EVALUATION PROPOSAL
ESTUARINE/NEARSHORE MARINE

I. Background

The Skagit River watershed, the Skagit delta estuary and Skagit Bay, form the juvenile rearing habitats for endangered ESA-listed Skagit Chinook. For the last 10 years the Skagit River System Cooperative (SRSC) has been studying habitat use of juvenile Chinook salmon in order to identify opportunities for effective habitat restoration. Past results have directed focus to Skagit Bay nearshore habitats, where SRSC has identified pocket estuaries (small sub-estuaries connected to Skagit Bay) as a priority for research and restoration. SRSC is involved in an ongoing intensive fish sampling program which has recently expanded the geographic scope of the current Skagit Bay pocket estuary research to more fully understand the role of non-natal pocket estuaries in nearshore juvenile salmon ecology. The SRFB proposal for Arrowhead Lagoon provides an opportunity for SRSC and Island County to apply research and sampling findings to site- specific restoration action in the southern Skagit Bay area.

A pocket estuary differs from the larger riverine/delta estuaries in that they are partially enclosed nearshore areas which receive freshwater influence from small streams, surface water runoff, and/or groundwater from adjacent upland areas. The freshwater influence results in a lower salinity than the surrounding bay waters. Pocket estuaries were historically very abundant within parts of Puget Sound. A preliminary habitat inventory conducted by SRSC has found over 100 sites within the Whidbey Basin where pocket estuaries are currently or were historically located. Over 80% of these estuaries have been extensively modified (no longer provide shallow water habitat, blind channels, productive marsh habitat, freshwater input, etc.) making undisturbed pocket estuary habitat a rare ecological occurrence (Beamer et.al. 2004).

Skagit Bay research conducted in recent years found that wild juvenile Chinook salmon appear to prefer non-natal pocket estuaries compared to other adjacent nearshore habitat areas (Beamer et al. 2003). Evidence suggests that juvenile Chinook in pocket estuaries experience improved growth and higher survival than fish in surrounding nearshore or offshore areas during the period from February through May. Preliminary results from fish sampling in 2003 further support earlier work and find that pocket estuaries serve a nursery role for a number of other fish species including surf smelt – an important salmon prey resource. In addition to the nursery role of pocket estuaries, other fish species (including threatened bull trout and cutthroat) appear to be linked to the nearshore habitat along the outside of barrier beaches or spits enclosing lagoon type pocket estuaries. These results suggest that pocket estuaries are an important ecological niche for some salmon life history types and other estuarine/marine fish species.

Arrowhead Lagoon is located down current of the mouth of both the South Fork Skagit and the Stillaguamish Rivers (Figure 1). As a result, it is strategically located to receive fry salmon from both of these large river systems and provide refuge, foraging, and rearing opportunity for endangered fry migrant Chinook, as well as a nursery and nearshore habitat for other estuarine/marine fish species, including surf smelt. The project is also located near four other fish restoration projects that are located at the mouths of both of these rivers.

The lagoon is bordered by north-sloping residential properties on a bluff to the south; more level residential properties to the west and northwest; open sand beach to the north; and the lagoon outlet and adjacent shallow tidal area to the east. A dike divides the lagoon approximately in

half from north to south (Figure 2 and Photo 4). The eastern portion of the lagoon is owned in common by the property owners of Eagle Tree Estates. The western portion of the lagoon (west of the dike) is owned by one or more property owners of the Arrowhead Beach Community.

