2008 Stormwater Needs Assessment Program

East Fork Lewis River (RM 00.00)/East Fork Lewis River (RM 03.19)/McCormick Creek Subwatershed Needs Assessment Report

Clark County Public Works Clean Water Program

April 2009

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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
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 East Fork Lewis River (RM 00.00), East Fork Lewis River (RM 03.19), and McCormick Creek subwatersheds. The assessment focused on those portions of the study area that are within unincorporated Clark County.

Intent

Stormwater Needs Assessment reports compile 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. The assessments are conducted at a subwatershed scale, providing a greater level of detail than regional Water Regional 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 three study area subwatersheds, 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 channel restoration, riparian and stream bank revegetation, and aquatic habitat enhancement and restoration.

Other projects are coordinated by Clark County Legacy Lands Program, Clark County Clean Water Program, Clark County Capital Improvement Program, and the Department of Ecology. The watershed continues to benefit from the efforts of these groups.

There are no stormwater projects in the East Fork Lewis River (RM 00.00), East Fork Lewis River (RM 03.19), and McCormick Creek subwatersheds under the 2009 through 2014 Stormwater Capital Improvement Program.

The Washington Department of Ecology is developing Total Maximum Daily Load (TMDL) for bacteria and temperature in the East Fork Lewis River watershed including McCormick Creek.

Category	Status
Water Quality	
Overall	• Poor (McCormick Creek) to Good (East Fork Lewis River (RM 00.00) and East Fork Lewis River (RM 03.19)
Fecal coliform bacteria	• All three fail standards; McCormick Creek by a large margin • All are included in East Fork Lewis River fecal coliform TMDL
Temperature	• East Fork Lewis River subwatersheds fail temperature standard; McCormick unknown • Highest recorded temperatures of entire East Fork system (2005) • All three are included in East Fork Lewis River temperature TMDL
Biological	
Benthic macro-invertebrates	• Low biological integrity for McCormick Creek; moderate biological integrity for East Fork Lewis River (RM 03.19); no data for East Fork Lewis River (RM 00.00)
Anadramous fish	• Known winter and summer steelhead, Coho, chum, fall Chinook (EF (RM00.00) and EF (RM 03.19); Presumed and potential winter steelhead and Coho (McCormick Cr) • Moderate to high regional recovery priority (EF (RM 00.00) and McCormick = Group B, Tier 2; EF 03.19 = Group A, Tier 1)
Habitat	
NOAA Fisheries criteria	• Forest, total impervious area, and road density percentages fall into the Non-Functioning category for all three • Projected effective impervious area falls into Non-Functioning (McCormick, EF 00.00), and Functioning (EF 03.19) categories • Stream crossing density falls in the Functioning category for all three
Riparian	• Overall riparian conditions impaired, except EF 00.00 (marginal) • Overall shade is low at 0-20%; upper McCormick Creek is shaded • Large woody debris recruitment varies from none to moderate
Wetland	• Extensive floodplain wetlands along East Fork mainstem within EF 00.00 and 03.19; some wetlands near channels in McCormick
Hydrology and Geomorphology	
Overall hydrology	• East Fork Lewis River is tidally influenced in this study area • Mixed rural land use suggests higher storm flows than forested areas
Channel stability	• Projected unstable to very unstable
Future condition	• Projected impervious area in East Fork Lewis River (RM 00.00) and McCormick Creek places them in Non-Functioning category
Stormwater (Uninc)	
System description	• Primarily road-side ditches • Four public stormwater facilities; thirteen private facilities
Inventory	• Complete
System adequacy	• Assumed adequate treatment; inadequate flow control
System condition	• 208 outfalls screened for illicit discharges. All were in compliance • 12 of 13 outfalls draining to critical areas in compliance

Opportunities

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

- Focused stormwater outreach and education to streamside landowners in headwaters areas.
- Inspection of one potentially at-risk earthen dam.
- Inspection and repair of two plugged culverts causing localized flooding.
- Maintenance to bring four public stormwater facilities into compliance with county standards.
- Potential retrofit of one stormwater outfall causing significant erosion.
- Cleanup of four illegal dump sites.
- Ditch retrofits to provide water quality treatment.
- Potential purchase or protection of three parcels suitable for large-scale wetland restoration.
- Technical assistance visits to landowners with potential source control and water quality ordinance issues.
- Exclusion of livestock from the stream in two locations.
- Investigation of two potential illicit discharges.
- Investigation of two significant headcuts and possible stabilization.
- Potential large-scale cooperative project with City of LaCenter and City of Ridgefield for multi-use regional sports complex with stormwater benefits.
- Evaluation of several potential fish barriers, and removal of several known barriers in lower McCormick Creek and tributaries.
- Small or large-scale invasive plant removal and riparian restoration projects.

Non-project stormwater management recommendations address areas where county programs or activities could be modified to better address National Pollution Discharge Elimination System (NPDES) permit components or promote more effective mitigation of stormwater problems. Management recommendations relevant to the study area include:

- Pursue future collaborative stormwater activities with the City of LaCenter
- Continue to coordinate with the Lower Columbia Fish Recovery Board through the Lower East Fork Lewis River Aquatic Habitat Restoration Plan.
- Continue active participation in Ecology's bacteria and temperature TMDL development for the East Fork Lewis River subwatershed.

- Increase maintenance of stormwater swales to increase treatment effectiveness and reduce erosion.
- Replace deteriorated stream name signs at road crossings.
- Perform targeted monitoring or screening to identify fecal coliform sources.
- In collaboration with LaCenter and Ridgefield, consider stormwater basin planning as a tool to better manage stormwater impacts due to future growth in the East Fork Lewis River (RM 00.00) and McCormick Creek subwatersheds.
- In developing areas, emphasize stormwater management that focuses on reduction of runoff and diffuse infiltration close to the source rather than in centralized facilities. Low impact development (LID) practices should be encouraged.
- Examine the use of small projects to improve stormwater retention and treatment in roadside ditches.
- Consider fish barrier removal projects in the upper McCormick Creek subwatershed as existing roads and culverts are upgraded or replaced. Restoring access to fish habitat is a priority in this study area.
- Develop literature and distribute to landowners educating about the water quality impacts and other potential hazards of on-line and off-line ponds.
- Increase education and technical support regarding the removal of invasive plants, and provide a list of suggested plants for stream revegetation and local nurseries that stock them for distribution to landowners

Introduction

This report is a Stormwater Needs Assessment for the East Fork Lewis River (RM 00.00), East Fork Lewis River (RM 03.19), and McCormick Creek subwatersheds in north-western Clark County. 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 assessment 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 the SNAP are to:

- Analyze and recommend the best, most cost effective mix of improvement actions to protect, restore, or enhance beneficial uses consistent with NPDES objectives and goals identified by the state GMA, ESA recovery plan implementation, 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 is also needed by county programs implementing critical areas protections and salmon recovery planning under the state Growth Management Act (GMA) and the federal Endangered Species Act (ESA).

Scope

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

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, the Community Planning Department, and the ESA Program. Potential project or leveraging opportunities are also referred to local agencies, groups, and municipalities as appropriate.

Assessment Approach

Priorities for Needs Assessment in the East Fork Lewis River (RM 00.00), East Fork Lewis River (RM 03.19), and McCormick Creek

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, East Fork Lewis River (RM 00.00), East Fork Lewis River (RM 03.19), and McCormick Creek subwatersheds are categorized as "Rural Residential Including City-Serviced Fringes of UGA". Subwatersheds in this category typically include rural areas bordering cities. These subwatersheds often score a high priority for stormwater management in general, but are not a high priority for Clark County due to the rural nature of unincorporated portions. Urban development in this assessment area is controlled by the cities of Ridgefield and LaCenter.

Assessment Tools Applied in East Fork Lewis River (RM 00.00), East Fork Lewis River (RM 03.19), and McCormick Creek

The SNAP utilizes a standardized set of tools for subwatershed assessment, including: desktop mapping analysis, modeling, outreach activities, and a variety of field data collection. 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 the SNAP. Tools with an asterisk (*) are those for which new data or analyses were conducted during the course of this needs assessment. The remaining tools and chapters were completed based on pre-existing information or were not included in the assessment.

Table 1: Stormwater Needs Assessment Tools

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

Assessment Actions

Outreach Activities

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

- August 2008 -- press release to local media.
- March 2008 & December 2008– articles in Clean Water Program E-Newsletter.
- April 2008 -- SNAP information distributed with Clean Water Program information at Small Farm Expo: 69 participants.
- August 2008 – information on the SNAP program distributed at 10-day Clark County Fair.
- Clean Water Program web pages updated as needed on an on-going basis; 138 visitors to the SNAP Web page and 95 unique downloads of SNAP documents (note, these figures are under reported as tracking software only records top 20 pages and documents monthly).
- A description of the SNAP is included in Clark County's annual stormwater management program plan submitted to Ecology.

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

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

- Site visits by clean water technical assistance staff.
- Letters detailing specific issues to individual landowners.
- General educational mailings 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.

Coordination with Other Programs

Purpose

Coordination with other county departments and with local agencies or organizations helps to explore potential cooperative projects and ensure that the best available information is used to complete the assessment.

Coordination is a two-way relationship; in addition to bringing information into the needs assessment process, coordinating agencies may use needs assessment results to plan projects and refine resource management options.

Methods

The CWP maintains a list of potential coordinating programs for each subwatershed area. Coordination takes the form of phone conversations, meetings, or electronic correspondence, and is intended to solicit potential project opportunities, encourage data and information sharing, and promote program leveraging.

Potential opportunities for coordination exceeded the scope of CWP and SNAP resources; therefore, not all potentially relevant coordination opportunities were pursued. Coordination was prioritized with departments and groups thought most likely to materially contribute to identifying potential projects and compiling information to complete the needs assessment.

Results

See Analysis of Potential Projects for an overall list and locations of potential projects gathered during the needs assessment process. Projects suggested or identified through coordination with other agencies are included.

The following list includes departments, agencies, and groups contacted for potential coordination in the assessment area:

- Clark County Endangered Species Act Program
- Lower Columbia Fish Recovery Board
- Clark County Legacy Lands Program
- Vancouver/Clark Parks and Recreation
- Washington Department of Ecology
- Clark County Transportation Improvement Program
- Fish First

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 those listed below:

- LCFRB Habitat Assessments
- LCFRB Workplan
- LCFRB Lower East Fork Lewis River Aquatic Habitat Restoration Plan (Draft)
- Ecology 303(d) list
- Ecology EIM Data
- Clark County Volunteer Monitoring Project Data
- Clark County Mitigation Opportunities Project
- Clark County 2007 Stormwater Needs Assessment Program
- Clark County 2006 Prioritizing Areas for Stormwater Basin Planning
- Clark County 2005 Benthic Macroinvertebrate and Water Temperature Monitoring
- Clark County 2005 Subwatershed Characterization and Classification
- Clark County 2003 Stream Health Report
- City of LaCenter Master Parks Plan (draft)

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 describes many subwatershed characteristics such as topography, geology, soils, hydrology, land cover, land use, and GMA critical areas. A standard GIS workspace including shape files for over 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, conclusions about general subwatershed condition and potential future changes, and potential mitigation or improvement site identification.

Map Products

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

General Conditions and Subwatershed Metrics

General Geography

The assessment area includes the East Fork Lewis River floodplain below Mason Creek and numerous smaller tributaries, at the transition from the Willamette Valley floor to low foothills along valley margin (Figure 1). Land use is predominantly rural with a developing area in the cities of Ridgefield and LaCenter and their urban growth areas. Public land and open spaces cover much of the East Fork Lewis River floodplain and include lower parts of several tributaries. Otherwise, the area is largely private land.

Topography

McCormick Creek and other creeks on the East Fork Lewis River's left bank have their headwaters in low rolling hills between 250 and 300 feet above sea level. Right bank tributaries drain from terraces along the East Fork Lewis River and steeper hills that rise to near 600 feet. The East Fork Lewis River cuts a wide floodplain that constricts to a confined channel downstream of LaCenter, and has floodplain elevations of 10 to 20 feet above sea level.

Geology and Soils

Older volcanic rocks underlie the area at depth and are exposed along the East Fork Lewis River where it forms a canyon downstream of LaCenter. Sedimentary rocks (sand and gravel) deposited by the ancestral Columbia and local streams overlie the volcanic rocks and are exposed above 350 feet and where canyons have cut through the overlying Ice Age deposits. Ice Age terraces form a prominent surface above the north side of the East Fork Lewis River between 130 and 150 feet elevation. Sandy to muddy Ice Age Cataclysmic flood deposits mantle the study area to about 350 feet above sea level

Soils formed on the East Fork Lewis River floodplain are sandy soils of the Sauvie and Puyallup series. Catastrophic flood deposits and terrace deposits are mapped in the Hillsboro, Gee and Ondne series. Older Columbia River sediments and volcanic deposits are generally overlain by finer grained Hesson and Olequa series soils.

Hydrology

Geology and topography play the main role in determining the study area's hydrologic framework. Streams in the Willamette Valley and the foothills on its fringe are on older sand and gravel geologic deposits and tend to form alluvial streams having pool riffle morphology where gravels are present and simpler mud- banked streams where fine substrate occurs. Tributary streams have a relatively steep gradient and form small canyons.

The East Fork Lewis River is tidally influenced within the study area, depending to some degree on Columbia River stage.

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

Very little hydrologic information exists for the study area tributary streams. In the late 1980s, the US Geological Survey made several summer base flow measurements at several tributaries. Flows were not measured for most of the unnamed tributaries, suggesting that they may have been dry at that time. Larger creeks such as McCormick and Dyer should have summer base flow. Smaller Creeks are likely to be dry during the summer.

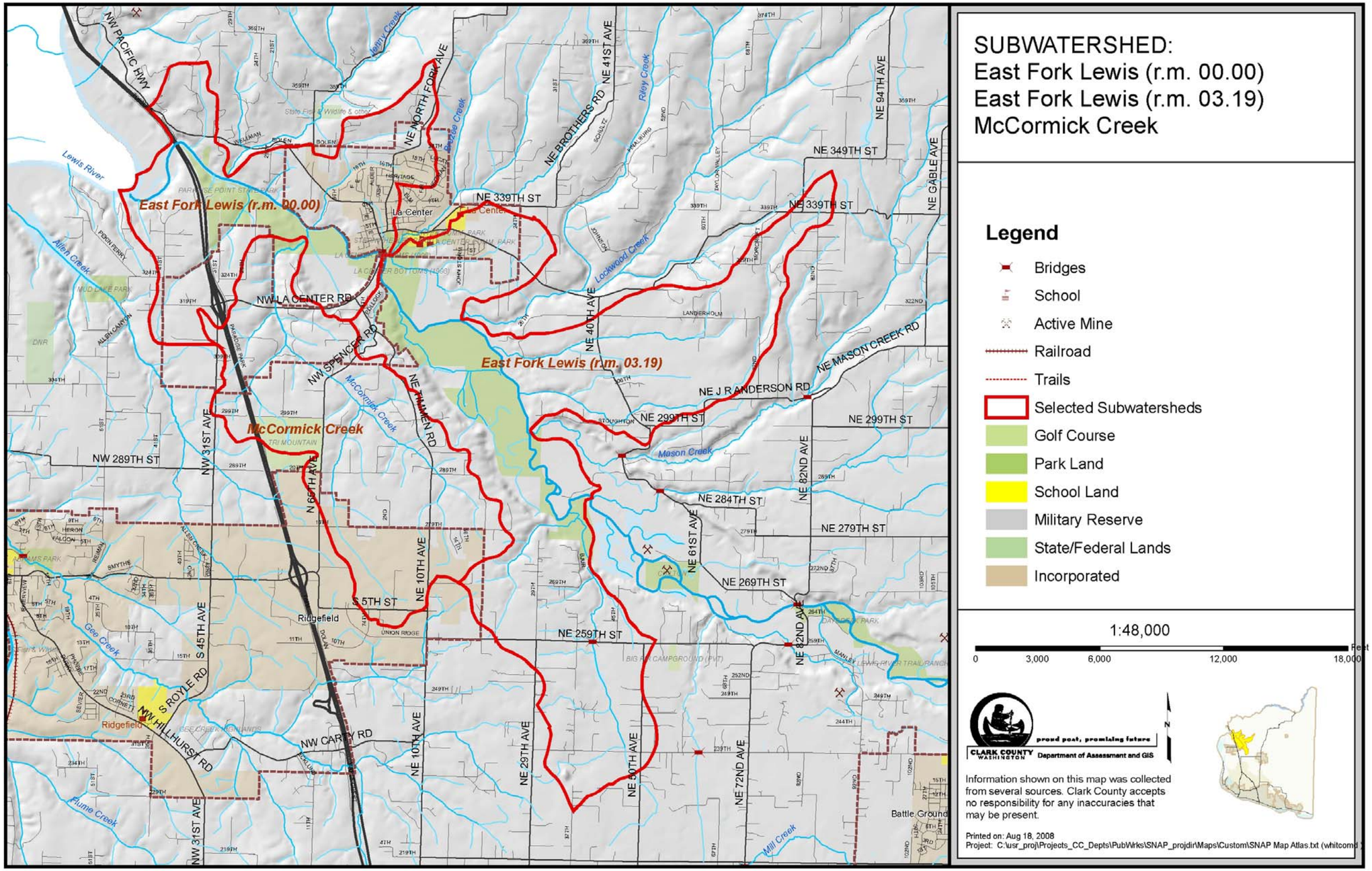


Figure 1: Subwatershed Map: East Fork Lewis River (RM 00.00), East Fork Lewis River (RM 03.19), and McCormick Creek

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 the study area has a largely non-functioning stream habitat (Table 2).

Table 2: Watershed Scale Metrics

Metric	McCormick Creek	East Fork Lewis River (RM 0.00)	East Fork Lewis River (RM 3.19)	Functioning	Non-functioning
Percent Forested (2000 Landsat)	20	28	23	> 65 %	< 50 %
Percent TIA (2000 Landsat)	19	18	15	< 5 %	> 15 %
Road Density 2007 data (miles/mile^2)	7.4	10.5	5.4	< 2	> 3
Stream Crossing Density (crossings per stream mile)	2.2	1.7	1.3	< 3.2/mile	> 6.4/mile
Percent EIA (estimated from Comprehensive Plan)	28	22	6	< 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.

Upland areas in the assessment area are almost entirely cleared for pasture, agriculture, and residential use. Forest remnants remain in a few places, primarily along steeper stream channels, but the overall lack of forest cover places these subwatersheds squarely in the non-functioning category.

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 five percent as fully functional and greater than 15 percent as non-functioning.

The TIA estimate is currently at or above the threshold for non-functioning habitat in all three subwatersheds. However, Landsat data tends to overestimate TIA.

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 all well into the non-functioning (>3 road miles/mi^2) category, suggesting degraded habitat.

Stream Crossing Density
Stream crossing densities are easily measured using available road and stream channel data. The salmon protection standard considers larger fills over 60 feet wide, which would be approximately five to ten foot high road fill. The study area subwatersheds all have stream 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 2008 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. The East Fork Lewis River (RM 00.00) and McCormick Creek subwatersheds are projected to see significant further increases in EIA under the 2008 Comp Plan, placing both firmly in the non-functioning category. The East Fork Lewis River (RM 03.19) subwatershed has a much higher percentage of floodplain wetlands and other undevelopable lands, leading to a relatively low projected future EIA, falling within the functioning habitat category.

Estimated Channel Stability Based on Forest and EIA
In a recent 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, streams in all three subwatersheds are expected to have unstable channels. Based on very high projected EIA and very low forest cover, the East

Fork Lewis River (RM 00.00) and McCormick Creek subwatersheds are particularly prone to instability and can be expected to have unstable stream channels.

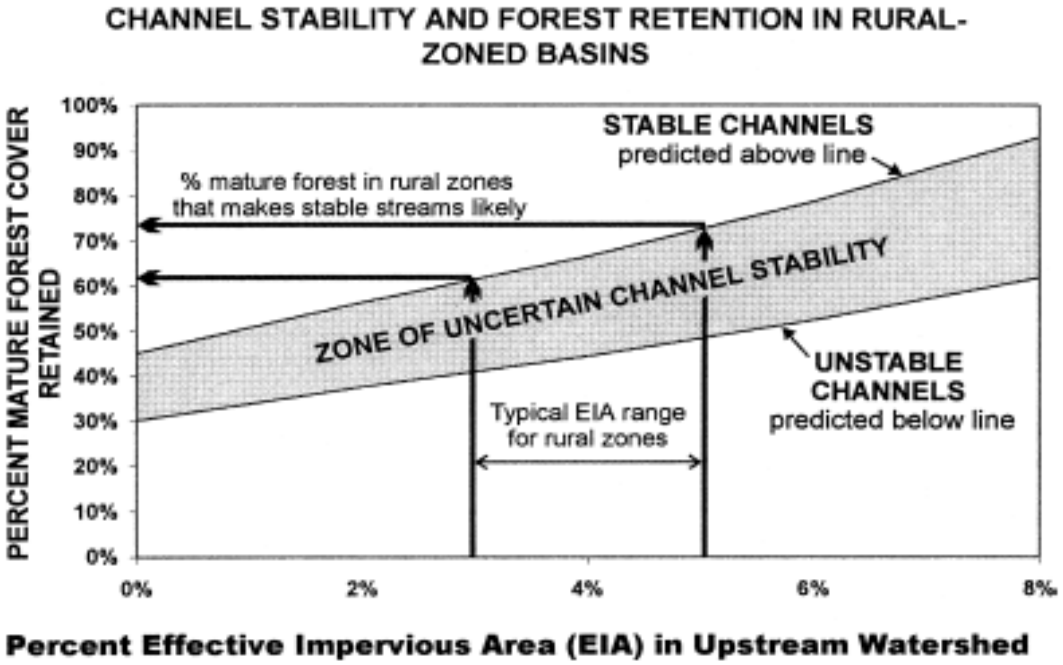


Figure 2: Channel stability in rural areas (Booth, Hartley, and Jackson, June 2002).

Water Quality Assessment

The Water Quality Assessment summarizes and references available water quality data for the East Fork Lewis River (RM 00.00), East Fork Lewis River (RM 03.19), and McCormick Creek subwatersheds. 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 state water quality standards, the three subwatersheds included in this assessment are to be protected for the designated uses of: Salmonid spawning, rearing, and migration; 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 and Table 602).

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

Table 3: Applicable Water Quality Criteria

Characteristic	Criteria
Temperature	≤ 17.5 °C (63.5 °F)
Dissolved Oxygen	≥ 8.0 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 percent 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 may be found on the Ecology website at:
http://www.ecy.wa.gov/programs/wq/303d/index.html

McCormick Creek is Category 5 listed (Polluted waters that require a TMDL) for fecal coliform bacteria and Category 2 listed (Waters of Concern) for temperature on the 2008 303(d) list. The East Fork Lewis River in the assessment subwatersheds is Category 5 listed for temperature and fecal coliform. Because McCormick Creek is a tributary to segments listed for temperature, all three subwatersheds are included in ongoing TMDL development for both temperature and fecal coliform in the East Fork Lewis River.

Clark County Stream Health Report

In 2004, the CWP compiled available data and produced the first county-wide assessment of general water quality.

Based on limited available datasets for general water quality, fecal coliform bacteria, and benthic macroinvertebrates, the two mainstem subwatersheds had good stream health, while McCormick Creek rated poor.

The 2004 Stream Health Report may be viewed on the county website at: http://www.clark.wa.gov/water-resources/stream.html.

Available Data

Recent water quality data are somewhat limited for all three subwatersheds, consisting primarily of stream temperature and bacteria data collected by Ecology in 2005 and 2006 during TMDL development. Complete data and available summaries for TMDL development may be viewed on the Ecology website at: http://www.ecy.wa.gov/programs/wq/tmdl/EForkLewis/index.html

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

Table 4: Data and Information Sources

Source	Data and/or Report
Ecology	East Fork Lewis River TMDL technical study for temperature and bacteria
Clark County Clean Water Program	2004 Stream Health Report and draft reports

Water Quality Summary

Ecology collected instream flow and fecal coliform data from the following stations during data collection for the East Fork Lewis River fecal coliform TMDL:

- 27-EFL-0.75 (East Fork Lewis River under I-5 bridge)
- 27-MCC-1.18 (McCormick Creek at La Center Road)
- 27-MCC-2.0 (McCormick Creek at NW Spencer Road)

- 27-MCC-3.4 (McCormick Creek at NE 289th and Timmen Road)
- 27-EFL-3.15 (East Fork Lewis River off La Center Road)

Continuous temperature data were collected from the following stations in this assessment area as part of the East Fork Lewis River temperature TMDL:

- 27EFL01.8 (East Fork Lewis River at gage near mouth)
- 27EFL04.6 (East Fork Lewis River above Lockwood Creek)
- 27MCC00.1 (McCormick Creek near mouth)

Clark County has no active monitoring stations in the assessment area.

Fecal Coliform Bacteria

Based on 32 samples (16 wet season and 16 dry season), the mainstem East Fork Lewis River at Station 27-EFL-0.75 met the geometric mean standard but failed the 10 percent not-to-exceed portion of the standard in both seasons. At Station 27-EFL-3.15, the mainstem met the geometric mean standard for both seasons and failed the 10 percent not-to-exceed portion of the standard during the wet season only.

Based on 32 samples, all three McCormick Creek stations failed both portions of the standard in both seasons. The most upstream station (27-EFL-3.15) had the most elevated bacteria concentrations, with a maximum tested value of over 15,000 cfu/100mL.

During a dry period sampled during 2005, McCormick Creek at station 27-MCC-1.18 carried approximately two percent of the total bacteria load measured in the East Fork Lewis River subwatershed. During a rain event sampled in 2005, the approximate load was less than one percent of the total.

Water Temperature

Temperature logging (2005) indicated that station 27EFL04.6 had the highest 7-DADMax of any station monitored in the East Fork Lewis River subwatershed (>30º C). Although the data record was missing the warmest portion of the year, station 27EFL01.8 near the river's mouth appears to have been the second warmest station with a 7-DADMax of at least 26º C.

Data from Station 27MCC00.1 is not presented in the graphical summary by Ecology.

Stream Health

Despite ongoing issues with temperature and fecal coliform bacteria, the mainstem East Fork Lewis River had good overall stream health according to the 2004 Stream Health Report.

McCormick Creek; however, was in poor health as of 2004. Consistently elevated fecal bacteria concentrations contributed significantly to the poor rating. Historical data from the early 1990s also indicated routinely high nutrient levels and other water quality problems. When studied extensively by Clark County in the early 1990s, McCormick Creek was the most polluted of any stream sampled in the East Fork Lewis River subwatershed.

Implications for Stormwater Management

Table 5 lists general water quality concerns in this assessment area and potential solutions for each. Solutions listed in bold indicate areas where CWP activities can have a positive impact. It should be noted that CWP activities, though important, are not likely to achieve water quality improvement goals on their own. Other county departments, local agencies, and not least of all, the public, must all contribute to water quality improvement.

Among the Clean Water Program activities most likely to have a positive impact on water quality are:

- Effective stormwater system designs, retrofitting, and maintenance;
- Source detection and removal projects; and
- Public education programs.

Stormwater system design, retrofitting, and maintenance include a range of activities that can address specific pollutants of concern. Source detection and removal projects help eliminate specific contributions of pollutants. Education programs are a critical element in modifying behavior and promoting better public stewardship of water resources.

