Appendix B. Summaries of OWEB-funded Tide Gate Related Projects

Coos Bay Estuary

Coquille River Estuary

Lower Columbia River Estuary

Nehalem Estuary

Nestucca Estuary

Salmon River Estuary

Siuslaw River Estuary

Tillamook Bay Estuary

Estuary: Coos	**Name**: Willanch Creek Fish Passage and Habitat Improvements		
Type: Restoration	**Action**: Upgrade	**Grant** #: 210-2024-7458	**OWRI** #: 20110069
Grantee: Coos Watershed Association		**OWEB**: $105,504 ($48,713 on OWRI)	**Total**: $161,956 ($87,965 on OWRI)

Summary: Willanch Creek is a tributary to Coos Bay that supports coho and Chinook salmon, steelhead, and cutthroat trout. The old tide gate was top-hinged made from wood and steel I-beams. It was very heavy and only partially opened during low ebb tides and closed quickly due to its mass. This caused limited opening times and hydraulic conditions unfavorable to passage even when the gate was open. Additionally, historic land management contributed to a lack of instream large wood. A 2001 survey found that the volume of large wood, and pool depth and frequency did not meet state benchmarks. This project aimed to improve fish passage and increase stream complexity in the lower gradient spawning and rearing reaches. The tide gate was replaced with a lighter side-hinged gate equiped with a muted tide regulator. Large wood was added to improve summer and winter habitats and increase complexity. In Dec 2014 willow were planted in one section to stabilize the banks and improve fish habitat.

Aerial Images:

Restoration Metrics: 2 tide gates (fish passage non-crossings) replaced or modified, 7.24 fish passage non-crossing miles	
Monitoring Focus: N/A	**Study Design**: No monitoring was described. The tide gate has been visually inspected to be sure that it is functioning properly.
Parameters: N/A	**Species Monitored**: N/A

Project Findings: A 2016 inspection confirmed that the tide gate was performing as expected and the muted tidal regulator is allowing the gate to stay open for longer periods. Log placements were also found to be performing as designed by retaining bedload, providing cover habitat, and creating complex pools. Many of the sites have recruited gravel and additional woody debris. Project sites have not required any maintenance or modification.
Lessons Learned: Partnering with timber companies for large wood placements may require site tours with local timber placement experts for ecologically successful placements. The timber company that was willing to place wood on their property was primarily concerned with liability and damage if wood broke free and getting successful placements was difficult.
Data Gaps:
Project Reports: Final Completion Summary, 2015. Post-Implementation Status Report, 2016
Associated Publications & Reports: Coos Watershed Association. Willanch Creek Project Effectiveness Monitoring & Stream Temperature Study, 1997-2005. 2006.

Estuary: Coos	**Name**: North Slough Restoration Project		
Type: Restoration	**Action**: Upgrade	**Grant** #: 212-2022-8872	**OWRI** #: 20150414
Grantee:		**OWEB**: $195,514	**Total**: $275,653
Summary: The North Slough sub-watershed is a tributary to the Coos River estuary. The previous tide gate was a heavy top-hinged wooden design that impeded juvenile and adult fish passage and did not permit cool estuary water to pass upstream. Several tributaries also ran through under-sized culverts that impeded fish passage. In January 2013 new lightweight tide gates with a muted tidal regulator were installed. This was intended to increase fish passage and tidal inundation. Additionally, three culverts were upgraded and four ditch relief culverts were installed to improved fish passage and reduce sediment transport to the streams. These actions will restore access to and water quality in 510 acres of marsh and ~12 miles of stream channel.			

Aerial Images:

Restoration Metrics: 3 culverts (passage crossings) replaced with embedded or flat culverts, 1.62 fish passage crossing miles, 1 tidegate replaced/ modified (fish passage non-crossing), 22 fish passage non-crossing miles, 4 permanent cross-drains added above stream crossings - improve surface drainage (4 road sd structures)	
Monitoring Focus: N/A	**Study Design**: N/A
Parameters: N/A	**Species Monitored**: N/A
Project Findings: N/A	
Lessons Learned: When permitting for the culverts was submitted the fish passage criteria had changed so this aspect was redesigned in coordination with NFMS and ACOE. Being up to date on fish	

passage design and permitting requirements is important.
Data Gaps: N/A
Project Reports: Project Completion Report
Associated Publications & Reports:

Estuary: Coos	**Name**: Coos Watershed Tide Gate Replacement Project Effectiveness Monitoring		
Type: Monitoring	**Action**: Upgrade	**Grant #**: 204-289	**OWRI #**: N/A
Grantee: Coos Watershed Association		**OWEB**: $115,880	**Total**:
Summary: Effectiveness monitoring began in 2004, three years after the Larson top-hinged gate was replaced with a side-hinged gate. This project aimed to understand the function and impacts of the new tide gate compared to a top-hinged gate, describe the coho populations, and discuss the influence of the gates on water quality and habitat.			

Aerial Images:

Restoration Metrics:	
Monitoring Focus: Tide Gate, Biological, Water Quality	**Study Design**: Not described
Parameters: Tide gate: water surface elevation upstream, downstream; open and closed cycles, duration of open cycle Habitat: temperature, vegetation surveys, limiting factors anaysis on available habitat Coho: adult weir counts, spawning ground surveys, mark-recapture, coho population abundance, total egg deposition estimates, juvenile screw traps, freshwater and marine survival	**Species Monitored**: Coho juveniles and adults

Project Findings: Tide gate: Larson gate opening time is influenced by tidal fluctuation and streamflow, and so is seasonally dependent: winter - ~3 hrs, summer - ~1 hr; Mar-May smolt outmigration gate opens once per day during spring tides. Late summer gate opened once per day regardless of tide cycle because of low inflow, complete drainage, and low sill height; Coho: Spawner estimates were 341-787 in Larson and 587-1915 in Palouse, freshwater survival was <1% for both years estimated; Habitat: in Palouse summer rearing area (T considered) is most limiting while in Larson winter rearing area is most limiting, temperature increased downstream in both creeks and limited use of lower stream reaches, especially in Palouse, which was above 70F Jul-Aug, no juvenile coho were found in either tide gate pool in summer but some moved back into Palouse pool after temperatures decreased (no mention of sampling in Larson).
Lessons Learned: Opening times could be increased by locking one side gate closed. Brackish backflow could be accomplished with a mitigator to hold the gate open for more of tidal cycle.
Data Gaps:
Project Reports: Project Completion Report, 12/2006
Associated Publications & Reports:

Estuary: Coos	**Name**: Coos Watershed Tide Gate Replacement Project Effectiveness Monitoring		
Type: Monitoring	**Action**: Upgrade	**Grant #**: 206-244	**OWRI #**: N/A
Grantee: Coos Watershed Association		**OWEB**: $80,229	**Total**:
Summary: The Larson Creek tide gate was replaced and the sill lowered 3 ft in 2001 to improve fish passage conditions and water drainage between stream and estuarine areas. Monitoring was begun in 2004, to evaluate the effectiveness of the new tide gate. In addition to monitoring Larson Creek tide gate function, CoosWA has conducted monitoring efforts of stream conditions immediately upstream of the tide gate and of coho populations in Larson and Palouse Creek.			

Aerial Images:

Restoration Metrics:	
Monitoring Focus: Tide Gate, Water Quality (as habitat), and Biological	**Study Design**: To assess the effectiveness of the Larson Creek tide gate replacement and to monitor the production and survival of coho salmon populations in each stream. Post-project conditions at the Larson Creek tide gate were compared to conditions at the Palouse Creek tide gate in order to assess potential differences between side- and top-hinged tide gate structures. Palouse Creek tide gate is assumed to be representative of pre-project conditions at the Larson Creek tide gate.

Parameters: Tide gate: water surface elevation upstream, downstream; open and closed cycles, duration of open cycle Habitat: salinity, aquatic vegative cover, water velocity, water temperature; amount of existing habitat Coho: adult weir counts, spawning ground surveys, mark-recapture, coho population abundance, total egg deposition estimates, juvenile screw traps, freshwater and marine survival	**Species Monitored**: Coho juveniles and adults
Project Findings: Tide gate: Larson gate generally opens twice daily but this influenced by tidal fluctuation and streamflow, duration of opening seasonally dependent: winter - 3+ hrs, summer - <90 min, and driven by streamflow. Opening frequency and time were higher during spring tides. Habitat: after replacement salinity was higher and velocity lower than before and Palouse 2008, pre-replacement patchy eel grass beds and algae present, post-replacement rushes, grasses, small algae patches along margins. Temperature was generally lower in Larson than Palouse and generally lower after replacement, T may reduce habitat availability especially in Palouse. Habitat in the two basins was comparable but capacity was higher in Palouse. Coho: 2001-2004 spawner counts were similar to historic levels but have since declined. Smolt abundance, freshwater and marine survival were similar in the two basins.	
Lessons Learned: N/A	
Data Gaps: juvenile coho distribution, utilization of reservoir habitats	
Project Reports: Project Completion Report, 8/2008	
Associated Publications & Reports:	

Estuary: Coos	**Name**: Coos Watershed Tide Gate Replacement Project-Effectiveness Monitoring		
Type: Monitoring	**Action**: Upgrade	**Grant #**: 207-238	**OWRI #**: N/A
Grantee: Coos Watershed Association		**OWEB**: $170,642	**Total**:
Summary: The CoosWA initiated Life Cycle Monitoring efforts in Palouse and Larson subbasins to augment the existing ODFW monitoring project by providing annual estimates of coho abundance and survival in lowland coastal streams. They used passive integrated transponder (PIT) technology to tag and remotely track individual fish, which complemented standard ODFW Life Cycle Monitoring procedures. Estimating coho salmon abundance and survival in Oregon coastal subbasins is an integral part of maintaining sustainable coho populations.			