In January 2004, the Island County Salmon Technical Advisory Committee (TAG) was approached by several representatives of the Eagle Tree Estates Property Owners' Association (ETEPOA) regarding concern over a failing culvert in their beach access trail. In its current condition, the trail blocks approximately 60-75% of the lagoon outlet and a historic tidal channel along the southwestern edge of the lagoon (see photos 1 & 2). Earthen fill serves as a base for the southern extent of this trail. A 24-inch culvert within the fill is reported by the property owners to be failing and in need of replacement. The culvert is located in a 3-5 foot wide tidal channel that follows the base of the steep hillside (photo 3). In addition, review of historic aerial photographs indicates that additional fill may have been pushed into the northeast portion of the lagoon over the years (Figure 3). This encroaching upland area has resulted in reduction of the available lagoon area. Today, Arrowhead Lagoon has approximately 1/3 of the original lagoon area (about 5 acres) potentially available to fish. The north-south dike blocks historic hydraulic exchange and fish access to the western portion of the lagoon and may impair water quality conditions during the summer and fall seasons when freshwater input and tidal exchange is reduced. Recent fish sampling indicates that salmon do not utilize the lagoon upstream of the trail constriction. As a result, approximately 80 percent (4 of 5 acres) of the remaining intertidal area is not being utilized for foraging, rearing, and refuge.

Recent research on the indirect effects of dikes on tidal channels indicates that dikes result in loss of fish opportunity outside as well as inside of dikes (Hood, 2004). Essentially, two dikes exist in Arrowhead lagoon. The trail functions as a partially breached or spur dike, restricting tidal action upstream and focusing flow at the restriction and downstream. Analysis of aerial photos between 1956 and 2001 reveal that channel width and length (fish opportunity) between the trail fill and the dike have been significantly reduced (63% and 56% respectively) over the intervening 45 years. Because channel width and depth are generally correlated (Myrick and Leopold 1963, Hume 1991), it is reasonable to assume that channel depth has also decreased causing an overall loss of fish opportunity in the lagoon, upstream of the trail. Visible evidence of this reduction can be seen in the encroachment of marsh vegetation within much of the channel upstream of the trail. Some of this can be attributed to the inlet/outlet constriction caused by the trail fill and the inner shore fill. The rest is likely the result of dike construction. In comparison, channel length downstream of the trail constriction appears to be about the same as in 1956 while channel width has decreased by approximately 29%.

SRSC has met with the Eagle Tree Estates Property Owners' Association regarding the failing culvert under the trail in the eastern portion of the lagoon and the fill along the inner lagoon shoreline. To date, SRSC has conducted two site visits with representative property owners, and has given a formal presentation to the ETEPOA. The Association supports trail fill removal and a replacement bridge to span the intertidal channel. They also support removal of fill along the northern interior shoreline provided it does not affect beach access and use. During the ETEPOA presentation several questions were raised regarding public access on the private trail, potential salt water intrusion into wells, potential affects on septic systems, possible erosion of the bluff, long term property rights, and ETEPOA liability. SRSC has committed to investigate and resolve these concerns, as well as others that may arise (see communtiy outreach).

Three years of fish sampling in the lagoon have revealed that salmonids do not utilize the lagoon upstream of the trail fill restriction. It is our expectation that fill removal will result in salmonids utilization of the larger lagoon area compared to current limited utilization.

While priority restoration ranking has not been done for the Whidbey Basin pocket estuaries, Arrowhead Lagoon would fall in the top 30% for prioritization due to its high potential for providing habitat connectivity at the large scale (close proximity to a major rivers with juvenile salmon life history types that utilize pocket estuary habitat) and site scale (depth and gradient that maximize inundation time and area) connectivity. Arrowhead Lagoon has a landowner - initiated need for correction of a failing culvert, has landowner support (ETEPOA), and can offer immediate benefit to juvenile Chinook among other species. This restoration proposal provides an opportunity to move from study to action, and seeks to meet the needs of the property owners while also restoring the larger ecological processes, salmon opportunity, and lost lagoon habitat area.

II. Project Hypothesis

Removal of approximately 2.0 acres of fill will result in approximately 30-40 percent increase in restored habitat capacity east of the dike; will improve ingress and egress for fish; and will restore natural tidal processes in the eastern portion of Arrowhead Lagoon.

