Improving Stream Habitat and Protecting Roads

Skagit River CED Nearing Completion, May 2014. – Dolotimber Engineered Logjam.

WSDOT CED Program Fiscal Year 2014 Report

Environmental Services Office

October, 2014

Washington State Department of Transportation
Environmental and Engineering Service Center
Environmental Services Office

Improving Stream Habitat and Protecting Roads
WSDOT CED Program Fiscal Year 2014 Report

CED Coordinator: Tim Hilliard
Box 47331
Olympia WA 98504-7331
360-705-7488
hilliat@wsdot.wa.gov

http://www.wsdot.wa.gov/Environment/Biology/FP/CEDretrofits.htm

Improving Stream Habitat and Protecting Roads - WSDOT CED Program Fiscal Year 2014 Report

Table of Contents

Figures iii
Tables iii
Abbreviations and Acronyms iii
Introduction 1
Annual Reports 1
The CED Program 1
Initial Identification of CED Sites 2
Site and Reach Analysis 2
Pre-scoping/Scoping 3
Prioritization 4
Funding 4
Design 5
Construction 5
CED Projects 6
FY 2014 Activities 12
New Sites 12
Reach Assessments 12
Concurrence 13
Construction 13
Highlighted Projects 16
SR 20, MP 100.7, Skagit River. 16
SR 101, MP 175.8, Hoh River Site 2. 20
SR 12, MP 118, Cowlitz River site. 21
SR 101, 54.4, Willapa River - South Bend site. 22
SR 542, MP 33, Glacier Creek Side Channel. 23
References 24

Figures

Figure 1. Collecting hydrology data at Glacier Creek Side Channel CED, SR 542. 3

Figure 2. Statewide distribution of CED projects and WSDOT Regions. 7

Figure 3. Skagit River CED nearing completion. 14

Figure 4. A: Twanoh Falls Creek before CED project. B: Twanoh Falls Creek after CED project. 15

Figure 5. Skagit plans – finished structure followed these specification nearly identically. 17

Figure 6. Single dolo with attached logs, ready for deployment (with human for scale). 18

Figure 7. Close up view of part of ELJ 1. 19

Figure 8. Hoh 2 site on the eve of construction, June 2014 – isolation structure will follow river bar in middle of picture. 20

Figure 9. Cowlitz River Site, US 12, March 2014. By June, another 10 feet had eroded. 21

Figure 10. Erosion threatens SR 101 at South Bend, 2013. 22

Figure 11. The new side channel flanking the highway. A portion goes through an undersized culvert and follows the other side of the road as well. 23

Tables

Table 1. Number of CED projects and status by WSDOT region. 6

Table 2. List of projects. 8

Abbreviations and Acronyms

CED – Chronic Environmental Deficiency

ER – Eastern Region

FY – Fiscal Year

NCR – North Central Region

NWR – Northwest Region

OR – Olympic Region

SCR – South Central Region

SRA – Site and Reach Assessment

SW – Southwest Region

WDFW – Washington State Department of Fish and Wildlife

WSDOT – Washington State Department of Transportation

Improving Stream Habitat and Protecting Roads
WSDOT CED Program Fiscal Year 2014 Report

Introduction

Annual Reports

This report summarizes the Washington State Department of Transportation's (WSDOT) Chronic Environmental Deficiencies (CED) program and program accomplishments for Fiscal Year (FY) 2014 (July 2013 to June 2014). We discuss active CED projects; other CED sites that are planned, analyzed, and funded for future construction; and nominated sites. For older projects, you may find more information in the reports from other years, available online at the link below, or by request. Also, of course, the staff are always happy to discuss the program with you (see contact information inside cover).

http://www.wsdot.wa.gov/Environment/Biology/FP/CEDretrofits.htm

The CED Program

When roads are located along rivers they are often subject to periodic damage from seasonal high flows and severe storms. The traditional maintenance or emergency response is to protect the roadway with rock armoring to stabilize eroding banks and fend off the water's force. This work may only address a symptom and so require frequent repetition. Threats to the roadway and risk of road closures may continue.

The design of the historical road system often ignored ecological and fluvial processes. While new projects do account for these processes, sometimes older projects require redesign to avoid chronic maintenance repairs that impact aquatic systems.

The traditional approach may also result in significant loss of aquatic habitat in the ongoing cycle of damage and repair. Severe weather, high flows and flooding exhibit increasing frequency and intensity in Washington State and elsewhere.

WSDOT, with the Washington Department of Fish and Wildlife (WDFW), established the CED program in 2001 to reduce the effect of repetitive maintenance activities on the aquatic environment and to find long-term solutions that optimize improvements for fish and fish habitat while addressing transportation needs.

The goal of the CED program is to:

- Reduce maintenance costs.
- Reduce societal impacts of road closures.
- Reduce or remove material that is or could be damaging to aquatic habitat.
- Protect infrastructure with rough woody structures and other bioengineered designs to enhance fish habitat.

A CED site is a location adjacent to the state highway system where recent, frequent, and chronic maintenance of the state transportation system is causing impacts to fish and fish habitat.

The CED program has set the following criteria for projects to be entered into the program. Adjustments may be made as projects get funded and constructed:

- Adverse habitat conditions related to fish or fish habitat are associated with repetitive repairs to WSDOT infrastructure.

- The infrastructure at the site has a history of maintenance actions, usually including at least three repairs and/or maintenance activities within the last 10 years.
- The project does not fit into another WSDOT funding category.

