CITY OF KELOWNA

MEMORANDUM

Date: July 3, 2007

File No.: 5280-30

To: City Manager

From: Environment & Solid Waste Manager

Subject: **Mission Creek Restoration Plan and Compensation Banking Project**

RECOMMENDATION:

THAT Council receives as information the Environment & Solid Waste Manager's report;

AND THAT Council endorses using $25,000 from the Casorso Bridge Compensation funds to match Provincial funds to hire a Mission Creek Restoration Plan Coordinator; for a one year period;

AND THAT Council have staff move forward updating the OCP to include Aquatic Habitat Protection and Compensation Policies in the Environment Section;

AND THAT staff report back to Council with periodic updates for the planning and financing of the Mission Creek Restoration Projects and Compensation Bank;

AND FURTHER THAT staff move forward with Mission Creek Restoration Plan projects that are compatible with the existing funding and continue to pursue any additional funding from external sources.

Background:

City Council has endorsed the Mission Creek Restoration Feasibility Plan (Sept.12, 2006-Attach #1) subject to required funding and partnerships. The Compensation Banking Project was approved through budget (2001 and 2007 budgets). More recently, Council was apprised of the Casorso Bridge-Swamp Road Project (Council Memo-Apr. 16, 2007) and the need to compensate for aquatic habitat losses resulting from that project.

Mission Creek Restoration Feasibility Plan Summary:

In 2002, the MOE (Ministry of Environment) examined the feasibility of restoring Mission Creek to enhance Kokanee and Rainbow Trout production. The study (Mission Creek Habitat Restoration Feasibility –Gaboury and Slaney, 2003) was endorsed by both the Habitat and Water Management Sections of the MOE. The plan was updated in 2004 to focus on a more limited set of projects as priorities and more recently updated (project costs in 2007 dollars) for possible application in Habitat Compensation Banking. These projects require land purchases in order to set back the existing dykes to provide improved fish habitat. Project costs including land purchase are significant and require external funding and partnerships.

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Habitat Banking Reports and Planning:

Since 2001, the City has been exploring Habitat Compensation Banking. An initial report (Feb. 2002) described the process of "habitat banking" as a method for achieving compensation for habitat that is lost due to development. Recommendations included engaging external agencies to establish an MOU (Memorandum of Understanding), OCP Policy changes and setting up a pilot project. In 2006, City Staff felt it was timely to continue with the project due to certainty of our infrastructure projects creating "net loss" of habitat including fisheries habitat.

Progress to date:

City Staff and their consultant have met with stakeholders (MOE, DFO, Friends of Mission Creek) to establish working relationships and to establish a framework for a Compensation Bank initially for the Mission Creek Restoration Feasibility Plan Projects. The concept however can be used for other Creeks and major infrastructure projects (e.g., COB or Airport Expansion in relation to Mill Creek).

Along with establishing the policy framework, there are 2 options to facilitate creation of the Mission Creek Habitat Compensation Bank. These 2 options are explained in attachment # 2 (Final Report, Mission Creek Habitat Compensation Projects Bank, Jul 2007). In brief:

- Option 1 requires substantial financing and commitment initially by the City, but because the replacement (compensating) habitat is built 'up front' at the same time as the habitat loss occurs, this option offers greater certainty in: a) meeting federal and provincial compensation requirements; b) controlling the costs of building the replacement habitat; and c) maintaining if not improving fish and wildlife habitat.
- Option 2 involves the construction of compensating habitat when sufficient funding is gathered.

City staff has worked with Friends of Mission Creek and the MOE to hire a coordinator (joint funding with City) for a fixed term to oversee implementation of the Mission Creek Restoration Plan Priority Projects and to seek external funding in addition to the compensation funding.

Staff are also still in consultation with MOE on the status of long-term dyke maintenance prior to initiating any dyke setback projects.

FINANCIAL IMPLICATIONS:

The preference of staff for Council consideration at this time is to explore additional funds but move forward at least with some aspects of the priority projects within current internal and external funding. This could include some land purchase, further consultant work and planning by the MOE coordinator position.

INTERNAL CIRCULATION TO:

CDRE Manager, Director of Financial Services

Considerations not applicable to this report:

LEGAL/STATUTORY AUTHORITY: N/A
LEGAL/STATUTORY PROCEDURAL REQUIREMENTS: N/A
EXISTING POLICY: N/A

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PERSONNEL IMPLICATIONS: N/A
TECHNICAL REQUIREMENTS: N/A

EXTERNAL AGENCY/PUBLIC COMMENTS: N/A
ALTERNATE RECOMMENDATION: N/A

Respectfully submitted by:

Approved for Inclusion:

Mark Watt
Environment & Solid Waste Manager

John Vos
Director of Works & Utilities

Attachments:
#1 - September 12, 2006 Council Report (Mission Creek Habitat Restoration Plan)

#2 - Mission Creek Habitat Compensation Bank, prepared by Lanarc Consultants Ltd.

CITY OF KELOWNA

MEMORANDUM

Date: September 12, 2006

File No.: 5225-03

To: City Manager

From: Environment & Solid Waste Manager

Subject: Mission Creek Habitat Restoration Plan

RECOMMENDATION:

THAT Council endorses the Mission Creek Habitat Restoration Plan;

AND THAT Council supports the plan subject to required funding in partnership with external agencies and local community groups;

AND FURHTER THAT Council has staff develop the framework strategy for plan implementation and funding.

BACKGROUND:

In March 2003 the Mission Creek Habitat Restoration Feasibility Plan was completed for the Ministry of Environment in Penticton.

The feasibility plan details the rationale for undertaking restoration in Mission Creek based on its relative contribution to Okanagan Lake fish production. The plan implementation involves the cooperation and commitment from all levels of government as well as local community groups.

It is envisioned that a strategic coalition of these committed participants would oversee and champion the long term restoration of Mission Creek.

The plan could be a multi year plan lasting up to 50 years and would include the following works outlined in the feasibility:

- Setback dykes (Gordon Drive to Regional Park)
- Meandering channel construction with riffle pool sequences (KLO and Regional Park)
- Riffle structures, sediment traps and meandering channel (Regional Park and East Kelowna Rd.)

The restoration objectives for these priority works are:

1. to maintain flood protection up to the design flow of 110cms.
2. to maintain existing drainage networks and water withdrawl off-takes
3. to maintain the quantity and quality of spawning and rearing habitat for salmonids
4. to improve the stability of salmonid spawning substrates.
5. to improve aesthetics and wildlife habitat
6. to increase and maintain biodiversity within the river corridor
7. to re-establish some of the physical structure, and hydraulic and geomorphic processes that are characteristic of natural rivers.

Since this plan was completed, an agreement between Stewardship and Water Management Divisions of the Ministry of Environment characterizes the works and plan for the benefits of both flood protection and habitat restoration.

To date the City of Kelowna and MOE have met with the Friends of Mission Creek to introduce the plan and have received their support in principle (attach 1). The City and Ministry also worked together to secure the Casorso lands that include the land under the dyke on the West side of Mission Creek. That land purchase was funded from HCTF.

This request is for Council's support for a strategy for implementation and funding of works and funding support for a partnership on an ongoing basis.

It is anticipated it will cost the City $25,000 to develop the strategy for implementation and another $150,000 for selected priority projects in 2007. A budget request will be submitted.

With a long term commitment the sustainability of the most important ecosystem next to Okanagan Lake can become a goal for Kelowna and a legacy for future generations.

_____
Mark Watt, Environment and Solid Waste Manager

Approved for inclusion:
John Vos
Director of Works & Utilities

Cc: Recreation, Parks & Cultural Services
Water & Drainage Division
Lands and Real Estate Division
Long Range Planning
RDCO Planning & Development Services
MOE Fisheries Section (Penticton)

HABITAT COMPENSATION STRATEGY
Phase 2

For Environment and Solid Waste Division
CITY OF KELOWNA

MISSION CREEK
HABITAT COMPENSATION BANK

June 2007

DRAFT

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City of Kelowna

HABITAT COMPENSATION STRATEGY
- Mission Creek Habitat Compensation Bank
DRAFT JUNE 2007

List of Tables

1. INTRODUCTION

Since 2001, the Environment and Solid Waste Division of the City of Kelowna has been looking at ways to create a habitat compensation banking system as a means of addressing environmental impacts associated with development in Kelowna. The City's interest in habitat compensation banking stems from a desire to find a more consistent approach to determining appropriate compensation measures when impacts to habitat are unavoidable. The City also wishes to direct compensation resources where they can be most effective in restoring habitat.

Phase 1 of the project generated a Backgrounder and a Final Report that made recommendations regarding policies for habitat compensation and a potential pilot project for a banking system. In this Phase 2, the Environment Division continued this initiative with the following objectives:

- Provide an update to Phase 1 in light of recently completed habitat studies for Okanagan Lake and Mission Creek and changes in related federal and provincial policies.
- Develop policies regarding habitat impact mitigation and compensation that can be incorporated into the City's Official Community Plan as the foundation for compensation strategies and priorities.
- In consultation with senior agency staff and stakeholder groups, develop a strategy for habitat compensation policy and practice in the city that provides a clear alternative to 'one-off' compensation decisions, and directs compensation efforts where they can be most effective.
- In particular, examine the application of habitat compensation banking to the Mission Creek Habitat Restoration Plan.

1.1 Definitions

Habitat Compensation

The federal *Fisheries Act* and the "Policy for the Management of Fish Habitat"[1] has been the principal source of requirements for mitigation and compensation for the "harmful alteration, disruption or destruction of fish habitat" (HADD). The Policy is based on the guiding principle of "No Net Loss" with respect to fish habitats, which means that no individual land use or development project should result in a net loss in habitat productivity, and the achievement of a net gain in habitat productive capacity in the long term. The No Net Loss principle has since been adopted as a general rule guiding land use decisions that affect many types of habitat, not just fish habitat.

In the context of No Net Loss, ***compensation*** is defined in the Policy as "the replacement of natural habitat, increase in the productivity of existing habitat, or maintenance of fish production by artificial means in circumstances dictated by social and economic conditions, where mitigation techniques and other measures are not adequate to maintain habitats for Canada's fisheries resources" (Fisheries and Oceans Canada, 1986: 26).

Habitat Compensation Banking

Habitat compensation banking can take one of two forms: a physical habitat area or site, or a fund designated for a specified habitat creation or restoration purpose.

Physical habitat compensation bank: In this form, a habitat compensation bank is a site that has been preserved, created, restored and/or enhanced expressly for the purpose of compensating for anticipated habitat losses *in advance of development actions*, when such losses will be unavoidable and full compensation cannot be achieved at the development site(s). Once it is established, a compensation bank

[1] Fisheries and Oceans Canada. 1986. Policy for the Management of Fish Habitat. http://www.dfo-mpo.gc.ca/canwaters-eauxcan/infocentre/legislation-lois/policies/fhm-policy/index_e.asp

is assigned a number of habitat "credits" based on the extent of restoration. Habitat "credits" are assigned a dollar value based on the costs associated with creating the restored site. Future development may apply to purchase credits or "debit" the bank as compensation for unavoidable impacts that cannot be mitigated or compensated for on site.

In the United States where they are called "mitigation" banks, habitat compensation banking has been used as a compensation tool since the 1970s when the passage of the federal *Clean Water Act* mandated the preservation of wetland habitat. In 2005, 405 mitigation banks had been approved across 31 states, of which 330 were active, 75 were sold out, and an additional 169 bank sites were awaiting approval.[2]

In Canada, the only recognized habitat bank is the North Fraser Port Authority Habitat Compensation Bank, where about 6500 m^2 of marsh habitat were created in 1993, of which about 815 m^2 have been used to date to compensate for development projects.

