

2010 Stormwater Needs Assessment Program

North Fork Lewis River (Lower) Subwatershed Needs Assessment Report

Clark County Department of Environmental Services

March 2011



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Responsible County Officials

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Project Code: SNAP
Department: Clark County Department of Environmental Services
Funding source: Clark County Clean Water Fee
Reporting Category: 4420 000 531 534 245 011403

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Acknowledgements

Development of Stormwater Needs Assessment reports is a team effort involving many individuals implementing various tools and tasks as described in Stormwater Needs Assessment Program, Volume I.

Thank you to staff who contributed chapters or support for this report, including: Cary Armstrong, Brent Davis, George Fornes, Holley Gilbert, Chad Hoxeng, Bob Hutton, Forest Shuler, Cindy Stienbarger, and Ian Wigger.

Special thanks to local agency staff and interested parties who provided discussion, coordination, and project suggestions, including:

- Patrick Lee, Clark County Office of Conservation Lands Management
- Joel Rupley, Clark County Endangered Species Act
- Jeroen Kok, Clark Parks and Recreation

Acronyms and Abbreviations

B-IBI	Benthic Macroinvertebrate Index of Biological Integrity
BOCC	Board of County Commissioners
BMP	Best Management Practices
CCD	Clark Conservation District
CIP	Capital Improvement Program
CPU	Clark Public Utilities
CRFPO	Columbia River Fisheries Program Office
CWA	Clean Water Act
CWC	Clean Water Commission
CWP	Clean Water Program
DNR	Department of Natural Resources
EDT	Ecosystem Diagnostic and Treatment model
EIA	Effective Impervious Area
EIM	Environmental Information Management
EMAP	Environmental Mapping and Assessment
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FPIA	Focused Public Investment Area
FWS	Fall, Winter, Spring
GCEC	Gee Creek Watershed Enhancement Committee
GIS	Geographic Information System
GMA	Growth Management Act
GPS	Geographic Positioning System
HPA	Hydraulic Project Approval
IDDE	Illicit Discharge Detection and Elimination
LCFEG	Lower Columbia Fish Enhancement Group
LCFRB	Lower Columbia Fish Recovery Board
LID	Low-Impact Development
LiDAR	Light Detection and Ranging
LISP	Long-term Index Site Project
LWD	Large Woody Debris
MS4	Municipal Separate Storm Sewer System
MOP	Mitigation Opportunities Project
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NTU	Nephelometric Turbidity Unit
NWIFC	Northwest Indian Fisheries Commission
ODEQ	Oregon Department of Environmental Quality

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OWQI	Oregon Water Quality Index
PFC	Properly Functioning Condition
RM	River Mile
SCIP	Stormwater Capital Improvement Program
SCIPIT	Stormwater Capital Improvement Program Involvement Team
SCMP	Salmon Creek Monitoring Project
SCWC	Salmon Creek Watershed Council
SNAP	Stormwater Needs Assessment Program
SWMP	Stormwater Management Program
SWMMWW	Stormwater Management Manual for Western Washington
TIA	Total Impervious Area
TIP	Transportation Improvement Program
TIR	Technical Information Report
TMDL	Total Maximum Daily Load
TP	Total Phosphorus
UGA	Urban Growth Area
UIC	Underground Injection Control
USFS	U.S. Forest Service
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
VBLM	Vacant Buildable Lands Model
VLWP	Vancouver Lake Watershed Partnership
WAC	Washington Administrative Code
WCC	Washington Conservation Commission
WDFW	Washington Department of Fish and Wildlife
WRIA	Water Resource Inventory Area
WSDOT	Washington Department of Transportation
WSU	Washington State University

Executive Summary

Study Area

This Stormwater Needs Assessment report includes the North Fork Lewis River (Lower) subwatershed.

Intent

Stormwater Needs Assessment reports compile and provide summary information relevant to stormwater management, propose stormwater-related projects and activities to improve stream health, and assist with adaptive management of the county's Stormwater Management Program. Assessments are conducted at a subwatershed scale, providing a greater level of detail related to stormwater management than regional Water Resource Inventory Area (WRIA) or Endangered Species Act (ESA) plans. Stormwater Needs Assessments are not comprehensive watershed plans or stormwater basin plans.

Findings

Watershed Conditions

The table on the following page summarizes conditions in the study area including water quality, biological health, habitat, hydrology and the stormwater system.

Ongoing Projects and Involvement

Current projects sponsored by Lower Columbia Fish Recovery Board (Lower East Fork Lewis River Restoration Plan) include land acquisition, channel restoration, riparian and stream bank revegetation, and aquatic habitat enhancement and restoration. Natural resources in the study area are managed with the help of Clark County under several programs in Environmental Services, Public Works and Vancouver-Clark Parks.

In the study area, there are no planned projects in the Stormwater Capital Program or 2010-2015 Clark County Transportation Improvement Program.

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Category	Status
Water Quality Overall Fecal coliform bacteria Pesticides, PCBs, PAHs Toxics Sediment	<ul style="list-style-type: none"> • Limited data, presumably fair to good • No listing • Nearly compliance with established human health criteria • No detections were recorded. • No data
Biological Benthic macroinvertebrates Anadromous fish	<ul style="list-style-type: none"> • No data • Chum, coho, fall and spring Chinook, summer and winter steelhead; presumed presence of bull trout
Habitat NOAA Fisheries criteria Riparian Wetland	<ul style="list-style-type: none"> • Forest cover and road density fall into the Non-Functioning category • Stream crossing density and estimated effective impervious area fall into the Properly Functioning category • Riparian conditions rated as moderately impaired to impaired • Large woody debris recruitment potential primarily low to moderate • Shade levels off-target with respect to the State Forest Practices shade/elevation screen standards • Primarily limited main channels of the river and its tributaries
Hydrology and Geomorphology Overall hydrology Future condition	<ul style="list-style-type: none"> • No hydrologic data is available but likely typical for a partly forested rural watershed • Project impervious area should remain at levels that do not alter hydrology if forest cover is retained or expanded
Stormwater (unincorporated areas) System description Inventory status System adequacy System condition	<ul style="list-style-type: none"> • Primarily road-side ditches; seven stormwater facilities • Complete • Adequate treatment is probably provided by vegetation in ditches • Minimal flow control other than infiltration in ditches • Minimal screening was performed • Largely undocumented but presumed functional

Opportunities

Projects listed in the SNAP report represent only a small part of those needed to protect and restore streams within the assessment area. Field work and review of existing information identified numerous projects and actions that can improve stream conditions, including:

- Technical assistance visits to landowners and businesses with potential source control problems and water quality ordinance issues
- Focused stormwater outreach and education to streamside landowners
- Continue to expand efforts to design and build runoff reduction strategies in county right-of-way
- Evaluation of wetland and riparian enhancement projects in areas having conservation covenants
- Small or large-scale invasive plant removal and riparian restoration projects.
- Continue research and mapping new stormwater infrastructure with the goal of maintaining a complete stormwater infrastructure inventory
- Evaluation of several potential Growing Green projects

Non-project stormwater management recommendations address areas where CWP programs or activities could be modified to better address NPDES permit components or promote more effective mitigation of stormwater problems. Management recommendations relevant to the assessment area include:

- Continue to coordinate with Washington Department of Ecology, Lower Columbia Fish Recovery Board, Clark County Legacy Lands and Vancouver-Clark Parks and Recreation in efforts to improve stream health.
- Replace deteriorated stream name signs at road crossings
- Develop a system to provide education about appropriate ditch maintenance practices to rural landowners
- Provide technical assistance to rural development projects required to implement stormwater controls
- Educate private landowners on importance of native riparian vegetation and intact riparian forests for shading streams and preserving hydrology
- Encourage landowners to adopt runoff reduction practices, such as disconnecting downspouts where feasible
- Focus overall management efforts on achieving a stabilized hydrologic regime and channel structure, which will increase the success of future channel and riparian rehabilitation

Introduction

This Stormwater Needs Assessment includes the North Fork Lewis River (Lower) subwatershed. The Clean Water Program (CWP) is gathering and assembling information to support capital improvement project (CIP) planning and other management actions related to protecting water bodies from stormwater runoff.

Purpose

The Stormwater Needs Assessment Program (SNAP), initiated in 2007, creates a system for the CWP to focus activities, coordinate efforts, pool resources and ensure the use of consistent methodologies. SNAP activities assess watershed resources, identify problems and opportunities, and recommend specific actions to help meet the CWP mission of protecting water quality through stormwater management.

The overall goals of SNAP are to:

- Analyze and recommend the best, most cost effective mix of actions to protect, restore or improve beneficial uses consistent with NPDES permit objectives and the goals identified by the state Growth Management Act (GMA), ESA recovery plan implementation, Total Maximum Daily Load (TMDLs), WRIA planning, floodplain management, and other local or regional planning efforts
- Inform county efforts to address the following issues related to hydrology, hydraulics, habitat and water quality:
 - Impacts from current or past development projects subject to lesser or non-existent stormwater treatment and flow control standards
 - Subwatershed-specific needs due to inherent sensitivities or the present condition of water quality or habitat
 - Potential impacts from future development

The CWP recognizes the need to translate assessment information into on-the-ground actions to improve water quality and habitat. Facilitating this process is a key requirement for the program's long-term success.

Results and products of needs assessments promote more effective implementation of various programs and mandates. These include identifying mitigation opportunities and providing a better understanding of stream and watershed conditions for use in planning county road projects. Similar information also is needed by county programs implementing critical areas protection and salmon recovery planning under the state GMA and federal ESA.

Scope

This report summarizes and incorporates new information collected for SNAP, as well as pre-existing information. In many cases, it includes basic summary information or incorporates by reference longer reports which may be consulted for more detailed information.

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SNAP reports produce information related to three general categories:

- Potential stormwater capital projects for county implementation or referral to other organizations
- Management and policy recommendations
- Natural resource information

Descriptions of potential projects and recommended program management actions are provided to county programs, including: Public Works CWP, Stormwater Capital Improvement Program (SCIP), and Development Engineering; Community Planning; Public Health; Legacy Lands; ESA. Potential project or leveraging opportunities also are referred to local agencies, groups and municipalities as appropriate.

Assessment Approach

Priorities for Needs Assessment in North Fork Lewis River (Lower)

Clark County subwatersheds were placed into a five year schedule for assessment using the procedures described in *Prioritizing Areas for Stormwater Basin Planning* (Swanson, July 2006).

For SNAP purposes, North Fork Lewis (Lower) subwatershed is categorized as Rural Residential with No UGA. Subwatersheds in this category generally are not heavily forested but have limited stormwater management needs due to the lack of urbanization. Assessment efforts for these subwatersheds focus primarily on summarizing existing information to identify potential restoration projects.

Assessment Tools Applied in North Fork Lewis River (Lower)

SNAP uses a standardized set of tools for subwatershed assessment, including desktop mapping analyses, modeling, outreach activities and a variety of field data collection procedures. Tools follow standard protocols to provide a range of information for stormwater management. Though not every tool is applied in every subwatershed, the use of a standard toolbox ensures the consistent application of assessment activities county-wide.

Table 1 lists the set of tools available for use in SNAP. Tools with an asterisk (*) are those for which new data was gathered or new analyses were conducted during this needs assessment. The remaining tools or chapters were completed based on pre-existing information.

Table 1: Stormwater Needs Assessment Tools

Outreach And Involvement *	Riparian Assessment *
Coordination with Other Programs *	Floodplain Assessment
Drainage System Inventory and Condition *	Wetland Assessment *
Review Of Existing Data *	Macroinvertebrate Assessment
Illicit Discharge Screening	Fish Use And Distribution *
Broad Scale GIS Characterization *	Water Quality Assessment *
Rapid Stream Reconnaissance	Hydrologic and Hydraulic Modeling
Physical Habitat Assessment *	Source Control *
Geomorphology And Hydrology Assessment	

Assessment Actions

Outreach Activities

Outreach activities were limited and focused primarily on raising awareness about the SNAP effort. The following activities were completed:

- Press release to local media
- April 2010 – article in Clean Water Program E-Newsletter
- August 2010 – information on SNAP distributed at 10-day Clark County Fair
- Clean Water Program web pages updated as needed; 135 visitors to the SNAP web page since June 2010 (Note: these figures are under-reported as tracking software only records top 20 pages and documents monthly)
- A description of SNAP is included in Clark County’s annual stormwater management program plan submitted to Ecology

Clark County Clean Water Commission members were updated periodically on SNAP progress.

Actions available to educate in response to identified problem areas include the following:

- Site visits by CWP technical assistance staff
- Letters detailing specific problems and solutions to individual landowners
- General educational mailings to selected groups of property owners
- Workshops on best management practices, including septic maintenance and mud, manure and streamside property management
- Referral to other agencies, such as Clark Conservation District or WSU Extension, for educational follow-up

Review of Existing Data

Data and information review is incorporated throughout this report in pertinent sections. A standardized list of typical data sources created for the overall SNAP effort is supplemented by subwatershed-specific sources as they are discovered. Data sources consulted for this report include, but are not limited to:

- LCFRB Habitat Characterization (2004)
- LCFRB 6-Year Habitat Work Plan
- Ecology 303(d) list
- WRIA 27/28 Plan
- Ecology EIM data
- Clark County 2004 Subwatershed summary

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- Clark County 2006 Stormwater Basin Planning
- Clark County 2010 Stream Health Report
- Clark County LISP/SCMP/ Project data
- Clark County 6-Year TIP

Broad-Scale GIS Characterization and Metrics

The broad-scale characterization is a GIS-based exercise providing an overview of the biophysical setting for each subwatershed, background information for use in implementing other SNAP tools, and identification of potential acquisition or project sites. GIS data describe subwatershed characteristics such as topography, geology, soils, hydrology, land cover, land use and GMA critical areas. A standard GIS workspace, including shape files for more than 65 characteristics, forms the basis for the characterization.

