CRESCENT HARBOR SALT MARSH RESTORATION

NEARSHORE DATABASE PROJECT NUMBER:	**07-1102**		
PROPONENT CONTACT INFO:	**Skagit River System Cooperative** **PO Box 368** **11426 Moorage Way** **LaConner, WA 98257** **(360) 466-7228**		
SITE ACCESS CONTACT INFO:	**John Philips** **Ecologist, N442** **Environmental Affairs Department** **NAS Whidbey Island** **1155 W, Lexington St, Bldg 113** **Oak Harbor, WA 98278-3800** **(360) 257-8873** **john.r.phillips1@navy.mil**		
STREET ADDRESS	**60 East Pioneer Avenue, Oak Harbor, WA 98277**		
LAT/LONG (decimal degrees):	**48.29 N, -122.60 W**		
DRIVING DIRECTIONS	Traveling South on Hwy 20 through Oak Harbor, WA, turn left (east) on SE Pioneer Way. At Coral Sea Drive, continue straight where this road turns into W Pioneer Way. At the intersection with Torpedo Rd, again continue straight (W Pioneer Way becomes E Pioneer Way). The site is located approximately 1800 feet from this intersection, and is recognizable by the wastewater treatment ponds to the north. Visitors should arrange permission to access site through NAS Whidbey Island.		
START DATE	**May 2008**	**END DATE**	**August 2008**
KEY PERSONNEL and their project implementation role:			
Steve Hinton: Primary Contact **SRSC Director of Restoration** **(360) 391-1354** **shinton@skagitcoop.org** ***Devin Smith: Alternate Contact*** **SRSC Senior Restoration Ecologist** **(360) 391-1984** **dsmith@skagitcoop.org**		***Greg Hood: Alternate Contact*** **SRSC Senior Restoration Ecologist** **(360) 391-466-7282** **ghood@skagitcoop.org**	

PROJECT NARRATIVE

1. Ecological Importance

1a. *Priority Habitats*

Pocket estuary habitat for Puget Sound salmon has been defined as small, partially enclosed, non-natal bodies of water that are measurably less saline than adjacent nearshore habitat (SRSC and WDFW 2005). Such sites include salt marshes, lagoons, and tidal channels, and are important refuges for juvenile Chinook salmon and other species (SRSC and WDFW 2005). Such habitats provide fry with a rearing and refuge opportunity as they migrate from their natal rivers toward the open ocean (Beamer et al. 2003). Restoration of pocket estuary habitat lowers the risk of mortality by reducing the time individual fish are exposed to nearshore or offshore hazards during this vulnerable phase of their life history (SRSC and WDFW 2005).

The Crescent Harbor salt marsh, located within Naval Air Station Whidbey Island (NASWI, Figure 1) is one of 12 pocket estuaries identified as high priority restoration sites in the Skagit Chinook Recovery Plan (SRSC and WDFW 2005), which has been incorporated into the Puget Sound Shared Strategy. Prioritization for these sites was based upon proximity to the Skagit River delta, size of restorable habitat, and likelihood of successful restoration. Data collected in the Whidbey Basin indicate that juvenile salmon displaced from Skagit River delta habitat as a result of high population densities or flood events could reach these sites in as little as five or six hours (SRSC and WDFW 2005).

The Crescent Harbor Salt Marsh Restoration Project will restore fish access and tidal inundation to what was once the largest open barrier salt marsh on Whidbey Island (approximately 300 acres, PWA 2003). Re-establishment of tidal inundation is likely to lead to formation of natural tidal channels (Hood 2007), and tidal sediment deposition is expected to lead to an overall increase in marshplain elevation to one more typical of salt marsh habitats (PWA 2003). Restoration of these processes translates to increased habitat area and quality for fry migrant Chinook and other native salmon species, and can be expected to benefit forage fish and wildlife species as well (SRSC and WDFW 2005).

