

CITY OF *Salem*
AT YOUR SERVICE
PUBLIC WORKS DEPARTMENT

555 Liberty Street SE / Room 325 • Salem OR 97301-3513 • Phone 503-588-6211 • Fax 503-588-6025

October 24, 2013

Benjamin Benninghoff
Stormwater Coordinator
Oregon Department of Environmental Quality
811 SW Sixth Avenue
Portland OR 97201-1390

**SUBJECT: National Pollutant Discharge Elimination System
Municipal Separate Storm Sewer System Permit
FY 2012-13 Annual Report
Permit No. 101513, File No. 108919**

Dear Mr. Benninghoff:

The City of Salem is pleased to submit the enclosed National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit Annual Report. This report describes Stormwater Management Plan activities the City of Salem completed during the period of July 1, 2012, through June 30, 2013. Additionally, this report addresses the 11 requirements listed under Schedule B(5) of the City's NPDES MS4 Permit (Permit No. 101513, File No. 108919) issued December 30, 2010.

This annual report was placed on the City's website from October 7, 2013, through October 21, 2013. An official press release was issued to solicit comments from the public. No comments were received.

Please contact Heather Dimke, Stormwater Program Coordinator, at 503-588-6063, extension 7734, if you have any questions or to request additional information.

Sincerely,



Francis Kessler
Operations Division Manager

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Enclosure: City of Salem NPDES MS4 Annual Report FY 2012-13

cc: Peter Fernandez, P.E., Public Works Director
Sam Kidd, Wastewater and Stormwater Collections Services Manager
Keith Bondaug-Winn, AIC Stormwater Quality Supervisor
File: Chrono; Regulatory

Engineering Division
Parks and Transportation
Services Division
555 Liberty Street SE / Room 325
Salem OR 97301-3513
Phone 503-588-6211
Fax 503-588-6025

Operations Division
1410 20th Street SE / Building 2
Salem OR 97302-1209
Phone 503-588-6063
Fax 503-588-6480

Parks Operations
1460 20th Street SE / Building 14
Salem OR 97302-1209
Phone 503-588-6336
Fax 503-588-6305

Willow Lake Water Pollution
Control Facility
5915 Windsor Island Road N
Kelzer OR 97303-6179
Phone 503-588-6380
Fax 503-588-6387

CITY OF SALEM, OREGON

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) MUNICIPAL SEPARATE STORM
SEWER SYSTEM (MS4) PERMIT
(Permit Number 101513, File Number 108919)

ANNUAL REPORT
FY 2012/13

October 23, 2013

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.


Francis Kessler, Operations Division Manager

10/23/13
Date

Prepared by
City of Salem Public Works Department



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LIST OF ACRONYMS

ACWA	Association of Clean Water Agencies
BMP	Best Management Practice
CFR	Code of Federal Regulations
CIP	Capital Improvement Plan
COE	U.S. Army Corps of Engineers
CON	Construction-related BMPs
DEQ	Oregon Department of Environmental Quality
EPA	U.S. Environmental Protection Agency
EPSC	Erosion Prevention and Sediment Control
ES	Environmental Services (City of Salem)
FEMA	Federal Emergency Management Act
GIS	Geographic Information System
IDEP	Illicit Discharge Elimination Program
IGA	Inter-governmental Agreement
ILL	Illicit discharge-related BMPs
IND	Industrial-related BMPs
MEP	Maximum Extent Practicable
mg/L	Milligrams per liter
MOA	Memorandum of Agreement
MS4	Municipal Separate Storm Sewer System
MWOG	Mid-Willamette Valley Outreach Group
ODOT	Oregon Department of Transportation
ppm	Parts per million
RC	Residential and commercial area-related BMPs
SDC	System Development Charge
SRC	Salem Revised Code
SSORP	Sanitary Sewer Overflow Response Plan
SWMP	Stormwater Management Plan
TMDL	Total Maximum Daily Load

1 INTRODUCTION

1.1 Background

In 1990, the United States Environmental Protection Agency (EPA) published its Phase I regulations governing stormwater discharges under the National Pollutant Discharge Elimination System (NPDES) program of the Clean Water Act. In Oregon, EPA has delegated the permitting of NPDES municipal separate storm sewer system (MS4) discharges to the Oregon Department of Environmental Quality (DEQ).

Under EPA's initial Phase I implementation of the program, municipalities having a population greater than 100,000 were required to obtain an NPDES MS4 Permit. The City of Salem (the City) passed that threshold with the 1990 Census and was included in the program by the DEQ, with the Oregon Department of Transportation (ODOT) originally designated as a co-permittee with Salem.

The regulations established a two-part application process for obtaining an NPDES Permit to discharge municipal stormwater to "waters of the state." The City submitted the Part 1 NPDES Stormwater Permit Application in April 1994. The supplemental Part 2 Application and associated Stormwater Management Plan (SWMP) were subsequently finalized and submitted to DEQ in July 1996. DEQ issued the City's initial MS4 Permit in December 1997, with an expiration date of September 2002.

In April 2002, the City submitted an application for renewal of its NPDES MS4 Permit, along with a revised SWMP that outlined the City's stormwater management efforts for the next five-year permit period. The DEQ issued the renewed MS4 permit in March 2004. In accordance with that permit's conditions, the City evaluated and updated the SWMP in conjunction with the 2nd Annual Report submitted to DEQ on November 1, 2005. The 2004 MS4 permit (and updated 2005 SWMP) expired on February 28, 2009, and was administratively extended by the DEQ.

The City submitted its NPDES MS4 permit renewal application to DEQ on September 2, 2008. Along with other required documents for the permit renewal process, the application included a revised SWMP. This SWMP (2008 SWMP) was developed in part using the EPA document *Municipal Separate Storm Sewer System Program Evaluation Guidance* (January 2008), followed by continued evaluation and revision of the 2005 SWMP. Following permit negotiations, this updated SWMP was further revised and submitted to the DEQ on August 13, 2010.

The City of Salem received a renewed MS4 permit on December 30, 2010. Consistent with requirements of Schedule D.6 of the renewed MS4 permit, the City re-submitted the SWMP (revised 2010 SWMP) to the DEQ on March 17, 2011. This Annual Report (FY 2012-13) describes the status of BMP-related activities in the 2010 SWMP. The renewed MS4 permit and revised 2010 SWMP are available on the City's website (www.cityofsalem.net).

1.2 Purpose and Scope

The MS4 permit area is defined as being within the current City Limits, as exhibited in Figure 1. Land use within this permit area is exhibited in Figure 2.

This NPDES MS4 Annual Report summarizes stormwater-related activities listed in the 2010 SWMP that were completed during the period of July 1, 2012, through June 30, 2013, as required by the City's current MS4 permit. The information presented in this report is based on the requirements listed in Schedule B.5 of the renewed MS4 Permit (see Table 1).

Table 1. Annual Reporting Requirements for the MS4 Permit		
Permit Section	Reporting Requirement	Location in Annual Report
B(5)(a)	The status of implementing the stormwater management program and each SWMP program element, including progress in meeting the measurable goals identified in the SWMP.	Section 2
B(5)(b)	Status or results, or both, of any public education program effectiveness evaluation conducted during the reporting year and a summary of how the results were or will be used for adaptive management.	Section 2 (RC 5-1)
B(5)(c)	A summary of the adaptive management process implementation during the reporting year, including any proposed changes to the stormwater management program (e.g., new BMPs) identified through implementation of the adaptive management process.	Section 1.3
B(5)(d)	Any proposed changes to SWMP program elements that are designed to reduce TMDL pollutants.	Section 1.3
B(5)(e)	A summary of total stormwater program expenditures and funding sources over the reporting fiscal year, and those anticipated in the next fiscal year.	Section 3
B(5)(f)	A summary of monitoring program results, including monitoring data that are accumulated throughout the reporting year and/or assessments or evaluations.	Section 2 (MON 1-1, 1-2, and 1-3), Appendix C
B(5)(g)	Any proposed modifications to the monitoring plan that are necessary to ensure that adequate data and information are collected to conduct stormwater program assessments.	Appendix C
B(5)(h)	A summary describing the number and nature of enforcement actions, inspections, and public education programs, including results of ongoing field screening and follow-up activities related to illicit discharges.	Section 2 (ILL 2-4), Section 4, Appendix A, Appendix B, Appendix C
B(5)(i)	An overview, as related to MS4 discharges, of concept planning, land use changes and new development activities that occurred within the Urban Growth Boundary (UGB) expansion areas during the reporting year, and those forecast for the following year including the number of new post-construction permits issued, and the estimate of the total new or replaced impervious surface area related to new development and redevelopment projects commenced during the reporting year.	Section 5
B(5)(j)	Results of ongoing field screening and follow-up activities related to illicit discharges.	Section 2 (ILL 2-4), Appendix C

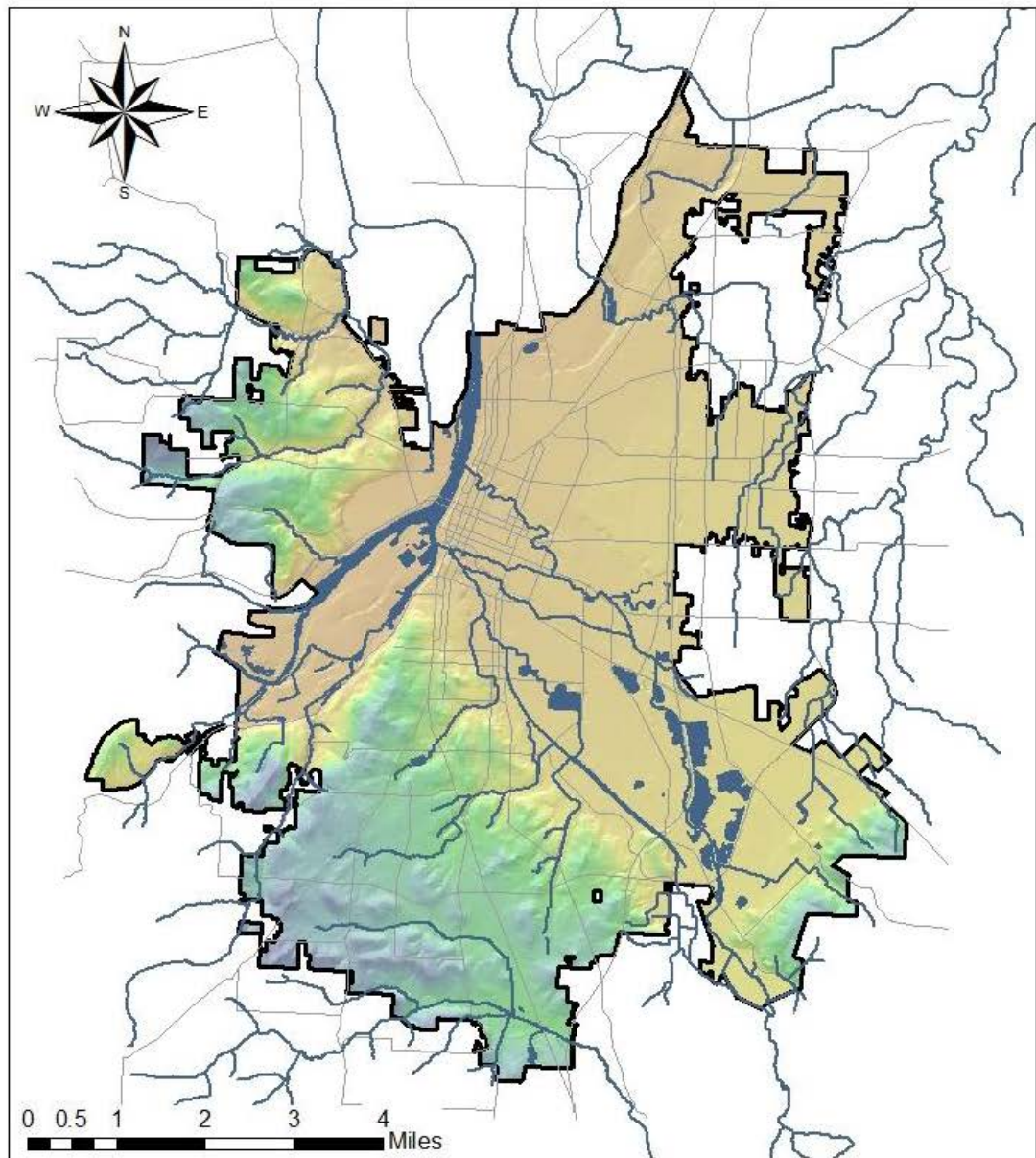
1.3 Adaptive Management

The stormwater management program that is described in the City of Salem's current SWMP is the result of adaptively managing (e.g., implementing, evaluating, and adjusting) the program since first being issued a MS4 permit in 1997. The history of this adaptive management approach may be found in Section 2 of the City of Salem's "National Pollutant Discharge Elimination System Municipal Separate Storm Sewer System Permit Renewal (September 2, 2008)," and describes how the current DEQ approved SWMP meets the 'maximum extent practicable' requirement. By adaptively managing its stormwater management program, the City of Salem continues to reduce the discharge of pollutants from its stormwater sewer system.

Consistent with Schedule D.4 of the renewed MS4 permit, City staff submitted an "Adaptive Management Approach" to the DEQ on October 24, 2011, that will be adhered to through expiration of the MS4 permit on December 29, 2015. This approach involves both an annual review of BMP activities and collected data, as well as a comprehensive assessment of BMP activities in preparation for MS4 permit renewal.

In preparation of this annual report and as described in the Adaptive Management Approach, City staff were asked to consider if changes in BMP activities were anticipated in the next fiscal year (FY 2013/14). Staff reported on activities anticipated to support a number of specific BMP measurable goals or MS4 permit due dates. Based on staff feedback, at this time no specific changes are proposed to BMPs in the current SWMP.

Figure 1. Permit Area Map



Legend

City Limit/MS4 Permit Boundary

City Limits

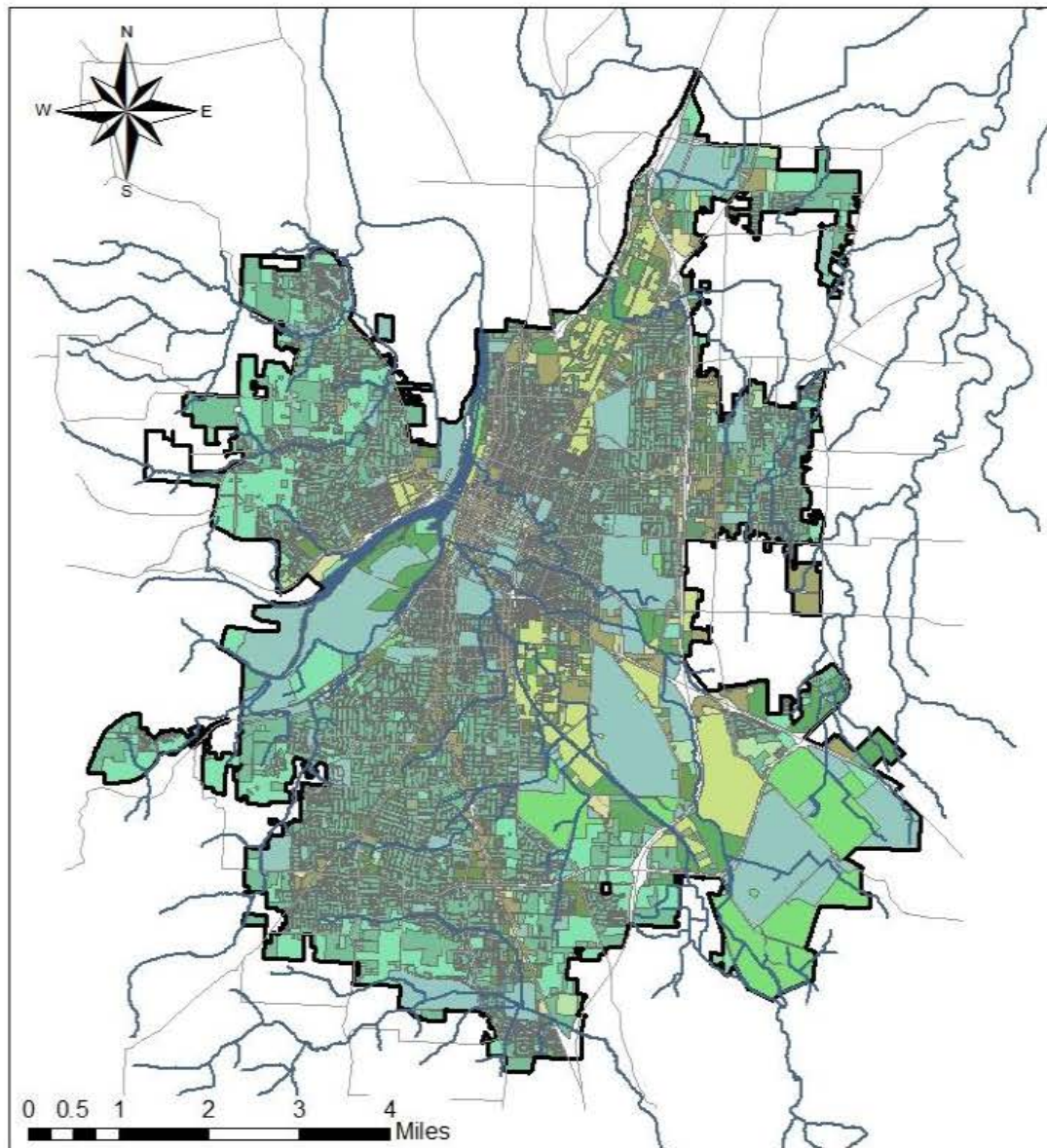
Waterbodies

Major Roadways

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Figure 2. Land Use



Legend

City Limit/MS4 Permit Boundary	Mobile Home Park
City Limits	Multi-Family
Waterbodies	Public Land
Major Roadways	Religious - Church Property
	Single Family
Duplexes	Vacant Commercial
General Commercial	Vacant Industrial
General Office Complex	Vacant Public
Industrial	Vacant Residential
Mixed Commercial	

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2 STATUS OF THE STORMWATER MANAGEMENT PLAN

The primary objective of the SWMP is to provide an outline of City activities that will satisfy the NPDES Phase I stormwater regulatory requirements (the MS4 permit) [40 CFR 122.26(d)(2)(iv)]. The intent of the regulations is to allow each permittee the opportunity to design a stormwater management program tailored to suit the individual and unique needs and conditions of the permit area, and reduce the discharge of pollutants from the stormwater sewer system to the maximum extent practicable.

The status of BMP activities listed in the 2010 SWMP are discussed in this section of the Annual Report. BMPs within the SWMP have been categorized into five types:

1. Structural and source controls for residential and commercial areas (RC);
2. A program for the control of illicit discharges and improper disposal into the storm drainage system (ILL);
3. A program to monitor and control pollutants from industrial facilities, hazardous waste treatment, storage and disposal facilities, and municipal landfills (IND);
4. A program to implement and maintain structural and non-structural BMPs to reduce pollutants from construction sites (CON); and
5. A program to conduct water quality monitoring activities within the MS4 drainage system and City waterways (MON).

Each BMP identified in the 2010 SWMP is discussed in this report with the following information:

- A table describing BMP tasks, associated measurable goals, and tracking measures as stated in the 2010 SWMP.
- A summary of activities completed during fiscal year 2012/2013 (July 1, 2012 through June 30, 2013) that demonstrate progress made in meeting the measurable goals and tracking measures.

2.1 RC1 – Planning

RC1 – PLANNING, TASK 1

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
Provide City-wide Master Planning for stormwater to address both water quality and water quantity. As part of master planning efforts, continue to evaluate new detention and water quality opportunities within the Urban Growth Boundary (UGB), and consider sites in upstream areas that may affect Salem, and in downstream areas that may be affected by runoff from Salem.	• Maintain Master Plan and complete next update within the MS4 permit cycle.	• Track schedule for updating Master Plan. • Report on Master Plan update actions.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

The project to update the Stormwater Master Plan is scheduled to begin in late 2013 with the release of a Request for Proposals (RFP) followed by consultant selection. An initial RFP has been drafted and is under internal review. Work on the update will accelerate as staff resources become available following the adoption process for new stormwater regulations and revisions to Public Works Design Standards. The Citywide Stormwater Master Plan is scheduled to be completed before the end of the current MS4 permit cycle.

RC1 – PLANNING, TASK 2

Task Description	Measurable Goals	Tracking Measures
Develop and maintain watershed management plans by developing a prioritized schedule and implementing watershed management plans based on available funding. Develop the Pilot Pringle Creek Watershed Management Plan as a model for the City's other prioritized urban watersheds. Identify capital improvement needs and potential "early action" activities and projects to ensure that the plan has a strong implementation component.	• Complete a hydromodification study and retrofit plan by November 1, 2014. • Incorporate recommendations and early action items of watershed management plans with completion of hydromodification study and retrofit plan. • Develop strategy for completing future watershed management plans by November 1, 2014.	• Report on completion of hydromodification study. • Report on completion of retrofit plan. • Track implementation actions of Pringle Creek Watershed Management Plan. • Report on strategy for completing future watershed management plans.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

In January 2013, ESA, Inc. (consultant) submitted the Phase 1 Hydromodification Assessment Final Report to the City which: 1) Provided an overview of hydromodification processes; 2) Detailed data sources and methods; 3) Presented the landscape context for the City's streams; 4) Provided results at a landscape-scale analysis regarding the extent of land use changes that can influence rainfall-runoff relationships; 5) Provided results of a rapid channel reconnaissance and other channel data collection that identifies existing status and trends of channel condition throughout the City of Salem; and 6) Concluded with an overall summary of conditions and discussion of implications for potential strategies and approaches to address hydromodification.

In April 2013, ESA, Inc. was awarded the contract for Phase 2 of the Hydromodification Assessment, which focuses on applying the outcomes from Phase 1 to developing strategies to address hydromodification. The components in the Phase 2 scope of work include, among other things: review of existing City documents and regional approaches, refinement of hydromodification assessment approach and methodologies, ancillary analyses to guide hydromodification strategy, and a final hydromodification assessment report. The final report is scheduled to be delivered in August 2014 to meet the DEQ's deadline of November 1, 2014.

Findings and strategies resulting from the hydromodification study are anticipated to be useful in guiding development of future watershed management plans and the City's retrofit plan. Efforts toward preparing a retrofit plan will occur concurrently while the hydromodification study progresses.

RC1 – PLANNING, TASK 3

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
City staff will continue to update the official “waterways” map for use by City staff in applying various regulations and standards. As studies are performed that warrant the revision of the designated waterways, including groundtruthing, that information will be incorporated into the update process.	• Compile database of maps and waterways references. • Complete field groundtruthing by end of FY 2011-12. • Update map by end of FY 2012-13.	• Track completion of groundtruthing and map updates.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

The acquisition of LIDAR data from the Fall of 2008, has made it easier for the City to accurately map the location of small waterways that would normally be hidden on aerial imagery. Most of the updates to the waterways were completed prior to the start of the last Fiscal Year. No edits were required or performed during the 2012/13 reporting year.

RC1 – PLANNING, TASK 4

Task Description	Measurable Goals	Tracking Measures
City staff will meet a minimum of once per year to discuss coordination of efforts relating to stormwater. Topics may include the following, as they are applicable: grant funding, outreach, program review, annual report, monitoring, sharing of data, adaptive management, review/update of documents and programs, training needs, documentation of protocols, coordination of databases, involvement of inspections, maintenance, and operations in plan review and program development, checklists, effective Erosion Prevention and Sediment Control Program including enforcement, strategizing addressing hotspots, plan review, stormwater BMPs, and development of written enforcement strategy. Provide factsheets/manuals to new employees at the City to inform them about the City's efforts for pollution prevention. At least annual trainings will be provided to specified City of Salem employees involved in MS4-related activities regarding the permit, including its intentions and their responsibilities in relation to the MS4. Feedback for improving processes will be encouraged and brought to the coordination meeting(s). Training needs will be determined by City staff meeting mentioned above. Consider adding stormwater pollution prevention training as an action item of the FY 2011-12 Environmental Action Plan that addresses pollution prevention on a city-wide level.	• Conduct annual formal coordination meetings for stormwater, more often if necessary. • Conduct annual training of employees involved in MS4-related positions, more often if necessary.	• Prepare an annual meeting summary. • Track changes made to the implementation of the stormwater program based on coordination discussions. • Track major items of coordination. • Track training attendance. • Share and document training suggestions for MS4 implementation changes.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

Staff from across the City convened at the beginning of this reporting period to participate in the Region 10 EPA inspection of the MS4 Program that occurred from July 31 through August 2, 2012. Staff members were present during this inspection to provide an overview presentation of MS4 related activities, answer questions from the EPA inspectors, and to retrieve any requested documentation. More than 30 City employees took part in this inspection.

On March 13, 2013, Stormwater Services staff presented information about the MS4 Permit and Stormwater Management program to staff from across the City that were selected to participate in

the City's Executive Leadership Academy. In addition, employees from across the City participated in meetings that were scheduled throughout this reporting year to continue the coordination needed for the completion of MS4 Permit deliverables and the measurable goals listed in the 2010 SWMP. These coordination meetings included but were not limited to the following MS4 related efforts:

- Hydromodification – reviewed Phase 1 Hydromodification assessment (Watershed Characterization) and identified needs for Phase 2 Scope of Work
- Erosion and Sediment Control - reviewed MS4 Permit requirements and initiated revisions to inspection procedures, plans review, project tracking/reporting, and contract language
- Salem Revised Code/Design Standards – staff continued to finalize revisions to SRC Ch. 71, Stormwater Design Standards, and associated Management Manual
- Outreach – staff met on a number of occasions to discuss website updates, options for *E. coli* and turbidity outreach, and coordination of the annual “Mid-Valley Erosion Control Summit”
- Integrated Pest Management - reviewed the existing IPM Plan and discussed desired updates
- Industrial/Commercial Facilities - finalized the internal process for facility identification/notification and submitted final strategy to the DEQ by the January 1, 2013, deadline
- Stormwater Facilities - defined updated process for inspections and maintenance of public and private facilities
- Water Quality Monitoring - developed updated procedures associated with Willamette River Sampling
- Adaptive Management Strategy - staff initiated discussions regarding options for the continued improvement of the individual BMP activities listed in our 2010 SWMP

A City of Salem Shops Complex Stormwater Pollution Control Plan (SWPCP) was completed in September of 2012 (see ILL1 Task 4). Following completion of this plan, a total of 244 employees received training pertaining to spill prevention and response, good housekeeping, and chemical storage. An "Employee Guide for Pollution Prevention" was developed during this reporting year and is now distributed to all new employees during employee orientation.

Public Works staff continued to participate in Oregon Association of Clean Water Agencies (ACWA) MS4 Phase I and Stormwater subcommittees this last year (see RC1 Task 8) and attended safety/training meetings every two weeks (see RC4 Task 4).

RC1 – PLANNING, TASK 5

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
Coordinate with other agencies such as NGOs, private environmental groups, and watershed councils.	• Develop a list of contacts and identify issues of coordination.	• Document any MOAs.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

Pringle Creek Watershed Council:

The City liaison facilitated a watershed council work party on Saturday 10/13 at Fairview Wetlands to rehabilitate a section of trail along 27th Court.

Claggett Creek Watershed Council:

During the reporting period, the City liaison attended watershed council meetings and provided information about possible projects at the Claggett Creek Wetlands. In addition, City staff provided input for the following projects: Weeding/thinning at Country Glen Park (Oct. 13, 2012); Planting/thinning at Claggett Creek Park (Nov. 10, 2012); Thinning at Ben Miller Park (Feb. 9, 2013); Plant count and reflagging at Claggett Creek Middle School (March 8, 2013); Tree planting at Country Glen Park (April 6, 2013); and the Earth Day project at Keizer Rapids Park (April 13, 2013).

Glenn-Gibson Creeks Watershed Council:

During the reporting year, City staff worked with the council to design an educational rain garden that will treat stormwater runoff from the public restroom at Wallace Marine Park. Funding for this project has come from the Urban Renewal Agency. The project includes a new roof for the restroom, construction and planting of the rain garden, three interpretive signs, a bench overlooking the rain garden and river, and a path leading to the bench. The effort has taken over a year to coordinate and is scheduled to be completed by October 2013. In continuation of previous work by the Council, City staff also helped to coordinate an “ivy pull” with the Boys and Girls Club at the Van Kleeck property during this reporting period.

Friends of the Straub Environmental Learning Center (FSEL):

Staff coordinated presentations of the Center’s “On the Grid” program regarding utilities (i.e., streets, drinking water, wastewater, and stormwater) and attended monthly Executive, Board, and Strategic Planning meetings. These meetings help guide the focus of the Environmental Learning Center’s programming.

Oregon Green Schools (OGS):

During this reporting period staff continued efforts to link OGS to state curriculum standards, Science Technology Engineering and Math (STEM) education, and to the City's Adopt-A-Stream program. The organization will likely need to pursue grant funding to facilitate this process.

Mid-Willamette Outreach Group (MWOG):

City staff continued to participate with this regional group on coordinated outreach activities (see RC 5 Task 2).

RC1 – PLANNING, TASK 6

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
The City will work with Marion and Polk Counties and the City of Keizer to coordinate stormwater management programs and activities within the greater Salem-Keizer Urban Growth Boundary. Coordination may include the establishment of appropriate intergovernmental agreements (IGAs) regarding potential uniform stormwater design standards, operations and maintenance activities, and public education and involvement efforts within the UGB.	• Review and update the October 2000 SKAPAC Stormwater Management Agreement by the end of the permit term to reflect each jurisdiction's respective MS4 Permit and SWMP.	• Report on significant coordination activities or programs. • Report on completion of SKAPAC Agreement and other IGAs.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

The City of Salem, Marion County, and the City of Keizer made a collective decision during the previous fiscal year to not make any changes to the existing SKAPAC agreement. They determined that the current language adequately addresses any concerns the jurisdictions may have. The group met in FY 2012/13, and will continue to meet at least twice a year unless there is a need to review public projects or private developments in the areas noted in the SKAPAC agreement.

Salem staff met with staff from Polk County in early February to discuss Phase I and Phase II MS4 Permit requirements, and attended Polk County's public "Stormwater Meeting" on February 28, 2013. Stormwater staff continued to work with Marion County, the Marion Soil and Water Conservation District, and the City of Keizer to coordinate multiple outreach events pertaining to turbidity and E. coli during this last fiscal year (see RC 5 Task 2).

RC1 – PLANNING, TASK 7

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
Evaluate existing detention facilities and potential new detention sites for potential conjunctive uses (as water quality facilities and for retrofitting opportunities). Continue to perform facility site searches to locate ponds, wetlands, vegetated swales and other water quality facilities as existing water quantity and quality facilities are evaluated and potential new sites are identified. Coordinate with RC1-1 and RC1-2.	• Complete a retrofit plan before end of year four of the MS4 permit cycle. • Develop a strategy to identify and prioritize potential retrofit projects by November 1, 2013. • Identify a minimum annual budget for stormwater retrofit projects as part of the retrofit strategy by November 1, 2014.	• Report on available budget and completion of retrofit project efforts.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

During this reporting period, the City of Salem retrofitted a surface detention basin (Saddle Club Road) into a subsurface gravel treatment wetland; which provides treatment as well as enhanced detention and infiltration. The subsurface gravel treatment wetland concept was adopted from wastewater treatment methods, and its efficacy in removing bacteria is very high. This project serves three functions in terms of developing a retrofit strategy: 1) It provides a better understanding of the City's capabilities in the internal design and construction of a retrofitted surface detention basin; 2) Monitoring data collected at this structural BMP facility will provide supporting data for bacteria removal, which may be used in the City's selection of a retrofit project that targets bacterial removal; and 3) The process used to identify this project helped to identify a preliminary list of City-owned detention facilities; which may serve as viable candidates for future retrofit projects. The City's strategy for identifying and prioritizing potential retrofit projects and developing a defined Retrofit Plan includes the continued pollutant monitoring of the Saddle Club subsurface gravel treatment wetland, the research and design of a stormwater improvement project that targets the reduction of bacteria, and the development of a GIS methodology to calculate the pollutant loading of catchment areas for potential stormwater retrofits.

The Preliminary Capital Improvement Plan dedicated \$80,000 in FY 2012/13 to the design and construction of a retrofit project that targets bacterial reduction. An additional \$100,000 is planned for project funding in FY 2013/2014. This project will be identified prior to the November 1, 2013, deadline identified in the MS4 Permit, and constructed during this permit term.

RC1 – PLANNING, TASK 8

Task Description	Measurable Goals	Tracking Measures
The City will continue to be an active member of the Oregon Association of Clean Water Agencies (ORACWA). The City will use this medium to obtain copies of materials that have been produced by others. City staff will stay current on latest available educational and technical guidance materials.	• Attend a minimum of one stormwater-related workshop or conference annually. Attend groundwater-related workshops and conferences as funds allow. • Make information obtained at these events available to other City staff.	• Report on City participation with ORACWA events.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

Public Works staff continued to participate in Oregon Association of Clean Water Agencies Stormwater and MS4 Phase I subcommittee meetings. During FY 2012/13, the City of Salem entered into a contractual agreement with members of ACWA's Stormwater subcommittee and a research consulting firm to pursue a Public Education Collaboration Project designed to meet MS4 Permit public outreach requirements (see RC 5 Task1). Additionally, City staff continued to participate in Stormwater subcommittee discussions and assisted in the completion of the Construction Site Stormwater Guide. Information acquired through ACWA meetings/activities is routinely passed on to other employees at regularly scheduled staff meetings and/or MS4 Permit coordination meetings.

Five staff members attended the ACWA Stormwater Summit on June 4. In addition, one staff member teamed up with staff from the City of Eugene to provide a presentation at the Summit titled "EPA Audit: Perspectives, Lessons Learned, and Program Improvements". Four staff members attended the ACWA Annual Conference that took place July 25 through July 27, 2012.

2.2 RC2 – Capital Improvements

RC2 – CAPITAL IMPROVEMENTS, TASK 1

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
Implement stormwater projects (including stormwater conveyance, quantity, quality, and stream/habitat improvement) based on priorities established under the Capital Improvement Program (CIP) and the Stormwater Master Plan consistent with available funding.	• Include a funding line item for CIPs in proposed stormwater budget. • Review and prioritize CIPs and budget annually. • Implement CIPs based on prioritization and available funding.	• Track number and description of projects completed. • Report updated CIP list annually.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

Stormwater treatment was incorporated into all new construction projects under the Streets and Bridges Bond and certain Urban Renewal Agency projects managed by Public Works Engineering. The City continued to work with ODOT in FY 2012/13 to install treatment facilities on the east and west ends of the Marion and Center Street Bridges. This project has been funded by an ODOT Retrofit Program Grant.

Stormwater quality and quantity facilities were incorporated into the design and construction of projects during FY 2012/13 as follows:

Parks and Transportation

- Aumsville Hwy. Widening and Signals - Stormwater quality and detention (construction 2013)
- Hawthorne Ave. Widening and Improvements - Stormwater quality and detention (construction in 2013)
- Commercial St. Bridge Replacement - Stormwater quality (construction in 2013)
- Eola Dr. Transportation Improvements - Stormwater quality and detention (construction in 2013)
- Marion/Center St. Bridges - Stormwater quality and detention (construction in 2013)
- Market/Swegle Transportation Improvements - Stormwater quality and detention (construction in 2013 & 2014)
- Glenn Creek/Wallace Rd Transportation Improvements - Stormwater quality (construction in 2014 & 2015)

Water Projects

- Mill Creek Reservoir - Stormwater quality and detention (construction in 2013 & 2014)

Wastewater Projects

- River Rd./Windsor Island Road at Willow Lake WPCF - Stormwater quality (construction in 2013)

RC2 – CAPITAL IMPROVEMENTS, TASK 2

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
Continue to coordinate capital improvement projects with the Water Resources Section to integrate multiple resource agency permitting needs. The review is intended to identify integrated opportunities and permitting needs to meet water quality-related requirements.	• Review and integrate multiple resource agency permitting needs, including MS4 permit requirements, into 100% of CIP projects.	• Track number of projects reviewed. • Track number of projects permitted.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

In FY 2012/13, Public Works Engineering staff reviewed and commented on 25 Capital improvement project plans. Opportunities to exceed the minimum requirements were identified and implemented.

RC2 – CAPITAL IMPROVEMENTS, TASK 3

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
The City continues to acquire physical access-easements for public and private stormwater facilities. This is done by identifying existing facilities for which easements, rights-of-way, or permit-of-entry agreements are needed for stormwater facilities; and developing a plan for acquiring the same, given current funding limitations.	• Within one year of completion of the hydromodification study and retrofit plan, prioritize easement acquisitions for stormwater facilities. • Following prioritization, identify funding source(s) for inclusion in budget.	• Report on easement acquisition and prioritization process.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

Easement acquisition and prioritization are anticipated to occur following completion of the retrofit strategy and hydromodification assessment that must be submitted to the DEQ by November 1, 2014. These efforts will help identify areas where easement acquisition should be prioritized.

During FY 2012/13, Public Works Engineering continued to work on revisions to the City's draft Stormwater Design Standards (see RC 3 Task 1). The draft standards discuss easement requirements for stormwater infrastructure. Currently, easements are acquired with new development for public stormwater infrastructure that is not located within the right-of-way.

2.3 RC3 – Update of Stormwater Management Design Standards

RC3 – STORMWATER MANAGEMENT DESIGN STANDARDS, TASK 1

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
Continue to encourage the use of structural BMPs for stormwater quality improvement and flood peak reduction opportunities. Develop stormwater quality design and associated maintenance standards for new and redevelopment. Continue to evaluate opportunities to provide incentives for alternative stormwater management practices, including Low Impact Development (LID). Maintain and update the Stormwater Management Design Standards after they are developed.	• Develop incentives for LID and other stormwater quantity and quality management practices. • Develop updated stormwater design standards to include structural stormwater quality BMPs. • Maintain Stormwater Management Design Standards and update as needed.	• Document revisions made to Stormwater Management Design Standards. • Document the development of any incentives for implementation of LID techniques.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

Incentives for Low Impact Development (LID) have been incorporated into Salem's Stormwater Utility in the form of credits that allow the impervious surface-based portion of the utility fee to be reduced based on the presence of stormwater quality and quantity facilities on the ratepayer's property. The Stormwater Utility was initially implemented in January 2013. Work on drafting new Stormwater Design Standards continued during FY 2012-13. Completing the standards is linked to development of new stormwater regulations, which are scheduled for adoption no later than January 2014. The draft standards will be consistent with the new regulations and will include design criteria for green stormwater infrastructure such as stormwater planters, rain gardens, vegetated filter strips, green roofs, and pervious pavement. The team developing the Stormwater Design Standards includes internal staff, consultant support, and a select group of local engineers involved in development in Salem. The new Stormwater Design Standards will be incorporated into the revised Public Works Design Standards and are scheduled to be adopted as Administrative Rules by January 2014.

RC3 – UPDATE OF STORMWATER MANAGEMENT DESIGN STANDARDS, TASK 2

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
Continue to implement process to identify and remove barriers for implementing LID techniques. Update the Stormwater Management Design Standards and associated Salem Revised Code (SRC) provisions as appropriate.	• Within three years of implementing the revised stormwater design standards, review and, as appropriate, modify design standards and SRC to minimize barriers to implementation of LID techniques.	• Document the review of design standards and SRC to minimize barriers to implementation of LID techniques.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

Barriers to implementing Low Impact Development techniques have been identified and recommended changes to the Salem Revised Code have been incorporated into a Staff Report that will go before Salem City Council before the end of 2013. Updates to the Stormwater Management Design Standards related to LID techniques are in progress (see RC3-1).

RC3 – UPDATE OF STORMWATER MANAGEMENT DESIGN STANDARDS, TASK 3

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
City staff is implementing the Water Quality Development Standards set forth by SRC Chapter 141 for all development requiring a Willamette Greenway Permit.	• Implement Water Quality Development Standards in Willamette Greenway.	• Track number of Willamette Greenway Permits issued and description of water quality measures employed. • Track number of new facilities constructed.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

Willamette Greenway permits are processed as either conditional uses or as administrative conditional uses, depending on their location. Greenway permits are tracked through AMANDA, the City's permit tracking system. No Greenway permit applications were received during this reporting period.

RC3 – UPDATE OF STORMWATER MANAGEMENT DESIGN STANDARDS, TASK 4

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
Continue to review all residential, commercial, and industrial plans submitted for City-issued building permits for compliance with the City's Stormwater Management Design Standards. Conduct inspections of completed projects prior to the City's acceptance of those projects and project close-out to ensure work was done in accordance with approved plans. Maintain database of plans reviewed and final inspections conducted. See IND1-Task 2 for standards specific to industrial facilities.	• Review all residential, commercial, and industrial plans submitted for City-issued permits for compliance with the City's Stormwater Management Design Standards and associated SRC provisions. • Conduct inspections once construction is completed to ensure work was done in accordance with approved plans.	• Maintain database of plans reviewed and final inspections conducted.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

All residential, commercial, and industrial plans submitted for City-issued permits are reviewed by Public Works staff for compliance with Stormwater Management Design Standards. Constructed stormwater facilities are inspected by Plumbing Inspectors within Community Development and/or Public Works to ensure that work was done in accordance with approved plans. All plan reviews and inspections are tracked in AMANDA, the City's permit tracking database.

2.4 RC4 – Operations & Maintenance

RC4 – OPERATIONS AND MAINTENANCE, TASK 1

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
Continue with the existing street sweeping schedule for all areas, maintaining the record of observations, quantity, and quality of material collected in the daily log books. Collect and compile this information for making recommendations for modified methods, schedules, and for NPDES MS4 permit annual reporting and overall program evaluation.	• Review street sweeping program annually for effectiveness and any necessary revisions to sweeping schedule. • Continue sweeping City streets on four zone schedule, sweeping heaviest zone 8 times per year and lightest zone 2-3 times per year. • Continue sweeping City-owned parking lots as needed.	• Record quantity of material collected during sweeping operations. • Record number of curb-miles of streets swept. • Track and report changes made to sweeping schedule, if any.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

The City continued to utilize two regenerative air sweepers during this reporting year to sweep residential and collector streets that have been categorized as having *High*, *Medium*, or *Light* debris accumulation as well as those within the Central Business District zone. A third machine is operated during peak leaf season or when one of the other machines is unavailable. Two operators sweep residential and collector streets during the day and two operators sweep arterial streets at night. City-owned parking lots are swept on an as-needed basis. The City does not sweep any commercial parking lots. During this reporting year the City swept a total of 16,112 miles, collected approximately 1,500 tons of street sweeping debris, and removed approximately 4500 cubic yards of leaves.

RC4 – OPERATIONS AND MAINTENANCE, TASK 2

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
The City will continue to perform de-icing operations in a way that minimizes stormwater pollution through: conducting annual inspections and training to ensure proper operation of the de-icing chemical storage facility; training and verification that application equipment is applying deicer at 1/2 to 1/3 the industry standard; construction of an expanded covered storage area for de-icing aggregate materials combined with FEMA floodgates to mitigate migration of aggregates (2011) ; maintaining proper function of adjacent sediment traps and catch basins in the storage yard; sweeping removal of operational de-icing aggregate spillage; and coordinating de-icing activities with Airport Operations and their 1200-Z permit.	• Continue current de-icing operations to prevent stormwater pollution.	• Document dates of activities for annual inspections and training. • Document de-icing quantities applied annually.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

Recycling opportunities for used deicing sand material have not been identified. Deicing aggregate materials cannot be reused as sanding material for reasons that include: the loss of angular surfaces that provide snow and ice traction, the accumulation of additional street debris, and the presence of street surface contaminants (heavy metals, petro chemicals, trash, etc.). Used aggregate can only be utilized as fill material in approved fill sites, depending on the levels of intermingled debris and/or contaminants.

Deicing material use is documented on time sheets and in the liquid deicing storage facility log book. City staff also document the number of lane miles that are treated annually. During FY 2012/13, the City treated 569 lane miles with liquid deicer. This equates to approximately 4,552 gallons of applied deicer.

Annual Snow & Ice Response training takes place in November each year and covers the setup of a heavy dump truck with plow and sander, tire chaining and chain repair, operation of the sand storage facility, filling and emptying of liquid deicer tanks, deicer storage containment pond drainage protocols, and full operation of our liquid deicer storage facility; including the use of redundant backup pump systems should power fail. A list of training dates and the staff who attend is kept on file.

The liquid deicer storage facility is inspected monthly during the off season and weekly during Snow and Ice season which runs from November 1st through March 30th. A Public Works Project Leader is assigned this task; which includes controlled drainage of accumulated liquid within the containment pond for the storage tanks and plumbing. With the assistance of Environmental Services and Wastewater Treatment staff, clear rainwater is released to the storm drain and contaminated water is released to the sanitary sewer. The drainage controls for this facility are locked and can only be accessed by authorized staff.

RC4 – OPERATIONS AND MAINTENANCE, TASK 3

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
Continue to review and update the O&M practices and activity schedules defined in the Drainage Program Evaluation Notebook (DPEN) (including updating GIS database). Utilize Hansen IMS data to develop and refine work programs. This review will serve as a basis for budgeting and allocating resources; scheduling work; and reporting on and evaluating the performance and costs for the overall O&M program and specific activities.	• Update DPEN and IMS database activities and schedules. • Create line items in budget for specific O&M activities. • Review and update O&M practices and activity schedules every 3 years.	• Track revisions made to O&M practices and activity schedules.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

During the FY 2012/13 reporting period, stormwater quality facilities were inspected by Operations and Maintenance staff and the associated asset/inspection information was entered into the Hansen Database. Having all of this information in Hansen enables City staff to track the frequency of maintenance activities and identify maintenance costs for future budgeting. Staff continue to update the Maintenance Management Plan annually for budgeting purposes.

RC4 – OPERATIONS AND MAINTENANCE, TASK 4

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
Continue to improve the O&M training program and activities especially with regards to safety and protection of water quality.	• Conduct O&M safety meetings twice per month. • Attend ACWA committee meetings and workshops as scheduled. • Conduct weekly tailgate meetings with Operations crews.	• Document reviews and modifications to the O&M training program. • Record O&M training activities completed. • Document ACWA meetings and workshops attended.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

City staff continued to conduct safety meetings on a biweekly basis during this reporting period. The following topics were covered during this reporting period: MS4 spill prevention, Confined Space, Chemical/Gas Safety, Natural Gas, Hand Tool Safety, Environmental Hazards, Power Tools, Gas Detectors, Blood Borne Pathogens, Alcohol/Drug Awareness, Erosion Control, Haz-Mat Refresher, Excavations, Lifting/Back Safety, Heat Stress, Housekeeping (slips, trips, falls), Heavy Equipment, Self Defense, Personal Protection Equipment, Chainsaw Safety, Fire/Electrical Safety, Bypass Pumping, Lockout/Tagout, Asbestos, and Vehicle Operation.

In addition, Public Works staff continued to participate in ACWA Phase I and Stormwater Committee meetings during the 2012/13 fiscal year (see RC1 Task 8).

RC4 – OPERATIONS AND MAINTENANCE, TASK 5

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
Integrated Pest Management (IPM) Program: Salem Parks Operations Division will continue their program for careful monitoring and management of pesticides, herbicides and fertilizers, and will provide public information. Review and refine the IPM Program during the permit cycle, ensuring proper handling and storage of pesticides, herbicides, and fertilizers.	• Review and refine IPM Program during the MS4 permit cycle. • Routine inspections of storage facilities for proper storage of materials and chemicals.	• Document revisions made to IPM Program. • Document inspections of storage facilities.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

The Wetlands/Stormwater crew had a cooperative work experience intern conduct invasive species weed mapping at the Fairview mitigation wetlands in February and March of 2013. These maps of weed population density were used to plan appropriate summer herbicide applications. This helped City staff ensure that applications were consistent with the City's IPM program and that the least amount of herbicide required for existing weed populations was used.

Routine inspections of the pesticide storage facilities and application equipment were conducted quarterly during this reporting period. There were no revisions to the IPM Program in FY 2012/13.

