

CHAPTER 6- PROJECT OPPORTUNITIES, PRIORITIZATION, AND CONCEPTUAL DESIGNS

Overview

Project opportunities and prioritization

A total of 55 project opportunities were identified on the lower East Fork Lewis River and tributaries. Projects were identified and scored according to the methods described in Chapters 4 and 5. In some cases, projects were amended based on input from the East Fork Working Group. Final ranking of projects occurred by first ranking projects according to their reach tier and then ranking projects according to their final benefit score. The cost-benefit score was not used to rank projects, but was included as a reference for determining which projects were carried forward to the conceptual design phase. Final project ranking was modified slightly by the Working Group. The final ranked project list can be found below in Table 14, followed by a table including the project cost estimates (Table 15). Project locator maps are included as well as descriptions of each of the 55 projects.

Conceptual Designs

A total of 13 projects were selected for development of conceptual designs. Selection of these projects was based on project scores, special considerations, and discussions/input of the Working Group. Table 14 indicates the projects that were carried forward to the conceptual design phase. In some cases, high ranking projects were not carried forward and lower ranking projects were carried forward. Considerations for making these determinations included whether or not landowners were amenable to developing conceptual designs and whether projects were already planned or underway for the site.

The conceptual designs are included as Attachment 1.

Prioritized project list

Table 14. Ranked project list.

Project ID#	Project Name	River Mile	Rch Tier	Final Benefit Score	Cost Benefit Score	Selection for Concept Design	Comment
EF-A 02	Daybreak Pits avulsion risk assessment	7.3 - 9.5	1	123	--	Yes (study concept)	High scoring project (moved to top of list per EFWG decision)
EF 28	Side-channel habitat enhancement	9 - 9.5	1	140	9	Yes	
EF 13	Side/off-channel restoration	11.7 - 12.3	1	139	7		Private land (permission not granted)
EF 41	Riparian restoration	5.7 - 7.3	1	127	29	Yes	
EF 26	Streambank / in-channel habitat enhancement	9.5	1	126	10		Design funding pending
MS 01	Lower Mason habitat enhancement	0 - 1	2*	126	12	Yes	
EF 10	Side-channel habitat enhancement	13 - 13.5	1	123	10	Yes	
EF 21	Side-channel habitat enhancement	10.5	1	119	18	Yes	
MN 02	Manley Creek habitat enhancement (downstream of 259th)	0.2 - 0.75	2*	117	19	Yes	
EF 42	Levee and drainage ditch removal	5.1	1	117	55	Yes	
EF 14	Side/off-channel restoration	11.6	1	116	12		Private land (permission not granted)
DE 02	Lower Dean Creek channel enhancement (upstream portion)	0.4 - 0.9	1	115	20		Private land (permission not granted)
EF 20	Side-channel and backwater habitat enhancement	10.7	1	114	13	Yes	
EF 12	Instream habitat enhancement	11 - 11.3	1	111	17	Yes	
EF 24	Side-channel / off-channel restoration	10	1	111	26		Design funding pending
EF 16	Side/off-channel restoration	11.3	1	110	12		
EF 07	Side-channel / in-channel enhancement	13.7	1	109	14		
EF-A 01	Ridgefield Pits alternatives assessment	7.3 - 8.3	1	108	--	Yes (study concept)	EFWG decision to move forward to Conceptual Design
EF 02	Side/off-channel restoration	14.5	1	107	9		
EF 25	Side-channel restoration	9.7	1	106	22		Design funding pending
EF 22	Chum channel	10.2	1	105	24		Private land (permission not granted)
DE 01	Lower Dean Creek channel enhancement (downstream portion)	0 - 0.4	1	104	21		Project underway at this site
EF 27	Off-channel restoration	9.5	1	104	43		Design funding pending
EF 18	Streambank / in-channel habitat enhancement	10.9	1	103	21		
EF 09	Side-channel restoration	13.3	1	102	27		
EF 34	Streambank restoration; channel structure	7.2	1	102	42		
EF 17 (A)	Riparian restoration	11 - 11.7	1	101	100		
EF 17 (B)	Riparian restoration	12.2 - 12.8	1	101	100		
EF 08	Riparian restoration / Streambank enhancement	13.6 - 13.9	1	101	43		
EF 11	Side/off-channel restoration	12.5	1	101	13		
EF-A 03	Temperature and groundwater assessment	5.7 - 15	1	101	--	Yes (study concept)	EFWG decision to move forward to Conceptual Design
EF 01	Side-channel restoration	14.6	1	101	30		
EF 15	Streambank (rip-rap) enhancement	11.5	1	100	31		
EF 35	Remove rip-rap / in-channel enhancement	6.8	1	99	12		
MN 03	Manley Creek passage restoration and habitat enhancement (upstream of 259th)	0.75 - 1.5	1	99	7		
EF 04	Streambank / in-channel enhancement	14.1	1	98	29		
EF 03	Side-channel restoration	14.4	1	96	50		
EF 05	Off-channel habitat enhancement	14	1	96	31	Yes	Unique temperature refuge opportunity
EF 06	Streambank enhancement	13.9	1	93	--		
EF 39	Off-channel enhancement	6.1	1	93	34		
EF 36	Remove rip-rap / in-channel enhancement	6.6	1	90	22		
EF 38	Off-channel enhancement	6.3	1	90	47		
EF 40	Streambank restoration; channel structure	6.1	1	85	52		
EF 37	Enhance rip-rap	6.5	1	83	68		
BR 01	Breeze Creek Dam		1	74	7		
DE-P 01	Dean Creek land acquisition	0.4-0.9	1	63	--		
MC 04	Residential pond reach 1G and 1H		1	61	10		
MC 03	Residential pond reach 1 D		1	53	49		
MI 01	Mill Creek 1 C habitat enhancement	1 - 1.3	1	46	9		
JE 01	Lower Jenny Cr channel enhancement and off-channel creation	0 - 0.13	1	46	9		
MC 01	Lower McCormick channel enhancement	0 - 0.6	2	127	13		
MC 02	Restore passage at La Center Road Crossing	1	2	67	5		
MS 02	Mason channel enhancement reach 3-4	3.2 - 3.6	2	46	8		
DY 02	Dyer reach 4 channel and passage enhancement	1.3 - 1.6	2	44	5		
EF 43	Levee removal/set-back	3.2 - 4.4	4	112	13		

*These projects are located in Tier 2 reaches but were ranked as Tier 1 due to the habitat benefits accrued to fish originating in adjacent downstream Tier 1 reaches

Project cost estimates

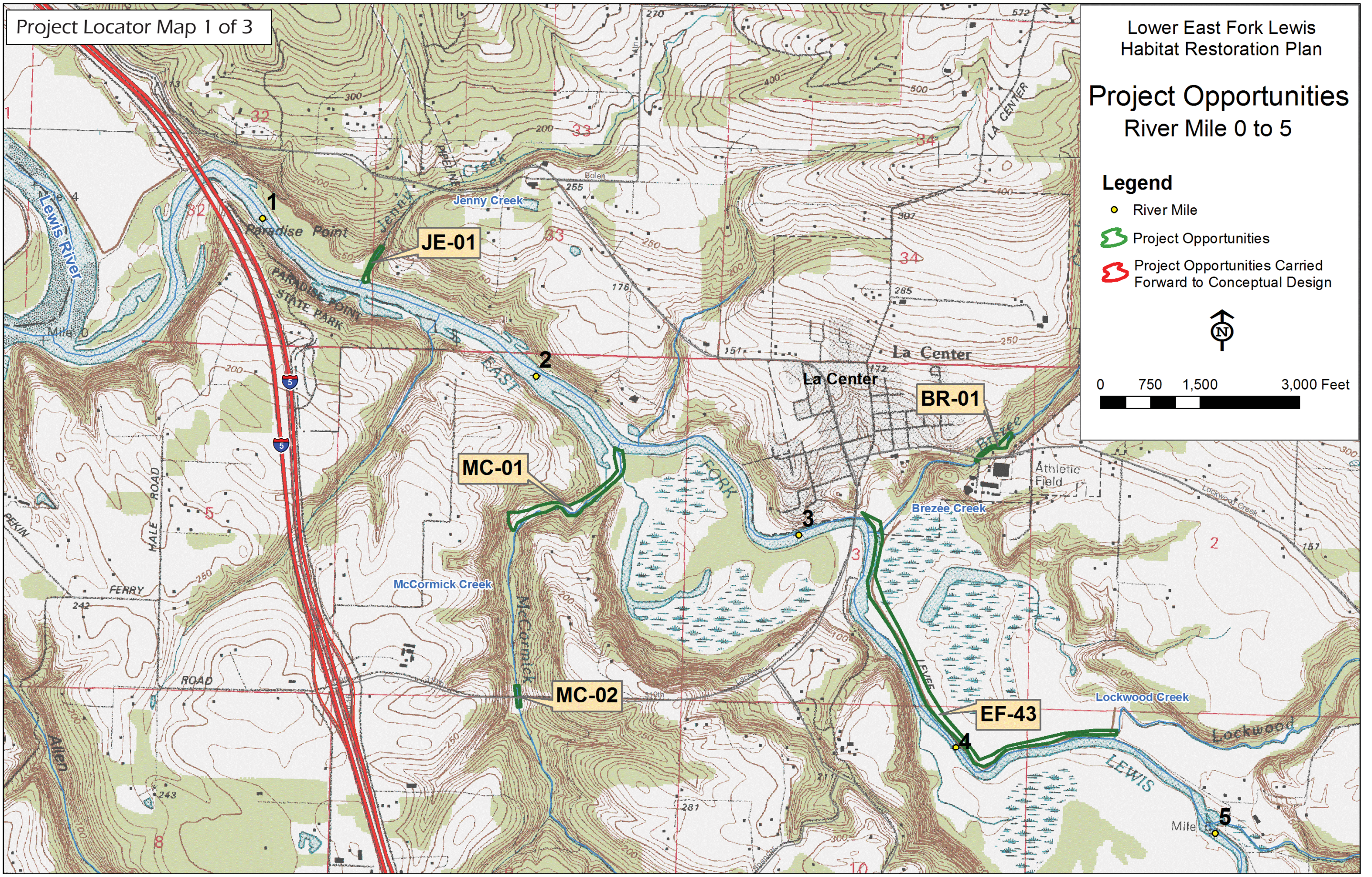
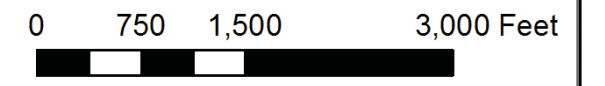
Table 15. Preliminary project cost estimates.

