Swan Lake Engineering Feasibility Assessment

1. Project Overview

The Skagit Fisheries Enhancement Group (SFEG) proposes to work with the Swan Lake watershed preservation Group (SLWPG) to develop a project that would improve salmonid rearing habitat and saltmarsh habitat functions in Swan Lake. The overall objective of the Swan Lake Restoration Project is to improve the habitat quality and ecological function of Swan Lake. The Swantown Sub-basin is the sixth largest drainage in WRIA 6, covering about 18.0 sq km. It is located on the west side of north Whidbey Island west of Oak Harbor and south of Ault Field (See project location map in PRISM). The project is located in a coastal marsh currently not accessible to unimpeded tidal flushing or salmonid access, known as Swan Lake. Swantown Creek flows into the coastal wetland therefore the project occurs in a pocket estuary.

Swan Lake is a large saltmarsh/historic pocket estuary. The lake is currently classified as a closed lagoonal marsh, which is defined as a back-barrier wetland free of a persistent tide channel (Shipman 2008). The lake receives substantial seasonal inflows from Swantown Creek. Historically the lake was mapped as open water surrounded by extensive saltmarsh vegetation, implying a relatively frequent tidal connectivity (Johannessen and Waggoner 2010). A previous SRFB project (#09-1459) funded a preliminary feasibility study that focused on the historic character and function of Swan Lake. That work, completed in the fall of 2010, was considered the first step in the completion of a larger engineering feasibility assessment to identify potential restoration alternatives, and confirmed additional investigation was warranted.

2. Salmon Recovery Context

A. Fish resources targeted by this project.

Pocket estuaries are valued for the fish and wildlife habitat they provide as well as the many other wetland functions. Such habitats are particularly vulnerable to the pressures of development and land use changes, which has resulted in a decrease in their frequency and abundance throughout the Puget Sound region, and particularly in the greater Whidbey Basin (Shipman 2008). These shoreforms are of particular value to juvenile salmonids which utilize them for refuge from predation, foraging and osmoregulation.

Admiralty Inlet is the northernmost portion of Puget Sound, and is bounded to the west by the mainland of the Olympic Peninsula and to the east by Whidbey Island. No large estuaries drain directly into the Admiralty Inlet; however, numerous small streams and protected coastal lagoons such as Swan Lake provide a diversity of rearing habitats for the salmonids of Puget Sound and Hood Canal as they migrate to marine waters in the Pacific. The majority of habitat along the west shore of Whidbey Island is high-energy exposed shoreline, most of which is in relatively undisturbed condition.

Extensive beach seining efforts were conducted along the west side of Whidbey Island in 2005 and 2006, by Wild Fish Conservancy (Wait et al. 2007). The beach west of Swan Lake was one of ten beaches regularly sampled. Thousands of migrant juvenile salmon were sampled at the Swantown beach site during this period. Six species of juvenile salmonids were present: Chinook, chum, pink, and coho salmon, and occasionally cutthroat trout, and steelhead. Chum and pink salmon were the most abundant species present. Wild juvenile Chinook were observed at the site from May through August, with peak catches in both years in July. Subsequent sampling of the lake conducted by Meridian and Associates in 2007 also failed to document salmonids in Swan Lake, although saltwater dependant species such as staghorm sculpin were present (Shappart 2007).

Puget Sound Chinook, Hood Canal summer chum, Coastal-Puget Sound bull trout, and Puget Sound steelhead trout are all listed as threatened under the federal Endangered Species Act (ESA). Coho salmon

are a federal species of concern and a Washington State Candidate Species. While WRIA 6 contains no streams large enough to support independent Chinook populations, the county lies on the migration corridors of all 22 independent Chinook populations in the Puget Sound region (WRIA 6 TAG 2005). The Wild Fish Conservancy Fish Use Assessment of the West Side of Whidbey Island reported that recovered tagged fish were from 16 of the 22 independent populations that make up the Puget Sound Chinook ESU. The report concluded that it is likely that some or all of these fish are present in the west Whidbey Nearshore, and utilize these habitats for some portion of the year. Overall, north sound salmonid stocks are declining, except for pink salmon (Table 1). The 2002 SaSI report (latest available data) indicated that 12 of 13 Chinook stocks, and 17 of 22 steelhead stocks had a "depressed" or "unknown" stock status. Most chum and coho were listed as healthy as of 2002, but recent returns in north sound have been poor (Barkdull. pers comm. 2010)

