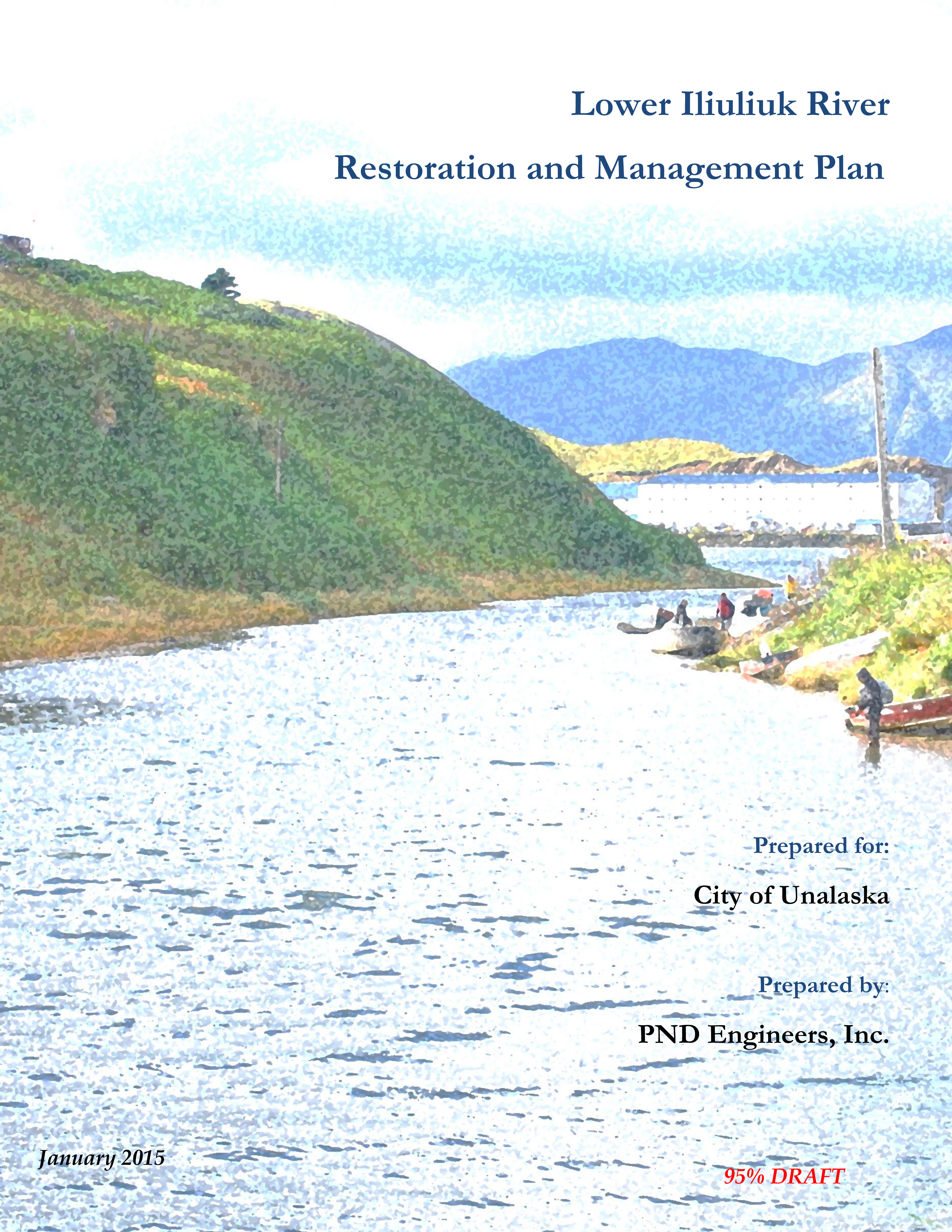


Lower Iliuliuk River

Restoration and Management Plan

Prepared for:

City of Unalaska

Prepared by:

PND Engineers, Inc.

January 2015

95% DRAFT

Lower Iliuliuk River

Restoration and Management Plan

Prepared for:

City of Unalaska

Prepared by:

PND Engineers, Inc.

This report is funded with qualified outer continental shelf oil and gas revenues by the Coastal Impact Assistance Program, Fish and Wildlife Service, U.S. Department of the Interior.

Table of Contents

List of Figures

List of Photos

List of Tables

Appendices

Executive Summary

PND Engineers, Inc. has been selected to produce a Restoration and Management Plan for the City of Unalaska pertaining to the lower Iliuliuk River under funding from the Coastal Impact Assistance Program. This plan is written to educate and discuss options available to implement under the grant funding. This includes restoration measures such as revegetation of the river bank and installation of light penetrating walkways, and includes measures for obtaining sockeye escapement numbers into the watershed. This plan's information is then to be used by the City of Unalaska to determine which measures should utilize the grant funding and be implemented in 2015. In addition to the specific restoration measures required by the aforementioned grant, additional options and management practice for the future are discussed in this plan.

List of Acronyms and Abbreviations

ADF&G: .... Alaska Department of Fish and Game
AWCRSA: .... Aleutians West Coastal Resource Service Area
CIAP .... Coastal Impact Assessment Program
COU........ City of Unalaska
DIDSON .... Dual frequency IDentification SONar
DPW .... Department of Public Works
OHW .... Ordinary High Water
PND:........ PND Engineers, Inc.
RMP: .... Restoration and Management Plan
ROM: .... Rough Order of Magnitude
UNFA:........ Unalaska Native Fisherman's Association
USACE:........ United States Army Corps of Engineers

1.0 Introduction

1.1 Site Location and Setting

The Iliuliuk River (also referred to as the Town or Unalaska Creek) is located on Unalaska Island, drains Unalaska Lake and discharges into Iliuliuk Harbor. The project area discussed in the Restoration and Management Plan (RMP) includes City-owned property within the lower 1,500 feet of the north bank from the small island adjacent to the Holy Ascension of Our Lord Cathedral (referred to as Church Hole), downstream to the mouth by the City of Unalaska's float and boat launch and Alyeska Seafoods. This is shown in Figure 1-1. An additional portion of the project area is just upstream of the 5th Street Bridge.

The Iliuliuk River contains a basin of approximately 72,000 acres of land that collects rainfall and runoff. The Dutch Harbor weather station provides information on precipitation and average temperatures with a record dating back to 1951 (Western Regional Climate Center 2012). The annual average temperatures range from 35.9°F as a minimum, and 45.8°F as a maximum, and average annual precipitation is approximately 61 inches. On average, the month with the highest amount of precipitation is typically December or January; however, storms occur throughout other periods of the year bringing higher than average precipitation quantities.

The lower river is highly tidally influenced, and therefore water surface elevations and discharges vary greatly. Additionally, the river flows through and from Unalaska Lake at a fairly close proximity to the project area. As lakes typically assist in attenuation of flow from the upper basin, the lower river likely sees less severe water surface elevation and discharge fluctuations than higher up in the watershed. Discharges of 600 cfs and 1600 cfs are estimated as conservative design flood flows having a 2-year and 10-year recurrence interval, respectively. These do not account for attenuation from the lake or tidal influence.

The north bank, within the project area, primarily consists of World War II road embankment. Road fill was observed underneath the vegetated mat. Based on historical photographs, it appears that vegetation has established on top of the gravel fill on its own. Photo 1-1 is a historical photo of the Iliuliuk River mouth prior to road construction, and filling of the north bank, and Photo 1-2 displays a photo taken in 2014 of the same area.

Photo 1-1. Historical Photo of the Mouth of the Iliuliuk River (courtesy of Jeff Hancock's public comment)

Photo 1-2. 2014 Photo of the Mouth of the Iliuliuk River

1.2 Background and Funding

The lower Iliuliuk River is an essential piece of habitat for salmon within the watershed. Although not all species of salmon spawn within the project area, this area is habitat for juvenile salmon of some species, and also provides refuge and proper habitat as all species of smolt transition from fresh to saltwater in this area as they migrate out to the ocean.

The lower Iliuliuk River riverbank has been impacted by snow removal practices and trampling by recreational and subsistence fishers without riparian management. The closest and most convenient access points have suffered bank disturbance, and in some cases caused it to erode such that high quality fish habitat has been lost along this important anadromous fish system. Skiffs are beached and moored at the mouth of the river. Beaching, launching, and storing boats has damaged, or otherwise prevented the establishment of vegetation and damaged near shore habitat used by juvenile salmon and other fish. The lack of sufficient guardrail along Haystack Drive encourages the plowing of snow to the upper stream bank. This snow contains gravel and other road debris that travels to the riverbank as the snow melts and thereby contributes to habitat degradation.

Funding for the restoration management plan and implementation is part of the Coastal Impact Assistance Program (CIAP) originally granted to the former Aleutians West Coastal Resource Service Area (AWCRSA), and is now under the City of Unalaska (also referred to as the City or COU). The funding provides a total of $351,657 over a two-year period. Year 1 includes $100,000 allocated for gathering pertinent information and providing this restoration planning document to be implemented in Year 2. Year 2 will utilize $251,657 for implementation of the restoration efforts discussed within this plan. The grant requires funding to be used for the purchase of one fish weir, 125 linear feet of aluminum light penetrating stairs/ramps/ walkways on the lower river, 1,500 feet of revegetation with placement of coir logs, and an unspecified amount of guardrail.

PND Engineers, Inc. (PND) has been selected to complete the Year 1 portion of this project, consisting of gathering pertinent data and a producing a RMP.

1.3 Purpose and Goals

The purpose of the lower Iliuliuk River RMP is to develop a final restoration planning document and proposal for implementation procedures for the lower Iliuliuk River riparian area.

The primary goal of this plan is to propose methods for improved habitat stewardship, provide preliminary design for limited habitat improvements, and for equipment to monitor salmon runs. Data collected while monitoring salmon runs could eventually be used to aid in the recovery of the Unalaska Lake watershed sockeye salmon population by improving factors that affect their survival in freshwater. The long term objective is to improve freshwater survival of sockeye salmon, monitor and assess the improvement, and increase understanding of the factors affecting survival.

PND ENGINEERS, INC.

LOWER ILIULIUK RIVER
RESTORATION & MANAGEMENT PLAN
PROJECT AREA

FIG 1-1

2.0 Existing Conditions

The lower Iliuliuk River has been used for hundreds of years by residents, with the north bank being the most accessible for river access. The entire 1,500 feet of bank line is fairly steep, consisting of World War II era road fill. Homemade docks and floats line the bank along the lower 1,000 feet, as shown in Figure 1-1, and some of the bank and areas within the mouth of the river contain derelict floats, abandoned boats (Photo 2-1) and trash. Access to the river along the upper half of the project area (near Church Hole) is concentrated to a few locations through openings in the guardrail (shown in Figure 1-1). These coincide with areas exhibiting erosion of the banks.

Photo 2-1. Abandoned Boat near Mouth of the Iliuliuk River

2.1 Salmon Population

Restoration of the lower river and related projects funded by the aforementioned grant are largely related to the concern for the native salmon populations in the watershed. The Iliuliuk River is home to four different species of Pacific Salmon, including coho (silver), sockeye (red), pink (humpy), and very few chum (dog).

To understand the salmon in the watershed, it is important to understand their lifecycle. Salmon begin the cycle as eggs within a gravel nest called a redd. The egg hatches and alevin remain in the redd and survive off an attached yolk sac for sustenance. Once the yolk sac has been consumed, the juvenile emerges from the redd as a fry. The juvenile fish will remain in the river for a certain period of time (depending on the species) finding food and living in low flow areas with sufficient vegetation and cover. The next stage within the salmon life cycle is a smolt. The juvenile fish begins its transition into saltwater and swims out to sea. Within the ocean, the salmon is considered an adult, and will remain at sea for another period of time dependent on the species. The final life stage of salmon occurs when adults travel back to their stream of birth to spawn. Female salmon use their tail to dig into the gravel, create a redd, and lay their eggs as male spawners swim by and fertilize them.

The different species of salmon within the Iliuliuk River watershed utilize the stream in different ways. Sockeye salmon, the primary concern of this plan, travel the furthest upstream on average to use the upper Iliuliuk River and Unalaska Lake for spawning and rearing. They live in freshwater for a total of approximately 2 years, travel back to their spawning ground in May through July (Holmes 1997), and have a total lifespan of about 5 years. Coho salmon also use the Iliuliuk River for spawning and rearing. Juveniles live along edges of the lower river in brackish/freshwater for 1 to 2 years prior to heading out to the ocean. They return to freshwater to spawn in late August to early November (Holmes), and also have a lifespan of approximately 5 years. Pink salmon mostly utilize the lower Iliuliuk River for spawning, and once juveniles emerge from the redd, they travel immediately out to saltwater. Pink salmon return from the ocean to the watershed to spawn from mid- to late July through August and have a strict 2-year lifecycle, with a lifespan of 3 years. Lastly, very few chum salmon utilize the Unalaska Lake watershed. Like pink salmon, they migrate out to sea almost immediately upon emergence from the redd. They return to spawn later than the other Pacific salmon species in year 3, 4 or 5 of their life cycle.