Project ID#	Project Name	Construction Cost Range Estimate	Cost Range Estimate (includes A& E and contingency)	Comment
EF-A 02	Daybreak Pits avulsion risk assessment			See conceptual design for cost detail
EF 28	Side-channel habitat enhancement			See conceptual design for cost detail
EF 13	Side/off-channel restoration	\$563,000 - \$845,000	\$760,000 - \$1,140,000	
EF 41	Riparian restoration			See conceptual design for cost detail
EF 26	Streambank / in-channel habitat enhancement	\$360,000 - \$540,000	\$486,000 - \$729,000	
MS 01	Lower Mason habitat enhancement			See conceptual design for cost detail
EF 10	Side-channel habitat enhancement			See conceptual design for cost detail
EF 21	Side-channel habitat enhancement			See conceptual design for cost detail
MN 02	Manley Creek habitat enhancement (downstream of 259th)			See conceptual design for cost detail
EF 42	Levee and drainage ditch removal			See conceptual design for cost detail
EF 14	Side/off-channel restoration	\$282,000 - \$422,000	\$380,000 - \$570,000	
DE 02	Lower Dean Creek channel enhancement (upstream portion)	\$173,000 - \$259,000	\$233,000 - \$350,000	
EF 20	Side-channel and backwater habitat enhancement			See conceptual design for cost detail
EF 12	Instream habitat enhancement			See conceptual design for cost detail
EF 24	Side-channel / off-channel restoration	\$127,000 - \$190,000	\$171,000 - \$257,000	
EF 16	Side/off-channel restoration	\$264,000 - \$396,000	\$356,000 - \$535,000	
EF 07	Side-channel / in-channel enhancement	\$224,000 - \$336,000	\$302,000 - \$454,000	
EF-A 01	Ridgefield Pits alternatives assessment			See conceptual design for cost detail
EF 02	Side/off-channel restoration	\$365,000 - \$547,000	\$492,000 - \$739,000	
EF 25	Side-channel restoration	\$141,000 - \$211,000	\$190,000 - \$285,000	
EF 22	Chum channel	\$128,000 - \$192,000	\$173,000 - \$259,000	
DE 01	Lower Dean Creek channel enhancement (downstream portion)	\$144,000 - \$216,000	\$194,000 - \$292,000	
EF 27	Off-channel restoration	\$72,000 - \$108,000	\$97,000 - \$146,000	
EF 18	Streambank / in-channel habitat enhancement	\$144,000 - \$216,000	\$194,000 - \$292,000	
EF 09	Side-channel restoration	\$113,000 - \$169,000	\$152,000 - \$228,000	
EF 34	Streambank restoration; channel structure	\$72,000 - \$108,000	\$97,000 - \$146,000	
EF 17 (A)	Riparian restoration	\$30,000 - \$45,000	\$41,000 - \$61,000	
EF 17 (B)	Riparian restoration	\$30,000 - \$45,000	\$41,000 - \$61,000	
EF 08	Riparian restoration / Streambank enhancement	\$70,000 - \$105,000	\$95,000 - \$142,000	
EF 11	Side/off-channel restoration	\$229,000 - \$343,000	\$309,000 - \$463,000	
EF-A 03	Temperature and groundwater assessment			See conceptual design for cost detail
EF 01	Side-channel restoration	\$99,000 - \$148,000	\$133,000 - \$200,000	
EF 15	Streambank (rip-rap) enhancement	\$96,000 - \$144,000	\$130,000 - \$194,000	
EF 35	Remove rip-rap / in-channel enhancement	\$240,000 - \$360,000	\$324,000 - \$486,000	
MN 03	Manley Creek passage restoration and habitat enhancement (upstream of 259th)	\$406,000 - \$609,000	\$548,000 - \$822,000	
EF 04	Streambank / in-channel enhancement	\$100,000 - \$150,000	\$135,000 - \$203,000	
EF 03	Side-channel restoration	\$56,000 - \$84,000	\$76,000 - \$114,000	
EF 05	Off-channel habitat enhancement			See conceptual design for cost detail
EF 06	Streambank enhancement	\$5,000 - \$7,000	\$6,000 - \$10,000	
EF 39	Off-channel enhancement	\$80,000 - \$120,000	\$108,000 - \$162,000	
EF 36	Remove rip-rap / in-channel enhancement	\$120,000 - \$180,000	\$162,000 - \$243,000	
EF 38	Off-channel enhancement	\$56,000 - \$84,000	\$76,000 - \$113,000	
EF 40	Streambank restoration; channel structure	\$48,000 - \$72,000	\$65,000 - \$97,000	
EF 37	Enhance rip-rap	\$36,000 - \$54,000	\$49,000 - \$73,000	
BR 01	Breeze Creek Dam	\$320,000 - \$480,000	\$432,000 - \$648,000	
DE-P 01	Dean Creek land acquisition	NA	NA	
MC 04	Residential pond reach 1G and 1H	\$176,000 - \$264,000	\$238,000 - \$356,000	
MC 03	Residential pond reach 1 D	\$32,000 - \$48,000	\$43,000 - \$65,000	
MI 01	Mill Creek 1 C habitat enhancement	\$144,000 - \$216,000	\$194,000 - \$292,000	
JE 01	Lower Jenny Cr channel enhancement and off-channel creation	\$150,000 - \$226,000	\$203,000 - \$305,000	
MC 01	Lower McCormick channel enhancement	\$288,000 - \$432,000	\$389,000 - \$583,000	
MC 02	Restore passage at La Center Road Crossing	\$400,000 - \$600,000	\$540,000 - \$810,000	
MS 02	Mason channel enhancement reach 3-4	\$168,000 - \$252,000	\$227,000 - \$340,000	
DY 02	Dyer reach 4 channel and passage enhancement	\$248,000 - \$372,000	\$335,000 - \$502,000	
EF 43	Levee removal/set-back	\$260,000 - \$390,000	\$351,000 - \$527,000	

Project Opportunities River Mile 0 to 5

Legend

- River Mile
- 🌿 Project Opportunities
- 🔴 Project Opportunities Carried Forward to Conceptual Design



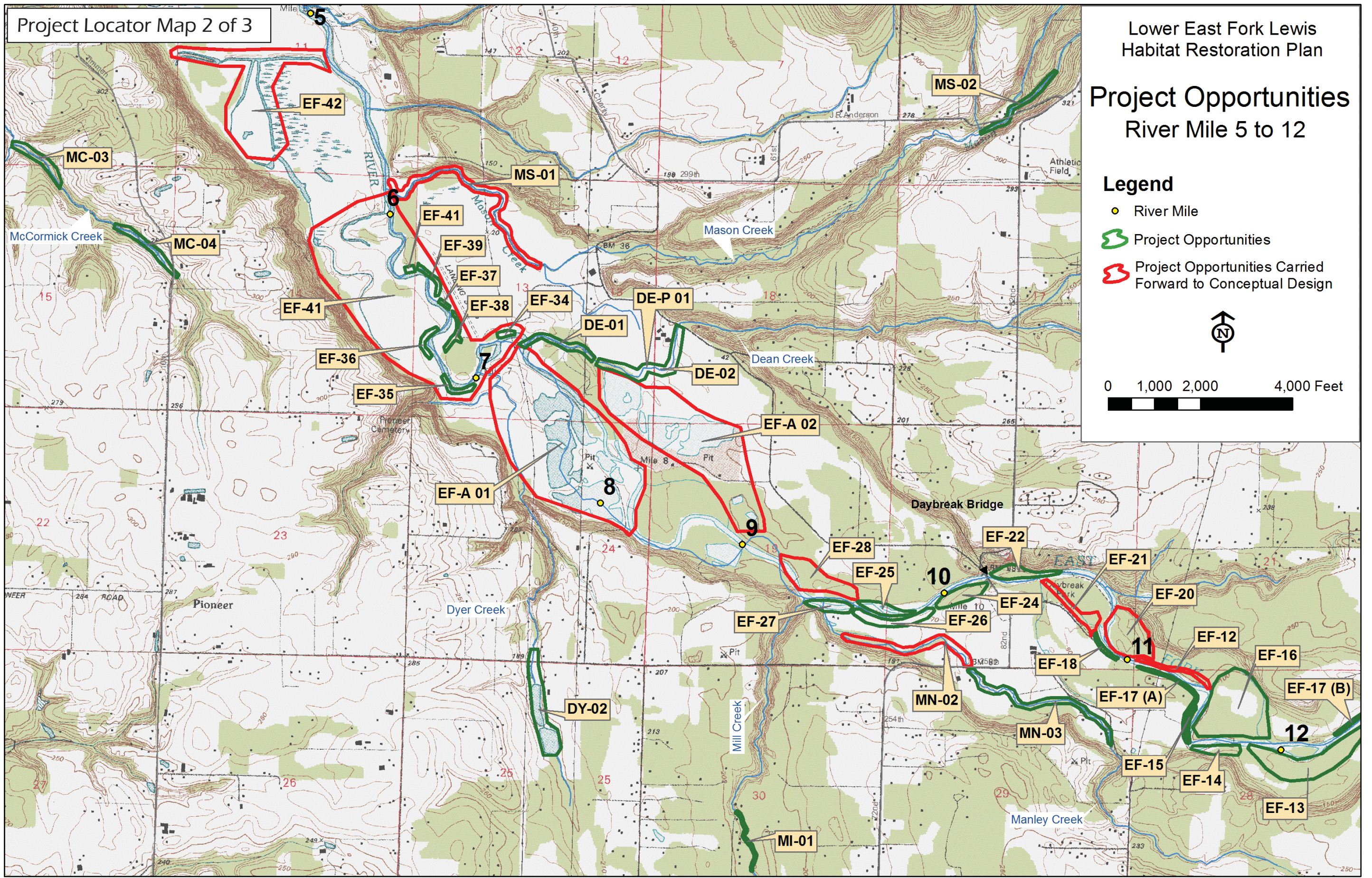
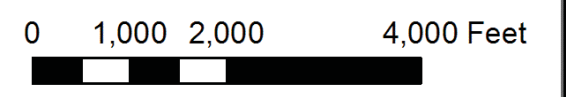
Project Locator Map 2 of 3

Lower East Fork Lewis
Habitat Restoration Plan

Project Opportunities
River Mile 5 to 12

Legend

- River Mile
- 🌿 Project Opportunities
- 🔴 Project Opportunities Carried Forward to Conceptual Design



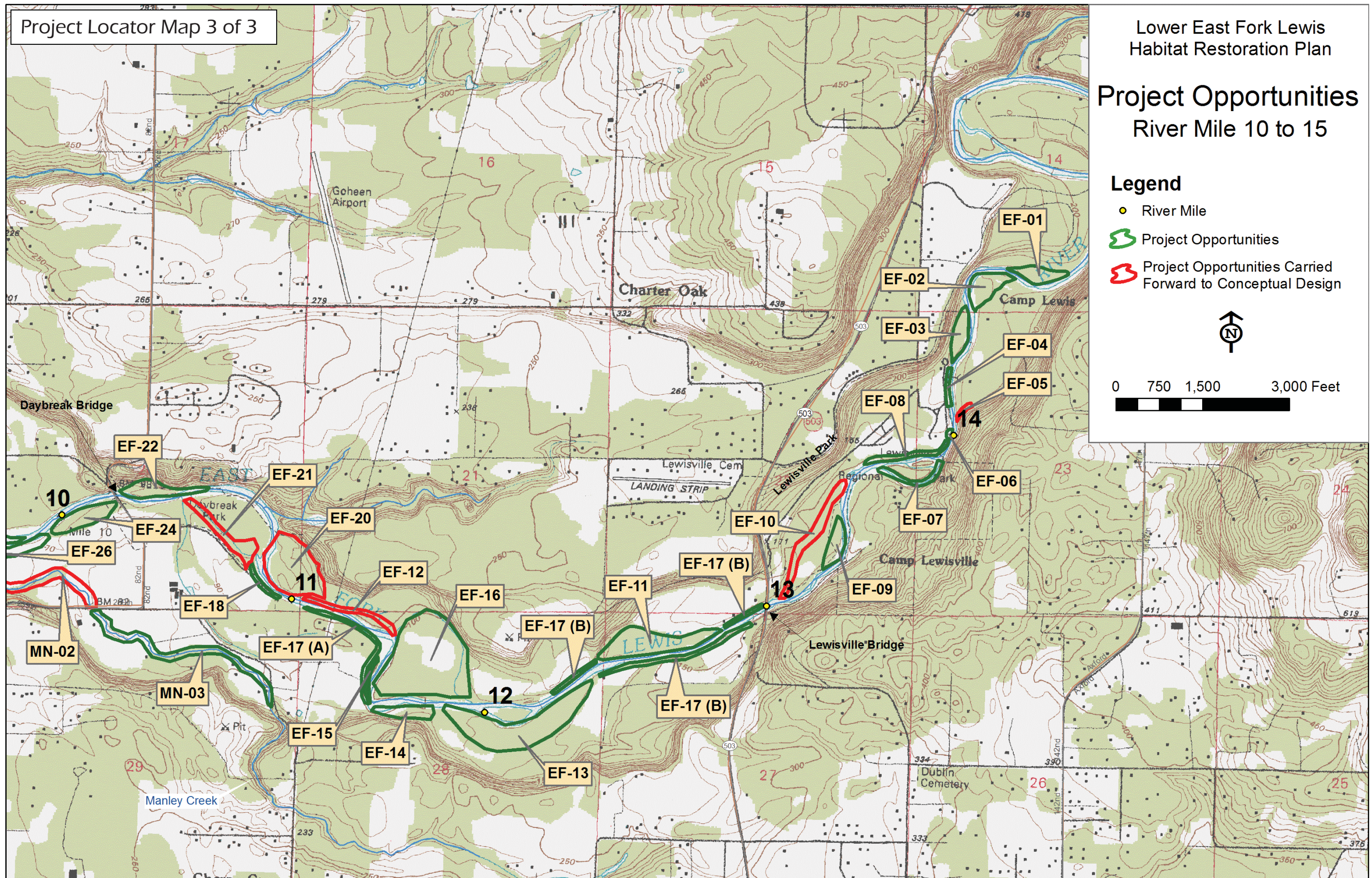
Project Opportunities River Mile 10 to 15

Legend

- River Mile
- 🌿 Project Opportunities
- 🔴 Project Opportunities Carried Forward to Conceptual Design



0 750 1,500 3,000 Feet



Project descriptions

Project Name: Side-channel restoration

Project ID#: EF 01

Reach Name: EF Lewis 8B

River Mile: 14.6

Location Description:

River right 0.4 miles upstream of upper Lewisville Park boat access

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

This is an old channel location and is within 100 feet of the existing channel. It is likely active at moderate winter flow levels but it is not active at low summer flows. This is an active channel adjustment, which needs to be considered during design.

