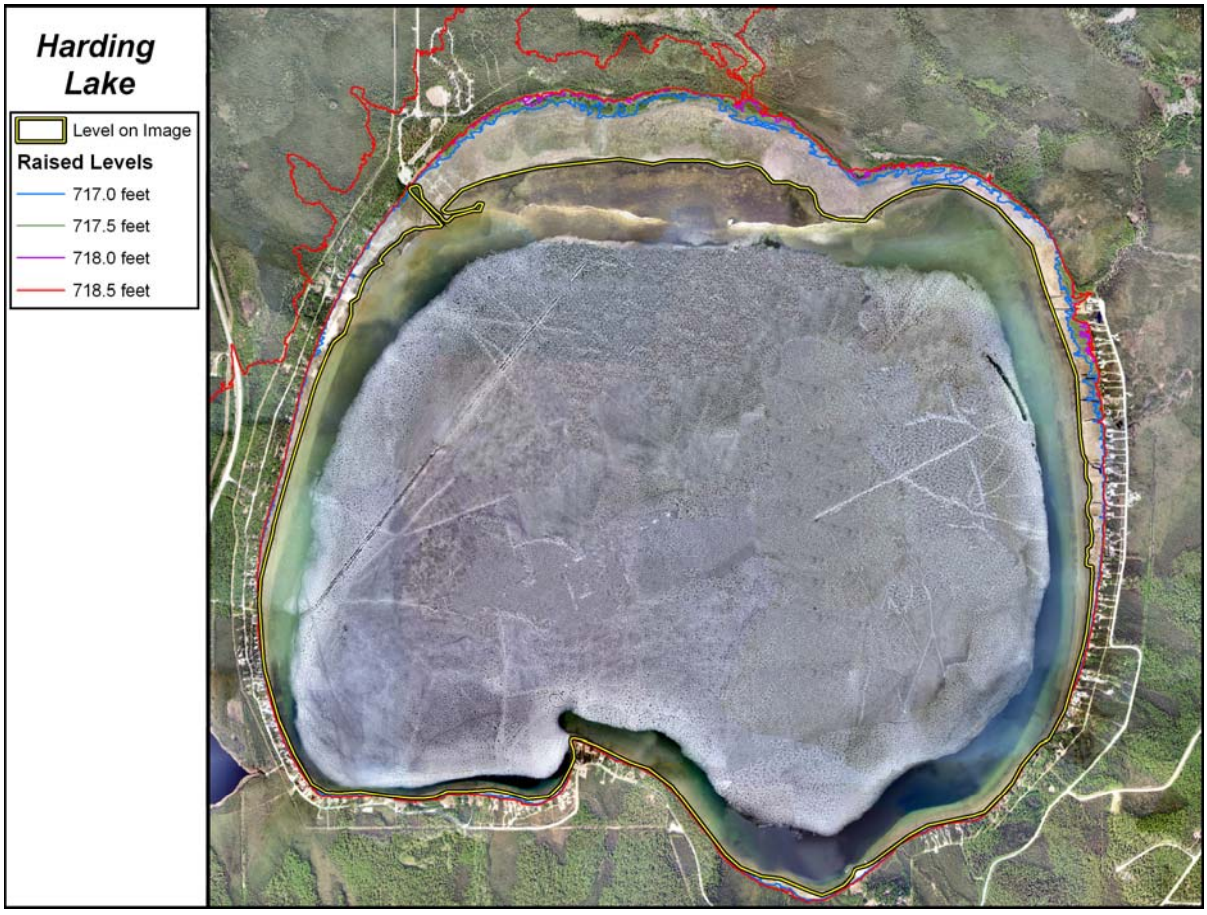
ENVIRONMENTAL ASSESSMENT

HARDING LAKE AQUATIC HABITAT ENHANCEMENT PROJECT



USDA – NATURAL RESOURCES CONSERVATION SERVICE – December 13, 2005

In partnership with Salcha-Delta Soil and Water Conservation District and the Alaska Department of Fish and Game

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SUMMARY

The U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS), through the Salcha-Delta Soil and Water Conservation District (SWCD), in cooperation with the State of Alaska, Department of Fish and Game (ADF&G), proposes to restore approximately 135 acres of vegetated lake-shallow (lacustrine littoral aquatic bed) (Cowardin, L. 1979) wetlands at Harding Lake, Alaska, for the purpose of restoring spawning and rearing habitat primarily for northern pike (*Esox lucius*) and least ciscoes (*Coregonus sardinella*). The water to re-flood these areas will come through the Harding Lake channel of Rogge Creek near the north shore of Harding Lake, Section 32, T 5S, R 5E, Fairbanks Meridian.

The proposed actions are intended to increase and regulate the water level in Harding Lake, through the operation of a sheet pile weir system on Rogge Creek

Three alternatives were evaluated:

- No action;
- A sheetpile weir system located at the Rogge Creek channel forks;
- A sheet pile structure with a 390’ earthen dike located approximately 285’ upstream of the Rogge Creek channel forks.

INTRODUCTION

Project Area Resources

General Description

Harding Lake is located 44 miles southeast of Fairbanks along the Richardson Highway. The lake has a surface area of about 2,470 acres when the lake level is high enough to submerge the entire lakebed. Maximum depth is approximately 140 feet. About 65% of the lakeshore is bordered by private property. There is also a State Park. Harding Lake is the largest roadside lake north of the Alaska Range, and important to residents and visitors for boating, fishing, swimming, and other water recreation, and winter recreation. The wetlands that border the lake, and the shallow waters that comprise the littoral zone, provide important habitat for fish and wildlife, and help maintain water quality in the lake.

Watershed Area

The current active watershed area for Harding Lake encompasses a primary basin of approximately 8.9 sq. miles. It is comprised of the land and hills immediately surrounding the lake, including Little Harding Lake and a north shore wetland complex that extends into Tanana Valley State Forest. A secondary intermittently active basin is the Rogge Creek drainage, which encompasses approximately 10 sq. miles and includes Whale Lake, Rogge Creek and associated small unnamed drainage features. The Rogge Creek drainage currently only provides water to Harding Lake during very high precipitation and break-up events.

Vegetation

Fire suppression efforts have resulted in the maturing of the boreal forest of the Harding Lake and Rogge Creek basins. Vegetation type is driven by terrain and soil type.

Along the Rogge Creek streambed, where drainage is better, there is a generally narrow zone with stands of larger deciduous trees (birch, aspen, and balsam poplar) and white spruce. In some areas there are well-developed shrub understories. Alder, some willows, high bush cranberries, wild rose and other shrubs and some grasses are present. The largest trees are along the lower part of the streambed just east of Harding Lake. Streamside trees get progressively smaller upstream.

Outward from these well-drained areas lays a poorly drained muskeg zone dominated by a boggy bed of sphagnum moss with generally small black spruce and Siberian larch (tamarack) as the dominant large vegetation. Understory is often sparse, and consists primarily of grasses in low densities, with a patchwork of Labrador tea, blueberries, low bush cranberries, and similar shrubs able to subsist in some areas. A few small depressions contain cottongrass and other semi-aquatic grasses. As terrain rises into the hills surrounding the valley and drainage improves, the wet muskeg/black spruce complex gives way to forest similar to that along the streambed, with white spruce (some stands of a commercially valuable quality) and deciduous vegetation and understory as occurs along the streambed.

Harding Lake nearshore emergent plants and rooted aquatic vegetation with floating leaves consists of beachgrasses tolerant to partial submergence, equisetum, elodea, scattered patches of eelgrass and duckweed, and a very few cattails and water hyacinths. While lily pads are present in Little Harding Lake (connected to Harding Lake by a short stream), there are none in Harding Lake. The nearshore plants exist in water depths out to about 30 inches, and are most abundant along the more gently sloping northern half of the lakeshore. Zones of dense emergent beachgrass and equisetum are present in the northeastern and northwestern portions of the northern flats. Potamageton is the dominant vascular plant in the deeper littoral zone, typically growing to the surface from depths ranging from about 36 inches to 18 feet. Distribution is driven by bottom type, and densities range from scattered individual plants to a patchwork of dense colonies. From the outside margins of potamageton colonies some mats of chara extend along the bottom off into the depths.