The main features that distinguish habitat compensation banking from project-specific compensation measures are:

- The compensatory habitat is created in advance of future habitat losses.
- A system of habitat 'credits' is established which future development projects could apply to purchase ('debit') for unavoidable habitat losses.
- A compensation bank is often used to compensate for multiple habitat losses across more than one development project.
- Future development projects that may use the compensation bank are located away from the bank site but within the same watershed or biophysical system, to ensure No Net Loss of productive habitat within the same system.

Financial habitat compensation bank: Under this form of banking, development projects may be approved to contribute compensation monies to a fund dedicated to a specified habitat restoration project. Like physical compensation banking, the amount of compensation paid should reflect the costs that would be incurred in creating the replacement habitat. In this case, estimates of these costs must be established along with the area of new or restored habitat area that would be created. These estimates are then translated to a value per unit area (typically $\$/m^2$) that can then be applied against the area of habitat loss associated with a development project.

In the U.S., this form of habitat compensation banking is called "in lieu-fee (ILF) mitigation", and funds are collected and administered by a sponsoring agency under an agreement with the applicable regulatory authority. In 2005, there were 42 approved and active ILF programs in the U.S.[2]

Like a physical habitat compensation bank, a financial compensation bank can be used to provide consolidated compensatory measures for multiple habitat losses. The downside is that the timing of compensatory habitat replacement is uncertain (compensatory habitat certainly is not created in advance of habitat losses), and the compensation funds collected are based on predicted rather than real costs and habitat areas. These estimates may be quite inaccurate by the time the restoration project is initiated.

In addition, under the federal fisheries policy, "cash in lieu" compensation is normally considered a last resort for compensating for loss of fish habitat. Exceptions may be made where a fisheries management plan exists that contains clear objectives, identifies limitations to productive capacity, lays out measures for restoring or improving that capacity, and provides a clear, defensible method for determining appropriate compensation contributions.

[2] J. Wilkinson and J. Thompson. 2006. *2005 Status Report on Compensatory Mitigation in the United States*. Environmental Law Institute, Washington DC. 104 p.

1.2 Mission Creek Habitat Restoration Plan

Mission Creek flows through Kelowna and is the major contributor of fish production to Okanagan Lake. However, over the past half century as Kelowna grew, the lower portions of the Creek have been dyked and channelized for flood control, with consequent impacts on channel morphology, watershed processes and aquatic and riparian habitat.

In 1995, a study by the Water Management Division of BC Environment (MOE) concluded that the dykes in the lower 7 km of Mission Creek did not meet provincial standards, having side slopes that were too steep and crest widths that were too narrow. The study proposed that lands be purchased and the existing dykes be removed and new dykes constructed in a setback location.[3]

Then, in 2002, in an effort to address depressed kokanee and rainbow trout stocks in Okanagan Lake, the provincial Ministry of Environment (MOE) examined the feasibility of using the setback dyke concept to restore and enhance habitat in Mission Creek. The Ministry commissioned two studies that identified limiting factors in habitat productivity, and priorized habitat restoration projects on the lower 12 km of the Creek, where most of the historical dyking for flood control occurred. The studies investigated possibilities for returning the Creek to a more natural configuration by setting back the dykes to widen selected portions, constructing riffle-pool sequences, and realigning portions of the channel to a more meandering route.

The resulting reports describe a suite of land acquisition priorities and restoration projects that address as well as flood protection improvements. The 2003 report [4] listed six restoration projects totaling approximately $2.8 million. The 2004 report[5] focused on a more limited set of projects identified as priorities from the 2003 report, and provided a more detailed assessment of actions and costs for these projects.

Recognizing the significance of Mission Creek and its restoration, City Council endorsed the Restoration Feasibility reports, adopting them as the Mission Creek Habitat Restoration Plan, and called on staff to develop a strategy for its implementation and funding.

Staff in turn saw the Plan as a 'bank' of potential compensation projects for use in future development proposals where habitat loss cannot be avoided or mitigated on site.

1.3 Purpose of the Report

This report examines options for applying the Mission Creek Habitat Restoration Plan to the creation of a Habitat Compensation Bank for Kelowna. Creating a Mission Creek Habitat Compensation Bank requires a method for converting habitat loss at a development site to an applicable habitat gain represented by the Mission Creek habitat restoration projects, or a dollar value to be contributed towards completing those projects.

This report examines both the physical and financial options for establishing a Mission Creek Habitat Compensation Bank, and discusses measures for applying compensation funding towards the restoration of Mission Creek.

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[3] L.A. Bergman. 1995. Report on Mission Creek corridor plan. Ministry of Environment, Lands and Parks Water Management Division. Quoted in M. Gaboury and P. Slaney, 2003 (below)

[4] M. Gaboury and P. Slaney. 2003. "Mission Creek Habitat Restoration Feasibility". Submitted to the Ministry of Water, Land and Air Protection. 29 p.

[5] M. Gaboury, V.C. Hawkes, S. Mould and J. Good. 2004. "Mission Creek Habitat Restoration: Detailed Feasibility Study." Submitted to the Ministry of Water, Land and Air Protection. 22 p. + appendices.

2. METHODOLOGY

Developing a Habitat Compensation Banking Strategy and a concept for a Mission Creek Habitat Compensation Bank involved the following steps:

1. *Background Report, November 2001* – based on research on habitat compensation policy and compensation banking programs in Canada and the U.S., resulting in a Background Report.
2. *Phase 1 report, February 2002* – based on a series of meetings with City and senior agency staff and representatives from the development and stewardship communities in Kelowna to examine the concept of habitat banking.
3. *Background Report, October 2006* - updating the information from the 2001 and 2002 reports.
4. *Roundtable Meeting, October 2006* - with staff from the City staff, Fisheries and Oceans Canada (DFO), Ministry of Environment (MOE) and Central Okanagan Regional District (CORD), and City consultants from EBA and LGL Limited, to review compensation goals and upcoming development plans that presented a need for off-site compensation mechanisms.
5. *Discussion Paper and 1st Draft OCP Policies, December 2006* - provided an initial framework for a Habitat Compensation Bank based on the Mission Creek Habitat Restoration Plan.
6. *Roundtable Meeting, January 2007* - the same stakeholders as in October 2006 plus representatives of the Friends of Mission Creek and Golder Associates, to comment on the Banking framework.
7. *Update of Mission Creek Habitat Restoration Projects* – to re-evaluate project costs in 2007 dollars and estimate habitat areas that would be restored. LGL Limited conducted the update of the project costs and estimate of habitat areas; the City's Real Estate Division reviewed and revised the land acquisition costs using standard land assessment methods. A formula for determining compensation costs was derived based on the estimates of project costs and habitat area created.
8. *Draft Report "Mission Creek Habitat Compensation Projects Bank", and 2nd Draft OCP policies, March 2007*.
9. *Roundtable Meeting, April 2007* – with the same stakeholders, to review the draft report; this led to the concept of two options for habitat compensation banking. The draft OCP policies were discussed in a follow-up meeting with senior agencies.
10. *Final Report "Habitat Compensation Strategy: Mission Creek Habitat Compensation Bank" and final OCP policies, June 2007.*

3. THE MISSION CREEK HABITAT RESTORATION PLAN PROJECTS

Table 1 lists seven restoration projects that are proposed to be included in a Mission Creek Habitat Compensation Bank, based on the projects from the Mission Creek Habitat Restoration Feasibility Plan. Map 1 (attached) shows the location of each of the projects.

The proposed order of the projects assumes that the greatest benefit to fish habitat productivity in Mission Creek is achieved by first providing high priority kokanee spawning habitat in the lower reach, then providing lower priority spawning and rearing habitat in the Benvoulin Woods and upstream portions. However, the work in the upper reach would have benefits to the lower spawning reach by trapping fines and excess gravel on the reconstructed floodplain. Hence, it could be argued that upstream projects (4 and 5) could be a higher priority than work in the Gordon-Casorso Rd reach (project 3)

It is important to remain flexible in following this proposed project sequence, particularly when considering land acquisition. Use of funds needs to be opportunistic with respect to land purchases, so that key parcels can be acquired as they become available. Hence, the order of priority could change as a consequence of land purchase opportunities.

Table 1: Mission Creek Habitat Compensation Bank projects in order of priority

PROJECT	HABITAT	TYPE	RATIONALE FOR PRIORITY
1. Casorso Rd to 730 m upstream	Kokanee spawning	Setback dyke	In the primary spawning reach for kokanee; a "proof of concept" project for setback dykes, floodplain and riparian zone rehabilitation aimed at showing the value of setting back the dykes. Majority of land is already purchased by the City; gives an opportunity to begin construction and getting something on the ground early in the process.
2. KLO Rd up to and including Benvoulin Woods	Kokanee spawning, Rainbow trout rearing	Setback dyke and channel construction	A significant spawning reach for kokanee; a "proof of concept" project for meandering channel reconstruction and riffle-pool rehabilitation as well as setback dykes, floodplain and riparian zone rehabilitation. Benefits to both fish and wildlife habitat in Benvoulin Woods because of the potential to have a meandering channel with riparian zones, more floodplain area for sedimentation, and greater instream habitat diversity. If the Benvoulin Woods property becomes available soon and all parties support the rehabilitation design, this project could be the 1st priority.
3. Gordon Rd to Casorso Rd.	Kokanee Spawning	Setback dyke	In the primary spawning reach for kokanee.
4. Benvoulin Woods to Mission Creek Reg'l Park - A	Kokanee spawn, Rain-bow rearing	Setback dyke	Important to get setback dyke installed; meandering channel with pools and riffles (project 5) can be constructed later, or allowed to see if they form on their own in the wider channel corridor.
5. Benvoulin Woods to Mission Creek Reg'l Park - B	Kokanee spawn, Rain-bow rearing	Channel reconstruction & riffle rehab.	Less important than setback dyke construction (project 4), as meandering channel with pools and riffles may form on their own (more slowly than if constructed) in the wider channel corridor.
6. North end of Project 1 (730 m north of Casorso) to KLO Road	Kokanee spawning	Setback dyke	Benefits of setback dyking in this section are constrained by existing land development; little land could be readily acquired from the adjacent properties. Relocating the dykes to the outer edge of existing ROWs would increase corridor widths only marginally, and result in a relatively narrow floodplain on either the right or left bank. Nonetheless, re-establishment of a somewhat wider channel corridor would have benefits on downstream instream habitats by improving hydrological and sediment processes associated with a more functional floodplain.
7. Upstream of Mission Creek Regional Park	Rainbow rearing/ Kokanee spawning	Riffle rehab-ilitation	Due to residential development on the north bank and relatively steep topography on the south bank, restoration options are limited. However, construction of riffles would potentially improve kokanee spawning and Rainbow rearing habitats and reduce the rate of bedload transport and excessive gravel accumulations in the lower reaches.

3.1 Bank Projects' Cost Estimates

To gain a better understanding of the funds needed to initiate a Habitat Compensation Bank, the costs of the Mission Creek restoration projects were updated from the 2004 Restoration Feasibility Study. The City's Community Development and Real Estate Division reviewed and revised land costs, and LGL Limited (coordinator of the 2003-2004 Mission Creek Habitat Restoration Feasibility studies) updated the restoration projects' costs.

