

Appendix C
WRIA 27 Restoration Opportunities

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Table C-1. Key to Programmatic Restoration Measures

Measure ID	Description
Water Quality	
WQ-1	Protect water quality.
WQ-2	Implement best management practices for use of pesticides and fertilizers.
WQ-3	Use construction best management practices to minimize runoff.
WQ-4	Restrict livestock access to streams.
WQ-5	Remove and/or replace failing septic systems.
WQ-6	Identify and reduce sources of contaminants in soils and water.
WQ-7	Maintain adequate summer flows to control high temperature.
WQ-8	Reduce excessive fine sediments.
WQ-9	Improve water quality (dissolved oxygen, bacteria, temperature).
WQ-10	Decommission or repair logging roads to prevent erosion.
WQ-11	Use timber harvest best management practices to reduce erosion.
WQ-12	Control agricultural runoff.
WQ-13	Educate shoreline property owners on best management practices to minimize impacts to water quality.
Fish Habitat	
F-1	Protect remaining off-channel habitat.
F-2	Create additional side channel habitat.
F-3	Restore off-channel rearing habitat.
F-4	Remove barriers to fish passage.
F-5	Remove or repair failing culverts.
F-6	Supplement large woody debris.
F-7	Enhance spawning gravel.
F-8	Recreate stream meanders.
F-9	Improve stream channel shading.
Hydrology	
H-1	Restore stream connectivity to off-channel and floodplain habitats.
H-2	Remove, lower, or set back dikes and levees.
H-3	Provide for adequate in-stream flows through management of water withdrawals.
H-4	Address water withdrawal policies for lakes.
H-5	Acquire diked properties.
H-6	Protect remaining floodplains.
H-7	Restore natural hydrology and movement of sediment.
Riparian	
R-1	Protect intact riparian areas.
R-2	Acquire riparian properties.
R-3	Enhance riparian vegetation.
R-4	Restore riparian forest.
R-5	Increase native conifer component of riparian vegetation.
R-6	Fence livestock away from riparian areas.
R-7	Restore riparian buffers impacted by agricultural practices.
R-8	Restore topsoil in riparian buffers impacted by fill, compaction, agricultural practices, or other uses.
R-9	Educate and provide incentives to landowners to restore riparian conditions.

Measure ID	Description
Stormwater	
SW-1	Retrofit stormwater facilities to meet performance standards.
SW-2	Implement stormwater best management practices.
SW-3	Improve urban stormwater infrastructure to provide flow treatment.
SW-4	Use groundwater recharge and infiltration techniques as part of stormwater management strategy.
Non-native Species	
NN-1	Take aggressive measures to prevent the introduction of non-native invasive plant and animal species.
NN-2	Control invasive riparian vegetation.
NN-3	Use weed management and education to control invasive plant species.
Wetlands	
W-1	Protect wetland habitat.
W-2	Enhance and restore degraded wetland habitats.

Timeline Definitions:

Short-term (approximately 1-5 years) restoration projects include those that could be implemented by local landowners and volunteers and that would benefit the areas that are most in need. Short-term restoration efforts include habitat restoration and enhancement efforts in publicly owned areas. These projects could be implemented in the near term, depending on grant cycles and coordination with volunteer and community organizations.

Long-term (more than 5 years) restoration projects could be those that require coordination with other jurisdictions or that cover larger land areas. These projects may be more difficult to implement and would likely require additional planning and permitting.

LOWER COLUMBIA RIVER

WRIA 27

Lower Columbia River Floodplain



Impairments:

- Installation of levees that reduced floodplain width, channel migration and disconnected associated wetlands.
- Removal of sediment to maintain deep channels.
- Reduced variability of flow and delivery of sediments due to hydropower dams.
- Channelization, dredging, jetties, removal of wetlands, and isolation of wetlands from the former floodplain.
- Non-native and invasive species.
- Listed industrial facilities and contaminated sites.
- Degraded water quality.

Programmatic Restoration Opportunities:

- F-2, WQ-6, WQ-7, W-2, H-2, H-5, R-3 (see Table C5-1)
- Restore floodplain connectivity and connections between channels, sloughs, lakes, and mainstem.
- Protect rearing and spawning habitat.

Information Sources and Organizations:

- Lower Columbia Fish Recovery Board web page: <http://www.lcfrb.gen.wa.us/default1.htm>
- Lower Columbia River Estuary Partnership web site: <http://www.lcrep.org/restoration-projects-0>
- Columbia River Estuary Study Task Force (CREST), web site: <http://www.columbiaestuary.org/projects.html>

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed
	See other Lower Columbia River Restoration table, WRIA 28 (Appendix D)		

MUD LAKE	WRIA 27	North Fork Lewis River Tributaries & Lakes
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Impairments:

- Conversion of forests to residential uses.
- Increased magnitude, duration and frequency of peak flows and reduced summer base flows caused by increases in impervious surfaces.
- Discharge of turbid waters (e.g., gravel mining operations) affecting water quality.
- Invasive aquatic species.

Programmatic Restoration Opportunities:

- NN-3, W-1 (see Table C-1)
- Acquire properties to improve vegetative buffer and increase habitat diversity.
- Protect wetland habitat to minimize sedimentation and improve water quality.
- Preserve habitat for waterfowl and wildlife.