Often, to protect the road from damage due to river processes, bank stabilization is needed. The traditional response is to use rip rap armoring to stabilize the bank. However, this may result in damage to or loss of habitat. WSDOT is focusing on habitat-enhancing bank stabilization methods. Many different techniques may be applied on a site-specific basis. One of these techniques is engineered logjams (ELJs). ELJs have been constructed as both bank stabilization and as mid-channel flow diffusion structures (Hoh, Nooksack and Clallam Rivers). Mid-channel flow diffusion structures take the pressure of the flows off of the bank that is being damaged. Other projects in the CED program have replaced bridges to allow channel migration (Nolan Creek), or placed buried woody groins (Snoqualmie), which can be constructed out of the water and work to protect the bank from the rivers advance toward the highway.

The first Hoh River project, completed in FY 2006, is WSDOT's largest completed CED to date, and includes the world's largest known ELJs. WSDOT staff is currently monitoring the use of habitat in the Hoh River project and comparing that with another failing site, a rip rapped bank just upstream. The comparison site, known as Hoh 2, is also a CED site and is now in design and funded as a CED project using log cribwall structures. Construction is being completed as this report goes to press.

Initial Identification of CED Sites

WSDOT and WDFW work together following a process specified in a Memorandum of Agreement established between WDFW and WSDOT (Washington State Department of Fish and Wildlife and Washington State Department of Transportation, 2008). Potential CEDs can be nominated by WSDOT, WDFW, Tribes or other concerned parties. Nominations come to the CED coordinator who works with WSDOT regional staff to identify possible CED projects. Nominations are screened to determine if the site meets the program's criteria with an initial site visit. The following people are involved in the initial site assessment and determine the eligibility:

- CED coordinator.
- CED technical lead.
- Region Maintenance Environmental Coordinator.
- Maintenance staff.
- Other persons familiar with the site.

Site and Reach Analysis

Reach analysis (Figure 1) is at the core of the CED project development process. A stream reach assessment or analysis is conducted for each CED project site. These assessments can vary in scope and form. A corridor analysis addresses a larger scope and often analyzes multiple sites along the highway river interface. The SRA report gives a "best available science" approach to a solution. With input from WDFW, WSDOT identifies multiple alternatives and selects a recommended alternative.

The SRA addresses key habitat and road features and describes contributing factors related to landscape, land use, and infrastructure that led to the identified chronic deficiencies, and presents an evaluation of corrective treatment alternatives. The general approach used is similar to the Level 1 geomorphic assessment described in Hydraulic Engineering Circular (HEC) 20 3rd edition (Lagasse et al, 2012) as well as to the methods specified in in chapters 2-5 of the Integrated Streambank Protection Guidelines (WDFW 2002).

Figure 1. Collecting hydrology data at Glacier Creek Side Channel CED, SR 542.

SRAs are primarily a tool for identifying the factors causing the problem and to develop conceptual solutions. It is neither a "cook-book" approach to solving CED problems, nor a substitute for design. It is anticipated that this approach will result in a project proposal that meets or exceeds applicable standards and other requirements for protecting public safety, preserving transportation infrastructure, and will gain regulatory approval from resource agencies.

As SRAs are completed, they go through an internal WSDOT hydrology technical review, and are then reviewed by WSDOT region and engineers and area habitat biologists from WDFW. At the completion of WDFW review, which takes approximately a month, a meeting is held to verify the intent of the recommended alternative and work out any technical concerns.

Many of the reach assessments may be viewed online or downloaded at:

http://www.wsdot.wa.gov/Environment/Biology/FP/CEDretrofits.htm

Pre-scoping/Scoping

At the conclusion of the SRA, a pre-scoping meeting is held. Typically, the attendees are an engineer and an area habitat biologist from WDFW; from WSDOT an engineer, a hydrologist, a maintenance staff person; and other interested parties. Here, the recommend-

ed alternative is discussed and WSDOT scoping engineers become familiar with the project. The pre-scoping meeting usually involves a presentation by the project's lead hydrologist, who describes the SRA and explains the recommended alternative. The CED coordinator facilitates the meeting and makes sure that experts on permitting, constructability, and feasibility are included as needed. Following the presentation attendees conduct a field review of the site to address constructability questions, environmental permitting, habitat features, and other feasibility questions. When the parties agree, a concurrence form is signed, and their conclusions are relayed to the scoping engineer to derive a cost estimate.

Prioritization

In 2005, a prioritization methodology was created to provide a scientifically-based priority to the order of CED correction (Sekulich, 2005). This prioritization allows WSDOT to submit a list of statewide prioritized projects to the Legislature. This process establishes a scientifically based priority index score (PI), allowing comparison with other proposed projects. The score is based on many factors related to amount of habitat protected, species present, transportation needs, and estimated cost ranges.

Multiple sites located along a highway corridor may be prioritized together using aggregated PI scores. This allows WSDOT to show cumulative benefits to addressing multiple projects in one area. This aggregate priority is established during the design phase, with major considerations being constructability and feasibility.

The prioritized and scoped projects are used as the basis to build a funding package and establish a request for project funds. WSDOT requests funding from the State Legislature on a project-specific, biennial basis. Funds from WSDOT's Highway Construction Improvement (I-4) Program are used to construct CED projects on state highways. Twenty-two projects have been completed with funding coming from the State Legislature within the CED program and in some cases from other sources including The Federal Highway Administration.

Funding

CED projects are funded through several different sources. These can include dedicated stand-alone projects using project funds from WSDOT's Highway Construction Improvement Program (I-4), existing road project funds, emergency funds, and partnerships with Tribes, non-profits, counties, etc. If the CED project is not part of a larger project, the CED program staff orchestrates scoping the recommended alternative. Once scoped, a request for funding is put forward to the legislature under Improvement - Environmental Retrofit to address the deficiency as a standalone project.