Table 5: Likely Water Quality Concerns, Sources, and Solutions for East Fork Lewis River (RM 00.00), East Fork Lewis River (RM 03.19), and McCormick Creek Subwatersheds				
Characteristic	**Beneficial Use Affected**	**Potential Sources**	**Mechanism**	**Solutions (bold indicates direct Clean Water Program involvement)**
Fecal coliform bacteria	Primary contact recreation	failing septic systems or sanitary sewers	groundwater seeps	**Storm sewer screening for source identification and removal** **Education programs** Agricultural Best Management Practices Septic system inspection and maintenance
		livestock, wildlife, pets	overland runoff storm sewers/ditches direct access	
Water temperature	Salmonid spawning and rearing	vegetation removal	direct solar radiation	**Stormwater infiltration to increase baseflow** **Streamside planting/vegetation enhancement / riparian preservation through acquisition** **Education programs**
		low summer flows	decreased resistance to thermal inputs	
Turbidity	Salmonid spawning rearing, and migration Aesthetic enjoyment	erosion *(development projects; land clearing; cropland; impervious surfaces; channel erosion)*	overland runoff storm sewers/ditches channel dynamics	Erosion control regulations **Storm water facility designs/retrofits to optimize settling and removal of suspended silt/clay** Agricultural Best Management Practices Stream bank stabilization/rehabilitation **Storm water outfall/facility retrofits to reduce flow-induced channel erosion**
Total phosphorus	Aesthetic enjoyment	natural groundwater	groundwater seeps	Erosion control regulations Septic system inspections and maintenance **Storm water facility designs/retrofits to optimize settling and removal of suspended silt/clay** Agricultural Best Management Practices
		erosion	(see turbidity)	
		livestock, wildlife	(see bacteria)	
		failing septic systems	(see bacteria)	

Drainage System Inventory

Clark County's drainage system inventory resides in the StormwaterClk GIS database and is available to users through the county's Department of Assessment and GIS, or viewable on the internet through the Digital Atlas located at:
http://gis.clark.wa.gov/imf/imf.jsp?site=digitalatlas&CFID=56651&CFTOKEN=98300052

Drainage system inventory is an ongoing CWP work effort focused on updating the StormwaterClk database to include all existing stormwater drainage infrastructure.

The work effort during 2008 in the East Fork Lewis River (RM 00.00), East Fork Lewis River (RM 03.19), and McCormick Creek subwatersheds focused on identifying and mapping previously unmapped discharge points and stormwater conveyance. Table 6 indicates the number of features previously inventoried in StormwaterClk prior to 2008 SNAP work, and the number of features added to the database as a result of 2008 SNAP and mapping project implementation.

The drainage system inventory for these three subwatersheds is generally completed. Inventory is on-going in 2009 as part of a county-wide inventory update.

Table 6: Drainage System Inventory Results, East Fork Lewis River (RM 00.00)/East Fork Lewis River (RM 03.19)/McCormick

Database Feature Category	Previously Inventoried	Added to Database during 2008
Inlet	48	2
Discharge Point (outfall)	13	290
Flow Control	2	0
Storage/Treatment	23	9
Manhole	1	0
Filter System	0	0
Channel	131	1088
Gravity Main	100	566
Facilities	12	5

Stormwater Facility Inspection

The stormwater facility inspection process includes two components:

- A public stormwater facility inspection using state and county standards
- An off-site inspection to check for problems such as downstream bank erosion

Component 1: Public Stormwater Facility Inspection

Purpose

The purpose of the Public Stormwater Facility Inspection project is to verify that maintenance activities are implemented, that facilities are properly functioning, and identify possible retrofit projects and major repairs.

Methods

The Public Stormwater Facility Inspection project is derived from county and state standards equivalent to maintenance standards specified in Chapter 4 of Volume V of the 2005 *Stormwater Management Manual for Western Washington*. The standards list the part or component of the facility that may need repairs, the condition when repair or maintenance is needed, and the expected results. Individual components of a facility are referred to as "facility objects".

The public stormwater facility inspection process involves inspecting all facility objects to determine if all maintenance is in compliance with the standards. If any facility object does not meet the maintenance standards, the entire facility is not in compliance. Non-compliant stormwater facilities are referred to the appropriate public works departments for repairs or maintenance.

Results

Based on the county's StormwaterClk database, as of October 2008, there were three mapped public stormwater facilities in the East Fork Lewis River (RM 00.00) subwatershed and one mapped public stormwater facility in the McCormick Creek subwatershed. There were no mapped public stormwater facilities in the East Fork Lewis River (RM 03.19) subwatershed.

The three public stormwater facilities in East Fork Lewis River (RM 00.00) subwatershed contained a total of 21 facility objects. Fifty-seven percent (57 percent) of the facility objects were in compliance.

Figure 3 summarizes notable inspection activities in East Fork Lewis River (RM 00.00) subwatershed including general facility location, compliant facilities and referrals of non-compliant facilities.

The inspection process in East Fork Lewis River (RM 00.00) subwatershed generated three referrals: all three referrals were to Public Works Maintenance and Operations for needed maintenance activities. No major defects or hazardous conditions were discovered; non compliant issues included excess sediment depth and vegetation.

The one mapped public stormwater facilities in the McCormick Creek subwatershed contained 15 facility objects. Twenty-seven percent (27 percent) of the facility objects were in compliance.

Figure 4 summarizes notable inspection activities in McCormick Creek subwatershed including general facility location, compliant facilities, and referrals of non-compliant facilities.

The inspection process in the McCormick Creek subwatershed generated one referral to Public Works Maintenance and Operations for needed maintenance activities. No major defects or hazardous conditions were discovered; non compliant issues included excess sediment depth and grate damage.

Maintenance Referrals

Referrals made to the public works maintenance and operations department have been either brought into compliance, or will be scheduled for repair or maintenance in early 2009.

Retrofit Opportunities

The public facility inspection process did not generate any retrofit opportunities.

Management Recommendations in the East Fork Lewis River (RM 00.00) Subwatershed

Standing water and sediment accumulation were the most common defects between facility objects. The most common facility objects found out of compliance during the public stormwater facility inspection process overall were bioswales. Bioswale defects included either standing water or uneven and/or clogged flow spreaders. Excessive sediment accumulation may lead to channelization of bioswales causing standing water to form. Uneven or clogged flow spreaders may exacerbate channelization and standing water defects in bioswales by not uniformly distributing stormwater through entire swale.

Removing excessive sediment from bioswales and other facility objects during maintenance activities reduces sediment accumulation. Regrading of bioswales as designed will help eliminate uneven or clogged flow spreaders and allow stormwater to be uniformly distributed throughout entire swale; therefore, increasing stormwater treatment.

Management Recommendations in the McCormick Creek Subwatershed

Sediment accumulation was a common defect between facility objects. The most common facility objects found out of compliance during the public stormwater facility inspection process overall were bioswales and energy dissipaters. Bioswale defects included either standing water or grasses exceeding 10 inches in height with nuisance weeds and other vegetation starting to take over. Energy dissipater defects included either sediment accumulation on dissipater or missing or moved rock (riprap). Excessive sediment accumulation or missing riprap may cause energy dissipaters to not dissipate stormwater flow evenly, which may lead to channelization of the bioswale and cause standing water to form.

Maintaining vegetation of bioswales on a more frequent basis will allow grasses to become established and out-compete nuisance weeds and other vegetation. Removing excessive sediment from facility objects during maintenance activities will help ensure facilities are functioning as designed.

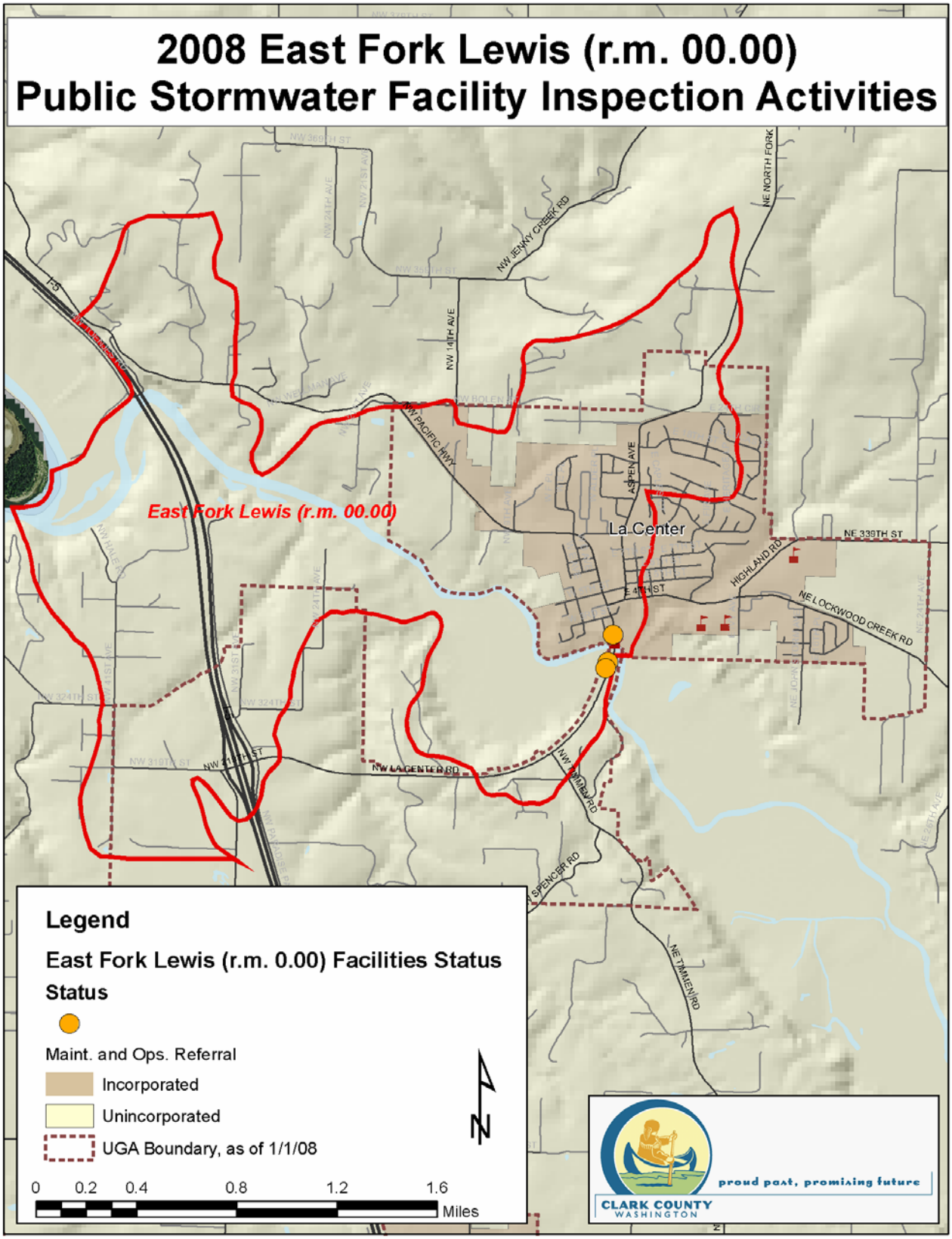


Figure 3: Summary of 2008 Public Stormwater Facility Inspection Activities in East Fork Lewis River (RM 00.00) Subwatershed

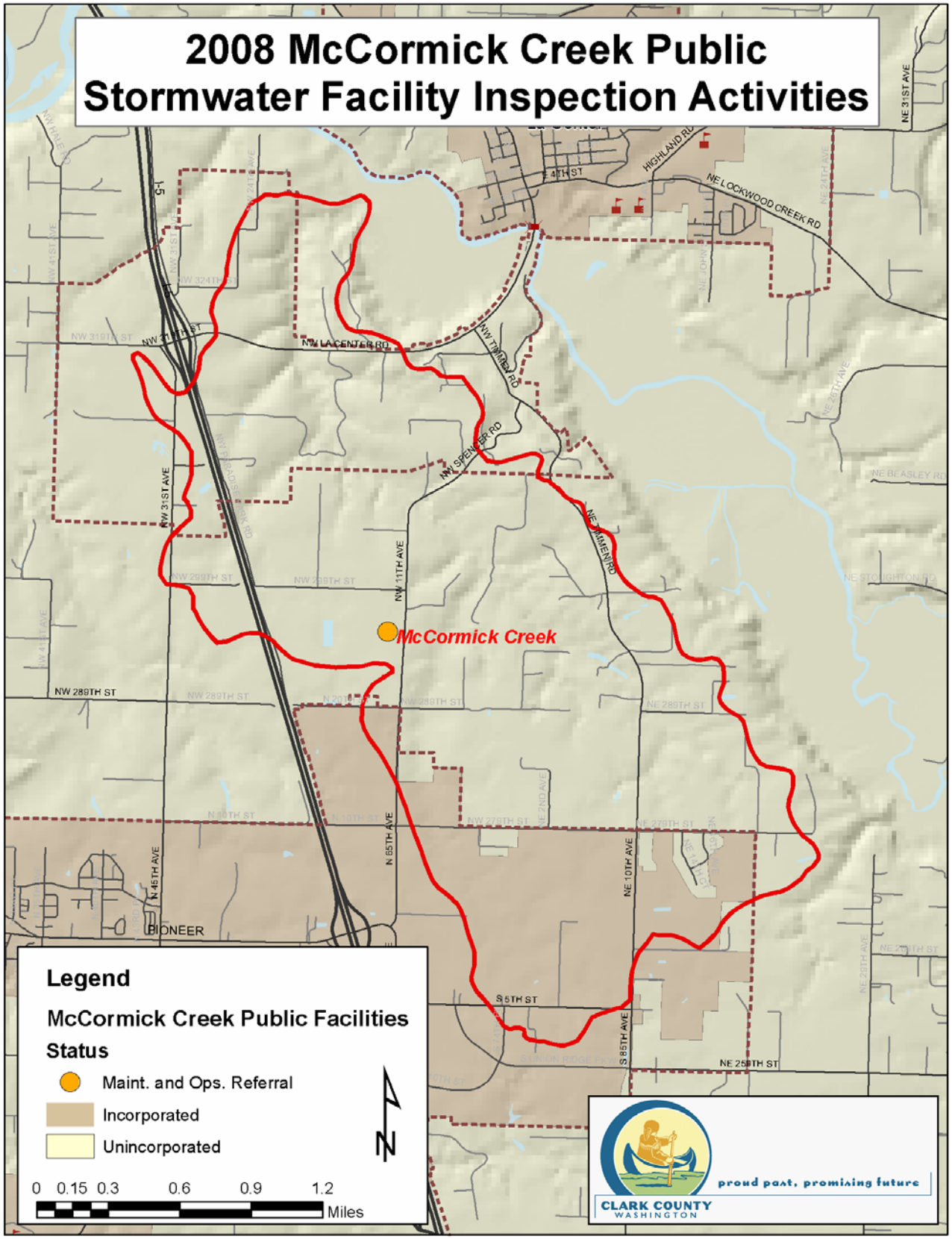


Figure 4: Summary of 2008 Public Stormwater Facility Inspection Activities in McCormick Creek Subwatershed

Component 2: Offsite Assessment

Purpose

Discharge 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 project detects possible 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 were included in the offsite assessment:

- Within 200 feet of a critical area such as a stream channel,
- Within 300 feet of a headwater stream,
- Located on public land,
- Discharges stormwater from a public-dedicated facility that is currently under the two year private maintenance warranty bond.

The offsite assessment inspects all outfalls that discharge into critical areas, as well as a 300 foot survey downstream of the outfall to look for any adverse impacts that may be caused by stormwater discharges.

If any 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.

Results

Based on the County's StormwaterCLK database, as of June 2008, there were 11 mapped outfalls in East Fork Lewis River (RM 00.00) subwatershed that discharged into critical areas and two mapped outfalls in East Fork Lewis River (RM 03.19) subwatershed that discharged into critical areas. There were no mapped outfalls in McCormick Creek subwatershed that discharged into critical areas.

Figure 5 summarizes notable outfall assessment activities in East Fork Lewis River (RM 00.00) subwatershed including general outfall locations.

Figure 6 summarizes notable outfall assessment activities in East Fork Lewis River (RM 03.19) subwatershed including general outfall locations.

As summarized in Table 7, thirteen outfalls that discharged into critical areas were assessed. Twelve outfalls were found to be in compliance. One outfall in the East Fork Lewis River (RM 00.00) subwatershed was not in compliance due to erosion and instability problems.

Potential Projects

The outfall assessment project initiated one referral to a Clean Water Program Engineer. It was discovered that a serious erosion problem was occurring at Outfall 2077 in the East Fork Lewis River (RM 00.00) subwatershed. The repair of this outfall is included in the Analysis of Potential Projects section and listed in Table 8.

Table 7: Description of Potential Retrofit Opportunities

ID	Basis for Project	Project Description	Subwatershed
OS-43	Moderate erosion of open channel downstream of outfall 2077	Monitor/investigate headcut more thoroughly to determine rate of migration and assess risk. If required, stabilize channel with grade control to prevent headcut migration and further erosion issues.	East Fork Lewis River (RM 00.00)

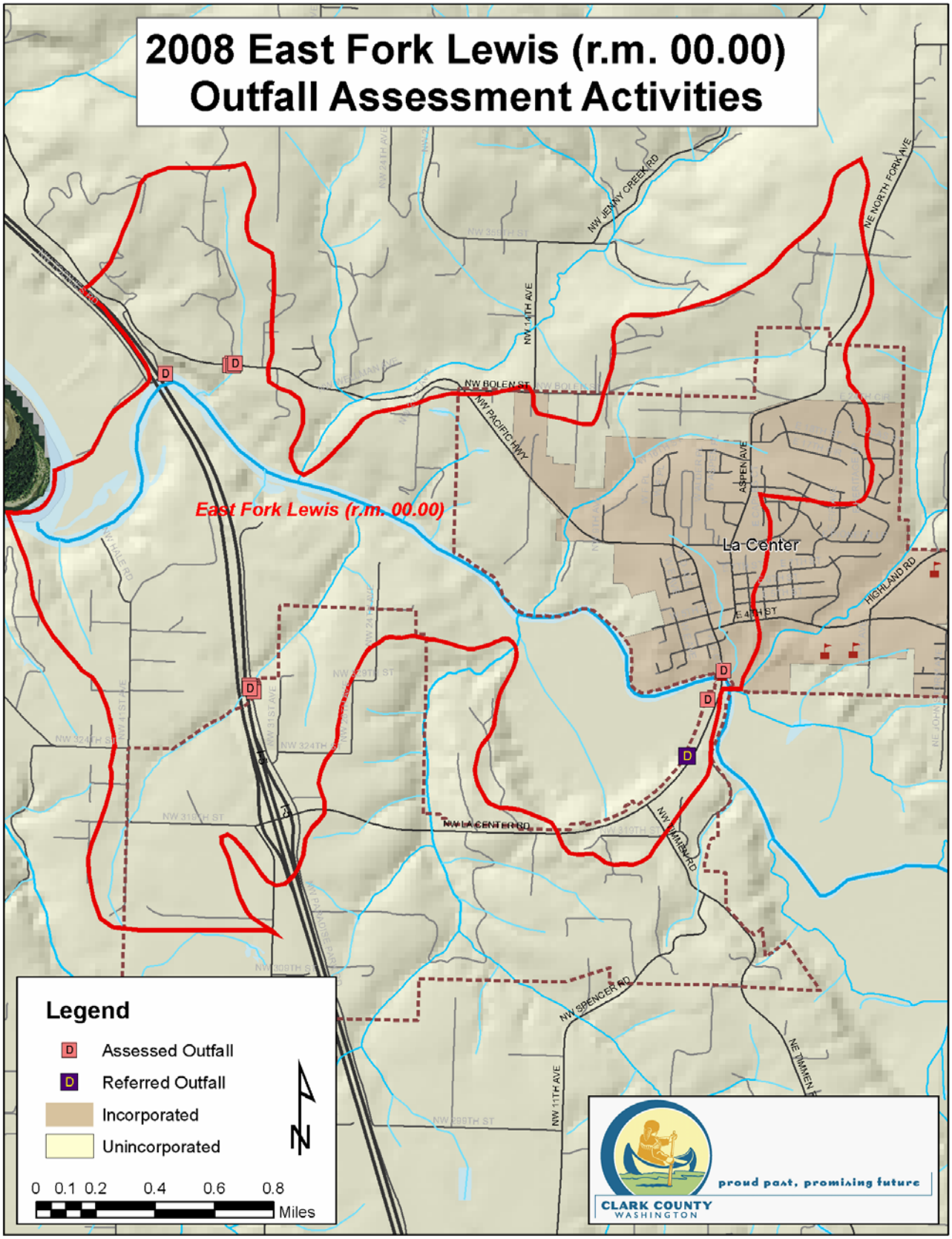


Figure 5: Summary of 2008 Outfall Assessment Activities in East Fork Lewis River (RM 0.00) Subwatershed

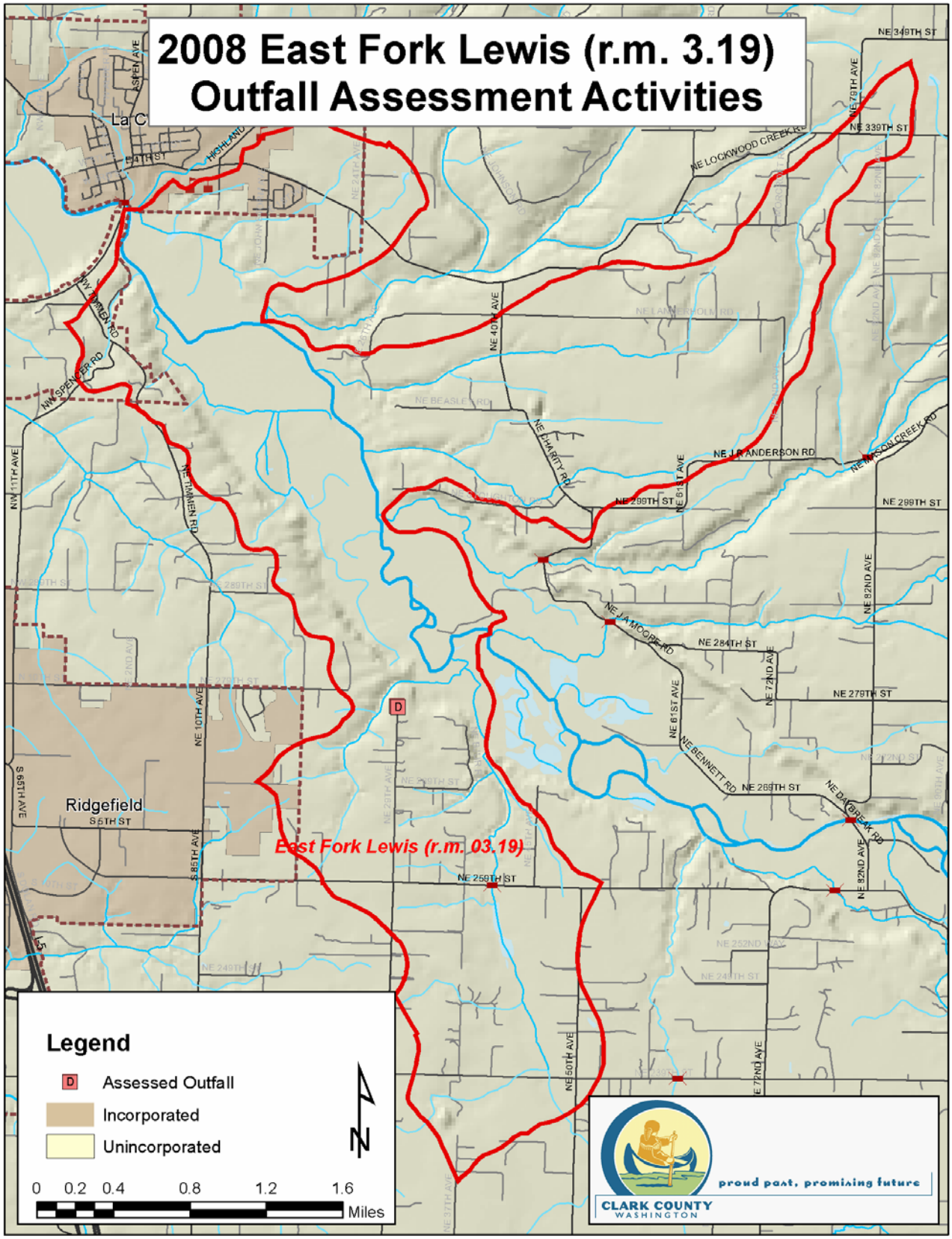


Figure 6: Summary of 2008 Outfall Assessment Activities in East Fork Lewis River (RM 03.19) Subwatershed

Table 8: 2008 Outfall Assessment Project Activity Summary of East Fork Lewis River (RM 00.00) and East Fork Lewis River (RM 03.19) Subwatersheds	
Metric	**Number**
# of outfalls assessed	13
# of outfalls compliant	12
# of noncompliant outfalls	1
# of referrals initiated	1
# of referrals ongoing	1
# of outfalls fixed	0

Illicit Discharge Detection and Elimination Screening

Purpose

The purpose of the IDDE Screening project is to detect, isolate, and eliminate illicit connections and illicit discharges to Clark County's municipal separate storm sewer system (MS4).

The IDDE screening project is designed to meet the requirements of Clark County's 2007 NPDES permit, which requires identifying and removing illicit connections to the county's MS4.

Methods

IDDE screening includes checking every stormwater outfall for potential illicit discharges, conducting follow-up investigations to track down suspected discharges or connections, and referrals to the proper agencies for termination. Field work is primarily conducted during the dry summer season.

IDDE Screening activities were completed in the East Fork Lewis River (RM 00.00), East Fork Lewis River (RM 03.19) and McCormick Creek subwatersheds during 2008.

Results

Based on the county's StormwaterClk database, as of July 2008, there were 208 mapped stormwater outfalls in the assessment area, consisting almost entirely of roadside ditches.

Figure 7 summarizes notable screening activities including general outfall locations, outfalls where water samples were collected, follow-up investigations performed, referrals made, and sources removed.

As summarized in Table 9, 202 outfalls were screened. No samples were collected because no measurable flow was found. Six mapped outfalls were either not accessible or were mapped incorrectly. No investigations were initiated.