Water Quality

There are no identified water quality impairments at Harding Lake and within its watershed. Sediment delivery to the lake has occurred from hillside development and spring and thunderstorm runoffs. Rogge Creek is a typical Alaskan hillside boreal forest drainage stream with waters that are usually tannic stained.

Recreation

Numerous recreational activities occur at Harding Lake and through out its watershed. Spring and summer activities include camping, fishing, boating, swimming and hiking. Fall and winter activities include ice fishing, hunting, trapping and snow machining. A State campground located along the northwest shore is operated by ADNR Parks and Recreation. A boat launch at the campground and numerous channels from private property are dredged out into the lake. In addition to channels, boat docks and elevated walk ways (some longer than 100 feet) also extend from private property out into the lake.

Riparian Zone

The riparian zone around Harding Lake varies from almost none along steep portions of the southern shoreline to widths of hundreds of feet within the dewatered northern flats. Narrow riparian zones along the southern parts of the eastern and western shorelines widen northward into the broad northern flats.

The northern flats of Harding Lake contain riparian vegetation in successional zones responding to the recession of the waterline as lake level drops and productive wetlands dry up. Progressing from the mature bordering forests, toward the dewatered lakebed, there are zones of progressively younger woody vegetation and grasses, grading into semi-aquatic grasses and finally barren, unvegetated flats near the waterline.

Along the shoreline of the southern half of the lake, beach zones are very narrow with forested hillsides dropping steeply to water or with higher, forested banks. Riparian zones are correspondingly narrow and poorly developed with areas where waves and ice scouring clean a narrow, unstable beach up to the forest.

Rogge Creek has no active floodplain within which the channel meanders. Therefore, except where it flows through the northeastern riparian zone of Harding Lake, there is very little riparian vegetation. Vegetation typical of well-drained boreal forest dominates the banks of the incised Rogge Creek channel.

Wildlife

Harding Lake contains a variety of wildlife. The lake serves as nesting, feeding, rearing, and resting habitat for numerous species of waterfowl and shorebirds, including swans, geese, loons, grebes, mallards, pintails, widgeons, shovelers, and green winged teal. Area birds and mammals include bald eagles, grouse, moose, muskrat, fox, bear, wolves and lynx.

Fisheries

Fish species include lake trout, burbot, northern pike, and least ciscoes.

Wetlands

The north shore of Harding Lake, at water elevation of 718’ ASL and higher, contains approximately 220 acres of contiguous lacustrine littoral aquatic bed wetlands. There are also small discontinuous areas of these wetlands scattered around the lake. Ground water and surface flow driven wetlands are present in low poorly drained areas through out the watershed. The Rogge Creek forks are adjacent to a typical poorly drained forest wetland complex. The Salcha channel of Rogge Creek is part of a drainage system that maintains a series of wetlands associated with the Salcha River lowlands.

Threatened and Endangered Species / State Species of Concern

There are no identified T&E species at Harding Lake. However, four birds listed as State Species of Concern are known to exist in the area and include: the Arctic Peregrine Falcon, Blackpoll warbler, Townsends warblers and Olive-sided flycatchers.

Other

It is highly probable that Harding Lake was used by indigenous peoples. However, the proposed project locations and the lake bed affected by this project are not typical deposition locations for cultural resources. Available archaeological records and surface site surveys conducted by ADNR and NRCS personnel have not identified any cultural resources in the affected areas.

PROBLEMS & OPPORTUNITIES

Watershed Area

The Harding Lake primary basin does not ordinarily produce enough runoff to maintain the lake level. The primary basin, approximately 8.9 square miles, consists of the lake, hillsides immediately around the lake and the Little Harding Lake basin. Reports written by Kane et al (UAF/IWR, 1979) and Kinshiro Nakao (U of Hokkaido, 1980) defined the hydrology and water budget of the lake with water entering the lake through hillside runoff, springs, permafrost seeps and the inlet from Little Harding Lake.

A 10 square mile historically connected secondary basin is located immediately over the hills to the east. Rogge Creek, which drains that basin, comes to a divide, at which point it can flow down a north fork into the Salcha River (through the Rogge Creek-Salcha channel), or a west fork into Harding Lake (through the Rogge Creek-Harding Lake channel). Due to the incised nature of the mainstream of Rogge Creek, the drainage currently supplies sporadic low flows to Harding Lake only during high precipitation or accelerated break-up events.

The Fall 2005 lake level was estimated at 714.5' ASL. (See Appendix C, Table 1) A water level of 717' ASL has been determined to be the minimum acceptable elevation to support sustained populations of pike and ciscoes. Casual observations by local residents and resource managers indicate that when water from Rogge Creek is flowing into the Salcha River (away from the lake) the lake level declines, except during periods of heavy precipitation or snowmelt when the level will stabilize or slightly rise due to runoff from the primary basin. Harding Lake responds slowly to inputs from ordinary precipitation events. In dry periods, Kane et al (1979) estimated that all of the runoff from the Harding Lake basin and the Rogge Creek basin would be needed to keep the lake at a productive level (approximately 717' ASL). It appears that the key to sustaining an acceptable lake level is intercepting flow from the Rogge Creek drainage.

A major 1967 flood event precipitated efforts by local residents in the 1970's to divert water toward and away from the lake with small dam structures in the Rogge Creek forks. The 1967 flood, along with the intermittent dam structures of the 1970's, resulted in a disparity in creek bed elevations at the forks. Currently, the Rogge Creek-Harding channel at the fork is at a higher elevation than the Rogge Creek-Salcha channel and requires increased water flows to overcome its higher bed elevation. The natural watershed slope flows toward the Rogge Creek-Salcha channel.

Rehabilitating flows into the Rogge Creek-Harding channel appears to be a viable option for raising and sustaining the lake level. Proposed Alternatives 1 and 2 would redirect a portion of Rogge Creek water to Harding Lake and create opportunities for more consistent and appreciable flows. This will likely result in raised lake water levels that are sustainable within a set of desirable elevation parameters.

Vegetation

The aquatic vegetation and submerged shoreline terrestrial vegetation associated with north shore pike wetlands are critical components of productive pike and least ciscoe habitat. The loss of this vegetation from declining waters has had negative impacts on both fisheries. The restoration of water into these areas will allow for re-colonization of aquatic vegetation and shoreline terrestrial vegetation.

Water Quality

The critical water quality improvement and maintenance functions typical of healthy wetlands are reduced and eventually lost as they are de-watered. Inundation and restoration of the lake wetlands will expand and enhance their water quality functions.

Recreation

Recreation at Harding Lake is impaired by the difficult lake access resulting from declining water levels. Low water level conditions result in limited boat access. The State Recreation Area and private landowners have dredge channels and install long docks into the lake at considerable expense to accommodate access needs.

Water levels also appear to impact the number of lake users. According to the Alaska Department of Natural Resources, Division of Parks and Recreation (ADNR) the public campground at Harding Lake has experienced a noticeable decline in usage compared to periods of higher water levels in the 1980's. This has resulted in a

loss of fee revenue and the associated personal spending of campground users at area businesses. ADNR expects campground and facility usage to increase if water access from the campground is improved through raised lake water levels. (See Appendix C, Table 2)

Fishing, a major lake recreation activity, has also declined. The absence of an open pike fishery, the primary sport fish opportunity at Harding Lake, has resulted in a 60% drop in angler days from a recent peak in 1996.

Riparian Zone

The riparian zones associated with the Rogge Creek-Harding channel are impacted by the lack of consistent and appreciable flows of water.

Riparian areas associated with Harding Lake are fluctuating with the declining water level. Many riparian areas along the northern end are in the process of converting into an upland community. The lake riparian zones will migrate with the water level, but the process is very slow. This slow migration of vegetation is currently dominated by grasses resulting in immature riparian areas with low function. Increased water levels with proper management will likely stabilize riparian zones along the lake shore.

Wildlife

Waterfowl

In the recent past, when lake level was higher and the wetlands were "mature" with a patchwork of aquatic vegetation at various densities interspersed with areas of open water, the northern shoreline areas were heavily used by waterfowl. Dabbling ducks (mallards, pintails, widgeons, shovelers, and green winged teal) and grebes rested and fed in these wetlands before migrating to other nesting areas as breakup progressed. High quality nesting habitat is also available adjacent to the lake. Harding Lake is a stopover for out-migrating waterfowl in the fall, and the northern wetlands were heavily utilized by ducks, geese, and swans.