By the end of FY 2013, 24 projects were completed, and five are funded for design and/or construction. A total of 138 sites have been nominated for CED analysis over the life of the program.

As mentioned above, some CED projects are funded under emergency situations. In these cases, collaboration with WDFW and the work that has been completed toward a site and reach analysis sets the stage to receive Federal funding. An SRA benefits WSDOT by outlining the problems, risks, and potential solutions at that site and in the project reach.

This document can be used to support the justification for an emergency action and to protect habitat in the occurrence of an emergency or imminent threat.

WSDOT has many other stand-alone funding sources, some of which have requirements that are similar to those in the CED program. Funding for the Unstable Slopes Program is based on geotechnical issues such as slope stability. Funding for the Fish Passage Program is based in part on the ability for fish to navigate through WSDOT infrastructure. These programs are examples of other areas where projects may be funded if they do not meet CED criteria.

Design

When the chosen alternative identified in the SRA is funded, the project is assigned to a project office. The CED coordinator arranges a meeting to discuss the CED goals and objectives and make sure the project office has the support it needs. Often, the lead hydrologist for the SRA will be a member of the design team. WDFW is involved throughout the process with design review. Once the conceptual design is agreed on by resource agencies, appropriate permits are obtained.

Construction

During construction the CED program staff verifies that the CED goals and design criteria are being met and provides technical assistance as needed.

CED Projects

The CED program is a statewide program. Sites are identified by regional personnel and others. The CED coordinator and technical staff inventory the sites and enter them into the CED process. Once a project is funded, the project specifics go back to the region where it is fully designed and constructed.

Table 1 summarizes CED projects and by their status and by WSDOT region, while Table 2 shows individual nominated CED projects and their status at the end of FY 2013. Status refers to current status at the end of the fiscal year. Figure 2 shows distribution of CED sites across the state.

Table 1. Number of CED projects and status by WSDOT region.

Status	ER	NCR	NWR	OR	SCR	SWR	Total
Nominated, not analyzed	1	4	14	11	8	11	49
Monitor *				1	2		3
Analyzed but not funded		3	14	13	6	6	42
Scoped			1	3		3	8
Concurred		1	1		1	2	4
Funded, not constructed			2		2	1	5
Constructed	1	2	14	5	3	2	27
Total	2	10	46	33	22	25	138

* Monitor means no further CED-related action is likely unless problems intensify.

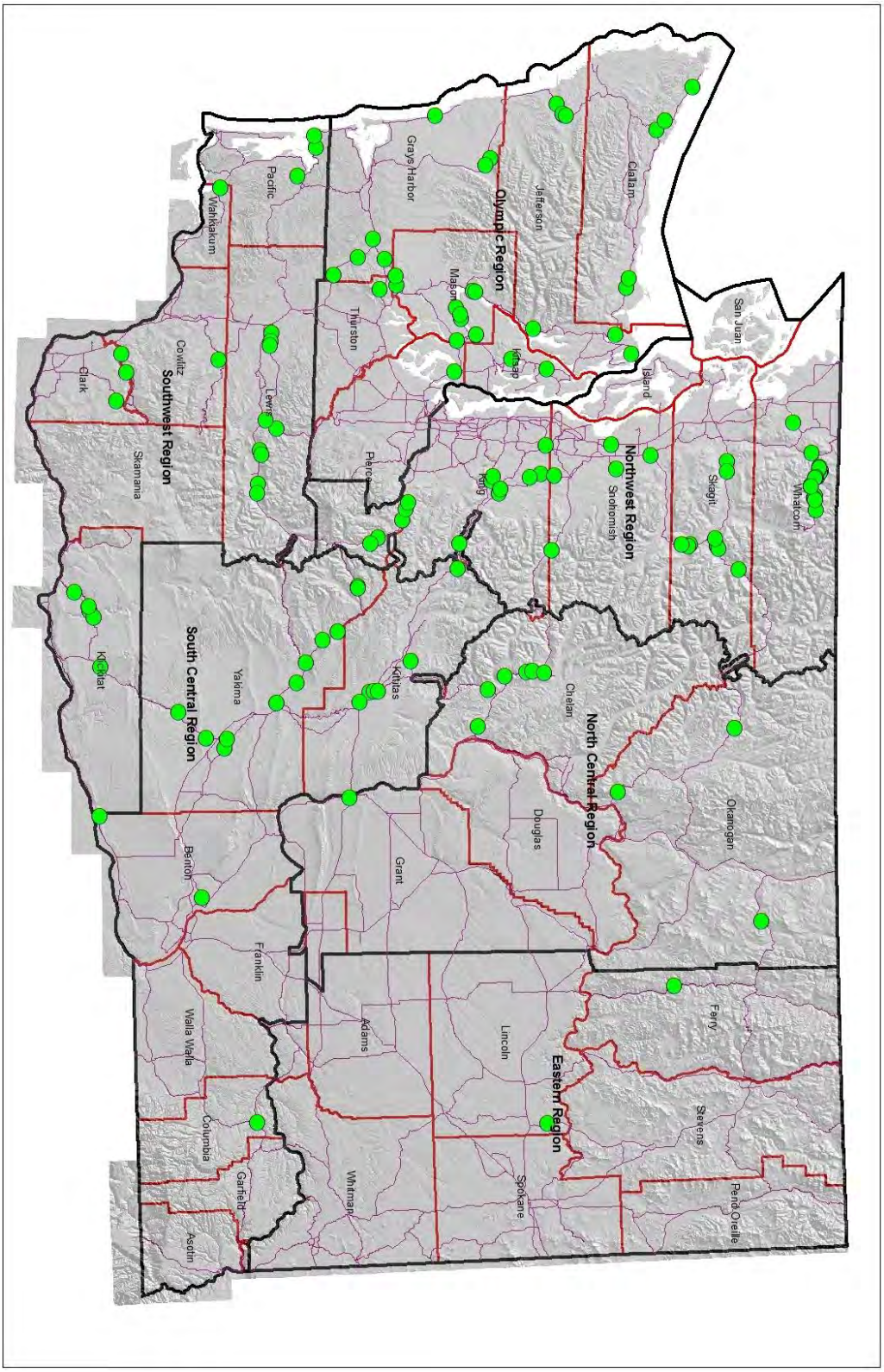

Figure 2. Statewide distribution of CED projects and WSDOT Regions.