Unalaska Lake and Iliuliuk River watershed salmon populations are lower than anticipated by biologists. The pink salmon population is observed as being fairly healthy; however, the coho run could use some improvement, and the sockeye run appears to have declined significantly. According to the grant language funding this project, annual sockeye escapements have ranged from 100 to 400 since 1970 (State of Alaska 2011). Comparing Unalaska Lake to similar systems in this part of the state, Alaska Department of Fish and Game (ADF&G) fisheries biologists estimate that a lake of this size could have an escapement of at least 2,000 to 3,000 sockeye. Currently, no measures are being taken to gather return numbers of sockeye salmon back into the watershed; however, stream surveys (aerial and foot) have been conducted on Unalaska in the past. These surveys are conducted by enumerating a number of salmon present in the water body at the specific time. The total escapement estimate is based on peak counts and given an expansion factor based on species research and literature. It should be noted that "aerial and foot surveys for salmon often underestimate the true number of salmon by not enumerating the entire population over time" (Holmes 1997). These escapement counts, as presented in Tscherish's 2007 report: Aleutian Islands and Atka-Amlia Islands Management Areas Salmon Management Report, 2006, are presented in Figure 2-1. According to Tschersich, "Unalaska Lake has not reached its minimum sockeye salmon peak count escapement objective of 400 fish in numerous years between 1987 and 2006). Siltation has occurred in this lake and its drainages since World War II".

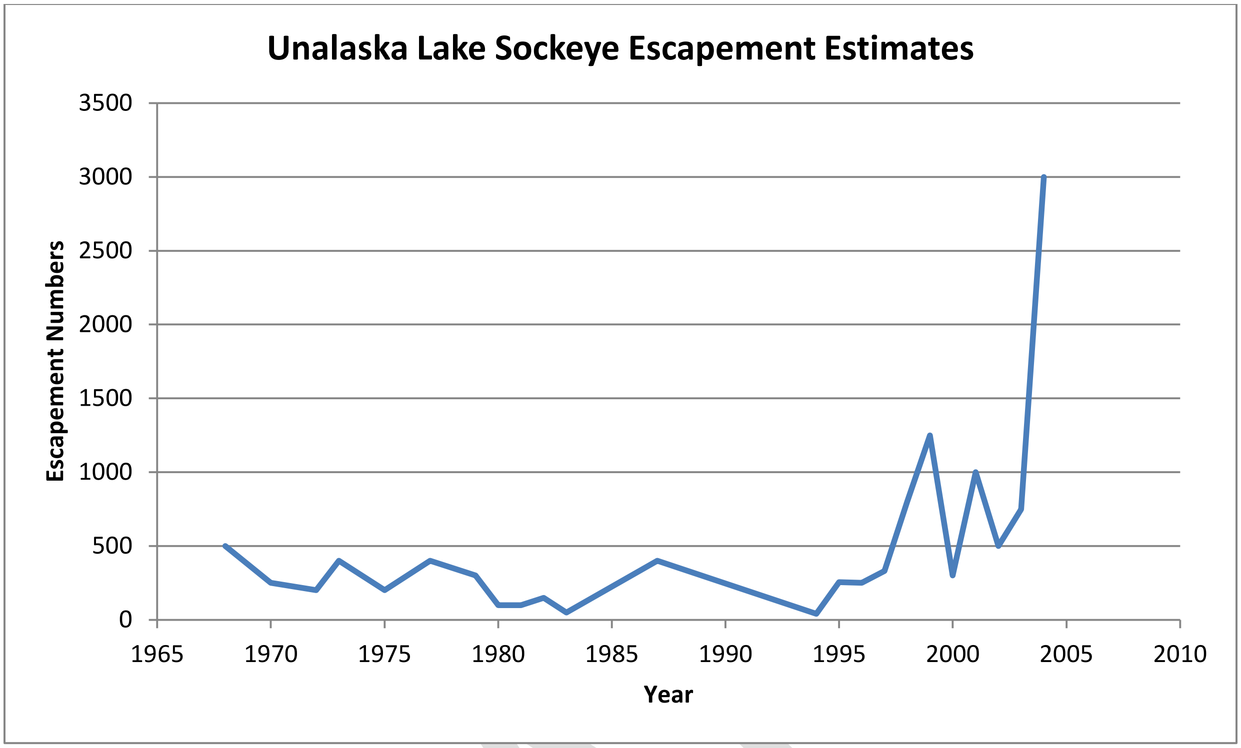


Figure 2-1. Unalaska Lake Sockeye Escapement Numbers (Tschersich 2007)

According to Holmes (1997) salmon runs at Unalaska Island have declined since the later 1980s. The cause is unknown; however, some speculation is that scouring due to large floods may be a factor. "The stock of sockeye which used to spawn in the inlet stream to Unalaska Lake was essentially eliminated after the flood [during the winter of 1984-85]". However, the data collection during the last stream surveys completed in the late 1990s and early 2000s appear to indicate the beginning of a recovery. No data is available from 2005 to present to quantify the current population, but anecdotal evidence and general sentiment of the community indicates low overall escapement.

Salmon escapement numbers have also been collected in the adjacent Summer Bay Lake within the past 15 years. A weir was put in place in 1999 to assess the salmon population as a result of the *M/V Kuroshima* seafood freighter oil spill that occurred in 1997. Sockeye escapement numbers in September 1999 totaled 3,375 sockeye (McCullough 2000). A weir has also been in place at McLees Lake from 2001 through 2006. Escapement numbers there peaked between 2001 and 2003 at 101,793 fish, but was measured at less than 13,000 fish in 2005 and 2006 (Tscherish 2007)

2.2 Reconnaissance

In September, PND conducted a reconnaissance visit of the Iliuliuk River, focusing on the lower 1,500 feet. Prior to the site visit, PND gathered historical data and literature (including historical aerial photos) to get better acquainted with the site and to determine historical changes around the river, particularly associated with World War II and more recent construction activities.

During the reconnaissance visit, PND took photos, noted observations of the watershed, met with locals, and completed a wetlands delineation. Additionally, in early October and again in November, PND conducted the first two stakeholder meetings and gathered public comments to add to background knowledge and assist with the preparation of this RMP. Draft reports were also distributed to the public in December to gather additional comments.

2.3 Wetlands Delineation

During the September reconnaissance visit, PND conducted a wetlands study along the north lower 1,500 feet of bank. As previously mentioned, the majority of the bank slope consists of very steep road fill covered with a shallow vegetated mat. Wetlands were found only in certain locations directly adjacent to the river on a flat or shallow slope where vegetation could grow (shown in Figure 1-1). A full wetlands delineation report is attached in Appendix A.

2.4 Lower River Usage

Through the September reconnaissance visit, observations were made regarding areas of primary access, overall use of the lower river, erosional issues, and presence of classified wetlands. Primary access appeared to occur around homemade floats and docks and also concentrated at openings in the guardrail down to the river. This was noted through well established pathways of trampled grass or areas with lack of vegetation (see Photo 2-2, left and Photo 2-3). Photo 2-2 (right) displays erosion likely due to uncontrolled surface drainage discharge from the adjacent road. Overall use of the lower river appeared to be focused on salmon fishing and gaining access to docks and floats. Salmon fishing is only legal downstream of a sign located within the lower 1,500 feet of river and is closed to sockeye fishing throughout the watershed.

Photo 2-2. Left: Trampled Vegetation along Guardrail; Right: Noted Erosion on Upper Riverbank due to Surface Drainage

Photo 2-3. Noted Erosion along the Banks of the Lower Iliuliuk River due to Foot Traffic

2.4.1 Fishing

Fishing for salmon along the lower river is only legal downstream of the previously mentioned sign (this point is shown in Figure 1-1), and fishing for sockeye salmon is not allowed at any location within the watershed. People were observed fishing, standing on the flat portion of the bank adjacent to the river, sometimes within wetlands. Often, fishermen were observed near openings in the guardrail where there is easy access to the riverbank (see Photo 2-4). Public comments also indicated users also fish from the top of the bank just behind the guardrail.

Photo 2-4. Fishing along the Lower Iliuliuk River near Opening in Guardrail

Public concern has been expressed regarding potentially excessive subsistence set net fishing along Front Beach located to the north of West Broadway Avenue and east of Alyeska Seafoods. This may result in capture of sockeye salmon returning to spawn in Unalaska Lake. There have been no recent attempts to determine escapement numbers for these fish, and therefore, current escapement numbers are unknown. Additionally, the spawning stream is unknown for the fish caught along Front Beach. Some fish may be swimming to McLees Lake or towards the Summer Bay watershed and not Unalaska Lake.

2.4.2 Recreation

Another main use for the lower river, particularly the lower 1,000 feet on the north bank, includes access to homemade docks and floats for locals to access and launch their boats. Locals and community members have commented that the native people have been using this portion of the river for thousands of years for the same purpose.

2.5 Operations and Maintenance of the Roadway

Current City of Unalaska road maintenance and operations along the road adjacent to the lower river that may affect the river ecosystem includes snow removal and use of traction control gravel. Observations have been made of snow being plowed into the river and along its banks near Haystack Drive. Additionally, gravel placed on icy gravel roads for traction control, is picked up in tires and deposited throughout the city. This gravel can run off or get pushed onto the banks and into the river. Snow piles that accumulate throughout the winter along the river can contain large amounts of gravel and other potential pollutants that will drain into the river each spring. Photo 2-5 displays the City Roads crew cleaning up a snow dump on the south side of the Iliuliuk River.

Photo 2-5. City Roads Crews Cleaning up Snow Dump along South Bank of the River

Gravel placed for traction control in Unalaska is primarily gap-graded angular gravel. This gravel, if discarded into the river, can abut up next to other angular rock and create a secure layer of rock on the streambed. This armor is a strong structural surface held together by the angularity of the individual rocks. Settleable solids create the following issues for salmon habitat: 1) Settleable solids may prevent eggs from receiving necessary oxygen and prevent natural removal of waste products from within the red; 2) this rock armor can also create a physical barrier for fry emergence from the red; and 3) finally, female spawning salmon require somewhat loose sub-rounded gravel for the red, as they use their tail to create the nest. A hard packed stream bottom, or even a stream bottom with lack of gravel, leads to loss of salmon habitat.

3.0 Restoration Goals

As previously mentioned, the CIAP grant requires funding to be used for the purchase of one fish weir, 125 linear feet of aluminum light penetrating stairs/ramps/ walkways on the lower river, 1,500 feet of revegetation with placement of coir logs, and an unspecified amount of guardrail. Restoration goals discussed in this section include the required measures, in addition to those that could be pursued with additional funding in the future. Restoration measures include streambank restoration, revegetation, erosion prevention through installation of light penetrating stairs and placement of coir logs and/or riprap, installation of a means of counting sockeye salmon escapement numbers, operation and maintenance adjustments, and public education and outreach.

Year 2 funding for this project will provide a specific amount of money for engineering, permitting, and implementation of these restoration goals. Since this funding is a limited amount, options to address the issues described above are presented below to be considered for implementation. A rough order of magnitude (ROM) cost estimate summary can be found later in the report for each of the lower river restoration options.

3.1.1 Revegetation

As noted in the attached wetlands delineation report, the majority of vegetation along the north bank of the lower river consisted of beach wildrye, and soil generally consisted of gravel road fill. Over time, vegetation has naturally started taking hold of the bank. Community member comment and historical photography supports this conclusion. As recently as the 1980s, very little area on the banks had healthy growing beach wildrye. The site visit in 2014 displayed a much wider area of vegetation with some wetland areas. See Photo 3-1.

Photo 3-1. Left: Bank Photo from 1980s; Right: Bank Photo from 2014

This suggests that the hardy beach wildrye grass will eventually begin to take hold on its own. Revegetating areas with lack of grass will speed up this process, and in turn, immediately provide some protection in areas that are eroding.

The 1,500 feet of the north bank should be revegetated as discussed within the grant using hydroseeding and placement of coir logs along ordinary high water for erosion protection. Additionally, for revegetating the bank in select areas, beach wildrye grass sprigs should be used. Planting already-started sprigs would be the preferable option to planting seeds. They are usually readily available (from native plants in the project area), can be used on erosive sites, tolerate flooding by high tides, and have a high degree of success (Wright 2010). Small sprigs of the natural grass can be pulled off of nearby existing healthy beach wildrye and replanted in areas of erosion.