RC4 – OPERATIONS AND MAINTENANCE, TASK 6

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
Continue the storm sewer cleaning and TV inspection program, concentrating on known areas of localized flooding complaints (this alerts the City to locations of debris build-up and minimizes erosion potential) and persistent operation and maintenance problems, and looking for potential illicit discharges and seepage from sanitary sewers, see ILL2. Also focus on significant industrial/commercial areas where potential illicit discharges may be of concern.	• Concentrate storm sewer cleaning and TV inspection on areas with historical problems and high potential for illicit discharges. • Inspect 120,000 LF of conveyance system annually.	• Track number of inspections; identify areas with persistent O&M problems. • Track number of cross-connections found. • Track length of conveyance system cleaned and inspected.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

During FY 2012/13, the TV/Flow Monitoring Section completed 1,060 TV inspections. This resulted in 163,455 linear feet of storm line inspected and 17,538 linear feet cleaned. Two residential cross-connections were found and corrected during this reporting period.

RC4 – OPERATIONS AND MAINTENANCE, TASK 7

Task Description	Measureable Goals	Tracking Measures
Continue supporting annual Stream Cleaning Program. More than one half of the stream miles in the City of Salem are inspected annually by walking each stream segment. Using summer interns the City inspects the riparian areas and streams, picks up litter and garbage, inspects for illicit discharges (ILL2), addresses potential conveyance concerns, and evaluates areas for stream restoration.	• Walk 50% of the waterways within the City each year for stream cleanup and enhancement. • Complete one stream restoration project each year.	• Track length of waterways walked each year. • Document stream restoration projects completed each year. • Document the amount of litter and garbage removed each year.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

The 2012 Stream Crew (beginning of reporting period) walked nearly 51 miles of Salem waterways, removing trash, debris jams, recyclable materials, and invasive vegetation. The crew removed 19,792 pounds of trash, 4,605 pounds of recyclable material, and 269 cubic yards of natural debris. Every year since 2000, the Stream Crew has completed one riparian restoration project. These projects are designed to provide bank stabilization, shade, wildlife habitat, and increase native plant diversity. This year the crew worked very closely with a property owner along Pringle Creek. The crew removed invasive vegetation, installed approximately 200 feet of coir logs and straw wattles for erosion prevention, and planted more than 170 native shrubs, trees, and grasses.

The 2013 Stream Crew (end of reporting period) consisted of 8 crewmembers and an environmental aide. The crew walked over 47 miles of streams within the City and removed 11,845 pounds of trash. They also removed approximately 63.25 cubic yards of natural debris (logs and invasive species) and sorted out 3,055 pounds of recyclable materials. The 2013 crew also completed a riparian restoration project along Mill Creek; in the vicinity of State Street and 21st Street. This project incorporated the removal of invasive vegetation followed by the planting of 317 native trees, shrubs, rushes, and sedges.

RC4 – OPERATIONS AND MAINTENANCE, TASK 8

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
Continue to regularly inspect and maintain public structural stormwater control facilities. Coordinate with RC4 Task 9.	• Regularly inspect all public detention and water quality facilities.	• Track number of public facilities inspected and maintained. • Track amount of sediment and debris removed from all facilities.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

During this reporting period, 99 public water quality facilities were inspected, and 109.8 cubic yards of sediment/debris was removed. In addition, 124 public detention basins were inspected. During the inspections this year staff collected GPS data points for all of the detention control structures. This will allow future inspection crews to locate these structures quickly for increased and consistent efficiency.

RC4 – OPERATIONS AND MAINTENANCE, TASK 9

Task Description	Measureable Goals	Tracking Measures
Develop and implement a long-term maintenance strategy for public and private stormwater control facilities. This strategy will identify procedures and/or priorities for inventorying, mapping, inspecting, and maintaining facilities.	• Document and implement a long-term maintenance strategy for public and private stormwater control facilities during the MS4 permit cycle.	• Track number of private facilities located, mapped, and inspected. • Track progress toward developing a facility long-term maintenance strategy.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

During this reporting period, 14 private water quality facilities and 35 private detention basins were added to the GIS storm grid maps. There were a total of 8 private water quality facility inspections and 771 private detention basin inspections completed by staff.

During the past fiscal year, progress was made toward developing a comprehensive program to inventory, map, inspect, and maintain both public and private stormwater control facilities. The City's *Stormwater Facility Inventory, Inspection, and Maintenance Program* was submitted to the DEQ on December 21, 2012. This document details the City's process of mapping public and private stormwater facilities in GIS, as well as the asset tracking methodology used in the Hansen database. Since implementation, the City has inventoried, mapped, inspected, and maintained all of its public vegetative (e.g. bioswales) and mechanical (e.g. water quality treatment manholes) treatment facilities through a quarterly inspection process. In June 2013, a seasonal employee was hired to commence the inventory of stormwater treatment facilities on private property. In FY 2013/14, staff will continue with the City's quarterly inspection and maintenance program of its public stormwater treatment facilities. In addition, staff anticipates that all private stormwater treatment facilities will have been inventoried in Hansen and mapped in GIS before the end of the fiscal year. Also planned for FY 2013/14 is an outreach effort to communicate to private facility owners their responsibility for maintaining and inspecting their stormwater facilities.

RC4 – OPERATIONS AND MAINTENANCE, TASK 10

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
Ditch maintenance is performed to assure adequate conveyance, and consists of two components: (1) Ditch Cleaning – Cleaning consists of removal of sediment in the bottom of roadside ditches only as needed for proper conveyance, with limited vegetation disturbance and the use of straw wattles to reduce sedimentation and erosion within the ditch. (2) Ditch Mowing – Mowing is typically conducted by inmate crews using hand-held equipment. Vegetation cutting facilitates conveyance and reduces the risk of potential fires in summer months.	• Regularly inspect and maintain 100% of City ditches using appropriate water quality BMPs.	• Track length of ditch maintenance performed (cleaning and mowing). • Track amount of sediment and debris removed.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

Stormwater crews cleaned and/or mowed all 37 miles of drainage ditches in the city and removed 576 cubic yards of debris/sediment during this reporting period with the assistance of inmate labor.

RC4 – OPERATIONS AND MAINTENANCE, TASK 11

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
Public catch basins are cleaned on a regular basis with a Vactor truck. During catch basin cleaning activities, inspections are done and repairs are scheduled if needed.	• Clean and inspect 75% of catch basins annually. • Periodically analyze the material removed from the catch basins.	• Track the number and percent of catch basins cleaned annually. • Report on any analysis of removed material.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

During FY 2012-13, crews cleaned and inspected 11,307 (75%) of the 15,072 public catch basins in the city. Through this process, a total of 168.2 cubic yards of sediment/debris was removed and 144 catch basin repairs were completed. As resources allow, staff anticipate utilizing GIS to map debris accumulations so that a prioritization scheme may be developed for future inspections and cleanings.

RC4 – OPERATIONS AND MAINTENANCE, TASK 12

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
Continue to refine the maintenance program for public and private stormwater detention and water quality facilities. The City maintains an informational packet outlining ownership and maintenance responsibilities and compliance assurance procedures to encourage owners of private detention and water quality systems to perform maintenance. Coordinate with RC 4 Task 9.	• Maintain informational package for ownership maintenance responsibilities for detention and water quality facilities. • Implement maintenance activities and requirements identified in long-term maintenance strategy (RC4 Task 9).	• Track number of information packets distributed regarding private stormwater control facilities. • Track maintenance requirements of long-term maintenance strategy.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

During FY 2012/13, City crews inspected and collected GPS data for all of the public and private detention basins in the city (see RC 4 Task 9). Information packets are handed out to private facility owners when they are requested during inspections. It is anticipated that information packets will be mailed out to all property owners again during the next fiscal year.

In December of 2012, the City submitted the *Stormwater Facility Inventory, Inspection, and Maintenance Program* to the DEQ. This document defines the process used to identify and track the long-term maintenance of public and private stormwater facilities (see RC4 Task 9). Outreach activities associated with this plan are anticipated for FY 2013/14.

2.5 RC5 – Public Education & Participation

RC5 – PUBLIC EDUCATION AND PARTICIPATION, TASK 1

Task Description	Measureable Goals	Tracking Measures
Develop and implement a public outreach and education strategy with goals, objectives, identified target audiences, partners, identified target contaminants, and messaging. Conduct a public education program effectiveness evaluation of outreach procedures/efforts. Adjust the program based on the results in year five. (See Table A.1 – Public Outreach Program Matrix, June 2008).	• Create two (2) public education campaigns* from the Public Outreach Program Matrix. • Support outreach and educational activities for other divisions**. • Conduct an effectiveness evaluation of the outreach program before the end of year four of the MS4 permit cycle.	• Document public outreach and involvement activities for two (2) education campaigns. • Document outreach activities for other divisions. • Document the results of the effectiveness evaluation and subsequent changes to the outreach procedures/efforts.
*A public education campaign focuses outreach efforts on a target contaminant. The Public Outreach Matrix (Table A.1) contains the outline for educational campaigns by target contaminant. The matrix is a complete list of prioritized outreach activities, tools, partners, key audiences, and measurable goals for Salem’s stormwater management program. The City will develop robust educational campaigns for the top priority contaminants – focusing limited resources on the most critical contaminants first. Top priority contaminants were selected based on the review of monitoring data. **Many of the City’s BMPs, in addition to RC5, contain outreach tasks. To ensure that all required outreach is being completed, outreach tasks from BMPs other than RC5 are included in the Public Outreach Matrix. RC4 – Inventory Private Stormwater Facilities is an example of a BMP that has an outreach task: Annual letters will be mailed to detention basin/water quality facility owners. That task is shown on the matrix and will be completed and documented each year.		

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 that demonstrate that Measurable Goals were attained or that progress was made.

The following efforts associated with the two selected outreach campaigns (related to *E.coli* bacteria and turbidity) were completed or initiated during FY 2012/13:

- Staff began sending a quarterly “Know the Scoop” mailer to approximately 620 people in targeted areas for the *E. coli* pilot study.
- In the summer of 2014, staff will determine the effectiveness of this outreach approach.
- Staff continued to provide radio advertisements messaging issues with *E. coli*.
- A “Capital Canine Club” website (www.cityofsalem.net/canineclub) went live this year. So far we have over 30 members. The “Capital Canine Club” is a joint effort of MWOG; hosted by the City of Salem, Marion County, and the City of Keizer.

- MWOOG hosted the first “Howl-a-Palooza” event during this reporting period to promote stormwater education to pet owners and to provide dog-related community resources.
- Staff placed six posts on the “Clean Streams Clear Choices” Facebook page regarding events, the canine club, waste reduction projects/news, the call for “Howl-a-Palooza” vendors, and additional links to articles about the “Howl-a-Palooza” event.
- “Howl-a-palooza” posters and flyers were handed out at Marion County Dog Services events.
- 96 “Mutt Mitt” dispensers that have been placed in 47 different parks were maintained by City staff.
- Staff finalized the design of the turbidity study during FY 2011/2012. However, a determination was made during this reporting year that this outreach campaign will be modified during FY 2013/14, and will not be included in the MS4 Permit required Effectiveness Evaluation.
- The City decided to participate in the joint effectiveness evaluation process led by ACWA. However, the City will still perform internal evaluations of *E. coli* outreach activities and will also make a determination on whether to also include an evaluation of the recently developed “Clean Streams Clear Choices” program.

Additional outreach activity information can be found in Appendix B of this report.

RC5 – PUBLIC EDUCATION AND PARTICIPATION, TASK 2

Task Description	Measureable Goals	Tracking Measures
Coordinate activities of various groups within the Public Works Department and other City departments assigned responsibility for public outreach and citizen contacts on stormwater matters.	Quarterly meetings of various groups assigned responsibility for public outreach and citizen contacts on stormwater matters.	Document quarterly meetings and outcomes.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

Mid-Willamette Valley Outreach Group (MWOOG):

During FY 2012/13, the City continued to participate in regional coordination of stormwater education through the Mid-Willamette Valley Stormwater Outreach Group that includes the City of Keizer, Marion County, and the Marion Soil and Water Conservation District. The primary goal of the group during this reporting period was to coordinate the “2nd Annual Erosion Control Summit” that took place on January 15, 2013. In addition, the group worked together to host “Howl-a-Palooza”; an educational event for pet owners that provides community resources and stormwater education. The group met three separate times in August of 2012 to plan for the October 6, 2013, event. This group generally meets once a month to discuss event planning and coordination of stormwater matters.

Free Tree Program:

City staff met several times during this reporting year to discuss options for modifying the City’s Free Tree Program based on riparian shade inventory data that was compiled for the City in 2009 (*City of Salem Shade Modeling and Riparian Inventory Report*). Since 2003, all streamside property owners in city limits were provided the opportunity to receive native trees/shrubs for streamside planting regardless of existing riparian shade. Staff are now using riparian shade data to strategically target areas along the streams that have less than 75% shade. Staff met several times during FY 2012/13 to develop a new contract for the updated program, to perform site assessments for potential project sites, to discuss possible grant opportunities, generate a sole source memorandum, and develop a pilot project with parks staff and Friends of Trees.

Citywide Communications Network:

In March of 2013, the City developed an informal Citywide Strategic Communications Group consisting of staff involved in public relations, which meets on a quarterly basis. This group is not specifically dedicated to stormwater matters, but works to provide consistency between citywide publications and avenues of outreach.

RC5 – PUBLIC EDUCATION AND PARTICIPATION, TASK 3

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
Increase the use of community partnerships to carry out outreach goals.	• Develop one new partnership per year to carry out outreach goals.	• Document partnerships and outcomes of partnership activities.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

A partnership with Marion County Dog Services was solidified in FY 2012/13, and they assisted with the coordination of “Howl-a-Palooza” in 2012. This event provided community resources for dog owners and participating vendors shared the “pick up pet waste” message at their booths. Two booths/stations were dedicated specifically to stormwater outreach; the “Poop - Scoop - Boogie” station and the “Capital Canine Club” station. The “Capital Canine Club” is an MWOG sponsored club that features dogs whose owners have taken a pledge to pick up after their pets. Marion County Dog Services will continue to be an event sponsor and has joined the planning committee for the next event that is scheduled in FY 2013/14.

Cultivation with four businesses to address *E. coli* issues and promote the Clean Streams Campaign was initiated in FY 2012/13. We will be looking to solidify these new partnerships in FY 2013/14.

RC5 – PUBLIC EDUCATION AND PARTICIPATION, TASK 4

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
Investigate the use of a stormwater utility to provide an adequate funding base to support expanded public outreach (see RC6-2).	• Develop a yearly public education budget. • Document public education and outreach needs in the Stormwater Utility Implementation Plan.	• Document public education budget and expenditures. • Document Utility implementation plan showing public education and outreach needs.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

Initial implementation of the stormwater utility began during this reporting year in January 2013 (see RC 6 Task 2). This utility will be phased in over a period of four years. During this time, stormwater outreach will continue to receive partial funding from wastewater rates. Outreach needs have been documented in a five year MS4 Education and Outreach Plan. During this reporting period, staff requested an additional seasonal outreach position and requested that \$38,630 be available in the FY 2013/14 budget to support stormwater outreach activities. A breakdown of the request is as follows:

Supplies: \$2790
 Advertisement: \$9860
 Training: \$750
 Other Professional Services: \$21,780
 Membership: \$250
Copy: \$3200
Total Requested: \$38,630

Supplies: \$1490
 Advertisement: \$9860
 Training: \$0
 Other Professional Services \$21,780
 Membership: \$0
Copy: \$3200
Total Approved (FY 2013/14 Budget): \$36,330

RC6 – Stormwater Program Management Financing

RC6 – STORMWATER MANAGEMENT PROGRAM FINANCING, TASK 1

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
In conjunction with the updated Stormwater Master Plan (RC1-1), review and update the Stormwater System Development Charge (SDC) methodology to address both stormwater quantity and quality.	• Adopt updated Stormwater SDC methodology by the end of the MS4 permit cycle.	• Report on update to Stormwater SDC methodology.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

It is anticipated that a review and update of the Stormwater System Development Charge (SDC) will be conducted in concert with the update to the Stormwater Master Plan. (see RC1 Task 1.)

RC6 – STORMWATER MANAGEMENT PROGRAM FINANCING, TASK 2

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
Implement a new stormwater utility capable of generating stormwater fees historically paid for by water and/or sewer utility customers. The new utility will include incentives to encourage users to implement alternative stormwater management practices such as LID.	• Adopt new stormwater utility by the end of the MS4 permit cycle.	• Report on adoption of new stormwater utility.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

The new Stormwater Utility was successfully implemented in January 2013. The fee structure includes credits that provide for reductions in the impervious surface-based portion of the utility fee for ratepayers who have stormwater treatment and/or flow control facilities on their property. Generally, the credit is higher for facilities that are categorized as green stormwater infrastructure than for more traditional stormwater facilities.

RC6 – STORMWATER MANAGEMENT PROGRAM FINANCING, TASK 3

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
Identify and pursue grant opportunities for stormwater quality projects, including potential retrofit and LID project opportunities.	• Pursue grant opportunities as staff resources allow.	• Track number of grants applied for each year. • Track number of grants received each year.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

During FY 2012/13, staff continued to research options for grant opportunities associated with stormwater retrofit projects that will target bacteria removal. There may be an opportunity to receive matching grant funds to complete a retrofit project if the project is included in the scope of work for park improvements. One option for a potential retrofit project in Eola Ridge Park is currently being reviewed.

Construction continued this fiscal year on the retrofit project that will provide treatment to stormwater runoff from the Marion and Center Street Bridges. This project was initiated in FY 2010/11 after staff pursued and received grant funding from ODOT.

2.6 RC7 – Maintain & Update GIS System

RC7 – MAINTAIN AND UPDATE GIS SYSTEM, TASK 1

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
Continue maintenance of the GIS database and Hansen IMS database. These on-going updates will also reflect completion of any stormwater Master Plan capital improvement projects, new facilities added to the system, potential “hot-spots” for illicit discharges, refinement of data for the existing system, updated information on wetlands, perennial streams, waterways, and floodplain/floodway designations, and information updated on a periodic basis for the City’s Urban Growth Boundary. The GIS database will be accessible by City departments for review purposes.	• Continue performing database updates annually. • Create record of GIS maintenance activities.	• Record maintenance / updates made to database.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

The GIS Section continued to perform routine maintenance of the GIS database and stormwater assets and inserted 4,525 linear feet of new Storm Sewer Mains during the 2012/13 fiscal year. This was all new installation from permitted development projects.

RC7 – MAINTAIN AND UPDATE GIS SYSTEM, TASK 2

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
Integrate the information in the GIS and IMS. The City plans to integrate the data from both the GIS and Hansen IMS databases so that information in the Hansen IMS database can be visualized using the GIS system.	• Create an action plan for how the GIS and IMS system will be integrated and updated. • Implement action plan to integrate GIS and IMS.	• Track completion of action plan items. • Track implementation status of database integration.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

GIS and Hansen staff began cleaning up data errors and inconsistencies in their respective databases during this reporting year in anticipation of the GIS/Hansen IMS integration that is expected to occur within the next few years. It will be necessary for staff to continue these cleanup duties in the next fiscal year, during, and after the physical integration of the two IMS databases.

2.7 RC8 – City Stormwater Grant Program

RC8 – CITY STORMWATER GRANT PROGRAM, TASK 1

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
Expand matching grant program for watershed protection and preservation to allow for funding of stormwater-related activities, such as promoting water-wise landscaping, reduction of stormwater discharges, restoring riparian areas, stormwater quantity reduction, stormwater quality/treatment, etc.	• Continue to fund \$50,000 grant program. • Expand matching grant program for watershed protection. • Promote the grant program in conjunction with RC5 outreach activities.	• Maintain a list of grant awards tracking funding and projects.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

During FY 2012/13, \$50,000 was available in the Watershed Protection and Preservation Grant program to fund watershed related projects. This grant can be awarded for projects that include stormwater-related activities, such as the following:

- Streamside riparian restoration; including bioengineering and tree planting for erosion control
- Removal or replacement (with native vegetation) of noxious vegetation in riparian areas
- Environmental education programs
- Preservation and or enhancement of wetlands
- Restoration and/or preservation of native vegetation and upland green space
- Design/construction/improvement of stormwater facilities that serve more than one residence

Three grant applications were received and awarded during FY 2012/13, for a total of \$18,495.00. These three grants were for:

1. Environmental Education (\$4,475.00)
2. Fish Habitat Enhancement (\$6,520.00), and
3. Project Implementation in the North Santiam River Watershed (\$7,500.00).

The grant was promoted once on Facebook, was promoted to Adopt-A-Stream teachers, and to community organizations (Straub Environmental Learning Center (\$4,475.00), local schools, Neighborhood Associations, and property owners in Salem during this reporting year. We also routinely provide information to teachers regarding available grants from the Pacific Northwest Clean Water Association and the Environmental Protection Agency.

2.8 RC9 – Legal/Ordinances

RC9 – LEGAL/ORDINANCES, TASK 1

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
In process of revising the Stormwater Management Design Standards (RC 3 Task 1) and developing a stormwater-dedicated chapter to the SRC (RC 9 Task 3), coordinate with Community Development's effort to adopt a Unified Development Code (UDC). It is envisioned that the stormwater dedicated SRC would be integrated into the UDC framework.	• Adopt the UDC and integrate stormwater-related revisions to the SRC by the end of the MS4 permit cycle.	• Report on progress for adoption of UDC and integration of stormwater-related SRC.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

City staff continued to incorporate selected chapters of the Salem Revised Code (SRC) into a single, Unified Development Code (UDC). Led by the Community Development Department, this effort involves grouping related sections and subsections of existing chapters of the SRC into a more cohesive UDC format.

The following new chapters were adopted in FY 2012/13:

- SRC Chapter 220 - Site Plan Review
- SRC Chapter 225 - Design Review
- SRC Chapter 240 - Conditional Use
- SRC Chapter 245 - Variances
- SRC Chapter 250 - Adjustments
- SRC Chapter 255 - Street Naming, Addressing, and Vacation of Public Property
- SRC Chapter 265 - Zone Changes
- SRC Chapter 270 - Non-Conforming Situations

RC9 – LEGAL/ORDINANCES, TASK 2

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
Continue to enforce the SRC and review and revise it as necessary to reflect the updated Stormwater Management Design Standards that principally focus on requirements associated with on-site water quality facilities for new development or redevelopment (RC3).	• Revise SRC (as needed).	• Track any MS4 stormwater pertinent revisions made to the SRC.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

Salem Revised Code (SRC) Chapter 20J (Administrative Rule Making and Contested Case Procedures) contains provisions for enforcement proceedings and civil penalties.

New subsections in SRC Chapter 70 (Utilities General) were adopted by City Council in December 2012 that clarify inspection procedures for enforcing the Utility Code and establishes operation and maintenance requirements for owners/operators of private stormwater facilities.

RC9 – LEGAL/ORDINANCES, TASK 3

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
Develop a new SRC chapter dedicated solely to stormwater management. It is currently envisioned that this will be done after the City's renewed MS4 Permit is issued, and in conjunction with implementation of the new stormwater utility and updated Stormwater SDC Methodology (RC6) and the updated Stormwater Master Plan (RC1).	• Adopt the new SRC chapter for stormwater by the end of the MS4 permit cycle.	• Report on adoption of the new SRC chapter for stormwater, and processes/milestones enroute to formal adoption of the SRC revisions.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

A new chapter of the Salem Revised Code (SRC) specific to stormwater was drafted during this reporting period and has now entered the adoption process. First reading of the ordinance took place at the August 26, 2013, City Council meeting and the code has been referred to the Planning Commission for review and public hearing. The public hearing is scheduled for October 1, 2013, after which Planning Commission will return the ordinance to Council, which is expected to take action in November 2013. Work on the Stormwater Code is linked to revisions currently underway on the City's Public Works Design Standards, which are now approaching final draft form.

2.9 ILL1 – Spill Prevention and Response Program

ILL1 – SPILL PREVENTION & RESPONSE PROGRAM, TASK 1

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
Continue to review and refine the existing spill prevention and emergency response program to protect ground and surface water quality. New activities will be proposed and implemented as appropriate, and coordination and cooperation among other relevant agencies and ODOT will be maintained and improved. This review will be coordinated with the de-icing activities of the Airport Operations and their 1200-Z permit, and possibly the Oregon Air National Guard.	• Continue to implement the spill prevention and emergency response program and review and revise as needed.	• Document refinements to cleanup procedures for vehicular accidents and structural fires.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

Salem Fire continued to respond to emergencies related to vehicular crashes, structural fires, and hazardous materials incidents utilizing *Salem Fire Standard Operation Guideline #4.16 – Minor Spill Response*. This Guideline provides guidance on Best Management Practices (BMP) for preventing discharge into storm drains. Salem Fire will continue to respond to any spill or leak of de-icing material at the Salem Airport. Procedures designed to eliminate runoff and/or the discharge of materials from firefighting training exercises into storm drain systems are included in *Salem Fire Standard Operating Guideline #2.6.3 – Live Fire Training*.

ILL1 – SPILL PREVENTION & RESPONSE PROGRAM, TASK 2

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
Continue to coordinate timely responses to, and clean-up of emergency response sites and structural fires among Fire, Building and Safety, Development Services, and Environmental Services staff. The Fire Department has the lead role for response at emergency response and structural fire sites and all major vehicular accidents. Environmental Services (ES) staff will provide assistance when requested by the on-scene incident commander. One of the ES responsibilities is to make sure that the cleanup activities are conducted in an environmentally sensitive manner.	• Develop a review schedule with a checklist for the spill response plan.	• Track the number and category of spill events responded to, including an estimate of the amount of spilled materials collected and any associated enforcement actions.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

Salem Fire continued to respond hazardous/chemical spills as requested by our emergency dispatch center in FY 2012/13. If spills and/or leaks exceed the amount of equipment carried on Fire response vehicles then the Fire Department Incident Commander will request assistance from Environmental Services. Fire staff responded to 20 chemical leaks/spills, 863 vehicle accidents, and 129 fuel/oil spills during this reporting period. Additionally, Environmental Services staff responded to 522 spill responses and 132 water quality issues in FY 2012/13.

ILL1 – SPILL PREVENTION & RESPONSE PROGRAM, TASK 3

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
Continue to conduct daily City vehicle and equipment inspections for leaks and repairs as needed. Staff will review current procedures on an ongoing basis and implement improvements as necessary.	• Continue to implement the daily equipment inspection program.	• Report revisions to the daily inspection program

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

Staff continued to stress the importance of completing daily vehicle inspections at monthly safety committee meetings. There are no revisions to this program needed at this time.

ILL1 – SPILL PREVENTION & RESPONSE PROGRAM, TASK 4

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
Develop an updated Operations Pollution Prevention Plan; incorporating new/expanded/relocated Operations-oriented facilities.	• Update the Operations Pollution Prevention Plan by the end of the MS4 permit cycle. • Implement the updated Operations Prevention Plan upon completion.	• Track progress toward updating the Operations Pollution Prevention Plan. • Track implementation of the Operations Pollution Prevention Plan.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

In 2012, work started on the development of the Shops Complex Stormwater Pollution Control Plan (SWPCP). The Shops Complex is made up of City of Salem user groups from Public Works, Administrative Services, Facilities Services, and Willamette Valley Communications Center Support Services. The SWPCP was completed in September of 2012.

There is approximately 760,000 square feet of impervious surface area at the Shops Complex and numerous sources for potential stormwater pollution. Preparation of a SWPCP allows these sources to be better managed for pollution prevention. This plan serves as a resource for potential spill locations at the Shops Complex, identifies drainage patterns, identifies the existing storm drainage system, and refines training requirements associated with pollution prevention. The SWPCP also contains site description overviews for the East and West Yard areas, maintenance activities, chemical storage areas, emergency spill control measures at the Fueling Station, outfall locations, spill prevention and response measures, preventative maintenance, building inspections, and good housekeeping practices.

In 2012, a training program was developed for the Shops user groups employees. Training is focused on spill prevention and the BMPs for good housekeeping, spill prevention and response, and chemical storage. A clipboard for user group buildings with maps was provided to supervisors during the training sessions. A total of 244 employees went through the training program in FY 2012/13.

As a result of the SWPCP, a new central recycling area has been established in the East Yard area of the Shops Complex. Recyclable materials now include metals, mixed recycling, glass, and PVC pipe products. On August 1, 2013, the Shops Complex was awarded an EarthWISE Certification.

2.10 ILL2 – Illicit Discharge Elimination System Program

ILL2 – ILLICIT DISCHARGE ELIMINATION PROGRAM, TASK 1

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
Continue to respond to reports of unusual discharges or suspicious water quality conditions within the stormwater system and urban streams. Where able, identify sources/causes and implement appropriate corrective actions. Utilize database to document associated activities.	• Respond to reports of illicit discharges and suspicious water quality conditions. • Maintain database to document unusual/suspicious discharges, sources found, and corrective actions taken.	• Track calls and mitigation actions taken in database.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

Environmental Services continues to provide staff to respond, 24/7, to reports of unusual discharges or suspicious water quality conditions. Staff responded to 132 water quality related responses during the reporting year. All responses and corrective measures are tracked in the Hansen system database. A summary of enforcement actions and inspections is provided in Section 4 of this report. Appendix A contains a complete list of MS4 violations for FY 2012/13.

ILL2 – ILLICIT DISCHARGE ELIMINATION PROGRAM, TASK 2

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
Environmental Services staff will continue inspections of the City's wastewater users, through the pretreatment program, verifying the proper handling and disposal of both wastewater and stormwater.	• Inspect City's wastewater users for proper management of wastewater and stormwater.	• Track number of inspections and associated findings.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

Environmental Services staff continued to inspect wastewater users for proper handling and disposal of wastewater and stormwater through FY 2012/13. Staff screened 527 industrial/commercial facilities and performed 1,411 wastewater discharge inspections/business contacts.

ILL2 – ILLICIT DISCHARGE ELIMINATION PROGRAM, TASK 3

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
Work with Wastewater Collection Services to identify and correct cross-connections between the sanitary sewer and stormwater systems.	• Review stormwater and ambient stream monitoring data to identify possible cross-connection discharges into the stormwater system. • Maintain communications with Wastewater Collections and other City staff to identify any system cross connection problems.	• Document number of cross-connections identified and corrective actions taken.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

Wastewater Collections provide smoke and dye inspection of lines to identify cross connections. Two cross-connections were identified in FY 2012/13 during the month of December 2012. . Two residential cross-connections were found and corrected during this reporting period.

ILL2 – ILLICIT DISCHARGE ELIMINATION PROGRAM, TASK 4

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
Develop and update a storm sewer outfall dry weather inspection and monitoring prioritization plan.	• Prioritize outfalls for storm sewer outfall inspection and monitoring, and inspect annually. • Coordinate prioritization process with ILL 2 Task 5.	• Document review of outfall monitoring plan. • Document priorities established for monitoring and inspection. • Track dry weather inspections conducted and results of inspection.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

For FY 2012-13, dry weather inspections included a total 34 structures (outfalls and manholes). All 34 structures inspected were identified in the "City of Salem's Dry Weather Outfall and Illicit Discharge Screening Plan". The plan identified a total of 35 structures; however, staff was unable to locate one of the structures. For further information on the results of the inspections refer to Appendix C.

A GIS shapefile was created during this reporting period for the priority outfall locations. All analytical test results were included in the attribute table of this shapefile. Structures with elevated fluoride concentrations were mapped and provided to the Water Section for their records.

ILL2 – ILLICIT DISCHARGE ELIMINATION PROGRAM, TASK 5

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
Identify and map contaminated sites in the GIS system. With input from other City departments, identify a list of areas where there either has been a substantial spill or there is the potential for a spill or illicit discharge. These areas are identified based on activities on site, history of problems, or specific industry, for example. These areas will be mapped in the GIS system for use across City departments.	• Continue to identify and map contaminated sites in the GIS system.	• Track number of contaminated sites added to the GIS system.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

Environmental Services continued to provide information on newly discovered contaminated sites to the Public Works GIS Supervisor in the Engineering Division. This Division adds new sites to the City GIS mapping system used throughout the City. During FY 2012-13 there were four sites added to Public Works GIS. The four sites that were added to the GIS system were contaminated with farm and dry cleaning chemicals.

2.11 ILL3 – Illegal Dumping Control Program

ILL3 – ILLEGAL DUMPING CONTROL PROGRAM, TASK 1

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
Continue to sponsor the Adopt-a-Street Program. The program is an effective way to get residents involved in keeping the community's streets clean and consequently preventing trash and debris from entering the storm drainage system.	• Continue to support the Adopt-a-Street Program.	• Record the miles of adopted streets, number of participating groups, and volume of litter collected through the Adopt-a-Street Program.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

The City continued to sponsor the Adopt-a-Street Program during this last reporting year and utilized an internal database to track active/inactive volunteer group activity, dates of cleanup activities, total pounds of trash removed, and miles of street right-of-way maintained. During FY 2012/13, there were 86 different participating groups, 1,710 total volunteers, 172 street miles maintained, and 9,000 pounds of litter removed through this program.

ILL3 – ILLEGAL DUMPING CONTROL PROGRAM, TASK 2

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
Continue to provide the 24-hour Public Works Dispatch Reporting Center to receive and respond to calls regarding illegal dumping and other environmental complaints/problems and responses thereto. Continue to advertise hotline on City website, utility bill inserts, business cards, public brochures, and consumer confidence reports. As circumstances warrant, publicly report illicit discharges through use of various media outlets.	• Continue to operate the 24-hour Public Works Dispatch Reporting Center. • Assign reports to appropriate City staff for action, including actions taken under ILL2-1.	• Record number and types of reported illegal dumping incidents. • Track media outreach when a discharge warrants.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

Environmental Services provides staff to respond, 24/7, to reports of illegal dumping and environmental complaints received through the Public Works Dispatch Center. Actions taken when responding to calls includes the completion of "Service Requests", a computerized record of calls received and actions taken. This database is in the Public Works Dispatch Center. Staff responded to 14 prohibited discharge violations during this reporting period. Refer to Section 4 and Appendix B for a list of MS4 related enforcement actions during the reporting year.

ILL3 – ILLEGAL DUMPING CONTROL PROGRAM, TASK 3

Task Description	Measurable Goals	Tracking Measures
Continue to support the Adopt-a-Stream program, which involves teachers and students in gathering water quality data from streams, thereby providing water resource education to students through experience. The City supports the program by facilitating projects and providing technical assistance and resources.	• Continue to support the Adopt-A-Stream Program.	• Maintain a descriptive list of adopt a stream program projects, objectives, outcomes upon completion, and number of participants.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 that demonstrate that Measurable Goals were attained or that progress was made.

Staff continued to provide presentations, water quality kits, and training assistance to teachers to support the Adopt-A-Stream (AAS) Program during the 2012/13 school year. This program maintains a small supply budget as well as \$1,000 of available funds for teachers who wish to coordinate field trips.

The projects that were completed by Adopt-A-Stream schools this reporting period are as follows:

Jane Goodall Environmental Middle School

- Worked at the McKay High School wetlands 5 times to pull weeds and plant the new area. Took two grade groups out in November, and three grade groups in May
- Conducted macroinvertebrate studies at Pringle Creek in Bush Park in October, and in Pringle Creek at Leslie Middle School in May
- Planted vegetation at Leslie Middle School along Pringle Creek in February
- Worked on the wetlands at Oregon School for the Deaf in November

Early College High School

- Participated in Salmon Watch at Packsaddle Park
- Raised and released Fall Chinook Salmon into Claggett Creek and Trout into Wirth Lake
- Conducted water quality testing in ditch that feeds Claggett Creek (near Winema Place)
- Conducted a variety of activities with the OSU Extension's Youth Enviro Squad:
 - Trail Building and invasive removal at Cascade Gateway Park
 - Native Plant Restoration in Bear Creek County Park Campsites (Little N. Fork)
 - Invasive plant removal at Fishermen's Bend Park
 - Assisted with several community garden projects
 - S-K Science Expo
 - Oregon Garden Earth Day Event

Forest Ridge Elementary

- Held the annual "Down by the Riverside" event to teach Forest Ridge Elementary students about the river ecosystem, ecology, and biology
- Marked 14 storm drains on June 10th
- Provided "Kids Care About Conservation" outreach (watershed protection) to the public at Science EXPO

Chapman Hill Elementary School

- Performed water quality testing in Glenn Creek (Orchard Heights Park)
- Pulled English Ivy, picked up litter, water quality testing

South Salem High School

- Applied for and received an EPA grant to fund planting of the stream that runs along the backside of the school property(Clark Creek), and coordinated with neighbors for the planting event

McNary High School

- Applied for and received an EPA grant to purchase equipment for schools
- Performed macroinvertebrate studies and water quality testing

ILL3 – ILLEGAL DUMPING CONTROL PROGRAM, TASK 4

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
Continue to support Marion County in their efforts to provide convenient alternatives for legal disposal of household hazardous wastes and other recyclable materials.	• Continue to support Marion County in providing alternatives for household hazardous waste disposal.	• Document frequency and type of support activities

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

The City continued to promote Marion County programs through radio advertisements and articles in the City's Community Connections Newsletter. These advertisements and articles included the following topics: household hazardous waste disposal, compact fluorescent lamp disposal, the Fall Leaf Haul event, e-cycling, proper motor oil disposal, promotion of the Green Awards.

Radio advertisements during FY 2012/13 aired as follows:

- July 2 - 6 (Proper Oil Disposal)
- September 3 - 7 (Proper CFL Disposal)
- September 24 - 28 (Medicine Disposal)
- October 29 - November 2 (Poison Prevention and Household Hazardous Waste Disposal)
- November 14 - 16 (Fall Leaf Haul Volunteer Request)
- November 26 - 30 (Fall Leaf Haul Event)
- December 24 - 28 (E-cycling)
- December 31 - January 4 (Medicine Disposal)
- January 7 - 11 (Green Award Nominations)
- February 25 - March 1 (Proper CFL Disposal)
- March 11 - 15 (Poison Prevention Week/ Household Hazardous Waste Disposal)
- April 8 - 12 (Grasscycling)

Community Connection articles/ads in FY 2012/13 included:

- November: Fall Leaf Haul Volunteer Request/Event Promotion
- March: Greenscapes Spring Garden Planner
- April: Oil Recycling
- July: Greenscapes Summer Garden Planner

ILL3 – ILLEGAL DUMPING CONTROL PROGRAM, TASK 5

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
Continue to support the annual yard debris cleanup effort.	• Support the annual yard debris cleanup effort.	• Record amount of debris cleaned up and level of participation.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

The annual "Fall Leaf Haul" was held on December 1, 2012. The City had three drop-off locations for this event: Sprague High School, Wallace Marine Park, and the State Fairgrounds. A total of 510 cubic yards of debris was collected from these three locations. This event was supported by City staff, local garbage haulers, Marion County Solid Waste Management, and 75 community volunteers.

2.12 IND1 – Industrial Stormwater Discharge Program

IND1 – INDUSTRIAL STORMWATER DISCHARGE PROGRAM, TASK 1

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
Environmental Services will inspect stormwater systems while conducting inspections of City-permitted industrial wastewater users, and work with DEQ to coordinate the permitting and compliance processes for industrial users in the Salem area, including DEQ-issued 1200-Z permitted sources, underground storage tank (UST) removal, and site remediation permits issued by DEQ for sources/sites within the City. Coordination options include: receiving information on proposed 1200-Z permits, commenting on proposed permits, and meeting periodically with DEQ on coordination efforts.	• Inspect stormwater systems while conducting inspections of City-permitted wastewater users. • Develop process to coordinate with DEQ on industrial permits within the City.	• Track coordination efforts with DEQ. • Include stormwater observations as appropriate on inspection reports and follow-up actions.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

Environmental Services continued to inspect stormwater systems as part of facility inspections performed under the industrial pretreatment program. Inspection records are maintained in the Environmental Services database. The Department of Environmental Quality (DEQ) includes the City of Salem in notifications of DEQ regulated remediation of contaminated sites affecting the Salem area.

Salem is not a permitting agent for DEQ's 1200-Z program but does have documented procedures in place (consistent with Schedule A.4.b. of the MS4 Permit) to screen facilities and provide notification to the DEQ when a site in Salem may be subject to State permitting. This documented strategy was submitted to the DEQ in December of 2012. Environmental Services identified 16 existing facilities in FY 2012/13 with the potential of requiring a DEQ 1200-Z permit. Environmental Services staff notified each facility owner or contact person of this potential requirement by letter. Staff from the DEQ Western Region were contacted by email with a scanned copy of each letter that was sent.

IND1 – INDUSTRIAL STORMWATER DISCHARGE PROGRAM, TASK 2

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
During plan review, review industrial facilities for the potential of requiring pretreatment of stormwater prior to discharge based on the industrial activities of the specific facility. Conduct inspections of industrial facilities requiring stormwater pretreatment to ensure structural controls have been built according to approved plans.	• Review industrial plans as necessary for additional stormwater treatment. • Conduct inspections once construction is completed to ensure work was done in accordance with approved plans.	• Maintain database of plans reviewed and final inspections conducted.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

Environmental Services continued to participate in the plan review and inspection processes to help insure appropriate treatment is included during construction, or remodel, of industrial sites. All plans reviewed and inspections completed are tracked in the Amanda database. Staff reviewed 400 industrial plans and performed 269 post-construction inspections during the reporting year.

IND1 – INDUSTRIAL STORMWATER DISCHARGE PROGRAM, TASK 3

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
Surveys are sent to applicable business classes (restaurants, metal finishers/platers, radiator shops, dry cleaners, printing shops, photo processors, etc.) as part of the pretreatment business survey database, part of the industrial pretreatment program for wastewater. Customers will be surveyed on major on-site activities to identify potential locations for public education, future sampling, and tracking down illicit discharges. Illicit stormwater discharges from these business groups are address in ILL2.	• Send surveys to new customers as accounts are opened. • Enter survey results into database – on-going as surveys are returned.	• Track number of surveys sent out. • Track number of surveys returned and entered into database. • Track targeted public education activities for specific industries.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

Environmental Services continued to send surveys to newly identified targeted businesses, at least twice annually. Businesses failing to return the survey were visited by an inspector to obtain the necessary information. Of the 38 surveys that were distributed, 35 were returned and entered into the pretreatment database.

IND1 – INDUSTRIAL STORMWATER DISCHARGE PROGRAM, TASK 4

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
Continue the semi-annual Technical Bulletin for the City's industrial users and produce other materials for these users. This activity is principally associated with the City's wastewater Pretreatment Program, but will be used as a vehicle to address stormwater related issues as well.	• Produce two technical bulletins for industrial users each year.	• Track published technical materials prepared for industrial users each year.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

Environmental Services continued to publish semi-annual Technical Bulletin's in FY 2012/13. Two separate Bulletin's were mailed to industrial users and placed on the City website for public access.

2.13 CON1 – Construction Site Control Program

CON1 – CONSTRUCTION SITE CONTROL PROGRAM, TASK 1

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
Continue implementation of the Erosion Prevention and Sediment Control program for developments that meet or exceed the threshold indicated in SRC Chapter 75, which includes the submission of erosion prevention and sediment control plans with structural and non-structural BMPs. Review program experiences annually and implement improvements as appropriate including Code amendments if needed.	• Implement SRC 75. • Conduct annual program reviews. • Implement appropriate improvements and/or Code amendments. • Perform plan reviews for erosion control requirements.	• Track number of erosion control plans reviewed for compliance with SRC 75.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

During FY 2012/13, the following improvements/activities associated with the Erosion Prevention and Sediment Control (EPSC) program occurred:

- Erosion control plan review process was updated to include a checklist for the EPSC Inspection Lead
- 265 erosion control plans were reviewed by City staff for compliance with SRC 75
- Amendments to the EPSC plan review process and inspection procedures were initiated

CON1 – CONSTRUCTION SITE CONTROL PROGRAM, TASK 2

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
Continue to train and educate City staff and private contractors about stormwater pollution at construction sites, with an emphasis on prevention and control BMPs. Provide notice to construction site operators concerning where education and training to meet erosion and sediment control requirements can be obtained.	• Provide annual erosion control training to City staff and private contractors.	• Track education and training programs conducted and number of staff/public trained.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

During FY 2012/13, Erosion Prevention and Sediment Control training was provided to regional area contractors and design consultants by City and local agency staff and to the City Engineering Division staff to ensure compliance with 1200-CA and MS4 Permit requirements. Concrete truck washout training was provided to all CIP contractors and a letter outlining the associated City policy was sent to all concrete suppliers. All Inspection staff are ODOT certified Environmental/Erosion Control Inspectors. The Inspection Supervisor is a certified Oregon DEQ Erosion & Sediment Control Inspector.

In addition to the training listed above, City staff continued to participate in the Mid-Willamette Outreach Group (MWOOG) during this reporting period and helped to coordinate the “2nd Annual Mid-Valley Erosion Control Summit” on January 15, 2013. This event provides education regarding erosion control practices and options for LID to local developers, contractors, and regional municipal staff.

CON1 – CONSTRUCTION SITE CONTROL PROGRAM, TASK 3

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
Document and streamline site plan review, inspection, and enforcement procedures for the construction site runoff control program.	• Complete documentation of site plan review, inspection, and enforcement procedures before the end of year four of the MS4 permit cycle.	• Track completion of documented procedures.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

During this reporting period one dedicated erosion control inspector was added to inspection staff, site plan review procedures and checklists were amended and documented, inspection procedures were adopted, and enforcement procedures were prepared. All of these procedures are being implemented and will continue to be reviewed and updated for improvements. Staff reviewed 265 erosion control plans, performed 2,972 erosion control inspections, and issued 452 erosion control permits in FY 2012/13.

CON1 – CONSTRUCTION SITE CONTROL PROGRAM, TASK 4

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
Continue to review and update the Erosion Prevention and Sediment Control Technical Guidance Handbook.	• Update Technical Guidance Handbook before the end of year four of the MS4 permit cycle.	• Track updates made to the Technical Guidance Handbook.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

The City is in the process of finalizing code changes and design standard changes that will guide implementation of the Erosion Prevention and Sediment Control (EPSC) program. In addition, the City is now using the ACWA Construction Site Stormwater Guide that was completed during this reporting period for field inspections. It is anticipated that an update of the Technical Guidance Handbook will occur in FY 2013/14 to fill any gaps in the program not covered in the design standards and field handbook.

CON1 – CONSTRUCTION SITE CONTROL PROGRAM, TASK 5

<u>Task Description</u>	<u>Measureable Goals</u>	<u>Tracking Measures</u>
Continue to coordinate with the City's 1200-CA Permit for City construction projects subject to its program.	• Requirements for 1200-CA compliance incorporated into City construction plans, specifications, and contract documents. • Make erosion prevention and sediment control a key agenda item at all pre-construction conferences. • Include inspection of all site erosion prevention and sediment control measures as part of City projects.	• Track renewal of 1200-CA permit.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

The following 1200-CA Permit coordination activities continued through the FY 2012/13 reporting year:

- 1200-CA Permits were included in City contract documents
- 1200-CA Permit and Erosion Prevention and Sediment Control (EPSC) enforcement continued to be a key discussion point at pre-construction conferences
- A designated EPSC Inspector inspected all City 1200-CA permitted projects

2.14 MON1 – Monitoring

MON1 – MONITORING, TASK 1

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
Continue to install and maintain flow and water quality monitoring stations in City waterways to support selection of capital improvement projects, update the hydrologic-hydraulic computer model, and help direct policies to protect the health of these water bodies. The actual rate of installation and the total number of stations will be based on the maintenance requirements of the stations, available funding, and coordination with urban watershed assessments/plans.	• Install additional monitoring stations. • Monitor the station alarms in conjunction with the illicit discharge control program (ILL2, Task 1). • Follow up on potential hotspots or problem areas as may be identified through data analyses.	• Track number of additional monitoring stations implemented.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

Three new monitoring stations were constructed during the last reporting period; a station on Pringle Creek (stage data only), a station on the West Fork Little Pudding River (stage data only), and a station on Shelton Ditch (water quality and stage data). These stations, however, did not start collecting data until July 2012 so this is the first reporting year for the data from these three stations. There are presently no plans to construct any new stations during FY 2013/14.

Environmental Services staff responded to 60 alarms during FY 2012/13. Of the 60 alarms, 18 were deemed erroneous due to instrument error. Of the remaining 42 alarms, 12 occurred during storm conditions and 30 occurred during dry conditions. Some alarms were caused by permissible activities (e.g. in water work permits, exemptions identified in the NPDES MS4 permit). Some of the alarms were the result of wildlife and/or kids playing in the creek. Regardless of what caused the alarm, each of the 60 alarms elicited some type of follow up response. All alarms that occurred during dry conditions were considered hot spot/problem areas that prompted field investigation. When dry condition alarms showed a recurring pattern, then some form of source tracking activity (e.g., TV inspection, smoke testing, etc.) was conducted.