Table 2. List of projects.

Project	Status	Re-gion	State Route	SRMP
American R. (Hells Crossing 1)	Concurred	SCR	410	83.50
American R. (Hells Crossing 2)	Analyzed	SCR	410	84.00
Anderson Creek	Funded	NWR	542	6.50
Bacon Creek	Funded	NWR	020	110.77
Bonaparte Creek	Constructed	NCR	020	278.00
Campbell Creek	Nominated	SWR	004	10.46
Carl Creek	Analyzed	SWR	097	17.20
Chehalis R.	Nominated	OR	012	27.71
Chelatchie Creek Tributary	Nominated	SWR	503	24.65
Chico Creek	Analyzed	OR	003	40.95
Childs Creek	Analyzed	NWR	020	72.80
Chiwaukum Creek	Scoped	NCR	002	89.96
Clallam R.	Constructed	OR	112	19.60
Clay Creek	Analyzed	NWR	410	35.76
Coe Clemmons Creek	Concurred	NWR	203	14.55
Contractors Creek	Analyzed	OR	101	278.00
Cowlitz R.	Funded	SWR	012	118.32
Davis Creek	Analyzed	SWR	012	121.00
Dogfish Creek	Nominated	OR	307	0.05
Dosewallips R.	Analyzed	OR	101	306.60
Dry Creek	Analyzed	OR	101	130.70
Dry Creek	Nominated	SCR	097	58.00
Dry Creek Ellensburg	Funded	SCR	097	137.90
EF Issaquah Creek 21.3	Analyzed	NWR	090	21.30
EF Issaquah Creek 22.5	Nominated	NWR	090	22.50
EF Stiltner Creek	Analyzed	SWR	012	109.30
Gold Creek	Nominated	SCR	090	55.50
Hoh R. (site #1)	Constructed	OR	101	174.40
Hoh R. (site #2)	Funded	OR	101	175.80
Houghton Creek	Nominated	SWR	503	47.80
Kennedy Creek	Analyzed	OR	008	15.30
Kenyon Creek	Nominated	SWR	503	49.03
Klickitat (Lower Bank Site)	Nominated	SWR	142	7.00
Little Bear Creek Bridge	Analyzed	NWR	202	0.14
Little Boulder	Analyzed	NCR	020	181.38
Little Klickitat Confluence	Nominated	SWR	142	19.00
Lower Dry Creek	Nominated	SCR	010	104.26
Marble Creek	Nominated	SWR	503	42.93

Matriotti Creek	Nominated	OR	101	260.93
McCormick Creek	Nominated	OR	016	15.00
McDonald Creek	Nominated	OR	108	8.90
Methow R.	Nominated	NCR	153	4.59
MF Wildcat Creek	Analyzed	OR	008	5.01
Milbourn Creek	Nominated	OR	101	127.97
Miller Creek	Analyzed	OR	101	329.93
Moclips R.	Analyzed	OR	109	31.50
Moon Creek	Nominated	OR	012	37.20
Mud Creek	Analyzed	NWR	202	23.50
Naches R. (410/12 Y)	Nominated	SCR	012	185.31
Naches R. (site #1)	Constructed	SCR	012	201.30
Naches R. (site #2)	Analyzed	SCR	012	192.00
Nason Creek	Nominated	NCR	207	0.50
Newaukum R. (site #1)	Constructed	SWR	508	7.00
Newaukum R. (site #2)	Analyzed	SWR	508	5.80
Newaukum R. (site #3) (Guerrier)	Analyzed	SWR	508	3.15
NF Nooksack R (Site No. 8a; Glacier Cr Side Channel)	Analyzed	NWR	542	33.60
NF Nooksack R. (Site No. 10; Warnick Bridge)	Analyzed	NWR	542	30.87
NF Nooksack R. (Site No. 12; Cornell Creek Road)	Nominated	NWR	542	30.50
NF Nooksack R. (Site No. 15; Fossil Creek Bridge)	Nominated	NWR	542	38.50
NF Nooksack R. (Site No. 17)	Nominated	NWR	542	41.90
NF Nooksack R. (Site No. 3)	Nominated	NWR	542	27.06
NF Nooksack R. (Site No. 4; Berry Stand)	Nominated	NWR	542	27.17
NF Nooksack R. (Site No. 6; Boulder Creek Bridge)	Constructed	NWR	542	28.34
NF Nooksack R. (Site No. 7; Gallup Bridge)	Constructed	NWR	542	33.41
NF Nooksack R. (Site No. 8) Glacier Creek Bridge	Scoped	NWR	542	33.50
NF Nooksack R. (Site No. 9; Canyon Creek Levee)	Nominated	NWR	542	30.89
NF Nooksack R., Bluff	Constructed	NWR	542	30.00
NF Nooksack R., Bruces Creek	Constructed	NWR	542	28.00
NF Nooksack R., Church Mt. Rd	Constructed	NWR	542	38.00
NF Nooksack R., Devine Property	Nominated	NWR	542	27.00
NF Nooksack R., powerline	Constructed	NWR	542	37.20
NF Nooksack R., revetment	Constructed	NWR	542	20.50