It is important to note that all cost estimates are in 2007 dollars and reflect 2007 market and construction conditions. As such, they are a snapshot of these costs at this point in time, and would need to be re-evaluated as these conditions change.

Based on a review of compensation banking programs in the U.S., the following components were included in estimating project costs for compensation purposes:

- *Land acquisition*: estimated for portions of 18 properties that were required for the restoration projects. These cost estimates included:
  - Land cost based on 2006 land assessments (assumed to represent market value) multiplied by a factor of 1.1 to reflect 2007 projections, then multiplied by the proportion of the property needed for the specific restoration project (i.e., area required/total property area).
  - Survey, legal, negotiation and appraisal costs: average $6000/property.
  - Expropriation: a contingency of $100,000/expropriation for two expropriations, if needed.
- *Project planning and design*: including preliminary and final design, construction drawings and regulatory agency approvals for setback dykes, new channel creation and enhancement of existing stream channel.
- *Project construction*: for setback dykes, new channel construction and existing channel enhancement.
- *Performance monitoring*: ranging from 3 to 5 years of monitoring, using a standard estimate of 5% or 10% (for "proof of concept" projects) of construction costs.
- *Long-term maintenance*: based on whether the project was assumed to be minimally affected by river flows (estimated at 5% of construction costs) or moderately affected by river flows (estimated at 10% of construction costs). The funds would apply to a 5-10 year period of maintenance, after which other funds or interest-derived dollars are assumed to take over maintenance costs. Note that these long-term maintenance costs are assumed to apply to habitat-related aspects of the projects (maintenance of riparian plants, riffle structures, etc.) but not to flood-control features or to trails.
- *Public information:* Providing effective public information on the restoration project was considered to be an important in the overall success of the Mission Creek Habitat Restoration Plan. For the proof of concept projects, these costs were roughly estimated at 3% of construction costs, and 2% of construction costs for the other projects.

Performance monitoring, maintenance and public information are activities that occur over several years after project construction. As such, their costs could be covered by placing a predetermined percentage of all funds received into a special trust fund earmarked for these long-term uses. This designated fund would be invested with the purpose of growing principle to protect against inflation, and to generate income for perpetual management of the restoration projects.

Differentiating Dyke-related Costs

Setting back the dykes as proposed in the Mission Creek Habitat Restoration Plan is aimed at improving fish habitat, but would also significantly improve the flood proofing capacity of the Mission Creek system.

Flood prevention has traditionally been a Provincial responsibility. The City maintains that the responsibility for management of the Mission Creek dykes should remain with the Province, and that funding for dyke design and construction should be derived from flood management and infrastructure funding sources.

Funds derived from compensation should therefore be directed to habitat-related components of the restoration projects.

Consequently, planning, design and construction costs for setting back the dykes were separated from the same costs for creating or enhancing stream channels. This allows dyke-related costs to be funded separately, as needed.

Table 2 summarizes the 2007 cost estimates for all projects. Appendix 1 contains fuller explanations of each cost item, and spreadsheets detailing the costs for each of the Mission Creek Bank projects.

Table 2: Costs for Mission Creek habitat restoration projects in 2007 dollars

(See Appendix 1 for details)

Project	Land	Set back Dykes		Create/enhance Channels		Performance Monitoring	Habitat Maintenance	Public Info	TOTAL
		Plan & Design	Construction	Plan & Design	Construction				
1	$125,250	$35,000	$540,337	$0	$0	$54,034	$27,017	$16,210	$797,849
2	$1,896,755	$64,680	$725,384	$41,879	$435,112	$116,050	$116,050	$34,815	$3,430,727
3	$854,837	$112,200	$1,258,319	$0	$0	$62,916	$62,916	$25,166	$2,376,357
4	$1,526,803	$121,440	$1,361,945	$0	$0	$68,097	$68,097	$27,239	$3,173,625
5	$0	$0	$0	$42,073	$503,708	$25,185	$50,374	$10,074	$631,419
6	$270,231	$86,790	$973,347	$0	$0	$48,667	$48,667	$19,467	$1,447,175
7	$0	$0	$0	$95,000	$526,960	$26,348	$52,696	$10,539	$711,550
Exprop contingency	$200,000								
Totals	$4,873,876	$420,110	$4,859,332	$178,952	$1,465,780	$401,297	$425,817	$143,510	$12,768,674
Without Dyke costs		- $5,279,442							$7,489,232

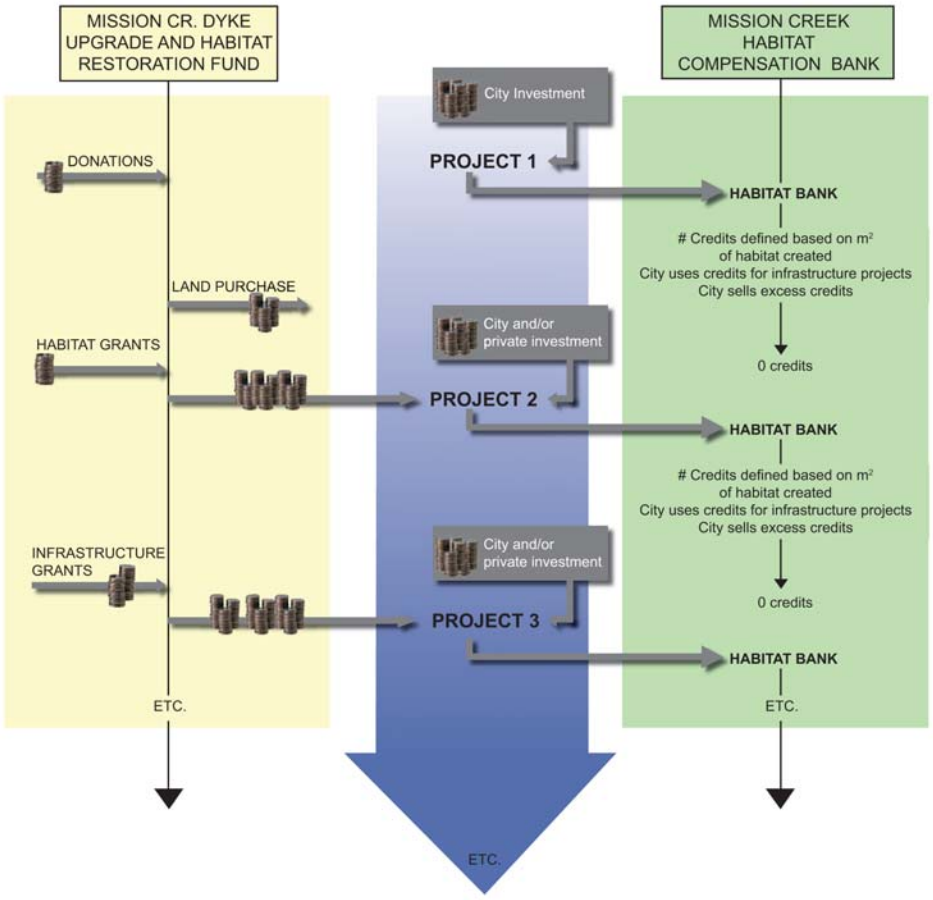
4. MISSION CREEK HABITAT COMPENSATION BANK OPTIONS

Given the two forms of habitat compensation banking introduced in section 1 – the physical bank and the financial bank, following are two options for a Mission Creek Habitat Compensation Bank. Both options take advantage of potential funding from grants and donations as well as compensation for habitat loss from development.

4.1 Option 1: Mission Creek (Physical) Habitat Compensation Bank

In this option (Figure 1), the Habitat Compensation Bank is the project site, or series of sites, that is preserved, created, restored or enhanced by completing each of the restoration projects under the Mission Creek Habitat Restoration Plan.

Figure 1: Mission Creek Habitat Compensation Bank – option 1



Under this option, there are two potential sources of money to complete the Mission Creek restoration projects:

- Senior government funding or grants for flood management infrastructure, and grants and donations for stream habitat restoration.

- Investors (including the City) who need off-site compensation credits or who are interested in establishing and selling compensation credits.

Projects (middle/blue) column:

1) Given the City of Kelowna's imminent need for off-site compensation for upcoming infrastructure projects (e.g., Swamp Road upgrade, bridge crossings across Mission Creek), this option sees the City completing the first restoration project under the Mission Creek Habitat Restoration Plan, making it a *Habitat Compensation Bank* for upcoming compensation needs.
2) Subsequent restoration projects under the Restoration Plan would be completed whenever:
   a) There are funds available from the Restoration Fund to complete another restoration project; and/or
   b) The City or a private interest (e.g., landowner, stewardship group, developer) is willing to invest funds to complete another project to create a habitat bank.

   Note that subsequent restoration projects could be funded independently or jointly by these two sources. If a restoration project is funded jointly by the Restoration Fund and private/City investment, then only a portion of the project that reflects the private funding could be used as a Habitat Bank.

   Also note that subsequent restoration projects could be completed prior to the all the credits in the previous Habitat Bank being used up. However, emptying the original Bank of its credits may act as an incentive to build another Bank (i.e., complete the next restoration project).

Habitat Compensation Bank (right/green column):

3) The total number of "credits" available from the Bank would be defined based on the number of square meters (m^2) of habitat created or restored. The City would use these credits (i.e., "debit" the Bank) to offset the loss of aquatic habitat at its infrastructure project(s).
4) If there are more credits in the Bank than the City needs, it can choose to sell credits to recoup some of its initial investment. Credit price would be determined on the basis of the cost of completing the restoration project on a per m^2 basis (see section 3.3).
5) Use or sale of all the available credits in the Bank would trigger the need for completing a second project under the Restoration Plan.

Restoration Fund (left/yellow column):

6) At the same time, a "Mission Creek Dyke Upgrade and Habitat Restoration Fund" is established to assist in completing the projects in the Restoration Plan.
7) The Fund can receive money at any time through grants and donations towards the habitat creation and restoration components of the Plan, as well as through infrastructure and flood management grants to assist with setting back the dykes. It may be advisable (even necessary) to apportion the fund into two parts, to make it clear which funds are being used for which activities.
8) Money from the Fund could be used at any time towards purchase of properties that are needed for the restoration projects.
9) Money from the Fund would also be applied towards completion of the projects under the Restoration Plan, independently or jointly with private investment.