Bald Eagles

Bald eagles were frequently seen hunting over the northern wetlands when the lake water level was higher. They traveled from nesting sites along the nearby Salcha River. While eagles take some waterfowl and muskrats, most of their attention seemed to be directed toward northern pike. Pike remain in the lake wetlands until late summer, and because they rest in shallow water were vulnerable to eagle predation. The pike provided a readily available food supply for the bald eagles during early summer before salmon (which arrive in July) are available in the Salcha River. As a result of low lake water levels, reduced pike population levels result in less fish available for eagles, possibly impacting eaglet rearing and fledging.

Shorebirds

With the current lake and floodplain topography, as lake level drops, the habitat for shorebirds decreases overall with the reduction in wetted lake perimeter. Net distances to favorable nest sites generally does not change as birds adjust, but smaller areas become available as dryer habitats displace suitable shorebird sites. Vegetation migrates and matures along the newly exposed lake bed, these areas are characterized by barren sand and gravel flats. Shorebird movement across these areas may increase vulnerability to predation.

Moose

The loss of shoreline wetlands reduces summer feeding area for moose seeking aquatic and emergent vegetation. An increased amount of aquatic summer feeding habitat for moose would be directly proportional to the surface area of restored shallow wetlands. Higher lake levels would also allow moose to remain closer to shoreline tree and shrub escape and shelter cover.

Muskrats

Muskrats have historically colonized shoreline areas of Harding Lake, but at present, appear to be absent from the lake. There is observed evidence that muskrats are still present at Little Harding Lake. In summer, muskrats depend on wetlands, backwaters, and margins with abundant aquatic vegetation for survival. The reduction in size of important shallow water vegetated areas has reduced potential summer muskrat food sources.

Of greater consequence, however, might be the impact of the receding waterline and lake surface elevation on winter habitat. In Harding Lake muskrats depend on vegetated deeper water areas, free of bottomfast ice. Frozen shoreline areas are not available to muskrats as a winter food source. Restoring a higher lake level will likely lead to muskrats from Little Harding Lake re-colonizing Harding Lake.

Predators

Avian (gulls and raptors), mammalian (fox, mink, lynx) and fish (northern pike) predators are impacted by the loss of prey species habitat. As prey species decline, so does the predator food supply. Water level increases will likely result in greater abundance of prey and ultimately provide increased food availability for many predator species.

Fisheries

Water levels at or below 715' ASL result in approximately 135 acres fewer wetlands and shallow littoral zones than desired by ADF&G for minimum lake water level (717'ASL), identified for sustained pike and least ciscoe populations. This habitat loss has resulted in a recruitment failure of the native northern pike population (See Table 3 appendix C). In 2000, this recruitment failure and subsequent population crash led to an emergency closure of the lake's pike fishery to sport harvest. The emergency closure was implmeneted as a permanent closure and remains in effect. The pike fishery was part of a sport fishery that generated an average of $479,146.00 a year ($122 per fishing day) in revenue prior the closure of the fishery. Currently, there is no revenue associated from the pike fishery at the lake, however, sport fishing opportunities for lake trout and burbot remain and generate an average of $258,396.00 per year. (See Appendix C, Table 3)

Stock assessment conducted by ADF&G Sport Fish Division during 1999 showed a sudden recruitment failure (no young fish) within the pike population (Scanlon and Roach, 2000). The missing age classes correspond with water level declines that reduced spawning and rearing habitat. This recruitment failure was probably not due to harvest pressure, since the parent stocks of the missing age classes were sufficiently abundant, and good recruitment should have resulted (Roach, 1998). (See Appendix C, Table 4)

Good habitat is the key to producing northern pike. When the lake level drops, spawning and rearing areas dry up or become unusable. Young pike have little cover and are subject to increased predation by other pike and fish-eating birds.

The young least ciscoes face a similar dilemma. Ciscoes spawn over deeper water, but in early summer the tiny young-of-the-year whitefish move into the vegetated areas to feed (and be eaten by young-of-the-year pike, and take advantage of the cover for a couple of months. When they are forced out to the edge of the open water, survival is reduced.

Two main adverse pike habitat effects occur in water levels below 717' ASL. The first adverse effect is to spawning and rearing success. Casselman and Lewis documented 8 inches of water as the minimum within the spawning depth range of northern pike (as well as the need for the presence of aquatic vegetation). This water depth is consistent with the size and body depth of female northern pike in their first year of spawning in Harding Lake. Water levels less than 717' ASL will move the potential spawning area toward open water, eventually resulting in no net gain of spawning and rearing areas if the final rise is less than 8 inches.

The second adverse impact on northern pike is discontinuous low berms and high spots along the contours of the shallow water areas to be restored. Most of these would be submerged with a lake level of 717' ASL. At lower water levels, they will become barriers to fish passage. These low-water barriers will prevent the wave-driven flushing action required to keep the wetlands functioning optimally and pulling nutrients into the lake.

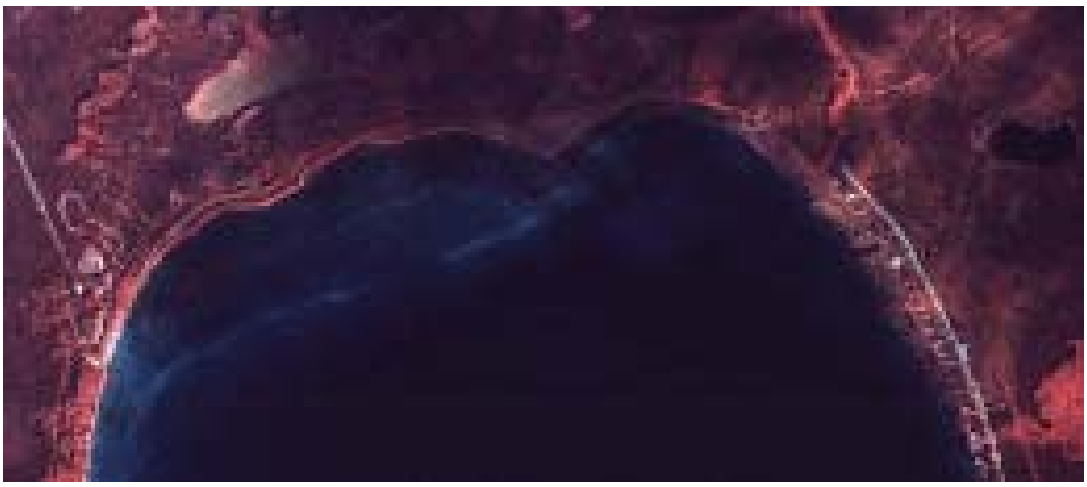
Restoration of Harding Lake water levels with attendant increased pike and ciscoe habitat could occur, via the Harding Lake channel utilizing the proposed alternative.

Once water levels are increased and pike and least ciscoe habitat is present, ADF&G has a formal management plan for restoring the pike fishery to a harvestable level and re-establishing pike sport fishing revenue.

Wetlands

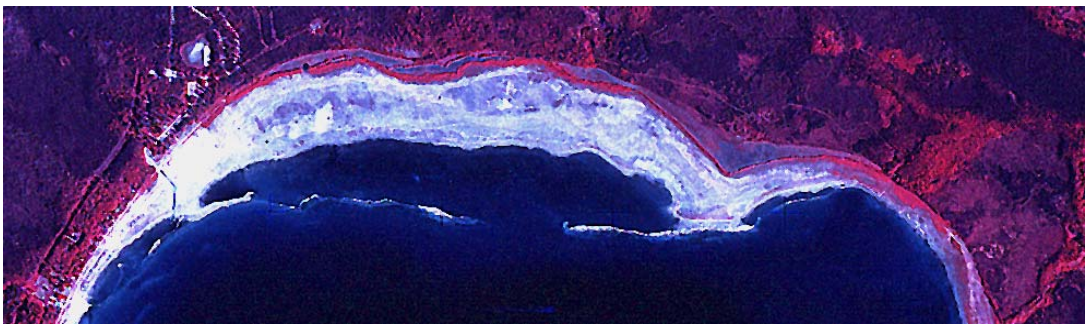
There is the potential for 220 acres of vegetated lake-shallow wetlands along the north shore of the lake when water levels are at or above 718' ASL. The current water level of 714.5' ASL has dewatered and exposed almost 100% of the 220 acre wetland complex.