Aerial Images:

Restoration Metrics:	
Monitoring Focus: Biological, Water Quality	**Study Design**: Adult population was sampled with weirs and spawning ground surveys and abundance estimated with mark recapture and area under the curve methods. Total egg depostition was estimated. The juvenile population was sampled with rotary screw traps. A portion of each catch was measured, marked, and released upstream for efficiency calculations. Abundance was estimated. Freshwater and marine survival were calculated. A portion of fish

	were PIT tagged to examine freshwater migration and habitat use and to complement survival estimates. Water quality parameters temperature, dissolved oxygen, conductivity/salinity were measured.
Parameters: Adult abundance, juvenile abundance, PIT recaptures and resights	**Species Monitored**: Coho juveniles and adults
Project Findings: Adult spawner abundance decreased '01-'04 and increased in '05 and '06. From life-cycle monitoring, freshwater survival was <3% for all brood years but '07 and marine survival was <2% in '04 and >6% for '07 and '08 for both creeks. Based on PIT data freshwater survival was ~30% in Palouse and 20% and 9% in Larson. Marine survival was 5% in Palouse in '05. <2% of the run returned as jacks in any year for both streams. Fish PIT tagged in tidally influenced areas moved extensively while those tagged in riverine reaches were mostly sedentary. Growth rates decreased throughout the season. Mobile juveniles' growth rates were more variable than those of sedentary juveniles.	
Lessons Learned: N/A	
Data Gaps:	
Project Reports: Project Competion Report, 11/2010	
Associated Publications & Reports: Bass, A.L. 2010. Juvenile coho salmon movement and migration through tide gates. M.S. Thesis, Dep't. of Fisheries and Wildlife, Oregon State University, Corvallis, OR. 124 pp.	

Estuary: Coos	**Name**: Coho Life History in Tide Gated Lowland Streams		
Type: Monitoring	**Action**: Upgrade	**Grant** #: 210-2071	**OWRI** #: N/A
Grantee: Coos Watershed Association		**OWEB**: $169,813	**Total**:
Summary: The coho salmon Life Cycle Monitoring project in Palouse and Larson Creeks is a long term monitoring study initiated in 2004 to examine coho salmon survival, production, and habitat use in tide gated coastal lowland streams. Coastal lowland streams are critical for the sustainability of Oregon Coast coho, but it is unclear how tide gates may affect coho movement, habitat use, and survival. This project is intended to describe variations in juvenile coho life histories, including the nomad strategy, and their contribution to adult spawning populations.			

Aerial Images:

Restoration Metrics: None available	
Monitoring Focus: Biological	**Study Design**: Adult population was sampled with weirs and spawning ground surveys and abundance estimated with mark recapture and area under the curve methods. Total egg depostition was estimated. The juvenile population was sampled with rotary screw traps. A portion of the juveniles were measured and fin-clipped for trap efficiency. Egg deposition and smolt abundance were estimated. Freshwater and marine survival were calculated. A portion of fish were PIT tagged to examine freshwater

	migration and habitat use and to complement survival estimates. Otolith microchemistry to determine fish size at migration. DNA samples taken and candidate gene analysis performed.
Parameters: Adult abundance, juvenile abundance	**Species Monitored**: Coho juveniles and adults, Chinook, steelhead
Project Findings: Spawner abundance decreased '01 to '04, increased to '07, and was about average in '08. Smolt abundance increased '04 to '09 and was lowest in '10. Freshwater survival was <3% except in '07 it was >6%. Marine survival varied from 1.6% to 18.2% in Palouse and 1.3% to 8.7% in Larson. Survival rates in both streams were within the ranges of other life cycle monitoring sites. PIT data: freshwater survival ~11% to >40% in both creeks, jack returns were <2% of the run in all years, marine survival was 5% in Palouse for the one year with data. Juveniles in lower reaches before their first October were considered early migrants. In '07 early migrants had the highest percent return. In summer ~3/4 of the fish were sedentary and in winter ~3/4 were mobile. In summer mobile fish were mainly in the lower two reaches. In winter mobile fish were distributed throughout the stream. Growth rate was influenced by water temperature, coho density and habitat complexity. Fish sedentary in summer or winter had higher winter survival, however, in reaches 2 and 3 no sedentary fish survived. Survival was higher for larger fish and for fish farther upstream. Total growth in the estuary was higher for estuary-rearing fish - longer time. High levels of interrelatedness were found in Larson so could not look for genetic differences in residents and nomads.	
Lessons Learned: N/A	
Data Gaps:	
Project Reports: Project Completion Report, 10/2013	
Associated Publications & Reports: Weybright, A.D. 2011. Juvenile coho salmon movement, growth and survival in a coastal basin of southern Oregon. M.S. Thesis, Dep't. of Fisheries and Wildlife, Oregon State University, Corvallis, OR. pp. 127 pp. Weybright, A.D., and G.R. Giannico. 2017. Juvenile coho salmon movement, growth and survival in a coastal basin of southern Oregon. Ecology of Freshwater Fish. 2017:1–14.	

Estuary: Coos	**Name**: Coho Life History in Tide Gated Lowland Coastal Streams		
Type: Monitoring	**Action**: Upgrade	**Grant** #: 212-2044	**OWRI** #: N/A
Grantee: Coos Watershed Association		**OWEB**: $148,962	**Total**: $307,482

Summary: Coos Watershed Association's (CoosWA) coho Life Cycle Monitoring Project (LCM) is a continuation of a long-term monitoring study initiated in 2004 to examine coho salmon abundance, survival, life histories and habitat use in two tide gated coastal lowland streams, Larson and Palouse Creeks. Productive utilization of these remarkable habitat types is critical for the recoverey and sustainability of Oregon Coastal coho. Specifically, this project developed, and adapted innovative mark recapture techniques using PIT tags to monitor the coho life cycle, further evaluated over-winter rearing strategies in relation to temporal and spatial habitat use and continued project effectiveness monitoring in these study streams. In addition, coho diet analyses were designed and conducted and will be analyzed in relation to seasonal and diurnal variations in environmental factors in order to assess proximal causes of habitat productivity.

Aerial Images:

Restoration Metrics: None available	
Monitoring Focus: Biological	**Study Design**: To determine the extent to which tide gates alter the trophic ecology of juvenile salmonids and how they affect coho ontogeny life cycle monitoring was completed in Palouse and Larson creeks. Spawner surveys and abundance estimates were completed. Outmigrant trapping allowed smolt estimates. Used PIT tags to assist

	with population estimates and efficiency calculations.
Parameters: spawner surveys, outmigrant trapping, female ratio, calculate adult spawner population (AUC estimates), egg deposition estimates, marine and freshwater survival estimates	**Species Monitored**: Coho juveniles and adults
Project Findings: Palouse Cr freshwater survival followed the same pattern as Larson Cr and other LCM sites in the Coos River watershed. Marine survival was variable with some years below 7% and others 13-18%. Larson Cr freshwater survival was variable, and closely tracked the survival at other LCM sites. Marine survival was 1-10% and within the range of other Coos watershed LCM sites. The pattern of survival was similar that that of the Smith River LCM site. Fork length distribution provided evidence for two age classes. Fish size distribution was similar in freshwater and brackish habitats. Adult spawner estimates vary up and down, a few years in each direction following the same pattern as other Coos LCM sites, especially Smith River.	
Lessons Learned: Female coho spawner number is inversely related to smolt abundance - suggests density dependence. Screw traps are difficult to use in these creeks because of sandstone geology. Low capture rates lead to abundance estimates that may not accurately reflect the population. Future sampling will couple screw traps and PIT antennas. NOAA has increased the min size for 12mm PIT tags; this may affect long term data sets - 8mm tags have lower detection.	
Data Gaps: 3000-4000 smolts need to be PIT tagged to estimate smolt to jack survival successfully	
Project Reports: Project Completion Report, 3/2015, and Final Completion Summary	
Associated Publications & Reports: Nordholm, K.E. 2014. Contribution of subyearling estuarine migrant coho salmon (Oncorhynchus kisutch) to spawning populations on the southern Oregon coast. M.S. Thesis, Dep't. of Fisheries and Wildlife, Oregon State University, Corvallis, OR. 81 pp.	

Estuary: Coos	**Name**: Coho Life History in Tide Gated Lowland Coastal Streams 2014-2016		
Type: Monitoring	**Action**: Upgrade	**Grant** #: 214-2031	**OWRI** #: N/A
Grantee: Coos Watershed Association		**OWEB**: $145,361	**Total**: $248,657

Summary: Coos Watershed Association's (CoosWA) coho life history in tide gated lowland coastal streams, a life cycle monitoring (LCM) project, adapts and advances a long-term monitoring study initiated in 2004 to explicitly examine coho salmon abundance, survival, life histories and habitat use in tide gated coastal lowland streams. Evidence from this project and across the range of coho strongly indicates that connectivity in diverse and dynamic tidal habitats provides alternative rearing pathways critical for the sustainability and recovery of Oregon Coastal (OC) coho stocks. Specifically, this project reestablished innovative PIT tag mark recapture techiniques to monitor coho movements and migrations. Temporal and spatial components of over-winter rearing strategies, in relation to habitat use and project effectiveness monitoring, is the focus in these paired study streams. Notably, monitoring was shifted to Willanch Creek from Larson Creek. Juvenile coho diet analyses revealed seasonal and diurnal variation in foraging strategies between early migrating sub-yearlings and yearling smolts across their range in estuarine habitats. These results reveal the fundamental mechanisms that promote increased juvenile coho growth and survival in the estuarine ecotone. In conjunction with prior and current data, results highlight the critical importance of these diverse habitats for recovering viable OC coho populations.

