

East Bowmont Natural Environment Park Design Development Plan



WATERSHED+



February 2014

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2.0 EXISTING CONDITIONS

The recently acquired Klippert Gravel and Sand Ltd. land (the gravel pit) within Bowmont Park offers the potential as a prime recreational destination for Calgarians. This disturbed piece of land offers scenic views, unique landscape features, and a wide range of habitat.

The study area includes steep escarpments with sweeping views, riverine forest and floodplain, ponds and wetlands, and open grasslands. Some areas are dominated by mature Balsam Poplar forest, others are in the process of regenerating from previous disturbances, and a significant area has been colonized by noxious weeds and invasive species that require controlling. Most of the escarpment is relatively stable while some requires stabilization.

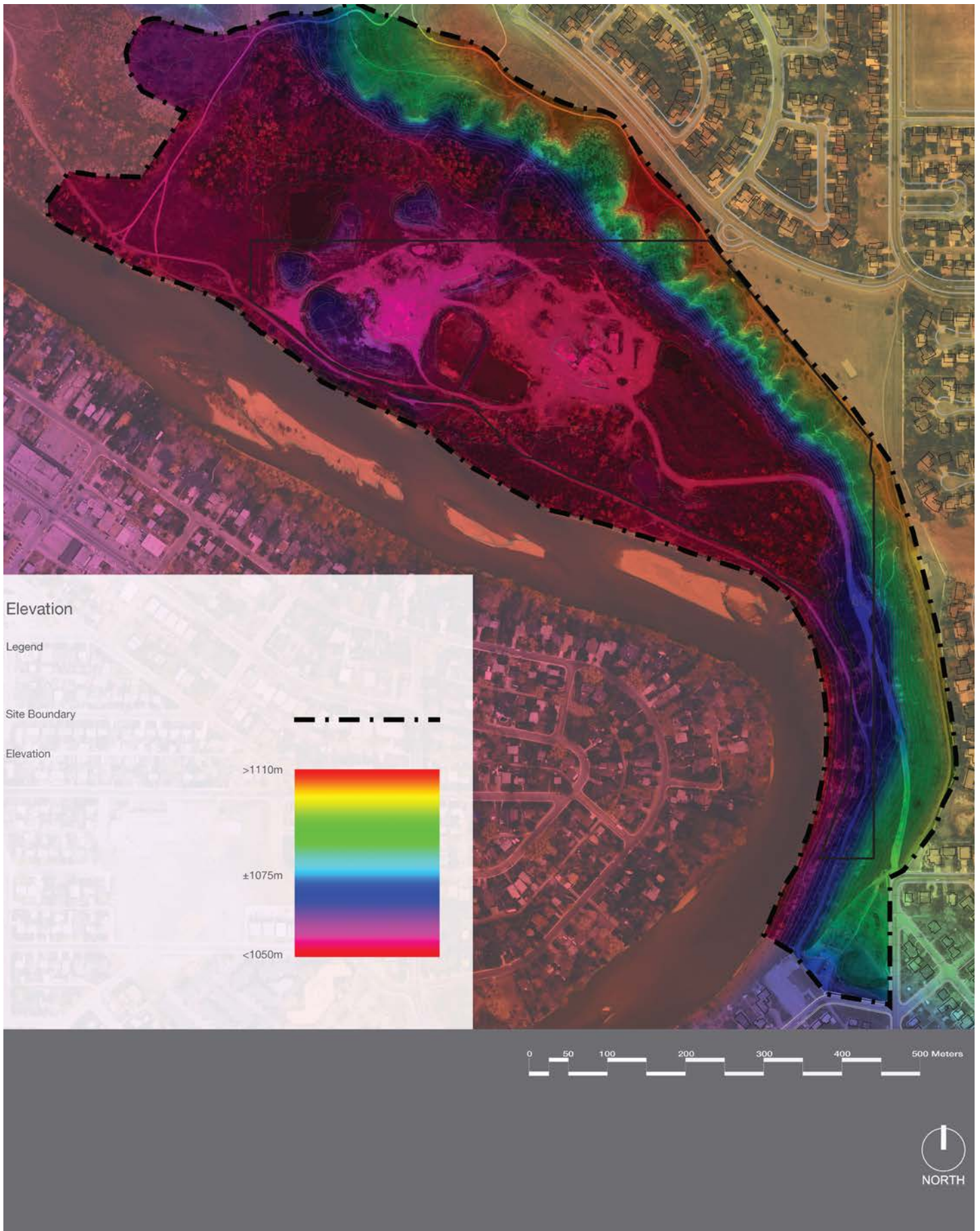
This section of the report outlines the existing conditions and character of the future East Bowmont Natural Environment Park (East Bowmont NEP), as well as the processes that have shaped the landscape over time.

Top Left: One piece of the escarpment where slope failure is occurring.

Top Right: A trail moving through the riverine forest.

Bottom: An overview of the project site.





2.1 Hydrography and Hydrology

The East Bowmont site includes a relatively flat floodplain area adjacent to the Bow River that is bounded by the river to the south and a steep escarpment to the northeast, rising to a height of about 50m above the floodplain. The topography of the site is shown on Map 6 Existing Elevations and Map 10 Existing Slopes.

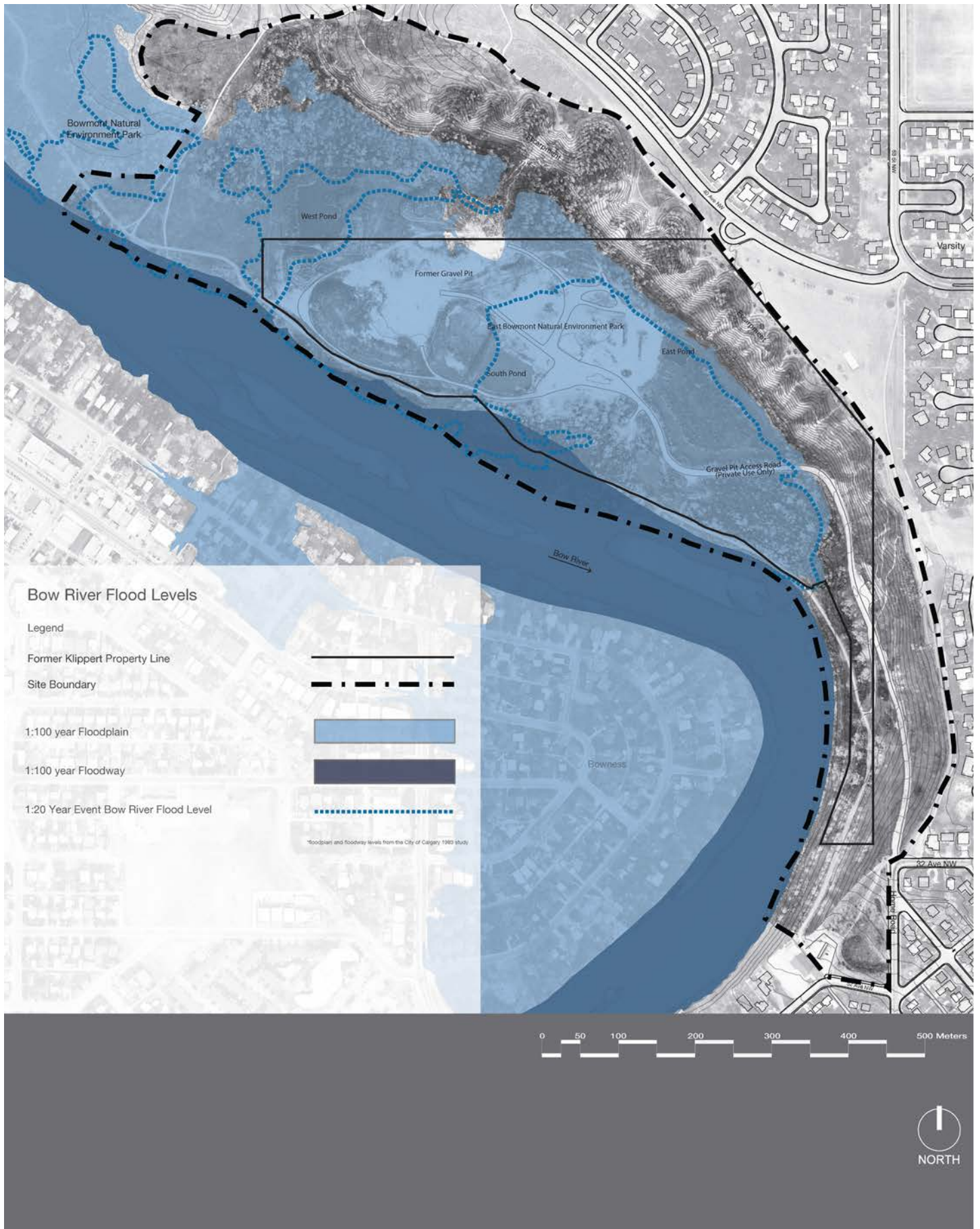
The surface drainage paths within the site were mapped using digital elevation data provided by the City of Calgary and the ArcHydro Geographic Information Systems tool. The areas of runoff accumulation during precipitation or snowmelt events were delineated as shown on Map 8 Existing Hydrography. Surface runoff from the top of the escarpment collects to flow down the scallop-shaped channels in the slope. Once the runoff reaches the bottom of the slope, it is assumed to infiltrate into the sand and gravel sub-surface layers. Precipitation falling on the site is assumed to do the same since there appear to be no active channels conveying runoff to the Bow River. Evidence of surface drainage does exist at the southern portion of the site where a culvert is located under the regional pathway.

Exceptions to the above include the three ponds that currently have open water conditions. The ponds appear to be either remnant depressions from gravel operations or were constructed as water storage facilities. It appears that ponds to the east and west of the gravel operation have been unused for some time. The south pond is within the mining footprint and according

Top: The Bow River as seen from the regional trail at the southern end of the study site.

Bottom: The west pond.





to aerial photography was used until recently. Groundwater investigations by Jacques Whitford in 2004² have shown contamination in the vicinity of this pond. Subsurface conditions in the ponds are unknown.

2.1.1 Flooding

The site is located almost entirely within the Bow River floodplain boundary for the 1 in 100 year flood event as defined by the City of Calgary Floodplain Study (1983³) (Map 7 Bow River Flood Levels (2012)). Water depths at the site may reach a maximum of 2.7m about 100m east of the gravel operations during a 1 in 100 year flood.

The floodway boundary runs approximately 10m inside the site boundary along the top of the bank of the Bow River; however, the boundary extends about 70m into the site to the southeast of the former gravel operation.

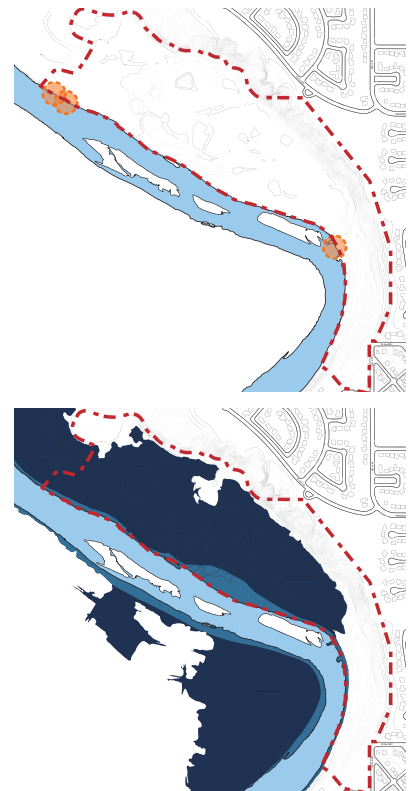
According to information from the City of Calgary hydraulic model (1996⁴), the Bow River will overtop the bank during flows in the range of the 1 in 20 year event (1,190m³/s). In 2005 a flood event close to 1 in 10 year magnitude inundated part of the site with shallow water, particularly to the south. In 2013 a near 1 in 100 year flood event covered the majority of the site, as shown in the photo below.

These flood levels will be taken into account when considering any type of permanent structure, required erosion protection and design feature that is proposed for the site.

² Jacques Whitford Consulting Engineers Environmental Scientists Risk Consultants, 2004, Phase II Environmental Site Assessment Klippert Property 32nd Avenue and Home Road NW Calgary, Alberta, The City of Calgary.

³ Alberta Department of the Environment Water Resources Management Services Technical Services Division, 1983, City of Calgary Floodplain Study - Volume One - Main Report, The City of Calgary.

⁴ The City of Calgary Water Resources, 1996, HEC-RAS Hydraulic Model, The City of Calgary.

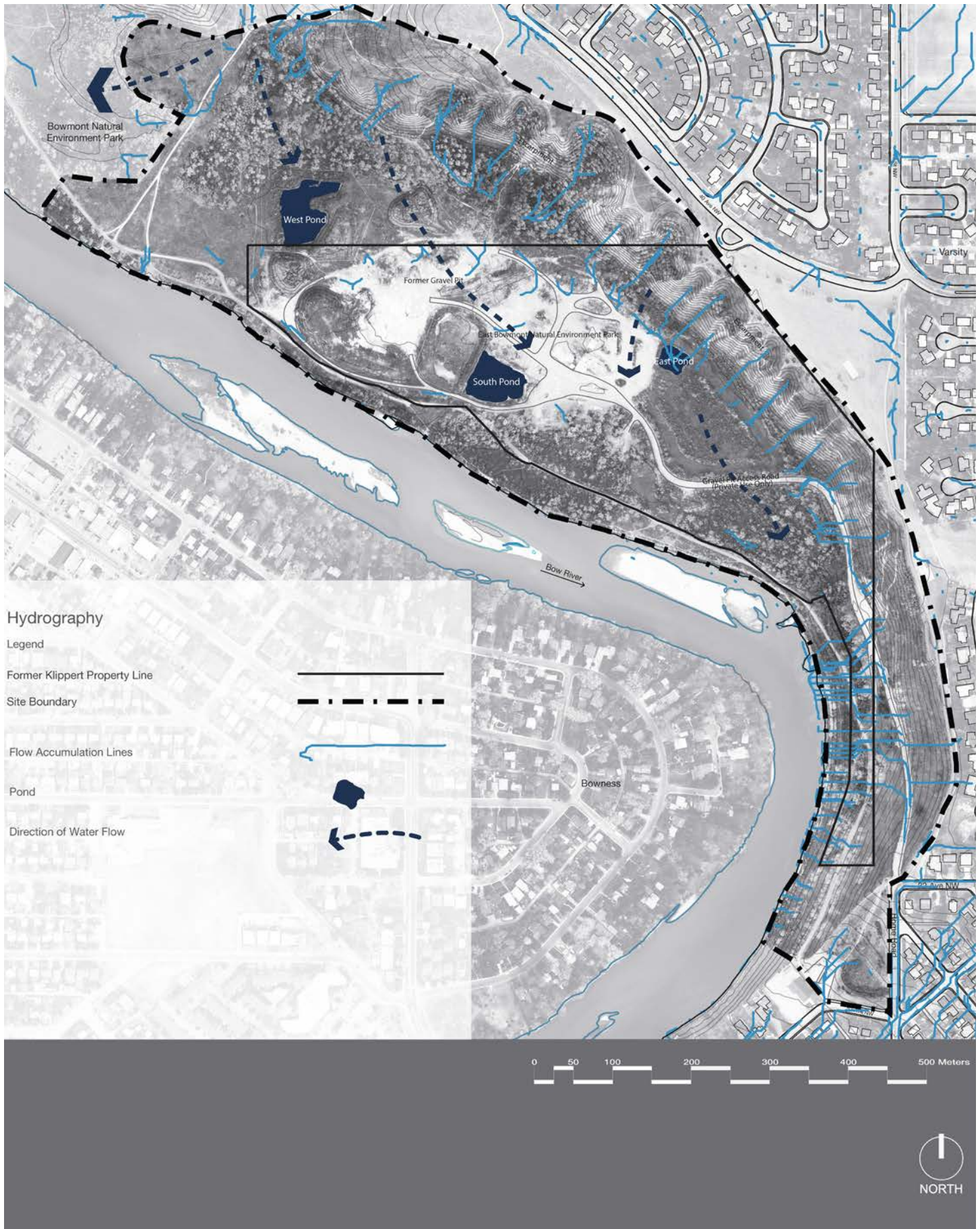


Top: Extent of the Bow River adjacent the study site. Orange circles indicate stormwater outfall locations.

Middle: Light Blue-Bow River;
Medium Blue = 1:100 year floodway;
Dark Blue = 1:100 year floodplain.



Above: Flood conditions during 2013 flood.



2.2 Groundwater

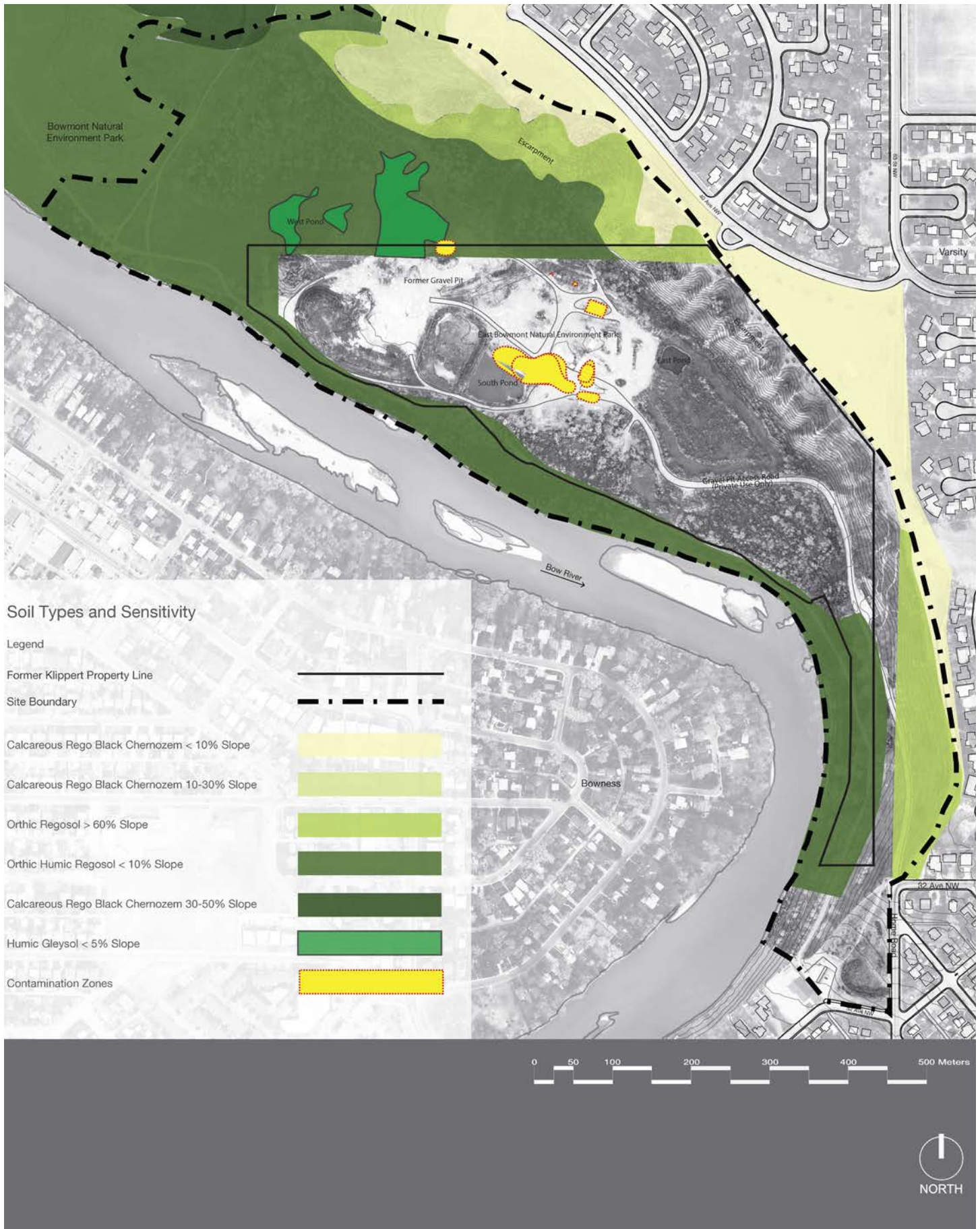
A groundwater investigation was conducted by Jacques Whitford (2004) over two periods during the spring of 2004. The depth to groundwater was found to range over the site from 2.0m to 4.2m in May 2004 and from 1.2m to 4.0m in June 2004. The groundwater flow direction was determined to be west to east based on water surface elevations. The flow velocity ranged from 2.4m/yr in the relatively undisturbed areas to 82m/yr in the gravel mining operations area.

The investigation also identified contamination from petroleum hydrocarbons, volatile organic compounds and heavy metals in the gravel mining operations area as shown on Map 9 Existing Soil Types and Sensitivity. Due to groundwater flow it is possible that the contamination boundaries and concentrations have changed since the study was conducted.

Top: Runoff collected in the former gravel mining area.

Bottom: A pond created by the surrounding spoil piles.





2.3 Geomorphology, Landforms and Soils

The sedimentary rock underlying the Calgary area is sandstone from the Porcupine Hills Formation. This formation was laid down over 60 million years ago when the land was flat and the climate was tropical.

The sandstone is typically overlain by glacial deposits, including till, glacial alluvial, and glaciolacustrine deposits. As the Bow River wound its way through the Calgary area, it has cut steep cliffs into the loose, fine-grained sediment deposited by glaciers and glacial lakes 10,000 to 25,000 years ago and through the Early Tertiary sandstone bedrock underlying the glacial deposits. This process produced the landforms seen today - escarpments, sandstone outcropping, ravines, floodplain, floodway, and the river islands.

2.3.1 Slopes and Soils

One of the most unique features of Bowmont NEP is the escarpment that dominates the northeast edge of the site. Averaging 50m in height, the escarpment is generally comprised of slopes of about 100%, or 45 degrees, with isolated areas approaching 150% (Map 10 Existing Slopes). The floodplain below the escarpment is flat to gently sloping, with the exception of the stockpiles of various excavated materials that remain from the gravel mining operations, many of which have side slopes of about 100%. Benches have been graded into the escarpment at the south end of the site where the maintenance access road and the regional pathway traverse the slope.

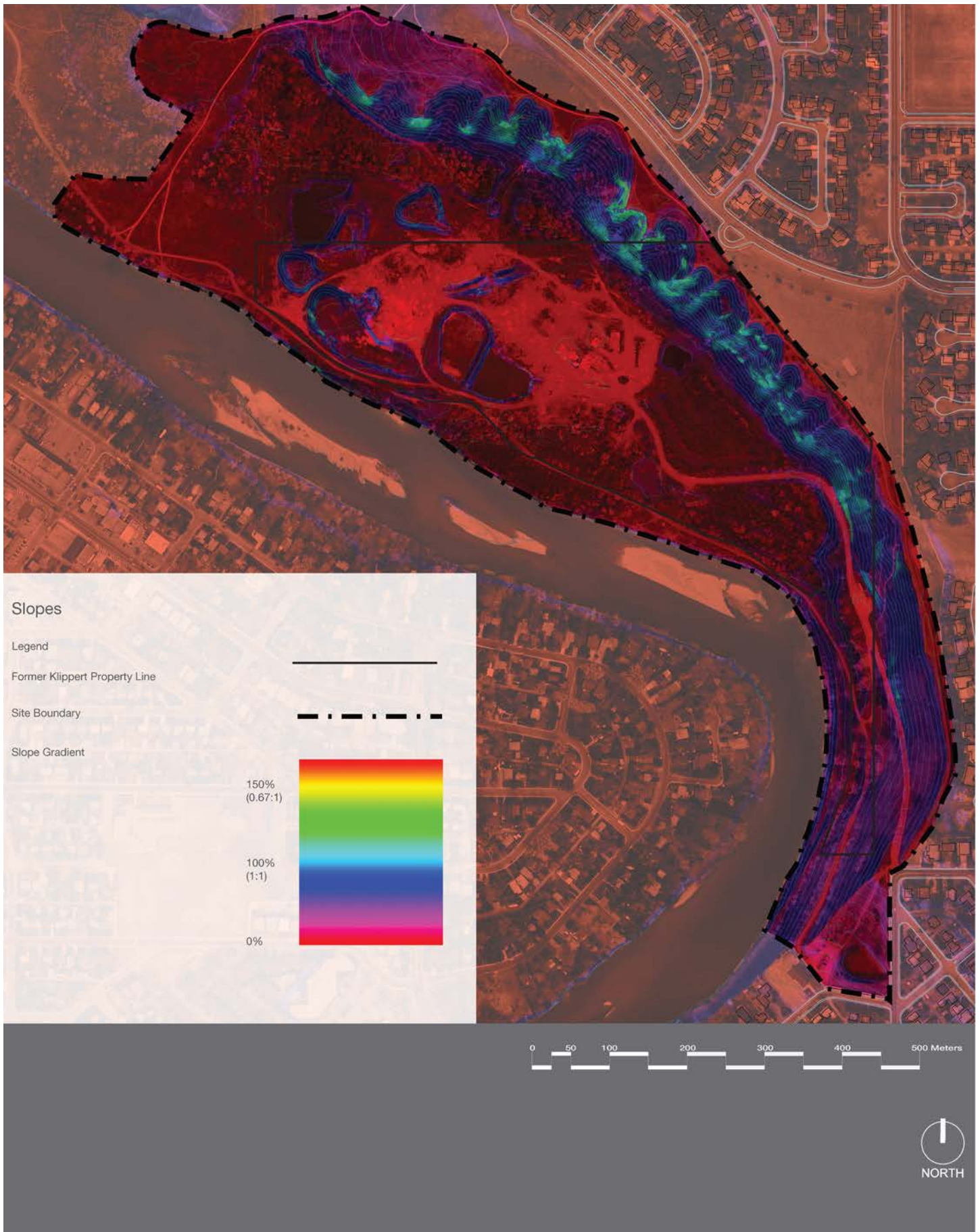
Soil studies adjacent to the Bowmont NEP site suggest that the escarpment is primarily made up of Orthic Regosols. "The characteristic feature of the Regosolic order is that the B horizon is absent or only has limited development (i.e., is less than 5 cm thick). Soils of the Regosolic order are most commonly associated with landforms where the land surface is (or has recently been) unstable. Because of the unstable surface, the soil has had little time to develop, and hence soil horizons are very weakly expressed if present at all."⁵ "Regosolic soils...occur naturally on hillslopes that have high rates of water

⁵ Website "Soils of Canada" (www.soilsofcanada.ca), Department of Soil Science, University of Saskatchewan.

Top: Slumping along the escarpment.

Bottom: The escarpment.





runoff and where slope processes cause downslope transport of soil.”⁴ “If the [slope] remains stable for a sufficient period of time, plants can occupy and stabilize the surface and contribute organic matter above and below the soil surface.”⁴ These soils are extremely vulnerable to erosion damage by water when unvegetated, and are highly susceptible to slumping.⁶

The flat area at the top of the escarpment and the more gentle slope at the north end of the study area are composed of Calcareous Rego Black Chernozems, which are typical of the Aspen Parkland region in which Calgary is located. The A horizon is darker than the underlying mineral horizons due to greater amounts of organic matter⁴. The risks of erosion damage by water when unvegetated and slope slumping are generally low for this soil type, although the risk of erosion becomes high on steeper slopes (10–30%) when the surface is unvegetated⁵.

The floodplain at the base of the escarpment is made up of Orthic Humic Regosols, except where the soil has been removed for gravel mining activities. Like the Orthic Regosols found on the escarpment, these soils have a limited or absent B horizon caused by frequent disturbance to the surface, in this case, deposition of sediments by river flooding. Accumulation of organic material from plants growing on the surface leads to formation of LFH horizons (organic horizons developed primarily from the accumulation of leaves, twigs, and woody materials), and the addition of below ground material causes development of Ah horizons⁷. If the surface remains stable, “with time the organic acids from the organic material and the weathering action of water penetrating the layer beneath the A horizon will lead to the development of a weak B horizon and ultimately the soil will be classified into a different soil order.”⁶ Because of the gentle slopes of the floodplain area, the risks of erosion damage by water when unvegetated and slope slumping have been characterized as negligible and low⁸.

⁶ Golder Associates, 2007, Bowmont Natural Environment Park Biophysical Impact Assessment and Restoration Plan.

⁷ Website “Soils of Canada” (www.soilsofcanada.ca), Department of Soil Science, University of Saskatchewan.

⁸ Golder Associates, 2007, Bowmont Natural Environment Park Biophysical Impact Assessment and Restoration Plan.

Top: Relic spoil piles.

Bottom: West pond with spoil piles in background.



Some of the stockpiled materials in the former Klippert property have been identified as Humic Gleysols, which are not typical of the river floodplain environment. Grouped around the west pond, these soils are created by “prolonged water saturation of the soil profile.”⁶ “In the grassland and non-boreal regions of the Prairies, saturated conditions result from both concentration of surface water flows (runoff) into depressions or from the groundwater table rising to an elevation where it intersects with soil forming processes.”⁶ The humic layer refers to an organically enriched A horizon greater than 10cm thick. Often such soils can result from the translocation of A horizon from upper slopes to depressions through water erosion.⁶ The presence of these soils suggest that either the west pond had existed for a sufficient amount of time as to alter the soils surrounding it, or that the soil piles surrounding the pond are comprised of clay soils excavated from offsite and stockpiled within the gravel pit. Other stockpiles within the gravel pit have not been classified, but largely consist of gravelly material that is lacking in topsoil.

2.3.2 Geological Forms and Processes

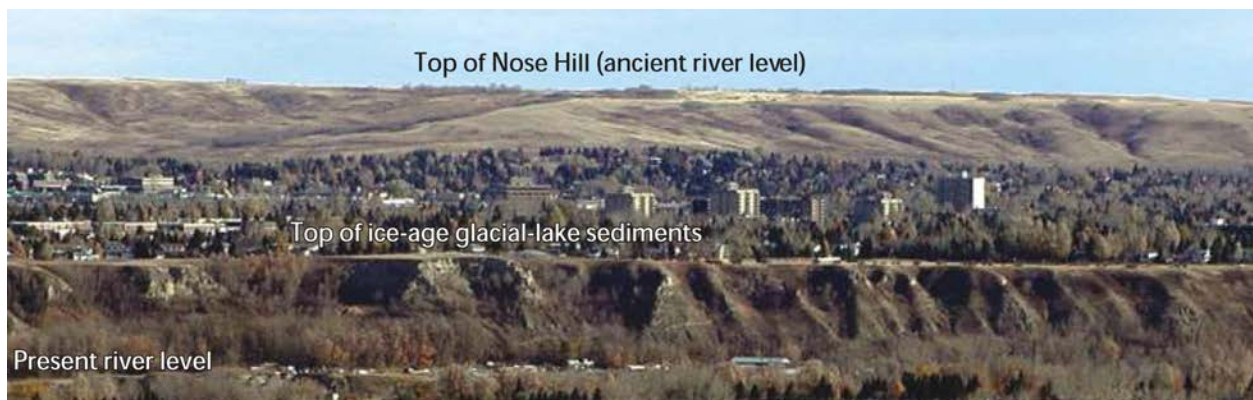
The superficial geology in the Bowmont area is the result of millions of years of erosion and deposition by rivers, lakes and glaciers.

Over 1.8 million years ago during the middle and late Tertiary period, rivers flowing out of the Rocky Mountains eroded and transported the early Tertiary and Cretaceous bedrock and deposited it on the valley bottom of the time (what are the major uplands of today) in the Calgary area. Erosion continued into the early Pleistocene with the ancestral Bow River cutting a valley in the sandstones and siltstones of the Porcupine Hills formation nearly to the level of the present day valley bottom. This Bow Valley was carpeted with gravel deposited by the ancestral Bow River.

Below: Historical River Levels: Terry Poulton, GSC¹.

¹ Poulton, T, Neumar, T, Osborn, G, Edwards, D, Wozniak, P 2002, *Geological Survey of Canada Miscellaneous Report 72, 2002*. Geological Survey of Canada, Calgary, Alberta.

Between about 18,000 and 15,000 years ago, the Bow Valley glacier advanced from the Rocky Mountains and filled the Bow Valley with till of the lower Spy Hill Formation. The Bow Valley glacier was overridden by the Laurentide Ice Sheet that advanced into the Calgary area from the northeast and deposited till of the upper Spy Hill Formation. As the glaciers melted, several lakes were



formed. In particular, a temporary lake referred to as Glacial Lake Calgary was impounded between the two glaciers and filled the broad depression between the outer limits of the Bow Valley, from Nose Hill in the north to Broadcast Hill in the south. The fine-grained silty to sandy sediments of the Calgary Formation were deposited in layers on the lake bottom over the glacial till.

As the glaciers melted exposing progressively lower outlets, the Bow River cut its valley back down to near its present level, re-eroding and re-depositing gravel at each level. The river cut its way through the deposited layers of lake, glacial and river sediments; hence valley walls in the project area reveal (from bottom to top) bedrock, early river gravels, glacial till and glacial lake deposits. Because Bow River flows at that time were significantly smaller than the ancestral river flows, this new channel was created well within the boundary of the old valley that is bounded by Nose and Broadcast Hills.

The early postglacial period of downcutting ended about 13,500 years ago when the climate warmed significantly. Mountain slopes that were previously frozen became highly unstable and released large amounts of glacial debris to the Bow Valley in repeated debris flows. The Bow River transported and distributed a significant amount of this debris referred to as the Bighill Creek formation downstream. In the Calgary-to-Cochrane corridor, as much as 10m of gravel and sand were deposited in the valley floor by the river.

The supply of sediment began to taper off around 11,800 years ago but by this time, the surface of the Bighill Creek Formation had formed a widespread terrace in the Calgary-to-Cochrane region, dominating broader areas of the valley bottom. By 10,000 years ago, the Bow River had downcut through the Bighill Creek Formation back down to the Paskapoo Formation of sandstone bedrock. The downcutting left terraces to the north and south of the river as the channel gradually became armored with large cobbles and boulders and assumed the alignment it occupies at present.

Below Right: The bluffs along the Bow River in northwest Calgary are an example of a steep slope cut by the Bow River in unstable glacial sediments. Lake sediments were deposited in Glacial Lake Calgary. Terry Poulton, GSC. Photograph by B.Groulx¹

Below Left: Digital rendering of the Laurentide Ice Sheet on today's landscape. Terry Poulton, GSC. Rectified Landsat on 60mDEM: Ron DaRoza¹

¹ Poulton, T, Neumar, T, Osborn, G, Edwards, D, Wozniak, P 2002, *Geological Survey of Canada Miscellaneous Report 72*, 2002. Geological Survey of Canada, Calgary, Alberta.

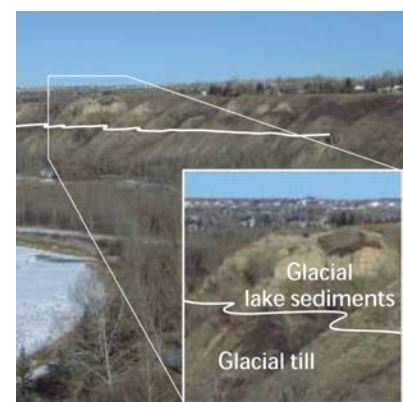
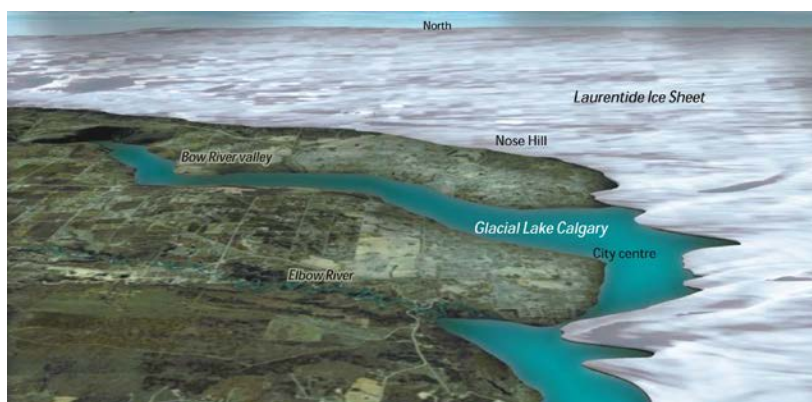


Figure 3. Historical Aerial Photos



1928



1948



1982



2010

2.3.3 Recent Forms and Processes

The site geomorphology was assessed using available historical aerial photographs from the years shown in Table 10 Historic Bow River Flows, which together can be used to determine bank stability and changes over time using mean daily flow calculations. Refer to Figure 3. Historical Aerial Photos, Figure 4. Historic Hydrography and Figure 5. Recent Evolution of the Site.

The East Bowmont site features three major elements that are the result of the processes described in the section above: a floodplain terrace, an escarpment and the Bow River. The majority of the site is in a lower flat area that is an example of a remnant terrace left by post-glacial downcutting by the Bow River through the Bighill Creek Formation. The terrace is at elevations where Bow River water levels periodically inundate and deposit fluvial sediments at high flows and functions as part of the floodplain for the Bow River.

The escarpment was formed during the early post-glacial downcutting by the Bow River and is composed of the lacustrine sediments from the Calgary Formation. It is highly susceptible to rapid and severe gully erosion where exposed on even gentle unvegetated slopes (Moran 1986). The scallop-shaped erosion features along the ridge of the escarpment show the history of gullying and minor slope failures. Recent slope instabilities have likely been caused by compaction and vegetation clearing from informal trail building along the slopes of the escarpment and from altered run-on patterns from upslope.

Large slope failures at the site have also been documented in the historical record. The largest documented slope failure is of the north bank of the Bow River below Crematorium Hill at the south entrance to the East Bowmont NEP site and took place sometime before 1948. A section of the bank about 450m long and 70m deep slumped into the Bow River and constricted the channel as can be seen in the aerial photograph from 1948. The slope was repaired and the river widened and protected with rock riprap along the north bank in

Table 10 Historic Bow River Flows

DATE	YEAR	MEAN DAILY FLOW (m ³ /s)
August 8	1948	174
August 21	1950	99.7
July 30	1953	239
September	1959	80.9 (Mean Monthly Flow)
May 22	1969	110
April 25	1982	66.3
May 11	1991	63.9
May 27	1995	129
September 27 or 30	2011	± 77

the early 1970's to reduce the likelihood of a repeat event and improve flood flow conveyance. The slope repair and riprap placement is first observed in the aerial photograph from 1982.

In the 1948 aerial photograph, there are several gravel bars and gravel bar islands shown in the Bow River. The largest, upstream from the site, appears to have once been part of the floodplain terrace. Over the span of photographs available, this gravel bar has been stabilizing and presently appears fully established and vegetated. With the exception of a gravel bar approximately mid-channel south of the site, other gravel bars are no longer visible. It is assumed that they were either displaced by Bow River flood flows, removed during construction of pipeline infrastructure or removed to improve flood flow conveyance. For example, a gravel bar adjacent to the site immediately before the 90 degree bend in the Bow River was likely removed during the repair of the north bank of the Bow River below Crematorium Hill to improve flood flow conveyance.

The bank of the Bow River upstream of the slope repair and rock riprap protection has not measurably changed over the historical record with the exception of the areas around each of the stormwater outfalls and sanitary sewer pipeline crossings. Rock riprap was placed along the bank to protect against localized erosion in these areas.

Prior to the extensive gravel mining operations that began in the early 1960's, there were several other local geomorphic features of note at the site. A natural drainage gully cut through the escarpment in the northeast corner of the site. At the base of the gully where it met the floodplain terrace, an alluvial fan was formed from deposited sediments. Flows from the gully passed through the alluvial fan and into a defined stream channel the length of the floodplain terrace running generally north-south along the toe of the escarpment to the Bow River. Additionally, a small Bow River side-channel was carved through the southwest corner of the floodplain terrace.

At present, the conditions at the site are largely comprised of remnants of gravel mining operations. The local features described above have been altered or are no longer present. The drainage gully and alluvial fan were reconfigured during the construction of storm and sanitary sewer pipelines. The stream channel along the toe of the escarpment is no longer identifiable. The Bow River side-channel was infilled at some point between 1969 and 1982; likely as part of the slope repair. The superficial features at the site now consist of relic spoil piles and remnant mining pits that have retained water and function as ponds.

