

Bow River 10 Street Gravel Bar Habitat Restoration Vision

Prepared for The City of Calgary by O2 Planning and Design Inc.

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HABITAT RESTORATION VISION

1 Project Summary and Mission Statement

Nature-based solutions and habitat restoration will repair, stabilize, and vegetate the Bow River's banks affected by construction as well as those currently impacted by informal human use. Rehabilitation of these sites will "enhance the natural environment through the deliberate reintroduction of species native to a given area or that are well adapted to the climate circumstance" (The City of Calgary Parks, 2014). Reference models were developed using riparian health assessment information collected from the north bank of the Bow River between the 10 Street C-Train bridge and the McHugh Bluff pedestrian bridge over the past 16 years and baseline inventory information collected on-site in 2023.

The project will include regulated and invasive weed management; informal trail closure and restoration; erosion control, slope stabilization, and revegetation in areas impacted by human use; erosion control and revegetation in areas impacted by construction activities; and revegetation of the gravel bars.

Mission statement: Restoration work will improve riverbank stability and resiliency and restore habitat and ecological connections within the project area.

1.1 Design considerations

Elements to support the mission statement that could be considered and integrated into design include the following.

1. Create formal river access points to allow other areas along the reach to remain undisturbed.
2. Use native vegetation with deep, stabilizing root masses in riparian areas.
3. Ensure riparian forests provide shade for fish habitat.
4. Collect seeds and germinate plant material at a local nursery for use in the project.
5. Install deep irrigation for use in bioengineering approaches (e.g., crib walls); abandon once plant material is established.
6. Create natural or natural-feeling barriers around restored areas to prevent unauthorized human access.
7. Sculpt river edges to allow water to access the flood plain where possible.
8. Employ a range of techniques to create habitat: plant diversity, structural diversity, habitat features, etc.
9. Install fencing to prevent herbivory and beaver damage in natural areas.
10. Incorporate strengthened or hardened river edges where erosion risks are moderate or high.
11. Integrate pre- and post-construction invasive species control to enhance the success of restored native ecologies.

2 Project Area Ecological Overview

The project area is located within the Foothills Fescue Natural Subregion of the Grassland Natural Region, where balsam poplar (*Populus balsamifera*), aspen (*Populus tremuloides*), and plains cottonwood (*Populus deltoides*) wooded areas are prevalent along rivers. Willow (*Salix* spp.), sedge (*Carex* spp.), and grass dominated communities are also common in riparian areas (Natural Regions Committee 2006).

2.1 Environmentally Significant Area

The Bow River and its riparian corridor within the City of Calgary has been determined to be an Environmentally Sensitive Area (CMRB 2024). The Bow River Valley has been designated as a National Environmentally Significant Area (ESA) (Fiera 2009). No provincial ESAs are present within the project area based on the 2014 provincial update (Fiera 2014).

2.2 River Morphology

According to the Calgary Rivers Morphology and Fish Habitat Study (KCB 2017), the risk of erosion along the south side of the Bow River is risk level 2, or moderate (Figure 1).