Aerial Images:

Restoration Metrics: None available	
Monitoring Focus: Biological	**Study Design**: Assess the effect of tide gates on habitat characteristics and the consequences for

	juvenile coho ontogeny, and the extent to which tide gates alter trophic and migratory ecology. Palouse (top-hinge) and Willanch (side-hinge muted tide regulator) creeks were monitored. Installed gate angle sensors, pressure transducers inside and outside, water quality sonde, HDX PIT array at Willanch. PIT array provides mark-recap closure and monitors juvenile migratory behavior. Switching to Willanch from Larson diminishes the long-term tracking ability but increases sampling ability - Larson was not completely accessible because of landowner restrictions.
Parameters: spawner surveys, adult abundance (AUC) estimates, female ratio, egg deposition estimates, juvenile outmigrant trapping and tagging, juvenile abundance estimates, freshwater and marine survival	**Species Monitored**: Coho juveniles and adults
Project Findings: Willanch data set shorter but tracks other Coos River systems at lower levels. Palouse peak spawner counts are influence by ocean conditions in the north Pacific - PDO, NPGO. Palouse fry and smolt estimates were lower in 2016 than 2015. Willanch fry and smolt estimates were both higher in 2016 than 2015. Palouse marine survival oscillated between high and low values. Freshwater survival was generally <5% with the exception of 2007, which was above 20%. No estimates could yet be made for Willanch Cr. Growth rates from PIT data for periods longer than 30 days show a growth rate reduction and then recovery at interval times >90 days for both length and weight. Juveniles residing in the stream-estuary ecotone exist in stressful conditions but they have increased growth rates relative to upstream rearing fish.	
Lessons Learned: all equipment should be securely anchored to withstand high water conditions and to deter theft	
Data Gaps: Winter habitat usage and growth are not measured because of seasonal sampling difficulties	
Project Reports: Project Completion Report, 12/2016 and Final Completion Summary	
Associated Publications & Reports:	

Estuary: Coos	**Name**: Coho Life History in Tide Gated Lowland Streams 2016-2018		
Type: Monitoring	**Action**: Upgrade	**Grant** #: 216-2068	**OWRI** #: N/A
Grantee: Coos Watershed Association		**OWEB**: $139,441	**Total**: $273,621

Summary: This project is a continuation of a long-term monitoring study initiated in 2004 to examine coho salmon survival, life histories and habitat use in tide gated coastal lowland streams. The objectives of the proposed project are to 1) obtain robust freshwater and marine survival estimates for coho salmon that can calibrate limiting factors models and identify habitat and or life history bottlenecks, 2) monitor migratory patterns, survival and growth rates of coho salmon populations in lowland stream systems where restoration projects have improved habitat connectivity. 3) Assess fish utilization and passage through a state-of-the-art tide gate in Willanch Creek in comparison to similar previous efforts of this project (Bass et al. 2012). Objective 1 expands ODFW Coho Life Cycle Monitoring sites from seven to nine and enhances the ability to identify trends in coho survival and abundance by adding critical data from productive tidal lowland coastal streams. Objective 2 will characterize habitat use by juvenile salmonids within the lower tidal and upper freshwater reaches of lowland coastal streams. Continuous mark-recapture methods will more fully elucidate seasonal variability and proportional utilization of the freshwater and estuarine rearing life histories previously characterized by this project and others. This monitoring strategy will also provide ongoing assessment of the effectiveness of past and current restoration projects and identify future potential restoration needs. Objective 3 provides critical baseline information for ODFW on fish passage statutes (HB 3002: 2001). Connectivity of rearing and migratory habitats within and between subbasins has been identified as the limiting factor in these systems. Restoration in the tidal ecotone is presumed to strengthen population resiliency in light of continued habitat alteration and climate change and associated interactions.

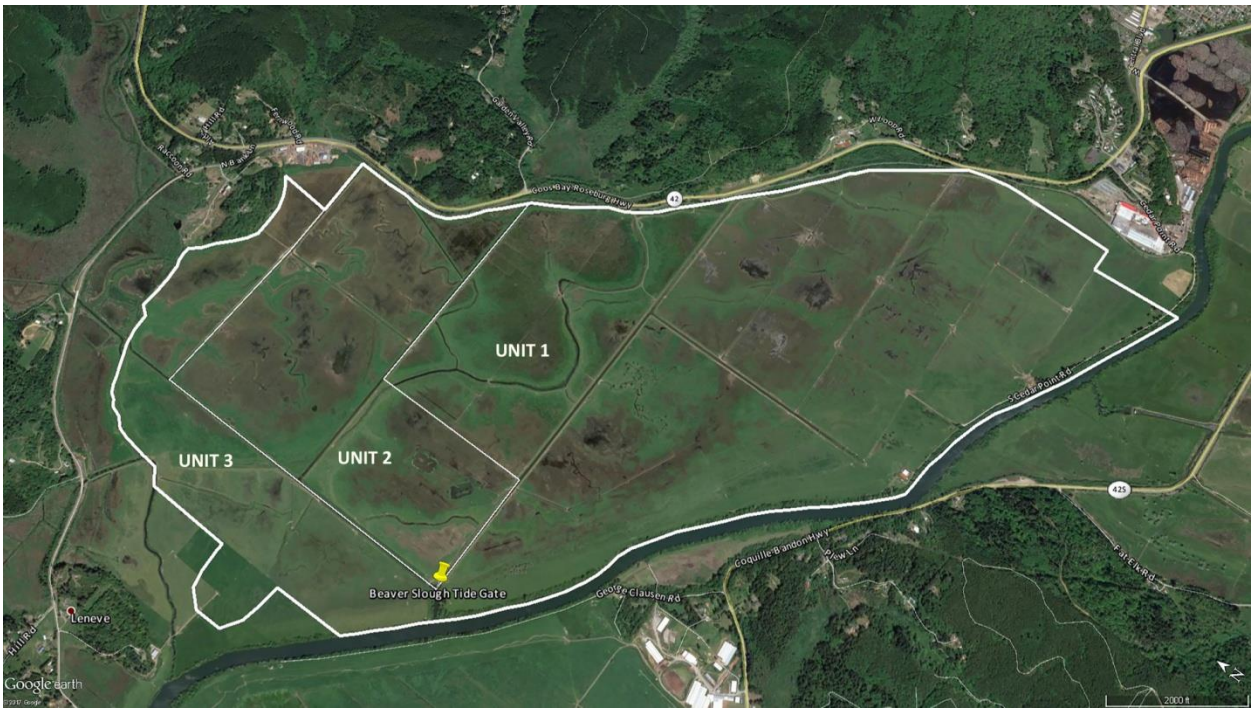
Aerial Images:

Restoration Metrics: None available	
Monitoring Focus: This project is a continuation of a long-term monitoring study initiated in 2004 to examine coho salmon survival, life histories and habitat use in tide gated coastal lowland streams. The tidal ecotone habitats of these streams are critical for the sustainability of Oregon Coastal coho.	**Study Design**: This project uses continuous PIT tag mark-recapture methods to monitor coho life cycles, to evaluate over-winter habitat use and for project effectiveness monitoring in Palouse and Willanch Creek subbasins.
Parameters: Gate open duration and water velocities (i.e., fish passage criteria). Effects of MTR tide gates on water quality (salinity, temperature). Freshwater and marine growth and survival rates for coho salmon. Freshwater rearing habitat quantity and quality. Adult and juvenile fish abundance and distribution.	**Species Monitored**: Coho juveniles and adults, Chinook, steelhead
Project Findings: In progress.	
Lessons Learned: In progress.	
Data Gaps: In progress.	
Project Reports: In progress.	
Associated Publications & Reports: In progress.	

Estuary: Coquille	**Name**: Coquille Valley Wetland Conservation and Restoration Project/ China Camp Creek/ Winter Lake Restoration		
Type: Restoration	**Action**: Upgrade	**Grant** #: 215-2000-11256, 211-115-10755	**OWRI** #: N/A
Grantee: Beaver Slough Drainage District		**OWEB**: $2,626,604	**Total**: $3,422,854

Summary: The project area is located in the Coquille River Estuary, approximately 3 miles west of Coquille, Coos County, Oregon. The area has been diked and drained for agricultural purposes for nearly a century. The Beaver Slough Drainage District was formed in 1906, and encompasses over 1,700 acres of tidally influenced land. The tide gate structures are reaching the end of their design life and the drainage district has developed a project to allow access for native migratory fish and restore wetland habitat while providing agricultural uses. The project will replace a metal culvert and wooden tide gate with a concrete box and aluminum tide gate structure. The project area will be divided into three parcels, two of which will be managed for agricultural activity and the center one for wetland habitat and restoration. The central parcel will be isolated with a berm and each parcel will have dedicated side-hinge tide gates. The Winter Lake restoration project is the result of long term collaboration between the Beaver Slough Drainage District, The Nature Conservancy, Oregon Department of Fish and Wildlife, China Camp Creek Gun Club and other public and private stakeholders. The project has the opportunity to build resilience and balance between agricultural use of historic tidelands and restoration of tidal wetlands to benefit Coho salmon and other wetland dependent species. The project has a detailed monitoring program to measure the ecological changes and evaluate the effectiveness of the effort, OWEB funds will be used for the completion of the infrastructure. This project is a continuation of grants 215-2000 and 211-215.

