Mission Creek

A Background on Stream Restoration

Stream Restoration Background

It is regrettable, albeit true that Mission Creek and many other streams in the Pacific Northwest have been severely compromised by human activities. This is largely true given that streams and their floodplains have been used for many purposes not consistent with conservation and natural processes (e.g. periodic flooding and habitat provision). Especially important is the loss of natural stream landscapes to channelization - typically due to urbanization and to agricultural production. These modifications are now being recognized as a major ecological concern. In addition, stream channelization has shown to increase, not diminish as was the original intent, the threat of losses – both to life and to property - due to major flood events. It is further recognized that flood risks could be exacerbated by climate change factors and the occurrence of "extreme" storm events, which climate change scientists believe will occur at greater frequencies than what has been witnessed in the past.

In response to past modifications, stream restoration is an attempt to re-create the natural form and function of a river. Restoration is typically achieved through changes in a stream's alignment (e.g. the introduction of meanders and off-channels) or its cross-section (e.g. the removal of materials from the bed and banks).

Stream restoration is often associated with enhancing aquatic habitat and restoring fish populations which have declined, often significantly, as a result of channelization and other modifications. Physical habitat degradation remains among the most significant threats to aquatic and riparian biodiversity. Fortunately, growing environmental awareness and concern for the loss of biodiversity and rivers and floodplain habitats have increased the relative importance of these ecosystems. In fact, physical stream restoration has rapidly become a priority for numerous governments, stakeholder groups and the public. The result of this attention is an increasing number of river restoration projects being introduced around the world, often with very impressive results.

While aquatic and riparian habitats are undoubtedly important justifications for stream restoration, a concurrent opportunity often exists with respect to flood protection and increasing community resiliency to weather and climate. While moisture regimes (i.e. mean annual precipitation) may or may not change, extreme events (e.g. 1:100 and 1:200 year storms) should be expected at a greater frequency. At the same time, urbanization continues to increase the amount of impermeable surface and the corresponding need to accommodate stormwater in existing streams. Recent events in Queensland, Australia and New Orleans, Louisiana vividly illustrate the consequences (loss of life and property) when large storm events cannot be accommodated within existing natural and constructed drainage pathways. The benefits associated with stream restoration are often multi-faceted as a result.

Mission Creek Background

There is little doubt of the historic importance of Mission Creek to Kelowna and to the greater Okanagan. While Mission Creek is often associated with the City of Kelowna given that the lower reaches of the Mission Creek are within the City of Kelowna, Mission Creek confers numerous benefits to the entire Okanagan valley. In fact, Mission Creek provides approximately one quarter of all water entering Okanagan Lake each year [average inflow 485,000 megalitres (ML), where 1ML = 1,000m^3], a considerable volume when one considers the sheer number of tributaries. The importance of this tributary is further increased when one considers that the turnover rate for water in Okanagan Lake is approximately 51 years.

The historic importance of Mission Creek led to the BC Heritage Rivers Board granting it "BC Heritage River" status in 1997. In awarding this status the Board noted that "The current

major effort to restore and manage the natural qualities of the waterway through a model process of stewardship within an urban environment is particularly significant."

The origin of Mission Creek is Mission Lake (1,860 metres) in the Greystoke Mountain Range east of Kelowna and currently descends for approximately 43 kilometres before emptying into Okanagan Lake (at 342 metres). Mission Creek runs through a wide range of ecosystems and significant geologic features from the upper reaches to the low elevations where most of us experience its splendour here in the valley.

Mission Creek was central to the settlement and economic development of Kelowna and an important resource in a number of ways. Prior to European settlement, First Nations relied on Mission Creek and the riparian areas for food, building materials and medicines. Kokanee salmon (a land locked sockeye salmon) were particularly important to Okanagan First Nation communities. So reliable was the annual kokanee run that a First Nations community developed at the location of the traditional fishery (later becoming the location of the Father Pandosy Mission). Anecdotal evidence suggests that 60 plus years ago Mission Creek was red with kokanee each fall. Local knowledge of the phenomenon suggests "millions of kokanee" returned annually.

