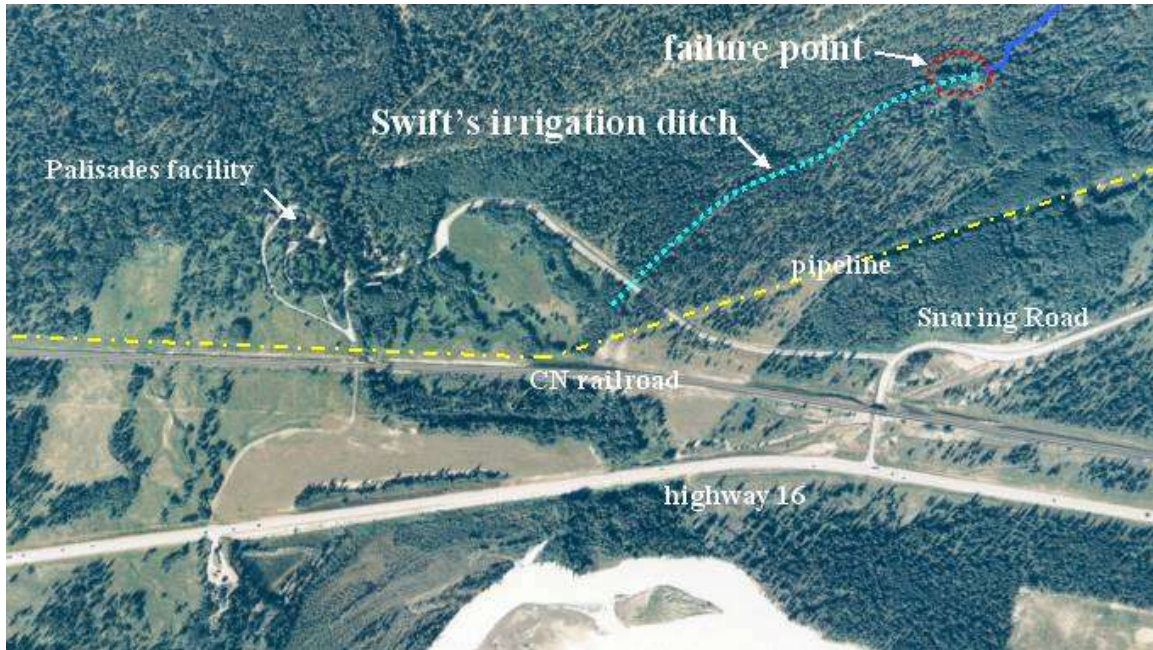


A Restoration Strategy for Swift's Ditch, Jasper National Park



The Study Site

Cardiff, 1999

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Abstract

The cultural and ecological history of Swift's Irrigation Ditch (ie. Swift's Ditch) in Jasper National Park (JNP), including information about the area's landscape processes and patterns, was studied to develop recommendations for ecological restoration at the site. The photograph on the cover of this report shows the location of Swift's Ditch and the surrounding landscape and infrastructure.

Swift's Ditch is remarkable both for the effort it took to create it and for its' association with the history of the Palisades Centre, JNP. The Palisades Centre site was farmed by Lewis Swift from 1892 to 1935, developed as a dude ranch by Arnold Wilby from 1935 to 1952, run as the Palisades Motel and Lodge by the Bried family from 1952 until they sold it to Parks Canada in 1962. The Palisades Centre then became a national training centre for Parks staff and later an environmental research and education centre.

The ecological influence of massive projects such as the building of the railway, roads and pipelines, have heavily impacted the landscape around the Palisades Centre and Swift's Ditch, both changing the natural drainage regime and created a drainage problem. On several occasions e.g. 1993, 1997, 1998 in the last 20 years, spring flooding has occurred along the entry road to the Palisades Centre. The floodwaters concentrate at the 3-way junction of the Palisades Centre road, the Snaring road and the off-ramp of Highway 16, posing concern for the integrity of the road sub-base.

The source of the flooding is the Palisades Creek which runs from an unnamed lake down the Palisades escarpment. It was diverted at some time in the past into an irrigation ditch, commonly called Swift's Ditch. The study area to the east of Swift's Ditch used to be a wetland complex or an Aspen forest regularly inundated by floodwaters.

The purpose of this report is to suggest how Swift's Ditch was created, and how the landscape has changed generally in the area. Methods used in the study included taking Global Positioning System (GPS) readings for landscape features, consulting historical photographs, such as the photographs taken in 1915 by Morris P. Bridgland, Dominion Land Surveyor. Air photographs, historical development plans and literature were reviewed and persons with knowledge of the site were interviewed. Vegetation transects were completed and soil pits were dug. The length of Swift's Ditch was walked several times in different seasons from 2009 to 2010.

Piecing together the history of Swift's Ditch and the history of disturbance and landscape change in the area was challenging. It was not possible to confirm who created or modified the ditch. Current theories about how Swift's Ditch was constructed are:

1. The ditch may have been constructed for agricultural purposes sometime between 1890 and 1920 by the Swift family, or perhaps later during a subsequent guest ranch phase.
2. The ditch may have been constructed to protect the pipeline (1952) or the access road to the Palisades Centre, that was constructed in 1979. There is a regular berm along the right side of the ditch, which may indicate it is a mechanically created or modified ditch rather than a hand dug ditch. The ditch appears in a 1949 aerial photograph.
3. The ditch may have been dug by Swift and then modified at a later date, perhaps to alleviate spring flooding concerns.

Recommendations are made for ecological restoration activities in the study area that help restore the area's natural drainage regime, while still protecting the road, rail bed and pipeline, as well as the commemorative integrity of Swift's Ditch. Restoration actions suggested include:

- removing invasive weeds e.g. mustard in the study site;
- carrying out dendochronological studies on any structural pieces of wood that can be found in the ditch;
- working with the area's stakeholders e.g. the railway, the pipeline and Parks Canada staff to improve the natural drainage regime and protect the area's infrastructure from flooding. A hydrological engineer should be included as a member of the team;
- investigating the possibility of installing a swale across the pipeline in the area of the original creek bed to ensure water is returned to the wetland and Aspen area that has historically been regularly inundated with water
- maintaining a written log of when and where flooding occurs;
- installing an interpretive sign near Swift's Ditch, including the need for additional information about the construction of the canal. A description of the ditch should be included in historical accounts about the Palisades Centre;
- annually monitoring the effects of the swale, if installed, e.g. on vegetation species and composition and the movement of water; and
- continuing research to find additional documentation e.g. photographs, maps, documents, and oral accounts about the creation of Swift's Ditch and general landscape change in the area.

Introduction

Swift's Ditch is a mystery. And like any good mystery there is much satisfaction in piecing together the parts of the puzzle. In this case, the mystery to be explored and reported on is the cultural and ecological history of Swift's Ditch in Jasper National Park, Alberta.

Swift's Ditch is located close to the Palisades Training Centre, found fourteen kilometres north of the town of Jasper, on the east side of the Athabasca River Valley in the shadow of the Palisade, a massive limestone cliff (see figure 1 for a map of the location of the Palisades Centre and Swift's Ditch).