Information Sources and Organizations:

- Washington Wildlife and Recreation Commission, web site: <http://wildliferecreation.org/>
- Clark County Legacy Lands at: <http://www.clark.wa.gov/legacylands/index.html>

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
All	County is acquiring 340 acres of property on Mud Lake using WWRP grant and Conservation Futures funding.	High	Habitat connectivity	Short term

LANCASTER LAKE

WRIA 27

Lower Columbia River Tributaries & Lakes

Impairments:

- Altered connections to the Lower Columbia River, therefore reduction in periodic flooding of floodplain.
- Invasive plants and invasive non-native fish (i.e., carp).
- Loss of riparian forest and native plant diversity through agricultural use.

Programmatic Restoration Opportunities:

- NN-3, W-1 (see Table C-1)
- A 500-acre wetland mitigation bank is proposed north of and partially including Lancaster Lake, extending from the east bank of the North Fork Lewis River to the BNSF railroad tracks.
- Protect wetland habitat to minimize sedimentation and improve water quality.

Information Sources and Organizations:

- Joint Public Notice, Proposal for a Wetland Mitigation Bank, Clark County Mitigation Partners LLC, March 23, 2007.
- Friends of the Ridgefield National Wildlife Refuge, source of volunteers, web site: <http://www.ridgefieldfriends.org/index.php>
- National Wildlife Refuges, web site: <http://www.fws.gov/ridgefieldrefuges/complex/>
- Ridgefield National Wildlife Final Comprehensive Conservation Plan (USFWS, Sept. 2010): <http://www.fws.gov/ridgefieldrefuges/ridgefield/>

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
All	Lake currently in good stewardship under private ownership. However, long-term preservation of lake shoreline habitat through easement or purchase by USFWS Ridgefield NWR would be consistent with goals of the Conservation Plan	Medium	Habitat	Long term

HATHAWAY LAKE (or Fowler Lake)**WRIA 27****Lower Columbia River Tributaries & Lakes****Impairments:**

- Altered connections to the Lower Columbia River, therefore reduction in periodic flooding of floodplain.
- Invasive plants and invasive non-native fish (i.e, carp).
- Conversion of forest to railroad tracks and roads.
- Loss of riparian forest and native plant diversity

Programmatic Restoration Opportunities:

- NN-3, W-1 (see Table C-1)
- Protect wetland habitat to minimize sedimentation and improve water quality.
- Acquire properties adjacent to Hathaway Lake to protect waterfowl habitat and increase habitat diversity.

Information Sources and Organizations:

- Friends of the Ridgefield National Wildlife Refuge, source of volunteers, web site:
<http://www.ridgefieldfriends.org/index.php>
- National Wildlife Refuges, web site:
<http://www.fws.gov/ridgefieldrefuges/complex/>
- Ridgefield National Wildlife Final Comprehensive Conservation Plan and EA (USFWS, Sept. 2010):
<http://www.fws.gov/ridgefieldrefuges/ridgefield/>

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
All	Restore riparian floodplain forests to increase habitat complexity	High	Habitat	Short term
All	Remove four roads on south side of lake to enhance and improve habitat for dusky Canada geese.	High	Habitat	Long term

**Impairments:**

- Floodplains and channel migration zones confined by development.
- Channel alterations, bridge stream crossings, culverts and fish passage barriers.
- Bank erosion caused by livestock access and grazing.
- Lack of large woody debris.
- Degraded riparian habitat conditions due to invasive vegetation.
- Private dams and associated ponds along the mainstem and tributary reaches.
- Increased magnitude, duration and frequency of peak flows and reduced summer base flows caused by increases in impervious surfaces.
- Drainage ditches in fields and along roadways
- Contaminants from agriculture, livestock, stormwater runoff impair water quality.

Programmatic Restoration Opportunities:

- R-3, R-4, R-6, R-8, NN-2, WQ-4, WQ-13, F-4 F-6, W-1, SW-4 (see Table C1)
- Prevent riparian degradation through education and acquisition.
- Remove or stabilize small dams.

Information Sources and Organizations:

- Clark County Monitoring Documents web page: <http://www.clark.wa.gov/water-resources/documents-monitoring.html#volmon>.
- Clark County Public Works Clean Water Program. 2007 Stormwater Needs Assessment Program Upper Gee Creek / Lower Gee Creek / Cathlapotle Subwatershed Needs Assessment Report. <http://www.clark.wa.gov/water-resources/documents/SNAP/GeeCreekSNAPfinal.pdf>.
- Gee Creek Watershed Restoration Project web page: <http://clark.wsu.edu/natural/geeCreek.html>
- Gee Creek Watershed Restoration Background Report (Cornelius 2006).

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
Lower watershed	<ul style="list-style-type: none"> Acquire wetlands west of NW 51st Avenue and north of NW 289th Street. 	High	Protect stream flow and hydrology	Long term
Upper watershed	<ul style="list-style-type: none"> Reforest the floodplain and riparian corridor upstream of I-5. 	Medium	LWD, habitat, instream fish habitat	Short term
Lower watershed	<ul style="list-style-type: none"> Preserve intact forest areas between Royle Road and I-5. 	High	Protect stream flow and hydrology	Long term
Various	<ul style="list-style-type: none"> Upgrade stormwater facilities and outfalls at numerous locations noted in 2007 Stormwater Needs Assessment Program report. 	High	Hydrology	Long term
Various	<ul style="list-style-type: none"> Control invasive vegetation at numerous locations noted in 2007 Stormwater Needs Assessment Program report. 	High	Habitat	Short term
	<ul style="list-style-type: none"> Conduct further analysis of fish passage barriers and replace culverts as needed at numerous locations noted in 2007 Stormwater Needs Assessment Program report. 	Medium	Habitat for salmonids	Long term
	<ul style="list-style-type: none"> Assess and replace fish passage barriers at Union Pacific railroad crossing near mouth of Gee Creek. 	High	Habitat for salmonids	Long term
	<ul style="list-style-type: none"> Assess and replace fish passage barriers between Main Street and Royle Road. 	High	Habitat for salmonids	Long term



Impairments:

- Hydropower system impacts on channels, floodplains, flow, sediment transport, and LWD transport.
- Lower seven miles of river is diked primarily to protect agricultural uses.
- Lower seven to 15 miles of river are armored to protect residential, agricultural and transportation uses.
- Diking and channelization have reduced connection to floodplains and off channel habitat.
- Increase in impervious area.
- Bank armoring, levees, dredging, and gravel extraction.
- Cleared riparian areas.
- Limited availability of large woody debris.
- Leaking underground storage tanks.
- Impaired water quality.