Similar to First Nations communities, early European settlers also recognized the immense importance of Mission Creek. For instance, Father Pandosy's mission (built in 1859) saw the first fruit trees in the valley planted in the fertile Mission Creek floodplain. In the early 20th century widespread irrigation works were constructed to support various agricultural pursuits. The first settlers also built along the creek recognizing its importance as a transportation route.

In 1938 the main Mission Creek channel was 60 to 80 meters wide on average and approximately 30 kilometres long (see Appendix A). As Kelowna grew in size and population, especially over the past half century, sections of Mission Creek were channelized and dyked and some sections were abandoned. The result is a loss of more than 60% of the creeks length, 80% of its spawning and rearing habitat, and 75% of its wetland and riparian areas. Today the stretch of Mission Creek which flows through the City of Kelowna averages 31 meters across and has been reduced to just 11 kilometres in length. A reduction in excess of 60% (see Appendix B).

In addition to increasing the productive land base that could be used for agriculture, a primary justification for the channelizing and dyking activities relate to flood prevention and protection. These activities took place in an era which reflected little concern for ecological values and “natural capital”, reflecting instead an engineering approach that would be unacceptable by contemporary standards. While the dyking along lower sections of Mission Creek was ecologically disastrous, the dykes constructed in the 1950s are now recognized as unsuitable in multiple respects.

To support this assertion, a 1995 Ministry of Environment study concluded that the dykes in the lower seven kilometres of Mission Creek are substandard for flood control purposes. That is to say that side slopes of the channel are too steep and the crest widths, which also functions as the Mission Creek Greenway, are too narrow. The substandard dykes are further compounded by reduced capacity in the channel as a result of sediment loading. Sediment loading continues to occur as upstream material is eroded and deposited in the slower moving, low gradient waters within the lower reaches. Thus, despite good intentions, a significant flood potential exists for large portions of the City located on the Mission Creek floodplain should floodwaters breach the crest of the dyke or the dyke fail at any location.

From an ecology perspective, the denaturalization of aquatic and riparian ecosystems is known to result in numerous impacts, with the extent often depending on the scale. Natural stream ecosystems are a prerequisite for abundant spawning and rearing habitat of stream fishes. The impact on fisheries values in Mission Creek, the largest stream for creek-spawning kokanee salmon in the Okanagan is evidence of this. In ecological terms, kokanee salmon are considered to be a keystone species because of their many interactions with other species, especially those of higher trophic levels. Kokanee are a critical fall food source for bears, eagles, osprey, and a number of other species. The spawned out carcasses of adult kokanee also provide fertilizer for terrestrial and aquatic ecosystems. Kokanee are also an indicator species for the overall health of the ecosystem because they are highly sensitive to changes in their habitat (e.g. reductions in water quality).

Estimates from the 1950s suggest between 700,000 to 1.2 million fish spawned in Mission Creek per year. The first government assessment of kokanee spawning populations was conducted over 30 years ago and estimated 300,000 stream spawners. Since then fall returns have steadily declined with the fishery being closed in 1995 as a result. Spawning numbers continued to worsen and in 1998 and 1999 less than 1,000 kokanee spawned in Mission Creek. While some population stabilization has been witnessed in recent years, kokanee stream spawning remains relatively low when compared with historic numbers.

The above summarizes the morphology of Mission Creek from a natural stream with abundant natural processes to a highly modified channel in an urbanized environment and the consequences from doing so. While the existing channel does not function well ecologically, the flood protection value is also questionable and may present liability considerations for all levels of government. The following outlines a recommended approach to the ecological and flood hazard conditions, while recognizing the highly urbanized context that exists at present.

