MISSION CREEK RESTORATION INITIATIVE

INVASIVE PLANT STRATEGY

Introduction

The Mission Creek Restoration Initiative (MCRI) was formally launched in 2008 to address declining fish stocks by restoring the natural hydraulic and biological functions to the lower twelve kilometers of Mission Creek from the East Kelowna Road bridge to Okanagan Lake.

The vision of the MCRI is to restore and protect Mission Creek to enrich historical, ecological, and recreational values for the Okanagan.

The restoration activities planned for Mission Creek include setting back sections of the original flood protection dikes to restore natural function, re-establishing the floodplain, reconnecting remnant oxbows, restoring fish habitat, planting riparian vegetation, and creating wetlands and habitat for species at risk.

In 2015 – 2016, following the completion of the construction and setback of 550 lineal meters of dike, invasive plant species and non-invasive plants were observed and becoming established on the newly constructed dike side slopes.

Purpose of the Invasive Plants Strategy:

The invasive plant strategy was developed to assess and manage the invasive plant species found growing along the disturbed and non-disturbed areas of the MCRI project sites following the post construction works. The strategy's focus will be mainly directed towards the sections of constructed replacement setback dike and the exposed side slopes along the setback dike.

The re-established floodplain areas along Mission Creek are being naturally colonized by native trees and riparian vegetation. At this time, the establishment of invasive plants are not problematic at this location but will be monitored in the future and action taken if required throughout the site.

The strategy will incorporate an adaptive and integrated management approach to deal with the invasive plants. This approach will allow for the implementation of multiple treatments in conjunction with the ongoing restoration activities such as re-planting of native species, grass seeding on the side slopes, and natural colonization by native plant species.

Goals:

- Identify, assess, prioritize and monitor the invasive plant species found on the MCRI project sites.
- Prevent and reduce the establishment of invasive plant species over time.
- Reduce the dispersal and quantity of invasive plant species on site over time.
- Restore the riparian habitat and enhance the establishment of native plant species.

Inventory and Monitoring

In 2014, a pre-construction baseline biophysical inventory (BBI) was carried out for the MCRI along the stretch of Mission Creek between Casorso Road to Gordon Drive in Kelowna. The vegetation inventory serves as the pre-construction baseline for the project (Appendix 1).

Subsequently, site observations carried out between 2017 - 2020 by MCRI members and volunteers, have contributed to the development of a working inventory of invasive plant species and management priority levels for treatment (Appendix 2).

The annual inventory, assessment, monitoring and preventative measures will be essential in the successful management of invasive plant species as part of the MCRI project.

Recommendations:

1. Conduct an annual inventory and assessment for invasive plant species on the dike side slopes and floodplain. The inventory and assessment will form a post-dike restoration baseline inventory of invasive plants and provide recommendations on management priority levels for treatment.

2. Avoid or minimize soil disturbance along the dike side slopes to reduce infestation of invasive plants and germination of existing dormant invasive plants seeds in the soil.

3. Annually assess the requirement for additional grass seeding on the dike side slopes until sufficient grass establishment is observed. As needed, apply an approved native and non-native grass seed mix (Appendix 3) onto exposed or disturbed soils and partially established areas along the dike side slopes and excavated floodplain drainage ditch. Seeding method to be high density broadcast grass seeding.

4. Implement multiple management strategies in combination to prevent spread and establishment of invasive plants and noxious weeds. Management strategies to consider

include: prevention (sowing grass seed, minimize disturbance, remove weeds before they form seed), biocontrol agents and removal (hand pulling, mowing, or cutting).[1]

5. Selectively remove the Provincial and regional noxious weeds to minimize the level of soil disturbance and potential for weed infestation on side slopes. The method of plant removal and treatment (manual removal, hand pulling, cutting, or release of biocontrol agents) will be dependent upon the targeted plant species to be treated.

6. Implement selective removal of invasive plant species, based upon recommended management priority levels and using established management methods such as manual removal, hand pulling and cutting only in areas where it will not result in future infestation of additional exposed soils and on steep, loose side slopes along the dike.

7. Herbicide application is not a recommended method for treating invasive plants at this site, given the site is instream habitat. Glyphosates (e.g., roundup) are broad spectrum herbicides that will kill all plants (native and exotic).

8. Develop an annual monitoring program for invasive plants, noxious weed species and the areas of infestation. Monitor and assess the effectiveness of treatment strategies.