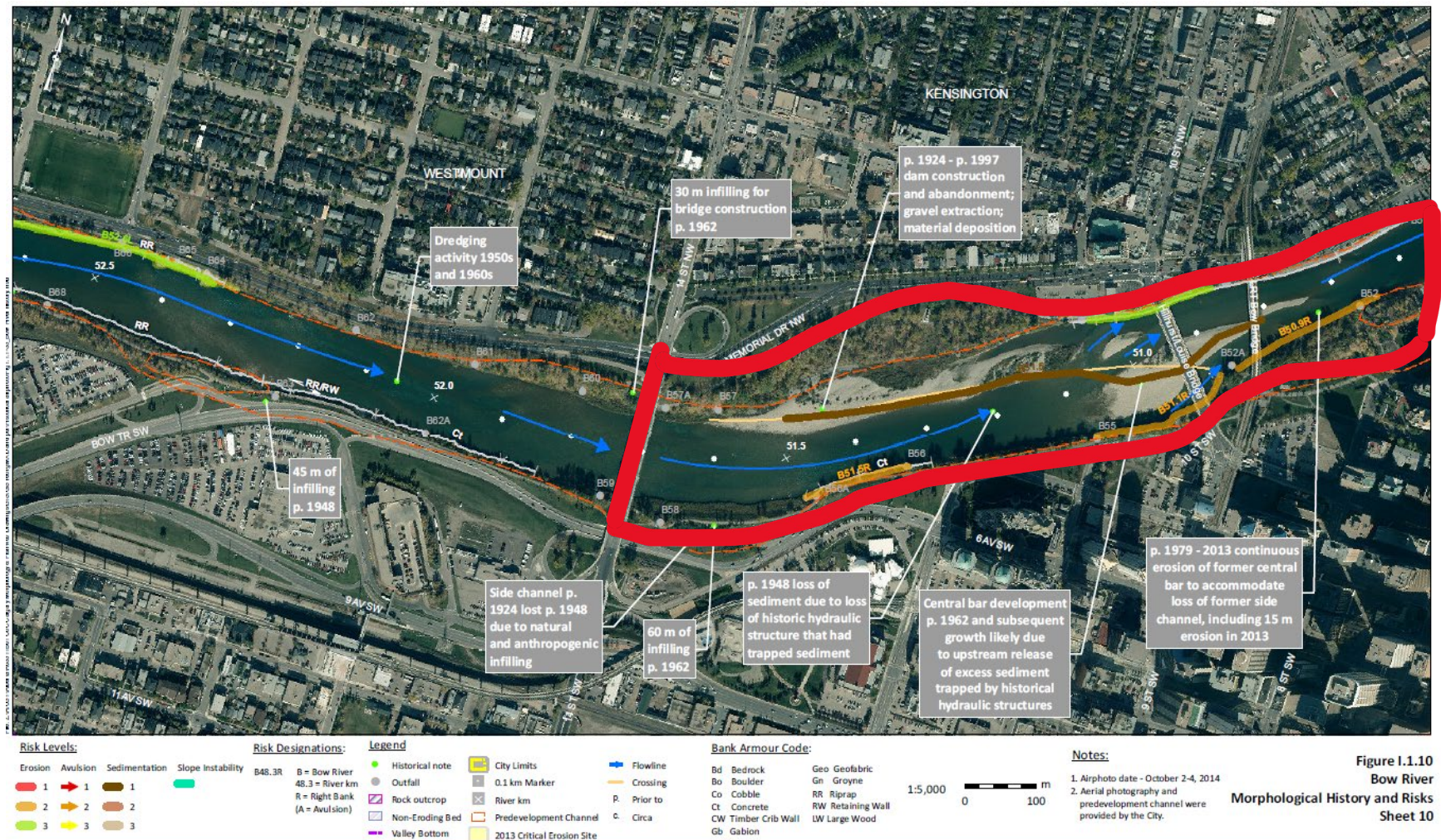


Figure 1. Morphological history and risks in the project area (KCB 2017). Approximate site boundaries shown in red.

2.3 Topography and Soils

The project area parallels the Bow River and is located in Soil Correlation Area 6 (AAF 2020); the thin black soil zone of south-central Alberta. The project area is characterized by shallow riverbanks, with nearly level slopes ranging from 0.5 to 2% on the upper banks, and mid and toe bank positions ranging from 10 to 15% slopes. Slopes range from 20 to 25% where the river has eroded the riverbank in a few locations within the project area (Matrix 2023).

Soils are Regosols and or Chernozems. Regosols are common along the Bow River and are often associated with steep erosional escarpments of riverbanks (Matrix 2023).