MCRI Background Information and Anticipated Benefits

The Mission Creek Restoration Initiative is a multi-disciplinary, multi-stakeholder undertaking with a goal of restoring the lower section of Mission Creek — from East Kelowna Road Bridge, downstream to Okanagan Lake - to a more natural condition. The nature of the restoration project is complex and intended to achieve a number of concurrent goals as will be described.

Given the complex nature of the proposed undertaking, a "Working Group" was established as part of the MCRI to create a plan for the restoration of Mission Creek within the City of Kelowna. The Working Group is comprised of representatives from local, provincial and federal governments (i.e. City of Kelowna, Regional District of Central Okanagan, Ministry of Environment and Fisheries and Oceans Canada); non-government organizations (i.e. Friends of Mission Creek and Central Okanagan Land Trust); and First Nations (i.e. Okanagan Nation Alliance and Westbank First Nation). This cross-section of groups and individuals is expected to expedite the various permitting processes and also help to galvanize local support and funding. To date much of the MCRI's progress has been driven by passion and a desire to create a positive community benefit with countless volunteer hours in the planning phase alone. It is expected that volunteerism will be key moving forward in subsequent planning and construction phases.

Consistent with what was alluded to earlier in this submission, the anticipated benefits of Mission Creek restoration on the lower, most impacted and confined stretches, are multiple. Past and present efforts of the Working Group have studied the feasibility of using the dyke

setback concept as a means to restore and enhance in-stream and riparian habitat in this critical area, while also enhancing stormwater capacity in this channel by creating a wider stream cross-section. Community resilience to flooding is expected to be enhanced by virtue of the existing substandard dykes being replaced by dykes that meet provincial standards.

As noted earlier, the Mission Creek fishery was closed in 1995 after a historic crash widely believed to have resulted from channel modifications and loss of critical in-stream spawning habitat. A primary goal of the Initiative is to create new in-stream habitat and improve existing aquatic habitat in support of kokanee salmon and rainbow trout specifically. It is also worth noting that while sockeye are not currently present in Okanagan Lake, current efforts in the United States and Canada would suggest that the return of sockeye to Okanagan Lake is a matter of time. If and when sockeye return to Okanagan Lake the MCRI will support sockeye stream spawning as well.

While the flood protection and in-stream benefits are expected to be immense, another important aspect associated with this Initiative is the anticipated benefit that will accrue to the riparian zone (the interface between land and a river or stream). Especially important is the benefit to federally and provincially-listed species and ecosystems at risk. Mission Creek and its associated riparian zone are known to host, or have the potential to host, numerous species at risk or concern. Red-listed species (provincially listed as "rare" or "endangered") associated with this area include: Black Cottonwoods, Lewis' Woodpecker, Western Screech-owl and Grasshopper Sparrow. In addition to endangered species and ecosystems, blue-listed species (at-risk) associated with this area and habitat type include: Gopher snake, Racer, Western Rattlesnake, Painted Turtle, Great Basin Spadefoot, Great Blue Heron, Long-billed Curlew, and Spotted Bat.

Another benefit of an enhanced riparian zone is that associated with carbon sequestration. The Province and City of Kelowna have set ambitious goals for reducing greenhouse gases and balancing emissions and sequestration. Among the best opportunities for sequestering carbon lies in nature and specifically in forests (including urban forests) and undisturbed grasslands. An enhanced Mission Creek riparian zone consisting mainly of deciduous vegetation would serve to enhance an existing carbon sink and sequester additional carbon near the source of greenhouse gas production. A healthy urban forest will also be important in offsetting the rapid loss of greenhouse gas sequestration as mountain pine beetle and tussock moth continue to wreak devastation on Okanagan forests, including the City's urban forest.