MON1 – MONITORING, TASK 2

<u>Task Description</u>	<u>Measurable Goals</u>	<u>Tracking Measures</u>
Continue the urban stream and Willamette River water quality sampling program, with emphasis on reviewing and evaluating sampling data to prioritize investigations and improvement/maintenance projects. This sampling augments the monitoring plan included in the City's 2008 NPDES MS4 Permit Renewal application.	• Update database for collected data. • Review collected data for purposes of trending and benchmarking by the end of the permit term. • Follow-up on potential hotspots or problem areas as may be identified by the data review.	• Document findings regarding trends.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

All historical urban stream data up to present have been moved from the Access database (previously maintained by Environmental Services) into the Aquarius Database (maintained by Stormwater Services). All data collected during FY2012/13 have been verified for accuracy. This review did not prompt any follow up investigation.

MON1 – MONITORING, TASK 3

Task Description	Measurable Goals	Tracking Measures
Continue to implement all components (MS4 outfall, instream, pesticide, and macro-invertebrate) of the City's "Surface Water and Stormwater Monitoring Plan."	• Implement the City's Stormwater Monitoring Plan, including MS4 outfall, instream, pesticide, and macro-invertebrate monitoring components.	• Provide summary statistics for sampling results from each wet-weather season. • Track any modifications to the monitoring plan.

FY 2012-13 ACTIVITIES & ACCOMPLISHMENTS

Briefly summarize specific activities completed in FY 2012-13 which demonstrate that Measurable Goals were attained or that progress was made.

During FY 2012/13, Stormwater Services monitoring staff completed six Instream Storm, four Stormwater, two Pesticide, one Macroinvertebrate, and one Mercury sampling events. The Macroinvertebrate monitoring requirement is now complete. Appendix C contains summary statistics for all sampling that was conducted during FY 2012/13.

The urban stream water quality sampling program (listed under MON 1 Task 2) is identified as "Monthly Instream Monitoring" in Table B-1 of the NPDES MS4 permit. This sampling program has been coordinated by Environmental Services (ES) staff since it was initiated in 2001. Beginning in FY 2012/13, Stormwater Services staff began to assist ES staff with the monthly sampling activities to help alleviate budget and staffing limitations. By March of 2013, Stormwater Staff had gained enough experience to efficiently take over the coordination of this sampling program.

Stormwater staff also began to coordinate the Willamette River water quality sampling program in FY 2012/13. This sampling program is listed in the 2010 SWMP (also under MON 1 Task 2), but is not a listed requirement in the City's NPDES MS4 Permit. Willamette River samples were previously collected by lab staff at the Willow Lake Pollution Control Facility. Again, due to budget and staffing constraints, staff at the Willow Lake lab was no longer able to perform the sampling. On March 1, 2013, the City submitted a revised monitoring plan and request to the DEQ that the Willamette River sampling effort be combined with the urban stream sampling program. The City received approval of the revised monitoring plan from the DEQ on March 15, 2013. Refer to Appendix C for additional information.

All of the water quality monitoring that is required by the City's NPDES MS4 Permit (with the addition of the Willamette River sampling) is now collected by Stormwater Services monitoring staff. This will provide increased consistency and accuracy in sampling techniques, equipment used, and sampling procedures.

3 PROGRAM EXPENDITURES AND FUNDING SOURCES

Stormwater-related program costs in Salem have been historically funded through wastewater rates, which are comprised of a water consumption (flow) component and a fixed user charge. In December of 2010, Salem City Council approved the adoption of a separate stormwater service charge or utility. Initial implementation of the stormwater utility began on January 1, 2013, and will be phased in over a period of four rate cycles.

The stormwater utility has been developed to provide an equitable way of paying for Salem's stormwater programs by more accurately and fairly linking the stormwater impacts of the ratepayer's property to the rate paid by each ratepayer. The stormwater service charge is based on each property's impervious surface and an assessment of stormwater programmatic costs that are shared equally among all ratepayers. Additionally, properties that take steps to reduce their impervious surface areas or that have onsite facilities that reduce stormwater impacts have an opportunity to reduce their stormwater service charge.

Table 2 provides a summary of the total stormwater program expenditures for the current reporting year, as well as those anticipated through the next (FY 2013/14) as identified in the adopted budget.

Table 2. Stormwater Expenditures		
<u>Stormwater Operating Costs</u>	<u>FY 2012/13 Budget</u>	<u>FY 2013/14 Budget</u>
Stormwater Operations & Maintenance	\$1,908,170	\$2,061,450
Stormwater Quality	\$1,567,700	\$1,698,400
Cleaning	\$513,058	\$389,649
T.V. Inspection	\$184,985	\$185,912
Water and Environmental Resources	\$165,018	\$105,086
Environmental Services	\$243,673	\$250,029
Planning & Development	\$515,860	\$723,198
Laboratory	\$33,877	\$32,092
Operations Administration	\$125,136	\$129,070
Utility Billing	\$303,960	\$319,263
Dispatch	\$66,311	\$69,999
Debt for Capital	\$770,957	\$767,005
Department Administration and Indirect Costs (Nondivisional)	\$1,705,904	\$1,780,409
Nondivisional (Street Sweeping, Watershed Grants, HazMat/Emergency Management)	\$1,207,070	\$1,427,740
Budgeted Capital Improvements	\$6,621,520	\$6,792,390
TOTAL:	\$15,933,199	\$16,731,692

4 ENFORCEMENT ACTIONS, INSPECTIONS, AND OUTREACH

Environmental Services staff responded to 132 water quality responses and reported 20 violations of the Municipal Separate Storm Sewer System (MS4). Of the 20 violations, 14 were prohibited discharges. Enforcement actions related to these violations included warnings, notice of violations, and one citation (refer to Appendix A).

Erosion control and 1200-CA Permit requirements are an integral part of all city-issued construction plans and specifications. The City of Salem continues to coordinate efforts with Department of Environmental Quality (DEQ) staff regarding 1200-C permitted sites. During the FY 2012/13 reporting period, 2,972 erosion control-related inspections were conducted by Public Works Development Services Inspectors and a total of 452 erosion control permits were issued (refer to CON 1 Task 1 through 5).

A complete description of outreach activities that occurred during this reporting year can be found in Section 2 of this report.

5 PLANNING, LAND USE CHANGES, AND DEVELOPMENT

The City of Salem Public Works Department Stormwater Management Design Standards (Design Standards) are currently being revised. The purpose of these Design Standards is to provide uniformity under which the City's stormwater infrastructure is designed, constructed, operated, and maintained.

Revisions to the Design Standards to reflect the post-construction requirements presented in the renewed MS4 Permit continued through FY 2012/13. These updates will be adopted via the City's relatively new administrative rule process. This requires Salem Revised Code changes in the form of a new stand-alone stormwater chapter (SRC 71) before the Design Standards can be formally adopted. Adoption of the revised Design Standards will follow shortly thereafter, with an anticipated effective date during FY 2013/14.

The City's Community Development Department is developing a Uniform Development Code (UDC) that principally focuses on revisions to the City's Zoning Ordinance as set forth by Salem Revised Code (SRC) Title X, Chapters 110 through 166. The UDC is targeted for adoption in FY 2013/2014.

5.1 Land Use Changes

Approximately 32 acres of residential land was added to the city limits in March of 2013 from annexations which were approved by the voters in 2012.

5.2 New Development

The City of Salem has continued to see a steady stream of new projects at all phases of development. During the FY 2012/13 reporting period, there was the addition of 1,569,577 square feet of new or replaced impervious surface area related to development projects in Salem. Below are several noteworthy projects that are moving forward in the development process:

Under Construction:

- Bonaventure Development, 3400 Boone Road S, Phase II (which includes corporate offices) is under construction.
- PacTrust medical office and shopping center, 4826 Battle Creek Rd. SE, grading permits issued. Scheduled completion date unknown.
- Madras Apartments at Wiltsey/Reed/Madras Rd, Phase II plans approved, 111 units total. Scheduled completion date Fall 2014.

- Orchard Ridge residential care facility (119 units), Linwood Street NW. Scheduled completion date Fall 2014.
- Cordon Rd and Highway 22 plans approved for 178 unit apartment complex.
- Power Auto Group at Market St/I-5 – car lot and associated buildings under construction.
- CarMax on Lancaster SE/I-5 (next to Santiam Theater) – new car lot with ~60,000 square feet of building and associated car sales/display area under construction.
- Norpac – expansion of existing plant on Madrona and 25th Street SE, permits in review.
- Garmin – expansion of existing business on Turner Road SE, permits in review.
- Lithia Motors (formerly O'Brien) – moving from current location on Liberty/High Street NE to Salem Parkway/Cherry Ave location. Will include the development of a vacant site with new buildings and car sales/display areas, permits in review, completion expected in Fall 2014.
- Copper Creek Manufactured Home Park, expansion, completion of Phase 4, in review. Will add room for ~ 60 manufactured dwelling spaces and includes a community center.

Estimate of Potential Future Development:

- Salem Renewable Energy and Technology Center, an 80-acre technology center on Gaffin Road SE.
- Mill Creek Corporate Center (MCCC), a 500- acre industrial development between Highway 22, Kuebler Boulevard SE, Turner Road SE, and Deer Park Road SE.
- Fairview Hills multi-family development at Fairview site (Reed Rd), 435 units total and 22,000 square feet of commercial buildings, approved but construction has not started.
- Salem Hospital new rehabilitation center and parking lot at former School for the Blind site. Request for demolition of historic Howard Hall expected to be submitted in Fall/Winter 2013 with possible construction in Summer 2014.

- Neighborhood Center Mixed-Use zone approved for 15 acres at corner of Orchard Heights and Doaks Ferry Road NW. No development application has been submitted.
- North Campus of the State Hospital (between Center Street and D Street) 47 acres to be surplussed by the State. Before development the following land use procedures are required: Historic Design Review of any proposed demolition or changes to existing buildings; possible changes to the National Historic District are required; Urban Growth Area permit to determine required infrastructure upgrades (water, sewer, stormwater and transportation); Comprehensive Plan Change and Zone Change to allow uses other than public hospitals; Site Plan Review and Building permits.

APPENDIX A. MS4 VIOLATIONS FY 2012-13

MS4 Violations Issued July 1, 2012 to June 30, 2013

Record	Business Name	Date	Violation	Enforcement	Action Taken	Outfall	Response	Received	Citation	Amount	Court Date	Date Paid	Compliance	Discharge	SRC1	SRC2	SRC3	Address	Zipcode
7592	Classique Marble and Granite Fabricators	8/31/2012	Prohibited Discharge To The Storm Sewer	8/31/2012	Warning	Storm							8/31/2012	Marble Slurry	73.160	73.165		1291 Madison St NE	97301
8742	Dave Morton Auto Sales Lot	2/16/2013	Prohibited Discharge To The Storm Sewer	2/19/2013	Warning	Storm	Yes						2/19/2013	Soapy Wash Water	73.160			1090 12th St SE	97302
840	Fitzmaurice Fertilizer Inc	8/9/2012	Prohibited Discharge To The Storm Sewer	8/9/2012	Warning	Storm	Yes	8/21/2012					8/21/2012	Fertilizer	73.160	73.165	73.240	4195 Salem Industrial Dr NE	97303
8827	GreenFLEX Prefab Buildings	11/16/2012	Prohibited Discharge To The Storm Sewer	11/16/2012	Citation	Storm			138585	\$250	11/28/2012	11/28/2012	11/28/2012	Cement Wash Water	73.160			110 Division St NE	97301
8789	HT Investments LLC Property	8/28/2012	Placing Pollutants Where Prohibited	8/28/2012	Warning	Environment	Yes	8/28/2012					8/28/2012	Oil	73.160			2200 Marine Dr NW	97304
2899	Jack In The Box Restaurant	11/21/2012	Illicit Discharge Violation	11/21/2012	Warning	Storm	Yes	11/27/2012					11/27/2012	Wash Water	73.165	73.160		1940 Lancaster Dr NE	97305
2333	Oil Can Henry's	2/12/2013	Prohibited Discharge To The Storm Sewer	2/12/2013	Warning	Storm							2/12/2013	Wash Water	73.165			4957 Commercial St SE	97302
8173	Pries Painting And Restoration Specialists	12/28/2012	Prohibited Discharge To The Environment	12/28/2012	Warning	Storm							12/28/2012	Mud and Debris	73.160			1300 Wilbur St SE	97302
8850	Private Residence-Bassham-Car Leaking Oil	12/22/2012	Prohibited Discharge To The Storm Sewer	12/22/2012	Warning	Storm							12/23/2012	Oil	73.160	73.165		4665 Crown Ct NE	97301
8814	Private Residence-Borchers-Sinkhole	9/4/2012	Sinkhole Problem Needing Repairs	9/5/2012	Warning	Both							9/26/2012	Sinkhole	73.095			1215 Nebraska Ave NE	97301
8901	Private Residence-Brown-RV Holding Tank Spill	3/18/2013	Prohibited Discharge To The Storm Sewer	3/18/2013	Warning	Storm							3/19/2013	Holding Tank Contents	73.160			1590 Elm St NW	97304
8918	Private Residence-Flores-Car Leaking Oil	4/3/2013	Prohibited Discharge To The Storm Sewer	4/3/2013	Warning	Storm							4/3/2013	Oil	73.160			3251 4th Ave N	97303
8846	Private Residence-Lydon-Illicit Discharge	12/10/2012	Illicit Discharge Violation	12/10/2012	Notice of Violation	Both							12/20/2012	Pollutants To Storm Sewer	73.160			269 Mountain Vista Ave SE	97306
8900	Private Residence-Nicolas-Illicit Discharge Washwater	3/25/2013	Prohibited Discharge To The Storm Sewer	3/25/2013	Warning	Storm							3/26/2013	Laundry Wash Water	73.160			2560 Northgate Ave NE	97301
8876	Private Residence-Salas-Illicit Discharge	2/12/2013	Illicit Discharge Violation	2/13/2013	Warning	Environment							2/13/2013	Wash Water	73.160	73.165		460 22nd St SE	97301
8847	Private Residence-Snethen-Illicit Discharge	12/10/2012	Illicit Discharge Violation	12/10/2012	Notice of Violation	Both							12/20/2012	Pollutants To Storm Sewer	73.160			275 Mountain Vista Ave SE	97306
2464	Roberson Car Wash	3/19/2013	Prohibited Discharge To The Storm Sewer	3/19/2013	Warning	Storm							3/19/2013	Vehicle Wash Water	73.160	73.165		3080 Ryan Dr SE	97302
2024	Salem Health	2/7/2013	Prohibited Discharge To The Storm Sewer	2/7/2013	Warning	Storm							2/7/2013	Vehicle Fluids	73.160	73.165		890 Oak St SE	97301
4069	Superior Tire Service	3/12/2013	Prohibited Discharge To The Storm Sewer	3/14/2012	Warning	Storm	Yes	3/22/2013					3/22/2013	Soapy Wash Water	73.160			4230 27th Ct SE	97302
8943	Total Solutions Janitorial and Maintenance	6/20/2013	Prohibited Discharge To The Environment	6/20/2013	Warning	Environment							6/20/2013	Carpet Wash Water	73.165	73.160		2794 Market St NE	97301

APPENDIX B. STORMWATER OUTREACH ACTIVITIES FY 2012-13

Outreach Matrix for *E. coli* and Turbidity During FY 2012/13

Target Contaminants	Outreach Partners	Audiences	Tools	Measureable Goals
E.Coli				
Source: <i>pet waste & streamside wildlife</i>	City of Keizer: FY 12/13 Howlapalooza and Capital Canine Club partner			1 of 2 partners sharing the pet waste / clean streams message
(TMDL)	Marion County Stormwater and Dog Control: FY 12/13 Howlapalooza and Capital Canine Club partner			2 of 2 partners sharing the pet waste / clean streams message
	Willamette Humane Society: explored partnership for FY 13/14.			In progress
		Dog owners in pilot study area.	Direct mailing of Know the Scoop	January 2013, April 2013, and June 2013 mailings to 620 residents per quarter.
		Park patrons	Event participation (Howlapalooza)	Approximately 200 participants
			Signs and dispensers in parks	There are 96 mutt mitt dispensers in 47 of Salem's parks. A minimum of 576,000 bags were ordered in FY 2012/13.
		General dog owners	Radio advertisements	4 weeks: Aug. 27 - Sept 1, Oct 1 - 5, Mar 25 - 29, and May 6-10
			Website information	Capital Canine Club website went live May 28, 2013. Pledge numbers will be determined beginning FY 13/14.
			Social media -- FB	6 pet waste-related posts were made: 10/2, 10/3, 5/1, 5/6, 6/12, and 6/27. Reach: 150
			Press Releases	1
			Print ads	3 advertisements in Salem Weekly: July, September, and June.
			Newspaper article	October Statesman Journal article regarding Howlapalooza
		Streamside pet owners	Streamside Guide mailing	January mailing to 1661 streamside owners that included pet waste disposal information.
Target Contaminants	Outreach Partners	Audiences	Tools	Measureable Goals
Turbidity				
Source: <i>erosion of soils and runoff from streets</i>	Marion SWCD			1 of 3 partners sharing the pet waste / clean streams message
	Marion County Stormwater			2 of 3 partners sharing the pet waste / clean streams message
	City of Keizer			3 of 3 partners sharing the pet waste / clean streams message
		City EPSC permittees, DEQ 1200-C permittees, contractors, engineers/architects		Event participation: 103 participants at the Erosion Control Summit
			Trainings: Local Erosion Control Summit and notices of other erosion control trainings	7/31 posted announcement for OREGON EROSION AND SEDIMENT CONTROL WORKSHOP presented by EOS Alliance, NW Envnrionmental Training Center
				3/26 posted announcement for oregon 2-day certified erosion and sediment control lead training offered by NW Environmental Training,
				4/26 posted announcement for erosion control training webinar by Forester University.
			Social media -- FB	11/16 early-bird registration posted.
		City staff	Erosion Control Training	Presentation to City staff 3/12/2013. Topics: EC on CIP projects, EC Implementation, City held permits and NPDES (postponed). Attendance: approx. 25
		General public	Print ads	January issues of Salem Weekly.
			Radio	Radio spots aired October 22 - 26
		Creekside homeowners	Streamside Guide mailing	January mailing to 1661 streamside owners that included information regarding erosion.

APPENDIX C. SUMMARY OF WATER QUALITY DATA FOR FISCAL YEAR 2012-13

**City of Salem
National Pollutant Discharge Elimination System (NPDES)
Municipal Separate Storm Sewer System (MS4)**

**Summary of Water Quality Data
For Reporting Year 2012/2013**

Prepared by:
City Salem Public Works Department
Stormwater Services
Stormwater Monitoring Staff

October 2013

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- Attachment A. Analytical Reports for Pesticide Screening, Pacific Agricultural Laboratory; received October 12, 2012 and June 18, 2013.
- Attachment B. "Results of Benthic Macroinvertebrate Sampling, Fish Sampling, and Physical Habitat Data Collection for Pringle Creek and Clark Creek in Salem, Oregon", Pacific Habitat Services, Inc.; June 27, 2013.
- Attachment C. City of Salem Surface Water and Stormwater Monitoring Plan Revision Packet (cover letter, monitoring plan, and approval email); March 1, 2013.

1.0 Introduction

This document provides all monitoring data collected in accordance with the City of Salem's NPDES MS4 Permit for the reporting year of July 1, 2012, to June 30, 2013 (RY 2012/2013). A background narrative for each monitoring element is provided below, and all collected data are provided in the tables, figures, and attachments¹.

2.0 Monitoring Elements

Specific details for each monitoring element can be found in the City's "Stormwater and Surface Water Monitoring Plan". Progress toward meeting monitoring requirements defined in Table B-1 of the City's MS4 Permit is summarized in Table 1. Monitoring site locations and parameters for each monitoring element are described in Tables 2 and 3, respectively.

2.1 Monthly Instream Monitoring

Monthly Instream² monitoring of urban streams is conducted on a predetermined schedule. This monitoring element includes the collection of grab samples and field measurements on 11 of Salem's MS4 stormwater runoff receiving streams. Ten of these streams are paired with upstream (at or near where the stream enters the City's jurisdiction) and downstream (at or near where the stream exits the City's jurisdiction or enters a receiving stream) site locations. The eleventh stream, the West Fork Little Pudding River, only has a downstream site location, because the West Fork Little Pudding River starts in the greater Salem area and runs dry during the summer months. Figure 1 denotes the locations of each site.

Water quality parameters collected at all sites include:

- Temperature
- Turbidity
- Specific Conductivity
- pH
- Dissolved Oxygen (DO)
- Nitrate + Nitrite as Nitrogen (NO₃+NO₂-N)
- *Escherichia coli* (*E. coli*)
- Biochemical Oxygen Demand (BOD_{stream})

Additional water quality parameters were added for the sites within the Pringle Creek Watershed (PRI1, PRI5, CLA1, and CLA10; refer to Table 2 for a list of site locations) and the West Fork Little Pudding River (LPW1) to meet requirements of the MS4 Permit. These additional parameters include:

- Zinc -total recoverable and dissolved: (CLA1, CLA10, PRI1, PRI5)
- Copper -total recoverable and dissolved: (CLA1, CLA10, PRI1, PRI5)
- Lead -total recoverable and dissolved: (CLA1, CLA10, PRI1, PRI5)

¹ All tables, figures and attachments are at the end of this document and are not necessarily discussed in the order in which they appear.

² Identified as Urban Streams monitoring in the City of Salem Stormwater Management Plan 2010

- Hardness: (CLA1, CLA10, PRI1, PRI5)
- Total Suspended Solids (TSS): (LPW1)

Data for this monitoring element are provided as follows:

- Table 5 - Monthly medians for collected data
- Table 6 - Number of water quality criteria exceedances
- Table 7 - All raw monthly data
- Figure 2 - Graphs of mean value comparison for dry and rain conditions
- Figure 3 - Upstream/downstream comparison of *E. coli* data

2.2 Continuous Instream Monitoring

The City maintains a network of Continuous Instream water quality monitoring sites and stream gauging sites on seven different urban streams within the city. One Continuous Instream water quality monitoring site (SHE3) and two stream gauge-only sites (PRI4 and LPW1) were added to the network in July of 2012, bringing the total to eleven water quality monitoring sites and two stream gauging-only sites. Data from these new sites are included in this year's Annual Report. Figure 1 denotes the locations of each site.

The monitoring sites for this monitoring element are positioned in an upstream/downstream configuration. The upstream sites are adjacent to where the stream enters the City and the downstream sites are either above the confluence with another stream or where the stream exits the City's jurisdictional boundary.

Continuous data collected includes:

- Turbidity
- Specific Conductivity
- Temperature
- pH
- DO
- Stage

All data are recorded in 15-minute intervals. All continuous statistical data summaries presented in the various tables and figures were computed using grade A and/or grade B data. Qualification of what constitutes grade A and grade B data is provided in Table 8.

The Continuous Instream monitoring element incorporates an alarm system that supports the City's Illicit Discharge Detection and Elimination (IDDE) program. The alarm system is used to record, notify, and prompt investigation of water quality abnormalities that may be indicative of illicit discharges. It serves as an important tool to aid in the elimination of periodic illicit discharges, helps to prioritize dry weather outfall screening activities (see section 2.9), and serves as an outreach/education opportunity for residents.

Monthly medians for collected data are summarized in Table 9. Plots of continuous data and a summary of system alarms are provided in Figures 4 through 7.

2.3 Instream Storm Monitoring

Instream Storm refers to the monitoring of MS4 receiving streams during defined storm events. Sampling occurs at three sites in the Pringle Creek Watershed (continuous instream monitoring sites PRI12, PRI3, and CLK1). Data collected are intended to increase understanding of receiving waters within the Pringle Creek Watershed and help guide Salem's stormwater management strategies in watersheds throughout the city. This is a new monitoring element that is expected to continue beyond the current MS4 Permit cycle; ultimately providing a dataset for long-term trending and spatial analyses.

Sampling consists of flow weighted composite samples, grab samples, and field measurements. Parameters include:

- TSS
- BOD_{stream}
- Total Phosphorus (TP)
- Ortho Phosphorus
- NO₃+NO₂-N
- Ammonia Nitrogen (NH₃)
- Copper (Total Recoverable and Dissolved)
- Lead (Total Recoverable and Dissolved)
- Zinc (Total Recoverable and Dissolved)
- Hardness
- Specific Conductivity
- DO
- Temperature
- pH
- *E. coli*

Data for this monitoring element are provided in Table 10.

2.4 Stormwater Monitoring

The City has collected water quality samples from a number of sites throughout the MS4 system since 1995. Following the current monitoring plan and strategy, there are three monitoring sites: one each for residential, commercial, and industrial land use. The commercial and industrial sites are new sites for this permit, while the residential site was sampled during the previous MS4 Permit cycle. Data from this monitoring element will be aggregated with previous data collected from similar land use types. The aggregated datasets will be used to characterize MS4 stormwater runoff pollutant concentrations.

Sampling consists of flow weighted composite samples, grab samples, and field measurements. Parameters include:

- TSS
- BOD_{5-day}
- TP
- Ortho Phosphorus
- NH₃

- NO₃+NO₂-N
- Copper (Total Recoverable and Dissolved)
- Lead (Total Recoverable and Dissolved)
- Zinc (Total Recoverable and Dissolved)
- Hardness
- Specific Conductivity
- Temperature
- pH
- DO
- *E. coli*

Data for this monitoring element are provided in Table 11.

2.5 Pesticide Monitoring

Monitoring for the presence of pesticides in MS4 stormwater runoff is a new requirement of the MS4 Permit. Pesticide monitoring occurs at the same three sites where Stormwater monitoring is conducted. Consistent with Table B-1 of the MS4 Permit, halogenated pesticide and chlorinated herbicide screens are performed. For RY 2012/2013, two sets of pesticide samples were collected at each of the three sites and sent to Pacific Agricultural Laboratory for analysis. In addition to the screens required in Table B-1, additional analyses included: Organophosphorous, Organosulfur, Organonitrogen, Phenylurea, and Carbamate pesticide screens. This resulted in a screening for 188 different pesticides at each site. Detected pesticides are summarized in Table 12, and the complete laboratory reports are provided as Attachment A.

2.6 Stormwater-Mercury Monitoring

Monitoring of low-level mercury and methyl mercury (total recoverable and dissolved) in MS4 discharges during storm events is a new requirement of the MS4 Permit. Monitoring occurs twice per year (summer and winter) at the same residential and commercial land use sites used for Stormwater and Pesticide monitoring. EPA Method 1669 ultra clean sampling protocols are followed to collect all samples.

Per the Department of Environmental Quality's (DEQ) request, additional grab samples were collected at the same time as the mercury samples and sent to CH2M Hill Applied Sciences Laboratory for analysis of:

- TSS
- Dissolved Organic Carbon (DOC)
- Total Organic Carbon (TOC)
- Sulfate
- Alkalinity

Field Measurements were taken for:

- Temperature
- pH
- Oxygen Reduction Potential (ORP)
- DO

- Specific Conductivity

Mercury data collected for this monitoring element are provided in Table 13 and additional data collected are provided in Table 14.

2.7 Benthic Macroinvertebrate Monitoring

Benthic Macroinvertebrate Monitoring is a new requirement of the City's MS4 Permit. Sampling for this monitoring element was conducted at sites along Pringle and Clark Creeks. The three sites, two on Pringle Creek and one on Clark Creek, were selected because of their close proximity to where benthic macroinvertebrate and physical habitat data were collected for two separate bioassessment collection events in 2000 and 2001.

The City utilized a consultant, Pacific Habitat Services, to collect benthic macroinvertebrates, physical habitat data, and conduct fish sampling. Data collection was performed in June 2012 and 2013 at the same sites, consequently satisfying this monitoring requirement. A summary of collected data are provided in Tables 15 through 17, and the complete data report is provided as Appendix B.

2.8 Willamette River Water Quality Data

Starting in 1990, Willamette River water quality data were collected by the City's Willow Lake Water Pollution Control Facility laboratory staff. This monitoring *is not* a requirement of the MS4 Permit, nor is it identified in the monitoring plan. However, collected data are being provided because the Willamette River water quality sampling program is referenced in the City of Salem Stormwater Management Plan 2010 (Best Management Practice MON1 Task 2).

Section 3.0 describes how this monitoring element will change for RY 2013/2014.

Willamette River water quality data are provided in Table 18.

2.9 Priority Dry Weather Outfall/Manhole Screening

For RY 2012/2013, dry weather inspections were completed at a total of 34 structures (outfalls and manholes), all of which were identified in the City of Salem's Dry Weather Outfall and Illicit Discharge Screening Plan. The plan had identified a total of 35 structures; however, staff were unable to locate one of the structures. Additionally, the plan identifies action levels (i.e. level that triggers a source investigation by City staff of a suspected illicit discharge) for all observed and analytical data collected.

Observational Data

Observational data collected did not produce any direct indication of the presence of an illicit discharge at any of the 34 priority structures.

Field Screening Pollutant Parameters

Field screening pollutant parameters include temperature, pH, specific conductivity, turbidity, and chlorine. Only chlorine had concentration levels above the action level, which occurred at

three of the 34 sites. However, further analytical testing of detergents, fluoride, potassium, sodium, and ammonia showed that these three sites did not show any conclusive evidence that an illicit discharge was present. See Table 19 for all data collected during inspections.

Laboratory Analysis Pollutant Parameters

As stated in the Dry Weather Outfall and Illicit Discharge Screening Plan, during the 2012 inspection season all observed flowing water at priority structures was tested for fluoride. This resulted in a total of 18 structures being tested for fluoride. Of the 18 structures screened, 15 had fluoride at or above the 0.1 mg/L action limit. When an aliquot had a presence of fluoride at or above the action limit, the laboratory tested for all other parameters identified in the screening plan (detergents, potassium, ammonia, and sodium). None of the other parameters were found to have concentrations above action levels.

Six of the structures did show ammonia to be present; however, concentrations were well below action levels. For an additional look at these structures, follow up samples were collected for *E. coli* testing. Two of the six structures sampled for *E. coli* had concentrations above the 406 acute water quality criteria. These two structures will have additional *E. coli* testing performed during the 2013 inspection season. See Table 19 for all data collected during inspections.

3.0 Revisions to the City of Salem Surface Water and Stormwater Monitoring Plan

3.1 Background

Historically, the laboratory staff at the City's Willow Lake Water Pollution Control Facility collected samples for the Willamette River water quality sampling program. However, due to budget reductions, this group was no longer able to fund the collection of these data. These data are of particular value to the MS4 monitoring program, and this program is referenced in the City's Stormwater Management Plan 2010. Therefore, it was decided that the program would be modified for integration into the Monthly Instream monitoring element identified in the City's Surface Water and Stormwater Monitoring Plan.

3.2 Correspondence with the DEQ

On March 1, 2013, the City submitted a letter to the DEQ requesting approval of revisions to the City's Surface Water and Stormwater Monitoring Plan, specifically the Monthly Instream monitoring element to include the Willamette River water quality sampling program. Stormwater staff had a phone conversation with Benjamin Benninghoff (Salem's Municipal MS4 Stormwater Coordinator) on March 7th, 2013 discussing the revisions, and received approval of the changes via email on March 15th, 2013.

A copy of the letter sent to the DEQ, a copy of the revised City of Salem Surface Water and Stormwater Monitoring Plan, and a copy of the email approval from the DEQ are included as Attachment C. Although changes to the monitoring plan and approval occurred during RY 2012/2013, the change was not implemented until July 1, 2013. Changes to data reporting will appear in the Annual Report Monitoring Appendix for RY 2013/2014.

4.0 Conclusion

The City completed all MS4 Permit monitoring requirements for this reporting year, and is on track to meet all of the minimum monitoring requirements outlined in the MS4 Permit before its expiration on December 29, 2015. Cumulatively, data collected throughout this MS4 Permit cycle will be utilized to meet monitoring objectives identified in the City's monitoring plan, while also supporting data analyses that will be conducted in preparation for an MS4 Permit renewal package.

Table 1.
Progress Towards Completion of Table B-1 Environmental Monitoring Elements

Monitoring Type	# of sites	Total "Events" Needed	Completed 2010/2011	Completed 2011/2012	Completed 2012/2013	Remaining "Events" Needed
Monthly Instream	21	48 / site	12 ¹	12 ¹	12 ¹	12 ¹
Continuous Instream	10	On going	NA	NA	NA	NA
Instream Storm	3	25 / site	0 ³	6	6	13
Stormwater (MS4)	3	15 / site	0 ³	4	4	7
Pesticides	3	4 / site	0 ³	1	2	1
Mercury	2	2 / site / year	0 ³	2	1	1 ²
Macroinvertebrates	3	2 / site	0 ³	1	1	COMPLETE

¹ 4 of the 21 sites had less than 12 data collection events due to no flow or access issues; however, all sites are on pace to meet the minimum permit requirements.

² Following Table B-1 Special Condition #6 of the City's NPDES MS4 permit, the City anticipates requesting that the Department eliminate the mercury and methyl mercury monitoring requirement after two years of monitoring.

³ Because the City's monitoring plan was not approved by the Department until June 29th, 2011, no sampling was conducted for this element.

Table 2.
Site Locations for Each Monitoring Element

Monthly Instream	
Site ID	Site Location
BAT 1	Commercial St SE
BAT 12	Rees Hill Rd SE
CGT 1	Mainline Dr NE
CGT 5	Hawthorne St NE @ Hyacinth St NE
CLA 1	Bush Park
CLA 10	Ewald St SE
CRO 1	Courthouse Athletic Club
CRO 10	Ballantyne Rd S
GIB 1	Wallace Rd NW
GIB 15	Brush College Rd NW
GLE 1	River Bend Rd NW
GLE 10	Hidden Valley Dr NW
LPW 1	Cordon Rd NE
MIC 1	Front St Bridge
MIC 10	Turner Rd SE
MRA 1	High St SE
MRA 10	Mill Race Park
PRI 1	Riverfront Park
PRI 5	Bush Park
SHE 1	Church St SE
SHE 10	State Printing Office

Continuous Instream	
Site ID	Site Location
BAT3	Commercial St SE
BAT12	Lone Oak Rd SE
CLK1 ³	Bush Park
CLK12	Ewald St SE
GLE3	Wallace Rd NW
GLE12	Hidden Valley Dr NW
LPW1 ²	Cordon Rd
MIC3	North Salem High School
MIC12	Turner Rd SE
PRI3 ³	Pringle Park
PRI4 ²	Salem Hospital Footbridge
PRI12 ³	Trelstad Ave SE
SHE3 ¹	Winter St. Bridge

¹ New water quality monitoring station (July 2012).

² New stage-only gauging station (July 2012).

³ Instream Storm sampling done at these sites.

Stormwater / Pesticides / Mercury	
Site Id	Site Location
Electric ¹	Electric St. SE and Summer St. SE
Hilfiker ¹	Hilfiker Ln. SE and Commercial St. SE
Salem Industrial	Salem Industrial Dr. NE and Hyacinth St. NE

¹ Mercury monitoring done at these sites.

Willamette River	
Site ID	Site Location (Approx. River Mile)
Wheatland Ferry	71
Spongs Landing	77
WLTP ¹	78
Sunset Park	81
Mill Creek	82.9
Railroad Bridge ²	83

¹ Willow Lake Treatment Plant (now called Willow Lake Water Pollution Control Facility)- 150 feet downstream from effluent diffuser.

² Field duplicates taken at this site.

BAT = Battle Creek, CGT = Claggett Creek, CLA and CLK = Clark Creek, CRO = Croisan, GIB = Gibson Creek, GLE = Glenn Creek, MIC = Mill Creek, MRA = Mill Race, PRI = Pringle Creek, SHE = Shelton Ditch, LPW = West Fork Little Pudding River

Table 3.
Parameters for Each Monitoring Element

Parameter	Units	Monitoring Element				
		Instream Storm	Stormwater	Monthly Instream	Continuous Instream	Willamette River
Alkalinity	mg/L					x
Biological Oxygen Demand (BOD _{stream})	mg/L	x		x		x
Biological Oxygen Demand (BOD _{5day})	mg/L		x			
Specific Conductivity	µS/cm	x	x	x	x	x
Copper (Total Recoverable and Dissolved)	mg/L	x	x	x ¹		
Dissolved Oxygen (DO)	mg/L	x	x	x	x	x
E. coli	MPN/100 mL	x	x	x		x
Hardness	mg/L	x	x	x ¹		
Lead (Total Recoverable and Dissolved)	mg/L	x	x	x ¹		
Ammonia Nitrogen (NH ₃ -N)	mg/L	x	x			x
Nitrate and Nitrite (NO ₃ +NO ₂)	mg/L	x	x	x		x
pH	S.U.	x	x	x	x	x
Total Dissolved Solids (TDS)	mg/L					x
Temperature	°C	x	x	x	x	x
Total Phosphorus (TP)	mg/L	x	x			x
Ortho Phosphorus	mg/L	x	x			
Total Solids (TS)	mg/L					x
Total Suspended Solids (TSS)	mg/L	x	x	x ²		x
Turbidity	NTU			x	x	x
Zinc (Total Recoverable and Dissolved)	mg/L	x	x	x ¹		

¹ Pringle Creek Watershed sites only (PRI1, PRI5, CLA1, and CLA10).

² West Fork of Little Pudding River site only (LPW 1).

Table 4.
Water Quality Criteria for Monitored Streams

Parameter	Season	Criteria	Applicable Waterbody
Dissolved Oxygen	January 1-May 15	Spawning: Not less than 11.0 mg/L or 95% saturation	Battle Creek*, Claggett Creek*, Clark Creek* ³ , Croisan Creek*, Glenn Creek*, West Fork Little Pudding River*
	October 1- May 31	Spawning: Not less than 11.0 mg/L or 95% saturation	Gibson Creek* [□] , Glenn Creek
	October 15 - May 15	Spawning: Not less than 11.0 mg/L or 95% saturation	Mill Creek*, Pringle Creek* ¹ , Shelton Ditch*
	Year Around (Non-spawning)	Cold water: Not less than 8.0 mg/L or 90% saturation	Battle Creek*, Croisan Creek*, Clark Creek, Glenn Creek* ⁴ , Pringle Creek ²
		Cool water: Not less than 6.5 mg/L	Claggett Creek*, Glenn Creek*, Mill Creek, Pringle Creek ¹ , Shelton Ditch, West Fork Little Pudding River
pH	Year Around	Must be within the range of 6.5 to 8.5 pH units	All Monitoring Streams
Temperature	October 15 - May 15	Salmon and steelhead spawning: 13°C 7-day average maximum	Mill Creek, Shelton Ditch
	October 1- May 31	Salmon and steelhead spawning: 13°C 7-day average maximum	Gibson Creek [□]
	Year Around (Non-spawning)	Salmon and trout rearing and migration: 18°C 7-day average maximum	All Monitoring Streams
E. coli	Fall-Winter-Spring	30 day log mean of 126 E. coli organisms per 100 ml (or) no single sample > 406 organisms per 100 ml	All Monitoring Streams
	Summer	30 day log mean of 126 E. coli organisms per 100 ml (or) no single sample > 406 organisms per 100 ml	All Monitoring Streams
Biological Criteria	Year Around	Waters of the state must be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities.	Claggett Creek*, Clark Creek*, Croisan Creek*, Glenn Creek*, Pringle Creek Trib*
Copper	Year Around	Freshwater Acute and Chronic Criteria: 18 and 12 µg/L respectively with values calculated for a hardness of 100 mg/L	Pringle Creek*
Lead	Year Around	Freshwater Acute and Chronic Criteria: 82 and 3.2 µg/L respectively with values calculated for a hardness of 100 mg/L	Pringle Creek*
Zinc	Year Around	Freshwater Acute and Chronic Criteria: 120 and 110 µg/L respectively with values calculated for a hardness of 100 mg/L	Pringle Creek*

Note: All waterbodies in this table are included under the Willamette Basin or Molalla-Pudding Subbasin TMDL for Temperature and E. coli.

* Oregon's 2010 Integrated Report Section 303(d) listed.

□ Gibson Creek is referred as Gibson Gulch in Oregon's 2010 Integrated Report.

¹ Applies to Pringle Creek from river mile 0 to 2.6.

² Applies to Pringle Creek from river mile 2.6 to 6.2.

³ Applies to Clark Creek from river mile 0 to 1.9.

⁴ Applies to Glenn Creek from river mile 4.1 to 7.

Table 5.
Median Values for Monthly Instream Sites (RY 2012/13)

Station	Number of Samples	Temperature (C)	DO (mg/L)	Specific Conductivity (µS/cm)	Turbidity (NTUs)	pH (S.U.)	E. Coli (MPN/100 mL)	NO ₃ +NO ₂ -N (mg/L)	BOD _{stream} (mg/L)
BAT 1	12	12.5	9.3	48.5	8.3	6.9	172.0	0.76	1.06
BAT 12	12	11.5	9.9	43.1	6.9	7.0	64.5	0.49	0.93
CGT 1	12	14.9	9.3	207.3	6.6	7.2	204.5	0.23	1.92
CGT 5	12	13.4	7.9	143.3	12.6	7.1	205.0	0.28	1.77
CLA 1	12	13.5	9.9	88.8	4.1	7.3	428.0	0.97	1.18
CLA 10	12	13.6	9.3	66.6	4.2	6.9	258.0	1.43	0.92
CRO 1	12	11.7	9.9	74.7	5.6	7.1	226.5	0.57	1.06
CRO 10	11	10.4	9.5	49.8	7.1	7.1	34.0	0.50	0.98
GIB 1	12	12.6	9.5	94.8	8.5	7.2	98.0	1.09	1.14
GIB 15	12	13.0	9.6	94.7	7.9	7.2	163.0	2.02	1.16
GLE 1	12	12.7	9.8	99.4	6.9	7.3	181.5	1.05	1.25
GLE 10	11	11.0	10.2	68.2	6.2	7.3	55.0	1.18	1.12
LPW 1	9	11.7	9.1	204.5	10.1	7.0	276.0	0.62	1.27
MIC 1	12	12.7	10.1	79.3	5.8	7.2	276.0	1.30	1.13
MIC 10	12	12.1	10.0	72.8	5.9	7.2	163.5	1.43	1.05
MRA 1	12	12.1	10.4	77.3	6.1	7.2	241.0	1.27	1.10
MRA 10	12	12.2	10.0	77.4	5.8	7.1	299.5	1.34	1.03
PRI 1	11	13.5	10.1	75.9	5.7	7.2	276.0	1.29	1.10
PRI 5	12	13.4	9.7	86.1	4.0	7.4	138.0	0.66	1.29
SHE 1	12	12.1	10.4	75.0	5.1	7.2	103.0	1.39	0.88
SHE 10	12	12.3	10.3	78.5	5.5	7.2	180.0	1.39	1.09

Table 6.
Water Quality Criteria Exceedances for Monthly Instream Sites (RY 2012/13)

Station	Number of Samples	DO	pH	E. Coli			Copper		Lead		Zinc	
				Total #	Dry ²	Rain ³	Total	Dissolved	Total	Dissolved	Total	Dissolved
BAT 1	12	3	2	3	1	2						
BAT 12	12	3	2	1	0	1						
CGT 1	12	4	0	1	1	0						
CGT 5	12	4	0	3	2	1						
CLA 1	12	0	0	6	3	3	1	0	0	0	1	1
CLA 10	12	0	1	5	2	3	0	0	0	0	0	0
CRO 1	12	2	0	1	0	1						
CRO 10	11	1	1	1	1	0						
GIB 1	12	5 ¹	0	0	0	0						
GIB 15	12	5 ¹	0	3	2	1						
GLE 1	12	5	0	2	1	1						
GLE 10	11	6	0	1	1	0						
LPW 1	9	3	0	4	2	2						
MIC 1	12	4	2	4	2	2						
MIC 10	12	3	0	3	0	3						
MRA 1	12	NA	0	4	3	1						
MRA 10	12	NA	1	5	3	2						
PRI 1	11	2	0	4	2	2	1	0	0	0	1	0
PRI 5	12	3	0	3	2	1	0	0	0	0	0	0
SHE 1	12	3	0	3	1	2						
SHE 10	12	3	2	3	1	2						

Note: Copper, lead, and zinc collected at Pringle Creek Watershed sites only (PRI1, PRI5, CLA1, and CLA10).

NA = Not available (City staff was unable to find dissolved oxygen water quality criteria associated with this waterbody)

¹ City staff was unable to find year-round dissolved oxygen water quality criteria associated with this waterbody.

² Dry is < 0.05 inches of rainfall in previous 24 hours.

³ Rain is ≥ 0.05 inches of rainfall in previous 24 hours.

Table 7.
Monthly Instream Data (RY 2012/13)

Site Name: BAT1									
Site Description: Commercial St									
Collection Date/Time	Temp (C)	DO (mg/L)	Sp Cond (µS/cm)	Turb (NTUs)	pH (S.U.)	E-Coli (MPN/ 100 mL)	NO2&NO3 (mg/L)	BOD (mg/L)	Rainfall previous 24 hrs
7/17/2012 11:20	18	8.75	50.4	8.5	7.21	727	0.5	0.67	0
8/21/2012 13:45	20.4	4.48	55.7	17.7	6.72	291	0.5	1.06	0
9/18/2012 10:35	14.5	7.63	58.4	13.1	7.11	345	0.4	1.11	0
10/16/2012 11:15	14.6	8.26	55.3	12.7	7.12	488	0.82	1.76	0.98
11/13/2012 11:10	11.5	9.48	52.2	8	7.16	152	0.7	1.18	0.04
12/11/2012 10:42	10	10.21	45.8	7.9	7.4	39	1.45	0.71	0
1/22/2013 11:26	4.6	12	44.3	7.5	7.21	39	1.21	1.05	0
2/19/2013 11:45	7.4	11.2	44.2	6.41	6.6	66	1.21	0.77	0.05
3/19/2013 11:35	7.7	11.27	44.1	7.42	6.42	64	0.95	1.27	0
4/16/2013 11:40	9.4	10.74	45	4.55	6.62	25	0.79	0.96	0.01
5/28/2013 11:35	13.4	9.14	47.2	9.15	6.46	866	0.72	0.94	0.12
6/18/2013 10:10	14.5	8.51	49.7	12.9	6.72	192	0.56	1.06	0
Median	12.45	9.31	48.5	8.25	6.92	172	0.76	1.06	

Site Name: BAT12									
Site Description: Rees Hill Rd.									
Collection Date/Time	Temp (C)	DO (mg/L)	Sp Cond (µS/cm)	Turb (NTUs)	pH (S.U.)	E-Coli (MPN/ 100 mL)	NO2&NO3 (mg/L)	BOD (mg/L)	Rainfall previous 24 hrs
7/17/2012 10:50	17.3	8.77	45.3	7.9	7.23	144	0.18	0.59	0
8/21/2012 11:40	17.2	6.94	56.1	11	6.96	172	0.16	0.95	0
9/18/2012 10:20	13.4	7.74	57.6	9.9	7.1	82	0.13	1.01	0
10/16/2012 11:00	13.4	8.67	58.1	12.4	7	866	0.29	1.98	0.98
11/13/2012 10:50	10.4	10.15	43.9	7	7.37	205	0.47	1.06	0.04
12/11/2012 10:30	9.6	10.28	42.2	4.4	7.31	11	1.39	0.5	0
1/22/2013 11:07	4.7	12.11	41.1	3.8	7.36	4	1.26	1.24	0
2/19/2013 11:25	7	11.31	40.6	4.17	6.49	8	1.23	0.9	0.05
3/19/2013 11:20	7.4	11.39	40.5	3.87	6.41	8	1.01	1.2	0
4/16/2013 11:30	8.9	10.84	40.2	4.34	6.73	35	0.76	0.6	0.01
5/28/2013 11:10	12.5	9.6	42.3	8.21	6.61	276	0.5	0.78	0.12
6/18/2013 9:50	14.6	8.93	44.4	6.81	6.76	47	0.33	0.83	0
Median	11.45	9.88	43.10	6.91	6.98	64.5	0.49	0.93	

Site Name: CGT1									
Site Description: Mainline Dr S									
Collection Date/Time	Temp (C)	DO (mg/L)	Sp Cond (µS/cm)	Turb (NTUs)	pH (S.U.)	E-Coli (MPN/ 100 mL)	NO2&NO3 (mg/L)	BOD (mg/L)	Rainfall previous 24 hrs
7/17/2012 13:50	23.6	11.18	230	4.8	7.22	161	0.17	1.59	0
8/21/2012 14:50	23.1	11.51	244	5.9	7.56	921	0.08	1.92	0
9/18/2012 13:15	19	7.01	238	55.3	7.11	345	0.08	1.74	0
10/16/2012 13:40	16.7	7.49	97.2	9	7.05	308	0.15	2.49	0.83
11/13/2012 13:55	11.4	6.05	132.8	13.5	6.85	313	0.22	2.32	0.02
12/11/2012 13:45	9.4	8.28	170.7	13.7	7.04	291	0.7	1.94	0
1/22/2013 14:00	5.1	10.02	211.7	6.2	6.72	46	0.77	1.91	0
2/19/2013 14:45	8.8	12.79	210.8	5.63	7.34	11	0.63	2.41	0.03
3/19/2013 13:35	9.9	10.27	203.8	5.82	7.19	144	0.67	1.83	0
4/16/2013 13:30	13.1	9.42	180.4	7.03	7.4	89	0.42	1.86	0.01
5/28/2013 13:30	17	9.14	139.6	8.16	7.39	248	0.23	1.76	0.06
6/18/2013 12:30	21	8.89	224	5.76	8.02	32	0.14	2.9	0
Median	14.90	9.28	207.30	6.62	7.21	204.5	0.23	1.92	

Note: Data in red exceed applicable water quality criteria (see Table 4).