The development of the Palisades Centre itself is well documented. Parks Canada first recognized the site as a Federal Heritage Complex because of its role in the early development of Jasper National Park. It was the only privately owned property within the park and was at one point a trail-related tourist industry, contributing to the development and use of the Park by the public (Wagner, 2000, p. 16).



Figure 1: Map showing location of Palisades Centre and Regional Context

Lewis Swift settled the land beneath the Palisades Centre in 1892 and farmed the area with his wife Suzette Chalifoux until 1935. Swift staked off approximately 2000 acres on the hillside, extending from the base of the Palisade's ridge down to the Athabasca River (Wagner, 2000, p. 21). During Swift's time the area was covered with Aspen and Cottonwood and a few large Douglas Fir trees. However, the great fire of 1889 which swept through the Athabasca Valley had also created many open meadows, including the land Swift had claimed for himself (Wagner, 2000, p. 21). Swift's farm became a provisioning point for expeditions moving further west because the land could grow a reasonable amount of northern vegetables and grain.

However, water was required and Swift is well known for digging the extensive irrigation system that took water from Swift Creek and moved it to the garden plots along the flats near the present railway tracts. Appendix A provides a cultural landscape plan of the Lewis Swift farmstead from 1892-1935. This is **not** Swift's Ditch ie. the irrigation ditch being documented in this report.

The irrigation ditch that was used to move water from Swift's Creek to the garden plots was a rock-lined trench about 2 feet wide and 6 to 8 inches deep. Each main trench extending down the slope had several lateral trenches leading to various parts of the property. Most of these trenches are still intact today with the exception of those leading to the garden (Wagner, 2000, p. 68).

Swift also constructed a water wheel to grind his own flour. He made a small dam uphill on the creek that, when wooden planks were dropped into place, diverted water toward the wheel. The water flowed in a flume made out of a hollowed jackpine tree trunk until it came to a boxed spillway that directed the water under the wheel to drive the wheel forward. The water then continued down a 2-foot trench until it re-entered the creek downstream (Wagner, 2000, p. 21).

The Swifts were industrious and by 1911, according to their application for a homestead patent, they were cultivating 18 acres of land e.g. wheat, potatoes, vegetables and barley, had 5 head of cattle and 40 horses, constructed a log house, 2 log stables, one with a roothouse, 2 storehouses, a feed mill, a small house in which Swift entertained his friends and 1 ½ miles of seven-rail fencing (Wagner, 2000, p. 23).

The Athabasca River Valley has historically been intensively used as a transportation corridor and this is reflected in the proximity of the railway and

highway to Swift's farm. By 1915 there were 2 separate railways—the Canadian Northern and the Grand Trunk Pacific—operating in the Athabasca Valley because of the obvious commercial advantages of forging links between eastern and western Canada. Both railways required right of ways through Swift's property, described as S.E. ¼, Section 15, Township 46, West of the 6th. In the end only one survived and the other rail alignment served as the roadbed for much of the Yellowhead highway through the park.

One of the interesting stories that is part of the Palisades Centre's past is that Swift formed a partnership with Charles Hays, president of the Grand Trunk Pacific, in order to develop a scheme in which his property would become a small resort town, consisting of 500 individually owned lots, called Swiftholm. The land was subdivided, and the brochures printed but in 1912 Charles Hays went down with the Titanic (Wagner, 2000, p. 7). The Swifts' home served as a meeting place, stopping house and provisioning place for people both passing through and resident in the valley until it was sold to Arnold Wilby in 1935. When Swift sold the property the character of the landscape changed from a farm to a summer home and then a dude ranch, known as The Pyramid Lodge. Wilby destroyed most of what Swift had constructed, but kept the garden, the waterwheel and the roothouse on the eastern side of the tracks and several other buildings erected (Wagner, 2000, p. 26). See appendix B for a cultural landscape plan of the Palisades Centre during Wilby's tenure. The irrigation ditch to the garden plots is shown on the plan but Swift's Ditch, the study site, is not shown.

In 1952 Gordon and Gwen Bried and his mother Connie, purchased and renovated the Pyramid Mountain Lodge and named it the Palisades Motel and Lodge. The first guests of the Palisades Motel and Lodge were workers on the TransMountain Pipeline (Wagner, 2000, p. 33). It is notable that Gordon Bried owned a construction company, meaning that he had access to heavy equipment that could have been used to create or modify Swift's Ditch (see appendix C for a cultural landscape plan of the Palisades Centre during the Brieds' tenure).

The Brieds sold the Palisades Motel and Lodge to the government in 1962, when it became a national training centre for Park Wardens and other national park employees, and later an environmental research and education centre. Today the Palisades Centre is an environmental education centre. In 1979 the Park relocated the access road from Highway 16 to the Palisades Centre. A culvert was installed under the new access road in the area of Swift's Ditch, the irrigation ditch under investigation (see appendix D for a cultural landscape plan of the Palisades Centre since 1962).

The ecological influence of massive projects such as the building of the railway, roads and pipelines, have heavily impacted the landscape around the Palisades Centre and Swift's Ditch, both changing the natural drainage regime and creating a drainage problem. On several occasions e.g. 1993, 1997, 1998, in the last 20 years, spring flooding has occurred along the entry road into the Palisades Learning Centre. The floodwaters concentrate at the 3-way junction of the Palisades Learning Centre road, the Snaring road, and the off-ramp of Highway 16, and pose concern for the integrity of the road sub-base.

The source of the flooding is the Palisades Creek which runs from an unnamed lake down the Palisades escarpment. It was diverted at some time in the past into an irrigation ditch, commonly called Swift's Ditch (see figure 2 for a map showing the Palisades Creek and Swift's Ditch and the area that floods intermittently).



Figure 2: Map showing Palisades Creek and Swift's Ditch

According to Leigh Pitoulis, the retired manager of the Palisades Centre, flooding occurred on the holiday weekend in May in the 1970's and again during

the 1980's. She stated that the ditch was dug deeper, but the area flooded again in 1993 (Leigh Pitoulis, personal communication, September 2009).

Flooding also occurred in 1997 when an ice-plug formed within a stream-bed, diverting waters over the bank and into the surrounding low-lying terrain. Parks Canada staff responded by removing several trees where the ice-plug formed, to reduce shading and increase micro-climate temperatures. In 1998, the stream bank failed entirely at the same location (see figure 2 for the location of the ditch blowout). Park staff responded by using a tracked hoe to build up the stream bank. The bank failure exposed old sand bags, confirming that this site was a problem in the past (Cardiff, 1999, p. 1).

As shown in figure 2, the study area to the east of Swift's Ditch used to be a wetland complex or an aspen forest regularly inundated by floodwaters. This has become a relatively rare ecosystem in the main Athabasca Valley (Higgs, 2003, p. 172). In addition, aquatic connectivity has been the focus of several recent restoration projects in the Athabasca Valley, including restoration work on the Swift Creek culvert.

Therefore, the purpose of this report is to suggest how Swift's Ditch was created, and how the landscape has changed, generally, in this area. Recommendations will be given about how the area's natural drainage regime could be restored, while still protecting the road, rail bed and pipeline, as well as the commemorative integrity of Swift's Ditch.