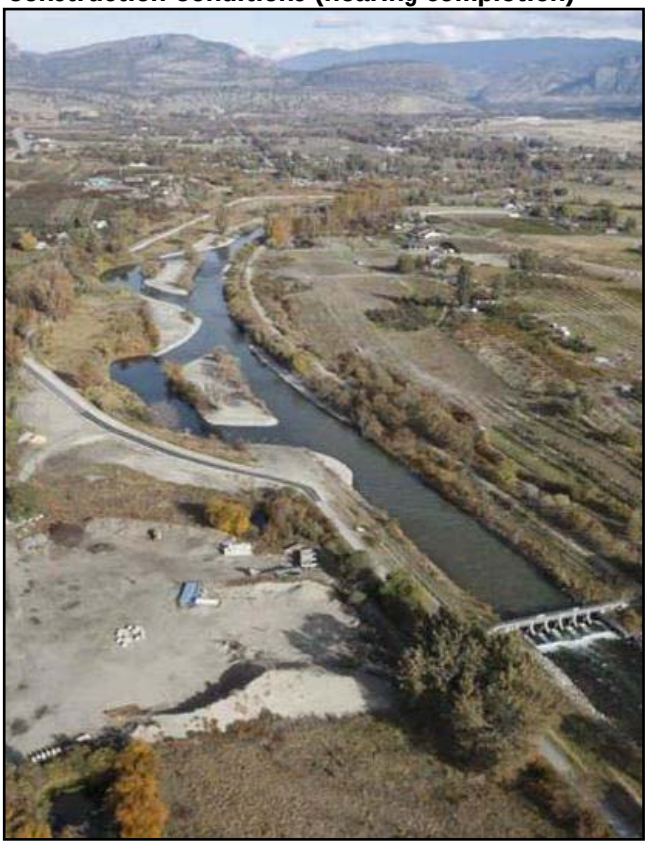
The presence of agricultural land and agricultural use adjacent to Mission Creek represents yet another opportunity. At present much of the adjacent land is not arable due to high water table conditions. A high water table is a limiting factor for crop production and yield. It is expected that a wider stream cross-section would lower the water table in these areas. Thus any potential loss of agricultural land due to dyke setbacks would be offset by the lower water table and improved soil conditions in upland agricultural areas.

While the MCRI is unquestionably large in scale and complexity, it is worth note that good precedent exists for what is being proposed. In fact, you are likely aware of the Okanagan River Restoration Initiative (ORRI). The Okanagan River connects Osoyoos Lake and Vaseux Lake in the south Okanagan and consistent with Mission Creek, was significantly modified by humans. Similar to Mission Creek, the Okanagan River provides an essential linkage and critical aquatic and terrestrial habitat, especially with respect to restoring sockeye salmon which have been cut off from traditional spawning grounds in the south and central Okanagan.

The Okanagan River Restoration Initiative is an outstanding example of what the MCRI is attempting to achieve in Mission Creek and on Okanagan Lake. ORRI provides excellent guidance for the MCRI given that our southern neighbours are far more advanced in their efforts. In fact, ORRI recently realized a historic milestone with the restoration of a 1.2 kilometre section (Phase I) of the Okanagan River. The completion of Phase I is a very encouraging development as we seek to replicate this success. The following images show the Phase I restoration area before and during channel restoration.

Figure 1: Phase I Okanagan River – Illustrating Pre-restoration Conditions

Figure 2: Phase I Okanagan River – Illustrating Construction Conditions (nearing completion)



While ORRI is a great local example, it is far from the only stream undergoing this type of remediation. Throughout North America and elsewhere governments and stakeholder groups are partnering in an effort to restore once natural areas to a semblance of their former glory. The following discussion will discuss funding sources and illustrate how the above objectives will be addressed through the Mission Creek Restoration Initiative.

Mission Creek Restoration Initiative Funding Sources

Given the high cost of both land and restoration, including dyke removal and setback reconstruction, creative solutions are central to our success. Significant achievements to date include the City of Kelowna's creation of the "Mission Creek Habitat Compensation Bank". The Bank was created in response to a need to compensate for habitat loss consistent with the Department of Fisheries and Oceans Policy relating to "No Net Loss of the Productive Capacity of Habitats". The ability to contribute to the Bank only exists in situations where compensation cannot be achieved onsite and as a result is somewhat limited. The Bank has accumulated approximately $500,000 in compensation from various City and Provincial

projects to date. The William R. Bennett and Gordon Drive Bridges are among the most recent examples. While the Bank has grown, in terms of what this project needs to advance, the available funds are expected to be relatively limited.