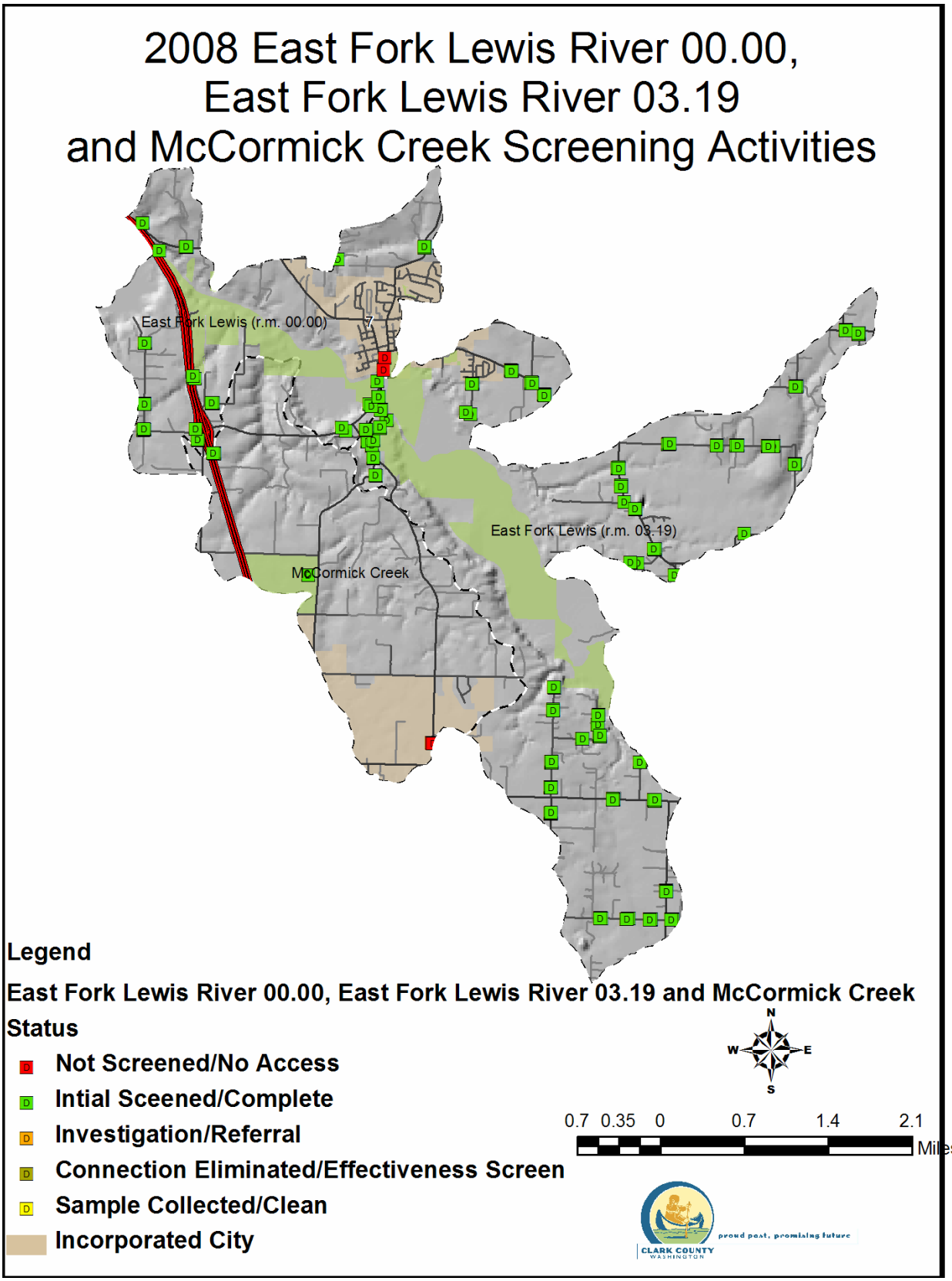


Figure 7: 2008 IDDE Screening Project in East Fork Lewis River (RM 00.00), East Fork Lewis River (RM 03.19), and McCormick Creek Subwatersheds

Table 9: IDDE Screening Project Activity Summary of East Fork Lewis River (RM 00.00), East Fork Lewis River (RM 03.19), and McCormick Creek Subwatersheds as of December 2008	
Metric	**Number**
# of outfalls screened	202
# of outfalls with sufficient flow to collect water samples	0
# of suspected illicit discharges	0
# of suspected illicit connections	0
# of investigations initiated	0
# of illicit discharge sources located	0
# of illicit connections identified	0
# of outfalls to be re-visited in 2009	0
# of referrals	0
# of illicit discharges removed	0
# of investigations and referrals ongoing	0
# of illicit connections terminated	0
# of cases closed without resolution	0

Stream Reconnaissance and Feature Inventory

Purpose

The Feature Inventory records the type and location of significant stream impairments, potential environmental and safety hazards, and project opportunities in selected stream reaches. Feature Inventory results are used primarily to document conditions and identify potential improvement projects or management actions for implementation by the CWP or other agencies.

Methods/Limitations

Geographic scope of the Feature Inventory was established by the County with input from Herrera Environmental Consultants, taking into consideration projected TIA, DNR water types, stream gradient, zoning, Clark County development permitting authority, and land ownership.

The Feature Inventory recorded significant conditions in the stream corridor relevant to SNAP components. Feature types are listed in Table 10.

The in-stream assessment approach allowed investigators to observe stream corridor features that are not always identifiable through other desk methods, such as analysis of existing aerial photographs and GIS data.

A GPS position, one or more digital photos, and relevant attribute information were collected for each logged feature. All data and linked photos are stored in the Feature Inventory Geodatabase located on the Clark County server at: W:\PROJECT\011403, Needs Assessment Planning and Reports\GIS\Data\Geodatabase. Feature data includes field observations, estimated measurements, and notes describing important feature characteristics or potential projects.

The Feature Inventory project is not intended to be an exhaustive inventory of all human alterations to the stream corridor. Rather, the project seeks to identify the most significant features pertaining to stormwater management and potential stormwater mitigation projects.

Feature dimensions and other attribute data are estimates, and should not be utilized for quantitative calculations.

For additional information pertaining to the Feature Inventory SNAP tool, see Volume 1 of the SNAP.

Study Area

The study area is located in the northern part of Clark County. The East Fork Lewis River (RM 03.19) subwatershed and the McCormick Creek subwatershed are both covered in this report.

East Fork Lewis River (RM 03.19) Subwatershed

The extent of the completed Feature Inventory in East Fork Lewis River (RM 03.19) subwatershed is shown in Figure 8. Approximately 4.25 miles of the stream corridor was assessed in the subwatershed. All of the proposed stream Feature Inventory reaches were successfully surveyed.

McCormick Creek Subwatershed

The extent of the completed Feature Inventory in McCormick Creek subwatershed is shown in Figure 9. Approximately 1.4 miles of the stream corridor was assessed in the subwatershed. One short reach on the mainstem of McCormick Creek was not accessible due to private property concerns (Tax Lot 211462000). That landowner was contacted by Jeff Schnabel (Clark County) and they discussed stream conditions on the reach of stream. That discussion resulted in the decision to remove the reach from the scope of the feature inventory.

Results/Findings

A total of 101 features were identified, with 71 in the East Fork Lewis River (RM 03.19) subwatershed and 30 in the McCormick Creek subwatershed. A breakdown of recorded features by type is presented in Table 10.

Stream crossings (culverts, bridges, and fords) were the most prevalent feature type identified in the East Fork Lewis River (RM 03.19) subwatershed, followed by impacted stream buffers and water quality impacts.

Miscellaneous features were the most prevalent feature type identified in the McCormick Creek subwatershed, followed by impacted stream buffers and stream crossings (culverts and a bridge).

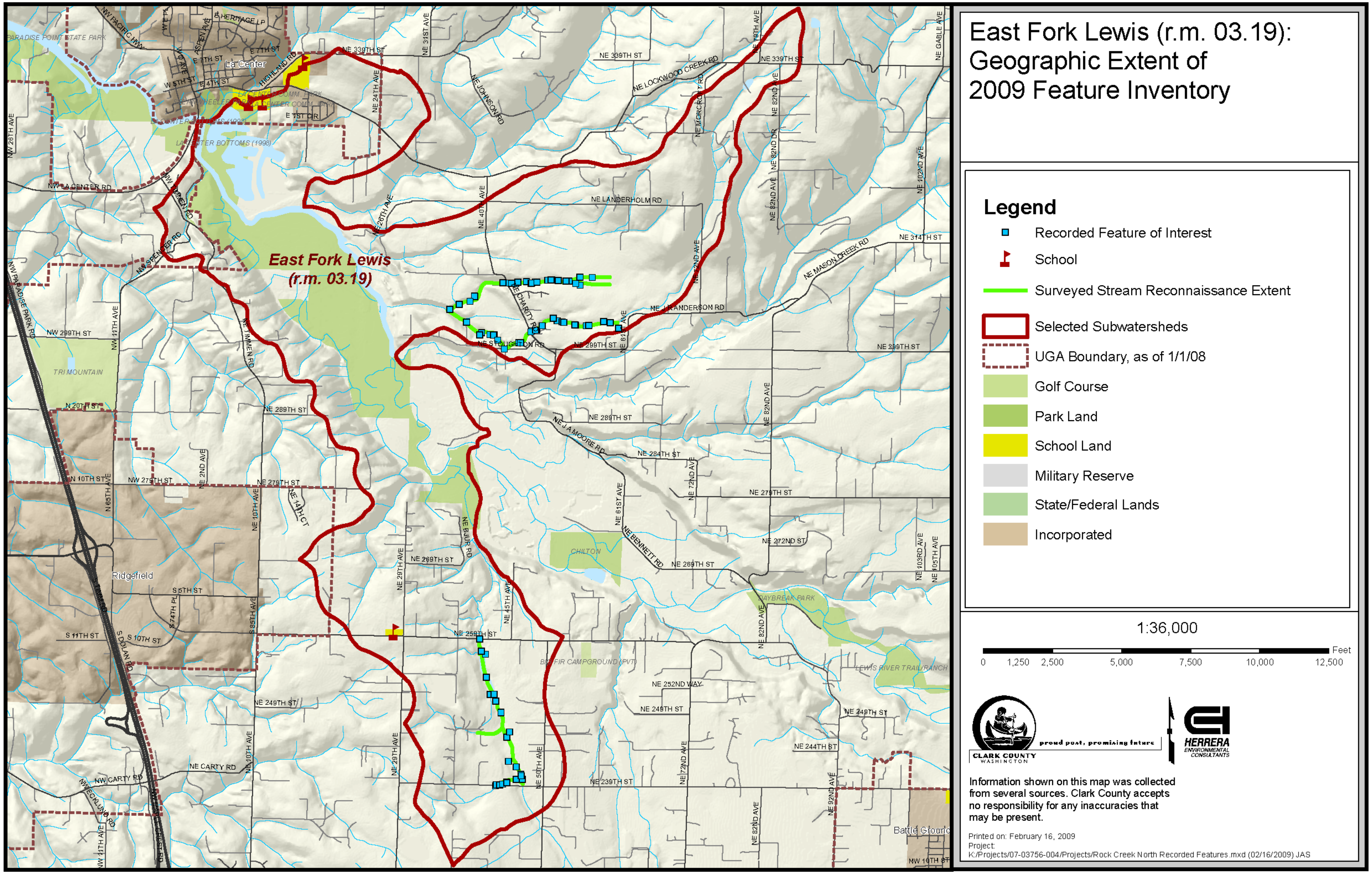


Figure 8: East Fork Lewis River (RM 03.19) Geographic Extent of 2009 Feature Inventory

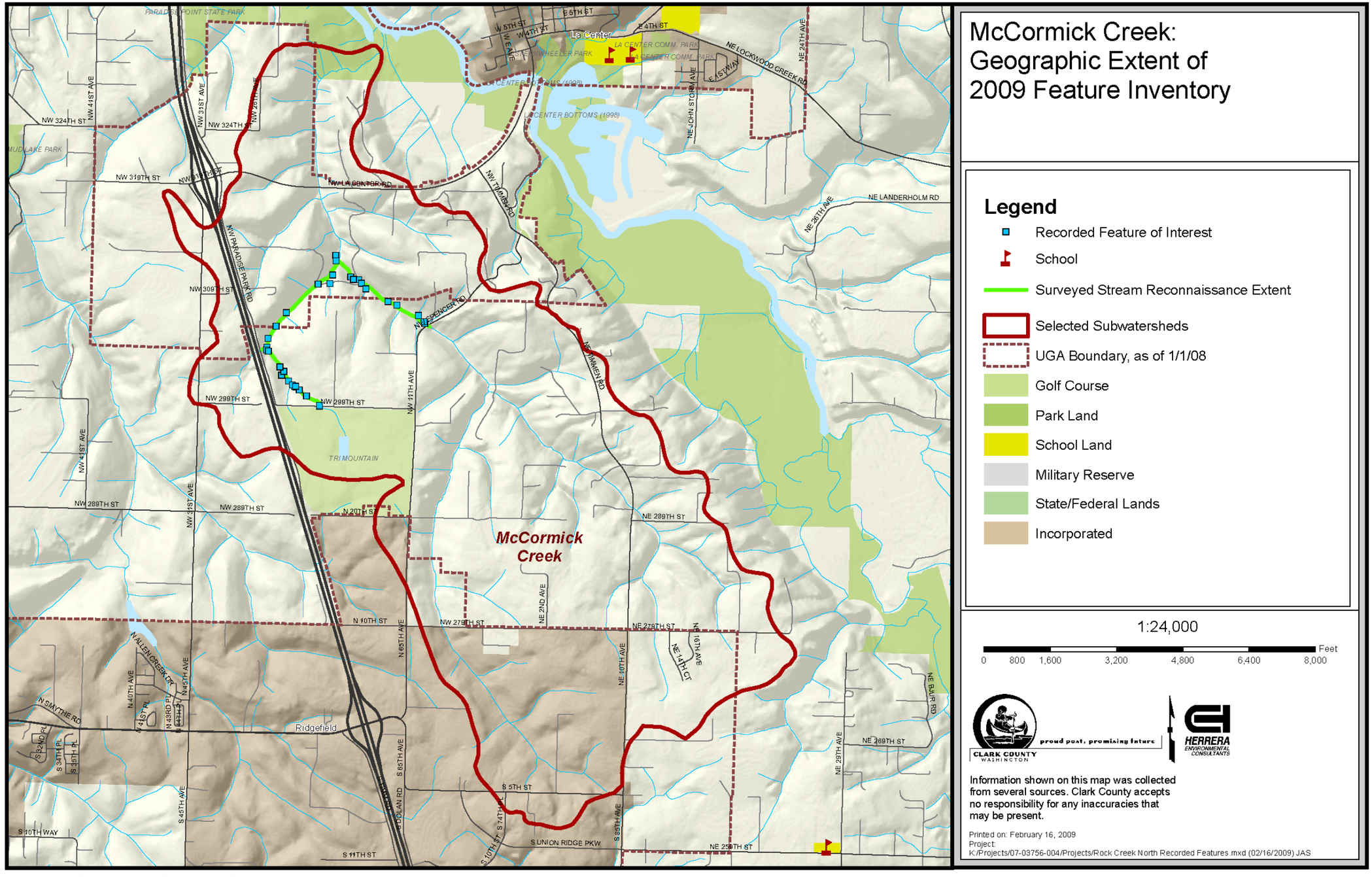


Figure 9: McCormick Creek Geographic Extent of 2009 Feature Inventory

Table 10: Summary of Features Recorded in East Fork Lewis River (RM 03.19) and McCormick Creek Subwatersheds		
Feature Type	**Number Recorded in East Fork Lewis River (RM 03.19)**	**Number Recorded in McCormick Creek**
AGR - Aggradation	3	0
AP – Access point	2	0
CM – Channel modification	1	0
ER – Severe erosion	5	2
IB – Impacted stream buffer	10	6
IW – Impacted wetland	1	0
MB – Miscellaneous barrier	4	2
MI – Miscellaneous point	4	7
OT – Stormwater outfall	5	2
RR – Road Reconnaissance feature	0	0
SCB – Stream crossing, bridge	8	1
SCC – Stream crossing, culvert	15	4
SCF – Stream crossing, ford	2	0
TR – Trash and debris	3	3
UT – Utility impact	0	0
WQ – Water quality impact	8	3
Total	**71**	**30**

The following subsections contain general descriptions of the East Fork Lewis River (RM 03.19) and McCormick Creek subwatershed conditions. The descriptions include observations, trends, and issues that were identified either during the field work or during subsequent review of collected information.

Stormwater Infrastructure

East Fork Lewis River (RM 03.19) Subwatershed

Due to the prevalence of agricultural land use in the subwatershed surrounding the surveyed reaches, existing stormwater infrastructure is minimal. The stormwater conveyance to surveyed streams is mainly via small ditches and overland flows that drain unforested, agricultural land located on the sloping terrain adjacent to the relatively narrow corridors that contain the streams. The predominant source of runoff to streams appears to be overland flow from agricultural land, including a number of vineyards. Some additional runoff originates on rural roads, rooftops, barns, and driveways. Baseflow from groundwater also contributes to stream flow, especially in the upstream portion of the survey reach south of the East Fork Lewis River. Flow in the subwatershed is predominantly east to west in the area north of the East Fork Lewis River. Flow in the subwatershed is predominantly south to north in the area south of the East Fork Lewis River.

McCormick Creek Subwatershed
Due to the prevalence of agricultural land use in the subwatershed surrounding the surveyed reaches, existing stormwater infrastructure is minimal. The stormwater conveyance to McCormick Creek and its tributaries is mainly via roadside ditches and small open channels that drain deforested, agricultural land located on the sloping terrain adjacent to the steep and narrow wooded valleys that contain the streams. Flow in the subwatershed is predominately south to north. The predominant source of stormwater in the surveyed areas of the subwatershed is overland runoff from agricultural land and road surfaces. These sources are primarily located in the upper reaches of the subwatershed. No formal stormwater detention or treatment facilities were present in the surveyed reaches. A large golf course south of NW 299th Street, just upstream of the extents of the surveyed reach, is another likely source of stormwater and water quality impairments.

Riparian Vegetation
East Fork Lewis River (RM 03.19) Subwatershed
The surveyed reaches to the north of the East Fork Lewis River have significantly different vegetation characteristics than the surveyed reaches south of the river.

The majority of the northern reaches have established riparian forest canopy along a narrow riparian corridor confined within the steep valley walls. There are occasional breaks in riparian forest canopy where individual landowners have cleared trees to the stream. Most of the clearing is located in areas where steep topography does not isolate the stream. Invasive plant species are widespread, but dense concentrations are intermittent, mainly in areas where the riparian forest canopy is absent. Undergrowth in portions of the riparian corridor is a mix of native and invasive plant species. Blackberry and reed canary grass are the most prevalent invasive plant species. In general, blackberry is more common in areas of dense canopy cover and reed canary grass is more common in areas with less dense canopy cover and wetter soil conditions.

The southern surveyed reach is dominated by agricultural land and pasture in the riparian area. The channel and riparian corridor are not confined by steeper topography, and the majority of woody riparian canopy vegetation has been cleared throughout the reach. Invasive plant species are common, but their density is mostly being held in check by grazing. The large lakes that dominate the lower half of the reach are surrounded by reed canary grass and the wetland areas in the upper half of the reach have significant reed canary grass infestations. In some areas, the infestations are kept in check by grazing cattle.

McCormick Creek Subwatershed
The majority of surveyed stream reaches have established riparian forest canopy. Nevertheless, impacted stream buffers and invasive plant species are prevalent in the McCormick Creek subwatershed, especially where there are breaks in the

canopy cover. While the riparian forest canopy is typically in good condition, undergrowth in much of the riparian corridor is a mix of native and invasive plant species. Blackberry and reed canary grass are the most prevalent invasive plant species. In general, blackberry is more common in areas of dense canopy cover and reed canary grass is more common in areas with less dense canopy cover and wetter conditions.

Additional Results

In other surveyed subwatersheds, stormwater and water quality impacts, as well as other features of interest were often discovered when field crews ventured up small, first-order tributary channels outside of the area defined by the geographic scope of work. The discovery of numerous features of interest on small tributary channels within other subwatersheds indicates that significant stream impairments, potential environmental and safety hazards, and potential project opportunities may exist outside of the geographic scope of this Feature Inventory.

East Fork Lewis River (RM 03.19) Subwatershed

Few tributary streams were identified along the surveyed reaches of the East Fork Lewis River (RM 03.19) subwatershed, but small ditches draining agricultural land were prevalent, and further investigation of the extent of those ditches may be warranted.

Water quality impacts associated with agricultural practices are widespread throughout the subwatershed. They are particularly common in the low gradient reach at the south end of the subwatershed. In this area, grazing in riparian areas is common, and vineyards surround the stream corridor. Because the impacts are uniform and widespread, and most appear to be non-point-source impacts, the point based Feature Inventory doesn't fully capture the broad extent of the impacts. Septic inputs may also be a concern in this reach where water tables are high and there is no sewer service to homes. Additional investigation of water quality issues may be warranted in this area.

Manmade ponds are also common in the subwatershed, with some in very poor condition. The ponds may be having a significant effect on water quality in the form of thermal loading in addition to potentially creating a risk for downstream properties if the impoundments fail.

McCormick Creek Subwatershed

The topography of the subwatershed makes the presence of features of interest on small tributary channels a distinct possibility. Field crews noticed evidence of significant bank erosion and channel degradation at the mouth of one tributary stream (MI-63). The steep valleys in the subwatershed effectively limit residential and agricultural development adjacent to much of the higher order streams. However, the flatter land above the canyon rims, where many of the first order tributaries to McCormick Creek originate, is presently developed with

rural, residential, or agricultural land use, and may be the source of many stream impairments.

The golf course in the headwaters of this subwatershed is also another likely source of water quality impairments. The golf course area was not surveyed as part of the Feature Inventory.

Potential Project Opportunities

A summary of identified project opportunities by potential project category is shown in Table 11. Listed opportunities represent potential projects or project areas. They are not fully developed projects, and therefore require additional evaluation and development by Clark County or consultant staff prior to submittal to the SCIP process. Identifying them as potential projects in this document is the first step in the process of developing SCIP projects.

Potential project opportunities were identified based on the results of the Feature Inventory conducted in the East Fork Lewis River (RM 03.19) and McCormick Creek subwatersheds. The CWP will evaluate the potential projects for further development or referral to the appropriate organization. Each potential project is listed in Tables 12 through 18, including the basis for the project and a description of the potential project. The location of each potential project is shown in Figures 10 through 14. Potential project opportunities were categorized into six groups based on the nature of the potential work. A total of 65 potential projects were identified; 46 in the East Fork Lewis River (RM 03.19) subwatershed and 19 in the McCormick Creek subwatershed.

Table 11: Breakdown of Potential Project Opportunities by Category

Potential Project Category	Potential Projects Identified in East Fork Lewis River (RM 03.19)	Potential Projects Identified in McCormick Creek
Emergency/Immediate Actions	4	0
Stormwater Facility Capital Improvement Projects	2	2
Stormwater Infrastructure Maintenance Projects	0	0
Habitat Restoration/Enhancement Projects	1	0
Property Acquisition for Stormwater Mitigation	0	0
Referral Projects for other Agencies	39	17

Emergency/Immediate Actions

Emergency/Immediate Actions require an immediate site response project to address a potential or imminent threat to public heath, safety, or the environment. Emergency/Immediate Actions identified based on the results of the Feature Inventory are described in Table 12.

No projects of this type were identified in surveyed reaches of the McCormick Creek subwatershed.

Table 12: Description of Potential Project Opportunities - East Fork Lewis River (RM 03.19)		
ID	**Basis for Project**	**Project Description**
SCC-156 AGR-3	Undersized, plugged, and failing culvert crossing impounds a significant volume of fine sediment and sand in the aggraded channel reach upstream. Embankments are failing and crossing has been overtopped multiple times. However, this barrier has locally halted channel incision.	Immediate site inspection to assess risk of catastrophic failure. Consider both positive and negative effects of this grade control and develop a project accordingly. Options include culvert crossing removal and channel restoration including LWD grade control to address downstream incision, or replacement of the crossing with an appropriately sized crossing less prone to plugging with debris.
SCC-158	Undersized and plugged culvert crossing. Embankments are failing and the perched outlet with a 3-foot drop height is a fish passage barrier. However, this barrier has locally halted channel incision.	Immediate site inspection to remove debris plugging the culvert and assess risk of failure. Consider both positive and negative effects of this grade control and develop a project accordingly. Options include culvert crossing removal and channel restoration including LWD grade control to address downstream incision, or replacement of the crossing with an appropriately sized crossing less prone to plugging with debris.
MB-34 MB-35 MI-64	Large, 10-foot-high earthen dam with two outlet pipes/channels. Backwater extends over 500 feet upstream. Outlet works are in disrepair and beavers are impairing the ability of the outlet to function properly. Failing embankments need immediate attention. High risk of catastrophic failure and a potentially serious hazard to downstream landowners and the environment. Pond may be acting as a source of thermal loading. Dam is an impassable barrier to fish. The left side outlet pipe may have originally been an emergency spillway, but is now running water into a deep channel that is actively incising into clay substrates. Numerous sections of pipe from the failing outlet works have been discarded in the channel.	Immediate site inspection by engineering staff to determine structural integrity of the dam and outlet works. May warrant removal of dam and restoration of tributary stream. At minimum, project should address failing outlet structures, stabilize the embankment, and appropriately mitigate for thermal and fish passage impacts of the dam.

Table 12: Description of Potential Project Opportunities - East Fork Lewis River (RM 03.19)		
ID	**Basis for Project**	**Project Description**
TR-64	Landowner is dumping used oil, burning debris, and yard waste on the right bank of the stream. Slope has been cleared and is failing.	Contact landowner immediately and remove hazardous waste. Conduct additional site cleanup as needed. Determine if slope stabilization and revegetation is required.

Stormwater Facility Capital Improvement Projects

Stormwater Facility Capital Improvement Projects are projects that create new or retrofit existing stormwater flow control or treatment facilities. Facility retrofits include 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 were identified based on the results of the Feature Inventory are described in Table 13 and 14.

Table 13: Description of Potential Project Opportunities - East Fork Lewis River (RM 03.19)		
ID	**Basis for Project**	**Project Description**
OT-220	Small eroding gully drains stormwater from an unknown source in the direction of houses south of the creek.	Investigate source of stormwater and construct a new stormwater facility to detain and treat runoff appropriately. Stabilize outfall gully with natural materials such as logs to prevent further erosion.
OT-221	4-inch pipe outlet drains water from unknown source onto an eroding dirt access road and then into the stream.	Investigate source of stormwater and install source control or construct a new stormwater facility to detain and treat runoff appropriately. Stabilize eroding dirt road surface to prevent or minimize erosion.

Table 14: Description of Potential Project Opportunities - McCormick Creek		
ID	**Basis for Project**	**Project Description**
OT-218	Culvert delivers water/stormwater from an unidentified source under I-5 to 50-foot-long open channel draining to the main stream. Based on the DNR stream layer, this culvert conveys runoff from a significant area that may include I-5.	Investigate source of water exiting culvert under I-5 and construct new stormwater facilities to detain and treat runoff appropriately.
OT-219	Roadside ditch drains stormwater from NW 310th Street without any apparent treatment.	Confirm source of runoff, drainage area, and pollutant loading characteristics. Construct facility retrofits on road ditches to detain and treat runoff appropriately.

Stormwater Infrastructure Maintenance Projects

Stormwater Infrastructure Maintenance Projects include potential projects which address and repair maintenance defects affecting existing stormwater infrastructure. Infrastructure maintenance projects are required by the County NPDES municipal stormwater permit. Projects in this category with estimated costs exceeding $10,000 are considered under the SCIP process. Projects addressing simpler maintenance defects are referred directly to the County Public Works Operations and Maintenance staff.

No projects of this type were identified in surveyed reaches of the East Fork Lewis River (RM 03.19) subwatershed.

No projects of this type were identified in surveyed reaches of the McCormick Creek subwatershed.

Habitat Restoration/Enhancement Projects

Habitat Restoration/Enhancement Projects include potential projects which result in the restoration or enhancement of wetlands, upland forest, or riparian habitat. In-stream channel habitat and bank protection projects do not fall within the scope of Clark County's CWP, and are placed under the category of Referral Projects for other Groups/Agencies. Habitat Restoration/Enhancement Projects identified based on the results of the Feature Inventory are described in Table 15.

No projects of this type were identified in surveyed reaches of the McCormick Creek subwatershed.

Table 15: Description of Potential Project Opportunities - East Fork Lewis River (RM 03.19)		
ID	**Basis for Project**	**Project Description**
IW-4	Wetland is cleared and grazed by cattle.	Create a protected riparian buffer by excluding livestock. Reestablish native undergrowth and canopy vegetation through a large scale revegetation project to enhance wetland, riparian, and aquatic habitat and shade out invasive plants.

Property Acquisition for Stormwater Mitigation

Property Acquisition for Stormwater Mitigation Projects includes potential acquisitions of properties for any purpose that meets permit requirements to mitigate for stormwater impacts. This includes preservation or restoration of upland forest and riparian habitat zones. Property Acquisition Projects identified based on the results of the Feature Inventory are described in Table 16.