GIS data are generally used as a tool to complete the report and not presented in the report itself. Summary metrics are taken from existing reports and data. For example, Wierenga (2005) summarized many GIS characteristics for Clark County subwatersheds. Some of these characteristics are described in greater detail in later sections.

The characterization includes three components:

- A set of four standard map products, as paper maps for SNAP use
- A summary table of selected subwatershed-scale metrics
- A brief narrative including comparison of metrics to literature values, and conclusions about general subwatershed condition and potential future changes

Map Products

The four standard SNAP map products are: 1) Stormwater Infrastructure and Hydrologic Soil Groups; 2) Critical Areas information; 3) Vacant Buildable Lands within UGAs; 4) Orthophoto. These maps are printed out for tabletop evaluations.

General Conditions and Subwatershed Metrics

General Geography

The study area includes the North Fork Lewis River floodplain below Cedar Creek and numerous smaller tributaries at the transition from the Willamette Valley floor to low foothills along the valley margin.

Land use is predominately rural, with floodplain surfaces adjacent to the North Fork Lewis River cleared and urbanized, used for residential development or agriculture. The area is largely private lands.

Topography

Hayes Creek and other creeks on the North Fork Lewis River's left bank have their headwaters in low rolling hills between 300 and 600 feet above sea level. Upstream of Eagle Island, the North

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Fork Lewis River is naturally confined within a bedrock canyon bordered by narrow, discontinuous floodplain deposits.

Geology and Soils

In the study area, geology is dominated by four major groups of deposits. Older, dense volcanic rocks underlie the entire area. Miocene to lower Pleistocene alluvial deposits of the ancestral Columbia River, often referred to as the Troutdale Formation, overlie the older volcanic rocks on hilltops to elevations of 700 to 800 feet. Quaternary alluvial and glacial sediment deposits are in the Lewis River valley. Terraces form along the Lewis River to an elevation of about 200 feet.

During Pleistocene and Holocene time, alluvial processes in the Lewis River valley were strongly influenced by regional uplift of the Cascade Range, glaciation in the Cascade Range, eruptive activity at the Mount St. Helens volcanic center, and cataclysmic flooding triggered by the failure of ice dams at glacial Lake Missoula in Montana.

The North Fork Lewis River flows through a mix of glacial outwash and Lake Missoula flood sand and silt deposits, as well as fine grained igneous andesite flows dating from the Oligocene to Eocene.

Soils are generally well drained Hesson-Olequa Association found in upland hills, low mountains and terraces. The Lewis River flood plain has sandy Sauvies- Puyallup soils.

Hydrology

Geology and topography play the main roles in determining the study area's hydrologic framework. Streams in the Willamette Valley and foothills on its fringe are on older sand and gravel geologic deposits. They tend to form alluvial streams having pool riffle morphology where gravels are present and simpler mud-banked streams where fine substrate occurs. Tributary streams to the Lewis River generally are high gradient streams draining over hard volcanic rocks that form small canyons.

The North Fork Lewis River is tidally influenced in the study area, depending to some degree on Columbia River stage. Downstream of Eagle Island, North Fork Lewis River is constrained by levees and disconnected from historic floodplain.

The mixed rural land cover leads to a fairly high amount of runoff compared with a forested condition, which leads to higher storm flows than in a forested condition.

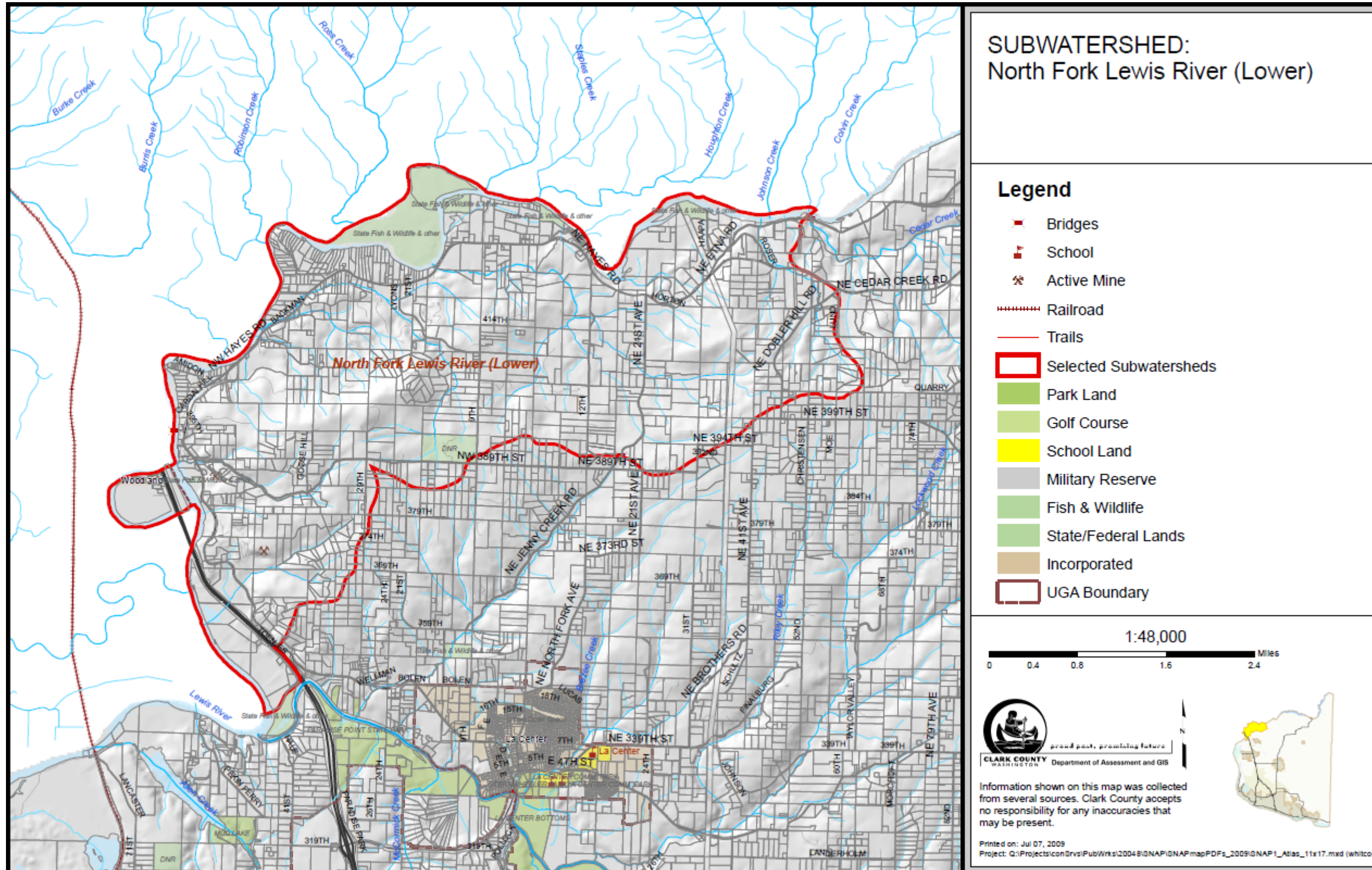


Figure 1: Subwatershed Map: North Fork Lewis River (Lower) Subwatershed

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Subwatershed Metrics

Subwatershed scale metrics provide a simple way to summarize overall conditions. Metrics are calculated from Landsat land cover analysis and current GIS data. Benchmarks for properly functioning and not properly functioning are based on NOAA fisheries standards for salmon protection and restoration (1996 and 2003).

Overall, these metrics suggest that North Fork Lewis (Lower) subwatershed does not completely meet standards due to lost forest and the amount of roads present. However, the stream crossing density and expected EIA imply suitability for protection and restoration in this study area (Table 2).

Table 2: Watershed Scale Metrics

Metric	North Fork Lewis (Lower)	Functioning	Non-functioning
Percent Forested (2000 Landsat)	43.8	> 65 %	< 50 %
Percent TIA (2000 Landsat)	14.3	< 5 %	> 15 %
Road Density 2007 data (miles/mile ²)	5.9	< 2	> 3
Stream Crossing Density (crossings per stream mile)	2.2	< 3.2/mile	> 6.4/mile
Percent EIA estimated from the Comprehensive Plan	3	< 10 %	> 10 %

Forest Cover

The proportion of a watershed in forest cover is known to have a profound influence on watershed processes. Forest cover estimates are taken from a report summarizing land cover for Clark County (Hill and Bidwell, January 2003). Research in the Pacific Northwest has shown that when forest cover declines below approximately 65 percent, watershed forming processes become degraded (Booth and Jackson, 1997). These include reducing riparian shade, less wood debris delivery to streams, increased stormwater runoff, and increased fine sediment delivery due to mass wasting.

North Fork Lewis (Lower) subwatershed has 43.8 percent forest cover, below the 50 percent NOAA fisheries threshold for non-functioning watershed processes. The forested areas are dispersed throughout the subwatershed, but much of the canopy cover remains along Lewis River tributary riparian corridors. Presumably, the level or mildly sloping areas in the North Fork Lewis (Lower) subwatershed were cleared for agricultural activities early in the 20th century. A comparison of 1955 aerial photographs to present condition suggests that 1955 forest cover is very similar to present conditions.

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TIA (Total Impervious Area)

Total impervious area is one of the most widely used indicators of urbanization and coincident watershed degradation (Center for Watershed Protection, March 2003). Total impervious areas are estimated from land cover data in Hill and Bidwell (January 2003). While various organizations and publications categorize stream condition based on TIA, the NOAA fisheries standard is less than 5 percent as fully functional and greater than 15 percent as non-functioning. The estimated 14.3 percent TIA for North Fork Lewis (Lower) subwatershed falls between the standards for fully functional at 5 percent and non-functioning at 15 percent.

Road Density

Road density, including all public and private roads, is an easily calculated development measure. Based on criteria set by NOAA Fisheries to protect salmon habitat, road densities are approximately twice as dense as the threshold for non-functioning (>3 road miles/mi²).

Stream Crossing Density

Stream crossing densities are easily measured using available road and stream channel data. The salmon protection standard considers larger fills more than 60 feet wide, which would be approximately five- to 10-foot high road fill. The North Fork Lewis (Lower) subwatershed has crossing densities within the functioning category (<3.2 crossings/stream mile NOAA Fisheries criteria).

Future Effective Impervious Area

Effective impervious area is the amount of impervious area that actually drains to a water body. Depending on factors such as soil types and level of development, effective impervious area is about half (lower intensity development) to almost equal (high intensity development) the TIA value.

The Comprehensive Plan guides development for the next few years, and when used to estimate effective impervious area, it can provide a metric for potential hydrologic impacts due to expected development. Expected EIA is 3 percent, well within the 10 percent EIA NOAA Fisheries standard for functioning salmon habitat.

Estimated Channel Stability Based on Forest and EIA

In a publication by Booth, Hartley, and Jackson (June 2002), a relationship between forest and percent EIA was presented as a graphic (Figure 2). According to this figure, North Fork Lewis (Lower) falls into the 'zone of uncertain channel stability' category. This indicates that through protection and restoration activities, it may be possible to increase forest cover and reduce the EIA as approaches to improve stream habitat. Conversely, increased land clearing could result in less stable channel conditions. Based on subwatershed scale conditions, North Fork Lewis (Lower) is a good candidate for improving forest functions that could have a measurable impact on channel stability.

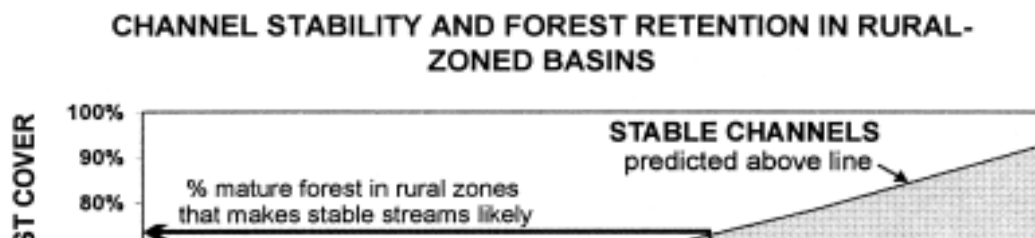


Figure 2: Channel stability in rural areas (Booth, Hartley, and Jackson, June 2002)

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Water Quality Assessment

This section briefly summarizes and references available water quality data from the North Fork Lewis River (Lower) subwatershed. A description of applicable water quality criteria is included, along with discussions of beneficial use impacts, likely pollution sources, and possible implications for stormwater management planning.

Water Quality Criteria

For a full explanation of current water quality standards see the Ecology website at: <http://www.ecy.wa.gov/programs/wq/swqs/index.html>

Under Washington state water quality standards, the Lewis River from Houghton Creek (including tributaries) to Lake Merwin is to be protected for the designated uses of: “Core Summer Salmonid Habitat; primary contact recreation; domestic, industrial, and agricultural water supply; stock watering; wildlife habitat; harvesting; commerce and navigation; boating; and aesthetic values” (WAC 173-201A-600, Table 602).

Table 3 summarizes currently applicable water quality criteria for the assessment area.