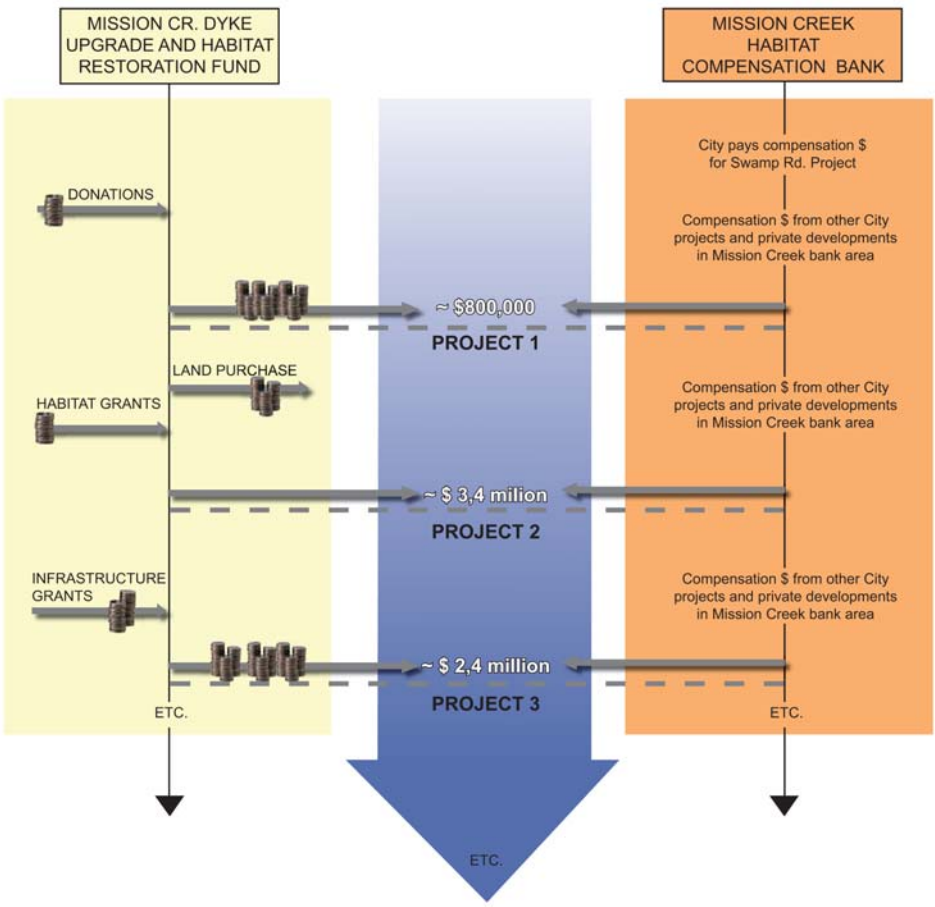
A key advantage of this option is that it will construct the compensatory habitat at least in parallel with, if not prior to, habitat losses resulting from development – which is typically required for on-site habitat compensation by DFO and MOE for habitat losses under the *Fisheries Act.* This option also relies on current restoration costs, reducing the risk of these costs escalating over time.

The main disadvantage is the initial outlay of funds required to construct the restoration projects, particularly project 1. This is offset by the fact that the City will have to pay compensation in some form anyway for its upcoming infrastructure projects, and that it can choose to sell the excess credits that it will not need immediately to help offset its initial investment.

4.2 Option 2: Mission Creek (Financial) Habitat Compensation Bank

In this option (Figure 2), the Habitat Compensation Bank is a fund established to receive compensation dollars from City infrastructure and other private development projects, to compensate for unavoidable losses of aquatic habitat caused are these projects and where adequate mitigation and compensation cannot be achieved at the development site. The Bank collects these funds for the purpose of completing the restoration projects under the Mission Creek Habitat Restoration Plan.

Figure 2: Mission Creek Habitat Compensation Bank – option 1



Under this option, there are also two potential sources of money to complete the Mission Creek restoration projects:

- Senior government funding or grants for flood management infrastructure, and grants and donations for stream habitat restoration.
- Compensation payments made to pay for future replacement habitat to offset habitat losses at proposed development sites.

Projects (middle/blue) column:

1. Projects under the Restoration Plan are initiated whenever there are sufficient funds available from either or both of the sources discussed below.

Habitat Compensation Bank (right/gold column):

2. The Bank acts as the repository of habitat compensation dollars. Figure 2 shows an initial compensation deposit by the City for the Swamp Road upgrade project being constructed in 2007; this would be followed over time by other infrastructure and private development projects that are required to provide off-site compensation.
3. Compensation charges are calculated based on a formula that uses the projected estimates of project costs and projections of how much habitat area would be restored to derive a compensation 'cost' in dollars per square meter ($/m^2). This is then applied against the unavoidable habitat loss caused by development. There are a number of assumptions and uncertainties associated with this formula, but at this point, it represents a relatively objective method for equating habitat loss to a dollar value. (See section 5 for a discussion of this formula.)

Restoration Fund (left/yellow column):

4. A "Mission Creek Dyke Upgrade and Habitat Restoration Fund" would be established and would function in the same way as in Option 1.

The main advantage of Option 2 is that there is no initial outlay of funds by the City (or any other investor) other than the required compensation amount. The disadvantage is that the timing of construction of the compensatory restoration projects is uncertain, and may not occur until well after the habitat losses due to development have occurred. This is not viewed favorably by senior agencies as it increases the risk in successful completion of the compensatory action; this in turn increases the compensation ratio that will be applied to the development project. This option also makes current restoration cost estimates less certain, increasing the risk of these costs escalating due to the delayed timeframe in constructing the restoration projects.

4.3 Comparison of Habitat Compensation Bank Options

	Option 1		Option 2	
Time lag in replacing lost habitat	Low-none	+	Moderate - high	–
Accuracy of compensation estimates	High based on actual costs and area restored	+	Low based on estimates at a certain point in time	–
Risk of cost escalation to complete restoration projects	Low	+	Moderate – high	–
Support of DFO and MOE	High	+	Low	–
Initial financial burden on City &/or bank investor	Mod-High	–	Low	+

In summary, there are generally more "plus-es" associated with option 1 than with option 2. The deciding factor may be whether the City or a private investor is willing to invest the funds needed to create the initial Habitat Bank in option 1, on the basis of recouping some of those funds (with reasonable interest, if desired) through sale of excess compensation credits from the Bank.

5. FORMULA FOR USING A HABITAT COMPENSATION BANK

Using a habitat compensation bank requires a formula that equates habitat losses at a development site to habitat gains through the bank in financial terms. After considerable discussion during the roundtable meetings with interested parties, the formula derived for determining compensation contributions to the Mission Creek Habitat Compensation Bank is:

Compensation Cost ($)	=	*Habitat lost due to development (m^2)*	X	*Relative habitat value factor*	X	*Compensation ratio*	X	*Compensation Bank unit cost ($/m²)*
		(section 5.1)		*(section 5.2)*		*(section 5.3)*		*(section 5.4)*

Components of the formula, and how they may differ between Option 1 (physical bank) and Option 2 (fund bank), are explained below.

5.1 Habitat Lost Due to Development

This is the residual habitat area for which impacts cannot be avoided or mitigated on-site. This is typically determined by a Qualified Environmental Professional (QEP) as part of a mitigation/compensation plan for a development proposal.

5.2 Relative Habitat Value (RHV) Factor

The RHV factor attempts to quantify the relative value of the habitat being lost to the value of the habitat being gained. In the Mission Creek case, RHV factors are assigned for each of the three types of habitat (stream, riparian and wetland) to be created or enhanced in Mission Creek. In each case, habitats are rated from low to very high based on criteria that reflect their relative importance as habitat; the RHV factor is a number between 0.25 and 1 that reflects the relative importance. The factor is applied to the habitat being lost due to development.

Applying the RHV factors assumes that:

- The habitat being created in Mission Creek will always be rated as 'very high' value within its respective category.
- The compensation habitat is the same type as habitat lost – i.e., 'like for like' replacement where stream habitat is being replaced by stream habitat, riparian by riparian ,etc. The factors are not intended to reflect relative habitat value between habitat types; e.g., comparing the relative value of wetland vs. instream habitat).
- Applicable factors would initially be determined by the applicant's QEP as part of a development proposal, for review by the applicable regulatory agencies.

The ratings and associated for each habitat type are defined as follows:

Stream habitat: stream habitat ratings and their associated RHV factors are adapted from the stream classification system developed by MOE and DFO for watercourses in urban/rural development areas in the Lower Mainland[6] and by the Fisheries Resources BC watershed restoration program:

Rating of Stream habitat to be lost	Rating Criteria	RHV Factor
High - V.High	Inhabited by salmonids and/or rare or endangered species year-round or overwinter, or potentially inhabited year-round with access enhancement; or Inhabited or potentially inhabited by salmonids during the overwintering period with access enhancement; summer usage would be restricted by temperature and dissolved oxygen levels; non-salmonid species are often present year-round.	1
Moderate	Tributary to and significant source or potentially significant source of food and nutrient value to downstream fish populations. No documented fish presence and no reasonable potential for fish presence through flow or access enhancement due to insignificant flows during critical life history stages and significant natural or man-made barriers (e.g. extensive enclosed or channelized reaches, large weirs or dams, etc.) to upstream or downstream migration.	0.5
Low	Insignificant food and nutrient value to downstream fish populations. No documented fish presence and no reasonable potential for fish presence.	0.25

Riparian: riparian habitat ratings are based on the vegetation categories from the Riparian Areas Regulation Assessment Methodology (2006):

Rating of riparian area to be lost	Classification Criteria	RHV Factor
V.High	Continuous vegetated areas averaging 30 m width or discontinuous but occasionally >15m	1
High	Continuous vegetated areas averaging 15 m width or discontinuous but occasionally >15m	0.75
Medium	Continuous vegetated areas averaging 5 m wide or discontinuous but occasionally > 5m	0.5
Low	Primarily bare of vegetation (hard surfaces or structures)	0.25

Wetland: The wetland ratings are adapted from the City's "Wetland Habitat Management Strategy" (March 1998) and Calgary's Wetland Conservation Plan (2004):

Rating of wetland area to be lost	Classification Criteria	RHV Factor
V.High	Connected to a fish bearing stream or tributary to a fish-bearing stream. Confirmed presence of a "red listed" (endangered/threatened) or "blue listed" (vulnerable) species. High diversity of flora/plant communities and fauna. Very little to no disturbance evident; rated as "unmodified" or "slightly modified" with $\geq$75% of the riparian zone intact. High contribution to flood and erosion control, as well as to long term maintenance of hydrologic regime beyond its boundaries.	1
High	May be connected to a fish bearing stream or tributary to a fish-bearing stream. Potential presence of a "red listed" (endangered/threatened) or "blue listed" (vulnerable) species. Moderate to high diversity of flora/plant communities and fauna. Very little disturbance evident; $\geq$50% of the riparian zone intact. Moderate to high contribution to flood and erosion control, as well as to long term maintenance of hydrologic regime beyond its boundaries.	0.75
Moderate	Some diversity of flora/plant communities and fauna. Disturbance evident; $\geq$50% of the riparian zone intact. Some contribution to flood, erosion control and hydrologic regime.	0.5
Low	Heavily modified, low species and community diversity. Little contribution to flood, erosion control and hydrologic regime.	0.25

[6] Ministry of Environment, Lands and Parks. 1998. Classificaiton System for Lower Mainland Region Watercourses. Information Bulletin. 8 p.

5.3 Compensation Ratio

Fisheries-related (HADD) compensation ratios to meet the No Net Loss principle have typically been set in the range of 1:1 to 3:1 (compensation habitat to lost habitat). Establishing compensation ratios for projects proposing to use a Mission Creek Habitat Compensation Bank will still be determined on a case-by-case basis, and would be based on the following factors:

Compensation project risk:

This reflects the relative success (or risk of failure) associated with creating or restoring the type of habitat being considered and/or whether the replacement habitat will achieve the increase in habitat productivity anticipated, based on experience with similar projects in similar environments. The greater the risk, the higher the ratio.

Under Option 1, where the replacement habitat may be already built and even functioning, the risk is low. Under Option 2 where the replacement habitat will not be built until some time after the development project, the perceived risk is high.

Temporal lag in achieving full habitat function:

This reflects the timeframe between when the habitat is lost (time of development-related impact) to when the replacement habitat is functional. This is dependent to some extent on the type of habitat being created; e.g., riparian habitat may be considered to take longer to become functional (it takes time for vegetation to grow) than in-stream habitat.