Aerial Images:



Restoration Metrics: Not available	
Monitoring Focus: Biological	**Study Design**: In the spring and summer the outer parcels will be managed for flood protection and drainage. In the winter the entire area floods and creates one large lake.
Parameters: spring and summer channel connectivity, fish passage, off-channel rearing habitat, and forested wetland habitat	**Species Monitored**: coho
Project Findings: In progress.	
Lessons Learned: In progress.	
Data Gaps: In progress.	
Project Reports: OWEB Grant Application, Coquille Wetland Conservation and Restoration Project, 8/2016. Final Completion Report, Grant 211-215-10753. OWEB Grant Application, Winter Lake Restoration, Grant 211-215, 8/2013. OWEB Technical Review Team Evaluation of 8/2013 Application, 2013.	
Associated Publications & Reports: In progress.	

Estuary: Coquille	**Name**: Ni-les'tun Tidal Marsh Restoration, Bandon Marsh National Wildlife Refuge		
Type: Restoration	**Action**: Removal	**Grant #**: 210-2032-7450	**OWRI #**: 20140361
Grantee: Ducks Unlimited		**OWEB**: $893,365	**Total**: $2,588,169.58

Summary: The Coquille River Estuary has lost the highest proportion of marsh habitat of any in Oregon. Dikes and tide gates have contributed to wetland loss. The Ni-les'tun Unit of the Bandon Marsh National Wildlife Refuge is 582 acres and was established in 2000 to protect and restore intertidal marsh, freshwater marsh, and riparian areas, provide habitats for migratory birds and songbirds, and to restore intertidal marsh habitats for anadromous fish such as steelhead, cutthroat trout, and chum, Chinook, and coho salmon. Restoration completed in 2011 increased Coquille River estuary tidal marsh habitat by 400 acres. Restoration involved removing levees and three tide gates, discing and filling ditches, constructing sinuous tidal channels, increasing culvert size, reconnecting small coastal streams, large wood placements, native plantings, non-native and invasive vegetation control, and power line relocation. This project is described as the largest of its kind in Oregon, with multiple partners. OWEB funded vegetation and tidal hydrology monitoring (next two entries in this appendix); USFWS funded pre- and post-project fish monitoring (see Silver et al. 2015, Appendix A).

Aerial Images (see 2 pages subsequent).

Restoration Metrics: 418 estuarine acres improved by channel modification, estuarine connection restored to 418 acres by dike/ berm removal/ modification	
Monitoring Focus: No monitoring under this restoration grant. Monitoring funded separately.	**Study Design**: N/A
Parameters: N/A	**Species Monitored**: N/A

Project Findings: Effectiveness monitoring indicated that the vegetative cover was moving toward native-dominated tidal marsh communities. Additionally, marsh use by native fish and aquatic invertebrates, and migratory shorebirds and waterfowl increased. Hydrology and channel morphology have also become more similar to reference conditions. Full tidal exchange has been restored. Tidal marsh function indicators are approaching or within the range of conditions at reference sites.

Lessons Learned: The potential to create mosquito breeding areas should be considered during the design phase, and will depend on the speicies present. 80,681 linear feet of tidal channel were excavated to alleviate water retention caused by restoration activity. A high priority should be placed on effective distribution of channels to provide adequate drainage for all areas of the site. Develop cost contingencies to support unexpected issues.

Data Gaps:

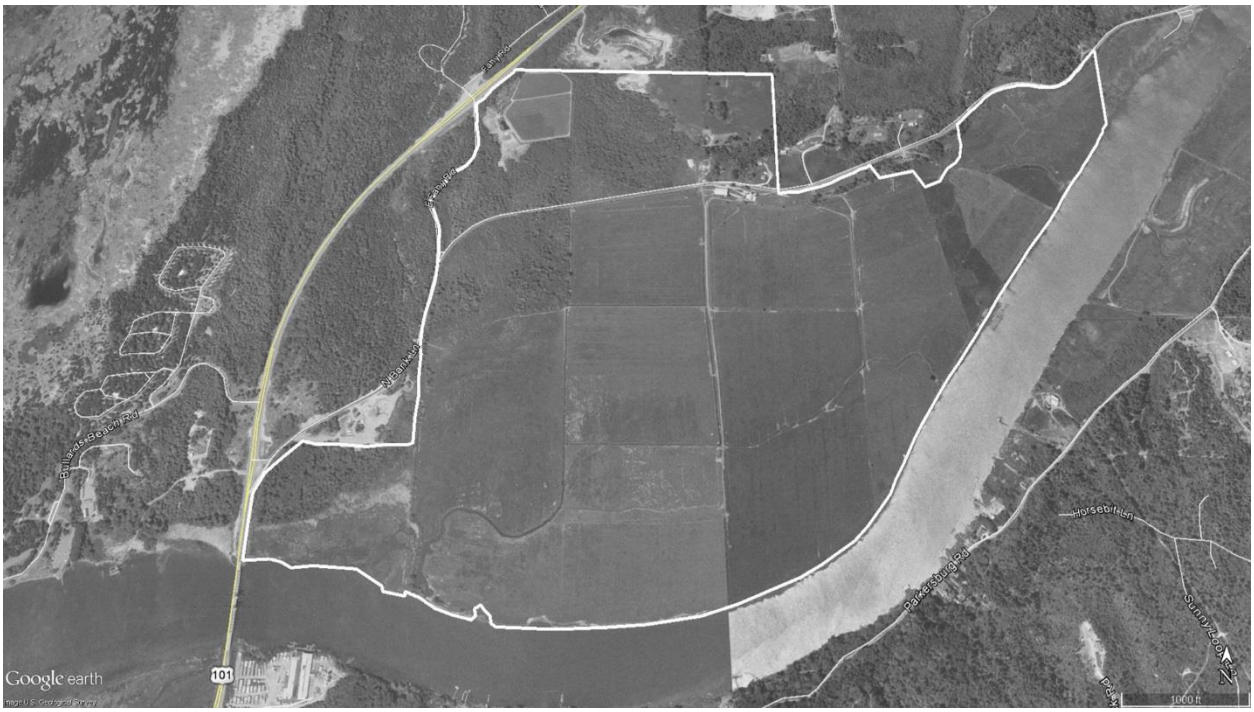
Project Reports: Final Completion Summary, 2015? Post-Implementation Status Report, 2016

Associated Publications & Reports: USFWS web page. Site history and project description.
https://www.fws.gov/refuge/Bandon_Marsh/what_we_do/restoration.html

Silver, B.P., J. M. Hudson, and T. A. Whitesel. 2015. Bandon Marsh National Wildlife Refuge Restoration Monitoring, Final Report. U.S. Fish and Wildlife Service, Columbia River Fisheries Program

Office, Vancouver, WA. 49 pp.
https://www.fws.gov/columbiariver/publications/Bandon%202015%20Final%20Report.pdf
NOTE: This report summarizes USFWS-funded fish monitoring.

Ni-les'tun Tidal Marsh Restoration – Before (5/26/1994):



Ni-les'tun Tidal Marsh Restoration – After (5/21/2015):

Estuary: Coquille	**Name**: Ni-les'tun Tidal Wetland Restoration Effectiveness Monitoring		
Type: Monitoring	**Action**: Removal	**Grant** #: 210-2032	**OWRI** #: N/A
Grantee: Ducks Unlimited		**OWEB**: $150,234.5	**Total**: $150,234.5
Summary: The final completion summary stated that the effectiveness monitoring project will determine rates of juvenile salmonid use within a) the three 6th field sub-basins and b) the complex (wood) and non-complex habitats located within the 430 acre Coquille River/Ni-les'tun restoration unit. Physical 'controlling factors' ('ecosystem drivers') and resulting biological characteristics that create desired wetland functions will be monitored. Ecosystem services provided, such as carbon sequestration in soils (tons), wildlife habitat (acres), and native plant community support (acres) will be quantified. Baseline data will be compared to post-restoration data to document restoration trajectory. The 'controlling factors' which structure the wetland and create valued biological functions will be tracked, including tidal inundation, groundwater hydrology, soil salinity, and soil organic mattter. Survival of woody plantings will be measured. However, in this project year only tidal hydrology and emergent vegetation were monitored. The only post-project fish focused monitoring was done in 2013 and is included in the following reference.			