Coir logs and stakes could be used to help protect the sprigs if these areas are within the zones of erosion or where the tidal influence could potentially damage them.

Large areas of beach wildrye revegetation has been conducted with great success in Adak, with over 90 percent success rates, and up to 99 percent success rates just after one year (Wright 2010). These sprigs were planted between late June and mid-September.

3.1.2 Erosion Prevention

The main source of erosion on riverbanks is often related to lack of natural vegetation and their root structure due to repetitive foot traffic. As discussed and observed during the reconnaissance visit, notable pathways were found at each opening in the guardrail (as shown in Figure 1-1). In order to protect that vegetation, prevent erosion of the bank and potentially the above roadway, PND suggests an option of installing aluminum light-penetrating stairways from the roadway down into the river at these locations. Additionally, to account for the 125 linear feet of walkways, an observation deck could be constructed just above Church Hole. Light-penetrating stairs and walkways keep people off vegetation, allowing the native vegetation to grow. They provide directed and safer access to certain locations, and protect fish and wildlife habitat. Disadvantages for these structures include their upfront cost, required maintenance, and potentially challenging foundation conditions.

Additional erosion prevention, not addressed in the grant, would require addressing drainage issues from the north and south sides of West Broadway Avenue. Several areas of erosion are threatening the road. During rain events, surface water drains over West Broadway Avenue's pavement and finds the lowest spot along the north bank. In some locations, the erosion is abutted or even has undermined the existing pavement structure. Some of these areas of notable erosion due to uncontrolled runoff are displayed in Photo 3-1(right) and Photo 3-2. An option for addressing this issue could include placement of riprap on top of the current eroded area. This would slow down runoff and protect the underlying soil from future erosion. Revegetation of beach wildrye could be incorporated into these areas as well.

Photo 3-2. Erosion from Runoff Threatening Roadway

3.1.3 Outfall Sediment Collection

The lower river is also subject to sedimentation. Storm drains can capture sediment throughout their runoff path and discharge the sediment into the lower river at an outfall. A settleable solid collection system at the outlet of the storm drain system could help collect the sediment, reduce stream bank erosion, and allow for easier maintenance and cleanout of the system where workers could flush out the storm drain without discharging directly into the river. This could be accomplished through installation of precast concrete barrel sections at the outlet of multiple culverts along the lower river. One of these structures is in place adjacent to the 5th Street Bridge as shown in Photo 3-3.

Photo 3-3. Outfall Sediment Collection System near 5th St. Bridge

3.1.4 Fish Counting

The community members, including the Qawalangin Tribe of Unalaska (Q-Tribe), through public involvement meetings and general conversation, expressed gaining a proper understanding of the sockeye salmon population in the Unalaska Lake watershed as their highest priority. ADF&G has been looking into a way of counting sockeye returns in the Unalaska Lake watershed, but has lacked the funding. Two options for counting salmon could be possible: sonar or a weir.

3.1.4.1 Sonar

Fish sonar is one option for counting fish returning to the Iliuliuk River for spawning. Sonar works through submerging the sonar transducer instrument into the stream where it emits sound waves into the water. When the sound waves come in contact with something that has a different density than water, the wave bounces back to the transducer providing data that can be analyzed by fisheries biologists. Different scales of data are available depending on the different types of sonar. Bendix Sonar counts echos within approximately 100 feet from the device. Split-beam can detect fish up to approximately 1,000 feet away and allows for the determination of fish swimming direction. The Split-beam is the most practical tool for wide rivers. Finally, DIDSON (Dual frequency

IDentification SONar) detects fish from approximately 120 feet away and produces high-resolution fish video, therefore allowing determination of fish travel direction and even size. DIDSON was initially used by ADF&G in 2002 and now is the most commonly used sonar tool for counting fish. Figure 3-1, below, displays a snapshot of video produced by DIDSON sonar.

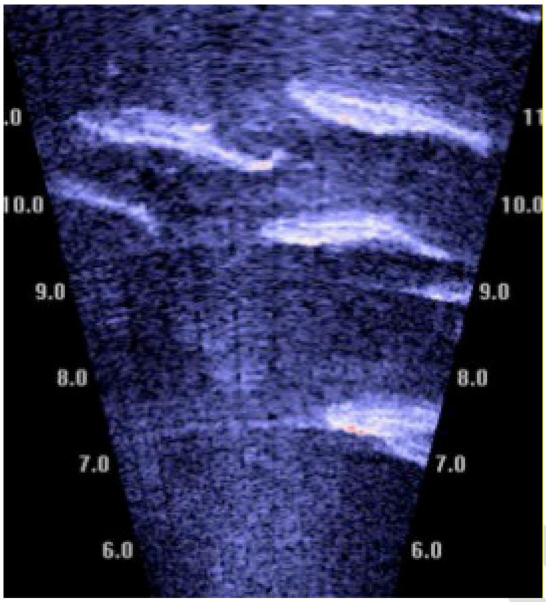


Figure 3-1. DIDSON Sonar Imagery (Neyman 2011)

Benefits of using sonar include: it does not impede fish; it's non-intrusive; it provides an exact count of fish; files can be recorded and reviewed at a later time; it requires very little manpower for installation and maintenance; and, it is extremely portable and able to be used in areas where weirs are not feasible. Some cons to sonar include: it requires a significant amount of time to count and review files; it is not as accurate as a weir due to the fact that fish can swim back and forth (potentially being counted twice); it cannot differentiate between different species (only based on size difference and timing of salmon runs which is not well documented in this watershed); and the upfront purchase cost is high (Loewen (ADF&G), email, September 29, 2014). Although the upfront purchase cost is high, it would require significantly lower design, permitting, and construction fees than a weir, and it would have very minimal future maintenance and storage costs.

If sonar is used to count returning salmon, the DIDSON system would likely be used as it is extremely user-friendly, has lower energy requirements, and essentially produces a video-like image for easy data reduction. A brochure can be found in Appendix B. This system requires a stream narrower than the sonar beam's length and suitable substrate that is hard enough to allow a strong echo signal back to the transducer. As with the weir, the location of placement would likely be near the 5th Street Bridge. Placement timing would have to be during the sockeye salmon run in order to avoid confusion with passing pink and coho salmon. Since species cannot be discerned by the data, any overlap in salmon runs that pass the same reach in the river on their way to spawn, would give erroneous data in a specific species return count. If it is of interest to count different species of salmon, length of deployment may need to be extended, and placement may need to be further downstream for pinks.

ADF&G stated that timing windows in the Iliuliuk River are not entirely known, but a past weir at Summer Bay provided some data (Donn Tracy, telephone conversation 12/2/14 3:38 PM). Sockeye typically run between mid-June through July. Pink salmon run through mid- to late-July, and possibly later. Silver salmon typically run in late-August and later. Some overlap is expected.

3.1.4.2 Weir

The alternative to sonar, and the measure discussed in the grant, is a weir. Weirs are used to gather extremely accurate data on spawning escapement numbers as well as allowing for the capture of fish for observation, sampling, and marking. Weirs are constructed across a stream, restricting salmon migration through a small chute or into a trap. As the salmon travel up the chute in the weir, a technician is able to count the amount of fish passing upstream to their spawning habitat. Oftentimes the chute is a v-shaped passageway, restricting movement back downstream, and ensuring the fish is not counted more than once.

A weir in the Iliuliuk River would need to be removable, only present in the stream during the sockeye salmon run (or longer depending on the species return counts of interest), to prevent excess damage due to debris and repeated storm events. Benefits to a weir include: the upfront cost is low; it is more accurate for fish counts and species identification; and it provides a better visual for educational purposes. Cons include: there are multiple long term costs that could add up (and are not covered by grant funding), including maintenance, storage, extensive monitoring of the weir, and yearly installation and removal; and the weir creates an impedance to fish as they queue at the gate. For accurate data and constructability, the location of placement within the river will be dependent on depth (must be less than approximately 3 feet), accessibility, water level fluctuation, streambed substrate, and width of the river. Two potentially feasible options are available for a fish weir on this river.

Rigid Weir

A rigid weir, or tripod weir, would be installed across the river, and semi-fixed to the stream. These weirs can be constructed out of varying materials, such as PVC pipe or aluminum pickets, screen or wire panels, and netting. Pickets are strung together and angled at 120 degrees from the streambed to allow pressure dissipation from the water, and are held in place by tripods constructed of pipe, such as electrical conduit. See Photo 3-3. These rigid weirs require a somewhat steady water surface elevation in order to work properly.

Photo 3-4. Rigid Tripod Weir Example (Zimmerman & Zabkar)

The rigid weir is removable, and can require a significant amount of maintenance. The rigid pickets across the stream tend to pick up debris, leaves, and algae, which clog the weir from water movement. This can create an elevated amount of pressure behind the weir leading to blow out. The panels need to be cleaned often. Additionally, during storm events, or high water, the entire weir can become damaged and carried downstream.

Resistance Board Weir

The other weir option, and most preferred, is called a resistance board weir, or floating weir. These structures, unlike the tripod weir, are designed to accommodate fluctuation in flow and debris. They are primarily constructed of three main components: 1) panels constructed of capped PVC electrical conduit (high resistance to ultraviolet light), 2) a rail anchored to the river substrate, attaching the panels to the river bottom, and 3) a trap or chute for fish passage. The weir has a resistance board attached at the downstream end of the structure that deflects the stream flow downward, causing lift that holds the downstream panels up. During high water events, the structure is designed to submerge at a point where the aforementioned rigid weir would wash out. This structure is easily removed and requires less maintenance than rigid weirs. See Figure 3-2 and Figure 3-3 for diagrams of a resistance board weir.

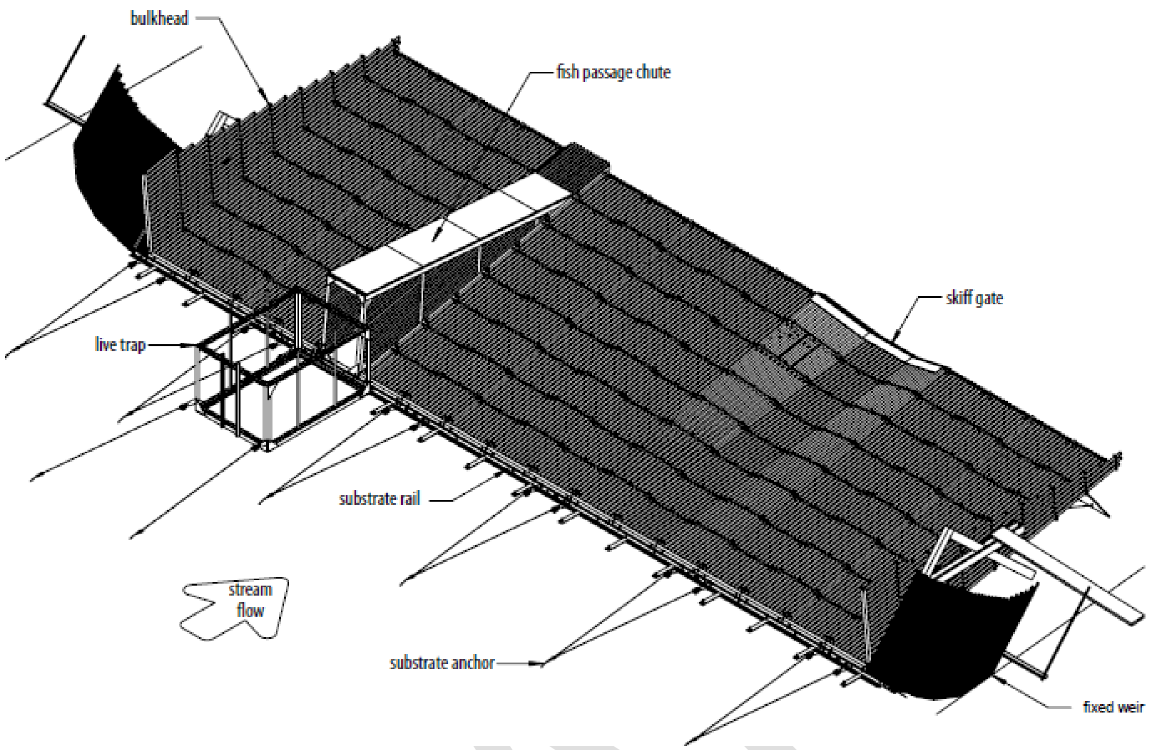


Figure 3-2. Resistance Board Weir (Diagram: Stewart, ADF&G 2002)