Project Objective:

Enhance connectivity of side-channel to be active at low summer flows. Enhance the quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris. Need to evaluate in context of active lateral adjustment area. As part of this objective, it will be important to evaluate and address the effects of flow reduction that would occur in the mainstem.

Special Considerations:

Private land. No project will be conducted at this site without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project. There may be possible access from adjacent private lands, if landowner permission can be obtained.

Major Life Stages Addressed:

Coho - spawning, egg incubation, fry colonization, juvenile rearing
Fall Chinook - spawning, egg incubation, fry colonization, early rearing
Chum - spawning, egg incubation
Steelhead - spawning, egg incubation, juvenile rearing

Limiting Factors Addressed:

Habitat diversity, key habitat quantity, channel stability, temperature

Data Gaps / Needs:

Total length not surveyed. ID source for sand deposits in channel.



Project Name: Side/off-channel restoration

Project ID#: EF 02

Reach Name: EF Lewis 8B

River Mile: 14.5

Location Description:

River left bank upstream of Lewisville Park

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

Potentially available side-channel habitat is only accessible during flood flows. Temperatures taken



during the survey show that isolated pools in the channel are 2 deg F cooler than mainstem, suggesting good hyporheic flow. There are abundant invasive plant species.

Project Objective:

Increase the availability of year round active side-channel and off-channel habitat. Enhance the quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris. At least one low-flow season of groundwater monitoring is recommended to support final designs. Reforest riparian and floodplain areas with native and locally-adapted species. As part of this objective, it will be important to evaluate and address the effects of flow reduction that would occur in the mainstem.

Special Considerations:

Private land. No project will be conducted at this site without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project. There may be difficult access. There is possible access from Lewisville Park across the river. The access conditions via the south bank are unknown.

Major Life Stages Addressed:

Coho - spawning, egg incubation, fry colonization, juvenile rearing
Fall Chinook - spawning, egg incubation, fry colonization, early rearing
Chum - spawning, egg incubation
Steelhead - spawning, egg incubation, juvenile rearing

Limiting Factors Addressed:

Habitat diversity, key habitat quantity, channel stability

Data Gaps / Needs:

Seasonality of hyporheic flow

Project Name: Side-channel restoration

Project ID#: EF 03

Reach Name: EF Lewis 8B

River Mile: 14.4

Location Description:

River right just downstream of upper Lewisville Park boat access

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

This is a side-channel/flood overflow channel that is within 100 feet of the existing channel. It is just downstream of the upper boat ramp in Lewisville Park. It is not active at summer flow levels. The inlet is perched several feet above the low summer water level, possibly as a result of grading of the boat ramp/parking lot area.



Project Objective:

Ensure consistency with Clark County objectives for boat ramp area. Enhance connectivity of side-channel to be active at low summer flows. Enhance the quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris. Need to evaluate in context of boat ramp area. As part of this objective, it will be important to evaluate and address the effects of flow reduction that would occur in the mainstem.

Special Considerations:

This project is located on Clark County property (Lewisville Regional Park). Designs should be coordinated with Clark County Parks Department staff. County concerns include bank protection, flood control, maintenance, and interface with park facilities.

Major Life Stages Addressed:

Coho - spawning, egg incubation, fry colonization, juvenile rearing
Fall Chinook - spawning, egg incubation, fry colonization, early rearing
Chum - spawning, egg incubation
Steelhead - spawning, egg incubation, juvenile rearing

Limiting Factors Addressed:

Habitat diversity, key habitat quantity, channel stability

Data Gaps / Needs:

See Objectives above

Project Name: Streambank / in-channel enhancement

Project ID#: EF 04

Reach Name: EF Lewis 8B

River Mile: 14.1

Location Description:

River right along ball field at Lewisville Park

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

Steep eroding bank (15 ft tall) along park with failing bio-engineered bank treatments, bike path on top, and narrow or non-existent riparian buffer. Lack of instream cover.



Project Objective:

Enhance channel structure and habitat while also providing bank stability and protection of Lewisville Park property. Enhance the quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris. Reforest the streambank and riparian area with native and locally-adapted species.

Special Considerations:

This project is located on Clark County property (Lewisville Regional Park). Designs should be coordinated with Clark County Parks Department staff. County concerns include bank protection, flood control, maintenance, and interface with park facilities.

Major Life Stages Addressed:

Coho - egg incubation, fry colonization, juvenile rearing
Fall Chinook - egg incubation, fry colonization, early rearing
Steelhead - egg incubation, juvenile rearing

Limiting Factors Addressed:

Habitat diversity, channel stability, sediment load

Data Gaps / Needs:

Detailed site investigation, including topographic survey, geomorphic analysis, and development of potential alternatives

Reach Name: EF Lewis 8B

River Mile: 14

Location Description:

River left near Boy Scout camp. Across the river and just upstream from Lewisville Park swim beach.

Species Use:

Coho, steelhead

Site Description:

This site is located on Boy Scouts property. There is a small trib that enters the mainstem on the river left bank that contains cool water input during the summer. Temperatures in the tributary were 10 deg F cooler than the mainstem at the time of the survey. There is good adjacent spawning in the mainstem. Site observations and temperatures suggest suitable groundwater connectivity for an off-channel project.



Project Objective:

Create an off-channel area connected to the mainstem at low summer flows that is sourced by hyporheic flow and flow from the small perennial tributary. Enhance the quantity and quality of habitat features including bank complexity and cover and instream woody debris. At least one low-flow season of groundwater monitoring is recommended as part of design. Dissolved oxygen and mineral content should be monitored.

Special Considerations:

Private land (Boy Scouts of America). No project will be conducted at this site without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project.

Major Life Stages Addressed:

Coho - fry colonization, juvenile rearing
Fall Chinook - fry colonization
Steelhead - juvenile rearing

Limiting Factors Addressed:

Habitat diversity, key habitat quantity, temperature

Data Gaps / Needs:

Should measure dissolved oxygen

Reach Name: EF Lewis 8B

River Mile: 13.9

Location Description:

River right at Lewisville Park swim beach

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

This is the swim beach at Lewisville Park. Fine material has been imported for the beach. This fine



material enters the stream and has potential negative impact on adjacent spawning grounds.

Project Objective:

Work with Clark County to replace fine material with gravels. Investigate the potential for enhancing bank complexity, cover, and instream LWD along the opposite bank.

Special Considerations:

This project is located on Clark County property (Lewisville Regional Park). Designs should be coordinated with Clark County Parks Department staff. County concerns include bank protection, flood control, maintenance, and interface with park facilities.

Major Life Stages Addressed:

Coho - spawning, egg incubation
Fall Chinook - spawning, egg incubation
Steelhead - spawning, egg incubation

Limiting Factors Addressed:

Sediment load

Data Gaps / Needs:

None identified

Project Name: Side-channel / in-channel enhancement

Project ID#: EF 07

Reach Name: EF Lewis 8B

River Mile: 13.7

Location Description:

River left at RM 13.7 across from Lewisville Park

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

This is an existing side-channel located across from Lewisville Park. There was flow in the channel at the time of the survey. There is a severe lack of channel structure, complexity, and spawning-sized gravels. This is a good opportunity to increase habitat diversity and pool quantity/quality.



Project Objective:

Enhance channel structure and habitat. Enhance the quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris. Consider adding spawning gravels. Maintain perennial flow into side-channel. As part of this objective, it will be important to evaluate and address the effects of flow reduction that would occur in the mainstem.

Special Considerations:

This project is located on Clark County property (Camp Lewisville). Designs should be coordinated with Clark County Parks Department staff. County concerns include bank protection, flood control, maintenance, and interface with park facilities.

Major Life Stages Addressed:

Coho - fry colonization, juvenile rearing
Fall Chinook - fry colonization, early rearing
Steelhead - juvenile rearing

Limiting Factors Addressed:

Habitat diversity, key habitat quantity, channel stability

Data Gaps / Needs:
See Objectives above

Project Name: Riparian restoration / Streambank enhancement

Project ID#: EF 08

Reach Name: EF Lewis 8B

River Mile: 13.6 - 13.9

Location Description:
Lewisville Park

Species Use:
Coho, steelhead, Chinook, chum (potential)

Site Description:
This area is along the river right bank at Lewisville Park. There is a lack of bank complexity, cover, and instream LWD. The riparian area has been cleared of forest vegetation along much of this segment. There is rip-rap and other bank armoring at several locations.



Project Objective:
Re-establish native riparian/floodplain vegetation to provide for natural channel stability, shade, and LWD recruitment. Work with the County (Lewisville Park). Remove rip-rap where feasible and enhance bank complexity, cover, and instream LWD.

Special Considerations:
This project is located on Clark County property (Lewisville Regional Park). Designs should be coordinated with Clark County Parks Department staff. County concerns include bank protection, flood control, maintenance, and interface with park facilities.

Major Life Stages Addressed:
All freshwater life-stages for coho, steelhead, fall Chinook, and chum

Limiting Factors Addressed:
Channel stability, habitat diversity, sediment load, temperature

Data Gaps / Needs:
Detailed site investigation

Project Name: Side-channel restoration

Project ID#: EF 09

Reach Name: EF Lewis 8B

River Mile: 13.3

Location Description:
River right side channel

Species Use:
Coho, steelhead, Chinook, chum (potential)

Site Description:
Side-channel only flows as flood overflow channel. Numerous old channel scars in this area. Most appear perched high above mainstem.



Project Objective:
Enhance connectivity of side-channel to be active at

lower flows (i.e. summer). Enhance the quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris. At least one low-flow season of groundwater monitoring is recommended to support final designs. As part of this objective, it will be important to evaluate and address the effects of flow reduction that would occur in the mainstem.

Special Considerations:

This project is located on Clark County property (Lewisville Regional Park). Designs should be coordinated with Clark County Parks Department staff. County concerns include bank protection, flood control, maintenance, and interface with park facilities.

Major Life Stages Addressed:

Coho - spawning, egg incubation, fry colonization, juvenile rearing
Fall Chinook - fry colonization, early rearing
Chum - spawning, egg incubation (potential)
Steelhead - spawning, egg incubation, juvenile rearing

Limiting Factors Addressed:

Habitat diversity, key habitat quantity, channel stability

Data Gaps / Needs:

Topographic survey

Project Name: Side-channel restoration

Project ID#: EF 10

Reach Name: EF Lewis 8B

River Mile: 13 - 13.5

Location Description:

River right through Lewisville Park

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

Side-channel only flows as flood overflow channel. There were some isolated pools with water at the time of the survey (4 deg F cooler than mainstem). Total length = 2500 ft. Avg gradient = 0.8%. An excavated pond in the side-channel was the same temperature as the mainstem at the time of the survey.



Project Objective:

Enhance connectivity of side-channel to be active at lower flows (i.e. summer). Enhance the quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris. As part of this objective, it will be important to evaluate and address the effects of flow reduction that would occur in the mainstem.

Special Considerations:

This project is located on Clark County property (Lewisville Regional Park). Designs should be coordinated with Clark County Parks Department staff. County concerns include bank protection, flood control, maintenance, and interface with park facilities.

Major Life Stages Addressed:

Coho - spawning, egg incubation, fry colonization, juvenile rearing
Fall Chinook - fry colonization, early rearing
Chum - spawning, egg incubation (potential)
Steelhead - spawning, egg incubation, juvenile rearing

Limiting Factors Addressed:

Habitat diversity, temperature, key habitat quantity, channel stability

Data Gaps / Needs:

Detailed site investigation, including topographic survey, geomorphic analysis, and development of potential alternatives

Project Name: Side/off-channel restoration

Project ID#: EF 11

Reach Name: EF Lewis 8B

River Mile: 12.5

Location Description:

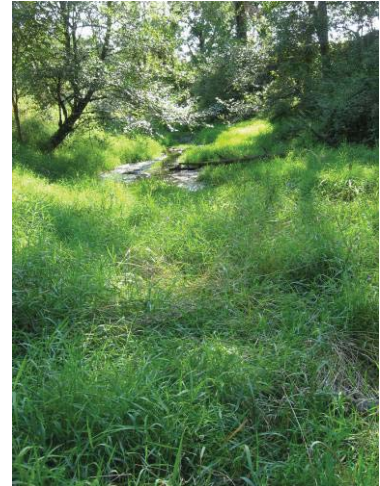
River right off-channel

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

This is an old channel scar (backwater area) that is not connected with the mainstem at low flows. Temperature in the backwater area was 5 deg F warmer than the mainstem at the time of the survey (stagnant water). There may not be adequate hyporheic flow to provide summer high temperature refuge habitat.