In addition to the Bank, the Working Group is actively seeking creative partnerships with private landowners adjacent Mission Creek. Land acquisition along Mission Creek is among the greatest hurdles that will need to be overcome. Further, the cost to acquire land is perhaps the most significant distinction between the ORRI and MCRI. To this end the Working Group has been working with landowners seeking redevelopment to obtain land through redevelopment and through little or no cost to the MCRI. While there are a couple of prospects at present, no land has been secured through redevelopment to date.

Canada's Ecological Gifts Program (AKA eco-gifting) represents another opportunity in terms of land acquisition. The Program provides an opportunity for Canadians with ecologically sensitive land to protect nature and leave a legacy for future generations. The Program offers significant tax benefits to landowners who donate land or a partial interest in land to a qualified recipient. Environment Canada (the program administrator) notes that the Program has been more successful with each year and the MCRI has high hopes that the Program will be central in our efforts. It is expected that most, if not all properties will qualify for the Program given their high biodiversity and ability to support species at risk.

Beyond these initiatives, the success of this initiative will largely be contingent on the benevolence of local, provincial and federal governments and indeed the public. In terms of public fundraising, the Friends of Mission Creek (FOMC) Society is an important strategic partner. The Society has a proven track record with respect to fundraising in the community as demonstrated by their very successful campaigns for the Mission Creek Greenway. Resident's interest and pride in the Greenway project is encouraging and it is hoped that the excitement will extend to what is being proposed through the MCRI.

While private donations of land and/or funds will be critical, it is acknowledged that community support alone will not be sufficient to advance this project. We see the Province as an essential partner in this effort and the consultation regarding capital priorities as timely based on where we are at. As with the Okanagan River Restoration Initiative, a first phase/ demonstration project is critical to the long-term success of this Initiative.