Aerial Images:

Restoration Metrics: None available	
Monitoring Focus: Water Quality, Biological	**Study Design**: Logged tidal hydrology for 1 year in 2010-11, 2012, 2013, and 7 mos in 2015. Compared the data to 2009 pre-restoration data. Calculated % inundation and daily water level maximum for 2009, 2013, 2015. Single plant community composition sample in 2010, 2013, and 2015. Measured % cover within 30x150 ft

	permanent plots (14 restoration, 4 reference). Summarized data with NDMS. Mapped area of each plant community over the entire restoration site using high resolution aerial photography and field truthing. Mapping was not done at the reference site in 2015 because field recon showed no changes since 2013. Surface elevation measured along transects in 2011 and 2015.
Parameters: Percent inundation, daily maximun water level, transect elevation, groundwater hydrology, soil salinity, soil organic matter, Plant community: species richness, total percent cover, and native and non-native percent cover, woody planting survival Ecosystem Functions: quantify carbon sequestration in soils (tons), wildlife habitat (acres), native plant community support (acres)	**Species Monitored**: Vegation community composition
Project Findings: Daily max water levels were similar inside and outside and inundation and exchange were restored at even the two highest elevation transects in the restoration site by 2015. Surface elevations were higher in the restored and reference marsh in 2015 (post) than in 2011 (pre). Elevation change was similar between marshes. Species richness was lower at the restoration site and did not change at the reference site post-restoration. Percent cover (total, native, non-native) did not differ between sites or among years. However, salt-tolerant plants were increasingly present. Native-dominated communities increased and non-native-dominated communites decreased from 2013 to 2015. The large changes in specific salt-tolerant early colonizers suggest that the plant community is not yet close to a stable state. Additional evidence: spatial distribution seemed based on individual plant tolerances rather than clear zonation. Elevations at specific transects increased an average of 4.9 cm (restored) and 3.6 cm (reference) post-restoration. NMDS showed that restoration plant community was moving toward a low salt marsh community as found at the reference site.	
Lessons Learned:	
Data Gaps: Results are not conclusive on the recovery of the estuary marsh in terms of fish use, fish habitat opportunity and capacity, prey availability, forested wetland plant communities, channel morphology, salinity, water temperature, groundwater, and soils.	
Project Reports: Year 4 Post-restoration (2015), 2/2016, revised 12/2016	
Associated Publications & Reports:	

Estuary: Coquille	**Name**: Ni-les'tun Tidal Wetland Restoration Effectiveness Monitoring		
Type: Monitoring	**Action**: Removal	**Grant** #: 212-2068	**OWRI** #: N/A
Grantee: Ducks Unlimited		**OWEB**: $157,117	**Total**:

Summary: This report describes the results of effectiveness monitoring at the Ni-les'tun tidal wetland restoration site, Bandon National Wildlife Refuge, Coquille River estuary, Oregon. The monitoring described in this report was conducted during 2013, which was the 2nd year after the site's dikes and tide gates were removed, restoring tidal flows to the site. Effectiveness monitoring was designed to determine whether the project is meeting its goals, and to provide information to help guide other restoration projects. The results and 'lessons learned' through monitoring at this landmark project are already helping to advance restoration science at many projects in Oregon, the Pacific Northwest, and beyond.

Aerial Images:

Restoration Metrics: N/A	
Monitoring Focus: Water Quality, Biological	**Study Design**: Measured plant community composition and extent, soil carbon, salinity, and pH, groundwater levels, surface water salinity and temperature. Estimated amount of habitat available to juvenile salmonids. Sampled benthic macroinvertabrates (abundance by taxon, taxon richness, S-W diversity index, community structure index) at one restoration sub-basin. Determined habitat use by juvenile fish and movement into and out of the estuary.

Parameters: N/A	**Species Monitored**: Benthic macroinvertabrates, Chinook, Pacific staghorn sculpin, three-spine stickleback (3 most abundant species).
Project Findings: Post-restoration tidal exchange was restored and tide height closely resembled mainstem. Channel morphology changed slightly - channels deepened, fine sediment increased, downcutting began in lower reaches. %cover and %non-native cover and species richness decreased. Pasture grass had died back and plant community was moving toward reference site. Soil salinity and %C increased, maybe caused by evaporation and plant die-back. Groundwater level and amplitude of fluctuation increased. Channel salinity increased; temperature was more similar to reference. Fish access to the channels increased from 2% to 27%. Benthic macroinvertabrate abundance increased and diversity decreased - dominated by Corophium. Mean peak CPUE in the restoration site was lower than reference pre-removal and higher post-removal for Chinook, staghorn sculpin, and was higher in the restoration site pre- and post-removal for stickleback. Restoration significantly affected sculpin and wood significantly affected Chinook and sculpin. Peak migration increased in the 3 restoration subbasins, but not in the reference site. Increased resilience to climate change and ability to moderate flooding.	
Lessons Learned: Restoration site was historically high marsh so used high marsh transects at reference site but restoration site has undergone subsidence and is currently in the low marsh elevation range. Non-excavated (natural) channels at restoration site were not sampled prior to restoration. Changes in individual channel cross-sections are not testable. Pre-and post: channel width and width:depth could not be compared because field methods differed.	
Data Gaps:	
Project Reports: Year 2 Post-restoration (2013), 7/2014, revised 5/2016	
Associated Publications & Reports: Brophy, L. and S. van de Wetering. 2012. Ni-les'tun Tidal Wetland Restoration Effectiveness Monitoring: Baseline (2010-2011).	

Estuary: Lower Columbia	**Name**: Thousand Acres Floodplain Restoration Project		
Type: Restoration	**Action**: Removal	**Grant #**: 214-3032-10845	**OWRI #**: 20150139
Grantee: Lower Columbia Estuary Partnership		**OWEB**: $82,566	**Total**: $682,879

Summary: The Thousand Acres site is located on USFS land and is part of the 1,500 acre natural area at the confluence of the Sandy and Columbia rivers known as the Sandy River Delta in the lower Columbia River estuary. The site was historically a dynamic alluvial floodplain with two distributaries of the Sandy River flowing across it and a mosaic of bottomland forests, wetlands and meadows. This area provided valuable habitat for many species, including rearing and refuge habitat for juvenile salmon. A combination of river flow regulation and human manipulation of natural hydrology at the site resulted in the disconnection of the floodplain channels, ponds, and wetlands. The system lacked habitat complexity and was dominated by noxious non-native invasive plants. An old tide gate and water control structure between the ponds and the Columbia River were removed creating an uninhibited flow path from the bluff through to the river. Excavation in the ponds and channels expanded the wetland and off channel juvenile salmonid habitat area. Additional enhancements include recontoured slopes, large wood placements, and planting riparian vegetation on 35 acres. The project followed several years of reforestation efforts by Lower Columbia Estuary Partnership, USFS and other partners. The project restored natural hydrology and access for juvenile salmonids and re-established the site's native plant communities. These habitat enhancements will also benefit many regionally important species of birds, amphibians and reptiles.

Aerial Images:

Restoration Metrics: 0.3 instream miles, 2 riparian miles, 52 riparian acres, 3 fish passage crossings, 2 fish passage crossing miles, 20 wetland acres, 3 culverts removed, 792 feet in 1 main channel created/

modified, 22 structures (key piece logs) placed - not anchored, 2 miles-2 stream sides-52 acres treated for non-native/ noxious plants, conifer and hardwood riparian trees planted and riparian shrubs or herbaceous vegetation planted/ reseeded, 20 wetland acres treated for non-native or noxious plant species, returned to shrub/scrub wetland, wetland vegetation planted	
Monitoring Focus: N/A	**Study Design**: No monitoring was described.
Parameters: N/A	**Species Monitored**: N/A
Project Findings: The project continues to be extremely effective at increasing access, as the removal of the former passage barriers allowed unimpeded fish access to the channels and wetland vegetative communities to provide shade and cover. Large numbers of juvenile salmonids were observed above the former passage barriers each year since the project was implemented. The revegetation of the 70 acres of riparian and wetland areas was implemented at the site as well, and plants were in the establishment phase. In most areas the plantings were growing rapidly and the goals were anticipated to be met by this portion of the project as the plants continued to grow to mature height.	
Lessons Learned: Consider additional costs when planning and budgeting, particularly for organizing, storing, delivering, and distributing plants. Bare root timing is critical because they should not dry out or be exposed to harsh weather. When excavcating, apply herbicide to germinating weeds prior to planting because it can be done with large equipment. Once plantings are done all herbicide application will need to be done by hand.	
Data Gaps:	
Project Reports: Project Completion Report, 2015. Post-Implementation Status Report, 2016.	
Associated Publications & Reports: http://www.estuarypartnership.org/thousand-acres-restoration-site NOTE: Detailed project description, with several photos. http://www.estuarypartnership.org/news/sandy-river-delta-thousand-acres-restoration-project-rfp-released	

Estuary: Lower Columbia	**Name**: Thousand Acres Floodplain Restoration Project, Plant Establishment		
Type: Restoration	**Action**: Removal	**Grant #**: 214-3032-11263	**OWRI #**: N/A
Grantee: Lower Columbia Estuary Partnership		**OWEB**: $44,933	**Total**:
Summary: 35 acres of the Thousand Acres site in the Sandy River Delta of the lower Columbia River estuary were planted with native riparian species. Plant establishment activities began in spring 2015 and will continue until spring 2018. Maintenance includes herbicide and mowing.			

Aerial Images:

Restoration Metrics: None available	
Monitoring Focus: N/A	**Study Design**: No monitoring was described.
Parameters: N/A	**Species Monitored**: N/A
Project Findings: Plantings in the lower wetland area have been very successful. Survival ranged from 75% in the two drier zones to 90% in the wetter lower wetland zone. Willow plantings were growing well and on a trajectory to out compete the reed canarygrass in areas where it persisted.	
Lessons Learned: In areas where grading was completed to expand the estuary and improve channel bank morphology it would have been ideal to add a layer of topsoil for plantings. Costs were prohibitive for this project. Awareness of post-restoration conditions and plant sensitivity is important for success of plantings. Cottonwood appears to be better adapted to harsh conditions than dogwood. During drought conditions the option to irrigate from an existing well was considered. However, it became apparent that the willow plantings were accessing enough water in the soil and irrigation was not needed.	