1b. *Habitat Linkages*

The distance fish must travel to find suitable habitat and the ease of travel over that distance both contribute to habitat connectivity (SRSC and WDFW 2005). Juvenile Chinook salmon density has been observed to increase with increasing habitat connectivity, so it can be inferred that maintenance of linkages between habitats will be beneficial to Chinook populations (SRSC and WDFW 2005). The Crescent Harbor salt marsh is located within one day's migration of the Skagit River delta (Figure 2, SRSC and WDFW 2005). This proximity, combined with observed density dependence in natal river estuary habitat (Beamer et al. 2003), establishes the site as critical for increasing survival of juvenile salmon displaced from delta rearing habitat. Restoration actions at the Crescent Harbor salt marsh would benefit all six stocks of wild Skagit Chinook salmon (SRSC and WDFW 2005). Additionally, restoration of fish access to this site may enable spawning coho salmon to access Crescent Creek, a freshwater input to the site.

1c. *Self-sustaining Processes*

The purpose of this project is to restore natural tidal processes to the Crescent Harbor salt marsh, so little future maintenance is expected.. Excavation of artificial fill and removal of hydraulic control structures such as tide gates and dikes will ensure unimpeded tidal circulation. Daily tidal inundation is anticipated to lead to the formation of an additional 33,658 linear feet of tidal channel habitat (Hood 2007). Restoration of marshplain elevation through sediment deposition is expected to lead to re-establishment of typical native salt marsh vegetation through natural propagation (Heatwole 2004). The project includes some limited excavation of tidal channels intended to restore historic channel locations and to jump-start the process of natural channel formation. These new channels will be closely monitored to determine the effectiveness of this approach.

1d. *At-risk species*

This project will restore natural tidal processes so it will provide benefits to all species that use natural salt marsh habitats. In particular, this project is expected to produce immediate and long-term benefits for ESA-threatened Chinook salmon. Juvenile Chinook are anticipated to use the site immediately upon project completion, and completed restoration will increase nearshore habitat Chinook capacity by an estimated 15,938 smolts annually (SRSC and WDFW 2005). This increase in habitat is also expected to benefit other native Puget Sound salmonids, including coho, bull trout, and cutthroat trout, which are Washington State Species of concern. Habitat area is also expected to increase for forage fish species, which have displayed higher population densities in pocket estuary habitat than in adjacent nearshore habitats (Beamer et al. 2006).In addition this project will provide benefits to a number of non-fish species, including blue herons, green herons, and numerous duck and shorebird species..

1e. *Information Gap*

This project will be used to increase understanding of natural tidal channel formation processes in restored salt marsh environments, and will evaluate the comparative habitat value of different channel patterns. In each of two marsh cells, a pair of tidal channels will be excavated. Within each pair, one straight channel and one sinuous channel will be constructed. These channels will be constructed so as to have similar length, width, depth, and surface area. Post-construction, these channels will be monitored to evaluate relative rates of blind channel evolution, development of channel complexity, and usage by juvenile salmon. Such understanding will contribute to current understanding of channel-geometry/marsh area relationships (Hood 2007), and will increase knowledge about important habitat parameters for juvenile Chinook. Monitoring results will also inform cost-effective implementation of salt marsh restoration for future projects.

The response of juvenile Chinook salmon to restoration at Crescent Bay salt marsh will add to the body of information that can be used to assess and plan restoration projects for other pocket estuary sites within Puget Sound. Post-restoration vegetation responses to salinity and elevation changes will also be evaluated. Deeper understanding of vegetation recruitment following restoration of tidal inundation will allow more effective evaluation of proposed restoration actions, and will contribute to a larger regional model of these processes.

2. Technical Merit

2a. *Conceptual Model*

Process Domain: Local domain of estuarine nearshore- Whidbey Basin, Puget Sound

Current Conditions: Crescent Harbor salt marsh is cut off from fish access and tidal exchange, except through groundwater and limited flow through a tide gate, due to a large beach berm separating the marsh from Crescent Harbor. The interior marsh is further subdivided by a series of dikes and a wastewater treatment pond (WWTP), preventing tidal circulation and freshwater mixing (Figure 3). Historic tidal channels have been straightened and shortened, which has reduced their habitat value. The elimination of tidal sediment inputs has potentially led to marsh elevation subsidence and associated changes in vegetation composition (Heatwole 2004, PWA 2003).