Table 3: Applicable Water Quality Criteria for the North Fork Lewis River (Lower) Subwatershed

Characteristic	Ecology criteria
Temperature	≤ 16° C (60.8° F)
Dissolved Oxygen	≥ 9.5 mg/L
Turbidity	shall not exceed 5 NTU over background when background is 50 NTU or less
pH	6.5 – 8.5 units
Fecal coliform bacteria	Geometric mean fecal coliform concentration not to exceed 100 colonies/100mL, and not more than 10% of samples exceeding 200 colonies/100mL.
Aesthetics	Aesthetic values must not be impaired by the presence of materials or their effects... which offend the senses of sight, smell, touch, or taste
Toxics	Toxic substances shall not be introduced... which have the potential...to adversely affect characteristic water uses, cause acute or chronic toxicity to the most sensitive biota dependent upon those waters, or adversely affect public health

Source: Washington Department of Ecology (<http://www.ecy.wa.gov/programs/wq/swqs/index.html>)

303(d) Listed Impairments

The 2008 303(d) list of impaired waters is on the Ecology website at: <http://www.ecy.wa.gov/programs/wq/303d/index.html>

There are no listings within the North Fork Lewis River (Lower) subwatershed.

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Clark County Stream Health Report

In 2010, the CWP compiled available data and produced a countywide assessment of general stream health.

Sufficient data were not available to score the North Fork Lewis River (Lower) subwatershed.

The 2010 Stream Health Report may be viewed on the county website at:
<http://www.clark.wa.gov/water-resources/stream.html>.

Available Data

Almost no recent water quality data are available for this study area. Ecology collected data in the Lewis River in 2003-2004 under the Pesticides, PCBs and PAHs in Lower Columbia River Drainage study.

Data and information sources reviewed or summarized as part of this water quality characterization are listed in Table 4.

Table 4: Data Sources

Source	Data and/or Report
Ecology EIM database	Pesticides, PCBs, and PAHs in Lower Columbia River Drainage (Site LEWISR)

Water Quality Summary

The lower Columbia River has numerous listings on the state 303(d) list of contaminated water bodies. In 2003-2004, Ecology conducted a study to identify major source areas and tributaries contributing to these listings. The full report can be viewed at:
<http://www.ecy.wa.gov/pubs/0503006.pdf>

Semipermeable membrane devices were used to monitor chlorinated pesticides (including DDT), polychlorinated biphenyls (PCBs) and polynuclear aromatic hydrocarbons (PAHs) in the lower Columbia and tributaries. Five mainstem Columbia sites and eight tributaries were sampled between Bonneville Dam and the Columbia River mouth, including the lower Lewis River.

While all measured compounds were detected in the Lewis River, concentrations were consistently lower than most other sites. Among the eight study sites, the Lewis River ranked as follows (1st being the most contaminated, 8th being the least contaminated):

DDT compounds: 5th
Dieldrin: 5th
PCBs: 6th
PAHs: 7th

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In nearly every case, concentrations in the Lewis River were in compliance with established human health criteria. The report concluded the Lewis River was not a significant source of pollutant loading contributing to the Columbia River listings for these compounds.

Drainage System Inventory and Condition

Inventory

Clark County's drainage system inventory resides in the StormwaterClk GIS database and is available to users through the county's GIS.

Drainage system inventory is an ongoing CWP work effort focused on updating the StormwaterClk database to include all existing stormwater drainage infrastructure. In 2008-2009, the inventory was a significant priority for the CWP, with a major work effort focused on identifying and mapping previously unmapped infrastructure and reviewing existing records for completeness and accuracy.

Table 5 indicates the number of features currently inventoried in StormwaterClk. Of the total seven stormwater facilities, five are publicly owned and operated.

Table 5: Drainage System Inventory Results, North Fork Lewis River (Lower)

Database Feature Category	Inventoried prior to 2007	Added during 2007-2009	Total Features
Inlet	12	27	39
Discharge Point (outfall)	3	335	338
Flow Control	2	0	2
Storage/Treatment	14	3	17
Manhole	4	0	4
Filter System	0	0	0
Channel	39	1058	1097
Gravity Main	117	470	587
Facilities	2	5	7

Condition

Stormwater system condition is assessed based on three components:

- An evaluation of retrofit opportunities at public stormwater facilities
- An inspection and maintenance evaluation at public stormwater facilities
- An off-site assessment to check for outfall-related problems in downstream receiving waters

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Component 1: Retrofit Evaluation

Purpose

The purpose of this component is to identify existing public stormwater facilities that may be retrofitted to provide additional storage or treatment beyond the level intended during original construction.

Methods

The evaluation is conducted at all public stormwater facilities that contain detention ponds, treatment wetlands, wet ponds, pre-settling cells, open filters or bioswales and discharge to surface waters or stormwater drainage infrastructure that eventually discharges to surface waters.

The retrofit evaluation includes a review of the drainage area, stormwater infrastructure condition, facility lot size, ownership of adjacent parcels, and the functionality of the facility objects listed above. Facilities or parcels with the potential to provide additional storage and/or treatment of stormwater are referred as "potential retrofit" opportunities for further evaluation as Capital Improvement Projects.

Results

Based on the county's StormwaterClk database, as of August 2010, there were five mapped public stormwater facilities in the North Fork Lewis River (Lower) subwatershed.

One (20 percent) of the mapped public stormwater facilities in North Fork Lewis River (Lower) subwatershed was evaluated for retrofit opportunities.

No public stormwater facilities were referred for further evaluation as Capital Improvement Projects.

No major defects or hazardous conditions were discovered in the North Fork Lewis River (Lower) subwatershed.

Component 2: Inspection and Maintenance Evaluation

Purpose

The inspection and maintenance evaluation verifies that maintenance activities are implemented and facilities are properly functioning.

Methods

The inspection and maintenance evaluation is conducted at public stormwater facilities in conjunction with retrofit evaluations. Public stormwater facilities are evaluated if they contain detention ponds, treatment wetlands, wet ponds, pre-settling cells, open filters or bioswales and discharge to surface waters or stormwater drainage infrastructure that eventually discharges to surface waters.

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Public stormwater facilities that contain filter systems, buried detention or retention vaults, and facilities that infiltrate stormwater typically are not included in this evaluation. They may be inspected on a case-by-case basis as resources allow.

The evaluation is conducted using county and state standards equivalent to maintenance standards specified in Chapter 4, Volume V, of the 2005 Stormwater Management Manual for Western Washington. The standards list the part or component of the facility, condition when repair or maintenance is needed, and expected results. Individual components of a facility are referred to as “facility objects.”

The inspection and maintenance evaluation process involves inspecting all facility objects to determine if maintenance complies with the standards. If any facility object fails to meet the maintenance standards, the entire facility is not in compliance. Noncompliant stormwater facilities are referred to the appropriate department for repairs or maintenance.

Results

One inspection and maintenance evaluations was conducted in the North Fork Lewis River (Lower) subwatershed. This facility was found in compliance with maintenance standards and included a total of seven facility objects.

The inspection process in the North Fork Lewis River (Lower) subwatershed generated no referrals to Public Works Maintenance and Operations for needed maintenance activities.

No major defects or hazardous conditions were discovered in the North Fork Lewis River (Lower) subwatershed.

Component 3: Offsite Assessment

Purpose

Discharges from stormwater outfalls can cause moderate to severe erosion as stormwater moves through the riparian zone and to the receiving water. Erosion creates a source of sediment to the stream due to incision and slope failures. It can also increase slope instability problems.

The Offsite Assessment looks for offsite or downstream problems associated with the county’s storm sewer system, particularly from facility outfalls that discharge to critical areas.

Methods

County-owned and operated stormwater outfalls meeting one or more of the following criteria are included in the offsite assessment:

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- Within 200 feet of a critical area (e.g. riparian, wellhead protection, landslide hazard, etc)
- Within 300 feet of a headwater stream
- Located on public land
- Originates from a public-dedicated facility currently under the two-year maintenance warranty bond

Stormwater outfalls are prioritized into three categories:

- Priority 1 outfalls are stormwater outfalls that discharge to landslide hazard areas outside of county road rights-of-way
- Priority 2 outfalls are stormwater outfalls that discharge to all other critical areas outside of county road rights-of-way
- Priority 3 outfalls are stormwater outfalls that discharge to critical areas within county road rights-of-way

At a minimum, all Priority 1 outfalls are inspected. As resources allow, Priority 2 and Priority 3 outfalls may be inspected. If an outfall fails to meet the general outfall design criteria or is contributing to a downstream erosion problem, the outfall is not in compliance. Non-compliant outfalls are referred to the appropriate Public Works program for maintenance or repair or, in some cases, referred as potential Capital Projects.

Results

Based on the county's StormwaterClk database, as of August 2010, there were 286 mapped outfalls in the North Fork Lewis River (Lower) subwatershed discharging to critical areas: two Priority 1 outfalls; three Priority 2 outfalls; 281 Priority 3 outfalls.

Figure 3 summarizes notable outfall assessment activities including general outfall locations.

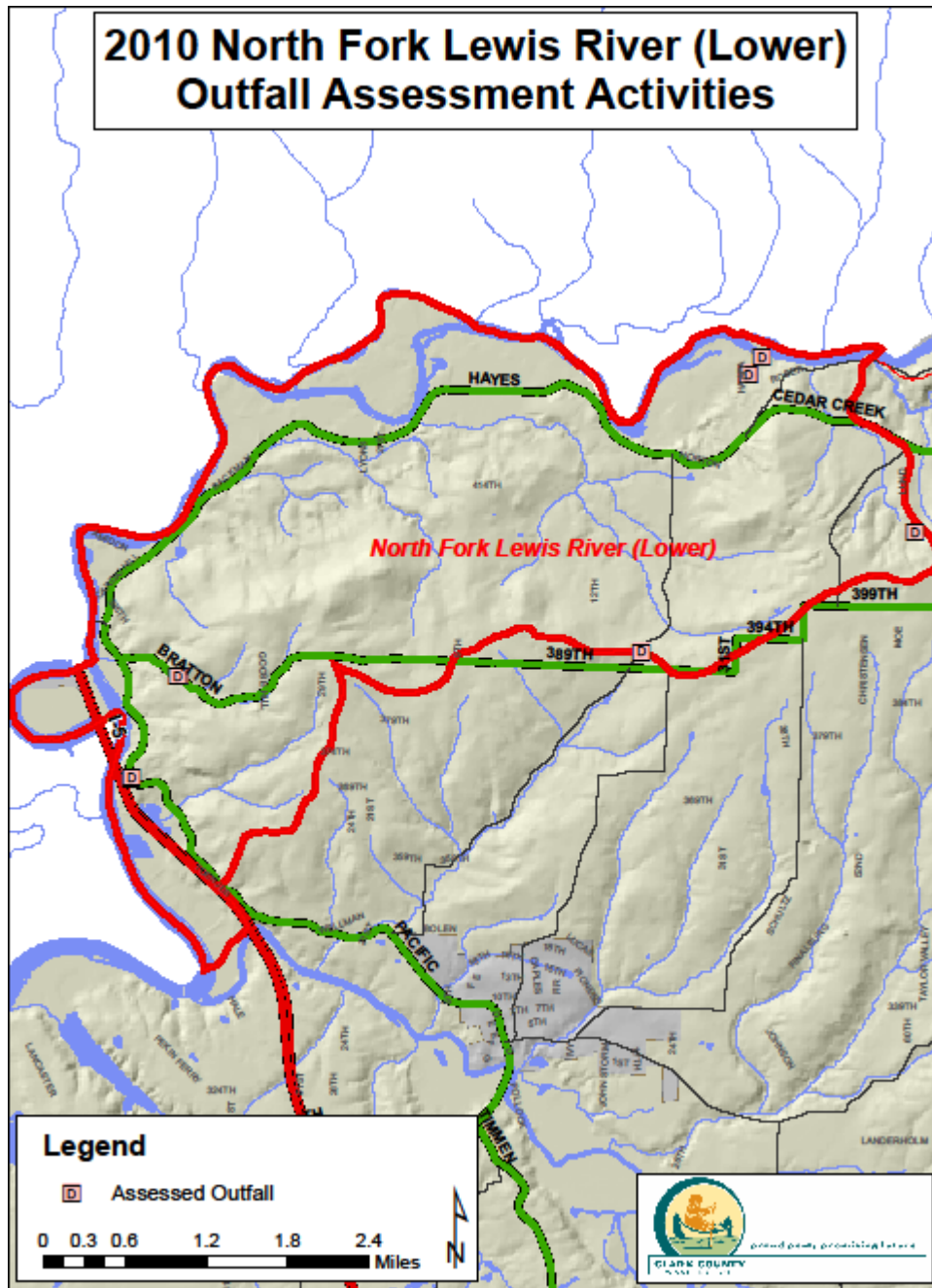


Figure 3: Summary of 2010 Off-site Assessment Activities in the North Fork Lewis River (Lower) subwatershed

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Table 6 summarizes results from North Fork Lewis River (Lower) subwatershed. There were 286 mapped outfalls discharging to critical areas. One Priority 1 outfall was assessed and was found to be out of compliance due to litter issues. The other Priority 1 outfall was not accessible through private property. One Priority 2 outfall was assessed and found to be in compliance. Two Priority 2 outfalls were not assessed. Eleven Priority 3 outfalls were assessed and found to be in compliance, and 270 Priority 3 outfalls were not assessed.

Table 6: 2010 Off-site Assessment Project Activity Summary for North Fork Lewis River (Lower) subwatershed

Metric	Number of Outfalls		
	Priority 1	Priority 2	Priority 3
Total number of mapped outfalls	2	3	281
# of outfalls assessed	1	1	11
# of outfalls compliant	1	1	11
# of noncompliant outfalls	1	n/a	n/a
# of referrals initiated	1	n/a	n/a
# of referrals ongoing	1	n/a	n/a
# of outfalls fixed	0	n/a	n/a

Potential Projects

The offsite assessment project yielded no potential project opportunities. One referral was made to Maintenance and Operations for litter removal.