Methods and Materials

Global Positioning System (GPS) Reading

A GPS reading (UTM and Lat.Long.[ddmmss]) was taken at the beginning of Swift's Ditch by the road leading into the Palisades Centre, at the opposite of the ditch where it starts to divert Palisades Creek and at the blow out where the walls of the irrigation ditch fail.

Historical Photographs

The Jasper-Yellowhead Historical Archives, the Parks Canada Library in Jasper and the Rocky Mountain Repeat Photography Project, University of Alberta were

searched for photographic evidence of the ditch's date of construction. The original photographs used in the Rocky Mountain Repeat Photography Project were taken in 1915 by Morris P. Bridgland, a Dominion Land Surveyor. These photographs were used to create the first topographic map of the newly established Jasper National Park. Bridgland took 750 photographs in all, creating an extremely valuable visual record of the state of the park in its early years. From 1998 to 1999 the Bridgland Repeat Photography team retook photographs from the same location as Bridgland to document how vegetation and other ecological and cultural features have changed.

Toni Klett's 1952 pipeline construction photographs were also consulted but did not provide any images of Swift's Ditch.

Air photos

Air photos from 1949, 1958, 1966, 1979 and 1997 were obtained from the Parks Canada Library in Jasper. An archivist at the Air Photo Distribution Office, Government of Alberta in Edmonton was consulted for information about the 1949 air photo of the study site.

Historical Development Plans

Historical development plans and maps of the area were obtained from Parks Canada in Jasper—Shawn Cardiff, Manager, Integrated Land Use Planning, JNP; Mike Dillon, Cultural Resource Specialist, JNP; Carol Doering, GIS Specialist, JNP and Mike Knaeur, Townsite Plans, JNP. Staff at the archives for what was TransMountain pipeline were contacted but did not have site plans available for the 1952 construction period around the Palisades Centre.

Maps that provided particularly useful information were a 1911 Grand Trunk Pacific Railway Map and a 1979 map of the new proposed access road into the Palisades Centre. 1914 survey maps created by H. Matheson were also consulted. These maps could have provided valuable information about the Palisades Creek, wetlands in the study area and perhaps Swift's Ditch, but the site in question was just beyond the borders of the maps available.

Literature Review and Individual Consultation

Pertinent books (as listed in the reference section of this report) were reviewed from the Parks Canada library to gain as thorough an understanding as possible of the biophysical, ecological and cultural development, characteristics and functions of the area around Swift's Ditch. A biophysical map of the area was also consulted. Parks Canada specialists and staff who lived and/or worked in the area were consulted: Bhuwan Devota, Asset Management Project Manager; Mike Dillon, Cultural Resource Manager, JNP; Jim Elliott, retired engineer; Mike Greer, Highways, JNP; Ward Hughson, Aquatics Specialist, JNP; Toni Klettl, retired Park Warden; Marion Lee, Highway Service Centre Operations Manager, JNP; Leigh Pitoulis, retired Manager, Palisades Centre, JNP; Dale Portman, retired Park Warden; and Barbara Sacrey, Asset Manager, JNP. Other people consulted included Margaret Mears, Environmental Lead, Kinder Morgan Canada; Sidney Wood, Air Photo Distribution Office, Government of Alberta.

The Jasper-Yellowhead Museum and Archives provided superintendent reports dating from the early days of the establishment of Jasper National Park and the development of the TransMountain pipeline. The Archives' photo database was also searched for images of the area but nothing pertinent was found.

Vegetation Plots

Two 30 metre vegetation transects were completed. One transect was done in the area with no impeded water flow northwest of the pipeline. The second transect was done in the area where water flow is impeded, northeast of the pipeline. All vegetation within 50 cm of the intersects on the transect was recorded in order of abundance, at 5 metre intervals. In addition, the percentage of all vegetation and ground cover in a 1 m² plot at each end of the 30 metre transect was recorded.

Hydrology

Analysis of the natural drainage regime and flooding occurring in the study site was done using a geographical information system (GIS) as well as GPS field survey data. This data was recorded on a GIS map to show the historical drainage regime and how flooding presently occurs.

Soil Pits

Soil pits measuring a square metre were dug to a depth where no further change in the type of soil was evident ie. approximately 50 to 60 cm deep. Pits were dug beside the Palisades Creek upstream of Swift's Ditch, and in the Aspen stand where water flow is now impeded.

Results and Interpretation

Site Description

Jasper National Park (52°N, 118°W) is located in the Rocky Mountains of Alberta, about 400 km west of the city of Edmonton, occupying a total of 10,880 km² (Higgs, 1999, p. 39). The study site, the Palisades Centre and Swift's Ditch, are located in the montane ecosystem of the Athabasca River Valley about 14 km northeast of and downstream from the Jasper townsite. The study site is backed by the Palisades Mountain Range. The area is disrupted by the Canadian National Railway line, the Edmonton-Jasper highway, the Snaring Road and two pipelines.

Hydrological interactions play a critical role in determining the distribution of vegetation, wildlife and natural structure within this landscape (Taylor, 1998, p. 3). Edith Gourley, a former member of the Jasper-Yellowhead Historical Society, remembers there being beaver ponds near the Palisades Centre before the entrance road was finished in 1979. It is difficult to know when the beavers were displaced but the size of the Aspen trees that have grown up around the former wetlands are at least a few decades old (Higgs, 2003, p. 171).

Re-establishing aquatic connectivity has become a primary ecological restoration goal for the Park. For instance, the Swift Creek culvert will be modified next year to re-establish the natural drainage regime to and from the Athabasca River to facilitate aquatic and fish connectivity. An unidentified fish species (< 3cm in length) was recorded last summer during electrofishing inventory work upstream of the culvert (Hughson, personal communication, August 2010).

Swift's Ditch measures approximately 1.5 m wide but ranges from 30 cm to 4 metres in depth. The canal runs for several hundred metres, paralleling the base of the Palisades escarpment, to deliver water to what was once an agricultural field at the Palisades Centre.



Figure 3: A Typical View of the Lower Section of Swift's Ditch

The substrate of the ditch's bank and bottom is primarily sand, with original reinforcement visible in places with sapling stringers. It appears that river rocks have been placed in the bottom of the ditch in some locations. The slope failure of the canal, or the blow out, occurs where there is a transition in gradient, where the canal descends escarpment slope and encounters the valley floor.



Figure 4: Breach of Swift's Ditch—ie. the Blow Out (2009)



Figure 5: Breach of Swift's Ditch—the Blow Out (2010)

A factor contributing to slope failure at the location of the blow out, is springtime retention of an ice plug, caused by differential thawing with the shading of several large spruce trees. Water flows over the sandy bank of the canal causing rapid erosion. When the canal breaches, the creek waters attempt to re-establish their natural drainage course, in a northeasterly direction. The original drainage course can still be traced, as a subtle intermittent meandering depression, with periodic exposure of its' rounded cobblestone bedding. From local topography and direction of flow, the former streambed is presumed to have drained to the nearby Athabasca River.

Water begins to back-flood the surrounding low lying terrain when it encounters the TransMountain pipeline (1952). No allowance was made for the watercourse during construction of the pipeline, the Snaring Road or the railway.