Change/Action: Tidal flow and fish access will be restored to the Crescent Harbor salt marsh via a breach in the beach berm and excavation to reconnect to existing channels (Figure 4). Interior dikes will be breached or notched to allow circulation and mixing of fresh and marine water and artificial fill will be removed to further increase marsh area (Figures 5, 6, and 7). Where necessary, tidal channels will be excavated to further facilitate tidal exchange and future channel development (Figure 8).

Restored Processes and Structural Changes: Restoring tidal inundation to this site will enable juvenile Chinook, other juvenile salmonids, and forage fish to access approximately 205 acres of barrier salt marsh habitat, which currently includes approximately 10,938 linear feet (6.82 acres) of tidal channel habitat. Restoring tidal flow is also expected to restore the natural process of tidal channel development. Allometric modeling based on data from South Fork Skagit River salt marshes indicate that although total acreage of tidal channel will change little from current conditions, total channel length will increase dramatically (Hood 2007). Sediment transported by tidal flow and freshwater inputs will likely increase marsh plain elevation from current levels.

The combination of increased marsh plain elevation and water table elevation have been predicted to more than triple areal coverage of euhaline vegetation, with freshwater and brackish vegetation remaining onsite (Heatwole 2004). Increases in vegetation coverage and associated production of organic detritus will likely also lead to significant changes in invertebrate community composition and increases in invertebrate density (Heatwole 2004).

Functional Response: Project implementation is anticipated to increase Chinook capacity by approximately 15,938 smolts annually, with juvenile salmon use expected immediately (SRSC and WDFW 2005). Fry migrant Chinook in pocket estuary habitat have a survival advantage over fry in adjacent nearshore habitat due to decreased risk of predation and increased opportunity for growth and rearing (Beamer et al. 2003). This in turn contributes to increased rates of return for spawning adults to natal rivers.

2b. Interdisciplinary Review

The project design was developed by an interdisciplinary team of scientists from Philip Williams and Associates (PWA) and the University of Washington Wetland Ecosystem Team (UW-WET). This design has received additional review and refinement from

scientists and project managers on staff at the Skagit River System Cooperative (SRSC) and the NASWI.

2c. Probability of Success

Project Goals

1. Restore natural processes, conditions, functions, and biological responses to the Crescent Harbor salt marsh
2. Restore critical pocket estuary rearing habitat for ESA-listed juvenile Chinook salmon
3. Restore estuarine habitat for other fish and wildlife species.

Primary Project Objectives

1. Restore tidal flow, natural channel development, and biological functions to the Crescent Harbor salt marsh. This will be accomplished by breaching the beach berm, modifying interior dikes, removing artificial fill, and limited channel excavation
2. Restore fish passage to the Crescent Harbor salt marsh

Secondary Objective

1. Provide compatible human use in the form of wildlife-viewing opportunities

Measures of project success follow directly from project goals and objectives. Success can be quantified in terms of:

1. The proportions of the restored sites that are exposed to daily tidal inundation.
2. Development and persistence of blind tidal channel habitat for juvenile salmon.
3. Seasonal occupation of the blind tidal channels by juvenile Chinook and other salmon.
4. Colonization of restored marsh surfaces by native salt marsh vegetation and invertebrate communities.
5. Seasonal occupation of the restored marshes by shorebirds, herons, ducks, and other marsh bird and animal species.

2d. Monitoring

Monitoring will include baseline, as-built, and post-restoration monitoring, and will enable evaluation of project goals and objectives as well as contribute to broader understanding of responses of salt marsh communities to process-based restoration. Monitoring parameters will include fish presence, site topography, channel geometry, and vegetation composition. Monitoring will extend over a two year period under the current proposed budget. We anticipate acquiring additional funds in the future to do long-term monitoring of this and other project sites.

Fyke seining will be used to determine fish presence within tidal channels and adjacent nearshore habitat. Fish usage of channel habitat will be compared between sites within the marsh and those outside the beach berm. Invertebrate community composition and rates of evolution of channel structural parameters such as sinuosity, depth, surface area,

and length will also be compared. Detailed elevation data and vegetation-elevation associations will be used to assess and improve predictive models of post-restoration vegetation recruitment.

