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**BEAVER CREEK PARK**

FORWARD

The report and design concepts for Beaver Creek Park were prepared for the Meewasin Valley Authority. The Beaver Creek Working Paper, prepared by the MVA after consultation with all other interest groups, sets out the objectives for the park and the program for design. These have been refined in this report to be more specifically oriented to design. Issues on which there is no consensus among the groups have been carefully considered and recommendation have been made.

BOB BROWN - 1980

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## I. PROBLEM IDENTIFICATION

The main goal of this project is to design a "nature Park" that encourages visitors, yet limits use to education and passive recreation. The M.V.A. Conceptual Master Plan suggests the following facilities and activities:

- (1) passive observation and recreation,
- (2) interpretation field centre,
- (3) public campground near highway,
- (4) picnic tables on flats along creek,
- (5) minor trails along creek, and
- (6) long term potential for park expansion.

There are, however, many other considerations that must be addressed in the design of Beaver Creek Park. These include:

- (1) integrative plan-none exists.
- (2) education- of school groups and other visitors.
- (3) wildlife- much of the existing fauna is in danger of disappearing with the continuation of present use.
- (4) natural character of the area- it is rapidly disappearing with present use.
- (5) proximity to Saskatoon- less than 15 kilometres and very easily accessed.
- (6) ecological fragility- the various environments of the park are easily disturbed and difficult to rejuvenate.
- (7) slump terraces- a very valuable resource for interpretation and research.
- (8) human activity on the site- is presently disturbing the environment and is not being well-controlled.
- (9) theme- there is presently no comprehensive theme for the park.

(10) grazing of cattle- is destroying the environment and polluting Beaver Creek.

(11) interpretation need- there is presently little information on the site to aid interpretation.

(12) bank instability- structures and roads presently in use are on unstable banks.

(13) flow of water- the water flow is determined by the Brightwater Reservoir, and the City of Saskatoon apparently has no control over amounts released into Beaver Creek.

(14) parking- is in various scattered places on the site, is destroying the vegetation and is often very visible from the park.

(15) access- there is vehicular access to both sides of the creek with poor or no control on vehicles in sensitive areas.

(16) Y.W.C.A. Camp- activities apparently in conflict with a nature park, and building very visually incompatible with the site.

(17) Toilets- are available in one area on the south side only.

(18) Drinking water- there is no drinking water available in the park, and the water in Beaver Creek is unsuitable for drinking.

(19) Coordination of all groups interested in Beaver Creek- presently there are many interest groups that are not coordinated in their efforts.

(20) maintenance- bridges, paths, stairs, etcetera are in poor repair.

(21) information base- despite all that is known about Beaver Creek Park, it has never been amalgamated.

(22) bridges- are in poor repair and one is probably very dangerous.

(23) information signs- are out of character with the site and poorly located.

(24) vandalism- is a real problem as the park is left open with no supervision at night.

(25) interpretive signs on the trails- have all disappeared and the self-guided trails are no longer understandable.

(26) research activities- the slump terraces are of much scientific interest and are presently accessible to vehicular traffic.

(27) public involvement- there is little public involvement in the park, which might be a cause of some of the vandalism.

(28) camping- there are no facilities for camping, although people often do camp in the park.

(29) picnic areas- are scattered, which leads to a spreading out of damage, and are alongside nature trails, which tends to destroy the naturalness of the trail.

(30) Beaver Creek Park is part of the Meewasin Valley- this should be considered in the design.

The problem is thus to maintain the naturalness of Beaver Creek Park, allow compatible passive recreation uses, and educate the public. Each problem outlined above has to be evaluated and the goals for the design should be to make all uses of the park compatible with the environment, and as much as possible, compatible with each other.

## II. GOALS

These broad underlying objectives are a reaction to the problems defined in section I and the character of the site:

- (1) integrative plan- should be developed.
- (2) education- heavy emphasis should be placed on the education of the public and school groups.
- (3) wildlife- a primary goal should be preservation of wildlife habitat.
- (4) natural character- any additions or construction in Beaver Creek Park must be compatible with the natural system both visually and functionally.
- (5) proximity to Saskatoon- visiting the park by Saskatoon residents should not be discouraged.
- (6) ecological fragility- construction methods and structures must be sympathetic to the environment.
  - visitors should be encouraged to stay on trails and roads.
- (7) slump terraces- keep vehicular traffic safely back but allow foot traffic right on the slumps.
- (8) human activity on the site- make sure people are controlled so the environment isn't unnecessarily disrupted.
  - take measures to keep people on paths.
- (9) theme- make sure a theme is developed that is compatible with the park and is maintained throughout the park.
- (10) grazing of cattle- must be stopped.
- (11) interpretation need- an interpretation centre should be developed.
  - trails should aid in interpretation.
- (12) bank instability- no permanent structures should be built or located on unstable banks.

(13) flow of water- the MVA should have some control over the rate of water released from Brightwater Reservoir.

(14) parking- should be concentrated in only one or two areas and should not be visible from the natural areas.

(15) access- the park should probably only have vehicular access to either the north or south side, but emergency access should be available to both sides.

(16) Y.M.C.A. camp- an alternate site outside Beaver Creek Park should be found.

(17) toilets- should be available on both sides of the creek and must be compatible with the environment both visually and functionally.

(18) drinking water- should be made available in at least one site on each side of the creek.

(19) coordination of all groups interested in Beaver Creek- all input should be directed through one organization, preferably the MVA.

(20) maintenance- a maintenance program has to be developed and the park has to be well maintained.

(21) information base- should be developed and be available for interpretation.

(22) bridges- sites of present bridges should be analyzed, and new bridges should be built as per Master Plan for Beaver Creek Park.

(23) information signs- new signs should be designed in accordance with the theme of the park and the existing signs should be removed.

(24) vandalism- every effort should be made to stop vandalism in the park.

(25) interpretation signs on the trails- new signs (vandal-proof), should be developed based on the theme and character of the site and the old



signs should be removed.

(26) research activities- should be encouraged but open vehicular access to the slumps should not be allowed.

-information learned could be of great interest in the interpretation centre.

(27) public involvement- the public should feel as if the park is their own, but it would probably be undesirable, for ecological preservation reasons, to have public participation in construction.

(28) camping- although it is recommended in the Conceptual Master Plan, camping is not a use that is compatible with the preservation of nature. If camping is deemed necessary it should be located in an area isolated from the natural areas.

(29) picnic areas- the present picnic areas should be closed and no new areas should be developed, as they are incompatible with the theme of the park. If they are considered necessary, tables of quality and design compatible with the environment should be located in one or two areas.

(30) Beaver Creek Park is part of the Meewasin Valley- the character of the MVA should be maintained at Beaver Creek Park.

### III. PROGRAM

The program is developed from the goals listed in the previous section. It includes an itemized statement of all the specific uses and facilities which the site must accomodate.

(1) Theme, determined by the MVA to be nature preservation for the purposes of education and passive recreation, must be maintained throughout Beaver Creek Park.

(2) easy vehicular entry from highway 219- this is already available on the south side, but the north side access is dangerous and more land would need to be purchased to ensure a safe entry.

(3) access road from entry to parking- hard surface, low visual and environmental impact, vehicles restricted from all other areas by three-dimensional barriers.

(4) hard surface parking area- low visual and environmental impact.

(5) screening- of parking lot so it is not visible from the natural areas of the park.

(6) interpretation centre- that is compatible with the environment.

(7) service area- for interpretation centre.

(8) washrooms- on both sides of the creek.

(9) drinking water- available on both sides of the creek at as many locations as possible.

(10) trails- each with a theme (eg. grasslands, creek features, vegetation, beavers, and slump terraces), surface that is inexpensive, compatible, easily maintained, has a low environmental impact during construction and use, designed to keep people on them, self-guided, set up mainly for educational use, have assembly area at beginning for introduction, some quite short and easy to traverse, with longer loops extending to more natural areas on more

rustic trails.

(11) assembly areas- at the beginning of a trail and near interpretation centre so classes can gather for nature talk before starting. Also, smaller assembly areas along the trails.

(12) controls- to keep vehicles on roads and people on trails.

(13) bridges- located where trails should logically cross the creek, and of character compatible with the environment.

(14) entry signs, information signs and trail signs- all compatible with the theme and character of the park.

(15) picnic area- if considered necessary- no vehicles, vandalproof, facilities compatible with the park, family-oriented, drinking water and toilets.

(16) camping areas- if considered necessary- in stable, non-sensitive area, easily maintained and monitored, water and toilets available.

(17) alternate site for Y.W.C.A. -outside Beaver Creek Park.

(18) pedestrian access to slump terraces- vehicles kept safely back, but emergency, research and service access to slumps by vehicles.

(19) all grazing and watering of cattle on park land stopped.

(20) construction methods sympathetic with the environment.

(21) relationship with Meewasin Valley maintained.

#### IV. SITE ANALYSIS

##### A. Introduction

Beaver Creek Park is located on the east bank of the South Saskatchewan River about 10 miles south of Saskatoon on highway 219. It consists of about 86 hectares of land where Beaver Creek meets the South Saskatchewan River and is owned by the City of Saskatoon.

The park is located in an agricultural area with market gardening across the creek to the south, cattle feedlot immediately upstream on Beaver Creek, and large fields of ranch and farm land in the area. A nature park with a small amount of use can be very compatible with these land uses, but some of these uses might be incompatible with a nature park. For example, the cattle upstream increase the nutrient and sediment loads of Beaver Creek and make the water unpleasant and dangerous for human use. Only part of the south side is in the park. The adjacent park area on the north side is relatively untouched and is seen as a valuable natural resource. If the land on the south side, which is privately owned, is developed in any way it would detract greatly from the naturalness of the north side. The MVA might consider purchase of this land to prevent its development, and include it in Beaver Creek Park.

Beaver Creek Park is located in a very unique area, the place where a prairie creek meets a prairie river. There is an area of natural, unbroken prairie on the site which is one of only a few remnants left in Saskatchewan. Beaver Creek is an extremely fine example of a meandering creek with the full range of associated features: spectacular cutbanks, sand deposits, oxbows, abandoned flow channels, and so on. These are a very valuable educational resource.

Just downstream of the point where Beaver Creek meets the South Saskatchewan River is a classic example of slump terraces created by the

river. They are spectacular and they too are a valuable educational resource.

Both Beaver Creek and the South Saskatchewan River have cut into the tableland creating large valleys that afford spectacular views from various spots along the top of the bank. These include views of many of the creek- and river-related features as well as panoramic views of the prairie grassland and the sand dune area.

There is a great diversity of flora and fauna on the site. The valley creates many microniches that support different types of vegetation thus creating a resource that is very interesting for interpretation and study.

Overall, though, Beaver Creek Park is ecologically fragile, with sandy soils that will erode readily if the vegetation is disturbed, and vegetation that cannot withstand very much human impact. This has profound implications for the design and future use of Beaver Creek Park. It cannot withstand large numbers of people and many of its unique features would disappear with overuse. Even a small amount of use would have to be carefully directed so as to preserve very sensitive areas. Measures have to be taken to keep people on foot paths thus minimizing the environmental impact, and the number of paths must be restricted.

Beaver Creek Park has been used as a park for some time and various people and organizations have made improvements and maintained the site. Some of the existing features include:

- (a) Signs listing the regulations of the park. (i) incompatible in character and position with a nature park
- (b) Sign indicating nature trails (i) very difficult to read and hard to understand (ii) It is no help in finding your way along the nature trails
- (c) Self-guided nature trails with bridges and boardwalks. (i) Many of the

trails are located in good positions, but the lack of a surface on them creates quite a large environmental impact (ii) the number of branches and side trails make it easy to get lost (iii) Any self-guided signs on the trails have been lost to vandals, and (iv) the bridges, although located in very good positions, are in poor repair, and one is quite dangerous.

- (d) Small maintenance building
- (e) Vehicular access roads with some fencing to keep vehicles out of more sensitive areas. (i) The fences are obviously not doing their job as there are well worn tire tracks all over the site. The impact would be much less if all travel was restricted to one road and the others revegetated.
- (f) Parking areas. (i) not well-defined and thus encourage vehicular encroachment on natural vegetation (ii) The fences around the parking areas, and in various other places to direct traffic, are inconsistent in character. Although some of them are compatible with the park, overall they are not.
- (g) Picnic sites and fire rings. These are scattered throughout the park in isolated areas. (i) There is quite a large impact caused by picnicking and by having several sites it is being spread throughout the park. Amalgamation of picnic sites into one area, if they are deemed necessary, or desirable, would certainly lessen the impact.
- (h) Grazing land on North side of the creek. The cattle have stripped much of the vegetation from the slopes where they have been allowed to graze. This is completely incompatible with the character and theme of the park, so should be discontinued immediately. The area should also be revegetated.
- (i) Toilets on the south side. (i) inappropriate location
- (j) Y.W.C.A. camp. 7.4 hectares of land located on the most prominent hill

in the park. (i) Although the character of the building is completely incompatible with Beaver Creek Park, the location is visible from almost everywhere in the park. If something more in character with the environment were built there it could act as the focal point for the whole park. This focal point, though, would have to be a public building so visitors would be encouraged to visit it.

## B. Landforms

### 1.1 Introduction

In spite of the multitude of variables in a natural environment the nature of any area is largely the result of the interactions of climate and landform. The landform directs drainage, becomes soil and determines the ration of light and water supplies which are available to plants. During the winter the landform redirects winds and traps snow, often allowing snowmelt only well into the spring or exposing the snow to early sunshine and warm winds.

The landforms of the Beaver Creek area are important not just in terms of their role in the natural environment but also in their implications for the design and development of facilities for users of the area.

### 2.0 Glacial History

#### 2.1 The Ice Sheets

Roughly 10,000 to 12,000 years ago the Beaver Creek Area was covered by a mile high continental glacier which, by that time, was receding as the climate generally warmed.