Programmatic Restoration Opportunities:

- H-1 (lower river), H-3, H-6, H-7, R-5, R-8, F-1, F-2, F-3, F-6, WQ-10, NN-2 (see Table C-1)
- Continue to support LCFRB and LCREP in ongoing restoration activities
- Address agricultural and rural/suburban development impacts to floodplains and riparian areas for the middle reaches.
- Use land use controls to protect habitat and watershed processes for the middle reaches.

Information Sources and Organizations:

- Lower Columbia Fish Recovery Board web page: <http://www.lcfrb.gen.wa.us/default1.htm>.
- Lower Columbia River Estuary Partnership site: http://maps.lcrep.org/program/habitat_restoration
- R2 Resource Consultants. 2004. Kalama, Washougal and Lewis River Habitat Assessments - Chapter 3: The North Fork Lewis River Basin.
- Inter-fluve, Inc. et al. 2009. Lewis River – Eagle Island Project Identification and Design.
- Inter-fluve Inc. et al. 2008. Lewis River Large Woody Debris Assessment.
- Clark County 2010 Stream Health Report web page: <http://www.clark.wa.gov/water-resources/stream.html>.
- G. Wade. 2000. Salmon and Steelhead Habitat Limiting Factors - WRIA 27. <http://www.scc.wa.gov/index.php/291-WRIA-27-Lewis-Watershed/View-category.html>
- PacifiCorp. 2008. Lewis River Wildlife Habitat Management Plan.

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
LEW_RV_01	<ul style="list-style-type: none"> A 500-acre wetland mitigation bank is proposed along the North Fork Lewis River, north of the confluence with Gee Creek, which provides an opportunity to restore degraded pasture to floodplain wetlands, and restore habitat connectivity between the wildlife refuge, the rivers, and surrounding agricultural fields. 	High	Habitat, LWD	Long term
LEW_RV_01	<ul style="list-style-type: none"> Restore tidal slough and floodplain forest habitats at the confluence of the Lewis and Columbia Rivers. 	High	Habitat, Hydrology	Long term
LEWI_RV_02, LEWI_RV_03	<ul style="list-style-type: none"> Preserve and restore floodplain habitats at RM 2 to 3 and RM 13 to 15. 	High	Habitat, Hydrology	Long term
Reach 1	<ul style="list-style-type: none"> Complete high priority projects identified in the Lewis River – Eagle Island Project Identification and Design Report including enhancement of: existing side channel habitat, channel dynamics, LWD, riparian habitat, and existing backwater habitat. 	High	Habitat, Hydrology	Short term
All Reaches	<ul style="list-style-type: none"> Add LWD in the lower main channel and side channels; several locations for LWD placement are identified up to RM 18.6. 	High	LWD	Long term
All Reaches	<ul style="list-style-type: none"> Add large wood to existing armored banks during future maintenance or repair activities from mouth to RM 15. 	Medium	LWD	Long term
LEWI_RV_02	<ul style="list-style-type: none"> Limit intensive recreational use of stream channel during adult salmonid holding and spawning periods, between Woodland and Merwin Dam. 	Medium/High		Long term

LAKE MERWIN**WRIA 27****North Fork Lewis River Tributaries & Lakes****Impairments:**

- Impoundment of the Lewis River upstream of Merwin Dam.
- Hydroelectric dam and facilities.
- Fish passage barriers.
- Impaired water quality.

Programmatic Restoration Opportunities:

- Encourage PacifiCorp Energy with implementation of the Lewis River Wildlife Habitat Management Plan.
- Coordinate with PacifiCorp as they reintroduce anadromous fish upstream of the dams.
- Work with PacifiCorp as they administer their Lewis River Aquatics Fund, to support projects to enhance and improve wetlands, riparian, and riverine habitats in support of salmonid recovery.

Information Sources and Organizations:

- Lower Columbia Fish Recovery Board web page: <http://www.lcfrb.gen.wa.us/default1.htm>.
- PacifiCorp: <http://www.pacificorp.com/index.html>

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
MERW_LK_01 and 02	Protect existing riparian forest	High	LWD, Habitat	Long term

YALE RESERVOIR

WRIA 27

North Fork Lewis River Tributaries & Lakes



Impairments:

- Impoundment of the North Fork Lewis River behind Yale Dam.
- Hydroelectric dam and facilities.
- Blocks natural fish passage.
- Water quality affected by impoundment.

Programmatic Restoration Opportunities:

- NN-2, R-3 (see Table C-1)
- Encourage PacifiCorp Energy with implementation of the Lewis River Wildlife Habitat Management Plan.
- Coordinate with PacifiCorp as they reintroduce anadromous fish upstream of the dams.
- Work with PacifiCorp as they administer their Lewis River Aquatics Fund, to support projects to enhance and improve wetlands, riparian, and riverine habitats in support of salmonid recovery.
- Recent preservation of forested shoreline for elk habitat (<http://lewisriver.com/valley/01-11-elk.pdf>).

