	Assessed value of parcels	\$0.20*	\$21,233,500
Shoreline Armoring	Tax	\$3,115,989,403	Assessed value of parcels with armoring	\$0.33	\$1,028,277
Shoreline Armoring	Fee	2,469	Lineal feet per year	\$45.00	\$111,105
Impervious surface	Fee	see Table 3	Percent impervious surface	see Table 3	\$15,494,870
Annual Total					\$59,796,366
10 yr plan funding					\$597,963,663

* NOTE - Property tax rates are levied based on dollars charged per \$1,000 in property value. Flood district revenue sharing may also be subject to a 10% limit that has been included in this calculation.

INTEGRATION WITH REGIONAL ACTION AGENDA

The December 2008 release of the Puget Sound Partnership (PSP) Action Agenda provides an important opportunity for integration between WRIA 9 funding mechanism development and similar planning on the Puget Sound regional scale. The Action Agenda states “county and city governments should support the design and establishment of a Puget Sound improvement district to collect and distribute funding for Action Agenda priorities” (Puget Sound Partnership 2008).¹⁰ Local jurisdictions face the challenge of coordinating with the PSP, since the Action Agenda specifications are relatively new and general in comparison with local habitat and flood plan development, particularly in King County.

This Action Agenda provides general priorities and strategies; in comparison the King County Flood Hazard Management Plan provide much more extensive and advanced detail with specific project and action plans. Moreover, the development of the WRIA 9 Salmon Habitat Plan and other similar local or county level ecosystem management plans have each required several years of planning. The Puget Sound Partnership may take time to develop a complete a detailed plan of more specific project and action specifications, particularly in light of the challenges that Washington State faces

¹⁰ The full Puget Sound Partnership Action Agenda document can be obtained at the following web link: http://www.psp.wa.gov/downloads/ACTION_AGENDA_2008/Action_Agenda.pdf

as a result of the present \$6 billion deficit. It also remains to be seen how the Puget Sound Partnership plans on coordinating planning with local partners.

Partners in Action—With these circumstances in mind, funding mechanisms at both local watershed and county levels must be conducted in parallel with the relatively new development of plans and funding mechanisms at the regional scale. Communication and collaboration between analysts and decision makers at both scales will be essential to success of these respective plans, particularly given the similarity of goals.

Collaboration on Funding Mechanism Development

The foundations of this communication and collaboration can already be seen in the process that launched development of this funding mechanisms report. An initial workshop hosted by Earth Economics in August 2008 included a brainstorm of potential funding mechanisms for habitat protection and restoration with members of the general public and a representative of the Parametrix consulting team, contracted by the PSP to develop the regional scale funding mechanism proposal to accompany the Action Agenda. Also, members of the PSP attended the November meeting of WRIA 9 Watershed Forum of Local Governments, participating in discussions following the Earth Economics presentation of initial recommendations for WRIA 9 funding mechanisms. Since that time there have been multiple conversations building on this discussion between Earth Economics and representatives of the Puget Sound Partnership with the intention of coordinating efforts.

Strategies and Tactics—The Puget Sound Partnership Action Agenda Financing Strategy was released in early 2009.¹¹ Preliminary tables of information provided from this Strategy have included many of the same proposals that were considered in this report, such as a property tax, cruise ship passenger fees, stormwater fee on impervious surfaces among others. In contrast to the WRIA 9 funding mechanism report prepared by Earth Economics, the draft report on Action Agenda Financing Strategy places greater emphasis on market mechanisms over tax, fee or other potential funding mechanisms. One noteworthy exception to this is the mention in the draft Strategy of a potential real estate excise tax to generate \$550 million of potential revenue, distributed in major part to the state general fund. The Partnership financing strategy also noted that counties are authorized to levy additional taxes to fund conservation and restoration efforts.

To coordinate for best results in the watershed, there will be need for discussion on the detailed specifics of how the Action Agenda funding mechanisms will provide and coordinate funding for projects and actions. As the Action Agenda is clarified, the PSP's funding proposal can be finalized. Such clarification will allow implementation to begin on the local scale. Detailed in the Action Agenda Financing Strategy, many of the proposed funding strategies and mechanisms can be further integrated with local and county efforts.