Project Objective:

Increase the availability of connected backwater habitat for coho overwintering. An alternative objective is to create a side-channel that is active at low summer flows, but gradient is low (<0.5%). Groundwater monitoring is recommended before advancing this project forward.

Special Considerations:

This project is located on Clark County property (Lewis River Ranch). The project should be consistent with the county’s master plan for the property and landowner sale agreements, and should consider the adjoining private property ownership. Public access and use is envisioned for this property, including development of a regional trail.

Major Life Stages Addressed:

Coho - fry colonization, juvenile rearing (winter)
Others potentially if re-connected as active side-channel

Limiting Factors Addressed:

Habitat diversity, key habitat quantity, channel stability

Data Gaps / Needs:

Topographic survey to investigate potential for side-channel

Project Name: In-channel habitat enhancement

Project ID#: EF 12

Reach Name: EF Lewis 8B

River Mile: 11 - 11.3

Location Description:

River left and right banks

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

Lack of channel habitat complexity (pools and bank cover) and in-stream wood structure to support juvenile rearing and adult holding.



Project Objective:

Increase the quality and complexity of mainstem pool habitat. Increase habitat complexity and cover along streambanks. Increase woody debris quantity.

Special Considerations:

This project is located on Clark County property (Lewis River Ranch). The project should be consistent with the county's master plan for the property and landowner sale agreements, and should consider the adjoining private property ownership. Public access and use is envisioned for this property, including development of a regional trail. Access for this project could potentially come from across the river, given landowner willingness.

Major Life Stages Addressed:

Fall Chinook - adult holding, fry colonization
Coho - adult holding, fry colonization, juvenile rearing
Steelhead - adult holding, fry colonization, juvenile rearing
Chum - adult holding, fry colonization

Limiting Factors Addressed:

Channel stability, habitat diversity, key habitat quantity, sediment load

Data Gaps / Needs:

Survey, hydraulic model

Project Name: Side/off-channel restoration

Project ID#: EF 13

Reach Name: EF Lewis 8B

River Mile: 11.7 - 12.3

Location Description:

River left off-channel complex

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

Large network of abandoned meander scars between RM 11.7 and 12.3. There are opportunities for creating connected side-channel and off-channel habitat in old channel scars. There is a small trib with temperatures 2 deg F cooler than the mainstem at time of survey that enters these channels. Site observations suggest suitable groundwater connectivity for off-channel project(s).



Project Objective:

Increase the availability of side-channel and backwater channel habitat that is connected to the mainstem during summer flow levels. Enhance the quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris. At least one low-flow season of groundwater monitoring is recommended to support final design. As part of this objective, it will be important to evaluate and address the effects of flow reduction that would occur in the mainstem.

Special Considerations:

Private land. No project will be conducted at this site without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project.

Major Life Stages Addressed:

Coho - spawning, egg incubation, fry colonization, juvenile rearing
Fall Chinook - fry colonization, early rearing
Chum - spawning, egg incubation (potential)
Steelhead - spawning, egg incubation, juvenile rearing

Limiting Factors Addressed:

Habitat diversity, temperature, key habitat quantity, channel stability

Data Gaps / Needs:

Subsurface flow conditions. Detailed topographic survey.

Project Name: Side/off-channel restoration

Project ID#: EF 14

Reach Name: EF Lewis 8B

River Mile: 11.6

Location Description:

River left back-channel

Species Use:

Coho, steelhead

Site Description:

Old channel scar. Did not investigate in detail due to private landownership. Aerial photo interpretation suggests the potential for creating connected off-channel habitat.



Project Objective:

Increase the availability of off-channel habitat that is connected to the mainstem during summer flow levels. Enhance the quantity and quality of habitat features including bank complexity and cover and instream woody debris. Needs further investigation. Groundwater monitoring is recommended before advancing this project forward.

Special Considerations:

Private land. No project will be conducted at this site without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project.

Major Life Stages Addressed:

Coho - fry colonization, juvenile rearing
Fall Chinook - fry colonization, early rearing
Steelhead - juvenile rearing

Limiting Factors Addressed:

Habitat diversity, temperature, key habitat quantity, channel stability

Data Gaps / Needs:

Was not able to survey because of private land. Needs further investigation for cold water sources, gradient, hyporheic flow, topography

Project Name: Streambank (rip-rap) enhancement

Project ID#: EF 15

Reach Name: EF Lewis 8B

River Mile: 11.5

Location Description:

Rip-rap bank at residence on river left RM 11.5

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

There is rip-rap protecting residences on the river left bank (approximately 900 feet long). There is a lack of cover and complexity in the form of pools and instream LWD.

Project Objective:

Enhance channel structure and habitat while addressing landowners concerns with bank protection. Enhance the quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris. To the extent possible, reforest the streambank and riparian area with native and locally-adapted species.

Special Considerations:

Private land. No project will be conducted at this site without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project.

Major Life Stages Addressed:

Fall Chinook - adult holding, fry colonization, early rearing
Coho - adult holding, fry colonization, juvenile rearing
Steelhead - adult holding, fry colonization, juvenile rearing
Chum - adult holding, fry colonization

Limiting Factors Addressed:

Habitat diversity

Data Gaps / Needs:

Detailed site investigation

Project Name: Side/off-channel restoration

Project ID#: EF 16

Reach Name: EF Lewis 8B

River Mile: 11.3

Location Description:

River right off-channel / side-channel

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

This is an old meander scar/backwater channel. There is the potential for side-channel or off-channel habitat. Gradient is ~0.5%. Site observations and temperatures suggest suitable groundwater



connectivity. Beavers may dam channel if constructed as connected side-channel.

Project Objective:

Increase the availability of off-channel habitat that is connected to the mainstem during summer flow levels. Enhance the quantity and quality of habitat features including bank complexity and cover and instream woody debris. At least one low-flow season of groundwater monitoring is recommended to support final designs. As part of this objective, it will be important to evaluate and address the effects of flow reduction that would occur in the mainstem. This project could be conducted as a phased project in conjunction with EF 20; potentially connecting these as a single long side-channel.

Special Considerations:

This project is located on Clark County property (Lewis River Ranch). The project should be consistent with the county's master plan for the property and landowner sale agreements, and should consider the adjoining private property ownership. Public access and use is envisioned for this property, including development of a regional trail.

Major Life Stages Addressed:

Coho - fry colonization, juvenile rearing
Fall Chinook - fry colonization, early rearing
Steelhead - juvenile rearing

Limiting Factors Addressed:

Habitat diversity, key habitat quantity, temperature

Data Gaps / Needs:

Need to survey total extent of potential side-channel / off-channel. Investigate subsurface flow conditions

Project Name: Riparian restoration

Project ID#: EF 17 (A)

Reach Name: EF Lewis 8B

River Mile: 11 - 11.7

Location Description:

Private residences in between RM 11 and 11.7

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

Degraded riparian function (LWD recruitment, bank protection, shade). Invasive species. Residential use impacts.

Project Objective:

Re-establish native riparian/floodplain vegetation to provide for natural channel stability, shade, and LWD recruitment. Work with County and other landowners to continue and expand existing efforts.

Special Considerations:

This area consists primarily of private property. No project will be conducted without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project.

Major Life Stages Addressed:

All freshwater life-stages for coho, steelhead, fall Chinook, and chum

Limiting Factors Addressed:

Channel stability, habitat diversity, sediment load, temperature, key habitat quantity

Data Gaps / Needs:

Level of potential landowner collaboration/willingness need to be explored

Project Name: Riparian restoration

Project ID#: EF 17 (B)

Reach Name: EF Lewis 8B

River Mile: 12.2 - 12.8

Location Description:

Private residences in between RM 12.2 and Lewisville Bridge

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

Degraded riparian function (LWD recruitment, bank protection, shade). Invasive species. Residential use impacts.

Project Objective:

Re-establish native riparian/floodplain vegetation to provide for natural channel stability, shade, and LWD recruitment. Work with private landowners.

Special Considerations:

This area consists primarily of private property. A narrow buffer of Clark County property is located on the north bank near RM 12.3. No project will be conducted without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project. Work on County land should be conducted in close coordination with the County.

Major Life Stages Addressed:

All freshwater life-stages for coho, steelhead, fall Chinook, and chum

Limiting Factors Addressed:

Channel stability, habitat diversity, sediment load, temperature, key habitat quantity

Data Gaps / Needs:

Level of potential landowner collaboration/willingness need to be explored

Project Name: Streambank / in-channel habitat enhancement

Project ID#: EF 18

Reach Name: EF Lewis 8B

River Mile: 10.9

Location Description:

river left bank

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

Long eroding cut-bank on left side (approx 200 meters long). Cleared riparian area. Lack of bank complexity and LWD.

Project Objective:

Slow or prevent accelerated erosion of unforested flood terrace until re-forested terrace can provide natural rates of stability. Increase the quality and complexity of mainstem pool habitat. Increase habitat complexity and cover along streambanks. Increase woody debris quantity. Reforest riparian and floodplain areas with native and locally-adapted species.



Special Considerations:

Private property. No project will be conducted at this site without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project.

Major Life Stages Addressed:

- Fall Chinook - adult holding, fry colonization
- Coho - adult holding, fry colonization, juvenile rearing
- Steelhead - adult holding, fry colonization, juvenile rearing
- Chum - adult holding, fry colonization

Limiting Factors Addressed:

Channel stability, habitat diversity, sediment load, temperature, key habitat quantity

Data Gaps / Needs:

See Special Considerations

Project Name: Side/off-channel restoration

Project ID#: EF 20

Reach Name: EF Lewis 8B

River Mile: 10.7

Location Description:

River right floodplain

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

This is an old meander scar/overflow channel. The channel is not connected at summer flow levels. The average gradient ~0.6%. There are good gravels and existing LWD present. Site observations and temperatures suggest suitable groundwater connectivity.



Project Objective:

Enhance connectivity of side-channel to be active at lower flows (i.e. summer). As part of this objective, it will be important to evaluate and address the effects of flow reduction that would occur in the mainstem. Increase availability of connected backwater channels. Enhance the quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris. At least one low-flow season of groundwater monitoring is recommended to support final designs. Potential chum spawning channel near outlet (needs further investigation). This project could be conducted as a phased project in conjunction with EF 16; potentially connecting these as a single long side-channel.

Special Considerations:

This project is located on Clark County property (Lewis River Ranch). The project should be consistent with the county's master plan for the property and landowner sale agreements, and should consider the adjoining private property ownership. Public access and use is envisioned for this property, including development of a regional trail.

Major Life Stages Addressed:

- Coho - spawning, egg incubation, fry colonization, juvenile rearing
- Fall Chinook - fry colonization, early rearing
- Chum - spawning, egg incubation (potential)
- Steelhead - spawning, egg incubation, juvenile rearing

Limiting Factors Addressed:

Habitat diversity, temperature, key habitat quantity, channel stability

Data Gaps / Needs:

Engineering survey. Seasonality of subsurface flows.

Project Name: Side-channel enhancement plus small levee removal

Project ID#: EF 21

Reach Name: EF Lewis 8A

River Mile: 10.5

Location Description:

River left active side-channel upstream of Daybreak Park

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

Lack of channel structure in side-channel. Good opportunity to increase habitat diversity and pool quantity/quality. There is a small levee at the upstream end of the side-channel on the left bank that may be having an impact on channel location at the side-channel entrance.



Project Objective:

Enhance channel structure and habitat. Enhance the quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris. Provide anchoring and ballast to LWD structures according to stakeholder objectives. Maintain perennial flow into side-channel. Remove small levee at head of side-channel (RM 10.8).

Special Considerations:

This is Clark County property (undeveloped area of Daybreak Regional Park, upstream of the developed portion). Consideration should be given to issues such as: potential impact to existing uses, long-term maintenance and management, opportunities for future recreational uses, etc.

Major Life Stages Addressed:

Coho - spawning, egg incubation, fry colonization, juvenile rearing
Fall Chinook - spawning, egg incubation, fry colonization, early rearing
Steelhead - spawning, egg incubation, juvenile rearing
Chum - spawning, egg incubation, fry colonization

Limiting Factors Addressed:

Habitat diversity, key habitat quantity, channel stability

Data Gaps / Needs:

See Special Considerations

Project Name: Chum channel

Project ID#: EF 22

Reach Name: EF Lewis 8A

River Mile: 10.2

Location Description:

River right immediately upstream of Daybreak Bridge

Species Use:

Chum, coho, steelhead

Site Description:

Potential chum channel location. Gradient is enough to create chum channel with sufficient flows. Temperatures was 4 deg F cooler than the mainstem at the time of the survey, suggesting hyporheic or spring flow into the area. There is existing grade control provided by the pool crest forming the pool under the bridge. The existing elevation of the outlet area is perched ~5 ft, possibly related to scour at the bridge location.