Management Recommendations

Drainage system inventory is an ongoing CWP work effort focused on updating the StormwaterClk database to include all existing stormwater drainage infrastructure. Prior to 2007, stormwater drainage infrastructure in the North Fork Lewis River (Lower) subwatersheds included 193 objects. In 2007-2009, an additional 1,898 previously unmapped objects were added to the StormwaterClk database.

Retrofit and inspection and maintenance evaluations were conducted at one public stormwater facility in the North Fork Lewis River (Lower) subwatershed. No referrals were generated for further evaluation as Capital Improvement Projects. All facility objects (7) were found to be in compliance with county maintenance standards.

Outfall assessments generated no potential project opportunities. One referral was generated to Maintenance and Operations for litter removal. Future efforts should be made to assess Priority 3 outfalls, which make up nearly all of the outfalls discharging to critical areas in these subwatersheds. Maintaining the frequency of offsite assessment activities may reduce

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downstream erosion problems by discovering potential issues before they become more serious erosion problems.

Illicit Discharge Detection and Elimination Screening

Illicit discharge screening was not conducted.

Source Control

Purpose

Source control visits to Clark County businesses provide both an educational and technical assistance purpose. An initial site visit allows staff to educate owners and employees by providing basic information about nearby water resources and Clark County's Water Quality Ordinance (13.26A). The initial site visit also provides information on how Clark County's storm sewer system works, how the site is connected to this storm system, and how the activities performed by the business may impact their subwatershed.

Most importantly, the source control visit can find, then eliminate or change, business activities that negatively impact stormwater runoff.

Methods

Under the County's 2007 NPDES municipal stormwater permit, each year staff is required to visit 20 percent of businesses that perform one of many potential pollution-generating activities listed in the permit. Additionally, the permit requires visits to any business with a paved parking area. To simplify project planning and tracking, the CWP plans to visit 20 percent of all county businesses each year.

To determine which specific businesses will be inspected each year, SNAP prioritizes a list of subwatersheds where source control visits will be performed. Once those subwatersheds are determined, GIS maps are developed to highlight all parcels paying the Type 4 (commercial and industrial property) and Type 3 (Multi-Family property) Clean Water Fee. Each highlighted parcel is labeled with the parcel number (Property Account Number).

At each site, staff asks the business manager or owner to lead a tour of the business, inside and out. By closely observing business activities and asking questions, staff gains information about site-specific conditions and current stormwater best management practices (BMPs).

If any business related activities allow contaminants to enter stormwater runoff, specific BMPs are suggested to the business manager or owner. Following the tour, BMP sheets explaining the issue and required fixes are left with the manager or owner. If the BMP will take some time to implement, a follow up visit date is agreed upon. Letters are sent to businesses when multiple activities require BMPs and/or when a specific BMP may take some time to implement. Letters usually give a deadline for completion of BMP implementation.

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Following the deadline date, a follow up visit is made to the business to confirm BMP implementation. As long as some corrective effort has been made, the source control staff will continue working with the business until it is in compliance. However, if the business fails to take any corrective action despite repeated visits, a referral to Clark County Code Enforcement and possibly the Washington Department of Ecology is made to assist with compliance through enforcement.

During or immediately after each site visit, a Business Site Visit Report Form is completed for entry into the Tidemark database.

Results

In 2010, staff visited all the businesses required under the NPDES permit in the North Fork Lewis River (Lower) subwatershed. Table 7 summarizes source control activities.

Table 7: Source Control Project Summary, NF Lewis River (Lower) subwatershed

Metric	Number
Number of sites visited	0
Number of sites with source control issues	0
Number of repeat visits	0
Number of sites with issues successfully resolved	0
Number of sites referred to other agencies	0

Overview

The North Fork Lewis River (Lower) subwatershed is located in northwestern Clark County. This subwatershed contains only a handful of Type 4 parcels, and none is a business requiring a source control visit. This subwatershed should be a very low priority for future business source control site visits.

Stream Reconnaissance and Feature Inventory

A stream reconnaissance and feature inventory was not conducted.

Physical Habitat Assessment

Purpose

Physical habitat assessments provide direct measurements of stream channel morphology, habitat conditions, and riparian conditions for specific stream reaches. This information can be used for planning projects and interpreting hydrologic, macroinvertebrate and geomorphologic information at reach and subwatershed scales.

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Methods

Physical habitat measurements were made for two reaches of the Lower North Fork Lewis River Mainstem (Lewis 4, RM 10.5 to RM 12.6, and Lewis 5, RM 12.6 to RM 15.4) by R2 Resource Consultants, Inc. (December 2004) for the Lower Columbia Fish Recovery Board. The project followed modified USFS Level II protocols.

Results

The R2 Resource Consultants, Inc. (R2) report includes a good narrative summary of the habitat survey results, including figures and tables, some of which are presented here. The full report may be found on the CWP website at:

<http://www.clark.wa.gov/water-resources/documents-monitoring.html#strmac>

The Lewis 4 survey reach encompasses the mainstem of the North Fork Lewis River as it traverses a 0.5 - 0.75 mile wide alluvial valley that represents its own floodplain. This survey reach is classified as a wide, low gradient flood plain and has a map gradient of 1.0 percent. Habitat consists primarily of glides, which represents 43 percent of the survey reach habitat by length, followed by small riffle (39 percent) and pool (18 percent). Pools habitats were infrequent but deep. On average, mainstem pools exceeded two meters, making them good habitat for returning adult fish prior to spawning.

R2 noted that the dominant and subdominant substrate classes of streambed riffles are comprised of gravel (57 percent) and cobble (37 percent). The overall mean embeddedness was low, typically less than 15 percent and often less than 10 percent. Table 8 summarizes habitat evaluations based on Washington Conservation Commission and NOAA Fisheries Properly Functioning Condition standards.

Table 8: Summary of Habitat Evaluations of North Fork Lewis River mainstem reach from RM 10.05 to RM 12.25 (Lewis 4 Survey Reach). Based on Washington Conservation Commission and NOAA Fisheries Properly-Functioning Condition Standards

Parameter	WCC¹	PFC²
% Pool by Surface Area		
Pool Frequency		
Pool Quality	Good	At Risk
LWD		At Risk
Substrate	Good	Properly functioning
Streambank Stability	Good	Properly functioning
Water temperature		
¹ Available Ratings: Good; Fair; Poor		
² Available Ratings: Properly Functioning; At Risk; Not Properly Functioning		

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The Lewis 5 survey reach encompasses the mainstem of the North Fork Lewis River as it traverses a 0.3 - 0.6 mile wide valley that represents its own floodplain until RM 15. Upstream of RM15, the river naturally is confined within a bedrock canyon bordered by narrow, discontinuous floodplain deposits. This survey reach is classified as a wide, low gradient flood plain and has a map gradient of 1.0 percent. Habitat consists predominately of small cobble riffle (48 percent) and glide (52 percent) habitat by length.

R2 noted that the dominant and subdominant substrate classes of streambed riffles are comprised of cobble (46 percent) and gravel (41 percent). The overall mean embeddedness was low (6 percent). Table 9 summarizes habitat evaluations based on Washington Conservation Commission and NOAA Fisheries Properly Functioning Condition standards.

Table 9: Summary of Habitat Evaluations of North Fork Lewis River mainstem reach from RM 12.26 to RM 15.04 (Lewis 5 Survey Reach). Based on Washington Conservation Commission and NOAA Fisheries Properly-Functioning Condition Standards

Parameter	WCC ¹	PFC ²
% Pool by Surface Area		
Pool Frequency		
Pool Quality		
LWD		At Risk
Substrate	Good	Properly functioning
Streambank Stability	Good	Properly functioning
Water temperature		
¹ Available Ratings: Good; Fair; Poor		
² Available Ratings: Properly Functioning; At Risk; Not Properly Functioning		

Geomorphology Assessment

A geomorphology assessment was not conducted.

Riparian Assessment

Purpose

The riparian assessment characterizes existing conditions, based on available data, to identify general riparian needs and potential areas for rehabilitation projects. Riparian enhancement projects, such as installation or protection of native plantings within riparian areas, can provide for increased future shading and woody debris recruitment which can further provide an opportunity for stormwater-related watershed improvement.

The need for riparian rehabilitation tends to be widespread and exceed the scope and resources of the CWP mission of stormwater management. Therefore, potential riparian projects usually are referred to agencies such as the LCFRB, Lower Columbia Fish Enhancement Group (LCFEG),

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Clark Public Utilities, Fish First, Washington State University (WSU) Watershed Stewards Program and Clark Conservation District for possible implementation.

This section focuses on opportunities likely to be on publicly owned lands within high priority salmon-bearing stream reaches as defined by LCFRB salmon recovery priorities.

Method

Where possible, the assessment is based on GIS data from existing reports, primarily the Habitat Assessment reports prepared for the Lower Columbia Fish Recovery Board (R2 Resource Consultants, Inc., 2004). Summary information summarized from the Draft Shoreline Inventory and Characterization (ESA Adolfson, June 2010) also is reviewed. These reports apply primarily to salmon-bearing stream reaches, and therefore do not provide information for many smaller streams. Results are based on aerial photo interpretation using Washington Forest Practices Board methods for LWD delivery and channel shade estimates.

In streams where no data exist from the LCFRB characterization, an examination of current orthophotographs is used to make a general assessment of riparian condition and identify areas where restoration or preservation projects may be appropriate.

Many riparian project opportunities are discovered through other SNAP activities, including Rapid Stream Reconnaissance feature inventories and geomorphological assessments. Potential projects discovered through these activities are discussed in their respective sections, and most are included on a final list for referral to outside agencies.

The 2004 LCFRB Habitat Assessment report, 2010 Draft Shoreline Inventory and Characterization Report, and aerial photographs also were reviewed for specific project opportunities in each subwatershed. Potential project sites have been reviewed and verified through field reconnaissance and are detailed in the results.

Results

Results are based primarily on the 2004 LCFRB Habitat Assessment for the North Fork Lewis (Lower) subwatershed, contained in the Kalama, Washougal and Lewis River Habitat Assessments Chapter 3: The North Fork Lewis River Basin. The full characterization report is available on the Clark County website at:

<http://www.clark.wa.gov/water-resources/documents.html#mon>

For areas in the subwatershed not included in the habitat assessment (several unnamed tributaries to the North Fork Lewis River), LWD recruitment potential and shade rating analyses were based on a qualitative review of 2010 orthophotographs available through Google Earth.

At the subwatershed scale, the LCFRB rated the riparian conditions in the North Fork Lewis (Lower) subwatershed as “Moderately Impaired” to “Impaired.”

Riparian (Large Woody Debris (LWD) Delivery)

Figure 4 shows the North Fork Lewis (Lower) subwatershed LWD delivery potential. In the North Fork Lewis (Lower) subwatershed, the survey includes the mainstem of the North Fork

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Lewis River and several tributaries entering the North Fork Lewis River from the north. The tributaries will not be considered in this analysis, as they are not located in Clark County. The mainstem of the North Fork Lewis River is shown as having primarily Low and Moderate LWD recruitment, with some areas of High recruitment potential. Review of survey data shows primarily “Fair” (41% of length) and “High” (35% of length) LWD recruitment potential, with some areas of “Poor” (24% of length) LWD recruitment potential.

Review of non-surveyed tributaries entering the North Fork Lewis River from the south (Clark County) indicates mostly moderate to high levels of LWD recruitment potential. Lowest levels are located in areas where drainages pass through open fields, such as between NW 21st Ave and NW 422nd St (from appx (45.925950, -122.690790) to (45.925177, -122.693059)).

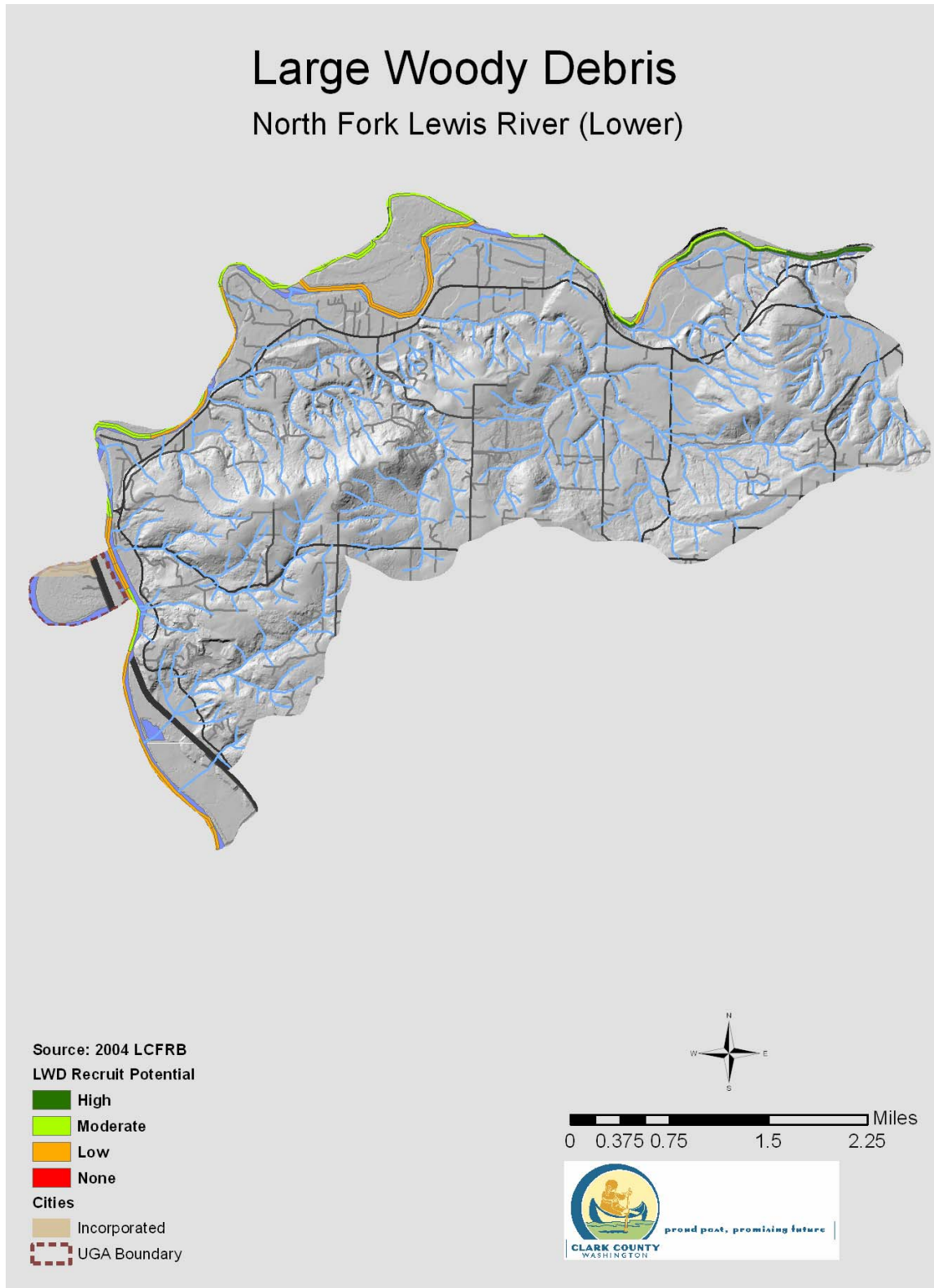


Figure 4: North Fork Lewis River (Lower) LWD Recruitment Potential (adapted from R2 Resource Consultants, Inc., 2004)