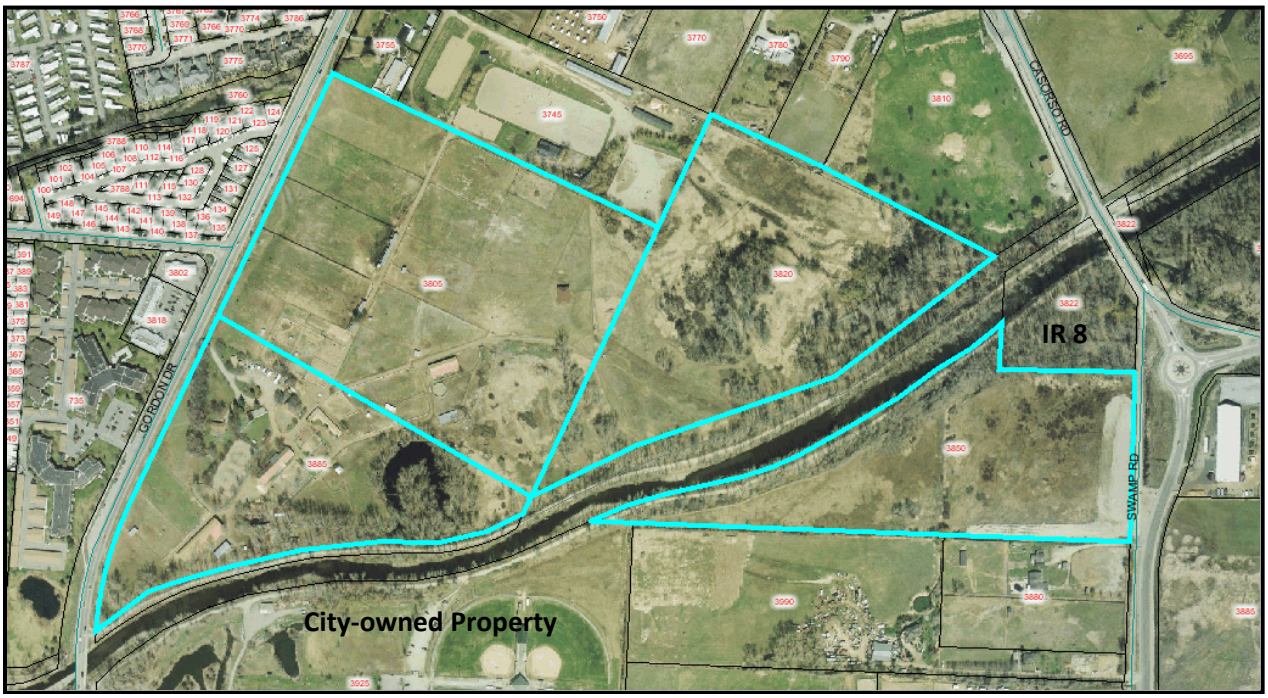
Phase I Restoration Opportunity

Through various studies over the years the Working Group has determined the stream segments of highest importance and greatest net benefit based on a number of criteria. Among the highest restoration potential stream stretches is a segment confined between Casorso Road Bridge and Gordon Drive Bridge downstream. An approximation of the proposed Phase I restoration boundary and conceptual re-meandering is illustrated in Figure 3 below.

Figure 3: Phase I Restoration Area With Conceptual Re-meandering

In addition to immense ecological value (i.e. remnant oxbows, Black Cottonwood forest), the segment has a high public profile and the land tenure is particularly encouraging at this time. This is true given that much of the land along this stretch is in large parcels with just two owners and is currently listed for sale, or is in the possession of project partners (i.e. the City of Kelowna and Westbank First Nation) as shown in Figure 4.

Figure 4: Properties Currently Listed for Sale – Highlighted in Blue



That these properties are currently for sale in a slightly depressed real estate market is a significant opportunity for the MCRI to advance Phase I at this time. In addition to being within an artificially contained stream segment, these parcels are also excellent candidates for restoration. This is true given what we know of this stream segments hydromorphology (i.e. the evolution of hydrologic systems) in the time since Kelowna was settled. The following orthographic photos depict the differences in surface hydrology between 1938 and 2009. The figure illustrates a sinewy section of Mission Creek with a number of off-channels providing spawning habitat and capacity for larger discharge events. Of note is that to the north and not shown in this illustration was a larger channel which comprised part of the Mission Creek main channel and which was abandoned some time after 1938 (see Appendix A, p.12)

Figure 5: OrthoPhoto (1938) Illustrating Natural Stream Alignment and Undeveloped Floodplain