Project Objective:

Create a chum channel sourced by hyporheic flow. Add spawning gravels and complexity appropriate to support chum spawning. An alternative objective is to create and enhance off-channel juvenile rearing habitat for coho and steelhead. At least one low-flow season of monitoring is recommended as part of design.

Special Considerations:

Private property. No project will be conducted at this site without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project. Project will require a detailed scour analysis sufficient to meet bridge program requirements, and must be approved by the Bridge Program Manager prior to starting work.

Major Life Stages Addressed:

Chum - spawning, egg incubation, fry colonization

Limiting Factors Addressed:

Key habitat quantity, channel stability, temperature

Data Gaps / Needs:

Need quantification of hyporheic flow conditions during chum spawning and egg incubation periods

Project Name: Side-channel / off-channel restoration

Project ID#: EF 24

Reach Name: EF Lewis 8A

River Mile: 10

Location Description:

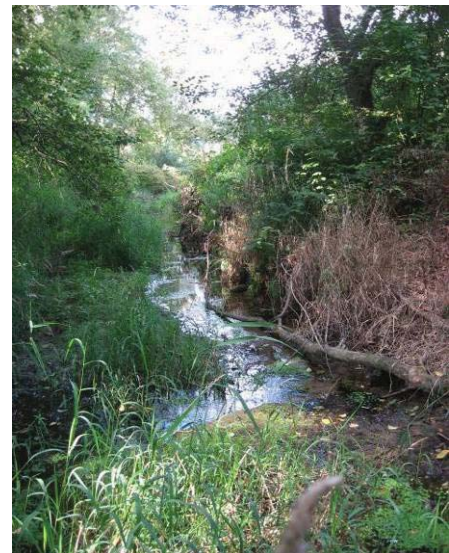
River left just downstream of Daybreak Park boat ramp

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

There is a side-channel that is only active as a flood-flow channel. There is a backwater area that is connected to the mainstem at the downstream end but this area has a lack of cover and instream wood complexity (80 ft of connected off-channel). Total average gradient of the overflow channel is ~0.5%. At the time of the survey, temperature in the existing backwater channel was 2-4 deg F cooler than the mainstem. There is good adjacent spawning in the mainstem.



Project Objective:

Enhance connectivity of side-channel to be active at lower flows (winter and summer). Enhance the quantity and quality of habitat features in the side-channel and the existing backwater area including bank complexity and cover and instream woody debris. Reforest riparian and floodplain areas with native and locally-adapted species. As part of this objective, it will be important to evaluate and address the effects of flow reduction that would occur in the mainstem.

Special Considerations:

Clark County property (Lower Daybreak). Project needs to be consistent with master planning process at this site. Project needs to take into consideration bank erosion, flood damage protection, and relationship with potential future recreation facilities. Mitigation credits should be pursued. Additional funding sources may be available. If there is any risk posed to Daybreak Bridge, this needs to be adequately evaluated.

Major Life Stages Addressed:

Coho -fry colonization, juvenile rearing
Steelhead - juvenile rearing
Fall Chinook - fry colonization, early rearing

Limiting Factors Addressed:

Habitat diversity, temperature, key habitat quantity, channel stability

Data Gaps / Needs:

Engineering survey. Hydraulic model

Project Name: Side-channel restoration

Project ID#: EF 25

Reach Name: EF Lewis 8A

River Mile: 9.7

Location Description:

River right across from W Daybreak site

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

This is the old channel location and is within 100 feet of the existing channel. It is likely active at moderate winter flow levels but it is not active at low summer flows. This is an active channel adjustment, which needs to be considered during design.

Project Objective:

Enhance connectivity of side-channel to be active at low summer flows. Enhance the quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris. Need to evaluate in context of active lateral adjustment area. As part of this objective, it will be important to evaluate and address the effects of flow reduction that would occur in the mainstem.

Special Considerations:

No project will be conducted at this site without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project. Clark County Public Works expects to lead final design and construction (at least for portion on County land) and will pursue mitigation credit to the extent possible. Other parties pursuing work on County land will need to work in close coordination with the County.

Major Life Stages Addressed:

Coho - spawning, egg incubation, fry colonization, juvenile rearing
Fall Chinook - fry colonization, early rearing
Chum - spawning, egg incubation (potential)
Steelhead - spawning, egg incubation, juvenile rearing

Limiting Factors Addressed:

Habitat diversity, key habitat quantity

Data Gaps / Needs:

Actions here may depend on design at W Daybreak site. Actions here may be transient due to active lateral adjustment potential

Reach Name: EF Lewis 8A

River Mile: 9.5

Location Description:

River left bank

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

Long eroding cut-bank on left side (approx 500 meters long). Cleared riparian area. Lack of bank complexity and LWD.



Project Objective:

Slow or prevent accelerated erosion of unforested flood terrace until re-forested terrace can provide natural rates of stability. Increase the quality and complexity of mainstem pool habitat. Increase habitat complexity and cover along streambanks. Increase woody debris quantity. Reforest riparian and floodplain areas with native and locally-adapted species. Reforest entire floodplain terrace from stream edge to valley wall.

Special Considerations:

Clark County property (Lower Daybreak). Projects need to be consistent with master planning process at this site. Projects need to take into consideration future of house, bank erosion, flood damage protection, and relationship with potential future recreation facilities. Mitigation credits should be pursued. Additional funding sources may be available.

Major Life Stages Addressed:

- Fall Chinook - adult holding, fry colonization
- Coho - adult holding, fry colonization, juvenile rearing
- Steelhead - adult holding, fry colonization, juvenile rearing
- Chum - adult holding, fry colonization

Limiting Factors Addressed:

Channel stability, habitat diversity, sediment load, key habitat quantity

Data Gaps / Needs:

Need to work our best approach with stakeholders

Reach Name: EF Lewis 7,8A

River Mile: 9.5

Location Description:

River left off-channel area at Manley Creek outlet

Species Use:

Coho, steelhead, Chinook

Site Description:

This is the backwater area on the river left bank that Manley Creek flows into. The backwater area is connected to the mainstem at the downstream end. There were beaver dams along this channel at the time of the survey. At the time of the survey, temperature in the off-channel area was 2 deg F warmer than the mainstem but 4 deg cooler than Manley Creek.



Project Objective:

Increase the availability of off-channel habitat that is connected to the mainstem during summer flow levels. Enhance the quantity and quality of habitat features including bank complexity and cover and instream woody debris.

Special Considerations:

Combination of private property and Clark County property (Lower Daybreak). No project will be conducted at this site without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project. Projects on County land need to be consistent with master planning process at this site. Projects need to take into consideration future of house, bank erosion, flood damage protection, and relationship with potential future recreation facilities. Mitigation credits should be pursued. Additional funding sources may be available.

Major Life Stages Addressed:

Coho - fry colonization, juvenile rearing
Fall Chinook - fry colonization, early rearing
Steelhead - juvenile rearing

Limiting Factors Addressed:

Habitat diversity, key habitat quantity

Data Gaps / Needs:

Current passability into off-channel area may be adequate

Project Name: Side-channel restoration

Project ID#: EF 28

Reach Name: EF Lewis 8A

River Mile: 9.0 – 9.5

Location Description:

Across from W daybreak site. Runs along County maintenance yard

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

Side-channel (~3,400 ft long) is only active during flood flows. Some of the channel may be from excavation for levee material for adjacent levee to the north. At the time of the survey, temperature was cooler in the upstream portion (52 deg F) compared to the mainstem (58 deg F) and in the channel downstream. Average gradient is 0.5%. Site observations suggest suitable groundwater connectivity for off-channel project.



Project Objective:

Enhance connectivity of side-channel to be active at summer flow levels. Increase hyporheic flow connectivity to the extent possible. Increase availability of connected backwater channels. Enhance the quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris. At least one low-flow season of groundwater monitoring is recommended to support final designs. As part of this objective, it will be important to evaluate and address the effects of flow reduction that would occur in the mainstem.

Special Considerations:

There is private property at the upstream portion of this project area; the remainder is Clark County property. No project will be conducted at this site without full landowner willingness. Any potential

landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project. Clark County Public Works expects to lead final design and construction (at least for portion on County land) and will pursue mitigation credit to the extent possible. Other parties pursuing work on County land will need to work in close coordination with the County. It is possible to limit the project extent to County land if upstream landowners do not agree to participate.

Major Life Stages Addressed:

Coho - spawning, egg incubation, fry colonization, juvenile rearing
Fall Chinook - fry colonization, early rearing
Chum - spawning, egg incubation (potential)
Steelhead - spawning, egg incubation, juvenile rearing

Limiting Factors Addressed:

Habitat diversity, temperature, key habitat quantity, channel stability

Data Gaps / Needs:

Engineering survey. Hydraulic model. Seasonality of subsurface flows.

Project Name: Streambank restoration; channel structure **Project ID#:** EF 34

Reach Name: EF Lewis 5B

River Mile: 7.2

Location Description:

Right bank at powerline crossing ("Powerline Bend")

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

There is a lack of channel structure along banks for juvenile rearing and adult holding. The riparian area is cleared of forest vegetation. There is accelerated erosion of the flood terrace compared to what would be present under naturally forested conditions. There is a lack of bank complexity and instream LWD.

Project Objective:

Slow or prevent accelerated erosion of unforested flood terrace until re-forested terrace can provide natural rates of stability. Increase the quality and complexity of mainstem pool habitat. Increase habitat complexity and cover along streambanks. Increase woody debris quantity. Reforest riparian and floodplain areas with native and locally-adapted species.

Special Considerations:

Private property. No project will be conducted at this site without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project.

Major Life Stages Addressed:

Fall Chinook - adult holding, fry colonization
Coho - adult holding, fry colonization, juvenile rearing
Steelhead - adult holding, fry colonization, juvenile rearing
Chum - adult holding, fry colonization

Limiting Factors Addressed:

Channel stability, habitat diversity, sediment load, key habitat quantity

Data Gaps / Needs: See Special Considerations

Reach Name: EF Lewis 5A

River Mile: 6.8

Location Description:
River left bank (upstream site)

Species Use:
Coho, steelhead, Chinook, chum (potential)

Site Description:
This is the left bank upstream of the airstrip (upstream site) that consists of a long rip-raped bank that lacks complex bank and in-channel habitat important for juvenile rearing. There is a lack of habitat structure and LWD.



Project Objective:
Remove the approximately 650 feet of rip-rap (in consultation with the landowner - Clark County). Increase the quality and complexity of mainstem pool habitat. Increase habitat complexity and cover along streambanks. Increase woody debris quantity. Reforest riparian and floodplain areas with native and locally-adapted species. Reforest entire floodplain terrace from stream edge to valley wall.

Special Considerations:
This project is located on Clark County property. This project must be consistent with a future greenway trail and should consider maintenance, management, and flood protection issues. Other parties pursuing work on County land will need to work in close coordination with the County.

Major Life Stages Addressed:
Fall Chinook - adult holding, fry colonization
Coho - adult holding, fry colonization, juvenile rearing
Steelhead - adult holding, fry colonization, juvenile rearing
Chum - adult holding, fry colonization

Limiting Factors Addressed:
Habitat diversity, key habitat quantity

Data Gaps / Needs:
Address the current benefit of the rip-rap

Reach Name: EF Lewis 5A

River Mile: 6.6

Location Description:
River left bank (downstream site)

Species Use:
Coho, steelhead, Chinook, chum (potential)

Site Description:
This is the left bank upstream of the airstrip (downstream site) that consists of a long rip-raped bank that lacks complex bank and in-channel habitat important for juvenile rearing. There is a lack of habitat structure and LWD.



Project Objective:

Remove the approximately 500 feet of rip-rap (in consultation with the landowner - Clark County). Increase the quality and complexity of mainstem pool habitat. Increase habitat complexity and cover along streambanks. Increase woody debris quantity. Reforest riparian and floodplain areas with native and locally-adapted species. Reforest entire floodplain terrace from stream edge to valley wall.

Special Considerations:

This project is located on Clark County property. This project must be consistent with a future greenway trail and should consider maintenance, management, and flood protection issues. Other parties pursuing work on County land will need to work in close coordination with the County.