UTM

- Beginning of Swift's Ditch by the road leading into the Palisades Centre:
11U 0428860 5869111
- Opposite end of the ditch where it starts to divert Palisades Creek:
11U 0428305 5869613
- The blow out, where the walls of the irrigation ditch fail:
11U 0428405 5869514

Latitude Longitude (dd.mm.ss)

- Beginning of Swift's Ditch by the road leading into the Palisades Centre:
N 52°58'00.7 " W 118°03'33.3"
- Opposite end of the ditch where it starts to divert Palisades Creek:
N 52°58'16.7 " W 118°04'03.4"
- The blow out, where the walls of the irrigation ditch fail:
N 52°58'13.4 " W 118°04'00.2"

Elevation: 1055 metres

Historical Photographs



Figure 6: 1915 Bridgland Photograph of Study Area Including Both Railways and the Palisades Creek Catchment Basin (Courtesy of Jasper National Park, Station Name: Hawk Mountain; Station Number: 40; Photograph #318).

Unfortunately, Swift's Ditch is not visible in this or other Bridgland photographs because of the angle at which the photographs were taken.

Historical Air Photos



Figure 7: September 7, 1949 Aerial View of Pyramid Ranch Lodge (known today as the Palisades Centre) (Photograph Courtesy of Alberta Photo Services—Roll AS145 Print 52, 1:40,000 original scale)

It took from 1949 to 1952 to take aerial photographs of the entire province of Alberta (Sidney Wood, personal communication, August 2010). Historical records held by Kinder Morgan Canada indicate that planning, survey, and mapping of the TransMountain pipeline started in 1951 (Mears, email August 16, 2010). Therefore, the fresh scar to the west/northwest of the north pasture appears to be Swift's Ditch.

The location of Swift's Ditch is clearer when comparing the 1949 aerial photograph to the 1958 aerial photograph taken after the construction of the pipeline (figure 8). The TransMountain pipeline is clearly visible as is the irrigation ditch, in the 1958 aerial photograph.



Figure 8: 1958 Aerial View of Palisades Ranch and Motel (known today as the Palisades Centre) (Photograph Courtesy of Alberta Photo Services—RollA16083 Print 116, 1:40:000)

Historical Development Plans

A 1911 Grand Trunk Pacific Railway map (figure 9) shows how Swift's Creek was diverted by an irrigation ditch to his garden plots. Swift's Ditch, the irrigation ditch that is the focus of this report is not shown on this sketch.

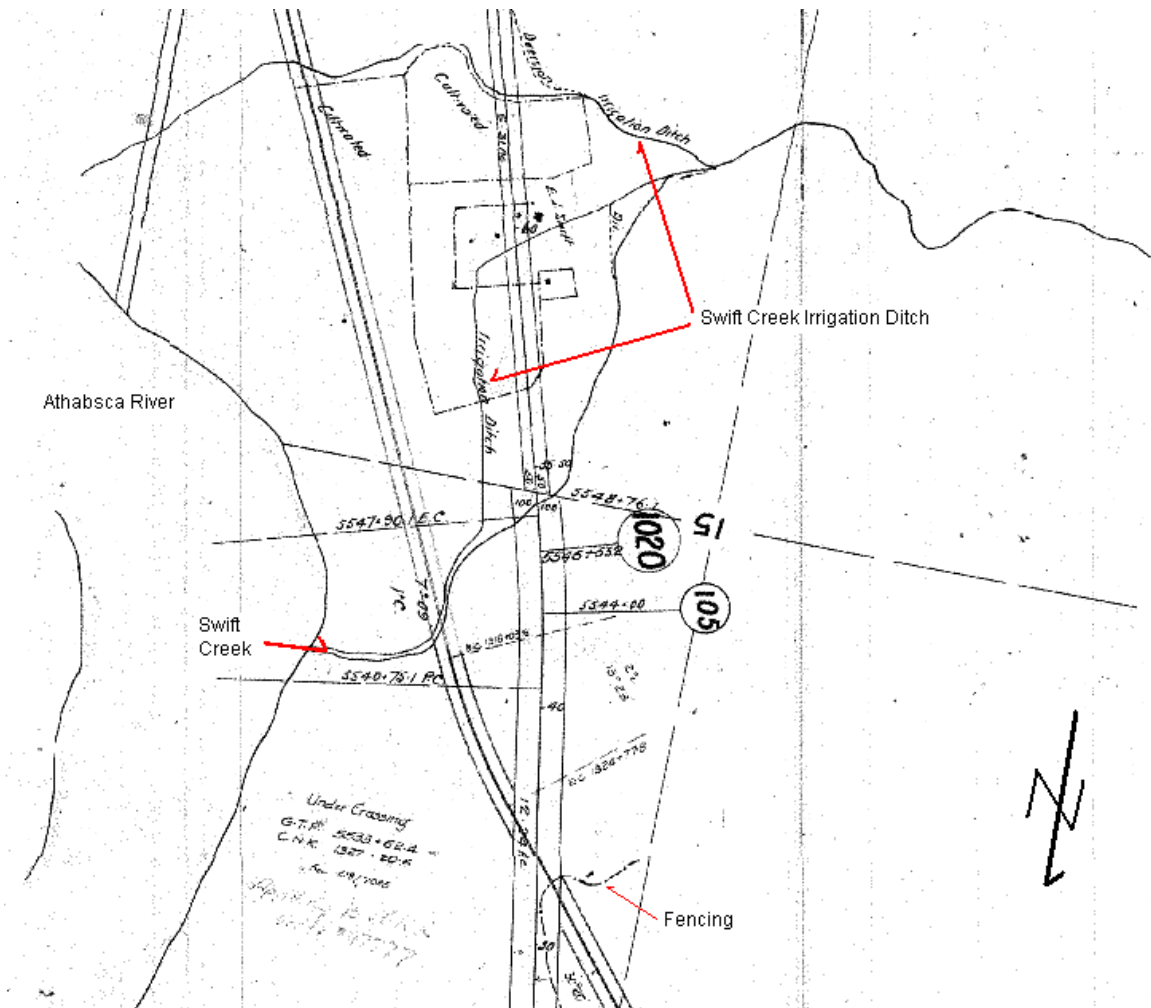


Figure 9: 1911 Grand Trunk Pacific Railway Map showing Swift Creek and the Irrigation Ditch to his Garden Plots. Swift's Ditch is not shown.

Swift Creek was redirected prior to 1911 as indicated on the above 1911 railway design plan. A portion of Swift Creek was abandoned, although the channel is still free to drain into a diversion ditch and the culvert under the railway and highway. Swift's Ditch, the study site, drains into the lower abandoned portion of Swift Creek (at N 52° 58'00.7" W 118° 03'33.3").

Presently, Swift Creek does not flow directly (above ground in its' channel) into the Athabasca River during the late winter months. A short distance upstream (< 0.3 km) there is water flow in Swift Creek during the same time period, thus, there is phreatic outflow from the creek.

A 1918 CNR Construction plan (figure 10) also shows Swift's Creek but not Swift's Ditch.