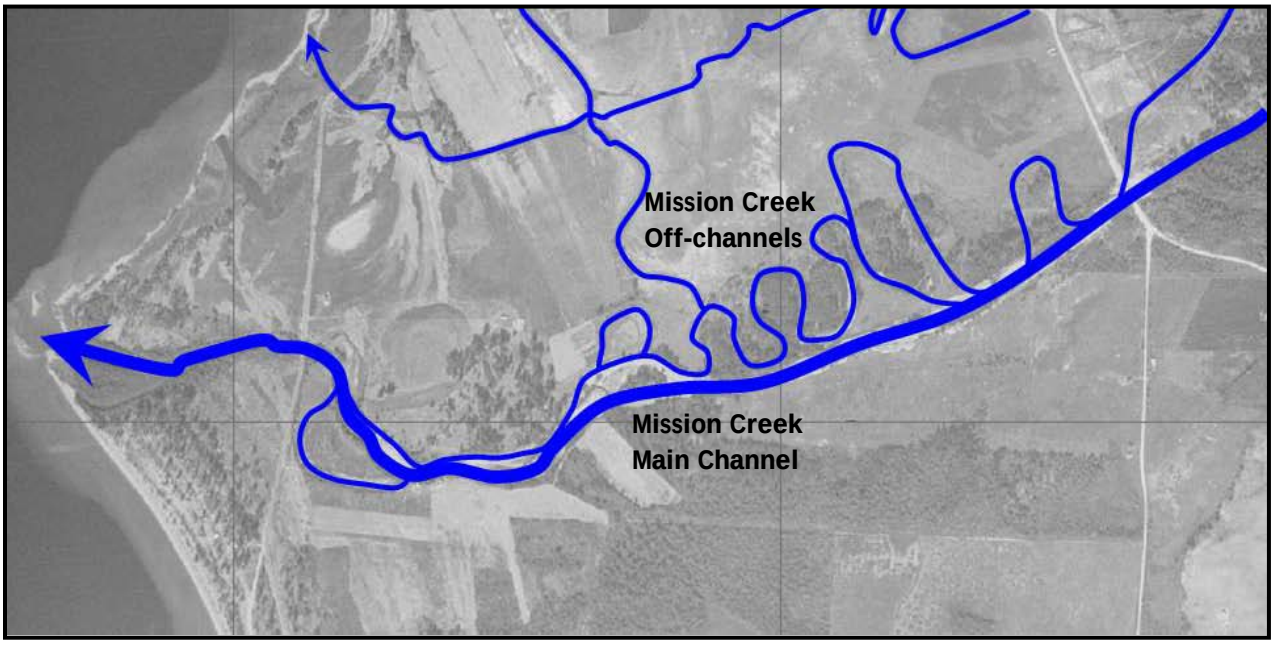


Figure 6: OrthoPhoto (2009) Illustrating Contemporary Stream Alignments and Developed Floodplain

Conclusions

The Mission Creek Restoration Initiative is worthy of consideration for a multitude of reasons. In this climate of multiple bottom line accounting, the MCRI addresses each of the economic, social, cultural, and environmental pillars in a meaningful way. It is also true that the positive direct and indirect impacts will be long-term and in perpetuity.

The MCRI approach to stream restoration is necessarily pragmatic. While the ideal re-naturalization of Mission Creek would result in "natural conditions" (i.e. lacking artificial in-

stream and bank structures and freedom of lateral movement for flows), this approach is recognized as unrealistic. The plan being advanced recognizes the impacts of settlement and attempts to restore ecological conditions and while ensuring an increased resiliency to flooding and an overall benefit to adjacent agricultural land. The recommended plan is therefore a compromise between what is currently a highly modified and unnatural river ecosystem and natural, pre-settlement conditions.

The poor health of stream spawning by kokanee and rainbow trout is an indicator of the poor health of Mission Creek from an ecological perspective. The MCRI will improve fish habitat and is widely expected to increase stream spawning success. The expected result being that depressed kokanee and rainbow trout stocks will be vastly improved. MCRI will also create more and improved riparian and wetland habitat, which will increase the overall biodiversity along the Mission Creek corridor and will assist in the protection and preservation of a variety of Species-At-Risk. Figures 7 and 8 provide a conceptual illustration of before and after conditions within and adjacent to Mission Creek.