Information Sources and Organizations:

- Lower Columbia Fish Recovery Board web page: <http://www.lcfrb.gen.wa.us/default1.htm>.
- PacifiCorp: <http://www.pacificorp.com/index.html>
- Lewis River Valley Information web page: <http://lewisriver.com/valley/>

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
YALE_LK_01	<ul style="list-style-type: none"> • Work with PacifiCorp to reduce total dissolved gas at outlet. 	High	Water quality	Short term

HORSESHOE LAKE

WRIA 27

North Fork Lewis River Tributaries & Lakes



Impairments:

- High nutrient levels causing excessive algal growth.
- Invasive aquatic plants including Eurasian milfoil.
- Poor water quality due to lack of water flow and urban runoff.
- Interstate 5 disconnects Horseshoe Lake from the Lewis River floodplain.
- Excess sedimentation in the lake from residential development.
- Shoreline erosion from boat wakes and/or development.

Programmatic Restoration Opportunities:

- WQ-13, R-3, R-8, NN-2, W-1 (see Table C-1)
- Educate landowners on lawn maintenance practices to reduce nutrient input.

Information Sources and Organizations:

- Lewis River valley web site:
<http://lewisriver.com/horseshoe.html>
- City of Woodland Parks, web site:
<http://www.ci.woodland.wa.us/Dept/ParksRec/cityparks.htm>
- Ecology Water Quality Assessment and Lake Restoration program, web site:
http://www.ecy.wa.gov/programs/eap/lakes/wq/lk_man.html

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
All	City of Woodland planted trees in March 2010. Coordinate with Woodland to continue planting native trees in the riparian zone.	High	LWD, Shade and Habitat	Short term

UNNAMED LAKE 1**WRIA 27****North Fork Lewis River Tributaries & Lakes****Impairments:**

- Increased runoff caused by increases in impervious surfaces.
- Runoff from adjacent highways, I-5 and NW Pacific Highway.
- Lack of riparian forest vegetation.

Programmatic Restoration Opportunities:

- NN-2, R-3, SW-1, SW-2, SW-3, SW-4 (see Table C-1)
- Work with private property owner to restore riparian areas.

Information Sources and Organizations:

- None available.

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
All	Restore riparian areas with planting of native trees	Medium	Habitat, LWD, Water Quality	Short term
All	Use best management practices in agriculture.	Medium	Water Quality	Long term

CEDAR CREEK

WRIA 27

North Fork Lewis River Tributaries & Lakes



Impairments:

- Deforestation has resulted in erosion.
- Lack of large woody debris.
- Poor substrate conditions between headwaters and Pup Creek.
- Rural residential and agricultural uses have impacted riparian areas and floodplains.
- Confined floodplains.
- Streambank instability and degraded riparian buffers, especially between Pup Creek and Chelatchie Creek (RM 11.2) due to logging, grazing, residential development.

Programmatic Restoration Opportunities:

- H-3, R-3, R-5, R-8, W-2, F-2, F-3, F-5, F-6, WQ-4, WQ-5, WQ-10, SW-1, SW-2, SW-3, SW-4, NN-2 (see Table C-1)
- Preserve and enhance Cedar Creek spawning habitats.

Information Sources and Organizations:

- R2 Resource Consultants, Inc. 2004. Kalama, Washougal and Lewis River Habitat Assessments - Chapter 3: The North Fork Lewis River Basin.
- Lower Columbia Fish Recovery Board web page: <http://www.lcfrb.gen.wa.us/default1.htm>.
- Friends of the East Fork Lewis River web page: <http://www.eastforklewisriver.org/river-restoration.html>.
- Fish First web page: <http://www.fishfirst.org>.

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
CEDA_CR_01	<ul style="list-style-type: none"> • Restore riparian habitats 	High	Habitat	Long term
CEDA_CR_02	<ul style="list-style-type: none"> • Survey for and control invasive weeds and maintain riparian plantings (i.e., Cedar Creek Wildlife Area). 	High	Habitat	Short term

PUP CREEK**WRIA 27****North Fork Lewis River Tributaries & Lakes****Impairments:**

- Conversion of forests to agriculture, residential development and roads.
- Degraded in-stream habitats and processes due to residential development and forestry activities.

Programmatic Restoration Opportunities:

- Educate and provide incentives to landowners to restore riparian conditions.
- Use of agricultural BMP's to protect water quality.

Information Sources and Organizations:

- Lower Columbia Fish Recovery Board web page: <http://www.lcfrb.gen.wa.us/default1.htm>.

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
All	Work with landowners to restore riparian vegetation	Medium	LWD, shade, habitat	Long term

CHELATCHIE CREEK**WRIA 27****North Fork Lewis River Tributaries & Lakes****Impairments:**

- Oversupply of fine sediments.
- Disruption of sediment supply to the stream by roads and riparian degradation.
- Lack of large woody debris.
- Streambank erosion and degradation due to livestock access.