Table 16: Description of Potential Project Opportunities		
ID	**Basis for Project**	**Project Description**
WQ-46	Large property parcel with favorable topography and hydrology for a large scale wetland creation/enhancement project. Located downstream of large agricultural area and other potential sources of water quality impairments.	Investigate the feasibility of obtaining Tax Lot 214926000 and developing a large scale wetland complex for habitat enhancement and water quality improvement.

No projects of this type were identified in surveyed reaches of the McCormick Creek subwatershed.

Referral Projects for Other Groups/Agencies

Referral Projects for other Groups/Agencies includes potential projects that do not fall within the defined scope of Clark County's CWP. This includes, but is not limited to, in-channel restoration, agricultural BMPs, fish-passage barrier removals, and invasive plant management. It also includes referrals for projects such as trash removal, stream culvert repairs/maintenance, and drainage projects. Referral Projects for other Groups/Agencies identified based on the results of the Feature Inventory are described in Table 17 and 18.

Table 17: Description of Potential Project Opportunities - East Fork Lewis River (RM 03.19)		
ID	**Basis for Project**	**Project Description**
SCC-157 AGR-4 AGR-5	Large scale aggradation is occurring for approximately 500 feet upstream of the culvert crossing under NE Charity Road. The culvert inlet is open, but the culvert is undersized and may be causing the backwater and aggradation. The culvert outlet is perched, with a two foot drop height creating a fish passage barrier. There is expansion scour on the downstream end as well. A positive effect of the undersized culvert may be that it is acting as a runoff detention/ flood storage facility during high flows.	Conduct additional barrier analysis and geomorphic investigation to determine if culvert retrofit or replacement of the crossing is required.
SCC-161	Undersized culvert crossing on a private driveway with failing embankments has been eroded by flows that recently overtopped the roadway. Likely a barrier to fish.	Conduct additional barrier analysis and geomorphic investigation and replace the crossing.
SCC-160	Undersized culvert with low freeboard under NE Charity Road.	Conduct additional barrier analysis and hydrologic investigation and retrofit or replace the crossing.
SCC-162	Undersized culvert with plugged and backwatered outlet.	Conduct additional barrier analysis and hydrologic investigation and retrofit or replace the crossing.
WQ-73	Irrigation withdrawal point from lake to vineyards.	Confirm water rights.
MB-33	Six foot high earthen dam creates a small online stockwater pond. Outlet works and dam appear to be in good condition, though standpipe outlet is somewhat undersized and directs high velocity flow into left bank downstream of the dam. This is a barrier to fish and the lake is likely a thermal sink.	Site inspection by engineering staff to determine structural integrity of the earthen berm and determine if a fish passage improvement project is appropriate. Monitor bank erosion downstream. At minimum, establish native canopy vegetation around the pond to shade out invasive plants and improve shading of water surface to reduce thermal loading.
MB-36	Four foot high concrete weir spans channel and is a low flow fish passage barrier. Likely installed to aid pumped diversion of water.	Conduct additional barrier analysis and geomorphic investigation. Investigate water rights. Remove the weir or retrofit it to provide fish passage.

Table 17: Description of Potential Project Opportunities - East Fork Lewis River (RM 03.19)		
ID	**Basis for Project**	**Project Description**
ER-43	Significant headcut with approximately five feet of vertical drop, progressing upstream at an unknown rate. Stream transitions into an incised reach.	Monitor/investigate headcut more thoroughly to determine rate of migration and assess risk to the stream. If required, stabilize channel with grade control to prevent headcut migration. Consider a larger, reach scale channel restoration project to address channel incision and lack of LWD.
ER-44	Two-stepped headcut in cohesive clay bed with approximately four feet of vertical drop, progressing upstream at an unknown rate. Headcut is immediately upstream of a significant inflow source of agricultural field and/or vineyard runoff.	Monitor/investigate headcut more thoroughly to determine rate of migration and assess risk to the stream. If required, stabilize channel with grade control to prevent headcut migration. Consider a larger, reach scale channel restoration project to address channel incision and lack of LWD.
ER-45	Significant headcut in Troutdale Formation sediments with approximately four feet of vertical drop, progressing upstream at an unknown rate. Stream transitions into a more incised reach.	Monitor/investigate headcut more thoroughly to determine rate of migration and assess risk to the stream. If required, stabilize channel with grade control to prevent headcut migration. Consider a larger, reach scale channel restoration project to address channel incision and lack of LWD.
WQ-41	Headwaters are in agricultural fields. Seeps and swales channel water from both banks. Hayfields/pasture along channel and vineyard present immediately to the south.	Confirm source of runoff, drainage area, and pollutant loading characteristics. Apply source control and/or construct appropriate facilities to enhance water quality (new stormwater facility to detain and treat runoff or agricultural water quality BMP).
WQ-42	Open channel drains agricultural runoff from fields/vineyards on right bank. Some foam observed on water.	Confirm source of runoff, drainage area, and pollutant loading characteristics. Apply source control and/or construct appropriate facilities to enhance water quality (new stormwater facility to detain and treat runoff or agricultural water quality BMP).

Table 17: Description of Potential Project Opportunities - East Fork Lewis River (RM 03.19)		
ID	**Basis for Project**	**Project Description**
WQ-43	Open channel drains agricultural runoff from vineyards on right bank. Large bark dust piles are not confined by silt fence or other erosion control measures.	Confirm source of runoff, drainage area, and pollutant loading characteristics. Apply source control and/or construct appropriate facilities to enhance water quality (new stormwater facility to detain and treat runoff or agricultural water quality BMP).
WQ-44	Livestock access with bare banks on left bank. Likely source of sediment and nutrients	Segregate livestock from riparian area and restore riparian vegetation. Investigate quality of agricultural runoff, apply source control, develop off channel watering, and/or construct appropriate facilities to enhance water quality.
SCF-4	Stream ford actively used by livestock. Cattle gates on both sides of creek.	Investigate alternative means for livestock to cross channel to minimize water quality impacts and reduce stream bank erosion.
SCF-3	Stream ford actively used by livestock. Cattle gates on both sides of creek.	Investigate alternative means for livestock to cross channel to minimize water quality impacts and reduce stream bank erosion.
OT-223	Open channel carries runoff from an unverified source to the stream from the north, in the direction of agricultural fields and vineyards.	Confirm source of runoff, drainage area, and pollutant loading characteristics. Apply source control and/or construct appropriate facilities to enhance water quality (new stormwater facility to detain and treat runoff or agricultural water quality BMP).
WQ-71	Six inch diameter metal pipe drains agricultural runoff into a severely eroding channel that enters the stream from the left bank.	Confirm source of runoff, drainage area, and pollutant loading characteristics. Apply source control and/or construct appropriate facilities to enhance water quality (new stormwater facility to detain and treat runoff or agricultural water quality BMP). Stabilize eroding inflow channel with natural materials such as LWD.

Table 17: Description of Potential Project Opportunities - East Fork Lewis River (RM 03.19)		
ID	**Basis for Project**	**Project Description**
WQ-70	Channel drains agricultural runoff from fields south of the stream. Fine soils on valley walls have been eroded forming a three foot-deep gully.	Confirm source of runoff, drainage area, and pollutant loading characteristics. Apply source control and/or construct appropriate facilities to enhance water quality (new stormwater facility to detain and treat runoff or agricultural water quality BMP). Stabilize eroding inflow gully with natural materials such as LWD.
WQ-69	Six inch diameter metal pipe drains agricultural runoff from a cleared field into a small channel that enters the stream from the right bank.	Confirm source of runoff, drainage area, and pollutant loading characteristics. Apply source control and/or construct appropriate facilities to enhance water quality (new stormwater facility to detain and treat runoff or agricultural water quality BMP).
WQ-45	Pile of goose droppings, horse manure, or pond dredge spoils located approximately 30 feet from the stream.	Remove pile and revegetate area. Discuss more appropriate disposal options with the landowner.
WQ-46	Suds observed in stream. Source of impairment was not apparent, but all upstream properties are on septic, cattle have access to the creek, and upstream landowner has dumped trash and other debris along the stream.	Investigate sources of water quality impairments more thoroughly in this area. Discuss more appropriate disposal options with the landowners. Consider testing septic systems with dye to spot failing systems.
SCC-165	Livestock crossing. Cattle have access to creek throughout this reach. Likely water quality issues.	Segregate livestock from riparian area and restore riparian vegetation. Investigate quality of agricultural runoff, and apply source control, develop off channel watering, and/or construct appropriate facilities to enhance water quality.
SCC-166 SCC-167	Livestock crossings. Cattle have access to creek throughout this reach. Likely water quality issues.	Segregate livestock from riparian area and restore riparian vegetation. Investigate quality of agricultural runoff, and apply source control, develop off channel watering, and/or construct appropriate facilities to enhance water quality.

Table 17: Description of Potential Project Opportunities - East Fork Lewis River (RM 03.19)		
ID	**Basis for Project**	**Project Description**
WQ-72	Channel/ditch drains agricultural runoff to the stream from the right bank. Dense algae are evidence of high nutrient concentrations in water.	Confirm source of runoff, drainage area, and pollutant loading characteristics. Apply source control and/or construct appropriate facilities to enhance water quality (new stormwater facility to detain and treat runoff or agricultural water quality BMP).
SCB-66	Bridge between two large manmade lakes. Lakes are a likely source of significant thermal loading and surrounding agricultural land/vineyards may be a source of significant nutrient loading. Potential water quality impacts of large scale agricultural land use may not be adequately described by the results of the feature inventory.	Investigate sources of water quality impairments more thoroughly in this area.
SCC-169 CM-36	Culvert crossing, berm, and concrete weir step-pool channel form the structure that creates backwater extending 1,500 feet up the channel, creating two large manmade lakes. The step pool is likely still a fish passage barrier, with one foot high drops at each of the three weirs. The culvert and outlet works are in good condition. Lakes are likely acting as a source of thermal loading and/or contributing to other water quality impairments. The lakes may also be helping to reduce the nutrient load downstream from the agricultural land and vineyards that drain to the lakes.	Investigate sources of water quality impairments more thoroughly in this area. Also check to see if "lakes" were constructed for runoff treatment. Conduct additional barrier analysis and hydrologic investigation and retrofit or replace the lake outlet structures if necessary. Lakes are probably too large for trees planted at the water's edge to provide significant shade to reduce thermal loading. Investigate lakes for presence of non-native and invasive fish and wildlife species.
IB-232	Lack of woody riparian vegetation along the channel and wetland swales upstream of a stockwater pond. Some blackberry present.	Reestablish native undergrowth and canopy vegetation through a large scale revegetation project to enhance riparian and aquatic habitat and shade out invasive plants. Eradicate blackberry.
IB-233	Widespread invasive plant species in riparian area and floodplain along aggraded reach upstream of NE Charity Road culvert. Predominantly nightshade and blackberry.	Eradicate nightshade and blackberry. Reestablish native undergrowth to shade out invasive plants and enhance riparian habitat.

Table 17: Description of Potential Project Opportunities - East Fork Lewis River (RM 03.19)		
ID	**Basis for Project**	**Project Description**
IB-234	Widespread invasive plant species in riparian area, floodplain, and up the valley walls at confluence of two streams. Predominantly blackberry.	Eradicate blackberry. Reestablish native undergrowth and canopy vegetation to shade out invasive plants and enhance riparian habitat.
IB-238	Widespread invasive plant species within the floodplain. Predominantly reed canary grass.	Eradicate reed canary grass. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-237	Widespread invasive plant species within the floodplain. Predominantly reed canary grass.	Eradicate reed canary grass. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-236	All trees have been removed from the north bank. Widespread invasive plant species in riparian area, floodplain, and up the deforested valley wall. Predominantly blackberry and reed canary grass.	Eradicate blackberry and reed canary grass. Reestablish native undergrowth and canopy vegetation to shade out invasive plants and enhance riparian habitat.
IB-235	Widespread invasive plant species in riparian area, floodplain, and up the valley walls. Predominantly blackberry on valley walls and reed canary grass on floodplain.	Eradicate blackberry and reed canary grass. Reestablish native undergrowth and canopy vegetation to shade out invasive plants and enhance riparian habitat.
IB-239	Widespread invasive plant species encroaching from road right-of-way. Predominantly blackberry.	Eradicate blackberry. Reestablish native undergrowth and canopy vegetation to shade out invasive plants and enhance riparian habitat.
IB-240	Both banks of channelized stream cleared of vegetation.	Reestablish native undergrowth and canopy vegetation through a large-scale revegetation project to enhance riparian and aquatic habitat and shade out invasive plants.
IB-241	Widespread invasive plant species within the floodplain. Predominantly reed canary grass.	Eradicate reed canary grass. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.

Table 17: Description of Potential Project Opportunities - East Fork Lewis River (RM 03.19)		
ID	**Basis for Project**	**Project Description**
ER-46	Chronic bank erosion on outside meander bends for 100 feet of channel, threatening culvert crossing.	Investigate cause of eroding banks and develop a bank stabilization and riparian restoration project with the landowner to address the problem. Keep in mind that the culvert crossing may be exacerbating bank erosion.
TR-62	Two barrels and two tires left at a private culvert crossing. Barrels did not appear to be leaking any hazardous material.	Remove barrels and tires.

Table 18: Description of Potential Project Opportunities - McCormick Creek		
ID	**Basis for Project**	**Project Description**
SCC-152	Culvert on private road is not flow-aligned.	Investigate further. Culvert may require replacement to improve capacity and potential to pass fish or additional maintenance to remove blockages.
SCC-153	Culvert under NW 310th Street is a fish passage barrier due to an estimated 4-foot drop height at the outlet and lack of streambed material in barrel.	Conduct additional barrier analysis and replace crossing and restore channel to facilitate fish passage.
SCC-154	Culvert under NW Spencer Road is a fish passage barrier due to an estimated 4-foot drop height at the outlet and lack of streambed material in barrel.	Conduct additional barrier analysis and replace crossing and restore channel to facilitate fish passage.
MB-31	Historic road crossing. The middle 20-feet of the crossing is washed out and is now occupied by a 6-foot-high beaver dam which creates a 400-foot-long pond upstream. A 3-foot-diameter CMP culvert drains water through the left side of the earthen embankment.	Investigate/evaluate fish passage and other potentially harmful effects of this feature including thermal effects, and the potential release of large volumes of impounded sediment if a failure occurs.
MI-63	Tributary exhibiting signs of instability and significant bank erosion enters from the right bank. Headwaters are in agricultural area.	Investigate tributary for potential water quality impacts and evidence of channel instability.

Table 18: Description of Potential Project Opportunities - McCormick Creek		
ID	**Basis for Project**	**Project Description**
WQ-38	Channel/ditch drains agricultural runoff to the stream from the right bank	Confirm source of runoff, drainage area, and pollutant loading characteristics. Apply source control and/or construct appropriate facilities to enhance water quality (new stormwater facility to detain and treat runoff or agricultural water quality BMP).
WQ-39	Channel/ditch drains agricultural runoff to the stream from the right bank	Confirm source of runoff, drainage area, and pollutant loading characteristics. Apply source control and/or construct appropriate facilities to enhance water quality (new stormwater facility to detain and treat runoff or agricultural water quality BMP).
WQ-40	Channel/ditch drains agricultural runoff to the stream from the right bank	Confirm source of runoff, drainage area, and pollutant loading characteristics. Apply source control and/or construct appropriate facilities to enhance water quality (new stormwater facility to detain and treat runoff or agricultural water quality BMP).
IB-226	Widespread invasive plant species within and immediately adjacent to the floodplain. Reed canary grass and blackberry.	Eradicate reed canary grass and blackberry. Reestablish native undergrowth and canopy vegetation to shade out invasive plants.
IB-227	Widespread invasive plant species in riparian area and floodplain. Predominantly blackberry.	Eradicate blackberry. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-228	Widespread invasive plant species in riparian area and floodplain. Predominantly reed canary grass.	Eradicate reed canary grass. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-230	Widespread invasive plant species in riparian area and floodplain. Predominantly reed canary grass.	Eradicate reed canary grass. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.

Table 18: Description of Potential Project Opportunities - McCormick Creek		
ID	**Basis for Project**	**Project Description**
IB-229	Widespread invasive plant species in riparian area and floodplain. Predominantly reed canary grass.	Eradicate reed canary grass. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
ER-41	50-foot long eroding bank immediately downstream of agricultural runoff inflow point (WQ-38).	Stabilize eroding bank. Investigate cause of erosion and address the problem.
TR-59	Washing machine, barrels, and metal roofing material in the channel.	Remove metal debris.
TR-60	Accumulation of fence posts, plywood, and other debris in channel.	Remove trash and debris.
TR-61	Approximately 100 tires 200-feet up small tributary stream that enters main channel from the right bank.	Remove tires.

Stormwater Management Recommendations

East Fork Lewis River (RM 03.19) Subwatershed

A number of general stormwater management measures should be implemented throughout the East Fork Lewis River (RM 03.19) subwatershed:

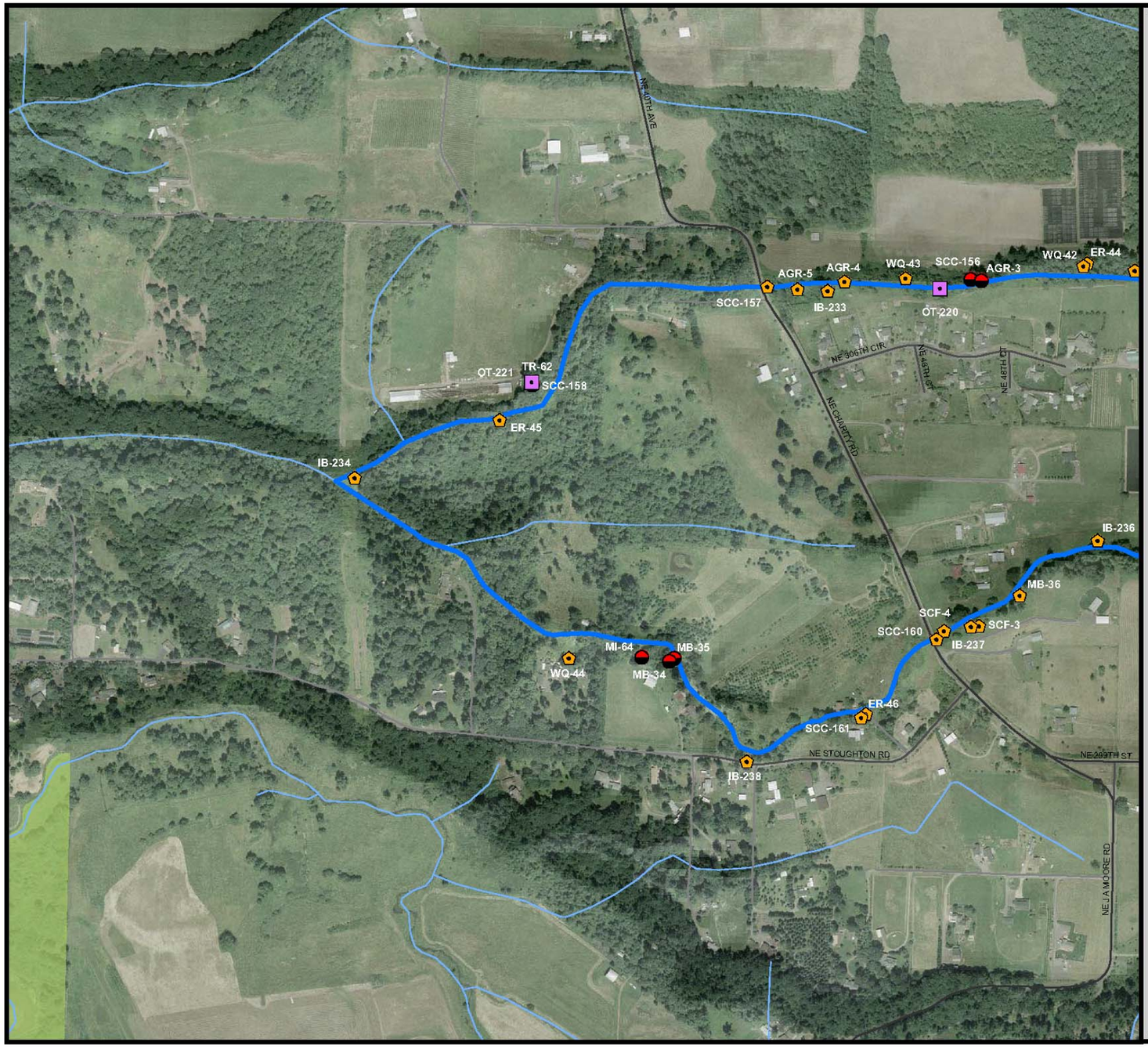
- Educate private landowners on importance of native riparian vegetation for shading streams.
- Educate landowners to discourage disposal of yard debris in streams or other receiving waters.
- Provide a list of suggested plants for stream revegetation and local nurseries that stock them for distribution to landowners
- Confirm that County ditch maintenance practices minimize vegetation removal whenever possible.
- Develop wetland restoration/construction projects to enhance water quality in agricultural areas. Low gradient, unconfined reaches in the portion of the subwatershed south of the East Fork Lewis River might be a great area for large scale restoration and wetland creation for habitat and water quality.
- Manmade ponds are widespread. Verify water rights of pond owners. Develop literature and distribute to landowners educating about the water quality impacts and other potential hazards of on-line and off-line ponds.
- Post stream identification signs where roads cross streams. Repair or replace deteriorated signs if necessary.
- Do not overlook stormwater inputs to small tributary streams that were not surveyed as a part of this Feature Inventory. These inputs may be more numerous than originally anticipated.

- Protect first-order tributary streams from further stormwater impacts by creating stream buffers, establishing conservation easements, and eliminating existing stormwater and agricultural runoff inputs. Encourage reforestation of lower gradient headwaters.
- Discuss current management practices with agricultural land users, and look for ways to reduce sediment and nutrient loads to headwaters streams.

McCormick Creek Subwatershed

A number of general stormwater management measures should be implemented throughout the McCormick Creek subwatershed:

- Educate private landowners concerning importance of invasive plant removal and suggest removal techniques.
- Educate private landowners on importance of native riparian vegetation and intact riparian forests for shading streams and preserving hydrology. Emphasize conservation of undeveloped and forested areas, especially within the riparian corridor and floodplain.
- Provide a list of suggested plants for stream revegetation and local nurseries that stock them for distribution to landowners
- Encourage transmission of stormwater through open channels such as grass lined conveyance ditches or bioswales rather than using piped systems to encourage filtration of suspended sediment.
- Confirm that County ditch maintenance practices minimize vegetation removal whenever possible.
- Post stream identification signs where roads cross streams. Repair or replace deteriorated signs if necessary.
- Do not overlook stormwater inputs to small tributary streams that were not surveyed as a part of this Feature Inventory. These inputs may be more numerous than originally anticipated, especially in Allen Canyon, where development is confined to the land outside of the canyon and mainstem riparian corridor.
- Protect first-order tributary streams from further stormwater impacts by creating stream buffers, establishing conservation easements, and eliminating existing stormwater and agricultural runoff inputs. Encourage reforestation of lower gradient headwaters.
- Discuss current management practices with golf course owners and agricultural land users, and look for ways to reduce sediment and nutrient loads to the headwater streams.



East Fork Lewis (r.m. 03.19): Location of Potential Project Sites (Sheet 1 of 4)

Legend

Potential Project Type

- Emergency/Immediate Actions
- Habitat Restoration/Enhancement Project
- Referral Projects for other Groups/Agencies
- Stormwater Facility Capital Improvement Projects
- Surveyed Stream Reconnaissance Extent
- Selected Subwatersheds
- UGA Boundary, as of 1/1/08
- School Land

1:6,000

0 200 400 800 1,200 1,600 2,000 Feet

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Project:
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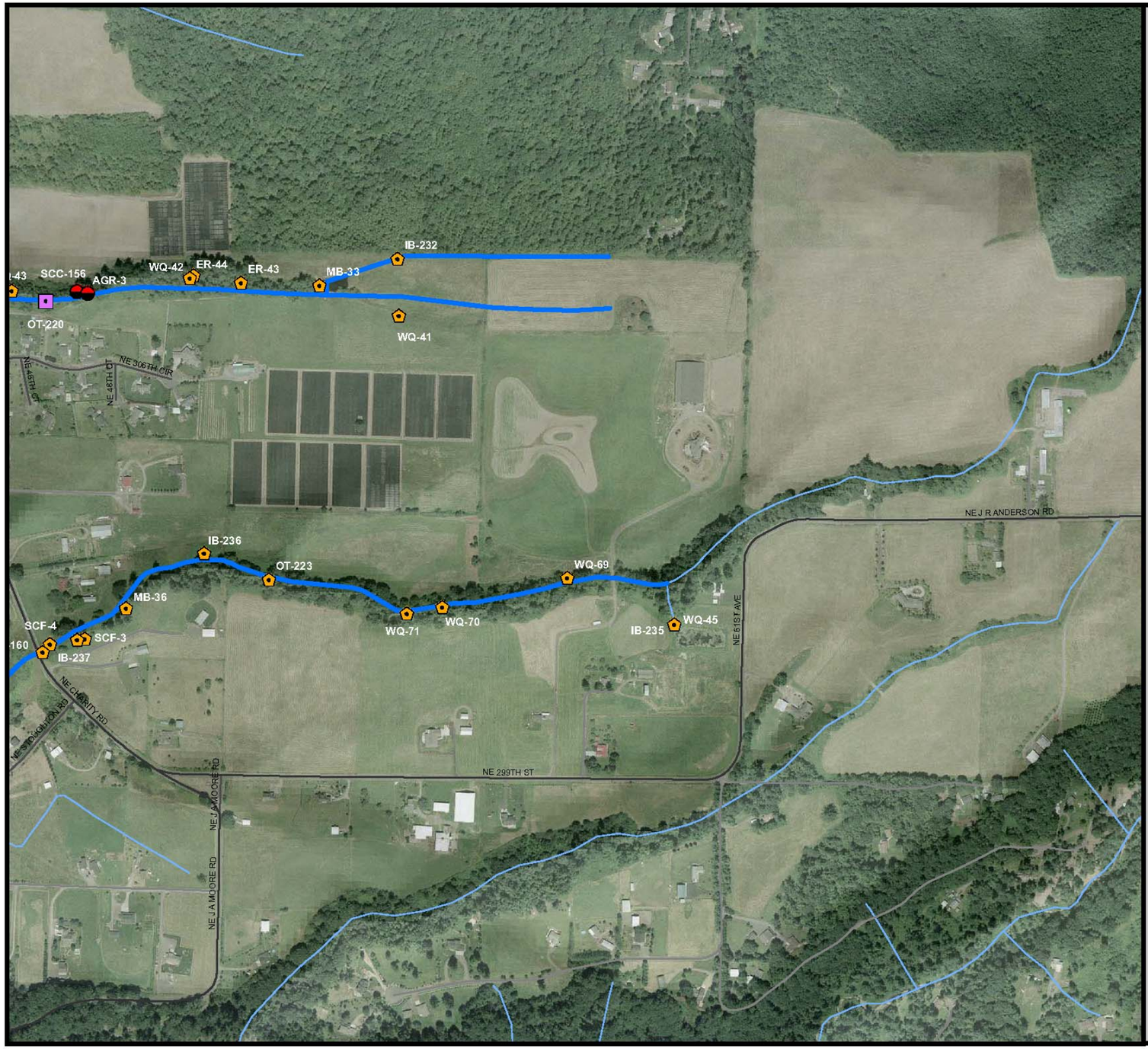
Figure 10: East Fork Lewis River (RM 03.19) Location of Potential Project Sites