Data Gaps:
Project Reports: Post-Implementation Status Report, 2016
Associated Publications & Reports:

Estuary: Lower Columbia	**Name**: Tide Gate Effectiveness Monitoring, Columbia River Tributaries		
Type: Monitoring	**Action**: Upgrade	**Grant #**: 204-277	**OWRI #**: N/A
Grantee: Clatsop Coordinating Council		**OWEB**: $25,134	**Total**:
Summary: This project was intended to demonstrate the effectiveness of newer 'fish-friendly' tide gates to allow passagefor rearing salmonid juveniles, collect data on water quality changes, and establish a volunteer training template.			

Aerial Images:

Restoration Metrics: None available	
Monitoring Focus: Biological, Water Quality	**Study Design**: Sub-yearling salmonids were collected via fyke-net migrating out of gated tidal channels during ebb tides. Water quality measurements were performed weekly, temperature logged continuously
Parameters: Fish: crew, time, species, number of fish, fish size, hatchery marks for all salmonids and a 30-ind subsample of other species; Water Quatlity: dissolved oxygen, salinity, turbidity,	**Species Monitored**:

conductivity, temperature	
Project Findings: Fish: Barrett Slough: sampled once - no salmonids and vegetation clogged the net. Larson Slough: Stickleback dominated all samples. Mainly warm water fish were collected as well as a few Chinook and coho. These samples were from below the tide gate; very few fish were collected above the tide gate and conditions did not seem conducive (thick mud substrate). Water quality: Vera Slough: Upstream water level and tidal amplitude increased after gate replacement. Preliminary data - temperature decreasing, salinity increasing and fluxing with tides. Blind Slough: Water quality did not change significantly after replacement. Temperature above the tide gates averaged higher than below. Warren Slough and Johnson Creek (Young's Bay): dissolved oxygen are similar above and below the tide gates at both sites, and temperature is similar above and below at Johnson Creek. Once equilibrium is established there will not be large above/below changes.	
Lessons Learned: Landowners may be reluctant to actively manage tide gates, even after cooperating on replacement. Therefore tide gate improvements are underutilized.	
Data Gaps:	
Project Reports: Project Completion Report, 8/2007.	
Associated Publications & Reports:	

Estuary: Nehalem	**Name**: McDonald Slough Reconnection Project		
Type: Restoration	**Action**: Upgrade	**Grant** #: 215-1017-11365; 215-1017-11607	**OWRI** #: N/A
Grantee: Lower Nehalem Watershed Council		**OWEB**: $331,365 ($36,362 for Monitoring (ID 11607)	**Total**: $478,551 (ODFW: $613,370.65)
Summary: McDonald Slough drains into the North Fork Nehalem River and is one of the largest sloughs in the estuary. It was historically disconnected from the river by two top-hinge tide gate structures (default closed) critical to the operation of surrounding agricultural land. The structures impaired access to over 1.5 miles of spawning and rearing habitat for salmonids, including 16 acres of slough habitat, disrupted the natural hydrology and nutrient exchange, and limited tidal influence in the slough. The top-hinged gates were replaced by two side-hinged epoxy-coated aluminum gates with muted tidal regulators. The new system is default open - the MTRs keep the gates open until the inside inundation level reaches a set height. Large woody debris placements were made in four locations within the slough near the old and new gates and downstream of the new gate.			

Aerial Images:

Restoration Metrics: 0.5 instream miles, 1 fish passage non-crossing, 1.5 fish passage non-crossing miles, 1 tidegate replaced/ modified, 20 rootwads placed - not anchored	
Monitoring Focus: Tide Gate, Water Quality (Project ID 11607 monitoring is focused on the gate that will be replaced and is occurring after completion of the associated restoration project)	**Study Design**: N/A

Parameters: gate duty cycles, inundation levels upstream of gate, water quality: T and salinity up and downstream	**Species Monitored**: N/A
Project Findings: Installation of the new structure has improved access to 1.5 miles of freshwater and forested/shrub and freshwater emergent wetland habitat to benefit coho, Chinook, and steelhead. The MTR tide gates allowed for more tidal flushing resulting in greater dissolved oxygen, decreased water temperatures, and improved water quality in McDonald Slough. The new tide gate system also provided improved fish passage. The large wood placements created complex habitat within the slough and North Fork Nehalem River, providing cover, encouraging pool scour, providing hard surfaces for aquatic invertabrates, and providing additional habitat for other aquatic and terrestrial species.	
Lessons Learned: It is imperative that project partners and permitting agencies establish a clear protocol for communication and outline expectations at the outset of a project. The federal and county permitting processes were delayed by lack of clear requirements and staff turn-over at the permitting agencies. The project was pushed back a year because the in-water work window was missed due to permitting delays. Developing an acceptable modeling approach, metrics to be evaluated, and conditions that will be accepted is key to successful permitting and project completion.	
Data Gaps:	
Project Reports: Final Completion Summary	
Associated Publications & Reports: ODFW R & E Grant Application, 13 Biennium, Project Information: McDonald Slough Reconnection Project http://www.dfw.state.or.us/fish/RE/projects/cycle_13-4_applications/13-062%20submitted%20Application%20Dec13%20w%20attachments%20for%20web.pdf NOTE: Detailed project background and description. Funding details differ from OWEB records -states that the project had $578,370.65 in Match Funding (partly OWEB) for a total of $613,370.65. OWEB docs say $331,364.93 OWEB funding, total project cost $478,550.93.	

Estuary: Nestucca	**Name**: Little Nestucca River Restoration		
Type: Monitoring	**Action**: Removal	**Grant** #: 207-261	**OWRI** #: 20070106
Grantee: Ducks Unlimited		**OWEB**: $146,691 ($170,616?)	**Total**: $640,697

Summary: [USFWS] Nestucca Bay, at 1,202 acres, is the largest refuge within the Oregon Coastal Refuge Complex. Located where the Nestucca and Little Nestucca rivers converge and debouch into the Pacific, the refuge is managed to provide wintering habitat for six subspecies of Canada Geese, including Aleutian and Dusky Canada Geese. The refuge also hosts several species of dabbling ducks, shorebirds and raptors on at least seven distinct habitat types. In 2007 an 83-acre tidal marsh restoration project was completed on the Little Nestucca River Unit of the refuge constituting a 30% increase in tidal marsh habitat in the estuary. The project is already benefiting juvenile salmonids, waterfowl and other species.

[N. Coast Citizen 3-14-2008] The area was diked and drained for agricultural use during the early 1900s and remained in pasture prior to restoration, said [ODFW Fish Biologist] Steve Pribyl. The project entailed 3,000' of levee removal and removal of two tide gates to restore full tidal inundation to the site, reconstruction of 3,700' of tidal channels, filling 2,800' of drainage ditches, and the placement of large woody material to stabilize the reconstructed tidal channels while enhancing juvenile salmonid habitat. To allow reconnection of the historic tidal channels and full tidal inundation to the west side of the project area, decommissioned Old Highway 101 was breached in three locations with each breach being excavated to a depth of 5' and a width of 55'.

In 1996 a dike breached naturally, leading to limited tidal influence. The 2007 project was undertaken to fully reestablish tidal exchange and wetland habitat over 87 acres of estuary. Two tide gates and parts of the dike were removed, the levee and an old road were breached, ditches were filled and tidal channels were excavated. Wetland use and function were monitored. Additionally, this project focused on the role of woody debris in estuaries for habitat formation and fish utilization.

Aerial Images (see next page)

Restoration Metrics: 0.84 instream miles, 3 fish passage noncrossings, 1.4 fish passage non-crossing miles, 82 estuarine acres, 2 tidegates removed and 1 other diversion modified, 3462 feet in 3 main channels modified/ created, 9 log weirs installed(not below culverts), 20 anchored habitat structures placed, 0.2 miles grass seeding and mulching, 10 stations(1000 ft) road effectively closed to public use, 2 stations (200 ft) road obliterated, decommissioned, or vacated, estuarine connection restored to 82 acres and .64 miles by dike/ berm modification/ removal

Monitoring Focus: Biological	**Study Design**: Vegetation was monitored using standard transects with quadrats. Plant communities were mapped over whole site. Evaluated change in plant community composition since 2001 baseline. Fish distribution was determined with seine sampling across a tidal cycle in Jun, Aug, and Oct. Tidal migration patterns were examined with underwater videography during the spring peak usage period. Macroinvertabrate distribution and abundance were described.

Parameters: Vegetation cover, frequency. Fish tidal migration, distribution, use of large woody debris. Macroinvertebrate abundance and distribution.	**Species Monitored**: N/A
Project Findings: 2008/2009: The amount of estuary covered by brackish tolerant plants increased dramatically post-restoration. Non-native, freshwater wetland, and pasture plant species decreased significantly. Reed canarygrass is no longer dominant but is still present at the highest elevations. The plant community was quite dynamic but on a trajectory toward typical native tidal marsh community. Fish use was significantly different post-restoration. Species composition was more similar to other marshes. Significantly more juvenile salmon were present during key rearing periods. After tide gates were removed the number of tidal migrants and the period of migration increased. Complex habitats with large wood placements had 10x more usage than non-complex habitats. Macroinvertabrate community was transitional - not similar to natural or degraded systems. 2011-2013: Native estuary plants are present over much of site. Most of the rest of the plant species are transitional brackish-tolerant. Tidal channels drained on falling tides and pools had formed around large woody debris placements. Reed canarygrass is still high density at highest elevations. In 2016: There were no noted changes from 2013.	
Lessons Learned: There are few contractors experienced in tidal area construction, but these people/groups are very valuable for restoration projects. Providing flexibility for a good contractor can achieve design goals while saving money and improving production and product. All utilities should be moved prior to restoration activity. Full time inspection helps achieve unfamiliar restoration goals.	
Data Gaps:	
Project Reports: Project Completion Report, 1/2010; OWEB Grant Compliance Monitoring, 7/2013; OWEB Grant Compliance Monitoring, 9/2016	
Associated Publications & Reports: https://www.fws.gov/refuge/Nestucca_Bay/about.html N. Coast Citizen article: “Ducks Unlimited group helps preserve, enhance tidal marsh” https://www.tillamookheadlightherald.com/news/ducks-unlimited-group-helps-preserve-enhance-tidal-marsh/article_a8242b64-3f1e-5d5c-8c89-df4fc4c3bc2a.html	

Little Nestucca River Restoration – Before (5/6/1994).