Figure 1. Aerial photo of Harding Lake, 1985, showing flooded wetlands on the north shore.



UAF Photo

Figure 2. Aerial photo of the North end of Harding Lake, 1976, showing the loss of wetlands at low water levels.



UAF Photo

A restoration of water levels to ~717' ASL will restore approximately 135 acres of north shore wetlands.

A reduction in water flowing into the Rogge Creek-Salcha channel, which is one of several drainages that feed the Salcha River lowlands, will have an impact on the wetlands associated with this system. Any efforts to redirect Rogge Creek flows toward the lake must ensure sufficient water flows in the Salcha channel. It was eventually determined that an equally divided flow (0 to 12 cfs) would provide an opportunity to adequately address lake level restoration and stabilization and minimize impacts to the Salcha River.

Threatened and Endangered Species / State Species of Concern

USFWS and ADF&G as project sponsor/ partners have not determined any short term or long term impacts to any T&E species which may be present.

With increased lake levels and pike production, eagles may find a more abundant source of fish in Harding Lake for nestlings prior to pre-salmon presence in the Salcha River.

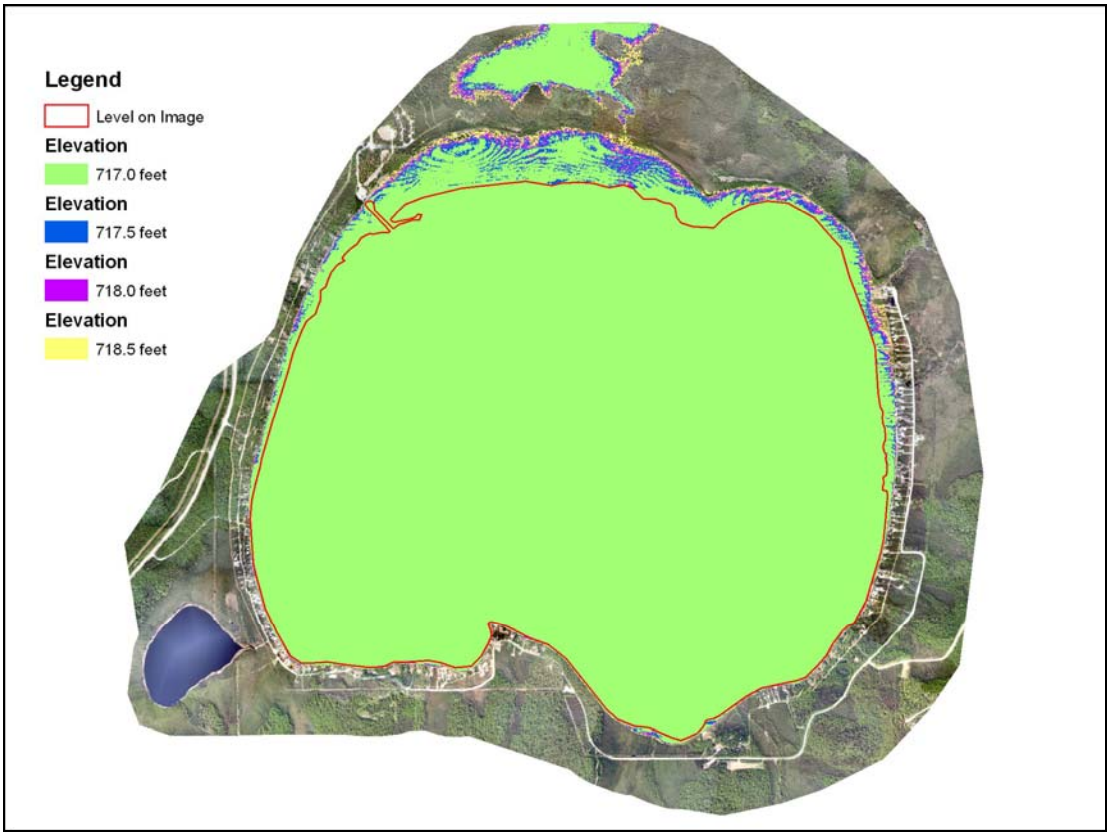
Other

Flooding

The flooding of private property and structures, including septic systems, was expressed as a significant public issue in regards to raising the lake level. According to local residents, septic systems are located upslope of the houses and away from the lake shore. Surface flooding impacts to septic systems seem highly unlikely and no reports of subsurface septic inundation during higher water levels have been discovered.

In addition to structure and septic flooding, the inundation of private property was also expressed as a concern. A detailed Ordinary High Water Mark (OHWM) survey was conducted in 2004 and resulted in a State of Alaska OHWM determination of 717' ASL. All land lower than 717' ASL is considered state property and available for inundation. This elevation is significantly lower than previous high lake levels and is the target elevation for the proposed restoration activities.

Figure 3. Varied lake water levels based on LIDAR survey data.



In situations where water levels may exceed 717' ASL, proposed measures can provide some flood control. The lake level responds slowly to water inputs. This will allow sufficient time to respond with a gate closure. All flows up to 100 cfs could be directed away from the Lake. If inflows from the primary basin and/or out of bank flooding along Rogge Creek continued to raise lake water levels, the lake level would then be subject to the natural outlet that appears to exist in the northern wetlands.

PURPOSE AND NEED FOR ACTION

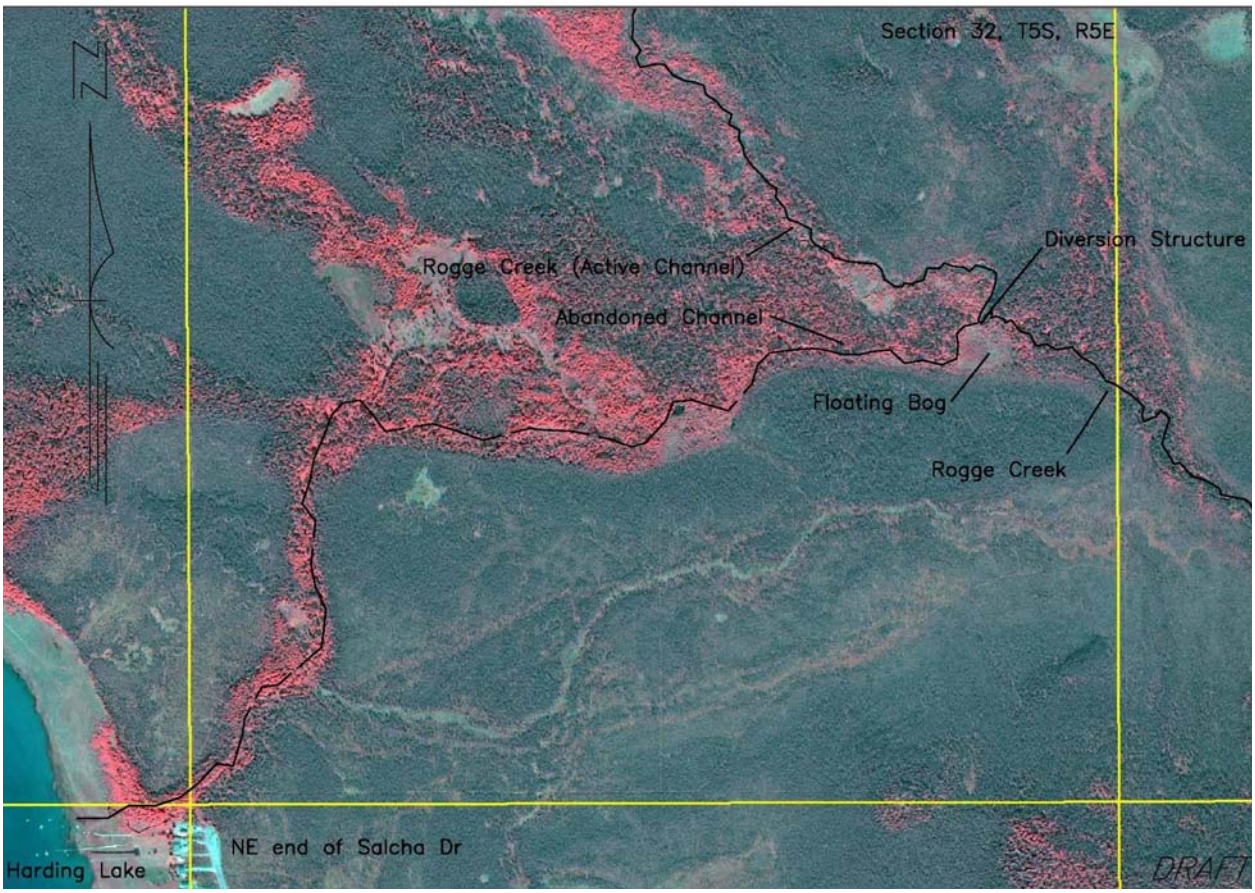
The purpose of this project is to restore and enhance approximately 135 acres of additional vegetated lake-shallow wetland in Harding Lake to serve as northern pike and least ciscoe spawning and rearing habitat. In addition, this project will provide improved habitat for mammalian and avian species. Recreation opportunities will be improved, lessening or eliminating the need for intrusive excavated access channels.