Table 7.
Monthly Instream Data (RY 2012/13)

Site Name: CGT5									
Site Description: Hawthorne Ave									
Collection Date/Time	Temp (C)	DO (mg/L)	Sp Cond (µS/cm)	Turb (NTUs)	pH (S.U.)	E-Coli (MPN/ 100 mL)	NO2&NO3 (mg/L)	BOD (mg/L)	Rainfall previous 24 hrs
7/17/2012 13:30	19.1	1.76	172.7	13	7.01	58	0.05	1.6	0
8/21/2012 14:40	20.1	3.72	129.9	13.7	7.02	172	0.05	1.75	0
9/18/2012 13:00	15.9	2.52	117.1	19.4	7.18	2420	0.07	2.04	0
10/16/2012 13:30	15.8	6.73	55.5	10.8	6.86	579	0.27	2.41	0.83
11/13/2012 13:35	10.6	7.97	95.5	11.9	7.14	866	0.76	1.78	0.02
12/11/2012 13:25	9.9	9.65	149.1	32.7	7.02	326	1.09	3.92	0
1/22/2013 13:43	3	11.39	193.2	15.3	6.89	206	0.56	1.99	0
2/19/2013 14:30	7.7	11.2	191.4	11.4	7.39	58	0.6	9.59	0.03
3/19/2013 13:20	8.1	11.06	279	10.9	7.36	119	0.14	1.68	0
4/16/2013 13:20	11.5	10.01	184.7	7.21	7.41	89	0.28	1.43	0.01
5/28/2013 13:10	15.2	7.9	104.4	12.1	7.15	261	0.28	1.47	0.06
6/18/2013 12:10	17.3	5.88	137.4	15.8	7.43	204	0.18	1.49	0
Median	13.35	7.94	143.25	12.55	7.15	205	0.28	1.77	

Site Name: CLA1																
Site Description: Bush Park																
Collection Date/Time	Temp (C)	DO (mg/L)	Sp Cond (µS/cm)	Turb (NTUs)	pH (S.U.)	E-Coli (MPN/ 100 mL)	NO2&NO3 (mg/L)	BOD (mg/L)	Rainfall previous 24 hrs	Total Copper (mg/L)	Dissolved Copper (mg/L)	Total Lead (mg/L)	Dissolved Lead (mg/L)	Total Zinc (mg/L)	Dissolved Zinc (mg/L)	Hardness
7/17/2012 14:30	17.4	9.44	87.4	5.4	7.67	291	0.71	0.76	0	0.0041	0.003	<0.0005	<0.0005	0.0049	0.0036	28
8/21/2012 11:30	17.6	9.29	91.2	4.3	7.44	55	0.61	1.21	0	<0.0025	<0.0025	<0.001	<0.001	0.0048	0.0047	26
9/18/2012 10:45	15.6	9.31	86.3	4.9	7.43	308	0.08	1.06	0	<0.0025	<0.0025	0.001	<0.001	0.0053	0.0044	26
10/16/2012 11:15	15.2	9.43	87.1	7.7	6.84	980	1.04	1.4	0.98	0.0063	0.0044	<0.0005	<0.0005	0.0181	0.0095	30
11/13/2012 12:00	13	10.21	91	3.8	7.66	1414	1.18	1.26	0.04	<0.0025	<0.0025	<0.001	<0.001	0.0132	0.0093	27
12/11/2012 10:40	11.2	10.45	96.2	2.4	7.34	248	1.4	0.63	0	0.0026	<0.0025	<0.0005	<0.0005	0.0084	0.0075	30
1/22/2013 13:45	6.6	11.92	90.2	19	7.21	548	1.07	1.22	0	<0.0025	<0.0025	0.0009	0.0007	0.0094	0.0086	26
2/19/2013 10:55	8.4	11.44	89.5	2.65	6.91	980	1.16	0.94	0.05	<0.0025	<0.0025	<0.0005	<0.0005	0.3229	0.287	29
3/19/2013 10:35	9	11.35	87.9	3.93	7.24	199	0.98	4.36	0	<0.0025	<0.0025	<0.0005	<0.0005	0.0112	0.0092	28
4/16/2013 10:40	10.4	11.01	88	2.42	7.25	84	0.95	1.14	0.01	<0.0025	<0.0025	<0.0005	<0.0005	0.016	0.0096	27
5/28/2013 11:15	13.9	9.64	86.7	5.07	7.27	1300	0.9	2.09	0.12	<0.0025	<0.0025	<0.0005	<0.0005	0.0115	0.0093	27
6/18/2013 10:25	14.9	9.55	89.5	3	7.16	2420	0.74	1.11	0	<0.0025	<0.0025	<0.0005	<0.0005	0.012	0.0084	29
Median	13.45	9.93	88.75	4.12	7.26	428	0.97	1.18						0.0114	0.0089	27.5

Site Name: CLA10																
Site Description: Ewald Ave																
Collection Date/Time	Temp (C)	DO (mg/L)	Sp Cond (µS/cm)	Turb (NTUs)	pH (S.U.)	E-Coli (MPN/ 100 mL)	NO2&NO3 (mg/L)	BOD (mg/L)	Rainfall previous 24 hrs	Total Copper (mg/L)	Dissolved Copper (mg/L)	Total Lead (mg/L)	Dissolved Lead (mg/L)	Total Zinc (mg/L)	Dissolved Zinc (mg/L)	Hardness
7/17/2012 10:00	15.5	9.09	66.4	4.4	7.17	1414	1.36	0.51	0	<0.0025	<0.0025	<0.0005	<0.0005	0.0053	0.0039	18
8/21/2012 10:55	16.6	9.06	66.2	6.8	6.71	1414	1.17	0.62	0	<0.0025	<0.0025	<0.0005	<0.0010	0.004	0.0052	19
9/18/2012 9:40	15.2	9.02	65.8	5.4	7.33	1300	1.12	1.07	0	<0.0025	<0.0025	<0.0005	<0.0010	0.0044	0.0038	18
10/16/2012 10:04	15.2	8.81	66	12.6	7.1	1733	1.16	1.6	0.98	<0.0025	<0.0025	0.0006	<0.0005	0.0184	0.015	22
11/13/2012 10:05	13.6	9.4	70.1	3.4	7.06	135	1.44	0.61	0.04	<0.0025	<0.0025	<0.0010	<0.0010	0.0144	0.0118	19
12/11/2012 9:44	12.2	9.76	73.9	5	7.05	99	1.95	0.59	0	<0.0025	<0.0025	0.0005	<0.0005	0.0102	0.0076	23
1/22/2013 10:06	8.6	10.83	68.5	3.1	7.26	50	1.72	1.41	0	<0.0025	<0.0025	<0.0005	<0.0005	0.0148	0.0137	20
2/19/2013 10:20	9.7	10.5	66.8	3.09	6.59	411	1.66	0.86	0.05	<0.0025	<0.0025	0.0005	<0.0005	0.0134	0.0109	23
3/19/2013 9:46	9.9	10.55	66.4	2.79	6.62	225	1.57	0.97	0	<0.0025	<0.0025	<0.0005	<0.0005	0.0085	0.0072	20
4/16/2013 9:50	11	9.88	67.1	5.01	6.6	291	1.44	1.07	0.01	<0.0025	<0.0025	0.0005	<0.0005	0.0124	0.0074	20
5/28/2013 10:15	13.5	9.11	65.3	4.09	6.49	214	1.3	0.69	0.12	<0.0025	<0.0025	<0.0005	<0.0005	0.012	0.0109	19
6/18/2013 9:00	14.2	8.6	68.6	3.82	6.67	76	1.41	1.05	0	<0.0025	<0.0025	<0.0005	<0.0005	0.0082	0.007	23
Median	13.55	9.26	66.60	4.25	6.88	258	1.43	0.92						0.0111	0.0075	20

Note: Data in red exceed applicable water quality criteria (see Table 4). Medians not calculated for copper and lead due to the large number of censored values.

Table 7.
Monthly Instream Data (RY 2012/13)

Site Name: CRO1 Site Description: River Rd S									
Collection Date/Time	Temp (C)	DO (mg/L)	Sp Cond (µS/cm)	Turb (NTUs)	pH (S.U.)	E-Coli (MPN/ 100 mL)	NO2&NO3 (mg/L)	BOD (mg/L)	Rainfall previous 24 hrs
7/17/2012 10:15	16.1	8.48	89.3	4.7	7.2	387	0.32	0.59	0
8/21/2012 11:10	16.7	7.37	94.1	5.3	7.01	225	0.31	1.04	0
9/18/2012 9:55	13.8	6.91	96.3	6.1	7.14	345	0.29	1.24	0
10/16/2012 10:20	13.8	8.7	84.8	120	7.07	1046	0.69	2.1	0.98
11/13/2012 10:20	10.5	10.24	78.2	6.1	7.31	45	0.6	1.27	0.04
12/11/2012 10:00	9.7	10.72	60.1	5.8	7.35	153	1.13	0.65	0
1/22/2013 10:24	3.6	12.76	63.5	4	7.32	18	0.98	1.59	0
2/19/2013 10:40	6.6	11.77	68.4	5.08	6.94	14	0.91	0.9	0.05
3/19/2013 10:09	6.8	11.78	62.6	13.4	6.84	228	0.7	1.62	0
4/16/2013 10:05	8.4	11.02	65.15	5.09	7.01	142	0.54	0.97	0.01
5/28/2013 10:35	12.9	9.62	71.2	11.2	7.11	248	0.4	0.64	0.12
6/18/2013 9:15	14.15	8.57	80.3	4.82	7.11	365	0.35	1.08	0
Median	11.70	9.93	74.70	5.55	7.11	226.5	0.57	1.06	

Site Name: CRO10 Site Description: Ballantyne Rd.									
Collection Date/Time	Temp (C)	DO (mg/L)	Sp Cond (µS/cm)	Turb (NTUs)	pH (S.U.)	E-Coli (MPN/ 100 mL)	NO2&NO3 (mg/L)	BOD (mg/L)	Rainfall previous 24 hrs
7/17/2012 10:35	15.5	8.55	58.5	12.6	7.22	68	0.33	0.59	0
8/21/2012 11:25	Dry, no sample								0
9/18/2012 10:10	13.3	8.12	71.2	11.6	7.05	54	0.25	1.13	0
10/16/2012 10:40	12.9	8.96	73.6	15.6	7.09	236	0.43	2.02	0.98
11/13/2012 10:35	10.4	9.52	51.8	7.1	7.19	39	0.5	0.98	0.04
12/11/2012 10:14	9.4	10.26	46.8	5.1	7.45	8	1.17	0.5	0
1/22/2013 10:45	4.1	12.13	46.1	4.2	7.14	7	1.1	1.57	0
2/19/2013 11:05	6.7	11.07	46.3	4.97	6.39	1	1.09	1.22	0.05
3/19/2013 10:50	7.3	11.05	46.4	5.85	6.55	34	0.74	1.26	0
4/16/2013 10:50	9.2	10.32	46.95	6.47	6.59	6	0.51	0.79	0.01
5/28/2013 10:50	12.6	9.28	49.8	11.6	6.66	34	0.26	0.75	0.12
6/18/2013 9:35	13.1	8.56	55.9	7.93	6.81	727	0.3	0.84	0
Median	10.40	9.52	49.80	7.10	7.05	34	0.50	0.98	

Site Name: GIB1 Site Description: Wallace Rd.									
Collection Date/Time	Temp (C)	DO (mg/L)	Sp Cond (µS/cm)	Turb (NTUs)	pH (S.U.)	E-Coli (MPN/ 100 mL)	NO2&NO3 (mg/L)	BOD (mg/L)	Rainfall previous 24 hrs
7/17/2012 10:30	16.9	7.39	99.2	10.1	7.68	260	1.25	1.23	0
8/21/2012 13:50	20	7.08	108.9	7.3	7.28	152	0.35	1.06	0
9/18/2012 12:40	16.7	6.88	109.4	13.3	7.29	326	0.37	1.17	0
10/16/2012 12:45	14.5	7.93	101.9	11.6	7.11	313	0.87	1.85	0.64
11/13/2012 13:20	10.9	9.87	95.3	8.8	7.36	119	0.84	1.92	0
12/11/2012 11:20	9.4	10.68	77.3	9.1	7.12	37	1.88	0.61	0
1/22/2013 14:50	4.1	12.2	83	15.7	7.25	55	1.81	1.34	0
2/19/2013 13:05	7.1	11.33	82.1	6.35	7.2	23	1.64	0.96	0.04
3/19/2013 12:50	7.8	11.25	84	6.05	7.15	33	1.44	1.11	0
4/16/2013 12:00	10.8	10.66	82.6	5.82	7.26	28	1.3	0.97	0
5/28/2013 12:45	14.2	9.21	94.2	8.28	7.24	126	0.92	0.85	0.1
6/18/2013 12:00	15.6	8.03	98.9	6	7.07	77	0.72	1.21	0
Median	12.55	9.54	94.75	8.54	7.25	98	1.09	1.14	

Note: Data in red exceed applicable water quality criteria (see Table 4).

Table 7.
Monthly Instream Data (RY 2012/13)

Site Name: GIB15									
Site Description: Brush College Rd.									
Collection Date/Time	Temp (C)	DO (mg/L)	Sp Cond (µS/cm)	Turb (NTUs)	pH (S.U.)	E-Coli (MPN/ 100 mL)	NO2&NO3 (mg/L)	BOD (mg/L)	Rainfall previous 24 hrs
7/17/2012 11:00	16.1	8.98	71.5	7.4	7.05	276	1.63	0.76	0
8/21/2012 14:00	20	7.51	120.8	79	7.4	2420	1.15	3.87	0
9/18/2012 12:50	16.6	8.42	118.4	13.9	7.5	2420	1.32	1.24	0
10/16/2012 13:00	14.6	9.04	110.7	10.3	7.26	816	1.87	2.03	0.64
11/13/2012 13:40	10.6	9.8	101.6	4.7	7.2	238	1.7	1.08	0
12/11/2012 11:30	9.9	10.58	84.7	8.4	7.25	88	2.41	0.51	0
1/22/2013 15:10	4.8	11.99	92.2	11.6	6.9	34	2.75	1.26	0
2/19/2013 13:20	8.1	11.15	89	5.57	6.98	11	2.65	2.74	0.04
3/19/2013 13:05	8.4	11.21	89	5.77	7.38	4	2.27	1.3	0
4/16/2013 12:30	11.4	10.74	85.5	6.65	7.01	18	2.04	0.72	0
5/28/2013 13:00	14.5	9.42	97.2	8.69	7.25	59	1.99	0.81	0.1
6/18/2013 12:15	17	8.75	103.9	6	6.97	285	2.18	1	0
Median	12.95	9.61	94.70	7.90	7.23	163	2.02	1.16	

Site Name: GLE1									
Site Description: River Bend Rd.									
Collection Date/Time	Temp (C)	DO (mg/L)	Sp Cond (µS/cm)	Turb (NTUs)	pH (S.U.)	E-Coli (MPN/ 100 mL)	NO2&NO3 (mg/L)	BOD (mg/L)	Rainfall previous 24 hrs
7/17/2012 10:15	17.8	9.02	115	8.5	7.61	185	1.6	1.24	0
8/21/2012 13:30	19.3	7.89	122.2	7.9	7.36	727	0.63	1.2	0
9/18/2012 12:30	16	7.73	126.7	9.1	7.3	326	0.5	1.25	0
10/16/2012 12:30	15.4	9.01	94.2	13.2	7.07	866	0.8	1.72	0.64
11/13/2012 13:00	11.7	10.03	106.3	5.5	7.35	91	0.95	1.14	0
12/11/2012 11:00	10.3	10.58	84.6	6	7.34	61	1.77	0.76	0
1/22/2013 14:40	4.7	12.3	90.3	5.1	7.15	52	1.47	1.45	0
2/19/2013 12:50	7.9	11.22	91.6	6.06	6.92	328	1.4	1.13	0.04
3/19/2013 12:25	8.3	11.31	93	7.36	7.19	178	1.2	1.38	0
4/16/2013 11:20	9.5	10.89	94.1	4.48	7.25	178	1.15	1.35	0
5/28/2013 12:30	13.7	9.53	104.5	6.89	7.37	140	0.93	0.86	0.1
6/18/2013 11:45	16.1	8.38	110.5	7	7.07	236	0.79	1.25	0
Median	12.70	9.78	99.35	6.95	7.28	181.5	1.05	1.25	

Site Name: GLE10									
Site Description: Hidden Valley Dr.									
Collection Date/Time	Temp (C)	DO (mg/L)	Sp Cond (µS/cm)	Turb (NTUs)	pH (S.U.)	E-Coli (MPN/ 100 mL)	NO2&NO3 (mg/L)	BOD (mg/L)	Rainfall previous 24 hrs
7/17/2012 11:30	16.5	9.55	70	4	7.31	276	1.62	0.81	0
8/21/2012 14:20	17.2	7.77	96.4	9.2	7.29	517	0.16	1.28	0
9/18/2012 13:10	Dry, no sample								0
10/16/2012 13:30	14.5	9.16	85.3	8.1	7.05	124	0.1	1.69	0.64
11/13/2012 13:50	11	10.18	69.1	3.1	7.27	26	1.05	0.8	0
12/11/2012 11:45	9.7	10.67	56.3	6.1	7.35	33	1.67	0.65	0
1/22/2013 15:20	5	12	55.9			5	1.51	1.36	0
2/19/2013 13:35	8.1	11.13	57.2	5.53	7.21	24	1.53	0.84	0.04
3/19/2013 13:20	8.2	11.23	58.3	6.22	7.32	8	1.23	1.13	0
4/16/2013 12:45	9.8	10.96	59.3	5.89	7.12	55	1.18	0.8	0
5/28/2013 13:25	12.3	10.08	68.2	6.31	7.35	93	0.68	1.19	0.1
6/18/2013 12:35	13.1	9.8	72	7	7.3	81	0.62	1.12	0
Median	11.00	10.18	68.20	6.16	7.30	55	1.18	1.12	

Note: Data in red exceed applicable water quality criteria (see Table 4).

Table 7.
Monthly Instream Data (RY 2012/13)

Site Name: LPW1										
Site Description: Cordon Rd.										
Collection Date/Time	Temp (C)	DO (mg/L)	Sp Cond (µS/cm)	Turb (NTUs)	pH (S.U.)	E-Coli (MPN/ 100 mL)	NO2&NO3 (mg/L)	BOD (mg/L)	Rainfall previous 24 hrs	TSS
7/17/2012 13:10									0	
8/21/2012 14:25									0	
9/18/2012 11:30									0	
10/16/2012 13:05	16	6.35	55.8	5.1	6.5	1120	0.19	2.89	0.83	3
11/13/2012 13:15	12.4	7.48	119.2	10.1	6.94	276	0.74	1.27	0.02	18
12/11/2012 13:10	9.5	9.07	197.2	7.4	7.06	86	2.04	0.88	0	6
1/22/2013 13:20	4.6	12.93	238	84.2	7.04	107	1.46	2.17	0	133
2/19/2013 14:15	8.7	12.96	245	25.9	7.35	687	1.04	1.38	0.03	
3/19/2013 13:02	9.2	11.8	230	14.2	7.21	649	0.62	1.71	0	17.6
4/16/2013 12:40	11.7	12.38	204.5	10.2	7.37	134	0.56	1.25	0.01	11.2
5/28/2013 12:20	14.9	6.28	91.5	8.95	6.74	2420	0.17	1.23	0.06	6
6/18/2013 11:10	15.5	1.29	223	5.71	6.93	130	0.08	1.21	0	4
Median	11.70	9.07	204.50	10.10	7.04	276	0.62	1.27		8.60

Site Name: MIC1										
Site Description: Front St.										
Collection Date/Time	Temp (C)	DO (mg/L)	Sp Cond (µS/cm)	Turb (NTUs)	pH (S.U.)	E-Coli (MPN/ 100 mL)	NO2&NO3 (mg/L)	BOD (mg/L)	Rainfall previous 24 hrs	
7/17/2012 9:30	18.4	8.95	51.7	8	7.22	156	0.2	0.65	0	
8/21/2012 10:10	19.1	8.98	50.5	5.6	6.18	276	0.18	0.89	0	
9/18/2012 9:30	15.6	9.52	48.4	4.1	7.15	308	0.1	0.9	0	
10/16/2012 9:35	14.4	9.71	73.7	9.2	7.34	866	1.12	1.78	0.83	
11/13/2012 9:40	10.8	10.67	112.7	21	6.98	2420	3.66	1.76	0.02	
12/11/2012 9:20	10	10.78	88.5	5.5	7.12	68	2.74	0.68	0	
1/22/2013 9:30	3.2	13.05	95	3	7.25	86	2.03	1.44	0	
2/19/2013 9:45	6.9	12.13	84.8	3.74	6.43	114	2.04	1.03	0.03	
3/19/2013 9:20	8.6	11.43	90.3	4.17	7.22	276	1.34	1.3	0	
4/16/2013 9:20	11.1	10.45	86.8	6.07	7.51	91	1.25	1.19	0.01	
5/28/2013 9:56	14.2	9.4	70.3	19.4	6.96	579	1.37	1.33	0.06	
6/18/2013 8:30	17.6	8.83	55.1	7.37	7.22	517	0.4	1.06	0	
Median	12.65	10.08	79.25	5.84	7.19	276	1.30	1.13		

Site Name: MIC10										
Site Description: Turner Rd										
Collection Date/Time	Temp (C)	DO (mg/L)	Sp Cond (µS/cm)	Turb (NTUs)	pH (S.U.)	E-Coli (MPN/ 100 mL)	NO2&NO3 (mg/L)	BOD (mg/L)	Rainfall previous 24 hrs	
7/17/2012 11:40	18.5	9.39	49.5	5.6	7.21	172	0.17	0.73	0	
8/21/2012 14:10	20	9.71	48.9	5.3	7.42	24	0.17	1.01	0	
9/18/2012 10:55	14.3	9.93	45.4	5.8	7.24	155	0.09	1.04	0	
10/16/2012 11:35	14.5	9.17	88.7	14.6	7.13	461	2.31	1.84	0.82	
11/13/2012 11:25	10.8	10.1	110.7	17.2	7.01	770	3.76	1.69	0.07	
12/11/2012 11:04	9.3	10.42	82.9	5.9	7.3	36	2.87	0.71	0.03	
1/22/2013 11:48	3.2	12.92	76.7	5.2	7.16	225	2.08	1.33	0	
2/19/2013 13:55	8.2	11.85	74.5	5.83	7.02	19	2.08	0.96	0.05	
3/19/2013 12:40	8.1	11.71	71	5.37	7.22	98	1.36	1.56	0	
4/16/2013 12:20	10	11.25	76.4	6.17	7.36	79	1.37	1.15	0.13	
5/28/2013 12:00	13.3	9.73	68.9	18.8	7.05	411	1.48	1.06	0.16	
6/18/2013 10:45	16.3	9.35	52	6.25	7.23	184	0.3	1.01	0	
Median	12.05	10.02	72.75	5.87	7.22	163.5	1.43	1.05		

Note: Data in red exceed applicable water quality criteria (see Table 4).

Table 7.
Monthly Instream Data (RY 2012/13)

Site Name: MRA1									
Site Description: High St.									
Collection Date/Time	Temp (C)	DO (mg/L)	Sp Cond (µS/cm)	Turb (NTUs)	pH (S.U.)	E-Coli (MPN/ 100 mL)	NO2&NO3 (mg/L)	BOD (mg/L)	Rainfall previous 24 hrs
7/17/2012 15:00	17.9	9.36	49.3	6.4	6.89	32	0.2	0.5	0
8/21/2012 11:00	19.4	9.31	50.6	4	7.4	206	0.17	0.86	0
9/18/2012 10:20	16	9.63	48	3.5	7.39	201	0.08	0.89	0
10/16/2012 10:30	14.3	9.43	71.1	9.5	7.15	387	1.06	1.77	0.83
11/13/2012 10:20	10.5	10.57	114.9	21.3	7.18	1414	3.3	1.64	0.02
12/11/2012 10:00	9.6	11.09	88.3	5.8	7.18	172	2.64	0.64	0
1/22/2013 13:15	3.6	12.99	84.5	5.5	7.2	435	2.1	1.9	0
2/19/2013 10:25	6.6	12.13	83.2	4.36	7.18	102	2.02	0.77	0.03
3/19/2013 10:10	8.4	11.4	95.7	8.01	7.32	1733	1.33	3.26	0
4/16/2013 10:15	10.4	11.58	85.4	4.88	7.23	145	1.26	1.13	0.01
5/28/2013 10:50	13.7	10.16	71.4	22.8	7.36	866	1.27	1.2	0.06
6/18/2013 9:52	17.4	9.45	54.7	7	7.29	276	0.33	1.07	0
Median	12.10	10.37	77.30	6.10	7.22	241	1.27	1.10	

Site Name: MRA10									
Site Description: 19th St.									
Collection Date/Time	Temp (C)	DO (mg/L)	Sp Cond (µS/cm)	Turb (NTUs)	pH (S.U.)	E-Coli (MPN/ 100 mL)	NO2&NO3 (mg/L)	BOD (mg/L)	Rainfall previous 24 hrs
7/17/2012 9:40	18.6	8.8	48.8	5.9	6.68	119	0.2	0.67	0
8/21/2012 10:20	18.8	9	51.5	4.1	6.56	228	0.18	0.9	0
9/18/2012 9:30	15.2	9.18	48.7	4.9	7.09	308	0.08	0.93	0
10/16/2012 9:30	14.3	9.08	75	10.3	6.91	770	1.14	1.95	0.83
11/13/2012 9:30	10.8	10.37	114.8	20.1	7.24	1203	3.76	1.77	0.02
12/11/2012 9:25	9.7	10.73	88.2	5.5	7.17	58	2.73	0.58	0
1/22/2013 11:45	3	12.82	85	4.9	6.3	488	2.09	1.96	0
2/19/2013 9:41	6.3	12.04	79.7	5.03	7.31	56	2.1	0.79	0.03
3/19/2013 9:25	8.3	10.24	93.4	7.28	7.27	1414	1.41	2.84	0
4/16/2013 9:30	10	10.7	85.5	5.7	7.39	116	1.31	1.05	0.01
5/28/2013 10:00	13.5	9.78	71.7	22.8	7.25	1300	1.36	1.16	0.06
6/18/2013 8:50	17	8.99	54.9	8	7.08	291	0.26	1	0
Median	12.15	10.01	77.35	5.80	7.13	299.5	1.34	1.03	

Site Name: PRI1																
Site Description: Waterfront Park																
Collection Date/Time	Temp (C)	DO (mg/L)	Sp Cond (µS/cm)	Turb (NTUs)	pH (S.U.)	E-Coli (MPN/ 100 mL)	NO2&NO3 (mg/L)	BOD (mg/L)	Rainfall previous 24 hrs	Total Copper (mg/L)	Dissolved Copper (mg/L)	Total Lead (mg/L)	Dissolved Lead (mg/L)	Total Zinc (mg/L)	Dissolved Zinc (mg/L)	Hardness
7/17/2012 9:55	18.9	9.29	55.5	4.9	6.69	143	0.21	0.64	0	<0.0025	<0.0025	<0.0005	<0.0005	0.0046	<0.0025	37
8/21/2012 10:40	19	9.27	58.2	2.8	7.37	93	0.16	0.74	0	<0.0025	<0.0025	<0.0010	<0.0010	<0.0025	0.0037	21
9/18/2012 10:00	15.4	9.76	50.5	5.7	7.31	276	0.1	0.96	0	<0.0025	<0.0025	<0.0010	<0.0010	0.0041	0.0034	17
10/16/2012 9:40	14.5	9.76	75.9	11.7	7.1	816	1.13	2.02	0.98	0.0028	<0.0025	<0.0005	<0.0005	0.009	0.0054	32
11/13/2012 10:00	10.8	10.71	112.6	17.2	7.2	1120	3.35	1.71	0.04	0.003	0.0027	<0.0010	<0.0010	0.0096	0.007	39
12/11/2012 9:50	Flooded, unable to access site								0	Flooded, unable to access site						
1/22/2013 12:10	3.3	13.1	82.5	4.1	6.95	411	2.04	1.9	0	<0.0025	<0.0025	<0.0005	<0.0005	<0.0025	<0.0025	28
2/19/2013 10:02	6.6	12.16	81.7	4.67	7	35	1.99	0.96	0.05	<0.0025	<0.0025	<0.0005	<0.0005	0.0094	0.0063	27
3/19/2013 9:45	8.3	11.56	84.5	6.02	7.22	365	1.36	2.03	0	0.0048	0.0042	<0.0005	<0.0005	0.0059	0.0029	26
4/16/2013 9:55	10	11.23	84.8	5.24	7.26	76	1.29	1.1	0.01	<0.0025	<0.0025	<0.0005	<0.0005	0.0053	0.0035	32
5/28/2013 10:25	13.5	10.1	72.1	21.4	7.34	816	1.36	1.19	0.12	0.0067	<0.0025	<0.0005	<0.0005	0.023	0.0058	27
6/18/2013 9:25	17	9.52	58	6	7.1	272	0.35	1.06	0	<0.0025	<0.0025	<0.0005	<0.0005	0.064	0.0029	21
Median	13.50	10.10	75.90	5.70	7.20	276	1.29	1.10						0.0090	0.0037	27

Note: Data in red exceed applicable water quality criteria (see Table 4). Medians not calculated for copper and lead due to the large number of censored values.

Table 7.
Monthly Instream Data (RY 2012/13)

Site Name: PRI5 Site Description: Bush Park																
Collection Date/Time	Temp (C)	DO (mg/L)	Sp Cond (µS/cm)	Turb (NTUs)	pH (S.U.)	E-Coli (MPN/ 100 mL)	NO2&NO3 (mg/L)	BOD (mg/L)	Rainfall previous 24 hrs	Total Copper (mg/L)	Dissolved Copper (mg/L)	Total Lead (mg/L)	Dissolved Lead (mg/L)	Total Zinc (mg/L)	Dissolved Zinc (mg/L)	Hardness
7/17/2012 14:45	17.2	9.06	74.4	3.7	7.22	345	0.25	0.92	0	0.0049	0.0038	<0.0005	<0.0005	0.0059	0.0026	27
8/21/2012 11:40	19.4	8.75	85.4	2.9	7.5	313	0.24	1.11	0	<0.0025	<0.0025	<0.0010	<0.0010	<0.0025	<0.0025	29
9/18/2012 10:50	16.7	8.88	86.8	3.9	7.42	488	0.09	1.39	0	<0.0025	<0.0025	<0.0010	<0.0010	0.0036	0.003	28
10/16/2012 11:00	15.5	8.67	65.6	8.8	7.05	816	0.35	2.25	0.98	0.0025	<0.0025	<0.0005	<0.0005	0.0148	0.0101	28
11/13/2012 11:40	12	9.74	94.8	6.8	7.53	128	0.77	1.3	0.04	<0.0025	<0.0025	<0.0010	<0.0010	0.0102	0.0081	35
12/11/2012 10:30	10.3	10.4	86.3	4.6	7.35	46	1.39	0.76	0	<0.0025	<0.0025	<0.0005	<0.0005	0.0083	0.0064	29
1/22/2013 13:45	4.8	12.61	87.5	4.3	7.39	38	1.28	1.57	0	<0.0025	<0.0025	<0.0005	<0.0005	0.0044	0.0033	31
2/19/2013 11:00	7.4	12.48	89.1	3.53	7.1	82	1.28	1.26	0.05	< 0.0025	< 0.0025	< 0.0005	< 0.0005	0.0095	0.0057	36
3/19/2013 10:50	8.7	11.99	89.3	3.15	7.19	45	0.89	1.25	0	< 0.0025	< 0.0025	< 0.0005	< 0.0005	0.0054	0.0036	32
4/16/2013 10:50	10.5	12.53	85.9	3.8	7.46	37	0.85	1.45	0.01	< 0.0025	< 0.0025	< 0.0005	< 0.0005	0.0053	0.0035	30
5/28/2013 11:25	14.8	9.7	74.7	8.48	7.4	148	0.55	1.27	0.12	< 0.0025	< 0.0025	< 0.0005	< 0.0005	0.0095	0.0054	26
6/18/2013 10:35	17.7	8.98	84.7	4	7.14	579	0.41	1.38	0	< 0.0025	< 0.0025	< 0.0005	< 0.0005	0.0072	0.0051	29
Median	13.40	9.72	86.10	3.95	7.37	138	0.66	1.29						0.0072	0.0051	29

Site Name: SHE1 Site Description: Church St.									
Collection Date/Time	Temp (C)	DO (mg/L)	Sp Cond (µS/cm)	Turb (NTUs)	pH (S.U.)	E-Coli (MPN/ 100 mL)	NO2&NO3 (mg/L)	BOD (mg/L)	Rainfall previous 24 hrs
7/17/2012 15:15	19	10.1	56.4	4.2	6.99	33	0.14	0.51	0
8/21/2012 11:15	19.1	9.27	54.3	2.4	7.55	40	0.17	0.71	0
9/18/2012 10:30	15.3	9.67	48.4	4.4	7.41	238	0.09	0.82	0
10/16/2012 10:45	14.4	9.59	78.5	12.5	7.02	816	1.36	1.86	0.98
11/13/2012 11:30	10.9	10.67	114.4	18.4	7.22	1120	3.77	1.49	0.04
12/11/2012 10:15	9.7	10.81	69.9	5.1	7.12	50	2.7	0.63	0
1/22/2013 13:30	3.4	13.11	80.2	3.9	7.5	158	1.99	1.67	0
2/19/2013 10:37	6.6	12.39	80.2	6.14	6.96	24	2.06	0.72	0.05
3/19/2013 10:15	8.2	11.63	79.9	5.19	7.26	121	1.45	1.71	0
4/16/2013 10:25	9.9	11.21	83.9	5.48	7.27	57	1.26	0.93	0.01
5/28/2013 11:00	13.3	9.94	71.4	21.9	7.3	548	1.41	1.09	0.12
6/18/2013 10:07	16.8	9.26	55.7	5	7.19	85	0.28	0.83	0
Median	12.10	10.39	74.95	5.15	7.24	103	1.39	0.88	

Site Name: SHE10 Site Description: Airport Road									
Collection Date/Time	Temp (C)	DO (mg/L)	Sp Cond (µS/cm)	Turb (NTUs)	pH (S.U.)	E-Coli (MPN/ 100 mL)	NO2&NO3 (mg/L)	BOD (mg/L)	Rainfall previous 24 hrs
7/17/2012 9:15	18.7	9.12	52.2	4.9	6.4	194	0.19	0.71	0
8/21/2012 12:00	19.1	9.37	51.5	3.5	7.54	67	0.18	1.08	0
9/18/2012 9:15	15.1	9.69	47.9	6.4	6.98	276	0.08	1.07	0
10/16/2012 9:15	14.4	9.56	78.3	12.8	6.76	435	1.4	1.74	0.98
11/13/2012 11:15	11.2	10.44	113.6	19	7.22	921	3.66	1.45	0.04
12/11/2012 9:15	9.9	10.83	86.5	5.3	6.81	53	2.72	0.69	0
1/22/2013 11:25	3.3	13.02	78.8	4.1	5.12	152	2.04	1.39	0
2/19/2013 9:25	6.6	12.04	79.7	5.03	7.31	44	1.98	0.9	0.05
3/19/2013 9:10	8.1	11.31	78.6	5.96	7.28	166	1.45	1.65	0
4/16/2013 9:15	9.9	11.12	83.1	5.62	7.2	146	1.35	1.1	0.01
5/28/2013 9:45	13.3	10.07	71.7	22.6	7.24	649	1.37	1.23	0.12
6/18/2013 8:35	17	9.26	54.3	5	7.21	308	0.32	1.06	0
Median	12.25	10.26	78.45	5.46	7.21	180	1.39	1.09	

Note: Data in red exceed applicable water quality criteria (see Table 4). Medians not calculated for copper and lead due to the large number of censored values.

Table 7.
Monthly Instream Duplicates (RY 2012/13)

Site ID	Collection Date/Time	Temp (C)	DO (mg/L)	Sp Cond (µS/cm)	Turb (NTUs)	pH (S.U.)	E-Coli (MPN/ 100 mL)	NO2&NO3 (mg/L)	BOD (mg/L)	TSS	Total Copper (mg/L)	Dissolved Copper (mg/L)	Total Lead (mg/L)	Dissolved Lead (mg/L)	Total Zinc (mg/L)	Dissolved Zinc (mg/L)	Hardness
BAT12	07/17/2012 10:50	17.4	8.75	45.3	8.1	7.18	194	0.12	0.61								
GLE10	07/17/2012 11:30	16.5	9.55	70	4	7.31	172	1.63	0.63								
SHE10	08/21/2012 12:00	19.1	9.35	51.4	3.7	7.6	91	0.17	0.91								
BAT1	08/21/2012 13:45	20.4	4.48	55.7	17.7	6.72	238	0.48	1.02								
MRA10	09/18/2012 09:30	15.2	9.18	48.7	4.8	7.1	308	0.09	0.87								
MIC10	09/18/2012 10:55	14.3	9.93	45.5	5.3	7.24	172	0.09	0.99								
PRI1	10/16/2012 09:41	14.6	9.76	76	10.6	7.11	921	1.16	2.07		0.0029	0.0029	<0.0005	<0.0005	0.015	0.0104	33
LPW1	10/16/2012 13:05	16	6.32	55.7	5.1	6.5	727	0.18	2.81	3							
MRA1	11/13/2012 10:00	10.5	10.55	114.8	21.1	7.17	1986	3.23	1.65								
CGT5	11/13/2012 13:35	10.6	7.97	95.7	12.1	7.02	770	0.76	1.57								
SHE1	12/11/2012 10:15	9.7	10.81	69.7	5.1	7.1	34	2.65	0.66								
CGT1	12/11/2012 13:45	9.4	8.28	170.8	13.7	7.02	133	0.71	1.68								
MIC1	01/22/2013 09:30	3.1	13.06	95.1	3	7.25	96	2	1.61								
CLA1	01/22/2013 13:45	6.6	11.9	90.2	18.8	7.31	548	1.12	1.06		<0.0025	<0.0025	0.0009	0.0007	0.0088	0.0091	28
PRI5	02/19/2013 11:00	7.4	12.47	89.1	3.62	6.98	73	1.35	1.13		< 0.0025	< 0.0025	< 0.0005	< 0.0005	0.0095	0.0057	33
CLA10	02/19/2013 13:30	9.7	10.35	66	3.11	6.73	172	1.66	0.59		< 0.0025	< 0.0025	< 0.0005	< 0.0005	0.0106	0.0096	23
CRO1	03/19/2013 10:09	6.8	11.78	62.6	15	6.87	226	0.72	1.15								
GLE1	03/19/2013 12:25	8.3	11.31	93.2	7.9	7.09	210	1.24	0.9								
CRO10	04/16/2013 10:55	8.9	10.44	47	6.53	6.69	4	0.45	0.69								
GIB1	04/16/2013 12:05	10.3	10.95	82.7	6.04	6.75	30	1.28	0.88								
BAT12	05/28/2013 11:15	12.5	9.6	42.3	8.49	6.65	172	0.5	0.57								
GIB15	05/28/2013 13:05	14.5	9.42	97.2	9.49	7.25	68	2	0.85								
BAT1	06/18/2013 10:15	14.6	8.51	49.7	12.9	6.73	225	0.56	0.84								
GLE10	06/18/2013 12:40	13.8	8.93	71.4	7	7.26	56	0.59	0.78								

Note: Duplicate field measurements and duplicate grab samples are taken at 10 percent of the sites each month. These sites are selected prior to sampling.

Table 8.
Continuous Instream Grade A and Grade B Data Qualifications

Grade Values	Temperature (°C)	pH	Specific Conductivity (µS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)
A	$\pm < 0.5$	$\pm \leq 0.30$	$\leq 10\%$	$\pm \leq 3$ or 5% (whichever is greater)	$\pm \leq 0.3$
B	± 0.51 to 2.00	$\pm > 0.3$ to 0.50	$> 10\%$ to $\leq 15\%$	$\pm \leq 5$ or 30% (whichever is greater)	$\pm > 0.3$ to $\pm \leq 1.0$

Note: As stated in the "Continuous Water Quality Monitoring Program Quality Assurance Project Plan", data grades are a result of the absolute difference (value or percent) of station instrument reading and audit instrument reading at the time of site audit.

Table 9.
Monthly Medians Values for Continuous Instream Data (RY 2012/13)

Monthly Medians for **Turbidity** at Continuous Instream Sites

	Jul 2012	Aug 2012	Sep 2012	Oct 2012	Nov 2012	Dec 2012	Jan 2013	Feb 2013	Mar 2013	Apr 2013	May 2013	Jun 2013
Station Name	Turbidity (NTU)	Turbidity (NTU)	Turbidity (NTU)	Turbidity (NTU)	Turbidity (NTU)	Turbidity (NTU)	Turbidity (NTU)	Turbidity (NTU)	Turbidity (NTU)	Turbidity (NTU)	Turbidity (NTU)	Turbidity (NTU)
BAT3	14.05	NA	NA	NA	NA	16.62	11.18	NA	10.63	NA	NA	NA
BAT12	7.76	5.54	5.34	6.76	7.43	8.34	4.96	5.82	7.01	7.68	7.72	7.63
CLK1	NA	NA	6.96	9.57	5.84	11.29	10.72	6.18	6.45	NA	5.05	4.84
CLK12	6.69	7.73	NA	NA	4.38	5.40	5.04	4.95	4.90	4.46	5.48	6.16
GLE3	6.70	7.30	NA	9.35	8.40	9.90	6.30	7.00	7.40	8.20	6.40	6.60
GLE12	4.10	4.40	5.80	5.60	4.60	7.50	4.90	9.10	7.00	5.90	5.20	5.90
MIC3	9.06	7.72	7.43	6.88	8.12	12.80	7.27	10.36	6.91	8.89	11.98	9.67
MIC12	10.21	10.35	7.73	7.22	12.68	12.54	8.79	10.44	8.98	9.34	10.73	10.04
PRI3	5.22	5.54	5.99	8.17	6.82	11.38	6.82	5.78	5.43	NA	5.46	5.28
PRI12	NA	10.80	9.15	9.80	7.86	9.02	8.91	7.37	6.81	11.48	8.70	9.83
SHE3	5.11	3.93	5.07	5.30	6.92	NA	8.84	8.74	8.68	7.14	7.87	9.27

Monthly Medians for **Specific Conductivity** at Continuous Instream Sites

	Jul 2012	Aug 2012	Sep 2012	Oct 2012	Nov 2012	Dec 2012	Jan 2013	Feb 2013	Mar 2013	Apr 2013	May 2013	Jun 2013
Station Name	Specific Conductivity (µS/cm)	Specific Conductivity (µS/cm)	Specific Conductivity (µS/cm)	Specific Conductivity (µS/cm)	Specific Conductivity (µS/cm)	Specific Conductivity (µS/cm)	Specific Conductivity (µS/cm)	Specific Conductivity (µS/cm)	Specific Conductivity (µS/cm)	Specific Conductivity (µS/cm)	Specific Conductivity (µS/cm)	Specific Conductivity (µS/cm)
BAT3	52.4	57.3	59.3	55.1	55.2	45.8	44.4	45	44.8	45.5	48.5	49.4
BAT12	44.4	50.5	52.7	53.5	45.9	43.4	NA	41.9	41.1	40.7	41.2	42.7
CLK1	89.7	90	88.5	88.3	90.3	88.4	89.7	87.6	87.9	89.5	87.5	89.1
CLK12	68.3	67.6	67.3	70.55	67.3	71.2	67.9	65.9	65.8	65.6	64	65.3
GLE3	118	122	124	121	90	80	84	89	87	90	101	111
GLE12	74	101	NA	76	64	58	59	59	59	61	64	72
MIC3	54.1	53	49.6	63.6	96.3	84	82.3	81.3	76.9	79.6	55.7	55.3
MIC12	51.2	51.2	47.4	80.9	96.4	81.8	80.5	79.1	73.7	72.1	53.5	53.5
PRI3	89.1	93.7	96.6	83	89.7	80.5	88.2	91.5	90.8	NA	90	92.9
PRI12	59.4	56.5	51.9	96.5	95.3	75.8	81.2	80.7	81.2	79.2	64.8	63.1
SHE3	57	56.4	49.3	56.2	115.9	119.5	83.9	83.6	79.4	84.9	56	58.7

Presented median values consist of A and B grade data only.

NA = 60% of the continuous record for a given month is not represented by A and B grade data.

Table 9.
Monthly Medians Values for Continuous Instream Data (RY 2012/13)

Monthly Medians for **Temperature** at Continuous Instream Sites

	Jul 2012	Aug 2012	Sep 2012	Oct 2012	Nov 2012	Dec 2012	Jan 2013	Feb 2013	Mar 2013	Apr 2013	May 2013	Jun 2013
Station Name	Temperature (°C)	Temperature (°C)	Temperature (°C)	Temperature (°C)	Temperature (°C)	Temperature (°C)	Temperature (°C)	Temperature (°C)	Temperature (°C)	Temperature (°C)	Temperature (°C)	Temperature (°C)
BAT3	17.26	18.68	15.94	12.82	10.87	9.08	6.70	7.74	9.03	11.01	13.45	15.49
BAT12	16.28	16.55	13.03	10.19	9.74	8.37	5.90	6.93	8.11	10.17	12.52	15.01
CLK1	16.58	17.49	16.00	13.77	12.23	10.51	7.97	8.95	10.21	11.78	13.87	15.17
CLK12	15.08	16.19	15.55	14.81	13.10	11.75	9.95	10.19	10.67	11.49	13.13	14.37
GLE3	16.70	17.41	14.89	12.57	11.01	9.18	6.38	8.05	9.43	11.64	13.67	15.60
GLE12	15.11	15.62	13.33	10.94	10.14	8.56	5.87	7.14	8.33	9.75	11.55	13.42
MIC3	19.05	19.83	15.90	11.61	10.23	7.64	4.55	7.22	8.99	12.16	14.37	17.08
MIC12	19.16	19.54	15.52	11.43	10.38	7.85	5.30	7.44	8.96	11.46	13.56	16.30
PRI3	18.75	18.62	16.48	13.51	13.54	8.99	6.50	8.09	9.71	NA	16.08	17.22
PRI12	18.63	19.22	15.62	12.56	11.10	9.04	6.45	7.82	9.36	11.34	13.90	16.58
SHE3	19.22	19.60	15.46	11.76	10.93	NA	5.41	7.46	9.07	12.23	14.02	16.98

Monthly Medians for **pH** at Continuous Instream Sites

	Jul 2012	Aug 2012	Sep 2012	Oct 2012	Nov 2012	Dec 2012	Jan 2013	Feb 2013	Mar 2013	Apr 2013	May 2013	Jun 2013
Station Name	pH	pH	pH	pH	pH	pH	pH	pH	pH	pH	pH	pH
BAT3	6.82	6.84	6.94	6.61	6.31	6.41	6.75	6.85	6.87	6.76	6.69	6.78
BAT12	7.30	7.53	7.22	7.31	7.24	7.11	NA	7.42	7.23	7.43	7.46	7.15
CLK1	NA	7.11	7.12	NA	7.28	7.02	7.36	7.35	7.33	7.26	7.32	7.39
CLK12	7.00	7.16	7.10	7.06	6.93	NA	NA	6.48	6.47	NA	5.97	6.35
GLE3	7.47	7.57	7.64	7.18	6.94	6.85	7.08	7.14	7.18	7.27	7.37	7.38
GLE12	7.30	7.23	7.05	6.99	6.92	7.08	7.09	7.04	6.85	7.27	7.19	7.25
MIC3	7.67	7.70	7.73	NA	NA	NA	7.39	7.63	7.76	7.54	7.38	7.48
MIC12	7.11	7.12	7.15	6.88	6.95	7.06	7.30	7.42	7.43	7.32	7.56	7.38
PRI3	7.43	7.53	7.66	7.60	NA	7.05	7.13	7.02	7.87	NA	7.76	7.58
PRI12	7.19	7.23	7.03	NA	6.38	6.45	6.64	6.71	6.76	6.60	6.62	6.88
SHE3	7.46	7.55	7.73	7.60	7.45	NA	7.53	7.48	7.29	7.48	7.40	7.60

Presented median values consist of A and B grade data only.