Programmatic Restoration Opportunities:

- H-3, WQ-8, R-3, R-5, R-6, SW-1, SW-2, SW-3, SW-4, NN-2, F-6, W-1, W-2 (see Table C-1)

Information Sources and Organizations:

- Lower Columbia Fish Recovery Board web page: <http://www.lcfrb.gen.wa.us/default1.htm>.
- R2 Resource Consultants, Inc. 2004. Kalama, Washougal and Lewis River Habitat Assessments - Chapter 3: The North Fork Lewis River Basin.
- The Conservation Registry, web: <http://www.conservationregistry.org/projects/3200>
- Fish First: <http://www.fishfirst.org/projects.htm>

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
Lower watershed	<ul style="list-style-type: none"> • Protect and enhance wetland complexes in the lower two miles to provide overwintering and rearing habitat for coho salmon. 	High	Hydrology, Habitat	Long term
All	<ul style="list-style-type: none"> • Restoration of riparian areas and fencing to limit livestock access along 2,400 feet of Chelatchie Creek. A joint project by NRCS, Clark Conservation District, Fish First and a private landowner. http://www.conservationregistry.org/projects/3200 	High	Habitat, LWD	Short term

UNNAMED TRIBUTARY TO CHELATCHIE CREEK

WRIA 27

North Fork Lewis River Tributaries & Lakes

Impairments:

- Disruption of sediment supply to the stream by roads and riparian degradation.
- Lack of large woody debris.
- Streambank erosion and degradation due to livestock access.

Programmatic Restoration Opportunities:

- R-3, R-5, R-6, NN-2, F-6, SW-4, H-3 (see Table C-1)

Information Sources and Organizations:

- Lower Columbia Fish Recovery Board web page: <http://www.lcfrb.gen.wa.us/default1.htm>.
- R2 Resource Consultants, Inc. 2004. Kalama, Washougal and Lewis River Habitat Assessments - Chapter 3: The North Fork Lewis River Basin.

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
UCHE_CK_01	Protection of associated wetlands in the upper watershed	High	Habitat, Hydrology, Protection of stream baseflow	Long term

CANYON CREEK**WRIA 27****North Fork Lewis River Tributaries & Lakes****Impairments:**

- Removal of timber in the upper watershed affecting runoff and water quality downstream.
- Lack of riparian vegetation.
- Elevated stream temperatures
- Landslides and bank instability due to increased surface water flows

Programmatic Restoration Opportunities:

- R-1, R-4, F-9, NN-2 (see Table C-1)
- Protect potential bull trout spawning areas by restoring riparian areas and controlling erosion/sedimentation.

Information Sources and Organizations:

- Lower Columbia Fish Recovery Board web page: <http://www.lcfrb.gen.wa.us/default1.htm>.
- Clark County 2010 Stream Health Report web page: <http://www.clark.wa.gov/water-resources/stream.html>.

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
All reaches	Protect riparian areas and restore riparian forests	High	LWD, water quality improvement	Long term
CANY_CR_02	Restore riparian forest and trees in upper watershed	Medium	LWD, water quality improvement	Long term

FLY CREEK**WRIA 27****North Fork Lewis River Tributaries & Lakes****Impairments:**

- Removal of trees in the upper watershed.
- Lack of riparian vegetation.
- Elevated stream temperatures

Programmatic Restoration Opportunities:

- WQ-10, R-4, F-5, NN-2 (see Table C-1).

Information Sources and Organizations:

- Lower Columbia Fish Recovery Board web page: <http://www.lcfrb.gen.wa.us/default1.htm>.
- Clark County Stream Health Report 2010

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
FLY_CR_01	Restore riparian forest by tree planting within 200 feet of OHWM	Medium	LWD, water quality and temperature improvement	Long term

SIouxON CREEK**WRIA 27****North Fork Lewis River Tributaries & Lakes****Impairments:**

- Removal of forest in the upper watershed.
- Inundation due to dam creating Yale Reservoir
- Dams are barrier to natural fish passage.

Programmatic Restoration Opportunities:

- WQ-10, R-4, F-5, NN-2 (see Table C-1)

Information Sources and Organizations:

- Lower Columbia Fish Recovery Board web page: <http://www.lcfrb.gen.wa.us/default1.htm>.
- Clark County 2010 Stream Health Report web page: <http://www.clark.wa.gov/water-resources/stream.html>.

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
SIOU_CR_01	Protect forested riparian zones	High	LWD, Habitat	Long term

NORTH SIOUXON CREEK**WRIA 27****North Fork Lewis River Tributaries & Lakes****Impairments:**

- Removal of forest in the upper watershed.
- Inundation due to dam creating Yale Reservoir
- Dam is fish passage barrier

Programmatic Restoration Opportunities:

- WQ-10, R-4, F-5, NN-2 (see Table C-1)

Information Sources and Organizations:

- Lower Columbia Fish Recovery Board web page:
<http://www.lcfrb.gen.wa.us/default1.htm>.
- Clark County Stream Health Report 2010

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
All	Work with landowners to revegetate riparian areas	Medium	LWD, shade, habitat	Long term



Impairments:

- Deforestation has reduced quality of riparian habitat.
- Wildfires have removed forested cover and increased sediment loading.
- Decline in LWD inputs to stream channel and floodplain.
- Agricultural ditching and runoff.
- Livestock access to stream causing streambank erosion.
- Bank armoring, levees, bridges, floodplain fill resulting in channel confinement and loss of processes that allow meanders to form.
- Predation on native salmonids by non-native warm water fish species in lower sections of river.
- Invasive vegetation in aquatic and riparian areas.
- Gravel mining has contributed to loss of floodplain function and channel instability.
- Failing culverts in tributaries to the river.
- Degraded water quality – TMDL under development for fecal coliform and temperature.

Programmatic Restoration Opportunities:

- H-1, H-2, H-3, H-7, WQ-1, WQ-4, WQ-5, WQ-9, WQ-10, WQ-12, R-4, R-6, NN-2, F-3, F-5, F-6, SW-1, SW-2, SW-3, SW-4, W-2 (see Table C-1)
- Protect intact middle and upper stream reaches.
- Monitor water temperatures and groundwater connectivity to support off-channel enhancement projects.