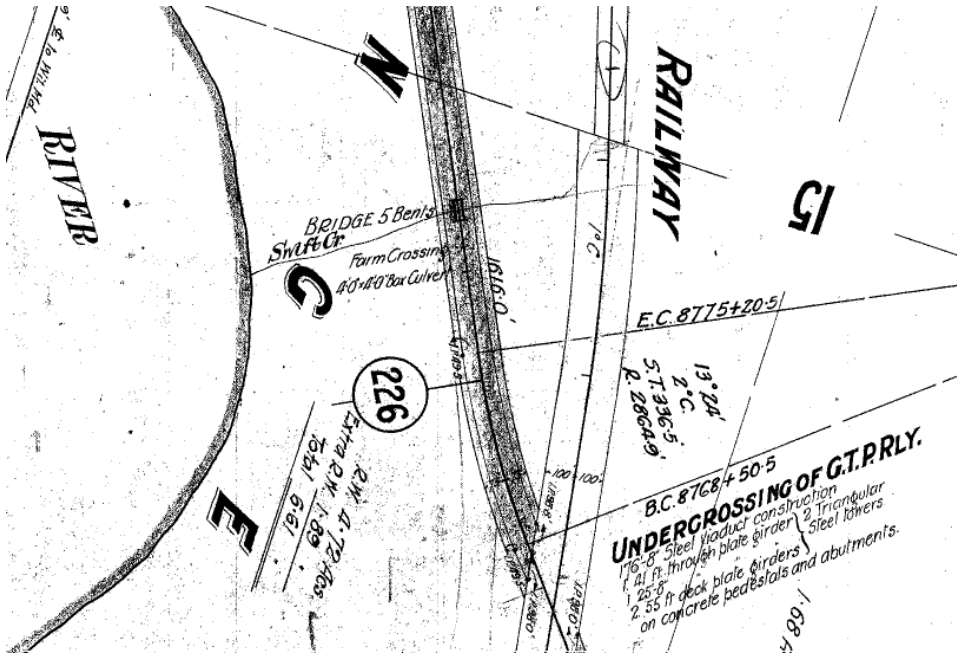


Figure 10: 1918 CNR Construction Plan—note Swift Creek. Swift’s Ditch is not shown.

Other infrastructure in the study site area includes roads and the pipeline. From 1948 onward the National Parks Branch invested heavily in upgrading roads, such as the Edmonton-Jasper Highway, paving many sections of road and building new bridges.

The pipeline in the study area was established in March 21, 1951 and completed in 1953. Engineering and construction of the pipeline was completed in 30 months with the first shipment of oil reaching TransMountain’s Burnaby terminal on Oct. 17th 1953.

Toni Klettl, retired Park Warden, first came to Jasper in the spring of 1952. He worked for Comstock Midwestern as a powderman doing the blasting along the right of way for the pipeline from Devona to Mt. Robson. According to Toni, no work was done on Swift’s Ditch when the pipeline went through.

The Superintendent’s Annual Report for the three months ending March 31st, 1952 states that the right of way of the proposed pipeline construction between Jasper and the East Gate and between Jasper and Yellowhead was cruised and the value of standing timber computed.

A core was taken through the pith of the largest tree (an Engelmann spruce) found standing in the ditch on November 16, 2009. The tree was located 50 metres west of the Palisades access road. A count of the tree rings in the core indicated that area of the ditch had not been disturbed since at least 1991.

Biophysical Description



Figure 11 showing the Ecosite boundary

Swift's Ditch is located in the AT1/3 ecosite (the Athabasca ecosection). The AT1/3 ecosection encompasses terraced landforms of calcareous glaciofluvial material in the montane ecoregion with a 0 to 5% slope. The AT1 ecosite is found on floors and the lower benchland of broad valleys with a gentle gradient that accommodated large volumes of glacial meltwater (Holland, 1982, p. 174).

Soils are typically predominantly Orthic and Eluviated Eutric Brunisols. They are also usually rapidly to well drained because of the pervious nature of the glaciofluvial materials and the low precipitation in the montane (Holland, 1982, p. 176).

AT vegetation is typically lodgepole pine/juniper/bearberry, lodgepole pine/buffaloberry/showy aster and lodgepole pine/buffaloberry/twinflower (Holland, 1983, p. 98). Most tracts of AT1 have generally been influenced by fire within the past century, including the study site. Tracts of AT1, such as the area around Swift's Ditch, are frequently disturbed by human activity e.g. borrow pits are common (Holland, 1982, p. 177).

The AT ecosection is very important to wildlife especially ungulates, carnivores and bats. Some small mammals also occur in large numbers. The relatively warm temperatures and low amount of snow accumulation make the area suitable for wildlife (Holland, 1983, p. 98).

Vegetation

The Aspen stand in the non-impered wet area appears to be healthier (larger and fuller canopy) than the drier site. Mature balsam poplar are present on the dry side, but are standing dead or down. There are thirteen plant species recorded in both transects. However, in the water impeded area there were also two invasive weeds as well as Lodgepole pine. The water impeded area has plants which thrive in moderate to drier areas and appears to have lost several species which require moist conditions e.g. Balsam poplar, White thistle, willow, Colts foot and horsetail.

There is a dense regeneration of Aspen (<1cm diameter) in both the water impeded and non-impered areas. The non-impered area was burned by a prescribed fire approximately 10 years ago, which likely explains why Aspen has re-generated in the drier, more stressed stand. While the regeneration in the wetter, non-impered area is concentrated in the regularly flooded areas of that particular site.

There are several other herbaceous species that are generally present in very low numbers (<1 to 5%) on the wider landscape but were not observed directly in the vegetation transects.

Transect 1. Impeded water flow area (NE of pipeline)



Figure 12: Vegetation in the Water Impeded Area, Northeast of the Pipeline

This area was burned in a prescribed fire approximately 10 years ago. All Balsam poplar are dead in this stand. The ground is dry, however it looks like it is moist for a portion of the year. Clover is present throughout the stand, and there are thick patches of mustard along the pipeline.

Start Location: N 52° 58'14.3" W 118° 03'41.5" heading NW

Intersect 0 m — 1 m² Vegetation Plot

Buffalo-berry	<i>Shepherdia Canadensis</i>	30 %
Wild Rose	<i>Rosa acicularis</i>	30 %
Snowberry	<i>Symphoricarpos albus</i>	15 %
Trembling Aspen	<i>Populus tremuloides</i> regen.<1cm diameter	5 %
Grass		15 %
Strawberry	<i>Fragaria virginiana</i>	5 %

Intersect 5 m (from most abundant to least abundant)

Balsam poplar	<i>Populus balsamifera</i> (are standing dead)
Buffalo-berry	<i>Shepherdia Canadensis</i>
Snowberry	<i>Symphoricarpos albus</i>
Wild Rose	<i>Rosa acicularis</i>
Grass	

Intersect 10 m (from most abundant to least abundant)

Wild Rose	<i>Rosa acicularis</i>
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Trembling Aspen *Populus tremuloides* regeneration <1 cm diameter
Raspberry *Rubus idaeus*

Intersect 15 m (from most abundant to least abundant)

Down woody debris ie. Trembling Aspen *Populus tremuloides*
Trembling Aspen *Populus tremuloides* regeneration <1 cm diameter
Red Osier Dogwood *Cornus stolonifera*
Raspberry *Rubus idaeus*