2.4 Existing Plant Communities

Upland and riparian vegetation communities are found within the project area. Upland communities are deciduous forest, and riparian communities include both deciduous and shrubby riparian areas as well as beach/gravel bar vegetation community types. Other communities include manicured park areas and disturbed vegetation in riprap areas along the riverbanks (Matrix 2023).

Upland

Areas above the 1:5-year flood level are considered upland. The upland deciduous forest community is dominated by young to mature balsam poplar with an understory of native shrub species including Saskatoon (*Amelanchier alnifolia*) and red-osier dogwood (*Cornus sericea*), and non-native shrub species like hedge cotoneaster (*Cotoneaster lucidus*) and caragana (*Caragana arborescens*)..

Riparian

The riparian deciduous forest community is dominated by balsam poplar (*Populus balsamifera*) with immature white spruce (*Picea glauca*), water birch (*Betula occidentalis*), Saskatoon, and red-osier dogwood in the understory. Varying levels of anthropogenic disturbances are evident within this vegetation community including compacted footpaths and garbage.

The riparian shrub community includes native species including balsam poplar saplings, red-osier dogwood (*Cornus sericea*), and sandbar willow (*Salix exigua*), and non-native shrub species such as Tatarian honeysuckle (*Lonicera tatarica*) and common cotoneaster (*Cotoneaster arborescens*). The presence of balsam poplar saplings indicates this might be an early successional forest community.

Beach/gravel bar community

The beach/gravel bar community has a limited amount of vegetation cover and sustains annual flooding and sediment loads. Shrub species are short and consist of sandbar willow (*Salix exigua*) and an ash species. Herbaceous species included a mix of native species such as tufted hair grass (*Deschampsia cespitosa*), alpine rush (*Juncus alpinoarticulatus*), and flat-topped goldenrod (*Euthamia*

graminifolia), and non-native species such as Kentucky bluegrass (*Poa pratensis* ssp. *Pratensis*), yellow clematis (*Clematis tangutica*), and common toadflax (*Linaria vulgaris*).

Marsh

A seasonal graminoid marsh community was found within the 1:2-year high water mark along the north bank of the Bow River (Matrix 2023). Herbaceous species included Sprengel's sedge (*Carex sprengelii*) and common great bulrush (*Schoenoplectus tabernaemontani*).

Disturbed

Areas of riprap were found predominantly along the north bank of the Bow River, closer to the east end of the project area. Vegetation within these areas was sparse and consisted almost entirely of non-native species. Species observed included creeping bellflower (*Campanula rapunculoides*), creeping thistle (*Cirsium arvense*), perennial sow-thistle (*Sonchus arvensis*), scentless chamomile (*Tripleurospermum inodorum*), and willow species (*Salix spp*).

2.5 Existing Ecological Condition

Riparian Health Inventory

The Alberta Riparian Habitat Management Society (Cows and Fish) Riparian Health Inventory assessed the riparian area to be in an unhealthy condition (ARHMS 2020). Vegetation is impacted by human and pet activities as well as river scouring (Photo 1 and Photo 2).

- 60% cover from woody plants (ARHMS 2020); poplars provide the main tree cover at 85% (2023 tree survey).
- Most woody plants have seedling/sapling cover in the understory and minimal dead/decadent cover (ARHMS 2020).
- Disturbance-caused plants have about 30% cover, mostly smooth brome, quack grass and Kentucky bluegrass (ARHMS 2020).
- Bare ground is mostly due to human-caused compaction (ARHMS 2020).



Photo 1. Compacted and bare ground on the south bank east of 10 Street.



Photo 2. Eroded and compacted riverbank on the south bank east of 10 Street.

Vegetation Surveys

No rare plants or rare ecological communities were observed during the vegetation surveys. Potential for rare plants to occur within the project is low, except in the seasonal graminoid marsh where rare plant potential is medium to high (Matrix 2023).