9. Coordinate the invasive plant strategy activities with the MCRI Demonstration Project Effectiveness Monitoring Plan and Adaptive Management Plan work and recommendations.[2]
    - *Continue monitoring vegetation establishment with focus on meander banks and other exposed slopes. Conduct planting/seeding to increase rate of colonization and stabilization. Bioengineering for stabilization is recommended over riprap and other hard engineered options.*
    - *Allow the floodplain to continue colonizing naturally while monitoring succession and introduced invasive vegetation.*
    - *Restorations of this nature require time for regeneration of vegetation. Vegetation monitoring should occur over at least 10 years to ensure stability, vegetation colonization, and habitat benefits are maximized.*

10. Plant native tree and shrub species in the floodplain areas to improve colonization of disturbed areas to reduce the establishment of invasive plant species. Native tree and shrub species should not be planted on the dike side slopes.

11. Follow Best Management Practices (BMPs) when dealing with the spread and establishment of invasive plant species.[3]

12. Explore and develop opportunities with MCRI project partners, volunteers and volunteer groups interested in assisting with the invasive plant removal on an annual basis.

13. Explore funding opportunities and sources to assist in implementing the invasive plant strategy recommendations and activities.

References

[1] Invasive Species Council of BC. *Invasive Species Toolkit for Local Government, Real Estate Professionals and Land Managers*. 2018. https://www.bcinvasives.ca/documents/Local_Govt_Real_Estate_Toolkit_18.12.18_WEB_.pdf

[2] Yuan, B., N. Lukey, and K. Alex. 2018. *Mission Creek Restoration Initiative Effectiveness Monitoring, 2016, 2017 and 2018*. Prepared for the BC Ministry of Forest Lands and Natural Resource Operations and Rural Development. Penticton, B.C. Prepared by Okanagan Nation Alliance Fisheries Department, Westbank, BC.

[3] Ministry of Environment and Climate Change Strategy (BC Parks) and Invasive Species Council of BC. Best Management Practices For Invasive Plants in Parks and Protected Areas of British Columbia. 2018 Edition. http://www.env.gov.bc.ca/bcparks/conserve/docs/iscbc-bc-parks-bmp-20180412.pdf?v=1576020302820

[4] Invasive Species Council of BC website https://bcinvasives.ca/invasive-species/about/what-are-invasive-species/

[5] Inter-Ministry Invasive Species Working Group (IMISWG). 2014. Invasive Species Early Detection and Rapid Response Plan for BC, p.36. https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/invasive-species/guidance-resources/prov_edrr_is_plan.pdf

Glossary

Invasive Plants – defined as any invasive plant species that has the potential to pose undesirable or detrimental impacts to people, animals or ecosystems. Invasive plants can establish quickly and easily on disturbed and undisturbed sites and can cause widespread negative economic, social and environmental impacts. [4]

Invasive Species – species that are not native to British Columbia or are outside of their natural distribution, and can negatively impact BC's environment, people or economy. [5]

Integrated Pest Management (IPM) – is a decision-making process that includes identification and inventory of invasive plant populations, assessment of the risks that they pose, development of well-informed control options that may include a number of methods, site treatments and monitoring. [4]

N**oxious Weed** – any plant species designated by the *BC Weed Control Act* to be a noxious weed, and includes the seeds of noxious weed. [5]

Appendix 1. List of Introduced Invasive Species, Pre-Restoration Work on Site

(source: List adapted from Ecoscape Environmental Consultants Ltd.'s MCRI report. 2014. Appendix 1. Introduced invasive species present at the site pre-restoration with recommended management priority level. Additional priority recommendations incorporated into the list from the MCRI Riparian Management Plan).