Intersect 20 m (from most abundant to least abundant)

Grass
Down woody debris Trembling Aspen *Populus tremuloides*
Wild Rose *Rosa acicularis*
Trembling Aspen *Populus tremuloides* regeneration <1 cm diameter
Clover

Intersect 25 m (from most abundant to least abundant)

Trembling Aspen *Populus tremuloides* regeneration <1 cm diameter
Wild Rose *Rosa acicularis*
Open ground 20%

Intersect 30 m – 1 m² Vegetation Plot

Grass		40 %
Down woody debris Trembling Aspen	<i>Populus tremuloides</i>	30 %
Snowberry	<i>Symphoricarpos albus</i>	15 %
Wild Rose	<i>Rosa acicularis</i>	5 %
Lodgepole pine	<i>Pinus contorta</i> regeneration < 1cm diameter	5 %
Northern bedstraw	<i>Galium boreale</i>	< 1 %

Transect 2. Area with no impeded water flow (NW of pipeline)



Figure 13: Vegetation in area of non-impeded water flow, northwest of the pipeline

Approximately 50% of this area appears to receive standing water as indicated by floatsam debris, moist and wet, open ground. The original channel for Palisades Creek is moist, there is no vegetation growing in it and it appears to have some water in it annually. The forest stand is approximately 80% Aspen and 20% Balsam poplar, which is concentrated along the original Palisades Creek channel, although they are found throughout the stand. The ground is dominated by leaf litter.

Start Location: N 52° 58'16.2" W 118° 03'58.2" heading SE

<u>Intersect 0 m –</u>	1 m² Vegetation Plot	
Balsam poplar	<i>Populus balsamifera</i>	25 %
Ground leaf litter		60 %
Down woody debris		5 %
Wild Rose	<i>Rosa acicularis</i>	5 %
Raspberry	<i>Rubus idaeus</i>	1 %
Colts Foot	<i>Petasites palmatus</i>	1 %
Horsetail	<i>Equisetum pratense</i>	1 %

Intersect 5 m (from most abundant to least abundant)

Currant	<i>Ribes triste</i>
Wild Rose	<i>Rosa acicularis</i>
Ground leaf litter	
Down woody debris	

Intersect 10 m (from most abundant to least abundant)

Red Osier Dogwood *Cornus stolonifera*

Grass

Down woody debris

1 Beaver stump

Intersect 15 m (from most abundant to least abundant)

Trembling Aspen *Populus tremuloides* regeneration <1 cm diameter

Grass

White Thistle *Cirsium hookerianum*

Ground leaf litter

Intersect 20 m (from most abundant to least abundant)

Willow *Salix spp.*

Red Osier Dogwood *Cornus stolonifera*

Trembling Aspen *Populus tremuloides* regeneration <1 cm diameter

White Thistle *Cirsium hookerianum*

Grass

Moss

Intersect 25 m (from most abundant to least abundant)

Red Osier Dogwood *Cornus stolonifera*

Currant *Ribes triste*

Grass

Ground leaf litter

Down woody debris and floatsom

Intersect 30 m – 1 m² Vegetation Plot

Currant *Ribes triste* 40 %

Grass 30 %

Ground leaf litter 20%

Down woody debris and floatsom 10 %

Hydrology



Figure 14: Swift's Creek and Palisades Area Hydrology

Figure 14 is a visual representation of the following data which was recorded using a GPS device:

1.26 km ²	Of the area is flooded annually
2.7 km ²	Of the area NW of pipeline regularly floods; no impediments
4.4 km ²	Of the area SE of pipeline floods irregularly due to impediments
1.3 km ²	Of the area which historically drained flood waters to Swift Creek
8.4 km ²	Total area which would have been flooded prior to impediments.
32 %	Percent of original area functioning as per natural drainage regime
52 %	Percent of original area that infrequently floods over pipeline
16 %	Percent of original area which no longer receives flood water

Palisades Creek drains a relatively small catchment (approximately 5 km²). The catchment area has a NE aspect and is therefore, partially shaded by the tall Palisades cliff. This probably results in lower temperatures and helps minimize winter and early spring melting, until higher temperatures are experienced later in the spring. The shading would also promote and extend ground frost, particularly in the moist soils associated with the lower flat areas of the study area. Thus, when spring melt conditions occur, a large portion of the study area may still have frozen soils, promoting flooding conditions.

Palisades Creek was redirected (at N 52° 58'16.7" W 118° 04'03.4") into a manmade ditch, commonly called Swift's Ditch (see figure 14). The original creek flowed into the flatter study area at the base of the Palisades cliff where water flow is non-impeded. Within the study area, the creek is a 50cm deep channel, with an extensive surrounding flat area. Flood conditions would result in this flat area being inundated with water. A breach ("blowout") in the Swift's Ditch (at N 52° 58'13.4" W 118° 04'00.2") presently allows the creek to drain into this same flat area. There is a pond here where there are 1m high watermarks on the trees.

During high water levels the original Palisades Creek in this lower flat area, fills with water and drains towards the pipeline. The pipeline is raised up approximately 1m above the surrounding terrain and has impounded the Palisades Creek. The creek water has made it out onto the pipeline, resulting in a small, eroded drainage area.

Prior to installation of the pipeline the creek would inundate the area referred to as the water impeded area (NE side of pipeline). There is no defined creek bed in this area and the water would have filled the lower terrain and drained towards Swift Creek. There are two 0.3 ha sized excavations which appear to be an attempt to impound water, adjacent to and on the NE side of the pipeline. One of these areas contains mature, live Aspen trees, and the second has extensive stocking of Aspen regeneration (<1 cm diameter) growth. The water impeded area (NE side of pipeline) would have received water annually and appears to presently only receive direct water flow during extreme flood conditions. The area likely receives some phreatic water flow.



Figure 15: Area of non-impeded water flow at base of slope below blow out in the area where beaver ponds have historically been found.



Figure 16: Showing the location where Palisades Creek (dip in the slope) meets the pipeline

The impeded water area NE of the pipeline flooded over the Palisades Training Centre road in 1993 and 1997. Archival records of total precipitation, snow pack, temperature and hydrological discharge for the larger watershed were analysed to determine if there is a cause and effect relationship for the flooding.