Figure 4. Historic Hydrography

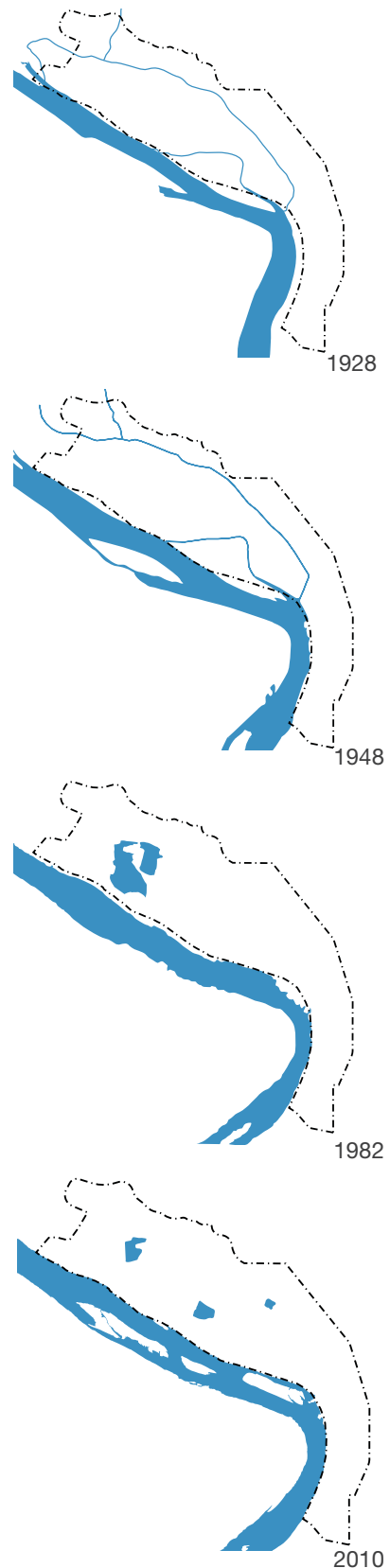
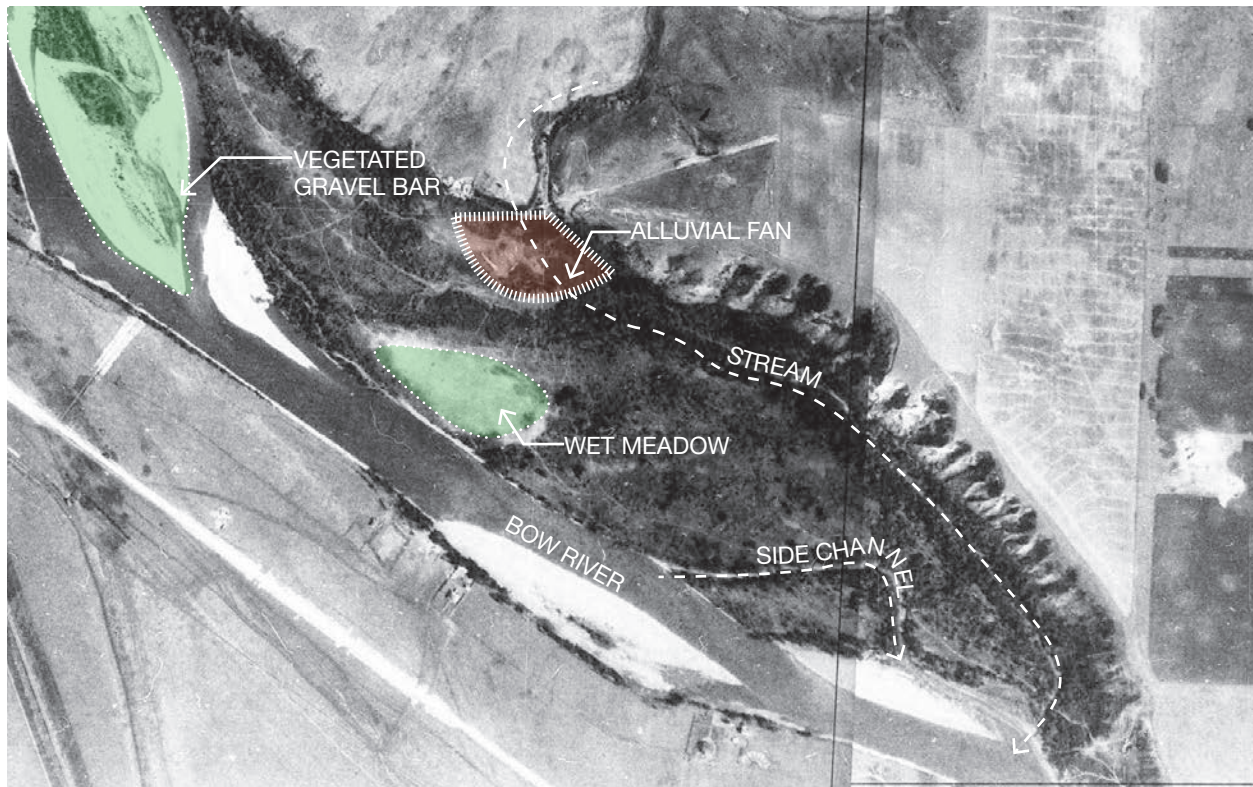
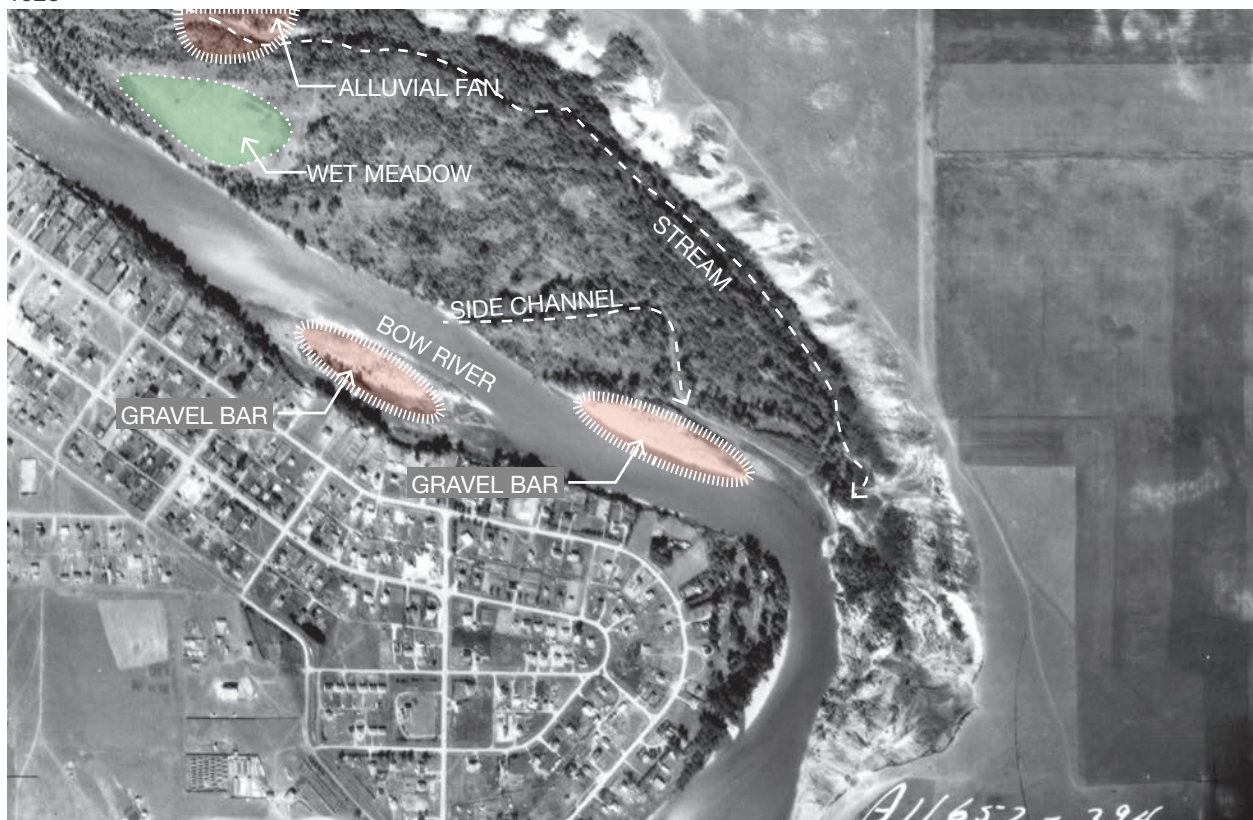


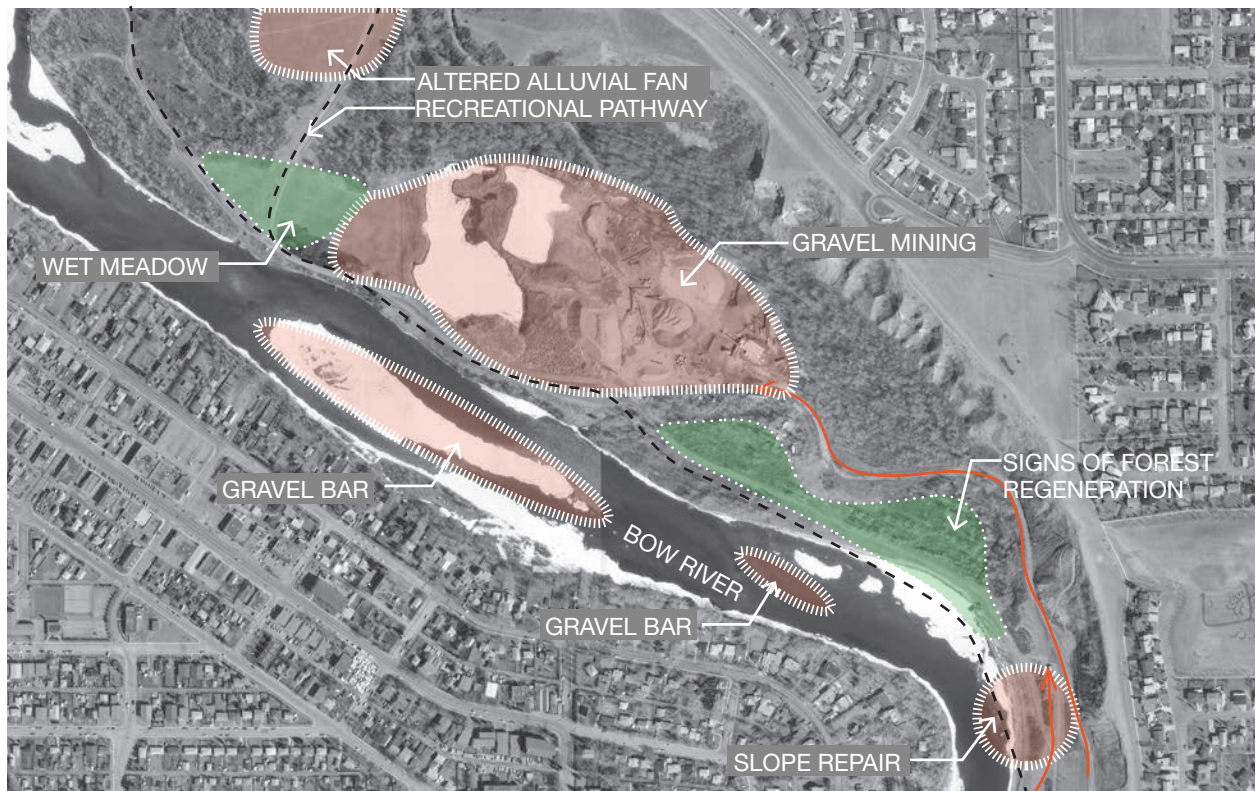
Figure 5. Recent Evolution of the Site



1928



1948



1982



2010

Figure 6. Home Road Slide Cross Section Pre-Remediation

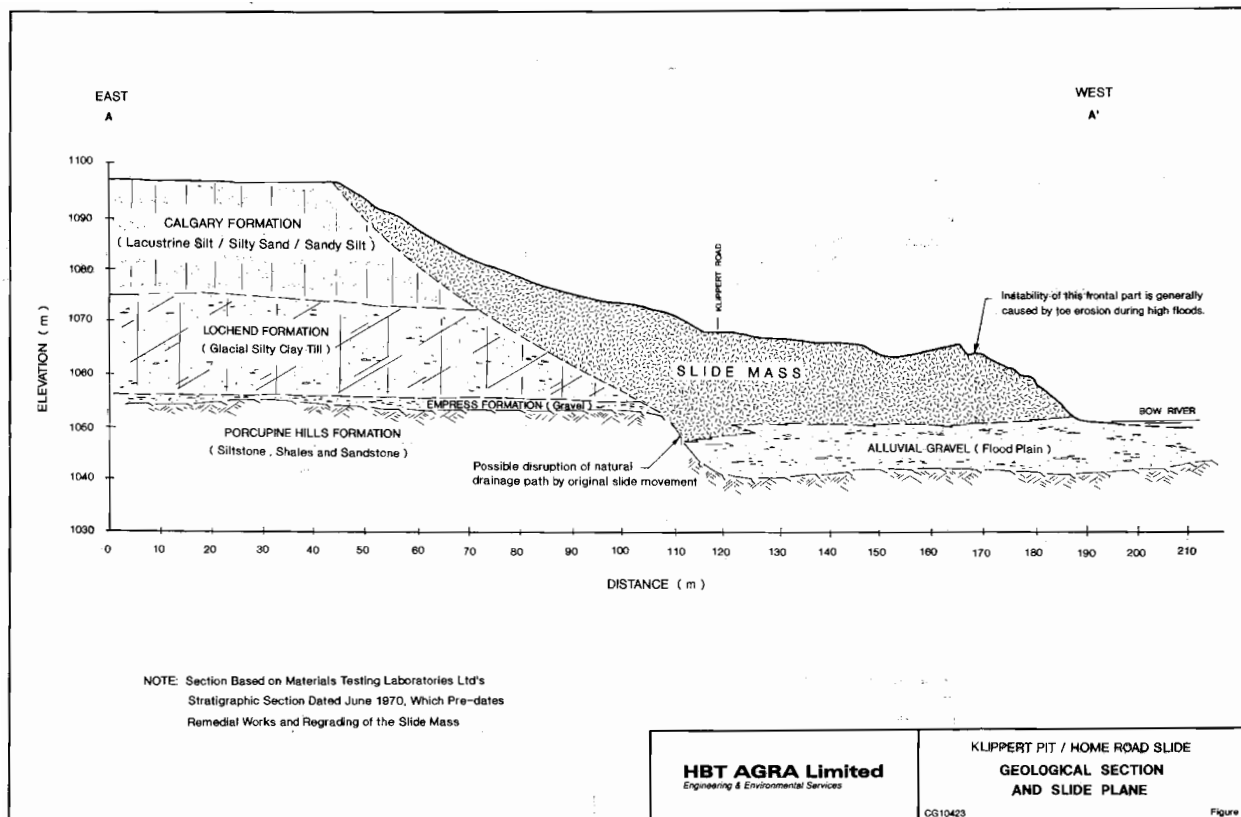
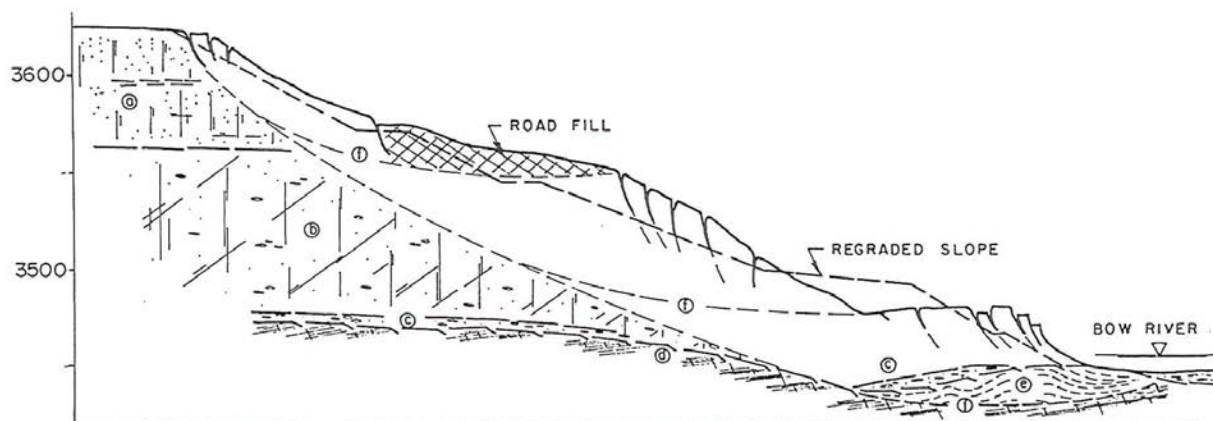


Figure 7. Home Road Slide Cross Section Post-Remediation



2.4 Geotechnical Considerations

During the 1950's and 1960's, a combination of slope undercutting along the river bank and construction of the gravel pit access road across the face of the escarpment led to a gradual slope failure at the southeast corner of the East Bowmont Park site, known as the Home Road Slide. The slide extended into the Bow River and resulted in constriction of the river channel, as shown in Figure 6. Home Road Slide Cross Section Pre-Remediation. It was determined that the grading and side slope embankments required to install the access road had impeded surface drainage and lead to the slope becoming surcharged by runoff. The constriction of the river channel also heightened the risk of flooding in Bowness. In the early 1970's, the landslide material was removed from the river, the slope was re-graded and covered with a 3m thick layer of crushed gravel and sand, and a series of perpendicular and horizontal pipe drains were installed in gravel trenches throughout the slope to help drain the runoff (see Figure 7. Home Road Slide Cross Section Post-Remediation). No significant movement of the slide has been recorded since the completion of this work.⁹

In 1992, Klippert Concrete Ltd. applied to expand its gravel mining operation into the southeast portion of the East Bowmont Park site. HBT AGRA Ltd. performed an impact assessment on behalf of The City of Calgary that included a preliminary hydrological and geotechnical assessment of the proposed expansion, although no test holes or other subsurface investigations were included in the work. The impact assessment concluded that any excavations should be kept well away from the toe of the Home Road Slide and the toe of the escarpment, and recommended a slope stability analysis for each area to determine an appropriate setback distance.¹⁰

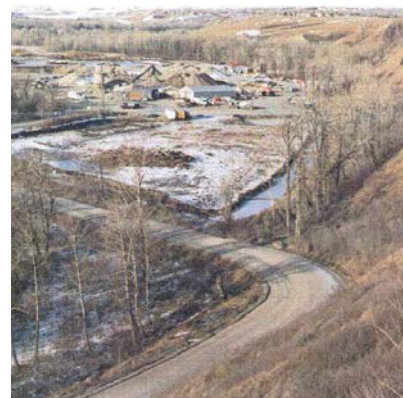
Historic aerial photos and reports, as well as recent evidence of surficial erosion and minor slumping along the escarpment indicate that this is a highly fragile feature that can be easily disturbed by even minor development. A detailed geotechnical investigation is recommended to assess the stability of the slope, especially if trail restoration or other park features are planned for these areas.

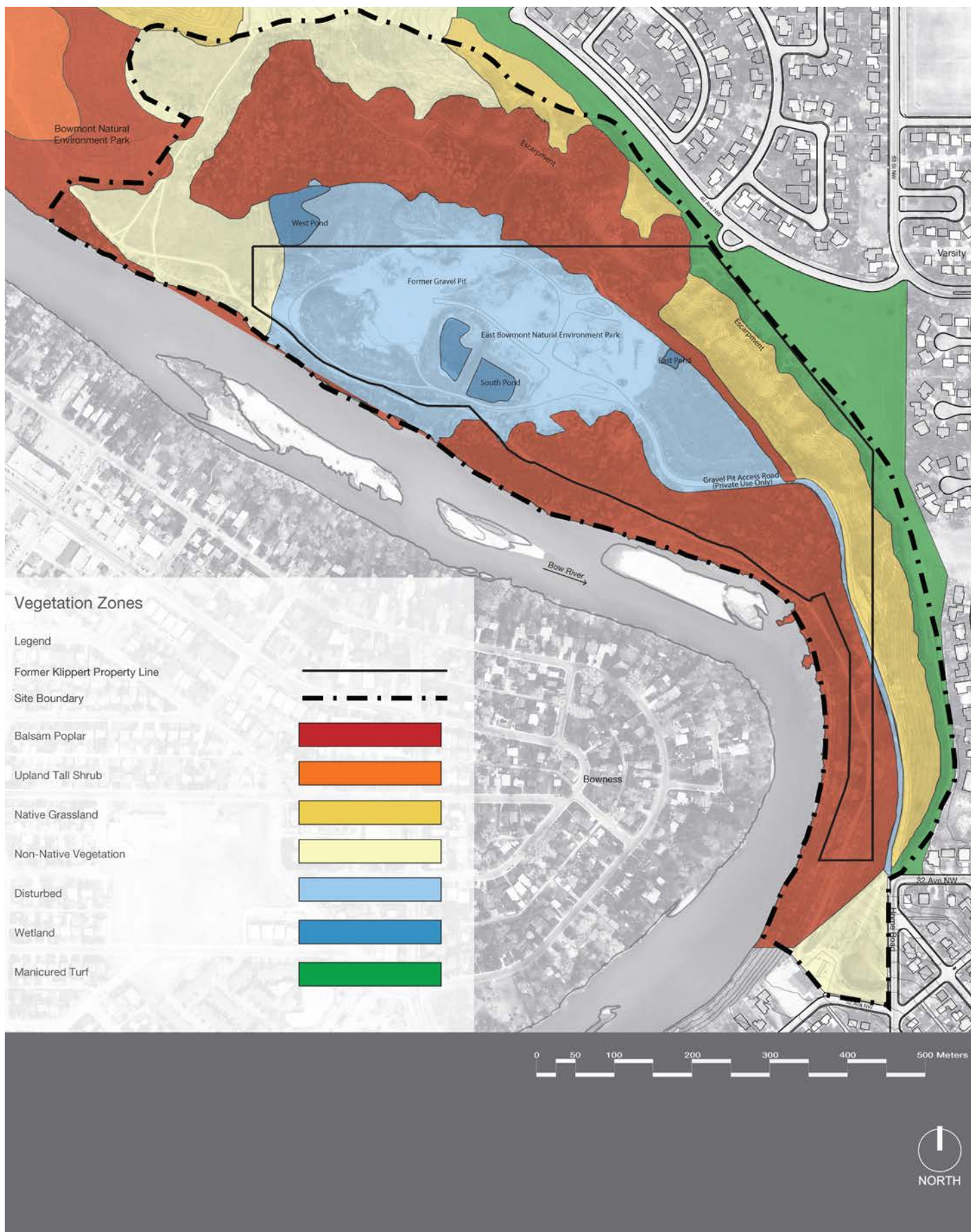
⁹ R. M. Hardy, J. I. Clark and M. Stepanek, 1978, A Summary of Case Histories Spanning 30 Years of Slope Stabilization in Calgary, Alberta

¹⁰ HBT AGRA Ltd., 1992, Klippert Gravel Pit Extraction Impact Assessment

Top: Moderate slumping on the escarpment.

Bottom: View of Klippert gravel operation in early 1990's.





2.5 Vegetation

Information on existing vegetation has been compiled from previous reports (Golder 2007¹¹; The City of Calgary 2004¹²; AECOM 2010¹³) and subsequent site visits in February 2012. The Klippert gravel operation was formerly listed as private property and was assessed for the first time during the Biophysical Impact Assessment (BIA) surveys in June 2012. The vegetation within the project area was further characterized during the preparation of the BIA and a summary of the results have been included here. The BIA forms a separate report independent of this document.

The geographically distinct vegetation communities have been identified as according to the Bowmont Natural Environment Park Management Plan (The City of Calgary 2004) for the purposes of this discussion. These areas were further characterized by Golder (2007) and serve to categorize management units within the park. The vegetation composition of these communities were also used to influence the planting prescriptions of reclamation and restoration areas identified in the Design Development Plan.

Bowmont Natural Environment Park is a floristically diverse area due to the varying topography and hydrological regimes. There is a range from dry grassland to wetlands shown on Map 11 Existing Vegetation Zones.

2.5.1 Balsam Poplar

Riparian forests develop as a result of natural flooding processes and have established along the rivers and creeks in Calgary. Balsam poplar forests have established on gravelly flood plain and terraces of the Bow River in moderately well-drained areas within Bowmont Park between the Bow River and the base of the escarpment. Age diverse stands, along with dense and variable shrub layers are present indicating that balsam poplar is regenerating through natural processes. These factors also indicate a mid-seral stage of forest succession.

The balsam poplar forests in Bowmont Park have encountered varying degrees of disturbance. Mature and relatively undisturbed balsam poplar forests have a developed shrub understory of red osier dogwood (*Cornus stolonifera*), willows (*Salix spp.*), water birch (*Betula occidentalis*), saskatoon (*Amelanchier alnifolia*), wolfwillow (*Eleagnus commutata*), or Canada buffaloberry (*Shepherdia canadensis*). The balsam poplar forest at the base of the escarpment has a diverse understory with mostly native plant species. However, localized populations of non-native forbs and shrubs are distributed unevenly throughout the understory and include many noxious weeds such

¹¹ Golder, 2007, Final Report Bowmont Natural Environment Park: Biophysical Impact Assessment and Restoration Plan, The City of Calgary.

¹² The City of Calgary Parks, 2004, Bowmont Natural Environment Park Management Plan, The City of Calgary.

¹³ AECOM Water, 2010, Stormwater Quality Retrofits East Bowmont Scoping Study, The City of Calgary.

as great burdock (*Arctium lappa*) and hound's tongue (*Cyniglossum officinale*). The balsam poplar forest adjacent to the Bow River is subject to heavy human use, and the understory is comprised of many non-native shrubs, forbs and grasses such as caragana (*Caragana arborescens*), smooth brome (*Bromus inermis*) and Canada thistle (*Cirsium arvense*).

2.5.2 Upland Tall Shrub

Taller shrubs are confined to specific areas of higher moisture such as depressions, ravines, floodable areas, or west, east- or north-facing slopes. Shrub lands are often a vegetation transition zone between the balsam forest and the grasslands or wetlands, and represent valuable edge for grassland and woodland wildlife species. Specifically, many species of birds take advantage of this habitat for nesting and foraging.

At Bowmont Park, tall willow communities (*Salix spp.*) commonly form dense thickets that present an obstruction to human use and are found on the lower, moister portions of a slope, adjacent to the wetlands or in sheltered ravines. Upland tall shrub communities are also comprised of red osier dogwood (*Cornus stolonifera*), saskatoon (*Amelanchier alnifolia*), chokecherry (*Prunus virginiana*), and water birch (*Betula occidentalis*). Low shrub species may also be part of the understory.

2.5.3 Low Shrub

Low shrub communities are present in areas of relatively higher moisture on south-facing slopes at Bowmont Park. These communities are composed of buckbrush (*Symphoricarpos occidentalis*), shrubby cinquefoil (*Potentilla fruticosa*), wolfwillow (*Eleagnus commutata*), or rose (*Rosa acicularis*). Canada buffaloberry (*Shepherdia canadensis*) and gooseberry (*Ribes oxycanthoides*) are present but not as common. Low shrub communities may also be found in micro-sites along the steep escarpment and in grasslands where pockets of moisture collect and may contain bearberry (*Arctostaphylos uva-ursi*) and juniper (*Juniperus communis*/*Juniperus horizontalis*).

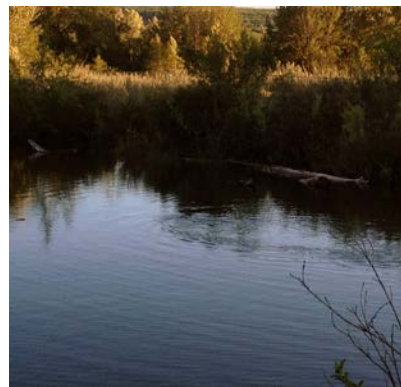
2.5.4 Native Grassland

Many areas of native prairie in Calgary have been altered due to the effects of human activities such as cultivation, grazing, and the introduction of non-native species. Most native grasslands grow in areas of high wind and sun exposure such as the south-facing slopes and upper benches in Bowmont Park. Grassland/juniper communities on the steep escarpments are mostly intact and demonstrate high native species richness (number of plant species) due to the unsuitability to cultivation and grazing. The presence of these grasslands is essential for maintaining slope stability. Some areas of the escarpment are subject to erosion and rutting due to opportunistic

Top: Manicured zones with primarily Non-Native Vegetation that has been planted and maintained to a high degree.

Middle: Wetland communities exist in ponds (shown below) where they have evolved within spoil pile boundaries and along the banks of the Bow River.

Bottom: Areas of disturbance within the site boundary are primarily located in spaces of former gravel extraction.



informal trails created by park users. These trails also provide openings for noxious and nuisance weeds to encroach and may reduce the species richness of this sensitive community. Wildflower populations that are common to grasslands in Bowmont Park are losing diversity due to ground disturbance and the subsequent increase in weeds such as smooth brome (*Bromus inermis*), and Canada thistle (*Cirsium arvense*).

Needle grasses (*Stipa sp.*), wheat grasses (*Agropyron sp.*), June grass (*Koeleria macrantha*) and Blue grama (*Bouteloua gracilis*) are typical of these grasslands and grow in open areas, while the rough fescue communities grow on slopes that are not as steep. Parry's oatgrass (*Danthonia parryi*) can be found with fescue in some areas.

2.5.5 Non-Native Vegetation

Bowmont Park has been affected by a number of activities in the past including agriculture (cattle and horses), recreational uses (camping, fishing, picnicking, walking), introduced species (smooth brome, Canada thistle), vehicles (off road) and utility use (power lines), and surrounding land use (roads, housing).

These various disturbances have resulted in areas that are unvegetated or dominated by communities like smooth brome/Canada thistle, balsam poplar /manicured grass and lawn grasses. Areas of non-native grasslands have developed as a result of material dumping, utility construction, and agricultural practices and through introduction of non-native invasive species. The majority of the non-native grassland is dominated by smooth brome grass, a non-native species that impacts the native grasslands and the forest understory in Bowmont Park. Smooth brome is not currently controlled by the Alberta *Weed Act*.

During site visits to the East Bowmont NEP site it was observed that many noxious weeds exist within the non-native grasslands. Species such as sow thistle (*Sonchus arvensis*), Canada thistle (*Cirsium arvense*), leafy spurge (*Euphorbia esula*) and common tansy (*Tanacetum vulgare*) should be eradicated if they are determined to be a threat to the surrounding plant communities. Prohibited noxious weeds such as knapweed (*Centaurea macrocephala*) must be destroyed under the Alberta *Weed Act*. Management or control of these introduced species is addressed in the BIA.

2.5.6 Wetlands

Wetland communities are typically situated in depressions along relatively flat terrain, or where the water table is in contact with the surface. Emergent wetland vegetation along the Bow River is not always present due to the steep banks in the Bowmont area. Cattails (*Typha latifolia*), sedges (*Carex spp.*) and rushes (*Juncus spp.*) are present in shallow bank areas, and in drier cut-off channels. Wet landscapes with muskweed (*Chara sp.*) and marsh reed grass (*Calamagrostis canadensis*) are also present.

Top: One of the ponds within the Disturbed area.

Bottom: The bank of the Bow River adjacent to the site.



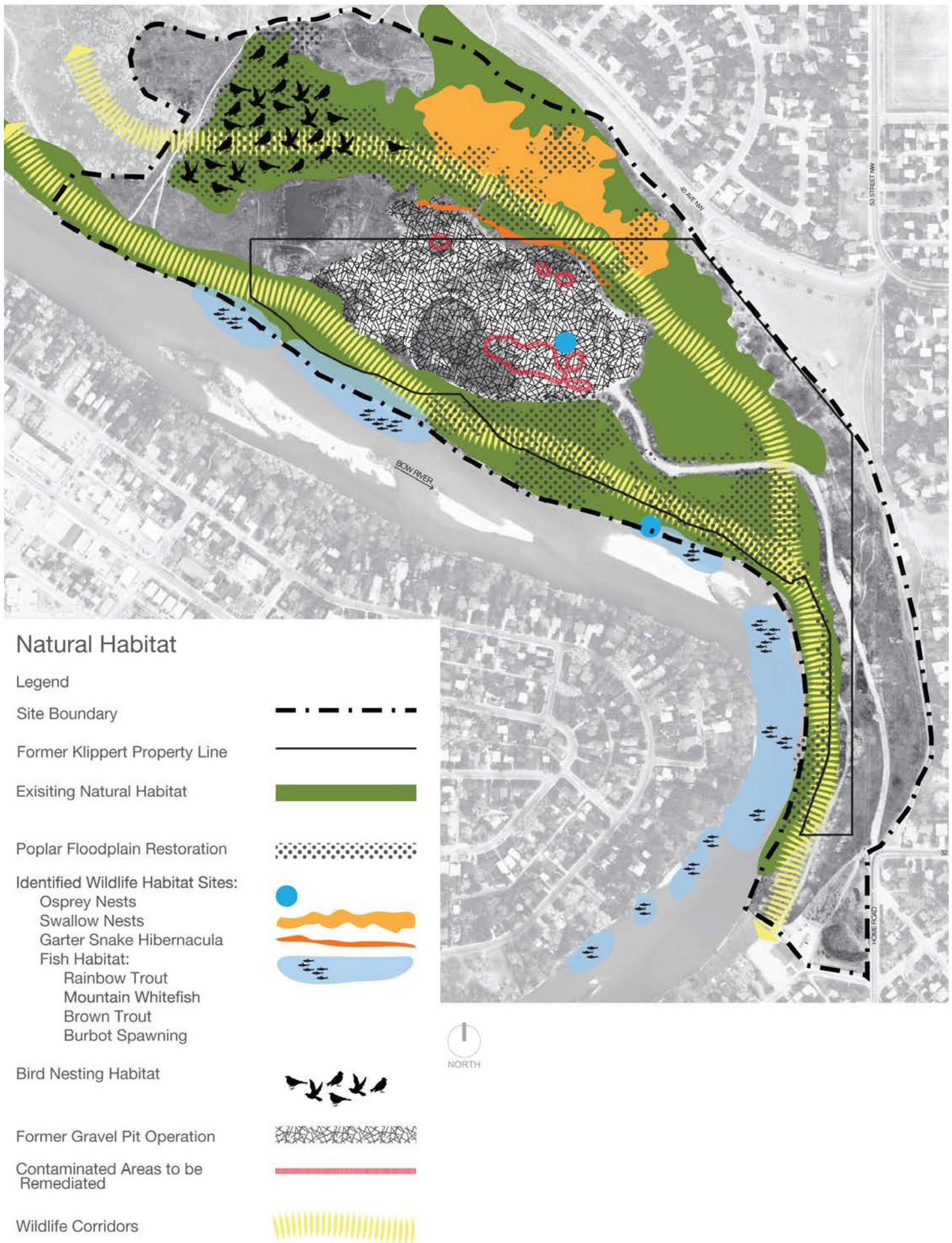


Figure 8. Existing Natural Habitat

Wetlands have formed as a result of gravel operations in and around the Disturbed area where wetland vegetation has naturalized in localized depressions. Rare plant and wildlife species can often be found in wetlands. These areas were fully assessed during the BIA surveys in June 2012; however, no rare plants were found. Typically, a shrubland buffer surrounds the wetland areas, and is comprised of river birch (*Betula occidentalis*), willows (*Salix lutea*), chokecherry (*Prunus virginiana*) and Saskatoon (*Amelanchier alnifolia*). Herbaceous species that are usually present include rushes (*Juncus balticus*), several sedges (*Carex spp.*), cattails (*Typha latifolia*) and horsetails (*Equisetum laevigatum*).

2.5.7 Disturbed

The Disturbed area on Map 11 Existing Vegetation Zones refers in part to the previous Klippert gravel operation. This area consists of various landforms, wetlands, and structural foundations that are direct result of material extraction and mine operations. Contaminated areas have also been identified (AECOM 2010¹⁴) that must be remediated. There are stockpiles of various soil and gravel materials, as well as a back-filled pit area that have become colonized with mostly non-native vegetation.

The invasive species in the Disturbed area outnumber the native species on the site. The noxious and prohibited weeds (such as knapweed and black henbane) will be managed carefully during the construction process so that they do not impact the reclaimed areas or adjacent communities. Management or control of these introduced species is addressed in the BIA.

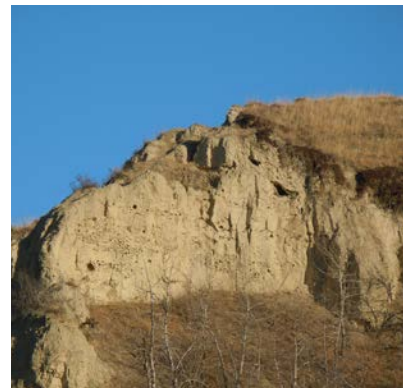
2.6 Wildlife Habitat

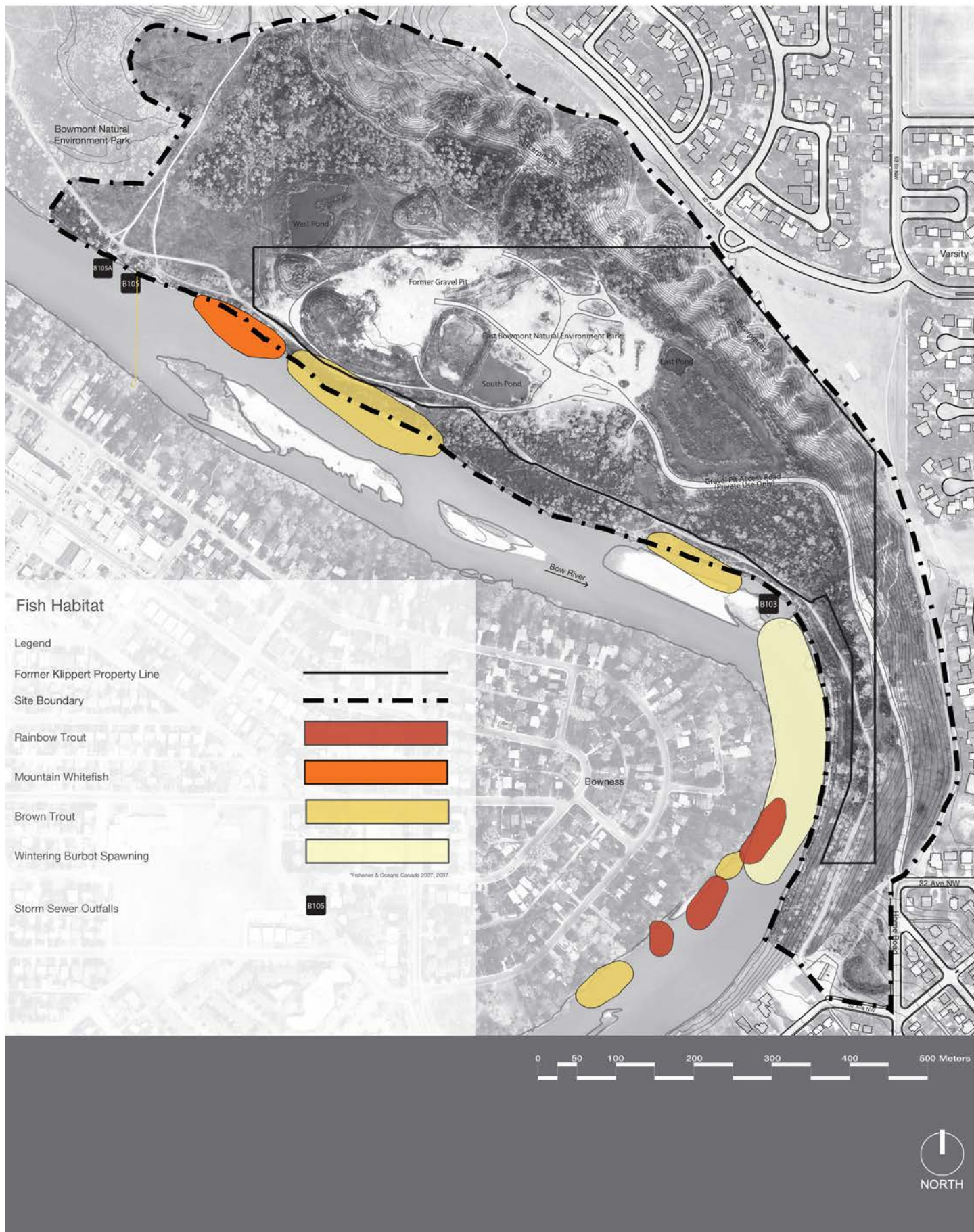
Urban riparian environments like Bowmont Park provide habitat types that are not found in the upland grassland and aspen woodlands. Bowmont Park is also part of the larger Bow River corridor which provides a continuous habitat for the movement of wildlife populations. Riparian areas are important habitats for fish and wildlife, and particularly for migratory and nesting birds. A wide range of wildlife species have been observed in Bowmont Park, from large mammals to amphibians. Among the most notable observations were osprey, garter snakes (and hibernacula), leopard frogs, barn and bank swallows, and the least flycatcher. During the June 2012 survey, great blue heron, boreal chorus frogs, goldeneye and killedeer were observed in the wetland. The most diverse communities were the riparian poplar forests, with approximately thirty different species of birds, five mammals and an observation of monarch butterflies flying along the Bow River.

¹⁴ AECOM Water, 2010, Stormwater Quality Retrofits East Bowmont Scoping Study, The City of Calgary.

Top: Cliff swallow nests along the escarpment.

Bottom: An Osprey nest on top of an existing utility pole in the site boundary.





In general:

- The diversity of species and varied canopy structure of the balsam poplar forest provides a variety of cover types for feeding, escape and nesting. This vegetation community is the most important habitat for breeding birds in Bowmont Park (Sweetgrass 2010).
- The juxtaposition of habitat types in Bowmont Park offers habitat diversity because many species are dependent upon edge conditions. For example, flycatchers inhabit the border between forests and grasslands.
- Shrublands are rich in food resources where birds and mammals are often found foraging. Shrub dominated areas in Bowmont Park are also used for cover, nesting and for the safety of birthing mammals. The high vegetation density and species diversity makes shrublands a valuable wildlife habitat.
- Transition zones (ecotones) between different grassland types and other communities are important areas for wildlife as they typically have greater species diversity than the adjacent communities themselves.
- The wetlands also provide valuable habitat for waterfowl, wading birds, amphibians and mammals.

Top: The Bow River holds breeding habitats for a variety of aquatic life.

Bottom: The remnant ponds created from the gravel operation provide habitats for waterfowl, mammals and insects.



2.6.1 Aquatic Habitat

Fish habitat in the Bow River adjacent to the site is characterized by shallow to deep runs, gravel to small cobble sized substrates, interspersed gravel bars and little to no instream cover other than from large boulders along the bank (AECOM 2010¹⁵).

Rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), mountain whitefish (*Prosopium williamsoni*) and burbot (*Lota lota*) have been observed using the Bow River as spawning and rearing habitat. A survey conducted in the fall of 2006 and winter of 2007 by Fisheries and Oceans Canada¹⁶ observed mountain whitefish and brown trout spawning along the north bank of the Bow River immediately downstream of the B105 and B105A stormwater outfalls (Map 12 Existing Fish Habitat). Additionally, the survey identified burbot spawning in the channel downstream of Outfall B103 during the winter. Some of the current threats to aquatic habitat are:

- Stormwater quality,
- Changes to overhead cover / bank stability, and
- Disturbances from dogs / human interactions.

¹⁵ AECOM Water, 2010, Stormwater Quality Retrofits East Bowmont Scoping Study, The City of Calgary.

¹⁶ Fisheries and Oceans Canada, 2007, Fall Spawning 2006/Spring Spawning 2007 Bowmont Park, The City of Calgary.

2.7 Visual Character

The visual units of the site include the escarpment, balsam poplar forest stands, open grasslands, the river's edge, and the former gravel pit.