Tree Species Inventory

Balsam poplar (*Populus balsamifera*) constituted 85% of recorded trees, and every tree with a diameter at breast height (DBH) exceeding 50cm was identified as balsam poplar (Photo 3 and Photo 4 ()). Significant large specimens of balsam poplar were observed along the river path on The South Slopes, contrasting with the absence of trees of similar size in The North Channel. The health of some of these trees and the riparian habitat's biodiversity along The South Slopes are currently impacted by caragana (*Caragana lucidus*).



Photo 3. Large balsam poplar tree inventoried; main stem dead.



Photo 4. Large balsam poplar inventoried, main stem split at base.

Non-native / Invasive species

Non-native plants observed include:

- Creeping Bellflower (*Campanula rapunculoides*)
- Creeping Thistle (*Cirsium arvense*)
- Black Henbane (*Hyoscyamus niger*)
- White Cockle, Bladder Campion (*Silene latifolia*)
- Common Tansy (*Tanacetum vulgare*)
- Purple Loosestrife (*Lythrum salicaria*)
- Scentless Chamomile (*Tripleurospermum inodorum*)
- Russian Leafy Spurge (*Euphorbia virgata*)

Caragana (*Caragana lucidus*), dominant within The South Slopes, is an unregulated nuisance weed with invasive potential. A list of all species observed by Matrix during their site assessment can be found in the project Biophysical Impact Assessment (Matrix 2023).

2.6 Wildlife Habitat

The Bow River is a primary corridor within Calgary's ecological network (The City of Calgary 2020). However, habitat in the project area is mostly disturbed (varying levels of anthropogenic disturbances), fragmented, and of lower wildlife habitat quality relative to other habitat along the corridor within The City of Calgary limits (e.g., Inglewood Bird Sanctuary). The project area provides habitat for migratory birds, raptors, water birds, waterfowl, and semi-aquatic mammals that are accustomed to urban disturbances (e.g., human and traffic noise). Mammals like ungulates and furbearers use the Bow River corridor for movement between habitats.

The project area occurs within the provincially designated sharp-tailed grouse survey range and sensitive raptor range. Sharp-tailed grouse have not been detected and are not expected due to the absence of suitable lekking habitat and surrounding urban development. There is suitable raptor nesting habitat, however, no raptor nests were identified during the field surveys. No other provincially recognized wildlife ranges, water bodies, zones, and areas were identified.

Common amphibian species, including the boreal chorus frog and wood frog, are expected to occur based on sightings of these species at other natural areas in Calgary. Amphibian SAR (i.e., tiger salamander, Western toad, Canadian toad, and northern leopard frog) are not expected to occur as there is a high amount of disturbance, limited suitable habitat and/or the ranges for these species has contracted from their historic ranges. Although there is habitat for some amphibians (i.e., seasonal graminoid marsh, margins of the Bow River), none were observed during the wildlife surveys completed in 2023 (Matrix 2023). However, no targeted amphibian surveys (e.g., nocturnal call) have been recently completed within the project area.

Reptile species potentially occurring, historically observed, or recently observed in the BAA include three species of garter snake (i.e., wandering, plains, and red-sided) (Matrix 2023). Garter snakes are often found near the Bow River in Calgary and may den, forage and travel through riparian habitats in the project area. Wandering garter snakes were observed along the banks of the river south of Memorial Drive during a snake hibernacula survey in 2015 including near the 14 Street bridge, and an historical inactive snake hibernaculum was identified by the City west of the Louise Bridge south of the old firehall (Matrix 2015).

Potential bird habitat includes deciduous forest, manicured park areas, shrubby riparian areas and the vegetation along the beach/gravel bar, wetland, and open water river habitats. All habitats (including disturbed and developed areas) may be used by birds, although the less disturbed areas (e.g., deciduous forest and shrubby riparian areas) provide higher quality habitat. Recent surveys in June 2023 identified 29 bird species, with an additional 13 historically detected species, many of which are familiar along the Bow River and in Calgary. Although no active nests were found during the 2023 surveys, many of these species have the potential to nest in the area in future years. Of the species observed in 2023, one species (i.e., sora found in the seasonal graminoid marsh) is considered a species at risk. One inactive cliff swallow nest was identified during the breeding bird surveys.