NF Nooksack R., upper powerline	Nominated	NWR	542	37.68
NF Nooksack R., washout	Constructed	NWR	542	26.70
No Name Creek (Tilton Trib.)	Nominated	SWR	508	24.30
Nolan Creek	Constructed	OR	101	170.50
Norris Slough	Constructed	SWR	105	16.55
Old Hancock Bridge (AKA Twin Creeks)	Analyzed	NWR	410	38.00
Old Joe Slough	Scoped	OR	101	174.61
Pataha Creek	Nominated	SCR	012	383.31
Peoples Creek	Nominated	NWR	203	19.52
Peshastin Creek	Nominated	NCR	097	181.90
Pysht R.	Nominated	OR	112	24.60
Rainey Creek	Analyzed	SWR	012	108.11
Rattlesnake Creek	Constructed	SCR	410	107.50
Red Cabin Creek	Constructed	NWR	020	75.80
Rock Creek	Analyzed	SCR	410	102.30
Sand Hill Road	Scoped	OR	300	2.00
Sand Hollow Wasteway	Constructed	NCR	026	1.30
Satus Creek	Funded	SCR	097	45.80
Sauk R. (confluence)	Constructed	NWR	530	56.00
Sauk R. (cribwall)	Constructed	NWR	530	58.45
Sauk R. (realignment)	Constructed	NWR	530	59.20
Skagit R.	Constructed	NWR	020	100.70
Skagit R. Bridge	Nominated	NWR	530	67.34
Skinney Creek	Analyzed	NCR	002	88.00
Skookum Canyon Creek	Scoped	SWR	142	14.80
Skykomish R. Gorman Property	Analyzed	NWR	002	39.70
Slide Creek	Nominated	OR	108	6.00
Snoqualmie R. (Tinkham)	Monitor	SCR	090	45.00
Snoqualmie R. Sinnema-Quaale Site	Nominated	NWR	203	11.05
Snoqualmie R., Preston-Falls City	Constructed	NWR	202	21.80
Snow Creek	Analyzed	OR	020	0.07
South Nanamkin Creek	Constructed	ER	021	133.60
Spring Creek	Nominated	ER	231	37.00
SR 106 Washouts 1 to 5	Scoped	OR	106	10.00
SR 529 Union and Steamboat Sloughs	Analyzed	NWR	529	5.35
SR 530 Stillaguamish	Nominated	NWR	530	21.81
SR92/Pilchuck R. CED	Analyzed	NWR	92	5.00
Strait of Juan de Fuca	Monitor	OR	112	5.00
Sund Creek	Analyzed	OR	101	329.08

Sutter Creek	Nominated	NWR	020	99.90
Teanaway R.	Analyzed	SCR	970	5.50
Tilton R. (site #1) @ Morton	Nominated	SWR	508	32.25
Tilton R. (site #2)	Nominated	SWR	007	4.75
Toutle R.	Concurred	SWR	504	16.00
Twanoh Creek	Analyzed	OR	106	12.30
Twanoh Falls Creek	Constructed	OR	106	13.50
Union R. Bridge	Analyzed	OR	300	2.00
Upper Dry Creek	Nominated	SCR	097	143.50
US 101 McDonald Creek	Analyzed	OR	101	258.21
Vance Creek	Nominated	OR	012	19.00
Victor Flood Issue	Nominated	OR	302	4.18
Wahkiakus Bridge	Scoped	SWR	142	16.33
Washaway Beach	Scoped	SWR	105	20.10
Weeping Hillside	Nominated	SCR	014	154.00
Wenatchee R. (Tumwater Canyon)	Analyzed	NCR	002	97.00
Wenatchee R. near Cashmere	Nominated	NCR	002	116.30
White R. (Federation Forest)	Analyzed	NWR	410	41.40
White R. (High Bank)	Analyzed	NWR	410	54.90
White R. (Skookum Falls View-point)	Analyzed	NWR	410	51.60
Willapa R.	Concurred	SWR	101	54.50
Wilson Creek	Monitor	SCR	090	109.14
Wooster Creek	Nominated	SWR	504	17.00
Yakima R. (site #4) @ Zillah	Nominated	SCR	082	53.00
Yakima R. (Thorp to Irene Rine-hart)	Analyzed	SCR	090	105.00
Yakima R. (Toppenish Bridge)	Analyzed	SCR	022	1.10
Yakima R. (Van Giesen Road)	Constructed	SCR	224	7.90

FY 2014 Activities

New Sites

Several new locations have been added to the list of CED-nominated sites this year. These include:

- SR 97, MP 143.50, Upper Dry Creek, South Central Region. At a Dry Creek crossing on SR97, an undersized double culvert conveys flow. During high flows the road has been overtopped.
- SR 101, MP 127.97, Milbourn Creek, Olympic Region. Where US101 crosses Milbourn Creek repeated actions have been taken to protect the bridge. The stream channel has incised both upstream and downstream of the bridge.
- SR 503, MP 47.80, Houghton Creek, South West Region. The creek is impinging on the base of the highway embankment due to apparent toe erosion and resulting mass-wasting.
- SR 504, MP 17.00, Wooster Creek, South West Region. The culvert that conveys Wooster Creek under SR 504 (Mt. St. Helens Highway) is damaged and probably severed, as most of the flow on the downstream end comes from the fill underneath and supporting the culvert.
- SR 508, MP 24.30, Tilton River Tributary (AKA No Name Creek), South West Region. The creek is an alluvial fan drainage that delivers a high load of coarse sediment and debris. This material accumulates under the bridge and can completely block the bridge opening during major storms.