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Shade

The North Fork Lewis River (Lower) subwatershed shade ratings from the 2004 LCFRB Habitat Assessment are illustrated on Figure 5. In the North Fork Lewis River (Lower) subwatershed, the survey covered the mainstem of the North Fork Lewis River and several tributaries entering the North Fork Lewis River from the north. The tributaries will not be considered in this analysis, as they are not located in Clark County. The mainstem of the North Fork Lewis River in the North Fork Lewis River (Lower) subwatershed has shade levels ranging from 10 percent to 55 percent. Percent shade levels were distributed as follows:

% Shade	% of Reach Length
10	62
30	14
55	24

Note that the lower North Fork Lewis River is wide enough that even if the entire riparian area contained mature forest, the vegetation would not likely shade the entire channel. Low levels of shade in the lower reaches of the North Fork Lewis River may be a natural function of its width. Even assuming full mature forest vegetation adjacent to the channel banks, the projected reference surface water temperatures in lower reaches of the North Fork Lewis River are not expected to “comply with aquatic use criteria for anadromous salmonid fishes or interior resident trout (LCFRB 2004, P.3-26).”

Review of non-surveyed tributaries entering the North Fork Lewis River from the south (Clark County) indicates mostly moderate to high levels of shade. Lowest levels are located in areas where drainages pass through open fields, such as between NW 21st Ave and NW 422nd St (from appx (45.925950, -122.690790) to (45.925177, -122.693059)). Also, a seasonally ponded area at appx (45.913407, -122.72455) is unshaded and discharges to the North Fork Lewis River about 750 feet away. Similar unshaded ponds exist at appx (45.88359, -122.72576) and (45.88176, -122.72934).

The LCFRB habitat assessment for the North Fork Lewis River (Lower) subwatershed indicated that all reaches are currently off-target with respect to the State Forest Practices shade/elevation screen standards.

Management Recommendations

Overall recommended management activities for the North Fork Lewis River (Lower) subwatershed include: restoration of the tidal slough and floodplain forest; enhancement of conifer species in riparian habitat by hardwood conversion or releasing conifers in mixed stands; maintaining floodplain, side channels and backwater habitats; preserving undeveloped land from future development; adding large wood into armored banks during future maintenance or repair activities.

Potential Projects

Potential riparian restoration projects for the North Fork Lewis River (Lower) subwatershed were identified from review of the 2004 LCFRB Habitat Assessment report, along with

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orthophotography analysis in areas not formally surveyed. Recommended restoration projects in this subwatershed included riparian forest restoration and invasive species removal. However, these two subwatersheds contain little publicly owned land and so specific potential projects are difficult to identify. Some small-scale reforestation and invasive removal projects are shown in Table 10, although the majority of publicly owned land adjacent to riparian areas appears to be in good condition and should be preserved as such.

Table 10: Tax Exempt Parcels Overlapping Potential Riparian Restoration Areas

ASSR_SN	ASSR_AC	OWNER	PT1DESC	Description
255240-000	2.55 acres	City of Woodland	Storage Warehouse	Appx. 0.5 acre of potential reforestation on Horseshoe Lake, at I-5 crossing.
255227-000	1.3 acres	Washington State	Unused or vacant land – no improvements	Invasive removal. Contains large patches of Himalayan blackberry, adjacent to existing Clark County Public Works mitigation project.
252022-000	112.72 acres	Washington State	Unused or vacant land – no improvements	Preserve Eagle Island
252655-000 252647-000	1.2 acres 16.1 acres	Washington State	Rivers, sloughs, streams, drainage ditches, and other water courses	Preserve
252881-000	7 acres	Washington State	One or more mobile homes	Preserve intact forest, some enhancement potential
253132-000	4.93 acres	Clark County Parks	Single-family unit	Preserve intact forest, plus appx 1 acre reforestation potential
256071-000	80 acres	School Land	Designated and improved viewpoints, scenic outlooks.	Preserve headwaters of tributary to North Fork

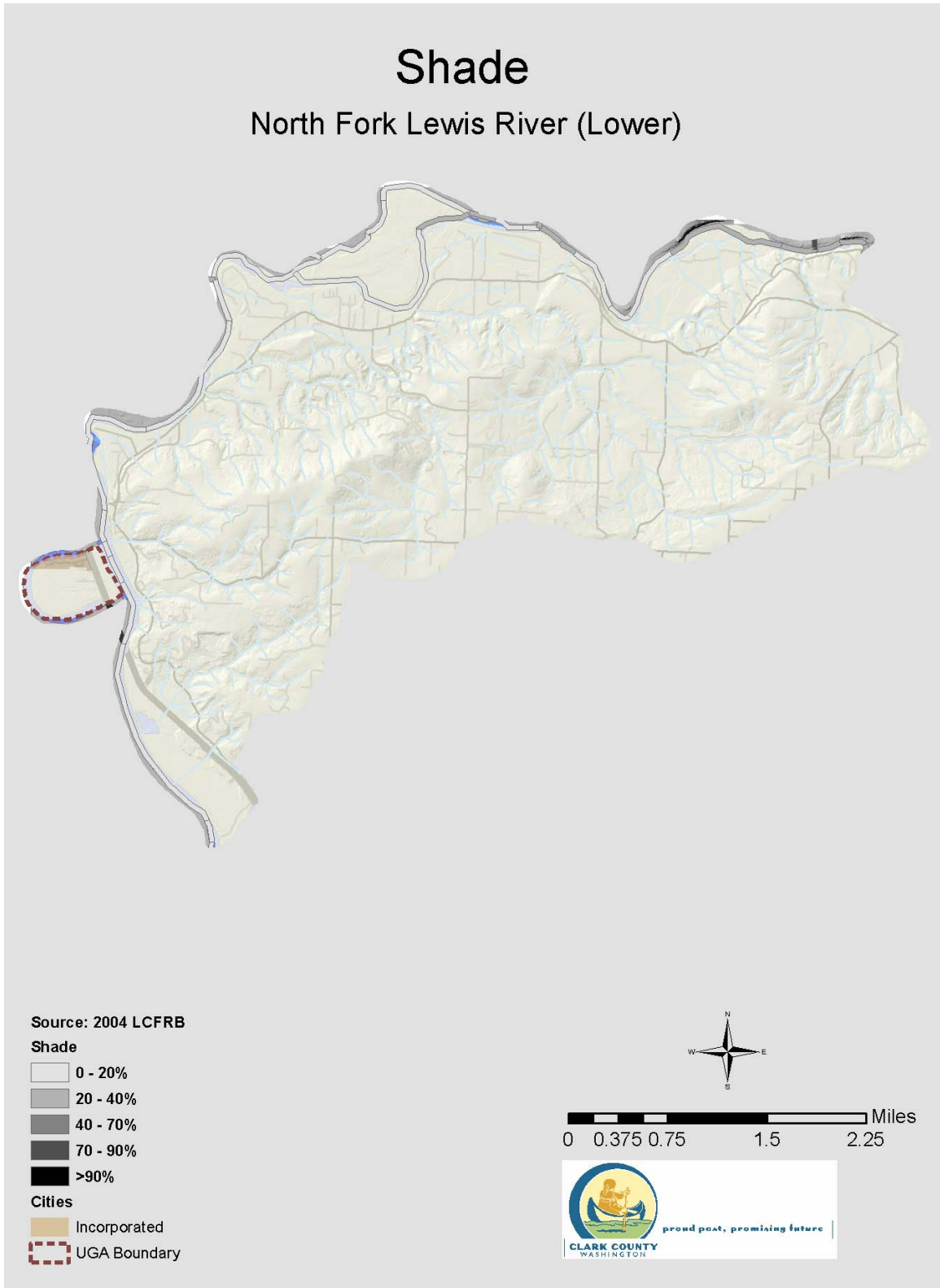


Figure 5: North Fork Lewis River (Lower) Shade Values (adapted from R2 Resource Consultants, Inc, 2004)

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Floodplain Assessment

A floodplain assessment was not conducted.

Wetland Assessment

Purpose

Wetlands perform important hydrologic, water quality and habitat functions. The primary reasons for the wetlands assessments are to:

- Describe wetland conditions related to how they influence hydrology, water quality and habitat
- Identify priority potential wetland projects to mitigate for stormwater impacts
- Make management recommendations for wetlands related to stormwater management

A primary objective of the wetland assessment is to identify sites containing modestly sized, degraded or ditched wetlands where minor construction projects can be used to improve wetland hydrology. Improved wetland function can reduce peak storm discharges, increase groundwater recharge and improve habitat through increasing biodiversity, species population health and organic input.

Methods

The assessment includes review of existing GIS data for wetlands. Primary information sources are the county wetlands atlas, Draft Watershed Characterization of Clark County Version 3 (Ecology, 2007), and personal communication with other county programs.

Potential project sites have been reviewed and verified through field reconnaissance and are detailed in the results section below.

Tax-exempt parcels often indicate the presence of publicly owned land, schools or churches where large parcel sizes and opportunities for leveraging may exist. Potential wetlands were overlaid with tax-exempt parcels and county vacant buildable lands model (VBLM) information to identify possible wetland enhancement opportunities.

Results

Figure 6 shows potential wetland areas within the North Fork Lewis River (Lower) subwatershed based on data from the county wetlands atlas, including the Clark County wetland model and National Wetlands Inventory.

The North Fork Lewis River (Lower) subwatershed has wetlands associated with the main channels of the river and its tributaries, including natural depressions and man-made impoundments, flood influenced riverine wetlands and sloped seep wetlands dominated by groundwater discharge. There are few large complexes of wetlands in headwater areas or on the valley floors.

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Table 11: Distribution of Wetlands by Hydrogeomorphic Class

HGM Class	Area (ac.)	% of Sub-basin*	% of total wetland
Slope Wetlands	58	0.6	6.4
Depressional Wetlands	365	3.9	40.3
Riverine Wetlands	482	5.1	53.3
All Wetlands	905	9.6	

*Subwatershed area 9,462 ac.

The majority of wetlands is in landscape positions (along stream channels) where there are limited opportunities to improve water quality or hydrologic functions. Review of the wetland inventories and studies did not identify any significant project opportunities in publicly held or tax-exempt land.