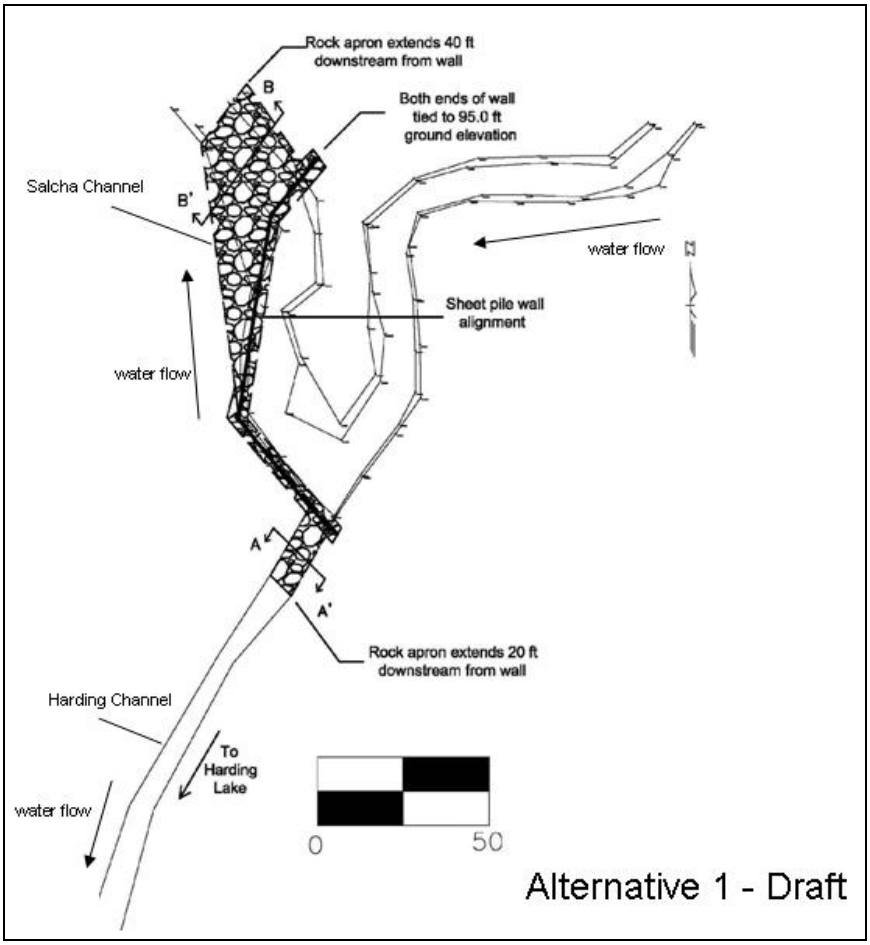
When last measured in 1999, the population of northern pike had declined 75% from the levels of the mid 1990's. Least ciscoe populations, although not specifically surveyed, are likely to have significantly decreased as well. Unless water levels are restored to suggested lake levels, pike populations and least ciscoe populations will not recover to provide the project identified benefits. Muskrats, moose and eagles will also remain un-optimized.

ALTERNATIVES, INCLUDING THE PROPOSED ACTION

Alternatives 1, 2 and No Action

Alternative 1 (Proposed Alternative)





The preferred design option will utilize a sheetpile wall, located at the channel forks. This wall will create backwater to such an elevation that water will be directed into the existing and currently abandoned channel to Harding Lake. At discharge levels below approximately 100 cfs, the distribution of flow will be controlled by two adjustable weir gates. At discharges greater than approximately 100 cfs the Rogge Creek channel exceeds its banks and the diversion structure will not control the distribution of the added flow. Out of bank flows will be subject to existing elevation changes in the surrounding land. It is unknown as to whether these flows will enter the lake, however, site specific survey data shows general watershed slope to the north, toward the Salcha River lowlands.

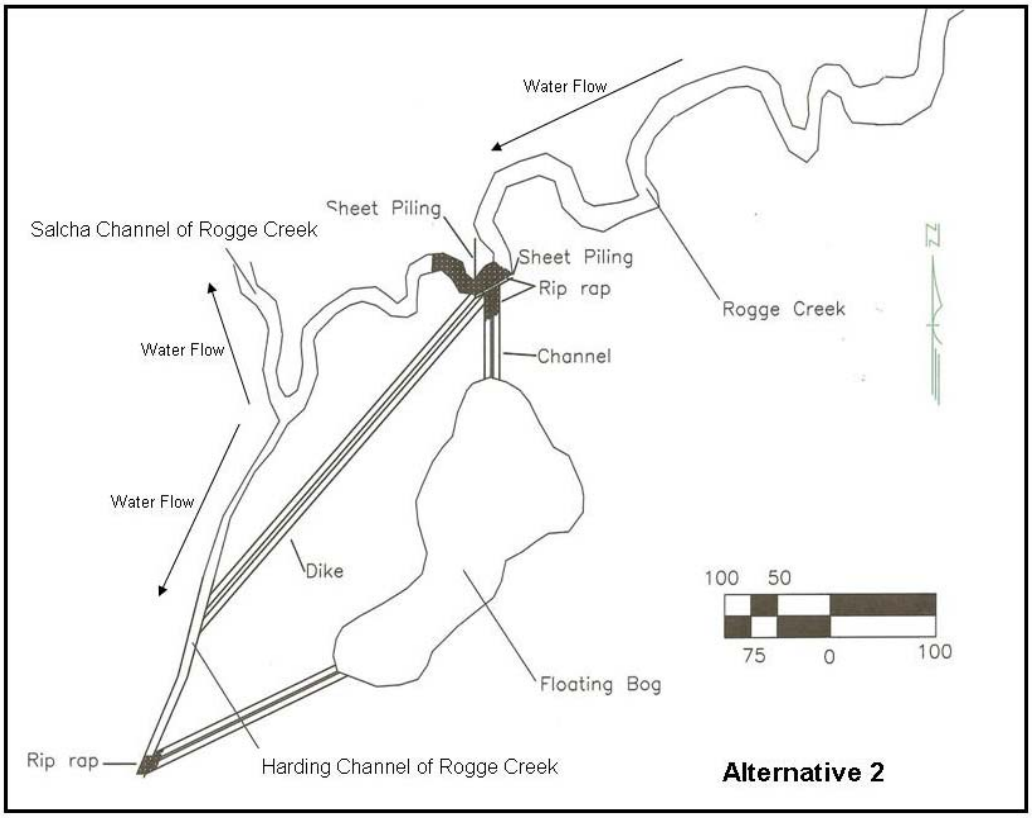
This alternative is expected to increase lake water levels and restore approximately 135 acres of critical pike and least ciscoe spawning and rearing aquatic wetland habitat. In addition, it will expand and enhance habitat for other area wildlife. Riparian areas associated with the lake and the Rogge Creek-Harding channel will likely expand and be enhanced. Recreational access will improve and lessen or remove the need for excavated boat access channels. This action could result in greater potentials for hydrocarbon water quality impairments from increased boat activity. Impacts to the riparian and wetland areas associated with the Rogge Creek-Salcha channel from the re-direction of a maximum of 12 cfs of water will be variable according to flow volumes.