The tremendous erosive forces of this glacier had removed immeasurable tons of debris from the bedrock regions of the Canadian Shield and transported it south, where this material was dropped from the ice as it melted. This ablation material is the till which exists some 30 metres below the surface at Beaver Creek.

## 2.2 Post-glacial Deposition

The weight of the glacier compressed the land considerably. Once the ice receded the land "rebounded" to more usual levels and density. This uplift away from the glacier caused meltwaters to be trapped against the ice or to flow along the edge of the ice to lower areas. Much of the material above the till at Beaver Creek is the result of deposition of lake clay, silts, and outwash sands in Glacial Lake Saskatoon which formed over the area some 10,000 years ago.

As the lake drained and the ice sheet melted back further the land at the Beaver Creek site was exposed. Water from the Brightwater Marsh area found the least resistant path to the receding lake, and eventually the river, and the Creek valley began to form. (see Figure 2.2.1)

As the valley of Beaver Creek was forming surface sands were being deposited by strong winds blowing off of the glacier and picking up the loose fine sands of the glacial outwash areas. These aeolean sands were worked into an extensive area of sand dunes which were eventually stabilized by vegetation. Part of the uplands of the Beaver Creek area consists of these dunes.

## 2.3 Creek Formation

Following glacial retreat, and with the gradual moderation of climate, the flow of water through the creek diminished but also meandered and cut down into the alluvial deposits of the area. This process of erosion and partial deposition has formed the valley as it is today. As a result of the various processes of post-glacial deposition, creek erosion, and so on, the landforms of the Beaver Creek area are many and diverse.

## 3.0 Landform Materials

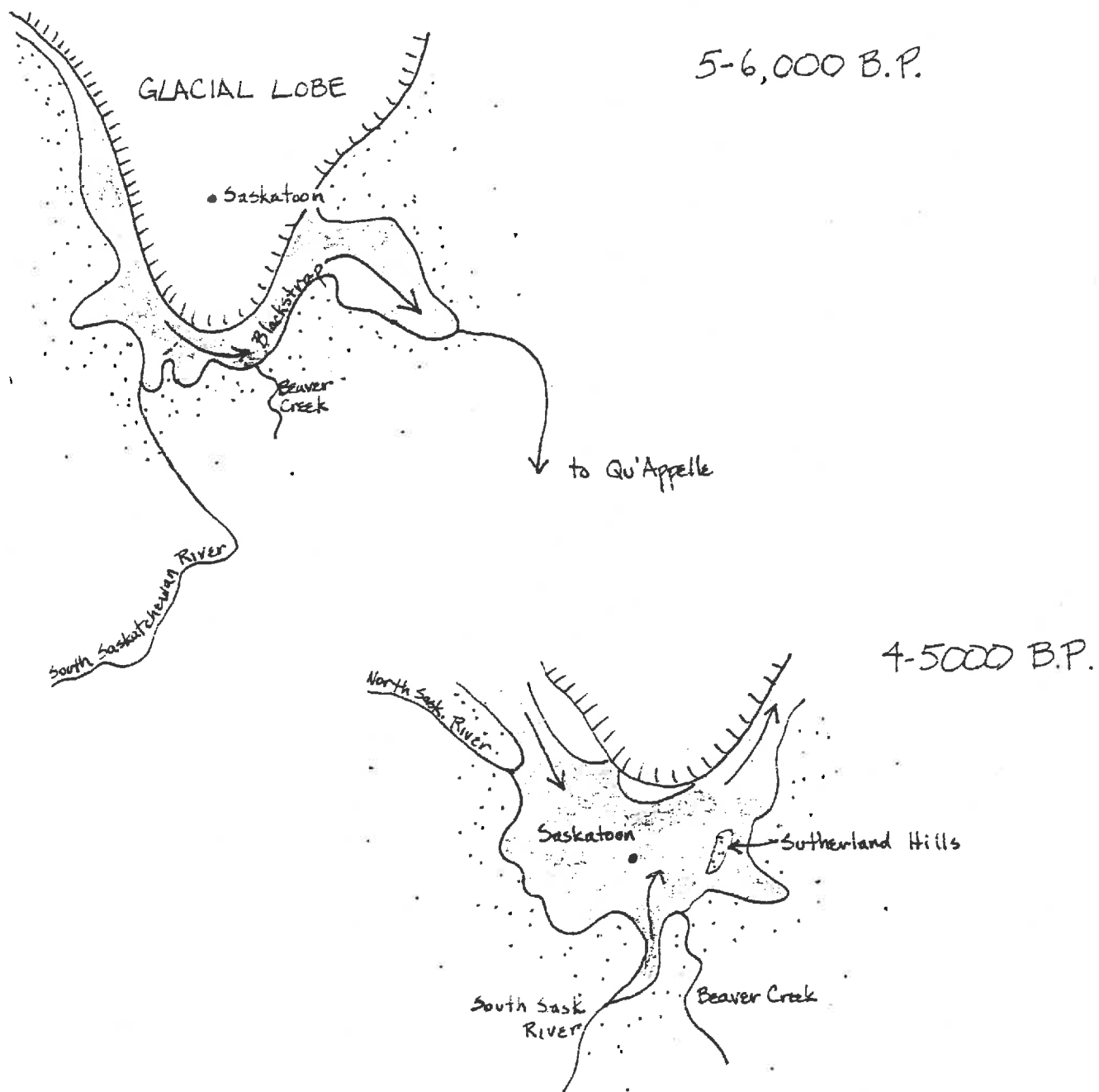
The base till at Beaver Creek is some 30 metres below the upland surface. Overtop of this is deposited lake clays, silt and outwash sands. On the surface



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Figure 2.2.1 Glacial Retreat

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From: Recession of the Wisconsin Glacier  
Report #67  
Department of Mineral Resources  
F.H. Edmunds, 1962

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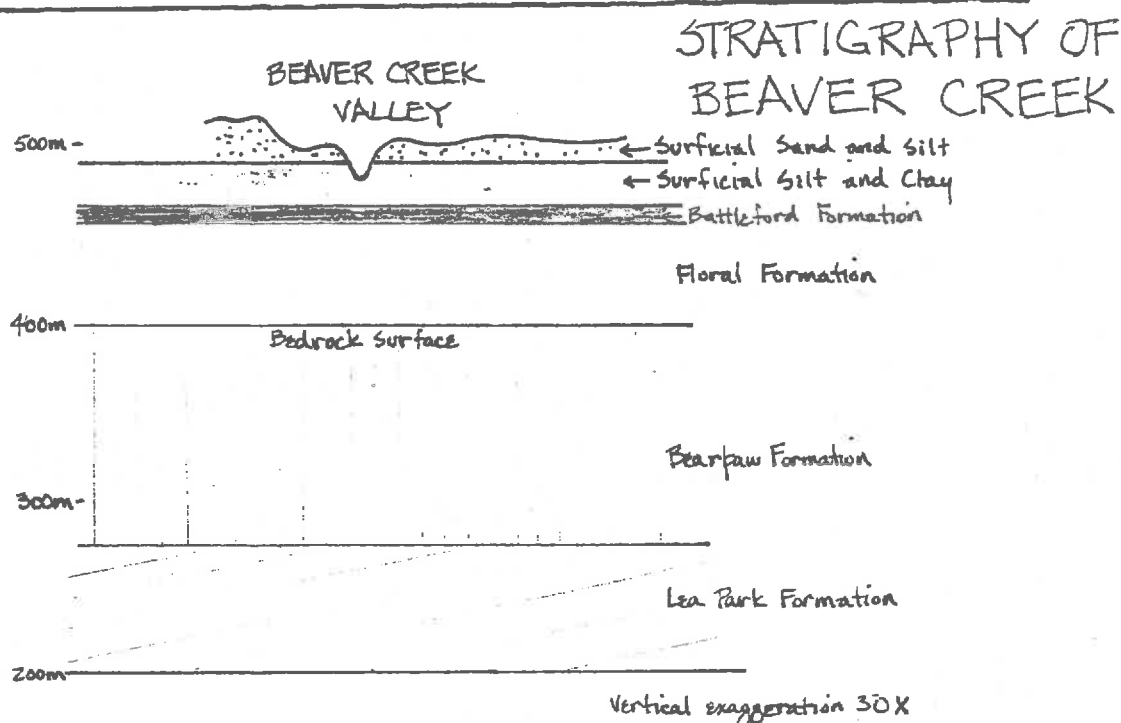
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of some parts of the area are aeolean dune deposits as well.

### 3.1 Stratigraphy

The stratigraphy of the area is taken from Christiansen, A.E., and Meneley, W.A. and is diagrammed in Figure 3.1.1

Figure 3.1.1



-  Surficial Sand and Silt; fine-to medium-grained becoming silty at base, upper part reworked by wind to form dunes.
-  Surficial Silt and Clay; locally very fine sandy in upper part becoming clayey at base of unit, gray, calcareous.
-  Battleford Formation- Till, upper part is soft and conformable with overlying silt and clay unit, lower part is harder.
-  Bearpaw Formation- Silt and clay with sand interbed, gray, non-calcareous.
-  Lea Park Formation- Silt and clay, gray, non-calcareous.

### 3.2 Moisture Conditions

The soils of the Beaver Creek area are well drained and behave as dry material. The slumps and other slope failures show no evidence of material flow.

### 3.3 Materials

The gray till layer is too low to be of any concern in the design or use of the area.

Low clays are found above the till and are a result of deposition in the early stages of Lake Saskatoon. Some fine clay is evident at the surface near the base of the slumps but in general, the creek and valley landforms are above the clay.

The silty clays of the "lower unit" were tested by Dee Haug (1976). The clay content at the slumps varied from 25-65%. The plastic limit varied from 20% to 30% and the liquid limits from 35% to 80%. My own field investigation shows the soil to be plastic up to perhaps 2 or 3 metres above the creek depending upon the site.

The upper layer of sand and sandy silt is composed of fine yellow-brown sand with interbedding of sand and silt frequently evident. These materials are non-plastic in nature.

### 4.0 Mapped Features

The map entitled "Landforms" is a compilation of information on the nature of slopes, terraces, erosion and deposition, dune features and so on.

Although all of nature is constantly in motion some of the features of the Beaver Creek area are particularly dynamic. An effort has been made to account for the dynamics of the site in this evaluation of hazard areas or site potentials.

The landforms of the creek area were observed very clearly once the foliage had fallen. The absence of foliage also bared the many scars

resulting from human use of the site. In short, there appears to be trails or trail remnants nearly everywhere.

#### 4.1 Eroding Banks

Eroding banks are those steep creek sides which are being wasted by the actions of water erosion.

A perusal of the map will reveal that eroding creek banks are, with few exceptions, exactly where the "text book" says they will be. Any assumptions which are made based upon general knowledge of stream channel behavior are true in the case of Beaver Creek.

Eroding banks are one of the least stable features of the area. In some cases it is perhaps dangerous to stand near the edge. Eroding banks are also an important interpretive feature of the valley because they show the process of stream meandering in a very clear way, and because the soils of the area are visible.

It is recommended that trails be kept back from areas of major bank erosion for the sake of safety and to avoid the need for frequent reconstruction of trails. This is perhaps especially important if these trails are to be used for skiing in the winter.

The banks opposite eroding banks are generally very stable and place the hiker in a better position to view the erosion process.

##### Additional comments:

(1) The most dangerous slopes are found where the creek is eroding the toe of a high bank at the edge of the valley. These sites are also the best for viewing the stratigraphy.

(2) Confinement of flow by beaver dams may be accentuating erosion of the banks by keeping them saturated higher up.

#### 4.2 Sand Deposits

Sand deposits are the creek-side bars which occur in response to stream

meandering on the inside banks of the curve of the creek. In most cases these deposits are small terraces along the bank and are sparsely vegetated. Where major erosion is occurring there are large sandy terraces across the creek. These are somewhat stabilized by grasses, weeds, rose, etcetera.

Sand or sand terrace deposits are important as they complement the interpretive value of eroding banks as indicators of meandering. Also evident on the sand deposits are aquatic vegetation and, on larger terraces, the colonization plants of the area. Sand deposits are also stable (although fragile) and provide safe access to the creek.

These sand deposits, particularly the larger ones, are natural stopping places. Although trails can pass along the back of these terraces without doing appreciable damage they should not traverse the edge. People will, however, go to the edge but need not be encouraged.

#### 4.3 Meander Cut-offs

There are two major points of cut-off in the creek channel NNE of the Y camp near the bank slide. Diagrammed below is the probable progression of channel change in the next decade or so depending upon rates of flow. (see Figure 4.3.1)

Because of the erosion and steep high banks in the vicinity of the south cut-off it is probably best viewed from the top of the opposite east bank-unless a short trail is developed on the west peninsula.

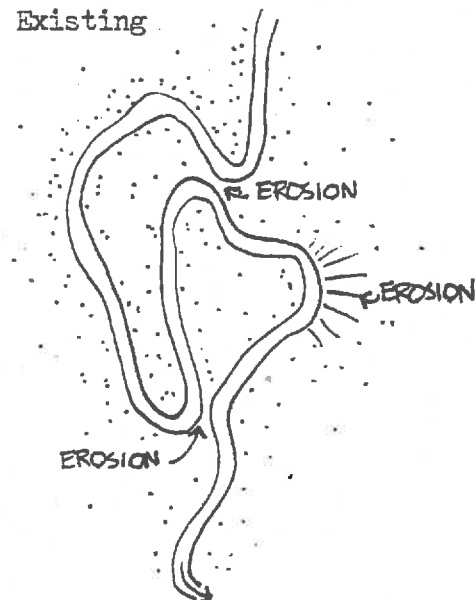
This cut-off process is one of the most exciting interpretive features of the valley and deserves considerable attention.