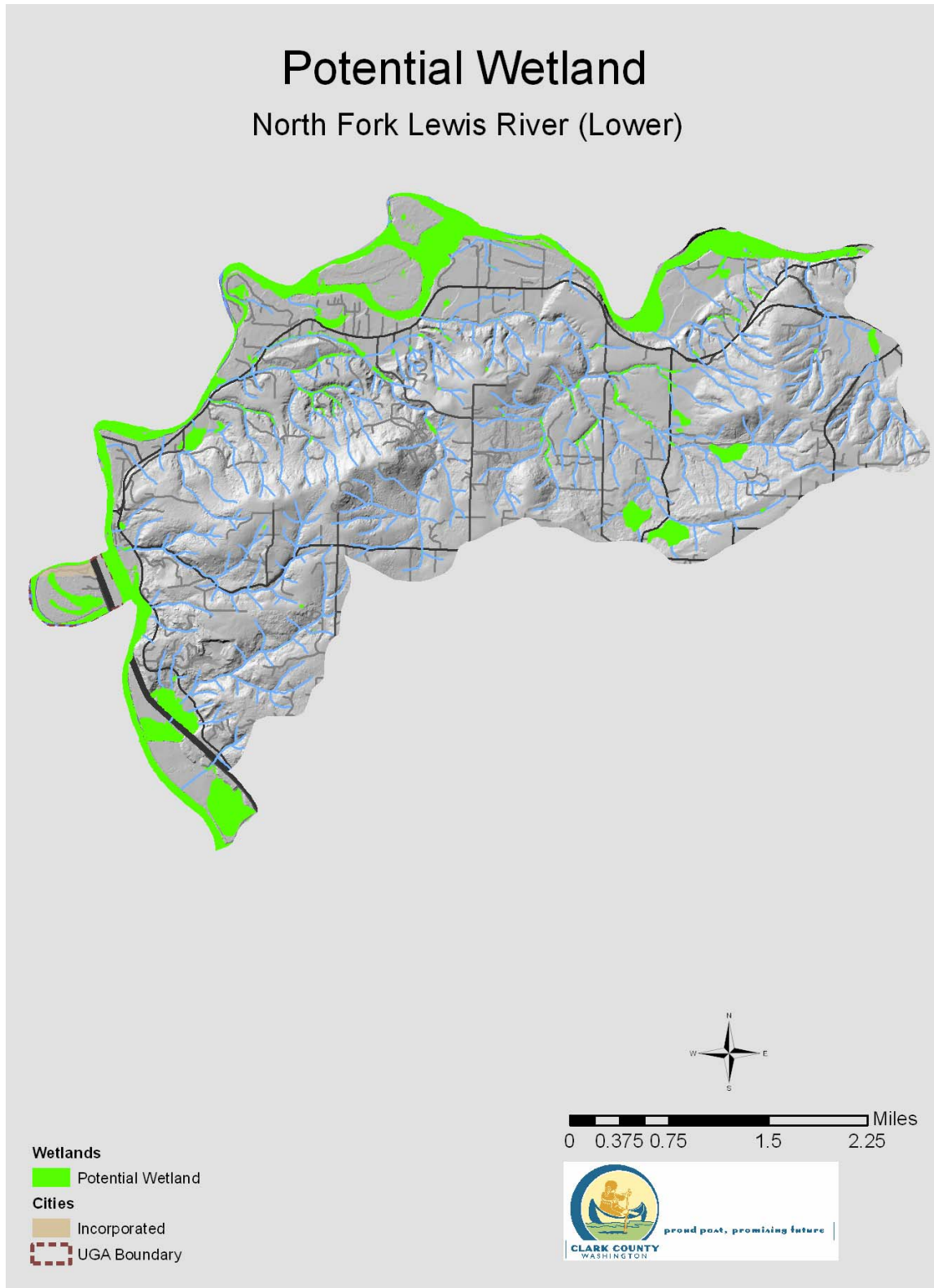


Figure 6: North Fork Lewis River (Lower) Potential Wetlands

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Watershed Characterization

The Washington Department of Ecology completed the Watershed Characterization and Analysis of Clark County (2009) to assist in planning wetland and riparian habitat restoration and preservation projects.

Results pertaining to the North Fork Lewis River (Lower) subwatershed are summarized below.

The North Fork Lewis River (Lower) subwatershed is part of the “Lewis” Rain Dominated Mountainous hydrogeologic unit. It is characterized by rain dominated precipitation, shallow and deep patterns of groundwater flow and glacial till over consolidated formations, as well as more permeable sedimentary formations (e.g. river alluvium and Troutdale formation) and moderate to steep topography (Ecology, 2009).

Figure 7 depicts priority areas for protection and restoration of hydrologic and denitrification processes county-wide based on an analysis of the relative importance and level of alteration in each subwatershed.

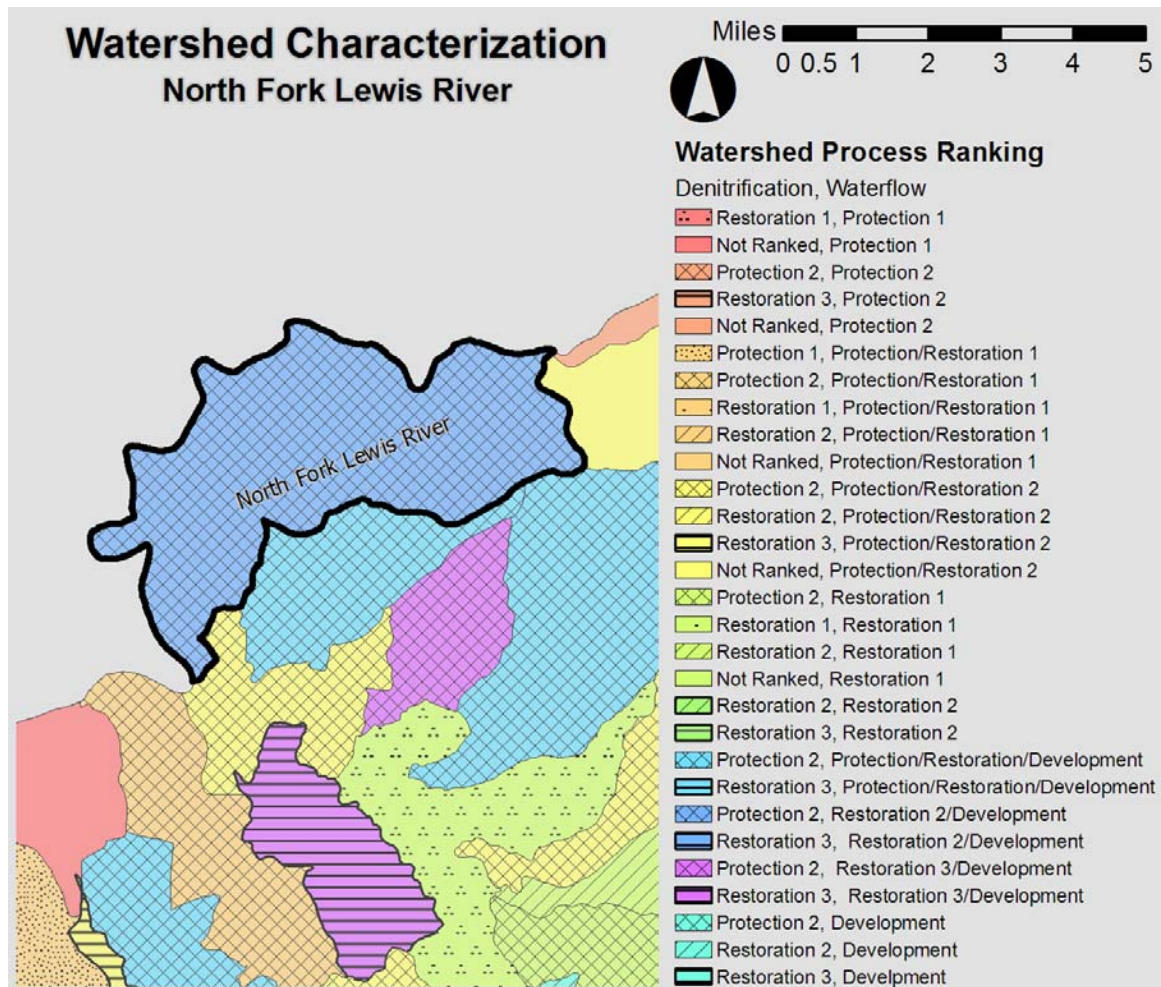


Figure 7: Priorities for suitability of areas for protection and restoration for the hydrogeologic process (from Watershed Characterization and Analysis of Clark County (Ecology, 2009))

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In general, red areas have higher levels of importance for watershed hydrologic processes and limited alteration and should be considered for protection. Yellow areas have a higher level of importance for watershed processes and a higher level of alteration and should be considered for restoration unless watershed processes are permanently altered by urban development. Green to blue areas have lower levels of importance for watershed processes and higher levels of alteration and should be considered as more suitable for development. Because green, purple and blue areas represent a transition from restoration areas, planning measures employing both restoration and appropriately sited development should be considered (Ecology, 2009). Hatch patterns represent the importance of denitrification processes.

Restoration of hydrologic (waterflow) processes and appropriately sited development are recommended for the North Fork Lewis River (Lower) subwatershed (blue), indicating that hydrologic processes are degraded to the point that protection of existing function is not much of a priority. This subwatershed also is ranked for protection of denitrification processes.

Macroinvertebrate Assessment

A macroinvertebrate assessment was not conducted.

Fish Use and Distribution

Purpose

Fish distribution refers to salmon and steelhead use. This information helps identify stream segments where land-use changes may impact fish populations, inform management decisions, and aid in identifying and prioritizing potential habitat improvement and protection projects.

Methods

Fish distribution for the North Fork Lewis River (Lower) subwatershed is mapped from existing Clark County GIS information, which reflects data collected and analyzed by the Northwest Indian Fisheries Commission (NWIFC). Fish distribution data for Clark County are available on the County's website.

Several sources of barrier assessment data are available and are briefly summarized here:

- WDFW passage barrier database
- SalmonScape (<http://wdfw.wa.gov/mapping/salmonscape/>)
- Clark County 1997 passage barrier data
- Clark Conservation District/LCFRB passage barrier dataset

Many stream crossings have not been assessed for passage barrier potential, and the extent of public and private road crossings is a good indicator of the potential for additional barriers. Road crossings were mapped by overlaying the county road layer with LiDAR-derived stream data.

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The barrier assessment data was also reviewed for specific project opportunities in each subwatershed. Potential project sites have been reviewed and verified through field reconnaissance and are detailed in the results section below.

Results/Summary

Distribution

The available evidence identified the presumed presence of bull trout in the mainstem of the North Fork Lewis River (Figure 8). Fish distribution data also identified that known anadromous fish use in the North Fork Lewis River (Lower) subwatershed includes chum (Figure 9), coho (Figure 10), fall and spring Chinook (Figure 11), summer and winter steelhead (Figure 11 and Figure 12), and sockeye (Figure 11). Both Coho salmon and winter steelhead are presumed to use several unnamed tributaries in the North Fork Lewis River (Lower) subwatershed, and may potentially use Hayes Creek (Figure 10 and Figure 12).