Construction of a new bridge and removal of trail fill across the tidal channel will increase the lagoon opening by approximately 60%; will restore fish opportunity to the 4.0 acres (6.0 acres after fill removal) above the restriction; will provide a more ecologically sound alternative to an undersized failing culvert; and will preserve desired access to the outer beach for property owners.

III. Project Goals and Objectives:

Goals

The primary goal of the restoration proposal is to restore natural tidal landscape processes and lost habitat area within the eastern portion of Arrowhead Lagoon to improve refuge, rearing, and foraging opportunity for salmon (specifically wild Chinook) and nearshore fish species.

Objectives:

1. Remove approximately 350 cubic yards of trail fill from the inlet tidal channel.
2. Remove the existing bridge and support structures from the tidal channel.
3. Remove approximately 2.0 acres (13,520 cu. yds.) of fill from the northern shoreline of the inner lagoon.
4. Construct a new bridge that spans the tidal channel, maximizing tidal exchange and habitat area, and provides property owner access (including small emergency vehicles such as an ATV) to the outer beach.
5. Work closely with ETEPOA and communicate with the adjacent landowners in Arrowhead Beach Community during planning, design, and project implementation.

IV. Project Approach

In January 2004, representatives from ETEPOA approached the TAG for assistance with a failing culvert that is located under their beach access trail. After initial discussions regarding property owner needs and restoration potential, SRSC agreed to take a closer look at the restoration opportunity within the lagoon.

Preliminary assessment of aerial photographs indicates that the historic lagoon area was approximately 15-16 acres. A dike divides the lagoon approximately in half from north to south effectively isolating the western lagoon from tidal influence. The eastern portion of the lagoon is owned in common by the property owners of Eagle Tree Estates.

Between February and May 2004, SRSC staff have been in regular contact with the citizen lead and/or the current association president for ETEPOA. An investigatory site visit was conducted in March 2004 and included a SRSC representative and two ETEPOA representatives. The association members assisted the SRSC staff with preliminary soil cores and provided helpful information regarding property owner access concerns, the lagoon, and the dike area.

A second informational site visit was conducted in April 2004 and SRSC conducted a formal presentation for the association members in May 2004 to inform them of the restoration proposal and to answer questions and solicit comments and concerns.

Individuals and methods

SRSC is a natural resource management agency that strives to restore natural riverine, estuarine, and coastal processes that lead to self-sustaining systems.

Darla Boyer – Skagit River System Cooperative
Aundrea McBride - Skagit River System Cooperative
Eric Beamer - Skagit River System Cooperative
Don Leak – Citizen lead for Eagle Tree Estates Property Owners' Association

Methods: 1. Site identified in Island County Salmon Recovery Strategy 2. Estuarine and nearshore habitats, and biological processes identified in Island County limiting factors report 3. Nearshore habitats ranked as #1 priority in Island County Salmon Recovery Strategy 4. Citizen request for assistance 5. GIS analysis of historical photos 6. SRSC pocket estuary sampling site

Consequences of not conducting the project:

The ETEPOA has requested assistance with a culvert in their trail but is supportive of a larger restoration effort. The two adjacent property owners are in support of the restoration action and permission for access across the preferred parcel for access has been granted. Delay in funding of this proposal may lead to citizen frustration and the replacement of a failing 24-inch culvert resulting in a missed opportunity for restoration of the larger lagoon opening and approximately 2.0 acres of lost fish opportunity. If sentiment or land ownership changed as the result of delay, preferred access could be denied and costs would increase significantly due to the steep bluff access in Eagle Tree Estates or the need to barge equipment to the site via the bay.