The escarpment overlooks the site, creating a spine along the northeast edge of the study area. Much of the escarpment is dominated by low shrubs and herbaceous species, and vegetative cover is lacking where the soft sedimentary soils that make up the escarpment have been eroded. The light-colored soils have been molded into dramatic outcroppings and gullies that are visible against the darker green backdrop of the forest from throughout the lower floodplain region of the study area.

From the top of the escarpment, much of the lower floodplain is visible and there are expansive views of Canada Olympic Park across the river valley. Viewed from the west side of the Bow River and Highway 1, the depositional layers of glacial lake sediments and river sediments that make up the site are clearly visible as the light-colored slopes of the escarpment.

Lush patches of mature balsam poplar forest have colonized at the base of the escarpment and along parts of the river. The high canopy lends a filtered light and shade to the forested areas, and the shrubby understory restricts passage through the forest to the well-used informal trails that have developed through continual use of the site since the closure of the gravel pit.

Open grassy meadows in the floodplain provide views of the escarpment and river from afar. The visual quality of the meadows themselves is not particularly high, as they feature a mix of native grasses and shrubs and weedy species. However, these grasslands provide a unique perspective on the other more scenic areas of the site, giving the viewer an opportunity to orient himself within the landscape.

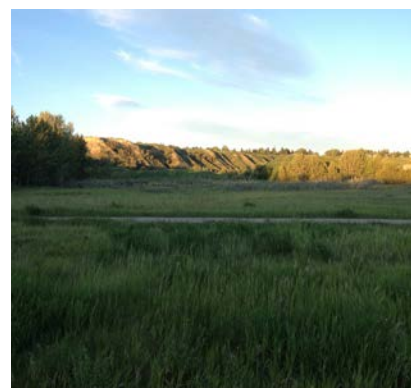
Much of the river edge consists of rocky, steep banks that are not very accessible. Other areas are hidden from the main pathway by thick vegetation. There are a few locations where the lack of vegetation opens up views upstream and downstream.

The former gravel pit is highly visible from the top of the escarpment, as much of the vegetation had been cleared away during gravel mining operations. The remnants of the gravel mining include a large, flat open area, large mounds of excavated material, and pits that have become wetlands. The mounds offer interesting vantage points from within the lower floodplain and create a sense of enclosure within the former gravel pit. Where a road or trail passes between two steep mounds, a gateway effect highlights the passage from one space into another. Overall, the former gravel pit stands out in strong contrast to its more natural surroundings.

Top: The regenerating balsam poplar forest.

Middle: Open grasslands with the escarpment in the background.

Bottom: The river's edge.



2.8 Current Uses and Infrastructure

Top: One of the numerous gravel paths that run throughout the site.

Bottom Right: The typical paved regional pathway that runs along Bow River.

Bottom Left: The single-track cycling path that runs along the face of the escarpment (foreground) and the private maintenance road (background).



East Bowmont NEP is mainly accessed on foot or bicycle via the Bow River Regional Pathway system. Visitors travelling to the site by vehicle must park on adjacent streets or in a small gravel parking lot and travel the remaining distance by regional pathway. The following section provides an overview of the different modes of circulation within and surrounding the park site. (Figure 9. Existing Access and Amenities).

2.8.1 Roads

Vehicular access to East Bowmont NEP occurs via a parking lot to the south of the site, from 52 Ave. NW (approximately 27 stalls) (Map 2 Existing Site Plan). Street parking is available along the length of 40 Ave. NW (approximately 142 parallel stalls). The parking lot to the south of the site is located adjacent the regional pathway approximately 350m from the nearest access point to the East Bowmont NEP property. From the street parking at the top of the escarpment, it is 1000m to the site property using the current pathway. Additional street parking is available within most of the neighboring streets surrounding Bowmont Natural Environment Park. Since 52nd Ave is a one-way street running north to south, access into the parking lot is from the north only. The parking itself consists of a gravel lot with a steep cross slope and 90° parking.



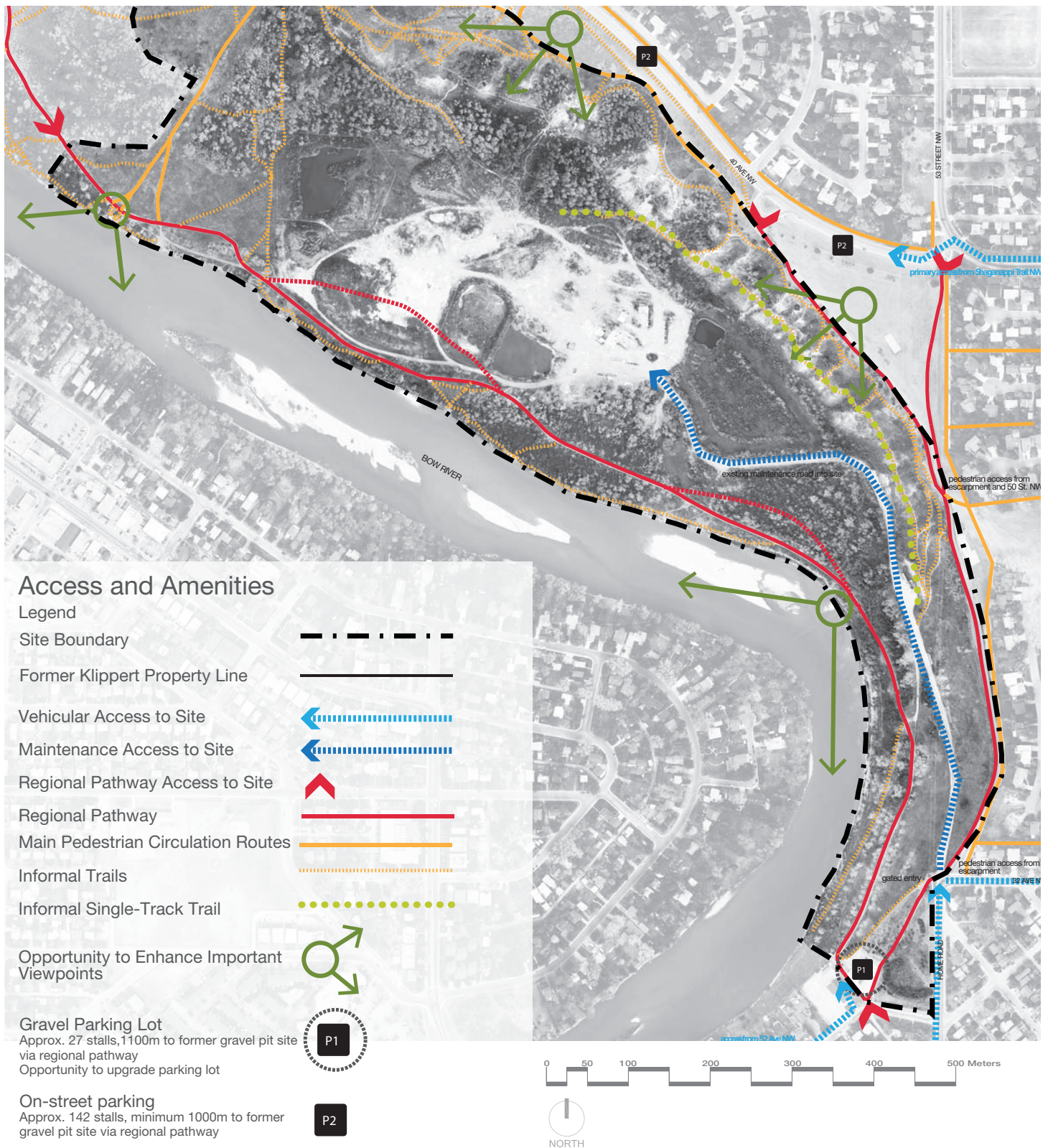


Figure 9. Existing Access and Amenities

A maintenance road leads into the site from the corner of Home Road NW and 32 Avenue NW. This road cuts along the side of a portion of the escarpment, and as a result parts of the road have very steep sides. The maintenance road is currently protected by a locked gate, and is not available to the public. Stability issues may exist where the road cuts across the escarpment. The intersection where the road meets Home Road is unsafe due to the 90° intersection of Home Road and 32nd Avenue, and the steep grades of each road approaching the intersection.

2.8.2 Pathways and Trails

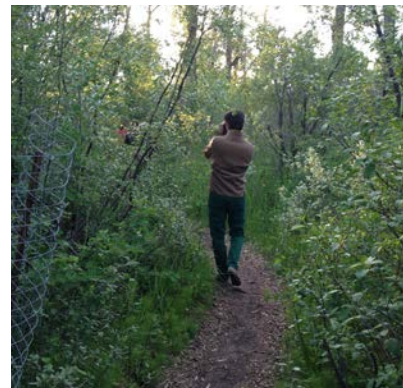
Bowmont Natural Environment Park includes a formalized trail system which is located between the bank of the Bow River and the former Klippert property line. This pathway is 3.5m wide asphalt paved multi-use regional pathway and allows for many levels of access and use. Between the south parking lot and the site, isolated pathway sections of less than 25m have slopes greater than 10%, while the average is less than 5%. The trail that leads from the street parking at the top of the escarpment to the regional pathway is 3.0m wide gravel trail and also has isolated trail sections where the slope exceeds 10%.

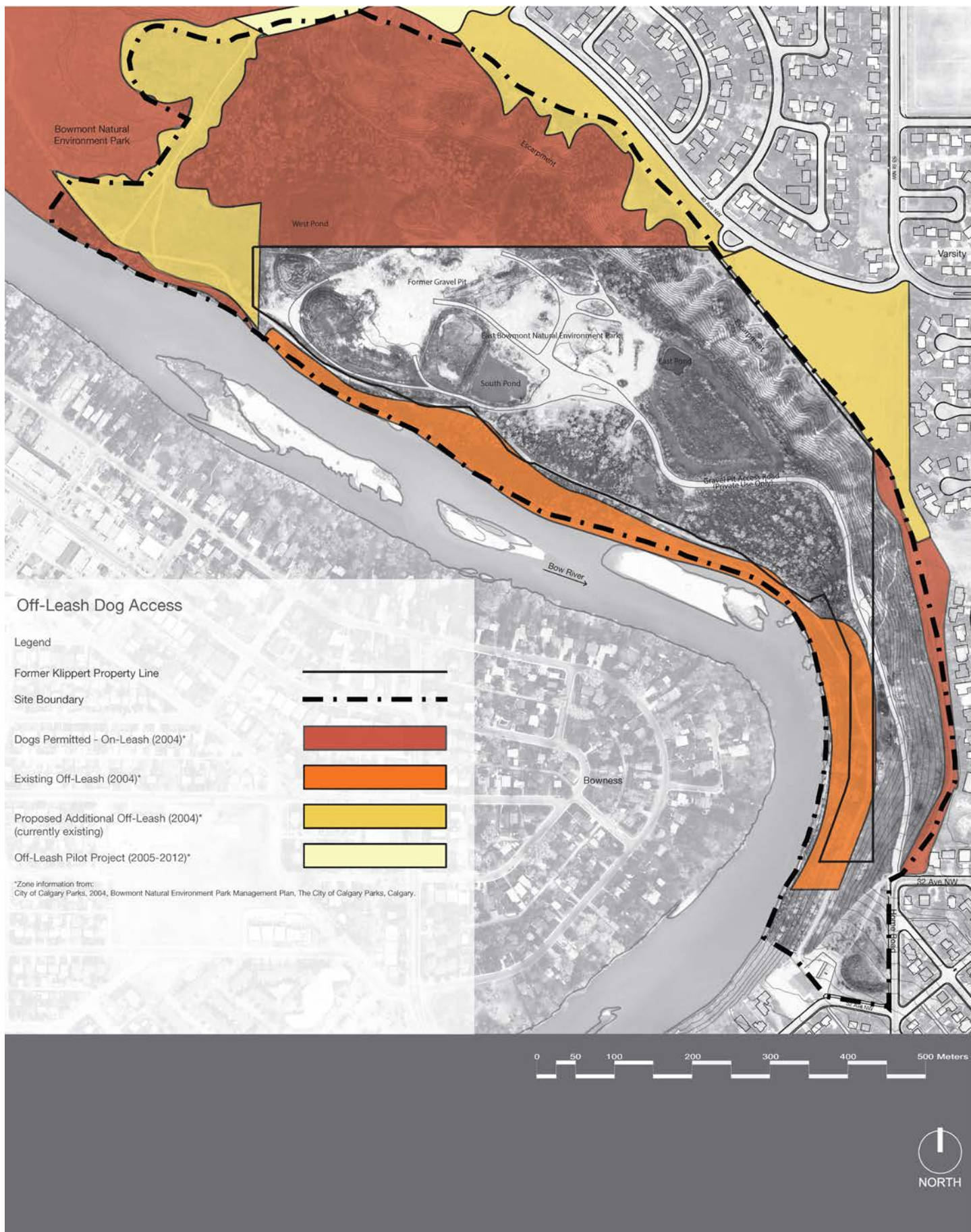
Even though the current Klippert boundary is fenced and intended to restrict access to the property, running throughout are a series of informal trails. A single-track running and cycling trail runs along the face of the escarpment, and is connected to other areas of the park by informal trails from the top or bottom of the escarpment. This single-track trail is popular and well-used, although it is not maintained by the City or identified as part of the city's trail network. Most of the trail maintenance is done by the trail's user-group. Because of the quality of the single-track cycling and running experience this trail offers, it is not recommended that the trail be closed. Minor improvements may be needed to improve safety and stability and to reduce erosion. Connector trails, bike jumps and other user improvements outside of the trail route may also require mitigation in order to protect the integrity of the slope. A number of fall-line trails running straight down the face of the escarpment are of particular concern in terms of contributing to erosion.

Throughout the site, additional informal trails run throughout the balsam poplar forest, along the river edge, and around the berms that exist within the site boundary. Some of these informal trails pass through sensitive areas and have created erosion problems or led to invasive species being introduced. It may be necessary to close and restore some of these trails to reduce their impact on the natural habitat of the park.

Top: The bark mulch nature appreciation area trail that is located at the north end of the study site adjacent the Bow River.

Bottom: One of the informal cycling/hiking trails going up the escarpment.





2.8.3 Off-Leash Dog Access

Top: Runners use the topography and trail systems throughout the site.

Middle: A dog and owner (not shown) utilizing the off-leash areas within the study area.

Bottom: One of the off-leash areas within the study area.



The current off-leash zones surrounding the study area are based on the recommendations of the 2004 Bowmont Natural Environment Park Management Plan. Since the plan was published, a pilot project has been ongoing in the park to test new off-leash areas and the impacts of off-leash use on the ecological integrity of the park. Most of the areas under the pilot project are outside of the study area boundary. Current off-leash zones within the study area include the bank of the Bow River, the trail accessing the northwest end of the park and two meadows on either side of the trail, and the flat area at the top of the escarpment.

The off-leash area at the top of the escarpment is in conflict with a playground located in the centre of the manicured park zone. This area is not part of the study area, but it is noted that in accordance with Bylaw 23M2006 Responsible Pet Ownership, dogs are not to be allowed in playground areas, whether they are off or on-leash¹⁷.

The off-leash area along the river bank is often immediately adjacent to, or includes part of the regional pathway, however Bylaw 23M2006 requires dogs to be on-leash on pathways, and the Off-Leash Area Management Plan recommends locating off-leash areas adjacent to pathways “only when effective strategies can mitigate potential safety concerns and/or conflict between users¹⁴.” The area adjacent to the river consists of sensitive riparian habitat that is easily damaged by excessive traffic, and is the preferred route for wildlife travelling along the river corridor. It also provides access to fish spawning areas in the river that can easily be damaged by the clawing action of dogs running, particularly at certain times of the year. In light of these considerations, the river bank may not be the most suitable location for an off-leash area.

The off-leash areas along the northwest trail and meadows do not conflict with bylaws or the recommendations of the Off-Leash Area Management Plan.

¹⁷ City of Calgary, Parks, 2010, Off-Leash Area Management Plan

2.9 Utilities and Stormwater

Existing utilities at the site are primarily either remnant site infrastructure related to gravel operations or City of Calgary pipeline infrastructure that traverses the site.

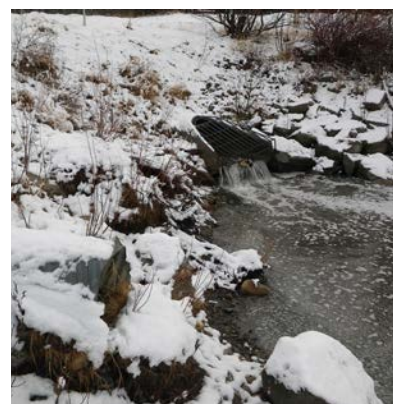
The following storm sewer infrastructure is located within or adjacent to East Bowmont NEP (Map 14 Existing Deep Utilities):

- Outfall B103 is located prior to a bend in the Bow River in the southeastern portion of the site and discharges to the Bow River. It services a catchment area of 88.1ha in the Varsity area centered on Market Mall. A 900 mm diameter concrete pipe conveys stormwater flow to Outfall B103 and crosses the site with what appears to be a minimum burial depth of 0.5m according to City of Calgary block profiles.
- Outfall B105 is located near the northwestern boundary of the site and discharges to the Bow River. It services portions of the communities of Varsity, Silver Springs, Dalhousie, Ranchlands, Edgemont, Hawkwood, Hamptons and Citadel. Two 2100 mm x 1800 mm concrete storm sewer ducts convey stormwater to Outfall B105: the east duct drains a catchment area of 846.2 ha and the west duct drains a catchment area of 841.1 ha. The east and west ducts appear to have minimum burial depths of 0.5m according to City of Calgary block profiles.
- Outfall B105A is located directly to the west of Outfall B105 and discharges to the Bow River. An 1800 mm diameter concrete pipe, constructed as part of flood mitigation measures in the Dalhousie/Crowchild Trail area, conveys stormwater diverted from the east duct system of Outfall B105 to Outfall B105A. The catchment area is the same as the east duct (846.2 ha); however, the flow through the 1800 mm pipe is restricted to a design flow of 13.7m³/s. The pipe appears to have a minimum burial depth of 0.5m according to City of Calgary block profiles.
- The slope below Crematorium Hill was repaired in the early 1970's. At some point since then, what is assumed to be a slope dewatering and monitoring system was installed as shown on the adjacent image. There are 15 manholes and monitoring pipes installed on the slope that lead to 6 unmetered outfalls to the Bow River. The outfalls are approximately 300mm dia. CSP.

Stormwater peak flows and volumes for outfalls B103, B105 and B105A are provided in Table 9 and Table 10. These flows currently are discharged directly into the Bow River without treatment, and together make up one of the largest volumes of untreated stormwater runoff in Calgary.

A City of Calgary sanitary sewer (914mm) line runs along the east side of the east and west duct storm sewer corridor then veers due south about 50m from the bank of the Bow River. It appears that the sewer line is buried a minimum of 0.55m below ground according to City of Calgary block profiles (further verification is required prior to construction). The sewer line then diverts into a chamber where a man hole is present before it splits into two siphon lines crossing the river (one 305mm and one 864mm).

Images depicting the slope dewatering system on the escarpment at the south end of the study area



Overhead electrical lines run from east to west near the south boundary of the site and presumably at one time provided electricity to the gravel mining operation but continue to provide service to a river water pump station (Map 15 Existing Shallow Utilities).

A river water pump station is located on the bank of the Bow River about 200m downstream of the sewage pipeline crossing. Electrical service to the building is provided via the overhead line discussed above. It is assumed that a pressurized water line leaves the building; however, the pipeline route, burial depth and destination are not known. Additionally, it is unknown if the pump station is operational. Further investigation is required prior to excavation in this area.

Top: Stormwater Outfall B 103.

Middle: Stormwater Outfall B105A.

Bottom: Stormwater Outfall B105.

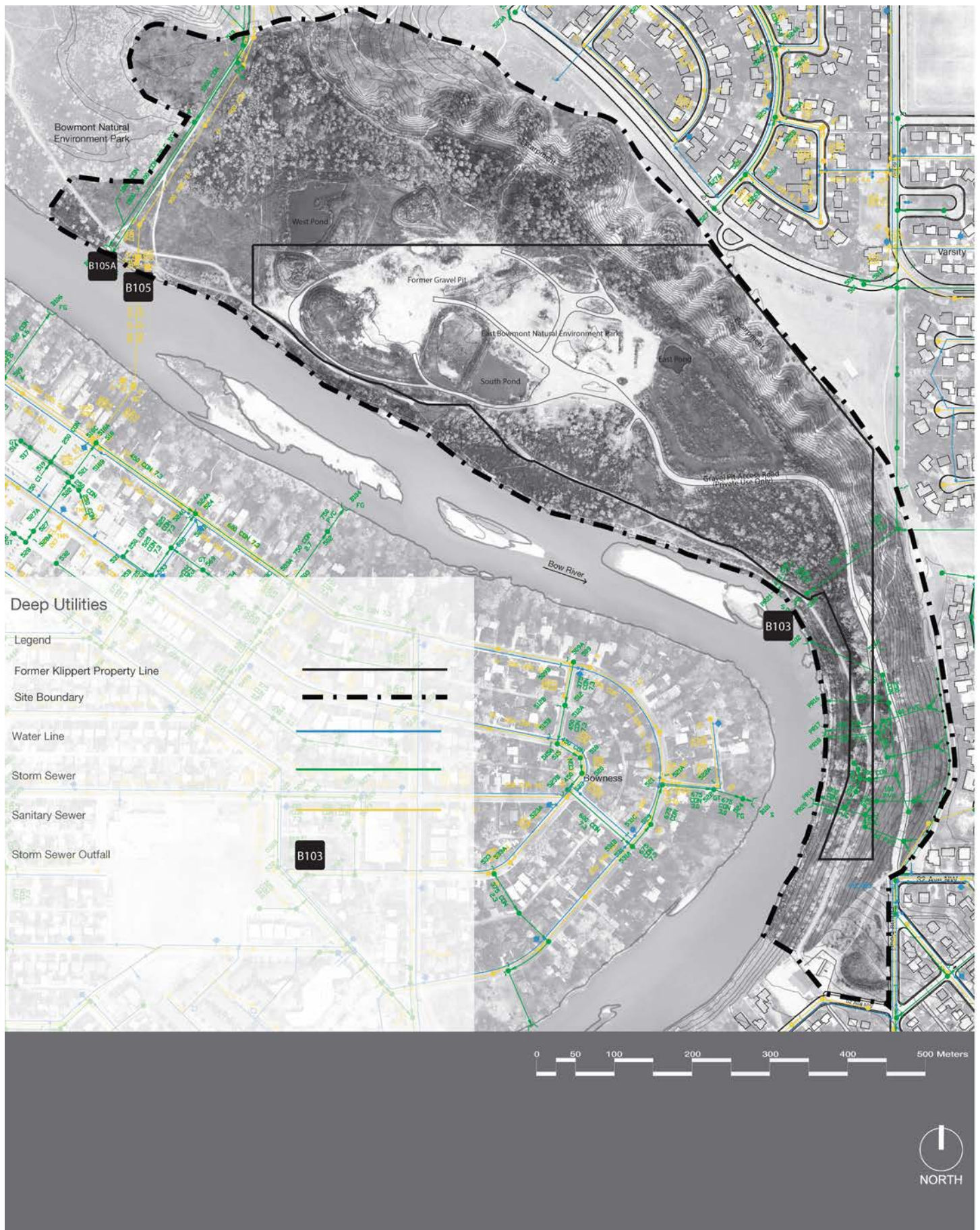


Table 11 Peak Flows from Stormwater Outfalls at the East Bowmont NEP for Various Return Periods (adapted from AECOM 2010)

OUTFALL	15mm 24Hour Water Quality Event (m3/s)	25mm 24Hour Water Quality Event (m3/s)	1 in 2 Year, 24 Hour Event (m3/s)	1 in 5 Year, 24 Hour Event (m3/s)	1 in 100 Year, 24 Hour Event (m3/s)
B103	0.15	0.26	3.64	5.62	7.62
B105 (West Duct)	1.41	2.48	25.94	24.87	25.89
B105 (East Duct)	1.10	1.80	25.29	25.46	25.47
B105A	0.35	0.69	14.17	15.90	16.18

Table 12 Water Volumes from Stormwater Outfalls at the East Bowmont NEP for Various Return Periods (adapted from AECOM 2010)

OUTFALL	15mm 24Hour Water Quality Event (m³)	25mm 24Hour Water Quality Event (m³)	1 in 2 Year, 24 Hour Event (m³)	1 in 5 Year, 24 Hour Event (m³)	1 in 100 Year, 24 Hour Event (m³)
B103	5,010	9,839	15,746	22,497	48,612
B105 (West Duct)	47,280	93,360	147,293	216,427	452,255
B105 (East Duct)	37,467	71,120	120,139	163,404	312,218
B105A	10,738	23,561	46,664	66,748	142,857
Total	100,495	206,554	329,842	469,076	955,942



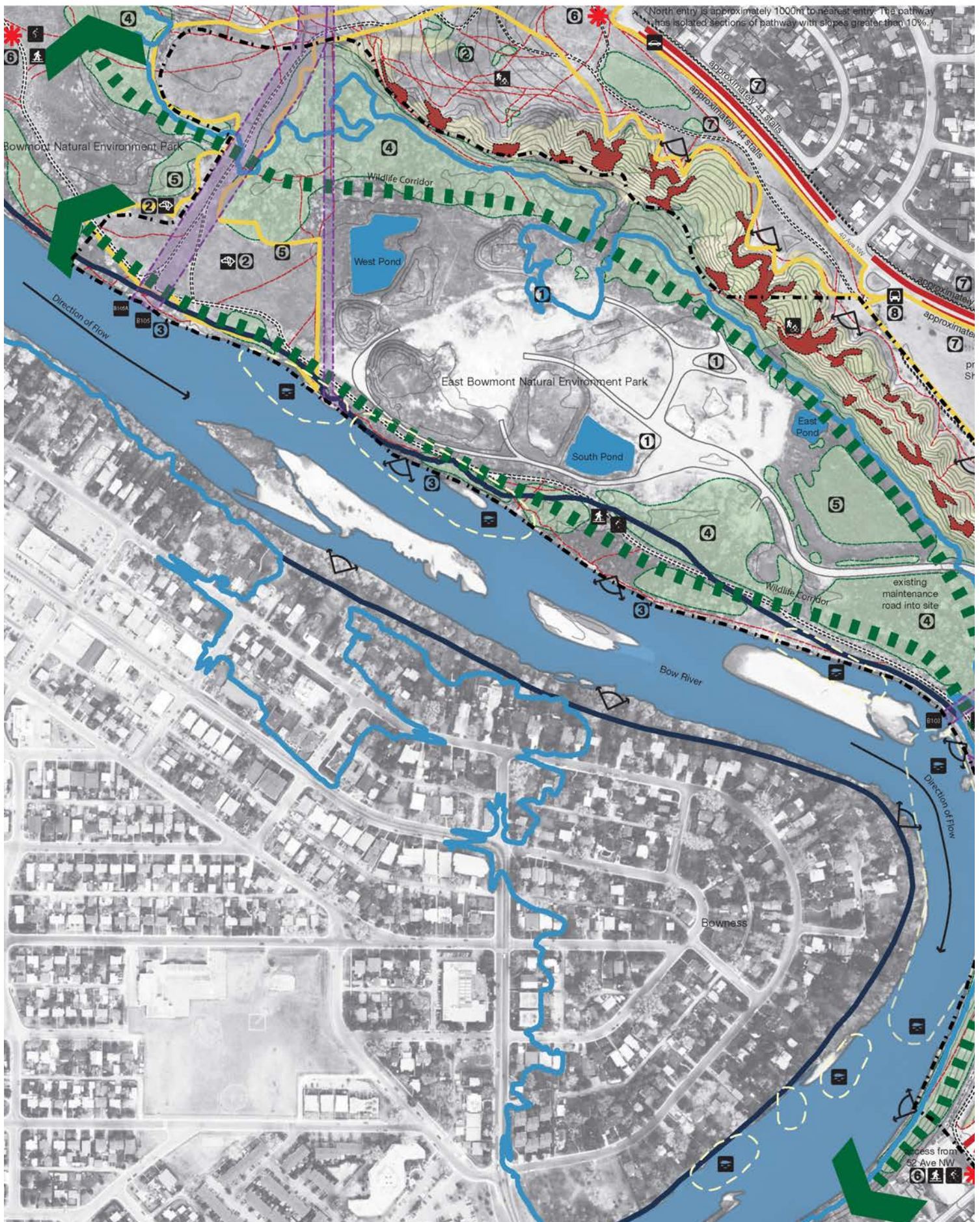


Figure 10. Site Analysis



Site Analysis

Legend

Site Boundary

Soil / Groundwater Contamination

Off-Leash Dog Access

Shoreline Access Points

Balsam Poplar Forest

Regenerating Forest

Bowmont NEP Access Points

Vehicular Parking

*Parking numbers are approximate

Transit Access (#9 Bus)

1 in 100 Year Floodplain

1 in 100 Year Floodway

Standing Water

Escarpment

Erosion Areas

Wildlife Corridor

Utility Easements

Viewpoints

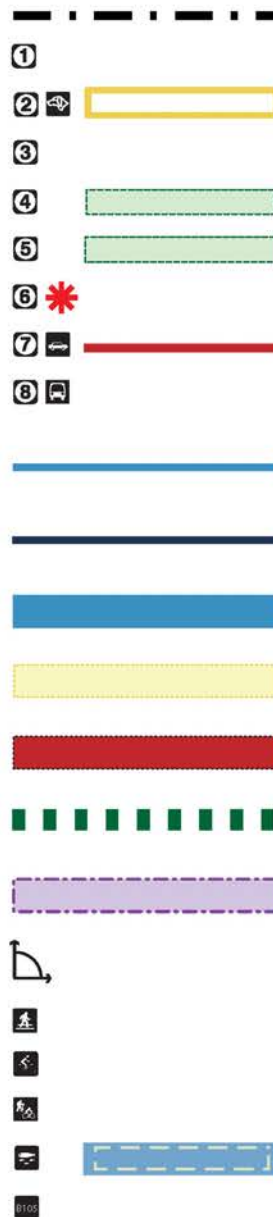
Walking / Running Trail

Cycling Trail

Hiking / Mountain Biking Trail

Fish Habitat

Storm Sewer Outfalls



3.0 OPPORTUNITIES AND CONSTRAINTS

The following section highlights some of the opportunities and constraints inherent to the site as a result of its physical characteristics. Issues and opportunities were also collected from a stakeholder perspective, which are summarized under the “4.0 Stakeholder Engagement Process” of this document.

Table 13 Opportunities and Constraints

Slope Stability and Erosion

The East Bowmont NEP has a steep escarpment running the length of the northeast edge of the site where mixed vegetation conditions exists. Along this escarpment, localized areas of erosion and gullying have occurred, partially as a result of trail proliferation. The banks of the Bow River have been stabilized using concrete rip rap and gabion mattresses in some areas. There are also indications that the maintenance road along the escarpment may be impacted by a lack of stability. A detailed geotechnical investigation is recommended to assess the stability of the slope.

Opportunities

- Improvements to the diversity and extent of the vegetation communities along the face of the escarpment could help to increase stability of the slope.
- Creative use of erosion and sediment control, bioengineering and revegetation measures can increase the opportunities for long term recreational use of the trails along the escarpment.
- There may be an opportunity to provide direct access down the slope of the escarpment (such as a stairway) to help minimize damage caused to the slope by informal trails.
- The types and placement of the rip rap along the edge of the Bow River could allow for increased or preventative access points to the river and improve fish habitat by creating more instream cover.

Constraints

- Historical evidence of slope failure along the escarpment prevents high levels of development along the slope.
- Creating easily accessible points to the escarpment trail proliferation zones may increase compaction and devegetation of the escarpment.
- Site development must avoid on the toe of the escarpment and not affect escarpment slope stability.
- Continued use of the maintenance access road may further weaken the slope. Slumping of the slope may cause damage to parts of the access road.

Contaminated Soils

A Phase II Environmental Site Assessment undertaken in 2004 determined that there is contamination above regulatory guidelines as a result of the previous operations on the Klippert property. It was determined that levels above regulatory guidelines do exist and phytoremediation is being explored as the primary means to remediate the contamination. It should be noted that due to the age of the data, updated testing will be required to confirm any changes to the levels and locations of contamination since 2004.

Opportunities

- The site conditions allow for opportunities to pursue phytoremediation as a means to remove the in-ground contaminants from the site.
- The use of phytoremediation may allow the project to apply for research funding, or for research collaboration with post-secondary institutions.
- Depending on the type and size of remaining contaminants in the soil, a variety of native species can be used to increase the biodiversity and local ecosystem.
- Due to the high rate of groundwater flow on the site, a majority of the contaminants may no longer be present on the site, or may require a reduced level of mitigation for treatment.

Constraints

- If the contaminated soil cannot be treated through phytoremediation it may need to be removed from the site.
- Depending on the method of treatment chosen, time may be a factor in when the site can be used by the public.
- Areas being remediated by phytoremediation may need to be fenced and/or closed to public access for a longer period of time (10 years or more).

Surface Water

The areas of surface water on the site include two existing ponds (the west and east ponds) and an existing water supply pond (the south pond). All three of these ponds now collect surface water from the site, have naturalized and hold water for most of the year. The regional pathway that runs along the edge of the Bow River is higher than the adjacent former gravel pit lands and prevents much of the surface flow from running across the pathway into the river. A culvert is located towards the southwest of the site to allow some of the surface water to run into the river. Stormwater collection from offsite areas drains into three outfalls located on the site. Two are located along the river near the north (B105, B105A) and one is located towards the south, near the bend in the river (B103). Together, these outfalls collect water from one of the largest collection areas in Calgary.

Opportunities

- The existing stormwater collection system features a large catchment area without any stormwater quality and minimal quantity management.
- The possibility of a stormwater wetland system could occupy the former gravel operation and help mitigate sedimentation.
- Proposed stormwater forebay, ponds and dikes mainly affect areas previously impacted by gravel operations.
- Substantial infiltration potential for runoff due to gravelly soils.
- The habitat value of the existing west pond provides opportunity to protect and preserve this habitat.

Constraints

- The risk of site flooding by the Bow River from water levels generated by the 1 and 20 year flood and greater events.
- There is evidence of fish spawning and rearing habitat in the Bow River adjacent to the site that may be impacted by stormwater runoff, construction or river access.
- Regulatory approvals are required for work in the floodplain of the Bow River.
- Proposed forebay is on the northwest side of existing stormwater and sanitary ducts. These lines must be crossed in order to connect the forebay to the proposed stormwater wetlands in the former gravel pit.

Groundwater

A groundwater investigation was conducted by Jacques Whitford (2004) over two periods during the spring of 2004. The depth to groundwater was found to range over the site from 2.0m to 4.2m in May 2004 and from 1.2m to 4.0m in June 2004. The groundwater flow direction was determined to be west to east based on water surface elevations. The flow velocity ranged from 2.4m/yr. in the relatively undisturbed areas to 82m/yr. in the gravel operations area.

Opportunities

- The direction of ground water flow may reduce the risk of pollutants that may be mobilized by construction activities or released by stormwater treatment measures to reach the Bow River.

Constraints

- Dewatering systems may be required for deep excavations since groundwater levels are relatively close to the surface.
- The groundwater is contaminated in some locations within the gravel mining operation footprint.
- Pond liners may be required to limit stormwater infiltration into the groundwater table and to prevent groundwater upwelling into the ponds.

Vegetation and Habitat Restoration

Habitat restoration goals will follow those that are outlined in the Bowmont Natural Area Management Plan and the Calgary Parks Natural Area Management Plan. Disturbed areas will be reclaimed with vegetation communities common to those existing in Bowmont Park as described in 2.5 Vegetation. The Design Development Plan (DDP) will prescribe planting of native species, either from transplants, cuttings, seed or nursery plugs. The DDP will work to replace non-native vegetation and disturbed areas with native communities with high habitat value (such as the balsam poplar forest). This will improve the overall ecological value of the park and increase habitat connectivity.

Opportunities

- Efforts could be made to manage and restore the age distribution of balsam poplar in the riparian forest to enhance habitat and ensure regeneration of the forest.
- The escarpment areas are experiencing varying degrees of erosion and will require slope stabilization enhanced by plant cover (grasses and shrubs) to mitigate further impacts.
- Reclamation of the Klippert gravel operation will serve to restore the continuity, structure, composition, ecological function to the habitats in Bowmont Park.
- Opportunity to restore wildlife corridors along the river and the base of the escarpment.
- Opportunity to protect and enhance nesting habitat for ospreys and songbirds.

Constraints

- The site is colonized with a number of noxious and invasive weed species that will require management to eradicate. This effort may take several years.
- There are a number of wildlife species currently living on the site that will have to be protected during construction activities. This may include incorporating a buffer zone around existing areas of high habitat value.

Scenic Resources

The study area provides opportunities for attractive, open, and sweeping views across and along the river valley. Elements of the landscape that positively enhance views include slopes, escarpments, and ravines.

Opportunities

- Views from the East Bowmont NEP site allow for a variety of opportunities, such as views to the river, of the escarpment, of balsam poplar forest, and of Calgary landmarks such as Signal Hill and Canada Olympic Park.
- Access to the top of the escarpment could provide increased viewsheds to elements not seen from the river's edge.
- Views into the site from the community of Bowness may help with citizen-supported enforcement of proper use of the park.
- Because much of the study area can be viewed from above, there is a unique opportunity to enhance the "plan view" design of the park.

Constraints

- Depending on site programming, views into the site may be restricted, potentially creating an unsafe environment for park users.
- All park activities will be viewable by the residences located across the Bow River in the community of Bowness.
- Crime Prevention Through Environmental Design (CPTED) guidelines may be difficult to follow in certain locations due to the natural landscape conditions.

Access - Vehicles

Vehicular access currently occurs via street parking along 40 Ave. NW, located at the top of the escarpment, and a gravel parking lot at the end of Bowmont Natural Environment Park off 52 St. NW.

Opportunities

- A maintenance access road is present and connects to the core of the site from the corner of Home Road and 32 Ave. NW. If parking is deemed necessary, appropriate space is available within the project site.
- Ample parking currently exists for current use levels of Bowmont Natural Environment Park and these parking locations could be used in conjunction with the East Bowmont NEP.
- Current parking areas are located within walking distance of the East Bowmont NEP site. The south parking lot is 350m from the study site and the street parking along 40 Ave NW is approximately 1000m to the East Bowmont NEP using existing pathways and trails from the nearest stalls.
- Street parking along 40 Ave. does not front immediately onto residential properties, helping to reduce parking conflicts with homeowners.

Constraints

- The maintenance access road that leads from the corner of Home Road and 32 Ave NW is narrow and steep and would require considerable refurbishments and maintenance to accommodate year-round access.
- The maintenance road is also potentially unstable as evidenced by recent slumping along the escarpment.
- The intersection where the maintenance road meets Home Road is unsafe due to the 90° intersection of Home Road and 32nd Ave., and the steep grades of each road approaching the intersection.
- The distance and some of the slopes on the pathways between the parking areas and the East Bowmont NEP may be restrictive to some users.
- Depending on the programming of East Bowmont NEP, the level of current available parking could prevent users accessing the site.
- Only one transit option is available to access the site, and this may also be a limiting factor for many visitors to the site.
- The existing gravel parking lot is steeply sloped, and can only be accessed from the north due to 52 Ave. being a one-way street.

Access - Pedestrians and Bicycles

The Calgary Regional Pathway currently runs the length of the west side of the site along the bank of the Bow River. This provides year round access by pedestrians and cyclists traveling along the Calgary trail network. A pathway connects 40 Ave NW and allows access for both cyclists and pedestrians.

Opportunities

- The existing regional pathway system provides direct access to the site for cyclists and pedestrians, as well as commuter cyclists travelling through the park.
- The site is well-used for mountain biking and cross-country running.
- The informal single-track trail along the face of the escarpment is being maintained by citizen volunteers.

Constraints

- Informal trails throughout the site have impacted native vegetation, disturbed swallow nesting sites, and created erosion issues on steeper slopes.
- Mountain bikers have built jumps and made other alterations along the cross-country trail on the face of the escarpment.
- Parts of the regional pathway exceed the maximum recommended slopes in The City of Calgary's trail and pathway design guidelines.

Access - River

The Bow River runs the length of the west side of the East Bowmont NEP site. The banks of the Bow River are lined with concrete rip rap and gabion mattresses. Evidence of slope failure as a result of site run off and river scouring can be seen, but appears to have been mitigated since the installation of the rip rap.

Opportunities

- Preservation of the riparian corridor could allow for increased diversity on both the land and in the water.
- Interpretive opportunities can be integrated into the preservation zones and stormwater outfalls that line the river's edge.
- Existing clearings adjacent to the river can be enhanced as river access/picnic areas

Constraints

- Evidence of degradation exists along the bank, and current protection methods (concrete rip rap) create access and safety concerns.
- The loss of additional riparian edge along the river would decrease appropriate habitat for fish and wildlife.
- Dog access to the river in particular can be damaging due to clawing action.
- Increased access along the river's edge may increase the percentage of slope failures along the edge, as well as increasing erosion and loss of bank during high water events.
- Fish spawning areas are located adjacent to many of the areas that are most suitable for river access.



East Bowmont Natural Environment Park

Map Station 1

Legend

Site Boundary

Former Klippert Property Line

KEEP THE EXISTING NATURAL CHARACTER OF SITE (AS LITTLE 'DEVELOPED' SINCE AS POSSIBLE). EXISTING GREEN SPACE AND PLANT SPECIES ARE GOOD
Are there any features of the park you think should be protected or retained that have not already been identified?

MUSQUITO CONTROL WITH NEW SHALLOW PONDS?

- WILL MOSQUITOES MAKE IT NON-USABLE?
- NO VEHICULAR TRAFFIC
- NO COMMERCIAL/STREETCARTS
- NO STATE BOARD PARK

- RECLAIM & REVEGETATE
- KEEP OUT INTERMEDIATE USE BY BIKES & SKATEBOARDS
- HAVE NATURE APPRECIATION AREA WITH PROTECTION FOR BIRDS & WILDLIFE

EROSION CONTROL VERY IMPORTANT

- OLD ACCESS ROAD AS PART OF NEW PATH (IF ENVIRONMENTALLY FEASIBLE)
- NO SKATING ON STORM PONDS

BETTER SHADING FOR DOG USE (CLEAR)

LIMITED OBSERVATION PLATFORMS (KEEP TO A MINIM)

MINIMAL SKATING

MORE PED. ACCESS POINTS INTO SITE

- DON'T MAKE BOWMONT "VANILLA" - WE HAVE ENOUGH DOG WALKS, SPURVE, FIRE PATHS IN CALGARY ALREADY. KEEP IT RAW & LET NATURE SHAPE THE PARK AS IT WILL.