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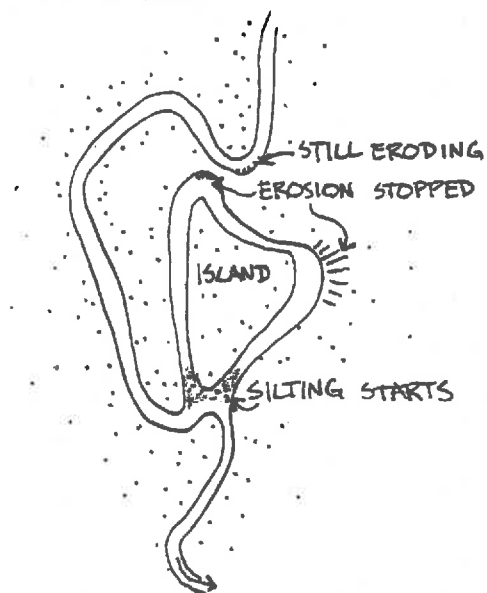
**Figure 4.3.1 Meander Cut-offs**

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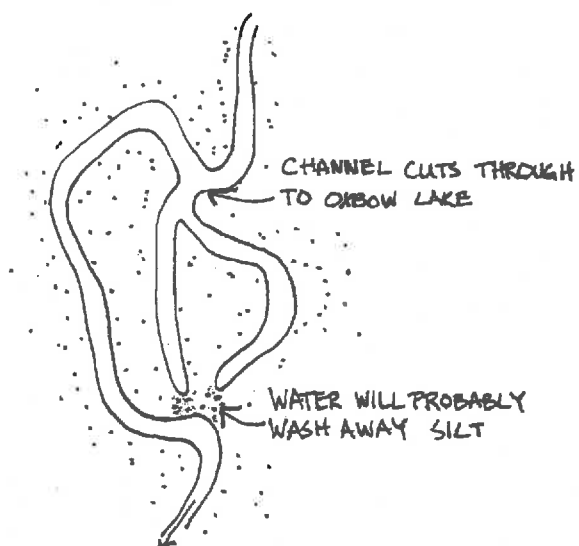
A. Existing



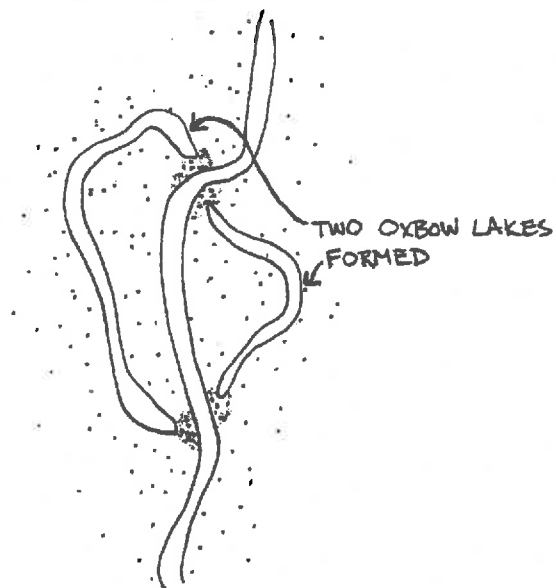
B. 2 Years



C. 10 Years



D. Soon After



#### 4.4 Terraces or Flats

Terraces or flats are found throughout the creek valley. These are broad areas of old creek deposition which resulted from the continual meandering of the creek in times past. As the creek down-cut these flats were left at various levels above current creek elevation.

Terraces are important for a number of reasons. The terraces of the valley are generally stable and well vegetated by a variety of species, usually not the larger tree species because of the high water table. Terraces are, and have on them, many important and very visible interpretive features (vegetation, old oxbow channels, wildlife, etcetera). The creek is approached on these terraces.

Terraces may have many implications for the design of the park. Except where an old flow channel or major vegetation barrier occurs, the activities on any one terrace will interact and must be compatible. In some cases the creek is not even an effective barrier except to actual physical interaction.

Terrace areas provide easy trail passage. In many places, the backs of terraces with high valley walls are sheltered, comfortable stopping places and would be natural gathering places if not excessively wet during wet years or early summers.

The slopes between successive terraces are sometimes very steep and trails, or stairs, should be located accordingly.

The succession of terraces is visible from several vantage points along the north arch of the creek at the top of the north bank.

Exposure of terraced areas to sun and wind, make them quite open in places and account, with the high water table, for the "brushy" vegetation as compared to the shady forested areas along sheltered slopes.

#### 4.5 Abandoned Flow Channels

There are several depressions on the creek terraces which are readily

identifiable as abandoned flow channels or ingrown oxbow lakes. These differ somewhat from river oxbows in that the creek has downcut more rapidly and the water table has drained below the level of the cut-offs more quickly. Consequently, the oxbows of the creek valley drained before there was a deep formation of black organic soil as one expects in major oxbow lakes. Nonetheless, soils in these depressions are somewhat "springy" and much blacker and richer than elsewhere in the area. This season the abandoned flow channels were very dry but may be wet in springtime or in wetter years.

These channels are important as interpretive features because of their unique soil, vegetation and relationship to the processes of valley formation. Abandoned flow channels, especially when wet, may form a major barrier to foot traffic.

Because of their tremendous interpretive value trails may be located along the edge of these features. Wetter conditions may necessitate a foot bridge over some parts of these old channels. Even dry, these channels would be hazardous to old people or those not fully capable.

#### 4.6 Existing Beaver Dams

The beaver dams are a very important but temporary landform. These are located throughout the creek channel. In the upper reaches the dams are maintained and keep the channel full year around to a depth of about one metre in places. Further downstream the dams are breached and present only partial flow obstruction.

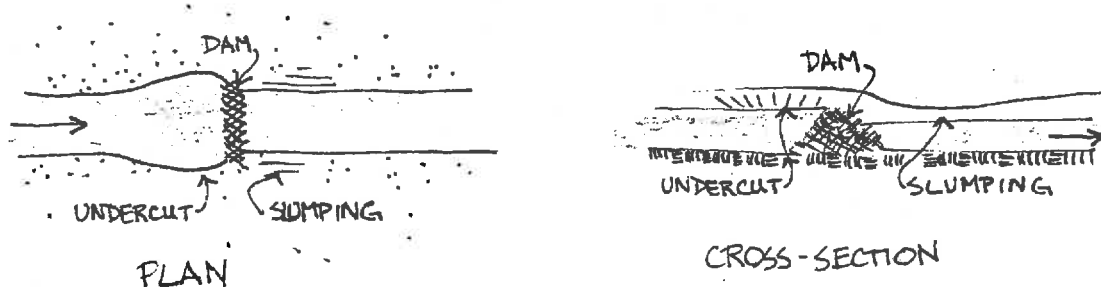
The dams are important as interpretive features. The impounding of creek flow seems to encourage bank erosion and renders the creek impassable on foot and more hazardous to hikers. Some users swim in the creek. The beavers cut substantial numbers of trees, particularly poplar, in order to maintain themselves and their dams. This cutting can be detrimental to the human appeal of the valley but perhaps should not be interfered with just



for the sake of satisfying human preferences. Instead, the beaver should be seen as a dynamic force shaping the valley.

An important feature associated with the beaver dams is accelerated bank failure near the dams. The banks upstream of the dam tend to fail as if undercut while just downstream small slumps are often evident. (see Figure 4.6.1)

Figure 4.6.1



The undercutting may be the result of the beaver using bank soil to pack their dams while the slumping could result from water seepage through the bank from above the dam.

Trails should not pass close to the banks near a dam but a side trail can be cleared. When a dam is eventually abandoned these side trails should be revegetated.

#### 4.7 Springs

In walking the creek channel there were several places where springs were noticeable in the bank. These are places where actual flow or the evidence of flow was clearly evident. There are no doubt many others which are not mapped as the water table is several metres above the creek in permeable silt. Some springs are evidenced by holes in the bank or by slight depressions in low terrace areas.

Major spring flow is evident along the south bank of the creek south of the "Y" camp. In these locations some water flows out of the upper sands of the area and forms a shallow ravine at the east spring. Considerable

water flows out of the lower silts particularly downstream at the west springs. This water was freezing along the banks on my last visit and the frozen creek bottom was resulting in greater apparent creek flow.

During the winter large amounts of ice pile up in the creek until thawed in the spring melt.

These springs are important because they are a major source of stream flow and the sight and sound of their presence adds considerable vitality to the valley. The flow from these springs, particularly the east spring at the south side of the area, makes trails muddy and treacherous. The presence of springs influences vegetation cover which is of additional interpretive value. Ice may be a restrictive factor in developing ski trails in the winter.

The only real implication of the springs pertains to the major ones at the south end. Where these flow on or saturate the surface, boardwalk structures or some other "overpass" trail feature is required. These springs are natural stopping places because of the attraction of the sight and sound of flowing water. Obviously, no structures should be set over springs.

Potable water might be readily available at these sites.

#### 4.8 Potentially Unstable Slopes

Areas designated as being particularly or "potentially" unstable are those which are currently slumping or otherwise failing or those which show evidence of soil creep or other indications of slope instability. In several locations old slope failures were partially or almost totally re-vegetated.

Slope stability is discussed earlier in this report. The slopes mapped are those most likely to present problems. Trails and structures should be located appropriately.

#### 4.9 Tablelands

The tablelands are, simply, the gently rolling prairie areas adjacent to the valley. The dune area is excluded and discussed separately. Most of this landform north of the creek has been cultivated at one time.

The tablelands south of the creek apparently were never cultivated and the plant community is an important interpretive resource.

North of the creek the tableland sits in contrast to the more dramatic features of the valley, the dunes, and the slumps. The soils of the tableland portions are sandy and will withstand limited traffic before the vegetation cover is destroyed and blowouts start to occur.

The implications of the tablelands for design are largely dependent upon the degree of use. The surface is dry and fragile but provides for easy walking.

The tablelands north of the creek can be used for any type of structure or road without damaging a "natural" environment which has not already been altered.

The tablelands are basically suited to interpretive activities south of the creek and intensive activity or structures, north of the creek.

#### 4.10 Dunes

An extension of the dunes to the north and east of the site is found north of the creek directly east of the slumps. This is more rugged, sandy terrain with large blowouts, stabilized dune ridges, and so on. These rise generally from the south and west to the north east.

The dunes are a totallly unique environment within the site. They are extremely fragile but have considerable interpretive value.

Perhaps a single trail passing as directly through the site but hitting as many interesting features as possible would be the best. This trail could then swing past the slumps and around to the south west. If extensive contact with the area occurs it will be rapidly deteriorated.

#### 4.11 Beaver Creek Landslide (Slumps)

The slumps of the Beaver Creek area are rotational with little evidence of flow.

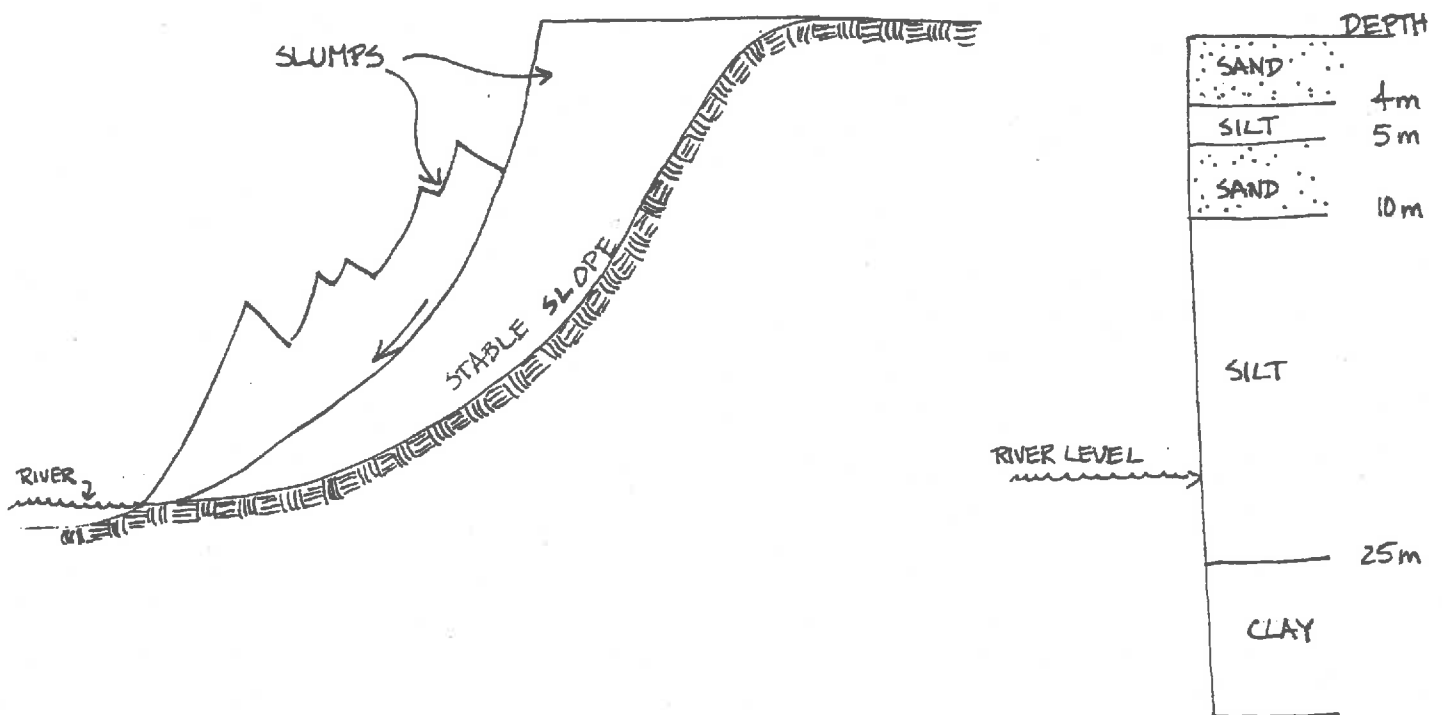
The slump is caused by:

- (a) undercutting of the river bank
- (b) the flow of groundwater at the base of the slumps above underlying clay

In the area of the slumps the stratigraphy is as diagrammed and the remainder of the area is similar. (see Figure 4.11.1)

Figure 4.11.1

#### STRATIGRAPHY OF THE BEAVER CREEK SLUMP TERRACES



FROM E.A. CHRISTIANSEN and W.A. HENELEY

The slumps apparently reced at a rate of 1.2 metres per year. (Clifton, 1978). Thus, they are a very dynamic feature.