Community Outreach and Education

To date, SRSC has extended a good faith effort to keep communication open between ETEPOA, the TAG, and the Island County Salmon Recovery Coordinator. Since the project was first introduced to us in January of this year, we have identified a citizen lead to act as spokesman for the association and we have been communicating with the ETEPOA lead and/or president on a regular (almost weekly) basis. We conducted two site visits with representatives from ETEPOA and received assistance from them in excavating preliminary soil pits. In May, SRSC gave a formal presentation to the ETEPOA to explain the restoration proposal, answer questions, and address concerns. Information exchanged during these gatherings has helped to form the community outreach component of this application.

In addition to the citizen lead, a citizen volunteer has gathered the names of all property owners in the Arrowhead Beach community, beyond the project boundary, but bordering the lagoon west of the dike. Discussions have been initiated with Island County Health and Island County Environmental Health in response to property owner questions regarding septic fields and wells within the project vicinity. We are developing an informational newsletter to be sent to the neighboring property owners in Arrowhead Beach. We have also contacted the two adjacent parcel owners on the western project boundary. Both have expressed support of the proposal. Permission (landowner willingness) has been given to cross one of these properties between the east end of the Ski Yu Drive and the project site in the Arrowhead Beach Community. Letters of support from the ETEPOA and the access property are included in the application.

Once funded, ongoing community outreach will include informational newsletters for the Eagle Tree Estates and Arrowhead Beach Communities, the TAG, the WRAC, and Island County Salmon Recovery Coordinator; one or two informal meetings to discuss the project and receive community input (vested property owners, and adjacent properties), presentation of bridge designs to the ETEPOA for approval, newspaper articles in the local newspaper, and additional solicitation of volunteers from the ETEPOA for bridge deck installation and revegetation and maintenance. Additional outreach efforts may be made as opportunity provides or as needs arise.

Project Design and how it will be implemented

The formal design element of this proposal is limited to the property owner access bridge to the outer beach area. Exact bridge location and design will be determined based on detailed fill location findings and property owner input. The intent is to locate the bridge at the shortest crossing (perpendicular to the historic channel) to minimize construction costs. In addition, on-site decisions will be made regarding tidal channel configuration modifications within the fill footprint as fill is removed. The disturbed channel areas will be contoured to match the existing channel on each side of the fill footprint. Additional on-site determinations will be made during removal of the fill along the northern inner shoreline. Removal of fill will be supervised by a restoration ecologist to ensure that fill removal is achieved and natural beach to intertidal contours are re-established. Since it is suspected that the fill originated from the existing sand spit area to the north of the lagoon, excavated fill will be re-deposited on the spit. Sand placement will be managed so as to minimize impacts to native plant communities and to maintain landscape aesthetics for property owners. Revegetation of denuded (graded) lagoon interface and/or sand spit areas will occur upon completion of fill removal, as soon as growing conditions allow. Revegetation will mimic existing native species which demonstrate successful colonization of the lagoon and sand spit. Property owner volunteers will be called upon to help monitor the plantings and assist with maintenance (exotic species removal, watering, etc) as needed.

Water quality sampling/monitoring of temperature, pH, dissolved oxygen, and salinity will be conducted on a monthly basis within the project area.

Grading activity and construction will be limited to a time that is least likely to disturb listed species such as Chinook (within and adjacent to the lagoon), bull trout (along the shoreline of the outer beach), and bald eagles (nesting on the bluff above the lagoon) utilizing the area, and will be guided by the permitting process.

Project cost estimates determined

Cost estimates were determined by comparing similar costs for fill removal in the intertidal area of the Deepwater Slough and costs for bridge construction on similar projects.

Project costs fall into 7 categories including 1. permitting, 2. bridge deconstruction and disposal, 3. fill removal and disposal (includes recontour work), 4. new bridge design, 5. bridge construction, and 6. revegetation. Engineering and administration costs comprise the seventh category and are expected to account for approximately 30% of the overall restoration effort.

Other approaches and opportunities

The project began as a request to replace a failing 24-inch culvert in a trail fill that was placed in a 93-foot wide intertidal lagoon inlet (aerial estimate). The TAG discussed the needs with the ETEPOA representatives and suggested that a more comprehensive approach addressing channel restoration would be preferred.