Collaborating Opportunities—The Puget Sound Partnership report includes general discussion on the concept of ecosystem service districts established with funding from a system of ecosystem service impact fees. It also cites a similar proposal for Ecosystem Service Districts proposed by the

¹¹ The financial strategy report for the Puget Sound Partnership was prepared by J. Cassin of Parametrix Inc. and A. Davis of Solano Partners Inc., is available at the following web link:
<http://www.psp.wa.gov/downloads/AAAPX/funding.pdf>

Washington State Forest Sector Working Group on Greenhouse Gas Mitigation, focused primarily on carbon sequestration services.¹²

These proposed ecosystem service district and fee concepts are generally consistent with specific rationale and proposal of funding mechanism prepared by Earth Economics in this report. The commonality in approaches is the central proposal that ecosystem service funding mechanisms are most appropriate if calculated based explicitly on the impacts to ecosystem services (air quality, water supply/purification, flood hazard mitigation, critical habitat and biodiversity, climate regulation, cultural/recreational, etc.).

We strongly encourage further discussion on the common ground between these ecosystem service funding mechanism reports in development next steps for Salmon Habitat Plan funding, particularly with regard to options for funding mechanisms and markets. It is also worth note that the Puget Sound Partnership report recommends selection of a smaller demonstration area in which to implement pilot applications of proposed funding mechanisms; towards this goal it would be appropriate for WRIA 9 and King County to begin actively planning for a position as a demonstration or pilot case study.

Our goal in this report on WRIA 9 funding mechanisms is primarily direct revenue generation; thus, this report includes detail on statutory processes required to establish individual funding mechanisms. In contrast, the Puget Sound Partnership research also covers a broader focus that included tax credits, feebates, certification programs, environmental performance initiatives, tradable development rights, mitigation programs and renewable energy green tag programs. PSP's research also includes other mechanisms that provide incentives for changing behavior but do not necessarily generate revenue.

CONCLUSION AND RECOMMENDATIONS

Healthy watersheds and the salmon populations they support are essential to the health of our economy. Investments in healthy ecosystems as natural capital assets within the watershed will provide tremendous value in the form of beneficial ecosystem services.

The WRIA 9 Salmon Habitat Plan is a significant investment in natural capital resulting from habitat restoration projects that will require dedicated funding mechanisms generating revenue that averages \$20-30 million each year over 10 years.

This report outlines proposed funding mechanisms for the plan based on principles of ecological economics to manage the economic efficiency, social equity and environmental sustainability of the Green/Duwamish and Central Puget Sound Watershed. We propose the following funding mechanisms for consideration by the WRIA 9 Watershed Forum:

9. A **tax lid lift**, at a rate of \$.10 per \$1,000 of property value, increasing the Flood Control District levy by an estimated \$1.1 million or more per year over 3-7 years for investment in projects that will accomplish objectives both flood hazard management and salmon habitat restoration.
10. A \$25 per passenger cruise ship **impact fee**, to pay for the impact of cruise ship wastewater on Puget Sound, generating an estimated \$20 million annually that may be distributed to several

¹² The proposal for ecosystem service districts can be found at the following the Department of Ecology web site link: http://www.ecy.wa.gov/climatechange/2008FAdocs/092308_for_esdproposal.pdf

jurisdictions.

11. A new \$5 per parcel **special assessment fee** generating an estimated \$866,950 for WRIA 9 subsequent to the proposed establishment of tax district status for the WRIA. Alternatively, a **new property tax** levy at a rate of \$.20 per \$1,000 property value, estimated to generate \$21.2 million for WRIA 9.
12. A **new district and tax** on marine shoreline armoring impacts, levied at a rate of \$.33 per \$1,000 of property value and estimated to generate approximately \$1 million annually. Alternatively, a **new fee** of \$45 per lineal foot on permits for new bulkhead development to raise approximately \$111,105 annually.
13. An added **fee on impervious surface impacts** on salmon habitat and ecosystem health, estimated to generate approximately \$15.4 million annually from a levy in unincorporated King County.
14. A **mitigation banking market** to provide funding and incentives for private sector investment in protecting and restoring the watershed's habitats.
15. Further research on opportunities for inter-departmental and multi-jurisdiction collaboration on creating a **watershed investment district**, with a combined system of funding mechanisms that will provide the most cost-effective approach for integrated management of all ecosystem services.
16. Initiate planning for demonstration or pilot program status in collaboration with the Puget Sound Partnership Action Agenda to align funding mechanism development with agenda financing strategies.