However, in the Mission Creek situation, the time lag in starting restoration activities is the greater consideration, and is a significant difference between Option 1 and Option 2. Under Option 1, compensation habitat would be established in parallel with the development project, if not before; hence, there is little to no time lag and a compensation ratio of 1:1 can be assigned. Under Option 2, the replacement habitat waits until there are enough funds to build it, which may be some time after a development project; hence, the compensation ratio may be 3:1 or higher, depending on the perceived time lag and uncertainty associated with completing the project.

Spatial disparity: The farther the compensation site is from the site of impact, usually the higher the ratio. This may be modified by considerations of the relative contribution to the overall aquatic system of the habitat in its existing location versus in the replacement location; e.g., an isolated wetland near the outer edge of a watershed or next to a busy road may contribute less to the watershed than a re-created wetland within a protected aquatic corridor.

Like vs. unlike habitat replacement: The ideal case is 'like for like' replacement; replacement with unlike habitat may increase the ratio. This may be modified by considerations of limiting factors in an aquatic ecosystem; i.e., if a different replacement habitat might address a limiting factor not represented in the lost habitat, it may be preferable over replacing the lost habitat with the same habitat type.

In the case of Mission Creek, there may be a shortfall in wetland habitat being created (i.e., wetland credits available) relative to the amount that may be lost through future development. Once the wetland credits in Mission Creek have been used up, allowing wetland habitat to be replaced by riparian or stream habitat will have to be considered on a case-by-case basis, and the compensation ratio adjusted accordingly. Alternatively, designing more wetlands into the Mission Creek system could be considered; the project cost estimates would need to be recalculated accordingly. A third option is to restore or re-create a wetland elsewhere for use specifically as a wetland habitat compensation 'bank'.

Similarly, there may be habitat types that may be impacted by future development in the Mission Creek watershed that are not represented by the habitats being restored in the Bank; e.g., upland woodlands or terrestrial herbaceous communities. These types of habitat should be compensated for separately elsewhere, but in the absence of opportunities to do so, the value of the habitat to be lost may be weighed against the value of the overall habitat, and associated fish and wildlife corridor, being created under the Mission Creek Plan and the compensation ratio adjusted accordingly.

5.4 Compensation Bank Unit Cost

Option 1 - $/credit

Option 1 represents the typical habitat compensation bank situation, where the number of 'credits' assigned to the bank are based on the net habitat area created or restored, and the cost or price assigned to those credits are based on the actual costs of completing the restoration or enhancement project. Because the bank unit cost can be calculated based on real costs, there is greater certainty that the compensation amount being required of a development project reflects the cost of replacing the habitat that would be lost in real terms.

The number of credits to assign to a bank is usually directly related to the net amount of habitat that is being created or restored by the restoration project; e.g., a net area of 10,000 m^2 of restored habitat would result in 10,000 credits being available for use or sale. Determining 'net' restored or created habitat would take the following factors into account:

- Habitat area that existed prior to the restoration may need to be 'netted out'. For example, where an existing straight channel of 1000 m^2) is replaced with new meandering channel of, 2000 m^2), the area of the former channel should be subtracted from the new channel area to derive a 'net' stream habitat enhancement of 1000 m^2.
- Adding riffles to a stream channel may be assumed to increase the productivity of the existing channel area by some percentage; e.g., if adding riffles to a 1000 m^2 channel is assumed to increase the channel's productivity by 50%, then the net habitat enhancement (for compensation purposes) would be 500 m^2.
- Preserving a habitat area is not considered equivalent to habitat creation, restoration or enhancement because preservation by itself does not replace lost habitat. Areas preserved (only) are typically credited at some percentage, such as 50%; e.g., if a 1000 m^2 wetland is preserved as the result of the restoration project, then the net habitat enhancement (for compensation purposes) would be 500 m^2.

Where restoration projects are funded partially by grants and donations (through the Dyke Upgrade and Habitat Restoration Fund) and partially by public or private investment, the number of credits and cost/credit should reflect only the investment funding. For example, if a $3 million restoration project is funded 50% by grants and 50% by investment, the habitat area for compensation purposes should be 50% of the total area and credit costs should be based on the investment dollars only.

Finally, where private or public funds have been invested to complete the restoration project, the cost of compensation credits may also include an interest charge to reflect income lost by not investing those funds elsewhere.

Option 2 - $/$m^2$

In Option 2, the compensation unit cost would be based on estimates of both project costs and habitat created.

The estimates of project costs are discussed in section 3.1 and summarized in Table 2 (page 7).

Habitat areas that would be created or enhanced by the restoration projects were estimated from 2001 orthophotos of the Mission Creek study area using GIS-based methods. Table 3 summarizes the calculations and assumptions for estimating habitat areas that would be created, enhanced or preserved in each restoration project.

Table 3: Estimates of Future Restored Habitat Area

Proj	Habitat Type	Net Restored Habitat Area (m^2)	Notes
1	Riparian	25,786	The riparian area that would be added was represented by the area from the stream edge (toe of slope) of the existing dyke to the stream edge (toe of slope) of the proposed new dyke. It was assumed that existing riparian habitat on the slope of the present dyke would be replaced by new riparian vegetation on the slope of a new dyke; hence, slopes were not included in the area calculated.
2	Riparian	65,955	See explanation for "riparian" in project 1.
	Instream – existing enhanced	8,060	Instream habitat area = channel length (m) x 31 m (average channel width in the study area). 16,120 m^2 of existing channel would be enhanced with riffle structures. Adding riffles is assumed to increase the productivity of the existing channel area by 50%; hence, the net habitat area enhanced is 50% of 16,120.
	Instream – new	7,950	Existing channel (8000 m^2) would be replaced with new meandering channel (13,300 m^2) with riffles. The area of the former channel is subtracted from the estimated new channel area and then multiplied by 1.5 (50% improvement in productivity due to addition of riffles) to derive a net increase in instream habitat.
	Wetland – existing preserved	593	Two existing wetlands totaling 1186 m^2 would be preserved behind the new dyke. Preservation of existing wetland is credited at 50% or ½ the value of creating new wetland.
	Wetland – new	4,960	New wetland habitat could be created from about 50% of the de-activated stream channel; the remainder would be infilled as part of the channel reconstruction.
3	Riparian	31,817	See explanation for "riparian" in project 1.
4	Riparian	51,824	See explanation for "riparian" in project 1.
	Wetland – existing preserved	332	An existing wetland of 663 m^2 would be preserved behind the new dyke. Preservation of existing wetland is credited at 50% or ½ the value of creating new wetland.
5	Instream – existing enhanced	10,540	21,080 m^2 of existing channel would be enhanced with riffle structures. Adding riffles is assumed to increase the productivity of the existing channel area by 50%.
	Instream – new	5,205	Existing channel (8,000 m^2) would be replaced with new meandering channel (11,470 m^2) with riffles. The area of the former channel is subtracted from the estimated new channel area and then multiplied by 1.5 (50% improvement in productivity with addition of riffles) to derive a net increase in instream habitat.
	Wetland – new	4,030	New wetland habitat could be from about 50% of the de-activated stream channel; the remainder would be infilled as part of the channel reconstruction.
6	Riparian	14,750	See explanation for "riparian" in project 1.
7	Instream – existing enhanced	56,730	113,460 m^2 of existing channel would be enhanced with riffle structures. Adding riffles is assumed to increase the productivity of the existing channel area by 50%.
	Total	288,532	

Given the estimates for project costs and net habitat area created by the restoration projects, Table 4 summarizes the estimated unit costs for each project both with and without costs associated with dykes.

For a unit cost for compensation banking purposes, where it is assumed that dyke costs would be covered by other sources and compensation funds are to be directed to habitat enhancement and restoration only, the average cost per m^2 of restored habitat is estimated at approximately $26.

Table 4: Unit Cost Estimates for Mission Creek restoration projects

Project	Estimated net habitat area (m^2)	Cost estimates with dyke costs (for all funding sources)	Estimated $/$m^2$ with dyke costs	Cost estimate without dyke costs (for compensation funding sources)	Estimated $/$m^2$ without dyke costs
1	25,786	$797,849	$30.94	$222,512	$8.63
2	87,518	$3,430,727	$39.20	$2,640,663	$30.17
3	31,817	$2,376,357	$74.69	$1,005,838	$31.61
4	52,156	$3,173,625	$60.85	$1,690,240	$32.41
5	19,775	$631,419	$31.93	$631,419	$31.93
6	14,750	$1,447,175	$98.11	$387,038	$26.24
7	56,730	$711,550	$12.54	$711,550	$12.54
Total	288,532	$12,768,674	$44.25	$7,489,232	$25.96

Option 2 Example Application

Using the formula -

Compensation Cost ($)	=	*Habitat lost due to development (m^2)*	*X*	*Relative habitat value factor*	*X*	*Compensation ratio*	*X*	*Compensation unit cost $/$m^2$*
		(section 5.1)		*(section 5.2)*		*(section 5.3)*		*(section 5.4)*

- one scenario for the Swamp Road upgrade project may look like the following, based on habitat area that would be lost estimated by Golder Associates:

Habitat type	Area to be lost (m^2)	RHV factor	Compensation ratio	Compensation unit cost ($/$m^2$)	Compensation required
Wetland	5832	0.5	2	25.96	$151,399
Riparian	687	0.5	2	25.96	$17,835
In-stream	603	1	2	25.96	$31,308
TOTAL					$200,541

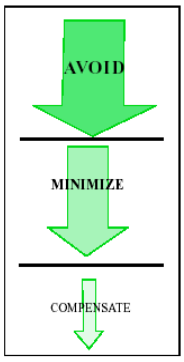
6. CONCLUSIONS AND RECOMMENDATIONS

The following summarizes main conclusions and recommendations regarding habitat compensation banking in Kelowna, and the implementation of a Mission Creek Habitat Compensation Bank.

6.1 Guiding Principles

Habitat compensation and habitat compensation banking in Kelowna should be guided by the following principles. These principles should be reflected in OCP policies relating to habitat compensation.

Habitat impact "hierarchy" (Cox and Grose, 2000:10)



1. No Net Loss Principle: Habitat management should adhere to the policy of "No Net Loss", whereby no development project should result in the net loss of the productive capacity of habitat, and land use decisions should strive for a net gain in productive capacity in the long term.
2. Habitat Impact Management Hierarchy: The management of impacts to habitat in Kelowna should follow the habitat impact management hierarchy under the federal "Policy for the Management of Fish Habitat", in which any land development proposal must, in the order given[7]:
   - Avoid impacts through appropriate project design and location;
   - Mitigate impacts on the site through repair and restoration of damaged habitat; and
   - Compensate only when residual loss of habitat is unavoidable, acceptable and compensatible. Circumstances where such impacts may be unavoidable include: the project site is so limited that to avoid any impact would preclude any use of the site for the purposes for which it is zoned; or the nature of the project makes adverse impacts unavoidable, such as transportation or utility corridors that must intersect a water body.
3. Habitat Compensation Preferences: In general, on- or near-site is preferred over off-site compensation, and 'like-for-like' compensation is preferred over replacing habitat with unlike habitat. However, these preferences may be excepted where there are no or very limited opportunities for on-site compensation and local management plans that contain clear habitat restoration, such as the Mission Creek Habitat Restoration Plan, are available.
4. Use of a Habitat Compensation Bank: A Habitat Compensation Bank may be used to compensate for residual habitat losses caused by development only where opportunities for mitigation and compensation on the development site have been exhausted. The onus lies with the development proponent to prove, through a comprehensive mitigation and compensation plan, that all efforts have been taken to avoid, mitigate and compensate for habitat impacts on site before proposing to use a Habitat Compensation Bank to cover residual habitat losses.
5. Real-cost Based: Use of a Habitat Compensation Bank requires that habitat loss at a project site be compensated by an appropriate habitat gain, represented by purchasing credits from an established Bank (option 1), or by a dollar value to be contributed towards a designated future restoration project (option 2). The cost of habitat credits (option 1) or the amount of compensation funds to be contributed to the Bank (option 2) should be based on real costs associated with acquiring land, planning, design, constructing, monitoring and maintaining the Bank or restoration project.