Obviously, no structures or trails which are surfaced, should be located at the edge of the slumps. The slump cliffs are steep and potentially hazardous. It is possible to establish a trail down onto the slump terraces which would allow those who are physically capable to investigate the landform and some unique vegetation more closely.

The value of 1.2 metres is an average. A structure with a 20 year life span should be greater than 24 metres back from the edge.

Interpretive features and facilities, may be of a semi-permanent nature and set up each year at safe locations along the top of the slumps. It appears that the slumps are relatively stable except during the spring and early summer. Nothing of any significant cost, weight or size should be located near the slumps but small facilities, (plaques or seating) might be appropriate down on the slumps.

### C. Geotechnical Information

#### 1. Introduction

This section indicates the feasibility for the construction of the facilities that might be included in Beaver Creek Park. The feasibility is based on geotechnical data and on other criteria when indicated. The design characteristics of the soils in the park are outlined first, then the various facilities are considered.

#### 2. Soil Characteristics in Design

##### 2.0 Factors

Three factors are of particular importance in assessing soil characteristics for land use and design purposes in the Beaver Creek area:

- (1) bearing capacity-the ability to support weight
- (2) erodability and stability-likelihood of erosion or slope failure

(3) drainage-ability to receive or transmit water

## 2.1 Bearing Strength

All soils will settle under the weight of structures, but with most soils this settling is not significant.

Soils of low bearing capacity are generally:

- clayey in content
- poorly consolidated
- water saturated

Clearly, the stratified sands and silts of the upper layers of the Beaver Creek area do not fall into the categories listed above.

If very large structures were planned then the lower clay might be of some significance. The roads, trails and interpretive centre will not be affected by these materials.

In short, the materials of the Beaver Creek area will easily accomodate the weight of any feature which might be constructed there.

## 2.2 Erodability

Most of the surface materials of the area are fine sand and silt. These are easily carried away by the strong winds of the region and are generally held in place by vegetation.

Erosion by water is not a major problem except as outlined in the analysis of creek bank erosion or erosion of the toe of the slumps. There is very low rainfall in this area and the fine sands allow rapid infiltration and groundwater drainage which effectively eliminates surface water erosion.

## 2.3 Slope Stability

According to Christiansen and Meneley the stable slope at the slumps is  $5^{\circ}$  from toe to top and roughly  $10^{\circ}$  on the mid-slope. This is consistent with observations of creek valley slopes. Valley mid-slopes range from  $10^{\circ}$  to  $31^{\circ}$ . Very few slopes approach  $10^{\circ}$  however, which means slope instability

is a problem at the site.

Many slopes of roughly  $15^{\circ}$  are well vegetated and show no evidence of failure. Thus, it might be that when vegetated, a  $15^{\circ}$  slope is relatively stable.

Allowing for transition, at the base and top of slopes, a stable, vegetated  $15^{\circ}$  mid-slope would have roughly a  $10^{\circ}$  slope from toe to top. This is a rise of .175:1. Conversely, for every metre of relief, a horizontal distance of 5.7 or 6 metres is taken by the stable slope.

The distance of 6 metres per metre of relief is suggested as a minimum safe distance for major structures to be located back from the toe of creek valley slopes. This distance is roughly drawn on the existing features map.

Trails and other features should try to avoid the very steep slopes and efforts should be made to retain, or even encourage where needed, vegetation cover.

#### 2.4 Drainage

There is little surface drainage evident except for the creek itself and a few springs flowing out of the hills on the south side of the site.

Drainage into the soil and through it is very efficient.

#### 2.5 Summary

The only soil characteristics which need influence design are the easy erosion of surface sands by wind if vegetation cover is disturbed and the need to stay away from the very steep bank areas-particularly where the toe of the slope is being eroded.

#### 3.0 Foundation Comments

The top 30 feet or so of material is sandy or sandy silt which is well suited to the construction of foundations and the installation of all excavated services.

This material is also a major factor in the fragility of the area so that as little surface cover as possible ought to be disturbed. For example:

- (1) minimum roads.
- (2) parking area stabilized or surfaced with care taken to ensure that lot drainage does not cause erosion.
- (3) structures should not funnel winds which might "blow out" surface.

In short: easily excavated, well drained and non expansive.

There is no problem providing even a major structure for an interpretive centre as long as it is away from slumping.

There evidently was, at one time, the intention to construct a large concrete structure to house a kitchen, sleeping facilities, showers, etcetera, for a children/adult camp. There were test holes drilled to considerable depths and the results were not in favor of such a large and substantial structure. Smaller structures, however, fare well in the area.

#### 4.0 Comments on Interpretive Centre

The Existing Features map indicates the best place for an interpretation centre based upon the following criteria:

- (a) not visible from in the valley
- (b) not on natural vegetation, that is, land which has never been cultivated
- (c) suitable foundation site
- (d) moderate topography
- (e) access possible from main road, that is, we have an easement on the North side
- (f) safe from slumping
- (g) central to most possible trails and interpretive activities
- (h) suitable sewage disposal conditions



If, however, the interpretation centre is to act as a focal point or aiming stake for the park, it could be built right to the edge of the safe slope line.

### 5.0 Bridge Sites

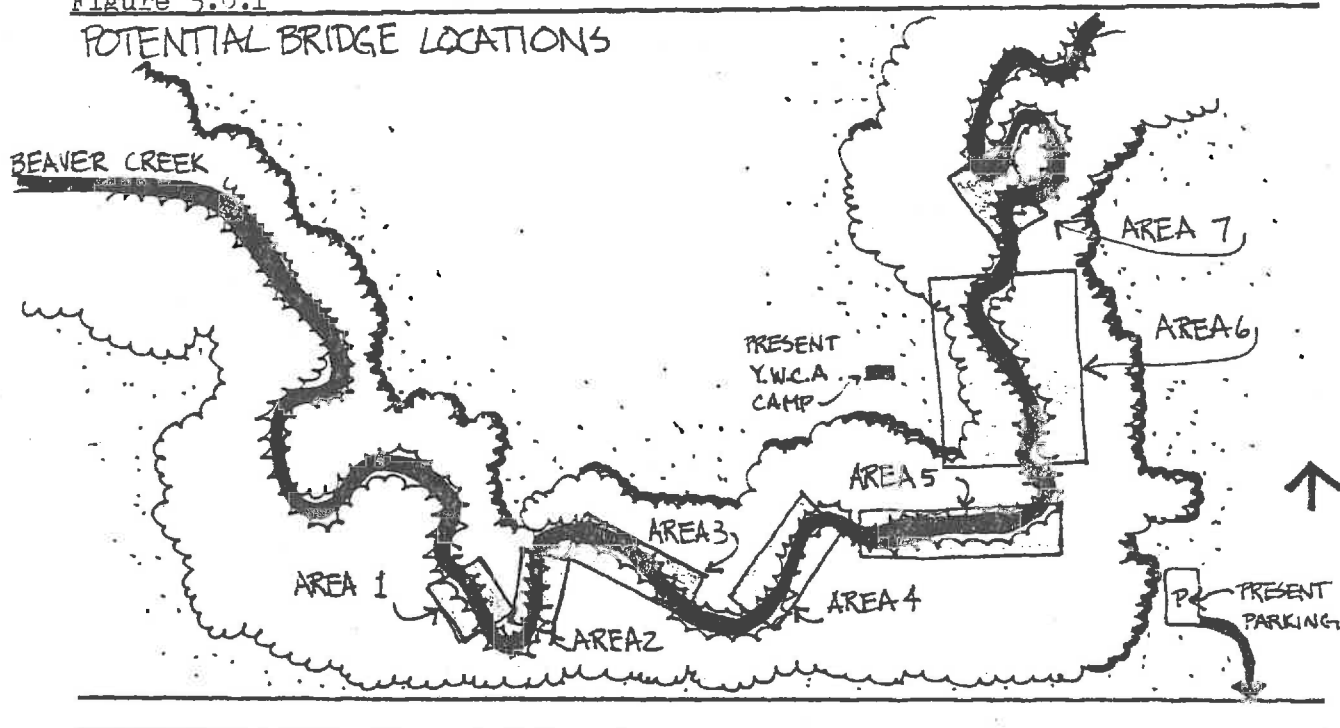
All of the creek from near Wing's pasture to the limits (property line on south bank) was walked, climbed and otherwise rambled to determine the most suitable bridge sites. (see Figure 5.0.1)

The following criteria were considered:

- (a) span of creek
- (b) depth
- (c) stability of banks
- (d) height of land (terraces) on each side of creek, preferably at same elevation
- (e) accessibility to edge, that is, steep back slope areas avoided
- (f) potential for erosion in the future

Figure 5.0.1

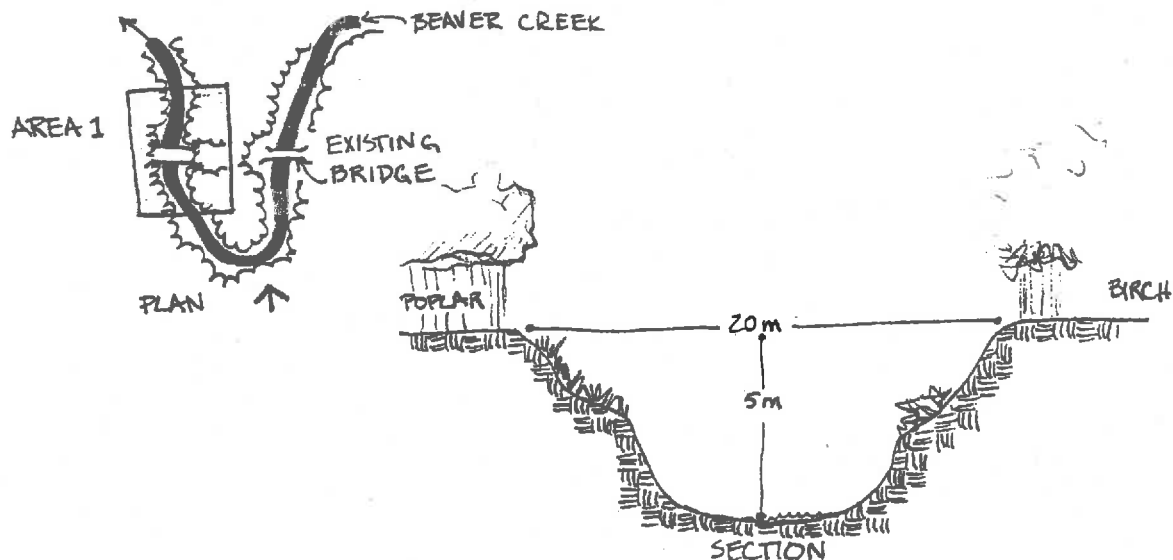
### POTENTIAL BRIDGE LOCATIONS



### 5.1 Area 1

- The west bank at this portion is not within the boundaries, but if the park were to expand, this would be a reasonable site.
- Poplar forest on east bank, birch forest on west.
- Strait channel, little erosion potential.
- Banks fairly gentle and stabilized by roots.

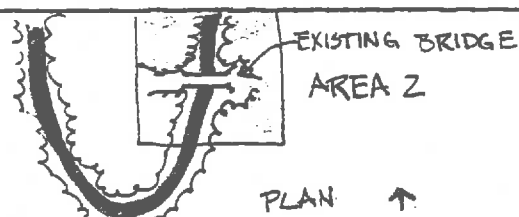
#### AREA 1



### 5.2 Area 2

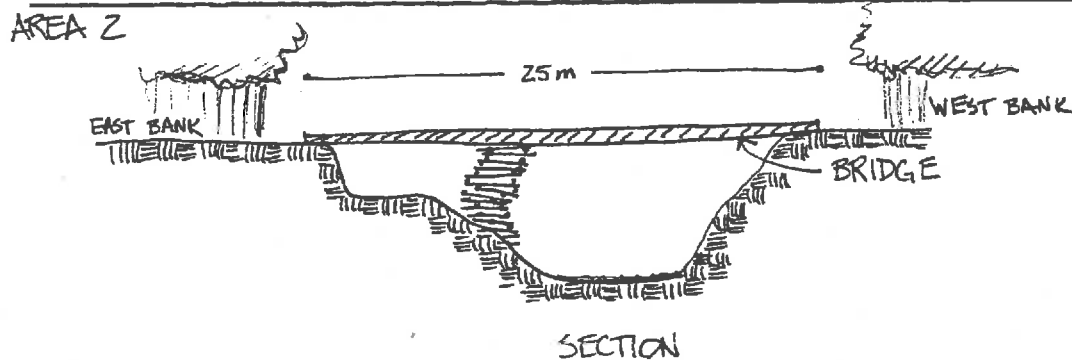
- This area is directly east and on the opposite side of the peninsula as Area 1.

#### AREA 2



-The site of the present bridge is the most ideal but the bridge is a poor structure to behold and probably unsafe.

-On the east bank the second terrace, which must support the bridge, comes closest to the creek cut, that is, least span at existing bridge site.