The Puget Sound region will benefit extensively from investing in the ecosystem goods and services of the watershed. This investment in natural capital will both protect and restore habitat for threatened and endangered species. Total annual revenue from proposed funding mechanisms is estimated at approximately \$59 million, exceeding the target amount to provide a contingency buffer, in case all the recommended funding mechanisms cannot be implemented.

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APPENDIX A - PROJECT HISTORY

At the request of the WRIA 9 Forum Management Committee and Steering Committee, representing the 17 local government members of WRIA 9, as well as other public and private members, and by a majority vote of the King Conservation District, the District approved a grant in June 2008 to Earth Economics to examine new mechanisms to fund implementation of the WRIA 9 Salmon Habitat Plan.

As part of this grant, Earth Economics hosted a workshop in August 2008 that included initial brainstorming of potential funding mechanisms. Participants at this event included representatives from WRIA 9, King County Department of Natural Resources and Parks, Pierce County Planning Department, various cities and public utilities, representatives from local non-profit organizations and consulting firms as well as members of the general public.

In October 2008, research on potential funding mechanisms was presented to the WRIA 9 Ad Hoc Funding Committee. Facilitated discussion in this meeting focused on advantages and disadvantages of each funding mechanism and general impressions of feasibility. In early November 2008, a revised table of funding mechanisms was presented to the WRIA 9 Steering Committee for additional input and discussion. In November 2008, Earth Economics presented preliminary research for this report to the WRIA 9 Forum of Local Governments, including elected officials or staff representatives of 16 local governments that have jurisdiction in WRIA 9, as well as King County and Tacoma Water Utility.

Earth Economics has previously completed work on valuation of ecosystem services for WRIA 9, providing the economic justification for salmon habitat restoration, including a \$5 million project at the North Winds Weir, drafting of Chapter 6, the Ecological Economics Foundation of the WRIA 9 Salmon Habitat Restoration Plan (specifically highlighted in the 2020 Award given to the Salmon Habitat Plan as a whole), and most recently in working KDC staff on an analysis justifying an increase in the assessment for the King Conservation District.