East Fork Lewis (r.m. 03.19): Location of Potential Project Sites (Sheet 2 of 4)

Legend

Potential Project Type

- Emergency/Immediate Actions
- Habitat Restoration/Enhancement Project
- Referral Projects for other Groups/Agencies
- Stormwater Facility Capital Improvement Projects
- Surveyed Stream Reconnaissance Extent
- Selected Subwatersheds
- UGA Boundary, as of 1/1/08
- School Land

1:6,000

0 200 400 800 1,200 1,600 2,000 Feet

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Figure 11: East Fork Lewis River (RM 03.19) Location of Potential Project Sites

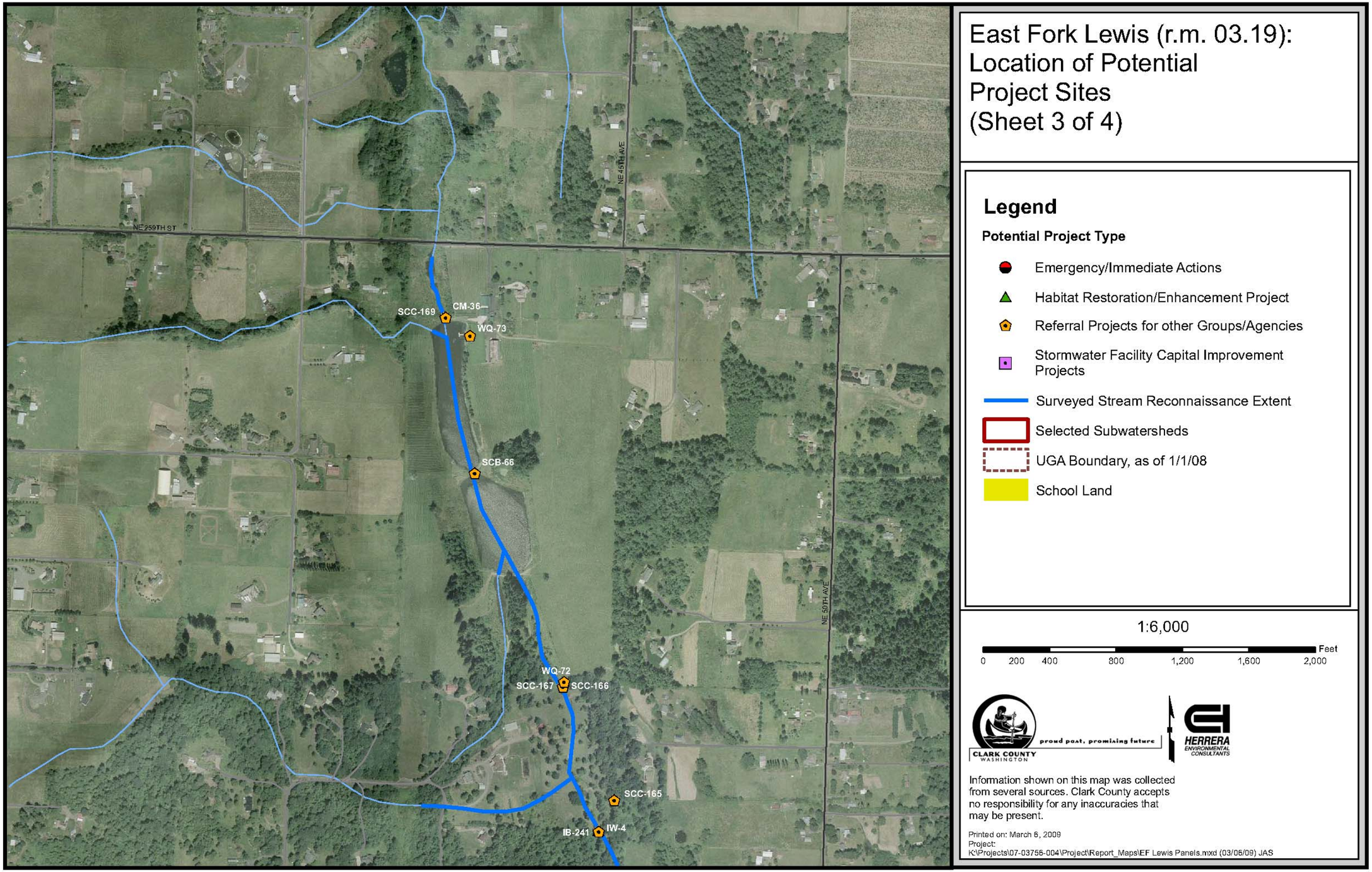

Figure 12: East Fork Lewis River (RM 03.19) Location of Potential Project Sites

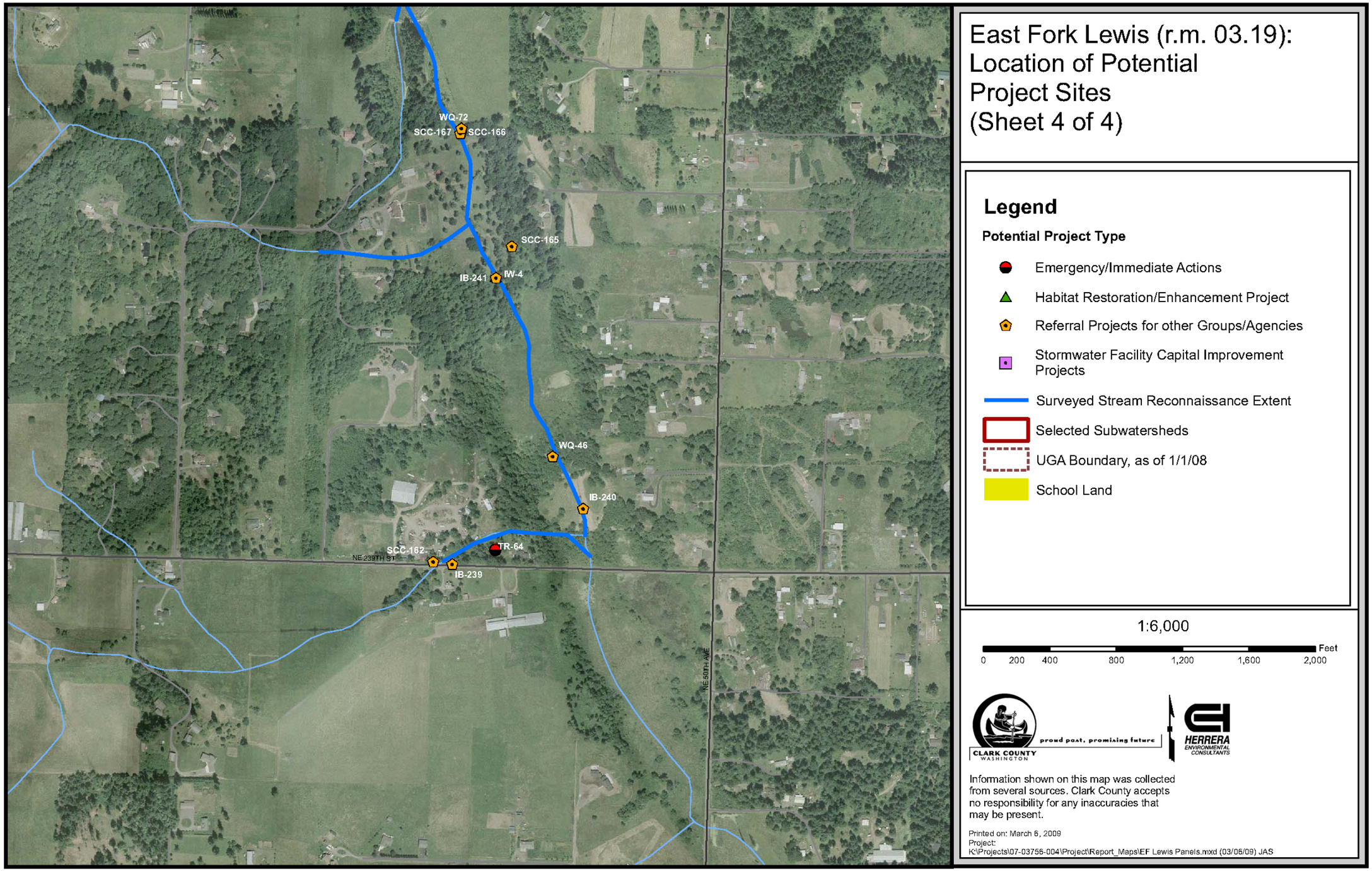

Figure 13: East Fork Lewis River (RM 03.19) Location of Potential Project Sites

McCormick Creek: Location of Potential Project Sites (Sheet 1 of 1)

Legend

Potential Project Type

- Referral Projects for other Groups/Agencies
- Stormwater Facility Capital Improvement Projects
- Surveyed Stream Reconnaissance Extent
- Selected Subwatersheds
- UGA Boundary, as of 1/1/08
- School Land

1:6,000

0 200 400 800 1,200 1,600 2,000 Feet

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HERRERA ENVIRONMENTAL CONSULTANTS

Information shown on this map was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.

Printed on: March 6, 2009
Project:
K:\Projects\07-03756-004\Project\Report_Maps\McCormick Creek Panels.mxd (03/06/09) JAS

Figure 14: McCormick Creek Location of Potential Project Sites

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.

Methods

Physical habitat measurements were made on the mainstem within the East Fork Lewis River (RM 00.00) and East Fork Lewis River (RM 03.19) subwatersheds, and in the McCormick Creek subwatershed for 0.50 miles upstream from the mouth. This survey was done by S.P. Cramer (January 2005) for the Lower Columbia Fish Recovery Board. The project followed modified USFS Level II protocols.

Results

The S.P. Cramer 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

Four of the five surveyed East Fork Lewis River mainstem reaches are tidewater influenced and had a mean gradient of 0.0 percent. Habitat types were difficult to classify because standard morphological unit definitions do not apply well in this area. These reaches have many qualities of glide habitat but they also have deep pools with residual depth. The pools do not have tailouts but rather slow transitions into glides. Overall, the habitat was estimated as 10 percent pool and 90 percent glide.

Embeddedness was not rated because these four reaches had no riffles or pool tailouts and were composed almost entirely of fines. These reaches are frequently inundated by flooding. Open space and wetlands comprise a significant portion of the riparian zone. Overall shade was low (shade rating of 0 to 20 percent). In these reaches of the East Fork Lewis River, cattle grazing occurs along some stretches of the lower mainstem.

The upper one third of East Fork Lewis River (RM 03.19), mainstem survey reach #5, had a mean gradient of 0.29 percent with pool-riffle morphology. Reach 5 is primarily pool habitat (80 percent), followed by small cobble riffle (15 percent), pool tailout (4 percent), and large cobble boulder riffle (1 percent). Gravel was the dominant substrate observed in both pool and riffle habitat. Embeddedness for riffles, glides, and pool tailouts were all rated as low (0 to 25 percent).

Table 19 summarizes mainstem survey Reach 5 habitat evaluations based on Washington Conservation Commission and NOAA Fisheries Properly Functioning Condition standards.

Table 19: East Fork Lewis River (RM 03.19) Habitat Ratings- Washington Conservation Commission and NOAA Fisheries Properly Functioning Conditions

Parameter	Reach 5	
	WCC[1]	PFC[2]
% Pool by Surface Area	Good	
Pool Frequency		NPF
Pool Quality		At Risk
LWD		NPF
Substrate		PF
Streambank Stability	Poor	NPF
Barriers	Good	PF

[1] Available ratings: good; fair; poor

[2] Available ratings: properly functioning; at risk; not properly functioning

Based on limited available data for McCormick Creek, overall habitat quality is poor. Habitat was classified within this survey reach as 91 percent beaver ponds or pools, 8 percent glide, and only 1 percent riffle.

Within the limited riffle area, substrate was 64 percent gravel and 36 percent sand. Median riffle and pool tailout embeddedness was rated as 50 to 75 percent. The survey reach had mostly open canopy with the valley bottom dominated by reed canary grass and limited cover provided at the valley edges by tree branches that hang into the stream. Essentially 100 percent of the surveyed section is impacted by invasive species and channel entrenchment up to 1.7 meters deep that contributes to the erosion of unstable streambanks.

Utilizing the NOAA criteria, the surveyed area was rated poor overall and not properly functioning for substrate, bank stability, large woody debris, pool frequency and pool quality. These survey results suggest degradation of important habitat features in lower McCormick Creek, including low percentage of riffle habitat, high substrate embeddedness, elevated levels of sand and fine particles, and poor shading by riparian vegetation.

Table 20 summarizes McCormick Creek habitat feature ratings based on Washington Conservation Commission and NOAA Fisheries Properly Functioning Condition standards.

Table 20 McCormick Creek: Habitat Feature Ratings		
Parameter	**WCC[1]**	**PFC[2]**
% Pool by Surface Area	Poor	
Pool Frequency	Poor	Not Properly Functioning
Pool Quality		Not Properly Functioning
LWD	Poor	Not Properly Functioning
Substrate		Not Properly Functioning
Streambank Stability	Fair	Not Properly Functioning
Barriers	Good	Properly Functioning

[1] Available ratings: good; fair; poor

[2] Available ratings: properly functioning; at risk; not properly functioning

Geomorphology and Hydrology Assessment

A geomorphology and hydrology 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 exceeds the scope and resources of the CWP mission of stormwater management. Therefore, potential riparian projects are usually referred to agencies such as the LCFRB, Lower Columbia Fish Enhancement Group (LCFEG), Clark Public Utilities, Fish First, the Washington State University (WSU) Watershed Stewards Program, Friends of the East Fork Lewis River and the Clark Conservation District for possible implementation.

This section focuses on opportunities likely to be considered by the CWP SCIP which are primarily 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 report prepared for the Lower Columbia Fish Recovery Board (S.P. Cramer and Associates, 2005). This report applies primarily to salmon-bearing stream reaches and therefore does 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 exists 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. Potential projects discovered through these activities are discussed in the respective sections, and most are included on a final list for referral to outside agencies.

The 2005 LCFRB Habitat Assessment report was also reviewed for specific project opportunities within each subwatershed. Potential project sites have been reviewed and verified through field reconnaissance and are detailed in the results.

In areas not surveyed by S.P. Cramer, orthophotographs were reviewed to assess overall riparian conditions and identify areas where restoration or preservation projects could be appropriate.

Results

Results are based primarily on the 2005 LCFRB Habitat Assessment for the East Fork Lewis River (RM 00.00), East Fork Lewis River (RM 03.19), and McCormick Creek subwatersheds. The full characterization report is available on the Clark County website at:
http://www.clark.wa.gov/water-resources/documents.html#mon

At the subwatershed scale, the LCFRB rated the riparian conditions within East Fork Lewis River (RM 00.00) as moderately impaired, and East Fork Lewis River (RM 03.19) and McCormick Creek as impaired.

Riparian (Large Woody Debris (LWD) Delivery)

The East Fork Lewis River (RM 00.00) and East Fork Lewis River (RM 03.19) subwatersheds LWD delivery potential is summarized on Figures 15 and 16. The survey only considered the mainstem of the East Fork Lewis River and showed it having 'low' or 'none' LWD recruitment potential, with the exception of two areas on the left bank adjacent to and downstream of Paradise Point State Park. These two areas were estimated as having 'high' LWD recruitment potential. Overall, the lower reaches of the East Fork Lewis River represented by these two subwatersheds have low recruitment potential as the riparian zone is primarily comprised of open space and emergent wetland areas. Two tributaries to the East Fork of the Lewis River in this assessment area, Dyer Creek and Stoughton Creek, were not surveyed but were reviewed using orthophotography to make an aerial estimation of LWD delivery potential. The majority of Stoughton Creek is densely vegetated with small trees, and it is estimated to have a 'moderate' LWD recruitment potential. Dyer Creek is estimated to have a 'low' LWD recruitment potential, as the riparian zone has been cleared due to past gravel mining and agricultural use.

Figure 6 summarizes the LWD delivery potential for the McCormick Creek subwatershed. This subwatershed transitions from estimates of 'low' LWD potential at the lower reach on the East Fork Lewis River floodplain to moderate estimates for the upper reach which is densely vegetated with small trees. Lowermost McCormick Creek would benefit from riparian forest restoration, as the overstory is limited to sparse ash, which limits the potential for wood recruitment (S.P. Cramer and Associates, 2005).

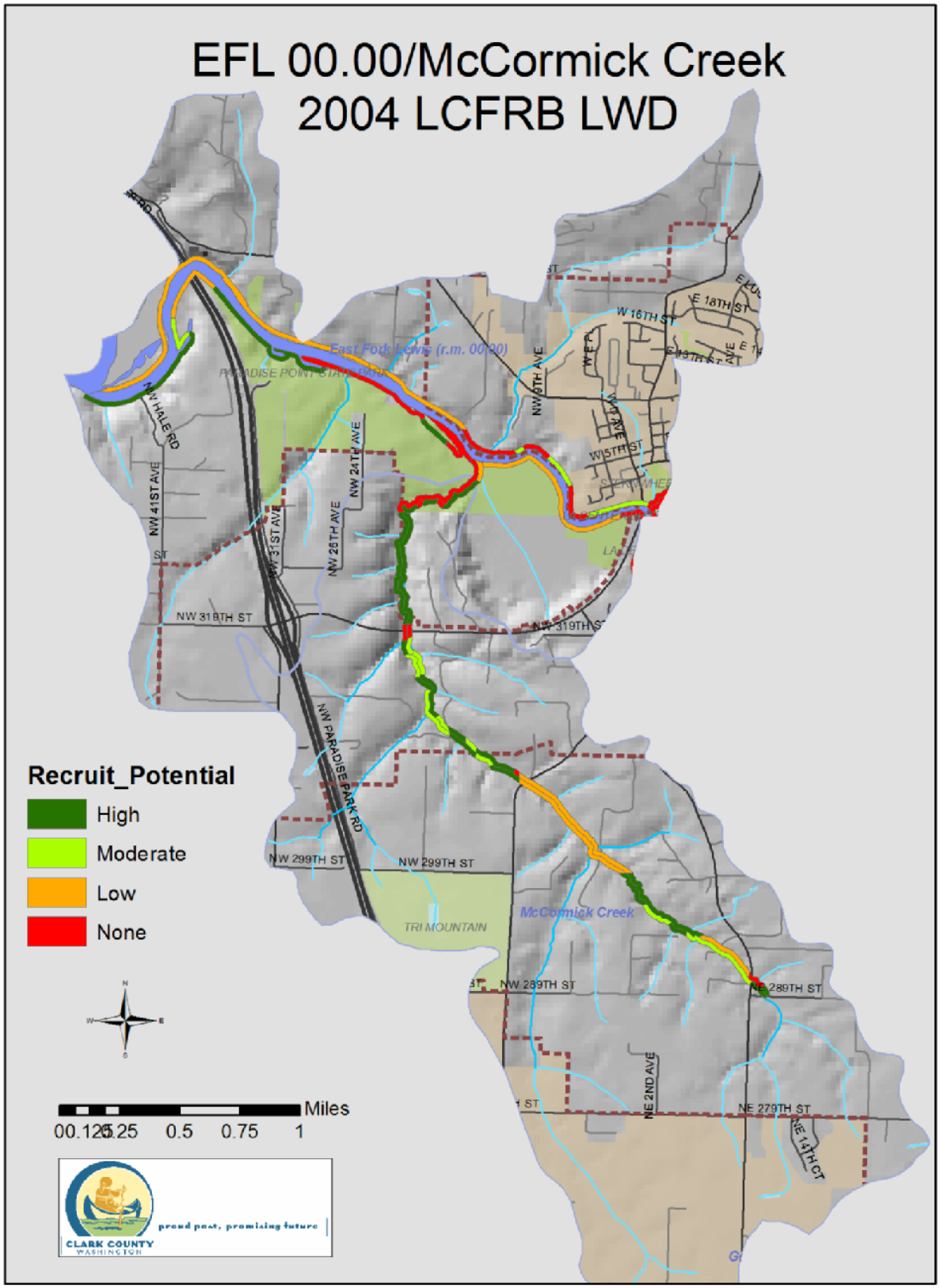

Figure 15: East Fork Lewis River (RM 00.00)/McCormick Creek LWD Recruitment Potential (adapted from S.P. Cramer and Associates, 2005)

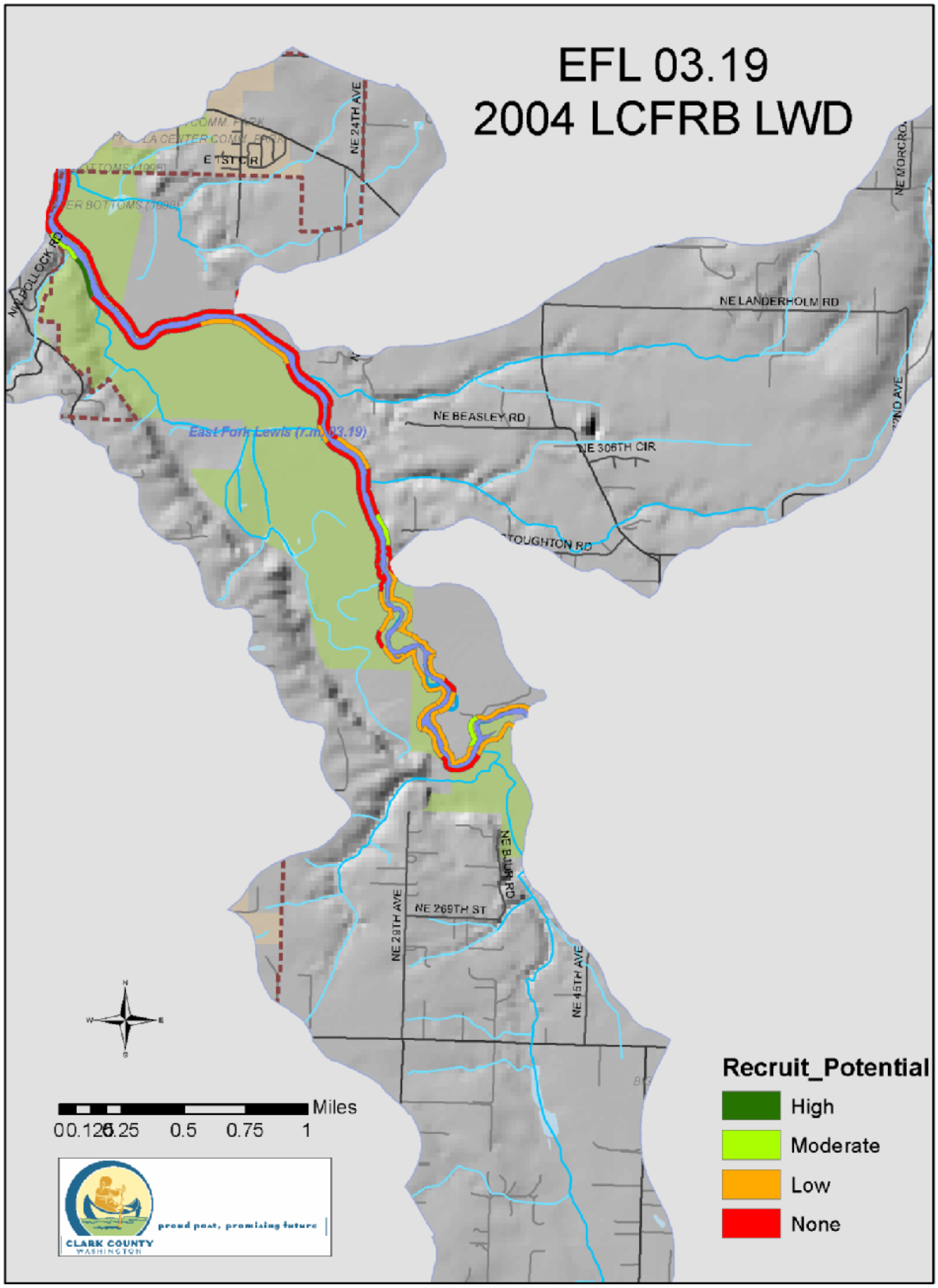

Figure 16: East Fork Lewis River (RM 03.19) LWD Recruitment Potential (adapted from S.P. Cramer and Associates, 2005)

Shade

Figures 17 and 18 illustrate shade conditions for the East Fork Lewis River (RM 00.00) and East Fork Lewis River (RM 03.19) subwatersheds from the 2005 LCFRB Habitat Assessment. Overall, shade levels along the East Fork Lewis River mainstem were between 0 and 20 percent, largely as a result of the riparian vegetation being composed predominately of grass species such as reed canary grass and other non-native invasive species. East Fork Lewis River (RM 03.19) subwatershed had the highest percentage of grass species, with surveyed reaches containing 82 and 67 percent (S.P. Cramer and Associates, 2005).

Two major tributaries to the East Fork Lewis River (within East Fork Lewis River (RM 03.19) subwatershed), Dyer Creek and Stoughton Creek, were not surveyed but were reviewed using orthophotography to assess an aerial estimation of shade levels. The majority of Stoughton Creek is densely vegetated with small trees, and it is estimated to have shade ratings in the range of 40 to 70 percent. Dyer Creek is estimated to have a shade rating in the 0 to 20 percent range, as the riparian zone has been cleared due to past gravel mining and agricultural use. As a result, the riparian areas consist primarily of grasses and weedy forbs, which provide only a few feet of shading across the channel widths.

Within the McCormick Creek subwatershed, the lower extent had shade ratings in the 0 to 20 percent range, while the upper extent was heavily shaded, with greater than 90 percent shading. The riparian area within the lowermost reach was composed primarily of reed canary grass, which provides little cover or shade to the stream where it is wider than a few feet.

Management Recommendations

Overall recommended management activities for the McCormick Creek subwatershed included fencing livestock from riparian areas, establishing riparian buffers, and acquisition of land for future protection of streams and watersheds.

Potential Projects

Although there were several potential areas listed for restoration in the S.P. Cramer and Associates (2005) report, the most severe problems caused by stormwater are found on the smaller tributary streams off of the lower East Fork Lewis River and McCormick Creek. Of these tributaries, Dyer Creek contains potential restoration opportunities in the lower reaches near its confluence with the lower East Fork of the Lewis River. This segment of Dyer Creek flows through a 108-acre county-owned parcel purchased in the 1990's as part of the East Fork Lewis River Greenway. Additionally, forest restoration could also potentially take place on the lowermost reach of McCormick Creek, which is located within county owned property, which is also part of the East Fork Lewis River Greenway. These projects are listed in Table 21.

Table 21: Tax Exempt Parcels Overlapping Potential Riparian Restoration Areas					
ID	**ASSR_SN**	**ASSR_AC**	**OWNER**	**PT1DESC**	**Description**
OS-41 (LCFR Project DY 01 – Lower Dyer Creek Channel Enhancement)	212103-000	108.00	Clark County	Unused or vacant land	Potential riparian reforestation area on Dyer Creek within the East Fork Lewis River Greenway.
OS-42 (MC 01 – Lower McCormick channel enhancement)	209745-000	69.53	Clark County	Unused or vacant land	Potential riparian reforestation near mouth of McCormick Creek within the East Fork Lewis River Greenway

Specific priority project areas listed in the S.P. Cramer and Associates (2005) report are areas upstream of the Mason Creek confluence between Mason and Dean Creek. Although there appears to be some previous restoration efforts on county-owned land on the south bank, there are still additional opportunities for restoration along the north bank in these areas.