[7] K. Cox and A. Grose. 2000. Wetland Mitigation in Canada: a Framework for Application. North American Wetlands Conservation Council (Canada) Sustaining Wetlands Issues Paper no. 2000-1. 93 p.

6. Fisheries Act-related Compensation: Whether a proposed project can use a Habitat Compensation Bank, and at what compensation ratio (replacement habitat to lost habitat), as a means of compensating for unavoidable habitat losses under the *Fisheries Act* (a HADD) will be at the discretion of MOE and/or DFO.
7. Bank Credit-Debit System: The habitat replacement capacity, represented by the number of habitat credits available, of any Habitat Compensation Bank is finite. A habitat 'credit/debit' system should be instituted to keep track of the area of habitat lost and habitat gained for each habitat type. This will avoid Bank oversubscription (i.e., allowing more habitat loss than is being gained through the Bank), thereby meeting the principle of No Net Loss of productive habitat.
8. Land Acquisition as a Compensation Measure: Land acquisition is normally not considered a satisfactory compensation measure because on its own, it preserves already existing habitat and does not represent the replacement of lost habitat. However, if specific land acquisitions are identified in an accepted habitat restoration plan and are critical to completing the restoration projects, using compensation funds to acquire those properties identified in the plan is an acceptable form of compensation.
9. Mission Creek Habitat Compensation Bank: A Mission Creek Habitat Compensation Bank will be based on the Mission Creek Habitat Restoration Feasibility Plan and the restoration projects that are documented in the Plan and for which the costs have been updated to current dollar values.
10. Mission Creek Area of Application: The Mission Creek Habitat Compensation Bank may be used to compensate for residual habitat losses by development that occurs within the portion of the current Mission Creek watershed that lies within the City of Kelowna boundaries. A map showing the area applicable to the Bank should be generated when the Bank is established. The onus lies with the applicant to prove that the development for which compensation is required lies within the Mission Creek watershed.
11. Compensation Transfer: Transferring compensation needs from other aquatic systems to the Mission Creek Habitat Compensation Bank will not be considered until restoration/ compensation opportunities on other key aquatic systems have been thoroughly assessed; e.g., restoration feasibility studies on Mill Creek and the Okanagan Lakeshore.

6.2 Future Management of the Mission Creek Dykes

Based on the Mission Creek Habitat Restoration Plan, the Mission Creek Habitat Compensation Bank would be comprised of seven projects listed in Table 1 (page 5). Five of those seven projects include removing and reconstructing (setting back) portions of the dyke along Mission Creek.

The costs to implement these projects were revised to 2007 dollars and summarized in Table 2 (page 7). Costs were estimated with and without the cost of dyke design and construction under the assumption that the dyke-related costs would be covered separately under flood management funding sources and not using habitat compensation funding. The estimate for all projects with dyke costs included is $12.8 million; without dyke-specific costs (dyke planning, design and construction), the estimate is $7.5 million.

The City and the Province should formalize their understanding that the Province will continue to administer dykes for flood management purposes in Kelowna. With respect to Mission Creek and its Habitat Restoration Plan, there should be agreement that as long as the proposed setback dykes meet Provincial dyke standards, the Province will continue to be responsible for their long term management and maintenance as floodproofing structures.

6.3 Mission Creek Habitat Compensation Bank – Option 1 vs. Option 2

As discussed in section 4, Option 1, the 'physical' Bank option, is preferred over Option 2, the 'financial' Bank option, for implementing a Mission Creek Habitat Compensation Bank for several reasons:

- Because the restoration projects are completed 'up front', there is little delay between the time of habitat loss and the creation of replacement habitat.

- For the same reason, the risk of cost escalation to complete compensation projects is reduced.
- The amount of compensation to be paid on any development project using the Bank can be determined more accurately as it is based on actual costs and habitat area restored versus projected estimates of these compensation components.
- Last but not least, option 1 meets federal and provincial compensation policy, and is more readily supported by DFO and MOE.

Therefore, to initiate the habitat banking process in Kelowna as well as to meet its own short to mid-term compensation needs, the City should consider sponsoring the construction of the first restoration project under the Mission Creek Habitat Compensation Bank. The estimated cost of the first project is about $800,000. The City may wish to seek a co-sponsor to assist with funding – potentially a developer that also needs off-site compensation opportunities within the Mission Creek watershed, or a donor of land and/or money. If co-sponsorship can be arranged, the Bank credits or sale thereof should be shared proportionately between the co-sponsors.

6.4 Habitat Banking Compensation Formula

Assuming Option 1 is the preferred method for implementing a Mission Creek Habitat Compensation Bank, the formula proposed for determining amounts to be paid for compensation by development projects that use the Bank is –

Compensation Contribution ($)	=	*Habitat lost due to development (m^2)*	X	*Relative habitat value factor*	X	*Compensation ratio*	X	*Compensation Bank unit cost ($/m^2$)*

- where:

- The residual habitat to be lost due to development is estimated by a qualified environmental professional.
- The relative habitat value factor is determined according to the values assigned for stream, riparian and wetland habitats in section 5.2.
- The compensation ratio is defined on a case-specific basis based on considerations of compensation project risk, temporal lag in achieving full habitat function, spatial disparity, and unlike habitat replacement, discussed in section 5.3.
- The Compensation Bank unit cost is based on the cost of building a Bank restoration project per square meter of net habitat area created or restored. This unit cost would be re-calculated each time a new Bank project is completed.

  Alternatively, an 'average' unit compensation cost estimated for all the restoration projects could be used over the total life of the Bank, based on projected costs and habitat area restored. The unit cost estimate in this report for all 7 projects is $26/$m^2$. This estimate would need to be revised as project costs and habitat areas are reviewed and revised (see Mission Creek Habitat Compensation Bank Advisory Committee below).

6.5 Mission Creek Dyke Upgrade and Habitat Restoration Fund

Both Banking options discussed in section 4 make use of a "Mission Creek Dyke Upgrade and Habitat Restoration Fund" to assist in completing the projects in the Restoration Plan. The City should set up this Fund to act as a repository for money received through grants and donations towards the habitat creation and restoration components of the Plan, as well as through infrastructure and flood management grants to assist with setting back the dykes. It may be advisable, and even necessary, to apportion the Fund into two parts, to make it clear which fund sources are being used for which activities.

The Fund should be structured to receive donations of money, land or in-kind service towards the Mission Creek projects, and to issue income tax receipts for these contributions.

Money from the Fund could be used at any time towards purchase of properties that are needed for the restoration projects. Money from the Fund would also be applied towards completion of the projects under the Restoration Plan, independently or jointly with private investment (option 1) or compensation payments (option 2).

6.6 Mission Creek Habitat Compensation Bank Operational Agreement

The City is the most apparent choice for becoming the initial operator of the Mission Creek Habitat Compensation Bank. Under Option 1, subsequent Bank projects could be built by private interests, such as developers who need off-site compensation credits or landowners along the Creek interested in restoring their portion of the Creek and selling credits to recoup the costs. These parties could become Bank operators, independently or in cooperation with the City.

Regardless of who the operator or operators may be, the establishment and operation of the Bank should be set out in an agreement or Memorandum of Understanding (MOU) among the City, DFO, MOE and operator. There are numerous examples of such agreements in the U.S. that can be drawn upon in drafting an agreement for the Mission Creek Habitat Compensation Bank. Box 1 lists some example components of an operational agreement.

Box 1: Example elements of an Operational Agreement for Mission Creek Habitat Compensation Bank

- Geographical Bank service area (watershed boundaries within the City).
- Description of the restoration project.
- Bank accounting format, including credits (creditable compensation area) used; credits (creditable compensation area) remaining.
- Monitoring schedule and process (specific parameters to be monitored).
- Performance standards for determining ecological success of compensation sites,
- Legal responsibility for ensuring compensation terms are satisfied fully.
- Provisions for remedial actions and responsibilities (e.g., contingency fund and who carries out remediation).
- Financial, technical and legal provisions for long-term management and maintenance.

6.7 Habitat Compensation Banking Coordinator

A person dedicated to Bank implementation and acting as a point of contact for all Bank related activities is considered by the stakeholders as a necessity. MOE staff has indicated that some provincial funding is available to assist with coordinating the Mission Creek Habitat Restoration Plan. The City should match these funds and hire a Coordinator to initiate the Plan and the Bank.

Likely a part-time position, this person would report initially to the City and MOE and ultimately to the Advisory Committee (see below). Responsibilities would include coordinating and facilitating the Advisory Committee, liaising with stewardship groups, designing and executing a public information program, and administering the Bank operations including receipt of funds, keeping track of credits sold and gained, etc.

6.8 Mission Creek Habitat Compensation Bank Advisory Committee

A Mission Creek Habitat Bank Advisory Committee should be established to:

- Oversee the use of Bank credits, assisting the Coordinator in maintaining a credit-debit account for Bank projects.
- Oversee the use of funds towards compensation/ restoration projects listed in the Mission Creek Habitat Restoration Plan.
- Based on experience with the “proof of concept” projects and as implementation of the Restoration Plan proceeds, review and update the project list on an annual basis. The Committee could consider revisions to existing projects and identify additional projects to be added. Overall, the Bank could contract, expand and be revised over time as restoration activities continue.
- Seek public input to priorities for HCP projects.
- Review project cost estimates on an annual basis and revise them accordingly, along with the Bank compensation unit costs.

- Provide input to DFO or MOE, if requested, on use of the Bank proposed by development proponents.

The Advisory Committee should initially be made up of representatives from the City, MOE, DFO and Friends of Mission Creek. These parties could consider expanding membership to include representation from other sectors of the community that have an interest in Mission Creek. Guidelines may need to be established to avoid conflict of interest on restoration projects or land acquisitions.

6.9 Role of Development Applicants and QEPs

The role of the Mission Creek Habitat Compensation Bank is to provide a practical and effective option for compensating for unavoidable and compensatible habitat losses in the watershed. It would be up to development proponents and their Qualified Environmental Professionals (QEPs) to be aware of this option and propose to incorporate it in their compensation plans within the context of the compensation hierarchy.

As such there would be little change in the actual development application and review process. QEPs would still be responsible for developing compensation plans that incorporate measures to avoid, mitigate, and compensate for habitat losses, and to develop measures for on site and/or off site compensation. MOE/DFO would still be responsible for assessing and approving HADDs. The only change would be that where off-site compensation is necessary, development projects within the Mission Creek watershed would have the additional option of estimating and applying to contribute funds to the Habitat Compensation Bank.

6.10 Preliminary Project Schedule

The ideal sequence of events to implement a Mission Creek Habitat Compensation Bank would be to acquire lands for the highest priority project followed by survey, design, approvals and construction of that project. The process would then be repeated for the next priority project. In actuality, assembling the land needed to carry out the restoration projects will initially be a high priority. The use of Bank funds also must be flexible in order to take advantage of land acquisition opportunities as they arise, regardless of what stage or project may be underway.