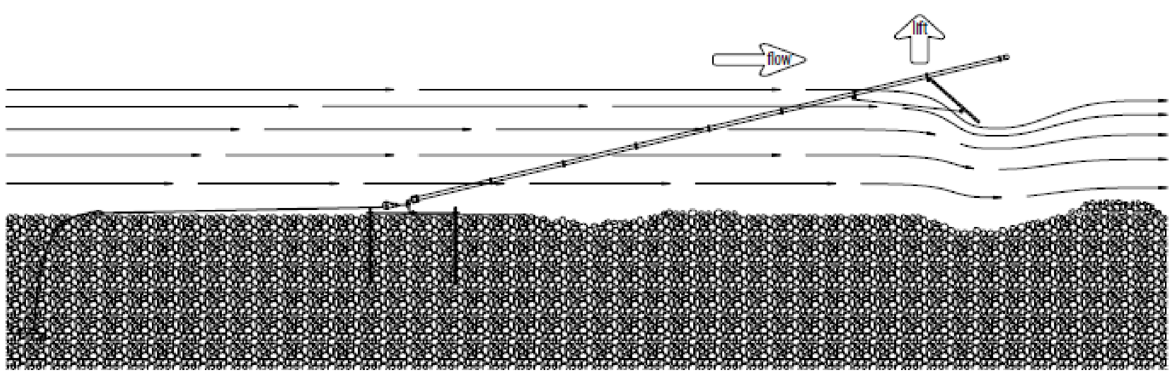


Figure 3-3. Section of Resistant Board Weir Panel and Lift (Diagram: Stewart, ADF&G 2002)

3.1.5 Radio Tagging

In order to determine spawning location of the salmon migrating in front of Front Beach, radio tags could be applied at this location. Salmon would be captured in nets; radio tags would be inserted into their stomachs via their mouth, and the fish would be released. A radio would then be used to track the path of these fish. This could determine whether the majority of the fish are migrating into the Unalaska Lake watershed (and where within the watershed) or if they are traveling to other watersheds on Unalaska. Additionally, fish could be tagged as they pass through the weir, and their preferred spawning location and corresponding habitat determined.

3.1.6 Operations and Maintenance of the Roadway

Road operations and maintenance along the river should be considered for any negative affects it may have on the river. This could include attentiveness when snow blowing around the river and over bridges, not leaving snow piles on the riverbanks where melt and associated sediments and pollutants will runoff into the stream, and plows to drive extra slow when going over bridges to ensure nothing is plowed over the edge into the river.

In addition to road maintenance and operations, the City could install a guardrail along Haystack Drive just above the south bank of the river in order to discourage snow and gravel being plowed off the road and into the wetlands and riparian area below. Public comment and observations concluded that the snow would be plowed over the top elevation of a guardrail and, therefore, the guardrail would be useless or provide little benefit.

3.1.7 Public Education

Additional funding for public education could result in greater knowledge and care for the river in the future and greater community support for the restorative measures being implemented. This can be taught in schools, incorporated into science fair projects, and done through placement of educational kiosks along the river. These kiosks could include information such as the salmon life cycle, importance of riparian areas and their attributes (such as vegetation), discussion on the upstream fish ladder, and information on the fish counting station (sonar and/or weir) at the 5th Street Bridge. Design of the interpretive kiosks would also be a great public involvement opportunity for high school students.

4.0 Community Teaming Opportunities

Implementing the restoration projects and fish counting discussed in this RMP allows for an opportunity for public education and outreach, in addition to potentially cutting future construction, maintenance, or operation costs. The public's involvement is accepted and encouraged for these restoration projects.

In addition to public involvement, additional funding could be pursued and allocated to training and education of the public. This could include placement of educational kiosks or informative signs along the river discussing the importance of vegetation to erosion control and fish habitat, discussing the life cycle of salmon, discussing the species of salmon and their importance, and/or other important aspects of the Iliuliuk River ecosystem. Additionally, training would be required for operators and counters at the weir or sonar, in order for ADF&G to accept the collected data.

Interest in this RMP has already been expressed by the Qawalangin Tribe of Unalaska and by the Unalaska High School's fisheries class, which is already activitely working on studying the Unalaska

Lake watershed and Iliuliuk River. Photo 4-1 shows a high school student conducting turbidity measurements on the Iliuliuk River near the 5th Street Bridge.

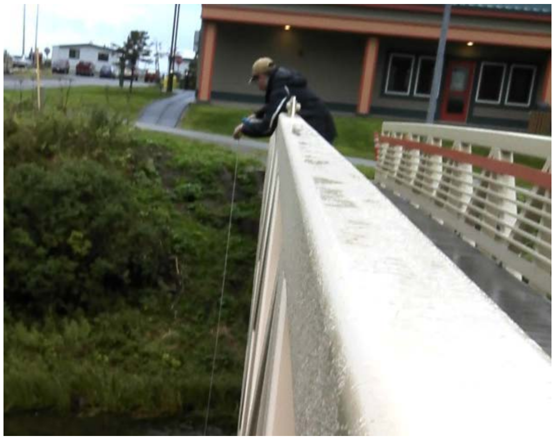


Photo 4-1. High School Student Measuring Transparency of the Water

4.1.1 Fish Counting

4.1.1.1 Construction

Public involvement could substantially decrease the cost of construction of a resistance board or tripod weir. Multiple documents have been published outlining the design and construction of these weirs, potentially making it a community-building project, or even something for a high school shop class to undertake with supervision. The ADF&G construction manual can be found at the following link: http://www.arlis.org/docs/vol1/57240706.pdf.

4.1.1.2 Counting

Counting fish will have to be closely coordinated with ADF&G biologists to ensure data meet their quality standards; however, there may be a large opportunity for public involvement for the counting of sockeye salmon as they pass through the chute in the weir. This could be a great opportunity for the Unalaska High School fisheries class, or even for volunteers from the Qawalangin Tribe, Unalaska Native Fisherman's Association (UNFA), or other organizations. Additionally, counting fish on sonar video could be a good learning experience for the fisheries class. Any fish count work would need to be coordinated with ADF&G to ensure adequate quality of data received. According to ADF&G, this may include a cooperative agreement, including proper training of all personnel involved in the operation of the equipment and collection of data (Telephone conversation with Donn Tracy (ADF&G) 12/2/14). This could help formalize the relationship and objectives of this project. Further coordination will be required with the weir operator and ADF&G to develop an agreement, obtain proper permits, and proceed with any necessary training.

4.1.2 Cleanup of the Lower River

Additional opportunities include cleanup of the lower river. Concerns have been expressed on the amount of trash in the streambed near the mouth of the Iliuliuk River. At the first stakeholder meeting, the Qawalangin Tribe of Unalaska expressed their pursuit in conjunction with the UNFA to gather funding and a collaborative effort in the cleanup of the lower river. Additional work and funding outside of this RMP and its grant allocations will substantially benefit the process. The Q-Tribe has been in contact with the City of Unalaska Director of Public Works, and a meeting is scheduled to discuss methods and equipment usage for this effort.

5.0 Plan Implementation and Maintenance

5.1 Implementation Timeline

All funding for implementation of the RMP must be used, per grant instructions, in Year 2 (2015). Some of these options are even further restricted by allowed fish windows for in-water construction. In-water work, below ordinary high water (OHW) will likely have to take place between November and late May, prior to salmon runs. A total of $251,657 will be allocated to the projects of the City's choosing as discussed in this RMP. This funding will be used for any required engineering, permitting, and construction costs. Some of the restoration options discussed in this RMP (such as the weir) will require continued maintenance, storage, installation/removal, and manpower costs which will not be funded by this grant. Implementation options are discussed below and displayed in Figure 5-1.

5.2 Lower River

5.2.1 Revegetation

The lower 1,500 feet of north bank will all be hydroseeded during the summer of 2015. Additionally, revegetation of sections on the north bank of the lower Iliuliuk River would require harvesting of existing beach wildrye sprigs and then planting. Due to the limited area of concern for sprig planting, this process would likely require less than 10 people and only a couple days of work. This would need to take place during late summer of 2015. Additional measures would need to be taken in order to protect the newly planted grass, such as taping off these areas, and placing signage. Revegetation will not take place below OHW; therefore, timing will not be dependent on fish windows.

5.2.2 Light Penetrating Stairways

Installation of light penetrating stairways would need to take place during the summer/fall of 2015. Procurement should take place as soon as the restoration measures are decided, and construction (such as drilling stair pile) should take place during early summer (within allowed fish windows if piles are within the water) in order to allow for any necessary revegetation in the disturbed area to take place afterwards. A rendering of light penetrating stairs at openings in the guardrail is shown in Figure 5-2.

PND Engineers, Inc.

LOWER ILIULIUK RIVER
RESTORATION & MANAGEMENT PLAN
RESTORATION/IMPLEMENTATION OPTIONS

FIG 5-1

Figure 5-2. Rendering of Light Penetrating Stairways

Maintenance of the stairs would include inspection and repair of any defects that could create a public safety hazard. Additional maintenance would be needed to make sure the stairs are clear of debris that would block the light penetration to the vegetation below.

5.2.3 Educational Kiosks

Educational kiosks along the river could be installed at any time as it is not restricted by the grant timeline. Maintenance would be required to clean up any potential vandalism, and even include replacement in the future.

5.2.4 Outfall Sediment Collection

Like the educational kiosks, the outfall sediment collection system would not be governed by the grant timeline and could therefore be installed at any point in time. Annual maintenance would be required in order to clean out the barrel section of any substantial sediment.

5.3 Fish Counting

Final location of the weir or sonar installation must be determined. The grant language discusses installation of a weir or sonar near the island and Church Hole. ADF&G has preliminary discussed preference in installation of a resistance board weir upstream of the 5th Street Bridge. This site has less water fluctuation due to tides, a stable stream bottom, and is fairly accessible. This site will also protect the fish queuing at the entrance to the chute from illegal fishing. The lower river by the Church Hole is near the site of legal salmon (not sockeye) fishing, but would create easy access for snagging the fish pooled up by the weir. Moving the weir location to the 5th Street Bridge would only count sockeye salmon and potentially silver salmon escapements (not all pink). This would also be a feasible location for sonar.

If a weir is selected, maintenance of the weir would need to be completed bi-annually and as needed. The weir would need to be installed and removed each year prior to the sockeye run and before freeze up. Additional maintenance would be required at any point when debris buildup along the weir is noticed.

It should be noted that the grant funding described in this plan only covers initial construction or procurement and initial implementation of the weir. It will not cover maintenance past 2015, and will not cover the required constant manning of the weir for counting fish, nor any storage or maintenance fees. Construction of the resistance board weir would be according to ADF&G's 2002 "Resistance Board Weir Panel Construction Manual", which can be found in Appendix C.

Additional aspects of the weir project could be the addition of a public viewing area. If the weir location is near the 5th Street Bridge, the existing pedestrian bridge provides a viewpoint to watch fish swim upstream and through the weir. Access for technicians during the sockeye salmon run to the weir would also likely need to be provided through use of light-penetrating stairs.

Coordination between the weir operator and ADF&G will be required, including a potential cooperative agreement, in order to ensure proper training for individuals that will be counting fish so that data would be accepted and usable by the State.

If sonar is chosen, a similar agreement and training program may be required by ADF&G to ensure adequacy and quality of collected data. Sonar equipment, including the device, recording equipment, and power, could be installed in 2015 prior to the sockeye run. The equipment would need to be removed prior to freeze up each year and stored.

5.4 Radio Tagging

Radio tagging of fish at Front Beach and at the weir location would have to occur at the very beginning of the sockeye salmon run. Prior to this happening, all necessary permits must be obtained.

5.5 Operations and Maintenance of the Roadway

PND recommends that the City of Unalaska consider snow blowing and gravel sweeping activities around the river banks and prevent placing material where it will runoff into the stream or within the riparian areas during spring melt.

To assist with this solution, addition of guardrails on Haystack Drive just above the south bank of the lower river could limit snow and gravel from leaving the roadway and falling down the extremely steep embankment into the underlying wetlands and stream, though the community is skeptical about the effectiveness of this method.

Implementation of any changes in operations and maintenance of the roadway by the City of Unalaska can take effect immediately.