NA = 60% of the continuous record for a given month is not represented by A and B grade data.

Table 9.
Monthly Medians Values for Continuous Instream Data (RY 2012/13)

Monthly Medians for **Dissolved Oxygen at Continuous Instream Sites**

	Jul 2012	Aug 2012	Sep 2012	Oct 2012	Nov 2012	Dec 2012	Jan 2013	Feb 2013	Mar 2013	Apr 2013	May 2013	Jun 2013
Station Name	Dissolved Oxygen (mg/L)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (mg/L)
BAT3	8.22	7.42	7.59	8.49	9.50	10.47	11.50	11.25	10.92	10.13	9.23	8.66
BAT12	9.04	8.29	NA	9.93	10.87	11.33	11.96	11.85	11.55	10.96	10.21	9.50
CLK1	8.97	8.83	9.16	9.54	10.34	10.94	11.84	11.56	10.97	10.36	9.67	9.42
CLK12	8.88	9.00	9.04	8.93	9.44	9.81	10.74	10.66	10.57	10.18	9.49	9.32
GLE3	9.03	8.59	9.29	9.87	10.32	11.03	12.04	11.76	11.28	10.50	9.77	9.30
GLE12	9.40	8.64	NA	9.92	10.55	11.19	12.13	11.84	11.65	11.13	10.25	9.86
MIC3	8.95	8.75	9.57	10.37	10.97	12.01	12.84	11.96	11.38	10.61	10.01	9.50
MIC12	8.93	8.55	9.58	11.02	10.60	10.97	12.36	11.73	11.18	10.27	9.86	9.17
PRI3	8.04	8.09	8.72	9.24	9.04	10.87	11.93	11.44	10.85	NA	9.10	8.54
PRI12	8.33	8.15	9.04	7.85	8.69	9.81	11.06	10.72	10.51	9.91	9.24	8.74
SHE3	8.64	8.46	9.52	10.30	10.35	NA	12.50	11.87	11.32	10.50	10.00	9.23

Monthly Medians for **Stage at Continuous Instream Sites**

	Jul 2012	Aug 2012	Sep 2012	Oct 2012	Nov 2012	Dec 2012	Jan 2013	Feb 2013	Mar 2013	Apr 2013	May 2013	Jun 2013
Station Name	Stage (ft)	Stage (ft)	Stage (ft)	Stage (ft)	Stage (ft)	Stage (ft)	Stage (ft)	Stage (ft)	Stage (ft)	Stage (ft)	Stage (ft)	Stage (ft)
BAT3	4.18	4.10	4.00	4.17	4.58	5.44	4.53	4.45	4.43	4.34	4.20	4.13
BAT12	4.70	4.60	4.55	4.68	4.95	5.31	5.02	4.98	4.98	4.91	4.79	4.74
CLK1	3.98	3.96	3.96	4.21	4.50	4.68	4.31	4.20	4.21	4.15	4.06	4.00
CLK12	3.95	3.94	3.92	4.07	4.26	4.39	4.11	4.11	4.11	4.10	4.05	4.03
GLE3	NA	NA	NA	NA	4.82	5.29	4.50	4.44	4.43	4.36	4.24	4.21
LPW1	No flow	No flow	No flow	No flow	1.68	1.97	1.49	No flow	No flow	No flow	No flow	No flow
GLE12	0.72	0.64	0.59	0.74	0.89	1.19	0.91	0.89	0.90	0.85	0.80	0.74
MIC3	5.91	5.88	5.59	5.55	5.90	6.62	5.47	5.45	5.23	5.24	5.35	5.59
MIC12	7.22	7.16	7.20	7.09	7.75	8.47	7.59	7.51	7.34	7.23	7.34	7.33
PRI3	4.24	4.20	4.20	4.35	4.60	4.93	4.53	4.51	4.47	4.45	4.38	4.37
PRI4	7.40	7.34	7.33	7.55	8.00	8.31	7.74	7.71	7.68	7.67	7.50	7.51
PRI12	4.25	4.15	4.1	4.06	4.44	4.76	4.34	4.32	4.29	4.3	4.3	4.37
SHE3	NA	NA	NA	NA	6.38	7.18	6.12	6.08	5.89	5.83	5.85	5.80

Presented median values consist of A and B grade data only.

NA = 60% of the continuous record for a given month is not represented by A and B grade data.

Table 10.
Instream Storm Monitoring Data (RY 2012/13)

Site Name: CLK1 Site Description: Lower Clark Creek just before confluence with Pringle Creek																			
Sample Collection Date/Time	E. Coli	Diss. Oxygen	pH	temp	Sp. Cond, field	Sp. Cond, comp	Cu	Cu diss	Zn	Zn diss	Pb	Pb diss	Hardness	NH3	NO3+NO2	Ortho P	TP	BODs	TSS
mm/dd/yyyy HH:MM	MPN/100 mL	mg/L	S.U	°C	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
10/12/2012 14:23	>24196	9.43	6.62	14.1	52.81														
10/12/2012 14:23 - dup	>24196	9.42	6.63	14.1	53.2														
10/13/2012 10:20						76.5	0.066	0.0178	0.539	0.161	0.0519	0.0017	98	0.938	0.88	0.109	1.33	6	616
11/29/2012 8:28	1986	10.62	7.17	9.87	70.78														
11/30/2012 9:05						63	0.0056	0.0027	0.0829	0.0422	0.0033	0.0007	24	0.05	1	0.03	0.123	3.8	41.2
01/23/2013 12:39	7270	11.67	7.39	6.9	160.5														
1/23/2013 12:40 - dup	7700	11.66 (11.0)	7.38	6.87	168.2														
01/24/2013 09:00						127	0.0098	0.0042	0.3	0.223	0.0042	0.0005	40	0.266	0.95	0.023	0.071	6.8	48
3/5/2013 7:40	1203	11.41	7.23	7.85	128.6														
3/5/2013 13:15						80.3	0.0092	0.0033	0.0973	0.0329	0.0052	0.0005	27	QNS	0.79	0.02	0.203	3.8	72
3/19/2013 19:31	2420	10.93	7.15	9.73	35														
3/20/2013 12:14						30.4	0.013	0.0036	0.182	0.0644	0.0088	0.0006	15	0.045	0.26	0.022	0.298	4	126
4/4/2013 10:57	2420	10.17	7.03	12.77	79.26														
4/5/2013 8:43						80.6	0.0163	0.0082	0.961	0.677	0.0048	0.0007	67	0.198	0.92	0.033	0.273	8.99	110
Median	4845	10.62	7.16	9.8	75.02	78.4	0.0114	0.0039	0.241	0.1127	0.005	0.00065	33.5	0.198	0.9	0.0265	0.238	5.00	91.0

Site Name: PRI3 Site Description: Lower Pringle Creek in Pringle Park, just upstream of confluence with Shelton Ditch																			
Sample Collection Date/Time	E. Coli	Diss. Oxygen	pH	temp	Sp. Cond, field	Sp. Cond, comp	Cu	Cu diss	Zn	Zn diss	Pb	Pb diss	Hardness	NH3	NO3+NO2	Ortho P	TP	BODs	TSS
mm/dd/yyyy HH:MM	MPN/100 mL	mg/L	S.U	°C	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
10/12/2012 15:05	24200	9.24	6.88	13.52	68.5														
10/13/2012 10:02						55.7	0.0252	0.0142	0.188	0.052	0.0144	0.001	68	0.379	0.38	0.095	0.662	> 7.4	216
11/29/2012 8:51	1414	10.54 (10.2)	7.22	9.37	76.66														
11/30/2012 9:15						69.2	0.0028	< 0.0025	0.0277	0.0193	< 0.0010	< 0.0010	28	< 0.050	1.43	0.018	0.055	2	11.6
1/23/2013 13:20	96	12.55	7.67	4.72	308.1														
1/24/2013 9:15						149	0.0031	< 0.0025	0.0711	0.0528	0.0008	< 0.0005	36	0.122	1.12	0.021	0.031	2.5	12
3/5/2013 8:30	291	11.2	7.5	7.73	88.26														
3/5/2013 13:28						88.3	< 0.0025	< 0.0025	0.0196	0.0133	0.0005	< 0.0005	29	QNS	0.99	0.014	0.047	1.84	8.4
3/19/2013 19:48	461	10.8	8.13	9.7	72.2														
3/20/2013 12:03						48.7	0.0104	< 0.0025	0.105	0.0241	0.0062	< 0.0005	25	0.011	0.36	0.013	0.308	3.7	126
4/4/2013 11:55	1553	10.37	7.42	13.22	94.53														
4/4/2013 11:56 - dup	4611	10.36	7.41	13.22	94.26														
4/5/2013 8:31						95.7	0.0029	0.0025	0.0286	0.0218	< 0.0005	< 0.0005	35	< 0.050	0.99	0.031	0.055	2.16	9.2
Median	1414	10.59	7.42	9.7	88.26	78.75	0.0031	NA	0.04985	0.02295	0.0035	NA	32	0.122	0.99	0.0195	0.055	2.33	11.8

Site Name: PRI12 Site Description: Upper East Fork Pringle Creek																			
Sample Collection Date/Time	E. Coli	Diss. Oxygen	pH	temp	Sp. Cond, field	Sp. Cond, comp	Cu	Cu diss	Zn	Zn diss	Pb	Pb diss	Hardness	NH3	NO3+NO2	Ortho P	TP	BODs	TSS
mm/dd/yyyy HH:MM	MPN/100 mL	mg/L	S.U	°C	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
10/12/2012 15:57	3448	9.18	6.84	11.99	74.05														
10/13/2012 11:13						74.2	0.0059	0.005	0.0429	0.0219	0.0012	< 0.0005	37	0.11	1.04	0.087	0.242	> 8.0	32
11/29/2012 9:24	228	9.1	6.61	9.64	85.65														
11/30/2012 10:05						75.1	< 0.0025	< 0.0025	0.0124	0.0095	0.0005	< 0.0005	29	< 0.050	2.62	0.013	0.04	1.07	6.4
1/23/2013 13:52	83	11.42	6.99	5.17	88.74														
1/24/2013 9:46						91.3	< 0.0025	< 0.0025	0.0119	0.0053	< 0.0005	< 0.0005	30	< 0.050	2.05	< 0.010	0.018	< 1.00	8.2
3/5/2013 9:00	66	10.5 (10.35)	6.9	6.59	83.25														
3/5/2013 11:35						83	< 0.0025	< 0.0025	0.0118	0.0081	< 0.0005	< 0.0005	28	QNS	1.95	0.011	0.028	< 1.00	6.4
3/19/2013 20:13	435	9.69	6.6	8.96	75.7														
3/19/2013 20:14	345	9.68 (9.45)	6.6	8.96	76.9														
3/20/2013 13:13						73.5	0.0027	< 0.0025	0.0099	0.0063	0.0006	< 0.0005	30	0.166	1.01	< 0.010	0.099	<2	25
4/4/2013 12:36	435	10.22	6.95	12.12	77.85														
4/5/2013 9:32						81.1	< 0.0025	< 0.0025	0.0286	0.0106	< 0.0005	< 0.0005	31	< 0.050	1.63	0.024	0.041	1.43	13.6
Median	345	9.69	6.84	8.96	77.85	78.1	NA	NA	0.01215	0.0088	0.0006	NA	30	NA	1.79	0.0185	0.0405	1.25	10.9

QNS= Quantity Not Sufficient for analyzing a parameter.

NA= Median not calculated because ≥ 50% of values were censored values.

Data in red exceed applicable water quality criteria (see Table 4).

Data in blue are QA/QC DO readings done using Winkler Titration.

Table 11.
Stormwater Monitoring Data (RY 2012/13)

Site Name: Electric Land use Type: Residential																			
Sample Collection Date/Time	E. Coli	Diss. Oxygen	pH	temp	Sp. Cond. field	Sp. Cond. comp	Cu	Cu diss	Zn	Zn diss	Pb	Pb diss	Hardness	NH3	NO3+NO2	Ortho P	TP	BOD5	TSS
mm/dd/yyyy HH:MM	MPN/100 mL	mg/L	S.U	°C	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
10/12/2012 13:10	17330	9.84	6.75	14.75	57.2														
10/13/2012 10:31						42.4	0.0163	0.0183	0.0802	0.0597	0.0023	0.0008	24	0.435	0.77	0.214	0.377	26.4	26
11/29/2012 8:00	3448	11.07	6.88	8.95	36.56														
11/30/2012 8:20						58.2	0.0062	0.0032	0.0415	0.0203	0.0024	< 0.0010	22	< 0.050	0.99	0.081	0.2	6.3	34
3/5/2013 8:52	921	11.6	6.85	8.04	60.71														
3/5/2013 13:07						99.1	0.0041	0.0029	0.0283	0.0182	0.0012	< 0.0005	32	NA	1.39	0.051	0.109	2.2	14.8
3/19/2013 18:35	866	10.98	7.04	10.05	42.42														
3/20/2013 12:24						50.4	0.0053	0.0042	0.0334	0.0227	0.0016	0.0007	19	< 0.004	0.57	0.081	0.131	2.4	22
Median	2184.5	11.03	6.865	9.5	49.81	54.3	0.00575	0.0037	0.03745	0.0215	0.00195	0.00075	23	NA	0.88	0.081	0.1655	4.35	24

Site Name: Hilfiker Land use Type: Commercial																			
Sample Collection Date/Time	E. Coli	Diss. Oxygen	pH	temp	Sp. Cond. field	Sp. Cond. comp	Cu	Cu diss	Zn	Zn diss	Pb	Pb diss	Hardness	NH3	NO3+NO2	Ortho P	TP	BOD5	TSS
mm/dd/yyyy HH:MM	MPN/100 mL	mg/L	S.U	°C	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
10/12/2012 11:50	548	9.85	6.4	13.75	47.01														
10/13/2012 10:57						31.3	0.019	0.0157	0.152	0.108	0.003	0.0007	15	0.648	0.65	0.099	0.247	18.9	45.5
11/29/2012 7:32	19860	11.33	6.45	7.56	30.77														
11/30/2012 8:00						29.4	0.0178	0.0059	0.216	0.0868	0.0054	< 0.0010	15	0.108	0.35	0.016	0.206	7.9	75.6
3/5/2013 7:28	41	11.87	6.99	6.18	89.89														
3/5/2013 7:29	16	11.85	6.96	6.1	90														
3/5/2013 12:02						57	0.0178	0.0081	0.157	0.0756	0.0043	0.0006	21	NA	0.35	0.015	0.18	7.3	74
3/19/2013 19:00	11	11.14	7.08	8.97	13.84														
3/20/2013 12:54						17.7	0.012	0.0042	0.129	0.0639	0.0037	< 0.0005	10	0.1	0.14	0.016	0.11	3.7	63
Median	294.5	11.33	6.96	7.56	47.01	30.35	0.0178	0.007	0.1545	0.0812	0.004	0.00065	15	0.108	0.35	0.016	0.193	7.6	68.5

Site Name: Salem Industrial Land use Type: Industrial																			
Sample Collection Date/Time	E. Coli	Diss. Oxygen	pH	temp	Sp. Cond. field	Sp. Cond. comp	Cu	Cu diss	Zn	Zn diss	Pb	Pb diss	Hardness	NH3	NO3+NO2	Ortho P	TP	BOD5	TSS
mm/dd/yyyy HH:MM	MPN/100 mL	mg/L	S.U	°C	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
10/12/2012 16:34	> 24200	9.29	6.37	14.15	39.45														
10/13/2012 11:44						73.2	0.0252	0.0119	0.327	0.187	0.0043	0.0006	58	0.398	1.09	0.194	0.864	21	201
11/29/2012 9:50	74	10.23	6.53	8.88	28.41														
11/29/2012 9:51	55	10.21	6.54	8.92	28.46														
11/30/2012 10:27						32.2	0.006	0.0043	0.0731	0.0517	0.001	< 0.0010	14	< 0.050	0.14	0.035	0.127	3	26.8
3/5/2013 9:45	8664	10.99	6.51	7.03	27.1														
3/5/2013 14:00						29.9	0.0061	0.0049	0.0905	0.07	0.0008	< 0.0005	24	NA	0.28	0.036	0.1	2.8	20
3/19/2013 20:41	52	10.17	6.88	8.75	32.25														
3/20/2013 13:35						22.7	0.011	0.0083	0.129	0.0913	0.0015	0.0006	13	< 0.004	0.1	0.049	0.26	5.6	61
Median	64.5	10.21	6.53	8.88	28.46	31.05	0.00855	0.0066	0.10975	0.08065	0.00125	0.0006	19	NA	0.21	0.0425	0.1935	4.3	43.9

NA= Median not calculated because ≥ 50% of values were censored values.

Table 12.
Pesticide Monitoring Data (RY 2012/13)

Site Name	Land Use Type	Sample Date	Time	Analyte	Type of Pesticide	Amount Detected (µg/L)	Limit of Quantitation (µg/L)
Electric	Residential	10/12/2012	13:01	2,4-D	Phenoxy Herbicide	1.5	0.08
				Dicamba	Phenoxy Herbicide	0.39	0.08
				MCPYP	Phenoxy Herbicide	0.33	0.08
				Triclopyr	Phenoxy Herbicide	0.34	0.08
		6/18/2013	15:16	2,4-D	Phenoxy Herbicide	0.25	0.08
Hilfiker	Commercial	10/12/2012	12:05	2,4-D	Phenoxy Herbicide	0.49	0.08
				Dicamba	Phenoxy Herbicide	0.23	0.08
				Triclopyr	Phenoxy Herbicide	0.32	0.08
		6/18/2013	15:00	2,4-D	Phenoxy Herbicide	0.29	0.08
Hilfiker DUP	Commercial	6/18/2013	15:03	2,4-D	Phenoxy Herbicide	0.33	0.08
Salem Industrial	Industrial	10/12/2012	16:38	Simazine	Organonitrogen pesticide	1.3	0.60
				Propiconazole	Halogenated Pesticide	0.3	0.30
				2,4-D	Phenoxy Herbicide	1.7	0.08
				Dicamba	Phenoxy Herbicide	0.51	0.08
				Triclopyr	Phenoxy Herbicide	0.97	0.08
		6/18/2013	15:42	Propiconazole	Halogenated Pesticide	0.95	0.15
				Diuron	Phenylurea Pesticide	0.44	0.12
				2,4-D	Phenoxy Herbicide	1.3	0.08
Salem Industrial DUP	Industrial	10/12/2012	16:47	Triclopyr	Phenoxy Herbicide	1.4	0.08
				Simazine	Organonitrogen pesticide	1.1	0.60
				2,4-D	Phenoxy Herbicide	1.8	0.08
				Dicamba	Phenoxy Herbicide	0.58	0.08
Salem Industrial DUP	Industrial	10/12/2012	16:47	Triclopyr	Phenoxy Herbicide	0.95	0.08
				Simazine	Organonitrogen pesticide	1.1	0.60
				2,4-D	Phenoxy Herbicide	1.8	0.08
				Dicamba	Phenoxy Herbicide	0.58	0.08

Note: Results only given for those analytes that were detected. See Attachement A for full suite of compounds that were analyzed.

Table 13.
Mercury Monitoring Data (RY 2012/13)

Sample Date	Site Name	Time:	Analyte	Result (ng/L)	Detection Limit (ng/L)	Reporting Limit (ng/L)
3/5/2013	Electric-native	9:05	Total Hg	4.9	0.28	1.00
		9:05	Diss. Hg	2.6	0.28	1.00
		9:12	Total MeHg	0.13	0.014	0.05
		9:12	Diss. MeHg	0.06	0.014	0.05
	Hilfiker-blank	7:39	Total Hg	U	0.28	1.00
	Hilfiker-native	7:59	Total Hg	5.7	0.28	1.00
		7:59	Diss. Hg	2.8	0.28	1.00
		8:15	Total MeHg	0.18	0.014	0.05
		8:15	Diss. MeHg	0.11	0.014	0.05
	Hilfiker-dup	8:08	Total Hg	5.1	0.28	1.00
		8:08	Diss. Hg	2.8	0.28	1.00
		8:22	Total MeHg	0.15	0.014	0.05
		8:22	Diss. MeHg	0.11	0.014	0.05

Note: CH2MHill Applied Sciences Laboratory used for analysis. Samples were composited in the field by City staff to help eliminate discrepancies in data due to length of time between total and dissolved Hg and MeHg sample collection.

U= Not detected at specified reporting limit.

Table 14.
Mercury Monitoring - Additional Data (RY 2012/13)

Site Name: Electric								
Sample Date/Time:	TSS	DOC	Sulfate	Alkalinity	TOC	pH	ORP	Sp. Cond
03/05/2013 08:55	9.00		3.11	16.00		6.85	0.23	60.71
03/05/2013 09:01		2.84			3.25			
Site Name: Hilfiker								
Sample Date/Time:	TSS	DOC	Sulfate	Alkalinity	TOC	pH	ORP	Sp. Cond
03/05/2013 07:43	61.60					6.99	0.24	89.89
03/05/2013 07:45		5.27						
03/05/2013 07:46			0.86	8.40				
03/05/2013 07:48					6.94			
Site Name: Hilfiker-duplicate								
Sample Date/Time:	TSS	DOC	Sulfate	Alkalinity	TOC	pH	ORP	Sp. Cond
03/05/2013 07:44	54.40					6.96	0.24	90.00
03/05/2013 07:46		5.22						
03/05/2013 07:47			0.86	7.72				
03/05/2013 07:49					6.38			
Reporting Limit:								
	2.0 mg/L	0.5 mg/L	0.10 mg/L	4.0 mg/L	0.5 mg/L			

Note: CH2MHill used for analysis; pH, Oxygen Reduction Potential (ORP) and specific conductivity are field measurements.

Table 15.
Benthic Macroinvertebrate Monitoring Data (RY 2012/13)
Benthic Invertebrate Index of Biological Integrity-BIBI (modified Karr 1998)

Metric	Clark Creek		East Fork Pringle Creek (PC1)		Pringle Creek (PC2)	
	Value	Score ^a	Value	Score ^a	Value	Score ^a
Total Number of Taxa ^b	28	3	39	3	31	3
Number of Ephemeroptera Taxa ^b	1	1	2	1	1	1
Number of Plecoptera Taxa ^b	0	1	0	1	0	1
Number of Trichoptera Taxa ^b	1	1	5	3	4	1
Number of Long-lived Taxa ^b	3	3	2	1	1	1
Number of Intolerant Taxa ^b	1	1	1	1	0	1
Percent Tolerant Taxa ^c	19.79	5	23.95	3	30.77	3
Percent Predators ^b	5.25	1	12.74	3	2.97	1
Number of Clinger Taxa ^b	6	1	14	3	8	1
Percent Dominance (3 Taxa) ^c	38.79	5	37.83	5	50.11	3
Total BIBI Score^d:	n/a	22	n/a	24	n/a	16
Biological Condition:	Low		Low		Low	

- Notes:
- a. Each metric scored: 1 = Low; 3 = Moderate; 5 = High
 - b. Metric value generally decreases with declining biological integrity.
 - c. Metric value general increases with declining biological integrity.
 - d. Key to Total BIBI Scores:

BIBI scores 0 – 24 = Low biological integrity BIBI scores 25 – 39 = Moderate biological integrity BIBI scores 39 – 50 = High biological integrity

Table 16.
Benthic Macroinvertebrate Monitoring Data (RY 2012/13)
Other Community Composition Metrics that are Indicative of Biological Condition

Metric	Clark Creek		East Fork Pringle Creek (PC1)		Pringle Creek (PC2)	
	Value	Score ^a	Value	Score ^a	Value	Score ^a
Total Abundance ^b	1937	H	1132	H	2543	H
EPT Taxa Richness ^b	2	L	7	L	5	L
Predator Richness ^b	3	L	6	L	2	L
Scraper Richness ^b	1	L	7	L	6	L
Shredder Richness ^b	4	L	5	M	3	L
Percent Intolerant Taxa ^b	0.4	L	3.23	L	0	L
Percent <i>Baetis tricaudatus</i> ^c	16.36	M	3.23	H	16.56	M
Percent Collector ^c	77.58	L	60.27	L	64.12	L
Percent Parasite ^c	0.4	H	6.27	L	1.49	H
Percent Oligochaeta ^c	4.85	M	11.98	L	16.77	L
Number of Tolerant taxa ^c	6	H	11	L	11	L
Percent Simuliidae ^c	3.43	H	0.76	H	12.1	L
Percent Chironomidae	67.88	L	48.29	L	37.79	L

- Notes:
- a. Low (L), moderate (M), and high (H) scores compared with a Pacific Northwest montane stream with high biological integrity.
 - b. Metric value generally decreases with declining biological integrity.
 - c. Metric value generally increases with declining biological integrity.

Table 17.
Benthic Macroinvertebrate Monitoring Data (RY 2012/13)
Fish Sampling Results

Fish Species	Sampling Reach		
	East Fork Pringle Creek	Clark Creek	Pringle Creek ^a
Sculpin	37	34	-
Redside Shiner	40	24	-
Largescale Sucker	1	-	-
Cutthroat trout	2	7	-
Speckled Dace	9	7	-
Total	89	82	-

Notes: a. Reach not sampled because necessary permit from NMFS could not be obtained in time to meet schedule constraints.

Table 18.
Willamette River Water Quality Data (RY 2012/13)

Willamette at Railroad Bridge River Mile 83														
Date	Temp	pH	Turb	DO	Cond	E.coli	BOD	Alk	TS	TSS	TDS	NO3+NO2	Tphos	NH3
M/DD/YYYY	°C	S.U	ntu	mg/l	uS/cm	#/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
7/10/2012	19.9	7.50	2.66	9.0	51.4	7	0.55	28	58	4	54	0.09	0.031	< 0.050
7/24/2012	18.1	7.37	2.75	9.0	51.7	8	0.52	31	66	4	62	0.12	0.038	< 0.050
8/14/2012	20.7	7.49	1.87	9.0	53.5	7	0.58	33	73	3.6	69	0.08	0.037	< 0.050
9/11/2012	15.6	7.48	3.31	10.0	46.0	12	0.65	26	70	5.6	64	0.08	0.032	< 0.050
9/25/2012	15.1	7.51	2.56	10.0	44.8	8	0.84	28	68	4	64	0.09	0.033	< 0.050
10/9/2012	12.9	7.49	4.64	10.0	45.2	15	0.74	27	67	5.6	61	0.09	0.036	< 0.050
10/23/2012	11.1	7.50	5.21	10.0	44.1	45	0.54	27	65	6.4	59	0.12	0.047	< 0.050
1/15/2013	4.1	7.31	6.52	13.0	47.6	3	0.91	27	45	3.6	41	0.46	0.039	< 0.050
2/12/2013	7.1	7.33	5.50	12.0	50.6	8	1.01	29	66	4	62	0.36	0.038	< 0.050
3/12/2013	8.5	7.40	5.42	12.0	50.3	8	0.84	27	70	4	66	0.33	0.037	< 0.050
4/9/2013	8.8	7.43	17.20	11.0	38.0	411	1.28	21	70	20.4	50	0.21	0.070	< 0.050
5/14/2013	15.2	7.53	2.69	10.0	45.4	6	0.73	28	58	4.4	54	0.10	0.032	< 0.050
6/11/2013	17.8	7.42	2.27	9.0	51.0	5	0.80	27	59	4.4	55	0.19	0.032	0.005
Median	15.1	7.48	3.31	10.0	47.6	8	0.74	27	66	4	61	0.12	0.037	0.005

DUPLICATE SITE- Willamette at Railroad Bridge River Mile 83														
Date	Temp	pH	Turb	DO	Cond	E.coli	BOD	Alk	TS	TSS	TDS	NO3+NO2	Tphos	NH3
MM/DD/YYYY	°C	S.U	ntu	mg/l	uS/cm	#/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
7/10/2012	19.9	7.54	2.63	9.0	51.7	2	0.57	29	58	4.4	54	0.10	0.035	< 0.050
7/24/2012	18.0	7.38	2.16	9.0	51.8	8	0.54	28	71	3.6	67	0.11	0.042	< 0.050
8/14/2012	20.7	7.51	1.79	9.0	53.9	6	0.54	33	69	4	65	0.09	0.038	< 0.050
9/11/2012	15.5	7.49	3.10	10.0	46.1	13	0.56	28	68	5.6	62	0.08	0.036	< 0.050
9/25/2012	15.1	7.55	3.38	10.0	44.8	12	0.80	28	72	4.8	67	0.09	0.032	< 0.050
10/9/2012	12.9	7.50	4.56	10.0	45.2	20	0.67	27	66	6.4	60	0.09	0.040	< 0.050
10/23/2012	11.1	7.53	5.73	10.0	44.0	28	0.58	27	68	6	62	0.12	0.050	< 0.050
1/15/2013	4.1	7.34	6.02	13.0	47.4	16	0.86	26	54	3.6	50	0.47	0.038	< 0.050
2/12/2013	7.0	7.36	5.58	12.0	50.5	10	0.89	30	66	3.6	62	0.34	0.038	< 0.050
3/12/2013	8.5	7.46	5.49	12.0	50.5	6	0.87	27	68	4.4	64	0.35	0.035	< 0.050
4/9/2013	8.7	7.42	16.70	11.0	37.9	345	1.41	24	67	20.8	46	0.18	0.069	< 0.050
5/14/2013	15.2	7.52	2.72	10.0	45.9	9	0.78	28	64	4	60	0.11	0.034	< 0.050
6/11/2013	17.8	7.47	2.46	9.0	52.4	3	0.64	27	61	4	57	0.22	0.033	0.008
Median	15.1	7.49	3.38	10.0	47.4	10	0.67	28	67	4.4	62	0.11	0.038	0.05

Table 18.
Willamette River Water Quality Data (RY 2012/13)

Mill Creek Confluence at River Mile 82.9														
Date	Temp	pH	Turb	DO	Cond	E.coli	BOD	Alk	TS	TSS	TDS	NO3+NO2	Tphos	NH3
MM/DD/YYYY	°C	S.U	ntu	mg/l	uS/cm	#/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
7/10/2012	19.4	7.45	6.77	9.0	46.7	144	0.53	29	62	6.8	55	0.22	0.055	< 0.050
7/24/2012	17.0	7.48	7.23	10.0	40.2	84	0.62	26	62	8	54	0.12	0.049	< 0.050
8/14/2012	19.9	7.55	3.61	9.0	44.0	172	0.50	30	59	3.6	55	0.21	0.048	< 0.050
9/11/2012	14.8	7.52	5.26	10.0	38.3	142	0.62	24	61	5.6	55	0.09	0.037	< 0.050
9/25/2012	14.1	7.58	4.54	10.0	37.9	921	0.82	27	68	4.4	64	0.16	0.030	< 0.050
10/9/2012	10.6	7.54	4.21	11.0	37.1	225	0.88	25	57	6	51	0.11	0.032	< 0.050
10/23/2012	9.7	7.56	4.96	11.0	67.7	365	0.93	35	83	5.2	78	1.12	0.044	< 0.050
1/15/2013	4.1	7.35	5.72	13.0	48.5	14	1.03	28	44	3.2	41	0.70	0.038	< 0.050
2/12/2013	7.1	7.36	5.51	12.0	56.6	6	1.13	29	79	3.6	75	0.44	0.039	< 0.050
3/12/2013	9.5	7.66	4.19	12.0	65.8	138	0.93	29	82	3.2	79	1.50	0.035	< 0.050
4/9/2013	No samples collected due to no boat access													
5/14/2013	14.0	7.43	5.23	10.0	43.6	178	0.88	28	62	5.2	57	0.26	0.053	< 0.050
6/11/2013	No samples collected due to no boat access													
Median	14.0	7.52	5.23	10.0	44.0	144	0.88	28	62	5.2	55	0.22	0.039	0.05

Sunset Park at River Mile 84														
Date	Temp	pH	Turb	DO	Cond	E.coli	BOD	Alk	TS	TSS	TDS	NO3+NO2	Tphos	NH3
MM/DD/YYYY	°C	S.U	ntu	mg/l	uS/cm	#/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
7/10/2012	20.0	7.62	2.20	10.0	51.4	18	0.69	30	67	2.4	65	0.11	0.032	< 0.050
7/24/2012	18.1	7.49	3.68	10.0	51.5	16	0.71	30	66	4.4	62	0.12	0.042	< 0.050
8/14/2012	20.9	7.53	2.20	9.0	53.6	12	0.62	32	69	4.4	65	0.09	0.040	< 0.050
9/11/2012	15.6	7.43	3.24	10.0	45.1	17	0.68	26	63	5.2	58	0.08	0.032	< 0.050
9/25/2012	15.0	7.55	3.92	10.0	44.1	25	0.94	28	71	5.2	66	0.10	0.031	< 0.050
10/9/2012	12.6	7.53	4.66	10.0	44.9	37	0.76	27	68	7.2	61	0.09	0.036	< 0.050
10/23/2012	11.0	7.53	5.94	10.0	44.7	50	0.60	28	70	6	64	0.14	0.052	< 0.050
1/15/2013	4.1	7.35	6.34	13.0	48.7	12	1.24	27	48	3.6	44	0.56	0.039	< 0.050
2/12/2013	7.1	7.22	5.05	12.0	51.8	12	0.91	29	68	3.6	64	0.43	0.039	< 0.050
3/12/2013	8.7	7.47	5.40	12.0	51.5	10	0.84	28	73	4	69	0.39	0.037	< 0.050
4/9/2013	8.9	7.42	15.20	11.0	38.8	248	1.15	23	72	17.2	55	0.22	0.065	< 0.050
5/14/2013	14.8	7.64	2.50	11.0	45.3	10	0.82	29	63	3.6	59	0.10	0.032	< 0.050
6/11/2013	17.8	7.60	3.39	9.0	51.8	14	0.67	29	54	4.4	50	0.20	0.034	0.007
Median	14.8	7.53	3.92	10.0	48.7	16	0.76	28	68	4.4	62	0.12	0.037	0.05

Table 18.
Willamette River Water Quality Data (RY 2012/13)

Willamette River at Mile 78														
Date	Temp	pH	Turb	DO	Cond	E.coli	BOD	Alk	TS	TSS	TDS	NO3+NO2	Tphos	NH3
MM/DD/YYYY	°C	S.U	ntu	mg/l	uS/cm	#/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
7/10/2012	20.0	7.49	2.73	9.0	55.1	12	0.78	30	64	4	60	0.12	0.068	0.156
7/24/2012	18.3	7.51	2.53	9.0	56.3	2	0.62	32	69	3.2	66	0.13	0.070	0.224
8/14/2012	21.1	7.43	1.69	9.0	58.6	4	0.68	35	68	3.2	65	0.10	0.056	0.163
9/11/2012	15.7	7.54	3.20	10.0	50.6	18	0.67	27	58	4.8	53	0.08	0.041	0.087
9/25/2012	15.1	7.53	3.02	10.0	47.5	16	0.90	30	64	4.8	59	0.10	0.048	0.131
10/9/2012	12.8	7.55	5.05	10.0	47.1	22	0.76	27	63	6	57	0.10	0.049	0.074
10/23/2012	11.2	7.40	5.42	10.0	45.8	30	0.66	26	69	6.4	63	0.14	0.056	0.057
1/15/2013	4.1	7.37	6.35	13.0	48.9	15	< 0.50	28	55	3.2	52	0.49	0.043	< 0.050
2/12/2013	7.1	7.37	5.18	12.0	52.3	5	1.09	31	66	3.6	62	0.38	0.055	0.125
3/12/2013	8.7	7.34	5.48	12.0	52.5	6	0.93	28	72	3.6	68	0.35	0.054	0.101
4/9/2013	8.9	7.46	16.40	11.0	39.3	236	1.26	24	72	21.2	51	0.19	0.071	0.066
5/14/2013	15.0	7.56	2.47	10.0	47.4	11	0.89	30	71	4.8	66	0.11	0.053	0.114
6/11/2013	17.9	7.48	3.16	9.0	54.5	10	0.80	30	60	4.4	56	0.22	0.059	0.19
Median	15.0	7.48	3.20	10.0	50.6	12	0.79	30	66	4.4	60	0.13	0.055	0.1195

Spongs Landing at River Mile 77														
Date	Temp	pH	Turb	DO	Cond	E.coli	BOD	Alk	TS	TSS	TDS	NO3+NO2	Tphos	NH3
MM/DD/YYYY	°C	S.U	ntu	mg/l	uS/cm	#/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
7/10/2012	20.0	7.57	2.13	9.0	54.0	3	0.65	30	60	4	56	0.10	0.052	0.109
7/24/2012	18.3	7.53	2.81	10.0	55.0	7	0.61	32	65	3.2	62	0.13	0.054	0.128
8/14/2012	21.1	7.56	1.98	9.0	56.2	4	0.68	33	73	4	69	0.09	0.047	0.089
9/11/2012	15.7	7.54	3.40	10.0	48.0	12	0.74	25	66	6	60	0.08	0.049	0.122
9/25/2012	15.1	7.58	3.23	10.0	45.3	15	0.88	29	70	4.4	66	0.10	0.041	0.084
10/9/2012	12.8	7.57	5.09	10.0	45.7	11	0.82	27	67	6	61	0.09	0.047	0.06
10/23/2012	11.1	7.51	5.65	11.0	45.1	46	0.64	28	73	7.2	66	0.12	0.052	< 0.050
1/15/2013	4.2	7.38	5.82	13.0	48.2	12	1.33	29	55	4	51	0.50	0.045	0.05
2/12/2013	7.1	7.38	5.33	12.0	52.1	11	0.96	31	69	3.6	65	0.37	0.046	0.073
3/12/2013	8.7	7.46	5.58	12.0	51.9	8	1.11	29	71	4	67	0.33	0.043	0.054
4/9/2013	8.9	7.45	15.80	11.0	38.9	291	1.44	25	69	20.8	48	0.20	0.076	0.075
5/14/2013	15.0	7.80	2.90	11.0	46.2	5	0.98	30	63	4	59	0.10	0.041	0.058
6/11/2013	18.0	7.58	2.40	9.0	52.7	3	0.66	28	76	3.6	72	0.25	0.044	0.076
Median	15.0	7.54	3.40	10.0	48.2	11	0.82	29	69	4	62	0.12	0.047	0.0755

Table 18.
Willamette River Water Quality Data (RY 2012/13)

Willamette at Wheatland River Mile 71														
Date	Temp	pH	Turb	DO	Cond	E.coli	BOD	Alk	TS	TSS	TDS	NO3+NO2	Tphos	NH3
MM/DD/YYYY	°C	S.U	ntu	mg/l	uS/cm	#/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
7/10/2012	20.2	7.52	3.40	9.0	54.3	4	0.78	32	63	4.4	59	0.15	0.052	0.067
7/24/2012	18.6	7.58	2.21	9.0	54.3	6	0.67	32	69	2.8	66	0.16	0.053	0.076
8/14/2012	21.3	7.54	1.66	9.0	55.2	3	0.71	34	73	3.6	69	0.13	0.046	0.05
9/11/2012	16.0	7.50	3.58	10.0	47.5	10	0.69	27	59	5.2	54	0.09	0.046	0.059
9/25/2012	15.2	7.48	3.69	10.0	45.0	4	0.96	29	68	4.8	63	0.11	0.040	< 0.050
10/9/2012	12.8	7.56	5.06	10.0	45.5	12	0.80	27	60	6	54	0.09	0.047	0.051
10/23/2012	11.2	7.43	5.08	10.0	45.6	27	0.71	28	65	6.8	58	0.16	0.054	< 0.050
1/15/2013	4.2	7.37	6.15	13.0	49.7	14	0.92	28	54	3.6	50	0.52	0.049	0.07
2/12/2013	7.1	7.19	5.21	12.0	52.3	10	1.08	31	68	3.2	65	0.40	0.048	0.067
3/12/2013	8.7	7.31	5.80	12.0	52.6	3	0.93	29	73	4	69	0.37	0.048	0.065
4/9/2013	8.9	7.46	17.40	11.0	38.9	411	1.40	25	77	20.8	56	0.20	0.079	0.081
5/14/2013	15.1	7.58	2.80	10.0	46.1	8	0.92	30	66	4.8	61	0.12	0.044	0.055
6/11/2013	18.3	7.41	3.58	9.0	53.6	3	0.83	31	67	5.2	62	0.23	0.047	0.065
Median	15.1	7.48	3.69	10.0	49.7	8	0.83	29	67	4.8	61	0.16	0.048	0.065

Note: Willamette River monitoring is not identified in the City's Surface and Stormwater Monitoring Plan, however, it is identified in the City of Salem Stormwater Management Plan 2010.

Table 19.
Priority Dry Weather Outfall/Manhole Screening Data (RY 2012/13)

Site Information				Flow		Physical Indicators		Field Screening					Laboratory Testing						Follow Up	
ID	location note	west, north, south	Date/time	Flow Present	Estimated flow	Flowing Outfalls	Flowing and non-flowing outfalls	Temp (C)	pH (S.U.)	Specific Conductivity (uS/cm)	Turbidity (NTU)	Chlorine (mg/L)	E. Coli	Detergents (mg/L)	Fluoride (mg/L)	K (mg/L)	Na (mg/L)	NH3 (mg/L)	Date/time of Follow up E.Coli Sample	notes
D51470203		north	8/6/12 10:30	n (stagnant water)			n	20.3	6.31	59		0			<0.10					
D54470205		north	8/6/12 11:10	y	1-3 gpm	n	n	17.8	6.43	136.9	3.2	0	119	<0.25	0.21	1.9	8.565	0.06	6/5/13 8:40	notified water department
D54486217		north	8/6/12 12:30	y	50 gpm	n	y (brown growth)	18.0	6.93	83.5	1.87	0	120	0.25	0.8	0.6	6.443	0.05	6/5/13 10:50	fish in pipe, notified water department
D51486216		north	8/6/12 13:00	y	1-2 gpm	y (trash)	y (green pipe growth)	18.3	6.75	174.7	4.47	0	33	0.25	0.71	2.5	13.1	0.22	6/5/13 10:40	notified water department
D51488236		north	8/7/12 8:55	n			n													
D51488203		north	8/7/12 9:15	n			n													
D51486211*	sub for 201	north	8/7/12 9:50	y	10 gpm	y (tan color)	y	20.5	6.56	227.5	7.64	0	461	0.25	0.33	2.9	11.4	0.21	6/5/13 9:35	notified water department
D48486207		north	8/7/12 10:20	y	10 gpm	y (tan color)	n	18.6	6.66	241	12.6	0	1414	0.25	0.32	2.9	11.5	0.22	6/5/13 9:45	notified water department
D45476217		north	8/7/12 11:05	y	15-20 gpm	n	n	19.4	7.1	223.7	1.02	0.5		<0.25	0.14	2.4	10.4	<0.050		ES investigated, water source not found, notify water department
D42476203		north	8/7/12 11:30	n			n													
D45476207		north	8/7/12 12:00	y	40 gpm	n	y (green pipe growth)	15.6	7.42	278.8	0.5	0		<0.25	0.11	2	9.189	<0.050		notified water department
D54494201		north	8/7/12 13:00	n			n													
D45466212		south	8/8/12 8:30	y	.5 gpm	n	n	18.3	7.76	240	10.1	0			0.07					
D48464249		south	8/8/12 9:00	n (stagnant water)			n													
D48464203		south	8/8/12 9:30	y	3 gpm	n	n	17.7	6.83	218.8	2.7	0	4	0.25	0.22	2.1	8.68	0.25	6/5/13 8:00	notified water department
D45464207		south	8/8/12 10:20	n (stagnant water)			n	18.2	7.24	98.4	unable to sample	0								
D42468235		south	8/8/12 10:30	n			n													
D48460229		south	8/8/12 11:00	y	10-20 gpm	n	n	18.2	7.5	297.3	unable to sample	0		0.12	0.16	3.5	11.4	<0.050		notified water department
D42468244		south	8/13/12 10:23	y	65 gpm	n	n	18.4	6.87	119.7	3.02	0.15		<0.25	0.09	0.55	7.36	<0.500		notified water department
D42468232		south	8/13/12 10:50	n			n													
D42466227*		South	8/13/12 11:03	y	2.5 gpm	n	n	20.4	6.97	131.1	7.8	0		<0.25	0.1	1.08	8.955	<0.500		
D39460252		south	8/13/12 11:32	y	20 gpm	n	n	17.8	6.83	58.2	3.64	0		<0.25	0.1	0.48	4.702	<0.500		
D39456229		south	8/13/12 12:05	y	10 gpm		n	16.0	6.3	65.4	1.93	0.5		<0.25	0.2	0.7	4.911	<0.500		notified water department
D42480223		north	8/14/12 9:20	y	15 gpm	n	n	16.4	7.33	117.6	2.5	0		<0.25	0.6	1.35	7.495	<0.5		notified water department
D42480214*	sub for 215	north	8/14/12 9:50	n			n													
D42480205		north	8/14/12 10:30	n			n													
D42482210	sub for 212	north	8/14/12 11:00	n			n													
D42482211*		north	8/14/12 11:30	n			n													
D42482228*	sub for 223	west	9/19/12 9:16	n			n													
D30470204*	sub for 203	west	9/19/12 9:30	n			n													
D36472227*	sub for 203	west	9/19/12 9:50	n (trickle)			n													
D39476232*	sub for 233	west	9/19/12 10:00	n			n													
D39478271		west	9/19/12 10:30	y	5-10 gpm	n	n	16.8	7.72	116.8	4.16	0		0.12	0.21	1.2	6.967	0.03		notified water department
D45468241		south	9/19/12 11:15	y	5-10 gpm	n	n	18.0	7.97	179.2	0.75	0			0.1					
D42456216	not found																			

Data in red exceed action levels, see Dry Weather Outfall and Illicit Discharge Screening Plan for more info.