APPENDIX B—ECOSYSTEM FUNCTIONS, PROCESSES, GOODS AND SERVICES

Functions		Infrastructure and Processes	Examples of Goods and Services
Regulation Functions		<i>Maintenance of essential ecological processes and life support systems</i>	
1	Gas regulation	Role of ecosystems in bio-geochemical cycles	Provides clean, breathable air, disease prevention, and a habitable planet
2	Climate regulation	Influence of land cover and biologically mediated processes on climate	Maintenance of a favorable climate promotes human health, crop productivity, recreation, and other services
3	Disturbance prevention	Influence of ecosystem structure on dampening environmental disturbances	Prevents and mitigates natural hazards and natural events, generally associated with storms and other severe weather
4	Water regulation	Role of land cover in regulating runoff and river discharge	Provides natural irrigation, drainage, channel flow regulation, and navigable transportation
5	Water supply	Filtering, retention and storage of fresh water (e.g. in aquifers and snow pack)	Provision of water for consumptive use, includes both quality and quantity
6	Soil retention	Role of vegetation root matrix and soil biota in soil retention	Maintains arable land and prevents damage from erosion, and promotes agricultural productivity
7	Soil formation	Weathering of rock, accumulation of organic matter	Promotes agricultural productivity, and the integrity of natural ecosystems
8	Nutrient regulation	Role of biota in storage and re-cycling of nutrients	Promotes healthy and productive soils and gas, climate, and water regulations
9	Waste treatment	Role of vegetation and biota in removal or breakdown of xenic nutrients and compounds	Pollution control/ detoxification and filtering of dust particles through canopy services
10	Pollination	Role of biota in movement of floral gametes	Pollination of wild plant species and harvested crops
11	Biological control	Population control through trophic-dynamic relations	Provides pest and disease control and reduces crop damage
Habitat Functions		<i>Providing habitat (suitable living space) for wild plant and animal species</i>	
12	Refugium function	Suitable living space for wild plants and animals	Maintenance of biological and genetic abundance and diversity (and thus the basis for most other functions)
13	Nursery function	Suitable reproduction habitat	Maintenance of commercially harvested species
Production Functions		<i>Provision of natural resources</i>	
14	Food	Conversion of solar energy into edible plants and animals	Hunting, gathering of fish, game, fruits, etc. and small scale subsistence farming and aquaculture
15	Raw materials	Conversion of solar energy into biomass for productive use	Building and manufacturing, fuel and energy; and fodder and fertilizer
16	Genetic resources	Genetic material and evolution in wild plants and animals	Improve crop resistance to pathogens and pests
17	Medicinal resources	Variety in (bio)chemical substances in, and other medicinal uses of, natural biota	Drugs, pharmaceuticals, chemical models, tools, test and assay organisms
18	Ornamental resources	Variety of biota in natural ecosystems with (potential) ornamental use	Resources for fashion, handicraft, jewelry, pets, worship, decoration, and souvenirs
Information and Cultural Functions		<i>Providing opportunities for cognitive and spiritual development</i>	
19	Aesthetic information	Attractive landscape features	Enjoyment of scenery
20	Recreation	Variety in landscapes with (potential) recreational uses	Travel to natural ecosystems for eco-tourism, outdoor sports, etc.
21	Cultural & artistic information	Variety in natural features with cultural and artistic value	Use of nature as motive in books, film, painting, folklore, national symbols, architecture, advertising, etc.
22	Spiritual & historic information	Variety in natural features with spiritual and historic value	Use of nature for religious or historic purposes (i.e., heritage value of natural ecosystems and features)
23	Science & education	Variety in nature with scientific and educational value	Use of natural systems for school excursions, etc. Use of nature for scientific research

APPENDIX C - SALMON HABITAT PROJECT OVERLAP ANALYSIS

Flood Hazard Management Plan Identification	WRIA 9 Project Identification	WRIA 9 Salmon Habitat Project Description	Flood Hazard Management Plan Information	Upstream River Mile (WRIA 9) (FHMP)	Downstream River Mile (WRIA 9) (FHMP)	Bank	Jurisdiction	Costs (low estimate)	Costs (high estimate)
Riverside Estates/Rodrigon (FLB021)	LG-1: Riverside Estates Side Channel Rehabilitation at RM 28.8 (Left Bank)	Reconnects off-channel habitat to mainstem. Briccos or removes Rodrigon Levee, repairs flood management function in setback location.	Reconnects side-channel to size and convey floodwaters. Corrects stream channel of middle reach due to malfunctioning bypass/return system. Acquisition to begin in 2019 with construction to follow in subsequent years.	28.8/29.64	28.8/28.69	L	Albion	\$ 503,980.00	\$ 577,007.90
Russell Upper Levee Project (Russell Road #2)	LG-10: Mainstem Maintenance (Including the Boeig Levee Setback and Habitat Restoration) Between RM 20.5 and 16.3	Set back existing levees and rework, improve flood storage and conveyance, restore channel edge and riparian habitat conditions. Includes individual projects bid separately here as LG-11 and several other items.	Set back steep, eroding reworkment increases flood storage/conveyance capacity, restores riparian vegetation and shrub/marginal habitat. Construction begins 2015.	20.46	20.42	R	Kent	\$ 34,810,100.00	\$ 40,468,400.00
Erzosa Levee Projects 1-3 (FLB016)	LG-12: Briccon (R Channel) Habitat Rehabilitation Between RM 16.1 and 10.6 (Right Bank)	Complete Briccon Levee setback at Kent's Briccon Park by removing solid reworkment, reconnecting floodplain, rehabilitating channel edge, and creating riparian/wetlands habitat.	Set back steep, eroding reworkment increases flood storage/conveyance capacity, restores riparian vegetation and shrub/marginal habitat. This is a priority project for the FHMP's scoping of projects begins in 2019 followed by acquisition and then construction.	16.1	16.8	R	Kent	\$ 703,600.00	\$ 1,208,800.00
Dashmore Levee #1 (FLD013), Dashmore Levee #2 (FLD014), Dashmore Levee #3 (FLD017), Dashmore Levee #4 (FLD021)	LG-13: Acquisition, Levee Setback, and Habitat Rehabilitation Between RM 15.3 and 14.7 (Right Bank)	Set back existing levees, improve flood storage and conveyance, restore channel edge and riparian habitat conditions	Purchase and remove single-family home. Should be reworked with levee setback of Levee's Levee and restoration of Burns Creek. Planned acquisition in 2009 or 2010 will fulfill the acquisition phase of the project.	15.3/15.6	14.7/14.65	R	Tulwala	\$ 2,587,200.00	\$ 3,696,000.00
Middle Green River Floodplain Acquisition, Maljich (Kouger/Medler-C'Grady)	MG-18: Protection of Fundraising Habitat along the Middle Green River Mainstem	Protection of priority habitats through acquisition, including in the Green River Natural Area (RM 40 to 35).		38.78	38.20	R	King County	\$ 23,739.00	\$ 28,172,248.00