Alternative 1: Design Discussion

1) This approach will increase the water levels in Rogge Creek for a distance approximately 600 to 700 feet upstream from the diversion, but it will not result in water being impounded in any locations that there is not water now, or has not been present in the past. This reduces the chances of degrading the fragile permafrost in this area.
2) All of the construction activities for this project are focused on one site which results in a smaller total footprint for the project.

3) The soils, coupled with the fragile permafrost in this area, do not make this an ideal site for this type of project. There is some concern for the long-term stability of the project. Potential frost jacking of the structure has been appropriately addressed by excavation of frost prone material and replacement with non-frost susceptible (NFS) material. Minor settlement of the structure can be compensated for by use of the adjustable weirs.

Alternative 2



The Alternative 2 design option will utilize a sheet-pile wall, located approximately 285' upstream of the site of the Rogge Creek channel forks. This wall will create backwater to such an elevation that water will be directed into a newly constructed channel (approximately 300') into and through a wetland/floating bog that will connect to the existing Harding Lake channel of Rogge Creek. To a discharge of approximately 100 CFS, the distribution of flow will be controlled by two adjustable weir gates. At discharges beyond approximately 100 CFS the Rogge Creek channel exceeds its banks and the diversion structure will not control the distribution of the flow.

This alternative is expected to increase lake water levels and restore approximately 135 acres of critical pike and least ciscoe spawning and rearing aquatic wetland habitat. In addition, it will expand and enhance habitat for other area wildlife. Riparian areas associated with the lake and the Rogge Creek-Harding channel will likely expand and be enhanced. Recreational access will improve and lessen or remove the need for excavated boat access channels. This action could result in greater potentials for hydrocarbon water quality impairments from increased boat activity. Impacts to the riparian and wetland areas associated with the Rogge Creek-Salcha channel from the re-direction of a maximum of 12 cfs of water should not be significant. Impacts to the wetlands (approximately 1 acre) associated with the construction site are likely. The constructed channel will likely drain the wetland complex to the level of the channel bed. A consistent and elevated flow through the wetland will change its function through increased flushing action. In addition, the installation of a 385' earthen dike will require substantial fill into wetlands.

Alternative 2: Design Discussion

For hydraulic reasons, this was the favored design concept prior to completion of the topographic survey. The survey data revealed several issues with this concept.

1) The dike was originally believed to be necessary as a training structure that would only block the flow of water infrequently during major runoff events. However the survey data revealed that the flow path from the flow-through bog wetland was back into the Salcha channel rather than towards the Harding channel. This meant that the dike would have to be constructed in a manner that would allow it to withstand moderate water levels at all times. Constructing this type of dike can not be completed during the winter, and constructing this type of dike at that location would be difficult and costly, even during the summer.
2) Summer construction access would be much more costly and have a far greater environmental impact.
3) This design would require channels to be constructed and/or allowed to form naturally, and water to be impounded, in areas where this does not occur at this time which could result in a degradation of the underlying permafrost.

No Action Alternative

Although it is impossible to predict the effect on lake level of this alternative, it is likely that Harding Lake's current level (approximately 714.5 feet ASL) would remain or decrease in the absence of a large increase in annual precipitation. Under this alternative, it is likely that at least in the near future, the wetlands habitat of northern pike and other vegetated lake-shallow dependent species would remain dry.

Pike and least ciscoe populations will remain low and the permanent fishery closure will remain in effect. Riparian and wetland areas will likely continue their conversion to upland vegetation, possibly affecting water quality from the loss of wetland filtering functions. Recreation access will probably continue to require excavated channels, resulting in the extension of existing channels and the installation of new channels. This may result in additional declines in recreational use. Wetlands along Rogge Creek will see no impacts.

PROPOSED ACTION

The proposed action of this project is to restore flow to Harding Lake through a historic channel of Rogge Creek by installing a driven-sheet-pile flow control structure at the Rogge Creek forks. The installation of this structure would also involve placement of 175 yards of rip-rap and the construction of approximately 1.75 miles of ice-road in order to provide access for heavy equipment.

EFFECTS OF ALTERNATIVES

The following table presents the comparison of the identified alternatives for ecological, economic and social concerns when analyzing effects, temporary, direct, indirect and cumulative effects are considered and presented.

COMPARISON OF EFFECTS OF ALTERNATIVES

Harding Lake wetlands restoration and Rogge Creek Channel Rehabilitation Project at Harding Lake, Alaska

	Existing Condition	**Alternative 1**	**Alternative 2**	**No Action** (future without project action)
Planned Measures	N/A	Water control structure at existing creek fork	Water control structure and dike upstream from existing creek fork	No structural installation to increase or maintain lake levels
Water Quality	No current impairments noted	Occasional sediment delivery from Rogge Creek may occur from increased flows. Localized temperatures at channel inflow will become lower. Construction activities could result in short term erosion and sediment deposition into lake. Expected increase in recreational boating increase chances for added lake hydrocarbons.	Occasional sediment delivery from Rogge Creek may occur from increased flows. Localized temperatures at channel inflow will become lower. Construction activities could result in short term erosion and sediment deposition into lake. Diverting water through wetland and constructed channel, possible source of wetland sink components. Expected increase in recreational boating increase chances for added lake hydrocarbons.	No change
Surface Water Quantity / Flooding	Lake level currently at 714.5' ASL. OHWM determined at 717' ASL. The Rogge Creek-Harding channel receives only sporadic flows. Channel capacity estimated at 12 cfs. Out of bank flows only during heavy precipitation events and accelerated break up.	Control structure will restore flows to Harding Lake, raising lake level to a maintained OHWM with variable fluctuations. Current lake size is approximately 2190 acres. At 717' ASL lake size will be approximately 2380 acres. Flooding above Rogge Creek channel capacity will see no effect.	Control structure will restore flows to Harding Lake, raising lake level to a maintained OHWM with variable fluctuations. Current lake size is approximately 2190 acres. At 717' ASL lake size will be approximately 2380 acres. Flooding above Rogge Creek channel capacity will see no effect	The lake water level, although historically cyclical, will mostly likely continue its decline Harding Lake channel will remain dewatered except during periods of extreme high water events. Rogge Creek mainstream will contribute all normal flows to the Salcha channel and the Salcha River.

		Reduction in flow (12 cfs maximum) to Salcha River.	Reduction in flow (12 cfs maximum) to Salcha River.	
Ground Water	Ground water quality and quantity are not currently an issue in the area.	No change	No change	No change.
Water Based Recreation	Permitted boat launches and lake access channels are being dredged from private property into the lake. ADNR and ADF&G have identified declining trends in recreational user and fishing days.	Increase lake level should reduce and potentially eliminate the need for dredge channels. ADNR and ADF&G expect increases in recreational user and fishing days through improved lake access and increased pike propagation resulting from increased water levels.	Increase lake level should reduce and potentially eliminate the need for dredge channels. ADNR and ADF&G expect increases in recreational user and fishing days through improved lake access and increased pike propagation resulting from increased water levels.	If water level declines continue, it is likely to cause increased channel access activities through the dredging of new channels and extending existing channels in order to reach adequate water depths for recreational use. Current recreational user and fishing day declines will probably continue.
Floodplain Urbanization	Currently there are private and state owned properties with houses and other structures around 65% of the lake shore. The remaining 35% of lake shore area is dewatered wetlands on State land.	No effect	No effect	No change Lowering water levels may eventually lead to allowances to add structures to a redefined lake floodplain zone.
Land Use Changes	The area is undergoing changes toward rural residential development, replacing natural areas on the limited amount of land available for development.	Development of the area will continue toward rural residential replacing natural areas on the limited amount of land available for development.	Development of the area will continue toward rural residential replacing natural areas on the limited amount of land available for development.	Structures may migrate closer to the 717' ASL OHWM. There will likely be an increase in uplands areas available for development.
Aquatic Resources	Primary aquatic resources in the area are Harding Lake at 2140 acres; and approximately 1.5 miles of the dewatered Rogge Creek-Harding channel.	135 acre increase in lake size. The Rogge Creek-Salcha channel will see a decrease in water volume from an equally divided flow, with a maximum of 12 cfs flowing away from the Salcha channel. The Rogge Creek-Harding channel will be re-watered for approximately 1.5 miles.	135 acre increase in lake size. The Rogge Creek-Salcha channel will see a decrease in water volume from an equally divided flow, with a maximum of 12 cfs flowing away from the Salcha channel. The Rogge Creek-Harding channel will be re-watered for approximately 1.5 miles.	Likely to see continued declines in Harding Lake water level, surface acres and loss of shallows.