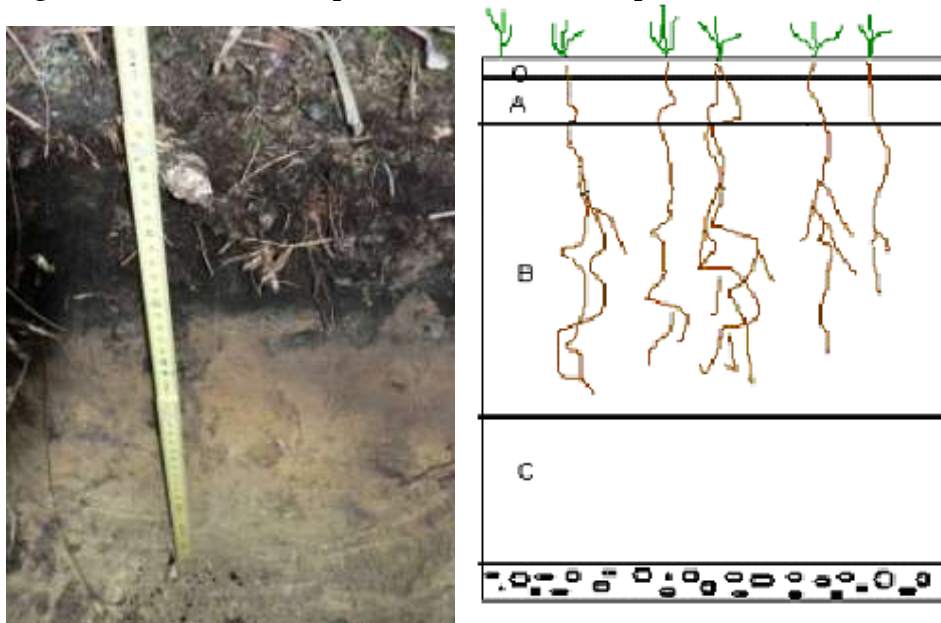
The total precipitation in 1993 was above the historic average, however, the other climatic parameters for 1993 and all values in 1997 were within norms. The minimum winter temperatures for both years were below average but within norms. Climatic conditions for both years were not considered extreme. Since data about the study area is limited at this time, the relationship between climatic

parameters and norms does not provide a reliable means of forecasting future floods, nor is there enough flood data available about the study area to do this.

A review of hydrometric archival data for peak discharge for the Athabasca River adjacent to the study suggests that there is no direct relationship between the larger watershed and the study area in regards to discharge and flood years. This data represents only the peak discharge per year and is influenced by factors not present in the study area such as upper icefield and extensive alpine snow pack melt (Water Survey Canada, archival hydrometric data, 1977 to 2009).

Soil Pits

Figure 17: Pit # 1 Aspen Stand – water impeded area



Horizon	Depth	%Sand	Ribbon	Feel	Taste	Texture
Of	0–9 cm					litter organics, moss
A	9–22 cm	0	thick, breaks	not grainy	no sand	dark organic soil with roots
B	22–32 cm	0	thick breaks	not grainy	no sand	dark brown with leaching
C	below 32 cm	>50%	none	v. grainy no flour	sand	sand and gravel

This is a flat area that has flooded in the past. The Biophysical Land Classification describes typical soils in the ecosite as Brunisols. However, the soil pit indicates more of a Gleysolic soil, which is often associated with fluvial landforms.

The soil pit within the water impeded area (NE of the pipeline) indicated that the soils there developed in an environment with regular litter accumulation and decomposition, moist but not saturated, and with little disturbance. It is consistent with the slightly depressed topography, somewhat regular water accumulation and deciduous forest with a thick understory.

Figure 18: Soil Pit #2 Palisades Creek side, upstream of Swift's Ditch



This uniformity of this pit indicates that there has been no digging or disturbance in this area. It also confirms the location where Swift's Ditch starts.

Discussion

In 1988 the Federal Heritage Building Review Office (FHBRO) recognized the Palisades Centre as a Federal Heritage Complex and Level II resource. A Level II resource is a resource that is not of national significance but which may have historic value and is therefore, considered a cultural resource (Wagner, 2000, p. 61). This includes such features as the buildings, the waterwheel, the graves, the survey pins and wooden culverts. The next step will be to ensure that the Palisades Centre is recognized as a cultural landscape, including Swift's Ditch. Measures to commemorate and preserve this cultural landscape will be included in a cultural resource plan for the area (Dillon, personal communication, August 2010).

The current theories about how Swift Ditch's was created are as follows:

1. The ditch may have been constructed for agriculture sometime between 1890 and 1920 by the Swift family, or perhaps later during a subsequent guest ranch phase.
2. The ditch may have been constructed to protect the pipeline (1952) or the access road to the Palisades Centre that was constructed in 1979. There is a regular berm along the right side of the ditch, which may indicate it is a mechanically created or modified ditch rather than hand dug. The ditch appears in aerial photography in 1949.
3. The ditch may have been originally dug by Swift and then modified at a later date. Leigh Pitoulis, retired manager of the Palisades Centre said that it was dug deeper in the 1980's to resolve the flooding issues (Pitoulis, personal communication, 2009). Mike Greer, highways staff, Parks Canada, reports that the ditch was not modified when the backhoe was used to remove trees in the area of the ice plug in 1998. Large rocks were also removed from the ditch at that time (Greer, personal communication, August 2010).

Hopefully other historical documents or personal accounts will be found that can provide more information about how the ditch was made. It would also be useful to gather data about how the drainage regime in the area and within Swift's Ditch functions throughout the year, over the course of several years. It would also be interesting to monitor hydrology and vegetation change on this landscape within the context of climate change.

Recommendations

1. Remove the invasive weeds e.g. mustard that are found in the area.
2. Carry out dendochronological work if appropriate structural pieces of wood can be found in Swift's Ditch. This may provide further information about how and when the irrigation ditch was constructed.
3. Gather stakeholders e.g. railway, pipeline, Parks Canada resource conservation, highways, and asset management and the Palisades Working Group, to discuss options for both returning natural drainage regime across the pipeline and addressing any floods that may arise and threaten the roadway, railbed, pipeline and the cultural integrity of the ditch. Include a hydrological engineer on the Parks Canada team. Static water is less of a concern as far as erosion of the roadbed than moving water but any modification of the present drainage pattern could have implications for infrastructure "downstream" of the changes (Lee, personal communication, August 2010). The Aspen area is currently functioning as a natural storm drainage pond.
4. Investigate the possibility of installing a swale across the pipeline in the area of the original creek bed to ensure water is returned to the wetland and Aspen area that has historically been regularly inundated with water. A swale directing annual water flow across the pipeline would support the re-establishment of the Aspen stand ie. species composition, structure and function. Presently 32% of the Aspen stand has full composition, structure and function. Allowing flow across the pipeline would increase this to 84%. A swale would also provide the pipeline with more protection from floodwaters than it presently has.
5. Although the ditch has been breached again since the repairs in 1998, ie at the "blowout", the road has not been flooded. Since repairs in the area of the blowout have not been successful in the past, re-establishing the flow to the lower portions of Palisades Creek should be considered. Flooding across the road only occurs during extreme discharge periods. This only occurs after the entire low laying Aspen stand has been inundated with water. Re-establishing the original creek flow would not change this process or increase flooding across the road. It would however, permit more regular flow of water to the stand on the northeast of the pipeline.

6. A written log of when and where flooding occurs should be maintained.
7. An interpretive sign should be installed near Swift's Ditch, including the need for additional information about the construction of the canal. A description of the ditch should be included in historical accounts about the Palisades Centre.
8. The effects of the swale, if installed, on e.g. on vegetation species and composition and the movement of water should be monitored on an annual basis.
9. Research should continue to find additional documentation e.g. photographs, maps, documents, oral accounts about the creation of Swift's Ditch, as well as landscape changes that have been made in the area e.g. National Archives of Canada. Images of the area dating to the 1920's may be available from the federal government.