Little Nestucca River Restoration – After (8/23/2016).

Estuary: Salmon	**Name**: Tamara Quays Dike Removal and Fish Passage Culvert		
Type: Restoration	**Action**: Removal	**Grant** #: 208-1040, 208-1061-7658	**OWRI** #: 20090336
Grantee: Salmon Drift Creek Watershed Council		**OWEB**: $232,614	**Total**: $529,200
Summary: Tamara Quays vacant mobile home park and extensive related infrastructure were removed. The tide gate was removed, undersized culverts were replaced with a 20' fish passage culvert. Ditches were filled, and dikes and fill removed. Reed canarygrass sod was removed and covered with landscape cloth. Some large woody debris and log jams were placed. Native tree species were planted. To discourage illegal entry by vehicles, gates, logs, and boulders were installed.			

Aerial Images: (see next page)

Restoration Metrics: 1 fish passage crossing, 1 fish passage crossing mile, 1 fish passage non-crossing, 1.25 fish passage non-crossing miles, 13 estuarine acres, 1 culvert replaced with open bottom arch culvert, 1 tidegate removed, 8.7 acres existing estuary vegetaion planted and improved by channel modification, estaurine connection restored to 4.3 acres restored by dike/ berm removal/ modofication	
Monitoring Focus: N/A	**Study Design**: N/A
Parameters: N/A	**Species Monitored**: N/A
Project Findings: N/A	
Lessons Learned: A more thorough walk through of the site prior to plan development would have made work and equipment estimates more accurate. A chain of command for responsibilities, delineating roles and an accounting system to share cost estimates clearly organizing and managing multiple fund sources are important for partnership no-cost agreements. Communication management is time consuming but necessary. Completion celebration with contributor and partner acknowledgement was an important component.	
Data Gaps:	
Project Reports: Final Report and Accounting, 2/2010	
Associated Publications & Reports: Brophy, L. and L. Brown. 2014. 2014 Monitoring Report: Tamara Quays Tidal Wetland Restoration. Prepared for Salmon-Drift Creek Watershed Council, Neotsu, Oregon. Corvallis, Oregon: Green Point Consulting and Estuary Technical Group, Institue for Applied Ecology. Ellingson, K.S. and B.J. Ellis-Sugai. 2014. Restoring the Salmon River Estuary: Journey and Lessons Learned Along the Way 2006-2014. Report to Siuslaw National Forest, Corvallis: OR. NOTE: Includes site history, project details, pictures, and additional “lessons learned”.	

Tamara Quays Dike Removal and Fish Passage Culvert – Before (5/5/1994).

Tamara Quays Dike Removal and Fish Passage Culvert – After (8/18/2016).

Estuary: Salmon	**Name**: Pixieland Phase 1 - Restoration		
Type: Restoration	**Action**: Removal	**Grant** #: 208-1061-8288	**OWRI** #: 20110314
Grantee: Salmon Drift Creek Watershed Council		**OWEB**: $183,815 ($183,186 on OWRI)	**Total**: $313,249 ($302,886 on OWRI)
Summary: The Pixieland parcel of the Salmon River estuary was developed as an amusement park and then purchased by USFS as part of the Cascade Scenic Research Area. Development included dikes, a tide gate, grading, fill, non-native plantings, buildings, and roads. Restoration involved removing roads and buildings, excavating fill, removing dikes, filling ditches, removing the tide gate, and invasive plant control.			

Aerial Images (see next page).

Restoration Metrics: 1 instream miles, 40 estuarine miles, 5280 feet in 1 main channel modified/ created, esuarine connection restored to 40 acres by dike/ berm removal/ modification	
Monitoring Focus: N/A	**Study Design**: At the time of the report restoration was ongoing. No monitoring was described.
Parameters: N/A	**Species Monitored**: steelhead, chum, Chinook, coho, sculpin, cutthroat,
Project Findings: N/A	
Lessons Learned: Cost-effectiveness of different grading equipment was examined. An excavator and dump trucks were more efficient than a scraper. Coordination between disciplines is very important. Grading equipment and fish evacuation schedules had to be timed precisely. Grading work was divided among contractors, which made oversight and scheduling difficult.	
Data Gaps:	
Project Reports: Final Report and Accounting, 2/2012	
Associated Publications & Reports: Brown, L. and L. Brophy. 2015. 2015 Monitoring Report: Pixieland Tidal Wetland Restoration. Prepared for Salmon-Drift Creek Watershed Council, Neotsu, Oregon. Corvallis, Oregon: Green Point Consulting, Estuary Technical Group, Institute for Applied Ecology. Ellingson, K.S. and B.J. Ellis-Sugai. 2014. Restoring the Salmon River Estuary: Journey and Lessons Learned Along the Way 2006-2014. Report to Siuslaw National Forest, Corvallis: OR.	

Pixieland Phase 1 Restoration – Before (5/5/1994)

Pixieland Phase 1 Restoration – After (8/18/2016)

Estuary: Salmon	**Name**: Pixieland Tidal Wetland Restoration		
Type: Restoration	**Action**: Removal and site grading, excavation	**Grant** #: 208-1061-8321	**OWRI** #: N/A
Grantee: Salmon Drift Creek Watershed Council		**OWEB**: $30,752	**Total**: $172,152
Summary: Monitor the Pixieland site elevation to ensure that the grading plan is adhered to and the final desired elevations are achieved, as well as to assess pre- and post-wetland delineation. Assess vegetation changes and conduct water quality testing for temperture, dissolved oxygen, and salinity. It is uncertain whether vegetation in this area will stabilize as tidal marsh so will investigate herbaceous and woody plantings for reed canarygrass control.			

Aerial Images:

Restoration Metrics: Not available	
Monitoring Focus: Biological, Water Quality	**Study Design**: Vegetation was monitored using standard transects, shrub plots, and reed canarygrass control experiment plots - 4 treatments. Percent cover, percent frequency, species richness were measured. Plant community composition was evaluated using NMDS. Soil salmples were collected from transects and analyzed for conductivity (for salinity), pH, %organic matter. Salinity and water temperature were measured in a separate contract. Water depth was logged in an internal channel and the river near the creek mouth.

Parameters: Vegetation cover, frequency, density. Water depth, salinity. Soil salinity. Community composition.	**Species Monitored**: Vegetation
Project Findings: Vegetation performance standards: The average cover of native herbaceous plants is higher than that of invasive species in the herbaceous but not the shrub zone. Cover of invasive species (except reed canarygrass) is <10% in all habitats. The moisture index is <3.0 for all habitats. In shrub habitats native woody species are >1600 stems/acre and no invasive trees or shrubs were present. Total plant cover is moving toward reference conditions. Hydrology performance standards: Tidal exchange moves freely. Vegetation change: Plant composition was largely unchanged and comprised of native species; but decrease in Baltic rush and increase in tall-fescue (non-native). Cover of litter, wood, moss, and open space increased. In control plots opportunistic colonizers were most prominent. Ratio of native to non-native species did not differ among treatments. NMDS showed separation between years in community composition. Soils and Water Quality: Salinity was high at some reed canarygrass plots - low willow survival and large decline in reed canarygrass. Summer salinity was high (15-20 psu) in tidal channels.	
Lessons Learned: Inundation and water levels were higher than anticipated. Resultant high salinity and failure of willow plantings in tidal marsh zone were also not anticipated.	
Data Gaps:	
Project Reports: Monitoring Report and Final Completion Summary, 12/2013	
Associated Publications & Reports: Ellingson, K.S. and B.J. Ellis-Sugai. 2014. Restoring the Salmon River Estuary: Journey and Lessons Learned Along the Way 2006-2014. Report to Siuslaw National Forest, Corvallis: OR.	

Estuary: Salmon	**Name**: Pixieland Phase II		
Type: Restoration	**Action**: Removal	**Grant** #: 208-1061-8990	**OWRI** #: 20140003
Grantee: Salmon Drift Creek Watershed Council		**OWEB**: $213,016	**Total**: $469,516 ($350,205 on OWRI)
Summary: The Pixieland Restoration project is the site of the former amusement park. Phase II of the restoration focused on hydrological connectivity. The work involved removal of the remaining infrastructure, including a large dike and a tidegate. Ditches were filled, Fraser Creek was re-meandered, spruce trees were removed and used for wood placements. Native vegetation was planted and managed while invasives were controlled.			