However, it is considered important to get a couple of projects 'on the ground' early in the program, to test the viability of the restoration designs. Also, these projects should be in easily accessible portions of the Mission Creek restoration area, so that they can be used to showcase the program and gain public understanding and support for the restoration projects and the Mission Creek HCP Bank.

Table 5 illustrates a possible Mission Creek project schedule, recognizing that it would need to be adjustable to funding circumstances and opportunities.

Table 5: Example Mission Creek project schedule

Funding Threshold (approx.)	Project	Timing (approx.)
$50,000	Hire Coordinator	2007
$800,000	1. Setback Dyke construction - Casorso Road to 730 m upstream	2008
$3 million	2. Setback Dyke and Channel construction – KLO Road to and including Benvoulin Woods	2012
$2.3 million	3. Setback Dyke construction – Gordon Rd to Casorso Rd	2016
$3.2 million	4. Setback Dyke construction – Benvoulin Woods upstream to Mission Creek Regional Park	2020
	5. Channel construction & Riffle Rehab – Benvoulin Woods up-stream to Mission Creek Reg'l Park	2022
$1.5 million	6. Setback Dyke construction – KLO Rd downstream to project 1	2024
$710,000	7. Riffle rehabilitation – upstream of Mission Creek Regional Park	2026

APPENDIX 1: DETAILS OF PROJECT COST ESTIMATES

The accompanying spreadsheets provide details on how updated costs were estimated for the Mission Creek Habitat Restoration Plan projects. The following provides further explanation of some the factors considered in updating the costs.

Land acquisition

The City's Community Development and Real Estate Division estimated Land costs for portions of 18 properties that were required for the restoration projects. These cost estimates included:

- Land cost: the 2006 land assessments for each property (assumed to represent market value) multiplied by a factor of 1.1 to adjust for the time advance to 2007; then multiplied by the proportion of the property needed for the specific restoration project (i.e., area required/total property area).
- Survey cost: average $2000/property.
- Legal costs: average $2000/property.
- Negotiations: average $1000/property.
- Appraisals: average $1000/property.
- Expropriation: a contingency of $100,000/expropriation for two expropriations, if needed.

The estimates are in current (2007) dollars and not to be relied on beyond the end of 2007 due to market changes. It is assumed that lands owned by the City and the Central Okanagan Regional District would also be purchased or reimbursed at market value, with the exception of the property in project 1 that was purchased in 2006 with HCTF funds.

Planning and design costs

A detailed estimate for design and acquisition of regulatory/environmental approvals was generated for Project 2 (Benvoulin Woods Dyke and Channel). The estimate totalled $106,559, of which $41,879 would be for channel design and $64,680 would be for dyke design. This detailed estimate was then used to generate the following average per-unit costs and applied to the other projects:

- $66/linear meter of dyke for survey, preliminary and final design, construction drawings and regulatory agency approvals.
- $47.95/linear meter of dyke for final design/construction drawings and regulatory agency approvals (used in project 1, where surveys and preliminary plans/drawings have already been completed).
- $66/linear meter of new channel creation – preliminary and final design/construction drawings.
- $25.96/linear m of existing channel enhancement (riffle structures) – final design/construction drawings.

Construction costs

Setback dyke construction: construction cost estimates were detailed for dyke construction in project 1 (Casorso Rd to 730 m upstream). A unit cost of $740.19/linear meter was derived and applied to dyke construction in projects 2, 3, 4 and 6.

New channel construction: construction cost estimates were detailed for each of project 2 and 5.

Existing channel enhancement – riffles added: estimated costs were proportional to the length of existing vs. new channel to which riffles were added in each project. Unit costs ranged from $132 to $186/linear meter.

Performance monitoring costs

The "proof of concept" projects (projects 1 and 2) were assumed to require 5 years of monitoring, and estimated to cost 10% of construction costs. The other projects were assumed to require 3 years of monitoring, estimated at 5% of construction costs.

Long-term maintenance costs

Contingency funding for long-term maintenance was estimated for each project based on whether the project area was assumed to be minimally affected by river flows (estimated at 5% of construction costs) or moderately affected by river flows (estimated at 10% of construction costs). The funding was assumed to apply to a 5-10 year period of maintenance, after which other funds or interest-derived dollars are assumed to take over maintenance costs.

Note that these long-term maintenance costs are assumed to apply to maintenance of the habitat-related aspects of the dykes and channel structures (such as maintenance of riparian plants, riffle structures, bank reinforcement in the event of erosion) but not flood-control aspects of the dykes and not trail maintenance for recreational purposes.

Public information costs

Providing effective public information on the restoration project was considered to be an important in the overall success of the Mission Creek Habitat Restoration Plan. For the proof of concept projects, these costs were roughly estimated at 3% of construction costs, and 2% of construction costs for the other projects.

Performance monitoring, maintenance and public information are activities that occur over several years after project construction. As such, their costs could be covered by placing a predetermined percentage of all compensation funds received into a special trust fund earmarked for these long-term uses. This designated fund would be invested with the purpose of growing principle to protect against inflation, and to generate income for perpetual management of compensation projects.

MISSION CREEK PROJECT COSTS WITH LAND COSTS FROM KELOWNA R.E. DIVISION revised 25 May 07

WITH DYKE COSTS

Priority	Project Name	Habitat	Land Acquisition ($)		Total Length (m)	Planning, Design ($)			Construction ($)			Total ($)		Project SubTotal $	Type of Habitat Created or Enhanced	Raw Area Created or Enhanced (m2)	Corrected Area Created or Enhanced (m2)	Performance Monitoring ($)		Long-term Maintenance ($)[2]		Public Information Materials ($)		Long-term costs total $	Project Total ($)	Project Total - Land Acq $
			Unit Cost ($/ha)	Total Cost		Unit Cost ($/m)	Dyke or Channel	Total Cost	Unit Cost ($/m)	Dyke or Channel	Total Cost	Dyke	Channel					Unit Cost ($/m)	Total Cost	Unit Cost ($/m)	Total Cost	Unit Cost ($/m)	Total Cost			
1	Setback Dyke Construction: Casorso Rd to 730 m upstream	Kokanee Spawning		125,250	730	47.95	Dyke	35,000	740.19	Dyke	540,337	700,587		$ 700,587	Riparian	25,786	25,786	74.02	54,034	37.01	27,017	22.21	16,210	97,261	797,848	672,598
			Need to purchase / easement of Westbank FN property on east side of Casorso Rd. (0.13 ha); 024-008-168, small parcel upstream of Casorso property (0.13 ha). 2.5 ha parcel from PID 008-504-130 already purchased by City; Conduct legal surveys		Setback dyke on west bank only	Planning & preliminary drawings complete; construction drawings required; regulatory & environmental approvals needed			Remove existing dyke, construct setback dyke, rebuild trail									Proof of Concept Project: 5 yrs of effectiveness monitoring; assume 5 yr total budget = 10% of construction costs		Setback dyking should be minimally affected by river flows and should require little maintenance over the long-term; assume budget = 5% of construction costs		Proof of Concept project should have higher level of Public Interpretation / Information; On-site signage / kiosk and project brochure; assume budget = 3% of construction costs				
2	Setback Dyke and Channel Construction: KLO Rd up to and including Benvoulin Woods	Kokanee Spawning		1,896,755	980	66.00	Dyke	64,680	740.19	Dyke	725,384	2,686,819		$ 3,163,810	Riparian	65,955	65,955	118.42	116,050	118.42	116,050	35.53	34,815	266,914	3,430,724	1,533,969
															Wetland - new[1]	4,960	4,960									
															Wetland - exist.	1,186	593									
					520	25.96	Existing Channel	13,499	132.47	Existing Channel	68,886		82,385		Exist. Instream Enhanced	16,120	8,060									
					430	66.00	New Channel	28,380	851.69	New Channel	366,226		394,606		New Instream Enhanced	13,330	7,950									
			Need to purchase / easement of portions of PIDs: 001-714-791, 001-714-783, 011-074-132, 024-208-124, 011-074-281 (plus two parcels near KLO Rd); Conduct legal surveys		980 m of setback dyke on west bank and 430 m of re-constructed channel with 2 riffles; 520 m of existing channel enhanced with 2 riffles	Need to 1) conduct topo survey, 2) prepare preliminary and final design / construction drawings, and 3) obtain regulatory & environmental approvals			Remove existing dyke, construct setback dyke, rebuild trail, construct new channel and two riffle structures									Proof of Concept Project: 5 yrs of effectiveness monitoring; assume 5 yr total budget = 10% of construction costs		Setback dyke and channel stabilities should be moderately affected by river flows and should require moderate level of maintenance over the long-term; assume budget = 10% of construction costs		Proof of Concept project should have higher level of Public Interpretation / Information; On-site signage / kiosk and project brochure; assume budget = 3% of construction costs				
															Note: Unit cost based on: cost of land purchase plus planning/design plus dyke and instream construction divided by total of riparian, wetland and instream area created/enhanced														
3	Setback Dyke Construction: Gordon Rd-Casorso Rd.	Kokanee Spawning		854,837	1700	66.00	Dyke	112,200	740.19	Dyke	1,258,319	2,225,356		$ 2,225,356	Riparian	31,817	31,817	37.01	62,916	37.01	62,916	14.80	25,166	150,998	2,376,354	1,521,517
			Need to purchase / easement of Westbank FN property, 011-099-895 and 014-767-538 on west side of Casorso Rd.; Conduct legal surveys		Setback dyke: 680 m on west bank and 1020 m on east bank	Need to 1) conduct topo survey, 2) prepare preliminary and final design / construction drawings, and 3) obtain regulatory & environmental approvals			Remove existing dyke, construct setback dyke, rebuild trail									3 yrs of effectiveness monitoring; assume 3 yr total budget = 5% of construction costs		Setback dyking should be minimally affected by river flows and should require little maintenance over the long-term; assume budget = 5% of construction costs		On-site signage / kiosk and project brochure; assume budget = 2% of construction costs				
4	Setback Dyke Construction: Benvoulin Woods to Mission Creek Regional Park	Kokanee Spawning/ Rainbow Rearing		1,526,803	1840	66.00	Dyke	121,440	740.19	Dyke	1,361,945	3,010,188		$ 3,010,188	Riparian	51,824	51,824	37.01	68,097	37.01	68,097	14.80	27,239	163,433	3,173,622	1,646,819
			Need to purchase / easement of PIDs: 003-979-440, 007-938-675, 011-074-311, 017-816-874; Conduct legal surveys		Setback dyke-910 m on west bank and 930 m on east bank	Need to 1) conduct topo survey, 2) prepare preliminary and final design / construction drawings, and 3) obtain regulatory & environmental approvals			Remove existing dyke, construct setback dyke, rebuild trail						Wetland-exist.	663	332	3 yrs of effectiveness monitoring; assume 3 yr total budget = 5% of construction costs		Setback dyking should be minimally affected by river flows and should require little maintenance over the long-term; assume budget = 5% of construction costs		On-site signage / kiosk and project brochure; assume budget = 2% of construction costs				
															Note: Unit cost based on: cost of land plus planning/design plus dyke construction divided by total of riparian and wetland area created protected														
5	Channel Reconstruction & Riffle Rehabilitation: Benvoulin Woods to Mission Creek Regional Park	Kokanee Spawning/ Rainbow Rearing			680	25.96	Existing Channel	17,653	185.70	Existing Channel	126,274		143,927	$ 545,781	Existing Instream Enhanced	21,080	10,540	37.04	25,185	74.07	50,371	14.81	10,074	85,630	631,411	631,411
					370	66.00	New Channel	24,420	1,020.09	New Channel	377,434		401,854		New Instream Enhanced	11,470	5,205									
															Wetland - new[1]	4030	4030									
			No Land Purchase Required; Completed in project 4		370 m of new meander channel; 680 m of existing mainstem with riffle (6) rehabilitation	Planning and design of channel and riffle rehabilitation completed in Project 4			Construct meandering channel and six riffle structures									3 yrs of effectiveness monitoring; assume 3 yr total budget = 5% of construction costs		Channel and riffle structure stabilities should be moderately affected by river flows and should require moderate level of maintenance over the long-term; assume budget = 10% of construction costs		On-site signage / kiosk and project brochure; assume budget = 2% of construction costs				
															Note: Unit cost based on: cost of planning/design plus dyke and instream construction divided by total of instream area and wetland area created or enhanced														
6	Setback Dyke Construction: Remainder downstream of KLO Road	Kokanee Spawning		270,231	1315	66.00	Dyke	86,790	740.19	Dyke	973,347	1,330,368		$ 1,330,368	Riparian	14,750	14,750	37.01	48,667	37.01	48,667	14.80	19,467	116,802	1,447,169	1,176,938
			Need to purchase / easement of PIDs: 024-008-184 and 009-417-770; Conduct legal surveys		Setback dyke-795 m on west bank and 520 m on east bank	Need to 1) conduct topo survey, 2) prepare preliminary and final design / construction drawings, and 3) obtain regulatory & environmental approvals			Remove existing dyke, construct setback dyke, rebuild trail									3 yrs of effectiveness monitoring; assume 3 yr total budget = 5% of construction costs		Setback dyking should be minimally affected by river flows and should require little maintenance over the long-term; assume budget = 5% of construction costs		On-site signage / kiosk and project brochure; assume budget = 2% of construction costs				
7	Riffle Rehabilitation: Upstream of Mission Creek Regional Park	Rainbow Rearing/ Kokanee Spawning			3660	25.96	Existing Channel	95,000	143.98	Existing Channel	526,960		621,960	$ 621,960	Existing Instream Enhanced	113,460	56,730	7.20	26,348	14.40	52,696	2.88	10,539	89,583	711,543	711,543
			No Land Purchase Required		3660 m of existing mainstem with riffle (19) rehabilitation	Need to 1) conduct topo survey, 2) prepare preliminary and final design / construction drawings, and 3) obtain regulatory & environmental approvals			Construct 19 riffle structures									3 yrs of effectiveness monitoring; assume 3 yr total budget = 5% of construction costs		Channel and riffle structure stabilities should be moderately affected by river flows and should require moderate level of maintenance over the long-term; assume budget = 10% of construction costs		On-site signage / kiosk and project brochure; assume budget = 2% of construction costs				
			exprop cost est	200,000								$200,000													$ 200,000	
Totals				**$4,873,876**	12,225			$599,062			$6,325,112	$10,153,318	$1,644,732			371,215	288,532		$401,297		$425,814		$143,511	970,622		
												TOTAL		**$11,798,050**											**$12,768,672**	$7,894,796
													$/m2	**$ 40.89**								**TOTAL $/m2**			**$ 44.25**	