Information Sources and Organizations:

- East Fork Lewis Working Group. 2009. Lower East Fork Lewis River Habitat Restoration Plan.
- Friends of the East Fork Lewis River web page: <http://www.eastforklewisriver.org/>
- Clark County 2010 Stream Health Report web page: <http://www.clark.wa.gov/water-resources/stream.html>.
- Clark County Stormwater Needs Assessment Program (SNAP) reports: <http://www.co.clark.wa.us/water-resources/documents>.
- Lower Columbia Fish Recovery Board web page: <http://www.lcfrb.gen.wa.us/default1.htm>.
- G. Wade. 2000. Salmon and Steelhead Habitat Limiting Factors - WRIA 27. <http://www.scc.wa.gov/index.php/291-WRIA-27-Lewis-Watershed/View-category.html>
- Ecology. 2010. Water Quality Improvement Projects (TMDLs) – Clark County projects. Available: <http://www.ecy.wa.gov/programs/wq/tmdl/overview.html>. Accessed February 2010.

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
EFLE_RV_03	<ul style="list-style-type: none"> Numerous restoration opportunities are identified on County and private properties near Lewisville Regional Park and Lewis River Ranch, including off-channel and side channel enhancement, streambank and in-channel enhancement, streambank stabilization, and riparian restoration. 	High	Hydrology, in-stream habitat, LWD	Short term (public properties) Long term (private properties)
EFLE_RV_03	<ul style="list-style-type: none"> Side channel enhancement, levee removal, off-channel restoration, in-channel and streambank enhancement at and near Daybreak Regional Park. 	High	Hydrology, in-stream habitat, LWD	Short term
EFLE_RV_03	<ul style="list-style-type: none"> Evaluate risk of channel avulsion into Daybreak Pits located in floodplain at RM 7.3 to 9.5; assess impact of existing levees; explore options to restore habitat. 	High	Hydrology	Long term
EFLE_RV_03	<ul style="list-style-type: none"> Off-channel restoration at mouth of Manley Creek. 	High	Habitat	Long term
EFLE_RV_03	<ul style="list-style-type: none"> Streambank restoration and in-channel habitat enhancement at power line crossing. 	High	Habitat	Long term
EFLE_RV_03	<ul style="list-style-type: none"> Remove riprap near airstrip, enhance in-channel and off-channel habitat, revegetate riparian area. 	Medium	Habitat	Long term
EFLE_RV_02	<ul style="list-style-type: none"> Revegetate riparian zone between Mason Creek and Ridgefield Pits. 	Medium	Habitat, LWD	Short term
EFLE_RV_02	<ul style="list-style-type: none"> Remove or set back levee on County owned Schaeffer property (RM 5). 	High	Channel migration, hydrology	Long term
EFLE_RV_01	<ul style="list-style-type: none"> Remove or set back levees on County owned property in La Center Bottoms (RM 3.2 to 4.4). 	High	Channel migration, hydrology	Long term
EFLE_RV_01	<ul style="list-style-type: none"> Riparian reforestation and wetland creation on Dyer Creek within East Fork Lewis River Greenway. 	High	Habitat, Surface water and stream baseflow	Short term
Various	<ul style="list-style-type: none"> Upgrade stormwater facilities and outfalls at numerous locations noted in SNAP reports. 	Medium	Surface water and stream baseflow	Long term
Various	<ul style="list-style-type: none"> Control invasive vegetation at numerous locations noted in SNAP reports. 	Medium	Habitat, LWD	Short term

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
Various	<ul style="list-style-type: none"> Work with landowners to apply agricultural BMPs at numerous locations noted in SNAP reports. 	High	Water quality	Long term
Various	<ul style="list-style-type: none"> Conduct further analysis of fish passage barriers and replace culverts as needed at numerous locations noted in SNAP reports. 	High	Habitat for Salmonids	Long term

LOCKWOOD CREEK**WRIA 27****East Fork Lewis River Tributaries & Lakes****Impairments:**

- Conversion of forests to residential development and high road density.
- Increased magnitude, duration and frequency of peak flows and reduced summer base flows caused by increases in impervious surfaces.
- Lack of floodplain connectivity.
- Lack of functioning pieces of large woody debris.
- Impaired water quality including elevated water temperatures and sediment levels.
- Potential fish passage barriers at road crossings.

Programmatic Restoration Opportunities:

- WQ-1, WQ-5, WQ-8, H-2, H-3, F-4, F-6, R-3, R-5, R-8, NN-2, W-1, W-2, SW-4 (see Table C-1)

Information Sources and Organizations:

- Clark County Clean Water Program. 2007 Stormwater Needs Assessment Program Lockwood Creek Subwatershed Needs Assessment Report. <http://www.clark.wa.gov/water-resources/documents/SNAP/LockwoodSNAPfinal.pdf>.
- Lower Columbia Fish Recovery Board web page: <http://www.lcfrb.gen.wa.us/default1.htm>.
- Clark Public Utilities, monitoring web page: <http://www.clarkpublicutilities.com/ourenvironment/streamTeam/monitoring>

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
Upper watershed	Complete riparian restoration project north of Lockwood Creek Road.	Medium	Habitat	Short term

MASON CREEK**WRIA 27****East Fork Lewis River Tributaries & Lakes****Impairments:**

- Conversion of forests to residential development and high road density.
- Degraded watershed conditions.
- Channel stability falls within a “zone of uncertain stability”.
- Impaired water quality (elevated temperature and fecal coliform).
- Channel simplification and incision, historic channel realignment for agricultural uses.
- Lack of woody cover in riparian zones.
- Invasive plant species.
- Fish passage barriers at road crossings.