Reach Assessments

Hydrology Program staff completed seven new or updated site and reach assessments (SRAs) during FY 2014. In some cases, the SRA was brand-new, and in other cases, it was extensively rewritten to reflect changes in the stream conditions or revised ideas about the preferred solution to the problem. Here are some highlights of the SRAs for FY 2014, each identified by State Route (SR), Milepost (MP), waterbody name, and the in-house name we use for the project:

- SR2, MP 39, Skykomish River, Gorman Property: Snohomish County and WSDOT are cooperating in an effort to buy flood-prone property and protect SR2. The SRA recommends that no construction be initiated in the immediate future but two sites that are subject to erosion and flood impacts be closely monitored using aerial photography and site visits to determine future actions.
- SR90, MP 105, Yakima River, Thorpe to Thrall reach: This major rewrite of the SRA that was originally called “Thorpe to Irene” extended the reach that was analyzed by several miles. The report recommends a partnership with the Kittitas County Flood Control Zone District for breaching levees and establishing floodplain restoration zones between Thorp and Thrall, as well as investigating additional opportunities to partner with land owners and managers to facilitate reach-scale flood risk mitigation and habitat improvements.
- SR101, MP 54, Willapa River - South Bend: This SRA was rewritten twice. The first time was due to the number of years that had passed between the original

draft and rekindled interest in the project due to continuing onsite degradation. This was followed by a formal concurrence process during which WDFW brought up new habitat concerns. The second revision of the SRA addressed those concerns and recommended a new alternative which did not encroach on the pickleweed beds at the foot of the bluffs. For more information, see the section on this project in "Highlighted Projects," below.

- SR410, MP 102, Rock Creek: The original SRA was seven years old and when this site became a pressing issue WSDOT determined that it also needed a new analysis. The report recommended a two-part design to address the issues at the site, involving a reconstructed crossing and porous weir structures to avoid ongoing maintenance issues.
- SR410, MP 84, Hells Crossing 2 (AKA Fife's Bluff): This new SRA recommends that woody material removed from the bridge be placed just downstream of the bridge for habitat improvement, and that WSDOT pursue a permanent solution of a riprap revetment with a roughened log toe.
- SR542, MP 33, Glacier Creek Side Channel: This new SRA is phase 2 of the Glacier-Gallop project. It recommends that the Gallop Creek Bridge be connected to a new bridge spanning both Glacier Creek and the emergent side channel that is flanking the highway. For more information, see the section on this project in "Highlighted Projects," below.

Concurrence

The project located at SR101 MP 54 (Willapa River - South Bend) went through two concurrence processes this fiscal year. During the first, habitat issues that had not been previously addressed led to a lack of concurrence. The SRA was rewritten (see "Reach Assessments," above) to address these habitat concerns and recommend a different alternative. This time, WDFW quickly concurred.

Construction

Two projects were constructed during the fiscal year and one was gearing up for construction as the FY ended. The completed projects were:

- SR20, MP 101.7, Skagit River CED: This long-awaited project built five concrete dolo-ballasted log structures with a log revetment connecting the four structures located on the shore of the river. The fifth structure is located on a mid-channel island. Construction began in April, 2014 and was completed ahead of schedule and under budget in May of 2014 (Figure 3). For more information, see the section on this project in "Highlighted Projects," below.
- SR 106, MP 13.53, Twanoh Falls Creek: This project on Lower Hood Canal was completed in late summer and early fall, 2013. A new bridge replaced an undersized culvert that had been repeatedly overwhelmed with sediment. Heavy traffic, close residential and commercial development, and high visibility complicated construction. See Figure 4.
- The "Hoh 2" project (SR101 MP 175.8) was gearing up for July 2014 construction. This project, in the works for many years, will use an innovative system of gravel-filled sacks to isolate the worksite without need for sheet-piles or other

more invasive means of diverting flow. For more information, see the section on this project in "Highlighted Projects," below.

Figure 3. Skagit River CED nearing completion.

Figure 4. A: Twanoh Falls Creek before CED project. B: Twanoh Falls Creek after CED project.

Highlighted Projects

SR 20, MP 100.7, Skagit River.

The Skagit River (SR 20 MP 100.7) project was finally constructed this year (see report front cover and Figure 3). Installation went very smoothly and it was completed much faster than expected. This project has attracted extensive media interest and has proved to be an eye-catching roadside attraction. This site has been an issue for many years. Repeatedly, NWR's Maintenance Office has had to use large rocks to protect the highway on an emergency basis. Design of an innovative project using wood structures anchored by concrete doloes (see figures 5, 6 and 7) utilized an innovative modular approach that proved to greatly streamline construction. Doloes are commonly used in marine applications such as jetties and breakwaters but are becoming more common in high-energy riverine systems around the world.

WSDOT constructed five Engineered Log Jams (ELJs) and four log-based revetments, which include concrete dolos for ballast, in the Upper Skagit River along SR 20. These bank protection structures mitigate repetitive damage to SR 20 caused by Skagit River streambank erosion, while simultaneously enhancing salmonid habitat. Approximately 1,300 feet of continuous ELJs and revetments were constructed along the SR 20 embankment and on a mid-channel bar, and approximately 100 feet of continuous revetments were installed along the shoreline of an adjacent forested parcel. The ELJs and revetments consist of an innovative design using dolotimbers and additional large woody material (LWM). The project was completed ahead of schedule, under budget, and is functioning as designed. Crews from newspapers and major TV stations came to report on the progress of this project.