* Manhole

Figure 1
Monitoring Sites Map
RY 2012/13

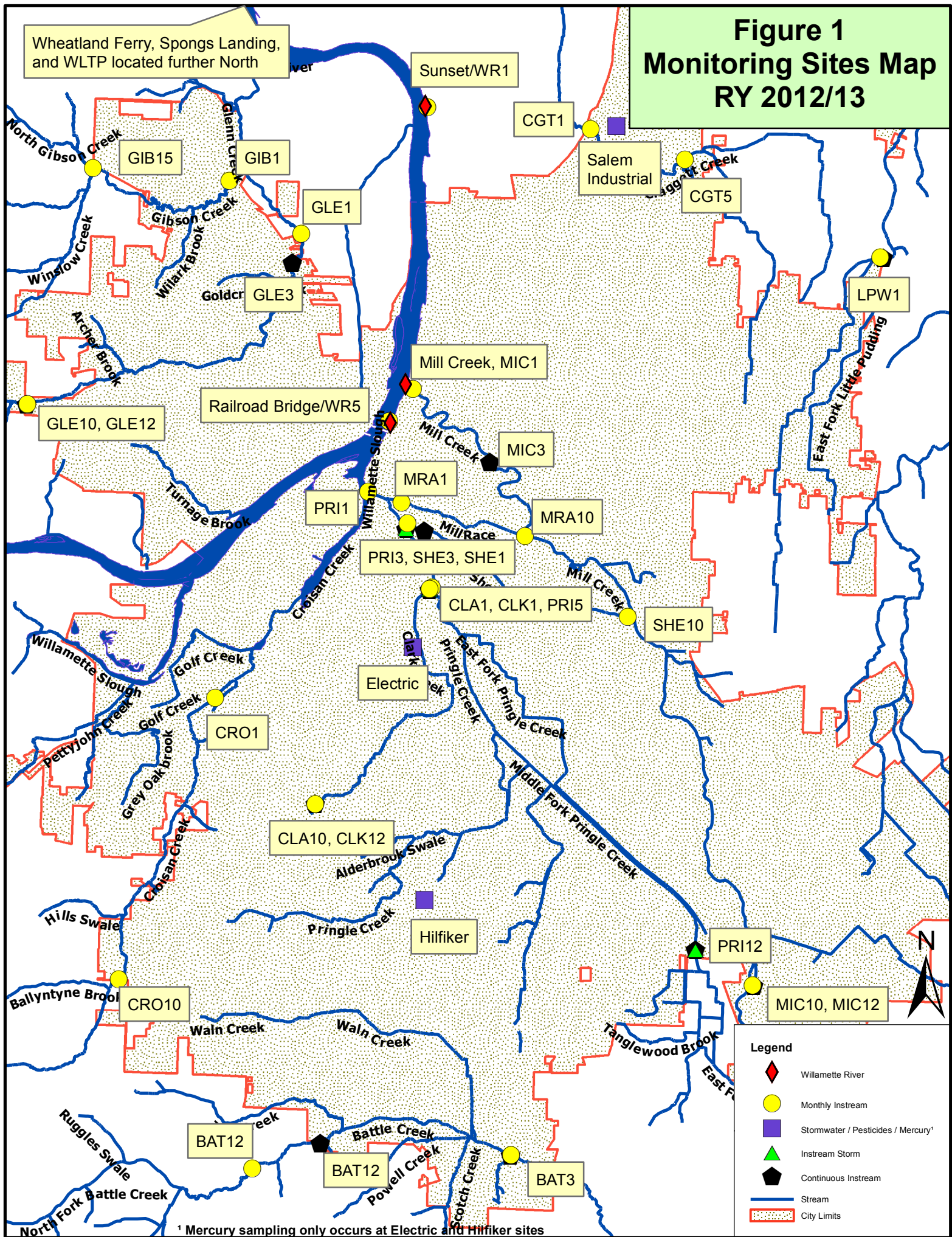
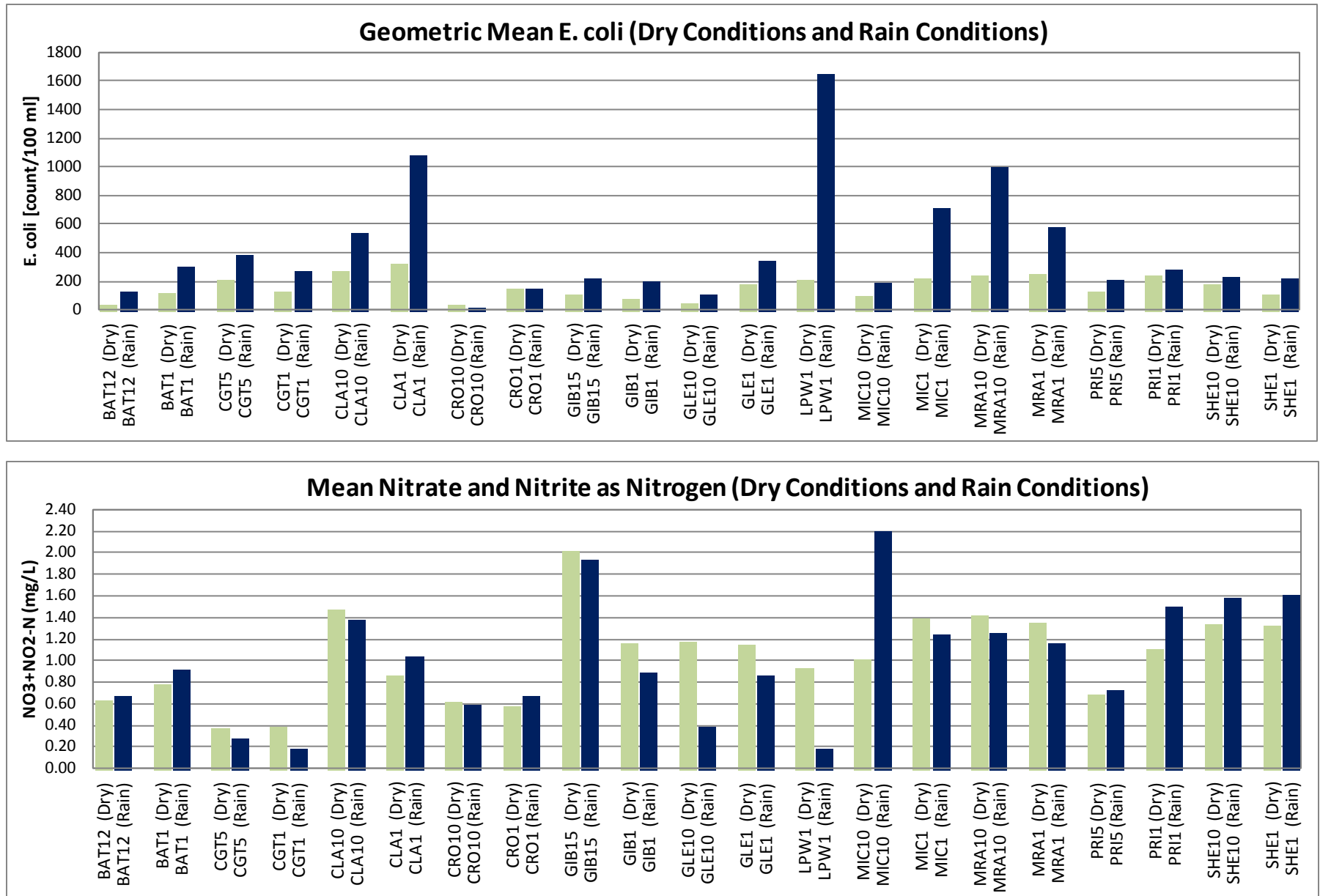


Figure 2

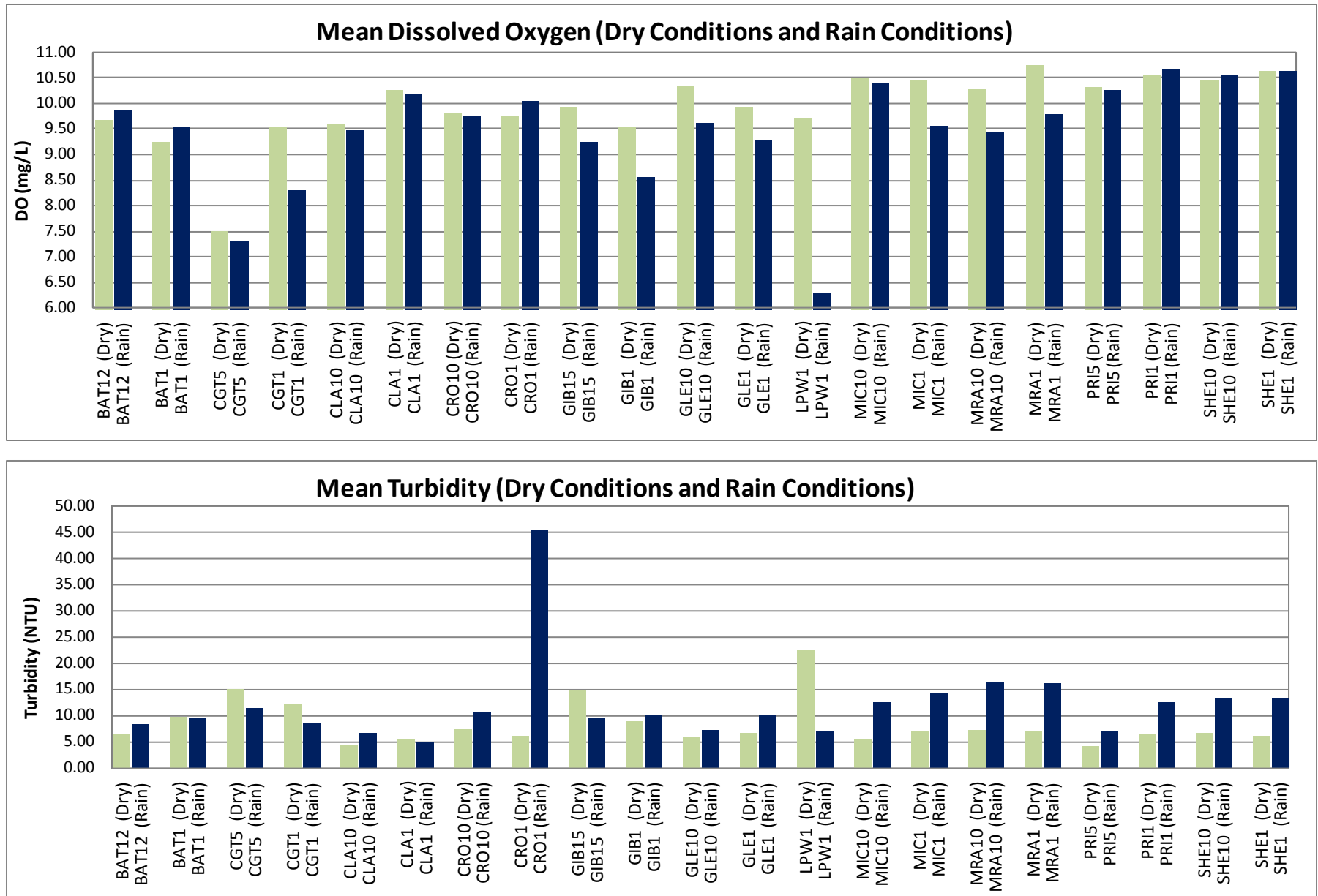
Monthly Instream Mean Value Comparison for Dry and Rain Conditions (RY 2012/13)



Dry conditions defined as less than 0.05 inches of rainfall in the 24 hours prior to sample collection; rain conditions defined as greater than or equal to 0.05 inches of rainfall in the 24 hours prior to sample collection.

Figure 2

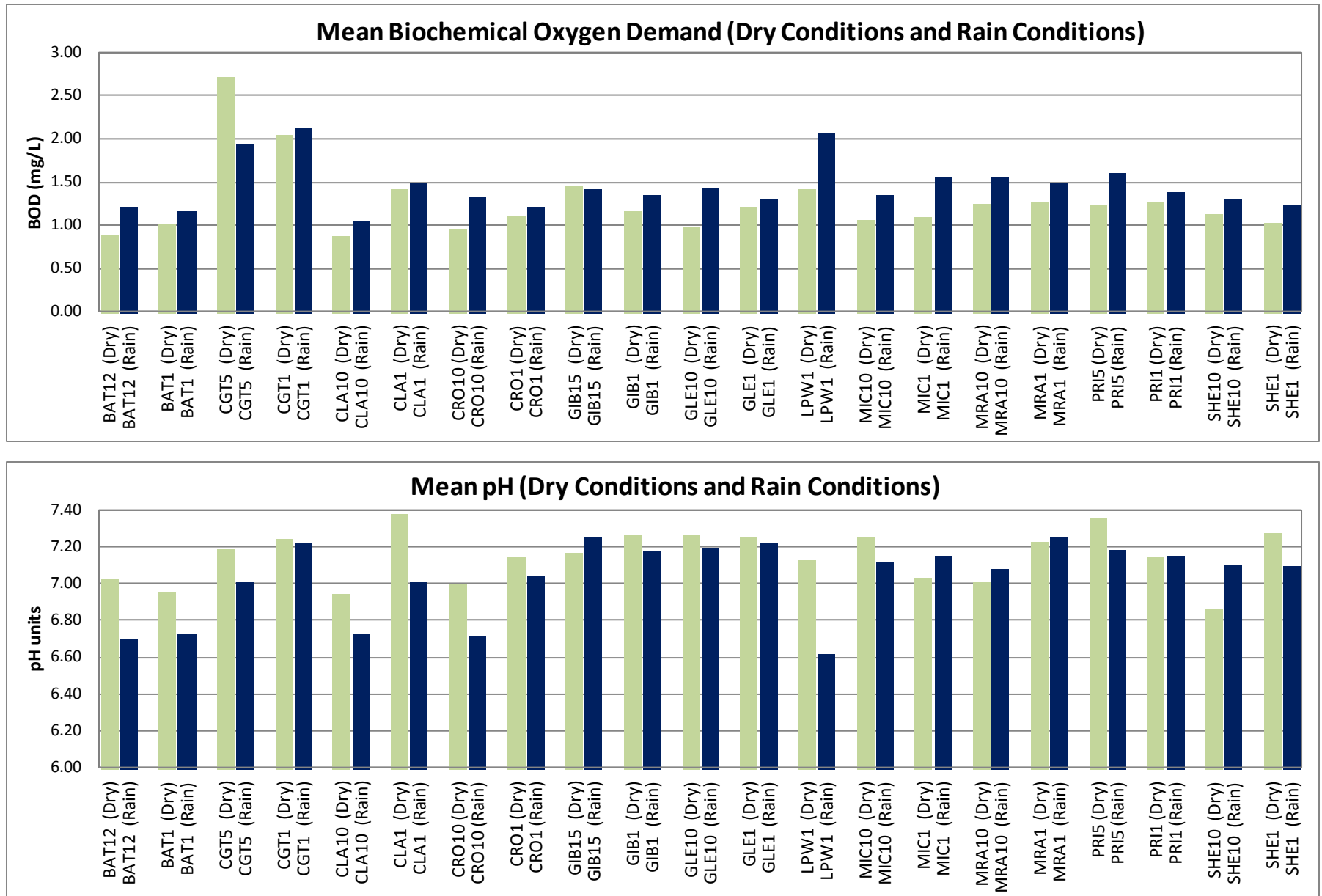
Monthly Instream Mean Value Comparison for Dry and Rain Conditions (RY 2012/13)



Dry conditions defined as less than 0.05 inches of rainfall in the 24 hours prior to sample collection; rain conditions defined as greater than or equal to 0.05 inches of rainfall in the 24 hours prior to sample collection.

Figure 2

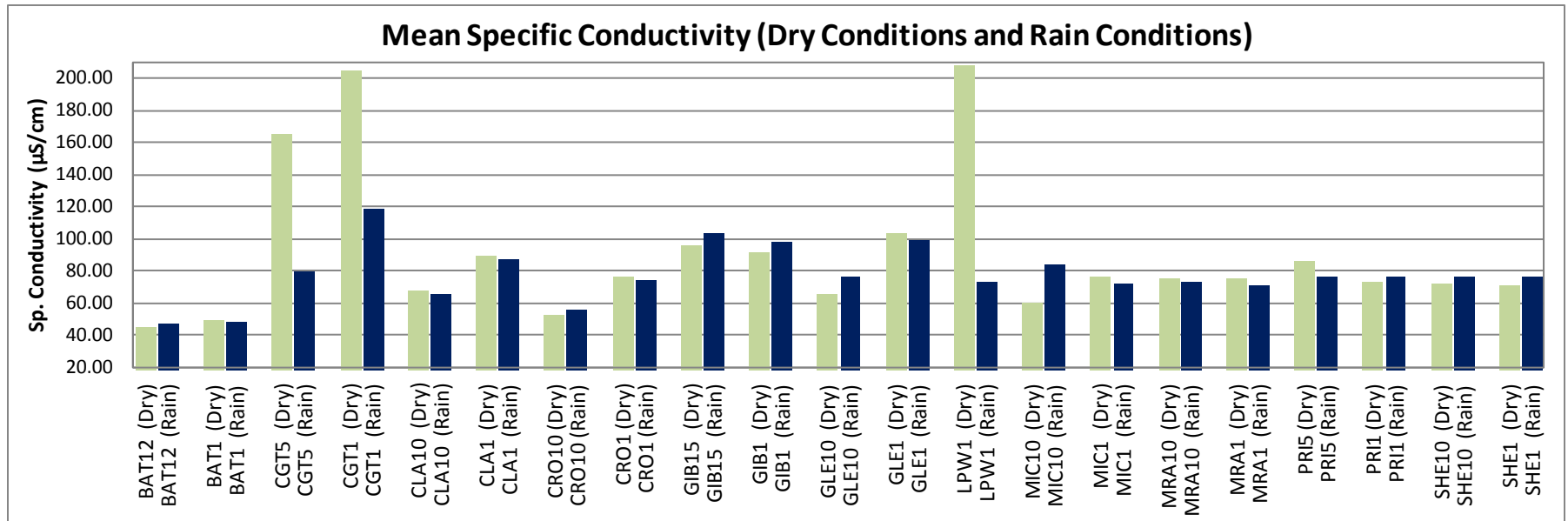
Monthly Instream Mean Value Comparison for Dry and Rain Conditions (RY 2012/13)



Dry conditions defined as less than 0.05 inches of rainfall in the 24 hours prior to sample collection; rain conditions defined as greater than or equal to 0.05 inches of rainfall in the 24 hours prior to sample collection.

Figure 2

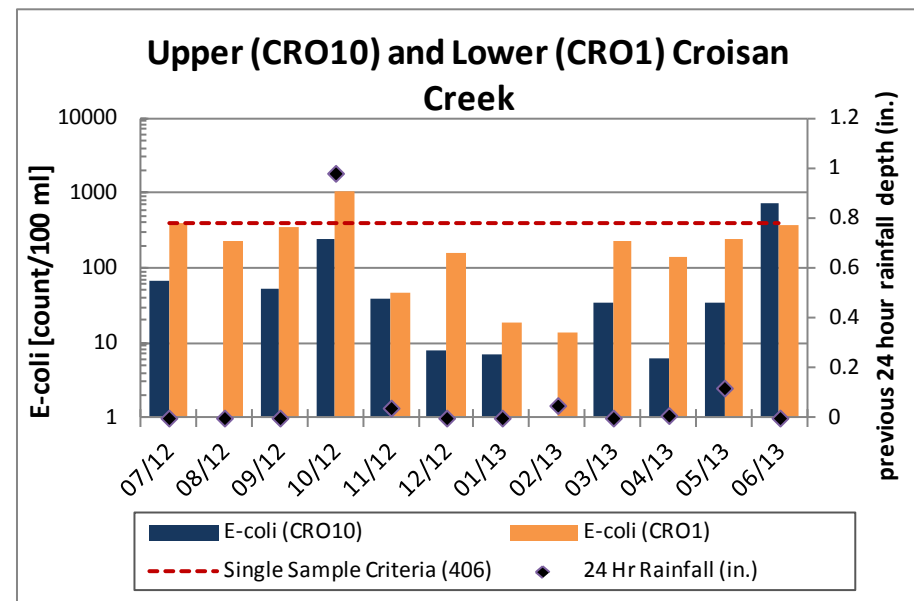
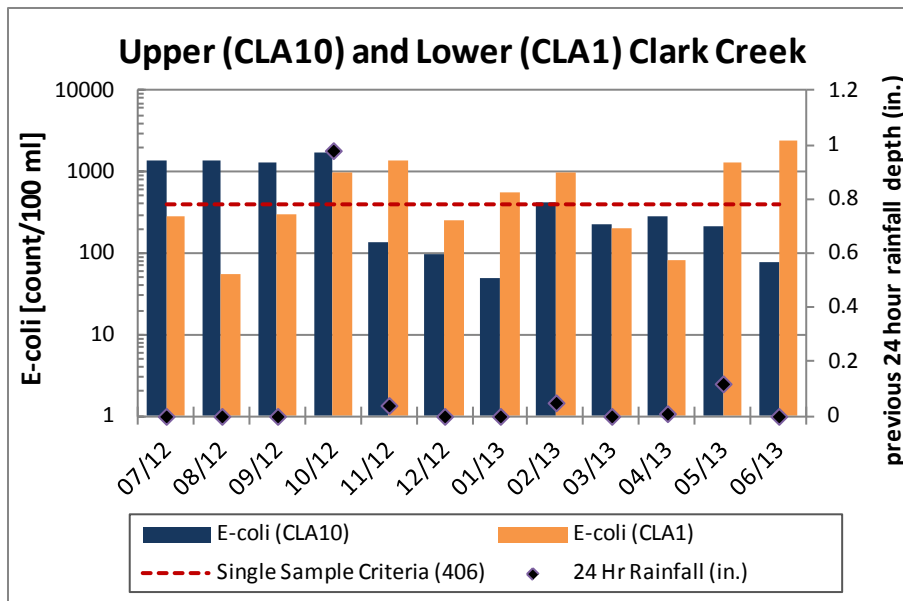
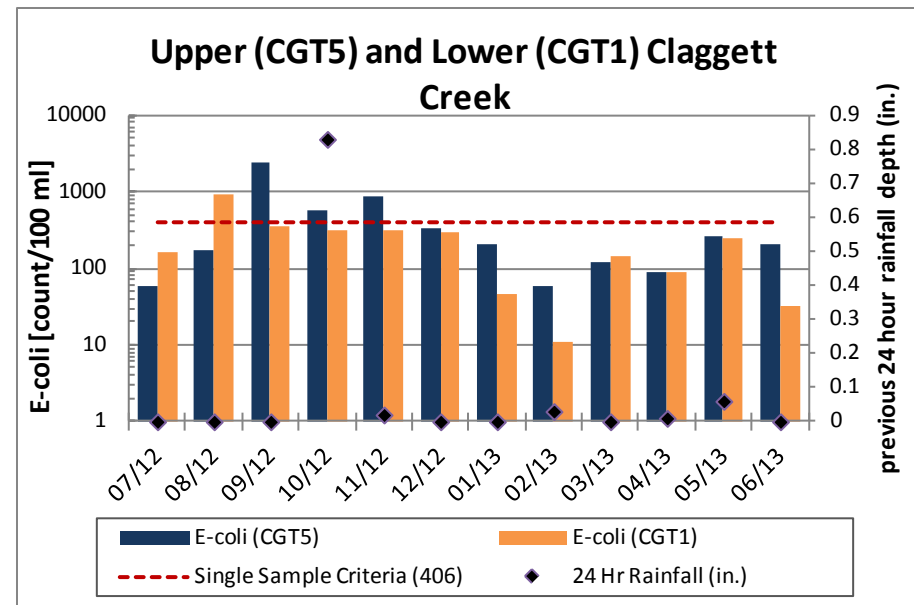
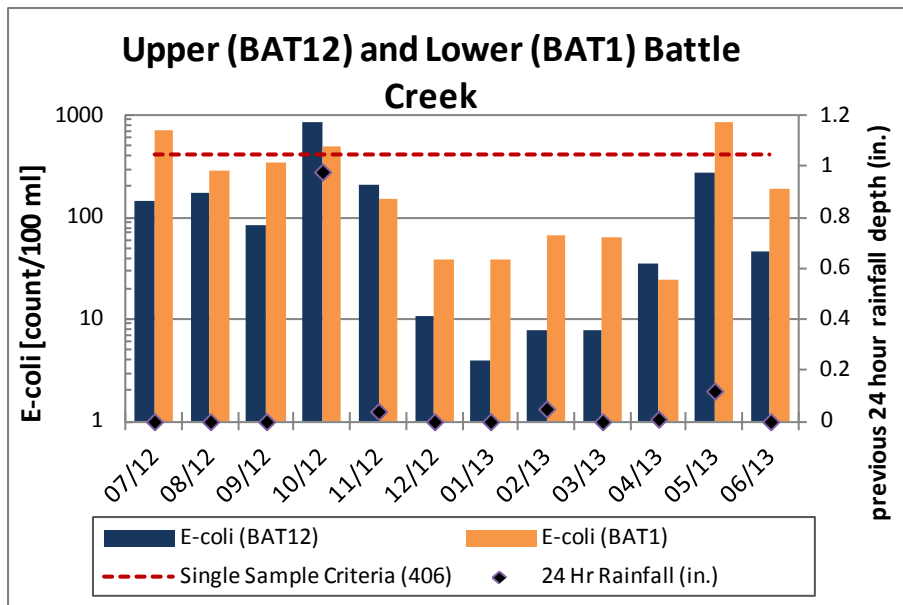
Monthly Instream Mean Value Comparison for Dry and Rain Conditions (RY 2012/13)



Dry conditions defined as less than 0.05 inches of rainfall in the 24 hours prior to sample collection; rain conditions defined as greater than or equal to 0.05 inches of rainfall in the 24 hours prior to sample collection.

Figure 3

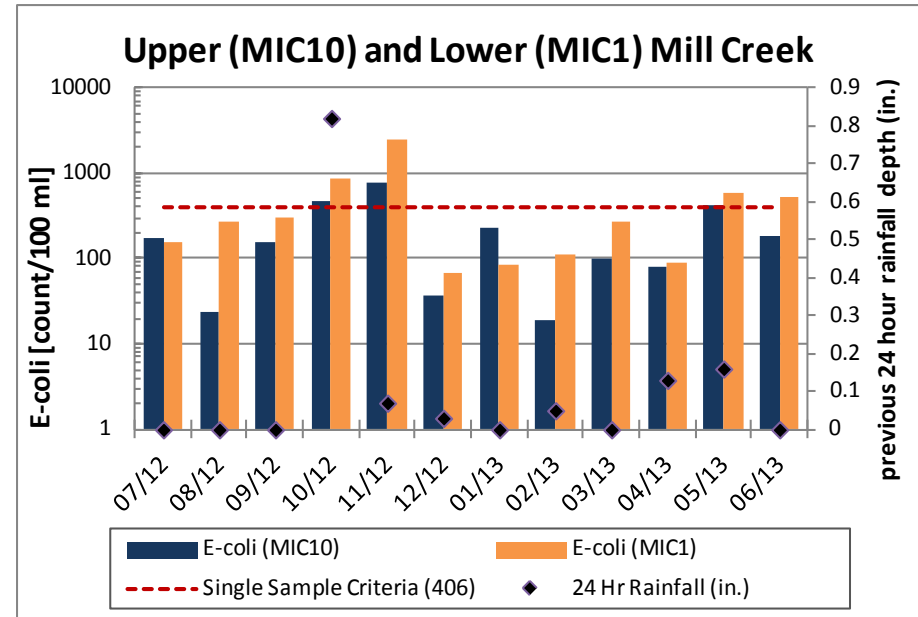
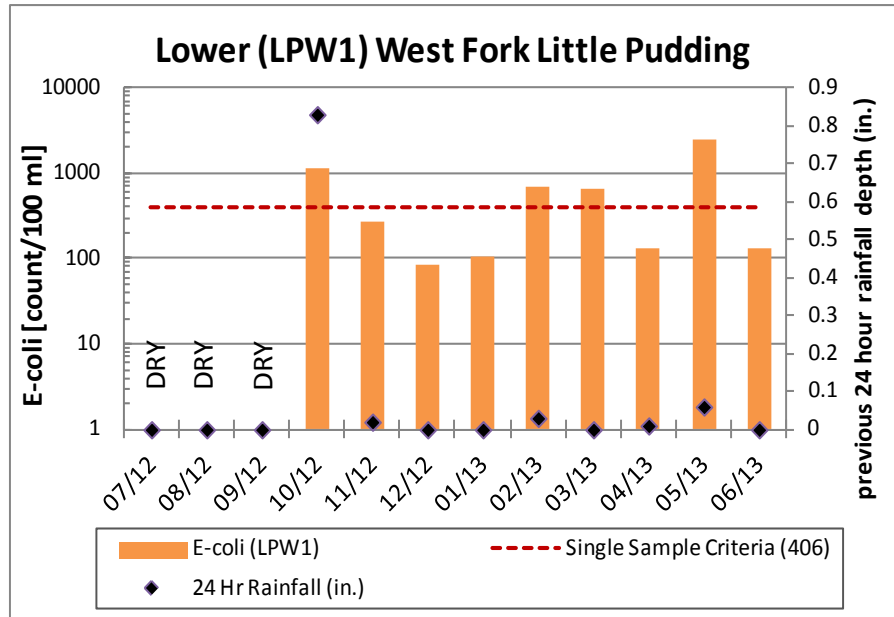
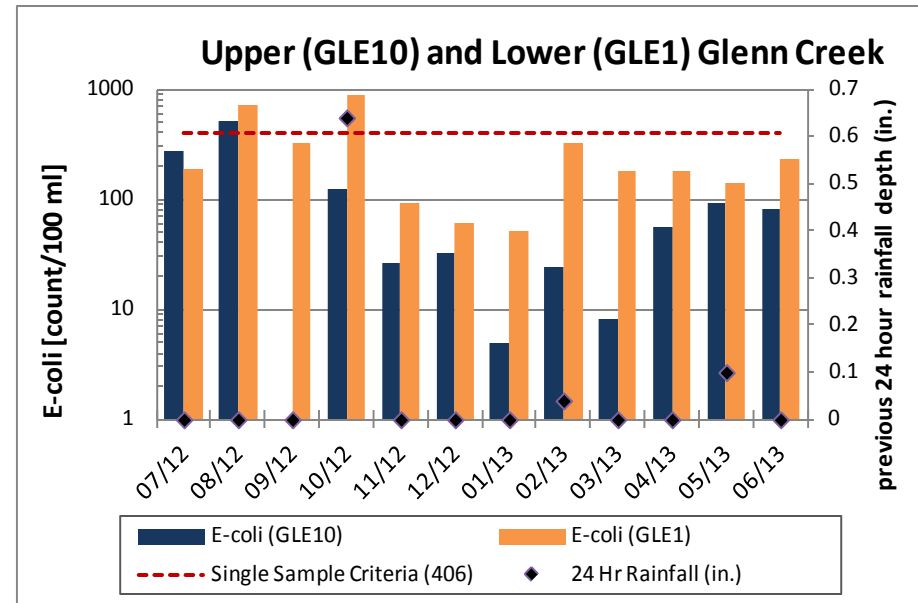
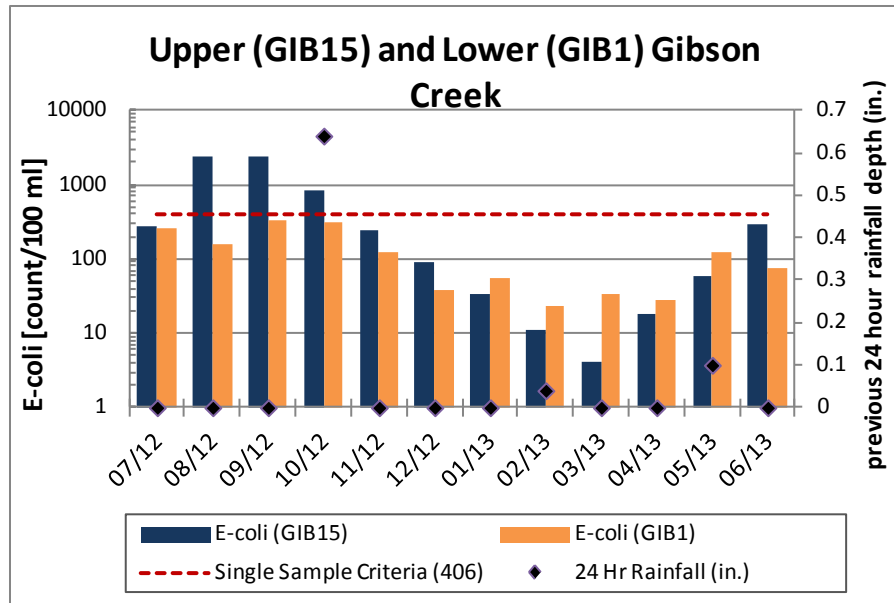
Monthly Instream E. Coli Upstream / Downstream Site Comparison (RY 2012/13)



If 24 hour rainfall depth prior to sample collection differed between upstream and downstream sites, the average rainfall was used.

Figure 3

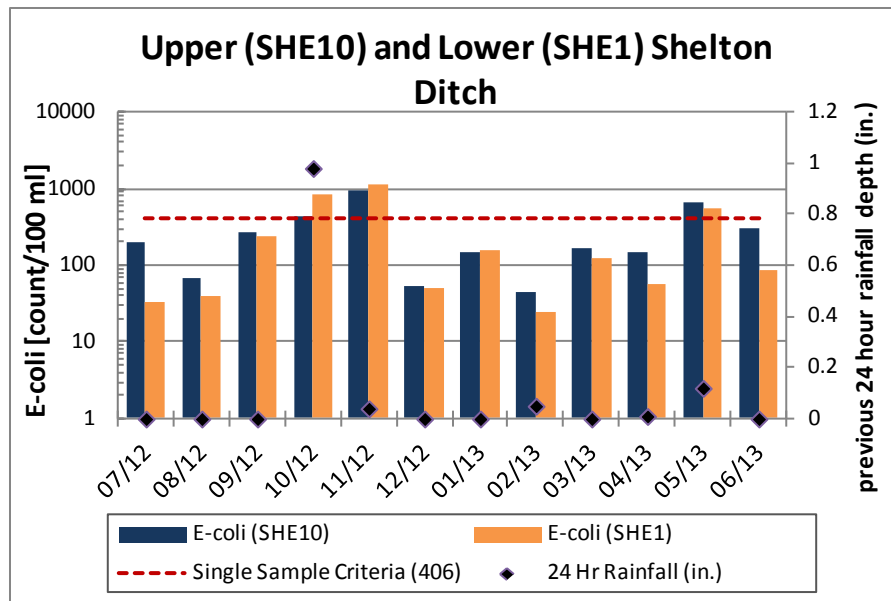
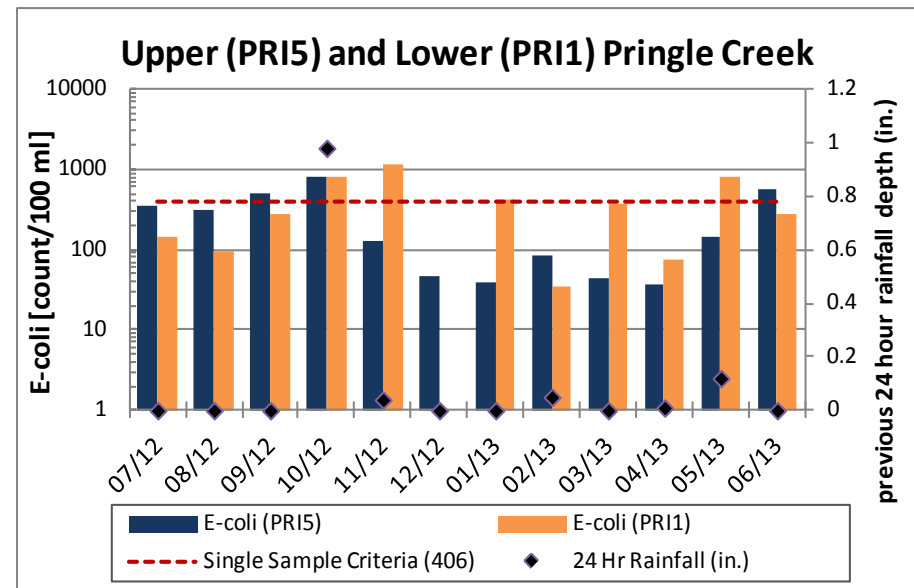
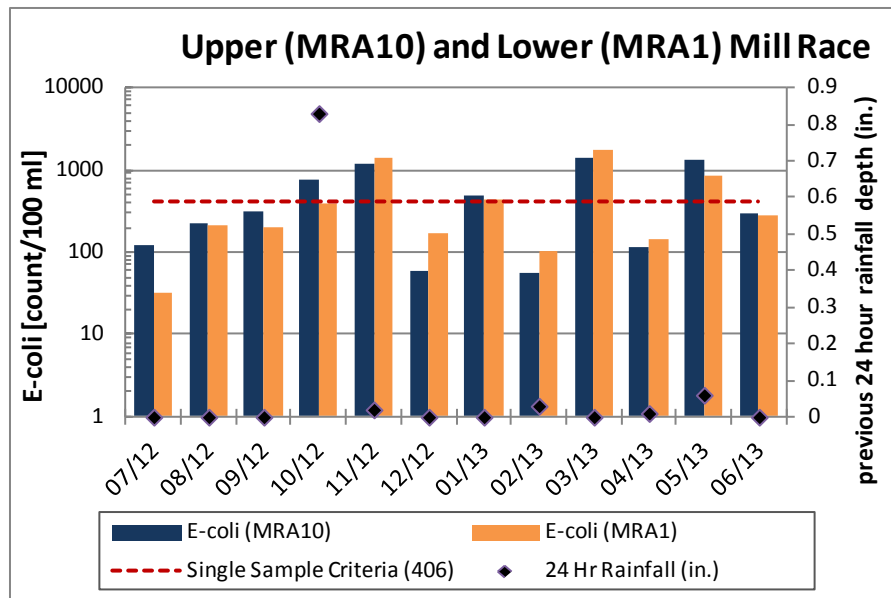
Monthly Instream E. Coli Upstream / Downstream Site Comparison (RY 2012/13)



If 24 hour rainfall depth prior to sample collection differed between upstream and downstream sites, the average rainfall was used.

Figure 3

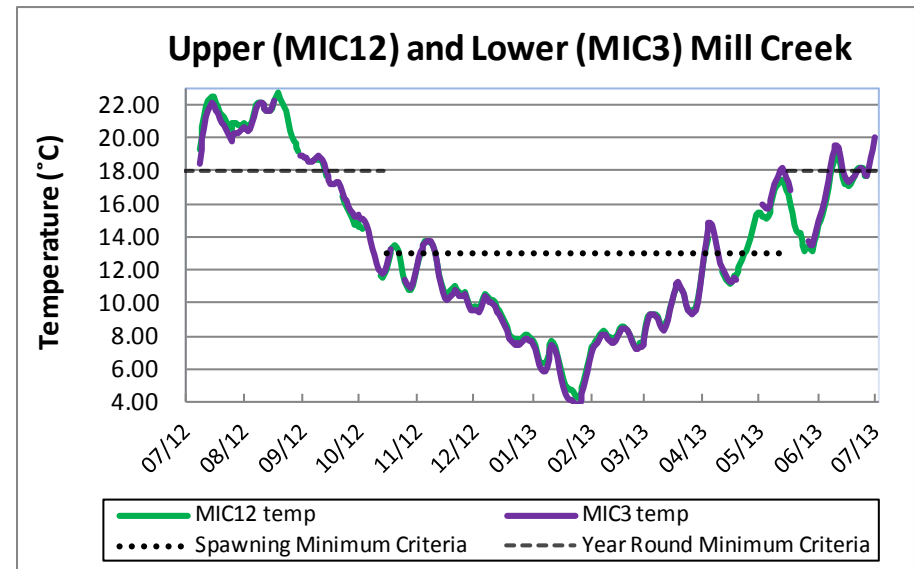
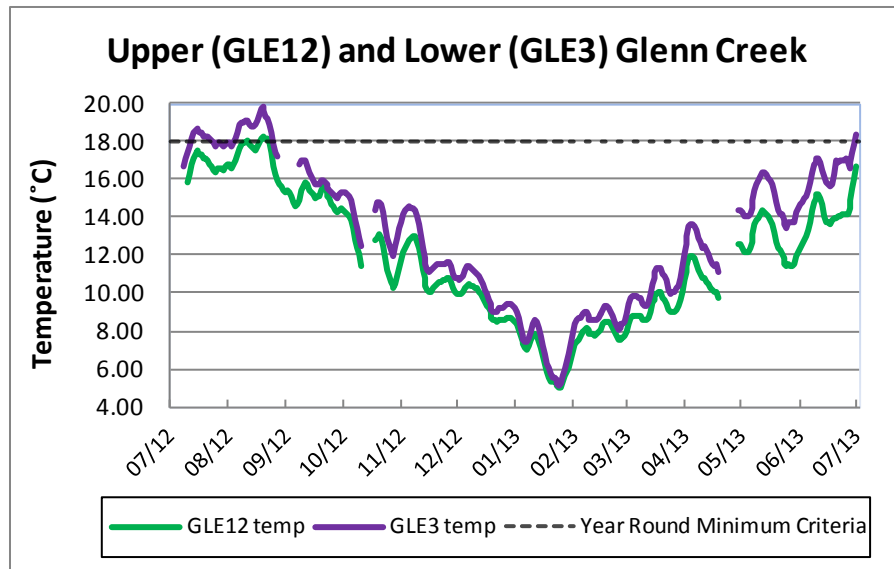
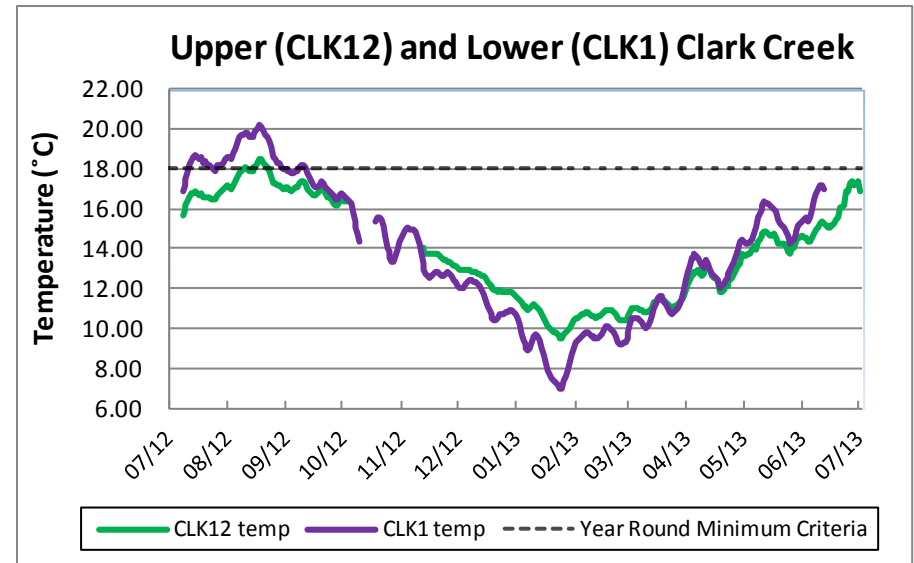
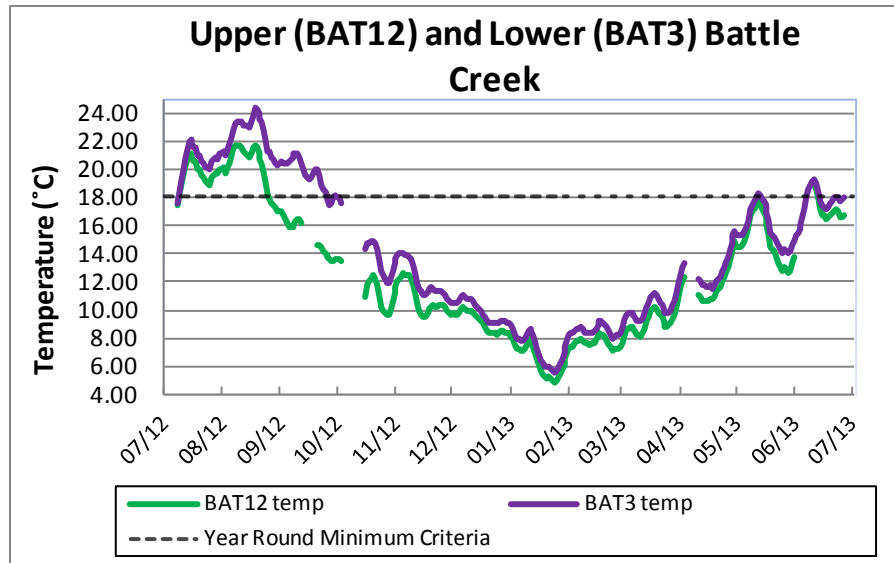
Monthly Instream E. Coli Upstream / Downstream Site Comparison (RY 2012/13)



If 24 hour rainfall depth prior to sample collection differed between upstream and downstream sites, the average rainfall was used.

Figure 4

Continuous Instream Temperature 7-Day Moving Average Maximum (RY 2012/13)



Presented temperature data consists of A grade data with greater than 80% of data points collected per day.

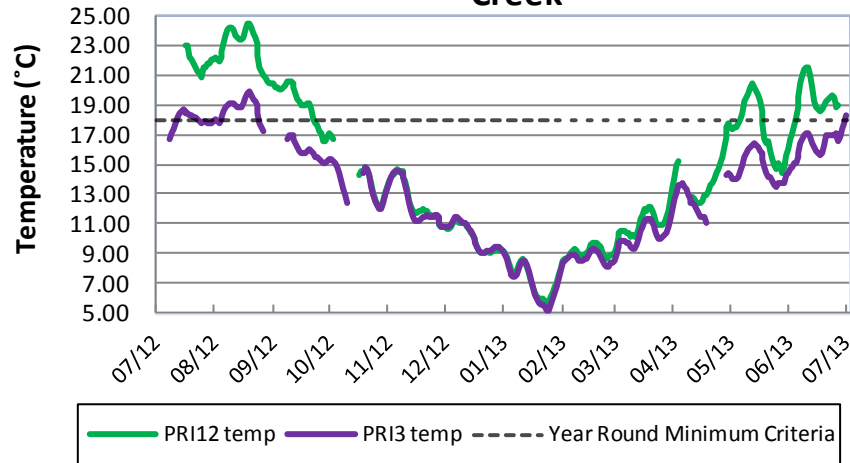
Temperature Criteria as defined in OAR 340-041-0028 and OAR-340-0340, Tables 340A and 340B.

- Spawning Minimum Criteria for applicable streams may not exceed 7-day average maximum of 13°C.
- Year Round Minimum Criteria may not exceed 7-day average maximum of 18°C.