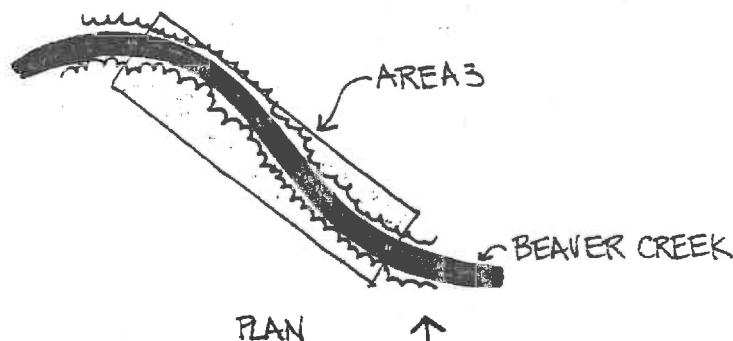
-Poplar forest on both sides. Clumps of birch on east bank near bridge.

-Best site for this area. Span should go substantially beyond edge on west bank in case of erosion.

### 5.3 Area 3

-Area 3 is the strait channel flowing ESE to WNW and located NE around the bend from Area 2.

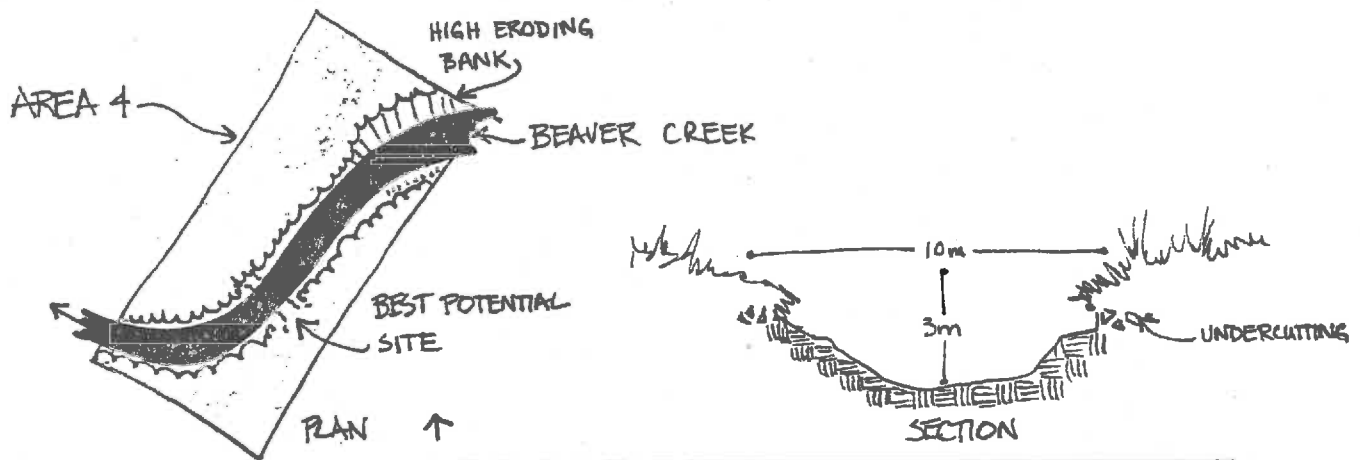
### AREA 3



- Although strait channels have the greatest likelihood of being suitable for bridge crossings, this is definitely not the case in Area 3.
  - The creek channel is very wide throughout this stretch.
  - There is extensive erosion of the north bank of the channel.
- In short, there are no suitable bridge sites in Area 3.

#### 5.4 Area 4

Area 4 is located immediately upstream of Area 3 and includes the stretch of creek running from the NNE to SSW.



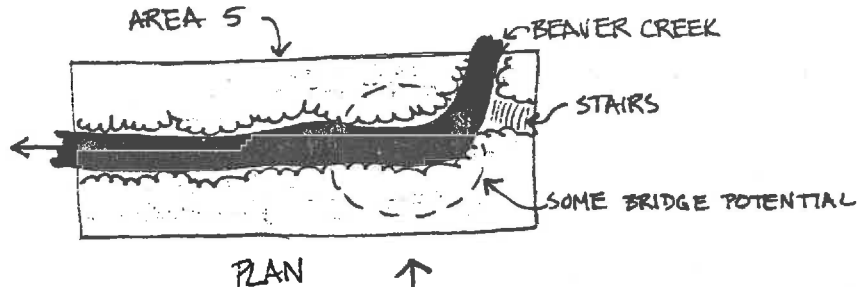
- The recommended site has potential but is far from ideal.
- There exists low, level approaching ground on either side.
- There is little current evidence of stream erosion but the location suggests that increased flow might widen the banks on both sides.
- Considerable undercutting by spring flow and/or animals at root level suggests that any bridge would have to rest on ground back from the creek edge.

#### 5.5 Area 5

-Area 5 is just upstream of Area 4 and flows generally from E to W after rounding a curve from the north. The steps down to the creek from the

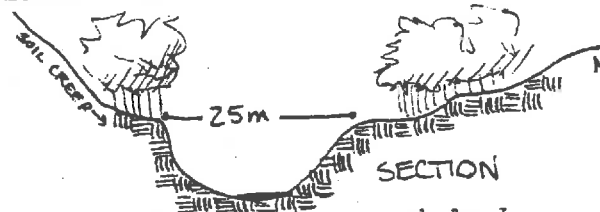
present picnic site are at the E end of Area 5.

## AREA 5



- At no location is there a real good bridge site.
- The south bank has steep backslope with overhanging birches suggesting soil creep on the slope.
- Although generally stable with present flows, both banks show some evidence of undercutting.
- The creek channel is very wide through Area 5.
- North bank (terrace) has good, level approach.

## AREA 5



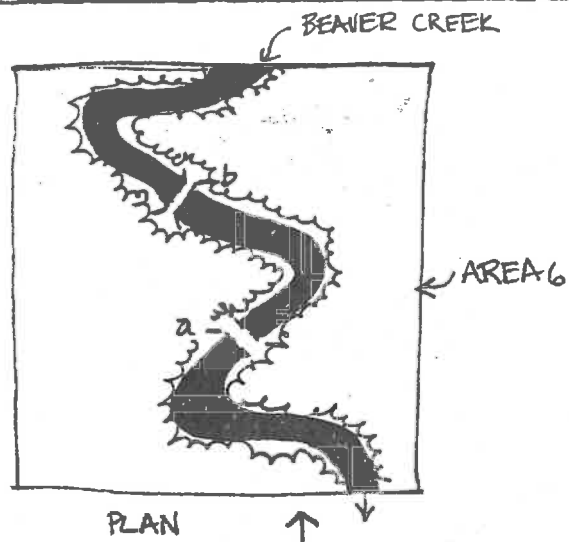
Approximately 80' span to safe support on each bank.

## 5.6 Area 6

Area 6 is immediately north of Area 5.

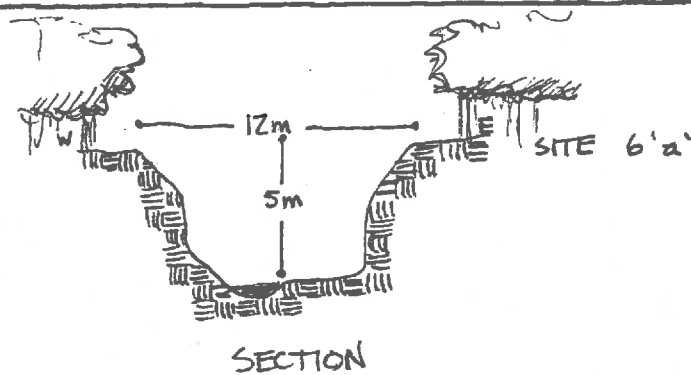
- There are two feasible bridge sites in this stretch of creek which is generally not suited to bridges.

## AREA 6

-Site "a"

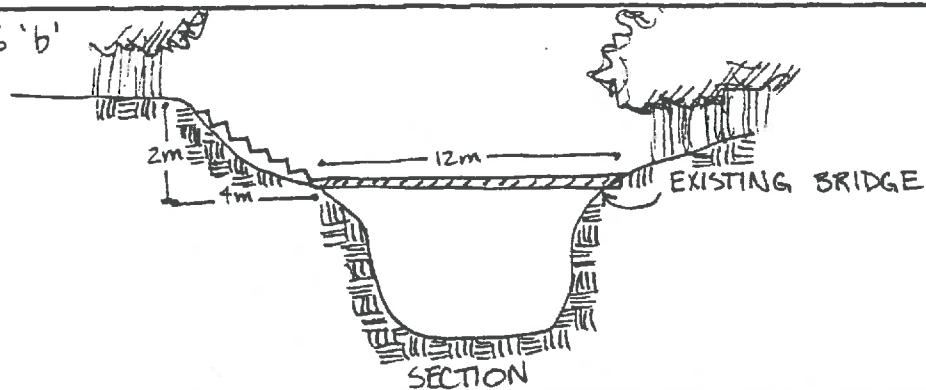
- Slow erosion of West bank and small slope failure (slump).
- Willows and shrubs in area with good bridge approaches.
- Narrow span.

## SITE 6 'a'

-Site "b" existing bridge

- Best site in this area
- Narrow span and currently stable banks with beaver dam. But steep banks!

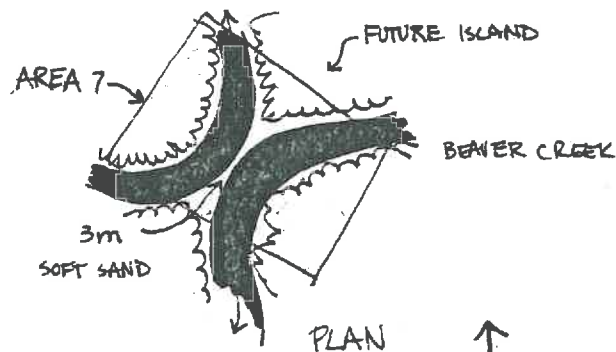
SITE 6 'b'



### 5.7 Area 7

Area 7 is just north of area 6. It is not a recommended bridge site but a future bridge might be an interesting feature.

AREA 7



-The site is special because it is almost cut off. Within a couple of years an island will be formed.

-A bridge to this island might be possible at the place that is now eroding.

### Remaining Areas

Those areas between Areas 1 through 7 are not suitable for bridge construction usually because of erosion in the creek bends or because opposite banks are far from the same elevation.

Upstream of Area 7 the creek wanders considerably between low and easily

eroding terraces. In some cases where erosion is perhaps less of a problem the facing banks are not nearly the same height or are generally unstable or provide poor approach.

Technically, a bridge is possible along any of the relatively straight stretches but will have to be anchored some distance back from the creek banks.

## 6.0 Roads and Access

### 6.1 Access

\* According to the best information at hand the triangle of land through which the north access is achieved is owned by the city and leased to Mr. Wing. The city retains a road easement.

The location of the north access is a problem. Poor visibility of traffic around the curve and uphill to the north makes it hazardous to get back onto the highway and proceed back to Saskatoon.

Perhaps the simplest solution is to slow traffic to a safe approaching speed on the highway from the north, 50 km/hr might do it. A pull off shoulder might be provided for right turns onto the site at the North entrance.

The best solution is for the City of Saskatoon or the MVA to purchase another triangle of land north of the present access that would allow access off the main road on the top of the hill. This would be much safer and the most easily controlled.

It is probably best for access safety and the creek to restrict cattle from this area and provide Mr. Wing with an alternate watering means.

The south access, if maintained, is good in its present location. Ideally, however, the best way to preserve the natural vegetation of the south side of the creek is to restrict access to hikers who enter from the north side.

### 6.2 North Access Road

There are several criteria which I feel are important to consider in



locating a road:

- (a) must be unobtrusive-low profile
  - out of the way
  - both if possible
- (b) safe from natural hazards
- (c) minimal length
- (d) suitable for all vehicles (bikes to busses)
- (e) easy to maintain
- (f) suited to the sensitive nature of the area
- (g) not conflicting with natural drainage

One way to meet all of these criteria is to locate the road as close to the north edge of the property as possible. This road would go only as far as the once cultivated land along the fence line. From this point people would have a short walk (a hundred metres or so) to the area recommended for the interpretive centre. This walk could be along the top of the creek valley and be quite scenic.

If the road were to progress beyond this point it could be located on the present road sites unless there was some sign of slope failure, in which case the road could follow close to the dune area. The service road to the interpretation centre could also follow existing roads from the parking lot.

### 6.3 Parking Lot

I counted cars at the site on several occasions. One count was as high as 33 vehicles on a Sunday afternoon in early October. I think that perhaps 100 cars can be expected on a summer afternoon once the site is developed and allowance might be made for more room if required.

However, the carrying capacity of the site is very low due to the sandy soil and low precipitation. Even 50 cars would mean over a hundred people roaming about the site. I believe this would deteriorate the environment,

unless their movement was carefully guided, and would certainly, by virtue of the crowding alone, detract from the nature experience.

Perhaps a detailed evaluation of carrying capacity should be recommended and the size of parking lot can effectively limit crowding on the site.

#### 6.4 Advantages and Constraints

On-site materials are not suitable for unsurfaced roads because of the potential for wind erosion. They are good for grade construction, but poor for base under surfaced roads.

Road surfaces and parking lots, if not permeable, could be long and narrow, where possible, to minimize the effect on local drainage. (as little surface as possible draining to any one location)

(1) Ground level, unsurfaced roads and parking lots are possible if the surface is stabilized by mixing fine materials and/or applying an oil or asphalt surface. These surfaces would require continuous maintenance if heavily used and may not be easily cleared of snow.

(2) Ground level, surfaced roads requiring some excavation to construct, may solve the problems of (1). These would be more expensive to build, would alter drainage slightly and the equipment required would do some damage to adjacent vegetation during construction.

In both (1) and (2) the problems of storm flooding in low places would have to be kept in mind but water does infiltrate rapidly at the site. Both options result in a very unobtrusive driving surface.