The highest priority projects in the Draft East Fork Lewis River Community Habitat Restoration Plan and Project Design Technical Memorandum 1 (LCFRB, 2008) were located in East Fork Lewis River (RM 03.19) subwatershed. Local agencies such as Clark Public Utilities and Clark County have completed multiple riparian enhancement projects on the priority reaches of the East Fork Lewis River listed above, and this continued restoration will continue to assist in re-establishment of native riparian vegetation to provide for natural channel stability, shade, and LWD recruitment.

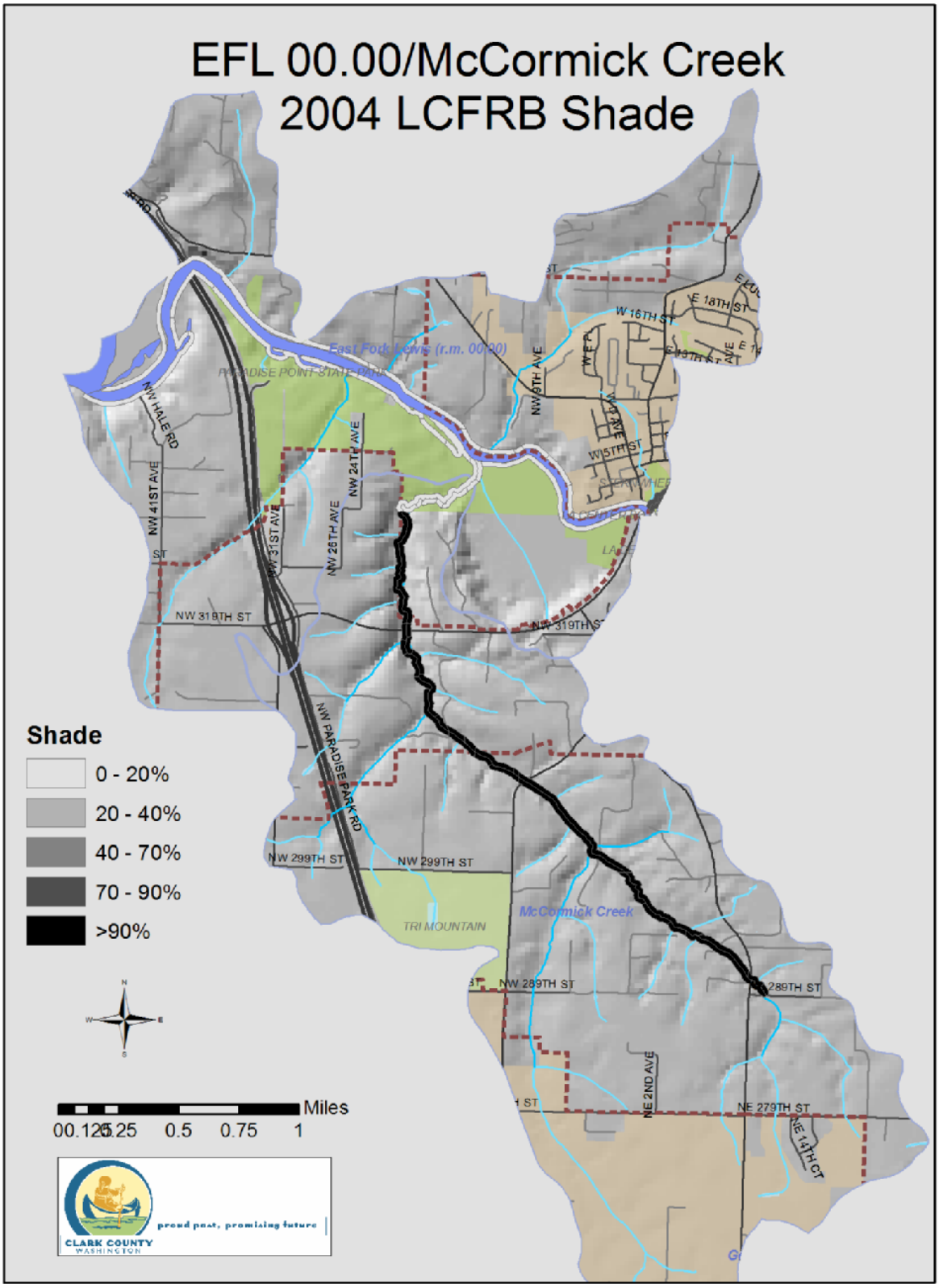

Figure 17: East Fork Lewis River (RM 00.00)/McCormick Creek Shade Values (adapted from S.P Cramer and Associates, 2005)

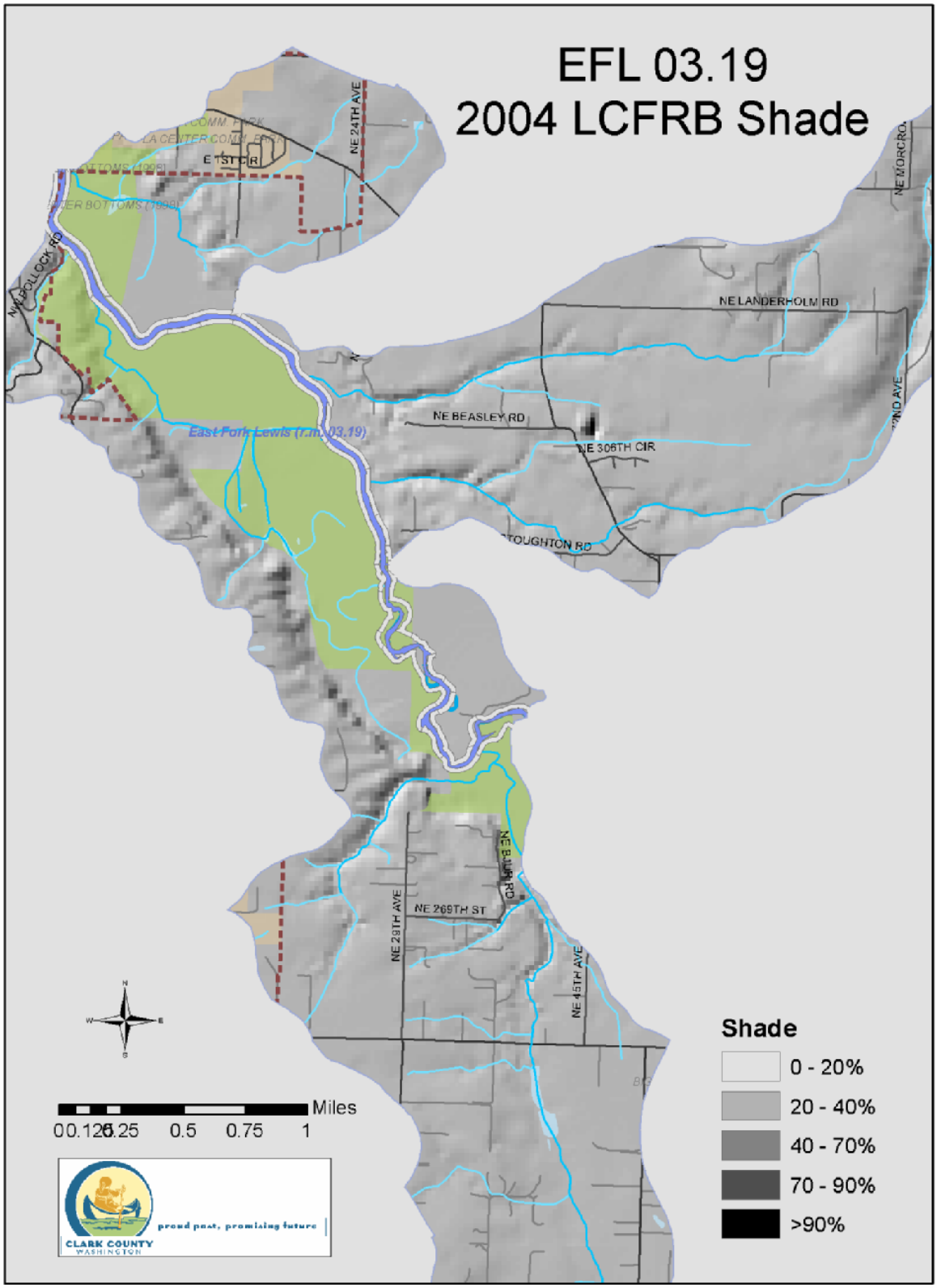

Figure 18: East Fork Lewis River (RM 03.19) Shade Values (adapted from S.P Cramer and Associates, 2005)

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; and
- 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.

Stream Reconnaissance and Geomorphology/Hydrology assessments may also discover potential wetland-related project opportunities. 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 with county vacant buildable lands model (VBLM) information to identify possible wetland enhancement opportunities.

Results

Figures 19 and 20 show potential wetland areas within the assessment area based on data from the county wetlands atlas, including the Clark County wetland model, National Wetlands Inventory, and high-quality wetlands layer.

The East Fork Lewis River (RM 00.00) and East Fork Lewis River (RM 03.19) subwatersheds have large expanses of potential wetland areas associated with the lower East Fork Lewis River riparian corridor and floodplain areas. Additionally, there are multiple potential wetlands in the vicinity of the headwaters of Dyer Creek.. In the McCormick Creek subwatershed, pockets of potential wetlands are primarily associated with near-stream areas.

Clark County has implemented a large-scale wetland enhancement project at La Center Bottoms, a 166-acre park property located at the northern tip of the East Fork Lewis River (RM 03.19) subwatershed, and smaller scale wetland enhancement projects continue to be slated for County-owned properties alongside the lower East Fork Lewis River, and within the lowermost East Fork Lewis River assessment area.

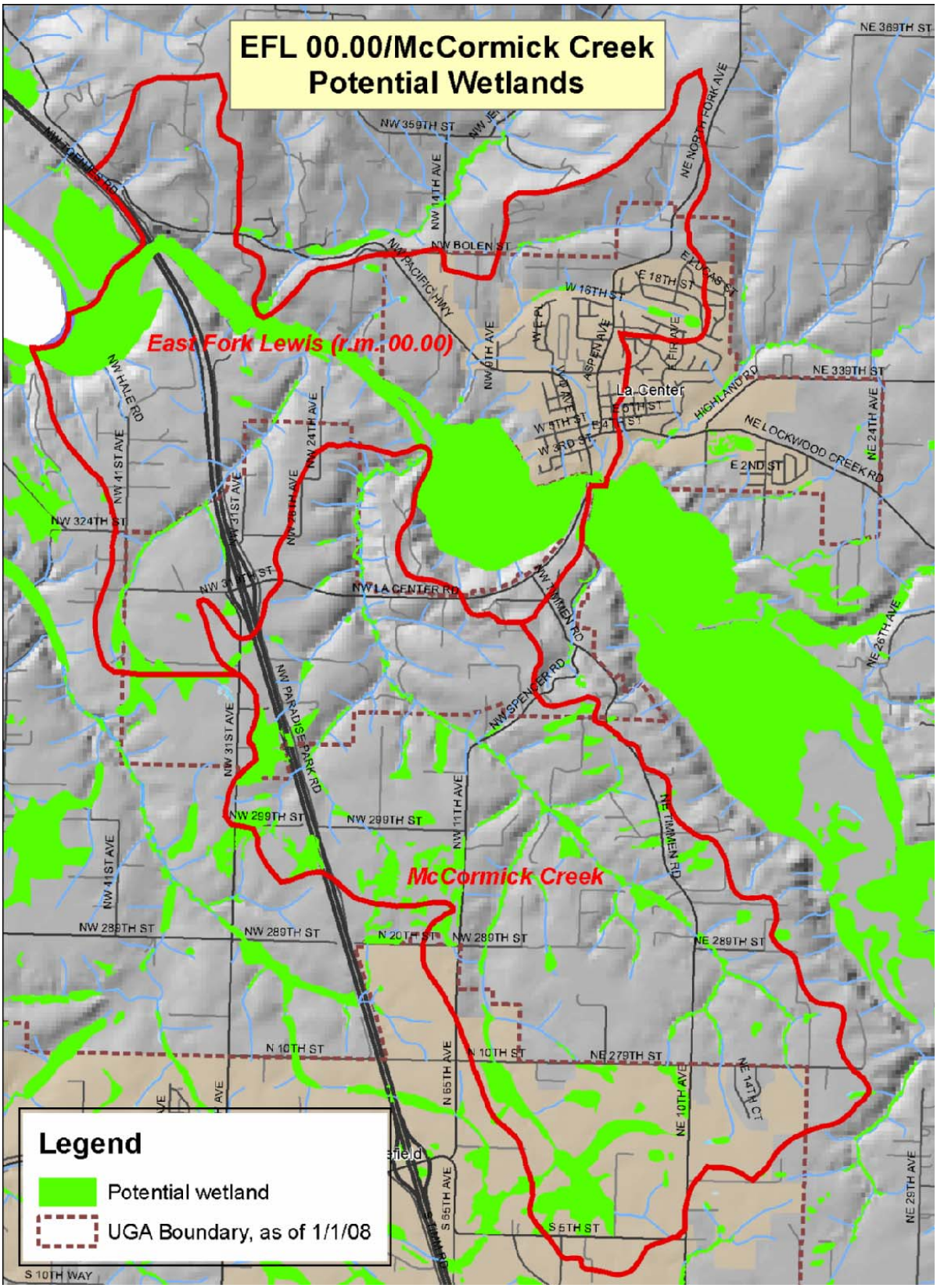

Figure 19: East Fork Lewis River (RM 00.00) and McCormick Creek Potential Wetlands

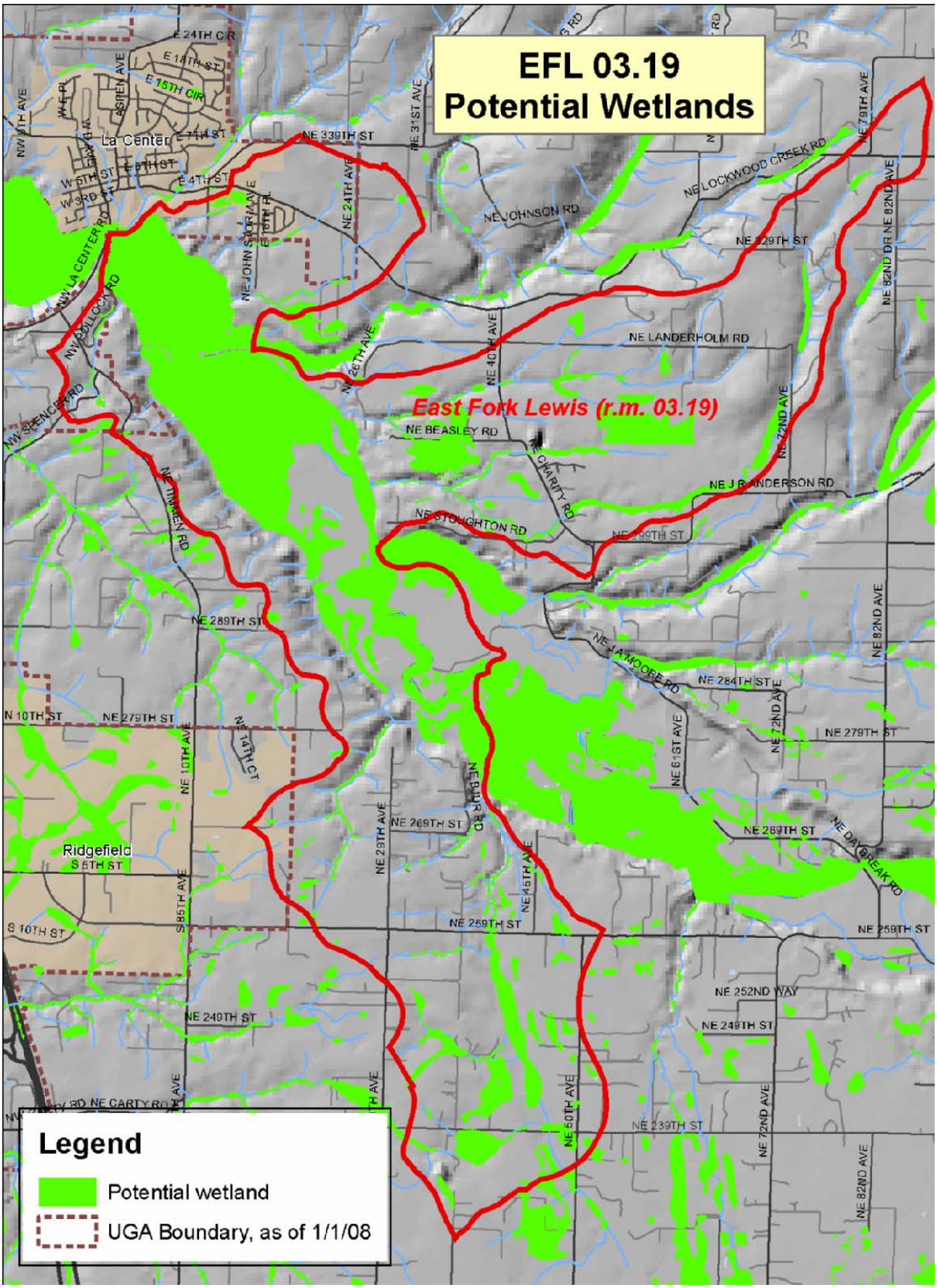

Figure 20: East Fork Lewis River (RM 03.19) Potential Wetlands

Draft Watershed Characterization
The Washington Department of Ecology completed a prototype watershed assessment to assist in planning wetland and riparian habitat restoration and preservation projects The Draft Watershed Characterization (Washington Department of Ecology, 2007) may be found on the Clark County website at: http://www.clark.wa.gov/mitigation/watershed.html.

Results pertaining to the lowermost East Fork Lewis River assessment area are summarized below.

The East Fork Lewis River (RM 00.00) subwatershed is part of the Columbia River hydrogeologic unit, described as the Columbia floodplain area dominated by the influence of the Columbia River. It is located in a rain zone, has sub-surface water flow patterns which are influenced by groundwater discharge from the adjacent upland units and recharge from the river surface waters, geologic deposits consisting primarily of relatively recent river alluvium (sand and silt), and a riverine floodplain and valley walls formed by fluvial action of the river (Ecology, 2007).

The McCormick Creek and East Fork Lewis River (RM 03.19) subwatersheds are part of the Rain-Dominated Mountainous Hydrogeologic Unit, which is characterized by rain-dominated precipitation, shallow and deep groundwater flow patterns, glacial till over consolidated formations, as well as more permeable sedimentary formations (i.e., river alluvium and Troutdale formation) and moderate to steep topography. (Ecology, 2007).

Figure 21 depicts priority areas for protection and restoration of hydrologic processes county-wide based on an analysis of the relative importance and level of alteration in each subwatershed.

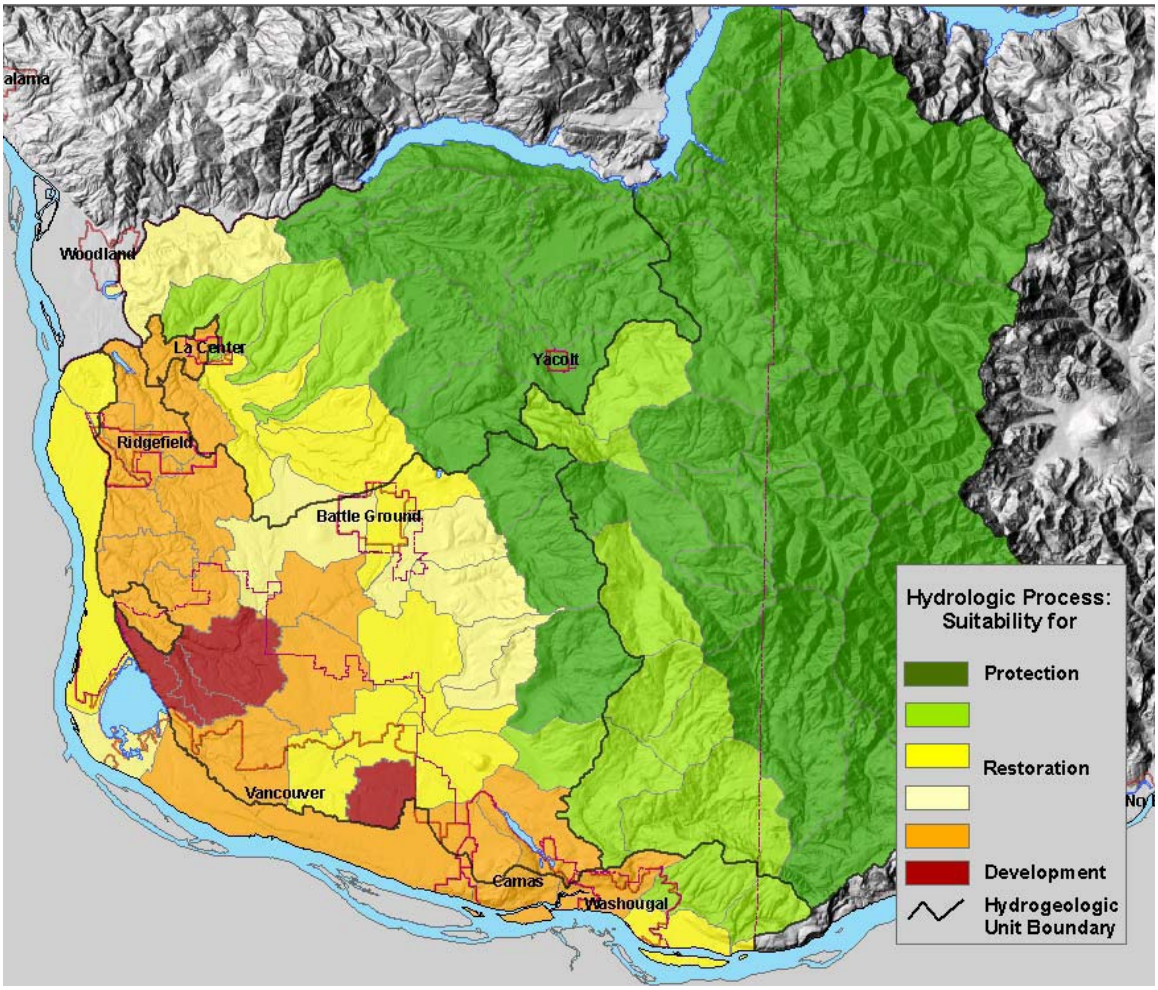

Figure 21: Priorities for suitability of areas for protection and restoration for the hydrologic process (from Draft Watershed Characterization of Clark County (Ecology, 2007)).

In general, green areas have higher levels of importance for watershed 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. Orange to red areas have lower levels of importance for watershed processes and higher levels of alteration and should be considered as more suitable for development. Because orange areas represent a transition from restoration areas, planning measures employing both restoration and appropriately sited development should be considered (Ecology, 2007).

The McCormick Creek and East Fork Lewis River (RM 00.00) subwatersheds are considered areas suitable for development and restoration ("orange" color) due to the significant alteration of processes in these subwatersheds. Restoration ("dark yellow") is the focus for the East Fork Lewis River (RM 03.19) subwatershed. According to the Draft Watershed Characterization, restoration in "dark yellow" areas will have the most significant benefit, relative to other rated subbasins, in restoring watershed processes and assisting in maintaining

downgradient aquatic resources (Ecology, 2007). According to Ecology recommendations, the restoration areas within the lowermost East Fork Lewis River assessment area have a "high percentage of depressional and riverine wetlands and sources of nitrogen" within and/or upstream of them. Restoration measures should focus specifically on restoring hydrologic processes (i.e., removing ditches and drains and restoring hydrology inputs) to depressional and riverine wetlands and restoring recharge processes that support riparian ecosystems" (2007).

Potential Projects

Although there are large expanses of potential wetlands on County-owned land within the lowermost East Fork Lewis River assessment area (primarily concentrated on the south bank of the lower reaches of the East Fork Lewis River floodplain) this assessment did not discover any high priority stormwater CIP projects related to wetlands in these areas. Based on wetland mapping, sites that could potentially have modestly sized, degraded or ditched wetlands within the assessment area were found primarily on private land, and were associated with smaller tributaries of McCormick Creek and the East Fork Lewis River (RM 03.19) subwatersheds. One such site is a potential wetland area near the headwaters of Dyer Creek (near the intersection of 239th Street and 50th Avenue). While areas such as these may be suitable for restoration, any potential project sites would need to be acquired before restoration could be initiated.

Macroinvertebrate Assessment

Purpose

The Benthic Macroinvertebrate Index of Biological Integrity or B-IBI (Karr, 1998) is a widely used measurement of stream biological integrity or health-based on macroinvertebrate populations. Macroinvertebrates spend most of their lives in the stream substrate before emerging as adults. While in the stream, they are subject to impacts from continuous and intermittent pollutant sources, hydrology and habitat changes, and high summer water temperatures.

The B-IBI score is an index of ten metrics describing characteristics of stream biology, including: tolerance and intolerance to pollution, taxonomic richness, feeding ecology, reproductive strategy, and population structure. Each metric was selected because it has a predictable response to stream degradation. For example, stonefly species are often the most sensitive and the first to disappear as human-caused disturbances increase, resulting in lower values for the metric "Number of Stonefly taxa".

In addition to the overall B-IBI scores, examining individual metric scores gives insight into stream conditions and better explains differences in the overall score.

Methods

All field and laboratory work followed CWP protocols for macroinvertebrate sampling and analyses (June 2003). Samples are collected during late summer, preserved, and delivered to a contracted lab for organism identification, enumeration, and calculation of B-IBI metrics.

Raw data values for each metric are converted to a score of one, three, or five, and the ten individual metrics are added to produce an overall B-IBI score ranging from 10 to 50. Scores from 10 to 24 indicate low biological integrity, from 25 to 39 indicate moderate integrity, and greater than 39 indicate high biological integrity.

Results are influenced by both cumulative impacts of upstream land use and reach-specific conditions at or upstream of sampling sites. Thus, samples from a reach integrate local and upstream influences. Many of the B-IBI metrics are also influenced by naturally occurring factors in a watershed; for example, the absence of gravel substrate can lower scores.

East Fork Lewis River (RM 03.19) subwatershed macroinvertebrate samples were collected by Clark Public Utilities in 2004, 2006, and 2008. All samples were from the same location near the west end of NE 290th Street about one-half mile southwest of J.A. Moore Road. There is no comparable macroinvertebrate information for the East Fork Lewis River (RM 00.00) subwatershed.

McCormick Creek macroinvertebrate samples were also collected by Clark Public Utilities in 2005 and 2007. Both samples were from a station located on

the upstream side of NW La Center Road approximately one mile southwest of La Center.

Results

The average of three years of B-IBI scores for East Fork Lewis River (RM 03.19) monitoring was 29, placing it in the category of moderate biological integrity. B-IBI results differed by eight points from 2004 to 2006 and by 12 points from 2006 to 2008. By comparison, year-to-year variation of less than five points is typical for Puget Sound streams (Karr 1998 and Law 1994).

Table 22 shows the ten individual average biennial metric results are classified as two low, eight moderate, and zero high for the East Fork Lewis River (RM 03.19) monitoring location. In particular, the low scoring metrics for intolerant taxa and percent predator taxa suggest signs, respectively, of: degraded water and habitat quality since intolerant taxa are among the first organisms to disappear as human disturbances increase, and decreasing diversity in prey items (Fore, 1999).