3. Readiness

3a. Qualifications:

SRSC provides fisheries management functions for the Sauk-Suiattle Indian Tribe and the Swinomish Indian Tribal Community and partners with numerous federal, state, and non-governmental organizations to improve fisheries resources in the Skagit River basin and the Puget Sound nearshore. In its role as co-manager, SRSC has been working diligently to reverse the precipitous drop in salmonids populations through research, environmental review, active habitat restoration, changes in harvest management practices and negotiation with other management agencies. SRSC has produced numerous publications, which have advanced the understanding of salmonid populations, the impacts of habitat degradation, and the benefits of habitat restoration. SRSC also co-authored the Skagit Chinook Recovery Plan, which has been in incorporated into the Puget Sound Regional Chapter (SRSC and WDFW 2005).

3b. Record of Success:

SRSC has an extensive history of successful restoration actions to benefit Chinook and other native salmonids and is not currently delinquent on any other grant or contract.

Similar Projects:

Deepwater Slough: In 2000, restoration was completed at Deepwater Slough, located in the South Fork Skagit River. This project involved removing 2.77 miles of dike, restoring natural tidal and river flow to 221 acres of historic estuary habitat. Post-restoration monitoring has documented juvenile Chinook use at restored sites within the first year, often with higher densities in treatment areas than in nearby reference channels (Beamer et al. 2006).

Lone Tree Lagoon: In 2006, restoration was completed for Lone Tree Lagoon, a pocket estuary on the west side of Fidalgo Island, on the Swinomish Indian Reservation. This project restored fish passage and tidal exchange to Lone Tree Creek, restoring habitat complexity and riparian vegetation for approximately 800 feet of stream, and restoring 0.54 acres of tidal marsh

Milltown Island: In 2006, the first phase of restoration was completed at Milltown Island in the South Fork Skagit delta. Explosives were used at this roadless site to remove 800 linear feet of dike to allow tidal and freshwater inundation. Approximately 1,460 linear feet of blind tidal channel habitat was also excavated, and the site was replanted with native vegetation. Further channel construction, dike removal, and vegetation planting are scheduled to be implemented in summer 2008. Following construction, post-restoration fish, tidal channel, and vegetation monitoring is scheduled.

3c. Project Readiness

Current Status: Design Complete

Initial restoration design for this project was completed in 2003 by PWA and the UW-WET. Design for this project considered historic and existing conditions, hydraulic processes, flood modeling, fish passage requirements, and site constraints into account. The preferred alternative provides the largest amount of tidal exchange and access for juvenile salmon, restores tidal salt marsh habitat to the site, and reduces potential for seasonal flooding of the WWTP (PWA 2003). In 2007, SRSC partnered with NASWI to undertake project implementation based on the PWA design.

Anticipated Status: Permits Complete

NASWI Environmental Affairs Department is working towards acquiring permits needed for project construction.

4. Cost Justification:

See attached budget and narrative.

5. Public Support

5a. Public Education

SRSC will work closely with Washington State University Extension to develop an outreach program with the Island County Beach Watchers Program. Monitoring objectives for this project will be partially achieved through the combined volunteer efforts of the Beach Watchers and other local groups, including People for Puget Sound and Oak Harbor Middle School. As such, this project has excellent potential for public education and outreach.

5b. Partnership

Local and regional partners for this project include: NASWI, Island County, WA, and City of Oak Harbor Public Works. SRSC will be coordinating with these groups for project design, implementation, monitoring, and education.

BUDGET

	ESRP Funds Requested	Non-State Funds Secured	State Funds Secured	Remaining Need*	Total
Personnel	$42,503			$20,950	$63,453
Fringe Benefits	$15,527			$7,700	$23,227
Travel	$1,680				$1,680
Equipment					$0
Supplies	$7,633			$3,150	$10,783
Contractual		$28,000			$28,000
Construction	$350,379	$45,000		$125,000	$520,379
Other					$0
Sub Total	$417,722	$73,000		$156,800	$647,522
Indirect Costs				$26,213	$26,213
Total	$417,722	$73,000		$183,013	$673,735

*Project Scope Change for the Arrowhead Lagoon Project submitted concurrently to Island County LE 5.17.07

Personnel:

Personnel costs included here cover SRSC personnel including the Restoration Program Director, Senior Ecology Personnel, GIS support and technicians.