Bats were detected in the project area in suitable summer roosting habitat (mature poplar tree cavities) but are not expected to remain over winter (Matrix 2023). Seven species potentially occur in the project area, five of which would be species at risk (Matrix 2023).

3 Reference Model

The existing plant communities' slope, aspect and relation to the river's water level (as described in Matrix 2023)) were used as the starting point for determining reference communities with appropriate ecosystem processes, structure, and function. The following resources were also referenced.

- Riparian health inventory conducted by Alberta Riparian Habitat Management Society (Cows and Fish) in 2020 (with comparison to RHAs it conducted in 2008 and 2015)
- *Classification and Management of Riparian and Wetland Sites of Alberta's Grassland Natural Region* (Thompson & Hansen 2002)

Since the primary goal of the restoration plan is focused on restoring ecological function rather than restoring to a climax community, the applicable reference habitats (described below) were considered as contemporary analogue communities to inform project design, including restoration prescriptions and plant and seed lists (to be developed). Factoring in natural variation within the context of future anticipated climate and environmental change, restoration targets were identified as follows.

- Upland sites, north-facing slopes: White Spruce/Common Horsetail Community Type
- Upland sites, south-facing sites: Aspen Poplar/Red-Osier Dogwood Habitat Type

- Riparian sites: Balsam Poplar/Red-Osier Dogwood Community Type
- Gravel bars: Sandbar Willow Community Type

Aspen Poplar/Red-Osier Dogwood Community Type

(Thompson & Hansen, 2002)

Aspen (*Populus tremuloides*) is found at the drier end of the wetness ranking of tree species that dominate riparian and wetland sites in Alberta (Photo 5). The Aspen/Red-Osier Dogwood habitat type is a major late seral/climax type in the Parkland Natural Region where white spruce (*Picea glauca*) is not generally found. This type is characterized by an overstory of aspen (*Populus tremuloides*) dominating an undergrowth of dense willow species (*Salix* spp.), red-osier dogwood (*Cornus sericea*), and other shrubs. This community has high value as wildlife cover and feeding areas for beaver, deer, and birds, and enhances fisheries by stabilizing banks and providing overhanging cover.



Photo 5. Aspen grove in Discovery Ridge Park, SW Calgary.

Balsam Poplar/Red-Osier Dogwood Community Type

(Thompson & Hansen, 2002)

The Balsam Poplar/Red-Osier Dogwood Community Type represents a mid-seral stage of primary succession. In this community type, an overstory of poplars dominates a potentially dense and diverse understory of shrubs and herbaceous plants (Photo 6). Other tree species that may be present in the project boundary include plains cottonwood (*Populus deltoides*) and narrow-leaf cottonwood (*Populus angustifolia*). Red-osier dogwood (*Cornus sericea*) is the diagnostic shrub for this type, and a variety of herbaceous species is usually present on undisturbed sites. Disturbed sites have a greater presence of buckbrush (*Symphoricarpos occidentalis*), awnless brome (*Bromus inermis*) and Kentucky bluegrass (*Poa pratensis*).



Photo 6. Balsam poplar forest in Fish Creek Provincial Park, Calgary.

White Spruce/Common Horsetail Community Type

(Thompson & Hansen, 2002)

The White Spruce/Common Horsetail Community Type represents a later seral stage of succession, with balsam poplar (*Populus balsamifera*) and aspen (*Populus tremuloides*) abundant in earlier seral stands along with seedling and sapling white spruce (*Picea glauca*). On sites where poplar trees (*Populus* species) gain early domination, young spruce (*Picea* species) establish and grow slowly under the closed canopy. Following disturbance, the understories of later seral stands appear to shift to heavier cover of common horsetail (*Equisetum arvense*) and greater presence of such forbs as wild white geranium (*Geranium richardsonii*), yellow avens, and large-leaved yellow avens (*Geum* spp.). This community type characteristically occurs on flat, low lying sites with poor drainage, on gentle toe slopes, seeps, and stream terraces (Photo 7).