Table 22: CPUEFSW Average Annual Macroinvertebrate Community Metrics and Total Score from Within the Period 2004 through 2008

B-IBI Metrics	CPUEFSW 2004, 2006, 2008 3-Yr Averages		
	Value	Score	Category
Total number of taxa	40.0	3	moderate
Number of Mayfly taxa	7.7	3	moderate
Number of Stonefly taxa	5.7	3	moderate
Number of Caddisfly taxa	5.3	3	moderate
Number of long-lived taxa	3.0	3	moderate
Number of intolerant taxa	0.0	1	low
Percent tolerant taxa	25.4	3	moderate
Percent predator taxa	6.9	1	low
Number of clinger taxa	20.7	3	moderate
Percent dominance (3 taxa)	59.3	3	moderate
Summary of avg. metric scores		26	moderate
Multi-yr average B-IBI Score		**29**	**moderate**

The average of McCormick Creek's 2005 and 2007 B-IBI scores was 21. This average is in the low biological integrity category. There was a ten point difference between the two scores, 26 in 2005 and 16 in 2007.

Table 23 shows McCormick Creek's ten individual average annual metric results are classified as five low, four moderate, and one high. In particular, note the relatively high proportion of low scoring metrics that include Caddisfly, long-lived, and intolerant taxa, as well as percent tolerant and predator taxa. These low scores suggest, in respective order, less varied stream habitat, exposure to chronic or recurring water quality or habitat impacts, signs of degraded water and habitat quality since intolerant taxa are among the first organisms to disappear as human disturbances increase, increasing human related stream impacts benefiting more tolerant taxa, and decreasing diversity in prey items (Fore, 1999).

Table 23: CPUMCC Average Annual Macroinvertebrate Community Metrics and Total Score from Within the Period 2005 through 2007

B-IBI Metrics	CPUMMC 2005, 2007 2-Yr Averages		
	Value	Score	Category
Total number of taxa	34.0	3	moderate
Number of Mayfly taxa	5.0	3	moderate
Number of Stonefly taxa	4.5	3	moderate
Number of Caddisfly taxa	4.5	1	low
Number of long-lived taxa	2.0	1	low
Number of intolerant taxa	0.5	1	low
Percent tolerant taxa	56.4	1	low
Percent predator taxa	4.4	1	low
Number of clinger taxa	21.5	5	high
Percent dominance (3 taxa)	53.8	3	moderate
Summary of avg. metric scores		22	low
Multi-year average B-IBI Score		**21**	**low**

Booth et al. (2004) found that there is a wide but well defined range of B-IBI scores for most levels of development, but observed overall that B-IBI scores decline consistently with increasing watershed total impervious area (TIA). Figure 22 shows that the East Fork Lewis River at RM 03.19 station's 2004, 2006, and 2008 B-IBI scores fall mostly in the middle portion of the range of expected scores (estimated 2000 Total Impervious Area from Wierenga, 2005). By comparing this East Fork Lewis River subwatershed site to the likely range of conditions for watersheds with similar amounts of development, measured as total impervious area, it is possible to make some general statements about the potential benefits from improving stream habitat.

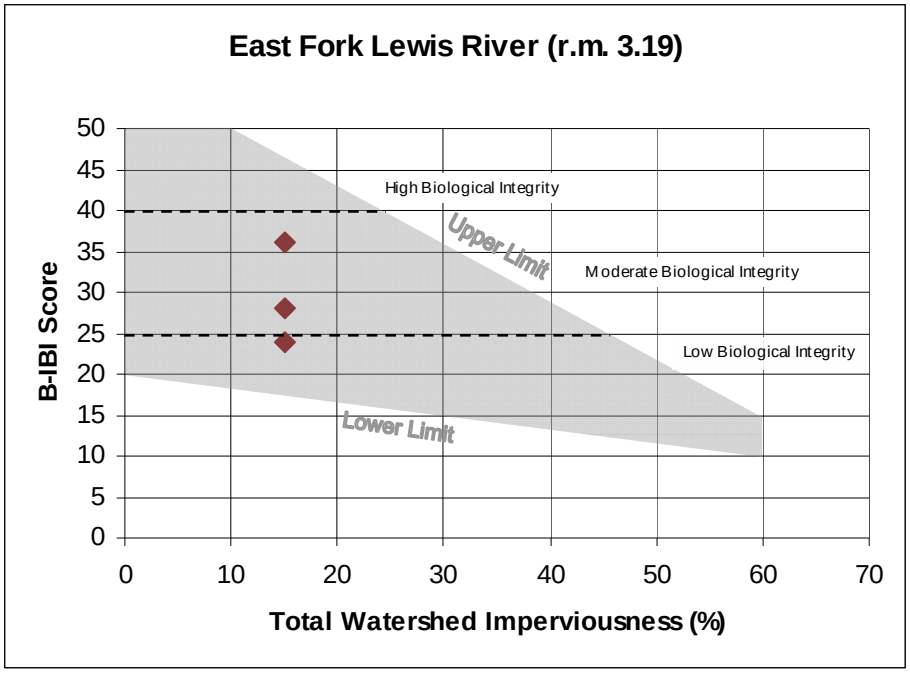

Figure 22: Approximate range of B-IBI in Puget Lowland watersheds, showing progressive decline with increasing imperviousness in the upstream watershed. Adapted from Booth et al., 2004. Markers indicate Total BIBI scores at East Fork Lewis River (RM 03.19) for particular years, versus estimated 2000 subwatershed TIA.

These East Fork Lewis River site's B-IBI scores are in the middle of the expected range for its 15 percent impervious area. This implies an opportunity to increase the level of biological integrity by improving habitat and stream conditions. Management strategies that limit further degradation and promote stream health, such as greater habitat complexity, are important for maintaining or improving biological integrity.

Figure 23 shows that the McCormick Creek station's 2005 and 2007 B-IBI scores fall in the lower portion of the range of expected scores (estimated 2000 Total Impervious Area from Wierenga, 2005).

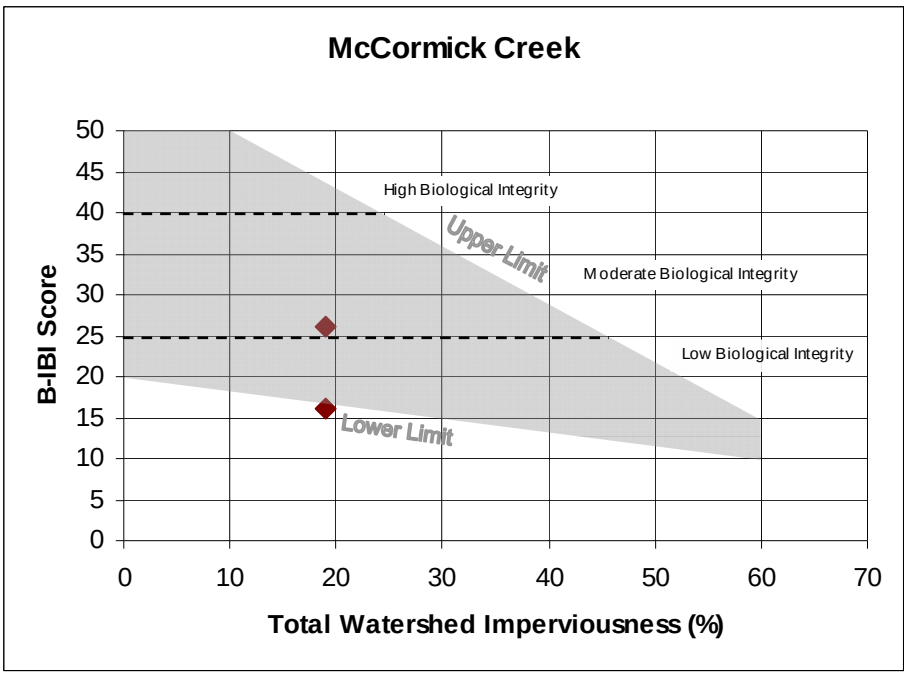

Figure 23: Approximate range of B-IBI in Puget Lowland watersheds, showing progressive decline with increasing imperviousness in the upstream watershed. Adapted from Booth et al., 2004. Markers indicate Total BIBI scores at McCormick Creek for particular years, versus estimated 2000 subwatershed TIA.

Given that McCormick Creek's surveyed B-IBI scores fall in the lower portion of the expected range for a watershed with 19 percent impervious area, it is likely that factors other than total watershed impervious area are contributing to the observed degradation of biological integrity. This implies an opportunity to significantly increase the level of biological integrity by improving habitat and stream conditions. Management strategies that limit further degradation and promote rehabilitation are important for improving biological integrity.

Fish Use and Distribution

Purpose

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

Methods

Fish distribution 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 is available on the County's website.

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

- 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.

The barrier assessment data was also reviewed for specific project opportunities within 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 fish distribution mapped from Clark County GIS information (Figures 24, 25, 26 and 27) varied slightly from fish distribution data originating from the SalmonScape database within the lowermost East Fork Lewis River assessment area. These differences are identified within the individual subwatershed discussions. For the purposes of this report, when the fish distribution mapping figures differ from SalmonScape fish distribution data, it is assumed that the SalmonScape distribution is a more accurate representation of the fish populations within the listed watersheds.

The available evidence suggests that anadromous fish use within the East Fork Lewis River (RM 00.00) and East Fork Lewis River (RM 03.19) subwatersheds) includes fall Chinook, chum and Coho salmon; and summer and winter steelhead (Figures 24, 25, 26 and 27). The SalmonScape fish distribution data also identified the presumed and potential presence of Coho salmon and winter

steelhead within Dyer Creek, the uppermost tributary to the East Fork of the Lewis River within the East Fork Lewis River (RM 03.19) subwatershed.

Within McCormick Creek, fish distribution mapping for presumed and potential anadromous fish use includes Coho salmon and winter steelhead (Figures 26 and 27). SalmonScape fish distribution data also indicated the additional presumed and potential presence of summer steelhead and chum salmon, as well as listing the presence of Coho salmon as being known versus presumed.

The LCFRB 2004 Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan and the Draft East Fork Lewis River Community Habitat Restoration Plan and Project Design Technical Memoranda 1 and 2 (LCFRB, 2008) identified the lower reaches of the East Fork of the Lewis River (within East Fork Lewis River (RM 00.00) subwatershed) as Tier 2 and Tier 4 reaches and the reaches within the East Fork Lewis River (RM 03.19) subwatershed as Tier 1 and Tier 2 reaches. The McCormick Creek subwatershed reaches are Tier 1 (some upper reaches), Tier 2 and Tier 4 reaches. The McCormick Creek and East Fork Lewis River (RM 00.00) subwatersheds are classified as Group B watersheds, as they contain primarily Tier 2 reaches. East Fork Lewis River (RM 03.19) subwatershed contains primarily Tier 1 reaches and is a Group A watershed. The reaches with the greatest potential benefit are categorized as Tier 1, as they are high priority reaches for one or more primary species.

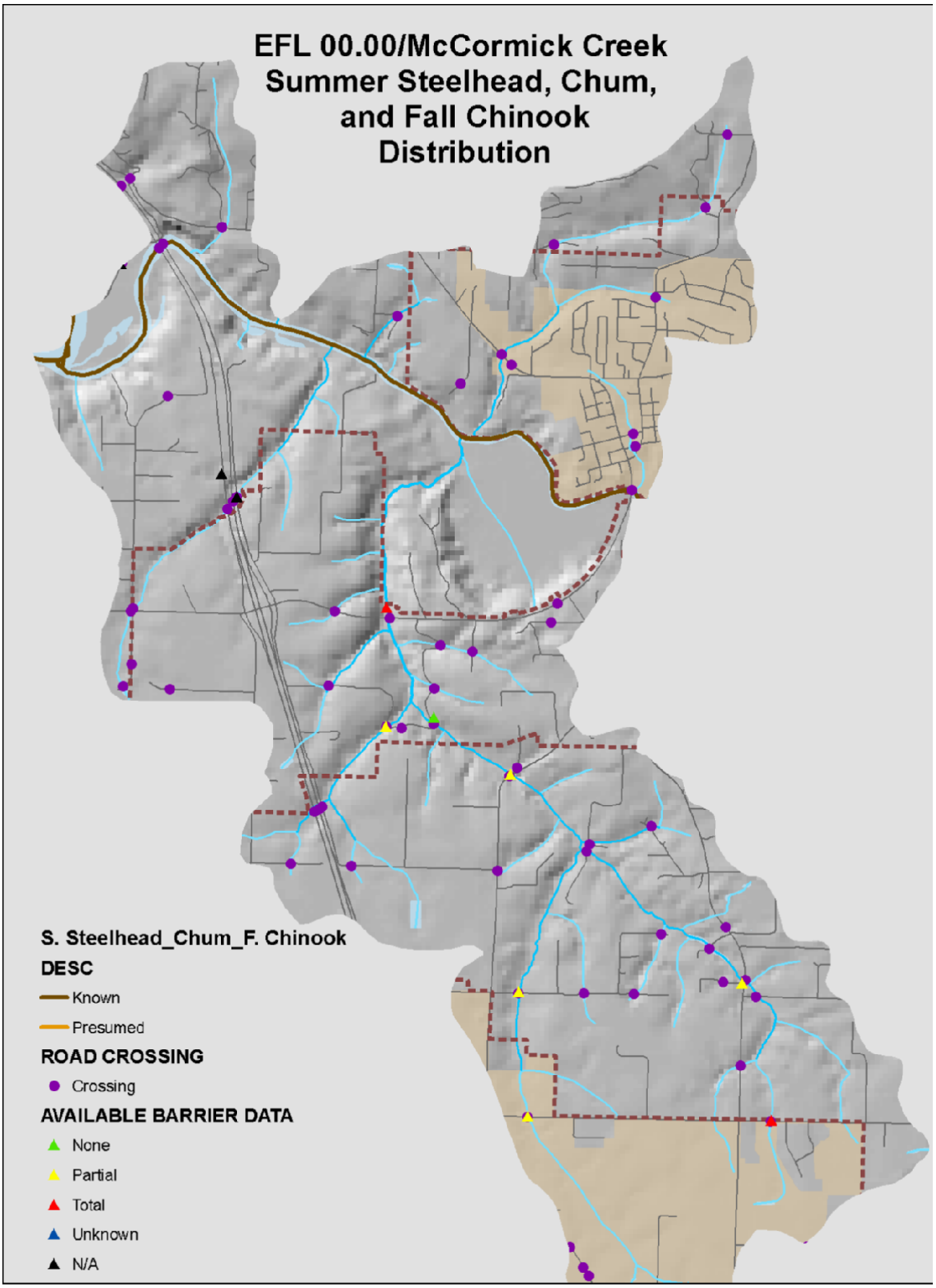

Figure 24: East Fork Lewis River (RM 00.00) and McCormick Creek Fish Distribution and Barriers

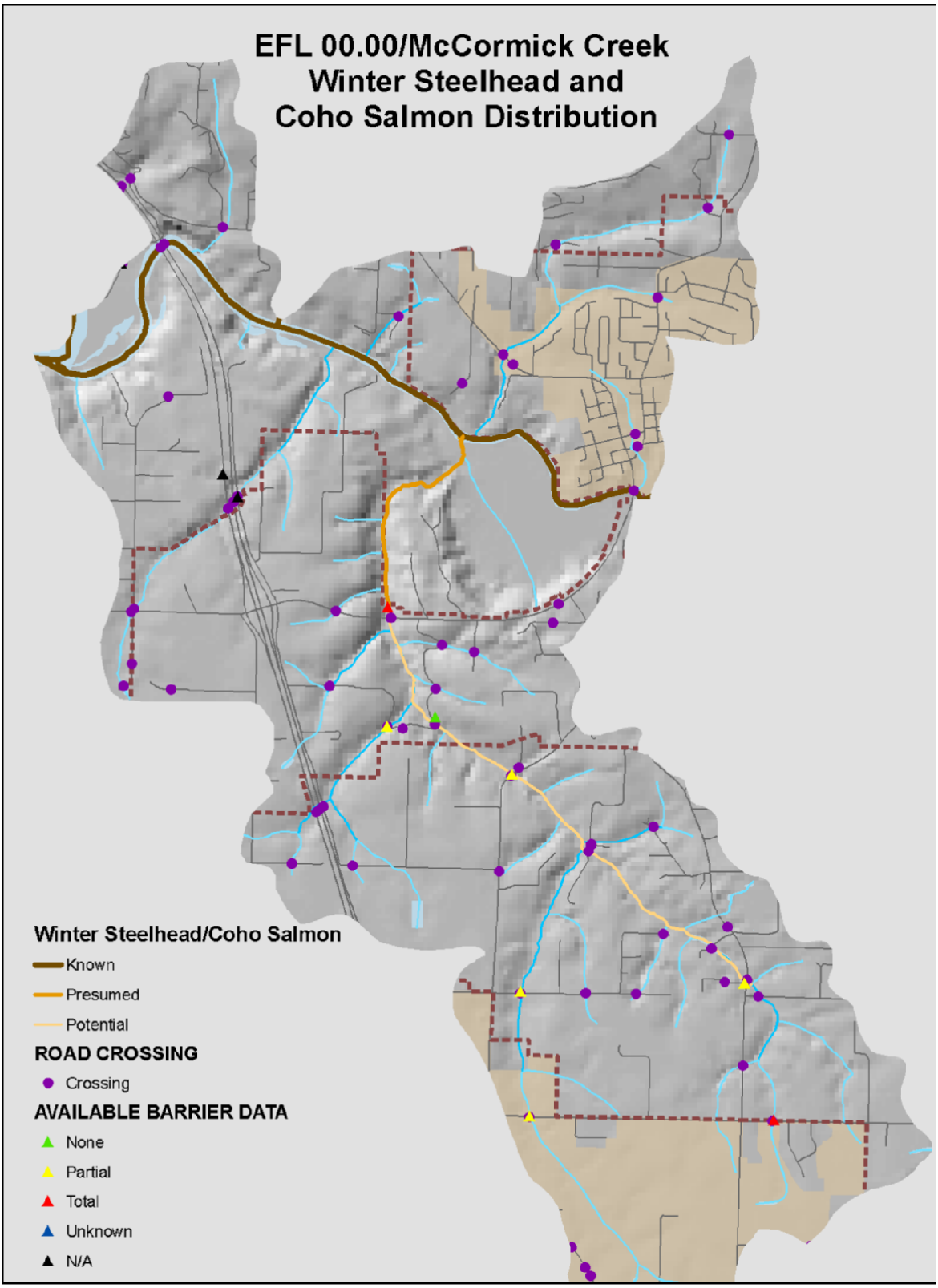

Figure 25: East Fork Lewis River (RM 00.00) and McCormick Creek Fish Distribution and Barriers

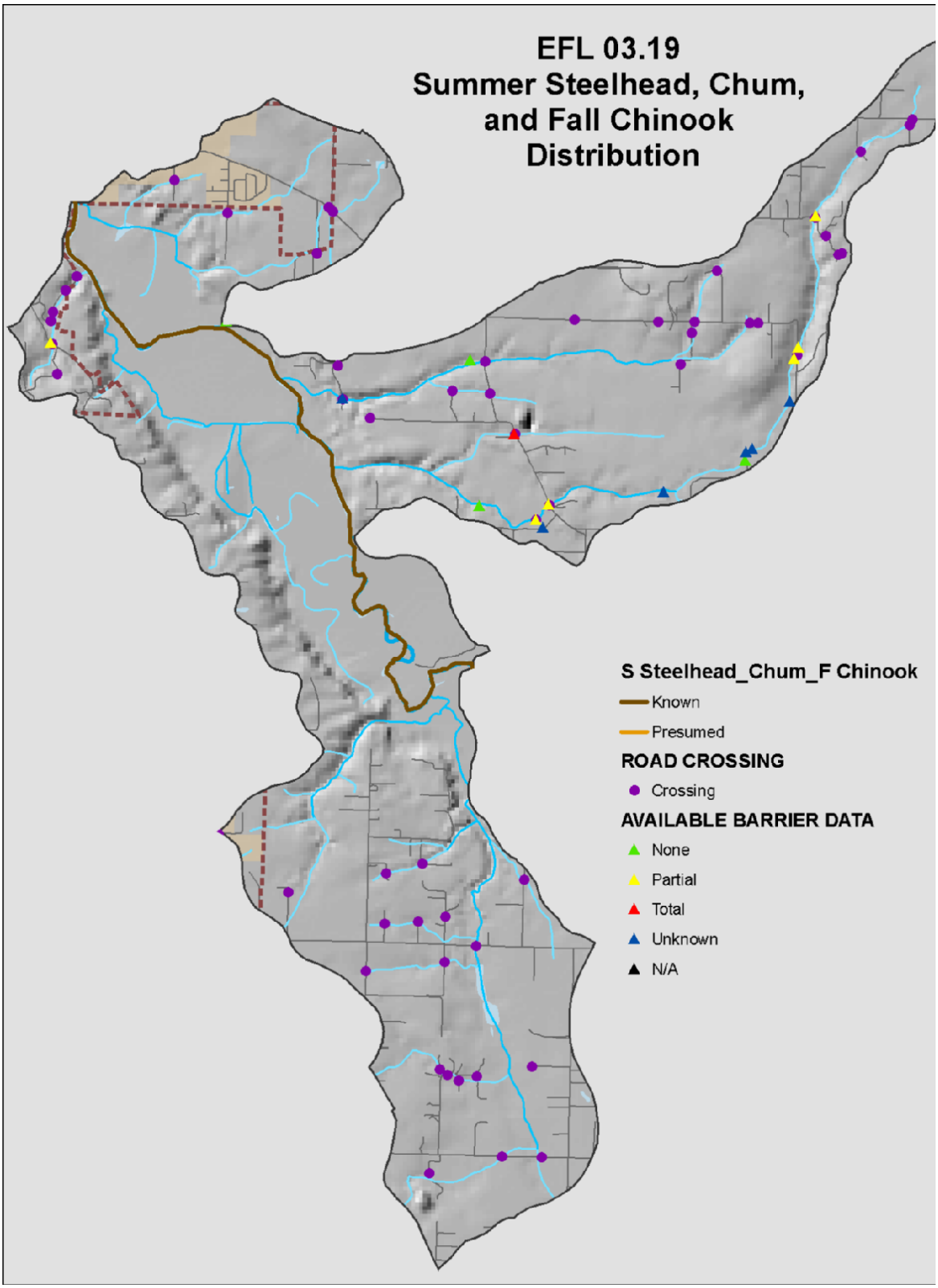

Figure 26: East Fork Lewis River (RM 03.19) Fish Distribution and Barriers

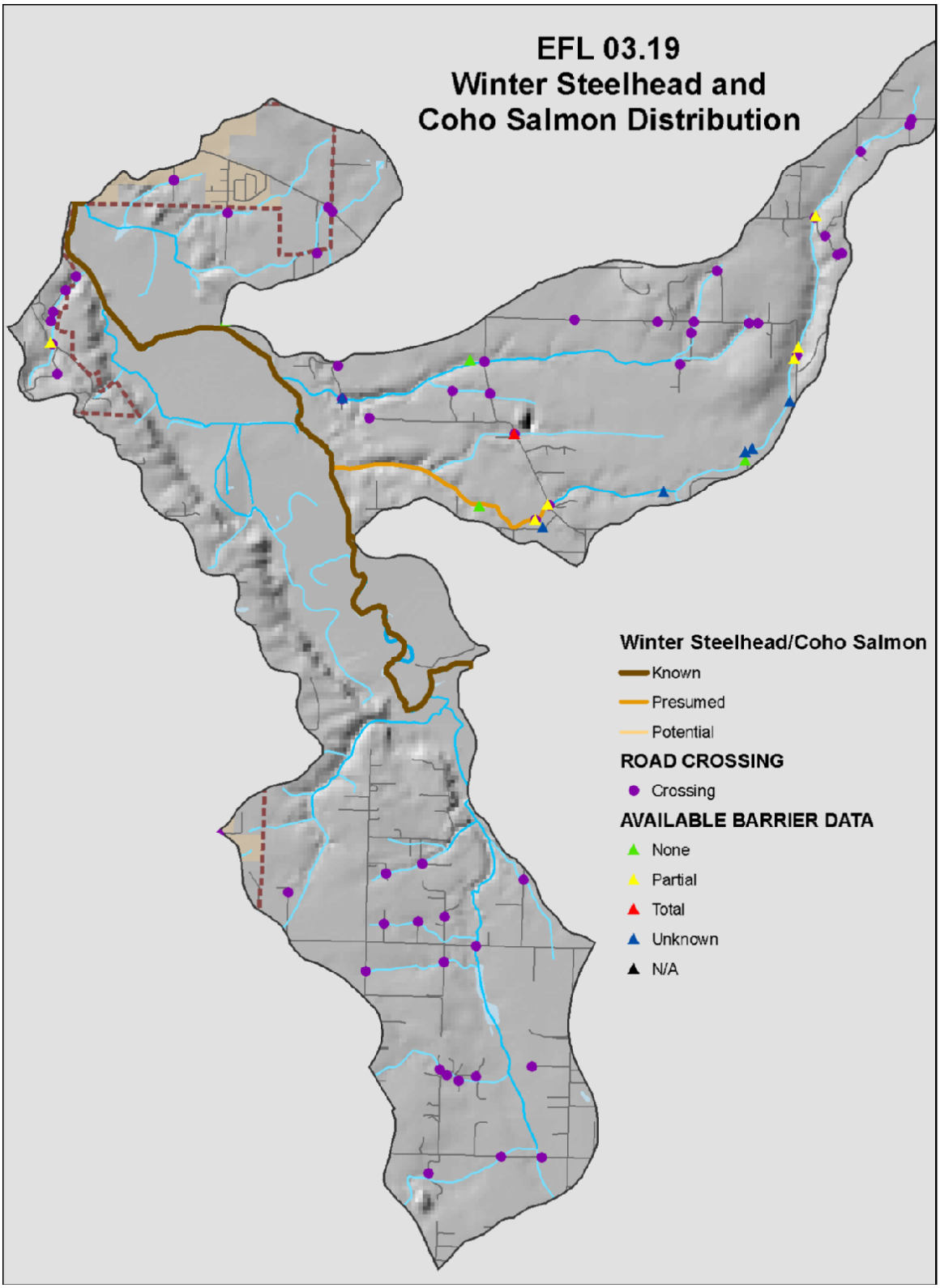

Figure 27: East Fork Lewis River (RM 03.19) Fish Distribution and Barriers

Barriers

The WDFW barrier database and the 2007 LCFRB Regional Culvert Survey provide the most complete assessment of barriers in the lowermost East Fork Lewis River assessment area (Figures 15, 16, 17 and 18). However, additional barrier/reach information was obtained from the Draft East Fork Lewis River Community Habitat Restoration Plan and Project Design Technical Memoranda 1 and 2 (LCFRB, 2008).

There are no barriers within the mainstem of the East Fork of the Lewis River reaches within the East Fork Lewis River (RM 00.00) and East Fork Lewis River (RM 03.19) subwatersheds. However, the Regional Culvert Survey and Technical Memoranda identifies partial barriers on some of the smaller tributaries to the lower East Fork of the Lewis River reaches. Stoughton Creek, which enters the lower East Fork of the Lewis River immediately downstream of Mason Creek, is listed as having five partial barriers at road crossings (culverts) and one dam within the four river miles surveyed during the Regional Culvert Survey. A partial barrier at the NE 72nd Avenue road crossing appears to be limiting potential upstream habitat for Coho and winter steelhead.

Dyer Creek, a tributary located downstream of Dean Creek and entering at the left bank of the East Fork of the Lewis River has a partial fish barrier at the 259th Street road crossing. Houser Dam, located just upstream from the 259th Street crossing also blocks fish passage to the lower reaches of Dyer Creek.

Within the McCormick Creek subwatershed, there are multiple impassible fish barriers on the mainstem of McCormick Creek and its tributaries. The impassable barrier at the La Center Road culvert blocks fish access (winter steelhead and Coho salmon) to the upstream reaches of McCormick Creek. Additionally, the upper reaches the mainstem are diverted into a system of privately owned ponds and reservoirs, which further restrict access to upstream habitat.