Dolotimbers are an innovative technology that has never been used in such a large application in a riverine setting. Concrete dolos (sometimes spelled dolosse) that resemble large jacks, have been used in marine environments to stabilize bulkheads and washout areas for many years. The design team coined the term "dolotimber" to describe a modified concrete dolo (cast in a form that makes the outside surface resemble tree bark) combined with large wood and placed in a fresh water environment. The use of dolotimbers was an innovative way to use existing and modified technology to solve a long term environmental degradation problem adjacent to SR 20 while enhancing threatened and endangered salmon habitat. Early in the planning process WSDOT and our partners determined that Engineered Log Jams (ELJs) were the most appropriate measure to protect the road at this location and provide habitat complexity for salmon habitat.

The Upper Skagit River is large, has extremely variable flow rates, and because of the buoyancy of the Large Woody Material (LWM) used in ELJs, they would need to be firmly anchored to keep them from washing away during the next flood event. Geotechnical investigations showed that the substrate was composed of boulders and the most common anchoring methods – steel "H" beams or log anchors– could not easily be driven into it. The use of dolotimbers avoids pile driving construction techniques known to impact salmon, allows incorporation of LWM, and provides an interlocking structure that creates interstitial spaces for microorganisms and juvenile salmon to thrive.

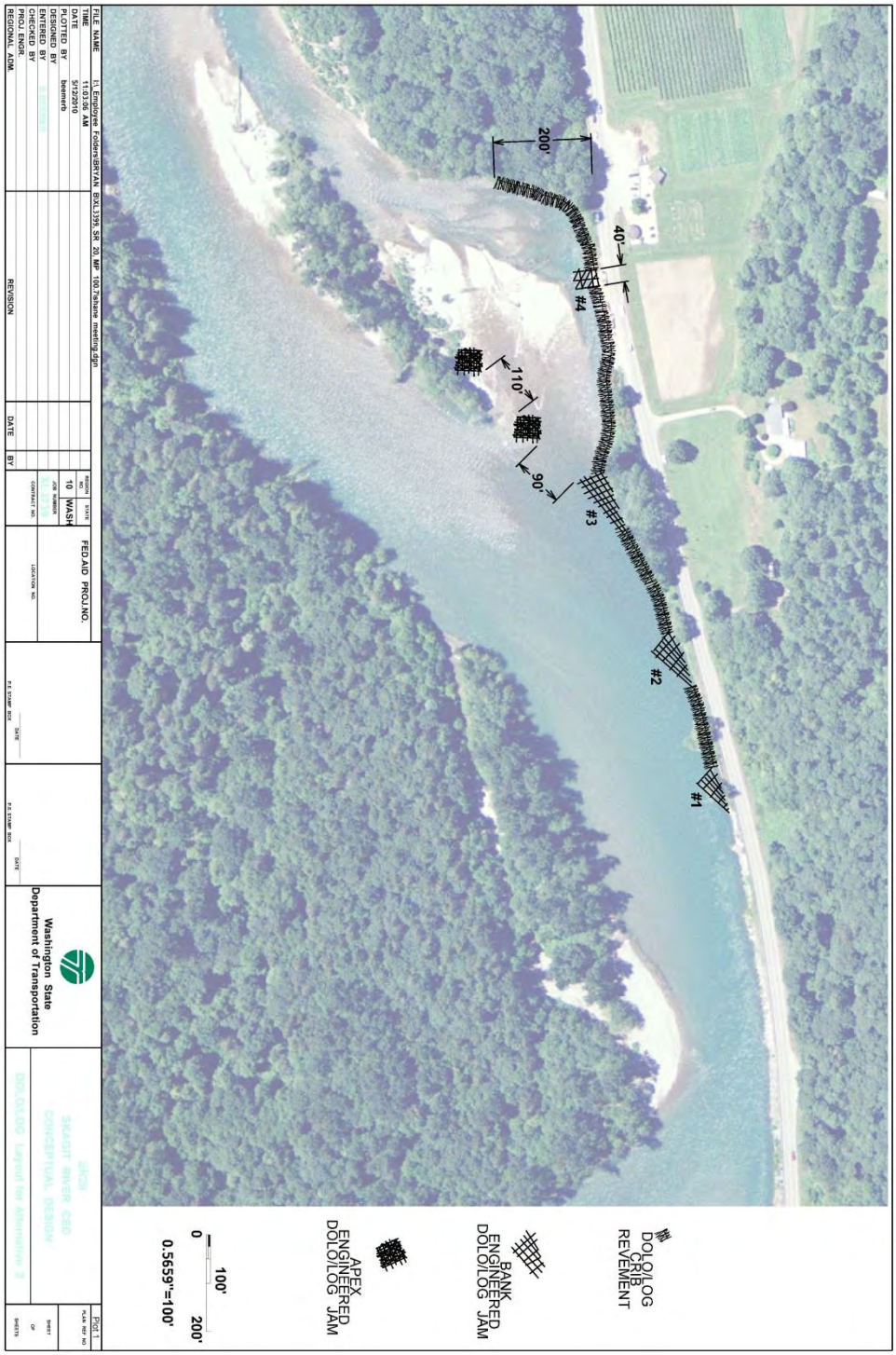

Figure 5. Skagit plans – finished structure followed these specification nearly identically.

All of these benefits enabled the project to avoid and minimize impacts to salmon during construction and enhance salmon habitat over the long term with this permanent restoration solution. Dolotimbers used for the project contained approximately 18,700 logs and 7,200 cubic yards of LWM (slash piles) designed to resemble natural logjams. Compared to traditional ELJ and log jam structures, the dolotimber structure creates more nine times more wood surface area and five times more interstitial spaces, thus providing more habitat complexity.