APPENDIX E - METHODOLOGY FOR PROJECT APPRAISAL

This report briefly presents tools for considering economic benefits that are then received by residents, cities and private firms as a result of a dedicated WRIA 9 funding source. More details are available in Chapter 6 of the WRIA 9 Salmon Habitat Plan, which also provides the ecological economics justification for the Salmon Habitat Plan. Further detail is also available in the report “Ecosystem Services Enhanced by Salmon Habitat Conservation in the Green/Duwamish and Central Puget Sound Watershed,” prepared by Earth Economics in February 2005.

Ecological and Natural Resource Economics

The valuation techniques for ecosystem services are products of work in traditional natural resource and environmental economics. However, the manner in which the results are used sometimes differs between traditional and ecological economics, due to differing basic concepts. Ecological economics differs from a more traditional natural resource economics approach in the following ways:

- taking into account the dynamics of ecological systems and the overall scale of the economy with respect to the scale and capabilities of the biosphere;
- conceptualizing natural systems as essential to human well-being and economic sustainability;
- and recognizing that maintaining natural systems as essential underpinnings to human well-being and economic activity is at least more cost-effective than engineering human substitutes and, in many important respects, may be the only alternative (i.e., natural capital is irreplaceable).

Also, the field of ecological economics fosters important dialogue about the proper role of economic valuation of ecosystem services in relation to fundamental philosophical approaches and social policy (Martinez-Alier et al. 1998, Spash and Vatn 2006). Scholarly dialogue between the fields of natural resource economics and ecological economics is increasing, and in some ways the differences are decreasing (Turner 2002).

Ecosystem Service Valuation

The best available method for assessing the economic value of changes to ecosystems is ecosystem service valuation, an applied value transfer method. Value transfer involves the adaptation of existing valuation information or data to new policy contexts.¹³ The analysis method involves obtaining an economic estimate for the value of non-market services through the analysis of a single study, or group of studies, that have been previously carried out to value similar services. The transfer itself refers to the application of values and other information from the original study site to a new policy site (Desvougues et al. 1998; Loomis 1992).

The value transfer method is increasingly being used to inform landscape management decisions by public agencies (Downing and Ozuna 1996; Eade and Moran 1996; Costanza 2007; Earth Economics 2005; Earth Economics 2007). Despite acknowledged limitations, such as the context sensitivity of value estimates, existing studies can and do provide a credible basis for policy decisions involving sites other than the study site for which the values were originally estimated. This is particularly

¹³ Following Desvougues et al. (1998), we adopt the term ‘value transfer’ instead of the more commonly used term ‘benefit transfer’ to reflect the fact that the transfer method is not restricted to economic benefits, rather can also include analysis of potential economic costs, as well as value functions themselves.

true when current net present valuations are either negligible or implicitly taken as zero because they have simply been ignored. The critical underlying assumption of the transfer method is that the economic value of ecosystem goods or services at the study site can be inferred with sufficient accuracy from the analysis of existing valuation studies at other sites.