Habitat degradation along the west Whidbey shoreline affects the recovery of all the stocks that utilize these habitats, links the functions of those river basins with the nearshore of Whidbey Island. The coded wire tag data generated by this study suggests that salmon recovery projects on the west side of Whidbey Island would primarily benefit Chinook stocks from the Whidbey Basin, but would also conserve and/or improve habitat for Chinook from the Hood Canal, north Puget Sound, central Puget Sound, and east Kitsap Peninsula.

On October 14, 2010 the Washington Department of Natural Resources formally designated Smith and Minor Islands, located just west of Swan Lake, as a state aquatic reserve intended to protect a diversity of physical habitats, including one of Puget Sound's largest bull kelp beds. Swan Lake is a key linkage between the freshwater stream system of Swantown Creek and the valuable marine habitats associated with the Smith and Minor Island Reserve.

Protection of lands surrounding Swan Lake, limitations on ongoing development in the watershed, and the proximity to existing aquatic reserves all reduce the likelihood of future development pressure. Given the protected status and the fact that Swan Lake is currently free of invasive species and supports extensive existing saltmarsh vegetation, restoration of tidal connectivity at Swan Lake is likely to result in long-term benefits to ESA-listed salmon.

B. Problem Description.

The primary cause of impaired ecological processes and habitat features at Swan Lake is an inadequate culvert and tidegate system that currently prevents adequate water flow in and out of the embayment, limits normal marine flushing, and is hypothesized to completely prevent fish access to and from this refuge. The culverts also inhibit prompt draining of the embayment during winter storm events. The current culverts are too small in diameter and too long to allow healthy exchange of marine and fresh waters. Both the diameter and velocity within the culverts combined with their length preclude nearly all fish passage.

Swan Lake is hypothesized to historically have been connected to the marine environment by an ebb tidal delta (Johannessen and Waggoner 2010). The ebb tidal delta may have been intermittent, in response to large precipitation/runoff and/or storm wave events. In 1871, Swan Lake was surrounded by saltmarsh vegetation, as mapped by the US Coast and Geodetic Surveyors. Overwash of the berm occurs periodically under present tide gate conditions, and the failing tide gates allow some volume of marine water to enter the lagoon. Saltmarsh vegetation is widespread around the lagoon at present, including pickleweed (*Salicornia virginica*) and saltgrass (*Distichlis spicata*), such that conditions obviously already support this vegetation community and would not need to be substantially altered for enhancement of habitat conditions.

Table 1. Salmonid species and lifestages targeted by the Swan Lake Engineering Feasibility Assessment Project.

Species	Life History Present (egg, juvenile, adult)	Current Population Trend (decline, stable, rising)	ESA Coverage (Y/N)	Life History Target (egg, juvenile, adult)
Chinook	juvenile	decline	Y	juvenile
Steelhead	juvenile	decline	Y	juvenile
Bull trout	juvenile	decline	Y	juvenile
Coho	juvenile	decline	N	juvenile
Chum	juvenile	decline	N	juvenile
Pink	juvenile	stable	N	juvenile

The preliminary feasibility study completed by Coastal Geologic Services (CGS) identified a suite of opportunities and constraints that affect the long-term sustainability of the proposed project. That list is presented in the supplemental information packet, and is described in detail in the Preliminary Feasibility Study Report (Johannessen and Waggoner 2010).