6.0 Permitting Requirements

All river restoration projects are within the jurisdiction of the ADF&G and will require Fish Habitat Permits in addition to in-stream construction/disturbance occurring outside of the specified fish windows. In-water work will likely have to be completed between November and end of May. Revegetation along the banks of the river and within wetlands may also require a permit from the US Army Corps of Engineers (USACE), but only if it occurs mechanically (not by hand). Installation of light penetrating stairs (if they lead into the water) will require a permit from USACE under Section 10 of the Rivers and Harbors Act, and must be done in appropriate fish windows. Installation of a removable fish weir would require a USACE permit and the Fish Habitat Permit from ADF&G, as well as an ADF&G Fish Resources Permit. A permitting checklist can be found in Appendix C.

7.0 Cost Estimate

As mentioned previously, the grant requires implementation of specific measures. Table 7-1 displays a ROM cost estimate summary for the aforementioned restoration projects for the Lower Iliuliuk River required in the grant. It presents approximate implementation costs for the various projects, including design, permitting, procurement, and construction/installation.

Table 7-1. Grant Funded Restoration Options ROM Costs

Description	Total Cost
Resistance Board Weir*	$140,000
1500' of Revegetation/Coir Logs and Rip Rap	$24,000
Light Penetrating Stairs/Walkway (125 linear feet)	$65,000
Guardrail at Haystack (500 linear feet)	$85,000
TOTAL	**$314,000**

* Will require additional funds, on a reoccurring basis, for 1) maintenance, 2) installation/removal, 3) operation, 4) storage

The total cost of the restoration measured required in the cost totals approximately $78,000 more than the grant provides. During the final review of this report, the City learned of and is pursuing a potential opportunity to obtain additional funding through the granting agency to allow a more complete implementation of the recommendations in this report; however, the additional funds are not guaranteed. These include the addition of fish sonar (including design, permitting, and installation), three informative kiosks and their installation, purchase of three pre-cast barrel sections that the City would install on their own, and radio tags and associated instrumentation. A ROM cost estimate for these is presented in Table 7-2.

Table 7-2. Non-grant Funded Restoration Options ROM Costs

Description	Total Cost
Shortfall (unfunded work)	$78,000
Fish Sonar	$170,000
Pre-cast Barrel Sections (3)	$15,000
Informative Kiosk (3 sets)	$25,000
Radio Tagging Sockeye (Supplies/Contractual)	$21,840/$52,000
TOTAL	$361,782.52

8.0 Future Opportunities

Future funding and involvement will be required to continually implement, maintain, and assess the measures discussed in this RMP. Grant funds do not cover continual manning of the potential weir and fish counts, and will not include additional restoration efforts past Year 2 (2015). This is one reason public involvement and participation will be extremely valuable when considering construction of a fish weir and other restoration efforts. Future restoration efforts for the Iliuliuk River identified through public comment and development of this plan, not thoroughly discussed and/or funded by the grant, could include (in no particular order):

1) Continued cleanup of the area around the mouth of the Iliuliuk River,
2) Incorporation of a biannual stream cleanup program (along the full length of the river),
3) Continued education and training within the community and school system regarding the importance of the river, watershed, salmon, and the ecosystem,
4) Revegetation of aquatic grasses in Unalaska Lake,
5) Training additional community members on use of the weir and/or sonar
6) Sample and research the bottom conditions of the stream and lake throughout the watershed to further characterize habitat quality and opportunities for improvement.
7) Permit the high school hatchery to rear sockeye.

9.0 Conclusions & Recommendations

According to the CIAP grant the funding must be used for the following:

1) A weir must be purchased,
2) 1,500 feet of bank must be revegetated,
3) 125 feet of light penetrating stairs and/or walkway must be installed, and
4) guardrail must be constructed to prevent snow deposition into the lower river by plows.

With funding constraints, PND recommends the purchase of a resistance board weir, hydroseeding and revegetation of beach wildrye in noted locations, installation of three stairways at openings in the guardrails in addition to an observation deck above Church Hole, and construction of a guardrail on Haystack Drive. If the City is able to obtain more funding, the following efforts should be considered as having the greatest benefit to river:

1) Adjustments in road operations and maintenance directly adjacent to the river;
2) Procurement of DIDSON sonar;
3) Pre-cast barrel installation at three locations along Haystack Drive;
4) Installation of three informational kiosks and other public education and outreach activities; and,
5) Radio tagging of sockeye salmon along Front Beach

Initial use of the weir would allow for identification of fish species run windows and a more accurate count. If the weir is too expensive to operate in the future, just the sonar could be used, utilizing the then known fish windows.

In order to determine the success of this RMP and its restoration measures, continual monitoring and evaluation is necessary. If revegetation or erosion protection is implemented, annual photography should be taken of the remediated areas at the same time each year. This could document success of the revegetation project if undertaken. PND also suggests that community involvement and public input be encouraged to assess the RMP's success and to continue restoration efforts outside of the funding from the CIAP grant.

Based on this RMP, the City of Unalaska will determine which aforementioned restoration measures to fund and how much funding will be allocated to each project. This document can also be used as a reference for beneficial restoration projects to be implemented in the future.

10.0 References

Holmes, P. B. 1997. Aleutians Islands Salmon 1982 Stock Assessment Survey and Current Status. Alaska Department of Fish and Game, Commerical Fisheries Management and Development Division, Regional Information Report No. 4K97-6, Kodiak, Alaska.

McCullough, J. N. October 2010. Biological Assessment and Monitoring of Anadromous Fish at Summer Bay Lake, Unalaska Island, Alaska, 1999: Juvenile and Adult Fish Production Two Years Following the M/V Kuroshima Oil Spill. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 4K00-63, Kodiak, Alaska.

Neyman, J. July 2011. Tools of the fish count trade – Fish and Game wrestles to land accurate Kenai king sonar data. Retrieved from The Redoubt Reporter December 1, 2014: https://redoubtreporter.wordpress.com/2011/07/13/tools-of-the-fish-count-trade-%E2%80%94-fish-and-game-wrestles-to-land-accurate-kenai-king-sonar-data/

State of Alaska Coastal Impact System Program, Project Narrative Attachment. 2011. Lower Iliuliuk River Restoration Phase I. CCIAP Project Narrative for Federal Grant Application, AWCRSA, T1-02, March 2011. AK CIAP NR AWCRSA T1-02 Revised and Submitted to BOEMRE 6.6.11.

Tobin, J. H. 1994. Construction and Performance of a Portable Resistance Board Weir for Counting Migrating Adult Salmon in Rivers. U.S. Fish and Wildlife Service, Kenai Fishery Resource Office, Alaska Fisheries Technical Report Number 22, Kenai, Alaska.

Tschersich, P. 2007. Aleutian Islands and Atka-Amlia Islands Management Areas Salmon Management Report, 2006. Alaska Department of Fish and Game, Divisions of Sport Fish and Commercial Fisheries, Fishery Management Report No. 07-28, Anchorage, Alaska.

Steward, R. 2002. Resistance Board Weir Panel Construction Manual. Alaska Department of Fish and Game, Division of Commercial Fisheries, Arctic-Yukon-Kuskokwim Region, Regional Information Report No. 3A02-21, Anchorage.

Walter, J., Hughes, D., & Moore, N. 2005. Streambank Revegetation and Protection: A Guide for Alaska. Alaska Department of Fish and Game, Division of Sport Fish.

Wright, S. 2010. Beach Wildrye: Planting Guide for Alaska. Alaska Department of Natural Resources, Division of Agriculture, Plant Materials Center, Palmer, AK. United States Navty, Engineering Field Activity Northwest, Poulsbo, Washington.

Zimmerman, C. & Zabkar, L. Weirs. Salmonid Field Protocols Handbook: Techniques for Assessing Status and Trends in Salmon and Trout Populations. American Fisheries Society in association with State of Salmon, Portland, OR. Accessed at http://www.stateofthesalmon.org/fieldprotocols/downloads/SFPH_p13.pdf

APPENDIX A

Wetland Delineation Report

LOWER ILIULIUK RIVER

Wetland Delineation Report

Prepared for:
City of Unalaska
43 Raven Way
Unalaska, Alaska 99685

October 2014

Prepared by:

PND ENGINEERS, INC.

SUMMARY

In September 2014, PND Engineers, Inc. (PND) conducted a wetland delineation of the lower Iliuliuk River in Unalaska, Alaska for the City of Unalaska (COU). This survey delineates and classifies wetland and upland areas along the last 1500 feet of the Iliuliuk River. Wetland determinations herein follow the U.S. Army Corps of Engineers Wetland Delineation Manual (1987) as well as the Alaska Regional Supplement (2007) three-tier approach. PND investigated vegetation, soils, and hydrology at all test plot locations.

The project site is located along the lower 1500 feet of the Iliuliuk River situated just to the southwest of West Broadway Avenue. The site was bound to the southwest by the lower Iliuliuk River and to the northeast by West Broadway Avenue, with the land averaging a width of approximately 20 feet throughout the length of the delineated area. Of the approximately 0.63 acres delineated, only 0.06 acres satisfy the criteria to be a wetland pursuant to the U.S. Army Corps of Engineers (USACE) 1987 Manual and the 2007 Alaska Regional Supplement with subsequent clarification memoranda and pursuant to confirmation by USACE. All wetlands found during the field investigation were found to be under the jurisdiction of the USACE per Section 404 of the Clean Water Act.

Table of Contents

List of Pictures

Appendices

1.0 INTRODUCTION

1.1 Site Location

The project site is located within several points along the lower 1500 feet of the Iliuliuk River situated just to the southwest of West Broadway Avenue. The site was bound to the southwest by the lower Iliuliuk River and to the northeast by West Broadway Avenue, with the land averaging a width of approximately 20 feet throughout the length of the delineated area.

Temperatures at the site range from a low of 27.8˚F in February to a high of 58.8˚F in August. Average monthly precipitation ranges from a low of 2.21 inches in July to a high of 7.9 inches in December. Snowfall annually averages 92.3 inches with the highest snowfall amounts occurring in January (WRCC). The climate is cold maritime with long periods of wind, drizzling rain, and fog (Alden & Bruce, 1989).

2.0 BACKGROUND INFORMATION

2.1 Existing Wetland Information

The National Wetland Inventory was searched prior to field investigations. No existing data was found on wetlands in Unalaska.

2.2 Existing Vegetation Information

Vegetation in the Aleutians is typically composed of low shrub communities along mountain flanks and coastlines such as willow, birch, and alder interspersed with ericaceous-heath, *Dryas*-lichen, and various grass communities. Upland areas are normally composed of peat and mats of heath tundra with sedges (ADF&G, 2006). See Section 4 for detailed descriptions of the vegetation communities found in the project area during delineation fieldwork.

2.3 Existing Soils Information

The U.S. Department of Agriculture Natural Resource Conservation Service (NRCS) soil surveys do not provide detailed coverage of the project area. The Exploratory Soil Survey of Alaska gives general information about the soils in the project area (NRCS, 1979). According to the Exploratory Soil Survey of Alaska, the majority of the soils in areas surrounding Unalaska Bay are loamy, Typic Cryandepts, typical in hilly to steep areas with rough mountainous land (NRCS, 1979). Typic Cryandepts are usually dark reddish brown or dark brown and can be made up of ash grains of sand and cinder size.

2.4 Existing Hydrology Information

The lower Iliuliuk River is a tidally influenced perennial stream located in the Summer Bay – Frontal Unalaska Bay watershed. The river drains Unalaska Lake and discharges into Iliuliuk Bay. Several streams drain into Unalaska Lake, including the Upper Iliuliuk River and numerous unnamed streams. Storm water flows from West Broadway Avenue into adjacent upland and wetland areas and eventually into the river. There is evidence of erosion along the road and adjacent vegetated upland areas related to the flows from storm water runoff.

3.0 METHODOLOGY

Methodology for this wetland delineation followed the process established in the U.S. Army Corps of Engineers (USACE) Wetland Delineation Manual (1987) and the Alaska Regional Supplement (2006). Methodology followed the three-tiered survey approach established in the USACE manual and included the examination of vegetation, soil, and hydrology at all wetland delineation test plot (TP) sites. The field preparation, wetland delineation, and data analysis were conducted by Lisa Baughman, a PND environmental scientist with Army Corps of Engineers Wetland Delineation Training.

3.1 Field Preparation

Prior to the wetland delineation field visit, various sources were searched for background information on the site. Aerial photos from 1951 and 1983 were viewed and compared to aerial photography from 2014. Due to the size of the site as well as the technology available when the older photos were taken, it was impossible to discern changes in vegetation. An initial site walkthrough was completed on September 16 and 17 to determine various types of vegetation and take photos of the site for further review. At this time two distinct vegetation communities were identified.

3.2 Wetland Delineation

According to the research done prior to the field reconnaissance, none of the areas within the project site had been delineated previously. Due to this, the decision was made to delineate the wetlands using the following steps.