Wildlife Resources	The lake pike fishery is permanently closed to harvest due to significant populations declines (an 83% drop from a recent high in 1997) from critical habitat losses. This loss also affects least ciscoes, the primary food source for developing pike. Other species affected by the low water habitat losses include moose, muskrat, waterfowl and various predators.	Restoration of lake levels to ~717' ASL will restore 135 acres of prime pike and least ciscoe habitat will likely result in a population rebound for both species. Other wildlife affected by the low water habitat loss will also benefit from the restoration of aquatic bed wetlands; including the muskrat, which will likely re-colonize the northern shore. Likely to see a decrease in use of the immediate project area by species sensitive to human encroachment.	Restoration of lake levels to ~717' ASL will restore 135 acres of prime pike and least ciscoe habitat will likely result in a population rebound for both species. Other wildlife affected by the low water habitat loss will also benefit from the restoration of aquatic bed wetlands; including the muskrat, which will likely re-colonize the northern shore. Likely to see a decrease in use of the immediate project area by species sensitive to human encroachment.	Pike and least ciscoe populations will likely continue to decline as the remaining spawning and rearing habitat continue to decrease. Species composition, including mammals and birds, will change in response to habitat reduction and conversion as water levels continue to decline. The dewatered wetlands areas will likely convert to upland vegetation providing additional habitat for tree and shrub dependant species.
Public Health and Safety	No current impairments to public health and safety.	No effect. Septic systems are not impacted by the 717' ASL OHWM.	No effect. Septic systems are not impacted by the 717' ASL OHWM.	No effect.
Forest Resources	Well drained areas contain birch, aspen, and balsam poplar and white spruce. Poorly drained areas have small black spruce and Siberian larch.	Minor impacts from ice road, resulting in a temporary loss of approximately 3.5 acres of spruce and brush.	Minor impacts from ice road, resulting in a temporary loss 3.5 acres of spruce and brush.	Forest resources are likely to increase as dewatered wetland areas are converted to upland vegetation.
Air Quality	No identified air quality impairments	Possibility of a deterioration in air quality during construction from diesel exhaust of the equipment.	Possibility of a deterioration in air quality during construction from diesel exhaust of the equipment.	No anticipated change.
Social Issues	Numerous residents have multi-generational connections to their land, home and lake. Harding Lake is a desired location for family gatherings and vacations, youth camps and social organization activities.	Improve and maintain area desirability as a vacation and recreation destination.	Improve and maintain area desirability as a vacation and recreation destination.	If lake water levels continue to decline, there is a potential for reduction in property values and recreational desirability.
Public Utilities/Services	All public service utilities are available along Salcha Drive, the	Successful project implementation may accelerate	Successful project implementation may accelerate	Services and utilities will adjust to meet demands of

	main paved road around the lake.	residential and commercial development and attending service infrastructure to limits allowed in project area.	residential and commercial development and attending service infrastructure to limits allowed in project area.	new construction in any new residential or commercial/ recreational ventures at a rate less than with the proposed alternative.
Clean Water Act, Waters in the U.S. including Special Aquatic Sites.	Dredging of access channels and wetland fill require USACE permits.	USACE permits will be required for project implementation. Should be a reduction in requests for permits to dredge channels when lake levels rise.	USACE permits will be required for project implementation. Should be a reduction in requests for permits to dredge channels when lake levels rise.	Increased 404(d) applications for dredging boat access channels.
Coastal Zone Management	Not applicable	Not applicable	Not applicable	Not applicable
Cultural Resources	Archaeological site inventories and surface site investigations conducted by NRCS and ADNR have not identified the presence of cultural resources at the project site.	No effect	No effect	No effect
Environmental Justice	There are no known legal actions engaged, nor identified potential groups, communities or individuals in the project area.	Not an action which would constitute a potential to cause adverse human health or environmental impacts to any known groups or individuals.	Not an action which would constitute a potential to cause adverse human health or environmental impacts to any known groups or individuals.	Not applicable
Essential Fish Habitat	No EFH has been designated or would be affected in the project area.	No change.	No change.	No change.
Fish and Wildlife Coordination	Alaska Department of Fish and Game regulated area.	Not a project requiring application of Section VII Fish and Wildlife Coordination Act, 1964	Not a project requiring application of Section VII Fish and Wildlife Coordination Act, 1964	ADF&G will have to develop regulations and O&M for the reducing pool.
Invasive Species	No identified noxious weeds within the project area. Likely to be non-native invasive species associated with developed areas.	Potential for seeds to be introduced in the area by construction equipment.	Potential for seeds to be introduced in the area by construction equipment.	Invasive plant species will likely be introduced through continued human land use developments, if no management is employed.
Migratory Birds	Shorebirds and waterfowl are present in the area and utilize the shoreline and	Numbers and species composition will change. The populations of	Numbers and species composition will change. The populations of	Reduction in the nesting and rearing potential use by waterfowl and

	adjacent terrestrial and aquatics areas for nesting and rearing, as well as part of their migratory flyway.	shorebirds vs. waterfowl will reflect that of the water levels as they recede and rise.	shorebirds vs. waterfowl will reflect that of the water levels as they recede and rise.	shorebirds as the pool size decreases. Seasonal migratory shorebird usage may increase from the periodic exposure of more shoreline hospitable for feeding and rearing activities. However, if wetted lands adjacent to the shoreline dry up, this trend may reverse.
Natural Areas	None designated in project area.	No change	No change	No change
Prime and Unique Farmland	Suitable land classes do not exist.	Not applicable	Not applicable	Not applicable
Riparian Areas	Riparian areas around the lake and along the Rogge Creek-Harding channel are degrading by the drop in water levels and are converting to upland vegetation.	Restoration of lake water levels and consistent flows through the Rogge Creek-Harding channel should promote a more sustainable riparian corridor of approximately 7.3 acres. The loss of water (12 cfs max) to the Rogge Creek-Salcha channel will result in a measured reduction in riparian area associated with this drainage. An estimated 135 acres of riparian area will likely decrease with higher water levels, converting to shallow water habitat.	Restoration of lake water levels and consistent flows through the Rogge Creek-Harding channel should promote a more sustainable riparian corridor of approximately 7.3 acres. The loss of water (12 cfs max) to the Rogge Creek-Salcha channel will result in a measured reduction in riparian area associated with this drainage. An estimated 135 acres of riparian area will likely decrease with higher water levels, converting to shallow water habitat.	A process of riparian areas converting to upland will run concurrently with wetlands converting to riparian conditions as the lake level recedes. Maximum low lake levels are not predictable. The rate of change will be dependent on annual development and hydrologic conditions in the area.
Scenic Beauty Visual and Aesthetic Resources	Dewatered shallows have resulted in stagnate areas and the proliferation of grasses and weeds along a drying shoreline. Landowners who	Increased lake water levels will inundate the shallows and promote their conversion back to aquatic vegetation with a more defined	Increased lake water levels will inundate the shallows and promote their conversion back to aquatic vegetation with a more defined	An upland and riparian community will mature in place of the previous wetland and aquatic sites and eventually separate the view