Common Name	Latin Name	Priority level
alfalfa	*Medicago sativa*	Low
birds-foot trefoil	*Lotus corniculatus*	Low
black locust	*Robinia pseudoacacia*	Med- high
black medic	*Medicago lupulina*	Low
bladder campion	*Silene vulgaris*	Low
Canada thistle*	*Cirsium arvense*	High (mandatory)
catnip	*Nepeta cataria*	Low
cheatgrass	*Bromus tectorum*	Med- high
chicory	*Cichorium intybus*	Med- high
clasping leaved peppergrass	*Lepidium perfoliatum*	Low
climbing nightshade	*Solanum dulcamara*	Med- high
common barberry	*Berberis vulgaris*	Med
common dandelion	*Taraxacum officinale*	Low
common mallow	*Malva neglecta*	Low
common mullein	*Verbascum thapsus*	Low
common parsnip	*Pastinaca sativa*	Low
common plantain	*Plantago major*	Low
common St. John's wort	*Hypericum perforatum*	Low
common timothy	*Phleum pretense*	Low
creeping buttercup	*Ranunculus repens*	Med- high
crested wheatgrass	*Agropyron cristatum*	Med- high
curled dock	*Rumex crispus*	Med
dame's rocket	*Hesperis matronalis*	Med- high
field bindweed	*Convolvulus arvensis*	Med
field pennycress	*Thlaspi arvense*	Low
flixweed	*Descurainia Sophia*	Med- high
forget me not	*Myosotis stricto*	Med
heart-podded hoary-cress*	*Cardaria draba*	High
hoary alysum*	*Berteroa incana*	High
hounds' tongue*	*Cynoglossum officinale*	High
lamb's-quarters	*Chenopodium album*	Low
leafy spurge*	*Euphorbia esula*	High
night-flowering catchfly**	*Silene noctiflora*	High
orchard grass	*Dactylis gomerata*	Med
perennial ryegrass	*Lolium perenne*	Low
perennial sow-thistle*	*Sonchus arvensis*	High
pineapple weed	*Matricaria discoidea*	Low
prickly lettuce	*Lactuca serriola*	Low- med
quackgrass**	*Agropyron repens*	High
reed canarygrass	*Phalaris arundinacea*	Med- high

Russian olive	*Elaeagnus angustifolia*	High
scentless mayweed	*Tripleurospermum inodorum*	Low-med
Siberian elm	*Ulmus pumila*	High
smooth brome	*Bromus inermis*	Low- med
spotted knapweed*	*Centaurea maculosa*	High
sulphur cinquefoil*	*Potentilla recta*	High
tall tumble mustard	*Sismbrium altissimum*	Low
tree of heaven	*Ailanthus altissima*	High
Virginia creeper	*Parthenocissus quinquefolia*	High
weeping willow	*Salix babylonica*	Low
western mountain ash	*Sorbus scopulina*	Med
wormwood*	*Artemesia absinthium*	High
yellow flag iris*	*Iris pseudacorus*	High
yellow salsify	*Tragopogon dubius*	Med

**Listed in BC Weed Control Act and Weed Control Regulation- all regions or Okanagan-specific*
http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/10_66_85

***Listed in BC Weed Control Act - specific regional listing but not under Okanagan region*
http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/10_66_85

Appendix 2. Invasive Plant Species Observed on Site (2017-2020) - Post-Construction and Restoration Works

Common Name	Latin Name	Proposed Priority Level
Alfalfa	*Medicago sativa*	Low
Black medic	*Medicago lupulina*	Low
Burdock	*Arctium minus*	High (Regionally noxious plant)
Canada thistle	*Cirsium arvense*	High (Provincial noxious plant)
Common bugloss	*Anchusa officinalis*	High (Regionally noxious plant)
Common mullein	*Verbascum thapsus*	Low
Curled dock	*Rumex crispus*	Med
Dalmatian toadflax	*Linaria genistifolia ssp. dalmatica*	High (Provincial noxious plant)
Field bindweed	*Convolvulus sp.*	Med
Field peppergrass	*Lepidium campestre*	Med
Flixweed	*Descurainia sophia*	Med- High
Greater celandine	*Chelidonium majus*	Low
Hoary cress	*Cardaria draba*	High (Regionally noxious plant)
Hound's tongue	*Cynoglossum officinale*	Med- High (Provincial noxious plant)
Jimson weed	*Datura stramonium*	High
Kochia, summer cypress	*Kochia scoparia*	Med- High (Regionally noxious plant)
Loesel's tumble mustard	*Sisymbrium loeselii*	Low
Narrow hawksbeard	*Crepis tectorum*	Med
Reed canarygrass	*Phalaris arundinacea*	Med - High
Russian knapweed	*Acroptilon repens*	High (Regionally noxious plant)
Scentless chamomile	*Matricaria maritima*	High (Provincial noxious plant)
Siberian elm	*Ulmus pumila*	High
Spotted knapweed	*Centaurea biebersteinii*	High (Provincial noxious plant)
Tall tumble mustard	*Sisymbrium altissimum*	Low
White cockle	*Silene latifolia*	Low
White sweet clover	*Melilotus alba*	Low

Note: Dalmatian toadflax, which has been identified as occurring at the MCRI site, is considered to be provincially noxious. Dalmatian toadflax is usually treated with a biocontrol (a weevil species). Other identified invasive weed species are generally considered to be common nuisance weeds (Josie Symonds, BC MFLNRORD).