1) Walk the site examining existing vegetation.
2) Determine the areas for Test Plot (TP) based on plant communities.
3) Determine whether plants are wetland plants.
4) Dig test pits to assess soils and hydrology.
5) Flag the wetlands and notate the boundaries.

After determining that two different plant communities were present within the site, the sites were examined using the three-tiered survey approach established in the USACE manual including the assessment of vegetation, soil, and hydrology. Sites that did not meet all three criteria were determined to be uplands.

3.3 Data Analysis and Mapping

The wetland boundaries at the site were walked with a handheld GPS unit during and after the wetland areas had been flagged. Pictures were taken throughout the site and used, along with the wetland determination data forms and field notes, to correlate data from the site reconnaissance.

Wetland areas were then assigned a classification using data collected from the field visit as well as existing NWI mapping and Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al., 1979). Wetland boundaries and TP are shown in the figure located in Appendix B.

4.0 RESULTS AND DISCUSSION

4.1 Wetland Habitat Types

Vegetation within the lower Iliuliuk River project area consists mainly of beach wildrye (*Leymus mollis*) with arctic bluegrass (*Poa arctica*) occurring in flat areas located along the river. The areas that were identified as wetlands were relatively flat in comparison to the sloping uplands. Appendix A contains the wetland delineation data forms, and Appendix B contains a figure which shows the extents of wetlands within the project boundaries. Portions of vegetation at the site were impacted by heavy traffic from local sport fishermen, but not significantly enough to consider vegetation at the site as "significantly disturbed."

Picture 1. River access stairs and impacted vegetation area.

The wetlands occurring near the river are adjacent to a USACE regulated water of the US, and as such are also regulated by the USACE. These wetlands, both above and within the streambank, were tidally influenced.

4.1.1 Persistent Emergent Tidal Riverine Wetland (R1EM1)

Flat areas near the river were determined to be persistent emergent tidal riverine wetlands. The dominant plant types included beach wildrye (*Leymus mollis*) and arctic bluegrass (*Poa arctica*), although the beach rye was less plentiful in wetland areas than in upland areas.

Soils in this wetland were topped with a vegetative mat. Below the vegetative mat, only 3 inches of soil occurred before dense gravel and cobbles (streambed materials) were encountered. The soils at TP 1 contained iron deposits occurring throughout the gleyed matrix seen in the following picture.

Picture 2. Presence of gleyed soils and iron deposits at TP 1.

Soils exhibited saturation at TP 1. During the high tide, the TP also exhibited a high water table as evidenced in Picture 3 below.

Picture 3. Presence of high water table within wetlands at TP 1.

4.1.2 Tidal Riverine Wetland (R1)

The lower Iliuliuk River within the project area was determined to be a tidal riverine wetland due to the tidal influences from Iliuliuk Bay on the river. During low tide periods, the rocky streambed could be seen along the river's edge. The streambed that remained underwater was assumed to include patchy cobbles due to the streambed conditions 50-100 feet upstream of the project boundaries. There were few wetland plants in this portion of the project area and the site was assumed to be wetland although wetland plants were not fully assessed.

Picture 4. River at low tide.

4.2 Upland Habitat Types

The sloping land along the lower Iliuliuk River project area was mainly covered with beach wildrye (*Leymus mollis*) with small amounts of seabeach senecio (*Senecio pseudoarnica*) and seacoast angelica (*Angelica lucida*) present, and even smaller amounts of sedge and arctic bluegrass (*Poa arctica*) present. The texture of the soils within the upland habitat was sandy loam. Soils in the upland TP (2) did not exhibit saturation as evidenced in picture 5 below. Hydric characteristics were not present in soils in TP 2. Soils at TP 2 felt dry, although they were slightly moist due to recent rain events. Upland areas appeared to be filled with gravel beginning 7 inches below ground surface. It is likely that this area was filled for the construction of West Broadway Avenue, but aerial photograph and available resources could not confirm.

Picture 5. Dry upland soils at TP 2.

4.3 Conclusion

The lower, flatter portions within the project boundaries exhibited wetland soils, vegetation, and hydrology, while sloping, upland portions only exhibited wetland vegetation. Of the approximately 0.63 acres of land delineated, only 0.06 acres satisfy the criteria to be a wetland pursuant to the U.S. Army Corps of Engineers (USACE) 1987 Manual and the 2007 Alaska Regional Supplement with subsequent clarification memoranda and pursuant to confirmation by USACE. All wetlands found during the field investigation were found to be under the jurisdiction of the USACE per Section 404 of the Clean Water Act.

REFERENCES

Alaska Department of Fish and Game. 2006. Our Wealth Maintained: A Strategy for Conserving Alaska's Diverse Wildlife and Fish Resources. Alaska Department of Fish and Game, Juneau, Alaska. xviii+824 p.

Alden, J.; Bruce, D. 1989. Growth of historical Sitka spruce plantations at Unalaska Bay, Alaska. Gen. Tech. Rep. PNW-GTR-236. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Experiment Station. 18 p.

Cowardin, Lewis M., Virginia Carter, Francis, C. Golet, and Edward T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Department of the Interior. Fish and Wildlife Service Office of Biological Services. Washington D.C. 20240

Department of the Army. 1987. U.S. Army Corps of Engineers Wetlands Delineation Manual. Waterways Experiment Station, Vicksburg MS.

Department of the Army. 2004. U.S. Army Corps of Engineers Navigation Improvements Integrated Interim Feasibility Report and Final Environmental Impact Statement. Alaska Region

Department of the Army. 2006. U.S. Army Corps of Engineers Interim Supplement to the Corps of Engineers Wetland Delineation Manual: Alaska Region.

Lichvar, R.W., M. Butterwick, N.C. Melvin, and W.N. Kirchner. 2014. The National Wetland Plant List: 2014 Update of Wetland Ratings. Phytoneuron 2014-41: 1-42.

Munsell Soil Color Charts. 2009 Revision. 2013 Production. Munsell Color X-Rite. Grand Rapids, MI.

National Resources Conservation Service. 1979. Exploratory Soil Survey of Alaska. USDA/NRCS, Palmer, AK.

Viereck, L.A., C.T. Dyrness, A.R. Batten, and K.J. Wenzlick. 1997. The Alaska Vegetation Classification. U.S. Department of Agriculture, Forest Service.

Western Regional Climate Center. Alaska Climate Summaries. (http://www.wrcc.dri.edu/summary/climsmak.html).

Appendix A

Wetland Figure

PND ENGINEERS, INC.

WETLANDS DELINEATION

FIG 1

Appendix B

Wetland Delineation Data Forms

WETLAND DETERMINATION DATA FORM – Alaska Region

Project/Site: Lower Iliuliuk River   Borough/City: Unalaska   Sampling Date: 9/18/14

Applicant/Owner: City of Unalaska   Sampling Point: 1 (Church)

Investigator(s): Lisa Baughman   Landform (hillside, terrace, hummocks, etc.): river bank

Local relief (concave, convex, none): ______   Slope (%): ______

Subregion: Aleutian AK   Lat: 53.8779 N   Long: -166.5412 W   Datum: GPS

Soil Map Unit Name: N/A   NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed?   Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic?   (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ___	**Is the Sampled Area within a Wetland?**	**Yes X No ___**
Hydric Soil Present?	Yes X No ___		
Wetland Hydrology Present?	Yes X No ___		

Remarks:

VEGETATION – Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:			
50% of total cover: ___ 20% of total cover: ___			
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
6.			
Total Cover:			
50% of total cover: ___ 20% of total cover: ___			
Herb Stratum			
1. Arctic bluegrass (Poa arctica)	35	Yes	FAC
2. Beach wildrye (Leymus mollis)	10	No	FACW
3. Sedge	70	Yes	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
Total Cover:	115		
50% of total cover: 57.5 20% of total cover: 23			

Plot size (radius, or length x width) ______ % Bare Ground ______

% Cover of Wetland Bryophytes ______ (Where applicable)   Total Cover of Bryophytes ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	10	x 2 =	20
FAC species	105	x 3 =	315
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	115 (A)		335 (B)

Prevalence Index = B/A = 2.91

Hydrophytic Vegetation Indicators:

- X Dominance Test is >50%
- X Prevalence Index is ≤3.0
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes X No ___**

Remarks:

SOIL

Sampling Point: 1 (Church)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
3	5YR 4/1	95	2.5YR 4/6	5	C	M	Sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol or Histel (A1)
- ___ Histic Epipedon (A2)
- ___ Hydrogen Sulfide (A4)
- ___ Thick Dark Surface (A12)
- X Alaska Gleyed (A13)
- ___ Alaska Redox (A14)
- ___ Alaska Gleyed Pores (A15)

Indicators for Problematic Hydric Soils[3]:

- ___ Alaska Color Change (TA4)[4]
- ___ Alaska Alpine Swales (TA5)
- ___ Alaska Redox With 2.5Y Hue
- ___ Alaska Gleyed Without Hue 5Y or Redder Underlying Layer
- ___ Other (Explain in Remarks)

[3]One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present unless disturbed or problematic.
[4]Give details of color change in Remarks.

Restrictive Layer (if present):

Type: Dense gravel, cobbles

Depth (inches): 3

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Dry-Season Water Table (C2)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-stained Leaves (B9)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Salt Deposits (C5)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes X No ___ Depth (inches): 2

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): Throughout

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Water table was tidally influenced. TP was dug and staked at low tide. Upon returning to retrieve the stake, water was present in the TP.

WETLAND DETERMINATION DATA FORM – Alaska Region

Project/Site: Lower Iliuliuk River Borough/City: Unalaska Sampling Date: 9/18/14

Applicant/Owner: City of Unalaska Sampling Point: 2 (Dock)

Investigator(s): Lisa Baughman Landform (hillside, terrace, hummocks, etc.): river bank

Local relief (concave, convex, none): ______ Slope (%): ______

Subregion: Aleutian AK Lat: 53.8757 N Long: -166.5369 W Datum: GPS

Soil Map Unit Name: N/A NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ___
Hydric Soil Present?	Yes X	No ___
Wetland Hydrology Present?	Yes X	No ___

Is the Sampled Area within a Wetland? **Yes** X **No** ___

Remarks:

VEGETATION – Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:			
50% of total cover: ___ 20% of total cover: ___			

Sapling/Shrub Stratum	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
Total Cover:			
50% of total cover: ___ 20% of total cover: ___			

Herb Stratum	Absolute % Cover	Dominant Species?	Indicator Status
1. Arctic bluegrass (Poa arctica)	0.5	No	FAC
2. Beach wildrye (Leymus mollis)	90	Yes	FAC
3. Sedge	0.5	No	FACW
4. Seabeach senecio (Senecio pseudoarnica)	10	No	FACU
5. Seacoast angelica (Angelica lucida)	5	No	FACU
6.			
7.			
8.			
9.			
10.			
Total Cover:	106		
50% of total cover: 53 20% of total cover: 21.2			

Plot size (radius, or length x width) ______ % Bare Ground ______

% Cover of Wetland Bryophytes ______ Total Cover of Bryophytes ______
(Where applicable)

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	0.5	x 2 = 1
FAC species	90.5	x 3 = 271.5
FACU species	15	x 4 = 60
UPL species		x 5 =
Column Totals:	106 (A)	332.5 (B)

Prevalence Index = B/A = 3.13

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

___ Prevalence Index is ≤3.0

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks:

SOIL

Sampling Point: 2 (Dock)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
7	2.5YR 2.5/1	100					Sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol or Histel (A1)
- ___ Histic Epipedon (A2)
- ___ Hydrogen Sulfide (A4)
- ___ Thick Dark Surface (A12)
- ___ Alaska Gleyed (A13)
- ___ Alaska Redox (A14)
- ___ Alaska Gleyed Pores (A15)

Indicators for Problematic Hydric Soils[3]:

- ___ Alaska Color Change (TA4)[4]
- ___ Alaska Alpine Swales (TA5)
- ___ Alaska Redox With 2.5Y Hue
- ___ Alaska Gleyed Without Hue 5Y or Redder Underlying Layer
- ___ Other (Explain in Remarks)

[3]One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present unless disturbed or problematic.
[4]Give details of color change in Remarks.