C. Relationship to regional recovery plan

Puget Sound nearshore habitats including estuarine embayments and closed lagoonal marshes such as Swan Lake are considered a Priority Habitat by the Washington Department of Fish and Wildlife (WDFW 2008). Hydraulic modifications to restore tidal connectivity are a targeted ecological process and management measure identified by PSNERP. Restoration of tidal connectivity at Swan Lake will improve saltmarsh function and provide access to over 150 acres of pocket estuary and saltmarsh habitat within the salmon rich waters of West Whidbey Island and Swan Lake.

Island County's goal for salmon habitat restoration is to balance the rights of property owners with creating a sustainable environment for future generations of people and fish. The county has already purchased +/-300 acres of property surrounding the lake including +/-100 acres of wetland with Conservation Futures Funds and there will be no "take" of uncompensated property rights of citizens. Neighboring private and public uses and surrounding environment will be studied in the feasibility study and protected. There are willing landowners. There is no adverse impact to the naval operations. There is potential for a significant benefit to juvenile salmon including Chinook. All of these are elements of the WRIA 6 lead entity's strategy and regional recovery plan.

Protection and Restoration of Swan Lake was initially identified as a high priority project in the Island County Estuarine Restoration Program prepared by Sheldon and Associates in 2001. The project is also identified in the WRIA 6 Limiting Factors Analysis completed by the Washington Conservation Commission in 2000, which described the tidal connectivity and habitat surrounding the lake as impaired and included recommendations for addressing limiting factors to improve habitat for salmonids (WSCC

2000). Swan Lake is located in an area identified by the WRIA 6 Salmon Recovery Plan (WRIA 6 TAG 2005) as a medium priority geographically (Geographic Area 2) for protection, restoration and enhancement of salmon habitat. However, the WRIA 6 Salmon Strategy gives high priority to projects such as the one proposed here that address physical and habitat forming process by removing the artificial impediments for tidal flushing and fish passage. Pocket estuaries and coastal marsh habitats such as Swan Lake are also one of the highest priority habitats for restoration, enhancement and protection according to the WRIA 6 Salmon Strategy. The Swan Lake Engineering Feasibility and Design is listed on the WRIA 6 3-year work plan for 2011-2013.

D. Consequences of not conducting this project.

Not taking advantage of the opportunity to evaluate the potential for providing fish passage to and from Swan Lake could preclude future opportunities to do so. The current tidegates are not functional and in need of repair. In the absence of evaluating the feasibility for providing fish access Island County may need to replace or upgrade the current system in place without incorporating a habitat restoration component. Once this work has been completed it would be more difficult to secure matching funds from the County or generate community support for alternative approaches.

3. Sources of information

A list of references has been uploaded to PRISM

4. Project Design

A. Project Description

A feasibility assessment is required to determine if natural processes are sufficient to support a hydrologic connection between Swan Lake and the Strait of Juan de Fuca that would provide for salmon passage in this high energy, human modified environment and be sustainable over the long-term. A previous grant from the SRFB (#09-1459) allowed us to initiate the feasibility assessment in 2009. The preliminary step involved collection of current and historic information of the lake configuration and geomorphology, and resulted in a report that concluded that continuing the assessment had merit, and that the feasibility analysis should be completed. In 2010, Island County allocated funding to initiate collection of baseline hydrologic data that will be required to support further technical analyses and complete the feasibility assessment. As a result we will be ready to begin data analysis immediately after securing funding for the project.