Conclusion

Swift's Ditch is remarkable for the effort it must have taken to excavate if hand dug early settler Lewis Swift, and also for the historical significance of the Palisades Centre with which it is associated. Piecing together the history of Swift's Ditch and the history of disturbance and landscape change in the area is challenging. However, considering both cultural and ecological history when developing an ecological restoration plan ensures that goals set for that particular place will be respect both elements. Historical information about landscape processes and patterns should be used to design that landscape's future. Not only does this approach suggest what might work for a particular site, it may also lead to the development of a wider range of possibilities for ecological restoration activities at that site and for ecosystem management on a wider scale (Higgs, 1999, p. 27).

Acknowledgments

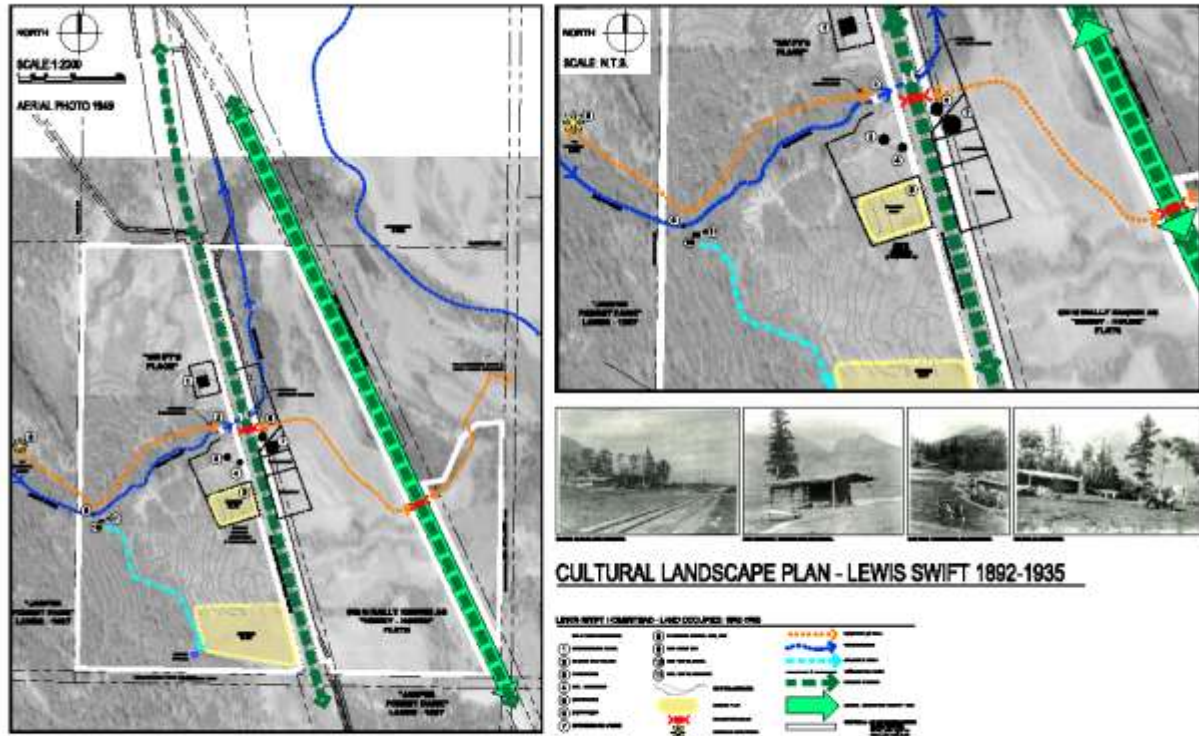
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Appendix A – Cultural Landscape Plan – Lewis Swift, 1892-1935



References

Bartram, J., L. Pitoulis. Dec. 2008. The Parks Canada (Palisades) Stewardship Education Centre. Parks Canada, Jasper.

Bayley, Dr. S., J. Guimond, S. Majewski and W. Hughson. June 15, 1998. Restoration of riparian and floodplain wetlands affected by transportation systems in the Athabasca Valley: First Year Report. Report to Parks Canada (1997) Jasper National Park.

Cardiff, S. February 11, 1999. Palisades restoration problem scenario. Parks Canada, Jasper.

Gem Trek Publishing. Jasper and Maligne Lake. Cochrane, Alberta, Gem Trek Publishing, 2004, scale 1:100,000

Higgs, E., S. Campbell, I. MacLaren, J. Martin, T. Martin, C. Murray, A. Palmer, and J. Rhemtulla. 1999. Culture, ecology and restoration in Jasper National Park. University of Alberta, Edmonton.

Higgs, E.S. 2003. Nature by design : people, natural process, and ecological restoration. The MIT Press, Cambridge, Massachusetts.

Holland, W.D., G.M. Coen. 1982. Ecological (biophysical) land classification of Banff and Jasper National Parks volume II: soil and vegetation resources. Alberta Institute of Pedology Publication No. SS-82-44, Edmonton.

Holland, W.D., G.M. Coen, 1983. Ecological (biophysical) land classification of Banff and Jasper National Parks volume I: summary. Alberta Institute of Pedology Publication No. M-83-2.

Holroyd, G., K.J. Van Tighem. 1983. Ecological (biophysical) land classification of Banff and Jasper National Parks volume III: the wildlife inventory. Environment Canada, Canadian Wildlife Service

Land Resource Branch Institute, Research Branch, Agriculture Canada. 1981. Ecological (biophysical) land classification of Banff and Jasper National Parks

Alberta, 8-2 Jasper National Park NTS 83C/12 Department of Energy, Mines and Resources. 1:50,000.

MacFarlane, K., Architectural History Branch. ?. National Training Centre (former Palisades Ranch), Jasper National Park, Alberta. Federal Heritage Buildings Review Office Building Report 87-10

MacLaren, I.S. 2007. Culturing wilderness in Jasper National Park : studies in two centuries of human history in the Upper Athabasca River watershed. The University of Alberta Press, Edmonton.

Parks Canada. 2000. Jasper National Park of Canada management plan. Minister of Public Works and Government Services Canada, Ottawa.

Pole, G. 1994. Classic hikes in the Canadian Rockies. Altitude Publishing Canada Ltd, Banff/Canmore.

Rhemtulla, J.M. 1999. Eighty years of change: the montane vegetation of Jasper National Park. Thesis for Master of Science, University of Alberta.

Taylor, C.J. 2009. Jasper a history of the place and its people. Firth House, Markham.

Taylor, G.W. 1998. Surface and groundwater observations Athabasca Valley, Jasper National Park May – October 1998. Part of the 1998 Summer Project on restoration of riparian and floodplain wetlands affected by transportation systems in the Athabasca Valley, Dr. Suzanne Bayley University of Alberta 1997-1999, Edmonton.

TransMountain: Celebrating 50 Years of Excellence 1951-2001. Calgary, 2001.

Urion, C.J. Summer 1995. Human Influence Project Pilot Final Report. Prepared for Parks Canada, Jasper.

Wagner, J.L. January 2000. The Palisades Centre, Jasper National Park, an adaptive rehabilitation of a cultural landscape. A Practicum Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Landscape Architecture, University of Manitoba, Winnipeg, Manitoba, Department of Landscape Architecture.