Aerial Images: see next page

Restoration Metrics: 1 fish passage non-crossing, 5 fish passage non-crossing miles, 10 estuarine acres improved by channel modification, 1 tidegates removed, estuarine connection restored to 10 acres and 0.5 miles by dike/ berm removal/ modification	
Monitoring Focus: Biological	**Study Design**: No monitoring was described.
Parameters: N/A	**Species Monitored**: native vegetation, coho, Chinook
Project Findings: N/A	
Lessons Learned: If water control devices are removed before all ground work is completed efforts must be made to keep water and fish out of the work area. A settlement curtain should be used to keep sediment from escaping downstream.	
Data Gaps:	
Project Reports: Final Completion Summary	
Associated Publications & Reports: Ellingson, K.S. and B.J. Ellis-Sugai. 2014. Restoring the Salmon River Estuary: Journey and Lessons Learned Along the Way 2006-2014. Report to Siuslaw National Forest, Corvallis: OR.	

Pixieland Phase II – Before (5/5/1994).

Pixieland Phase II – After (8/18/2016).

Estuary: Salmon	**Name**: Pixieland Tidal Wetland Restoration Effectiveness Monitoring		
Type: Monitoring	**Action**: Removal	**Grant** #: 208-1061-8991	**OWRI** #: N/A
Grantee: Salmon Drift Creek Watershed Council		**OWEB**: $8,465	**Total**: $43,865
Summary: At Pixieland, an old amusement park, Phase I reestablished tidal marsh and Phase II restored channel meanders for the Fraser Creek mainstem and two tributaries. Monitoring was intended to focus on the effectiveness of the physical restoration including the number of acres of tidal and freshwater wetland were created and whether vegetation is transition to native species.			

Aerial Images:

Restoration Metrics: None available	
Monitoring Focus: N/A	**Study Design**: Water quality, vegetation and hydrology were monitored. No details were provided. A paired report was mentioned.
Parameters: N/A	**Species Monitored**: N/A
Project Findings: N/A	
Lessons Learned: Conductivity at the output of Fraser Creek was higher than in the Salmon River.	
Data Gaps:	
Project Reports: Final Completion Summary, 12/2013	
Associated Publications & Reports: Ellingson, K.S. and B.J. Ellis-Sugai. 2014. Restoring the Salmon River Estuary: Journey and Lessons Learned Along the Way 2006-2014. Report to Siuslaw National Forest, Corvallis: OR.	

Estuary: Siuslaw	**Name**: Waite Ranch Tidal Wetlands Restoration: Infrastructure Demolition		
Type: Restoration	**Action**: Removal	**Grant** #: 212-8004-9544	**OWRI** #: 20130356
Grantee: Ecotrust		**OWEB**: $33,960	**Total**: $110,635
Summary: The Siuslaw Basin historically was one of the most productive for anadromous fish in the Pacific Northwest. The long-term goal of the Waite Ranch Tidal Wetlands Restoration Project is to improve habitat and restore tidal exchange between the Siuslaw River and approximately 211 acres of estuarine wetlands previously altered for agricultural uses. Waite Ranch is being managed and restored to maximize ecological benefits. Agricultural ditches will be filled, meandering tidal channels excavated, the tide gate removed, and levees breached in order to reestablish natural inundation and kick-start processes that create high-quality estuarine wetland habitat for numerous fish and wildlife species. This first phase of the project was comprised of the safe and efficient removal of farm infrastructure covering ~1.5 acres, prior to ditch filling and channel excavation. It was completed in 2013.			

Aerial Images:

Restoration Metrics: 1.5 estuarine acres improved by debris removal	
Monitoring Focus: N/A	**Study Design**: N/A
Parameters: wetland area, groundwater recharge, groundwater containment, water quality	**Species Monitored**: N/A
Project Findings: N/A	
Lessons Learned: Major cost savings were realized by hiring a local demolition company with knowledge of the site and a commitment to working efficiently. Additionally, enrollment in the local	

fire department's 'Burn to Learn' program was a cost-effective way to dispose of buildings with the added benefit of providing training opportunities for local volunteer fire fighters. If possible give preference to competent local contractors. Their intimate knowledge of the project area can result in benefits such as cost savings and positive grass roots public relations.
Data Gaps:
Project Reports: Final Completion Summary, 2014? Post-Implementation Status Report, 2015.
Associated Publications & Reports: Brophy, L.S., L.A. Brown, and M.J. Ewald. Waite Ranch Baseline Effectiveness Monitoring: 2014. Prepared for Siuslaw Watershed Council, Mapleton, OR. Corvallis, Oregon: Estuary Technical Group, Institute for Applied Ecology. http://www.mckenzieriver.org/protected-lands/owned-properties/waite-ranch/ NOTE: McKenzie River Trust web page with site info and project description and goals, project partner list. http://www.siuslaw.org/waite-ranch-tidal-wetland-restoration-project/ NOTE: Siuslaw Watershed Council web page for the project. https://ecotrust.org/project/restoring-the-lower-siuslaw-estuary/ NOTE: Ecotrust web page, with site and project description, details of funding history and partners. Says work was scheduled to be finished in 2016. Ecotrust: Waite Ranch Tidal Wetland Restoration Project DATA SHARING PLAN http://www.habitat.noaa.gov/pdf/NA13NMF4630130WaiteDataSharingPlan.pdf

Estuary: Tillamook	**Name**: Kilchis Estuary Preserve Restoration; Kilchis Wetlands Conservation and Restoration Project		
Type: Restoration	**Action**: Removal	**Grant #**: 214-1034-10974	**OWRI #**: N/A
Grantee: The Nature Conservancy		**OWEB**:	**Total**: $1,325,246

Summary: [NOAA] This project will restore freshwater and tidal connections on a Nature Conservancy (TNC) acquistion located on the banks of the lower Kilchis River in the Tillamook Bay watershed. This project will remove fill from Stasek Slough, remove the Kilchis River dike, remove tidegates, elevate subsided lands, and construct tidal channels to restore the connection between Kilchis River and Stasek Slough and to restore tidal exchange to Stasek Slough. Restoration planting and control of invasive plant species will occur in tidal spruce swamp, riparian forest, and scrub-shrub tidal marsh. The removal of culverts within the dike and the removal of debris are incidental to the stream and tidal channel work. The project incorporates projected climate change impacts by designing the restoration with sea level rise and precipitation changes in mind.

The primary project purpose is to restore tidal wetlands on 66 acres in the salt-freshwater transition zone that will provide off channel habitat for salmon and steelhead. A primary limiting factor for salmonids in the Kilchis system is availability of off-channel habitat in low-lying areas, especially habitat in the salt-freshwater transition zone of the estuary. The restored habitats will benefit all salmonid species present in the Kilchis system and will represent a large percentage increase in transition zone habitats in natural condition. Spruce swamps and riparian habitats will benefit salmonids by shading streams and channels, supporting food webs for prey for fish, and serving as a source of large wood for the system. Tidal wetland habitat will provide additional cover for salmonids along tidal channels.

[TNC] After removing dikes and re-creating tidal channels, water has returned to Kilchis Estuary Preserve near Tillamook Bay. And with the water, came newfound beaver activity and spawning chum salmon— exciting to see at a marsh that had been disconnected from the tides for nearly 100 years. With channel work complete, staff is now focused on stabilizing and restoring the preserve by planting native trees and shrubs, such as Sitka spruce, Hooker's willow, twinberry and spiraea. During the next two years, the TNC hopes to plant a total of 200,000 native plants, including 120,000 willows and 8,000 Sitka spruce trees.

Aerial Images: See next pages

Restoration Metrics: N/A	
Monitoring Focus:	**Study Design**: N/A
Parameters: Instream Habitat: Stream Miles Treated; Estuarine Habitat: Acres Created, Acres Treated; Riparian Habitat: Stream Miles Treated, Acres Treated	**Species Monitored**: N/A
Project Findings: N/A	

Lessons Learned: TNC: "Working with neighboring landowners has been a critical element to success during this project, and the Conservancy is thankful for these positive relationships."

Tillamook Bay Watershed Council (link below): "The Kilchis Preserve has sparked controversy among the agricultural community and neighboring landowners, both for the loss of farm land it represents,

and for changes made to the area's hydrology. Then, December of 2015 brought the second highest flood on record to the area, leading to fears that the project was responsible."

Data Gaps:

Project Reports:

Associated Publications & Reports:
https://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/oregon/our-priorities/restoring-the-kilchis-estuary.xml?redirect=https-301

NOTE: TNC page, says TGs have been removed, project summary.

https://www.webapps.nwfsc.noaa.gov/apex/f?p=309:19:0::::P19_PROJECTID:39097982

NOTE: NOAA web page with project and funding details. Indicates tide gates were removed.

National Coastal Wetlands Conservation Grant Program: Staff Briefing (OWEB)
http://www.oregon.gov/OWEB/docs/board/2016/April/2016-April-Item-L-Coastal-Wetlands-ppt.pdf

NOTE: Powerpoint presentation; lists this project as receiving NCWCG Program grant of $1,000,000.

http://www.fishhabitat.org/waters-to-watch/detail/kilchis-estuary-oregon

NOTE: Fish Habitat Partnership web page for project. Lists project partners.

https://tillamookbay.org/2016/06/21/tncs-kilchis-preserve-reconnecting-salmon-with-estuarine-habitat/

NOTE: Tillamook Bay Watershed Council page; describes controversy about this project. Also shows a good project map.

http://www.donbestphotography.com/Portfolio/Tideland-Restoration-Aerials/i-HQNQkPB

NOTE: Aerial photos of restoration site.

Kilchis Estuary Preserve -Before (7/30/2014).

Kilchis Estuary Preserve - After (8/23/2016).