- RESTORE THE FLOOD PLAIN TOPOGRAPHY TO WHAT IT WAS

- THERE ARE NOT ENOUGH DOG WALKING AREAS

0 100 200 300 400 500 Meters

KEEP EAST-WEST WILDLIFE CORRIDORS

SMALLEST POSSIBLE FOOTPRINT

02

02

Calgary (416) 31-1

CITY OF CALGARY
Parks



Top: Stakeholder feedback drawn on map at Open House #1
Bottom: Open House #1

4.0 STAKEHOLDER ENGAGEMENT PROCESS

The East Bowmont NEP Design Development Plan (DDP) project was broken down into three phases:

Phase I	Site Analysis and Review of Existing Information
Phase II	Program Development
Phase III	Concept Design Development

Stakeholder engagement was carried out in Phase I and II to facilitate public participation in the design of the park.

In Phase I, information about the project site was gathered and analyzed to inform design decisions that would be made in the program and concept design development phases. Key stakeholders and citizens were engaged to provide information about the site and to help the design team identify some of the issues and opportunities that should be addressed by the DDP.

In Phase II, information about the park site and stakeholder/public feedback that was gathered in Phase I was used to inform the program development for the park. Stakeholders and citizens were engaged to review the conceptual design and provide feedback on different aspects of the plan.

The two phases of engagement used a combination of stakeholder workshops, public open houses and online surveys to gather feedback related to the park design.

4.1 Community Stakeholder Involvement

A community stakeholder group was formed in Phase I of the project, consisting of community groups and local community associations with an interest in East Bowmont NEP. The design team worked with the City of Calgary to identify potential participants in the stakeholder group, and an email invitation was sent to these organizations seeking up to three participants from each group to join the East Bowmont NEP community stakeholder group, who would be consulted throughout the DDP process.

The community stakeholder group included representatives from the following groups who were initially contacted to participate in the project:

Organizations Identified as Potential Community Stakeholders	Organizations Represented in East Bowmont NEP Community Stakeholder Group
Varsity Community Association	•
Montgomery Community Association	•
Bowness Community Association/ Society of Bowness Residents	•
Silver Springs Community Association	•
Nature Calgary	•
Calgary Mountain Bike Alliance	•
Calgary Pathways Advisory Council	•
Alderman Dale Hodges, Ward 1	•
Calgary River Valleys	•
Off Leash Calgary	
Calgary Roadrunners Club	

Of the groups contacted, only the Calgary Roadrunners Club declined to attend or participate in the community stakeholder workshops. Several attempts were made to engage a representative for off-leash dog park users (refer to Summary of Phase I Stakeholder Engagement for details), but the design team was not successful in identifying an off-leash representative to participate in the community stakeholder group.

4.2 Phase I Stakeholder Engagement Activities

During Phase I of the East Bowmont NEP Design Development Plan, information about the project site was gathered and analyzed to inform design decisions that would be made in the program development and concept design development phases. Conclusions were made about the physical attributes and current uses of the site through field observations and by reviewing existing reports and studies about the area. City of Calgary plans, policies and bylaws that apply to the site were also reviewed to establish the regulatory framework for the design. Another important part of the process involved identifying and collecting feedback from key stakeholders and citizens. These groups provided information about the site and helped the design team identify key issues and opportunities that should be addressed by the DDP.

The initial phase of stakeholder engagement consisted of six elements:

1. Workshop #1 – City of Calgary Stakeholders
2. Workshop #2 – Community Stakeholders
3. Public Open House #1
4. Online Survey #1
5. Workshop #3 - Community Stakeholders
6. Summary Report

Throughout this phase of engagement, the intent was to build an understanding of the major issues and opportunities to be addressed by the East Bowmont NEP DDP. In each of the various engagement activities, the design team sought to answer the following questions:

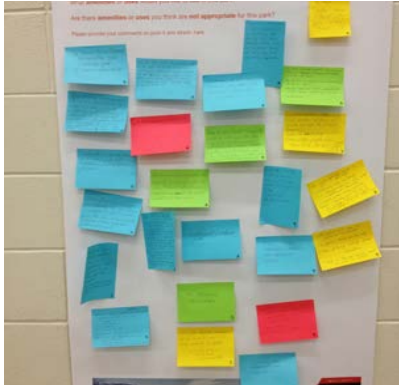
- What are the key issues that should be addressed in this plan?
- What are the key opportunities that this plan should consider?

4.2.1 Workshop #1 – City of Calgary Stakeholders March 29, 2012

Workshop #1 was held at The City of Calgary's offices at 205 8th Avenue SE on March 29, 2012. The City of Calgary provided a list of key stakeholders from within The City's organization, who were invited to participate in a workshop. The business units and specialty groups represented at the workshop included:

- Public Art
- Communications
- Parks Operations and Maintenance
- Watershed+ Art Program
- Natural Areas
- Recreation
- Water Resources
- Education and Facilities
- Public Engagement
- Parks Planning and Development
- Access and Disability Planning
- Pathways

Workshop participants brainstormed in pairs on two different topics: issues that should be addressed by the DDP and opportunities that should be considered by the DDP. Each pair determined the top five most important issues from their brainstorming session and reported them back to the group in a round-robin format. Comment cards used to record the issues during the brainstorming session were collected by the meeting facilitator and summarized as meeting notes.



Top: Stakeholder feedback at Open House #1

Bottom: Open House #1

4.2.2 Workshop #2 – Community Stakeholders May 1, 2012

Workshop #2 was held at the Hotel Alma at the University of Calgary campus on May 1, 2012. The project team invited a total of ten different community organizations to attend and participate. The organizations represented at the workshop included:

- Varsity Community Association
- Montgomery Community Association
- Bowness Community Association
- Silver Springs Community Association
- Nature Calgary
- Calgary Mountain Bike Alliance
- Calgary Pathways Advisory Committee
- Calgary River Valleys
- City of Calgary, Parks
- City of Calgary, Water Resources
- Alderman Dale Hodges, Ward 1 (observer only)

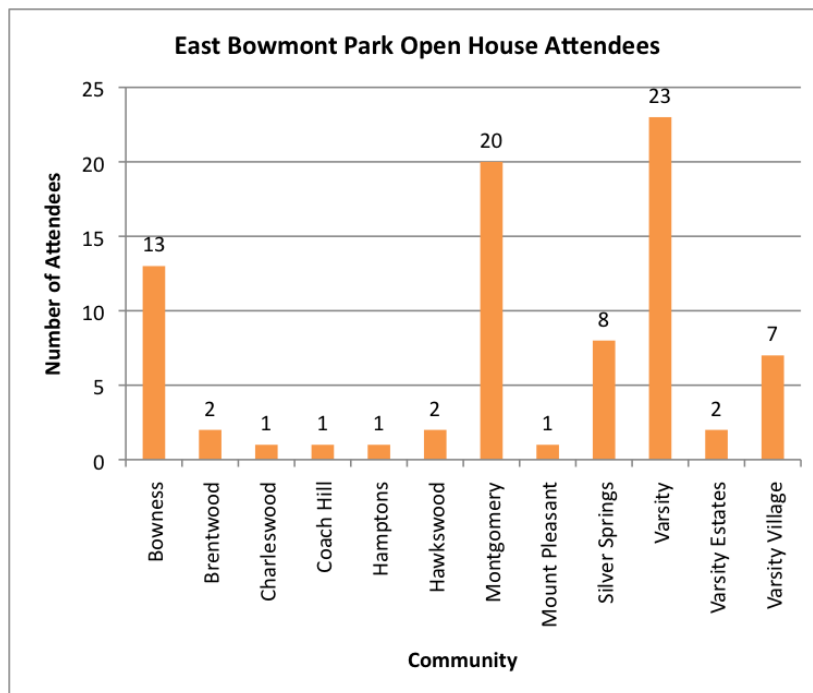
A brief presentation was given to provide background on the site, the phases of work involved in the project, and the analysis of the site that had been done to date. Workshop participants then broke out into pairs and interviewed each other about criteria that they felt it was important for the plan to address. Responses were reported back to the group and comment cards used to record the responses during the interview session were collected by the meeting facilitator and summarized as meeting notes.

In the second part of the workshop, participants were randomly broken into four smaller groups and used maps to identify areas that needed to be retained or protected in the park and new ideas that could be considered in the design. Maps used to record the ideas discussed were collected by the meeting facilitator and scanned.

4.2.3 Public Open House #1 June 6, 2012

Public Open House #1 was held at the Montgomery Community Association Hall on June 6, 2012. The open house was open to the public in two separate sessions, from 2:00 – 4:00pm and 6:00 – 8:00pm.

In total, 81 people attended and signed the sign-in sheet for the afternoon and evening sessions of the open house. Most of the attendees lived in the four communities surrounding the park (see table following page).



A total of six stations were set up around the venue, with each station focused on a particular topic. The station topics were distributed as follows:

Sign-In Station

Station 1: General Project Information

- Project process + schedule | Context map and study area

Station 2: Natural Habitat

- What elements of natural habitat need to be preserved in this park?
- What ideas do you have for protecting or creating natural habitat?

Station 3: Access + Amenities

- What ideas do you have regarding access to the site (vehicles, bicycles, pedestrians)?
- What amenities or uses would you like to see in this park?
- Would you like to see a new off-leash dog area?

Station 4: Stormwater Management

- What elements of stormwater management need to be integrated in the function and design of the park?
- What ideas do you have for integrating stormwater management in this park?

Station 5: New Ideas

- Is there any additional feedback you would like to give that has not already been addressed?
- Project process and schedule for review.

Maps showing issues and opportunities that had been gathered through Workshops #1 and #2 were posted at each station, as well as posters summarizing the feedback gathered to date. At each station, open house attendees were given an opportunity to write their comments on a sticky note and post their feedback at the station. At Station 5: New Ideas, blank maps were available for attendees to draw or make notes on other issues or opportunities they felt had not been addressed by the previous stations. Each station included a facilitator from the design team who was experienced in the subject matter being discussed at the station. Maps and sticky notes used to record the ideas discussed during the open house were collected by the meeting facilitator and scanned or compiled.

4.2.4 Online Survey #1 **June 7 to July 7, 2012**

An online survey was posted on the City of Calgary, Parks website from June 7 to July 7, 2012. A total of 82 surveys were completed, including two paper copies that were filled out at the public open house event.

The online survey included a mix of rating scale-type questions and free response questions. In the rating scale questions, the survey respondent was asked to rate their feelings about an issue on a 1 to 5 scale. In the free response questions, the respondent had the ability to provide a written response explaining their unique opinions on a topic.

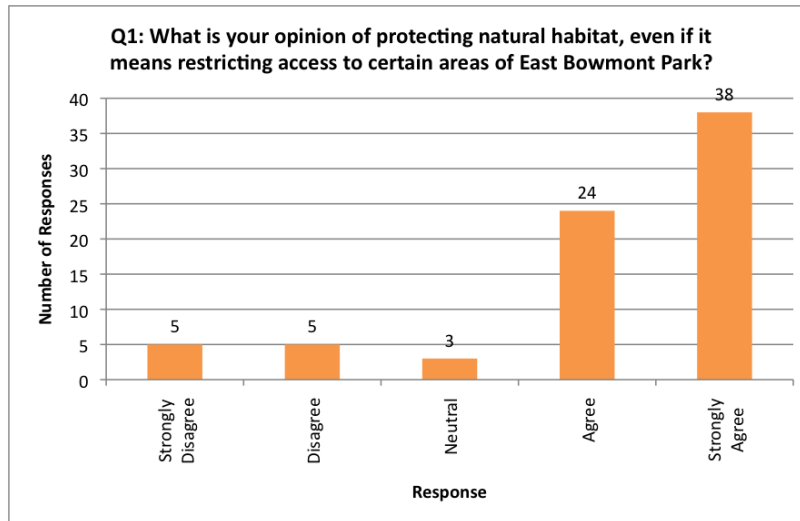
Online Survey #1 was organized into the topic categories of:

- Background information (information only, no questions asked)
- Natural habitat
- Access and amenities
- Off-leash dog use
- Stormwater management
- Other feedback

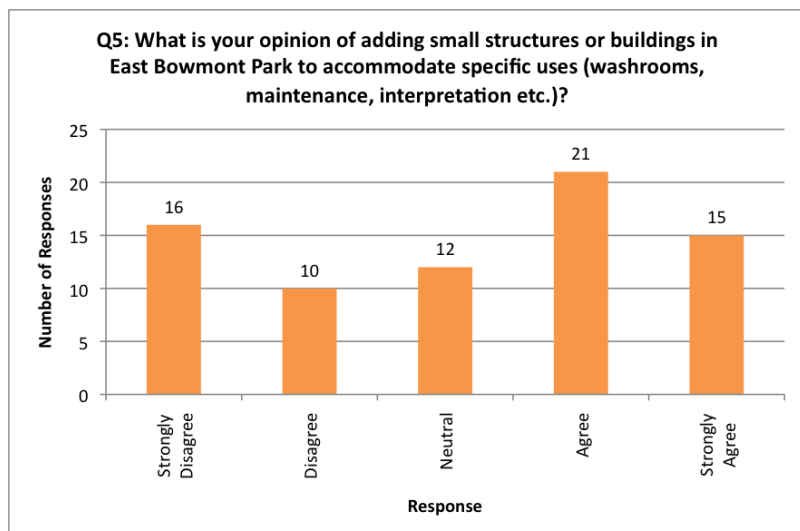
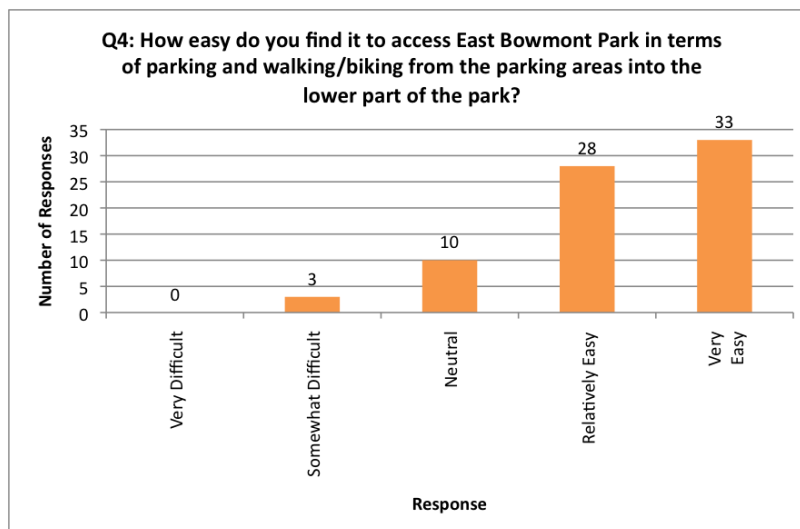
In each topic, a link to a map showing relevant issues and opportunities was provided. Respondents were able to view the map and then return to the survey and answer questions related to the map.

The following graphs illustrate the responses received to the rating scale questions. The survey question is shown at the top of each graph, with the distribution of responses below.

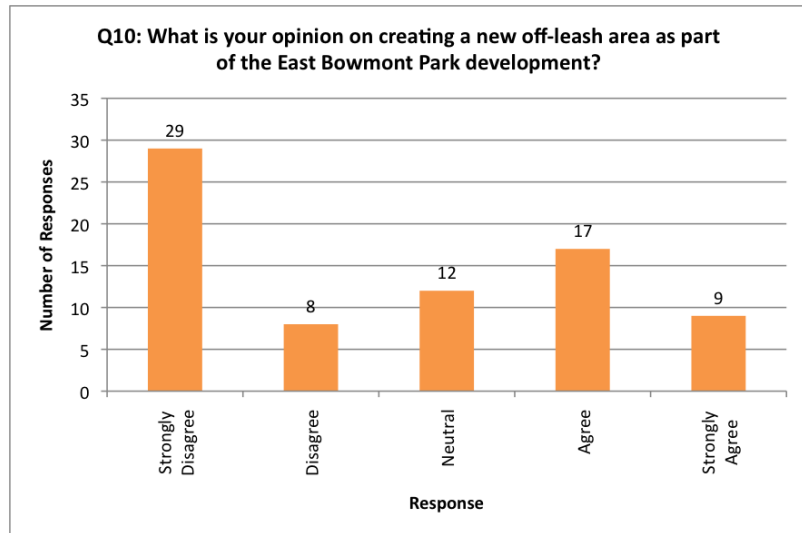
Natural Habitat



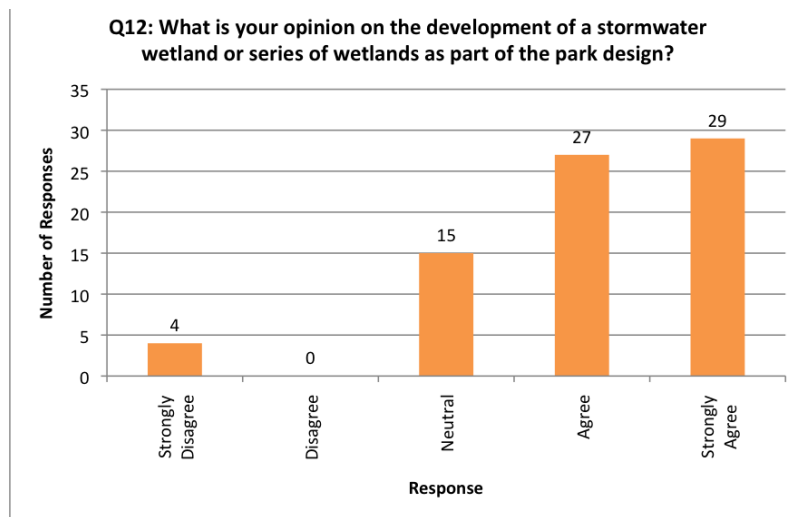
Access and Amenities



Off-Leash Dog Access



Stormwater Management



4.2.5 Workshop #3 – Community Stakeholders September 18, 2012

On September 18, 2012, a workshop was held at the Varsity Community Centre, 4303 Varsity Dr. NW, to provide an update to the community stakeholder group on the results of the Phase I engagement activities and progress of the design.

The design team presented the results of Online Survey #1 and the common themes that were identified in all of the feedback received throughout Phase I. The City of Calgary, Water Resources, then presented some information about the need to provide stormwater quality management for existing stormwater collection systems without treatment and what the East Bowmont NEP stormwater treatment system might look like.

This workshop was an information session with no formal feedback collected.

4.3 Summary of Phase I Engagement Feedback

To facilitate comparison of stakeholder feedback from the four different events held in Phase I, all written comments received were compiled into the topic categories of:

- Natural habitat
- Access and amenities
- Stormwater management
- Other ideas

The detailed written feedback from each engagement activity was analyzed to identify common themes in the comments. In each topic category, the most frequently repeated opinions were grouped into themes that generally express ideas that recurred in different ways throughout the detailed feedback.

4.3.1 Common Themes

The following themes were repeated throughout the Phase I stakeholder engagement process. Not all of the participants necessarily agreed with the statements below, but they reflect the popular opinion as indicated by the feedback collected.

Keep the Park Natural

Throughout the engagement events, one of the biggest concerns of the participants was keeping the park natural, protecting and preserving existing habitat, and creating new habitat to support wildlife. It is clear that the majority of people who participated in the Phase I process would like to see the park as



Sample comments received in Phase I engagement

a natural area with limited development. The river edge and escarpment were two areas highlighted by the stakeholders as areas of particular sensitivity or importance. People saw restricting access for dogs and bicycles in certain areas as a way to achieve this goal, as well as restricting access for all park visitors to areas of high sensitivity, or areas where reclamation work is taking place.

Restrict Vehicular Access into the Park

Most of the respondents agreed that it was not appropriate to provide public vehicular access into the lower part of the park, or to provide parking lots within the park. Some people did not want any vehicles in the park at all, although this may not be practical, as there will be maintenance requirements and elimination of all vehicles may impair access for physically challenged park visitors. Many felt the current amount of parking was sufficient (12%), although some people thought it would be acceptable to improve or expand the existing parking lot at the south end of the park (9%).

Provide a Range of Trails for Different User-Groups

Many people noted that there have been conflicts between different user-groups on the regional pathway, such as pedestrian vs. cyclists or cyclists vs. off-leash dogs, and requested that separate trails be provided for pedestrians only. A large number of the respondents requested the addition of more nature trails to the park, citing wood chip trails that are for pedestrian use. Cross-country skiing trails were also requested by a few people.

Provide Mountain Biking Trails in the Park

Opinions were divided about whether the current single track mountain biking trail on the escarpment should stay open. Some thought the escarpment is too sensitive to support this type of activity (22%), while others thought the trail just needed a few improvements to make it safer and reduce the environmental impact (22%). Several respondents strongly stated that they believed the trail should remain open (53%), and cited this as a main attraction for the park. A few people requested additional mountain biking trails or a skills park, and a few people noted they did not feel a specific mountain biking area was appropriate for the park.

Stormwater Management Should be Incorporated into the Park

Most of the respondents agreed with the idea of providing some amount of stormwater treatment in the park, although it was important to the stakeholders that the amount of land dedicated to stormwater management is balanced with other uses or considerations such as habitat and passive recreation, and that the wetlands and outfalls be designed to look natural. Most supported a land area of about 10 hectares being used for stormwater treatment wetlands. Some people had suggestions for the design of the wetlands, such as using many small connected wetlands instead of a few large ponds, and providing access into the wetlands with a boardwalk system. A minority of stakeholders did not think stormwater treatment should be incorporated into the park at all, or were concerned about negative impacts, such as smells or mosquitoes.

Integrate Educational Opportunities

A number of respondents suggested providing interpretive signage, nodes, wildlife viewing areas, interpretive trails, or supported an interpretive centre in the park. Topics for education recommended by the stakeholders included wildlife, native plants, invasive plants, proper trail use, and the historic Shouldice Residence.

Limit Off-Leash Dog Access

The majority of people who participated in the Phase I engagement process thought that off-leash dog access should be restricted or eliminated from East Bowmont Park (86%). Conflicts with other users and wildlife and destruction of habitat were most commonly cited as the reasons for restricting access. A minority of respondents to the online survey thought the existing off-leash areas should be maintained or expanded (12%).

4.3.2 Points of Tension

There was a split between those who wanted to minimize development in the park and those who wanted to provide some passive recreation and supporting facilities. This split was reflected in opposing views on whether the following uses were appropriate:

- Washroom facilities
- Picnicking
- Interpretive centre

Many people thought that it would be acceptable to provide some facilities as long as any buildings, parking, etc. were kept to the edges of the park.

Off-Leash Dog Access

While the majority of respondents said they thought off-leash access should be limited to specific areas or even eliminated from the park (86%), some people also thought existing off-leash areas should be maintained or expanded (12%).

Mountain Biking

Some respondents felt that mountain biking is damaging to the park and should be restricted or eliminated (22%). Others felt strongly that mountain biking should be a continued use in the park, either on existing or new trails (75%).

Public Open House #1



4.4 Phase II Stakeholder Engagement Activities

During Phase II of the East Bowmont NEP DDP, information about the project site and stakeholder / public feedback that was gathered and analysed in Phase I was used to inform the program development for the park. The design team, made up of artists, landscape architects, and stormwater engineers, worked collaboratively with The City of Calgary, Parks and Water Resources project managers to develop a concept for the park that addresses the functional requirements of stormwater management, while creating an exciting new park amenity that can be enjoyed by a wide range of park visitors. The concept plan was presented to stakeholders and the public in a series of workshops, open house and online survey activities. As part of the process, the design team showed how the feedback from Phase 1 was addressed, or explained why it could not be incorporated into the design.

The second phase of stakeholder engagement consisted of five elements:

1. Workshop #4 – City of Calgary Stakeholders
2. Workshop #5 – Community Stakeholders
3. Public Open House #2
4. Online Survey #2
5. Summary Report

Throughout this phase of engagement, the intent was to gather opinions about the proposed conceptual program for the park.

4.4.1 Workshop #4 – City of Calgary Stakeholders May 21, 2013

Workshop #4 was held at The City of Calgary's offices at 205 8th Avenue SE on May 21, 2013. The same business units and specialty groups who participated in Workshop #1 were invited to attend Workshop #4. Those represented at the workshop included:

- Public Art
- Parks Operations and Maintenance
- Watershed+ Art Program
- Natural Areas
- Recreation
- Water Resources
- Parks Planning and Development
- Access and Disability Planning
- Pathways

The workshop began with a presentation of the proposed conceptual program for the park. The slide show included an overview of the engagement activities completed in Phase I and highlighted the most common feedback relating to the topics of natural habitat and biodiversity, access and amenities, mountain

biking, off-leash dog access and stormwater management. The presentation explored how the conceptual program relates to these topics, as well as providing background about how the forms and shapes of the design were inspired by natural forms and processes of rivers.

Following the presentation, an informal discussion about the design and the presentation in general took place. Participants were then asked to fill out a survey to collect specific feedback on the design through a mix of rating scale-type questions and free response questions.

4.4.2 Workshop #5 – Community Stakeholders May 21, 2013

Workshop #5 was held at the Varsity Community Centre, 4303 Varsity Dr. NW, on May 21, 2013. The same group of community organizations that participated in Workshop #2 was invited to attend and participate in Workshop #5. The organizations represented at the workshop included:

- Varsity Community Association
- Montgomery Community Association
- Bowness Community Association
- Silver Springs Community Association
- Nature Calgary
- Calgary Mountain Bike Alliance
- Calgary River Valleys
- City of Calgary, Parks
- City of Calgary, Water Resources
- Alderman Dale Hodges, Ward 1 (observer only)

The workshop began with a presentation of the proposed conceptual program for the park. The slide show included an overview of the engagement activities completed in Phase I and highlighted the most common feedback relating to the topics of natural habitat and biodiversity, access and amenities, mountain biking, off-leash dog access and stormwater management. The presentation explored how the conceptual program relates to these topics, as well as providing background about how the forms and shapes of the design were inspired by natural forms and processes of rivers.

Following the presentation, workshop participants were broken into two groups and given maps of the proposed East Bowmont NEP conceptual program. A design team facilitator in each group led a discussion about the concept, including how well the feedback from Phase I was addressed, elements of the design that were particularly successful, and modifications that could be made to make the design better. The facilitator recorded the key points of the discussion on a flip chart and reported the results of the discussion back to the workshop participants.

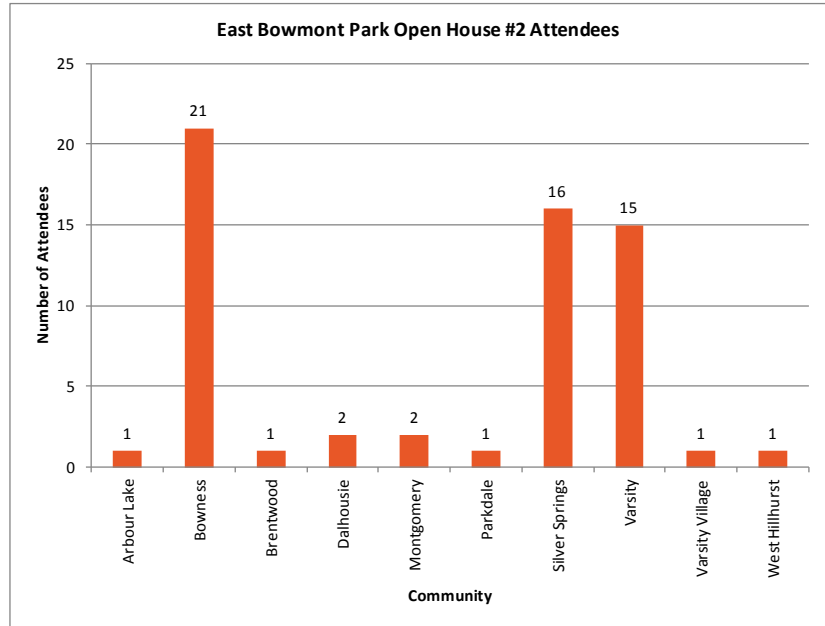
Participants were then asked to fill out a survey to collect specific feedback on the design through a mix of rating scale-type questions and free response questions.

Stakeholder Workshop #5



4.4.3 Public Open House #2 May 22, 2013

Public Open House #2 was held at the Bowness Community Centre and Arena on May 22, 2013. The open house was open to the public from 3:00 – 8:00pm. In total, 61 people attended and signed the sign-in sheet for the open house. Most of the attendees lived in the communities surrounding the park (see table below).



A total of seven stations were set up around the venue, with each station focused on a particular topic. The station topics were distributed as follows:

Sign-In Station

Station 1: Introduction

- Project background information
- Context map and study area
- Site photos

Station 2: Concept - Habitats Along the Water

- Concept development process
- Rendered plan and visualizations of the proposed conceptual program
- Comment sheet

Station 3: Enhancing Biodiversity

- Habitat diagram
- Succession strategy and vegetation communities
- Phytoremediation

- What we've heard so far - Natural habitat and environment
- Comment sheet: "How well do you feel the plan preserves, protects and enhances natural habitat in the park?"

Station 4: People in the Park

- Circulation diagram
- Trail and pathway types
- Activities and facilities
- Off-leash area
- Single track mountain biking trail plan
- Detailed plans and visualizations of select areas of the park
- What we've heard so far - Access and amenities
- Comment sheet: "Are you satisfied with the variety and level of access provided for the park?"; "Do you agree that the visitor amenities in the park design are appropriate?"; "Do you agree with the proposed improvements to the existing single track mountain biking trail?"; "Do you agree with the proposed changes to the off-leash areas in East Bowmont Park?"

Station 5: Protecting the Bow River

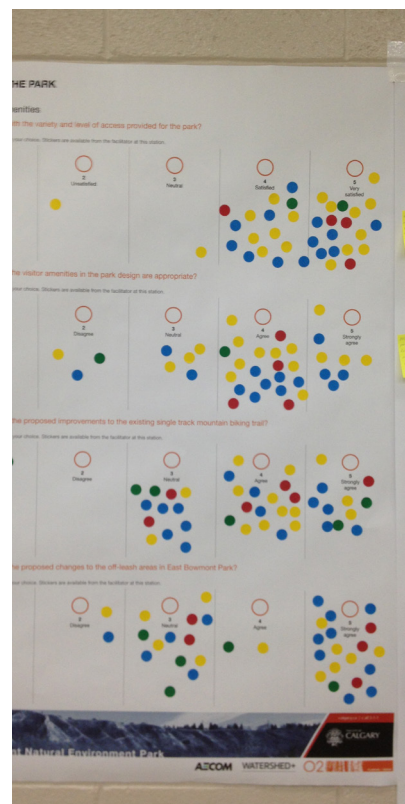
- Stormwater management issues in Calgary
- Stormwater management concept
- Stages of stormwater quality management
- What we've heard so far - Stormwater management
- Comment sheet: "Are you satisfied with the way that stormwater management has been integrated into the design?"

Station 6: Map Station

- Blank concept plans that attendees could draw or make notes on

Posters and maps showing different aspects of the proposed conceptual program were posted at each station, as well as posters summarizing the feedback gathered to date as it related to each station topic. At each station, comment sheets with relevant questions from the survey were posted. Open house attendees were provided with stickers with which to vote on the survey questions. Sticky notes and pens were made available throughout the open house for attendees to post additional comments at any station. Each station

Public Open House #2



included a facilitator from the design team who was experienced in the subject matter being discussed at the station. Maps and sticky notes used to record ideas during the open house were collected by the facilitators and photographed.

4.4.4 Online Survey #2 May 23 to July 5, 2013

An online survey was posted on the City of Calgary, Parks website from May 22 to July 5, 2013. A total of 382 surveys were completed, including four paper copies that were filled out at the public open house event.

The online survey was mainly based on rating scale-type questions, with one free response question at the end of the survey. In the rating scale questions, the survey respondent was asked to rate their feelings about an issue on a 1 to 5 scale. In the free response question, the respondent had the ability to provide a written response explaining their unique opinions on the conceptual program for the park.

Online Survey #2 was organized into the topic categories of:

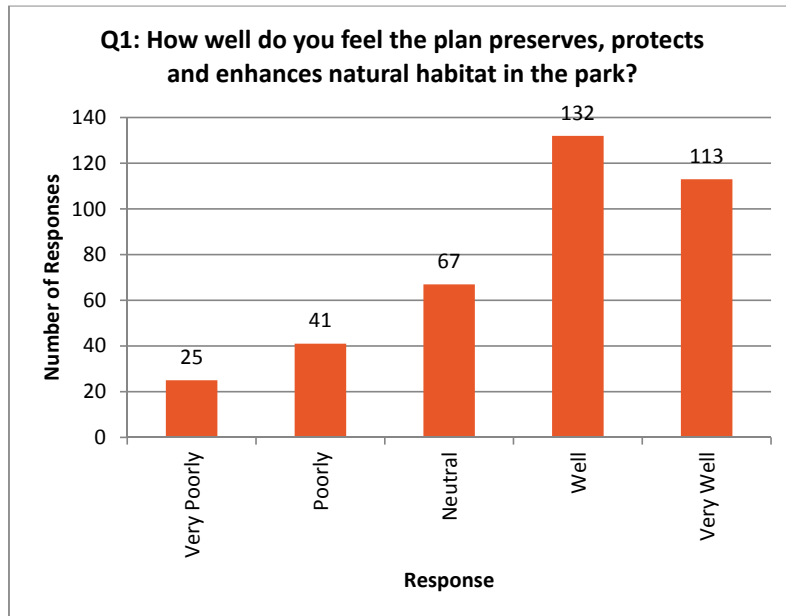
- Background information and conceptual program (information and images only, no questions asked)
- Natural habitat
- Access and amenities, including
 - Access
 - Amenities
 - Single track mountain biking trail
 - Off-leash dog use
- Stormwater management
- Other feedback

In each topic, a link to a map or series of maps showing specific aspects of the conceptual program related to the topic was provided. Respondents were able to view the map and then return to the survey and answer questions related to the map.

4.5 Summary of Phase II Engagement Feedback

Throughout the Phase II engagement events, participants filled out surveys and provided written feedback on the conceptual program. The following graphs summarize the total responses received for the rating scale questions of the survey.

Natural Habitat

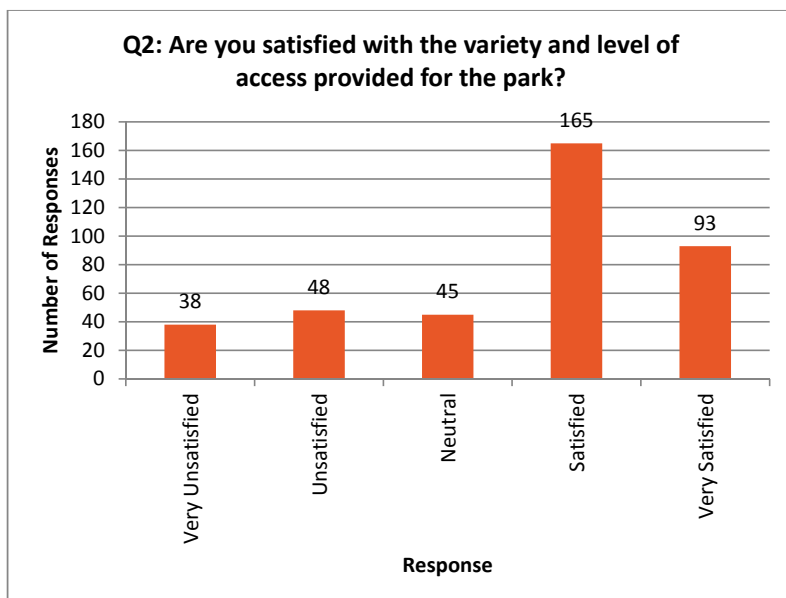


65% Support for the plan

(245 out of 378 responses)

17% Opposed to the plan (66 out of 378 responses)

Access and Amenities | Access



66% Support for the plan

(258 out of 389 responses)

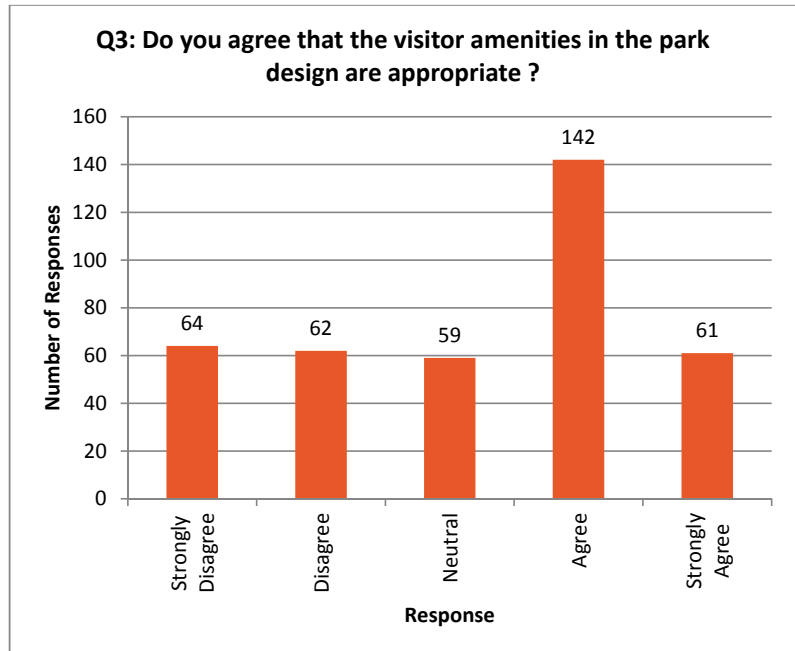
22% Opposed to the plan (86 out of 389 responses)

Access and Amenities | Amenities

**52% Support
for the plan**

(203 out of 388 responses)

**32% Opposed to the
plan** (126 out of 388 responses)

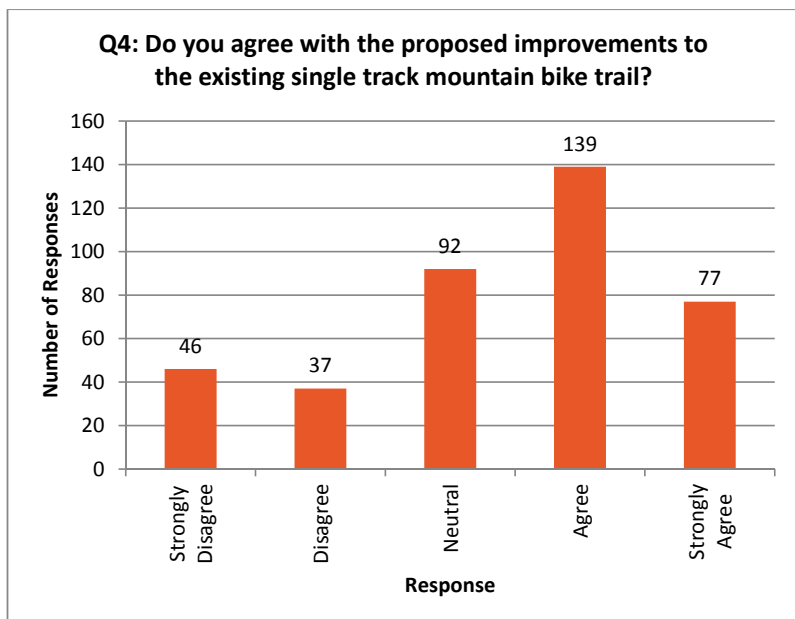


Access and Amenities | Single Track Mountain Biking Trail

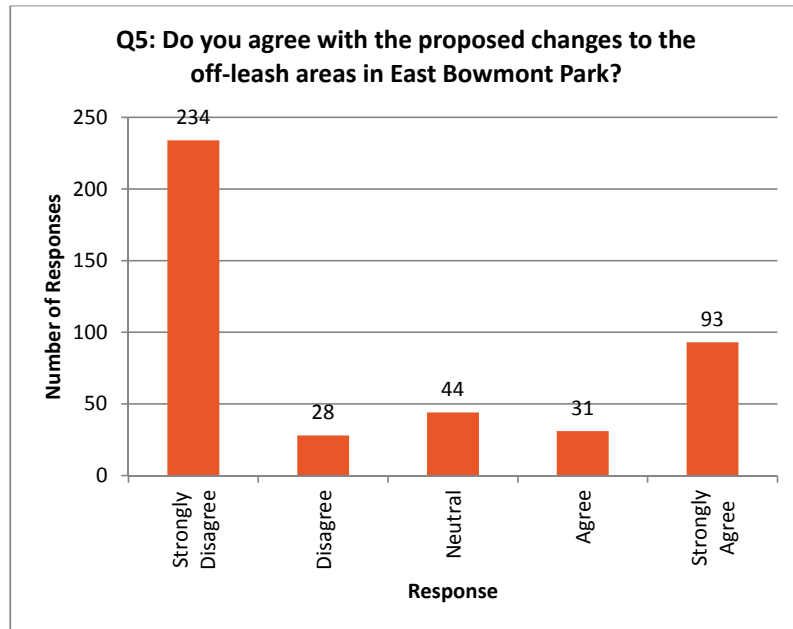
**55% Support
for the plan**

(216 out of 391 responses)

**21% Opposed to the
plan** (83 out of 391 responses)



Access and Amenities | Off-Leash Dog Access



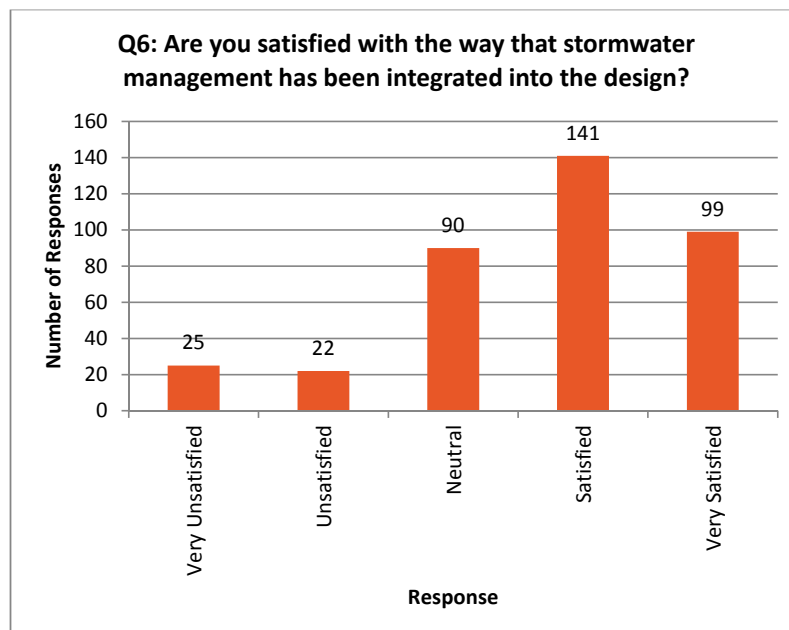
29% Support for the plan

(262 out of 430 responses)

61% Opposed to the plan

(124 out of 430 responses)

Stormwater Management



64% Support for the plan

(240 out of 377 responses)

12% Opposed to the plan (47 out of 377 responses)

The detailed written feedback from each engagement activity was analyzed to identify common themes in the comments. In each topic category, the most frequently repeated opinions were grouped into themes that generally express ideas that recurred in different ways throughout the detailed feedback.