With the increasing sophistication and number of empirical economic valuation studies in the peer-reviewed literature, value transfer has become a practical way to inform decisions when primary data collection is not feasible due to budget and time constraints. As such, the transfer method has become a very important tool for policy makers, since it can be used to reliably estimate the economic values associated with a particular landscape, based on existing research, for considerably less time and expense than a new primary study.

The raw data for a value transfer method application are drawn from previously conducted empirical studies that measured the economic value of ecosystem services. Studies subsequently undergo expert review, with the results analyzed for value transfer to the marine, riverine, riparian and other environments of the Pacific Northwest. Any studies that have occurred in these habitat types in Washington are then prioritized for inclusion in the value transfer exercise. The original results are then entered into a relational database format, where each dollar value estimate can be identified with unique searchable criteria (i.e., type of study, author, location, etc.), thus allowing the team to associate specific dollar estimates with specific conditions on the ground. For example, all aquatic and river-related value estimates can be chosen to come from economic studies that were originally conducted in temperate forests and aquatic/riverine systems similar to those in Washington and the Pacific Northwest. To achieve this, once analyzed, the valuation data are integrated with land and water cover data and habitat types for WRIA 9 or King County. Tables and maps are then generated from this fusion of economic and geographic information.

The research team subsequently develops a set of decision rules for selecting empirical studies from the literature. . The research team reviews the best available economic literature and select valuation studies that are most relevant to ecosystem types, processes or functions that influence salmon habitat dynamics. This process has allowed us to estimate the economic value of ecosystem services in the marine and freshwater aquatic habitats in WRIA 9 and King County

The quality of original studies used in a value transfer exercise always determines the overall quality and scope of the final value estimate (Brouwer 2000). From past work, three general categories of valuation research, each with its own strengths and weaknesses, have been identified (Table 5).

- Type A studies are peer-reviewed empirical analyses that use conventional environmental economic techniques (i.e., Travel Cost, Hedonic Pricing, and Contingent Valuation) to elicit individual consumer preferences for environmental services.
- Type B studies are commonly referred to as the “grey literature” and generally represent non peer-reviewed analyses such as technical reports, PhD dissertations, and government documents using conventional environmental economic techniques that also focus on individual consumer preferences.
- Type C studies represent secondary, summary studies such as statistical meta-analyses of primary valuation literature that include both conventional environmental economic techniques as well as non-conventional techniques (energy analyses, marginal product estimation) to generate synthetic estimates of ecosystem service values.

Table 1. Value-Transfer Data Source Typology

<i>Type A</i>	<i>Type B</i>	<i>Type C</i>
Peer-Reviewed Journal Article or Book Chapter	Non Peer-Reviewed (PhD Thesis, Raw Data, Technical Report, etc.)	Secondary (meta) Analysis of Peer- Reviewed and Non Peer- Reviewed studies
Uses Conventional Environmental Economic Valuation Methods	Uses Conventional Environmental Economic Valuation Methods	Uses Both Conventional and Non-Conventional Valuation methods
Restricted to Conventional, Preference-based Values	Restricted to Conventional, Preference-based Values	Includes conventional Preference-based, Non-Conventional Preference-based, and Non-Preference-based Values

The Earth Economics research team has applied two alternative approaches to capture possible variation in results across the different literature types: (1) first limiting the value transfer analysis to peer-reviewed studies that use conventional environmental economic methods (hereafter Type A studies) and (2) then adding a few additional Type B studies and Type C meta-analyses of ecosystem service values that were readily accessible (hereafter Type A-C). Results are presented separately for Type A and Type A-C categories, to generate a more complete picture of the full range of ecosystem service values associated with the salmon habitats in WRIA 9 and King County.