Notes: [1] For Projects 2 & 5, it is assumed that 50% of existing channel area that will be deactivated under the restoration design will be in-filled and 50% will be designed as high quality wetland habitat
Wetland area also comprised of existing habitat identified in Kelowna Wetland Management Strategy: Project 2 - 1186 m ^{2} of 'high wetland rating'; Project 5 - 663 m ^{2} of 'unconfirmed wetland sites'

[2] Assume total long-term maintenance cost is over 5-10 year period

Land costs - based on per-property estimates from Real Estate Division. Project estimates include $6000/property for survey, legal, negotiation and appraisal; possible expropriation costs estimated as separate item at bottom.

MISSION CREEK PROJECT COSTS WITH LAND COSTS FROM KELOWNA R.E. DIVISION revised 26 March 07

WITHOUT DYKE COSTS

Priority	Project Name	Habitat	Land Acquisition ($)		Total Length (m)	Planning, Design ($)			Construction ($)			Total ($)		Type of Habitat Created or Enhanced	Raw Area Created or Enhanced (m2)	Corrected Area Created or Enhanced (m^2)	Project SubTotal ($)	Long term costs total $ (from dykes sheet)	Project Total $ (sans dykes)	Project Total - land acq $
			Unit Cost ($/ha)	Total Cost		Unit Cost ($/m)	Dyke or Channel	Total Cost	Unit Cost ($/m)	Dyke or Channel	Total Cost	Total Without Dykes	Channel							
1	Setback Dyke Construction: Casorso Rd to 730 m upstream	Kokanee Spawning		125,250	730		Dyke			Dyke		125,250		Riparian	25,786	25,786	125,250	97,261	$ 222,511	$ 97,261
			Need to purchase / easement of Westbank FN property on east side of Casorso Rd. (0.13 ha); 024-008-168, small parcel upstream of Casorso property (0.13 ha). 2.5 ha parcel from PID 008-504-130 already purchased by City; Conduct legal surveys		Setback dyke on west bank only	Planning & preliminary drawings complete; construction drawings required; regulatory & environmental approvals needed			Remove existing dyke, construct setback dyke, rebuild trail										
2	Setback Dyke and Channel Construction: KLO Rd up to and including Benvoulin Woods	Kokanee Spawning		1,896,755	980		Dyke			Dyke		1,896,755		Riparian	65,955	65,955	2,373,746	266,914	2,640,660	743,905
														Wetland	6,146	5,553				
					520	25.96	Existing Channel	13,499	132.47	Existing Channel	68,886		82,385	Existing Instream Enhanced	16,120	8,060				
					430	66.00	New Channel	28,380	851.69	New Channel	366,226		394,606	New Instream Enhanced	13,330	7,950				
			Need to purchase / easement of portions of PIDs: 001-714-791, 001-714-783, 011-074-132, 024-208-124, 011-074-281 (plus two parcels near KLO Rd); Conduct legal surveys		980 m of setback dyke on west bank and 430 m of re-constructed channel with 2 riffles; 520 m of existing channel enhanced with 2 riffles	Need to 1) conduct topo survey, 2) prepare preliminary and final design / construction drawings, and 3) obtain regulatory & environmental approvals			Remove existing dyke, construct setback dyke, rebuild trail, construct new channel and two riffle structures										
														Note: Unit cost based on: cost of land purchase plus planning/design and construction for instream habitat divided by total of riparian, wetland and instream area created/enhanced						
3	Setback Dyke Construction: Gordon Rd-Casorso Rd.	Kokanee Spawning		854,837	1700		Dyke			Dyke		854,837		Riparian	31,817	31,817	854,837	150,998	$ 1,005,835	$ 150,998
			Need to purchase / easement of Westbank FN property, 011-099-895 and 014-767-538 on west side of Casorso Rd.; Conduct legal surveys		Setback dyke: 680 m on west bank and 1020 m on east bank	Need to 1) conduct topo survey, 2) prepare preliminary and final design / construction drawings, and 3) obtain regulatory & environmental approvals			Remove existing dyke, construct setback dyke, rebuild trail										
4	Setback Dyke Construction: Benvoulin Woods to Mission Creek Regional Park	Kokanee Spawning/ Rainbow Rearing		1,526,803	1840		Dyke			Dyke		1,526,803		Riparian	55,854	51,824	1,526,803	163,433	1,690,236	163,433
			Need to purchase / easement of PIDs: 003-979-440, 007-938-675, 011-074-311, 017-816-874; Conduct legal surveys		Setback dyke-910 m on west bank and 930 m on east bank	Need to 1) conduct topo survey, 2) prepare preliminary and final design / construction drawings, and 3) obtain regulatory & environmental approvals			Remove existing dyke, construct setback dyke, rebuild trail					Wetland-exist.	663	332				
														Note: Unit cost based on: cost of land divided by total of riparian and wetland area created/enhanced						
5	Channel Reconstruction & Riffle Rehabilitation: Benvoulin Woods to Mission Creek Regional Park	Kokanee Spawning/ Rainbow Rearing			680	25.96	Existing Channel	17,653	185.70	Existing Channel	126,274		143,927	Existing Instream Enhanced	21,080	10,540	545,781	85,630	631,411	631,411
					370	66.00	New Channel	24,420	1,020.09	New Channel	377,434		401,854	New Instream Enhanced	11,470	5,205				
														Wetland - new	4,030	4,030				
			No Land Purchase Required; Completed in A4		370 m of new meander channel; 680 m of existing mainstem with riffle (6) rehabilitation	Planning and design of channel and riffle rehabilitation completed in Project 4			Construct meandering channel and six riffle structures										
														Note: Unit cost based on: cost of instream construction divided by total of instream area created/enhanced						
6	Setback Dyke Construction: Remainder downstream of KLO Road	Kokanee Spawning		270,231	1315		Dyke			Dyke		270,231		Riparian	14,750	14,750	270,231	116,802	387,033	116,802
			Need to purchase / easement of PIDs: 024-008-184 and 009-417-770; Conduct legal surveys		Setback dyke-795 m on west bank and 520 m on east bank	Need to 1) conduct topo survey, 2) prepare preliminary and final design / construction drawings, and 3) obtain regulatory & environmental approvals			Remove existing dyke, construct setback dyke, rebuild trail										
7	Riffle Rehabilitation: Upstream of Mission Creek Regional Park	Rainbow Rearing/ Kokanee Spawning			3660	25.96	Existing Channel	95,000	143.98	Existing Channel	526,960		621,960	Existing Instream Enhanced	113,460	56,730	621,960	89,583	711,543	711,543
			No Land Purchase Required		3660 m of existing mainstem with riffle (19) rehabilitation	Need to 1) conduct topo survey, 2) prepare preliminary and final design / construction drawings, and 3) obtain regulatory & environmental approvals			Construct 19 riffle structures										
			exprop cost est	200,000								$200,000					200000		$ 200,000	
Totals				$4,873,876	12,225			$178,952			$1,465,780	$4,873,876 (land)	$1,644,732 (channel) $6,518,608		376,431	288,532	$6,518,608	970,621	**$ 7,489,229**	$ 2,615,353
																		Total $/m2	**$ 25.96**	

Notes: [1] For Projects 2 & 5, 50% of existing channel area that will be inactive under the restoration design will be in-filled and 50% will be designed as high quality wetland habitat

Wetland area also comprised of existing habitat identified in Kelowna Wetland Management Strategy: Project 2 - 1186 m^2 of 'high wetland rating'; Project 5 - 663 m^2 of 'unconfirmed wetland sites'

MAP 1: LOCATIONS OF MISSION CREEK HABITAT COMPENSATION PROJECTS

5 Project #

Existing Constructed Riffle

7

Riffle Structure

4 dykes

5 channel

Proposed Sediment Traps

Proposed Meander Channel

Proposed Meander Channel

Benvoulin Woods

2

6

Set-back Dyke

1

Cross Section

3

Contemporary orthophoto plan view of Mission Creek showing Private Lands affected by proposed Setback Dyke Projects.

Riffle
Setback Dyke
Proposed Sediment Trap
Cross Section
Mission Creek Channel
Proposed Meander
Affected Property
Portion Affected
Portion Unaffected

1:7500

0 100 200 300 400 500 600 700 800 900 1000

Metres

Universal Transverse Mercator
Zone 11 (CM 117 W)
North American Datum 1983

LDL Lawlers Sep 2006