4.5.1 Common Themes

The following themes were repeated throughout the Phase II stakeholder engagement process. Not all of the participants necessarily agreed with the statements below, but they reflect the popular opinion as indicated by the feedback collected.

Support for Protection of Natural Habitat

In rating scale-based questions throughout the Phase II engagement process, participants voted in favour of the protection and restoration of natural habitat as shown in the concept design (65% support for the plan). Out of a total of 375 individual comments that were analyzed, 22 respondents (6%) felt that the concept showed too much development for a natural environment park.

Support for Parking, Trails and Pathways

In rating scale-based questions throughout the Phase II engagement process, participants voted in favour of the variety and level of access shown in the concept design (66% support for the plan). A few people noted that the proposed stairway from the top of the escarpment would be more useful if it was moved slightly to the north, with better connections to the playground area at the top of the escarpment. Degradation of unpaved trails by cyclists and speeding cyclists on the regional pathway were two issues that emerged in the online survey. A total of 51 out of 245 comments received in the online survey (21%) were about bicycle speed and access in the park. A few people noted that they would like to see some trails identified specifically for cross country skiing.

Issues Surrounding Specific Proposed Amenities

Respondents were somewhat divided regarding the new amenities proposed in the park (52% support for the plan). Specific issues included concerns that covered or enclosed amenities, such as the picnic shelter, amphitheatre and washrooms, particularly the proposed seasonal washroom in the lower area of the park, would invite vandalism and use by transients. Residents near the parking lot off 52nd Street were also concerned that the proposed picnicking and washroom amenities were too close to residences. A number of respondents (20 out of 265 comments, or 8%) did not support the proposed design for the view platforms or stairs, citing that these types of structures would detract from the natural park setting. 3% of online survey respondents did not think an amphitheatre was an appropriate use in the lower park area.

Support for Mountain Biking Trails in the Park

Overall, survey respondents supported the proposed improvements to the existing single track mountain biking trail (55% support for the plan). Out of 260 comments, 26 respondents (10%) specifically stated their support for retaining the trail. Another 3% of respondents noted that they would like to see a mountain bike skills area with jumps included in the design.

Opposition to the Proposed Reduction in Off-Leash Area

The majority of respondents that were engaged in Phase II were opposed to the proposed reductions in off-leash area in the park (61%). It should be noted that The City of Calgary was making changes to off-leash areas throughout Bowmont Park at the same time that the East Bowmont Park engagement process was ongoing. Information regarding the proposed changes throughout Bowmont Park was presented by Parks at the East Bowmont Park public open house on May 22, 2013, and was posted on the Parks website at the same time as the East Bowmont Park online survey. It appears that some of the feedback received was in response to the proposed changes throughout Bowmont Park, rather than the specific changes proposed for East Bowmont Park.

However, two areas of concern related to East Bowmont Park emerged through the free response comments. First, out of 269 comments, 61 (23%) noted that an off-leash swimming area should be provided for dogs. Many commenters specified an area near the existing stormwater outfall that has been popular for swimming in the past. Second, a number of respondents noted that the playground at the top of the escarpment is infrequently used and supported fencing the playground to reduce conflicts with dogs rather than changing the area at the top of the escarpment to on-leash.

Support for Stormwater Design

In rating scale-based questions throughout the Phase II engagement process, participants voted in favour of the way that stormwater management has been integrated into the concept design (64% support for the plan). A few online survey respondents (2%) had concerns that the design of the Nautilus Pond™ forebay was too artificial, or that it could be unsafe for children playing in the park.

Enforcement of Park Bylaws

Whether it was in relation to speeding cyclists on the pathways, dog owners disregarding pet use bylaws, or vandalism, crime and transient use of the park, many respondents (43 out of 258 comments, or 17%) felt that better enforcement of park bylaws was important in ensuring the success of the park and the enjoyment of its diverse visitors.



Rendering of concept design as seen from above, from the east

5.0 VISION, PRINCIPLES AND OBJECTIVES

The design vision, principles and objectives for East Bowmont NEP provide over-arching direction for the park concept and the Design Development Plan. The vision, principles and objectives presented below reflect stakeholder input, and are informed by the analysis of existing conditions.

5.1 A Vision for the Park

The Design Development Plan for East Bowmont Natural Environment Park will restore the ecological integrity of the area, while at the same time enhancing the recreational and educational value of East Bowmont Park. The plan will incorporate stormwater treatment as a functional element of the park that also provides a major park amenity, contributing to visitor experience in the park.

5.2 Design Principles

The following design principles were developed in collaboration with the community stakeholder group during Workshop #2 on May 1, 2012. Attendees were asked to identify criteria that were important for the Design Development Plan to address, which were grouped into the design principles below.

Provide enjoyment for a variety of users

The park plan will include designated trails and amenities for a range of different uses, from highly active cycling trails and pathways to more passive nature trails and wildlife viewing areas, while at the same time providing appropriate separations between incompatible uses to reduce conflicts between different user-groups in the park.

Provide a variety of appropriate access points (safe and accessible)

The existing access points to the park are too steep to be universally accessible and are located at either end of the park. The new park plan will improve universal accessibility to the park and provide more options for accessing the park from adjacent neighborhoods.

Preserve and enhance natural elements and systems

Existing areas of low habitat value, such as the former gravel pit lands, will be restored to improve habitat and existing areas of high-value habitat will be protected from significant disturbance. Overall, the natural environment in the park will be improved as a result of the Design Development Plan.

Align with existing plans and policies

The Design Development Plan will align with existing plans and policies that govern the site, including the Calgary Natural Area Management Plan and the Bowmont Park Management Plan. The new park will be a natural environment park and as such, should meet The City's guidelines for these types of parks.

Provide opportunities for learning and engagement

The park plan will incorporate learning and engagement by providing opportunities to interact with the park environment, venues for teaching and learning, and illustrating processes at work in the park through design, as well as traditional interpretive methods.

Integrate water management into the park's function and design

The plan will incorporate stormwater treatment as a functional element of the park that also provides a major park amenity for visitor interaction and enjoyment.

Provide accessible and environmentally sensitive trails

A range of trails for different levels of accessibility will be included. All new and existing trails will be reviewed for environmental sustainability and alignments adjusted as needed to minimize environmental impact of trails in the park.



Rendering of stormwater conveyance stream

Address maintenance and enforcement issues

Maintenance and enforcement issues stem from operational concerns, such as budgets and policies, as well as design concerns. The park plan will address design concerns related to maintenance and enforcement by designing the park to make bylaw requirements more explicit and easier to understand, improving safety, and using elements that are durable and easy to maintain.

5.3 Design Objectives

Table 14 below shows how each design principle was broken down into specific objectives to help realize the design vision and principles for the park plan.

Table 14 Design Objectives

Design Principle	Objectives
Provide enjoyment for a variety of users	<ul style="list-style-type: none">- Develop a hierarchy of trail types and uses- Designate some trails as pedestrian-only to reduce conflicts between cyclists and pedestrians- Reduce off-leash conflicts with pathways- Reduce off-leash conflicts with wetlands, sensitive habitats, and other areas where wildlife is likely to be impacted by the presence of dogs- Provide a variety of amenities that can be enjoyed by visitors of different age groups and activity levels
Provide a variety of appropriate access points (safe and accessible)	<ul style="list-style-type: none">- Accommodate disabled and elderly park visitors by providing a method of accessing the lower park area- Provide additional pedestrian / bicycle access closer to the centre of the park
Preserve and enhance natural elements and systems	<ul style="list-style-type: none">- Avoid intensive development within the core of the park- Focus on passive activities that have a smaller impact on wildlife and habitat- Protect existing high-value habitat from disturbance caused by construction of new amenities- Restore existing disturbed areas using native vegetation- Where an existing habitat will be disturbed by construction, replace with equal or better habitat value- Relocate or eliminate existing uses that are damaging the natural environment in the park- Manage weeds and invasive species in the park
Align with existing plans and policies	<ul style="list-style-type: none">- Refer to existing plans and policies in making design and management recommendations for the park

Design Principle	Objectives
Provide opportunities for learning and engagement	<ul style="list-style-type: none"> - Provide opportunities to interact with the park environment, such as wildlife viewing areas - Include venues where teaching and learning activities can be centred - Illustrate processes at work in the park through design, rather than relying strictly on signage
Integrate water management into the park's function and design	<ul style="list-style-type: none"> - Treat as much stormwater from existing outfalls as is feasible - Treat stormwater to meet City of Calgary requirements of 85% removal of total suspended solids for particle sizes 50 microns and greater - Provide secondary and tertiary treatment of stormwater to further improve water quality - Expose the physical infrastructure and processes of stormwater collection that are normally hidden from view - Create valuable and biodiverse habitats within treatment areas - Optimize the contribution of stormwater facilities to recreational opportunities and visitor experience - Call attention to and educate visitors about the journey of the water and flood events through design - Limit the impact of flooding and stormwater facilities on existing high-value habitat
Provide accessible and environmentally sensitive trails	<ul style="list-style-type: none"> - Provide trails or pathways that are universally accessible to the key amenities in the park - Assess existing trail alignments to determine whether they are causing environmental damage - Relocate or eliminate existing trails that are damaging the natural environment in the park - Avoid establishing new trails in environmentally sensitive areas
Address maintenance and enforcement issues	<ul style="list-style-type: none"> - Make bylaw restrictions (e.g. off-leash areas, pathway speed limits, park hours) easier to understand by clearly delineating boundaries and access - Provide for security cameras in areas of concern - Avoid thick vegetation that blocks views near higher-use amenities, and provide views into amenity areas through vegetation to maintain visibility in the park - Encourage more visitors during park hours by improving access, parking and amenities in the park - Use durable materials for the construction of all amenities - Design buildings and structures to be closed off and less vulnerable to vandalism during off-hours / off-season - Avoid specifying specialty products and materials that are difficult to obtain and replace - Provide vehicular access through areas that require maintenance - Ensure infrastructure and utilities are easily accessible for maintenance

6.0 CONCEPT DESIGN

The concept plan for East Bowmont NEP is structured around a series of habitats that will restore areas previously impacted by gravel pit operations, treat stormwater, and provide a variety of recreation opportunities for park users. Interwoven within the different habitat areas of the park is a hierarchy of trails and pathways that provide access to park amenities and recreational activities.

6.1 Design Inspiration

The design vision for East Bowmont NEP celebrates the valued ecosystems of the Bow River Valley. Drawing inspiration from meander scrolls, a unique riparian phenomenon that leaves a physical record of a river's changing path over time, the concept plan uses fluvial landforms as a basis for the design approach to the park.

An anabranch or meander scroll is a section of a river or stream that diverts from the main channel or stem of the watercourse and rejoins the main stem downstream. Local anabranches can be the result of small islands in the watercourse. In larger anabranches, the flow can diverge for a distance of several kilometers before rejoining the main channel.

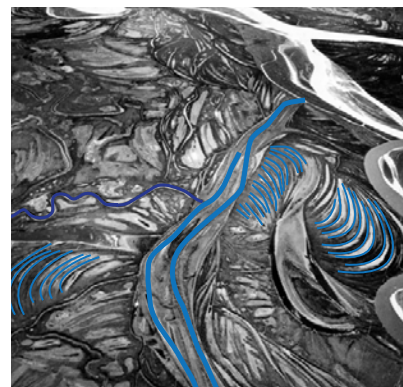
In meander bends, a similar phenomenon is displayed through vegetation as even-aged lines of trees, each of which regenerated in a year when flooding conditions were suitable for seedling establishment. Dating these tree lines maps out the flood history of a river and allows measurement of the rate of floodplain growth.

The concept design for East Bowmont NEP builds upon these fluvial landforms as an organizing principle for the site, along with the functional requirements of the stormwater treatment system. The sculptural forms and shapes of the concept design will contrast with the natural park experience of the varied habitat areas within the park to add a layer of complexity and interest to the visitor's experience of the place.

6.2 Site Program

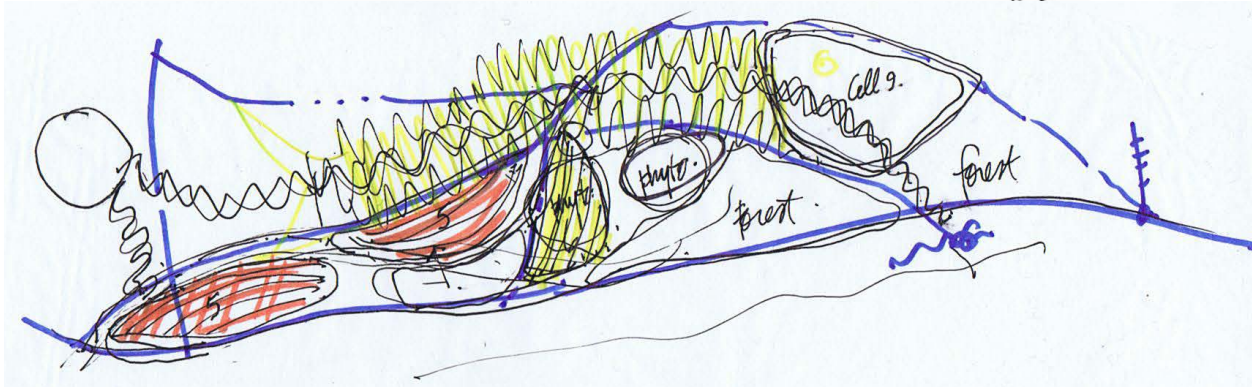
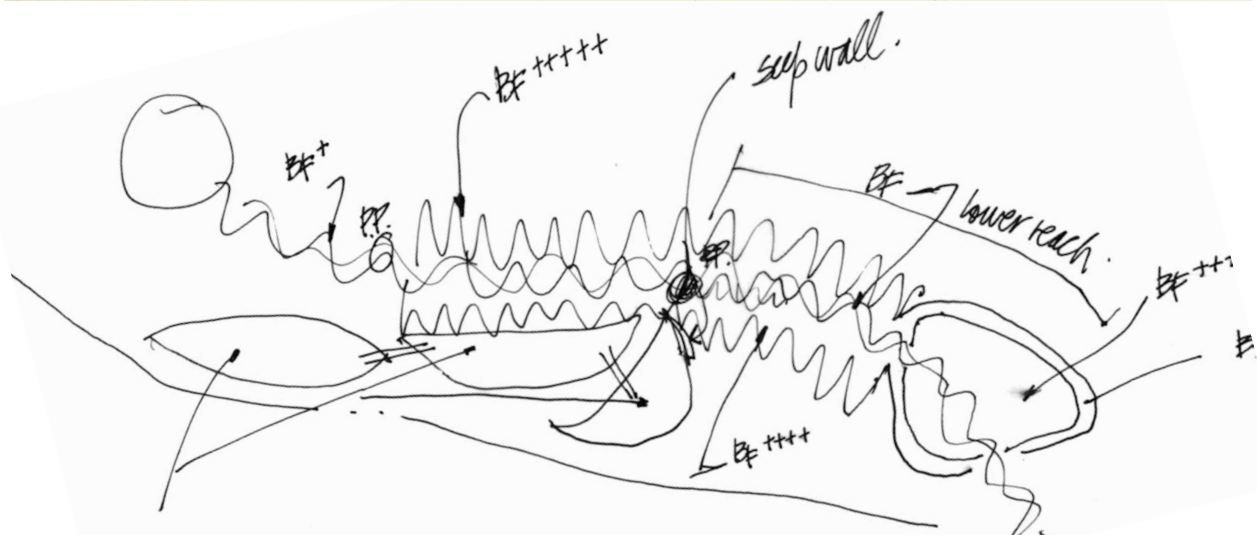
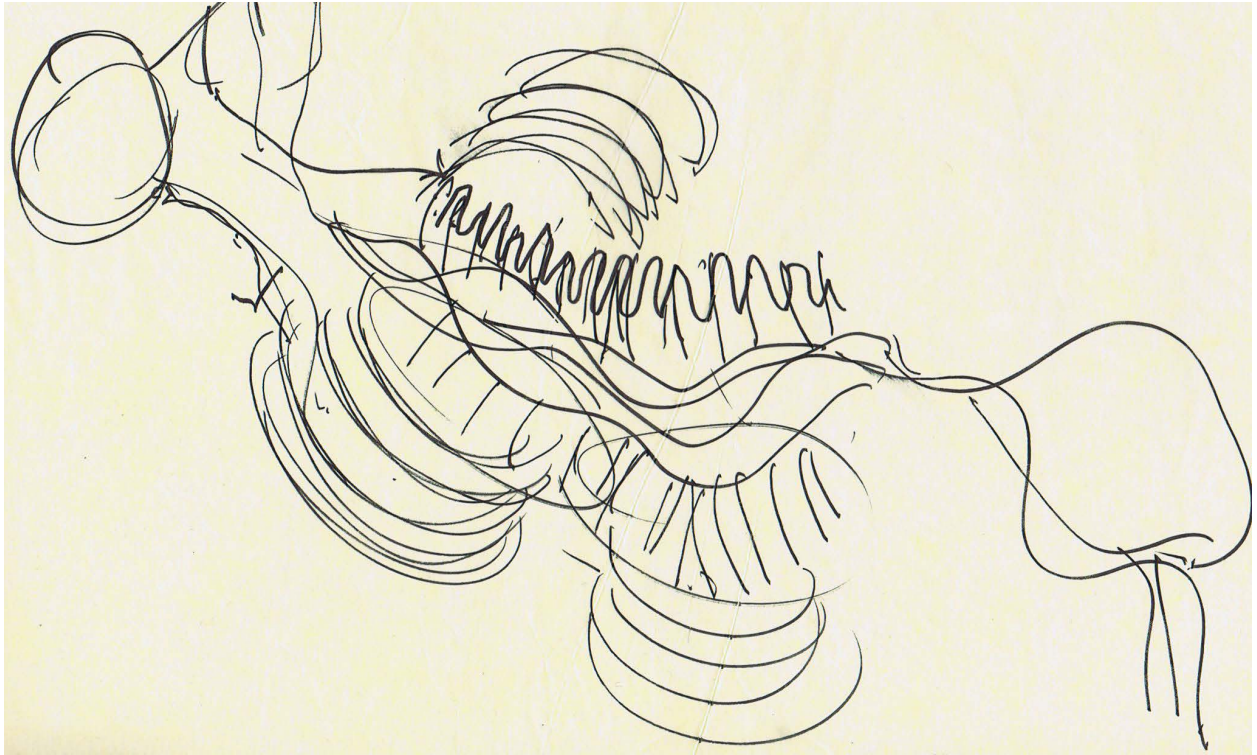
The site program comprises a series of natural habitats, and the proposed activities and land uses that will occur within them. These habitats are based on an analysis of existing conditions, including site hydrography and hydrology, geotechnical considerations, vegetation, wildlife habitat, visual character, current uses and infrastructure, and utilities and stormwater.

Key features of the site program are treatment of stormwater runoff, restoration and reclamation of degraded areas, and the incorporation of these processes into a design that promotes recreation, enjoyment and understanding of the site.



Top and bottom: Koyukuk River, Alaska (Google Maps)

Middle: Banded vegetation showing flood history of the Koyukuk River, Alaska (Google)



Early conceptual diagrams

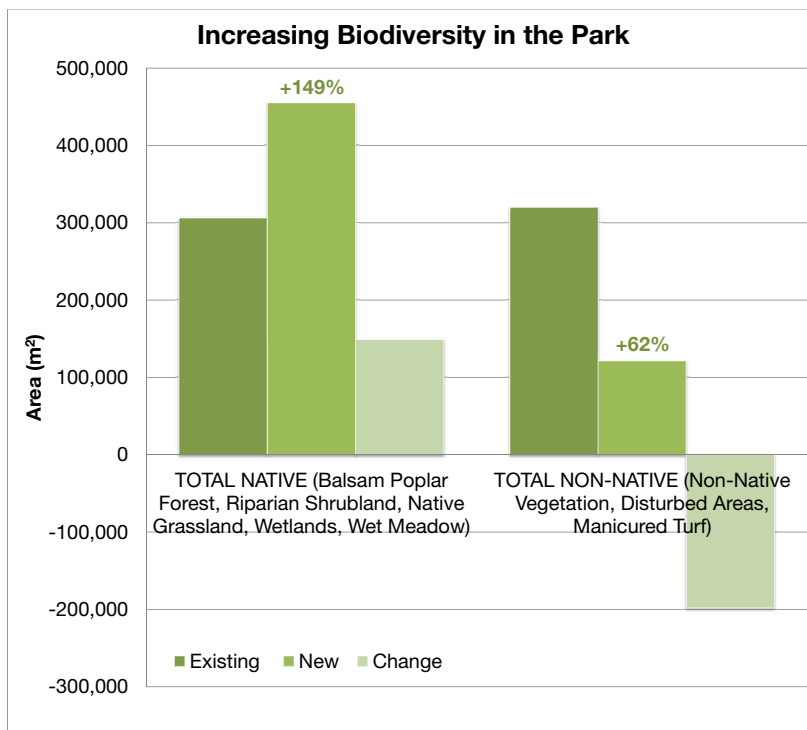
6.2.1 Natural Habitat

The natural habitats identified for the park respond to the conditions and character of the site, as well as the processes that have shaped the landscape over time. The natural habitats contribute to ecological processes, enhance recreation opportunities, and provide for functional integration of stormwater quality management processes.

Habitat will transition through the park, from native grasslands along the escarpment to Balsam Poplar forest and riparian shrubland along the edge of the Bow River. Manicured turf at the top of the escarpment will provide a transition from the built environment to the park.

The existing vegetation in the park is a mix of Balsam Poplar forest, native grassland, non-native vegetation, disturbed areas, wetlands, and manicured turf. The concept plan replaces the disturbed areas (largely the former gravel pit operation) with wetlands, wet meadows, riparian shrubland and Balsam Poplar forest. Additional areas of non-native vegetation will be replaced with wetlands, riparian shrubland and native grasslands where existing off-leash areas are being removed. Off-leash areas to remain in use will remain as non-native vegetation or manicured turf.

Overall, the plan will result in a 149% increase in natural habitat and 62% decrease in disturbed areas and non-native vegetation.



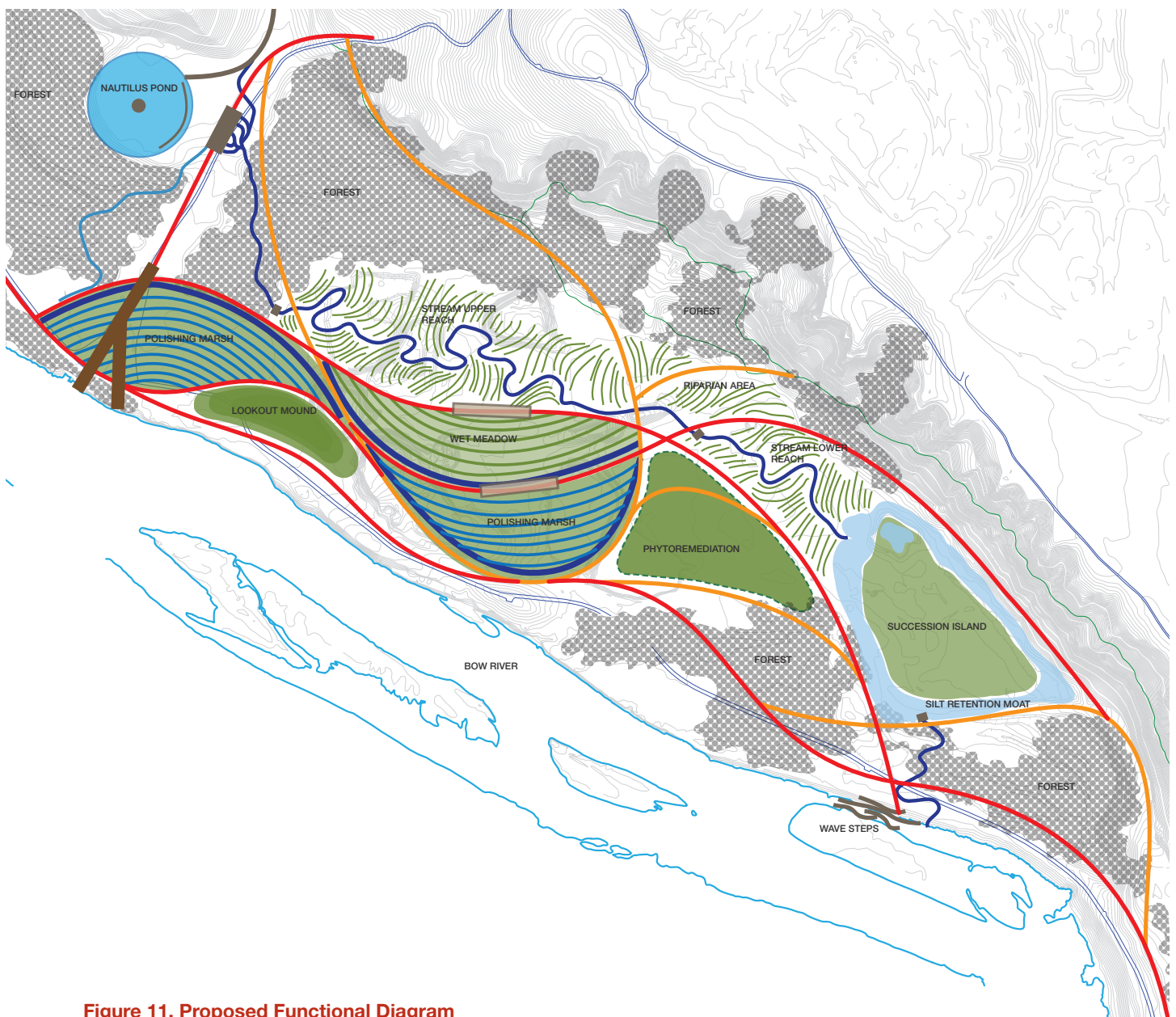


Figure 11. Proposed Functional Diagram

6.2.2 Proposed Activities and Land Uses

Three core activities are proposed for the park, with corresponding land uses to manage these activities.

Restoration

There are several areas within the park that will be restored to improve the ecological integrity of the site. Site restoration will include the area that was contaminated with hydrocarbons from fuel during gravel mining operations, the disturbed area of the gravel pit itself, and areas along informal trails that are eroded and populated with invasive species.

Recreation

Passive and active recreation activities will be integrated throughout the park, characterized by formal and informal facilities to promote education and enjoyment. The main activities undertaken in the park will include: mountain biking in designated areas; cycling; walking and dog walking; picnicking; educational tours; and viewing of wildlife and landscapes within the park, such as the dramatic backdrop of the Bow River, Canada Olympic Park and the Rocky Mountains beyond. A mountain biking trail along the escarpment, designated cycling trails, nature trails, accessible pathways, boardwalks and viewing platforms, and seating and picnic areas throughout the site will facilitate these activities.

Stormwater Management

The stormwater quality management system will be designed to reduce the annual sediment load to the Bow River from the Outfall B105 and B105A catchment area. Stormwater will be treated using best management practices that mimic natural hydrologic patterns, while celebrating the journey of the stormwater through the park to enrich the visitor's understanding of stormwater treatment and water-based landscapes. Stormwater management will be integrated in the design of the park, providing functional benefits that will improve water quality, create biodiverse habitats within treatment areas, and contribute to recreational opportunities and visitor experiences.

6.3 Functional Diagram

The functional design of the park is centred around the stormwater treatment facilities. Interwoven throughout the stormwater treatment area is a series of trails and pathways that provide recreational opportunities and access to observe and interact with the stormwater treatment system, as well as other park amenities.



Figure 12. Proposed Concept Plan

- 1 **Nautilus Pond™**
This circular pond will act as the forebay for the stormwater quality management system. The pond will remove larger sediment from the stormwater.
- 2 **Stormwater Polishing Marsh**
See below
- 3 **Wet Meadow**
Together, the polishing marsh and wet meadow will provide enhanced treatment of the stormwater by removing very fine particles of sediment that would not typically be removed by the Nautilus Pond™ or a conventional forebay. These areas will provide valuable marsh and wet meadow habitat for a variety of species.
- 4 **Stream**
After stormwater has flowed through the polishing marsh and wet meadow, it is collected by a stream that carries the stormwater to a new outfall. The Stream roughly follows the route of an old side channel of the Bow River that existed here before the gravel pit.
- 5 **Outfall**
A new outfall will be constructed where the stream meets the Bow River. The outfall will have a different character than a conventional outfall, with subtle drops in elevation that will allow fish to take refuge in the stream during floods.
- 6 **Normally Dry Stream**
When stormwater flow exceeds what can easily pass through the polishing marsh and wet meadow, the normally dry stream conveys stormwater through the floodplain forest to the lower area of the system. Much of the time the channel will remain as a dry rocky stream bed.
- 7 **Riparian Areas**
During larger storms, there may be water flowing into the stormwater system faster than can be safely released to the river. In these events, stormwater will bypass the polishing marsh and wet meadow and back up from the system into side channels in the riparian areas, temporarily creating a floodplain environment and supplying water to riparian plants along the side channels. Underlying gravel will allow this water to be absorbed into the ground.
- 8 **Phytoremediation**
The area that was contaminated with hydrocarbons from fuel during gravel mining operations can be treated using plants. Willows and poplars will be planted in this area to take up contaminants that remain in the soil and groundwater. Until the remediation has been successfully completed (about 10-15 years from planting), the area will remain off-limits to the public except for a boardwalk passing through the forest. In the long term, this area will become part of the restored floodplain forest in the park.
- 9 **Floodplain Forest**
Weeds and invasive plant species will be gradually managed and controlled in existing forest areas. Disturbed areas in the former gravel pit that are not part of the stormwater quality management system will be reclaimed and restored to floodplain forest.
- 10 **Lookout Mound**
A large mound will be constructed using material excavated from stormwater areas and existing stockpiles on the site. This area will provide views of the stormwater quality management system, seating and informal picnicking, a challenging running trail, and an amphitheater for educational presentations.
- 11 **Lookouts and Stairs**
The lookouts and stairs will formalize view points along the top of the escarpment and create a vertical connection to the floodplain below. Providing structures in these areas will help to mitigate damage to the escarpment by encouraging park visitors to use established trails and viewing platforms that are designed to handle heavier foot traffic. Stabilization and planting of the slope below will help to restore these areas.
- 12 **Succession Island**
An island cut off from the rest of the park by water, this area is already exhibiting the early stages of establishing a Balsam Poplar forest. Isolating Succession Island from the park will provide high quality habitat that is protected from human disturbance. Natural forest succession will be allowed to progress over time as the vegetation matures.
- 13 **Picnic Area**
Existing picnic areas along the Bow River will be refurbished and enhanced with new equipment and vegetation management. Additional picnic areas will be added in forested areas of the park, and in a meadow near the parking lot that has great views of the city, the Rocky Mountains and the river.
- 14 **Off-Leash Swimming Access**
Two potential locations with good beach access have been selected along the Bow River to provide an opportunity for dog owners to allow their pets to enter the river. The design of these access points will be finalized in a future stage of the project.

6.3.1 Features and Amenities

Key features of the concept design for East Bowmont NEP will allow for mainly passive interaction with the park landscapes. The most active area is a single track trail on the face of the escarpment that provides a unique mountain biking experience in Calgary. Although the escarpment is a fragile landscape, it has been determined through detailed analysis of the existing trail that it is a sustainable use in the park, with some minor modifications.

At the south end of the park, the site of the historic Shouldice Residence, an existing parking lot will be improved and new amenities, including a washroom, picnic shelter and picnic pads, and interpretive programming will occupy the former home site to re-energize this area, improving safety by increasing the level of activity and providing a needed washroom facility in the park.

Along the top of the escarpment, fencing and view platforms will be used to mitigate the impact of erosion on the escarpment caused by fall-line (downslope) trails. The view platforms will provide a hard surface outlook from which to view the park and the Bow River, Canada Olympic Park and the Rocky Mountains, while helping to preserve the sensitive soils on the escarpment from foot traffic and providing opportunities for interpretive signage and interactive amenities, like binoculars.

In the lower area of the park, a network of trails, pathways and boardwalks provides access to the different stormwater treatment areas, where park visitors will be able to observe the stormwater as it travels via streams and weir structures from one area to the next. These circulation routes pass through Balsam Poplar forest, riparian zones, marshes and wet meadows, providing opportunities for visitors to watch birds, insects and other wildlife in these distinctive habitats. A lookout mound and amphitheatre will utilize fill excavated from the stormwater treatment system to allow for a centralized teaching venue with views over the lower area of the park, while providing variety in topography for regular walkers and runners in the park.

6.3.2 Site Circulation

Through the public consultation that was done for the project, it became clear that the majority of stakeholders did not wish to see vehicles in the lower part of the park. The prevailing public opinion was that the amount of parking provided by the existing parking lot and on-street parking on 40 Ave. NW is sufficient for the current level of use. At the same time, it was noted that the park does not accommodate physically challenged users very well because the slopes into the lower park are steep and the distance from parking areas is significant (350m to 1000m to lower park area with gradients over 10%).

As a solution to these conflicting concerns, the concept design allows for private vehicles, such as school buses and handi-buses, to make arrangements to drive partway into the park using the existing access road from the corner of Home Road and 32 Ave. NW. This access point will remain

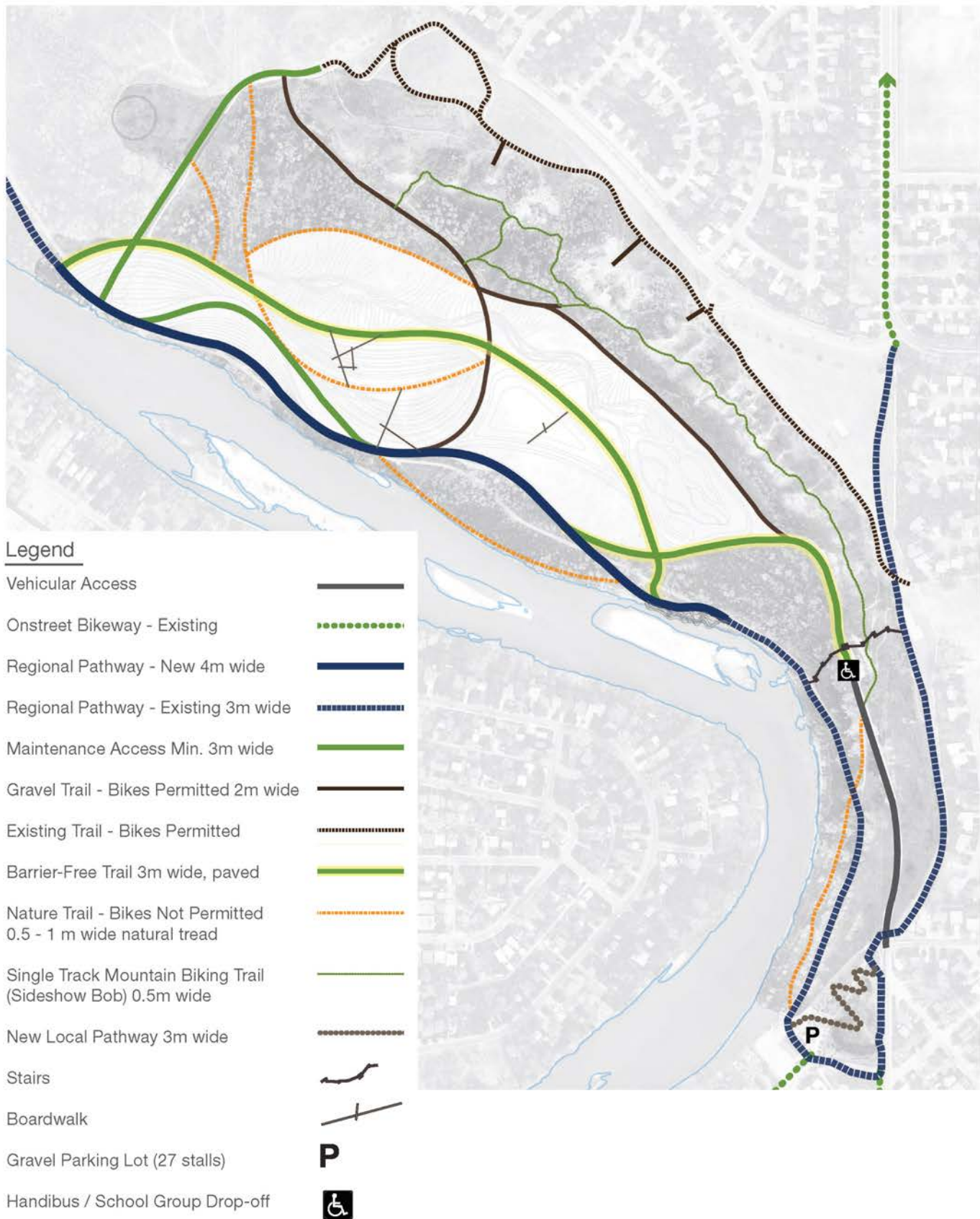


Figure 13. Proposed Circulation Diagram

gated when not in use to prevent private passenger vehicles from driving into the park. Maintenance vehicles will also use this access point.

A looping network of trails within the park provides a variety of access, including maintenance vehicle access (paved or gravel surface), barrier free pathways (paved surface), cycling trails and pathways (paved or gravel surface), mountain biking (single track trail), and pedestrian-only trails (natural tread or bark mulch).

Vehicular access routes and the regional pathway will be the widest routes, due to functional requirements and pathway design guidelines. Other trails will vary in width depending on the type of traffic they are designed to accommodate.

In areas outside of the former gravel pit, existing trail alignments have been used where possible to limit disturbance to existing vegetation. Some informal trails will be closed to allow for restoration of habitat. In general, where there are multiple existing informal trails in an area, one alignment will remain as a formalized trail while other alignments will be closed and reclaimed. Consolidating informal trails reduces fragmentation of habitat and limits the disturbance by park visitors to a central route.

The regional pathway will be relocated along the edge of the former gravel pit to move part of the pathway that is currently within the Bow River floodway out of this designated zone.

A stair has been provided from the top of the escarpment to the lower park area, beginning in the manicured turf zone near the end of 53 St. NW. This stairway will provide view points and exercise opportunities, while allowing for more direct access into the lower park for Varsity residents.

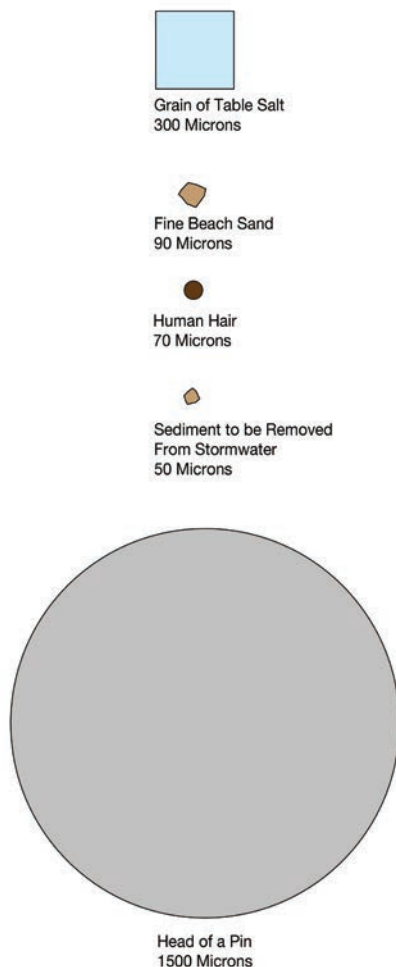


Diagram showing relative size of 50 micron sediment particle

6.3.3 Hydrology and Stormwater Features

The existing stormwater outfalls B105 / B105A handle one of the largest flows within Calgary: approximately one tenth of the city's untreated stormwater arrives at the river loaded with the sediment and detritus from the roads and sidewalks above. Making improvements to the quality of this stormwater is a high priority for the City's Water Services and Water Resources departments. With no other viable space upstream, the Bowmont East site was identified as an ideal location to improve the quality of stormwater being released into the Bow River.

The City's goal is to reduce the sediment loading to the Bow River to the 2005 level or less by 2015 while the city continues to grow. Part of comprehensive stormwater management strategy is aimed at no net increase in TSS (sediment) loading to the Bow River while accommodating the next 30% growth in the city's population.

East Bowmont was selected as a potential site based on the following criteria:

- Located on public lands
- Near existing stormwater outfalls, preferably with gravity drains from existing stormwater systems
- Existing land use could beneficially coexist with stormwater facilities
- Serving catchments that discharge primarily untreated stormwater

Stormwater diverted from the B105 and B105A outfall conduits travels through a series of increasingly more naturalized environments as it journeys from the forebay to outfall. The different landscapes shaped by the stormwater facilities will offer a natural park experience for visitors, who will be able to occupy these varied environments and observe the native plant habitats and wildlife supported by the stormwater treatment facility.