The concrete dolos, weighing eight tons each, interlock with one another for more stability when subjected to strong hydrodynamic forces (see Figure 6). They are attached to almost thirty different designs of bundles of logs and other types of LWM, to anchor them in place. Construction was modular with dolotimber components assembled upland. Workers then placed the completed modules into the river following a carefully sequenced plan with no pile driving and minimal substrate disturbance. This method allowed construction to proceed with fewer impacts than a typical ELJ project. For example, there were no pile driving, no in-water excavation, minimal riverbank excavation, no earth anchoring or rock ballast, minimal in-water equipment access/construction, less fish handling, and less turbidity.

Special form liners were used to cast each dolo. These form liners made the surface of the dolos appear to look and feel like tree bark. This innovation was not done simply for its looks, but to provide roughness and expedited growth of benthic invertebrates on the surface of the dolos for small fish to feed on.

Figure 6. Single dolo with attached logs, ready for deployment (with human for scale).

Figure 7. Close up view of part of ELJ 1.

SR 101, MP 175.8, Hoh River Site 2.

Final preparations for the construction of the **Hoh River Site 2 are underway as of the end of the fiscal year, with construction slated for summer of 2014.** This site, a major erosion site along a high-energy reach of the Hoh River, is only a mile from the Hoh 1 site, one of the largest CED projects ever. The plan calls for a log cribwall between the road and the river (see Figure 8). A system of gravel-filled sacks will be used isolate the worksite without need for sheet-piles or other more invasive means of diverting flow. Any increase in turbidity will be treated onsite with a mobile water treatment plant.

Figure 8. Hoh 2 site on the eve of construction, June 2014 – isolation structure will follow river bar in middle of picture.

SR 12, MP 118, Cowlitz River site.

The Cowlitz River site continues to erode rapidly toward the highway (see Figure 9). The top of the eroded bank was only about three feet from the right-of-way fence by the end of June. Funding has been identified for construction in the 2015-2017 biennium. There is concern that the highway will be impacted earlier than that and the site is being monitored closely. Difficult negotiations with the adjacent landowner have slowed the planning process. WSDOT has developed interim planning for emergency measures that may be taken during the winter of 2014-2015.

Figure 9. Cowlitz River Site, US 12, March 2014. By June, another 10 feet had eroded.

SR 101, 54.4, Willapa River - South Bend site.

Bank failures along an 850-foot section of US 101 near milepost 54.4 at the Willapa River in South Bend are threatening the integrity of the roadbed (see Figure 10). The site is located on a tidal reach of the Willapa River, and is surrounded by urban development and hardened banks. The failure is caused primarily by localized erosional forces and bank conditions. Failure of the bank is causing tilting of the road shoulder and sidewalk that indicates geotechnical instability in the terrace that underlies US 101, requiring bank treatments that support the slope as well as offer erosion protection. WSDOT identified a treatment to address these issues using a rock riprap revetment with habitat logs which would provide flow resistance, wave energy dissipation, and cover habitat. Large wood would be embedded in the toe of the revetment to provide habitat.

A concurrence meeting with WDFW led to a different solution - a steep or vertical structural seawall would be constructed along the face of the existing bank for the length of the site. This would allow WSDOT to avoid impacts on estuarine marsh habitat at the foot of the bluff. After updating the SRA and changing the preferred treatment, a second concurrence process led to a signed concurrence form.

Figure 10. Erosion threatens SR 101 at South Bend, 2013.

SR 542, MP 33, Glacier Creek Side Channel.

State Route 542 (SR542) crosses Glacier Creek, a braided stream with rapidly shifting channels. Gallop Creek, a similar creek with a high sediment load, intersects the highway only about 100 feet west of Glacier Creek. There was a SRA completed for the combined Glacier and Gallop crossing in 2008 that recommended a bridge be constructed spanning both creeks and the combined floodplain. However, only the portion crossing Glacier Creek was built. Since then, new problems occurred at Glacier Creek, related to a reactivated side channel east of the main channel (see Figure 11). A new SRA addressing just the Glacier Creek crossing was completed this year.

The SRA found that a portion of the embankment at the eastern end had been eroded and the main channel partially blocked by coarse sediment, sending much of the discharge into the "east" channel. Another flow split, caused by an LWD jam, has reactivated parts of an old channel on the easternmost side of the floodplain. The "new" side channel has cut through the floodplain and has partially removed rock groins previously installed by the U.S. Forest Service. There is a small culvert under SR542 that is often submerged by the flow in the side channel. The highway embankment has been partly eroded by backwater at this site. A knickpoint has developed on the downstream end of the side channel, north of SR542. This steep drop down to the main channel of Glacier Creek is about 8 feet in height. The report recommends that WSDOT modify the original (uncompleted) bridge to extend the bridge approximately 200 feet to include the side channel, and connect to the existing Gallop Creek bridge. The CED program places a high priority on this project due to the strong possibility of the road being washed out by the side channel. There is no detour route and Mt. Baker Ski Area and many residences would be isolated if the road is lost.

Figure 11. The new side channel flanking the highway. A portion goes through an undersized culvert and follows the other side of the road as well.

References

Lagasse, P.F., L.W. Zevenbergen, W.J. Spitz, and L.A. Arneson. 2012. Stream Stability at Highway Structures. Hydraulic Engineering Circular 20. Fourth Edition. U.S. Dept. Transportation and Federal Highway Administration. http://www.fhwa.dot.gov/engineering/hydraulics/pubs/hif12004.pdf

Sekulich. Paul. 2005. A Prioritization Methodology for Chronic Environmental Deficiencies.

Washington State Department of Fish and Wildlife. 2003. Integrated Streambank Protection Guidelines. Aquatic Habitat Guidelines Program. http://www.wdfw.wa.gov/hab/ahg/ispgdoc.htm.

Washington State departments of Transportation and Fish and Wildlife. 2008. Memorandum of Agreement established between WDFW and WSDOT.