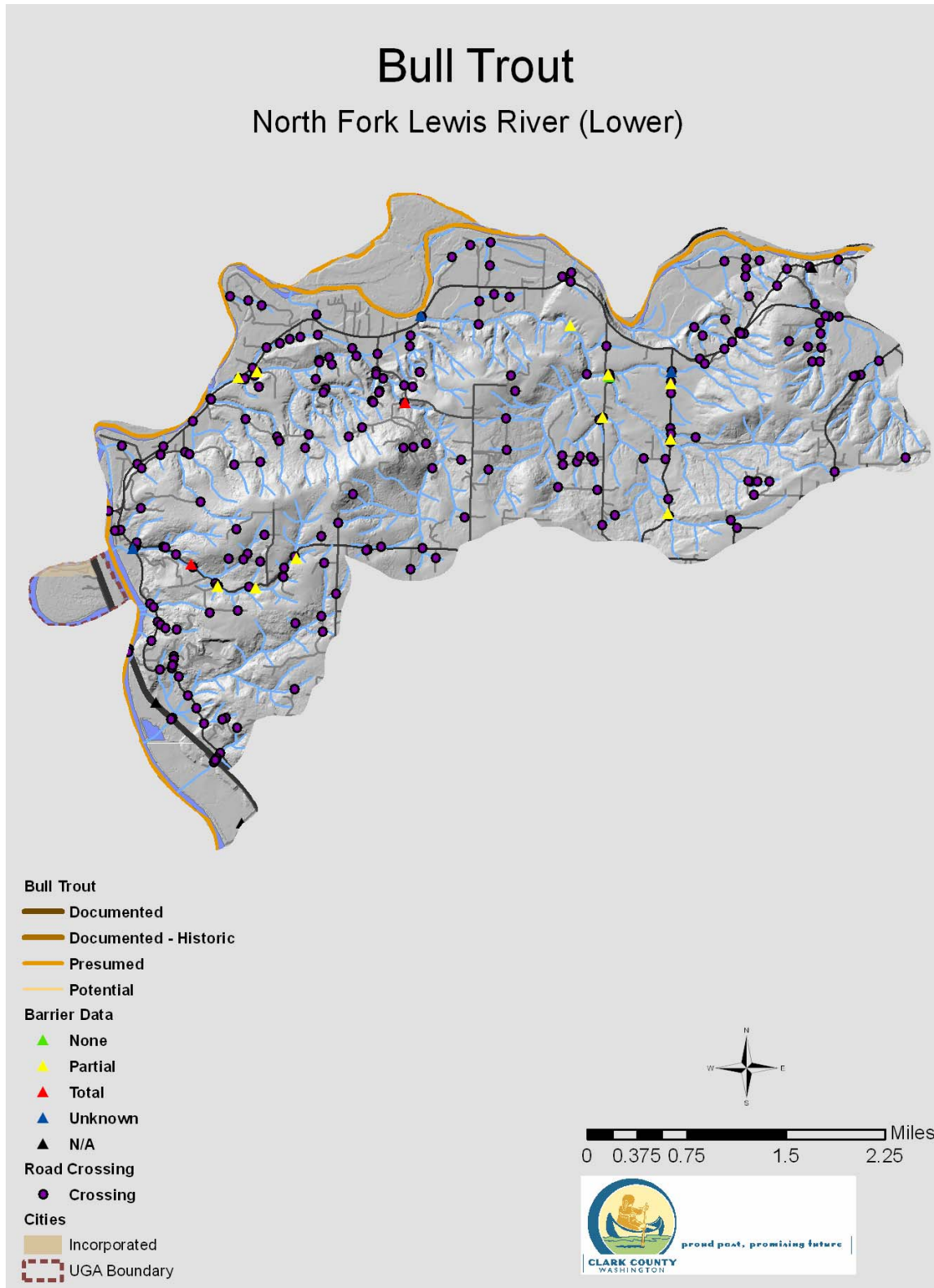


Figure 8: North Fork Lewis River (Lower) Bull Trout Distribution and Barriers

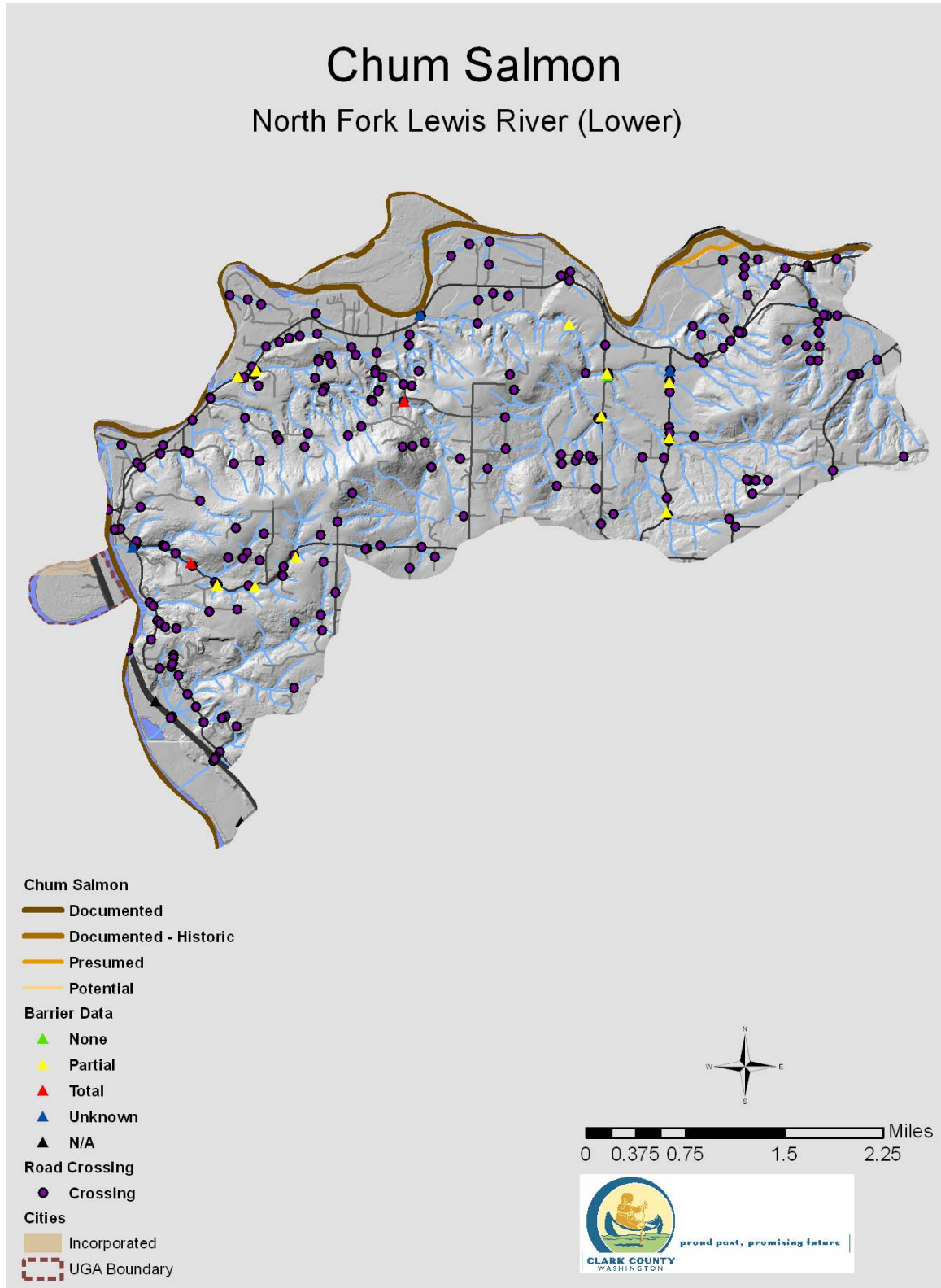


Figure 9: North Fork Lewis River (Lower) Chum Distribution and Barriers

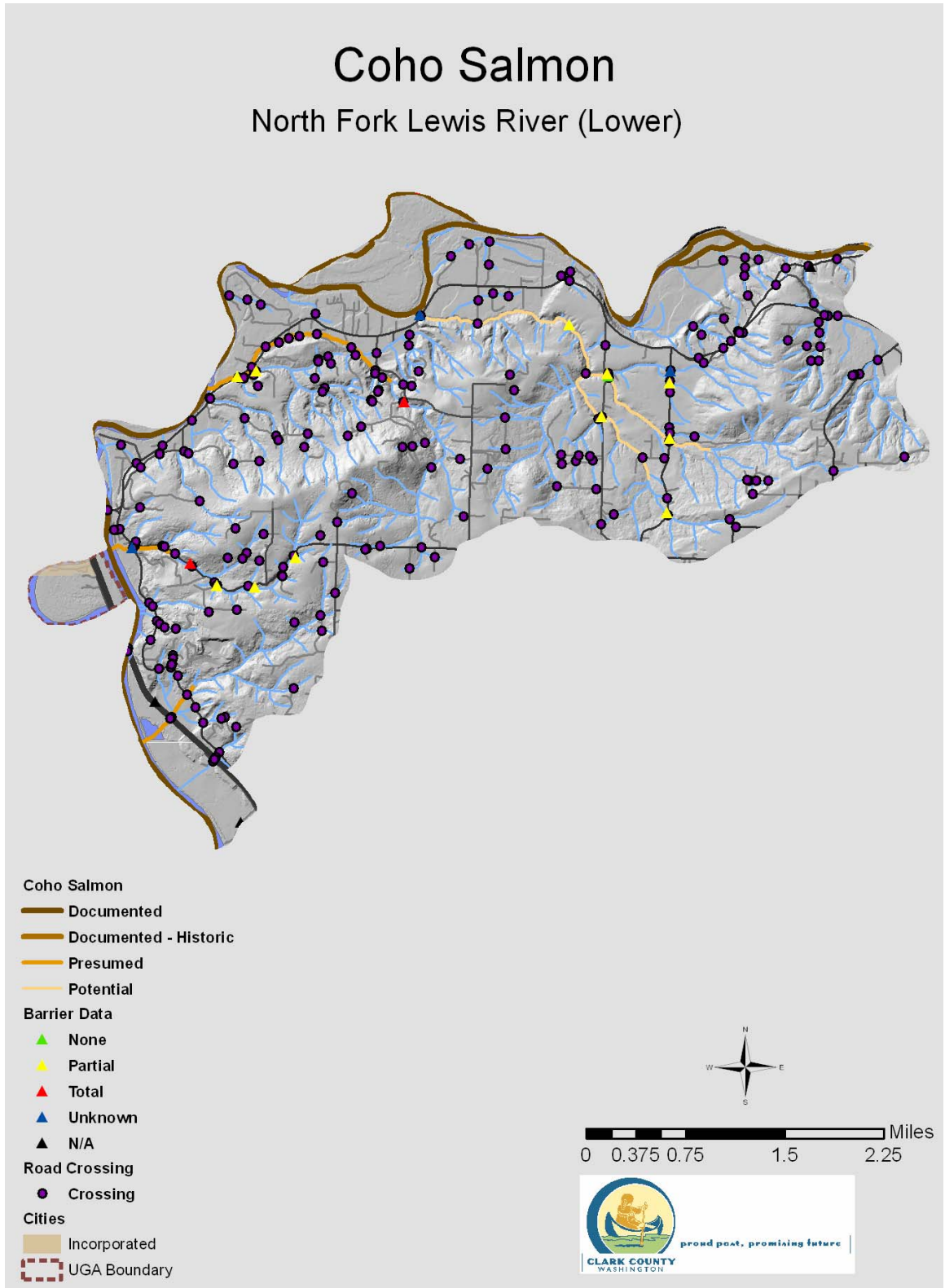


Figure 10: North Fork Lewis River (Lower) Coho Distribution and Barriers

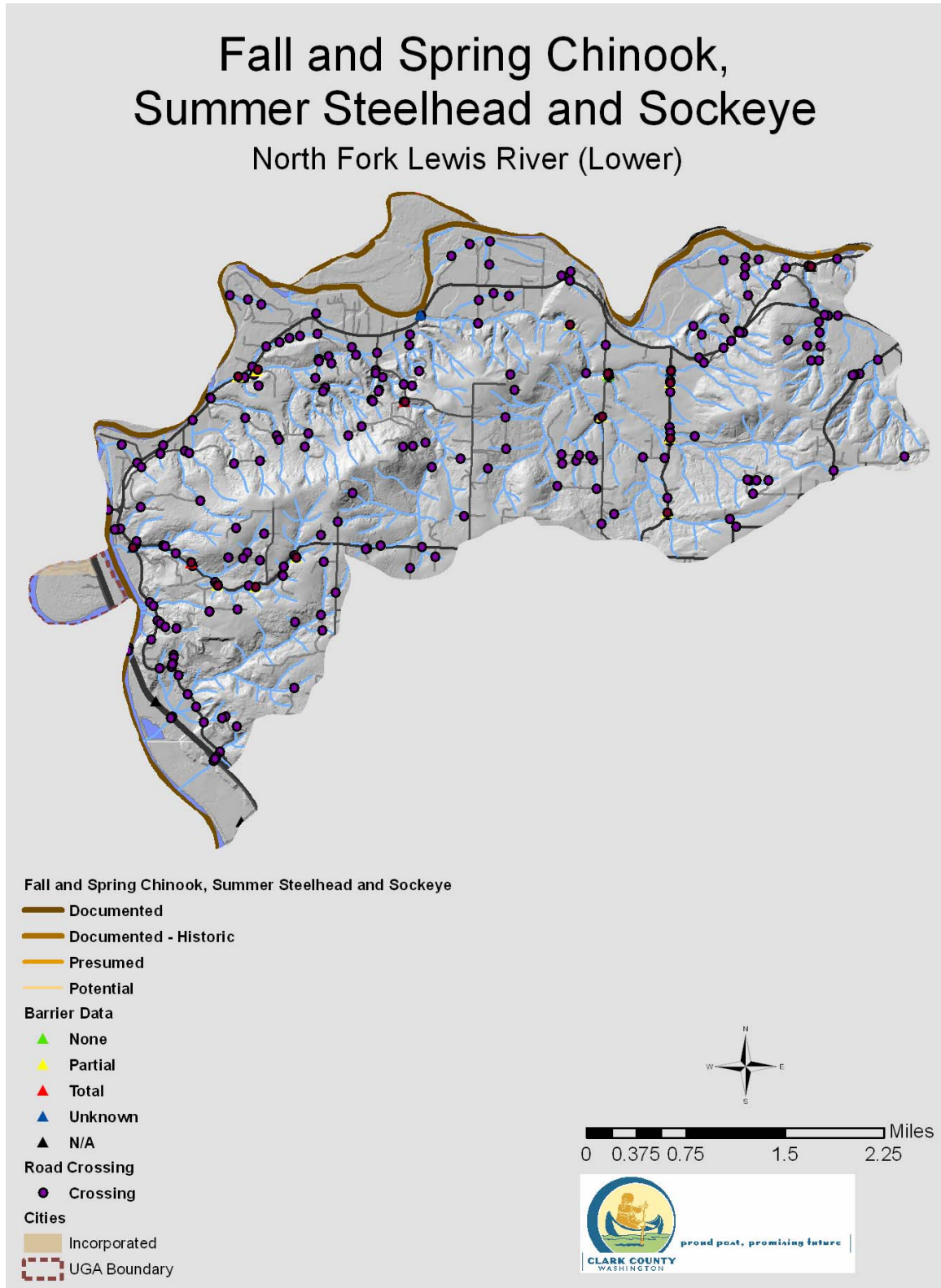


Figure 11: North Fork Lewis River (Lower) Fall/Spring Chinook, Summer Steelhead, and Sockeye Distribution and Barriers

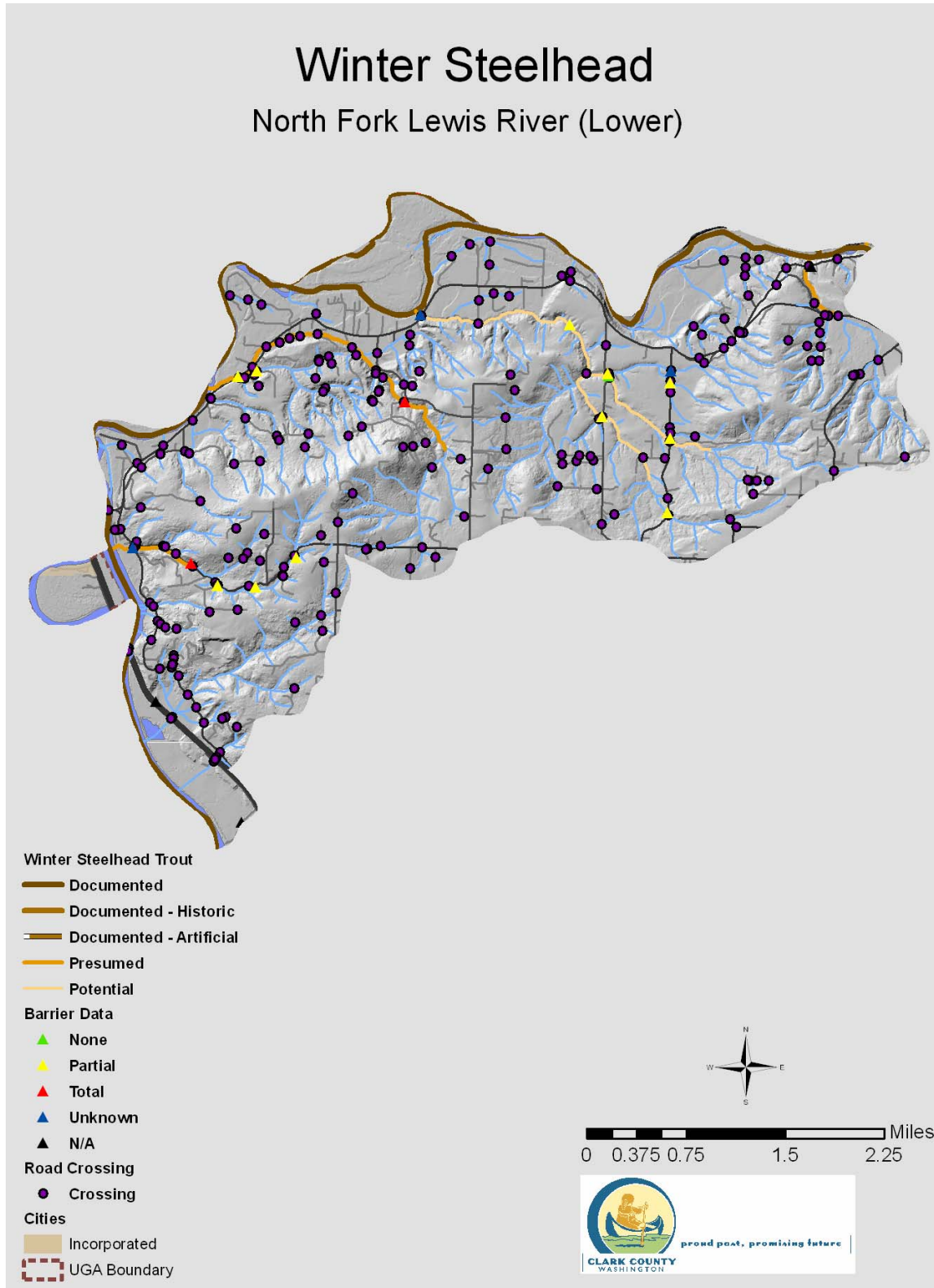


Figure 12: North Fork Lewis River (Lower) Winter Steelhead Distribution and Barriers