Appendix 3. MCRI Grass Seed Mix

Grass Species	Latin Name	% of Mix	Introduced/ Native
Crested wheatgrass	*Agropyron cristatum*	20%	Introduced
Slender wheatgrass*	*Elymus trachycaulus*	10%	Native
Tall wheatgrass	*Thinopyrum ponticum*	10%	Introduced
Hard fescue	*Festuca trachyphylla*	15%	Introduced
Perennial ryegrass	*Lolium perenne*	7%	Introduced
Annual ryegrass	*Lolium multiflorum*	15%	Introduced
Fall rye	*Secale cereal*	20%	Introduced
Canada bluegrass	*Poa compressa*	3%	Introduced

*Slender wheatgrass is a native species. The rest of the grass species are introduced.

Note: For areas with challenging growing conditions, this grass mix has proven to provide higher survival and effective coverage in areas with challenging growing conditions.

Appendix 4: Literature and Key Resources

- BC Ministry of Agriculture Food and Fisheries. *Seven Steps to Managing Your Weeds.* Province of B.C., 2002. https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/invasive-species/guidance-resources/7stepstomanagingyourweeds.pdf
- BC Ministry of Environment & Climate Change Strategy. Environmental Protection & Sustainability. Invasive Species webpage https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/invasive-species
- BC Weed Control Act http://www.bclaws.ca/Recon/document/ID/freeside/00_96487_01
- BC Weed Control Regulation http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/10_66_85
- Guide to Weeds in British Columbia. www.for.gov.bc.ca/hra/plants/weedsbc/GuidetoWeeds.pdf
- Invasive Species Council of BC. Invasive Species Toolkit for Local Government. 2014. https://bcinvasives.ca/
- Invasive Species Council of BC. List of Regulated Invasive Plants in BC. 2020. https://bcinvasives.ca/
- Inter-Ministry Invasive Species Working Group. Invasive Species Early Detection and Rapid Response Plan for British Columbia. November 2014. https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/invasive-species/guidance-resources/prov_edrr_is_plan.pdf
- Invasive Species Strategy for BC (2018-2022) https://bcinvasives.ca/about/invasive-species-strategy-for-bc
- Weed Identification Poster https://www.regionaldistrict.com/media/19074/Weed_ID_Poster.pdf
- Regional District of Central Okanagan Consolidated Noxious Weeds Bylaw No. 179. https://www.regionaldistrict.com/media/17193/Consolidated%20Noxious%20Weeds%20Bylaw%20179.pdf

Appendix 5: Treatment Strategies for Dealing With Specific Invasive Weed Species

(Source: ISCBC. Best Management Practices For Invasive Plants in Parks and Protected Areas of British Columbia. 2018 Edition)

- **Common Burdock** *Arctium minus*
  - For first year rosettes – easily remove by hand pulling.
  - Mature plants that are deep rooted, need to dig to remove most of the tap root as possible.
  - Remove flower heads which form burs. Prevent the dispersal of burs is important.

- **Common Mullein** *Verbascum thapsus*
  - For first year rosettes – easily remove by hand pulling.

- **Hound's-Tongue** *Cynoglossum officinale*
  - For first year rosettes – easily remove by hand pulling.
  - Mature plants that are deep rooted, need to dig to remove most of the tap root as possible.

- **Knapweed, Diffuse** *Centaurea diffusa*
  Knapweed, Spotted *Centaurea stoebe*
  - Taproot can be hand pulled if soil is moist.
  - Remove as much of the root system as possible.

- **Knapweed, Russian** *Acroptilon repens*
  - Highly competitive plant. Incomplete pulling or cutting can stimulate the remaining roots to re-sprout and can worsen the infestation
  - Continual, repeated cutting or pulling will eventually deplete the root reserves.

- **Reed Canary Grass** *Phalaris arundinacea*
  - Cut plants frequently and regularly (3 times/year for 4 years at a minimum) to prevent seed production and to weaken root reserves.
  - Spreading rhizomes are very difficult to pull and any remaining fragments will readily re-sprout.
- **Thistle, Canada** *Cirsium arvense*
  - Highly invasive plant. Incomplete pulling or cutting can stimulate the remaining roots to re-sprout and will worsen infestations.
  - Continual, repeated cutting or pulling will deplete the root reserves.