The geographic landscape for a full ecosystem service valuation can be the marine and aquatic ecosystems providing salmon habitat. Alternatively, the scope of analysis can be expanded to include all land cover types in the upland parts of the watershed that affect salmon habitat conditions in the county, including upland forest, agricultural land, and urban areas. Satellite imagery mapped into Geographic Information Systems (GIS) provides a powerful tool for understanding and using large amounts of geographic data with the full range of land uses, vegetation types, and other aspects of the landscape.

Specific ecosystems and their services that are affected by WRIA 9 salmon habitat restoration projects have been identified. The change in ecosystem types or extents are translated into changes in acreages of land cover, for example acres of restored channel habitat or riparian area. The increased amount of habitat area translates into increased delivery of services from those cover types, since there are then more acres as a result of a restoration activity. Removal of structures from a buy-back program would also show up in calculations of avoided cost (see below). For example, removing houses from a former riparian area allows the reclamation of riparian habitat and also removes a source of chronic flood insurance claims.

The total ecosystem service value (ESV) of a given land use/land cover type for a given unit of analysis (i.e., watershed or salmon habitat project) is determined by adding up the individual ecosystem service values associated with each land use/land cover type. The following formula is used for this calculation (from Costanza et al. 2007):

$$\sum_{k=1}^n A(LU_i) \times V(ES_{ki})$$

$$V(\text{ESVi}) =$$

Where:

$A(\text{LUi})$ = area of Land cover or ecosystem type (i)

$V(\text{ESVi})$ = annual value of Ecosystem Services (k) for each Land Use (i).

Total ESV flow estimates for each land cover category is estimated by taking the product of total average per acre service value and the area of each land cover type. This procedure is repeated for low and high values reported in the literature, to give both a full picture of the range of estimates and an assessment of the lack of precision that still exists in this field.

A study using this overall method could produce the following outputs:

- Tables synthesizing the results of all of the primary studies on the value of each ecosystem type and ecosystem service flow included in the study;
- Tables compiling the value of ecosystem service flows for all WRIA 9 or King County ecosystems (alternatively, only those directly influencing salmon habitat);
- Maps of the current value of ecosystem service flows in areas of salmon habitat within WRIA 9 or King County based on these estimates;
- An analysis of the effects on ecosystem service values of using salmon habitat protection or restoration techniques that result in changes in ecosystem processes.
- The results of converting annual flows of ecosystem service values to estimates of the value of the stock of natural capital affected by the WRIA 9 Salmon Habitat Plan.

Proposed Project Appraisal Methodology

The 2005 report “Ecosystem Services Enhanced by Salmon Habitat Conservation in the Green/Duwamish and Central Puget Sound Watershed” provided a proof-of-concept example of the ecosystem service valuation methodology applied to analysis of the benefit produced through implementation of the North Winds Weir project. Project costs were estimated to include land acquisition costs of \$1.9 million, with estimated ecosystem restoration costs of \$1.79 million for a total project cost of \$3.69 million. These cost estimates were provided by the WRIA 9 Watershed Coordination Services Team. Benefits resulting from the North Winds Weir project were calculated by Earth Economics through an applied value transfer method for ecosystem service valuation analysis, resulting in both low-end and high-end estimate proposed as a conservative estimate of the total economic value from ecosystem service improvement. We propose using only the high-end estimate for the proposed project appraisal methodology to assess benefits.

The total benefit calculation for the North Winds Weir project analysis resulted in an estimate of \$47,343, with a present value projected over 100 years at a 0% discount rate totaling \$23.75 million. In this case, we present only the high-end estimate of the ecosystem service valuation of benefits. This is ultimately a conservative underestimate of the total economic value, as reiterated by the original report analysis. We have also chosen to use a 0% discount rate, given the clear problem presented by flaws in discounting that prevent the accurate consideration of future generations for a long-term recognition of socio-economic equity. Also, ecosystem services and other benefits from natural capital investment ultimately appreciate in value over time, rather than depreciating in a manner similar to built capital investments.