(3) A regular type grade and surfacing (ground or pavement) complete with ditches and culverts, is possible anywhere on the site. This option is expensive, very damaging to the site, and results in a road which would dominate the area. It could be built to meet any performance criteria, however.

Perhaps a surface level paved road is the best if there is to be sufficient

traffic. Otherwise, a stabilized dirt track might do the job.

The existing roads should be immediately leveled and seeded with native grasses. All traffic, even by foot, should be kept off until revegetation is certain.

#### D. Climate

##### 1.1. Macroclimate

Saskatchewan has a continental climate with considerable seasonal variation in temperature and with low moisture conditions. As Beaver Creek is very close to Saskatoon, the climatic information about Saskatoon is applicable.

Based on the monthly temperature means (Figure 1.1.1) and the mean monthly precipitation (Figure 1.1.2), less than half of the year is likely to be warm enough for nature interpretation, and there will probably only be enough snow for skiing for less than four months of the year.

FIGURE 1.1.1  
MEAN MONTHLY TEMPERATURES

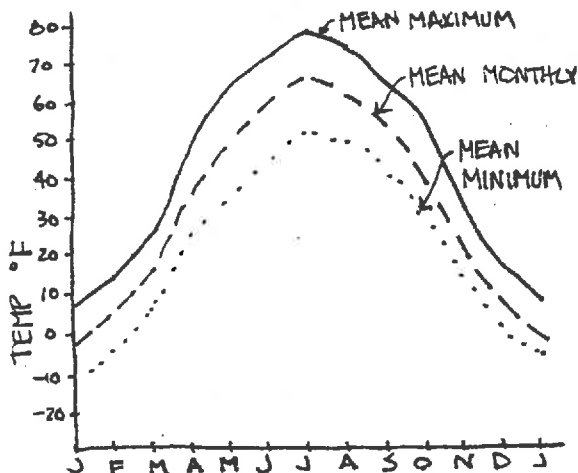
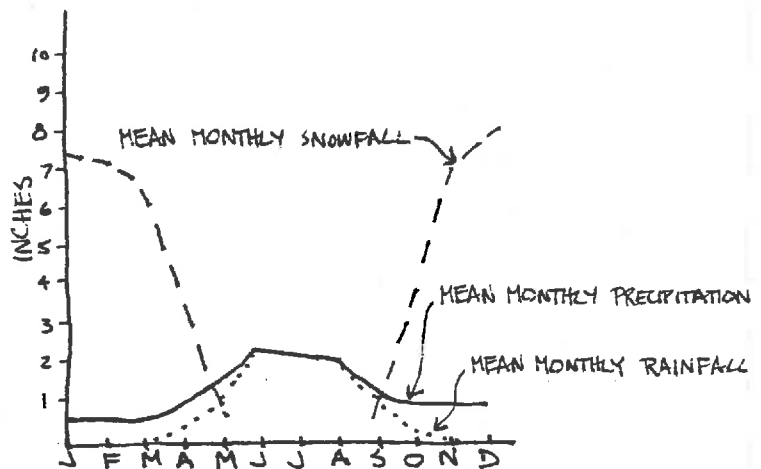


FIGURE 1.1.2  
MEAN MONTHLY PRECIPITATION



According to the Koeppen classification of climate, Beaver Creek is Dfb, cold forest (moist), with cool summer. It receives an average of 345 millimetres of annual precipitation, about 70% of which is rainfall in the growing season. Little runs off into the streams because of the high evapotranspiration. The annual evapotranspiration at Beaver Creek exceeds the annual precipitation creating a moisture deficit.

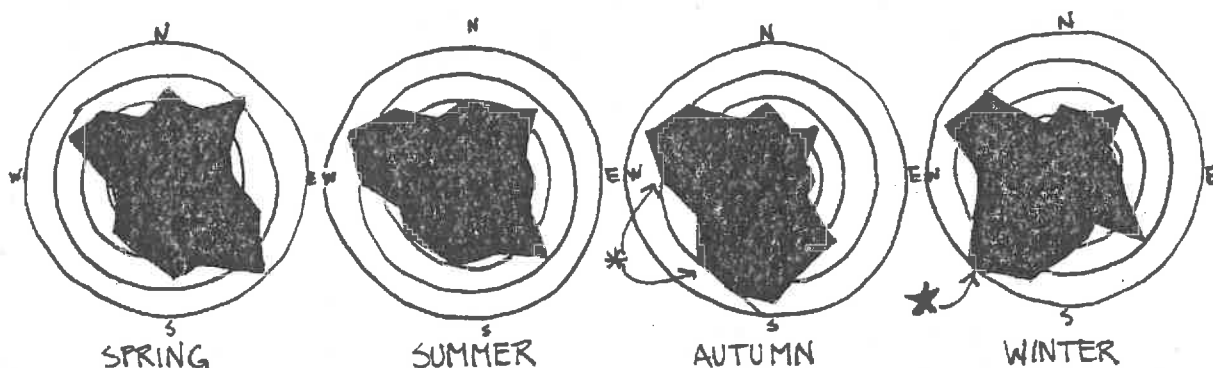
An average of about 100 centimetres of snow is received each winter. Considerable amounts are trapped in the forests of Beaver Creek and create good cross-country ski conditions.

Wind directions vary seasonably as indicated in Figure 1.1.3. Winds in autumn and winter are predominately from the northwest and southwest, while in spring and summer the winds are mostly from the northwest and southeast. This is important information for determining orientation and aspect of trails and buildings.

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FIGURE 1.1.3 SEASONAL WIND DIRECTIONS

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CANADIAN ATMOSPHERIC ENVIRONMENT SERVICE.

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The sun angle at Beaver Creek Park varies from a high of  $62^{\circ}$  on June 21 to a low of  $14^{\circ}$  on December 21. (see Figure 1.1.4.) This has implications for human comfort in all seasons, as sunshine in winter can be very comforting, while it can be stifling and uncomfortable in summer.

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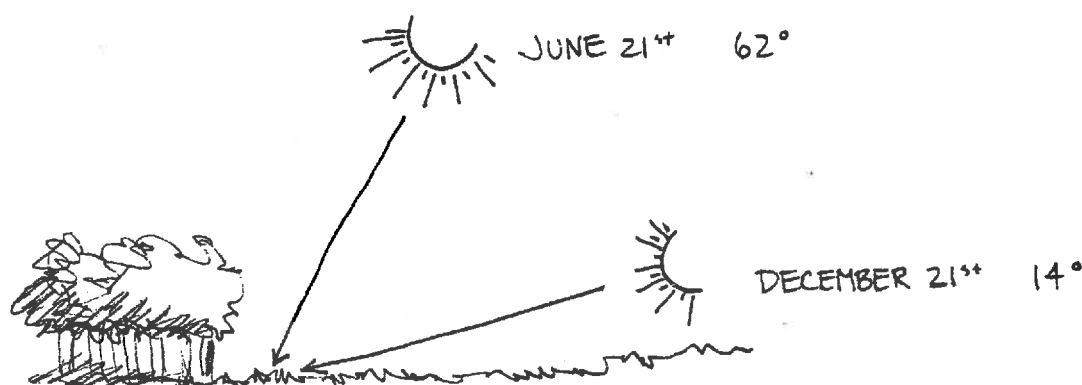
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FIGURE 1.1.4 NOON SUN ANGLES AT BEAVER CREEK

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## 2.0 Microclimate

Little information exists on this topic in regard to small creek valleys and no data has been collected for Beaver Creek. Nonetheless, there are some observations and speculation that can be made in general.

Some factors are obvious. Where there is forest cover the amount of sunlight and wind along the ground is reduced. The result is cool, moist conditions where a lush understorey of plants may survive. Soils are more developed with a deeper leaf litter. The presence of surface springs further accentuates the cool, damp conditions.

On the other hand, south facing slopes receive maximum insolation, are dry, less vegetated, exposed to the wind, and, in general, arid conditions prevail on the sandy soils of the site.

The South Saskatchewan River does tend to alter the track of storms in the summer. This might result in the Beaver Creek area getting slightly more summer shower activity than areas back from the river.

There is a very noticeable drainage of cool air into the creek valley at dusk. On one occasion I would guess the wind into the valley to be 15 km/hr.

and a temperature change of almost  $10^{\circ}\text{C}$  from creek bottom to grassy upland.

It is also possible, based upon the previous paragraph's content, that small inversions and some fog might occur in the creek valley similar to those of the river valley in the winter.

Unlike the adjacent river valley which, in Saskatoon, often funnels winds which are perhaps 15 km/hr faster than winds in surrounding areas, the creek valley might provide considerable shelter from the winds of the uplands. This would be attractive to hikers, and seems to result in considerable winter snow trap, which is good for skiing.

### 3.0 Significance

Climate has some importance beyond its influence on plants and stream flow.

- (a) the open parts of the site can get very hot, dry, and windy. Therefore drinking water taps should be supplied on the site.
- (b) ski trails are probably best confined to the forested areas of the creek valley where snow accumulates.
- (c) the creek is not safe even in the winter because of continual spring flow.
- (d) dry conditions result in rapid loss of vegetation cover in open, sandy areas.
- (e) the creek valley can be very cool in the evening even when the upland is comfortably warm.

## E. Flora (Vegetation)

### 1.1 Introduction

The Beaver Creek site encompasses a variety of plant communities from dry grassland communities to aquatic communities. This diversity renders the park of tremendous value as an interpretive area. The variety of landform

and plant communities also complicates the description of the area in terms of its advantages and constraints for use as a park.

### 2.1 Vegetation History

Early man favoured the site probably because of the availability of the many resources of the woods of the creek and river valley. These native people had little effect on the vegetation of the area.

Between 1954 and 1961 some of the land north of the creek was cultivated. This area has since grown in. From 1962 to 1969 the same portion of land was grazed. Since 1969, no agricultural activity has taken place on this city owned property. Considerable damage was already done, however, by 1969.

The land both north and south of the creek has long been subject to various degrees of recreational use. This is evidenced by the numerous car tracks, fire pits, trails and damaged trees throughout the site. Campers, ATV drivers, flower-and berry-pickers, and others have taken their toll of plants in the area. Of particular interest to those who "harvest" the forest are the Saskatchewan Lillies, and other showy flowers.

Over the years various crops have been planted or otherwise introduced to the area. Clover, crested wheat grass, and a variety of common but not native weeds have been inadvertently introduced to the site and are evident even in areas where the natural vegetation has never been disturbed.

Man is not the only disruptive element which has affected the site. Cattle are currently causing considerable damage just upstream and adjacent to the site. Removal of slope cover renders the bank susceptible to erosion and may increase stream load (turbidity) at peak flow times. Also, the wastes of these cattle might be altering the nutrient levels in the creek. Both factors might be altering the nature of the aquatic communities.

### 3.0 General Vegetation Distributions

### 3.1. Disturbed Prairie

This is the area which was once cultivated and later seeded to wheat grass and alfalfa. The species are adapted to the dry, sandy soils of the area. This area has also been grazed.

#### Plant Species of the Disturbed Prairie

<u>Scientific Name</u>	<u>Common Name</u>
Agropyron sp.	Wheat grass varieties
Arabis holboellii	Rock cress
Bromus sp.	Brome grasses
Calamovilfa longifolia	Sand grass
Chrysopsis villosa	Hairy golden aster
Goutelova gracilis	Blue grama
Haplopappus spinulosa	Spinulose ican plant
Helianthus nuttallii	Clustered sunflower
Lygodesmia juncea	Rush-like skeleton weed
Medicago sativa L.	Alfalfa
Melilotus alba	White sweet clover
Melilotus officinatus	Yellow sweet clover
Ratibida columnifera	Brown-rayed cone flower
Stipa viridula	Green needle grass
Symphoricarpos occidentalis	Western snowberry

### 3.2 Natural Prairie

The natural prairie is the grassland area south of the creek which has not been cultivated or grazed. It is also assumed that parts of the uncultivated area north of the creek will resemble this area to the south but have been modified by past grazing.

#### Plant Species of the Natural Prairie

<u>Scientific Name</u>	<u>Common Name</u>
Agropyron sp.	Wheat grasses
Allium textile	Prairie onion
Anemone patens var. Wolfgangiana	Crocus anemone
Antennaria parviflora	Low pussy-toes
Bromus sp.	Brome grasses
Chrysopsis villosa	Hairy golden aster
Comandra pallida	Pale comandra
Erigeron asper	Rough fleabane
Gaura coccidea	Scarlet butterfly plant
Geum triflorum	Three flowered avens
Goutelova gracilis	Blue grama
Heuchera richardsonii	Alum root
Lithaspermum incisum	Narrow-leafed puccoon
Oenothera nuttallii	White evening primrose
Orthocarpus luteus mitt	Owl's clover



### Plant Species of the Natural Prairie continued

<u>Scientific Name</u>	<u>Common Name</u>
<i>Psoralea argophylla</i>	Silver leafed psoralea
<i>Solidago missouriensis</i>	Low goldenrod
<i>Stipa comata</i>	Spear grass
<i>Symphoricarpos occidentalis</i>	Western snowberry
<i>Thermopsis rhombifolia</i>	Golden bean

Other plants common to most grassland areas include:  
*Phlox houdii* Moss phlox  
*Artemisia frigida* Pasture sage

### 3.3 Dunes

The dunes are a complex vegetation area because of the hummocky dune relief and the dry sandy conditions, blow-outs and other features.