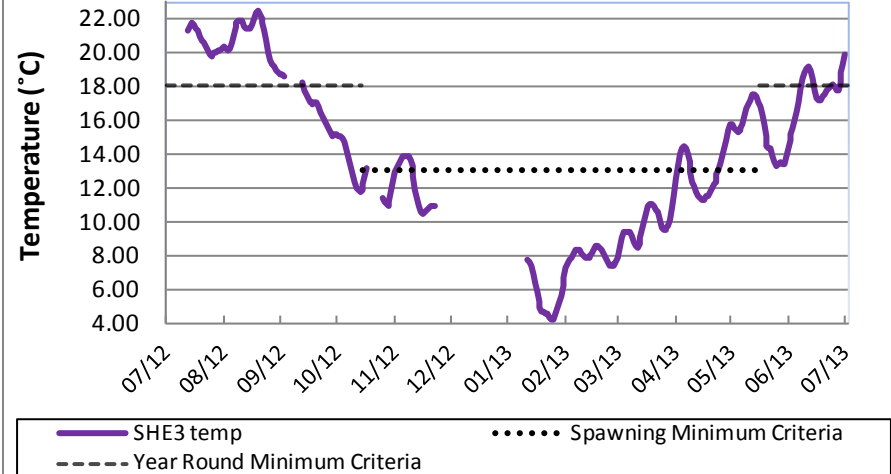
Figure 4

Continuous Instream Temperature 7-Day Moving Average Maximum (RY 2012/13)

Upper (PRI12) and Lower (PRI3) Pringle Creek



Lower (SHE3) Shelton Ditch



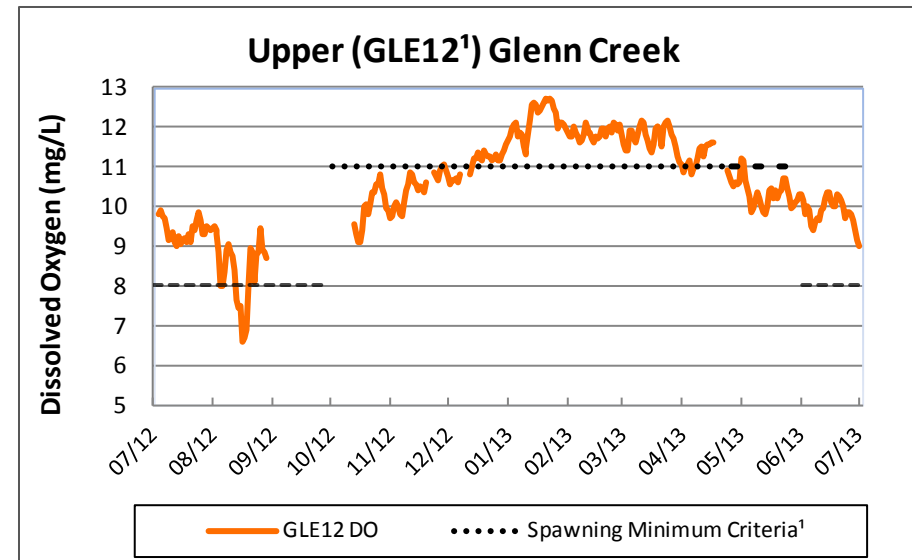
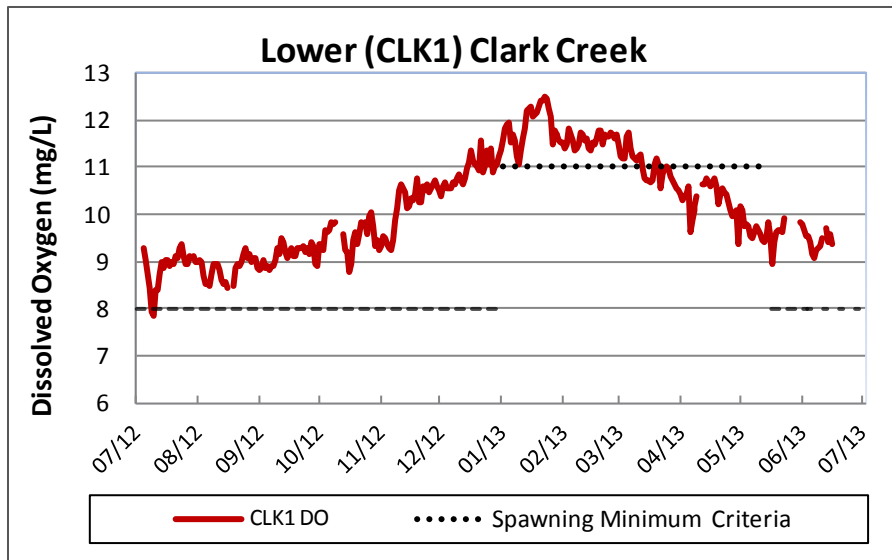
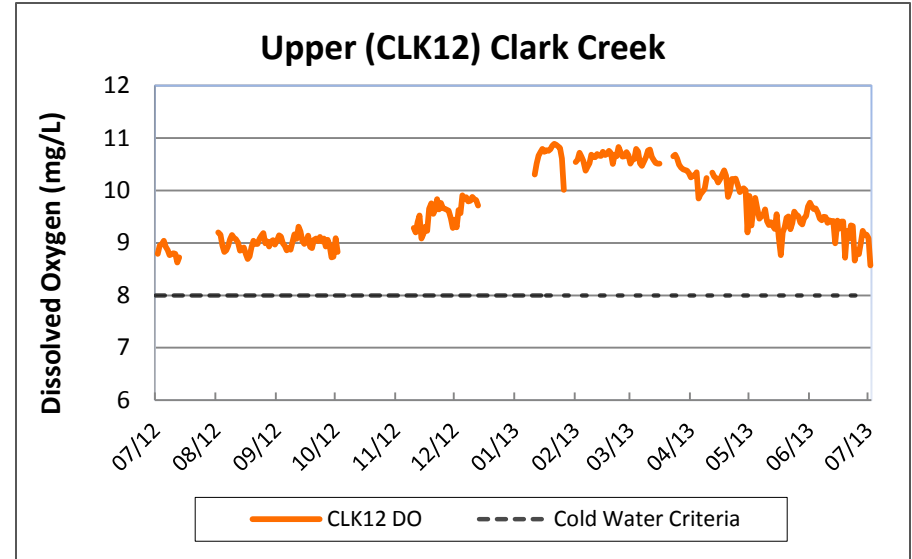
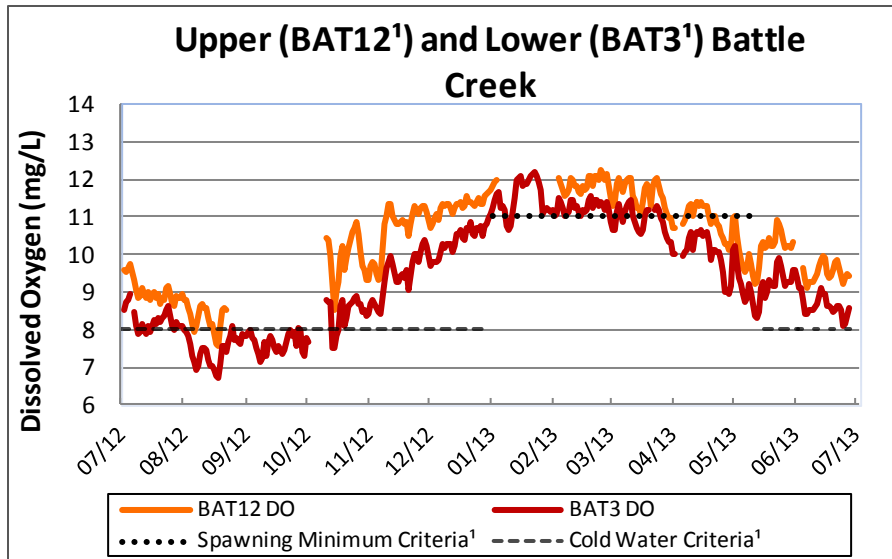
Presented temperature data consists of A grade data with greater than or equal to 80% of data points collected per day.

Temperature Criteria as defined in OAR 340-041-0028 and OAR-340-0340, Tables 340A and 340B.

- Spawning Minimum Criteria for applicable streams may not exceed 7-day average maximum of 13°C.
- Year Round Minimum Criteria may not exceed 7-day average maximum of 18°C.

Figure 5

Continuous Instream Dissolved Oxygen Daily Mean (RY 2012/13)



Presented DO data consists of A and B grade data with greater than or equal to 80% of data points collected per day.

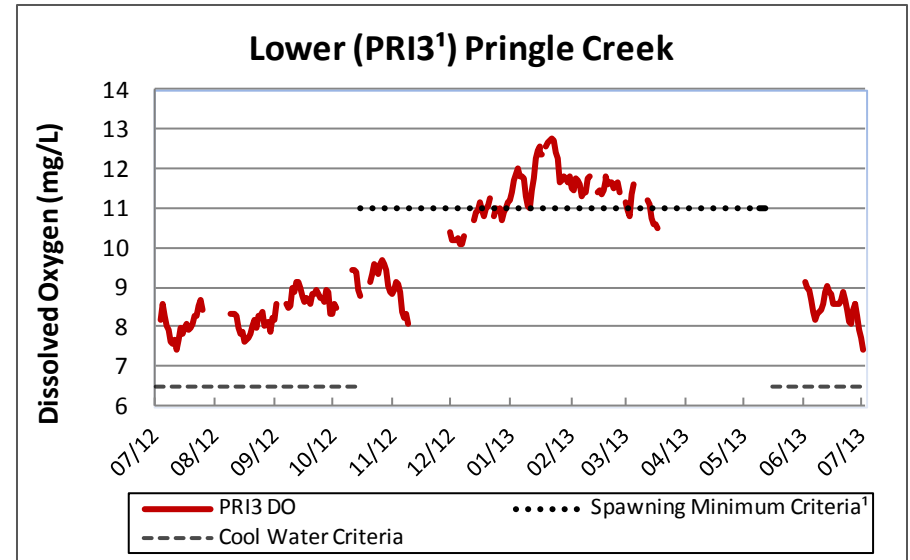
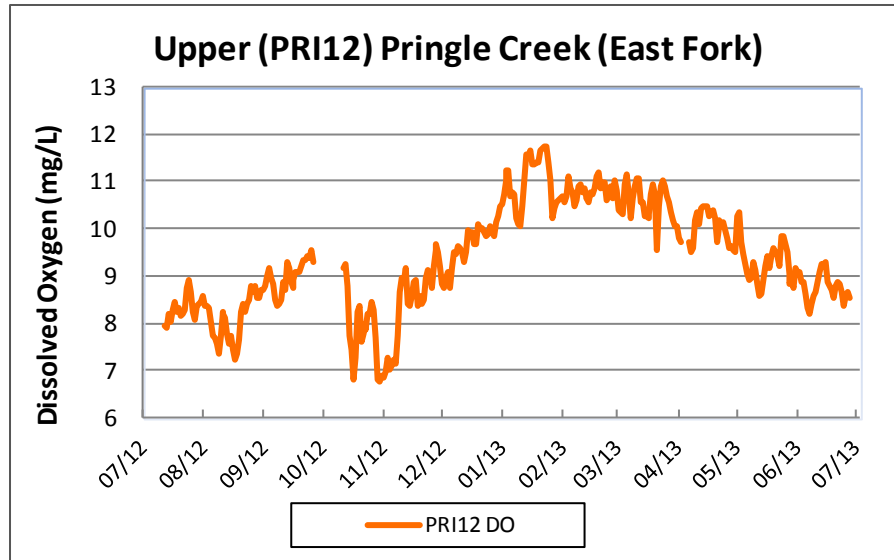
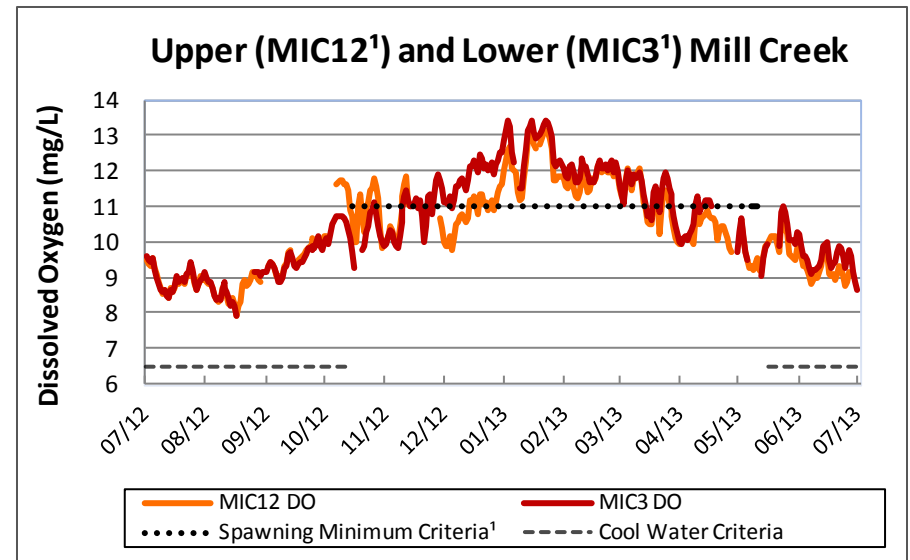
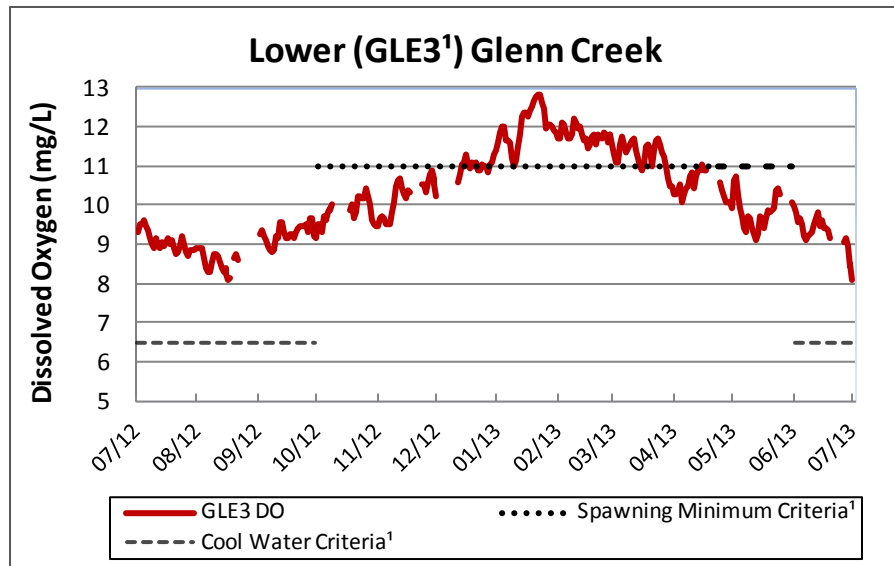
DO Criteria as defined in OAR 340-041-0016 and OAR-340-0340, Tables 340A and 340B.

- Spawning Minimum Criteria for applicable streams may not be less than 11 mg/L .

- Cold Water Criteria for applicable streams may not be less than 8 mg/L.

¹ Oregon's 2010 Integrated Report Section 303(d) listed.

Figure 5
Continuous Instream Dissolved Oxygen Daily Mean (RY 2012/13)



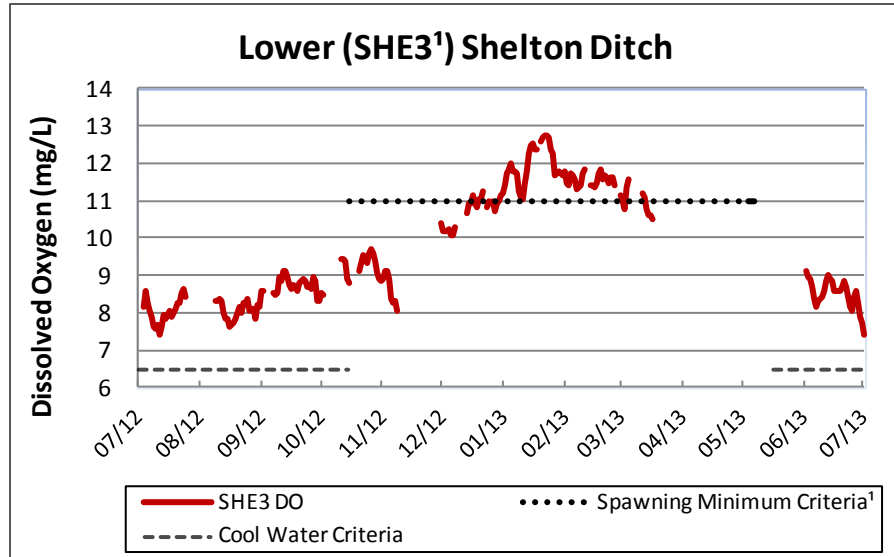
Presented DO data consists of A and B grade data with greater than or equal to 80% of data points collected per day.

DO Criteria as defined in OAR 340-041-0016 and OAR-340-0340, Tables 340A and 340B.

- Spawning Minimum Criteria for applicable streams may not be less than 11 mg/L .
- Cool Water Criteria for applicable streams may not be less than 6.5 mg/L.

¹ Oregon's 2010 Integrated Report Section 303(d) listed.

Figure 5
Continuous Instream Dissolved Oxygen Daily Mean (RY 2012/13)

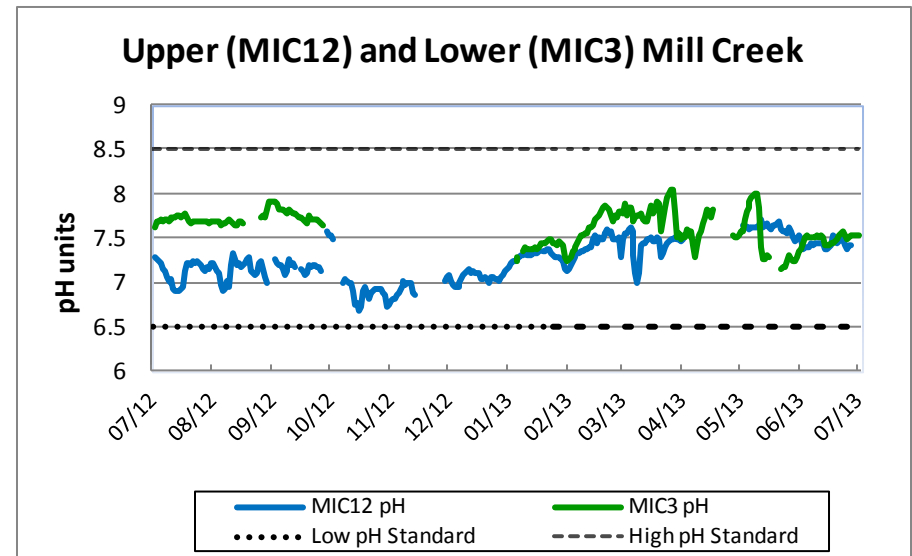
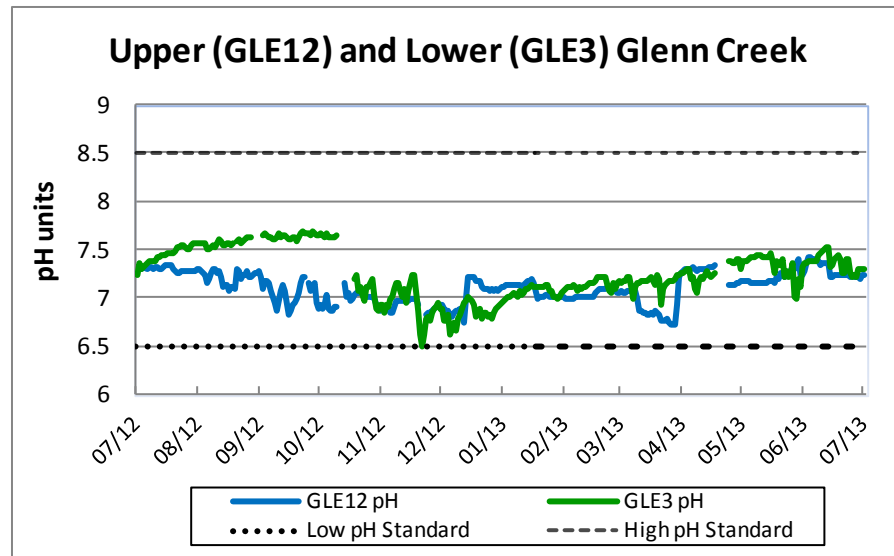
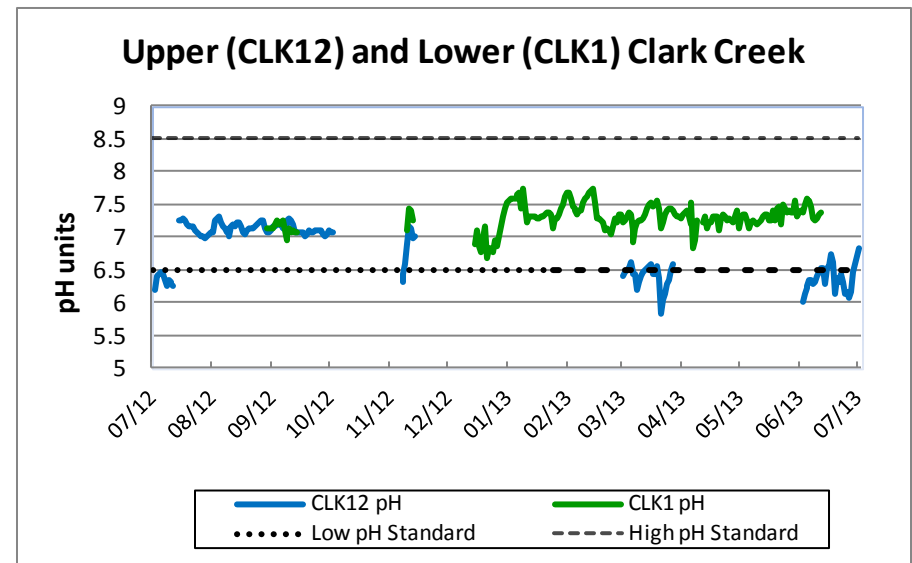
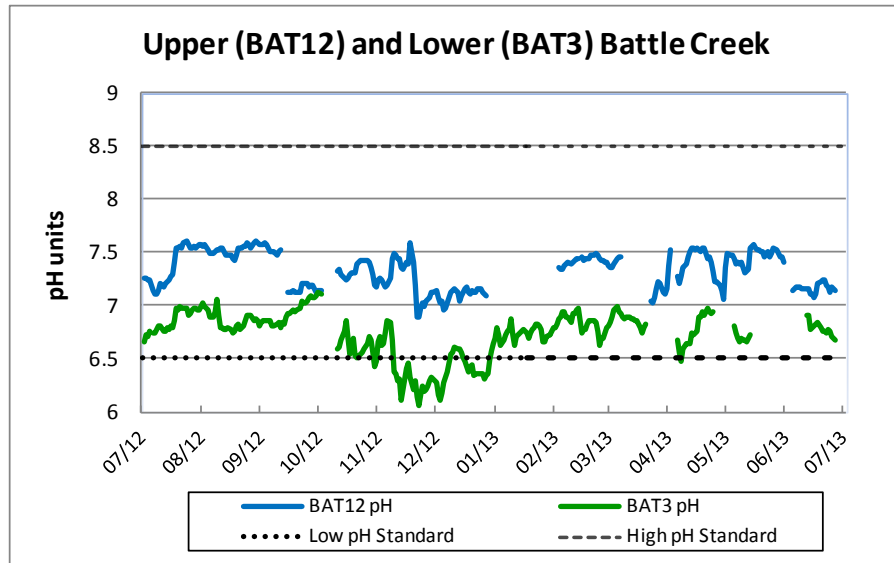


Presented DO data consists of A and B grade data with greater than or equal to 80% of data points collected per day.
DO Criteria as defined in OAR 340-041-0016 and OAR-340-0340, Tables 340A and 340B.

- Spawning Minimum Criteria for applicable streams may not be less than 11 mg/L .
- Cool Water Criteria for applicable streams may not be less than 6.5 mg/L.

¹ Oregon's 2010Integrated Report Section 303(d) listed.

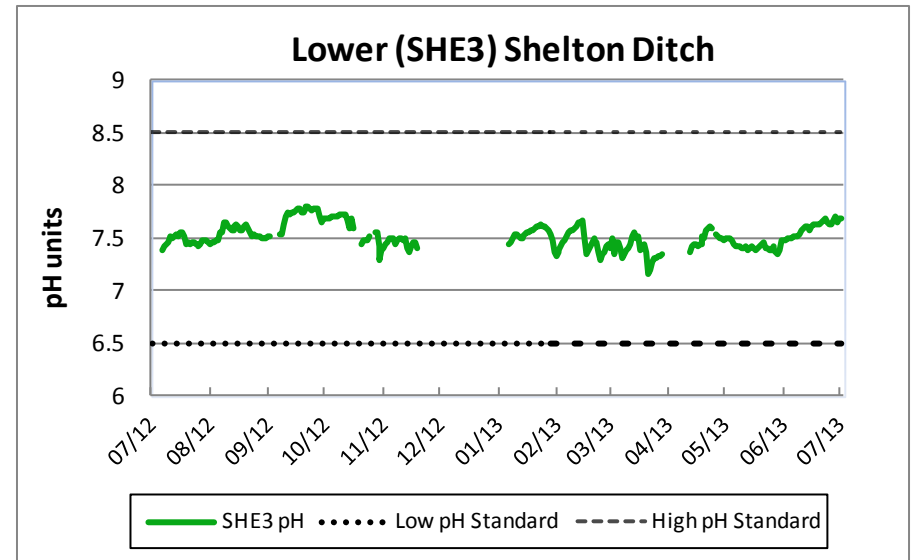
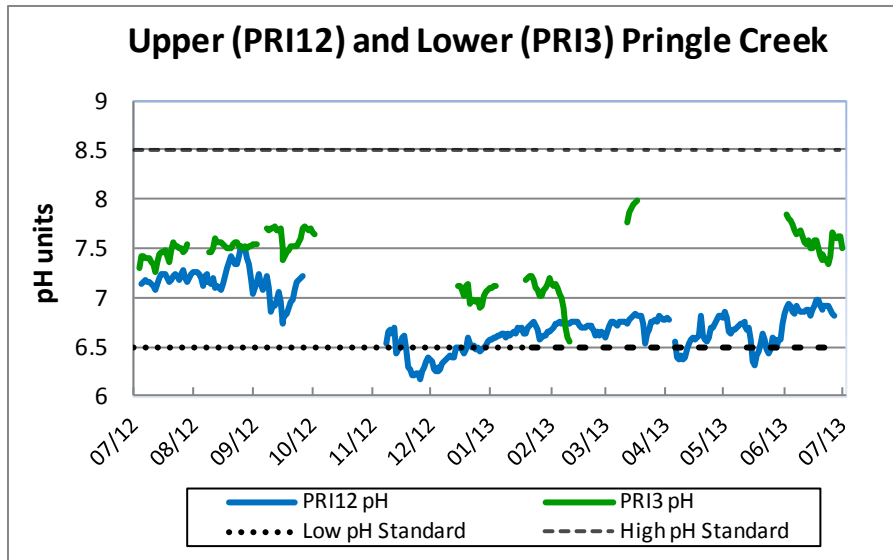
Figure 6
Continuous Instream pH Daily Mean (RY 2012/13)



Presented pH data consists of A and B grade data with greater than or equal to 80% of data points collected per day.
As defined in OAR 341-041-0035, Water Quality Standards for the Willamette Basin, pH may not fall outside the ranges of 6.5 to 8.5.

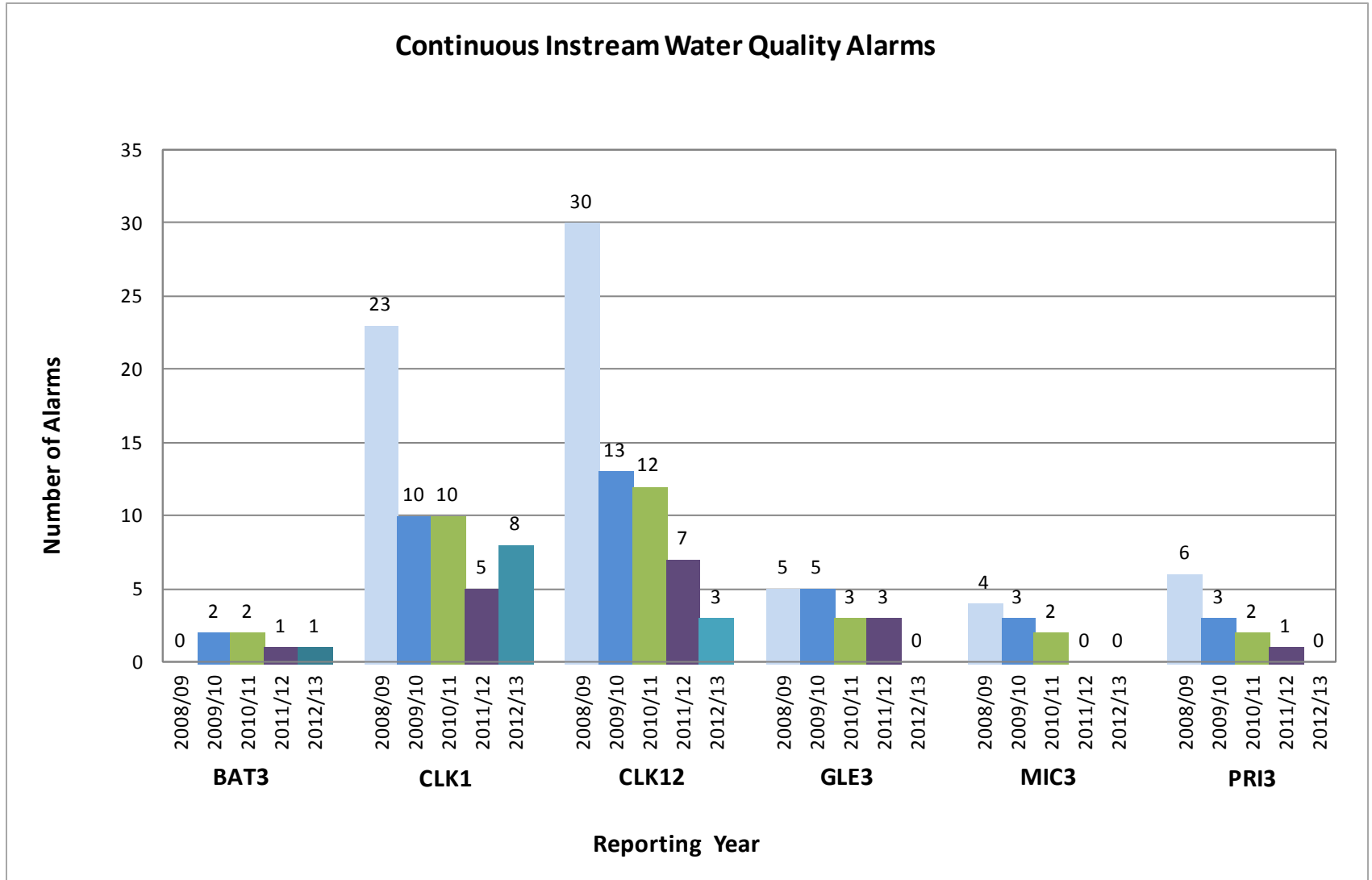
Figure 6

Continuous Instream pH Daily Mean (RY 2012/13)



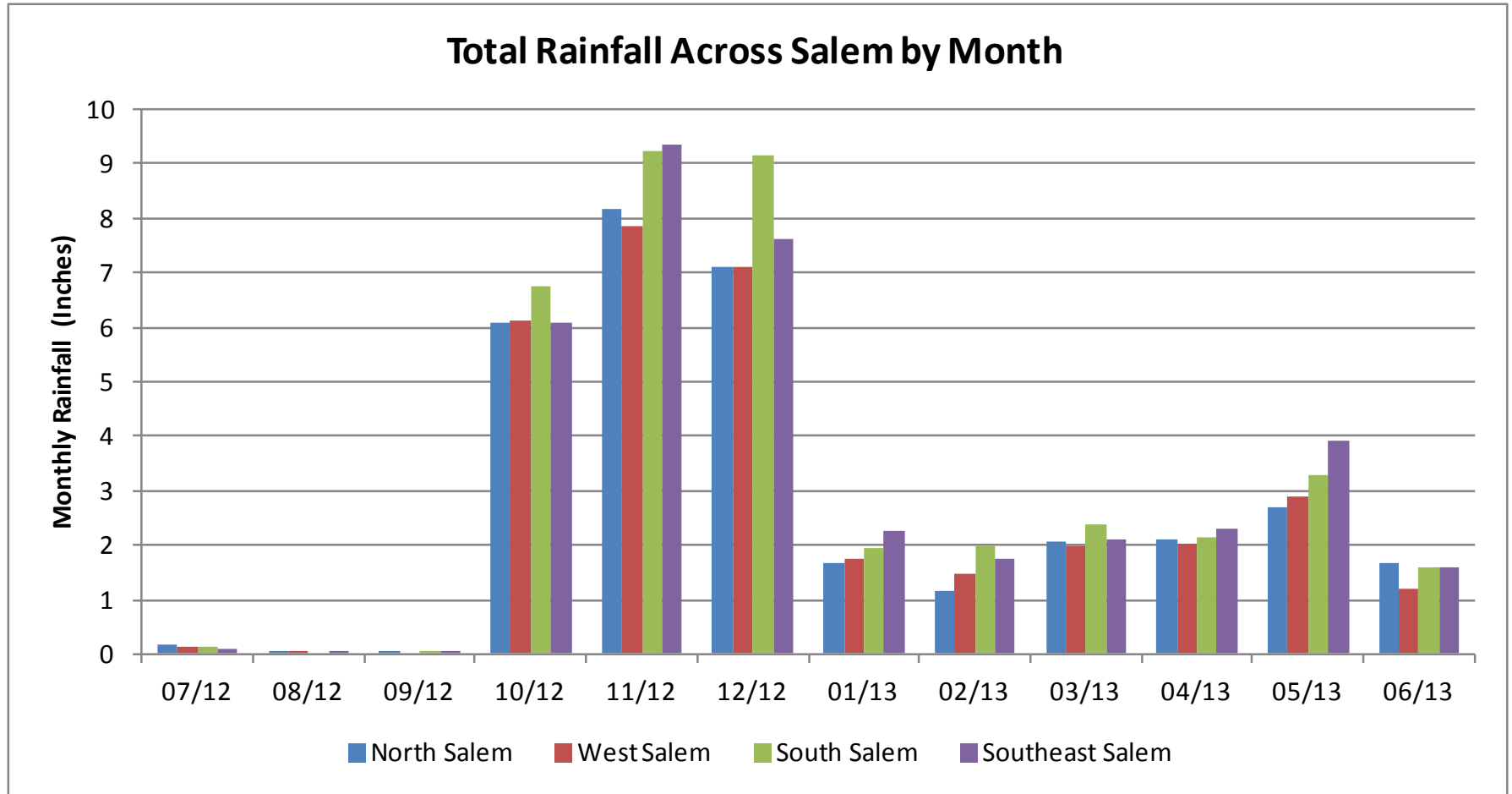
Presented pH data consists of A and B grade data with greater than or equal to 80% of data points collected per day.
As defined in OAR 341-041-0035, Water Quality Standards for the Willamette Basin, pH may not fall outside the ranges of 6.5 to 8.5.

Figure 7
Continuous Instream Water Quality Alarms (RY 2008/09 to 2012/13)



Note: The alarm counts have been filtered, based on best professional judgment, to remove alarms resulting from: rain events, non-prohibited activities identified in Schedule A.4.a.xii in the City's NPDES MS4 permit, permitted activities during the in-water work period, and wildlife activity.

Figure 8
Total Rainfall Across Salem by Month (RY 2012/13)



Rainfall data are from 4 rain gauges maintained by City of Salem that best represent each section of town.

ATTACHMENT A. Analytical Reports for Pesticide Screening, Pacific Agricultural Laboratory (October 12, 2012 and June 18, 2013).

City of Salem
1410 20th St. SE Building 2
Salem, OR 97302

Report Number: P121441
Report Date: November 05, 2012
Client Project ID: [none]

Analytical Report

Client Sample ID: Electric

Matrix: water

PAL Sample ID: P121441-01

Sample Date: 10/12/12

Extraction Date	Analysis Date	Analyte	Amount Detected	Limit of Quantitation	Notes
Method: Multiresidue Profile					
10/18/12	10/25/12	MR Pesticides	Not Detected	See Analyte List	
Surrogate Recovery: 66 %					
Surrogate Recovery Range: 32-160					
(DCBP used as Surrogate)					

Client Sample ID: Hilfiker

Matrix: water

PAL Sample ID: P121441-02

Sample Date: 10/12/12

Extraction Date	Analysis Date	Analyte	Amount Detected	Limit of Quantitation	Notes
Method: Multiresidue Profile					
10/18/12	10/25/12	MR Pesticides	Not Detected	See Analyte List	
Surrogate Recovery: 52 %					
Surrogate Recovery Range: 32-160					
(DCBP used as Surrogate)					

Client Sample ID: Salem Industrial

Matrix: water

PAL Sample ID: P121441-03

Sample Date: 10/12/12

Extraction Date	Analysis Date	Analyte	Amount Detected	Limit of Quantitation	Notes
Method: Multiresidue Profile					
10/18/12	10/24/12	Simazine	1.3 ug/L	0.60 ug/L	
10/18/12	10/25/12	Propiconazole	0.30 ug/L	0.30 ug/L	
10/18/12	10/25/12	Other Pesticides	Not Detected	See Analyte List	
Surrogate Recovery: 81 %					
Surrogate Recovery Range: 32-160					
(DCBP used as Surrogate)					





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City of Salem

1410 20th St. SE Building 2

Salem, OR 97302

Report Number: P121441

Report Date: November 05, 2012

Client Project ID: [none]

Analytical Report

Client Sample ID: Salem Industrial-DUP

Matrix: water

PAL Sample ID: P121441-04

Sample Date: 10/12/12

Extraction Date	Analysis Date	Analyte	Amount Detected	Limit of Quantitation	Notes
Method: Multiresidue Profile					
10/18/12	10/24/12	Simazine	1.1 ug/L	0.60 ug/L	
10/18/12	10/25/12	Other Pesticides	Not Detected	See Analyte List	

Surrogate Recovery: 78 %

Surrogate Recovery Range: 32-160

(DCBP used as Surrogate)

Steve Thun For Rick Jordan, Laboratory Manager



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City of Salem

1410 20th St. SE Building 2

Salem, OR 97302

Report Number: P121441

Report Date: November 05, 2012

Client Project ID: [none]

Quality Assurance

Method Blank Data **Matrix:** water

Extraction Date	Analysis Date	Batch QC Sample #	Analyte	% Recovery	Expected % Recovery	Notes
Method: Multiresidue Profile						
10/18/12	10/25/12	2101801-BLK1	MR Pesticides	Not Detected	<LoQ	

Blank Spike Data **Matrix:** water

Extraction Date	Analysis Date	Batch QC Sample #	Analyte	% Recovery	Expected % Recovery	Notes
10/18/12	10/21/12	2101801-BS1	Bendiocarb	64	11-100	
10/18/12	10/21/12	2101801-BSD1	Bendiocarb	62	11-100	
10/18/12	10/24/12	2101801-BS1	Diazinon	85	34-145	
10/18/12	10/24/12	2101801-BSD1	Diazinon	85	34-145	
10/18/12	10/25/12	2101801-BS1	Dieldrin	97	48-152	
10/18/12	10/25/12	2101801-BSD1	Dieldrin	101	48-152	
10/18/12	10/21/12	2101801-BS1	Monuron	79	46-122	
10/18/12	10/21/12	2101801-BSD1	Monuron	83	46-122	
10/18/12	10/25/12	2101801-BS1	Oxadiazon	111	71-129	
10/18/12	10/25/12	2101801-BSD1	Oxadiazon	110	71-129	
10/18/12	10/23/12	2101801-BS1	Paclobutrazol	79	40-120	
10/18/12	10/23/12	2101801-BSD1	Paclobutrazol	79	40-120	
10/18/12	10/24/12	2101801-BS1	Parathion methyl	68	40-120	
10/18/12	10/24/12	2101801-BSD1	Parathion methyl	66	40-120	
10/18/12	10/23/12	2101801-BS1	Propiconazole	90	40-120	
10/18/12	10/23/12	2101801-BSD1	Propiconazole	87	40-120	

Steve Thun For Rick Jordan, Laboratory Manager



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City of Salem

1410 20th St. SE Building 2

Salem, OR 97302

Report Number: P121441

Report Date: November 05, 2012

Client Project ID: [none]

Project Information

Methodology Employed

Modified EPA 8081B (GC-ECD)

Modified EPA 8270D (GC-MS SIM)

Modified EPA 8321B (HPLC-MS)

Analyte Information

Method: Modified EPA 8321B (HPLC-MS)

DCPMU is the primary breakdown product of Diuron.

Steve Thun For Rick Jordan, Laboratory Manager

City of Salem
1410 20th St. SE Building 2
Salem, OR 97302

Report Number: P121441
Report Date: November 05, 2012
Client Project ID: [none]

Multiresidue Analyte List

Organophosphorous and Organosulfur Pesticides

Analyte	Reporting Limit	Analyte	Reporting Limit
Chlorpyrifos	0.12 ug/L	Aspon	0.30 ug/L
Azinphos-methyl	0.30 ug/L	Carbofenthion	0.30 ug/L
Chlorfenvinphos	0.30 ug/L	Chlorpyrifos-methyl	0.30 ug/L
Coumaphos	0.30 ug/L	Demeton	0.30 ug/L
Diazinon	0.30 ug/L	Dichlorofenthion	0.30 ug/L
Dichlorvos	0.30 ug/L	Dimethoate	0.30 ug/L
Disulfoton	0.30 ug/L	EPN	0.30 ug/L
Ethion	0.30 ug/L	Ethoprop	0.30 ug/L
Famphur	0.30 ug/L	Fenamiphos	0.30 ug/L
Fenitrothion	0.30 ug/L	Fensulfothion	0.30 ug/L
Fenthion	0.30 ug/L	Malathion	0.30 ug/L
Merphos	0.30 ug/L	Propargite	0.60 ug/L
Methidathion	0.30 ug/L	Mevinphos	0.30 ug/L
Parathion	0.30 ug/L	Parathion methyl	0.30 ug/L
Phorate	0.30 ug/L	Phosmet	0.30 ug/L
Phosphamidon	0.30 ug/L	Pirimiphos-methyl	0.30 ug/L
Ronnel	0.30 ug/L	Sulprofos	0.30 ug/L
Terbufos	0.30 ug/L	Tetrachlorvinphos	0.30 ug/L
Tokuthion	0.30 ug/L	Trichloronate	0.30 ug/L

City of Salem

1410 20th St. SE Building 2

Salem, OR 97302

Report Number: P121441

Report Date: November 05, 2012

Client Project ID: [none]

Halogenated Pesticides

Analyte	Reporting Limit	Analyte	Reporting Limit
Acetochlor	0.30 ug/L	Alachlor	0.30 ug/L
Aldrin	0.12 ug/L	Benfluralin	0.12 ug/L
Bifenthrin	0.12 ug/L	a-BHC	0.12 ug/L
b-BHC	0.12 ug/L	d-BHC	0.12 ug/L
g-BHC	0.12 ug/L	Captafol	0.12 ug/L
Captan	0.30 ug/L	Chlordane	0.60 ug/L
Chlorobenzilate	0.30 ug/L	Chloroneb	0.30 ug/L
Chlorothalonil	0.12 ug/L	Cyfluthrin	0.60 ug/L
Cyhalothrin	0.60 ug/L	Cypermethrin	1.2 ug/L
p,p'-DDD	0.12 ug/L	p,p'-DDE	0.12 ug/L
p,p'-DDT	0.12 ug/L	Dacthal	0.12 ug/L
Deltamethrin	1.2 ug/L	Dichlobenil	0.12 ug/L
Dicloran	0.12 ug/L	Dicofol	0.30 ug/L
Dieldrin	0.12 ug/L	Dithiopyr	0.12 ug/L
Endosulfan I	0.12 ug/L	Endosulfan II	0.12 ug/L
Endosulfan sulfate	0.12 ug/L	Endrin	0.12 ug/L
Endrin aldehyde	0.12 ug/L	Endrin ketone	0.12 ug/L
Esfenvalerate	0.12 ug/L	Ethalfuralin	0.12 ug/L
Etridiazole	0.12 ug/L	Fenarimol	0.12 ug/L
Fenvalerate	0.12 ug/L	Flutolanil	1.2 ug/L
Folpet	0.12 ug/L	Heptachlor	0.12 ug/L
Heptachlor epoxide	0.12 ug/L	Hexachlorobenzene	0.12 ug/L
Iprodione	0.12 ug/L	Methoxychlor	0.12 ug/L
Metolachlor	0.30 ug/L	Mirex	0.12 ug/L
Norflurazon	0.12 ug/L	Ovex	0.12 ug/L
Oxadiazon	0.12 ug/L	Oxyfluorfen	0.12 ug/L
PCNB	0.12 ug/L	Permethrin	1.2 ug/L
Prodiamine	0.12 ug/L	Pronamide	0.12 ug/L
Propachlor	0.30 ug/L	Propanil	0.12 ug/L
Propiconazole	0.30 ug/L	Terbacil	0.12 ug/L
Toxaphene	6.0 ug/L	Trifloxystrobin	0.12 ug/L
Triflumizole	0.12 ug/L	Trifluralin	0.12 ug/L
Vinclozalin	0.12 ug/L		



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Organonitrogen Pesticides

Analyte	Reporting Limit	Analyte	Reporting Limit
Ametryn	0.30 ug/L	Amitraz	0.60 ug/L
Atrazine	0.30 ug/L	Azoxystrobin	0.12 ug/L
Bensulide	0.12 ug/L	Boscalid	0.12 ug/L
Bromacil	0.12 ug/L	Bromopropylate	0.60 ug/L
Carfentrazone-ethyl	0.12 ug/L	Clothianidin	0.12 ug/L
Cyanazine	0.60 ug/L	Diclofop-methyl	0.60 ug/L
Dimethenamid	0.30 ug/L	Diphenylamine	0.12 ug/L
Ethofumesate	0.30 ug/L	Fenbuconazole	0.60 ug/L
Fenoxaprop-ethyl	0.60 ug/L	Fipronil	0.60 ug/L
Fluazifop-p-butyl	0.60 ug/L	Fludioxonil	0.60 ug/L
Flumioxazin	0.12 ug/L	Fluometuron	0.12 ug/L
Fluroxypyr-meptyl	0.30 ug/L	Hexazinone	0.30 ug/L
Imidacloprid	0.12 ug/L	Isoxaben	0.12 ug/L
Mefenoxam	0.30 ug/L	Metalaxyl	0.30 ug/L
Metribuzin	0.60 ug/L	Myclobutanil	0.60 ug/L
Napropamide	0.60 ug/L	Pendimethalin	0.12 ug/L
Pirimicarb	0.30 ug/L	Prometon	0.60 ug/L
Prometryn	0.30 ug/L	Propazine	0.30 ug/L
Pyraclostrobin	0.12 ug/L	Pyridaben	0.60 ug/L
Pyrimethanil	0.12 ug/L	Sethoxydim	6.0 ug/L
Simazine	0.60 ug/L	Simetryn	0.30 ug/L
Sulfentrazone	0.12 ug/L	Tebuconazole	0.60 ug/L
Tebuthiuron	0.60 ug/L	Thiabendazole	0.12 ug/L
Triadimefon	0.60 ug/L		

Phenylurea Pesticides

Analyte	Reporting Limit	Analyte	Reporting Limit
DCPMU	0.12 ug/L	Diuron	0.12 ug/L
Fenuron	0.12 ug/L	Linuron	0.12 ug/L
Monuron	0.12 ug/L	Neburon	0.12 ug/L
Siduron	0.12 ug/L		

Carbamate Pesticides

Analyte	Reporting Limit	Analyte	Reporting Limit
3-Hydroxycarbofuran	0.12 ug/L	Aldicarb	0.12 ug/L
Aldicarb Sulfone	0.12 ug/L	Aldicarb Sulfoxide	0.12 ug/L
Bendiocarb	0.12 ug/L	Carbaryl	0.12 ug/L
Carbofuran	0.12 ug/L	Fenobucarb	0.12 ug/L
Methiocarb	0.12 ug/L	Methomyl	0.12 ug/L
Oxamyl	0.12 ug/L	Propoxur	0.12 ug/L
Thiobencarb	0.12 ug/L		



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City of Salem

1410 20th St. SE Building 2

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Report Number: P121441

Report Date: November 05, 2012

Client Project ID: [none]

Analytical Report

Client Sample ID: Electric

Matrix: water

PAL Sample ID: P121441-01

Sample Date: 10/12/12

Extraction Date	Analysis Date	Analyte	Amount Detected	Limit of Quantitation	Notes

Method: EPA Method 8321B, Phenoxy Herbicides (HPLC-MS)

10/18/12	10/27/12	2,4,5-T	Not Detected	0.080 ug/L	
10/18/12	10/27/12	2,4,5-TP	Not Detected	0.080 ug/L	
10/18/12	10/27/12	2,4-D	1.5 ug/L	0.080 ug/L	
10/18/12	10/27/12	2,4-DB	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Acifluorfen	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Bentazon	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Clopyralid	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Dicamba	0.39 ug/L	0.080 ug/L	
10/18/12	10/27/12	Dichlorprop	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Dinoseb	Not Detected	0.080 ug/L	
10/18/12	10/27/12	MCPA	Not Detected	0.080 ug/L	
10/18/12	10/27/12	MCPP	0.33 ug/L	0.080 ug/L	
10/18/12	10/27/12	Picloram	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Quinclorac	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Triclopyr	0.34 ug/L	0.080 ug/L	

Surrogate Recovery: 87 %

Surrogate Recovery Range: 22-111

(DCPAA used as Surrogate)

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City of Salem

1410 20th St. SE Building 2

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Report Number: P121441

Report Date: November 05, 2012

Client Project ID: [none]

Analytical Report

Client Sample ID: Hilfiker

Matrix: water

PAL Sample ID: P121441-02

Sample Date: 10/12/12

Extraction Date	Analysis Date	Analyte	Amount Detected	Limit of Quantitation	Notes

Method: EPA Method 8321B, Phenoxy Herbicides (HPLC-MS)

10/18/12	10/27/12	2,4,5-T	Not Detected	0.080 ug/L	
10/18/12	10/27/12	2,4,5-TP	Not Detected	0.080 ug/L	
10/18/12	10/27/12	2,4-D	0.49 ug/L	0.080 ug/L	
10/18/12	10/27/12	2,4-DB	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Acifluorfen	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Bentazon	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Clopyralid	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Dicamba	0.23 ug/L	0.080 ug/L	
10/18/12	10/27/12	Dichlorprop	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Dinoseb	Not Detected	0.080 ug/L	
10/18/12	10/27/12	MCPA	Not Detected	0.080 ug/L	
10/18/12	10/27/12	MCPP	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Picloram	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Quinclorac	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Triclopyr	0.32 ug/L	0.080 ug/L	

Surrogate Recovery: 95 %

Surrogate Recovery Range: 22-111

(DCPAA used as Surrogate)

Steve Thun For Rick Jordan, Laboratory Manager

City of Salem
1410 20th St. SE Building 2
Salem, OR 97302

Report Number: P121441
Report Date: November 05, 2012
Client Project ID: [none]

Analytical Report

Client Sample ID: Salem Industrial
Matrix: water

PAL Sample ID: P121441-03
Sample Date: 10/12/12

Extraction Date	Analysis Date	Analyte	Amount Detected	Limit of Quantitation	Notes
Method: EPA Method 8321B, Phenoxy Herbicides (HPLC-MS)					
10/18/12	10/27/12	2,4,5-T	Not Detected	0.080 ug/L	
10/18/12	10/27/12	2,4,5-TP	Not Detected	0.080 ug/L	
10/18/12	10/27/12	2,4-D	1.7 ug/L	0.080 ug/L	
10/18/12	10/27/12	2,4-DB	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Acifluorfen	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Bentazon	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Clopyralid	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Dicamba	0.51 ug/L	0.080 ug/L	
10/18/12	10/27/12	Dichlorprop	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Dinoseb	Not Detected	0.080 ug/L	
10/18/12	10/27/12	MCPA	Not Detected	0.080 ug/L	
10/18/12	10/27/12	MCPP	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Picloram	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Quinclorac	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Triclopyr	0.97 ug/L	0.080 ug/L	

Surrogate Recovery: 106 %

Surrogate Recovery Range: 22-111

(DCPAA used as Surrogate)





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City of Salem

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Report Number: P121441

Report Date: November 05, 2012

Client Project ID: [none]

Analytical Report

Client Sample ID: Salem Industrial-DUP

Matrix: water

PAL Sample ID: P121441-04

Sample Date: 10/12/12

Extraction Date	Analysis Date	Analyte	Amount Detected	Limit of Quantitation	Notes

Method: EPA Method 8321B, Phenoxy Herbicides (HPLC-MS)

10/18/12	10/27/12	2,4,5-T	Not Detected	0.080 ug/L	
10/18/12	10/27/12	2,4,5-TP	Not Detected	0.080 ug/L	
10/18/12	10/27/12	2,4-D	1.8 ug/L	0.080 ug/L	
10/18/12	10/27/12	2,4-DB	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Acifluorfen	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Bentazon	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Clopyralid	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Dicamba	0.58 ug/L	0.080 ug/L	
10/18/12	10/27/12	Dichlorprop	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Dinoseb	Not Detected	0.080 ug/L	
10/18/12	10/27/12	MCPA	Not Detected	0.080 ug/L	
10/18/12	10/27/12	MCPP	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Picloram	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Quinclorac	Not Detected	0.080 ug/L	
10/18/12	10/27/12	Triclopyr	0.95 ug/L	0.080 ug/L	

Surrogate Recovery: 99 %

Surrogate Recovery Range: 22-111

(DCPAA used as Surrogate)

Steve Thun For Rick Jordan, Laboratory Manager

City of Salem
1410 20th St. SE Building 2
Salem, OR 97302

Report Number: P121441
Report Date: November 05, 2012
Client Project ID: [none]

Quality Assurance

Method Blank Data Matrix: water

Extraction Date	Analysis Date	Batch QC Sample #	Analyte	% Recovery	Expected % Recovery	Notes
10/18/12	10/27/12	2101804-BLK1	2,4,5-T	Not Detected	< 0.080 ug/L	
10/18/12	10/27/12	2101804-BLK1	2,4,5-TP	Not Detected	< 0.080 ug/L	
10/18/12	10/27/12	2101804-BLK1	2,4-D	Not Detected	< 0.080 ug/L	
10/18/12	10/27/12	2101804-BLK1	2,4-DB	Not Detected	< 0.080 ug/L	
10/18/12	10/27/12	2101804-BLK1	Acifluorfen	Not Detected	< 0.080 ug/L	
10/18/12	10/27/12	2101804-BLK1	Bentazon	Not Detected	< 0.080 ug/L	
10/18/12	10/27/12	2101804-BLK1	Clopyralid	Not Detected	< 0.080 ug/L	
10/18/12	10/27/12	2101804-BLK1	Dicamba	Not Detected	< 0.080 ug/L	
10/18/12	10/27/12	2101804-BLK1	Dichlorprop	Not Detected	< 0.080 ug/L	
10/18/12	10/27/12	2101804-BLK1	Dinoseb	Not Detected	< 0.080 ug/L	
10/18/12	10/27/12	2101804-BLK1	MCPA	Not Detected	< 0.080 ug/L	
10/18/12	10/27/12	2101804-BLK1	MCPD	Not Detected	< 0.080 ug/L	
10/18/12	10/27/12	2101804-BLK1	Picloram	Not Detected	< 0.080 ug/L	
10/18/12	10/27/12	2101804-BLK1	Quinclorac	Not Detected	< 0.080 ug/L	
10/18/12	10/27/12	2101804-BLK1	Triclopyr	Not Detected	< 0.080 ug/L	

Blank Spike Data Matrix: water

Extraction Date	Analysis Date	Batch QC Sample #	Analyte	% Recovery	Expected % Recovery	Notes
10/18/12	10/27/12	2101804-BS1	2,4-D	107	41-133	
10/18/12	10/27/12	2101804-BSD1	2,4-D	114	41-133	
10/18/12	10/27/12	2101804-BS1	Dicamba	112	38-122	
10/18/12	10/27/12	2101804-BSD1	Dicamba	115	38-122	
10/18/12	10/27/12	2101804-BS1	Triclopyr	110	46-111	
10/18/12	10/27/12	2101804-BSD1	Triclopyr	117	46-111	R1

Analyte Information

Method: EPA Method 8321B, Phenoxy Herbicides (HPLC-MS)

Chlorinated acids were converted to free acids. Residues were quantitated as free acids.