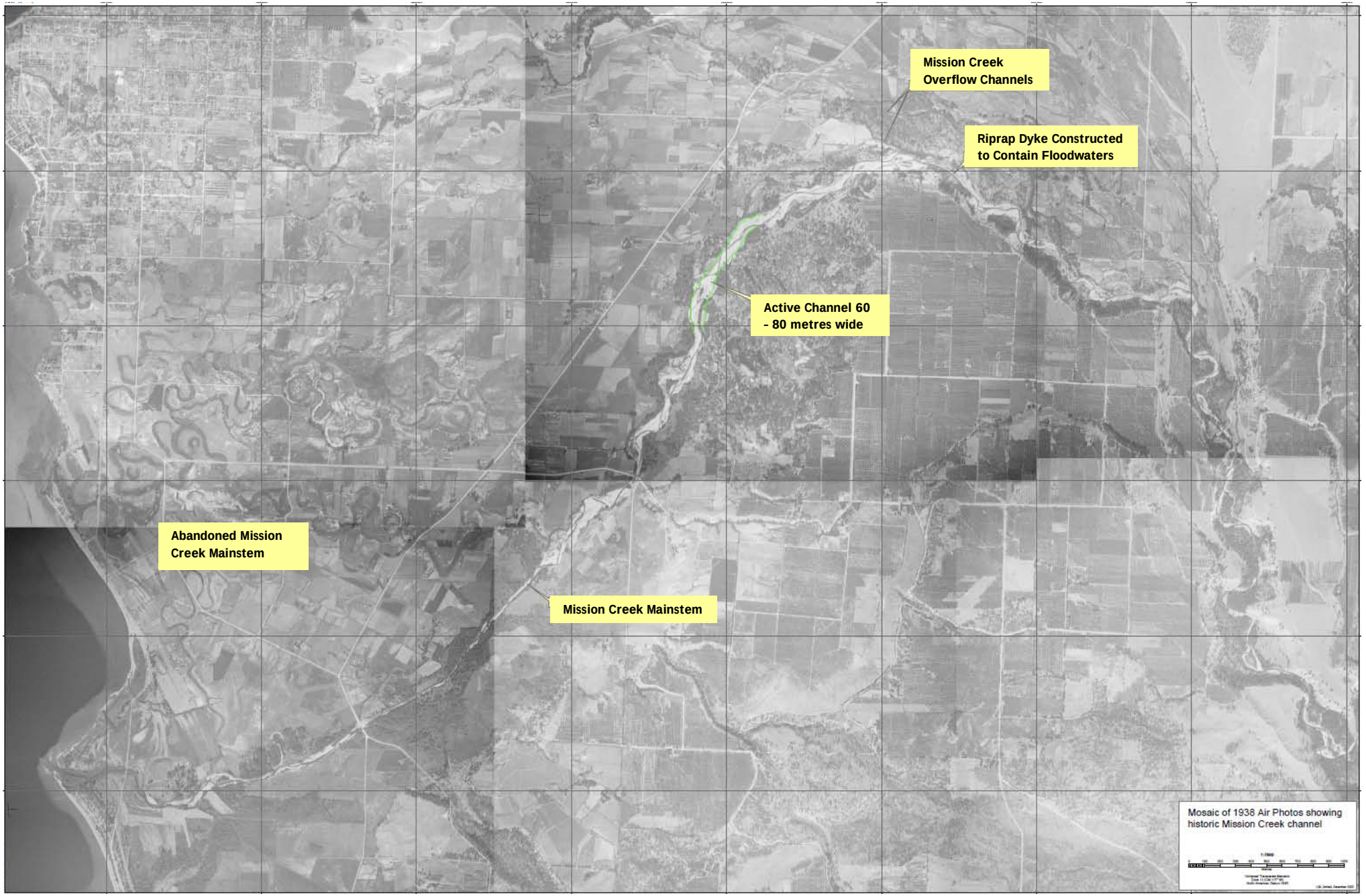
Figure 7: Mission Creek Illustrating Pre-restoration Conditions

Figure 8: Mission Creek Illustrating Restored Conditions

In addition, the MCRI should reduce sediment accumulation in the creek, thereby lessening the potential for flooding of adjacent agricultural and residential properties when a significantly large and intense event does occur. All of this is achievable while maintaining the integrity of the Mission Creek Greenway trail – a recreational asset recognized as a jewel in this community.

In sum, the Mission Creek Restoration Initiative is a major undertaking which will require the assistance of all levels of government to ensure success. The Working Group sincerely appreciates any consideration and welcome any opportunity to further discuss opportunities to advance the Initiative.

Appendix A: Orthographic Photo (1938) Illustrating Pre Channelization Conditions Along Mission Creek



Appendix B: Orthographic Photo (2000) Illustrating Post Channelization Conditions Along Mission Creek