### Plant Species of the Dune Area

<u>Scientific Name</u>	<u>Common Name</u>
<i>Agropyron</i> sp.	Wheat grasses
<i>Allium textile</i>	Prairie onion
<i>Amelanchier alnifolia</i>	Saskatoon berry
<i>Arctostaphylos uva-ursi</i>	Bearberry
<i>Astragalus</i> sp.	Milk vetch
<i>Bromus</i> sp.	Brome grasses
<i>Chrysopsis villosa</i>	Hairy golden aster
<i>Goutelova gracilis</i>	Blue grama
<i>Juniperus communis</i>	Low juniper
<i>Juniperus horizontalis</i>	Creeping juniper
<i>Opuntia polyacantha</i> How.	Prickly pear cactus
<i>Rosa acicularis</i>	Wild prickly rose
<i>Rumex occidentalis</i>	Western dock
<i>Stipa viridula</i>	Green needle grass

Some of the common weeds are also present in the blow-outs and along the road at the north of the dunes and along other bare roads and slopes.

### Common Weeds of the Beaver Creek Area

<u>Scientific Name</u>	<u>Common Name</u>
<i>Amaranthus retroflexus</i>	Pigweed
<i>Cirsium arvense</i>	Canada thistle
<i>Grindella squarrosa</i>	Gumweed
<i>Salsola pestifer</i>	Russian thistle
<i>Sanchus arvensis</i>	Sow thistle
<i>Tragopogon dubuns</i>	Goatsbeard

### 3.4 South Facing Valley Slopes

These slopes receive greater amounts of sunshine and therefore are more

arid. The snow leaves these slopes very quickly. The effects of early melt, are sparse vegetation and loose sandy soil. Hence, vegetation is low and sparse which further exposes the slope and results in less snow catch.

Some grazing and considerable beaver cutting has also stripped these slopes.

The common tree species of the valley are sparse on the south facing slopes. That is, *Populus balsamifera* (Balsam pop.), *Populus tremuloides* (Trembling aspen), and *Betula papyrifera* (Paper Birch). Beaver have removed most of the poplar and a few clumps of Birch remain; perhaps where springs are active.

#### Plant Species of South-Facing Slopes

<u>Scientific Name</u>	<u>Common Name</u>
<i>Arctostaphylos uva-ursi</i>	Bearberry
<i>Campanula rotundifolia</i>	Bluebell
<i>Carex</i> sp.	Sedge
<i>Juniperus horizontalis</i>	Creeping juniper
<i>Liatris punctata</i>	Blazing star
<i>Penstemon nitidus</i>	Blue beardtongue
<i>Rosa acicularis</i>	Wild prickly rose
<i>Stipa</i> sp.	Spear grasses
<i>Symphoricarpos occidentalis</i>	Western snowberry

Juniper and Bearberry seem to be the main groundcover plants which protect unstable sandy slopes or exposed sandy soil.

#### 3.5 North Facing Slopes

The north facing slopes are generally well vegetated, trap more snow-fall, are cooler and damper and retain snow melt later into the spring. In short, ground conditions are cooler and wetter (including several flowing springs), and soils are more stable and better developed, and have a deeper leaf cover.

The north facing slopes support dense growth of *Pop. tremuloides* and *Populus balsamiferus* as well as *Betula papyrifera* (Birch) along the creek edge.

### Plant Species of the North-Facing Slopes

<u>Scientific Name</u>	<u>Common Name</u>
<i>Achillea millifolium</i>	Yarrow
<i>Anemone canadensis</i>	Windflower
<i>Aster laevis</i>	Blue aster
<i>Astragalus eucosmus</i>	Milk vetch
<i>Cornun canadensis</i>	Bunchberry
<i>Cornus stolonifera</i>	Red ozier-dogwood
<i>Disporium trachycarpum</i>	Fairy bells
<i>Erigeron asper</i>	Fleabane
<i>Erysimum asperum</i>	Prairie rocket
<i>Galium triflorum</i>	Sweet-scented bedstraw
<i>Heuchera richardsonii</i>	Alum root
<i>Juniperus communis</i>	Low juniper
<i>Lathyrus ochroleucus</i>	Pea-vine
<i>Linnaea borealis</i>	Twin flower
<i>Lonicera dioica</i>	Honeysuckle
<i>Maianthemum canadense</i>	2 leafed Solomon's seal
<i>Pyrola asarifolia</i>	Pink wintergreen
<i>Sanicula marilandica</i>	Black snake root
<i>Schizachne purpurascens</i>	Purple oat grass
<i>Sisyrinchium montanum</i>	Blue-eyed grass
<i>Smilacina stellata</i>	Star-flowered Solomon's seal
<i>Solidago canadensis</i>	Canada goldenrod
<i>Thalictrum venulosum</i>	Veiny meadow rue
<i>Thermopsis rhombiflora</i>	Richardson's golden bean
<i>Vicia americana</i>	American vetch
<i>Viola adunca</i>	Early blue violet
<i>Viola regulosa</i>	White wood violet
<i>Zizia aptera</i>	Meadow parsnip

Other species are more common in the vicinity of the spring flow at the south slopes of the site:

<i>Achillea sibiricum</i>	Siberian yarrow
<i>Aster hesperius</i>	Western willow aster
<i>Botrychium lunaria</i>	Moorwort
<i>Botrychium virginianum</i>	Virginia grape fern
<i>Fragaria virginiana</i>	Wild strawberry
<i>Habenaria hyperborea</i>	Northern bog orchid
<i>Lycopus asper</i>	Western water horehound
<i>Petasites sagittatus</i>	Arrow-leaved colt's foot

It is evident that the north facing slopes support a rich variety of vegetation and, consequently, diverse wildlife and so on.

### 3.6 Creek Flats

There is no species lists for this area. Basically the vegetation here is a complex of all of the surrounding slope and prairie species barring

those which are specifically dry condition plants like Juniper.

#### Plant Species of the Creek Flats

<u>Scientific Name</u>	<u>Common Name</u>
Betula papyrifera	Paper birch
Cornus stolonifera	Red-osier dogwood
Populus balsamifera	Balsam poplar
Populus tremuloides	Trembling aspen
Prunus spp.	Cherries
Rosa spp.	Roses
Salix spp.	Willows
Viburnum sp.	High bush cranberry

Most of the wildflowers seen elsewhere seem to be here. In sandy flats the rose, grasses and Canada thistle are common as is wild sarsaparilla along the edge of the flats.

#### 3.7 The Creek Bed Vegetation

The creek varies from being full to the edge of steeply eroding banks, to having sandy low banks, to consisting of only a small stream within a wider, muddy bed. The vegetation of the creek or aquatic community varies accordingly.

Some aquatic plants are listed as present near the springs on the north facing banks.

Plants within the waters of the creek are beyond the scope of this report.

#### Plant Species of the Creek Banks and Bed

<u>Scientific Name</u>	<u>Common Name</u>
Anemone canadensis	Canada anemone
Aster hesperius	Western willow aster
Carex sp.	Sedge
Equisetum arvense	Common horsetail
Equisetum palustre	Horsetail
Eleocharis sp.	Spike rush
Helianthus nuttallii	Clustered sunflower
Juncus balticus	Wire rush
Lycopus asper	Western water horehound
Mentha arvensis	Wild mint
Poa palustris	Fowl bluegrass
Polygonum lapathifolium	Willow leafed persicaria
Rumex occidentalis	Western Dock
Salix interior	Sandbar willow
Salix lutea	Yellow willow
Scirpus validus	Common great bullrush

Some of these species occur only near the outflow of the creek but potentially may grow upstream.

Willows (*Salix* spp.) and Red-osier Dogwood (*Cornus stolonifera*) are common along the creek banks and on the lower, (damp) terraces.

The following species are evident in areas which are wet during spring runoff but dry thereafter:

<i>Juncus nodosus</i>	Knotted rush
<i>Plantago</i> sp.	Plantain
<i>Sagittaria</i> sp.	Arrowhead plants

### 3.8 Slump Terraces

(Based on the thesis by Hall, 1963.)

#### Plant Species of the Slump Terraces

<u>Scientific Name</u>	<u>Common Name</u>
<i>Achillea lanulosa</i>	Woolly yarrow
<i>Agropyron dasytachyum</i>	Northern wheat grass
<i>Artemesia frigida</i>	Pasture sage
<i>Artemesia biennis</i>	Biennial wormweed
<i>Artemesia campestris</i>	Plains wormwood
<i>Calanagrostis montanensis</i>	Plains reed grass
<i>Chrysopsis villosa</i>	Hairy golden aster
<i>Elymus canadensis</i>	Nodding wild rye
<i>Equisetium</i> sp.	Horsetail
<i>Erigeron canadensis</i>	Horse weed
<i>Galeum boreale</i>	Northern bedstraw
<i>Goutelova gracilis</i>	Blue grama
<i>Ribes</i> sp.	Currant or gooseberry
<i>Rosa</i> sp.	Wild prickly 'or wild woods rose
<i>Smilacina stellata</i>	Star-flowered Solomon's seal
<i>Stripa spartia</i> var. <i>curtiseta</i>	Western porcupine grass
<i>Symphoricarpos</i> sp.	Western snowberry
<i>Thermopsis rhombifolia</i>	Golden bean
<i>Viola Adunca</i>	Early blue violet

There are also poplar on the slumps and many other plants of the adjacent prairies which are not mentioned in the above list.

### 4.1 Flowering Plants at Beaver Creek

The following list is a fairly comprehensive list of the flowering plants found at Beaver Creek Park. They are listed under their approximate flowering times and can be an invaluable guide to interpretation.

Common Flowering Plants at Beaver Creek

<u>Scientific Name</u>	<u>Common Name</u>	<u>Flowering Time</u>
Anemone patens	Prairie crocus	Prairie;
Cymopterus acaulis	Plains cymoptaris	mid-late April
Phlox hoodii	Moss Phlox	
Thermopsis rhombifolia	Golden bean	
Populus tremuloides	Trembling aspen	Woods;
Salix discolor	Pussy willows	mid-late April
Shepherdia argentes	Thorny buffaloberry	
Viola adunca	Early blue violet	
Viola nuttallii	Yellow violet	
Oxytropis sericea	Early yellow locoweed	Prairie;
Penstemon nitidus	Smooth blue beardtongue	late May
Allium textile	Wild onion	
Arctostaphylos uva-ursi	Bearberry	Woods;
Betula Papyrifera	Paper Birch	late May
Amelanchier alnifolia	Saskatoon berry	
Prunus virginiana	Chokecherry	
Prunus pensylvanica	Pin cherry	
Disporum trachycarpum	Fairy bells	
Lithospermum incisum	Puccoon	Prairie;
Cerastium arvense	Chickweed	early June
Corydalis aurea	Golden corydalis	
Viola rugulosa	Western Canada violet	Woods;
Fragaria virginiana	Strawberry	early June
Smilacina stellata	Star-flowered false Solomon's seal	
Aralia nudicaulis	Sarsaparilla	
Potentilla anserina	Silverweed	
Anemone multifida	Cut-leaf anemone	Prairie;
Comandra pallida	Pale comandra	mid-late June
Antennaria sp.	Pussy-toes	
Vicia sparsifolia	Narrow leaved vetch	
Eleagnus commutata	Wolf willow	
Geum triflorum	Three-flowered avens	
Sisyrinchium montanum	Blue-eyed grass	
Achillea millefolium	Yarrow	
Tragopogon dubius	Goat's beard	
Linum lewisii	Blue flax	
Heuchera Richardsonii	Alumroot	Prairie;
Erigeron asper	Fleabane daisy	mid-late June
Gaura coccinea	Scarlet Gaura	
Penstemon gracilis	Lilac-flowered beard tongue	
Sphaeralcea coccinea	Scarlet mallow	
Anemone canadensis	Canada anemone	Woods;
Actea rubra	Baneberry	mid-late June
Thalictrum venulosum	Meadow rue	
Cornus stolonifera	Red-osier dogwood	
Zizia aptera	Heart-leaved meadow parsnip	
Galium boreale	Northern bedstraw	
Cypripedium calceolus	Yellow ladies slipper	
Campanula rotundifolia	Harebell	Prairie;
Rosa arkansana	Rose	early July
Linum rigidum	Yellow flax	
Monarda fistulosa	Bergamot	

Common Flowering Plants at Beaver Creek continued

<u>Scientific Name</u>	<u>Common Name</u>	<u>Flowering Time</u>
<i>Psoralea argophylla</i>	Silver-leaf psoralea	
<i>Gaillardia aristata</i>	Gaillardia	
<i>Cornus canadensis</i>	Bunchberry	Woods;
<i>Lincaea borealis</i>	Twinflower	early July
<i>Maianthemum canadense</i>	Wild lily of the valley	
<i>Lonicera dioica</i>	Twining honeysuckle	
<i>Apocynum androsaemifolium</i>	Dogbane	
<i>Asclepias ovalifolia</i>	Milkweed	
<i>Lilium philadelphicum</i>	Western wood lily	
<i>Pyrola</i> sp.	Wintergreen	
<i>Oenothera nuttallii</i>	Evening primrose	
<i>Petalostemon purpureum</i>	Prairie clover	Prairie;
<i>Ratibida columnifera</i>	Coneflower	mid-late July
<i>Lygodesmia juncea</i>	Skeletonweed	
<i>Heterotheca villosa</i>	Hairy yellow aster	
<i>Symphoricarpos alba</i>	Western snowberry	
<i>Liatrus punctata</i>	Blazing star	
<i>Mentha arvensis</i>	Mint	Woods;
<i>Geum</i> sp.	Yellow avens	mid-late July
<i>Oenothera biennis</i>	Yellow evening primrose	
<i>Glycyrrhiza lepidota</i>	Wild licorice	
<i>Artemisia</i> sp.	Sages	Prairie;
<i>Helianthus petiolaris</i>	Prairie sunflower	August
<i>Aster laevis</i>	Smooth leaved aster	
<i>Solidago</i> sp.	Goldenrod	
<i>Orthocarpus luteus</i>	Owl's clover	
<i>Gutierrezia sarothrae</i>	Broomweed	

In summary, eight areas of somewhat different vegetation are outlined.