Completion of the **Feasibility Study** includes the following elements:

1) Technical Assessment:

a) Conduct topographic/bathymetry survey to create map for basin geometry and to get potential tidal prism and stage storage curve

b) Water balance model. Water level recorders were installed in the lake and Swantown Creek in January 201 to collect hydrologic data necessary to develop a hydrodynamic model of water balance. Estimate runoff using available precipitation, watershed data, and hydrology calculations. Develop a one-dimensional hydrodynamic model of the lake, the adjacent drainage channel, culverts and Strait. Rainfall and runoff, evaporation, and overtopping will be considered. The overall objective is to understand the relationship between rainfall-runoff, discharge and water level in the lake, determine the volume and frequency of surface discharge from the lake to the sound that would be expected under current and future climatic conditions, and to develop a tool to evaluate the expected hydraulics of alternative inlet configuration.

c) Assess wave climate and littoral transport. Conduct a wind wave generation hindcast analysis using Smith Island wind data. Use available maps to characterize wind wave generation fetches. Analyze data from NOAA NNDBC Buoy 46088 to confirm the wind wave climate and characterize penetration of waves from the ocean. Apply the wave climate to characterize wave power incident to the site in order to address inlet closure/ stability, longshore sediment transport and wave overtopping.

d) Perform inlet analysis: wave power vs. runoff power and tidal prism to estimate breaching frequency. Applied geomorphology indexes will be used to investigate the likelihood of an inlet remaining open.

e) Identification of infrastructure constraints (septic, roadway, fill, buried utilities, and foundations) for two or three potential locations of structures/open channels.

f) Wetlands functional assessment. Identification of current marsh habitats, wildlife species using these habitats, and projected impacts due to changed tidal regime.

2) Conceptual Design

Once the technical analyses are complete SFEG, affected landowners and the engineering consultant will work together to identify potential project alternatives and develop conceptual approaches for each alternative.

a) Identification of various alternatives for achieving the project objectives (each alternative will be presented as a plan view drawing located on an accurately-scaled site plan).

b) Evaluation of the various alternatives and discussion of the pros and cons of each alternative including a rough construction cost estimate

3) Outreach

SFEG and SLWPG will convene a series of community meetings to solicit feedback and address community concerns throughout the project period. At a minimum we envision hosting three outreach events including:

In addition SFEG and SLWPG will work closely with landowners, including Island County and the Washington Sate Parks Department to ensure that the project is consistent with their needs. We envision that this will require periodic meetings/site visits with landowners.

Deliverables: The results of tasks completed in support of the technical assessment, and the outcomes of community meetings leading to the selection of a preferred alternative will be presented in a final report. The final report will include a conceptual sketches for the preferred alternative that are suitable for seeking funding to support project design (Phase 2).

B. Project Sequencing

The Swan Lake Project is being conducted as a Phased Project. The phases include: 1) Feasibility Assessment; 2) Design; and 3) Construction. A previous grant from the SRFB (#09-1459) allowed us to initiate the feasibility assessment in 2009. The preliminary step involved collection of current and historic information of the lake configuration and geomorphology. In 2010, Island County allocated funding to initiate collection of data that will be required to complete technical analyses and complete the feasibility assessment. The proposed project represents a continuation of Phase 1, and will result in sufficient information determine whether or not to proceed with the work as a salmon restoration project. If the results of this study indicate that a cost-effective project is possible, SFEG and SLWPG will work together to seek funding for Phases 2 and 3.

5. Project Development

A. Determination of Cost Estimates.

Cost estimates for technical analyses were developed in consultation with Coastal Geologic Services, a consulting firm specializing coastal processes and beach management. Jim Johannessen of Coastal Geologic Services will lead the consultant team undertaking technical analyses and engineering design. Mr. Johannessen is a recognized local expert in the field of coastal geomorphology, and has been monitoring coastal processes and assisting with the development of coastal restoration processes at a wide variety of sites in Puget Sound.

B. Alternatives

Alternatives to the project include taking no action and allowing the existing tidegate system to fail or implement repairs that may or may not provide for fish passage and other ecological functions. This alternative would provide no benefits to ESA-listed salmonids, and would likely preclude future restoration opportunities that might support creating or enhancing fish habitat both in Swan Lake, and in Swantown Creek.