Photo 7. White spruce community in Fish Creek Provincial Park, Calgary.

Sandbar Willow Community Type

(Thompson & Hansen, 2002)

The Sandbar Willow community type occurs on moist alluvial deposits subject to frequent annual flooding, ditches, and lakeshores (Photo 8). It is an early seral (pioneer) primary successional stage on newly deposited sediments and commonly occurs in open stands of balsam poplar (*Populus balsamifera*), narrow-leaf cottonwood (*Populus angustifolia*), or plains cottonwood (*Populus deltoides*). Sandbar willow is the major shrub species of this community type and persists under repeated flooding events, sometimes accompanied by red-osier dogwood (*Cornus sericea*), rose species (*Rosa* spp.), and chokecherry (*Prunus virginiana*). Yellow willow (*Salix lutea*) may be present, indicating a possible successional trend toward communities dominated by that species. The herbaceous layer may include a wide variety of pioneering species.



Photo 8. Sandbar willow community type on the 10 Street gravel bar.

4 Restoration Goals, Objectives, and Prescriptions

The following table (Table 1) outlines the goals and objectives for the project. It includes targets for each objective and how it will be evaluated. The prescriptions describe the restoration method used on site and its anticipated time frame to be complete (to be added). Time frames for the project can be defined as:

- Construction period (CCC): Up to construction completion
- Short-term (FAC): 3 years after construction completion (i.e. establishment/ maintenance period)
- Long-term: 3+ years after construction completion

Performance measures are linked to Cows and Fish riparian health parameters (Cows and Fish 2023). Cows and Fish assess riparian health every five years, providing a regular and reproducible score of riparian ecosystem health and function that the City can use to assess restoration performance over time.

The City of Calgary is developing a protocol to assess the success of restoration projects. This protocol will guide the development of targets and performance measures at later stages in this project.

Table 1: Goals, prescriptions and performance measures to guide restoration activities.

Goal	Objective / Target	Prescription	Performance Measure
1. Improve bank stability and resiliency	Create suitable grades to allow river to access the flood plain	• Ensure the floodplain is accessible to flood flows by repairing banks that are severely undercut.	• Floodplain accessibility within the restoration polygon (Cows and Fish parameter 15). • Riverbank root mass protection (Cows and Fish parameter 9).
	Riverbanks within restoration polygons have 95% cover of native woody vegetation with known deep root production	• Preferred planting time is late fall at onset of dormancy cycle for woody vegetation. Seed in the spring or late fall. • Protect new woody plantings with beaver fencing. • Perform establishment measures (e.g., watering) and control weeds for 3 years. • Perform consistent inspections and management during the establishment period.	• Human-caused bare ground (Cows and Fish parameter 10). • Riverbank root mass protection (Cows and Fish parameter 9). • Live woody vegetation removal by beaver or human cutting/clearing (Cows and Fish parameter 5b).
	Within restoration polygons, there is no bare ground greater than 300x300mm	• Minimize soil exposure during construction. Prevent erosion with appropriate vegetation cover and erosion mitigation techniques. • Seed the repaired areas with appropriate native vegetation cover crop. • Monitor human activities and if needed provide further barriers or signage to prevent unwanted movement. • Mow native grasses after seed set and leave seedheads on ground to assist regeneration.	• Human-caused bare ground (Cows and Fish parameter 10). • Total canopy cover of woody species (Cows and Fish parameter 6).
	Riverbanks at high risk of erosive forces are strengthened.	• Bioengineering, together with appropriately spaced native woody vegetation, will create resiliency to future erosional forces on the banks. Options include vegetated cobbles or brush layers above cobbles and/or boulders (e.g., Harvie Passage).	• Riverbank root mass protection (Cows and Fish parameter 9).