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Barriers

The WDFW barrier database provides the most complete assessment of barriers in the North Fork Lewis River (Lower) subwatershed (Figure 8, Figure 9, Figure 10, Figure 11 and Figure 12). According to the database, there are no known barriers on the mainstem of the North Fork Lewis River in the North Fork Lewis River (Lower) subwatershed. Several partial barriers are identified on tributaries to the North Fork Lewis River. The inventory identifies two total barriers on tributaries; a culvert at the crossing of NW Maple ridge Dr (45.918525, -122.691240) and a culvert at the crossing of NW Bratton Road (45.900215, -122.724110). The Bratton Road culvert was extended by Clark County Public Works in 2005 to improve traffic flow and safety.

Recommendations

The North Fork Lewis River (Lower) subwatershed contains a number of full and partial fish barriers in tributaries to the North Fork Lewis River. All are on private property and landowner cooperation would be required. The LCFRB report suggests that reconnecting some in-channel and off-channel habitats could have significant positive benefits for all species using the system. However, “The blocked habitat is believed to be marginal in the majority of cases and no individual barriers in themselves account for a significant portion of blocked miles.” Therefore, projects should be carefully selected to optimize the cost to benefit ratio (LCFRB 2009).

Hydrologic and Hydraulic Models

Modeling was not conducted in this study area.

Analysis of Potential Projects

The analysis of potential projects:

- Briefly summarizes stormwater conditions, problems and opportunities
- Notes recently completed or current projects in the study area that may be relevant to SNAP project selection
- Describes the analytical approach
- Lists recommended projects and activities for further evaluation

Projects or activities are placed in one of several categories.

Project descriptions summarize more detailed descriptions found in report sections. Project planners are encouraged to reference the longer descriptions and use information found for each potential project in the SNAP GIS database available from the Clean Water Program. Reference IDs for the database are included in the tables for each project.

Summary of Conditions, Problems, and Opportunities

Conditions and Problems

This section briefly summarizes important results from the assessment chapters and identifies overall stormwater-related problems.

Coordination with Other Programs

The CWP actively coordinates with the Washington Department of Ecology, Lower Columbia Fish Recovery Board, Clark County Legacy Lands and Vancouver-Clark Parks and Recreation in efforts to improve stream health. In the study area, there are no planned road improvement projects included in the 2010-2015 Clark County Transportation Improvement Program or in the Stormwater Capital Program.

Broad-Scale Characterization

The study area includes the North Fork Lewis River floodplain below Cedar Creek and numerous smaller tributaries at the transition from the Willamette Valley floor to low foothills along the valley margin. Land use is predominately rural, with floodplain surfaces adjacent to the North Fork Lewis River cleared and urbanized and used for residential development or agriculture. The area is largely private lands.

Standard subwatershed scale metrics, such as percent forest and road density, when compared to NOAA fisheries standards, suggest stream habitat is not properly functioning. Metrics stream crossing density and expected EIA are within the functioning category. Based on subwatershed scale conditions, the study area is a good candidate for improving forest functions that could have a measurable impact on channel stability.

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Water Quality Assessment

There are no listings in the North Fork Lewis River (Lower) subwatershed.

Measured water quality data are limited in the study area. Data collected in 2003-2004 by Ecology indicate the North Fork Lewis River was not a significant source of organophosphorus, nitrogen pesticides, PCBs or PAHs to the Columbia River.

Drainage System Inventory

Significant updates to the drainage mapping database were completed in 2008 and 2009. Nearly 1,900 stormwater infrastructure features were added during this time. A total of 2,091 features are mapped in this study area, including seven stormwater facilities, five of which are publicly owned and operated. Capital project retrofit opportunities and maintenance evaluations generated no referrals. Outfall assessments generated no potential project opportunities. One referral was generated to Maintenance and Operations for litter removal.

Illicit Discharge Screening

Illicit discharge detection and elimination screening was not conducted.

Source Control

Source control visits were not conducted.

Stream Reconnaissance Feature Inventory

A stream reconnaissance feature inventory was not conducted.

Physical Habitat

Physical habitat measurements in this assessment area were made in 2004 (R2 Resource Consultants, Inc., 2004) for two reaches of the North Fork Lewis River.

The upper survey reach in the North Fork Lewis River is classified as a wide, low gradient flood plain. This survey reach has a map gradient of 1.0 percent, and habitat consists primarily of small cobble riffle and glide. Habitat parameters including substrate and streambank stability are classified as properly functioning. LWD is classified as at risk.

The lower survey reach in the North Fork Lewis River is classified as a wide, low gradient flood plain. This survey reach has a map gradient of 1.0 percent, and habitat consists primarily of glides and small cobble riffle. Habitat parameters including substrate and streambank stability are classified as properly functioning. LWD and pool quality are classified as at risk.

Geomorphology and Hydrology

A geomorphology and hydrology assessment was not conducted.

Riparian Assessment

In the 2004 LCFRB Habitat Assessment, overall riparian conditions were rated as moderately impaired to impaired. Large woody debris recruitment potential was primarily low to moderate in the mainstem of the North Fork Lewis River. Shade levels are currently off-target with respect to the State Forest Practices shade/elevation screen standards.

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Wetland Assessment

The North Fork Lewis River (Lower) subwatershed has wetlands associated with the main channels of the river and its tributaries, including natural depressions and man-made impoundments, flood influenced riverine wetlands, and sloped seep wetlands dominated by groundwater discharge.

Macroinvertebrate Assessment

A macroinvertebrate assessment was not conducted.

Fish Use and Distribution

The available information suggests that anadromous fish use in the mainstem of the North Fork Lewis River includes chum, coho, fall and spring Chinook and summer and winter steelhead. The available evidence identified the presumed presence of bull trout in the mainstem of the North Fork Lewis River and coho salmon and winter steelhead are presumed to use several unnamed tributaries. There are no known barriers on the mainstem of the North Fork Lewis River in the study area. Several partial barriers and two total barriers are identified on tributaries to the North Fork Lewis River.

Recently Completed or Current Projects

There are no stormwater projects planned for any of these four subwatersheds in the Stormwater Capital Program or 2010-2015 TIP.

Analysis Approach

Purpose

The Analysis of Potential Projects narrows the initial list of possible opportunities to a subset of higher priority items. Listed opportunities in sections of the SNAP report include sites requiring immediate follow-up, possible stormwater capital improvement projects, internal follow-up by DES staff, and, in some cases, information to be forwarded to other county departments or outside agencies.

Stormwater capital improvement project opportunities are recommended for further evaluation by engineering staff and potential development for consideration through the capital planning process. Sites flagged for internal action by ongoing programs such as illicit discharge screening, operations and maintenance, and source control outreach receive follow-up within the context and schedules of the individual programs. Information forwarded to other county departments, such as Public Health, or to outside agencies, such as Clark Conservation District and Clark Public Utilities, may lead to additional activities outside the scope of DES work.

Methods

An initial review is conducted for all potential projects identified during the stormwater needs assessment. Field notes, descriptions, field photos and other associated information are reviewed. In some cases, additional field reconnaissance is performed.

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In general, capital project opportunities initially are evaluated by considering problem severity, land availability, access, proximity and potential for grouping with other projects, and potential for leveraging resources. Staff considers supporting data and information from throughout the SNAP report to assist in the initial project review.

Based on this review, lower priority opportunities are removed and higher priority opportunities are recommended for further consideration below.

Emergency/Immediate Actions

Emergency/Immediate actions may be pursued by Clark County staff or referred to other appropriate agencies. These cases represent a potential or immediate threat to public health, safety or the environment, and require timely follow-up.

No projects of this type were identified.

Potential Stormwater Capital Projects

Stormwater Capital Improvement Projects include projects that create new or retrofit existing stormwater flow control or treatment facilities, substantial infrastructure maintenance projects, habitat enhancement projects, or property acquisition to mitigate for stormwater impacts. Facility retrofits refer to projects that will increase an existing facility's ability to control or treat stormwater in excess of the original facility's design goals.

Stormwater Facility Capital Improvement Projects

No projects of this type were identified.

Stormwater Infrastructure Maintenance CIPs

No projects of this type were identified

Stormwater Class V Underground Injection Control (UIC) Projects

No projects of this type were identified

Habitat Rehabilitation/Enhancement Projects

ID	Basis for Project	Project Description	Action
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OS-231	Tax lots 253132-000, 253089-000,	Evaluate opportunity for Growing Green reforestation project	Refer to CWP Capital Planning
OS-232	258225-000, 254781-000,		
OS-233	255238-000		
OS-234			
OS-235			

Property Acquisition for Stormwater Mitigation

ID	Basis for Project	Project Description	Action
OS-236	Tax lot 252223000 contains 600 feet of degraded wetland and riparian areas of unnamed tributary of North Fork Lewis River	Investigate the feasibility of acquiring property (13.6 acres) for riparian restoration, headwater wetland rehabilitation, and reforestation.	Refer to CWP Capital Planning

Follow-up Activities for Referral within DES

This category includes opportunities other than capital projects that are dependent upon DES programs or oversight. Examples include referrals to: Public Works Operations for public stormwater infrastructure maintenance or private facility inspection; DES Sustainability and Outreach for landowner letters regarding trash pickup or agricultural BMPS; the Illicit Discharge screening project; general reach information forwarded to DES engineers for capital planning purposes. Other opportunities, such as possible fish barriers or culvert maintenance issues, also may be included.

Private Stormwater Facilities Maintenance

No projects of this type were identified.

Public Works Stormwater Infrastructure Maintenance

No projects of this type were identified.

CWP Outreach/Technical Assistance

No projects of this type were identified.

CWP Infrastructure Inventory

No projects of this type were identified.

CWP Capital Planning

No projects of this type were identified.

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CWP Illicit Discharge Screening

No projects of this type were identified.

Other

Identifier	Issue	Project	Action
OS-237	Total Fish Barrier; NW Maple ridge Dr (45.918525, -122.691240)	Removal or modification of fish barrier to allow fish passage	DES Assessment and Monitoring to inform WDFW
OS-238	Total Fish Barrier; NW Bratton Road (45.900215, -122.724110).	Removal or modification of fish barrier to allow fish passage	DES Assessment and Monitoring to inform WDFW

Non-Project Management Recommendations

Non-project stormwater management recommendations address areas where county programs or activities could be modified to better address NPDES permit components or promote more effective mitigation of stormwater problems. Information of this type contributes to adaptive management strategies and more effective stormwater management during the permit term.

Management and programmatic recommendations in the study area subwatersheds, by NPDES permit component, include:

Storm Sewer Mapping and Inventory

- Continue research and mapping new stormwater infrastructure with the goal of maintaining a complete stormwater infrastructure inventory

Coordination of Stormwater Activities

- Continue to search for opportunities to coordinate or leverage projects with the Lower Columbia Fish Recovery Board through the 2010 WA Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plan.

Mechanisms for public involvement

- Publish SNAP reports on CWP web page

Development Regulations for Stormwater and Erosion Control

None

Stormwater Source Control Program for Existing Development

- Continue to expand efforts to design and build runoff reduction strategies in county right-of-way
- Focus on protecting reaches that currently are unstable or sensitive to future disturbance
- Conserve agricultural and forest lands and promote healthy practices

Operation and Maintenance Actions to Reduce Pollutants

None

Education and Outreach to Reduce Behaviors that Contribute Stormwater Pollution

- Perform targeted technical assistance to ensure that timber harvest, land development and road BMPs are implemented
- Educate private landowners on importance of native riparian vegetation and intact riparian forests for shading streams and preserving hydrology
- Provide landowners a list of suggested plants for stream re-vegetation and local nurseries that stock them
- Replace missing or deteriorated stream name signs

TMDL Compliance

None

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Monitoring Stormwater Program Effectiveness

None

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