Even if the feasibility analysis is completed it may conclude that no cost-effective means exist for providing fish passage into and out of Swan Lake. In this case SFEG would not continue to pursue salmonid habitat restoration and enhancement projects at the site. However, the SLWPG has a long-term commitment to working with Island County to ensure that Swan Lake property is managed to maximize ecosystem benefits. As a result SLWPG would likely continue their efforts to restore and protect the lake and associated wetland habitats via volunteer efforts and/or other grant programs.

C. Partners

The Swan Lake restoration project was initially identified in the Island County Comp Plan and WRIAI 6 Salmon Recovery Plan, but has since been championed by local non-profit groups including SFEG, SLWPG, and the Whidbey Audubon Society. SFEG is partnering with SLWPG on this proposal, and Island County has allocated funds in support of the project as it will aid in their ongoing management of the Swan Lake property, which was purchased in 1999 with Conservation Futures Funds and since designated as a Habitat of Local Importance.

Jim Johannessen of Coastal Geologic Services will lead the consultant team undertaking technical analyses and engineering design. Mr. Johannessen is a recognized local expert in the field of coastal geomorphology, and has been monitoring coastal processes and assisting with the development of coastal restoration processes at a wide variety of sites in Puget Sound. Coastal Geologic Services completed the preliminary feasibility assessment, is currently under contract to Island County to collect baseline hydrologic data, and has assisted with project planning and cost estimation.

D. Landowners

There are five major landowners in the vicinity of the Swan Lake Project site, as well as a number of small private parcels immediately west of the lake (see Parcel map in PRISM). Island County owns the parcel containing Swan Lake and is supportive of the project. Affected landowners to the north include Alice Sorenson, and GT Group Telecom (USA) LLC, Washington State Parks (Joseph Whidbey State Park). Three of the four landowners have signed landowner acknowledgement foms (in PRISM) and expressed verbal support for the project. Phone calls to GT Group Telecom have not been answered, but a copy of the landowner acknowledgement form has been sent to the Company's business office via certified mail.

Other landowners surrounding the lake are supportive and interested in the project. The largest private landowner of Swan Lake water frontage to the east is the Ashworth family. Two letters of support for the original 2009 grant application from individual members of the Ashworth Family have been uploaded

into PRISM. Many of the landowners along West Beach Road west of the lake are also members of SLWPG and supportive of the project.

E. Experience managing this type of project.

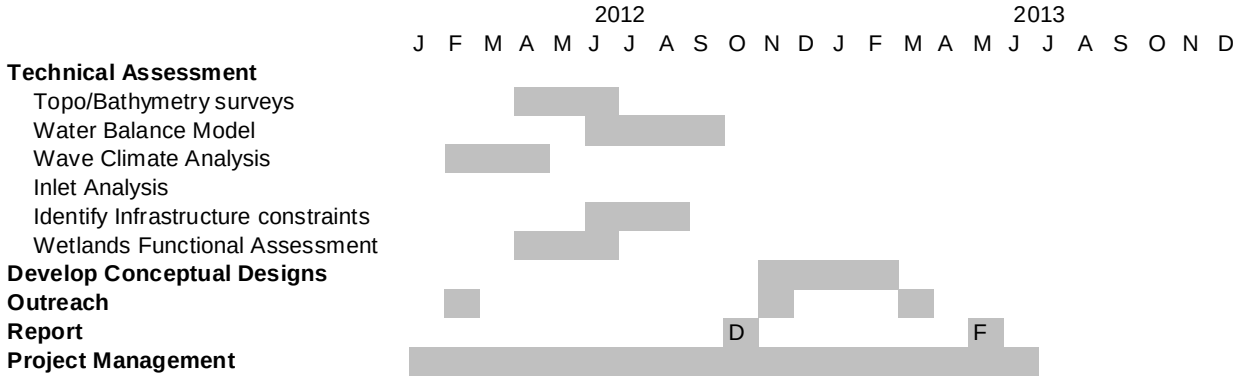
The Skagit Fisheries Enhancement Group is one of 14 Regional Fisheries Enhancement Groups in Washington State. SFEG has been a leader in implementing restoration projects throughout the Skagit/SanJuan/North Whidbey Service area 1990, including several aimed at restoring nearshore habitat for salmonids and forage fish. Specifically, SFEG managed the McElroy Slough Estuary Restoration Project from feasibility phase to construction which involved the removal of a tide gate system under a County owned road and the replacement with a new tide gate structure which involved a self regulating tide gate. We are also currently working on a project on Blakely Island that will remove wood waste and improve forage fish habitat in a small bay. Project design and permitting are complete, and construction will be initiated as soon as sufficient funding is secured. SFEG's Executive Director, Alison Studley has over 10 years experience with salmon restoration projects and has managed SRFB grants since the SRFB was created in 1999.