Programmatic Restoration Opportunities:

- H-2, F-4, F-5, R-3, WQ-1, WQ-9, WQ-13, W-1, W-2, SW-4 (see Table C-1)
- Educate and provide incentives to landowners to restore riparian conditions, reduce nutrient inputs.
- Remove ponds in headwater tributaries.

Information Sources and Organizations:

- Clark County Public Works Clean Water Program. 2007 Stormwater Needs Assessment Program Mason Creek Subwatershed Needs Assessment Report. <http://www.clark.wa.gov/water-resources/documents/SNAP/MasonCreekSNAPfinal.pdf>.
- East Fork Lewis Working Group. 2009. Lower East Fork Lewis River Habitat Restoration Plan.
- Lower Columbia Fish Recovery Board web page: <http://www.lcfrb.gen.wa.us/default1.htm>.

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
MASON_CK-01	<ul style="list-style-type: none"> • Enhance channel structure and habitat, revegetate riparian areas along lower Mason Creek. 	Medium	LWD, shade, in-channel habitat	Long term
MASON_CK-01	<ul style="list-style-type: none"> • Enhance channel structure and habitat near Anderson Road crossing (RM 3.2 to 3.6). 	Medium	in-channel habitat	Long term

ROCK CREEK (LOWER)**WRIA 27****East Fork Lewis River Tributaries & Lakes****Impairments:**

- Lack of riparian vegetation causes streambank instability and erosion.
- Limited floodplain connectivity.
- Impaired stream function (hydroperiod) caused by water diversions.
- Failing culverts and fish passage barriers.
- Invasive vegetation in riparian areas.
- Streambank armoring and incised channels.
- Poor pool quantity and substrate.
- Lack of large woody debris.
- Impaired water quality.
- Agricultural runoff and livestock access to stream.

Programmatic Restoration Opportunities:

- H-3, WQ-2, WQ-4, WQ-5, WQ-12, R-4, R-5, R-8, F-3, F-4, F-5, F-6, NN-2, W-1, W-2, SW-1, SW-4 (see Table C-1)
- Control reed canarygrass and Himalayan blackberry.
- Educate and provide incentives to landowners to restore riparian and stream channel habitat; reduce nutrient inputs.
- Investigate and potentially remove small dams.

Information Sources and Organizations:

- Clark County Public Works Clean Water Program. 2009. 2008 Stormwater Needs Assessment Program - Rock Creek (North)/East Fork Lewis River (RM 15.75) Subwatershed Needs Assessment Report.
- Lower Columbia Fish Recovery Board web page: <http://www.lcfrb.gen.wa.us/default1.htm>.

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
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Various	• Upgrade stormwater facilities and outfalls at numerous locations noted in 2008 Stormwater Needs Assessment Program report.	High	Water quality	Long term
Various	• Control invasive vegetation at numerous locations noted in 2008 Stormwater Needs Assessment Program report.	High	Habitat	Short term

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
Various	<ul style="list-style-type: none"> Work with landowners to apply agricultural BMPs at numerous locations noted in 2008 Stormwater Needs Assessment Program report. 	High	Water quality	Short term
ROC1_01	<ul style="list-style-type: none"> Reforest riparian areas immediately downstream from Rock Creek Road bridge. 	Medium	Habitat, shade, LWD	Long term
ROC1_01	<ul style="list-style-type: none"> Reforest riparian areas in upper reaches within DNR land and near Farger Lake. 	Medium	Habitat, shade, LWD	Long term

BIG TREE CREEK**WRIA 27****East Fork Lewis River Tributaries & Lakes****Impairments:**

- Sub-basin is heavily logged and surface water runoff has increased in the watershed.
- Conversion of forests to impervious surfaces.
- Impaired water quality.

Programmatic Restoration Opportunities:

- WQ-1, WQ-10, F-5, R-4, W-1, W-2, SW-4 (see Table 5C-1)

Information Sources and Organizations:

- Clark County Public Works Clean Water Program. 2008 Stormwater Needs Assessment Program- Big Tree Creek/East Fork Lewis River (RM 26.30)/King Creek Subwatershed Needs Assessment Report. <http://www.co.clark.wa.us/water-resources/documents/SNAP/2008/BigTreeSNAPReport.pdf>
- Lower Columbia Fish Recovery Board web page: <http://www.lcfrb.gen.wa.us/default1.htm>.

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed
<u>Lower reaches</u>	No site-specific opportunities <u>Work with private landowners to re-vegetate riparian areas.</u>	<u>Moderate</u>	<u>LWD, shade, habitat</u>

YACOLT CREEK	WRIA 27	East Fork Lewis River Tributaries & Lakes
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- Impairments:**
- Conversion of forests to impervious surfaces; especially high road density.
 - Impaired water quality.
 - Loss of riparian forest to logging, agriculture, and residential use.
 - Invasive vegetation in riparian areas.
 - Lack of large woody debris.

- Programmatic Restoration Opportunities:**
- NN-2, R-4, WQ-1, WQ-5, SW-4, F-9, W-1, W-2 (see Table C-1)
 - Coordinate stormwater management activities with the Town of Yacolt

- Information Sources and Organizations:**
- Clark County Public Works Clean Water Program. 2009. 2008 Stormwater Needs Assessment Program – Yacolt Creek/East Fork Lewis River (RM 21.40) Subwatershed Needs Assessment Report. April 2009.
 - Cramer, S.P. & Associates, Inc. (January 2005). Chapter 4: East Fork Lewis River Basin – Habitat Assessment, report prepared for the Lower Columbia Fish Recovery Board under contract to Clark County Water Resources.