These are mapped on the map entitled Biophysical Units.

Trails designed to pass through these areas will lend hikers to a diversity of experience of plant cover, topography, soil, and so on. In the grassland areas the cover is low and dry, the feeling open and the view very broad. In the open slope portions of the valley the vegetation is harsh, the sun bright on dry, sandy slopes and the feeling is somewhat open. The view can be panoramic upslope. In the forested areas hikers will find shade, a richness of vegetation and wildlife and some solitude. By the creek it is cool and sheltered in many places. Attention is focused on the water and activities confined by the surrounding valley. By the creek there is a tendency to sit down and look at some of the smaller plants of the valley. The dunes are a strange place

and probably not particularly appealing to many. The plants are sharp and dry, the thistles stick and the sand and wind are hot. Although the diversity of plants are interesting, many people may wish to pass through the dunes quickly on route to the slumps or back. At the slumps is found a diversity of plants from open grass flats to shady forests. The landform, however, dominates ones' attention at this location as does the panoramic view of the river valley.

## F. Fauna (Wildlife)

### 1.1 Introduction

There is a great diversity of wildlife in Beaver Creek Park due partly to the great variety of environments, but even more to the large number of ecotones, or edges, between different environments. Although some, possibly many, of the birds and animals on the site would survive disruption of the area, most are living in Beaver Creek Park because it is in a natural or nearly natural state. It is vital that as much of the park as possible be left unchanged to maintain favourable environments for the fauna that is there.

### 2.0 Ornithological Inventory

#### 2.1 Nesting Species

American Goldfinch	House Sparrow
Baltimore Oriole	House Wren
Bank Swallow	Killdeer
Barn Swallow	Least Flycatcher
Black Tern	Mallard
Black-billed Magpie	Marsh Hawk
Black-capped Chickadee	Mountain Bluebird
Brewer's Blackbird	Mourning Dove
Brown Thrasher	Pintail
Brown-headed Cowbird	Red-eyed Vireo
Catbird	Red-winged Blackbird
Cedar Waxwing	Red-tailed Hawk
Clay-colored Sparrow	Ring-billed Gull
Common Crow	Ring-necked Pheasant
Common Nighthawk	Robin
Eastern Kingbird	Rock Dove
Franklin's Gull	Sharp-tailed Grouse
Gray Partridge	Song Sparrow
Horned Lark	Spotted Sandpiper



Nesting Species continued

Sprague's Pipit  
 Starling  
 Swainson's Hawk  
 Tree Swallow  
 Veery  
 Vesper Sparrow

Warbling Vireo  
 Western Kingbird  
 Western Meadowlark  
 Yellow-shafted Flicker  
 Yellow Warbler

2.2 Migratory Species

American Coot  
 American Widgeon  
 Bald Eagle  
 Belted Kingfisher  
 Blue Jay  
 Blue-winged Teal  
 Bohemian Waxwing  
 California Gull  
 Canada Goose  
 Chipping Sparrow  
 Common Goldeneye  
 Common Merganser  
 Common Redpoll  
 Downy Woodpecker  
 Gadwall  
 Gray-cheeked Thrush  
 Great Horned Owl  
 Green-winged Teal  
 Hairy Woodpecker

Lapland Longspur  
 Lesser Yellowlegs  
 Myrtle Warbler  
 Palm Warbler  
 Ruffed Grouse  
 Short-eared Owl  
 Shoveler  
 Slate-colored Junco  
 Snow Bunting  
 Sparrow Hawk  
 Swainson's Thrush  
 Tree Sparrow  
 Western Grebe  
 White-crowned Sparrow  
 White-throated Sparrow  
 Yellow-bellied Sapsucker  
 Yellow-headed Blackbird

3.0 Common Mammalian Fauna in the Beaver Creek Area

Mammals are rarely seen, but in contrast to birds, signs of their presence may often be seen.

3.1 Order Chiroptera

Family Vespertilionidae

Little Brown Myotis (Myotis lucifugus LeConte)

-most common bat in the area and is more likely to be seen near dark.

3.2 Order Carnivora

Family Canidae

Foxes and coyotes are rather common but rarely seen except in early morning or evening.

Family Mustelidae

-all members are secretive.

Mink (Mustela vison Schreber)

-common along the stream and their tracks can often be seen in the mud.

Otter (Lutra canadensis Schreber)

-likely use the area in winter, but are very shy and unlikely to be seen.

Skunks (Meophitis meophitis Schreber)

-rather common.

Badgers (Taxidea faxus Schreber)

-only on the prairie area. Their burrows can be seen.

Family Procyonidae

Raccoon (Procyon lotor L.)

-trails might be seen (rare).

### 3.3 Order Rodentia

Family Sciuridae

Ground Squirrels

-there are three species of these "gophers" seen (Richardson's, Franklin's, and Thirteen-lined). Burrows can be seen.

Chipmunks (Eutamias minimus Bachman)

-are relatively common in brush.

Family Castoridae

Beaver (Castor canadensis Kuhl)

-presence is revealed by their dams and trees which have been cut.

Family Cricetidae

Muskrats (Ondatra zibethicus L.)

-rather common.

Mice (Several species)

-rather common.

Family Erethizontidae

Porcupines (Erethizon dorsatum L.)

-likely examples of porcupines feeding in trees could be found as well as winter "denning" areas.

### 3.4 Order Artiodactyla

Family Cervidae

Deer

-Both white-tailed and Mule deer could occur in the area.

## V. DESIGN CONCEPTS

Based on the program and the site analysis, design concepts were developed for Beaver Creek Park. There are basically two categories:

- (1) a concept including campgrounds, picnic area, and vehicular access to the slumps, and
- (2) concepts without campgrounds, picnic areas or vehicular access to the slumps. The decision between these two categories depends on how much development is desirable for Beaver Creek Park. Based on the theme and character of the park, the concepts without camping, picnicking, or vehicular access to the slumps are most compatible, but for public use the other is better.

### Concept 1

This concept attempts to use, as much as possible, areas that have already been disturbed so that disruption of natural lands is at a minimum. Visitors to the park enter through the south side only. Emergency and service access is available on the north side along the fence line at the perimeter of the park. All vehicular traffic is strictly confined to roads. Upon entering the park visitors drive around a treed area and are exposed to a panoramic view of the natural prairie. They then approach the interpretation centre, where passengers can be let off before the driver takes the car through the trees into a visually buffered parking area. A path leads from the parking through the trees to the interpretation centre.

The interpretation centre is backed into the trees and has a spectacular view of the natural prairies in front, with the creek vegetation, which surrounds it on all sides, in the distance. This centre has an administration office for a warden or interpretive officer, nature displays of the flora and fauna of the site, washrooms, and a concession with cold condiments in

summer and hot in winter. The structure is designed for year-round use, acting as a ski hut in winter.

There are two main, well-surfaced paths leading from the centre. They both enter an assembly area almost immediately. This is a place where groups can assemble before a nature walk. The two main loops are relatively short, but include a sample of most of the features in the park except the slump terraces. Extending from these paths are longer loops of nature trails that have more rustic surfaces and allow visitors to wander through nature. People should stay on the paths as they are the path of least resistance. One of these paths examines more closely the creek features. Another looks at beaver dams and natural vegetation, while a third explores the spectacular slump terraces and traverses across the sand dune area on the way back. This trail can readily become part of any riverbank trails from Cranberry Flats and continuing south.

The natural prairie has no development or trails on it and is meant to remain natural for interpretation and for its beauty. The area west of the last bridge, along the creek, is to be left as natural as possible. If the land across the creek were developed, though, this naturalness might be lost. The MVA should consider acquisition of this land.

All disturbed areas not developed in this concept would be revegetated and returned to as near the natural state as possible. Measures would be taken to ensure that no vehicles be allowed to drive off the roads (even snowmobiles in winter). This would mean the part of the perimeter of the park that is adjacent to vehicular traffic would have to be inaccessible.

The advantages of this concept are:

- (1) little new disruption would occur,
- (2) the features that are there now would be consolidated into a much more

useful and less destructive form,

(3) There is a progression in length and difficulty of trails with two well-defined loops.

The disadvantages are:

- (1) possibly too much pressure would be put on the natural prairie area,
- (2) The drive into the site is not as spectacular as it could be,
- (3) Beaver Creek is not visible from the area of the interpretation centre.

## Concept 2

Access to the park in this concept is from the north side. The present north side access is dangerous and the MVA would have to consider purchase of a small parcel of land to the north along the highway to ensure safe access. As this road winds into the park spectacular views of Beaver Creek Valley are exposed as are panoramic views of the sand dunes and the grass-land area. The interpretation centre is approached and viewed with the valley vegetation as a backdrop. Passengers can disembark before the driver disappears into a visually buffered parking lot. From the parking a path leads back to the interpretation centre. The interpretation centre has a dual purpose here:

- (1) it serves to orient visitors to the park and
- (2) it acts as an aiming stake for hikers that acts as a direction finder and the visual point that ties the whole park together. The building would be compatible with the environment but would be visible from many vantage points in the park. It would include the same features as in Concept 1, that is, washrooms, an administration office, nature displays, a concession and a winter warm-up area.

From the interpretation centre one path leads down to a large assembly area on a creek terrace. This area would act as an assembly area for groups

going on the nature trails. There is one short path that completes a loop across the creek to the north, up a south-facing slope, onto the edge of natural prairie, through north-facing slope vegetation, across another bridge and back. Hikers taking this trail experience a little bit of all the environments in the park except the slump terraces. The other nature trails extend off of this basic loop into increasingly longer loops, one experiencing the natural prairie and its ecotones with surrounding areas, one following the creek and seeing closeup its spectacular erosional features, one cuts through exciting vegetation and alongside beaver dams, while a long trail extends out to the fascinating slump terraces and back across the sand dunes to the interpretation centre.

This trail system has the advantage of a range from a very short, hard-hitting trail, to a very long, much more leisurely, wandering trail.

There is a road, along the north fenceline, to the slump terraces to be used only by emergency and service vehicles. All disturbed areas are re-vegetated and measures are taken to keep vehicles on the roads. As in Concept 1 strict measures are to be taken to keep all motor vehicles out of the park except when on roads.

The natural prairie area is left untouched as is the creek area on the west side of the park. Again in this concept the MVA should consider purchase of the land across the creek.

The advantages of this concept are:

- (1) very exciting and spectacular drive into the park,
- (2) interpretation centre that is the visual centre and aiming stake for the whole park,
- (3) The natural prairie has very little pressure on it and is most likely to remain natural, and
- (4) stages of nature trails from very short and straightforward to very long

and wandering.

The disadvantages are:

- (1) land would have to be purchased to the north of the park along the highway to ensure safe access,
- (2) alteration of the landform and character of the land around the interpretation centre would be necessary to hide the parking and locate the building,
- (3) a considerably longer road would be required here than in Concept 1 at a much greater cost and with greater environmental impact.

### Concept 3

There is access to the park on both the north and south sides of the creek. The north side access leads to a spectacular drive along the edge of Beaver Creek Valley, then across the prairie and sand dunes to the South Saskatchewan River slump terraces. A small nature/warmup shelter is located at the slump with parking beside. This shelter has nature displays and explains the river features including the slumps. It is also used as a warm-up shelter for skiers travelling along the riverbank from Cranberry Flats or other locations. There is one major path from here to the edge of the slumps and down to the picnic area overlooking Beaver Creek. Smaller trails lead along the slumps and have the potential to link up with Cranberry Flats trails and others lead east to the rest of the park along the rim of the valley. The road from the slumps leads back to the point of land that commands a dramatic view of the Beaver Creek Valley. A lookout platform here accents the view. From here major paths lead, in a double loop, through some spectacular creek features, across Beaver Creek 3 times, and over to the interpretation centre. There is a picnic and assembly area on the flats below the lookout platform that acts also as a dispersal point for the main paths. The



nature trails loop off these main paths into longer and more remote trails.

The developments on the south side of the creek include an interpretation centre and a campground. The road allows panoramic views of the natural prairie, then approaches the centre, allowing passenger discharge. Parking is in a visually buffered area behind the centre with a path leading back. A picnic and assembly area is immediately beside the centre that includes washrooms, administration offices, nature displays, winter warm-up area, and a concession. The major paths from the centre join up with the major paths from the picnic area across the creek, and link the two areas across three bridges.

A campground is located on a creek terrace in a wooded area. Access to it is a branch off the road to the interpretation centre. The heavily-wooded area would make a beautiful campground but much vegetation would have to be destroyed and the naturalness would disappear. A small nature trail is available to campers and is linked to the other trails of the park.

No areas of the park would be left as preservation areas, but almost all would be considered conservation areas.

The advantages of this concept are:

- (1) Maximum use is made of the park without totally destroying its character,
- (2) It meets the criteria set up by the Conceptual Master Plan,
- (3) It has something for everyone. That is, a whole range of people are accommodated from the nature-hikers to the drive-and-lookers.

The disadvantages of this concept are:

- (1) It would encourage too many people to use the site thus probably destroying its naturalness,
- (2) Picnic and campground areas are incompatible with the theme of preservation,
- (3) Too many areas of development leading to too many areas of disruption.

Summary

Concept 3 is probably not feasible even though it meets the criteria of the Conceptual Master Plan. That much development would destroy the theme of nature preservation.

Concept 2 is the most exciting, with the drive along the valley edge, the interpretation centre acting as the visual aiming stake for the whole park, and the totally preserved prairie area. The drawback is the necessity to purchase additional land for access from the highway.

Concept 1 is very reasonable, and is more subtle than Concept 2, as it doesn't have the spectacular drive where everything is exposed to the visitors before they leave their car. In Concept 1 the exciting and dramatic aspects of the park are slowly unfolded as visitors experience the interpretation centre, then wander off on the nature trails.

Either Concept 1 or 2 would be recommended.