	moved to the community did so largely because of the lakes presence and appealing lifestyle.	shoreline, restoring appeal to project area residents.	shoreline, restoring appeal to project area residents.	from a smaller lake.
Sole Source Aquifer	Not applicable	Not applicable	Not applicable	Not applicable
Threatened and Endangered Species And State Species of Concern	USFWS and ADF&G as project sponsor/ partners have not determined nesting presence of any T&E species. Incidental use by eagles has occurred in the past for foraging purposes.	USFWS and ADF&G as project sponsor/ partners have not determined any short term or long term impacts to any T&E species which may be present. With increased lake levels and pike production, eagles may find a more abundant source of fish for nestlings during pre-salmon presence in the Salcha River.	USFWS and ADF&G as project sponsor/ partners have not determined any short term or long term impacts to any T&E species which may be present. With increased lake levels and pike production, eagles may find a more abundant source of fish for nestlings during pre-salmon presence in the Salcha River.	Threatened and Endangered species and State Sensitive Species future potential presence unknown. Even lower or non-existent pike populations may reduce eagle use further.
Wetlands	Wetland areas are undergoing transition between types and sizes. Some are converting to other vegetated types with the drying regime. Since the early 1990's approximately 135 acres have been lost.	Lakeside wetland type will change becoming more shallow aquatic bed as water level increases. Approximately 135 acres of north shore wetlands will be restored. Rogge Creek-Harding channel associated wetlands will likely expand and be enhanced by a more sustained and increased water flow. The loss of water (12 cfs max) to the Rogge Creek-Salcha channel will result in a measured reduction in wetland area associated with this drainage.	Lakeside wetland type will change becoming more shallow aquatic bed as water level increases. Approximately 135 acres of north shore wetlands will be restored. Rogge Creek-Harding channel associated wetlands will likely expand and be enhanced by a more sustained and increased water flow. The loss of water (12 cfs max) to the Rogge Creek-Salcha channel will result in a measured reduction in wetland area associated with this drainage. The wetland area (floating bog) adjacent to project site is approximately 1 acre will see an increase in water flow and flushing and is likely drain	Wetlands will continue transitioning between types and sizes. Some areas will convert to other vegetated types with the drying regime. Rogge Creek-Harding channel wetlands acres will become drier and more ephemeral. Rogge Creek-Salcha channel will express wetland response and presence according to the indigenous hydrology.

			2' to 3' lower to the level of the constructed channel bed. Earthen dike will require fill to be placed in wetlands.	
Wild and Scenic Rivers	None in project area	No change	No change	Unknown; area waters do not meet current standards for designation.

Alternative Selection

Alternative Number 1 is the preferred action for the following reasons:

- Restores approximately 135 acres of Pike and least ciscoe shallow water spawning and rearing habitat.
- Restores approximately 75 acres of riparian area and wetlands along the Rogge Creek-Harding channel and lake shoreline areas.
- Provides a mechanism, to alter lake levels to match a management plan for pike and least ciscoe species, as well as other area wildlife.
- Restores greater recreational social and economic opportunities for sport fishing, boating, swimming and camping.
- Reduces or eliminates the need for excavated boat access channels.
- Increases and enhances water quality associated wetland functions.
- Can be entirely constructed during frozen soils conditions.
- Does not require placement of fill (earthen dike) in wetlands.
- Eliminates need to construct new 300' diversion channels per Alternative 2
- Will not impact 1 acre wetland (floating bog) adjacent to Rogge Creek forks.
- The cost of Alternative 1 is lower than Alternative 2.

CONSULTATION AND COORDINATION

Interdisciplinary Team

An interdisciplinary group including the Salcha-Delta Soil and Water Conservation District (SDSWCD), Alaska Department of Fish and Game (ADF&G), Alaska Department of Natural Resources (ADNR), USDA Natural Resources Conservation Service (NRCS), biologists, engineers, environmental specialist, cultural resources coordinator, resource conservationist, and others helped gather basic project information, developed the preliminary determinations of the environmental and social effects of the alternatives, and provided input for the development of this document. Local area residents, as well as other private individuals and agencies, were contacted during plan development to provide needed information and coordinate activities.

Project Sponsor

The sponsoring local organizations are the Salcha-Delta Soil and Water Conservation District (SDSWCD) and the Alaska Department of Fish and Game (ADF&G). Meetings were held between NRCS, SDSWCD and ADF&G throughout the development of the project plan to determine local needs and concerns regarding the project. The meetings were used to acquire data relative to the project area, ascertain the scope of the problem, begin developing alternative approaches, explain program criteria and operating procedures, develop measures to tailor the project to address local concerns, and to work out other project details.

Public/Agency Participation

Input from the public and other agencies was solicited during development of the plan. Harding Lake Watershed Council meetings have been held since 2001 to discuss and develop this proposed action and solicit public input.

The ADF&G, the SDSWCD and the NRCS consulted the private organizations, individuals, Federal, State, and local agencies during the development of this environmental assessment. (See Appendix A)

APPENDICES

Appendix A

Stakeholder Organizations

Harding Lake Association
458 Terrace Drive
Fairbanks, AK 99712

Trout Unlimited
P.O. Box 10104
Fairbanks, AK 99710

State, Federal, and Local Agencies

USDA-Natural Resource Conservation Service
1420.5 Alaska Highway, Jarvis Office Center
P.O. Box 547
Delta Junction, AK 99737-9315

Alaska Dept. of Natural Resources, Division of Land, Mining, and Water
3700 Airport Way
Fairbanks, AK 99709

Alaska Dept. of Natural Resources, Division of Parks and Outdoor Recreation
3700 Airport Way
Fairbanks, AK 99709

Alaska Dept. of Natural Resources, Office of Habitat Management and Permitting
1300 College Rd.
Fairbanks, AK 99709

Alaska Dept. of Natural Resources, Division of Forestry
3700 Airport Way
Fairbanks, AK 99709

U.S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office
101 12th Ave.
Fairbanks, AK 99701

Fairbanks North Star Borough, Department of Land Management
P.O. Box 71267
Fairbanks, AK 99707

U.S. Army Corps of Engineers, Regulatory Office
3437 Airport Way
Suite 206 Washington Plaza
Fairbanks, AK 99709-4777

United States Department of Interior, Bureau of Land Management
1150 University Avenue
Fairbanks, AK 99708

University of Alaska, Statewide Land Management Office
910 Yukon Drive
Fairbanks, AK 99709

Appendix B

REFERENCES

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Appendix C

HARDING LAKE LEVEL HISTORY (Table 1)

YEAR	**LAKE LEVEL** - Above Sea Level (NAVD 88)
1968	719.3’
1978	715.0’
Mid 1980’s	718.0’
2005	714.5’

HARDING LAKE STATE RECREATION AREA VISITOR COUNT (TABLE 2)

Year	Number of Visitors
1999	13818
2000	10146
2001	11130
2002	10725
2003	10725
2004	9417
2005	6087

HARDING LAKE SPORT FISHERY (TABLE 3)

Year	Harding Lake Angler Days	Harding Lake Pike Catch	Harding Lake Pike Harvest
1983	708	N/A	178
1984	1,707	N/A	766
1985	850	N/A	503
1986	2,064	N/A	673
1987	5,125	N/A	1,886
1988	3,256	N/A	2,092
1989	4,935	N/A	1,764
1990	3,895	3,629	591
1991	5,155	5,071	1,888
1992	5,068	3,400	341
1993	4,885	8,471	391
1994	4,913	5,559	539
1995	6,743	3,852	502
1996	6,734	4,070	363
1997	3,383	1,665	62
1998	3,410	1,425	139
1999	2,973	828	38
2000	2,538	396[a]	24[a]
2001	1,038	Fishery closed	Fishery closed
2002	2,094	Fishery closed	Fishery closed
2003	2,246	Fishery closed	Fishery closed
2004	2,675	Fishery closed	Fishery closed
Averages			
Average: 1983-1999	3,870	N/A	748

	(before closure)		
Average: 2000-2004	2,118 (after closure)	-	-

PIKE STOCK ASSESSMENT (Table 4)

Year	Pike Population	Lake Level
1985		719.0
1986		718.3
1987		717.8
1988		
1989		
1990	2,285	
1991	2,308	
1992	2,868	717.8
1993	3,765	717.5
1994	no assessment performed	
1995	2,338	
1996	3,377	717.0
1997	1,780	717.0
1998	1,376	
1999	583	715.5
2000	no assessment performed	715.6
2001	no assessment performed	715.8
2002	no assessment performed	715.6
2003	no assessment performed	715.5
2004	no assessment performed	715.3
2005	no assessment performed	715.0