Goal	Objective / Target	Prescription	Performance Measure
2. Restore ecosystem functioning and associated wildlife habitat	100% native or future-native species to be planted with enough species diversity to achieve structural layering. Target is presence of each layer (tree, shrub, grass).	• Only use species that are approved, locally sourced, and available native plant species. The plant list will be developed to include sufficient biodiversity to achieve the objective. Plant list will also consider structural layering to create a typical ecosystem structure and provide wildlife habitat. • Collect seeds prior to construction and germinate at a local nursery for re-use within the project area. • Preferred planting time is late fall at onset of dormancy cycle for woody vegetation. Seed in the spring or late fall. • Establishment measures to improve survivability rates of planted/seeded vegetation (e.g., watering, weed control, fertilizing, over-seeding, cover crops, weed smothering, etc.) • Pre- and post-construction removal of noxious and invasive species. • Perform establishment measures and control weeds for 3 years. • Controlled access points/paths will be incorporated, as well as barriers and signage to manage human activities and limit damage to vegetation during establishment. • Beaver fencing will be used to prevent loss of woody vegetation during establishment.	Riparian communities: • Cottonwood and balsam poplar regeneration (Cows and Fish parameter 1). • Regeneration of other native tree species (Cows and Fish parameter 2). • Regeneration of preferred shrub species (Cows and Fish parameter 3). Upland communities: • More than 25% of the total area is occupied by all woody species. • Less than 5% of the site is covered by unwanted plants. • All structural layers are present. • Less than 5% bare ground.
	Create wildlife habitat at 10 locations within the project area	• Plan for habitat features and niches, including the grading of rough and loose riparian and upland terrain, sunning rocks on south-facing bank, cobble and muddy shorelines, islands, rock and wood debris piles. • Create snags and install bee hotels. • Pick indicator species from the BIA (brown trout? Other indicator species? Ducks? Bats?) and target interventions to support its habitat.	• Number of wildlife habitat features installed.

5 Restoration Hypothesis

Without intervention, continued erosion of the south bank during high-water waters is expected to undermine the integrity of the Regional Pathway and Bow Trail. In addition, human caused disturbance has resulted in reduced canopy structure and increased bare ground both on the south bank and throughout the project area. These factors have contributed to the proliferation of noxious and exotic weeds throughout the project area and increased levels of erosion.

6 Monitoring Program

The following monitoring strategy is recommended to provide an assessment of progress and success relative to the goals of the restoration plan. It is intended to provide a representative view of the ecological health of the project area.

1. Establish polygons along the reach to encompass the entire project area. Describe the treatment applied to each: “restoration” or “no restoration.”
2. Randomly select 10% of the “restoration” polygons as test plots. Assess riparian health at the test plots at one-year intervals during the maintenance period.
3. At the conclusion of the monitoring program, assess an un-restored polygon adjacent to each test plot. This will allow comparison between the test plots and the “no restoration” condition.

Monitoring may occur yearly and may be completed by visual inspection and photomonitoring. Photomonitoring locations will be determined in the final restoration report and baseline photos obtained prior to the start of restoration activities. Photomonitoring logs will be included in progress reports and the final restoration closeout report. Objectives and measurable targets will be described in a Restoration Wheel so that progress is tracked graphically from pre-project to closeout.

6.1 Adaptive Management

The management approach during the maintenance period will be adaptive in response to site conditions and responses to previous activities. Information from the monitoring program will inform the restorative activities implemented in response to site-specific conditions. Adaptive management is essentially a series of well-informed experiments. If objectives are not being met, The City may consider implementing alternate management strategies, including barriers to human and wildlife access, and/or the implementation of engineered solutions for bank and slope erosion within the project area.

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