Restrictive Layer (if present):

Type: Gravel, cobbles

Depth (inches): 7

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

Very gravelly. May have been filled previously due to road construction (pre-1951). Riverbed materials were also present.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Dry-Season Water Table (C2)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-stained Leaves (B9)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Salt Deposits (C5)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No X Depth (inches): _____

Water Table Present? Yes _____ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No X Depth (inches): _____

Wetland Hydrology Present? **Yes** _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

APPENDIX B

Relevant Specification & Concept Drawings

RMP DRAFT SPECIFICATIONS

Hydroseeding:
Hydro seed mixes are attached. Preparation will be done at the job site. Water, mulch, fertilizer, binder, and other ingredients shall be added to the tank and mixed. Seed will be added last and discharged within 2 hours of last addition. Once fully loaded, the slurry shall be agitated for at least 5 minutes to allow uniform mixing. Hydroseeding shall be done in a sweeping motion to form a uniform application. Hydroseeding shall take place within Zones 3 and 4 as referenced in *Streambank Revegetation and Protection: A Guide for Alaska*.

Beach Wildrye Revegetation:
For sprig planting, follow the *Beach Wildyre Planting Guide for Alaska* by Stoney Wright. Native plants in the direct area shall be used.

Coir Logs:
Coir logs shall be 100% biodegradable made from coconut with a strong, coir twine surrounding the mix of coconut mattress coir, such as the EZ-Log. See attached specification.

Light-Penetrating Stairs & Gratewalks:
Gratewalks and stairs should be constructed with at least 60% light penetration. They must be constructed such that no parts, other than supporting posts, are within 4" off the ground. All grating must be galvanized steel or fiberglass. Stairs may be aluminum. Framing and posts shall be treated timber or galvanized steel.

Interpretive Signs:
Interpretive signs may be made out of wood, metal or plastic material. They must be weatherproof. Final design must be approved by the City.

Resistance Board Weir:
The resistance board weir shall be constructed out of materials and per directions as shown in ADF&G's *Resistance Board Weir Panel Construction Manual*.

DIDSON Sonar:
Sonar shall be the DIDSON 300m. See attached cut sheets.

Radio Tagging:
Radio tagging equipment shall include the Lotek SRX 800-MD2 VHF radio receiver, F150-3FB antenna, and MCFT2-3A transmitter tags. See attached cut sheets.

Alaska Garden & Pet Supply Inc. **dba Alaska Mill & Feed Co.**

114 North Orca • P.O. Box 101246 • Anchorage, Alaska 99510 • Phone (907) 279-4519 • FAX (907) 276-7416

October 11, 2013

City Electric

Reference: Dutch Harbor Seeding
Seed Submittal

Gentlemen:

The seed mix you have requested consists of 40% Boreal Red Fescue, 40% Nortran Tufted Hairgrass, and 20% Glaucous Tundra Blue The seeds meet the germination and purity minimums as required. All seeds are in compliance with the USDA Federal Seed Act, the State of Alaska Seed Regulations, and contain no invasive species.

Certification will accompany actual product.

Sincerely,

Steve Rooke
Alaska Garden & Pet Supply, Inc.

Use for seeding on rock (lower 1,500 feet of north bank).

RINGER II PERENNIAL RYEGRASS

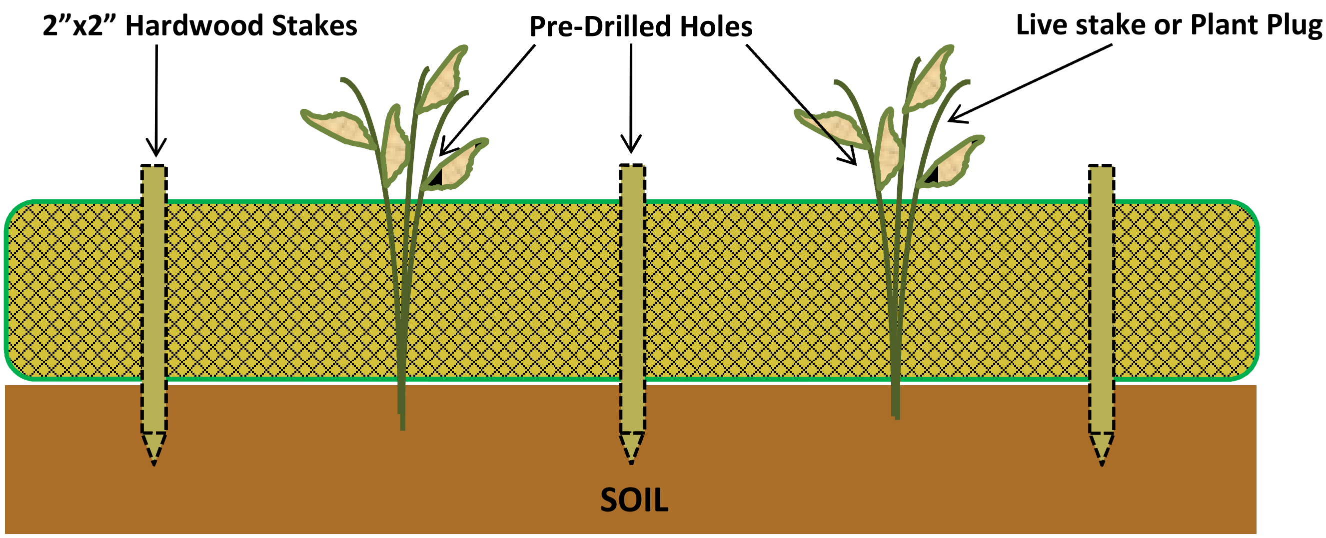
98.00 %	PURE SEED	GERM 90 %	ORIGIN OR
0.10 %	OTHER CROP	LOT # Y38 – 12 – PR21	
1.89 %	INERT MATTER	NET WT. 50 LBS	
0.01 %	WEED SEED	TEST DATE: 4/13	
		AMS 634	

NOXIOUS WEED:
NONE FOUND

ALASKA GARDEN AND PET SUPPLY

PO BOX 101246
ANCHORAGE, AK 99510

EZ-Log™



Installation Instructions

1. Dig trench if needed and place EZ-Log™ in desired location according to standard coir log installation specifications or plans.
2. Remove cardboard insert from the pre-drilled hole.
3. Install hardwood stake or plant material in the pre-drilled hole. Length of stake should be based on log diameter and soil type classification.
4. If installing multiple EZ-Logs™ end to end, secure ends together with coir twine.

Product Notes

1. EZ-Logs™ are modified coir logs with pre-drilled slots for hardwood stakes or vegetation placement.
2. Pre-drilled slots are approximately 2' apart and are approximately 1.25" in diameter.
3. 2"x2" hardwood stakes are recommended for stabilization.
4. Live stakes or plant plugs can be used to promote ideal rooting through the EZ-Log™.

Available Diameters: 12", 16" and 20"
Available Lengths: 10' and 20'
Available Densities: 7 and 9 lb. /linear foot

EcoDepot

Available From: EcoDepot, LLC - 2621 Brickhead Road Gambrills, MD 20154
Phone: 410-451-4400 –Email: Info@EcoDepotSales.com Web: www.EcoDepotSales.com

Applications:

"See" in the most turbid waters

Structure Inspection

Hull and Berth Sweeps

Threat Identification

Search and Recovery

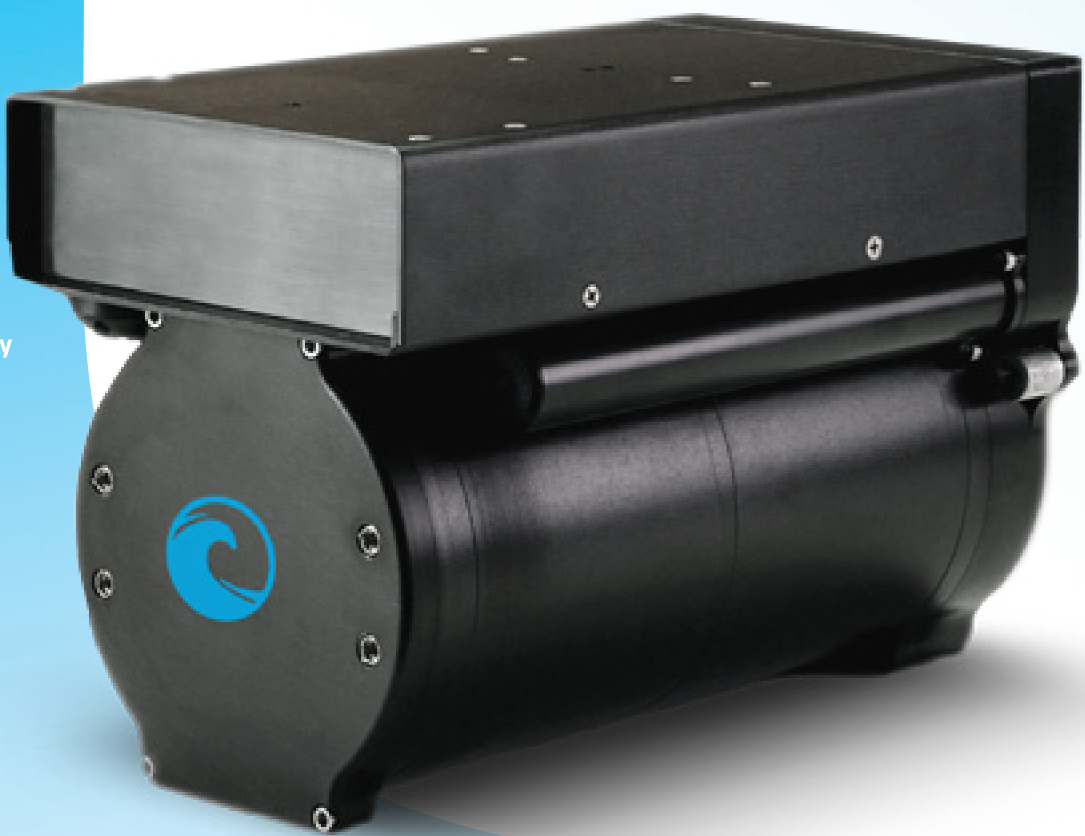
Fisheries Management

Environmental Monitoring

DIDSON 300

DIDSON 300: See what others can't

The DIDSON 300 delivers image clarity that is unmatched by any other sonar in its class. At 1.8 MHz, this imaging sonar provides the detail that is required for thorough inspection. At the lower frequency, 1.1 MHz, the DIDSON's clarity makes it an ideal tool for detecting targets up to 35 meters. These near-video-quality images are presented through a powerful, multifunctional interface. The DIDSON 300 is a favorite of fisheries/marine biology for its ability to deliver necessary detail in real-time. This level of resolution is ideal for inspecting underwater structures, hull and berth sweeps, and for military and law enforcement when accuracy is a must.



Identification Frequency
1.8 MHz

Detection Frequency
1.1 MHz

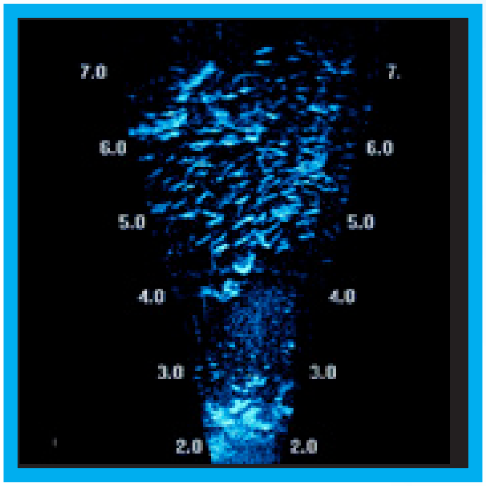
Depth Rating
300m

*Image samples at **soundmetrics.com**.*

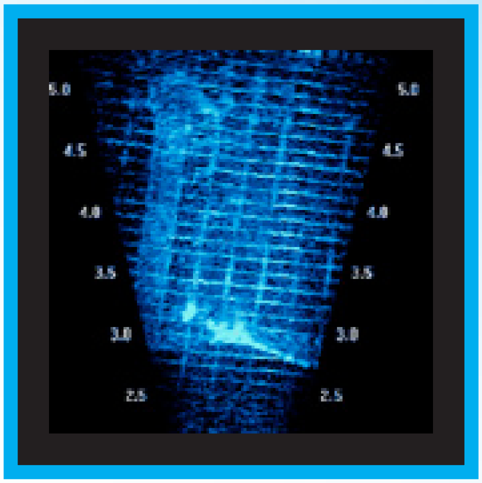
SOUND METRICS

FEATURES

- Near-video-quality dynamic images
- Optional sensor for sonar heading, roll and pitch
- Data easily converted to AVI files
- Ethernet interface with Windows™ computer for real-time data display and control
- Extensive software functions for image processing



School of perch



Pipe wrench on grate

DIDSON 300	Operating Frequency*	Beamwidth	Number of Beams Physical / Displayed
Identification Mode	1.8 MHz	0.3° H by 14° V	96 / 480
Detection Mode	1.1 MHz	0.6° H by 14° V	48 / 240

Max Frame Rate	Field of View	Power Consumption	Weight (Air)	Weight (Water)	Dimensions
20 frames/s	29°	30 W (12-36 Vdc)	7.7 kg	.6 kg	30 x 20 x 17 cm

***The Long Range (LR) system uses lower frequencies (0.7 MHz and 1.2 MHz) and has a maximum range of 80m.**

Founded in 2002, Sound Metrics Corp. is one of the first manufacturers of high resolution imaging sonars. These units are used in virtually every marine industry by some of the most recognizable companies around the world. In addition to being the technological leader in image quality, Sound Metrics has built a reputation for support and for innovating solutions around their customers' applications.