Initially, SRSC considered a full restoration approach including a feasibility study for the entire 15-16 acre historic tidal lagoon area. Ideally, it would be best to remove the existing dike and restore the western portion of the lagoon to tidal influence. After much consideration, it was determined that a phased approach was more desirable due to the immediate need of the Eagle Tree Estates property owners and the significant constraints posed by the alteration or removal of the existing dike that currently isolates the remaining western area of the historic lagoon. As proposed, the project should have no impacts to residential properties. By including dike removal, consideration must be given to new dike construction along the south property lines on the sand spit, impacts to septic fields and structures at Arrowhead Beach, significant increases in fill removal costs, etc. In addition, a more intensive community outreach and approval would be necessary. While a worthy pursuit, this would cause significant delay to rectification of the substandard culvert in Eagle Tree Estates and a window of opportunity may be lost.

Replacement of the existing 24-inch culvert with a larger culvert was considered, but because the original channel opening has been reduced by approximately 60-75%, and no salmonids have been found upstream of the trail fill, this option would not meet the intent of restoration. Aerial photo interpretation indicates that opportunity (channel width, channel depth, channel length) for fish has been significantly reduced since the 1950s. Culvert replacement would result in improved conditions upstream of the culvert, but based on findings in the nearby Skagit Delta (Hood, 2004) culvert replacement would not restore the necessary tidal prism to maintain natural lagoon processes including suitable channel formation and maintenance for fish.

As a result and given the current need for action, the proposed restoration has taken into consideration the overall historical ecological processes within the lagoon and has directed the restoration efforts in the eastern lagoon area to complement and support a larger restoration effort that may be taken in the future. The project focuses on restoration of historic conditions east of the dike, which will not impede or negatively affect the restoration potential in the western portion of the lagoon. If a restoration opportunity arises for the remaining portion of the lagoon, restoration activities (primarily fill removal and dike relocation to protect existing homes on the spit) can occur without notable re-disturbance to the eastern lagoon restoration site.

Staff, consultants, and subcontractors

SRSC will take project lead on the restoration effort with expertise and project design input from engineers and the landowners. A consultant may assist in obtaining necessary permits for fill removal and bridge construction, as well as community outreach. Earthwork will be conducted by a licensed contractor. Bridge design will be completed by a professional engineer and construction will be completed by a licensed contractor.

Project Sponsors
Bureau of Indian Affairs

Landowner names
The lagoon property is commonly owned land. The Eagle Tree Estates Property Owners' Association represents 23 of 24 property owners. The remaining property owners are Lesley Link and John Ellison. They have requested that the association maintain their privacy.

How project will contribute to understanding or restoration

Pocket estuaries were historically very abundant within parts of Puget Sound. A preliminary habitat inventory conducted by SRSC found that over 80% of Whidbey Basin pocket estuaries have been modified. Restoration of Arrowhead Lagoon will increase historic nearshore intertidal area down current of the Skagit and Stillaguamish Rivers for a variety of fish species including endangered Chinook; will restore natural tidal processes that maintain the lagoon environment; and will serve as an example for future PE restoration efforts in the Whidbey Basin. This restoration project also provides an opportunity for citizens on Camano Island to participate in restoration efforts that directly support salmon (including Chinook fry), and other nearshore fish. The project provides an opportunity for education and team building between SRSC staff; Eagle Tree Estates property owners; contractors; and the project partners. Public outreach efforts will serve to educate the adjacent property owners regarding the importance of PEs and nearshore areas for salmon and other nearshore aquatic species.

In addition, restoration will complement the recent delta restoration efforts (Deepwater Slough and Wiley Slough) and the recently expanded intensive fish sampling program of the Skagit Bay pocket estuary research. Provided funding is available, SRSC will continue fish sampling at the lagoon to identify the response of fish utilization to restoration actions.

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