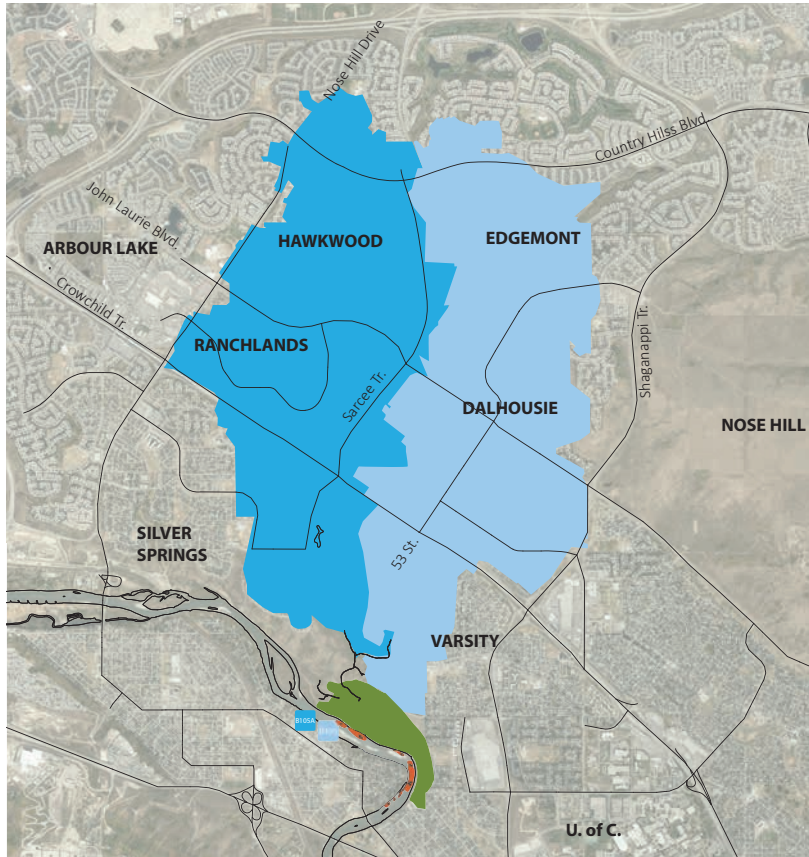
Although the experience of these places will be one of a natural park atmosphere, the shapes and forms of the stormwater treatment areas are purposeful and sculptural. This contrast will serve to highlight the journey of the water through the site, whereas attempting to blend the stormwater elements into the park landscape to make them seem “natural” would serve to disguise the journey of the water from the visitor’s interpretation and understanding.



Stormwater precedent projects in Calgary

Top: Burnsmead Pond, Fish Creek Provincial Park

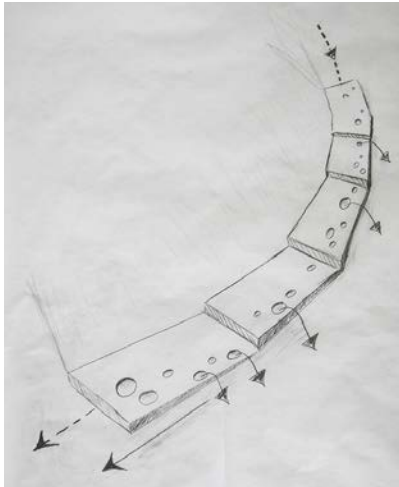
Bottom: Marshall Springs Pond and Wetland, Fish Creek Provincial Park



Legend

- B105A Catchment area for stormwater outfall B105A
- B105 Catchment area for stormwater outfall B105
- East Bowmont Park
- Fish habitat

Map of stormwater catchment area for Outfall B105 / B105A



1 Schematic design of stormwater overflow and energy dissipator into Nautilus Pond™



Precedent image of energy dissipator



2 Schematic design of Nautilus Pond™ draining system

Stormwater treatment systems are usually visually disconnected - the open water in cells is visible but the connections are piped for efficiency and ease. Hidden underground, the journey of the stormwater, its source, route and destination is either unapparent or largely invisible.

Instead of an invisible system at East Bowmont NEP, the journey of the stormwater throughout the park and its part in the creation of different habitats will be apparent throughout. The journey is an exciting and integral element in the park, expressing the stages of this active treatment train and the role of the stormwater management system in a kinetic and expressive way. Maintaining a visual above-ground stream connection from one treatment area to the next allows the treatment process to be observed and comprehended at face value, without relying solely on written interpretive elements.

6.3.4 Art in the Landscape

A goal of the project from the outset has been to integrate art in the landscape as a component of the design, rather than an object to be placed in the landscape after the design is complete. In order to facilitate this, the design team included resident artists from The City of Calgary's Watershed+ program, which seeks "to develop awareness and pleasure in the environment...by creating a climate of opportunity for water initiatives to build an emotional connection between people and the watershed" through art.

As the stormwater journeys through the park, moments or transition points between the stages will be designed to call out the processes active on the site, bringing interest and intrigue to the active systems in play. These transition points serve an engineering function of controlling water levels and transferring water from one cell to another, but have been designed to emphasize the visual and auditory cues that announce the water's passage along the treatment train.



Precedent image of Nautilus Pond™ draining system

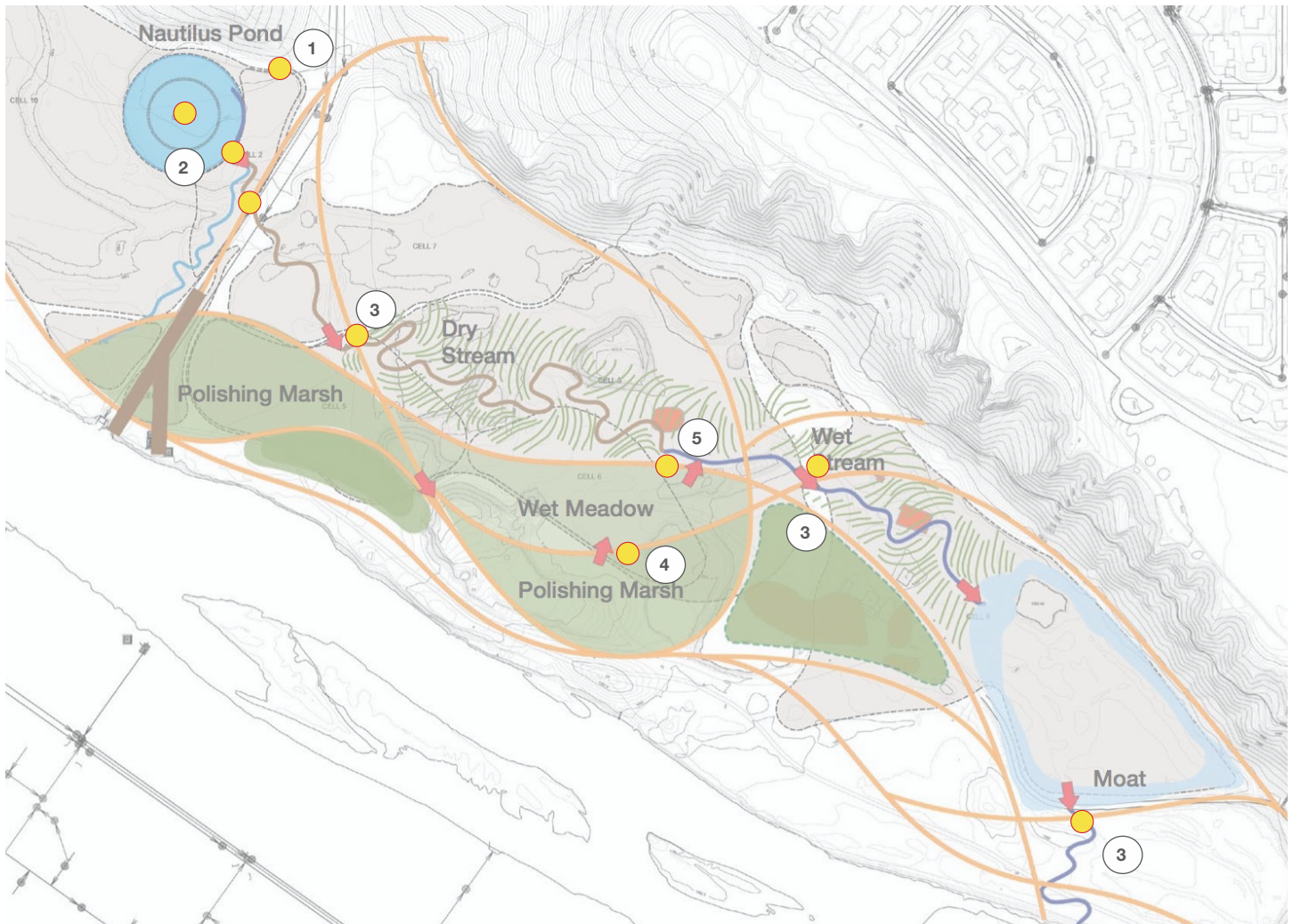
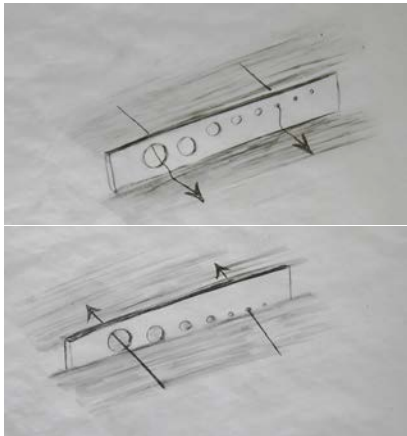
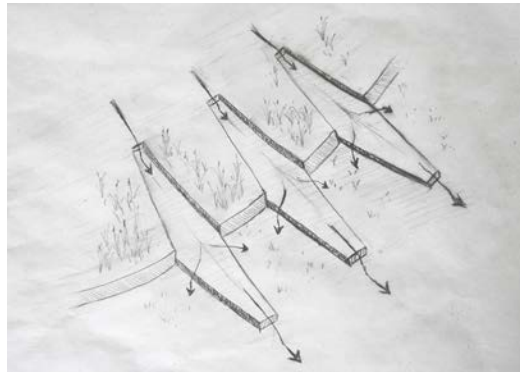


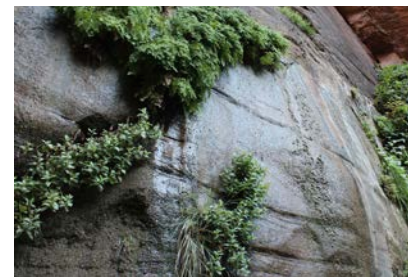
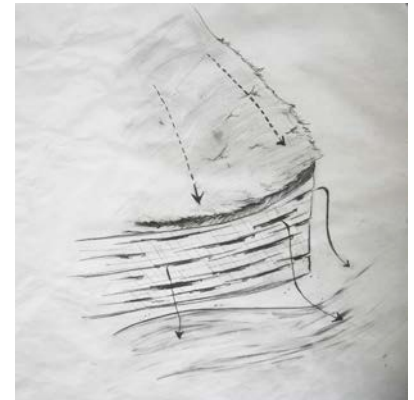
Figure 14. Map of Proposed Public Art Elements



3 Schematic design and precedent image of flow control structure at stream control points



4 Schematic design and precedent image of conveyance structure between Polishing Marsh and Wet Meadow



5 Schematic design and precedent image of conveyance structure between Wet Meadow and Stream

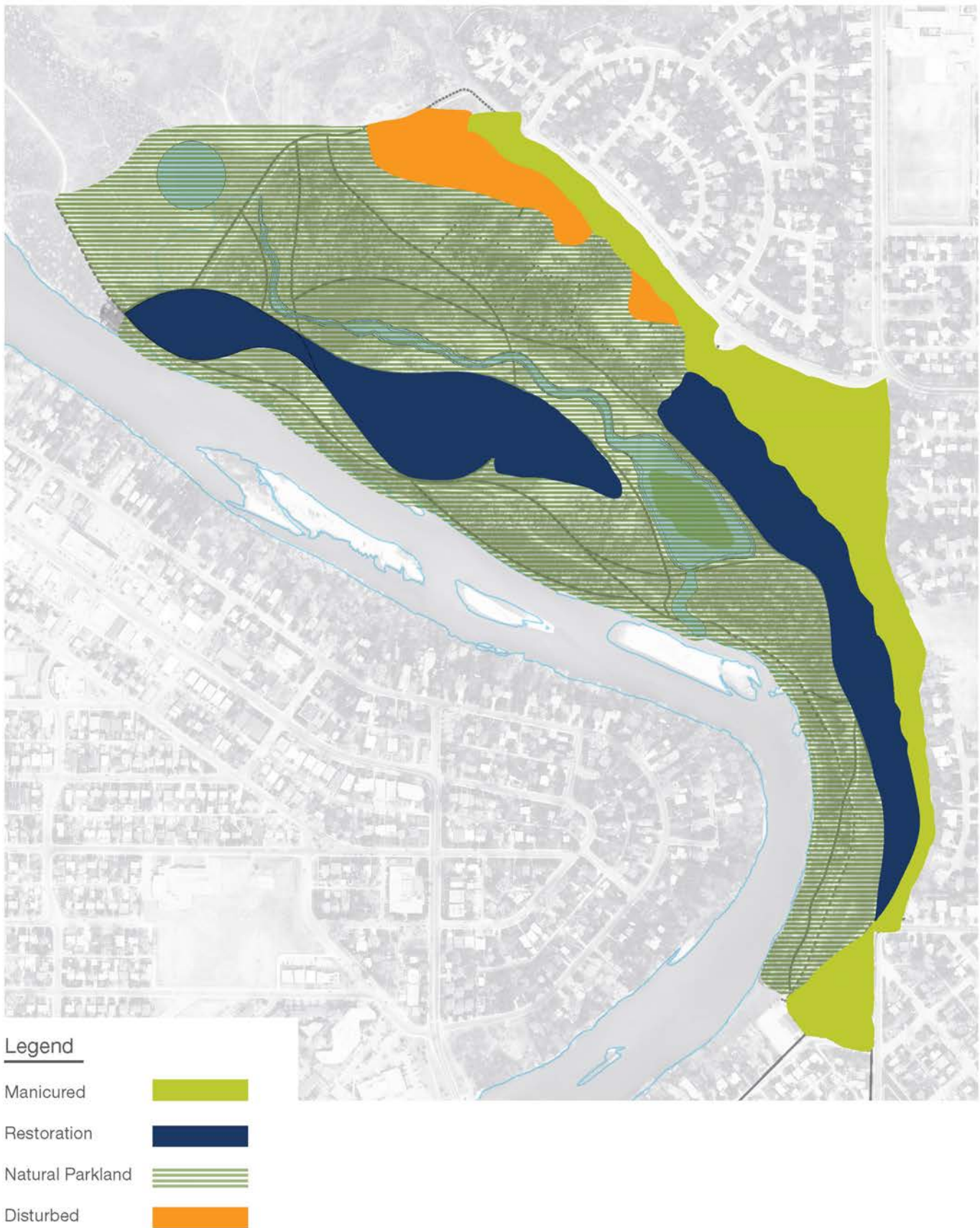


Figure 15. Proposed Resource Management Zones

7.0 DESIGN + MANAGEMENT RECOMMENDATIONS

The Design Development Plan is the basis of future planning and development decisions for East Bowmont NEP. The following sections comprise a detailed description of the elements of the park plan and management strategies for the park.

7.1 Proposed Management Zones

As described in Section 1.4.3, five park management zones are specified in the Bowmont NEP Management Plan. These zones outline different management goals for the park: Preservation Zone, Naturalized Zone, Disturbed Zone, Manicured Zone and Recreation Zone. The DDP recommends that these zones are applied to East Bowmont Park, as shown in Table 15 East Bowmont NEP Proposed Management Zones and Figure 15 Resource Management Zones.

Table 15 East Bowmont NEP Proposed Management Zones

Type/Zone	Purpose	Areas within East Bowmont NEP
Preservation	Protects and maintains currently undisturbed natural areas, and enhances existing natural features. Limit human access to these areas.	There are no undisturbed areas in the park.
Natural Parkland	Rehabilitates previously disturbed areas for less intensive park use; creates a more natural appearance through the re-establishment of native vegetation; and reduces long-term maintenance requirements.	Balsam Poplar forest, riparian shrubland, and native grassland areas throughout the park that incorporate recreational facilities such as trails and pathways, picnic areas and interpretive features.
Disturbed	Provides the greatest active recreational opportunities as this zone applies to areas that have been previously manicured, cultivated or otherwise disturbed and are not currently maintained. This zone usually contains the highest percentage of introduced plant species. Restoration to some areas within this zone may be required to provide a positive recreational experience.	Unmanicured off-leash areas at the top of the escarpment will remain as disturbed areas.
Manicured	Provides for areas that are used intensively for activities such as outdoor sports, picnicking, holding festivals, and other gatherings where large numbers of park users are anticipated. This zone is designed as the traditional high-maintenance groomed park.	Existing manicured areas at the top of the escarpment that are used for off-leash and playgrounds provide a buffer between the urban environment and the natural environment park.

Type/Zone	Purpose	Areas within East Bowmont NEP
Restoration	High potential for rehabilitation into productive wildlife habitat. First priorities are areas that will contribute to significant ecological processes within the system.	Restoration zones include the native grassland on the escarpment slope and the marshes and wet meadow in the stormwater treatment system. Although these wetlands will be part of a functioning public infrastructure facility, the intensive planting planned for these areas will result in high-value habitat. The phytoremediation area has also been designated a restoration zone, as the combination of native planting and closing off the area from public access will create a protected island of wildlife habitat.

7.2 Habitat Restoration and Management

The park will include five habitat types with distinct vegetation communities, as outlined below.

Balsam Poplar Forest

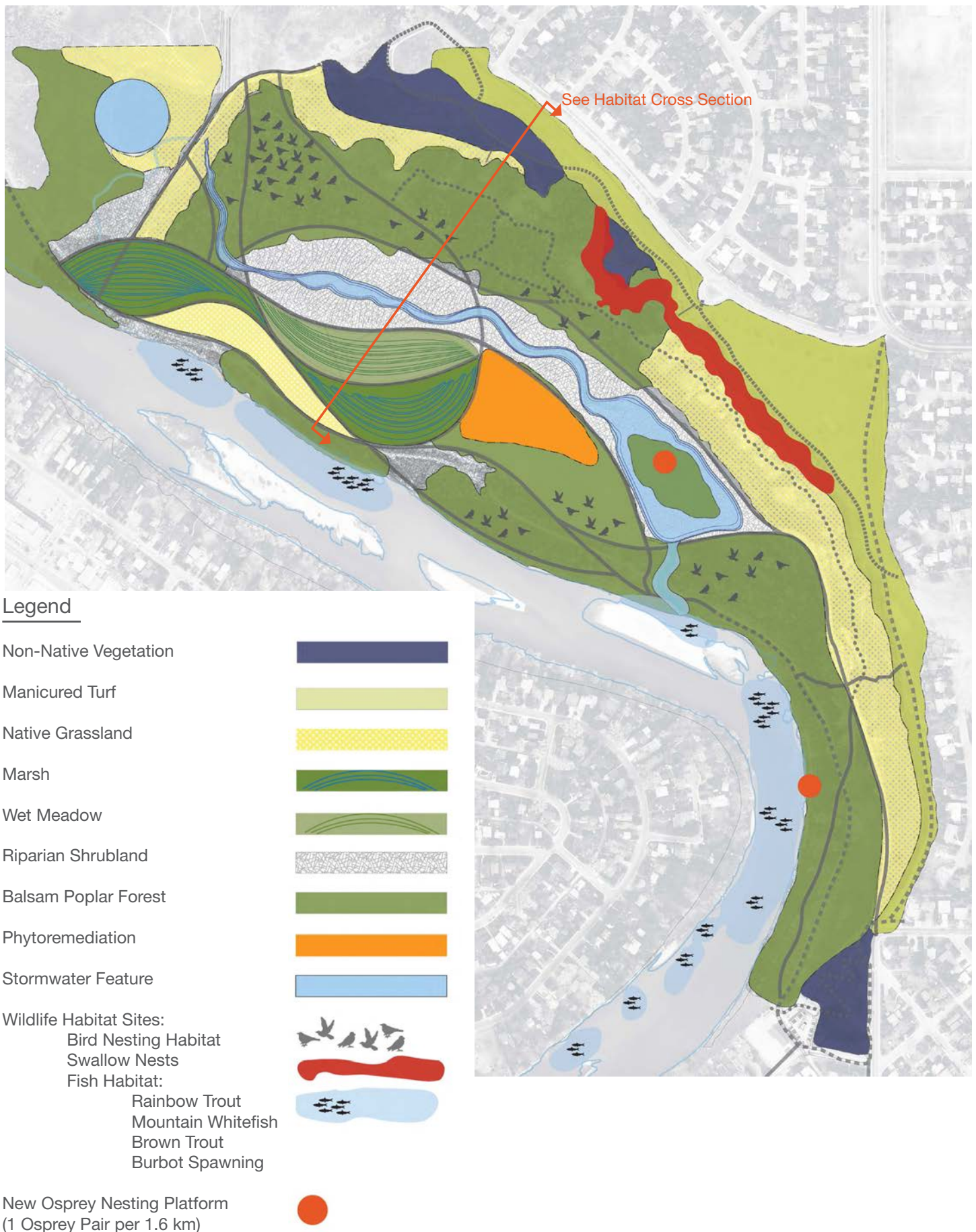
This habitat will form the majority of the forest community in the park. It is characterized by a high canopy of Balsam Poplar, and a diverse strata of shrubs with varied patch distribution. A healthy Balsam Poplar-Dogwood forest will become home to a wide variety of fauna, including birds of prey, migrating neotropical songbirds, weasels, bats and frogs.

Native Grassland

Native grassland communities will characterize the steep slopes of the escarpment. Grasslands perform important ecological functions such as preventing soil erosion, discouraging weed establishment, recycling soil nutrients, contributing to park biodiversity, and providing rich habitat for wildlife.

Riparian Shrubland

The riparian zone will provide a vegetation buffer of varying widths, comprised mainly of shrubs, adjacent to the Bow River and the stormwater conveyance stream. The root systems of vegetation communities within this habitat are adapted to seasonal flooding and will serve to stabilize the river and stream banks. A healthy riparian zone supports a variety of nesting birds, shorebirds, small rodents, reptiles and amphibians.



Marsh



Constructed wetlands will remove sediment from stormwater, increase overall community diversity in the park, and provide opportunities for education and recreation. The marsh will support a diversity of native wetland vegetation, overwintering invertebrates, amphibians, small mammals, birds and waterfowl.

Wet Meadow



Wet meadows are ephemeral wetlands that become wetter or drier depending on the amount of rainwater and snowmelt available. Even though water may not be visible at the surface, the soil is generally saturated. The wet meadow will serve as a filter for stormwater as it moves through the plants and spongy soil, eventually finding its way to the stream. The wet meadow will provide nesting habitat for ground nesting songbirds and waterfowl, as well as forage habitat for birds of prey.

7.2.1 Management Considerations

There are a number of invasive, noxious and prohibited weed species in the park that require management under the *Alberta Weed Act*. Other management concerns include closing and reclaiming informal trails that are contributing to habitat fragmentation and invasive species establishment, and restoring and preventing further erosion of the escarpment and river bank. Table 16 below lists the prevalent noxious weed species in the park by vegetation zone.

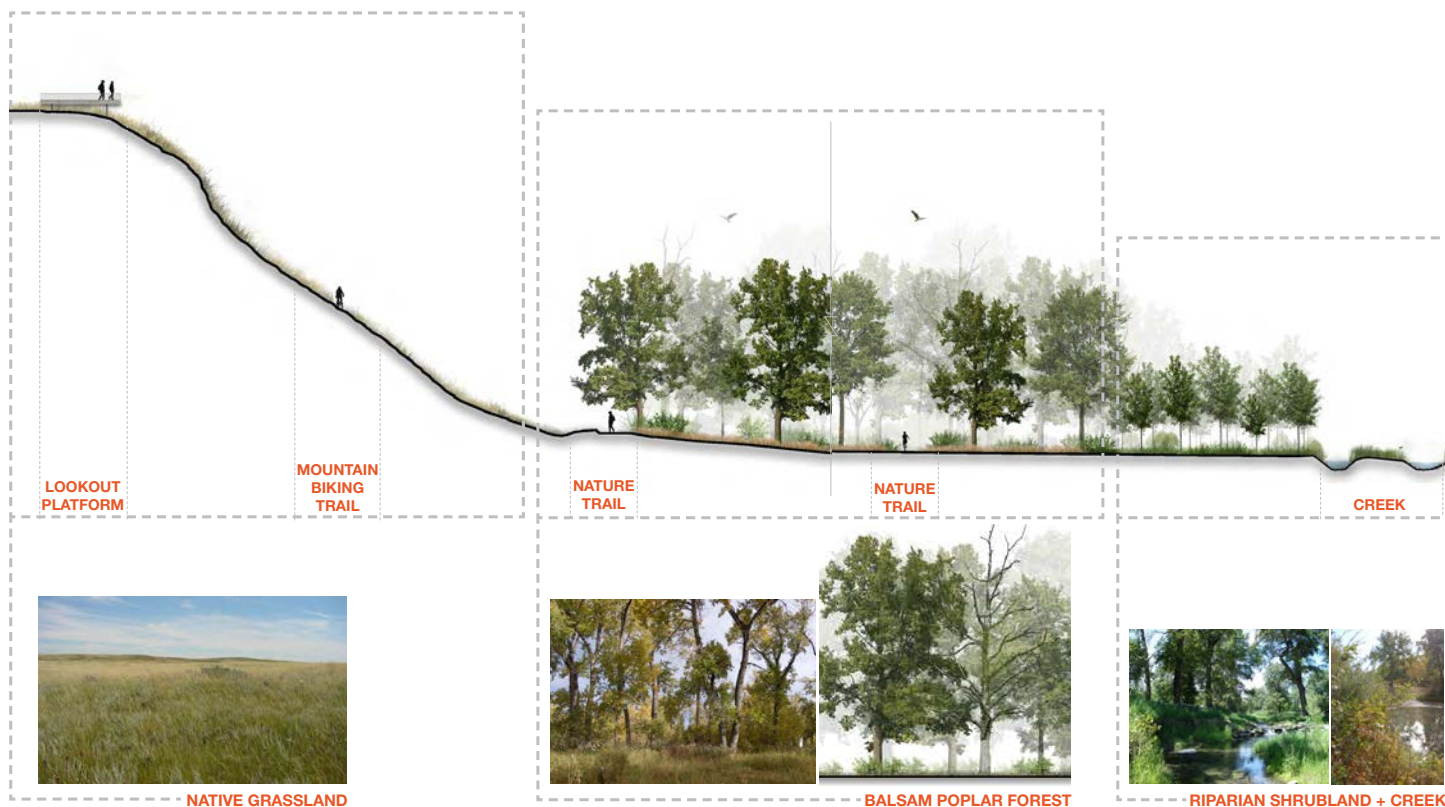
Top: Character of new marsh habitat

Bottom: Character of new wet meadow habitat

Table 16 Weed Species in East Bowmont NEP

Vegetation Zone	Weed Species	Classification
Balsam Poplar Forest	Great Burdock (<i>Arctium lappa</i>)	Noxious
	Canada Thistle (<i>Cirsium arvense</i>)	Noxious
	Oxeye Daisy (<i>Chrysanthemum leucanthemum</i>)	Noxious
	Hound's Tongue (<i>Cynoglossum officinale</i>)	Noxious
	Scentless Chamomile (<i>Matricaria perforata</i>)	Noxious
Disturbed	Great Burdock (<i>Arctium lappa</i>)	Noxious
	Bighead Knapweed (<i>Centaurea macrocephala</i>)	Prohibited Noxious

Vegetation Zone	Weed Species	Classification
Disturbed	Canada Thistle (<i>Cirsium arvense</i>)	Noxious
	Oxeye Daisy (<i>Chrysanthemum leucanthemum</i>)	Noxious
	Yellow Clematis (<i>Clematis tangutica</i>)	Noxious
	Hound's Tongue (<i>Cynoglossum officinale</i>)	Noxious
	Leafy Spurge (<i>Euphorbia esula</i>)	Noxious
	Black Henbane (<i>Hyoscyamus niger</i>)	Noxious
	Yellow Toadflax (<i>Linaria vulgaris</i>)	Noxious
	Scentless Chamomile (<i>Matricaria perforata</i>)	Noxious
	Common Tansy (<i>Tanacetum vulgare</i>)	Noxious
Native Grassland	Great Burdock (<i>Arcticum lappa</i>)	Noxious
	Canada Thistle (<i>Cirsium arvense</i>)	Noxious
Non-Native Vegetation	Great Burdock (<i>Arcticum lappa</i>)	Noxious
	Bighead Knapweed (<i>Centaurea macrocephala</i>)	Prohibited Noxious
	Canada Thistle (<i>Cirsium arvense</i>)	Noxious
	Yellow Clematis (<i>Clematis tangutica</i>)	Noxious
	Hound's Tongue (<i>Cynoglossum officinale</i>)	Noxious
	Leafy Spurge (<i>Euphorbia esula</i>)	Noxious
	Yellow Toadflax (<i>Linaria vulgaris</i>)	Noxious
	Common Tansy (<i>Tanacetum vulgare</i>)	Noxious
Wetland	Great Burdock (<i>Arcticum lappa</i>)	Noxious
	Canada Thistle (<i>Cirsium arvense</i>)	Noxious
	Hound's Tongue (<i>Cynoglossum officinale</i>)	Noxious



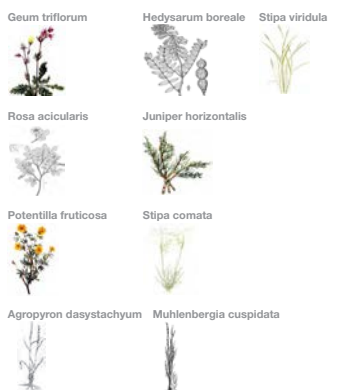
Vegetation Communities + Habitat Types

BALSAM POPLAR FOREST



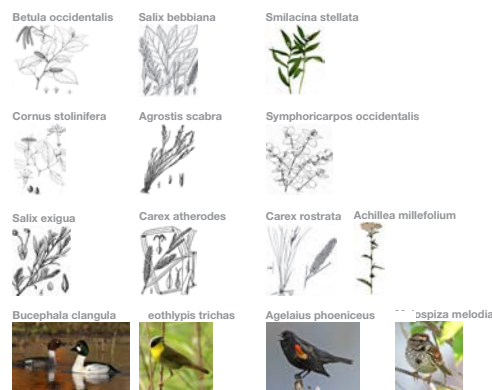
This habitat describes the majority of the forest community in the park. It is dominated by a high canopy of balsam poplar, and a diverse strata of shrubs with varied patch distribution. A healthy balsam poplar-dogwood forest is home to a wide variety of fauna including birds of prey, migrating neotropical songbirds, weasels, bats and frogs.

NATIVE GRASSLAND



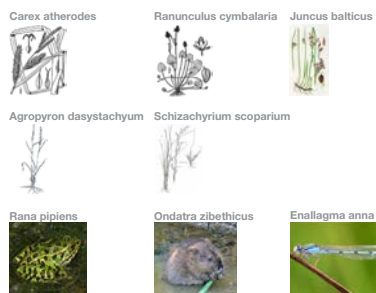
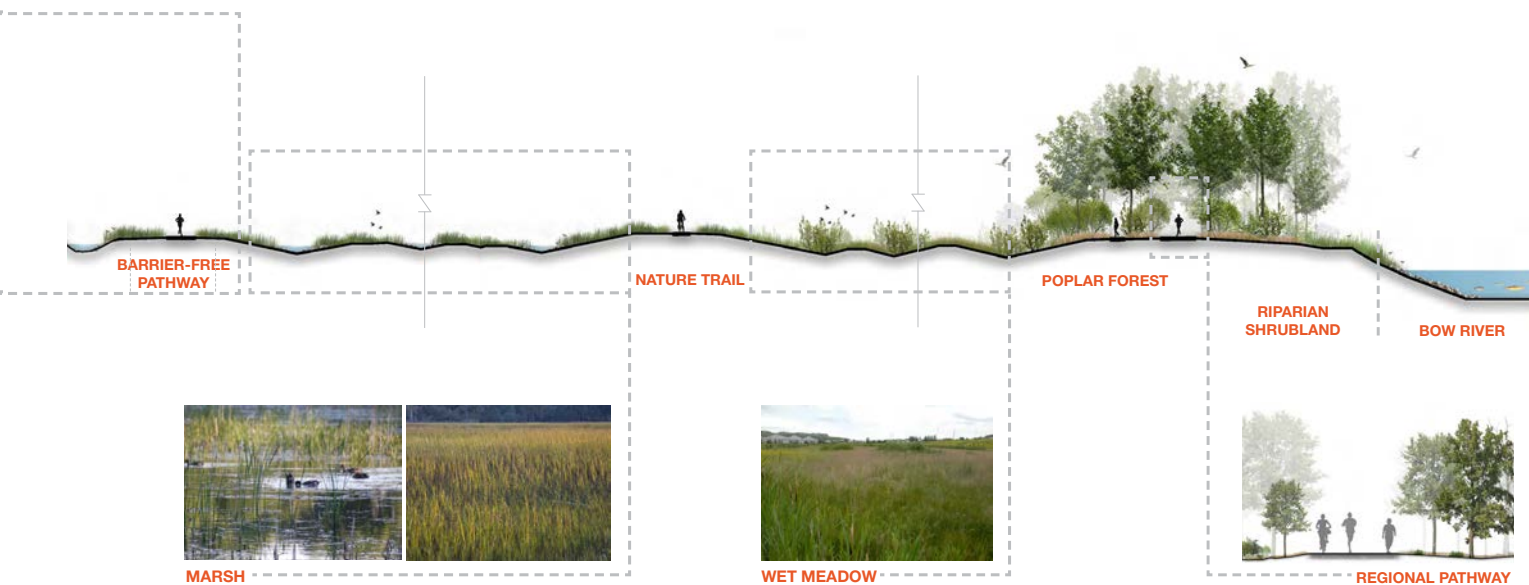
Native grassland is found along the steep slopes of the escarpment. Grasslands perform important ecological functions such as preventing soil erosion, discouraging weed establishment, recycling soil nutrients, contributing to park biodiversity, and providing rich habitat for wildlife.

RIPARIAN SHRUBLAND



The riparian zone is a vegetation buffer of varying widths, comprised mainly of shrubs, adjacent to the Bow River and the stormwater conveyance stream. The root systems are adapted to seasonal flooding and serve to stabilize the river bank. A healthy riparian zone supports a variety of nesting birds, shorebirds, small rodents, reptiles and amphibians.

Figure 17. Proposed Habitat Cross Section Through the Park



Constructed wetlands will remove sediment from stormwater, increase overall community diversity in the park, and provide opportunities for education and recreation. The marsh will support a diversity of native wetland vegetation, overwintering invertebrates, amphibians, small mammals, birds and waterfowl.

Wet meadows are ephemeral wetlands that become wetter or drier depending on the amount of rainwater and snowmelt available. Even though water may not be visible at the surface, the soil is generally saturated. The wet meadow will serve as a filter for stormwater as it moves through the plants, the spongy soil, and eventually find its way to the stream. The wet meadow will provide nesting habitat for ground nesting songbirds and waterfowl, as well as forage habitat for birds of prey.

In the more intact vegetation zones, such as Balsam Poplar forest and native grassland, weed management should be restricted to biological controls, spot spraying of herbicide, or mechanical removal.

In the disturbed vegetation zones where the bulk of park development construction will take place, large scale herbicide application is the recommended method of weed control, as the weed species outnumber the native species. These areas will undergo significant soil disturbance when the stormwater treatment facilities are excavated. It is important to ensure that noxious and prohibited noxious weeds are not transported offsite with export fill, and one or more applications of herbicide may be required to address this issue prior to starting excavation on the site.

Once the earthwork is completed, 2 to 3 additional applications of herbicide will likely be required to control weeds that will regenerate through disturbance of the seed bank. There is little value in establishing new native plantings until the existing weed population has been adequately controlled, as it is difficult to selectively target weed species once a native grass community begins to take root.

In the restoration and natural parkland management zones, informal trails should be managed to prevent the establishment of invasive species, habitat fragmentation, and erosion of sensitive soils. Public access should be deterred by placing logs, brush, or semi-permanent fencing at the access points to informal trails with signage describing why the area has been closed. The closed trail bed should be roughened and species associated with the plant community should be planted along the closed trail to encourage the area to regenerate more quickly, thereby closing off physical and visual access to the former trail.

7.2.2 Wildlife Habitat

Three existing wetlands in the former gravel pit may be removed as part of the plan. However, the new habitat that will be established as part of the stormwater treatment system will contribute high quality wetland, wet meadow and stream environments suitable for bird and insect use.

There is one established osprey nesting platform in the park, as well as a power pole that is informally used by nesting ospreys. The power pole will be removed as part of the park development, as it conflicts with the location proposed for the stormwater treatment system. A new nesting pole will be established near the existing power pole, in a location that is protected from direct interaction with park visitors by a generous vegetative buffer, as well as a section of the stormwater treatment system. A second nesting platform will be established downstream to provide enough range along the riparian corridor for each nesting pair.

A small group of cliff swallow nests in an existing soil pile in the former gravel pit will be displaced as part of the park development. This work will be done outside of the swallow nesting period to avoid harming the birds and their young. Other swallow habitat at the top of the escarpment will be protected

from direct interaction with park visitors by the addition of a fence at the top of the escarpment.

Previous reports prepared for the East Bowmont NEP site identify the possibility of garter snake hibernacula existing in the park. Four separate field surveys were conducted in 2013, as well as extensive research through local naturalists who have been frequenting the park for several years. No hibernacula were observed physically or anecdotally in the specific area of East Bowmont NEP during this research. However, it is possible that a hibernaculum exists that was not identified, or could be established between the time that the survey was undertaken and the start of construction. Alberta Environment and Sustainable Resource Development (ESRD) has recommended that prior to and during construction, all personnel on site should take note of any snake activity, especially between August 15 and October 31. Any observations of groups of snakes should be reported to ESRD, followed by a secondary reptile survey to locate the hibernacula. Should no snakes be observed, but a hibernaculum is uncovered upon digging in the area, ESRD should be contacted immediately.

A one-day breeding bird survey and herptile (amphibian and reptile) is recommended during the year of anticipated construction if construction is planned anytime between April and August. Although the breeding bird survey conducted in July 2012 provides important information on which species are utilizing the proposed project area, different species or returning birds may choose to nest in the area and/or in different locations. In compliance with the *Canada Migratory Bird Act*, disturbance of birds and bird nests during the specified breeding window is not permitted.



Rendering of stairs on escarpment



Photos showing a phytoremediation project. Typically the plantings will consist of 1-2 species of uniform age and spacing.

7.2.3 Phytoremediation

According to a 2004 Phase II Environmental Site Assessment (ESA) for East Bowmont NEP (Jacques Whitford, 2004), there is contamination in the soils and groundwater from the former gravel mining operation. Of the main types of contamination (heavy metals, volatile organic compounds (VOC's) and hydrocarbons), the majority of the contamination is from VOC's and hydrocarbons, which are easily remediated using plants, a process known as phytoremediation.

Phytoremediation relies on three main pathways of contaminant removal, which is carried out by different interactions with the plants, as outlined below.

Phyto-Volatilization

Plants take up water containing organic contaminants and release the contaminants into the air through their leaves. Plants can also break down organic contaminants and release the broken down products in the same way.

Phyto-Degradation

This refers to the metabolism of contaminants within plant tissues. Enzymes produced by the plant help to break down the contaminant into simpler molecules that are incorporated into the plant tissues.

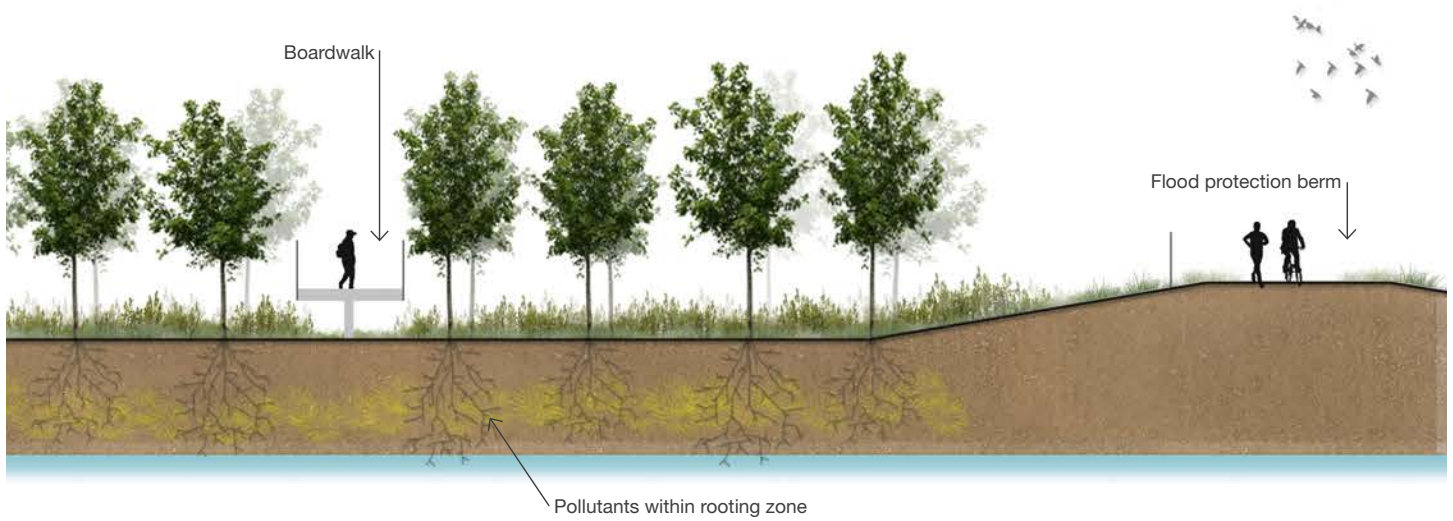
Soil Biodegradation

Microorganisms on the plant roots and in surrounding soil break down contaminants into simpler molecules that are taken up by plants and incorporated into plant tissue.