<u>Recommendations</u>

The lowermost East Fork Lewis River Assessment area contains many full and partial fish barriers within tributaries to the mainstem of the East Fork of the Lewis River and McCormick Creek. Many of these reaches are high and medium priority (Tier 1 and Tier 2) reaches as they provide the greatest potential for increased habitat for one or more primary fish species. Additionally, based on research observations by ELS, there are several potential projects within the McCormick Creek subwatershed that could improve channel condition through the removal of fill and levees, and are listed below.

Sites for further evaluation:

- Improve or remove the full barrier at La Center Road and NE 279th Street (McCormick Creek).

- Improve or remove the partial barrier at NW 11th Avenue and Timmen Road (McCormick Creek).
- Remove fill and riprap near McCormick Creek confluence with the East Fork of the Lewis River (McCormick Creek).
- Remove fill on the southern approach to the La Center bridge, and the levee originating at the La Center bridge and extending approximately one mile upstream (McCormick Creek).
- Improve or remove the full barrier at a dam on Dyer Creek
- Improve or remove the partial barrier at the 259th Street crossing (Dyer Creek)
- Improve or remove the partial barrier at N.E. 72nd Avenue crossing (Stoughton Creek). Field visit details are included in Table 24 below.

In addition to the project recommendations above, barriers should be removed over time as stream crossing infrastructure is replaced or upgraded.

Table 24: Field Visit Results

ID	Basis for Project	Project Description
(315 block and 72nd Ave Culvert/Stoughton Creek FB)	Culvert is a complete blockage (100%) to fish passage. The existing 36 inch culvert is too small, creating velocity issues. There is a 2 ½ foot outfall drop, that has created a 20 foot long, 14 ½ foot, 4 ½ deep plunge pool. During flood events road fill is becoming saturated.	Replace culvert with a new fish passable culvert. Recommended culvert size is a 10 foot concrete box or bottomless culvert. Fill plunge pool and culvert with streambed material. Install LWD into plunge pool.

Hydrologic and Hydraulic Models

No modeling was performed for this assessment area.

Analysis of Potential Projects

The analysis of potential projects:

- Briefly summarizes stormwater conditions, problems, and opportunities.
- Notes recently completed or current projects within 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.

Summary of Conditions, Problems, and Opportunities

Conditions and Problems

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

Coordination with Other Programs

The Washington Department of Ecology is developing TMDLs for bacteria and temperature in the East Fork Lewis River subwatershed. The CWP actively participates in TMDL development and implementation, and coordinates on an ongoing basis with the Lower Columbia Fish Recovery Board, Clark County Legacy Lands, and Vancouver-Clark Parks and Recreation.

Broad-Scale Characterization

Upland areas in the assessment area are almost entirely cleared for pasture, agriculture, and residential use. Forest remnants exist in a few places, primarily along steeper stream channels.

Standard subwatershed scale metrics compared to NOAA fisheries standards suggest this study area has largely non-functioning stream habitat. The only functioning metric for the three subwatersheds was stream crossing density. Percent forested area, total impervious area, and road density metrics all suggest non-functioning habitat. Additionally, the East Fork Lewis River (RM 00.00) and McCormick Creek subwatersheds are projected to see significant further increases in effective impervious area under the 2008 Comprehensive Plan, placing both firmly in the non-functioning category. The East Fork Lewis River (RM 03.19) subwatershed has a much higher percentage of floodplain wetlands and other undevelopable lands, leading to a relatively low projected future EIA, falling within the functioning habitat category.

Water Quality Assessment

Based on overall data, McCormick Creek has poor water quality, while the two East Fork Lewis River subwatersheds have good water quality. McCormick Creek is on the 2008 Ecology 303(d) list of impaired waters for fecal coliform, and the two East Fork Lewis River subwatersheds in this assessment are listed for both fecal coliform and water temperature. All are included in the temperature

and fecal coliform TMDLs being developed for the East Fork Lewis River. State monitoring during 2005and 2006 indicated that all three subwatersheds failed to meet fecal coliform bacteria standards, and the East Fork Lewis River in this assessment area had the highest water temperatures in the entire watershed.

Drainage System Inventory
The drainage system inventory is complete for these three subwatersheds. Storm drains in this area consist almost entirely of roadside ditches, with 290 associated outfalls to surface water.

Stormwater Facility Inspection
As of October 2008, there were four known public stormwater facilities in unincorporated areas of East Fork Lewis River (RM 00.00) and McCormick Creek subwatersheds. Fifty-seven percent of facility components within these facilities were in compliance with standards in the *2005 Stormwater Management Manual for Western Washington Volume 5*. All four facilities required referrals for maintenance work.

Off-site assessments conducted for 13 public stormwater outfalls discharging to critical areas identified one case of moderate erosion caused by an outfall.

Illicit Discharge Screening
Screening conducted at 208 stormwater outfalls mapped at the time of the screening, primarily from roadside ditches, identified no illicit connections or discharges. Additional screening is anticipated as part of future bacteria TMDL implementation.

Physical Habitat Assessment
Physical habitat measurements made in 2004 on a lower portion of McCormick Creek indicated that overall habitat quality is generally poor. Pool frequency, pool quality, LWD recruitment potential, substrate, and streambank stability classified as not properly functioning.

Habitat parameter ratings were difficult to classify in the lower reaches of East Fork Lewis River (RM 00.00) due to tidal influence, a mean gradient of 0.0 percent, and frequent inundation by flooding. Open space and wetlands comprise a significant portion of the riparian zone in these reaches with low shade occurrence with little to no large woody debris recruitment potential.

East Fork Lewis River (RM 03.19) had habitat parameters streambank stability, large woody debris recruitment potential, and pool frequency rated as not properly functioning.

Geomorphology and Hydrology
These tasks were not included in this assessment.

Riparian Assessment

The most reliable riparian assessment data in Clark County is limited to the areas assessed during the 2004 LCFRB Habitat Assessment. The major streams and some of their tributaries were included in this assessment or had more qualitative assessments made from orthophotos.

Generally, riparian conditions within East Fork Lewis River (RM 00.00) are moderately impaired. Riparian conditions within East Fork Lewis River (RM 03.19) and McCormick Creek are impaired.

Overall, the lower reaches of the East Fork Lewis River represented by East Fork Lewis River (RM 00.00) and East Fork Lewis River (RM 03.19) have low LWD recruitment potential as the riparian zone is primarily comprised of open space and emergent wetlands. Two tributaries (Dyer Creek and Stoughton Creek) within East Fork Lewis River (RM 03.19) have low to moderate LWD recruitment potential. The lower stem of McCormick Creek had low LWD recruitment potential with the middle to upper reaches ranging from low to high LWD recruitment potential.

Riparian shade levels for McCormick Creek range from 0 percent to 20 percent in the lower extent while the upper extent is heavily shaded (greater than 90 percent). Shade levels along the East fork Lewis River mainstem ranges from 0 percent to 20 percent. The majority of Stoughton Creek is well vegetated and is estimated to have a shade rating in the range of 40 to 70 percent. Dyer Creek is estimated to have a shade rating in the 0 percent to 20 percent range.

Wetland Assessment

Extensive existing and potential wetlands are primarily associated with the lower East Fork Lewis River riparian corridor and floodplain areas. Additionally, there are multiple potential wetlands in the vicinity of the headwaters of Dyer Creek, a major tributary of the lower East Fork Lewis River. In the McCormick Creek subwatershed, pockets of potential wetlands are primarily located along stream channels.

Ecology's draft wetland characterization of Clark County places the East Fork Lewis River (RM 00.00) and McCormick Creek subwatersheds in a category that is suitable for both development and restoration due to a higher level of alteration and a lower level of importance to regional watershed processes. Because this category represents a transition from restoration areas, planning measures employing both restoration and appropriately sited development should be considered. East Fork Lewis River (RM 03.19) is in a category suitable for restoration due to a higher relative level of importance for watershed processes and a higher level of current alteration from historical conditions.

The lower-most East Fork Lewis River assessment area contains large expanses of potential wetlands within county-owned land. However, this assessment did not discover any high priority stormwater-related CIP projects in these areas.

Macroinvertebrate Assessment:
Based on three samples from the mainstem within the East Fork Lewis River (RM 03.19) subwatershed, this portion of the mainstem displayed moderate biological integrity. Based on two samples from McCormick Creek, the creek displayed low biological integrity. No comparable data exists for the mainstem within the East Fork Lewis River (RM 00.00) subwatershed.

Scores are low to mid-range compared to the predicted range of B-IBI scores for areas with similar levels of total impervious area, suggesting that factors other than TIA are contributing to low observed scores. Thus, it is likely that biological integrity could be improved through rehabilitation of habitat and stream conditions.

Fish Use and Distribution:
Regional recovery priority is moderate to high in this assessment area, consisting primarily of Tier 1 and Tier 2 reaches. The East Fork Lewis River subwatersheds have known use by winter and summer steelhead, Coho, chum, and fall Chinook, while McCormick Creek has presumed or potential use for winter steelhead and Coho.

There are no barriers to fish migration on the mainstem East Fork Lewis River within this assessment area. Multiple barriers exist on the mainstem of McCormick Creek and its tributaries. A recovery priority in McCormick Creek is to restore access to habitat blocked by artificial barriers

Recently Completed or Current Projects

There are no stormwater projects in the East Fork Lewis River (RM 00.00), East Fork Lewis River (RM 03.19), and McCormick Creek subwatersheds under the 2009 through 2014 Stormwater Capital Improvement Program.

The LCFRB Lower East Fork Lewis River Aquatic Habitat Restoration Plan (Draft) identifies a large number of habitat restoration projects to be considered along the East Fork Lewis River mainstem and tributaries within this assessment area. Prioritization of potential projects is ongoing through coordination with a number of regional groups and agencies including Clark County.

Analysis Approach

Purpose

The Analysis of Potential Projects narrows the initial list of possible projects to a manageable subset of higher priority opportunities. Listed opportunities in sections of the SNAP report include sites requiring immediate follow-up, possible stormwater capital improvement projects, referrals to ongoing programs, and potential projects for referral to other county departments or outside agencies.

Stormwater capital improvement project opportunities are recommended for further evaluation by engineering staff, and potential development into projects for consideration through the SCIP process. Referrals to ongoing programs such as IDDE screening, operations and maintenance, and source control outreach receive follow-up within the context and schedules of the individual program areas. Referrals 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 CWP scope.

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.

In general, potential capital projects are evaluated considering problem severity, estimated cost and benefits, 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 projects are recommended for further consideration by the CWP.

Emergency or Immediate Actions

No projects of this type were identified in the East Fork Lewis (RM 03.19) and McCormick Creek subwatersheds.

ID	Basis for Project	Project Description	Action
East Fork Lewis (RM 03.19)			
SCC-156 AGR-3	Undersized, plugged, and failing culvert crossing impounds a significant volume of fine sediment and sand in the aggraded channel reach upstream. Embankments are failing and crossing has been overtopped multiple times. However, this barrier has locally halted channel incision.	Immediate site inspection to assess risk of catastrophic failure. Consider both positive and negative effects of this grade control and develop a project accordingly. Options include culvert crossing removal and channel restoration including LWD grade control to address downstream incision, or replacement of the crossing with an appropriately sized crossing less prone to plugging with debris.	Refer to CWP engineering
SCC-158	Undersized and plugged culvert crossing. Embankments are failing and the perched outlet with a 3-foot drop height is a fish passage barrier. However, this barrier has locally halted channel incision.	Immediate site inspection to remove debris plugging the culvert and assess risk of failure. Consider both positive and negative effects of this grade control and develop a project accordingly. Options include culvert crossing removal and channel restoration including LWD grade control to address downstream incision, or replacement of the crossing with an appropriately sized crossing less prone to plugging with debris.	Refer to CWP engineering
MB-34 MB-35 MI-64	Large, 10-foot-high earthen dam with two outlet pipes/channels. Backwater extends over 500 feet upstream. Outlet works are in disrepair and beavers are impairing the ability of the outlet to function properly. Failing embankments need immediate attention. High risk of catastrophic failure and a potentially serious hazard to downstream landowners and the environment. Pond may be acting as a source of thermal loading. Dam is an impassable barrier to fish. The left side outlet pipe may have originally been an emergency	Immediate site inspection by engineering staff to determine structural integrity of the dam and outlet works. May warrant removal of dam and restoration of tributary stream. At minimum, project should address failing outlet structures, stabilize the embankment, and appropriately mitigate for thermal and fish passage impacts of the dam.	Refer to CWP engineering

	spillway, but is now running water into a deep channel that is actively incising into clay substrates. Numerous sections of pipe from the failing outlet works have been discarded in the channel.		
TR-64	Landowner is dumping used oil, burning debris, and yard waste on the right bank of the stream. Slope has been cleared and is failing.	Contact landowner immediately and remove hazardous waste. Conduct additional site cleanup as needed. Determine if slope stabilization and revegetation is required.	Refer to CWP engineering and Code Enforcement

Potential Stormwater Capital Projects

Stormwater Capital Facility Improvement Projects

No projects of this type were identified in the East Fork Lewis River (RM 00.00) subwatershed.

ID	Basis for Project	Project Description	Action
East Fork Lewis (RM 03.19)			
OT-220	Small eroding gully drains stormwater from an unknown source in the direction of houses south of the creek.	Investigate source of stormwater and construct a new stormwater facility to detain and treat runoff appropriately. Stabilize outfall gully with natural materials such as logs to prevent further erosion.	Refer to CWP engineering
McCormick Creek			
OT-218	Culvert delivers water/stormwater from an unidentified source under I-5 to 50-foot-long open channel draining to the main stream. Based on the DNR stream layer, this culvert conveys runoff from a significant area that may include I-5.	Investigate source of water exiting culvert under I-5 and construct new stormwater facilities to detain and treat runoff appropriately.	Evaluate for 2009 SCIP
OT-219	Roadside ditch drains stormwater from NW 310th Street without any apparent treatment.	Confirm source of runoff, drainage area, and pollutant loading characteristics. Construct facility retrofits on road ditches to detain and treat runoff appropriately.	Evaluate for 2009 SCIP

Stormwater Infrastructure Maintenance CIPs

No projects of this type were identified

Stormwater Class V Underground Injection Control (UIC) Projects

No county-owned Class V UIC wells are known in the three subwatersheds.

Habitat Restoration/Enhancement Projects

Clark County has implemented a large-scale wetland enhancement project at La Center Bottoms, a 166 acre park property located at the northern tip of the East Fork Lewis River (RM 03.19) subwatershed. Additional habitat enhancement projects continue to be slated for county-owned properties along the lower East Fork Lewis River and should be examined for stormwater-related benefits that could be leveraged through SCIP.

ID	Basis for Project	Project Description	Action
East Fork Lewis (RM 03.19)			
OS-41	Potential riparian reforestation area on Dyer Creek within the East Fork Lewis River Greenway. LCFRB project # DY 01	Investigate the feasibility of developing a large scale wetland complex for habitat enhancement and water quality improvement.	Evaluate for 2009 SCIP
McCormick Creek			
OS-42	Potential riparian reforestation area on McCormick Creek within the East Fork Lewis River Greenway. LCFRB project # MC 01	Investigate the feasibility of developing a large scale wetland complex for habitat enhancement and water quality improvement.	Evaluate for 2009 SCIP

Property Acquisition for Stormwater Mitigation

ID	Basis for Project	Project Description	Action
East Fork Lewis (RM 03.19)			
WQ-46	Large property parcel with favorable topography and hydrology for a large scale wetland creation/ enhancement project. Located downstream of large agricultural area and other potential sources of water quality impairments.	Investigate the feasibility of obtaining property and developing a large scale wetland complex for habitat enhancement and water quality improvement.	Evaluate for 2009 SCIP

Other than listed above, no specific potential acquisition sites were discovered. However, there are a few relatively large blocks of intact forest cover along the lower portions of McCormick Creek. Due to the loss of historical forest cover watershed-wide, future opportunities to protect or acquire forested land in this area should be pursued.

Follow-up Activities for Referral within CWP

Private Stormwater Facilities Maintenance

No projects of this type were identified.

Public Works stormwater infrastructure maintenance

The Public Facility Inspection section describes additional routine stormwater infrastructure maintenance needs referred to Public Works Operations during ongoing inspections.

CWP Outreach/Technical Assistance

No projects of this type were identified in the East Fork Lewis River (RM 00.00) subwatershed.

ID	Basis for Project	Project Description	Action
East Fork Lewis (RM 03.19)			
IW-4	Wetland is cleared and grazed by cattle.	Create a protected riparian buffer by excluding livestock. Reestablish native undergrowth and canopy vegetation through a large scale revegetation project to enhance wetland, riparian, and aquatic habitat and shade out invasive plants.	Refer to CWP Outreach; contact landowner about BMPs, CCD assistance
OT-223 WQ-41 WQ-42 WQ-43 WQ-69 WQ-70 WQ-71 WQ-72	Pipe and/or open channel drains agricultural runoff from fields to the stream.	Confirm source of runoff, drainage area, and pollutant loading characteristics. Apply source control and/or construct appropriate facilities to enhance water quality (new stormwater facility to detain and treat runoff or agricultural water quality BMP). Stabilize eroding inflow channel with natural materials such as LWD.	Refer to CWP Outreach; contact landowner about BMPs
WQ-44 SCF-3 SCF-4 SCF-165 SCF-166 SCF-167	Livestock access or crossing through stream. Likely source of sediment and nutrients	Investigate alternative means for livestock to cross channel to minimize water quality impacts and reduce stream bank erosion.	Refer to CWP Outreach; contact landowner about BMPs

East Fork Lewis (RM 03.19) continued			
WQ-45	Pile of goose droppings, horse manure, or pond dredge spoils located approximately 30-feet from the stream.	Remove pile and revegetation area. Discuss more appropriate disposal options with the landowner.	Refer to CWP Outreach; contact landowner about BMPs
McCormick Creek			
WQ-38 WQ-39 WQ-40	Channel/ditch drains agricultural runoff to the stream from the right bank	Confirm source of runoff, drainage area, and pollutant loading characteristics. Apply source control and/or construct appropriate facilities to enhance water quality (new stormwater facility to detain and treat runoff or agricultural water quality BMP).	Refer to CWP Outreach; contact landowner about BMPs, CCD assistance

CWP Illicit Discharge and Detection Elimination Screening

No projects of this type were identified in the East Fork Lewis River (RM 00.00) subwatershed.

ID	Basis for Project	Project Description	A
East Fork Lewis (RM 03.19)			
WQ-46	Suds observed in stream. Source of impairment was not apparent, but all upstream properties are on septic, cattle have access to the creek, and upstream landowner has dumped trash and other debris along the stream.	Investigate sources of water quality impairments more thoroughly in this area. Discuss more appropriate disposal options with the landowners. Consider testing septic systems with dye to spot failing systems.	Refer IDDE Progr
McCormick Creek			
OT-221	4-inch pipe outlet drains water from unknown source onto an eroding dirt access road and then into the stream.	Investigate source of stormwater and install source control or construct a new stormwater facility to detain and treat runoff appropriately. Stabilize eroding dirt road surface to prevent or minimize erosion.	Refer IDDE Progr

CWP Engineering Evaluation

Identifier	Basis for Project	Project Description	Action
East Fork Lewis (RM 00.00)			
OS-43	Significant headcut with channel erosion (StormwaterCLK DP2077)	Monitor/investigate headcut more thoroughly to determine rate of migration and assess risk to the channel. If required, stabilize channel with grade control to prevent headcut migration.	Refer to CWP engineering
East Fork Lewis (RM 03.19)			
ER-43 ER-44 ER-45	Significant headcut with vertical drop, progressing upstream at an unknown rate. Stream transitions into an incised reach.	Monitor/investigate headcut more thoroughly to determine rate of migration and assess risk to the stream. If required, stabilize channel with grade control to prevent headcut migration. Consider a larger, reach scale channel restoration project to address channel incision and lack of LWD.	Refer to CWP engineering
ER-46	Chronic bank erosion on outside meander bends for 100-feet of channel, threatening culvert crossing.	Investigate cause of eroding banks and develop a bank stabilization and riparian restoration project with the landowner to address the problem. Keep in mind that the culvert crossing may be exacerbating bank erosion.	Refer to CWP engineering
McCormick Creek			
Identifier	**Basis for Project**	**Project Description**	**Action**
SCC-153	Culvert under NW 310th Street is a fish passage barrier due to an estimated 4-foot drop height at the outlet and lack of streambed material in barrel.	Conduct additional barrier analysis and replace crossing and restore channel to facilitate fish passage.	Refer to CWP engineering

McCormick Creek Continued			
Identifier	**Basis for Project**	**Project Description**	**Action**
SCC-154	Culvert under NW Spencer Road is a fish passage barrier due to an estimated 4-foot drop height at the outlet and lack of streambed material in barrel.	Conduct additional barrier analysis and replace crossing and restore channel to facilitate fish passage.	Refer to CWP engineering
MB-31	Historic road crossing. The middle 20-feet of the crossing is washed out and is now occupied by a 6-foot-high beaver dam which creates a 400-foot-long pond upstream. A 3-foot-diameter CMP culvert drains water through the left side of the earthen embankment.	Investigate/evaluate fish passage and other potentially harmful effects of this feature including thermal effects, and the potential release of large volumes of impounded sediment if a failure occurs.	Refer to CWP engineering
MI-63	Tributary exhibiting signs of instability and significant bank erosion enters from the right bank. Headwaters are in agricultural area.	Investigate tributary for potential water quality impacts and evidence of channel instability.	Refer to CWP engineering
ER-41	50-foot long eroding bank immediately downstream of agricultural runoff inflow point (WQ-38).	Stabilize eroding bank. Investigate cause of erosion and address the problem.	Refer to CWP engineering

CWP Infrastructure Inventory

No projects of this type were identified.

Projects for Referral to Other County Departments, Agencies, or Groups

No projects of this type were identified in the East Fork Lewis River (RM 00.00) subwatershed.

Identifier	Basis for Project	Project Description	Action
East Fork Lewis (RM 03.19)			
OS-44	Culvert is a complete blockage (100%) to fish passage. The existing 36 inch culvert is too small, creating velocity issues. There is a 2 ½ foot outfall drop, that has created a 20 foot long, 14 ½ foot, 4 ½ deep plunge pool. During flood events road fill is becoming saturated.	Replace culvert with a new fish passable culvert. Recommended culvert size is a 10 foot concrete box or bottomless culvert. Fill plunge pool and culvert with streambed material. Install LWD into plunge pool.	Refer to Washington Department of Fish and Wildlife for further evaluation
OS-48	Full fish passage barrier.	Improve or remove the full barrier.	Refer to Washington Department of Fish and Wildlife for further evaluation
IB-232 IB-233 IB-234 IB-235 IB-236 IB-237 IB-238 IB-239 IB-240 IB-241	Lack of woody riparian vegetation along the channel and wetland swales upstream of a stockwater pond. Some blackberry present.	Reestablish native undergrowth and canopy vegetation through a large scale revegetation project to enhance riparian and aquatic habitat and shade out invasive plants. Eradicate blackberry.	Refer to Clark County Conservation District
TR-62	Two barrels and two tires left at a private culvert crossing. Barrels did not appear to be leaking any hazardous material.	Remove barrels and tires.	Refer to Clark County Code Enforcement

Identifier	Basis for Project	Project Description	Action
East Fork Lewis (RM 03.19)			
OS-46	Partial fish passage barrier.	Improve or remove the full barrier.	Refer to Washington Department of Fish and Wildlife for further evaluation
OS-47	Remove fill and riprap	Remove fill and the levee originating at the La Center bridge and extending approximately one mile upstream	Refer to Washington Department of Fish and Wildlife for further evaluation
McCormick Creek			
Identifier	**Basis for Project**	**Project Description**	**Action**
OS-49 OS-50 OS-51	Full fish passage barrier.	Improve or remove the full barrier.	Refer to Washington Department of Fish and Wildlife for further evaluation
OS-45	Remove fill and riprap	Remove fill and riprap	Refer to Washington Department of Fish and Wildlife for further evaluation
IB-226 IB-227 IB-228 IB-229 IB-230	Widespread invasive plant species within and immediately adjacent to the floodplain. Reed canary grass and blackberry.	Eradicate reed canary grass and blackberry. Reestablish native undergrowth and canopy vegetation to shade out invasive plants.	Refer to Clark County Conservation District

McCormick Creek Continued			
Identifier	**Basis for Project**	**Project Description**	**Action**
TR-59	Washing machine, barrels, and metal roofing material in the channel.	Remove metal debris.	Refer to Clark County Code Enforcement
TR-60	Accumulation of fence posts, plywood, and other debris in channel.	Remove trash and debris.	Refer to Clark County Code Enforcement
TR-61	Approximately 100 tires 200-feet up small tributary stream that enters main channel from the right bank.	Remove tires.	Refer to Clark County Code Enforcement

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 East Fork Lewis River (RM 00.00), East Fork Lewis River (RM 03.19), and McCormick Creek subwatersheds, by permit component, include:

Storm Sewer Mapping and Inventory

None. Inventory is complete in this assessment area.

Coordination of Stormwater Activities

- Pursue future collaborative stormwater activities with the City of LaCenter related to interconnected storm systems and habitat protection/rehabilitation
- Continue to search for opportunities to coordinate or leverage projects with the Lower Columbia Fish Recovery Board through the Lower East Fork Lewis River Aquatic Habitat Restoration Plan.
- Continue active participation in Ecology's bacteria and temperature TMDL development for the East Fork Lewis River subwatershed.

Mechanisms for public involvement

- Publish SNAP reports on CWP web page.

Development Regulations for Stormwater and Erosion Control

- EIA is expected to increase in much of the study area under the 2008 Comprehensive Plan. Clark County has adopted standards that include stormwater management for most rural building projects to reduce flow and increase treatment of stormwater runoff.
- Emphasize stormwater management that focuses on reduction of runoff and diffuse infiltration close to the source rather than in centralized facilities. LID practices should be encouraged.
- In collaboration with LaCenter and Ridgefield, consider stormwater basin planning as a tool to better manage stormwater impacts due to future growth in the East Fork Lewis River (RM 00.00) and McCormick Creek subwatersheds.
- Protect first-order tributary streams from further stormwater impacts by creating stream buffers, establishing conservation easements, and eliminating existing stormwater and agricultural runoff inputs. Encourage reforestation of lower gradient headwaters.

Stormwater Source Control Program for Existing Development

- Examine possible flow reduction practices that can be applied to roadside ditches

Operation and Maintenance Actions to Reduce Pollutants

- Increase maintenance of stormwater swales to increase treatment effectiveness and reduce erosion.
- Confirm that county ditch maintenance practices minimize vegetation removal whenever possible.

Education and Outreach to reduce behaviors that contribute stormwater pollution

- Perform targeted technical assistance responding to results of field assessments.
- Increase education and technical support regarding the removal of invasive plants, and provide a list of suggested plants for stream revegetation and local nurseries that stock them for distribution to landowners. Eradication and/or control of invasive plants is beyond the resources of public agencies and requires actions by private landowners.
- Post stream identification signs where roads cross streams. Repair or replace deteriorated signs if necessary.
- Develop a process to provide education about appropriate ditch maintenance practices to rural landowners.
- Discuss current management practices with agricultural land users, and look for ways to reduce sediment and nutrient loads to headwaters streams.
- Educate landowners to discourage disposal of yard debris in streams or other receiving waters.
- Develop literature and distribute to landowners educating about the water quality impacts and other potential hazards of on-line and off-line ponds.

TMDL Compliance

- There are no existing TMDL requirements in the assessment area.

Monitoring Stormwater Program Effectiveness

None.

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