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
All reaches	Restore riparian forest zones	Medium	Habitat, LWD	Long term

KING CREEK	WRIA 27	East Fork Lewis River Tributaries & Lakes
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Impairments:

- Impaired substrate.
- Lack of large woody debris due to timber harvest.
- Impaired water quality.
- Riparian zones lack forest cover.

Programmatic Restoration Opportunities:

- R-3, R-5, R-8, F-5, F-6, W-1, WQ-10 (see Table C-1)
- Prevent riparian degradation through education and acquisition.
- Undertake selective clearing and replant riparian areas with native trees, particularly conifers.

Information Sources and Organizations:

- Lower Columbia Fish Recovery Board web page: <http://www.lcfrb.gen.wa.us/default1.htm>.

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
All	<ul style="list-style-type: none"> • Restore vegetative canopy in logged areas to improve shading of pool and braided channel habitats and reduce the potential for erosion. 	High	LWD, shade, habitat	Long term

COPPER CREEK**WRIA 27****East Fork Lewis River Tributaries & Lakes****Impairments:**

- Timber harvest in upper watershed has affected stream flow and erosion.

Programmatic Restoration Opportunities:

- R-3, R-5, R-8, WQ-1, WQ-10, F-5, F-6, W-1 (see Table C-1)
- Prevent riparian degradation through education and acquisition.
- Undertake selective clearing and replant riparian areas with native trees, particularly conifers.

Information Sources and Organizations:

- Lower Columbia Fish Recovery Board web page: <http://www.lcfrb.gen.wa.us/default1.htm>.

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
All reaches	<ul style="list-style-type: none"> • Install LWD to increase the formation of pools and offset time required for conifers planted along streambanks to be mature. 	High	Habitat, LWD	Long term

ROCK CREEK (UPPER)**WRIA 27****East Fork Lewis River Tributaries & Lakes****Impairments:**

- Logging road crossings and culverts.
- “Poor” or “not properly functioning” pool quantity, due largely to the topography and stream gradient.
- “Not properly functioning” LWD.
- Impaired water quality

Programmatic Restoration Opportunities:

- WQ-1, WQ-10, R-3, R-5, R-8, F-5, F-6, W-1, W-2, SW-4 (see Table C-1)
- Undertake selective clearing and replant riparian areas with native trees, particularly conifers.
- Prevent riparian degradation through education and acquisition.

Information Sources and Organizations:

- Clark County Public Works Clean Water Program. 2008 Stormwater Needs Assessment Program- Cedar Creek (East Fork)/Lower Rock Creek (South)/Upper Rock Creek (South) Subwatershed Needs Report. <http://www.co.clark.wa.us/water-resources/documents/SNAP/2008/CedarEFSNAPreport.pdf>.
- Lower Columbia Fish Recovery Board web page: <http://www.lcfrb.gen.wa.us/default1.htm>.

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
All reaches	<ul style="list-style-type: none"> • Install LWD to increase the formation of pools and offset time required for conifers planted along streambanks to be mature. 	High	Habitat, LWD	Long term
ROC3_CR_01 and 02	<ul style="list-style-type: none"> • Revegetate riparian areas along the lower reaches that have been impacted by residential development and downstream of the Dole Valley Road crossing. 	High	Habitat, LWD	Short term

CEDAR CREEK (EAST FORK LEWIS RIVER TRIBUTARY)

WRIA 27

East Fork Lewis River Tributaries & Lakes

Impairments:

- Logging road crossings and culverts.
- High water temperatures and summer low flow issues
- Lack of LWD and in-stream habitat

Programmatic Restoration Opportunities:

- R-3, R-5, R-8, WQ-1, WQ-10, F-5, F-6, SW-4, W-1, W-2 (see Table C-1)
- Undertake selective clearing and replant riparian areas with native trees, particularly conifers.
- Acquire riparian areas and preserve habitat.

Information Sources and Organizations:

- Clark County Public Works Clean Water Program. 2008 Stormwater Needs Assessment Program- Cedar Creek (East Fork)/Lower Rock Creek /Upper Rock Creek (South) Subwatershed Needs Report. <http://www.co.clark.wa.us/water-resources/documents/SNAP/2008/CedarEFSNAPPrep ort.pdf>.
- Friends of East Fork Lewis River, web site: <http://www.eastforklewisriver.org/river-restoration.html>

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
All reaches	<ul style="list-style-type: none"> • Install LWD to increase the formation of pools and offset time required for conifers planted along streambanks to be mature. 	High	Habitat, LWD	Long term

COYOTE CREEK	WRIA 27	East Fork Lewis River Tributaries & Lakes
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Impairments:

- Logging road crossings and culverts.
- Timber harvest in the upper watershed affects stream flow and water quality.

Programmatic Restoration Opportunities:

- R-3, R-5, R-8, WQ-1, WQ-10, F-5, F-6, W-1, W-2, SW-4 (see Table C-1)
- Undertake selective clearing and replant riparian areas with native trees, particularly conifers.
- Prevent riparian degradation through education and acquisition.

Information Sources and Organizations:

- None identified

Reach or Location	Site-Specific Restoration Opportunities	Relative Priority of Actions	Ecosystem Functions Addressed	Timeline
All reaches	<ul style="list-style-type: none"> • Install LWD to increase the formation of pools and offset time required for conifers planted along streambanks to be mature. 	High	Habitat, LWD	Long term