Willows and poplars will be planted in the area of the groundwater and soil hydrocarbon contamination to take up contaminants that remain in the soil and groundwater. Cuttings can be used from species that currently exist on the site. The typical recommended depth for phytoremediating soil and groundwater contaminants is 1 to 1.5m to ensure the contaminants are accessible to tree roots. Some of the sample sites in the Phase II ESA indicate contaminants as deep as 3m. It may be necessary to remove some of the contaminated soil from the deeper areas and spread out to ensure that the maximum depth of impacted soil is 1.5m.

Until the remediation has been successfully completed (about 10 years from planting), the area will remain off-limits to the public except for a boardwalk passing through the forest. In the long term, this area will become part of the restored floodplain forest in the park.

It is recommended that a new sampling program be undertaken to confirm whether the 2004 Phase II ESA is still valid, as the contaminants may have migrated outside of the documented areas in the 9 years since the original sampling was done.



Top: Cross Section of phytoremediation area

Bottom: Rendering of phytoremediation area

7.3 Recreational Features

The park will include several distinct, programmed areas that will serve as destination points as visitors move through the park.

Lookout Mound

A large mound will be constructed using material excavated from stormwater areas and existing stockpiles on the site. This area will provide views of the stormwater quality management system, seating and informal picnicking, a challenging running trail, and an amphitheater for educational presentations.

Lookouts and Stairs

The lookouts and stairs will formalize view points along the top of the escarpment and create a vertical connection to the floodplain below. Providing structures in these areas will help to mitigate damage to the escarpment by encouraging park visitors to use established trails and viewing platforms that are designed to handle heavier foot traffic. Stabilization and planting of the slope below will help to restore these areas.

The selected view points are currently well-used for this purpose and provide expansive views of the lower park area, the Bow River, Canada Olympic Park, and the Rocky Mountains. They also provide an opportunity to observe nesting cliff swallows on the adjacent escarpments, and are well-suited to interpretive signage and interactive exhibits due to their unique vantage point.

Picnic Areas

Existing picnic areas along the Bow River will be refurbished and enhanced with new furnishings and vegetation management. Additional picnic areas will be added in forested areas of the park, and in a meadow near the parking lot that has great views of the city, the Rocky Mountains and the river.

The picnic area nearest to the parking lot will include a shelter and serviced washroom, which will be developed on the historic Shouldice Residence site. A remnant caragana hedge that was planted when the house occupied the site (between 1913 and 1974) will be pruned to control spreading and create views out of the meadow to the west. Interpretive content may be developed to enhance the picnic area.

Boardwalks

Boardwalks will be constructed over phytoremediation, wet meadow and marsh areas. These boardwalks will be part of the circulation system, and will also provide visitors with the opportunity to observe specialized park habitats and stormwater management processes. Interpretive signage and interactive exhibits may be incorporated in these areas to provide information about the functions of these different landscapes.





1 FORMALIZED VIEWPOINTS

- Create formalized viewing platforms at strategic locations on the upper escarpment
- Restrict access to the escarpment edge and close and reclaim dangerous trails down the steep escarpment



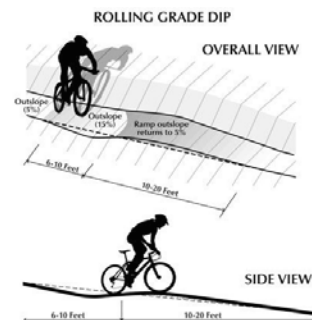
2 SLOPE STABILIZATION

- Existing exposed eroding slopes should be stabilized and revegetated
- Ridge areas have exposed cutslopes - Retaining walls or reinforcement matting required



3 PASSING AREAS + DRAINAGE IMPROVEMENT

- Create wider tread surface (1.25m) to create passing areas
- Stabilize and reclaim exposed slopes and vertical trail connections
- Construct / improve retaining and drainage structures



Rolling grade dips are a sustainable alternative to water bars. Dips are large enough to be self-cleaning and subtle enough that cyclists won't steer around them. A dip is longer than a bike and shaped like a knick. Use bondable soil from a dip to make a long, gentle ramp just past it. The ramp should be nearly twice as long as the dip.



Legend

- Escarpment Trail Alignment ———
- Informal Trail to be Reclaimed ———
- Proposed Passing Node
- Proposed Viewing Platform
- Direction of Travel

Figure 19. Proposed Single Track Mountain Biking Trail



④ RECLAMATION + TRAIL CLOSURE

- Reclaim exposed cut slopes
- Remove jumps
- Close foot trails and reclaim
- Re-grade fall line sections
- Eliminate trail braiding



⑤ PROPOSED STAIRS

- Proposed timber stairs connection to top of escarpment
- Single track trail alignment to pass under proposed stairs
- Multiple landings and lookouts



⑥ TRAIL SIGNAGE

- Regulatory signage
- Risk of use
- Level of difficulty
- Preferred direction of travel
- Use during wet conditions

TRAIL MAINTENANCE

- Re-grade tread surface at trail entry



7.3.1 Single-Track Mountain Biking

The existing single-track trail that currently runs along the escarpment will be improved and signed as one-way, running from east to west. The trail is in relatively good condition, with minor improvements required where water is collecting on the trail. Passing zones and signage are recommended to improve the trail riding experience, and user-built jumps and trails outside of the main trail will be removed and reclaimed.

Specific recommended improvements include:

- Stabilize and revegetate existing exposed and eroding slopes
- Provide for retaining walls or reinforcement matting along ridge areas with exposed cutslopes
- Create passing areas by widening the tread surface to 1.25m
- Construct drainage improvements using a rolling grade dip

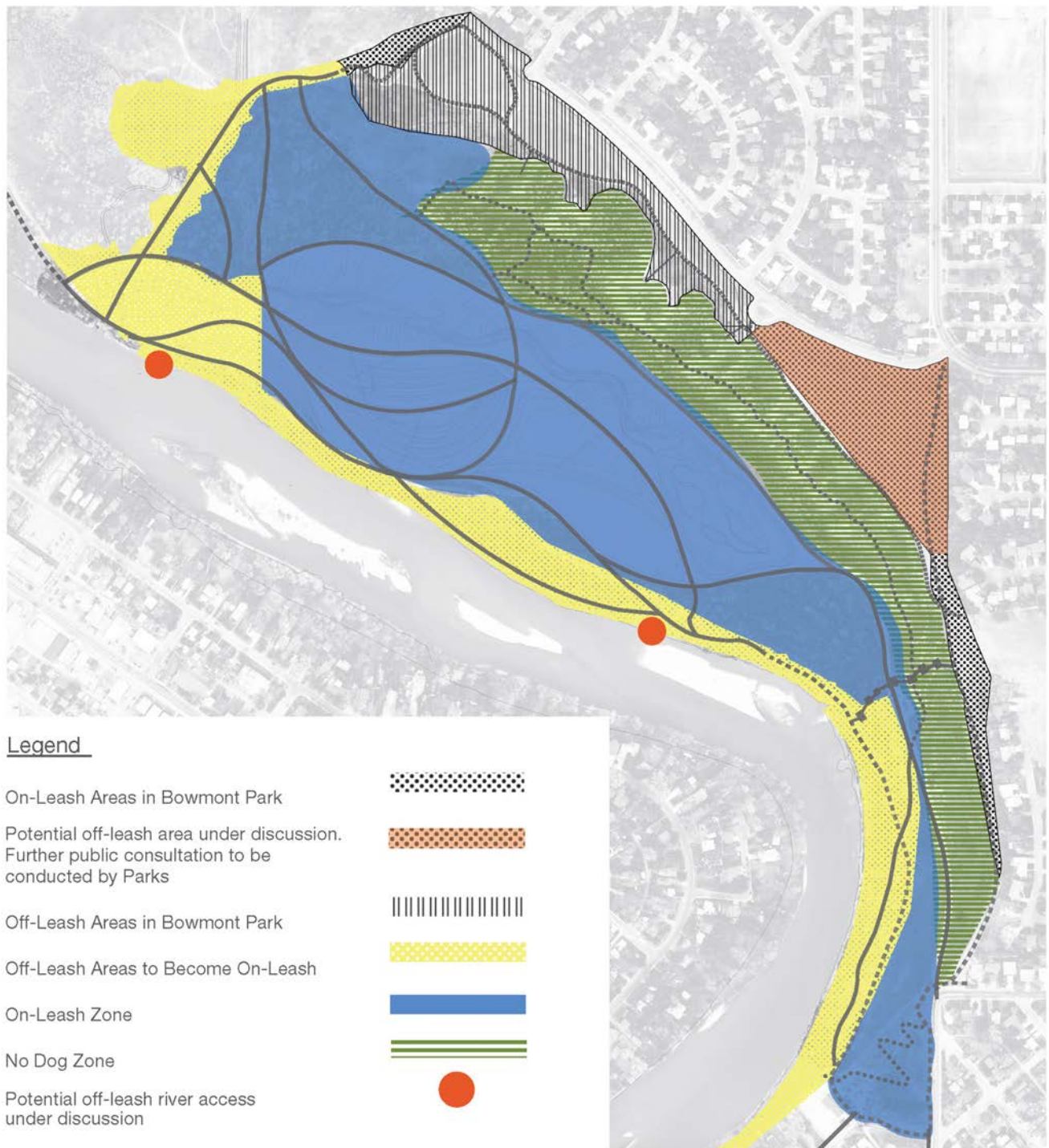
A detailed assessment of the trail showed that the majority of the erosion on the escarpment is being caused by ridge-line trails running vertically down the face of the escarpment, not by the single-track trail, which runs horizontally across the escarpment. These ridge-line trails act as channels for water, creating concentrated zones of runoff that soaks into the soil and weakens the slope, making it more vulnerable to erosion. The plan will use a combination of access restriction at the top of the slope and slope stabilization and planting on the escarpment itself to help restore these areas.

7.3.2 Off-Leash Areas

Existing off-leash areas at the top of the escarpment along 40 Ave NW will remain. A triangular area near the intersection of 40 Ave. and 53 St. NW, which includes an existing playground, is currently under review by The City of Calgary. According to the Off-Leash Area Management Plan (City of Calgary, 2011), playgrounds are not a compatible use with off-leash areas. However, there is a second playground within a few hundred metres of the playground in the off-leash area, which may allow for the conflicting playground to be closed and the area maintained as off-leash.

Other off-leash zones in the park that conflict with regional pathways alignments, sensitive riparian habitats along the river, and proposed stormwater treatment facilities are recommended as on-leash in the DDP. Off-leash use is not compatible with cycling, stormwater wetlands, or wildlife habitat, and as noted in the Off-Leash Area Management Plan, “the protection of park assets, particularly natural habitats and wildlife, takes precedence over off-leash opportunities”. Dogs will be required to stay on-leash throughout the lower park area, and no dogs will be permitted along the escarpment and the single-track mountain bike trail.

Opportunities for an off-leash river access point in East Bowmont NEP are currently being reviewed by The City of Calgary in response to the public feedback received in Phase II engagement activities.



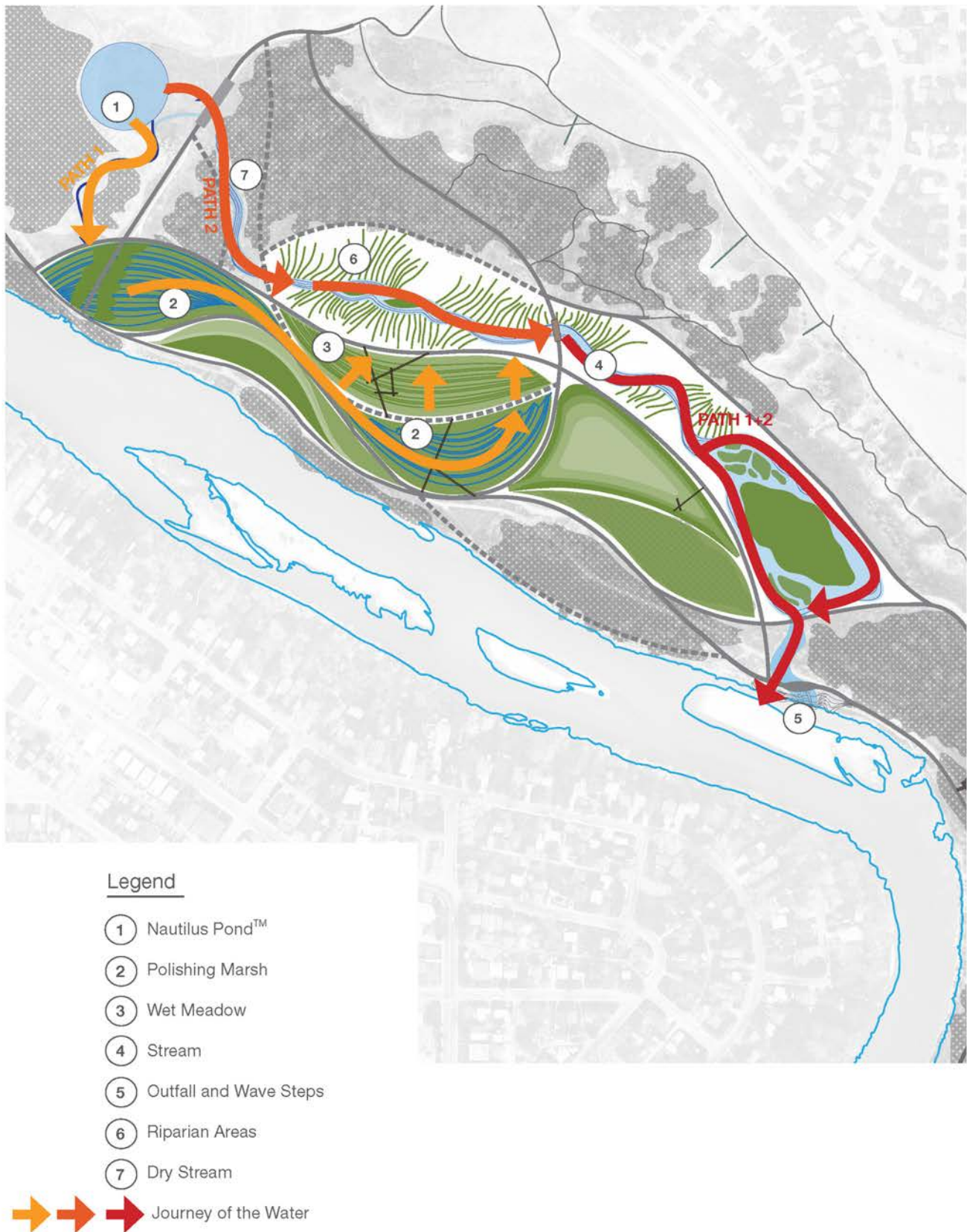


Figure 21. Proposed Stormwater Quality Management Concept

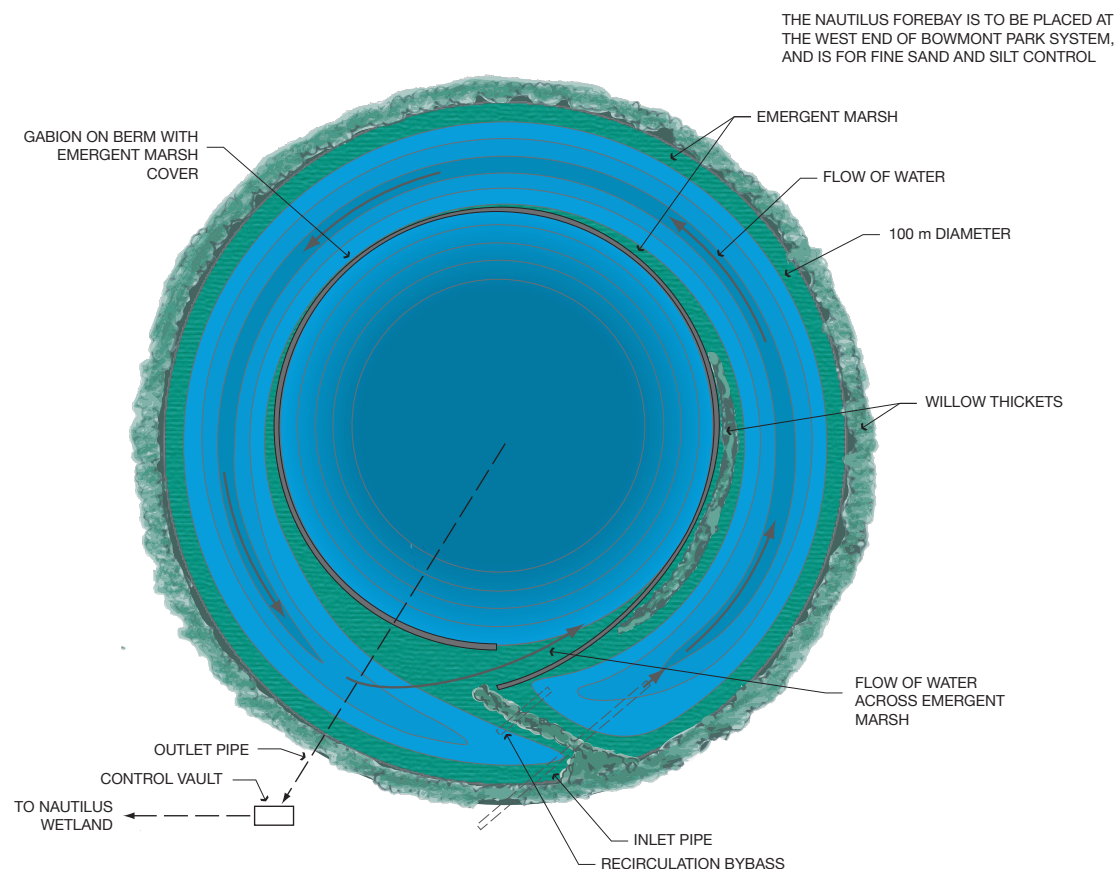
7.4 Stormwater Facilities

The stormwater quality management system is made up of a variety of ponds, streams and wetlands that will work together to clean sediment from a portion of the flow in the existing stormwater outfall pipes at the northwest end of East Bowmont Park. In total, the system is expected to reduce by approximately 50% the annual sediment load to the Bow River from the existing outfall. During larger storm events, areas adjacent to the stormwater streams will temporarily flood to control the release of stormwater into the Bow River, and during very large storms, some of the flow will bypass the treatment system and be discharged directly into the river.

The stormwater quality management system includes the following elements:

Nautilus Pond™

A circular pond will act as the forebay for the stormwater quality management system. Stormwater enters the park through this circular pond, where larger sediment particles are removed.



Plan view detail of Nautilus Pond™ (Nautilus Ponds Inc., 2012)

Polishing Marsh

Water slowly moves through the soil and roots of wetland plants, which remove the very fine particles of sediment that still remain in the stormwater.

Wet Meadow

The wet meadow provides enhanced treatment of stormwater by removing very fine particles of sediment. The areas will provide valuable marsh and wet meadow habitat for a variety of species.

Streams

Stormwater flows from the Nautilus Pond™ to the polishing marsh through a surface stream. Further down, the stream collects stormwater as it seeps out of the wet meadow and conveys it to the outfall. The stream roughly follows the route of an old side channel of the Bow River that existed before the gravel pit operation.

Riparian Areas

During larger storms, there may be water flowing into the stormwater system faster than can be safely released to the river. In these events, stormwater will bypass the polishing marsh and wet meadow and back up from the system into side channels in the riparian areas, temporarily creating a floodplain environment and supplying water to riparian plants along the side channels. Underlying gravel will allow this water to be absorbed into the ground.

Conveyance, Control and Outfall Structures

Built infrastructure facilities will move water through the different treatment environments, and discharge treated water into the Bow River. These facilities will be designed as architectural components of the landscape, to make visible processes that are typically hidden from view.

Floodplain Forest

Weeds and invasive plant species will be gradually managed and controlled in existing forest areas. Disturbed areas in the former gravel pit that are not part of the stormwater quality management system will be reclaimed and restored to floodplain forest.

Succession Island

An island cut off from the rest of the park by water, this area is already exhibiting the early stages of establishing a Balsam Poplar forest. Isolating Succession Island from the park will provide high quality habitat that is protected from human disturbance. Natural forest succession will be allowed to progress over time as the vegetation matures.



Top: Rendering of polishing marsh and lookout mound

Bottom: Rendering of wet meadow

7 Normally Dry Stream

When the flow exceeds what can easily pass through the polishing marsh and wet meadow, the normally dry stream conveys stormwater through the floodplain forest and riparian shrubland habitat to meet up with the stormwater seeping from the wet meadow.

When?

The normally dry stream will flow with water under all but the lightest rainfall events.

How Long?

When the normally dry stream flows with water after a light rain event, it will take about 12 hours for it to stop flowing.

8 Riparian Area Flooding

During larger storms, there may be water flowing into the stormwater system faster than can safely be released to the Bow River. In these events, stormwater will bypass the polishing marsh and wet meadow and will back up from the stream into side channels in the riparian areas. This will temporarily create a floodplain environment and supply water to riparian plants along the side channels of the stream. Underlying gravel will allow this water to be absorbed into the ground.

9 Flooding of Succession Island

Succession Island is a low-lying flat area of floodplain forest in the early stages of forest development. Being surrounded by water means that the island will temporarily become flooded as water backs up in the stream during larger storms.

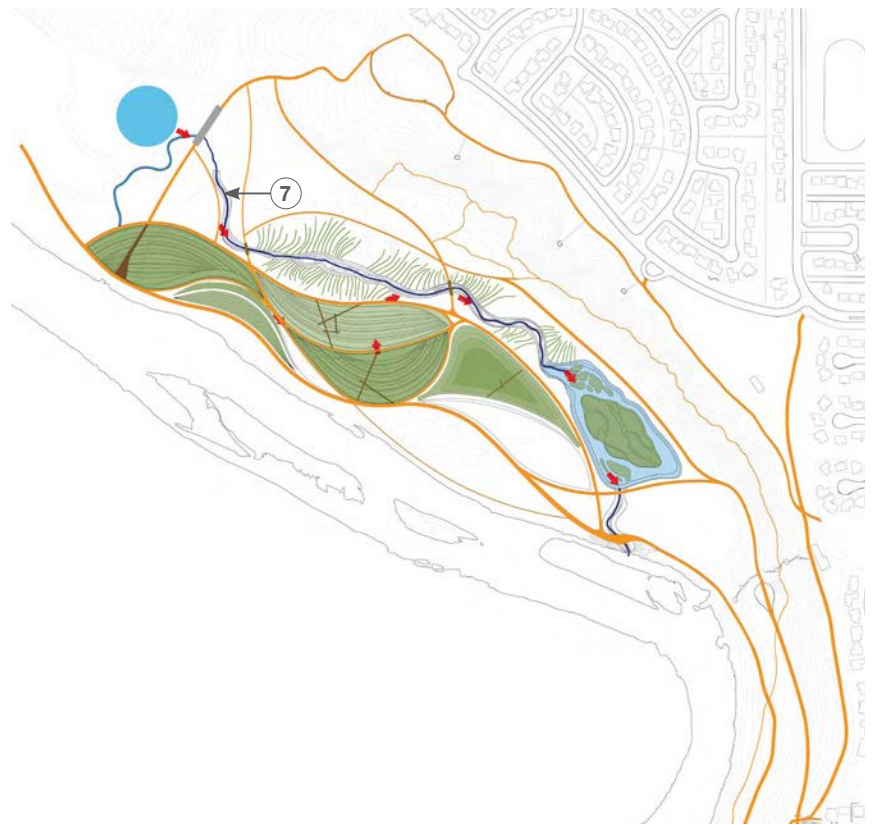
When?

Stage 2 flooding will occur about once per year in response to relatively heavy storm events.

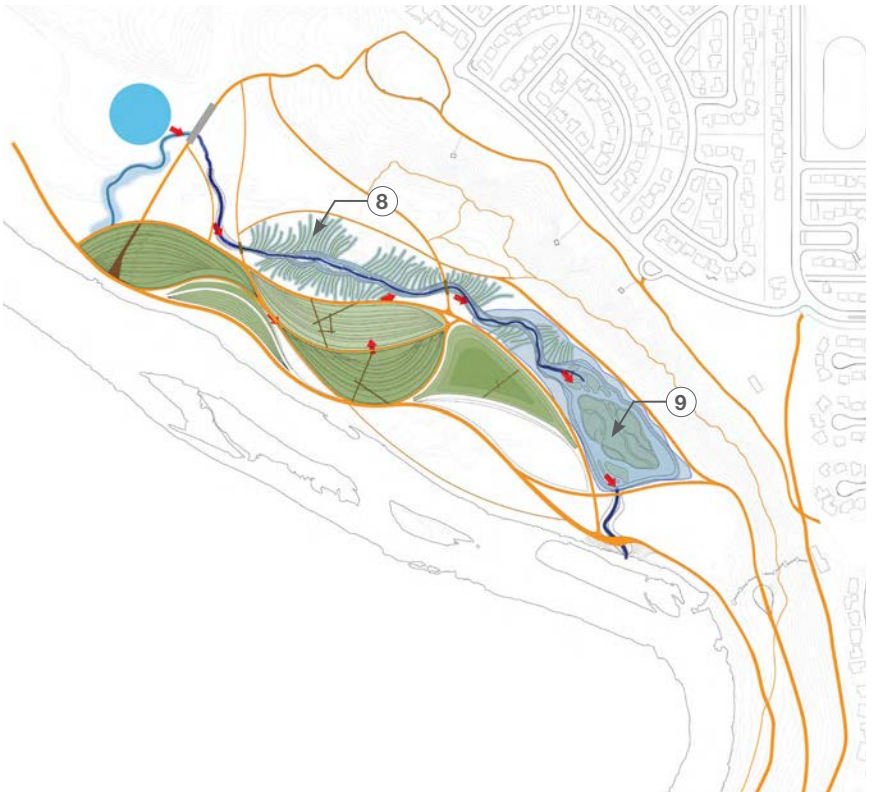
How Long?

It will take about 12 – 24 hours for the water level to drop down to the Stage 1 condition.

Stage 1 (Light Rainfall)



Stage 2 (Once per Year)



10 Flooding of Marsh and Wet Meadow

In very large storms, there may be a need to temporarily flood the marsh and wet meadow to store the water until it can be released to the Bow River more slowly. In these rare events, water would be visible at the surface of the marsh and wet meadow and boardwalks may be under water.

When?

Stage 3 flooding will occur about once every 2 – 5 years in response to relatively heavy storm events.

How Long?

It will take about 12 – 24 hours for the water level to drop down to the Stage 2 condition.

Stage 3 (Every 2-5 Years)



11 Flooding of Floodplain Forest

In the largest storms that the stormwater quality management system can handle, stormwater may flood the lower areas of the floodplain forest around the riparian areas. In these rare events, parts of the park that are normally accessible to the public would be temporarily inaccessible.

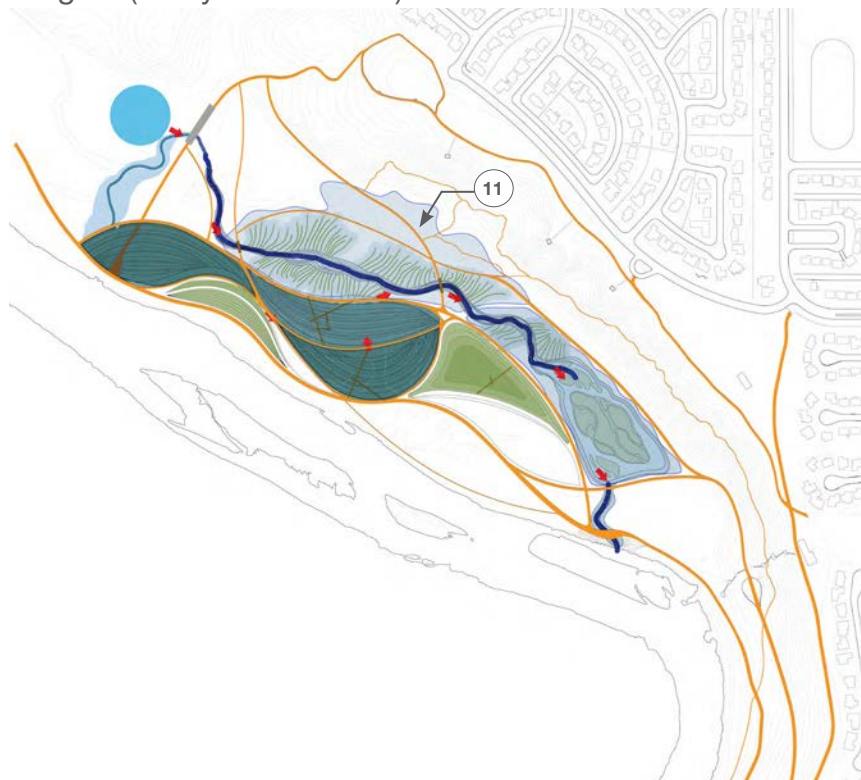
When?

A Stage 4 flooding condition will be rare and is expected to occur about once every 10 – 20 years.

How Long?

Flooding at the Stage 4 level is not expected to last more than 12 – 24 hours before returning to a Stage 3 flood condition.

Stage 4 (Every 10-20 Years)



7.4.1 Stages of Stormwater Quality Management

The stormwater quality management system has been designed to treat a range of the smaller, most common runoff events, which are responsible for transporting the bulk of sediment into the stormwater system. The following stages describe how the stormwater quality management system will function during different runoff events.

Stage 1 – Light Rainfall

When the flow exceeds what can easily pass through the polishing marsh and wet meadow, the normally dry stream conveys stormwater through the floodplain forest and riparian shrubland habitat to meet up with the stormwater seeping from the wet meadow. The normally dry stream will flow with water under all but the lightest rainfall events. When the normally dry stream flows with water after a light rainfall event, it will take about 12 hours for it to stop flowing.

Stage 2 – Once per Year

During larger storms, there may be water flowing into the stormwater system faster than can safely be released to the Bow River. In these events, stormwater will bypass the polishing marsh and wet meadow and will back up from the stream into side channels in the riparian areas. This will temporarily create a floodplain environment and supply water to riparian plants along the side channels of the stream. Underlying gravel will allow this water to be absorbed into the ground.

Succession Island is a low-lying flat area of floodplain forest in the early stages of forest development. Being surrounded by water means that the island will temporarily become flooded as water backs up in the stream during larger storms. Stage 2 flooding will occur about once per year in response to relatively heavy storm events. It will take about 12 - 24 hours for the water level to drop down to the Stage 1 condition.

Stage 3 – Every 2 to 5 Years

In very large storms, there may be a need to temporarily flood the marsh and wet meadow to store the water until it can be released to the Bow River more slowly. In these rare events, water would be visible at the surface of the marsh and wet meadow and boardwalks may be under water. Stage 3 flooding will occur about once every 2 – 5 years in response to relatively heavy storm events. It will take about 12 – 24 hours for the water level to drop down to Stage conditions.

Stage 4 – Every 10 to 20 Years

In the largest storms that the stormwater quality management system can handle, stormwater may flood the lower areas of the floodplain forest around the riparian areas. In these rare events, parts of the park that are normally accessible to the public would be temporarily inaccessible. A Stage 4 flood condition will be rare and is expected to occur about once every 10 – 20 years. Flooding at the Stage 4 level is not expected to last more than 12 - 24 hours before returning to a Stage 3 flood condition.

7.5 Circulation and Parking

The concept plan shows a wide range of trail types for different user groups, including paved trails that allow barrier-free access to many of the new amenities in the park, pedestrian-only nature trails, and new regional and local pathway routes. A drop-off for handi-bus charters and school field trips will be provided using the existing access road off of Home Road. The size and location of the parking lot will remain the same, but the lot will be re-graded and reconfigured for better access. The majority of the access to the park will be on foot or bicycle, as currently exists.

7.5.1 Roads and Parking

Vehicles will continue to access the site from 52 St. NW, at the southern edge of the park. The existing gravel parking lot will be reconfigured and re-graded to improve access, reducing the steep cross slope with retaining walls and providing landscape areas to collect surface drainage. The parking lot will continue to accommodate 27 parking stalls, and will remain as a gravel lot.

The existing access road at the corner of Home Road and 32 Ave. NW will be improved with gravel resurfacing to provide vehicle access for handi-bus and school groups as far as a turn-around loop located partway down the access road. At this point, buses will park and unload and park visitors will make their way into the park on foot, bicycle, or other non-motorized means. The access road will remain gated when not in use to prevent private passenger vehicles from driving into the park. Maintenance vehicles will also use this access point.

The existing access road below the turn-around loop will be narrowed for use as a gravel trail to improve the natural environment park experience. A minimum width of 3m will be maintained for Parks and Water Services maintenance vehicle access.

Visitors who use on-street parking along 40 Ave NW, and within neighbouring streets of the park will continue to access the park via the pathway that runs along the top of the escarpment.



Maintenance access



Legend

- ① Gravel parking lot (27 stalls). Reconfigured and regraded for better access.
- ② Pathway realigned at driveway to reduce driver/cyclist conflicts.
- ③ New switchback pathway connection to top of hill.
- ④ New all season indoor washroom building.
- ⑤ New picnic shelter and interpretive building
- ⑥ Remnant hedge from original Shouldice House (1913-1974) with views cut through hedge
- ⑦ Landscape buffer



KEY PLAN

Figure 23. Proposed Parking and Facilities at South Entrance

East Bowmont Natural Environment Park
Design Development Plan | February 2014

7.5.2 Pathways and Trails

Visitors travelling by bicycle or on foot will continue to access the park from the Bow River Pathway in the northwest and the south, or from the designated on-street bikeway on 52 St. NW.

The pathway near the entrance to the parking lot on 52 St. NW will be realigned at the driveway to reduce driver/cyclist conflicts, and a new 3m wide paved local pathway will be provided linking the parking lot to the corner of Home Road and 32 Ave. NW along well-used existing desire line. This route will switchback up the steep hill to comply with The City of Calgary's pathway design guidelines for maximum slope.

On Home Road, pull-outs will be added to provide resting points for cyclists and pedestrians climbing this steep regional pathway route.

Within the lower park, the regional pathway will be relocated along the edge of the former gravel pit to move part of the pathway that is currently within the Bow River floodway out of this designated zone. The pathway will also be widened to 4m to meet The City's new guidelines for river pathways and to help reduce conflicts between cyclists and other users.

A hard-surface barrier-free pathway route will provide wheelchair access to the key features of the park, including the marshes, wet meadow, stormwater conveyance stream, phytoremediation area and outfall, and to the boardwalks that intersect these areas.

All maintenance vehicle routes and barrier-free pathways are a minimum of 3m in width, and use a combination of regional pathway, existing access road, and new pathway alignments.

Gravel bicycle trails connect the east and west ends of the single-track mountain biking trail, creating a loop that can be ridden repeatedly by mountain bikers. Cycling routes vary from 2m to 4m in width, with the exception of the single track mountain biking trail, which is only about 0.5m wide. These surfaces are a combination of paved pathways and gravel trails.

Pedestrian-only nature trails provide access to bird-watching opportunities in the Balsam Poplar forest and riparian areas along the stormwater conveyance stream and the Bow River. These trails will consist of a natural tread or bark mulch, and will be a maximum of 1m in width.

A summary table of the trail and pathway hierarchy in the park is shown below in Table 17.



Cycling routes



Barrier-free pathways



Pedestrian-only access

Table 17 Trail and Pathway Hierarchy

Pathway / Trail Type	Description	Width	Surface Material
Regional Pathway - New	<ul style="list-style-type: none"> - Upgrades a portion of the existing Bow River Pathway. - Barrier-free. - Maintenance access route. - Accommodates bicycles and pedestrians. 	4.0m	Asphalt
Regional Pathway – Existing	<ul style="list-style-type: none"> - Maintains the existing regional pathway in its current location. - Barrier-free. - Maintenance access route. - Accommodates bicycles and pedestrians. 	3.0m	Asphalt
Barrier-Free Pathway	<ul style="list-style-type: none"> - Primary circulation route through the park, providing access to multiple park environments. - Connects to the handi-bus / school group drop-off. - Barrier-free. - Maintenance access route. - Accommodates bicycles and pedestrians. 	3.0m	Asphalt, chip seal or similar
Local Pathway - New	<ul style="list-style-type: none"> - Provides improved connection to the top of the hill at Home Road. - Barrier-free. - Maintenance access route. - Accommodates bicycles and pedestrians. 	3.0m	Asphalt
Maintenance Access Trail	<ul style="list-style-type: none"> - Provides maintenance access to marsh and wet meadow areas. - Accommodates bicycles and pedestrians. 	3.0m	Gravel
Gravel Trail	<ul style="list-style-type: none"> - Secondary circulation route through the park, providing access from the escarpment to the river. - Accommodates bicycles and pedestrians. 	2.0m	Gravel

Pathway / Trail Type	Description	Width	Surface Material
Nature Trail	<ul style="list-style-type: none"> - Loops through the forest, wet meadow, polishing marsh and riparian areas. - Pedestrian-only. 	0.5 - 1.0m	Natural tread or bark mulch
Single Track Mountain Biking Trail	<ul style="list-style-type: none"> - Formalizes the existing single-track mountain biking trail along the escarpment. - Allows bicycles. 	0.5m	Natural tread
Boardwalk	<ul style="list-style-type: none"> - Provide access through sensitive habitats, including phytoremediation and wet meadow areas. - Pedestrian-only. 	2.0m	Timber
Stairs	<ul style="list-style-type: none"> - Provide safe connection to top of escarpment. - Single track trail alignment to pass under stairs. - Pedestrian-only. 	2.0m	Timber



Figure 24. Typical Trail Cross Sections

7.6 Site Amenities and Furnishings

The new facilities in the park allow for passive activities such as walking and bicycling, picnicking, and wildlife observation. An all-season indoor washroom will be provided next to the parking lot, and a seasonal washroom will be provided in the lower area of the park. Boardwalks and look-out platforms throughout the park will incorporate interpretive signage about the park, and a picnic shelter near the parking lot can also provide interpretive information. A small amphitheatre on the lookout mound will provide seating for educational presentations, and a storage building for Parks maintenance supplies will be located mid-way down the existing access road into the park.

All park amenities and facilities should be designed using a common language of forms and materials, which will help to create a unique identity for the park.

Small buildings, such as the washroom buildings and picnic shelter, will be constructed using durable materials that can withstand vandalism, and will be designed to be securely closed during off-hours. Durable building materials for these structures should consist of concrete, stone and steel. All exterior spaces should be visible, and roofs should be high enough to deter access without special equipment. Security cameras and lighting levels should be considered during detailed design.



Rendering of view platform

Materials used in landscape structures, interpretive elements and site furnishings should consist primarily of durable wood, concrete and steel.

Wood is a natural material that adds warmth to small-scale landscape structures and furnishings, and is appropriate for use in a natural environment park. More durable wood types such as cedar, ipe and iroko will withstand weathering better than softer woods, but may be more costly to replace if planks are burned or deeply scratched.

Steel elements provide strength and durability. Steel should be powdercoated in colours that complement the natural setting of the park or galvanized to protect the metal from rusting. Steel elements should be used sparingly to meet functional requirements in site amenities and furnishings.

Concrete is a cost-effective material for constructing retaining walls, engineered conveyance structures, and paved surfaces. It is versatile in color and finish, and provides a simple and practical method of construction that is durable and easy to maintain.

7.7 Park Maintenance

A key factor in maintaining a natural park successfully is providing adequate access for the equipment needed to carry out maintenance. For example, a trash receptacle that is easily accessible by vehicle is easier to empty than an isolated trash receptacle that must be emptied by hand. Park maintenance access will be provided by the vehicle access road, barrier-free pathways, maintenance trails and the regional and local pathways. A small maintenance equipment storage facility will be provided at the handi-bus / school group drop-off area, consisting of a small secure building or storage container.

Regular maintenance in natural areas and manicured areas includes garbage pick-up, amenity repair, and some cutting of vegetation. More specialized maintenance will be undertaken by the Natural Areas Management division of The City of Calgary Parks. Specialized maintenance activities are those related to natural area restoration, or those requiring special skills such as erosion control and habitat enhancement.

Maintenance of stormwater quality management facilities will be undertaken by the Water Resources business unit of The City of Calgary, and will include removal of floating debris on a regular basis, as well as periodic dredging of sediment from the stormwater cells, particularly in the forebay, where the bulk of the sediment will be captured. These activities may require the use of large equipment, a factor that has been considered in the design of the park trail and pathway network.

An annual assessment of the park should be conducted to determine specific maintenance requirements. A summary of typical regular Parks maintenance activities that may be required in East Bowmont NEP is shown in Table 18 below.