Major Life Stages Addressed:

- Fall Chinook - adult holding, fry colonization
- Coho - adult holding, fry colonization, juvenile rearing
- Steelhead - adult holding, fry colonization, juvenile rearing
- Chum - adult holding, fry colonization

Limiting Factors Addressed:

Habitat diversity, key habitat quantity

Data Gaps / Needs:

Address the current benefit of the rip-rap

Project Name: Enhance rip-rap

Project ID#: EF 37

Reach Name: EF Lewis 5A

River Mile: 6.5

Location Description:

River right bank at airstrip

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

This is the right bank at the airstrip. The bank is composed of rip-rap material. There is a lack of complex stream edge habitat important for juvenile rearing. There is a lack of habitat structure and LWD.



Project Objective:

Include any potential landowner concerns, such as erosion, flooding or safety considerations into design criteria for the project. Enhance channel structure and habitat while addressing landowners concerns with bank protection. Enhance the quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris. To the extent possible, reforest the streambank and riparian area with native and locally-adapted species.

Special Considerations:

Private land. No project will be conducted at this site without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project.

Major Life Stages Addressed:

- Fall Chinook - adult holding, fry colonization
- Coho - adult holding, fry colonization, juvenile rearing
- Steelhead - adult holding, fry colonization, juvenile rearing
- Chum - adult holding, fry colonization

Limiting Factors Addressed:

Habitat diversity

Data Gaps / Needs:

Address the current benefit of the rip-rap

Project Name: Off-channel enhancement

Project ID#: EF 38

Reach Name: EF Lewis 5A

River Mile: 6.3

Location Description:

Upstream back channel at airstrip

Species Use:

Coho, steelhead, chum (potential)

Site Description:

This is old chum channel. Now serves as a juvenile rearing channel (winter and summer). There was a large beaver dam at the downstream end at the time of the survey. There is good potential temperature refuge (the downstream end was 2 deg F cooler than the mainstem at the time of the survey).

Project Objective:

Enhance the quantity and quality of off-channel habitat features including bank complexity and cover and instream woody debris.

Special Considerations:

Private land. No project will be conducted at this site without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project.

Major Life Stages Addressed:

Coho -fry colonization, juvenile rearing
Steelhead - juvenile rearing
Fall Chinook - fry colonization, early rearing

Limiting Factors Addressed:

Habitat diversity, temperature, channel stability

Data Gaps / Needs:

More complete summer temperature profile needed



Project Name: Off-channel enhancement

Project ID#: EF 39

Reach Name: EF Lewis 5A

River Mile: 6.1

Location Description:

Downstream back channel at airstrip

Species Use:

Coho, steelhead, chum (potential)

Site Description:

This channel is the downstream backwater channel that was constructed along the airstrip property. There is good temperature



refuge potential. The upstream end of the backwater channel was 8 deg F cooler than the mainstem at the time of the survey.

Project Objective:

Enhance the quantity and quality of off-channel habitat features including bank complexity and cover and instream woody debris.

Special Considerations:

Private land. No project will be conducted at this site without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project.

Major Life Stages Addressed:

Coho -fry colonization, juvenile rearing
Steelhead - juvenile rearing
Fall Chinook - fry colonization, early rearing

Limiting Factors Addressed:

Habitat diversity, temperature, channel stability

Data Gaps / Needs:

More complete summer temperature profile needed

Project Name: Streambank restoration; channel structure

Project ID#: EF 40

Reach Name: EF Lewis 5A

River Mile: 6.1

Location Description:

Right bank across from "Car Body Hole"

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

Lack of channel structure along banks for juvenile rearing and adult holding. Cleared riparian area. Lack of bank complexity and LWD.

Project Objective:

Slow or prevent accelerated erosion of unforested flood terrace until re-forested terrace can provide natural rates of stability. Increase the quality and complexity of mainstem pool habitat. Increase habitat complexity and cover along streambanks. Increase woody debris quantity. Reforest riparian and floodplain areas with native and locally-adapted species.

Special Considerations:

Private land. No project will be conducted at this site without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project.

Major Life Stages Addressed:

Fall Chinook - adult holding, fry colonization
Coho - adult holding, fry colonization, juvenile rearing
Steelhead - adult holding, fry colonization, juvenile rearing
Chum - adult holding, fry colonization

Limiting Factors Addressed:

Channel stability, habitat diversity, sediment load, key habitat quantity

Data Gaps / Needs:

None identified

Project Name: Riparian restoration

Project ID#: EF 41

Reach Name: EF Lewis 5A, EF Lewis 5B

River Mile: 5.7 - 7.3

Location Description:

EF Lewis: Mason Creek to Ridgefield Pits

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

Degraded riparian function (LWD recruitment, bank protection, shade). Effects from past grazing/ag. Abundant invasives.

Project Objective:

Re-establish native riparian/floodplain vegetation to provide for natural channel stability, shade, and LWD recruitment. Work with County to continue and expand existing efforts. Incorporate considerations for waterfowl habitat, wetlands, and habitat for terrestrial species.

Special Considerations:

This area has a combination of private and Clark County property. No project will be conducted without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project. This project must be consistent with a future greenway trail and should consider maintenance, management, and flood protection issues. Other parties pursuing work on County land will need to work in close coordination with the County.

Major Life Stages Addressed:

All freshwater life-stages for coho, steelhead, fall Chinook, and chum

Limiting Factors Addressed:

Channel stability, habitat diversity, sediment load, temperature, key habitat quantity

Data Gaps / Needs:

Identify where existing Clark County riparian restoration work has taken place

Project Name: Levee removal/set-back

Project ID#: EF 42

Reach Name: EF Lewis 4B

River Mile: 5.1

Location Description:

River left levee near RM 5

Species Use:

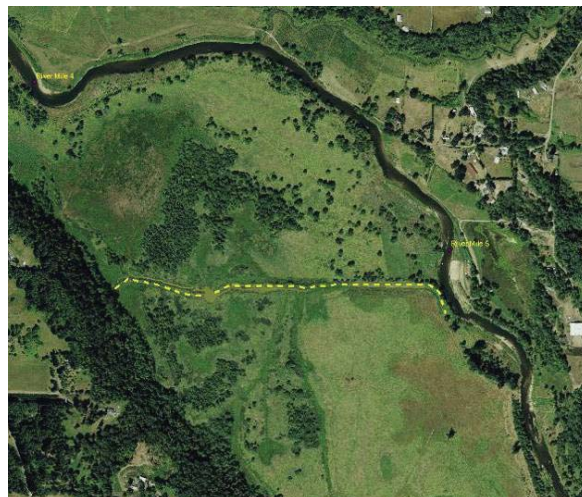
Coho, steelhead, Chinook, chum (potential)

Site Description:

Long levee perpendicular to valley across floodplain terrace.

Project Objective:

Remove levee to restore CMZ processes and connectivity of mainstem to adjacent floodplain wetlands. Take into consideration waterfowl habitat, wetlands, and habitat for terrestrial species. Investigate presence of levee on south bank near RM 4.



Special Considerations:

This project is located on Clark County property (Schaeffer Property). This project must be consistent with a future greenway trail and should consider maintenance, management, and flood protection issues. Existing landowner sale agreements also need to be considered. Other parties pursuing work on County land will need to work in close coordination with the County.

Major Life Stages Addressed:

Coho - fry colonization, juvenile rearing
Fall Chinook - fry colonization, early juvenile rearing
Chum - fry colonization

Limiting Factors Addressed:

Key habitat quantity, habitat diversity

Data Gaps / Needs:

Evaluate flood protection benefit of levee

Project Name: Levee removal/set-back

Project ID#: EF 43

Reach Name: EF Lewis 3

River Mile: 3.2 - 4.4

Location Description:

River right levee upstream of La Center

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

This is the long La Center levee on river right upstream of the La Center Bridge. The levee constrains the channel to its current location.

Project Objective:

In coordination with Clark County and other stakeholders, and as appropriate given the County's objectives for this area, restore/enhance channel migration and floodplain connectivity processes to the extent possible. This could include removing, setting-back, or selectively breaching the levee and conducting instream habitat enhancement along the bank margin.



Special Considerations:

Clark County ownership (La Center Bottoms). Projects need to take into consideration future establishment of a greenway trail through this area. Issues including maintenance, management, and flood protection need to be addressed. Existing agreements need to be considered. Any work should be conducted in close coordination with County staff.

Major Life Stages Addressed:

Coho - fry colonization, juvenile rearing
Fall Chinook - fry colonization, early juvenile rearing
Chum - fry colonization

Limiting Factors Addressed:

Key habitat quantity, habitat diversity

Data Gaps / Needs:

Evaluate flood protection benefit of levee

Reach Name: Brezee Creek 2

River Mile:

Location Description:

Upstream of Lockwood Road Crossing

Species Use:

Coho, steelhead

Site Description:

Fish passage is limited at the culvert under Lockwood Road. Passage is also limited by an earthen dam at the upstream end of reach 2. There is a lack of channel structure and habitat throughout this segment.

Project Objective:

Restore/enhance passage at the Lockwood Road crossing. Restore channel processes by removing the earthen dam. Restore the channel through the existing reservoir and enhance the existing channel between the culvert and the dam. Enhance the quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris.

Special Considerations:

Private land. No project will be conducted at this site without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project.

Major Life Stages Addressed:

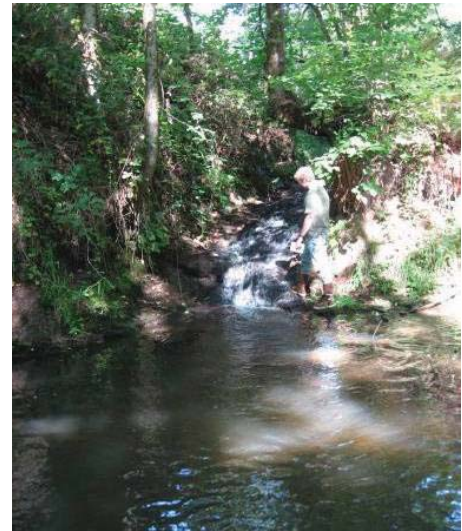
Coho - all freshwater life-stages
Steelhead - all freshwater life-stages

Limiting Factors Addressed:

Access, habitat diversity, key habitat quantity, temperature

Data Gaps / Needs:

Detailed site investigation, including topographic survey, geomorphic analysis, and development of potential alternatives



Project Name: Lower Dean Creek Channel Enhancement (downstream portion)

Project ID#: DE 01

Reach Name: Dean Cr 1 A

River Mile: 0 - 0.4

Location Description:

Mouth to Storedahl property

Species Use:

Coho, steelhead, chum (potential)

Site Description:

High temperature may create passage barrier in summer. There is water pollution (sediment, fecal coliform). There is channel incision, lack of floodplain connectivity, lack of channel structure and habitat components, degraded riparian zone, and abundant invasive riparian species. The stream has been impacted by agricultural uses, past channel re-locations, and adjacent mining operations.



Project Objective:

Enhance instream habitat conditions, increase floodplain connectivity, and reduce water temperatures. Temperature issues must be successfully addressed for this project to be successful. Enhance the quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris. Investigate the potential and need for isolating subsurface connections between the Daybreak gravel mine pit and the stream. Daybreak Pits avulsion risk assessment may impact the timing and specifics of design. Reforest riparian and floodplain areas with native and locally-adapted species.

Special Considerations:

Primarily in Clark County ownership. Any work here needs to be conducted in close coordination with the County and should take into consideration on-going restoration efforts, public use of the site, and maintenance and management issues.

Major Life Stages Addressed:

- Coho - all freshwater life-stages
- Steelhead - all freshwater life-stages
- Chum (potential) - all freshwater life-stages

Limiting Factors Addressed:

Channel stability, habitat diversity, temperature, key habitat quantity, sediment load

Data Gaps / Needs:

Detailed site investigation, including topographic survey, geomorphic analysis, and development of potential alternatives

Project Name: Lower Dean Creek Channel Enhancement (upstream portion)
Project ID#: DE 02

Reach Name: Dean Cr 1 A

River Mile: 0.4 - 0.9

Location Description:

Storedahl property to J.A. Moore Road

Species Use:

Coho, steelhead, chum (potential)

Site Description:

High temperature may create passage barrier in summer. Water pollution concerns (sediment, fecal coliform). There is channel incision, lack of floodplain connectivity, lack of channel structure and habitat components, degraded riparian zone, and abundant invasive riparian species. The stream has been impacted by agricultural uses, past channel re-locations, and adjacent mining operations.



Project Objective:

Enhance instream habitat conditions, increase floodplain connectivity, and reduce water temperatures. Enhance the quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris. Investigate the potential and need for isolating subsurface connections between the Daybreak gravel mine pit and the stream. Daybreak Pits avulsion risk assessment may impact the timing and specifics of design. Reforest riparian and floodplain areas with native and locally-adapted species.