Project Implementation

SRSC's Senior Restoration Ecologist will be charged with overall project management including bid packages, contracting, providing construction and monitoring supervision, and coordination with project partners. Field Technicians and GIS support will be available to assist construction contractors and project partners with assistance on labor tasks, monitoring activities, data collection, and other duties as needed. These are all existing staff at SRSC. *An asterisk denotes C.V. attached to proposal.*

Construction	# of Hours	Rate	Total Cost
*Program Director	40	$ 71.00	$ 2,840
*Senior Restoration Ecologist	400	$ 50.00	$ 20,000
Field Technicians/Labor	400	$ 24.25	$ 9,700
Total Direct Personnel Costs- Construction:			**$ 32,540**

Post-Project Monitoring	# of Hours	Rate	Total Cost
*Senior Restoration Ecologist	400	$ 50.00	$ 20,000
Field Technicians/Labor	450	$ 24.25	$ 10,913
Total Direct Personnel Costs- Monitoring:			**$ 30,913**

Fringe Benefits:

Position	# of Hours	Rate	Total Cost
Program Director	40	$ 24.14	$ 957
Senior Restoration Ecologist	800	$ 17.00	$ 13,600
Field Technicians/Labor	850	$ 10.20	$ 8,670
		Total Fringe Benefits:	**$ 23,227**

Travel:

Trip	# Trips	Distance	Rate	Total Cost
Burlington to Crescent Harbor	50	70 miles	$0.48	$ 1,680
			Total Travel:	**$ 1,680**

Equipment:

All project equipment will be provided by contractors.

Total Equipment: $ 0

Supplies:

Item	Quantity	Rate	Total Cost
Silt Fencing and Stakes	3,000’	$ 27.00/100’	$ 810
Straw Bales	100	$ 10.00/bale	$ 1,000
Field Equipment	n/a	n/a	$ 750
Diversion Culverts	tbd	tbd	$ 690
Arch Culvert, Delivered	46’	$99.71/ft + Deliv.	$ 4,946
Light Loose Riprap, Delivered	54 tons	$38.52/ton	$ 2,080
Gasoline and Oil For Boat	140 gal	$3.42/gal +oil	$ 507
		Total Supplies:	**$ 10,783**

Contractual and Construction:
Cost estimated for project completion based on 30% design

1. General Excavation and Construction contract	Total Cost
a. Mobilization	$ 6,400
b. Fill Removal, Dike Breach Excavation, Coffer Dam Const.	$ 248,530
c. New Channel Construction, Ditch and Channel Fill	$ 124,449

2. Sewer Bypass and Reconstruction	Total Cost
a. Install New Sewer Line/ Protective Structure, Monitor	$ 96,000

3. Permit and Engineering Review	Total Cost
a. Write and Acquire Permits	$ 8,000
b. Engineering Support	$ 20,000

4. Armor WWTP Dikes	Total Cost
a. Armor Dikes and Construct West Intake Dike Notch	$ 45,000

Total Contractual and Construction: $ 548,379

Indirect:

26.44% Indirect costs are approved 2006 rates by Department of Interior. These rates are applied to all direct costs except Contracts and Capital Equipment.

Total Indirect Costs: **$ 26,213**

REFERENCES

Beamer, E.M., A. McBride, R. Henderson, J. Griffith, K. Fresh, T. Zackey, R. Barsh, T. Wyllie-Echeverria, and K. Wolf. 2006. Habitat and fish use of pocket estuaries in the Whidbey Basin and North Skagit County Bays, 2004 and 2005. Report to the Northwest Straits Commission.

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Skagit River System Cooperative and Washington Department of Fish and Wildlife. 2005. Skagit Chinook Recovery Plan. Skagit River System Cooperative, LaConner, WA.

Please see Appendices A-E (attached)