Table 18 Typical Maintenance Activities

Group	Maintenance Activity	Management Zones	Recommended Frequency
Roads and Parking	Top up and grade vehicle access road, turn-around loop and gravel parking lot	Natural Parkland, Manicured	Annually each spring, or as needed
	Oil swing gate at vehicle access road	Manicured	Annually each spring, or as needed
	Snow removal	Natural Parkland, Manicured	As needed during winter months
Trails and Pathways	Top up and grade gravel trails	Natural Parkland, Disturbed	Annually each spring, or as needed
	Patch and resurface asphalt pathways	Natural Parkland, Manicured	As needed
	Top up bark mulch nature trails	Natural Parkland, Restoration	Annually each spring, or as needed
	Repair erosion and wet areas on single track trail	Restoration	As needed through Calgary Mountain Bike Alliance volunteer group
	Close and reclaim informal trails	Natural Parkland, Restoration	As needed
	Remove deadfall	Natural Parkland, Manicured, Disturbed, Restoration	As needed
	Snow removal (regional pathway only)	Natural Parkland, Manicured	As needed during winter months
Facilities and Amenities	Pump out seasonal vault toilet tanks	Natural Parkland	Varies depending on use. Not required when closed for winter season.
	Clean and stock seasonal washroom	Natural Parkland	Daily during summer
	Clean and stock serviced washroom	Manicured	Daily
	Remove graffiti from park amenities	Natural Parkland, Manicured	As needed
	Clean picnic tables and benches	Natural Parkland, Manicured	Annually each spring
	Replace damaged boards on site furnishings and landscape structures with wood finishes	Natural Parkland, Manicured, Restoration	As needed

Group	Maintenance Activity	Management Zones	Recommended Frequency
Facilities and Amenities	Apply stain or wood oil to site furnishings and landscape structures with wood finishes	Natural Parkland, Manicured	Every 1-2 years, if softwood used. Not required for durable hardwoods.
	Paint chipped or scratched finishes on steel surfaces	Natural Parkland, Manicured, Restoration	As needed
	Empty trash receptacles	Natural Parkland, Manicured, Disturbed	Weekly, or as needed
	Replace damaged interpretive signage	Natural Parkland, Manicured, Restoration	As needed
	Repair fences	Disturbed, Manicured, Restoration	As needed
	Remove trash and debris from amenity areas	Natural Parkland, Manicured, Disturbed, Restoration	Weekly
Vegetation	Manage noxious and prohibited noxious weeds	Natural Parkland, Manicured, Disturbed, Restoration	Monthly during growing season
	Manage invasive nuisance weeds	Natural Parkland, Restoration	Monthly during growing season
	Mow grass	Manicured	Every other week, or as needed during growing season
	Prune trees and shrubs	Manicured	Annually each fall, or as needed
	Replace damaged plant material	Natural Parkland, Manicured, Restoration	As needed

8.0 PHASING AND IMPLEMENTATION

The implementation of the East Bowmont DDP is envisioned to take place over 3 to 4 sequential phases. Some of the key factors in determining the scope of work for each phase include budget availability and regulatory approvals for work involved in the project such as wetland compensation and remediation of contaminated soils and groundwater.

The stormwater quality management facilities in the park will be designed and constructed under separate budgets by the Water Resources business unit. Phasing of the park development is structured to address the construction of the stormwater quality management facilities by focusing on those areas adjacent to the stormwater features to ensure that they are accessible and safe for park visitors to enjoy. Subsequent phases of park development will address habitat restoration, trail and pathway development and amenities and facilities that are not directly associated with the stormwater quality management area.

A summary of the work items included in each phase follows.

8.1 Phase 1 Development

In Phase 1 development, construction will focus on the areas adjacent to the stormwater features and circulation networks to provide access to those areas. Remnant infrastructure from the gravel pit operation will be removed, and the process of reclaiming the areas disturbed by gravel mining will begin.

Phase 1 includes the following work:

- Demolition of infrastructure that remains from the former gravel pit operation.
- Establishment of a trail and pathway network to access the lower park area, including a new regional pathway, maintenance access trails, gravel trails, nature trails, and bridges across the proposed stormwater conveyance stream.
- Weed control, topsoil placement and planting to restore Balsam Poplar forest and riparian shrubland areas in the former gravel pit.
- Slope stabilization on the escarpment slope.

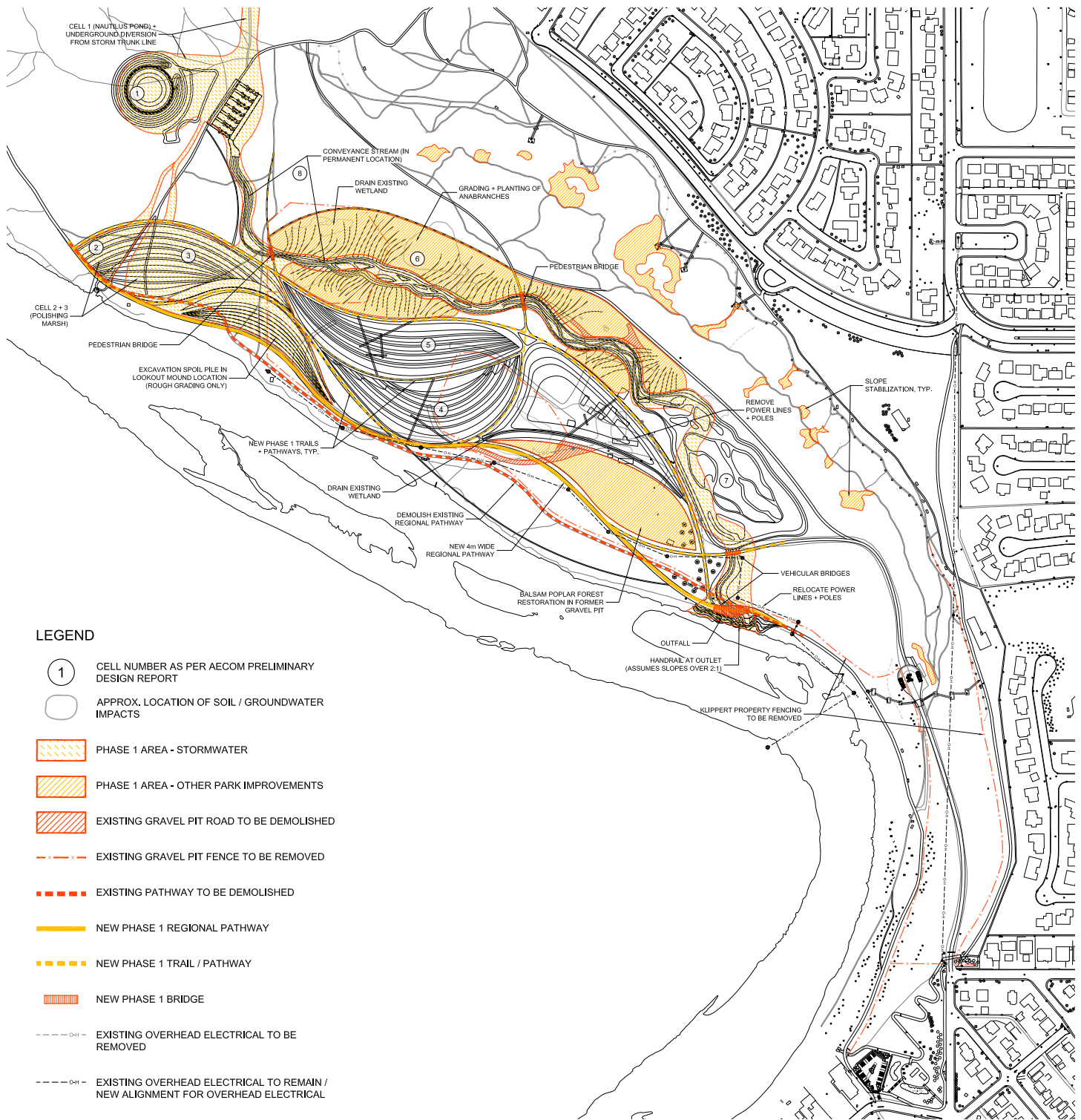


Figure 25. Phase 1 Development

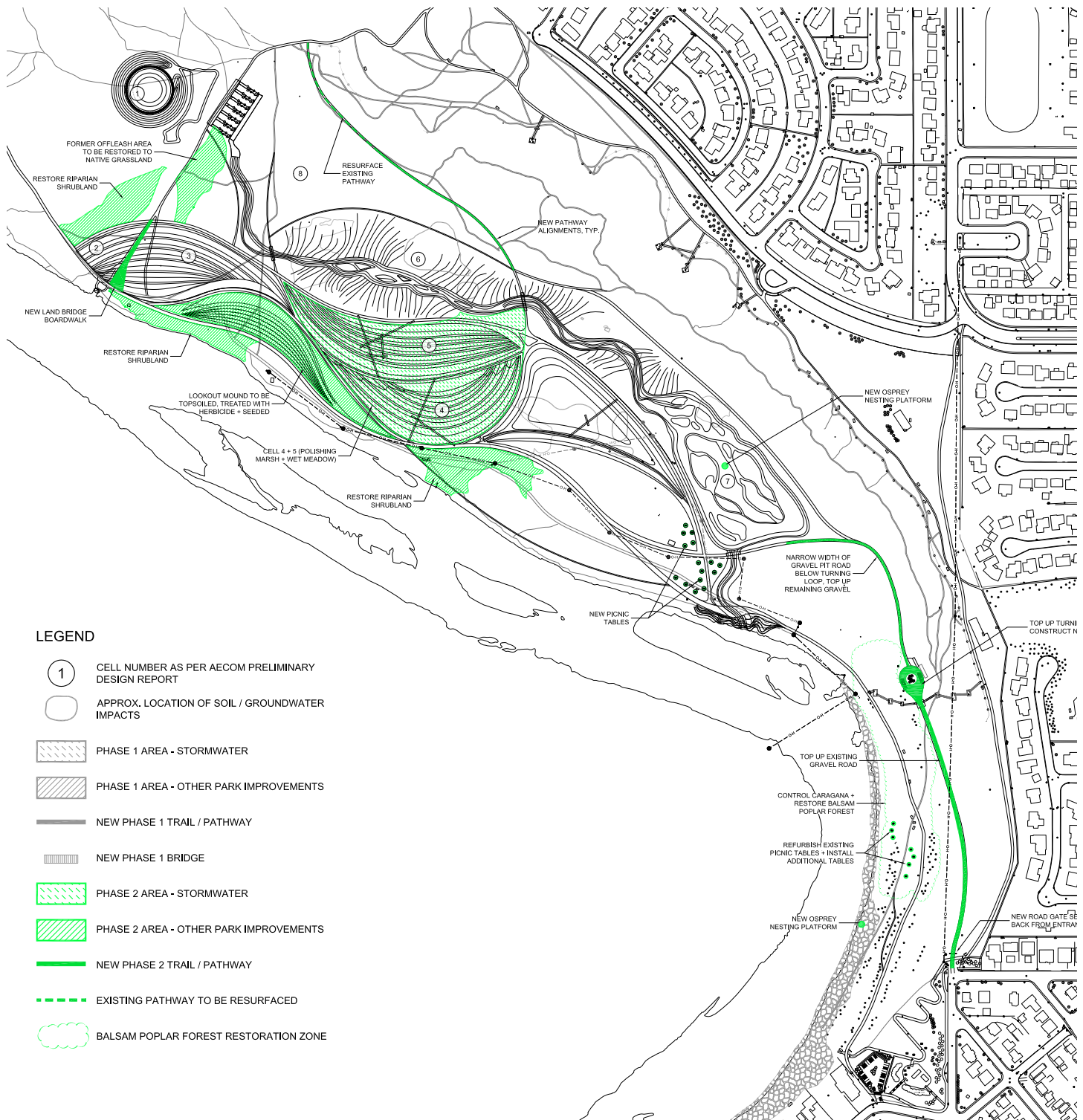


Figure 26. Phase 2 Development

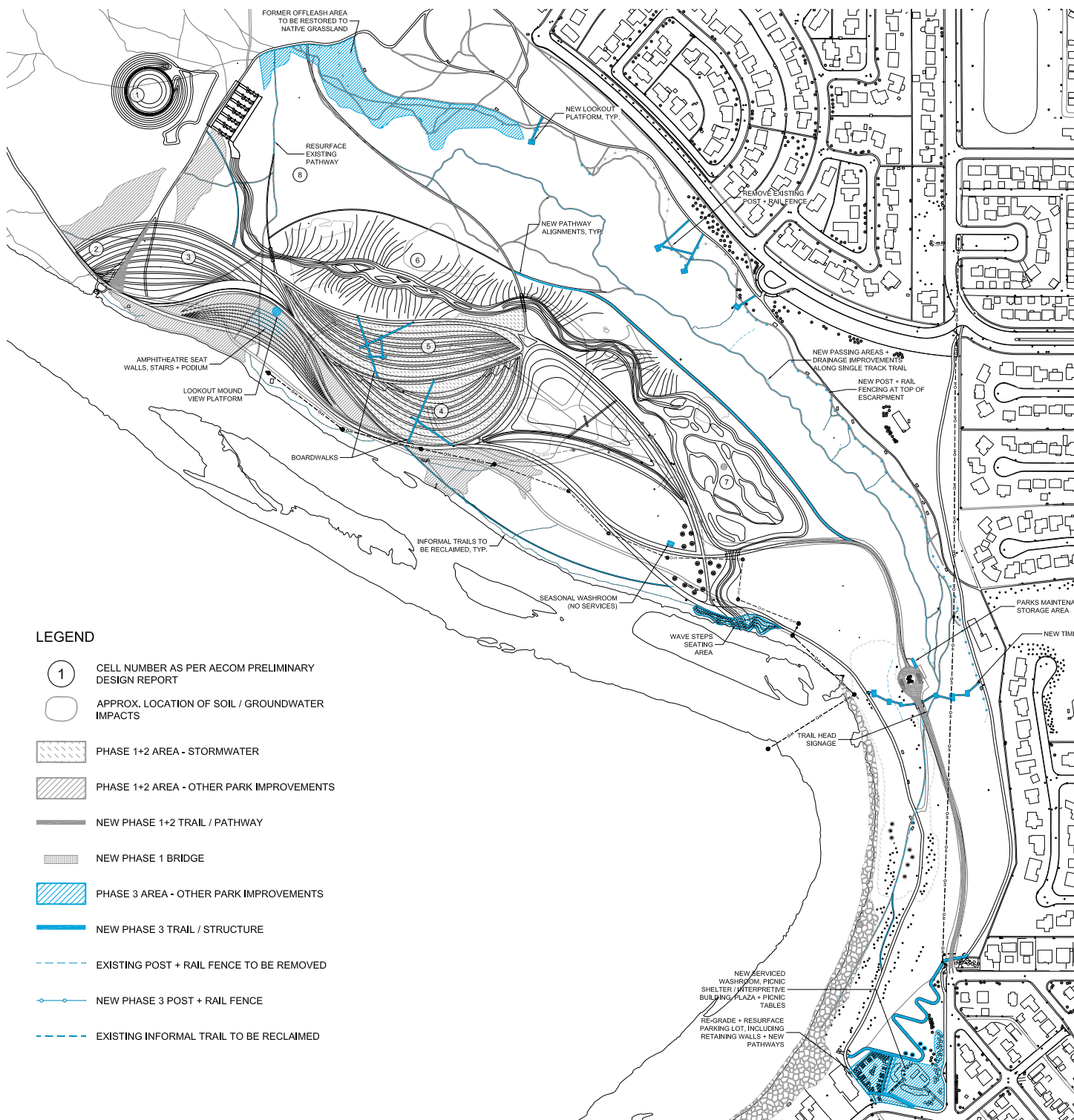


Figure 27. Phase 3 Development

8.2 Phase 2 Development

In Phase 2, vehicular access for handi-bus, school group and maintenance vehicles into the lower park area will be improved, site furnishings added to the lower park, and habitat restoration work will be continued.

Phase 2 includes the following:

- Narrowing of the old gravel pit access road below the turn-around loop.
- Construction of gravel trails to connect the area between the stormwater quality management system and the escarpment into the trail and pathway network.
- Topping up and re-grading the existing vehicle access road and turn-around loop to provide access for handi-bus, school group and maintenance vehicles.
- Site furnishings to create a new picnic area and enhance an existing picnic area.
- Planting to restore existing Balsam Poplar forest and riparian shrubland adjacent to the former gravel pit.
- Weed control, topsoil placement and planting to establish new native grassland areas in the former gravel pit.

8.3 Phase 3 Development

Phase 3 will involve construction of the bulk of the park amenities and facilities that are shown in the DDP, including the parking lot and associated washroom amenity area at the south end of the site, formalized seating and viewing areas along the Bow River near the stormwater conveyance stream outfall, lookout platforms, the amphitheatre and seasonal washroom, reclamation of informal trails, and improvements to the single-track mountain biking trail.

Specific work involved in Phase 3 includes:

- Removing the existing fence at the top of the escarpment and installing new fencing to control informal access from the top of the escarpment.
- Constructing new local pathways, gravel trails and nature trails throughout the park.
- Making recommended improvements to the single-track mountain biking trail.
- Re-grading and enhancing the parking lot at the south end of the site.
- Building the new serviced washroom and picnic / interpretive area near the south parking lot.
- Formalized seating and viewing areas along the Bow River near the stormwater conveyance stream outfall.
- Installation of wayfinding and interpretive signage throughout the park.
- Lookout platforms and stairs connecting the top of the escarpment to the lower park.
- Adding the amphitheatre to the lookout mound.
- New seasonal washroom and parks maintenance building.
- Constructing boardwalks throughout the marsh and wet meadow.
- Native grassland restoration (continued from Phase 2).
- Closure and reclamation of informal trails.

8.4 Remediation and Phytoremediation

Site remediation and phytoremediation may be conducted during any of the other phases of park development, or as a separate phase. It is not known how this work will be sequenced due to regulatory requirements that must be satisfied before proceeding with construction. In the event that other phases of work are started before the remediation plan is approved, the contaminated areas must be isolated and avoided during park construction.

Current environmental sampling is required to confirm the required steps for remediating the site (existing data is from 2004). Actions that may be part of the remediation plan could include:

- Excavating soils with heavy metal contamination and disposing of this material at an approved hazardous waste facility or landfill (depending on contamination levels).
- Demolishing concrete vaults, pads and foundations that remain from the gravel pit operation.
- Excavating and grading, placing topsoil, planting and fencing the phytoremediation area.
- Providing a boardwalk through the phytoremediation area.

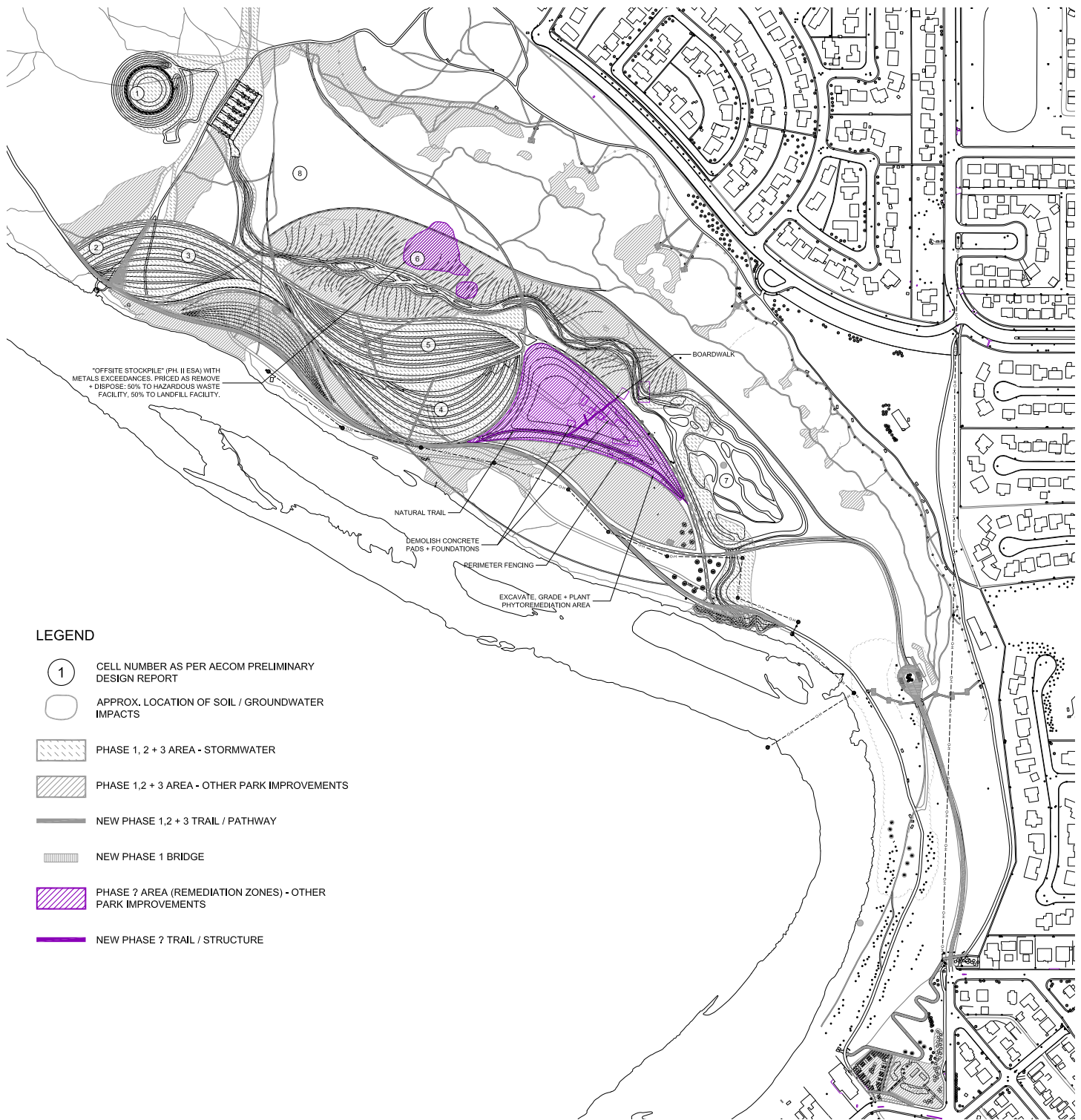


Figure 28. Remediation Phase

8.5 Preliminary Cost Estimate

A preliminary opinion of probable construction cost has been developed for the park improvement work included in the DDP (refer to Appendix B). This estimate does not include the costs of building the stormwater quality management facilities or any art features that may be incorporated into the stormwater facilities. The estimated costs for these items have been developed separately by AECOM and Watershed+, and are detailed in a Preliminary Design Report that is specific to the proposed stormwater facilities.

The total cost to implement the park improvements shown in the DDP is estimated to be \$12,665,747. Note that these figures are an opinion of probable costs, not a guaranteed cost figure, and will be refined as detailed designs are prepared. Due to the conceptual nature of the Design Development Plan, these figures may not reflect actual costs. Furthermore, The City of Calgary may reallocate work from one phase to another as needed.

Phase	Estimated Cost
Phase 1 - Former Gravel Pit Restoration	\$3,256,835
Phase 2 - Access and Habitat Restoration	\$2,033,961
Phase 3 - Park Amenities and Facilities	\$4,863,765
Remediation and Phytoremediation	\$2,511,186
TOTAL	\$12,665,747

APPENDIX A. PLANS, BYLAWS, STUDIES AND SPECIFICATIONS

A.1. Plans

The following council-approved planning and policy documents were reviewed to guide the planning process for this project.

Study	Author	Year	Purpose	Outcome
Calgary Natural Area Management Plan	The City of Calgary	1994	The primary role of the Natural Area Management Plan is to ensure the long term viability and public use of the City of Calgary's natural environments.	<p>Natural Environment Policies:</p> <ul style="list-style-type: none"> Calgary Parks will protect and maintain representative and viable natural habitat types, within city boundaries, as an integral component of the parks and open space system. Calgary Parks will manage designated natural parklands in a manner which will, by intent, maintain the natural character and integrity of these sites. Calgary Parks will encourage and welcome informed public, corporate and community participation, stewardship and partnerships in the acquisition, management, research and protection of appropriate natural environments. Year-round enjoyment and use by all Calgarians will be encouraged with appropriate sensitivity to environmental impact and safety. Where recreational use and the long-term survival of significant habitats conflict, protection of the resource will take precedence. Recreational facilities will be designed and managed to minimise negative impact on natural areas. The City of Calgary will work with adjacent municipalities to cooperatively protect contiguous natural habitat.
Open Space Plan	The City of Calgary	2003	The Open Space Plan is a policy document. It identifies broad principles, policies and strategies for the acquisition, development and use of open space in the City of Calgary.	<p>General Open Space Principles:</p> <ul style="list-style-type: none"> The open space plan identifies several principles that are common to all types of open space acquisition, development, and use, regardless of the scale or function of the open space. Very broadly, the principles address access and distribution, the environment, and economic vitality. Many of the principles are interrelated. For example, open space sustainability is related to the efficiency of land uses, which can result in both economic and environmental benefits. <p>Environmental Open Space</p> <ul style="list-style-type: none"> All park development/redevelopment within the inner city should meet all neighborhood or community open space needs to provide effective, safe, and sustainable open space environments. <p>A commitment to the conservation of Environmental Open Space should be demonstrated through the policies of the Calgary Natural Area Management Plan of 1994.</p>

Study	Author	Year	Purpose	Outcome
Wetland Conservation Plan	The City of Calgary	2004	<p>The purpose of the Wetland Conservation plan is to provide an over arching guiding set of principles for how wetlands should be managed, maintained and respected by the City of Calgary and its citizens.</p> <p>Vision</p> <ul style="list-style-type: none"> Calgarians have an awareness, understanding and appreciation of the benefits of wetlands. As a result, wetlands have become an integral part of our city's urban fabric and they are maintained for the benefit, use and enjoyment of present and future Calgarians and visitors. 	<p>Principles and Goals</p> <p>No net loss</p> <ul style="list-style-type: none"> The City of Calgary shall ensure that there is no net loss of Calgary wetlands after efforts have been made to avoid impact from development. <p>Regional planning</p> <ul style="list-style-type: none"> Ecological boundaries of watersheds and/or aquifers do not respect political boundaries. Therefore, a regional planning perspective should be considered when unavoidable losses to existing wetlands are compensated through wetland enhancement and/or creation. <p>Management of wetland habitats</p> <ul style="list-style-type: none"> Calgary wetlands shall be managed to ensure their long-term sustainability. <p>Wetland monitoring, research and development program</p> <ul style="list-style-type: none"> In partnership with other government, community, corporate and/or commercial organizations, The City of Calgary shall support a wetland monitoring and research and development program that will develop standards for, and measure the success of incorporating existing, restored, enhanced and created wetlands into the urban landscape. <p>Public education</p> <ul style="list-style-type: none"> Educating the public about the importance of wetland functions and their value in producing environmental, social and economic benefits will play an important role in wetland conservation and protection.
Bowmont Park Management Plan	The City of Calgary	2004	<p>The purpose of the Bowmont Park Management Plan is to establish sound management direction to achieve a gradual improvement in the health and condition of Bowmont Park, ensuring its protection for the enjoyment of generations to come.</p> <p>The Bowmont Management Plan recognizes Bowmont as a major Natural Environment Park, and recommends compatible visitor uses with appropriate management strategies.</p>	<p>Objectives:</p> <ul style="list-style-type: none"> To maintain the natural environment in its native state with an emphasis on maintaining or enhancing the biological diversity of the area. To protect areas of high environmental significance and to restore areas that have been previously disturbed or degraded. To ensure public access, safety, and use at the appropriate environmentally-sensitive level. To conform to Council-approved policy and plans. To give precedence to the protection of wildlife (both flora and fauna) and the natural resource over human use where the two come into serious conflict. To provide volunteer, education and interpretive opportunities. <p>Zones:</p> <p>The following zones (defined by The City of Calgary) have been included for Bowmont Natural Environment Park:</p> <ul style="list-style-type: none"> Preservation Zone Natural Parkland Zone Disturbed Zone Manicured Zone Restoration Zone

Study	Author	Year	Purpose	Outcome
Calgary Urban Parks Masterplan	The City of Calgary	1994	<p>The Urban Park Master Plan (UPMP) is a policy document that has guided the development of Calgary's River Valley System since 1994. The plan identifies a core vision and 18 principles that remain relevant to the design and management of Bowmont Park.</p> <p>Bowmont Park is included as part of the vision and master plan for the Bow River West segment – Planning Unit 13.</p>	<p>The proposed improvements include:</p> <ul style="list-style-type: none"> • Indigenous rehabilitation of disturbed areas. • Maintenance of existing regional pathway. • Unpaved secondary trails as necessary to prevent further deterioration of natural areas. Secondary trails will be designed for pedestrian use only and will be kept to a minimum. • Improvement of trail connections to adjacent communities. • Parking at periphery (52nd Street NW and 85th Street NW). • Limited self-guided interpretive trails. • Creation of wetlands and drylands habitat in existing gravel extraction area. • Retention of existing rest areas and picnic facilities. • Landscape management of Silver Springs golf course to enhance wildlife habitat.
A Public Art Plan for the Expressive Potential of Utility Infrastructure	The City of Calgary Utilities and Environmental Protection Department	2007	<p>The intention of this plan is to create a visual and aesthetic legacy that will highlight Utilities and Environmental Protection (UEP) services and infrastructure, as well as Calgarians' impact upon the Bow River watershed. While the main focus of the plan is to bring art into the mix of urban life in Calgary, these projects will also foster stewardship and educate the public about UEP services, infrastructure, and the surrounding watershed.</p>	<p style="text-align: right;">Mission</p> <p>The UEP Public Art Plan will create distinctive places throughout the community while building awareness, appreciation and understanding of The City's commitment to the protection and long term sustainability of its water supply and the vast ecologies which support it.</p> <p>Goals</p> <ul style="list-style-type: none"> • Communicate that the water system is not a disposal system. • Create a narrative of the watershed and water cycle for an awareness of UEP services throughout the city. • Make explicit the overlay of the man made watershed on the natural watershed, recognizing that the watershed has no political boundaries. • Foster stewardship of the natural watershed by creating the opportunity to understand our daily impact on it. • Enhance the security of infrastructure by identifying it. Pump station and other UEP infrastructures are identified only by signage providing their street address (for fire and emergency purposes). When residents are aware of "what that building is," they might be more unlikely to report unusual activity around it. • Expand our consciousness of UEP infrastructure in relationship to the watershed and our limited natural resources.

Study	Author	Year	Purpose	Outcome
Off-Leash Area Management Plan	The City of Calgary Parks	2010	<p>The Off-Leash Area Management Plan is an administrative document that provides recommendations for the establishment, management and operation of off-leash areas.</p> <p>The plan combines existing policies and bylaws with new guidelines for the management of off-leash areas.</p>	<p>Applicable recommendations include:</p> <ul style="list-style-type: none"> • Off-leash areas should be designed to maximize safety, minimize potential for user conflicts, and ensure clarity of the boundaries of the off-leash area. • New off-leash areas should be considered in or adjacent to Special Protection Natural Environment Parks, Major Natural Environment Parks and Environmentally Significant Areas only when it can be demonstrated that an off-leash area is in accordance with natural habitat goals. • Where a biophysical evaluation shows that natural habitats or wildlife are being negatively impacted by an existing off-leash area, strategies should be implemented to protect the natural area, including closure of the off-leash area, if necessary. • The impact of off-leash use on native plants and wildlife and the fragmentation of natural habitats should be eliminated. • New off-leash areas should only be considered adjacent to “no dog” areas, pathways and major roadways when strategies can be implemented to mitigate safety concerns and conflict between users. • Where safety concerns or user conflict has been identified in an existing off-leash area adjacent to “no dog” areas, mitigation strategies should be implemented, including closure of the off-leash area, if necessary.

A.2. Bylaws

The following Council-approved bylaws were reviewed to guide the planning process for this project.

Bylaw	Code	Purpose	Relevant sections to this study
Parks and Pathways Bylaw	20M2003	<p>The Park and Pathways bylaw contains the rules and regulations expressed to maintain the integrity of a high quality and diverse park and pathway system, and to provide a safe, aesthetically pleasing, and comfortable environment. The bylaw is designed to protect parks and natural areas, provide environmental stewardship, programs and services, and prohibit activities that damage city assets and jeopardize public safety.</p> <p>In general, the bylaw contains rules for park use: park hours, fires, camping, vehicles, water, prohibited activities, signs, waste, pathways, bicycles, and other wheeled conveyances. The bylaw gives the Parks Director discretion to allow some uses in all or part of the park that may be prohibited by the bylaw. Some prohibited uses may be allowed if a permit is obtained. The bylaw sets out a schedule of fines for bylaw enforcement.</p>	<p>Sections of the bylaw that are relevant to this study area include:</p> <ul style="list-style-type: none"> Vehicles must be parked in designated areas. Speed limit for autos on park roads is 20km/hr unless different speed is posted. Speed limit for bicycles on park pathways and roads is 20km/hr. Activities that are prohibited unless allowed by Parks Director include; wade, swim or skate in/on water; launch a boat, canoe, kayak or similar craft from or within a Park; and ride downhill on a toboggan, sleigh, carpet, or other sliding device. Bicycle or other wheeled conveyances can only be used on a pathway, trail, or park roadway.
Responsible Pet Ownership Bylaw	23M2006	<p>The responsible pet ownership bylaw deals with the licensing and regulation of animals within the city.</p>	<p>Sections of the bylaw that are relevant to this study area include:</p> <ul style="list-style-type: none"> Dogs are required to be on a leash where there is no signage indicating otherwise. Dogs are not permitted on school grounds, playgrounds, sports fields, golf courses, cemeteries, wading or swimming areas, pathway, or any other area where dogs are prohibited by posted signs. Cycling with a dog on a leash is prohibited. <p>The Parks Director has the discretion to set rules that differ from the bylaw, such as allowing dogs to swim in the river, be on or near regional pathways, or increasing the distance that dogs should be kept from playgrounds.</p>

A.3. Related Studies and Projects

Additional studies and capital projects are underway that could impact design concepts or management recommendations for the study area. Note that information about ongoing studies was updated in July 2012, and may not reflect the latest information.

Study	Author	Year	Purpose	Outcome
City of Calgary Floodplain Study	Alberta Environment	1983	The purpose of this study was to delineate the floodway and floodplain areas for the 1% (1 in 100 year) flood for the Bow River, Elbow River and Nose Creek through the City of Calgary.	
Northwest Calgary Drainage Study	CH2M Hill Engineering Ltd.	1992	This study explored various option for determining a solution for flooding problems in northwest Calgary.	<p>The preferred option for the west trunk major works includes:</p> <ul style="list-style-type: none"> • Increase the number of catch basins to provide 5-year level of service • Implement major and minor system diversions to dry ponds at both Ranchlands Boulevard and 53rd Street N.W. • Implement a major system diversion to a dry pond at Dalton Drive. • Construct a new interceptor sewer from Ranchglen Drive to the intersection of Crowchild Trail and Sarcee Trail. • Upgrade the existing outfall pipe to the Bow River (Outfall B105).
Northwest Calgary Drainage Study, Additional Evaluations	CH2M Hill Engineering Ltd.	1992	This study evaluated environmental impacts of a stormwater pond at Nose Hill Park proposed by the Northwest Calgary Drainage Study, and evaluated alternative locations of the stormwater pond.	This study was an amendment to the previous Northwest Calgary Drainage Study. The revised recommendations focus on the east trunk of the northwest Calgary stormwater drainage system, which does not directly impact East Bowmont Park or Outfall B105.

Study	Author	Year	Purpose	Outcome
Crowchild Trail Stormwater Diversion, Preliminary Design	CH2M Hill Engineering	1995	This study provided a preliminary design for the Crowchild Trail Stormwater Diversion that was proposed as part of the Northwest Calgary Drainage Study.	<ul style="list-style-type: none"> The Crowchild Trail Stormwater Diversion project was proposed so that some of the water flowing along Crowchild Trail would be intercepted and taken to the Bow River. The goal is to reduce the water flowing down Crowchild Trail and by implementing other major works to increase the capacity of the existing storm sewers in the Varsity Acres, Brentwood, Charleswood, and Collingwood areas, the potential for flooding in these areas would be reduced. This report discusses the investigation of various alternatives, including the pipeline option, for the Crowchild Trail Stormwater Diversion.
Bowmont Natural Environment Park - Final Report Biophysical Impact Assessment and Restoration Plan	Golder Associates	2007	The purpose of this plan was to explore the existing condition and recommend restoration improvements for Bowmont Natural Environment Park. At the time of this report the area of the study area owned by Klippert Sand and Gravel Ltd. was still private land and was not considered. The report is divided into two components.	<p>Component one:</p> <ul style="list-style-type: none"> Includes the BIA and addresses proposed developments within the park. <p>Component two:</p> <ul style="list-style-type: none"> Includes the restoration plan. Two options for restoration were proposed, the first is to maintain the current vegetation types, while the second is to convert the current vegetation types to poplar floodplain forest and wetland.
Bowmont Natural Park Breeding Bird Surveys	Sweetgrass Consultants Ltd.	2010	<p>The purpose of this study was to conduct breeding bird surveys for six management areas of Bowmont Natural Environment Park:</p> <ul style="list-style-type: none"> Bowness North Pilot Area Bowness Island West Pilot Area Bowness Island East Pilot Area Bowness Control Area Varsity Pilot Area Varsity Control Area 	It was determined that the most productive vegetation type for breeding birds, based on density and species richness, was balsam poplar/red osier.

Study	Author	Year	Purpose	Outcome
Bowmont Natural Environment Park Off-Leash Dog Pilot Project	EBA Engineering Consultants Ltd.	2005	The purpose of this study is to examine the long-term biophysical and user impact of off-leash dog use within the Off-leash Pilot Project Area in Bowmont Park.	<p>The two main objectives are to:</p> <ul style="list-style-type: none"> • Conduct a baseline biophysical and user survey; and • Conduct a five year biophysical assessment and evaluation of off-leash pet impacts on the park's ecosystems, health, and integrity and on the utility and enjoyment by all park users. <p>This report is the first part of a five-year study and its main purpose was to set a baseline for the biophysical conditions within the park.</p>
Bowmont Natural Environment Park Pilot Dog Off Leash Water Quality Study Part II	Matrix Solutions Inc. Environment & Engineering	2011	The goal of this study is to conduct a health and safety water quality study on three pilot dog off-leash river access points to determine if these areas are deemed safe for public use.	All of the test zones were located upstream from the study site, and the summary of the preliminary study found that there were no water quality parameters in any of the samples that were above guideline values. Part two of the study was not available at the time of review.

Study	Author	Year	Purpose	Outcome
Phase II Environmental Site Assessment (ESA)	Jacques Whitford Ltd.	2004	The primary purpose of this Phase II Environmental Site Assessment (ESA) was to assess for the presence or absence of environmental impacts at the site and to delineate the extent of contamination, if necessary, for the development of a Remediation Action Plan (RAP) or Risk Management Plan (RMP).	<p>The concluding recommendations of the report are for a Remediation Action Plan be developed to address the identified environmental impact in the former Klippert gravel pit area, including the AST Nest and Maintenance Shop area, the Trailer area, the Caterpillar area and the Off-Site Stock Pile.</p> <p>Hydrocarbons and metals were detected in soils and groundwater in the vicinity of the area where equipment was stored and refueled, and in some soil stockpiles.</p>
Pathway Safety Review Report	The City of Calgary	2011	The study was completed by The City of Calgary Parks as a safety review of the existing pathways. The report outlines recommendations for pathway surfaces, additional pathways infrastructure, planning and design, maintenance and education/enforcement activities.	<p>Recommendations in five categories have been established:</p> <ol style="list-style-type: none"> 1. Pathway surface infrastructure <ul style="list-style-type: none"> Establish ongoing capital funds to address pathway life cycle needs taking into consideration the backlog of current declining pathway surfaces and future needs identified through annual surface inspections. Resource additional operating funds to increase minor pothole and miscellaneous repairs thereby extending the life of some pathways before life cycling is required. 2. Additional pathway system infrastructure improvements <ul style="list-style-type: none"> Establish capital funds to address safety issues on the existing pathway system infrastructure, excluding pathway surfaces. Safety issues relating to the following pathway components will be addressed adjacent landscaping, curves, hills, blind corners, signage, intersections, bollards, bridge/pathway transitions, lighting, fixed objects within 1 metre. 3. Planning and Design <ul style="list-style-type: none"> New infrastructure Existing pathways New planning initiatives 4. Maintenance <ul style="list-style-type: none"> Increase annual snow and ice removal on pathways from 157km (22%) to 300km (42%) 5. Education/enforcement activities <ul style="list-style-type: none"> Develop and implement a comprehensive joint education plan for multi-use pathways with transportation parks and animal and bylaw services. Increase bylaw officer presence and targeted and animal and bylaw services work plan.

Study	Author	Year	Purpose	Outcome
City of Calgary Stormwater Quality Retrofits East Bowmont Scoping Study	AECOM	2010	<p>The scoping study report outlines the feasibility of various options for diverting stormwater from the existing major stormwater system into a Stormwater Quality Retrofit (SWQR) wet pond system for treatment prior to releasing to the Bow River. The study also looked at the feasibility of various SWQR wet pond system options on the former Klippert property (the East Bowmont NEP site).</p>	<p>Option one is a restored stream option with cutoff pond</p> <ul style="list-style-type: none"> Option is based on a review of historic air photos. Option simulated a stream and creates a cut-off pond that imitates a common feature in the Bow River (old meander bends). Provides an overall treatment volume of 215,775m3 <p>Option two is a stepped pond/marsh option</p> <ul style="list-style-type: none"> Based on gravel extraction to increase the volume below normal water level, combined with low dikes (approximately 1.5m above current terrain). Larger ponds that currently dominate the current conditions create increased area of riparian thicket. Similar appearance to East Fish Creek Pond/Wetland. Best option from a water quality management point of view. Provides an overall treatment volume of 319,375m3. <p>Option three is a naturalized oxbow</p> <ul style="list-style-type: none"> Option uses the secondary principle of the restored stream (cut off pond) option. Includes two ponds that imitate the geometry, aesthetics and biological conditions of a natural cut off meander. The use of two ponds allows a low dike to be created to increase the feasible treatment volume. Existing ponds would be excavated to increase treatment volume. Most of the Klippert property around the ponds would be regenerated riverine forest and thicket. Provides an overall treatment volume of 241,350m3.

Study	Author	Year	Purpose	Outcome
Bowmont West Stormwater Quality Retrofit Project – City of Calgary Water Resources – Biophysical Impact Assessment	Stantec	2010	<p>The Biophysical Impact Assessment (BIA) was undertaken on behalf of The City of Calgary Water Resources in anticipation of the Bowmont West Stormwater Quality Retrofit Project. As the site is located north of the East Bowmont NEP project site boundaries, only general observations can be taken from this study.</p>	<p>It was determined that the change resulting from the proposed project on the site would be positive due to the removal of sediments from stormwater prior to discharging to the Bow River, the re-introduction of native vegetation species to previously disturbed area, and the overall increase in landscape, community, habitat, and vegetation species diversity. No additional cumulative effects were identified in association with the project.</p> <p>The BIA observed that the subject area is characteristic of the Bow River Valley and consists of low drainage channels, flood plains, and steep valley slopes. The area acts as a nature reserve and contains several areas of native vegetation including an abandoned drainage channel containing wetlands, balsam poplar and aspen forest, several tall shrub communities, and a native grassland community. Vegetation species within the subject lands are dependent on location, with native trees, shrubs, grasses and forbs found along the Bow River and non-native and introduced species found within the off-leash areas, and around the property.</p>