Assessment of the benefit can subsequently be accomplished by calculating the net present value (NPV) and also the benefit-cost ratio. Net present value is calculated as the difference between the

present value of benefits and the present value of costs. Benefit-cost ratio is the ratio of total benefits to total costs, both calculated as a present value over the long term. Applying these calculation methods to the North Winds Weir project results in an estimated NPV of \$17.06 million and a benefit-cost ratio of 6.44. This amounts to an estimated \$6.44 in valuable economic benefit for every dollar invested in natural capital—a relatively high level of efficiency, cost-effectiveness and return on investment.

Building on the previous analysis of the North Winds Weir project, these calculations provide an example of the proposed methodology for analyzing the return on investment or net benefits to watershed residents of WRIA 9 as a result of salmonid restoration projects and actions. At this time, there is insufficient data to apply the proposed methodology for comprehensive analysis of all projects in the salmon habitat management plan. Such data would need to be compiled on a project-by-project basis through applied ecosystem service valuation analysis and present value analysis of long-term project benefits. Undertaking a more accurate estimate of project costs would improve on the coarse rule-of-thumb method of estimates used in calculating projected costs of Salmon Habitat Plan projects; the economic dynamics have changed significantly since these estimates were generated for the 2005 plan release. In particular, land acquisition costs will have changed since that time. If project cost estimates of \$200 million are accurate, and the benefit-cost ratio for the North Winds Weir project accurately approximates the total NPV, the long-term benefit from implementing all the habitat management projects may well be as high as a \$1.29 billion. This coarse estimate is provided as a methodological example; more precise valuation and analysis calculations for costs and benefits on a project-by-project basis are necessary to provide an accurate estimate of total benefit.

In the aforementioned report prepared by Earth Economics, ecosystem service valuation and present value analysis have been extensively presented as methods that can be combined to assess the long-term benefit provided by ecosystem service improvement. Benefit-cost analysis considers the long-term benefit provided by comparing the present value of ecosystem service benefit to the net cost of project implementation. The proposed methodology best suited for project appraisal, and potentially also for project prioritization, uses the high end estimate of ecosystem service valuation analysis projected over 100 years at with a 0% discount rate. The high-end estimate is most appropriate because the full range of ecosystem service valuation analysis has a high probability of being a conservative under-estimate of the total economic value of ecosystem services improvements due to salmon habitat restoration.

In summary, the economic analysis methods comprising the proposed methodology for project appraisal include the following sequence of calculations:

1. **Present value analysis** of total cost in projects planned over 10 years.
2. **Valuation analysis** of project benefits, including ecosystem goods and services.
3. **Benefit-cost analysis** calculated as the ratio of improved ecosystem service benefits over total project costs, projected over 100 years at a 0% discount rate.
4. **Cost-effectiveness analysis** calculated at the project scale as a ratio of total costs to post-project evaluation rating based on a metric of salmon habitat improvement.

All of these methods are conventional economic analysis calculations that are commonly applied to project appraisal, with the exception of ecosystem service valuation analysis. Earth Economics has been a pioneer in the development and applied use of ecosystem service valuation analysis. This proposed methodology was applied in part for case-by-case project appraisal of the King County

Flood Hazard Management Plan (Earth Economics 2007); the only steps not undertaken are the final benefit-cost calculations, which can easily be accomplished with available data.

This report has outlined the ecosystem service valuation method and offers a general discussion of other, more conventional aspects of our proposal methodology for project appraisal. This methodology can also be used for project prioritization to produce a year-by-year schedule of project sequencing for the WRIA 9 Salmon Habitat Plan.

Salmon habitat protection, restoration and rehabilitation all provide protection to threatened species in addition to investment in critical natural capital. Opportunities abound for cost effective investment in watershed benefits, viable salmonid populations, flood control and drinking water quality and to date these valuable public assets have been underinvested. An efficient allocation of resources would see a funding mechanism providing restoration investment sufficient to restore viable salmonid populations, restoring watershed health and the extensive public benefits they provide. This should be a model for other watersheds, and both support and dovetail with funding mechanisms for the Puget Sound Partnership and other Conservation Districts.