Special Considerations:

Private land. No project will be conducted at this site without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project.

Major Life Stages Addressed:

Coho - all freshwater life-stages
Steelhead - all freshwater life-stages
Chum (potential) - all freshwater life-stages

Limiting Factors Addressed:

Channel stability, habitat diversity, temperature, key habitat quantity, sediment load

Data Gaps / Needs:

Detailed site investigation, including topographic survey, geomorphic analysis, and development of potential alternatives

Project Name: Dyer reach 4 channel and passage enhancement **Project ID#:** DY 02

Reach Name: Dyer Cr 4

River Mile: 1.3 - 1.6

Location Description:

Near 259th Street crossing

Species Use:

Coho, steelhead

Site Description:

Fish passage is limited at 259th street (Clark County Conservation District study). The information provided is based on aerial photograph interpretation; a site visit in coordination with willing landowners will be required to develop designs. There are assumed to be water temperature concerns related to private residential ponds upstream. Cleared riparian areas and adjacent residential uses suggest impacts to riparian, streambank, and in-channel habitats.

Project Objective:

Address passage issues at the 259th Street crossing. In cooperation with willing landowners, enhance/restore fish passage and habitat in this area. Alternatives may include pond removal or disconnection from the mainstem. Enhance the quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris. Reforest riparian and floodplain areas with native and locally-adapted species.

Special Considerations:

Private land. No project will be conducted at this site without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project.

Major Life Stages Addressed:

Coho - all freshwater life-stages
Steelhead - all freshwater life-stages

Limiting Factors Addressed:

Passage, channel stability, habitat diversity, temperature, key habitat quantity, sediment load

Data Gaps / Needs:

Detailed site investigation, including topographic survey, geomorphic analysis, and development of potential alternatives

Project Name: Lower Jenny Cr channel enhancement and off-channel creation
Project ID#: JE 01

Reach Name: Jenny 1

River Mile: 0 - 0.13

Location Description:

Mouth to barrier falls

Species Use:

Coho, steelhead

Site Description:

Lower Jenny Creek has channel simplification and incision, lack of instream LWD, lack of habitat structure and cover, invasive plant species, high fine sediment load from upstream sources, and cleared riparian areas. There is an existing wetland area in the right bank floodplain and a remnant levee between the wetland and the stream channel.



Project Objective:

Enhance channel structure and habitat. Enhance the quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris. Increase the availability of off-channel habitat by removing the levee and connecting the existing wetland habitat to the stream. Reforest riparian and floodplain areas with native and locally-adapted species. Upstream sediment sources must be identified and controlled as part of this effort.

Special Considerations:

Combination of private property and Clark County property. No project will be conducted at this site without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project.

Major Life Stages Addressed:

Coho - all freshwater life-stages

Steelhead - all freshwater life-stages

Limiting Factors Addressed:

Channel stability, habitat diversity, temperature, key habitat quantity, sediment load

Data Gaps / Needs:

Identify and control upstream sediment sources

Project Name: Lower McCormick channel enhancement

Project ID#: MC 01

Reach Name: McCormick 1 A

River Mile: 0 - 0.6

Location Description:

Mouth to stream mile 0.6

Species Use:

Coho, steelhead, chum (potential)

Site Description:

The lower half mile of McCormick Creek has channel simplification and incision, lack of wood cover, and abundant invasive plant species. There is considerable beaver activity in this area.



Project Objective:

Enhance channel structure and habitat. Enhance the quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris. Increase the availability of off-channel habitat for coho and steelhead rearing. Look for opportunities to enhance floodplain connectivity. Reforest riparian and floodplain areas with native and locally-adapted species.

Special Considerations:

Clark County property. This project must be consistent with a future greenway trail and should consider maintenance, management, and flood protection issues. There may be other potential funding sources for project work in this area.

Major Life Stages Addressed:

Coho - all freshwater life-stages
Steelhead - all freshwater life-stages
Chum (potential) - all freshwater life-stages

Limiting Factors Addressed:

Channel stability, habitat diversity, temperature, key habitat quantity

Data Gaps / Needs:

Detailed site investigation, including topographic survey, geomorphic analysis, and development of potential alternatives

Project Name: Restore passage at La Center Road Crossing **Project ID#:** MC 02

Reach Name: McCormick Creek 1A and 1B

River Mile: 1

Location Description:

La Center Road crossing

Species Use:

Coho, steelhead

Site Description:

The stream crossing at La Center Road is listed as a complete barrier in the WDFW database and the 1997 Clark County barrier study. LiDAR data shows the culvert is about 510 feet long, has a 10 -15 foot drop, and is under about 70 feet of road fill.

Project Objective:

Restore passage at the La Center Road crossing

Special Considerations:

Appears to be located within County road right of way. Work should be conducted in coordination with Clark County. This is a long culvert with a deep road fill.

Major Life Stages Addressed:

Coho - all freshwater lifestages
Steelhead - all freshwater lifestages

Limiting Factors Addressed:

Passage

Data Gaps / Needs:

Passage evaluation

Project Name: Residential pond reach 1 D

Project ID#: MC 03

Reach Name: McCormick 1 D & 1 E

River Mile: 2.25

Location Description:

2.25 miles up McCormick Creek

Species Use:

Coho, steelhead

Site Description:

The dam at Hilm Reservoir is a complete barrier (Clark County Conservation District survey). The following information is based on aerial photograph interpretation; a site visit in coordination with willing landowners will be required to develop designs. There are assumed to be water temperature concerns related to private residential ponds. Ponds, cleared riparian areas and adjacent residential uses suggest impacts to riparian, streambank, and in-channel habitats.

Project Objective:

In cooperation with willing landowners, enhance/restore fish passage and habitat in this area. Alternatives may include pond removal or disconnection from the mainstem. Enhance the quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris. Reforest riparian and floodplain areas with native and locally-adapted species.

Special Considerations:

Private land. No project will be conducted at this site without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project.

Major Life Stages Addressed:

Coho - all freshwater life-stages

Steelhead - all freshwater life-stages

Limiting Factors Addressed:

Passage, channel stability, habitat diversity, temperature, key habitat quantity, sediment load

Data Gaps / Needs:

Need info on specific passage conditions and excavation/restoration details

Project Name: Residential pond reach 1G and 1H

Project ID#: MC 04

Reach Name: McCormick 1G and 1H

River Mile: 2.8

Location Description:

2.8 miles up McCormick Creek

Species Use:

Coho, steelhead

Site Description:

Fish passage conditions at the private road crossing are unknown. The following information is based on aerial photograph interpretation; a site visit in coordination with willing landowners will be required to develop designs. There are assumed to be water temperature concerns related to private residential ponds. Ponds, cleared riparian areas and adjacent residential uses suggest impacts to riparian, streambank, and in-channel habitats.

Project Objective:

In cooperation with willing landowners, enhance/restore fish passage and habitat in this area. Alternatives may include pond removal or disconnection from the mainstem. Enhance the quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris. Reforest riparian and floodplain areas with native and locally-adapted species.

Special Considerations:

Private land. No project will be conducted at this site without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project.

Major Life Stages Addressed:

Coho - all freshwater life-stages
Steelhead - all freshwater life-stages

Limiting Factors Addressed:

Passage, channel stability, habitat diversity, temperature, key habitat quantity, sediment load

Data Gaps / Needs:

Need info on specific passage conditions and excavation/restoration details

Project Name: Manley Creek stream habitat enhancement (downstream of 259th)
Project ID#: MN 02

Reach Name: Manley Creek 1B - 1C

River Mile: 0.2 - 0.75

Location Description:

Lower Manley Creek

Species Use:

Coho, steelhead, chum (potential)

Site Description:

Channel simplification and incision, lack of cover, invasive plant species. Affected by past channel re-location, residential development, agriculture, riparian clearing, and upstream gravel mining. Possible passage limitation at driveway culvert.



Project Objective:

Enhance channel structure and habitat. Enhance the quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris. Add spawning gravels as necessary. Increase the availability of off-channel habitat that is connected to Manley Creek during summer flow levels. Look for opportunities to enhance floodplain connectivity. Assess and enhance passage at driveway culvert if necessary. Reforest riparian and floodplain areas with native and locally-adapted species.

Special Considerations:

The property is currently owned by Columbia Land Trust, with a memorandum of understanding with Clark County that the property will eventually be transferred to County ownership. Projects need to be consistent with the County's master planning process at this site. Projects need to take into consideration the future of the house that is located at the site, bank erosion, flood damage protection, and the relationship with potential future recreation facilities. Mitigation credits should be pursued. Additional funding sources may be available.

Major Life Stages Addressed:

Coho - all freshwater life-stages
Steelhead - all freshwater life-stages
Chum (potential) - all freshwater life-stages

Limiting Factors Addressed:

Channel stability, habitat diversity, temperature, key habitat quantity, sediment load, passage

Data Gaps / Needs:

Detailed site investigation, including topographic survey, geomorphic analysis, and development of potential alternatives

Project Name: Manley Creek passage restoration and habitat enhancement (upstream of 259th)

Project ID#: MN 03

Reach Name: Manley Creek 1C - 1G

River Mile: 0.75 - 1.5

Location Description:

Lower Manley Creek

Species Use:

Coho, steelhead, chum (potential)

Site Description:

Multiple passage obstructions (partial) at road and driveway culverts (at least 7 crossings). Channel simplification and incision, lack of cover, invasive plant species. Affected by past channel re-location, residential development, agriculture, riparian clearing, and upstream gravel mining. Culverts located at stream miles 0.15, 0.6, 1, 1.05, 1.2, 1.4, and 1.5.

Project Objective:

Restore passage at stream crossings. Enhance channel structure and habitat. Enhance the quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris. Increase the availability of off-channel habitat that is connected to Manley Creek during summer flow levels. Look for opportunities to enhance floodplain connectivity. Reforest riparian and floodplain areas with native and locally-adapted species.

Special Considerations:

Private land. No project will be conducted at this site without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project.

Major Life Stages Addressed:

Coho - all freshwater life-stages
Steelhead - all freshwater life-stages
Chum (potential) - all freshwater life-stages

Limiting Factors Addressed:

Passage obstruction, channel stability, habitat diversity, temperature, key habitat quantity, sediment load

Data Gaps / Needs:

Detailed site investigation, including culvert hydrology/hydraulics, topographic survey, geomorphic analysis, and development of potential alternatives

Reach Name: Mason Creek 1

River Mile: 0 - 1

Location Description:
Lower Mason Creek in EF valley bottom

Species Use:
Coho, steelhead, chum (potential)

Site Description:
Channel simplification and incision, lack of wood cover, invasive plant species. Affected by historical channel relocations, riparian clearing, agricultural uses.

Project Objective:
Enhance channel structure and habitat. Enhance the quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris. Increase the availability of off-channel habitat that is connected to Mason Creek during summer flow levels. Look for opportunities to enhance floodplain connectivity. Reforest riparian and floodplain areas with native and locally-adapted species.

Special Considerations:
Private land. No project will be conducted at this site without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project.

Major Life Stages Addressed:
Coho - all freshwater life-stages
Steelhead - all freshwater life-stages
Chum (potential) - all freshwater life-stages

Limiting Factors Addressed:
Channel stability, habitat diversity, temperature, key habitat quantity, sediment load

Data Gaps / Needs:
Detailed site investigation, including topographic survey, geomorphic analysis, and development of potential alternatives



Reach Name: Mason Creek 3, 4

River Mile: 3.2 - 3.6

Location Description:
Upstream and downstream of Anderson Road

Species Use:
Coho, steelhead

Site Description:
These reaches of Mason Creek show signs of incision, accelerated erosion rates, and a lack of in-channel habitat structure, complexity, cover, and LWD. These reaches are affected by road crossings, channel re-alignments, and residential development.



Project Objective:

Enhance channel structure and habitat. Enhance the quantity and quality of habitat features including pools and riffles, bank complexity and cover, and instream woody debris. Use structure to speed the recovery of incised channels.

Special Considerations:

Private land. No project will be conducted at this site without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project.

Major Life Stages Addressed:

Coho - all freshwater life-stages
Steelhead - all freshwater life-stages

Limiting Factors Addressed:

Channel stability, habitat diversity, key habitat quantity, sediment load

Data Gaps / Needs:

Some work has been conducted in this segment already. Identify remaining needs. Confirm potential project extents

Project Name: Mill Creek 1 C habitat enhancement

Project ID#: MI 01

Reach Name: Mill Creek 1 C

River Mile: 1 - 1.3

Location Description:

Middle mainstem Mill Creek

Species Use:

Coho, steelhead

Site Description:

The information provided is based on aerial photograph interpretation; a site visit in coordination with willing landowners will be required to develop designs. Cleared riparian areas and adjacent residential uses suggest impacts to riparian, streambank, and in-channel habitats.