WORLDWIDE SALES INFORMATION:
Ocean Marine Industries, Inc.
Contact: Jeanne Dorsey • Ph: 757-382-7616
Email: jdorsey@**oceanmarineinc.com**

SOUND METRICS

Specifications UL300

DIDSON SV	Depth rated to 300 meters
Detection Mode	
Operating Frequency	1.1 MHz
Beamwidth (two-way)	0.4° H by 14° V
Number of Beams	48
Beam Spacing	0.6°
(Extended) Window Start	0.83m to 52.3m in 0.83m steps
(Extended) Window Length	5m, 10m, 20m, 40m
Range Bin Size (relative to window length)	10mm, 20mm, 40mm, 80mm
Pulse Length (relative to window length)	18μs, 36μs, 72μs, 144μs
Identification Mode	
Operating Frequency	1.8 MHz
Beamwidth (two-way)	0.3° H by 14 ° V
Number of Beams	96
Beam Spacing	0.3°
(Extended) Window Start	0.42m to 26.1m in 0.42m steps
(Extended) Window Length	1.25m, 2.5m, 5m, 10m
Range Bin Size (relative to window length)	2.5mm, 5mm, 10mm, 20mm
Pulse Length (relative to window length)	4.5μs, 9μs, 18μs, 36μs
Both Modes	
Max Frame Rate (range dependent)	4-21 frames/s
Field-of-view	29°
Remote Focus	1m to Infinity
Control & Data Interface	UDP Ethernet
Aux Display	NTSC Video
Max cable length (100/10BaseT)	61m/152m (200ft/500ft)
Max cable length (twisted pair, Patton Extender)	1220m (4000ft)
Max cable length (fiber optics)	kilometers
Power Consumption	25 Watts typical
Weight in Air	7.9 kg (17.4 lb)
Weight in Sea Water	1.0 kg (2.2 lb)
Dimensions	31.0cm x 20.6cm x 17.1cm
Topside PC Requirements	Windows (XP, Vista, 7), Ethernet
Optional	NTSC video monitor

Aquatic, Avian, Terrestrial
VHF Radio

NEW

SRX 800

Preliminary
Product Information

VHF Radio Receiver

The Lotek SRX-receiver remains the telemetry instrument of choice for tracking fish, wildlife and birds within their natural environment since 1991. SRX 800 inherits reliability and sensitivity from predecessors SRX 400 and SRX 600, with additional features, such as simultaneous beeper and coded transmitter tracking, and new, weather resistant packaging. Best of all, affordability has been significantly increased without sacrificing quality. The SRX 800 is the latest standard on which to base your next telemetry project.

Key Features

- Reliable: Lotek standard **two-year** warranty based on field proven technology
- Versatile: Manual tracking or autonomous datalogging for both “beeper” & coded transmitters
- Scalable: Wide range of receiver configurations to meet application requirements and budgets

- Receivers
- Dataloggers
- Radio transmitters
- Acoustic transmitters
- Archival tags
- GPS systems

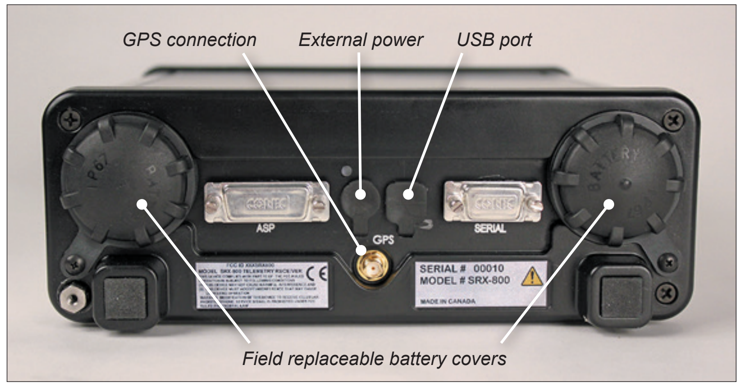
LOTEK WIRELESS
FISH & WILDLIFE MONITORING
Innovative solutions for a sustainable future.

- Hydrophones
- Wireless hydrophones
- 2D/3D Position systems
- Sensor transmitters
- Accessories
- Consulting

SRX 800

Applications

- Species migration patterns
- Presence/absence monitoring
- Survival studies
- Passage/guidance efficiency
- Species interactions
- Critical habitat use



Specifications

GENERAL	
Size:	8 x 21 x 25 cm
Weight with batteries:	2.2 Kg (including batteries)
Batteries	Six (6) primary alkaline (included) or rechargeable NIMC C-cells
Operating Temperature Range:	-20° C to +55° C
Operating Life to Battery Exchange:	12/16 Hours (primary cells at 20° C backlight on/off)
Memory/Record Storage Capacity:	4 - 16 Mb (250K - 1M records)
Display Data (mobile tracking mode):	Frequency, code, signal strength, sensor data
ELECTRICAL	
Operating Voltage Range:	9 VDC
Operating Frequency Range:	8 or 26 MHz Band (within 138 - 218 MHz)
Channel Spacing:	1KHz
Minimum discernible audio level sensitivity:	-150 dBm
Minimum discernible software sensitivity:	-135 dBm
Dynamic Gain Control Range:	90 dB
I/O:	RS-232 and USB
Antennas	1 - 8

Accessories

Manual included
AC adapter included
SRX Host software included
Lotek case and/or carry strap
12V car and battery adapters
Antenna switch box sold separately

Please speak with your Lotek representative to determine what accessories are included with each model.

Preliminary specifications listed are subject to change.
Please contact your Lotek representative for current specifications.

SRX800-D-series in protective case

J0614 - 001

Tel: 905-836-6680
Fax: 905-836-6455

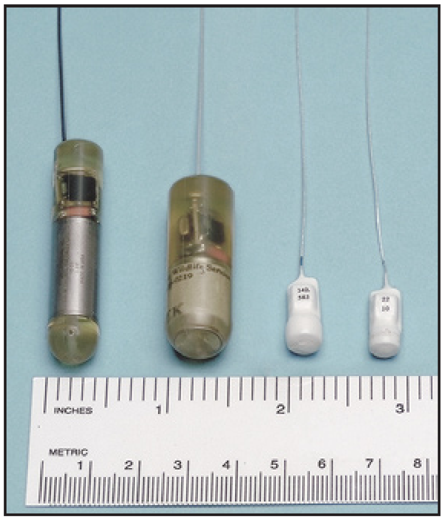
LOTEK WIRELESS
FISH & WILDLIFE MONITORING
Innovative solutions for a sustainable future.

Web: www.lotek.com
Email: biotelemetry@lotek.com

Freshwater Radio

MCFT2 Series

Coded Radio Transmitters



MCFT2 Series radio transmitters are designed for operation in Lotek digitally encoded telemetry systems. Based upon a proprietary coding scheme, these systems allow up to 521 transmitters on a single frequency, while retaining the ability to identify individual animals.

This capability significantly reduces the need for additional frequencies, with a corresponding reduction in total scan time over conventional pulsed systems. Spatial and temporal resolution is enhanced accordingly.

Key Features

The use of the latest microprocessor technology results in a significant improvement in efficiency that extends operational life (nearly 100% over comparable models at 5 second burst rate) providing researchers with the option of reduced tag size and decreased impact upon the species of interest.

The MCFT2 Series also offers advanced and extremely flexible asynchronous ON/OFF and variable burst rate programming. The MCFT2 Series is compatible with sensor technology, including motion and temperature.

Applications

- Long term (multi-year) studies
- Fish passage evaluation
- Microhabitat utilization
- Monitoring of fish entrainment around hydro facilities during migration

MCFT2 Series

Specifications

Operating Frequencies: 140-175 MHz

Typical Frequency Separation: 10 kHz

All transmitters are activated upon removal of a magnet

Activation Programming:

- delay start
- definable hourly/daily/weekly activation periods and burst rates
- Asynchronous programming available

Model	Physical Specifications			Estimated Life (days)*	
	Size (dia x length) (mm)	Air weight (g)	Water weight (g)	2.0 sec. between bursts	5.0 sec. between bursts
MCFT2-3BM	11 x 43	8.0	3.7	184/306	444/723
MCFT2-3B	14 x 37	9.0	4.0	66/110	160/258
MCFT2-3EM	12 x 53	10	4.3	219/364	528/860
MCFT2-3FM	11 x 59	11	4.6	366/609	882/1432
MCFT2-3LM	12 x 69	13	5.4	340/566	819/1330
MCFT2-3A	16 x 46	16	6.7	574	1376
MCFT2-3L	16 x 73	25	11	1241	2929

** Standard Life/Extended Life*

Notes on specifications

Physical dimensions and weights are typically within ± 3%of listed specification. Periodic design modifications to individual transmitter models may alter specifications. Selection of external attachment design, sensor option or antenna may further affect stated specifications. It is recommended that specifications be confirmed when placing an order. Transmitter operational life may vary, dependent in part upon the conditions to which they are subjected. For this reason, calculated operational life values are specified, based on component specifications and transmitter measurements.

Warranty life is defined as 80% of the calculated value effective from date of shipment. Any Lotek transmitter found to be defective with respect to material, workmanship or warranty life, will be repaired or replaced subject to Lotek product warranty conditions and limitations.

Maximum warranty life is three (3) years (1095 days).

F1512 - 001

Tel: 905-836-6680
Fax: 905-836-6455

Web: www.lotek.com
Email: biotelemetry@lotek.com

APPENDIX C

Permit Checklist

APPENDIX B - PERMITTING CHECKLIST

ADF&G Fish Habitat Permit

Because the Iliuliuk River is an anadromous stream, a Fish Habitat permit from the Alaska Department of Fish and Game (ADF&G) is required for any work that occurs within or across the waterbody. The jurisdiction of the ADF&G typically extends to the OHWM but can also include the banks of anadromous streams that occur above this mark.

ADF&G Fish Resource Permit

A Fish Resource Permit (FRP) is required for any activity to collect fish, shellfish, or aquatic plants that is not covered by current sport, personal use, aquatic farm, and commercial regulations. This requirement includes methods and means (i.e., gear), numbers of animals, locations, and seasons in which collection can occur. The permit may address whether or not any of the collected specimens, or the water in which they have been held, can be released back to the wild. The ADF&G only issues FRPs to organizations and individuals engaged in legitimate scientific, educational, propagative, or exhibition activities, and who meet other requirements stated in the department's guiding policy.

USACE Section 404/10

The US Army Corps of Engineers (USACE) is responsible for issuing permits for the placement of materials within waters of the US under Section 404 of the Clean Water Act. The USACE also issues permits under Section 10 of the Rivers and Harbors Act of 1899, which requires approval prior to the accomplishment of any work in, over or under navigable waters of the United States, or which affects the course, location, condition or capacity of such waters. Tidal waters are considered navigable waters.

ADEC Stormwater

Any stormwater project causing over an acre of disturbance and discharging to waters of the U.S. would also need to attain coverage under the Construction General Permit (CGP). This would involve the submittal of a Storm Water Pollution Prevention Plan (SWPPP) to the Alaska Department of Conservation (ADEC) detailing measures that would be taken to ensure that storm water runoff from the project would not negatively impact waters of the U.S.

Engineering plans for permanent stormwater projects with impacts of less than one acre would need to be submitted to the ADEC. A letter of non-objection is typically issued by the ADEC two weeks after these plans have been submitted. Plans would include signed and stamped drawings and calculations as well as a project narrative with a description of soil types and existing land cover.

APPENDIX B - PERMITTING CHECKLIST

RMP				
Restoration Measure	**ADF&G**		**USACE**	**ADEC**
	Fish Habitat	**Fish Resource**	**Section 404/10**	**Stormwater**
Resistance Board Weir	X	X		
Sonar				
Hand revegetation	X			
Hydroseeding	X			
Riprap placement (above OHW)	X			
Light-penetrating stair installation	X		X	
Installation of "barrels" at the outfalls of storm drains	X		X	X