Our project manager for this project will be Sue Madsen. Ms. Madsen joined Skagit Fisheries Enhancement Group in 2009. Prior to joining SFEG she worked an a consulting geomorphologist for R2 Resource Consultants. Ms. Madsen has over 15 years experience in managing large assessment and restoration projects. Her experience as a consultant provides the insight and expertise needed to effectively manage contracts and consultants retained to complete the proposed project.

6. Tasks and Schedule

SFEG and CGS are in the process of collecting data and will therefore be able to initiate work as soon as funding becomes available. Our goal is to complete work on this project by the summer of 2013 in order to support request for grant funding to develop designs and complete construction (Figure 1).

Figure 1. Proposed schedule for Swan Lake Engineering Feasibility Assessment Project



7. Constraints and Uncertainties

There are several known constraints to developing an effective salmonid habitat restoration project at the Swan Lake site. First and foremost, any proposed project must have neutral or beneficial effects on adjacent properties in terms of flooding or adverse effects to infrastructure (i.e. septics, wells etc). The following list of opportunities and constrains was identified during preliminary feasibility work completed by CGS in 2010:

Opportunities

• A fish passable connection from Swan Lake to the Strait of Juan de Fuca would add 150 acres or more of coastal lagoon/estuarine habitat and also make habitat improvements on Swantown Creek possible.

• The relatively large drainage area and potential tidal prism at Swan Lake suggests that some type of channel to the Strait is likely to be feasible.

• Improving tidal exchange such that lagoon levels do not exceed water levels in the Strait of Juan de Fuca would help ameliorate upstream flooding issues caused by stormwater backing up at the tide gates.

• If an open channel is not feasible other means of engineered fish-passable structures could be used.

Constraints:

• Developed lots on the beach berm make it difficult to locate an open channel there as the channel may tend to be dynamic.

• This reach of shore likely has a high littoral drift rate and high wave energy.

• Any channel would need to pass under West Beach Road, requiring a bridge or other structure.

• Easement/Acquisition on the parcels located north of Swan Lake would need to be secured before a channel could be located to the north.

• The northern property is the location of a communications cable, so special consideration of the cable would need to be made if it is still in use.

8. Detailed project cost estimate.

The proposed project is expected to cost $192,654. We are requesting $163,654 from the SRFB. An Excel spreadsheet containing a detailed cost estimate has been uploaded to Prism.

SLWPG has submitted a grant application to the Island County Conservation Futures Fund to provide matching funds for this project. To date the CFF Technical Advisory Group and CFF Citizen's Advisory Group have both unanimously voted to approve some level of funding for the project. However, the amount of funding available for such projects is limited, and will not be known for several months. In addition final approval for funding lies with the Board of County Commissioners, and thus the amount of funding available from this source (if any) will not be known this project will not be known until later this year. The CFF grant request of $66,000 included approximately $30,000 in funds that could be used to provide additional match for the Swan Lake Project. Since those funds are not yet secured we are not comfortable reducing our SRFB request; however, if CFF funding is secured we may be able to apply some of that funding to this project and thus reduce the overall SFRB request.