Project Objective:

Enhance stream channel structure and habitat. Reforest riparian and floodplain areas with native and locally-adapted species.

Special Considerations:

Private land. No project will be conducted at this site without full landowner willingness. Any potential landowner concerns, such as erosion, flooding, or safety considerations should be addressed as specific design criteria for the project.

Major Life Stages Addressed:

Coho - all freshwater life-stages
Steelhead - all freshwater life-stages

Limiting Factors Addressed:

Channel stability, habitat diversity, key habitat quantity, sediment load

Data Gaps / Needs:

Detailed site investigation, including topographic survey, geomorphic analysis, and development of potential alternatives

Reach Name: Dean Cr 1 A

River Mile: 0.4-0.9

Location Description:

Dean Creek upstream of Becker Property

Species Use:

Coho, steelhead, chum (potential)

Site Description:

This site encompasses Dean Creek from the upstream boundary of the Becker Property upstream to J.A. Moore Road. This area is subject to future land-use impacts and has good restoration potential. It is currently privately owned.

Project Objective:

Explore opportunities for entering into a conservation easement or purchasing land from willing sellers in order to implement channel, riparian, and floodplain protection and restoration measures.

Special Considerations:

Private property. No project will be conducted at this site without full landowner willingness. This site provides a potential opportunity to leverage resources with the Clark County Clean Water Fund.

Major Life Stages Addressed:

All freshwater life-stages for coho, steelhead, and chum

Limiting Factors Addressed:

Multiple

Data Gaps / Needs:

It is necessary to assess landowner interest

Project Name: Ridgefield Pits Alternatives (includes lower Dyer Creek area)

Project ID#: EF-A 01

Reach Name: EF Lewis 6B; Dyer Cr 1 and 2

River Mile: 7.3 - 8.3

Location Description:

Ridgefield Pit avulsion area and surrounding floodplain

Species Use:

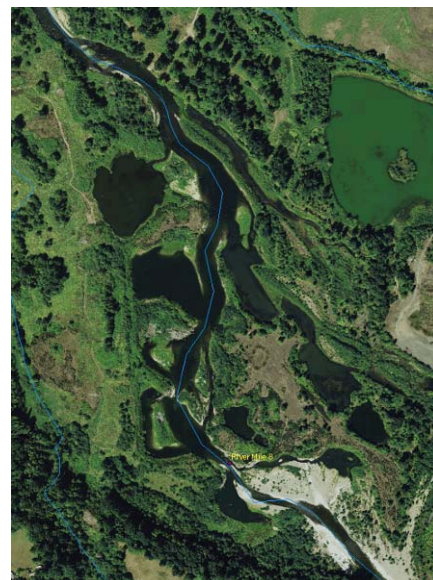
All

Site Description:

Channel avulsion / stream capture in 1996 re-routed mainstem through pits with severe impacts on key habitat quantity, habitat diversity, temperature, sediment, and invasive aquatic and plant species. There is a very large deficit of valley bottom material. There are now large deep ponds with invasive and predatory species. The riparian and floodplain area is severely degraded and overrun with invasive plant species.

Project Objective:

Evaluate alternatives for re-configuring this reach to enhance existing habitat and recover this area. Alternatives to be evaluated should range from no-action to full reach re-configuration. Conceptual designs for addressing channel and habitat conditions in this reach should be included as a product of this evaluation.



Alternatives for restoration/enhancement of lower Dyer Creek within the valley bottom should also be included in this evaluation and should include conceptual designs for this tributary.

Special Considerations:

Multiple private and public (Clark County) land parcels are located in this area. On-the-ground investigative work will only occur in full coordination with all landowners.

Major Life Stages Addressed:

All freshwater life-stages for coho, steelhead, fall Chinook, and chum

Limiting Factors Addressed:

Channel stability, habitat diversity, sediment load, temperature, key habitat quantity, competition, predation, flow

Data Gaps / Needs:

Detailed site investigation including detailed topographic survey, geomorphic and sediment transport analysis, development of potential alternatives, hydraulic modeling of alternatives.

Project Name: Daybreak Pits avulsion risk assessment

Project ID#: EF-A 02

Reach Name: EF Lewis 6A, 6B, 6C, 7, 8A

River Mile: 7.3 - 9.5

Location Description:

Below Ridgefield pit avulsion to RM 9.5

Species Use:

All

Site Description:

Daybreak Pits are in floodplain adjacent to river and pose a potential risk of stream capture that would severely degraded existing habitat conditions.



Project Objective:

Assess the potential of stream capture of Daybreak Pits. Develop measures to protect against stream avulsion while also enhancing habitat and river processes. Assess the impact of existing levees in this area (north of mainstem between RM 8.3 and 9.5). Evaluate potential alternatives for reducing risk of pit capture while restoring habitat and protecting river processes to the extent possible (e.g. removing/relocating existing levees or creating connected off-channel habitat at existing RM 9 pond complex). Describe analyses that will be required to evaluate alternatives.

Special Considerations:

Multiple private and public (Clark County) land parcels are located in this area. Assessment work will occur in full coordination with all landowners.

Major Life Stages Addressed:

All freshwater life-stages for coho, steelhead, fall Chinook, and chum

Limiting Factors Addressed:

Multiple

Data Gaps / Needs:

Detailed site investigation including detailed topographic survey, geomorphic and sediment transport analysis, and hydraulic modeling of a variety of potential flood and avulsion scenarios. There is existing information that relates to this matter that will need to be incorporated into the analysis.

Project Name: Groundwater and temperature monitoring to support off-channel enhancement
Project ID#: EF-A 03

Reach Name: EF Lewis 5A, EF Lewis 5B, EF Lewis 6A, EF Lewis 6C, EF Lewis 7, EF Lewis 8A, EF Lewis 8B

River Mile: 5.7 - 15

Location Description:

Lower mainstem from Mason Creek to Lewisville Park

Species Use:

Coho, steelhead, Chinook, chum (potential)

Site Description:

There are multiple sites for potential enhancement of off-channel areas (side-channels and connected backwaters) along the lower mainstem that could provide temperature and velocity refuge to support juvenile rearing. Specifics of temperature conditions and groundwater connectivity are unknown for many of the sites. For many sites already identified as restoration projects, site observations suggest there is suitable groundwater connectivity; however, specific water table depths, temperatures, water quality, and seasonal groundwater flow rates are unknown.

Project Objective:

Assess temperature, water quality (e.g. D.O., minerals) and groundwater (hyporheic) flow conditions at multiple potential off-channel enhancement sites in order to help select project sites and to support design at selected sites. Monitoring will help to identify sites that have the best potential and cheapest cost for tapping into cool, consistent groundwater sources. Multiple seasons of temperature and groundwater monitoring is not an absolute requirement for project advancement, but it will enhance the ability to compare project cost/benefit; and for projects that are carried forward, it will provide a robust dataset to be used in project design.

Special Considerations:

Some potential off-channel enhancement sites are located on private lands. No investigative work will be conducted without full landowner willingness.

Major Life Stages Addressed:

Coho - summer rearing

Steelhead - summer rearing

All species and all freshwater life-stages affected to some degree

Limiting Factors Addressed:

Temperature, key habitat quantity, habitat diversity

Data Gaps / Needs:

This fills a key data gap

Conceptual Designs

A total of 13 projects were carried forward to the conceptual design phase. These projects are listed in the table below. The conceptual designs are included in Attachment 1.

Project ID	Project Name	Reach Name	River Mile
EF-A 02	Daybreak Pits avulsion risk assessment	EF Lewis 6A, 6B, 6C, 7, 8A	7.3 - 9.5
EF 28	Side-channel restoration	EF Lewis 8A	9.0 – 9.5
EF 41	Riparian restoration	EF Lewis 5A, 5B	5.7 - 7.3
MS 01	Lower Mason habitat enhancement	Mason Creek 1	0 - 1
EF 10	Side-channel habitat enhancement	EF Lewis 8B	13 - 13.5
MN 02	Manley Creek habitat enhancement (downstream of 259th)	Manley Creek 1B - 1C	0.2 - 0.75
EF 21	Side-channel habitat enhancement	EF Lewis 8A	10.5
EF 42	Levee and drainage ditch removal	EF Lewis 4B	5.1
EF 20	Side-channel and backwater habitat enhancement	EF Lewis 8B	10.7
EF 12	Instream habitat enhancement	EF Lewis 8B	11 - 11.3
EF-A 01	Ridgefield Pits alternatives assessment	EF Lewis 6B; Dyer Cr 1,2	7.3 - 8.3
EF-A 03	Temperature and groundwater assessment	EF Lewis 5A-8B	5.7 - 15
EF 05	Off-channel habitat enhancement	EF Lewis 8B	14

REFERENCES

- Groot, C., and L. Margolis editors. 1991. Pacific salmon life histories. University of British Columbia Press, Vancouver.
- Knighton, D. 1998. Fluvial forms and processes: A new perspective. Oxford University Press, Oxford, England. UK.
- Lestelle, L.L, L.E. Mobrand, & W.E. McConnaha. 2004. Information structure of Ecosystem Diagnosis and Treatment (EDT) and habitat rating rules for Chinook salmon, coho salmon, and steelhead trout. Mobrand Biometrics, Inc., Vashon Island, WA.
- Lichatowich, J., L. Mobrand, L. Lestelle, and T. Vogel. 1995. An approach to the diagnosis and treatment of depleted Pacific salmon populations in Pacific Northwest watersheds. *Fisheries* 20: 10-18.
- Lower Columbia Fish Recovery Board. 2004. Lower Columbia Salmon and Steelhead Recovery and Sub-basin Plan. Lower Columbia Fish Recovery Board. Longview, WA.
- Lower Columbia Fish Recovery Board. 2004a. Lower Columbia Salmon and Steelhead Recovery and Sub-basin Plan. Volume II – Subbasin Plan Chapter G – NF and EF Lewis River. Lower Columbia Fish Recovery Board. Longview, WA.
- Lower Columbia Fish Recovery Board. 2005. East Fork Lewis River Habitat Assessment. Prepared by SP Cramer and Associates.
- Lower Columbia Fish Recovery Board. 2008. Lower Columbia Salmon Recovery 6-Year Habitat Work Schedule and Lead Entity Habitat Strategy
- Melchior, M. and M. Brunfelt. 2005. The Importance of Side-channels: An Inter-Fluve White Paper. Prepared for Portland General Electric, Portland, Oregon.
- Norman, D. K. 1998. Reclamation of flood-plain sand and gravel pits as off-channel salmon habitat. *Washington Geology* 26(2/3):21–28.
- Poole, G.C, and C.H. Berman. 2002. Pathways of Human Influence on Water Temperature Dynamics in Stream Channel. *Environmental Management*.
- Poole, G.C. and C.H. Berman. 2001. An Ecological Perspective on In-Stream Temperature: Natural Heat Dynamics and Mechanisms of Human-Caused Thermal Degradation. *Environmental Management* 27(6): 787–802.
- Roni, P. 2002. Habitat use by fishes and pacific giant salamanders in small western Oregon and Washington streams. *Transactions of the American Fisheries Society* 131:743–761
- Wade, G. 2000. Salmon and steelhead habitat limiting factors: water resource inventory area 27. Washington Conservation Commission, Olympia, Washington.
- WDOE. Washington Department of Ecology Instream Flow Monitoring: EF Lewis River at Dollar Corner. <https://fortress.wa.gov/ecy/wrx/wrx/flows/station.asp?sta=27D090>
- WDOE. 1998a. Washington State 303(d) list of impaired water bodies due to exceedances of temperature and fecal coliform standards: <http://www.ecy.wa.gov/programs/wq/303d/1998/1998ByWrias.html>
- WDOE, 2008b. Washington Department of Ecology Instream Flow Rules for WRIA 27/28. <http://www.ecy.wa.gov/biblio/0811006.html>

APPENDIX A – REACH OBJECTIVES AND STRATEGIES

APPENDIX B – TRIBUTARY EXISTING CONDITIONS

APPENDIX C – ANNOTATED BIBLIOGRAPHY

APPENDIX D – PERMITTING GUIDANCE

APPENDIX E – PROJECT SCORING DETAIL

**APPENDIX F – PUBLIC AND LCFRB TAC COMMENTS ON
DRAFT PLAN**

ATTACHMENT 1 – CONCEPTUAL DESIGNS