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Report Number: P121441

Report Date: November 05, 2012

Client Project ID: [none]

Project Notes

Notes	Definition
R1	Spike recovery is outside of control limits.

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City of Salem
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Report Number: P130608
Report Date: July 09, 2013
Client Project ID: [none]

Analytical Report

Client Sample ID: Electric

Matrix: water

PAL Sample ID: P130608-01

Sample Date: 6/18/13

Extraction Date	Analysis Date	Analyte	Amount Detected	Limit of Quantitation	Notes
Method: Multiresidue Profile					
6/24/13	7/3/13	MR Pesticides	Not Detected	See Analyte List	
Surrogate Recovery: 75 %					
Surrogate Recovery Range: 32-160					
(DCBP used as Surrogate)					

Client Sample ID: Hilfiker

Matrix: water

PAL Sample ID: P130608-02

Sample Date: 6/18/13

Extraction Date	Analysis Date	Analyte	Amount Detected	Limit of Quantitation	Notes
Method: Multiresidue Profile					
6/24/13	7/3/13	MR Pesticides	Not Detected	See Analyte List	
Surrogate Recovery: 72 %					
Surrogate Recovery Range: 32-160					
(DCBP used as Surrogate)					

Client Sample ID: Hilfiker DUP

Matrix: water

PAL Sample ID: P130608-03

Sample Date: 6/18/13

Extraction Date	Analysis Date	Analyte	Amount Detected	Limit of Quantitation	Notes
Method: Multiresidue Profile					
6/24/13	7/3/13	MR Pesticides	Not Detected	See Analyte List	
Surrogate Recovery: 67 %					
Surrogate Recovery Range: 32-160					
(DCBP used as Surrogate)					

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Report Number: P130608
Report Date: July 09, 2013
Client Project ID: [none]

Analytical Report

Client Sample ID: Salem Industrial
Matrix: water

PAL Sample ID: P130608-04
Sample Date: 6/18/13

Extraction Date	Analysis Date	Analyte	Amount Detected	Limit of Quantitation	Notes
Method: Multiresidue Profile					
6/24/13	6/29/13	Propiconazole	0.95 ug/L	0.15 ug/L	
6/24/13	7/3/13	Diuron	0.44 ug/L	0.12 ug/L	
6/24/13	7/3/13	Other Pesticides	Not Detected	See Analyte List	

Surrogate Recovery: 70 %

Surrogate Recovery Range: 32-160

(DCBP used as Surrogate)

Steve Thun For Rick Jordan, Laboratory Manager



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Report Number: P130608

Report Date: July 09, 2013

Client Project ID: [none]

Quality Assurance

Method Blank Data

Matrix: water

Extraction Date	Analysis Date	Batch QC Sample #	Analyte	% Recovery	Expected % Recovery	Notes
Method: Multiresidue Profile						
6/24/13	7/3/13	3062401-BLK1	MR Pesticides	Not Detected	<LoQ	

Blank Spike Data

Matrix: water

Extraction Date	Analysis Date	Batch QC Sample #	Analyte	% Recovery	Expected % Recovery	Notes
6/24/13	6/27/13	3062401-BS1	Atrazine	73	49-100	
6/24/13	6/27/13	3062401-BSD1	Atrazine	75	49-100	
6/24/13	6/28/13	3062401-BS1	Chlorpyrifos	133	51-138	
6/24/13	6/28/13	3062401-BSD1	Chlorpyrifos	130	51-138	
6/24/13	7/3/13	3062401-BS1	Clothianidin	68	40-120	
6/24/13	7/3/13	3062401-BSD1	Clothianidin	66	40-120	
6/24/13	6/29/13	3062401-BS1	Diazinon	115	34-145	
6/24/13	6/29/13	3062401-BSD1	Diazinon	109	34-145	
6/24/13	6/28/13	3062401-BS1	Dieldrin	87	48-152	
6/24/13	6/28/13	3062401-BSD1	Dieldrin	86	48-152	
6/24/13	6/27/13	3062401-BS1	Ethofumesate	83	51-101	
6/24/13	6/27/13	3062401-BSD1	Ethofumesate	85	51-101	
6/24/13	7/3/13	3062401-BS1	Fluometuron	118	40-120	
6/24/13	7/3/13	3062401-BSD1	Fluometuron	113	40-120	
6/24/13	6/27/13	3062401-BS1	Napropamide	82	40-120	
6/24/13	6/27/13	3062401-BSD1	Napropamide	83	40-120	
6/24/13	6/28/13	3062401-BS1	Oxadiazon	128	71-129	
6/24/13	6/28/13	3062401-BSD1	Oxadiazon	131	71-129	
6/24/13	6/29/13	3062401-BS1	Parathion methyl	114	60-140	
6/24/13	6/29/13	3062401-BSD1	Parathion methyl	110	60-140	
6/24/13	7/3/13	3062401-BS1	Thiobencarb	85	40-120	
6/24/13	7/3/13	3062401-BSD1	Thiobencarb	80	40-120	

R3

Steve Thun For Rick Jordan, Laboratory Manager



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City of Salem

1410 20th St. SE Building 2

Salem, OR 97302

Report Number: P130608

Report Date: July 09, 2013

Client Project ID: [none]

Project Information

Methodology Employed

Modified EPA 8081B (GC-ECD)
Modified EPA 8141B (GC-FPD)
Modified EPA 8270D (GC-MS SIM)
Modified EPA 8321B (HPLC-MS)

Analyte Information

Project Notes

Notes	Definition
R3	Spike recovery above control limit. Sample results are not detected, data quality has not been affected.

Steve Thun For Rick Jordan, Laboratory Manager

City of Salem
1410 20th St. SE Building 2
Salem, OR 97302

Report Number: P130608
Report Date: July 09, 2013
Client Project ID: [none]

Multiresidue Analyte List

Organophosphorous and Organosulfur Pesticides

Analyte	Reporting Limit	Analyte	Reporting Limit
Chlorpyrifos	0.060 ug/L	Aspon	0.30 ug/L
Azinphos-methyl	0.30 ug/L	Carbofenthion	0.30 ug/L
Chlorfenvinphos	0.30 ug/L	Chlorpyrifos-methyl	0.30 ug/L
Coumaphos	0.30 ug/L	Demeton	0.30 ug/L
Diazinon	0.30 ug/L	Dichlorofenthion	0.30 ug/L
Dichlorvos	0.30 ug/L	Dicrotophos	0.30 ug/L
Dimethoate	0.30 ug/L	Disulfoton	0.30 ug/L
EPN	0.30 ug/L	Ethion	0.30 ug/L
Ethoprop	0.30 ug/L	Famphur	0.30 ug/L
Fenamiphos	0.30 ug/L	Fenitrothion	0.30 ug/L
Fensulfothion	0.30 ug/L	Fenthion	0.30 ug/L
Malathion	0.30 ug/L	Merphos	0.30 ug/L
Methidathion	0.30 ug/L	Mevinphos	0.30 ug/L
Monocrotophos	0.30 ug/L	Parathion	0.30 ug/L
Parathion methyl	0.30 ug/L	Phorate	0.30 ug/L
Phosmet	0.30 ug/L	Phosphamidon	0.30 ug/L
Pirimiphos-methyl	0.30 ug/L	Ronnel	0.30 ug/L
Sulprofos	0.30 ug/L	Terbufos	0.30 ug/L
Tetrachlorvinphos	0.30 ug/L	Tokuthion	0.30 ug/L
Trichloronate	0.30 ug/L	Propargite	0.60 ug/L

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Report Number: P130608
Report Date: July 09, 2013
Client Project ID: [none]

Halogenated Pesticides

Analyte	Reporting Limit	Analyte	Reporting Limit
Acetochlor	0.15 ug/L	Alachlor	0.15 ug/L
Aldrin	0.060 ug/L	Benfluralin	0.060 ug/L
Bifenthrin	0.060 ug/L	a-BHC	0.060 ug/L
b-BHC	0.060 ug/L	d-BHC	0.060 ug/L
g-BHC	0.060 ug/L	Captafol	0.060 ug/L
Captan	0.15 ug/L	Chlordane	0.30 ug/L
Chlorobenzilate	0.15 ug/L	Chloroneb	0.15 ug/L
Chlorothalonil	0.060 ug/L	Cyfluthrin	0.30 ug/L
Cyhalothrin	0.30 ug/L	Cypermethrin	0.30 ug/L
p,p'-DDD	0.060 ug/L	p,p'-DDE	0.060 ug/L
p,p'-DDT	0.060 ug/L	Dacthal	0.060 ug/L
Deltamethrin	0.30 ug/L	Dichlobenil	0.060 ug/L
Dicloran	0.060 ug/L	Dicofol	0.15 ug/L
Dieldrin	0.060 ug/L	Dithiopyr	0.060 ug/L
Endosulfan I	0.060 ug/L	Endosulfan II	0.060 ug/L
Endosulfan sulfate	0.060 ug/L	Endrin	0.060 ug/L
Endrin aldehyde	0.060 ug/L	Endrin ketone	0.060 ug/L
Esfenvalerate	0.060 ug/L	Ethalfuralin	0.060 ug/L
Etridiazole	0.060 ug/L	Fenarimol	0.060 ug/L
Fenvalerate	0.060 ug/L	Flutolanil	0.60 ug/L
Folpet	0.060 ug/L	Heptachlor	0.060 ug/L
Heptachlor epoxide	0.060 ug/L	Hexachlorobenzene	0.060 ug/L
Iprodione	0.060 ug/L	Methoxychlor	0.060 ug/L
Metolachlor	0.15 ug/L	Mirex	0.060 ug/L
Norflurazon	0.060 ug/L	Ovex	0.060 ug/L
Oxadiazon	0.060 ug/L	Oxyfluorfen	0.060 ug/L
PCNB	0.060 ug/L	Permethrin	0.30 ug/L
Prodiamine	0.060 ug/L	Pronamide	0.060 ug/L
Propachlor	0.15 ug/L	Propanil	0.060 ug/L
Propiconazole	0.15 ug/L	Terbacil	0.060 ug/L
Toxaphene	3.0 ug/L	Trifloxystrobin	0.060 ug/L
Triflumizole	0.060 ug/L	Trifluralin	0.060 ug/L
Vinclozalin	0.060 ug/L		

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Report Number: P130608
Report Date: July 09, 2013
Client Project ID: [none]

Organonitrogen Pesticides

Analyte	Reporting Limit	Analyte	Reporting Limit
Ametryn	0.30 ug/L	Amitraz	0.60 ug/L
Atrazine	0.30 ug/L	Azoxystrobin	0.12 ug/L
Bensulide	0.12 ug/L	Boscalid	0.12 ug/L
Bromacil	0.12 ug/L	Bromopropylate	0.60 ug/L
Carfentrazone-ethyl	0.12 ug/L	Clothianidin	0.12 ug/L
Cyanazine	0.60 ug/L	Diclofop-methyl	0.60 ug/L
Dimethenamid	0.30 ug/L	Diphenylamine	0.12 ug/L
Ethofumesate	0.30 ug/L	Fenbuconazole	0.60 ug/L
Fenoxaprop-ethyl	0.60 ug/L	Fipronil	0.60 ug/L
Fluazifop-p-butyl	0.60 ug/L	Fludioxonil	0.60 ug/L
Flumioxazin	0.12 ug/L	Fluometuron	0.12 ug/L
Fluroxypyr-meptyl	0.30 ug/L	Hexazinone	0.30 ug/L
Imidacloprid	0.12 ug/L	Isoxaben	0.12 ug/L
Mefenoxam	0.30 ug/L	Metalaxyl	0.30 ug/L
Metribuzin	0.60 ug/L	Myclobutanil	0.60 ug/L
Napropamide	0.60 ug/L	Pendimethalin	0.060 ug/L
Pirimicarb	0.30 ug/L	Prometon	0.60 ug/L
Prometryn	0.30 ug/L	Propazine	0.30 ug/L
Pyraclostrobin	0.12 ug/L	Pyridaben	0.60 ug/L
Pyrimethanil	0.12 ug/L	Sethoxydim	6.0 ug/L
Simazine	0.60 ug/L	Simetryn	0.30 ug/L
Sulfentrazone	0.12 ug/L	Tebuconazole	0.60 ug/L
Tebuthiuron	0.60 ug/L	Thiabendazole	0.12 ug/L
Triadimefon	0.60 ug/L		

Phenylurea Pesticides

Analyte	Reporting Limit	Analyte	Reporting Limit
DCPMU	0.12 ug/L	Diuron	0.12 ug/L
Fenuron	0.12 ug/L	Linuron	0.12 ug/L
Monuron	0.12 ug/L	Neburon	0.12 ug/L
Siduron	0.12 ug/L		

Carbamate Pesticides

Analyte	Reporting Limit	Analyte	Reporting Limit
3-Hydroxycarbofuran	0.12 ug/L	Aldicarb	0.12 ug/L
Aldicarb Sulfone	0.12 ug/L	Aldicarb Sulfoxide	0.12 ug/L
Bendiocarb	0.12 ug/L	Carbaryl	0.12 ug/L
Carbofuran	0.12 ug/L	Fenobucarb	0.12 ug/L
Methiocarb	0.12 ug/L	Methomyl	0.12 ug/L
Oxamyl	0.12 ug/L	Propoxur	0.12 ug/L
Thiobencarb	0.12 ug/L		



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Salem, OR 97302

Report Number: P130608

Report Date: July 09, 2013

Client Project ID: [none]

Analytical Report

Client Sample ID: Electric

Matrix: water

PAL Sample ID: P130608-01

Sample Date: 6/18/13

Extraction Date	Analysis Date	Analyte	Amount Detected	Limit of Quantitation	Notes

Method: EPA Method 8321B, Phenoxy Herbicides (HPLC-MS)

6/25/13	6/28/13	2,4,5-T	Not Detected	0.080 ug/L	
6/25/13	6/28/13	2,4,5-TP	Not Detected	0.080 ug/L	
6/25/13	7/5/13	2,4-D	0.25 ug/L	0.080 ug/L	
6/25/13	6/28/13	2,4-DB	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Acifluorfen	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Bentazon	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Clopyralid	Not Detected	0.080 ug/L	
6/25/13	7/5/13	Dicamba	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Dichlorprop	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Dinoseb	Not Detected	0.080 ug/L	
6/25/13	6/28/13	MCPA	Not Detected	0.080 ug/L	
6/25/13	6/28/13	MCPP	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Picloram	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Quinclorac	Not Detected	0.080 ug/L	
6/25/13	7/5/13	Triclopyr	Not Detected	0.080 ug/L	

Surrogate Recovery: 68 %

Surrogate Recovery Range: 22-111

(DCPAA used as Surrogate)

Steve Thun For Rick Jordan, Laboratory Manager

City of Salem
1410 20th St. SE Building 2
Salem, OR 97302

Report Number: P130608
Report Date: July 09, 2013
Client Project ID: [none]

Analytical Report

Client Sample ID: Hilfiker
Matrix: water

PAL Sample ID: P130608-02
Sample Date: 6/18/13

Extraction Date	Analysis Date	Analyte	Amount Detected	Limit of Quantitation	Notes
Method: EPA Method 8321B, Phenoxy Herbicides (HPLC-MS)					
6/25/13	6/28/13	2,4,5-T	Not Detected	0.080 ug/L	
6/25/13	6/28/13	2,4,5-TP	Not Detected	0.080 ug/L	
6/25/13	7/5/13	2,4-D	0.29 ug/L	0.080 ug/L	
6/25/13	6/28/13	2,4-DB	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Acifluorfen	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Bentazon	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Clopyralid	Not Detected	0.080 ug/L	
6/25/13	7/5/13	Dicamba	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Dichlorprop	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Dinoseb	Not Detected	0.080 ug/L	
6/25/13	6/28/13	MCPA	Not Detected	0.080 ug/L	
6/25/13	6/28/13	MCPP	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Picloram	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Quinclorac	Not Detected	0.080 ug/L	
6/25/13	7/5/13	Triclopyr	Not Detected	0.080 ug/L	

Surrogate Recovery: 70 %

Surrogate Recovery Range: 22-111

(DCPAA used as Surrogate)





Pacific Agricultural Laboratory

12505 N.W. Cornell Rd. • Portland, OR 97229-5651 • Ph 503.626.7943 • Fx 503.641.0644

City of Salem

1410 20th St. SE Building 2

Salem, OR 97302

Report Number: P130608

Report Date: July 09, 2013

Client Project ID: [none]

Analytical Report

Client Sample ID: Hilfiker DUP

Matrix: water

PAL Sample ID: P130608-03

Sample Date: 6/18/13

Extraction Date	Analysis Date	Analyte	Amount Detected	Limit of Quantitation	Notes

Method: EPA Method 8321B, Phenoxy Herbicides (HPLC-MS)

6/25/13	6/28/13	2,4,5-T	Not Detected	0.080 ug/L	
6/25/13	6/28/13	2,4,5-TP	Not Detected	0.080 ug/L	
6/25/13	7/5/13	2,4-D	0.33 ug/L	0.080 ug/L	
6/25/13	6/28/13	2,4-DB	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Acifluorfen	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Bentazon	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Clopyralid	Not Detected	0.080 ug/L	
6/25/13	7/5/13	Dicamba	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Dichlorprop	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Dinoseb	Not Detected	0.080 ug/L	
6/25/13	6/28/13	MCPA	Not Detected	0.080 ug/L	
6/25/13	6/28/13	MCPP	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Picloram	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Quinclorac	Not Detected	0.080 ug/L	
6/25/13	7/5/13	Triclopyr	Not Detected	0.080 ug/L	

Surrogate Recovery: 65 %

Surrogate Recovery Range: 22-111

(DCPAA used as Surrogate)

Steve Thun For Rick Jordan, Laboratory Manager

City of Salem
1410 20th St. SE Building 2
Salem, OR 97302

Report Number: P130608
Report Date: July 09, 2013
Client Project ID: [none]

Analytical Report

Client Sample ID: Salem Industrial
Matrix: water

PAL Sample ID: P130608-04
Sample Date: 6/18/13

Extraction Date	Analysis Date	Analyte	Amount Detected	Limit of Quantitation	Notes
Method: EPA Method 8321B, Phenoxy Herbicides (HPLC-MS)					
6/25/13	6/28/13	2,4,5-T	Not Detected	0.080 ug/L	
6/25/13	6/28/13	2,4,5-TP	Not Detected	0.080 ug/L	
6/25/13	7/5/13	2,4-D	1.3 ug/L	0.080 ug/L	
6/25/13	6/28/13	2,4-DB	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Acifluorfen	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Bentazon	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Clopyralid	Not Detected	0.080 ug/L	
6/25/13	7/5/13	Dicamba	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Dichlorprop	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Dinoseb	Not Detected	0.080 ug/L	
6/25/13	6/28/13	MCPA	Not Detected	0.080 ug/L	
6/25/13	6/28/13	MCPP	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Picloram	Not Detected	0.080 ug/L	
6/25/13	6/28/13	Quinclorac	Not Detected	0.080 ug/L	
6/25/13	7/5/13	Triclopyr	1.4 ug/L	0.080 ug/L	

Surrogate Recovery: 83 %

Surrogate Recovery Range: 22-111

(DCPAA used as Surrogate)



Steve Thun For Rick Jordan, Laboratory Manager



Pacific Agricultural Laboratory

12505 N.W. Cornell Rd. • Portland, OR 97229-5651 • Ph 503.626.7943 • Fx 503.641.0644

City of Salem

1410 20th St. SE Building 2

Salem, OR 97302

Report Number: P130608

Report Date: July 09, 2013

Client Project ID: [none]

Quality Assurance

Method Blank Data

Matrix: water

Extraction Date	Analysis Date	Batch QC Sample #	Analyte	% Recovery	Expected % Recovery	Notes
6/25/13	6/28/13	3062501-BLK1	2,4,5-T	Not Detected	< 0.080 ug/L	
6/25/13	6/28/13	3062501-BLK1	2,4,5-TP	Not Detected	< 0.080 ug/L	
6/25/13	6/28/13	3062501-BLK1	2,4-D	Not Detected	< 0.080 ug/L	
6/25/13	6/28/13	3062501-BLK1	2,4-DB	Not Detected	< 0.080 ug/L	
6/25/13	6/28/13	3062501-BLK1	Acifluorfen	Not Detected	< 0.080 ug/L	
6/25/13	6/28/13	3062501-BLK1	Bentazon	Not Detected	< 0.080 ug/L	
6/25/13	6/28/13	3062501-BLK1	Clopyralid	Not Detected	< 0.080 ug/L	
6/25/13	6/28/13	3062501-BLK1	Dicamba	Not Detected	< 0.080 ug/L	
6/25/13	6/28/13	3062501-BLK1	Dichlorprop	Not Detected	< 0.080 ug/L	
6/25/13	6/28/13	3062501-BLK1	Dinoseb	Not Detected	< 0.080 ug/L	
6/25/13	6/28/13	3062501-BLK1	MCPA	Not Detected	< 0.080 ug/L	
6/25/13	6/28/13	3062501-BLK1	MCPD	Not Detected	< 0.080 ug/L	
6/25/13	6/28/13	3062501-BLK1	Picloram	Not Detected	< 0.080 ug/L	
6/25/13	6/28/13	3062501-BLK1	Quinclorac	Not Detected	< 0.080 ug/L	
6/25/13	6/28/13	3062501-BLK1	Triclopyr	Not Detected	< 0.080 ug/L	

Blank Spike Data

Matrix: water

Extraction Date	Analysis Date	Batch QC Sample #	Analyte	% Recovery	Expected % Recovery	Notes
6/25/13	6/28/13	3062501-BS1	2,4-D	96	41-133	
6/25/13	6/28/13	3062501-BSD1	2,4-D	93	41-133	
6/25/13	6/28/13	3062501-BS1	Dicamba	108	38-122	
6/25/13	6/28/13	3062501-BSD1	Dicamba	97	38-122	
6/25/13	6/28/13	3062501-BS1	Triclopyr	94	46-111	
6/25/13	6/28/13	3062501-BSD1	Triclopyr	91	46-111	

Analyte Information

Method: EPA Method 8321B, Phenoxy Herbicides (HPLC-MS)

Chlorinated acids were converted to free acids. Residues were quantitated as free acids.

Steve Thun For Rick Jordan, Laboratory Manager

ATTACHMENT B. Results of Benthic Macroinvertebrate Sampling, Fish Sampling, and Physical Habitat Data Collection for Pringle Creek and Clark Creek in Salem, Oregon; Pacific Habitat Services, Inc. (June 27, 2013).

Results of Benthic Macroinvertebrate Sampling, Fish Sampling, and Physical Habitat Data Collection for Pringle Creek and Clark Creek in Salem, Oregon

Prepared for

City of Salem

Attn: Anita Panko
Public Works Department
555 Liberty Street SE
Salem, Oregon 97301

Prepared by

Craig Tumer
Dale Groff

Pacific Habitat Services, Inc.

9450 SW Commerce Circle, Suite 180
Wilsonville, OR 97070
(503) 570-0800
(503) 570-0855 FAX

PHS Project Number: 5244

June 27, 2013



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APPENDIX B – Benthic Macroinvertebrate Sampling Data

APPENDIX C – Physical Habitat Data – East Fork Pringle Creek

APPENDIX D – Physical Habitat Data – Clark Creek

APPENDIX E – Physical Habitat Data – Pringle Creek

1.0 INTRODUCTION

This report describes the results of the benthic macroinvertebrate sampling, fish sampling, and physical habitat characterization conducted in May and June 2013, fulfilling the “Benthic Macroinvertebrate Monitoring” requirements listed in Table B-1 of the City of Salem’s NPDES MS4 Permit. The field methodology and parameter collection used during this study follow procedures identified in the “Technical Memorandum for the City of Salem’s MS4 Permit Requirements for Benthic Macroinvertebrate Sampling and Hydromodification Assessment” (Pacific Habitat Services, Inc., March 21, 2011). Benthic macroinvertebrate sampling was conducted on May 15, 2013; fish sampling was conducted on June 14, 2013; and physical habitat characterization was conducted on June 17, 19, and 25, 2013. Benthic macroinvertebrates, fish and physical habitat parameters were collected along the same reaches and using the same methodology as in May and June 2012. This memorandum provides the data from the 2013 sampling effort.

2.0 STUDY AREA DESCRIPTION

In May and June 2013, PHS collected data on benthic macroinvertebrate communities, fish presence, and physical habitat characteristics at three sample reaches within the City of Salem. These reaches are the same reaches sampled by PHS in May and June 2012, and are in close proximity to a previous macroinvertebrate sampling effort that was conducted during 2000 and 2001 (Pringle Creek Watershed Bioassessment Project). General locations of each of the sampling reaches are as follows:

- East Fork Pringle Creek where the stream enters the City (2000/2001 sampling site PR00-15),
- Pringle Creek below the confluence with Clark Creek and upstream of confluence with Shelton Ditch (2000/2001 sampling site PR00-02), and
- Clark Creek in Gilmore Field (2000/2001 sampling site PR00-24).

The East Fork Pringle Creek sampling reach is located downstream (north) of Trelstad Avenue SE, near the Salem city limits (Figure 1, see Appendix A for all figures). The upstream end of the reach begins just north of the riprap apron of the culverts that carry the stream under Trelstad Avenue and extends for 150 meters downstream. In this area, East Fork Pringle Creek has been channelized and straightened with a berm of discharged dredge material along the bank. A short concrete sluice is present near the downstream end of the reach. The substrate of the stream is generally dominated by fine gravel and smaller sediments.

The Pringle Creek sampling reach is located within Bush’s Pasture Park, approximately 10 meters downstream of the confluence of Clark Creek and Pringle Creek (Figure 2), and extends for 292.5 meters downstream. Within this reach, Pringle Creek is gently meandering. The stream banks are generally low and gently to moderately sloped, though vertical and undercut, eroding banks are present in some areas. A vertical concrete wall is present along the right bank near the upstream limits of the sampling reach, where private residences occur in close proximity to the stream. Substrates within the channel are generally dominated by cobbles and coarse gravel.

The Clark Creek sampling reach is located within Gilmore Field, just south of Hoyt Street SE (Figure 3). The downstream end of the project reach begins upstream of the detention structure south of Hoyt Street SE and continues upstream for 150 meters along the west side of Gilmore Field. In general, the stream banks are steep and the stream channel is incised. Substrates within the channel are generally dominated by silt and fine gravel, with areas of exposed clay hardpan.

3.0 METHODOLOGY

As recommended in the “Technical Memorandum for the City of Salem’s MS4 Permit Requirements for Benthic Macroinvertebrate Sampling and Hydromodification Assessment”, dated March 21, 2011, PHS followed the Oregon Department of Environmental Quality’s *Water Monitoring and Assessment Mode of Operations Manual (MOMs)* (June 2010) transect sampling approach for collecting benthic macroinvertebrate samples and the methodologies found in the Environmental Protection Agency’s *Environmental Monitoring and Assessment Program - Surface Waters: Western Pilot Study Field Operations Manual for Wadeable Streams (EMAP-SW)* for collecting physical habitat data within the project area. Both protocols require the collection of data at evenly spaced transects within the sampling reach. Therefore, prior to the initiation of sampling and data collection, PHS established permanent transects within each of the three sampling reaches.

Both the MOMs and EMAP-SW protocols specify that the length of the sampling reach is forty times the average wetted width of the channel or a minimum of 150 meters long, when the average wetted width is less than four meters. Because the average wetted widths of East Fork Pringle and Clark Creeks are less than four meters, PHS determined that the reach length for each of the reaches on these streams is 150 meters. PHS measured the wetted width of Pringle Creek at five representative locations and determined that the average wetted width is approximately 7.31 meters and the total reach length is 292.5 meters.

PHS identified the upstream end of the East Fork Pringle Creek reach (PC1) downstream of the pool below the culverts under Trelstad Avenue SE and flagged it as Transect “K”. One-half-inch-diameter PVC pipe was pounded into the ground at the top of the bank on either side of the stream so that the transect crosses the stream perpendicular to the stream flow at the transect location. The PVC pipe was marked with “K” to indicate Transect K. Using a tape measure, PHS measured 15 meters downstream from Transect K and marked this spot as Transect J. PHS proceeded downstream with the tape measure and flagged the positions of 9 additional transects labeled “I” through “A”, with Transect A being the transect marking the downstream limits of the sampling reach. PHS used the same general procedure to mark transects along the Clark Creek and mainstem Pringle Creek sample reaches. For Clark Creek, measurement began at Transect A, the downstream end of the reach, at a point approximately 50 meters upstream of the detention basin control structure, which is located north of Hoyt Street SE, and transects were located every 15 meters along the reach. At the mainstem Pringle Creek reach, Transect K was located approximately 10 meters downstream of the confluence of Clark Creek and Pringle Creek, and transects were located every 29.25 meters. Following the identification of all transects along all sampling reaches, PHS located the endpoints of each transect using a handheld GPS. An electronic file of the transect locations will be provided to the City of Salem for future reference. Figure 4 shows representative transect layout along the East Fork Pringle Creek Reach.

3.1 Benthic Macroinvertebrate Sampling

Benthic macroinvertebrates were sampled using a transect sampling approach, as described in the Oregon Department of Environmental Quality's *Water Monitoring and Assessment Mode of Operations Manual (MOMs)* (June 2010).

One kick-net sample was collected at each of the eleven transects on the reach beginning at Transect A, which is located at the downstream end of the reach. The Transect A sample was collected from the middle of the left one-third of the stream; the Transect B sample was collected from the middle of the center one-third of the stream; and the Transect C sample was collected from the middle of the right one-third. For transect D, the sample was collected from the left one-third, and the cycle was repeated for all 11 transects. Samples were not collected from the stream margins.

At each sampling location, a D-frame kick net with 500 μ m mesh net was placed in the stream with the flat part of the hoop resting on the streambed and perpendicular to the stream flow. Substrate preventing the flat part of the kicknet from sitting flush with the bottom was removed, when necessary.

Macroinvertebrate samples were collected from a one-square-foot sample area immediately upstream of the net. Before disturbing the substrate, this area was inspected for large macroinvertebrates such as mussels, and any such organisms were picked by hand and placed directly into the sieve. Within the sample area, all substrate particles larger than approximately five centimeters were carefully rubbed by hand in front of the net to dislodge any clinging macroinvertebrates. After rubbing, the substrate materials were placed outside of the sample plot. After all large substrate materials within the sample area were scrubbed by hand and removed from the sample area, the remaining substrate in the sample area was disturbed with the hands or feet for one minute. When samples were collected in slow-moving water where the water current was not strong enough to carry any dislodged organisms into the net, the net was pulled through the water as the substrate is disturbed to capture suspended organisms. After the sample was collected and the net removed from the stream, large substrate was returned to the sample area. Following collection of each sample, the contents of the net were placed in a 500 μ m mesh sieve, and the procedure was repeated at each transect, working from downstream (Transect A) to upstream (Transect K). The samples from each transect were composited into the sieve.

After the samples from all transects on the reach were completed and transferred to the sieve, large organic material and rocks were rinsed, carefully inspected for clinging macroinvertebrates, and removed. Fine sediment was washed away to the extent possible. The composite sample was placed in a jar labeled with the date and reach name and preserved with 95% denatured ethanol for transport to the lab for sorting and subsampling. A label with site information written in pencil on Rite in the Rain paper was placed inside the container. After all samples were collected, they were delivered to Aquatic Biology Associates, Inc. in Corvallis for sorting, subsampling, and data analysis.

3.2 Fish Sampling

An Oregon Scientific Take Permit (STP) must be obtained from the Oregon Department of Fish and Wildlife (ODFW) to conduct fish sampling within the State. Prior to conducting the fish sampling within the project area, PHS completed the online permit application (<https://apps.nmfs.noaa.gov/>) and obtained the necessary Oregon STP from ODFW. Due to the potential presence of salmonid species listed under the Endangered Species Act in the mainstem Pringle Creek reach, a permit from the National Marine Fisheries Service (NMFS) must also be obtained. Correspondence with NMFS personnel in 2012 indicated that the turn-around time for such a permit would require a minimum of six months. Because of time constraints, PHS did not pursue the permit from the NMFS, and therefore, fish sampling was not conducted on the mainstem Pringle Creek reach. Fish sampling was conducted on the East Fork Pringle Creek and Clark Creek sampling reaches.

Starting at the downstream end of the sampling reach and working upstream along the reach, fish sampling was conducted using a Smith-Root backpack electrofishing unit. A second person followed the operator of the electrofishing unit with a dip net to retrieve stunned fish. All retrieved fish were transferred to a five-gallon bucket equipped with an aerator for later processing. Following completion of electrofishing at the upstream end of the sampling reach, all captured fish were identified and counted before being returned to the stream.

Following completion of the fish sampling, PHS completed the follow-up reporting required by the Oregon STP.

3.3 Physical Habitat Characterization

The EMAP-SW protocol was used to collect physical habitat data for the three stream reaches. The habitat characterization portion of the EMAP-SW protocol includes five components: thalweg profile; woody debris tally; channel and riparian characterization; assessment of channel constraint, debris torrents, and major floods; and discharge. While the characterization of all of these components is not especially useful for a hydromodification assessment, collection of certain data prescribed by the protocol may be useful. The following additional data, as described by the EMAP-SW habitat characterization protocol, were collected for future hydromodification analysis:

- Water Depth - The water depth is determined along the thalweg profile at low flow for 10 uniformly spaced intervals between transects.
- Wetted Width - The wetted width is determined at the 11 transects also used for macroinvertebrate sampling and at the mid-points of the intervals between those transects for a total of 21 measurements. In addition, the stream substrate is assessed at each of these transects at 5 points: left and right edge of water, midpoint of channel, and the two points midway between center of channel and water's edge. The substrate at these 5 points is characterized by size as boulders (> 250 mm), cobbles (>64 to 250 mm), coarse gravel (>16 to 64 mm), fine gravel (>2 to 16 mm), sand (>0.06 to 2 mm), and fines (<2 mm). Indications of burial around substrate particles at each of the substrate locations within a radius of 5 cm are used to assess the embeddedness as a fraction of the sediment particles surrounded by sand or finer particles.

- **Water Surface Slope** – Water surface slope is calculated for each of the ten intervals between transects within the assessment reach.
- **Channel Morphology** - The channel morphology is measured at the 11 transects also used for macroinvertebrate assays. The bank angles from the edge of water to the top of the stream bank are recorded. The distance of bank overhang (if occurring) is measured from the edge of water to the vertical projection of the edge of bank. The vertical distance from the water surface to the lowest floodplain terrace is recorded for each transect as well as the vertical distance to the bankfull elevation. The bankfull width is also recorded at each transect.

In addition to the information described above, PHS collected data related to riparian habitat condition. The methodologies used to collect the physical habitat data within the sampling reaches are described below. More detailed descriptions of the methodologies can be found in the EMAP-SW document.

Thalweg Profile

Beginning at the downstream end of the reach, measurement stations were established at intervals between transects. As recommended by the EMAP-SW protocol procedures for streams with a wetted width less than 2.5 meters wide. Stations were numbered “0” through “14” at one-meter intervals beginning at the downstream end of the first transect (Transect “A”) and measuring upstream to the next transect. The wetted width of the stream was measured to the nearest 0.1 m at stations “0” and “7”. At station 7 the substrate particle size at the tip of the depth measuring rod was classified at the left wetted margin and at positions 25%, 50%, 75%, and 100% of the distance across the wetted width of the stream. Because the average wetted width of Pringle Creek is greater than 2.5 meters, stations numbered “0” through “9” were spaced at 2.9-meter intervals (one-tenth the distance between transects), as recommended by the EMAP-SW protocol procedures. The wetted width of the stream was measured at stations 0 and 5, and the substrate particle size was measured at station 5.

The procedure for determining substrate particle size at the mid-way station is identical to the substrate size evaluation procedure described for regular channel cross-sections A through K, except that for these mid-way supplemental cross-sections, substrate size is entered on the Thalweg Profile side of the field form.

At each thalweg profile station, a meter ruler was used to locate the deepest point (the “thalweg”), and the thalweg depth was measured to the nearest cm. The depth was read on the side of the ruler to avoid inaccuracies due to the wave formed by the rod in moving water. At the point where the thalweg depth was measured, the presence or absence of “soft/small sediment” (defined as fine gravel, sand, silt, clay or muck readily apparent by “feeling” the bottom with the staff) was noted.

The channel unit code and pool forming element codes for the station were determined and recorded on the field data form using the standard codes provided on the form. According to the EMAP-SW protocol, the unit should be at least as long as the channel is wide to be recorded. The same measurements were recorded for all stations upstream to the next transect and for all stations to the upstream end of the sampling reach (Transect “K”).

Large Woody Debris Tally

Large woody debris (LWD), defined by this methodology as woody material with a small end diameter of at least 10 cm and a length of at least 1.5 m, within the reach was tallied while working upstream to collect the thalweg profile data. All pieces of LWD that were at least partially in the baseflow channel, the "active channel" (flood channel up to bankfull stage), or spanning above the active channel were included in the tally. LWD in the active channel was tallied over the entire length of the reach, including the area between the channel cross-section transects. The procedure for tallying LWD is presented in more detail in Table 7-5 of the EMAP-SW methodology.

All pieces of LWD within the segment that are at least partially within the bankfull channel were tallied by class based on the diameter of the large end (0.1 m to < 0.3 m, 0.3 m to <0.6 m, 0.6 m to <0.8 m, or >0.8 m, and the class based on the length of the piece (1.5m to <5.0m, 5m to <15m, or >15m). A tally mark was placed in the appropriate box in the "Pieces All/Part In Bankfull Channel" section of the Thalweg Profile and Woody Debris Form.

All pieces of LWD within the segment that are not actually within the bankfull channel, but are at least partially spanning (bridging) the bankfull channel were tallied by class based on the diameter of the large end (0.1 m to < 0.3 m, 0.3 m to <0.6 m, 0.6 m to <0.8 m, or >0.8 m), and the length of the piece (1.5 m to <5.0 m, 5 m to <15 m, or >15 m). For each piece observed, a tally mark was placed in the appropriate box in the "Pieces Bridge Above Bankfull Channel" section of the Thalweg Profile and Woody Debris Form.

After all pieces within the segment were tallied and marked on the form, the total number of pieces for each class were written in the small box at the lower right-hand corner of each tally box.

Water Surface Slope

The water surface slope was measured by "backsighting" downstream between transects (e.g., transect "K" to "J", "J" to "I", etc.). The EMAP-SW protocol recommends using a clinometer to measure slope. However, because of the very shallow slopes of the streams within the project area, a clinometer was not used for this project.

For this project, the water surface slope was measured by two people, each with a surveyor's rod held vertically in the center of the stream at the upstream cross section and the next cross section downstream. The elevation of the water surface was measured to the nearest 0.01 feet and later converted to the metric equivalent for both the upstream and downstream transects. The person at the upstream cross section placed a level against the surveyor's rod and backsighted to the downstream rod, recording the elevation of the level on the upstream rod and the corresponding elevation on the downstream rod. These readings were then used to calculate the water surface slope between the transects. If it was not possible to see from one transect to the next due to the stream curvature, streamside vegetation, distance, or low light levels, supplementary slope measurements were taken between the transects.

Substrate Size/Channel Dimensions

The wetted channel width was divided into four equal segments to locate substrate measurement points on the cross-section. The distances corresponding to 0% (Left), 25% (LCtr), 50% (Ctr), 75% (RCtr), and 100% (Right) of the measured wetted width were recorded in the “DistLB” fields of the form. The distance recorded for the right bank was the same as the wetted channel width. At each measurement point on the cross section, (Left, LCtr, Ctr, RCtr, Right), the depth of the water was recorded. Because the left and right measurement points were at the limits of the wetted width of the stream, the water depth at these points was recorded as “0”.

Substrate size and embeddedness were evaluated at each of the 11 cross-section transects. A substrate particle was picked up at each measuring point (unless the substrate was bedrock or consolidated hardpan material), and the size of the particle was visually estimated, according to the table on the Channel/Riparian Cross-section Form. The substrate embeddedness was also evaluated according to the guidelines on the form and in the EMAP-SW protocol and the value was recorded on the data form. By definition, sand and fine-grained sediments were considered 100 percent embedded; bedrock and hardpan were considered 0 percent embedded.

Bank Characteristics

Bank angle and bank undercut distance were determined on the left and right banks at each cross section transect. To measure bank angle, the surveyor’s rod was laid against the bank, with one end at the water’s edge. A clinometer was placed on the rod, and the bank angle in degrees was read from the external scale on the clinometer. The angle was recorded in the field for the left bank in the “Bank Measurement” section of the Channel/ Riparian Cross-section Form. If the bank was undercut, the horizontal distance of the undercutting (defined as the distance from the water’s edge out to the point where a vertical plumb line from the bank would hit the water’s surface) was measured to the nearest 0.01 m, and the distance was recorded on the field data form.

The incised height of the stream was measured by holding the surveyor’s rod vertically, with its base at the water’s edge. Using the surveyor’s rod as a guide while examining both banks, the channel incision as the height up from the water surface to elevation of the first terrace of the valley floodplain was visually estimated, and the value was recorded in the “Incised Height” field of the bank measurement section on the field data form.

At each transect, both banks were examined to estimate and record the height of bankfull flow above the thalweg elevation. The EMAP-SW protocol calls for bankfull height to be measured relative to the water surface elevation at the time of sampling; however, recording bankfull height relative to the thalweg elevation allows for comparison from year to year without the need to account for differing flow conditions. Potential bankfull indicators looked for included the following:

- An obvious slope break that differentiates the channel from a relatively flat floodplain terrace higher than the channel;
- A transition from exposed stream sediments to terrestrial vegetation;
- Moss growth on the banks;

- Presence of drift material caught on overhanging vegetation; and/or
- Transition from flood- and scour-tolerant vegetation to that which is relatively intolerant of these conditions.

The procedure for obtaining bank and channel dimension measurements is presented in more detail in Table 7-8 of the EMAP-SW protocol.

Canopy Cover

Canopy cover over the stream was determined at each of the 11 cross-section transects using a Convex Spherical Densiometer taped as shown in the procedures outlined in the EMAP-SW protocol. The EMAP-SW protocol recommends obtaining six measurements at each cross-section transect (four measurements in four directions at mid-channel and one at each bank). The mid-channel measurements are used to estimate canopy cover over the channel. The two bank measurements complement your visual estimates of vegetation structure and cover within the riparian zone itself, and are particularly important in wide streams, where riparian canopy may not be detected by the densiometer when standing midstream. Because the stream channels within the project area are relatively narrow, only the four mid-channel measurements were collected for this project.

Facing upstream at mid-channel at each cross-section transect and with the densiometer held level at 0.3 m (1 ft.) above the surface of the stream the number of grid intersection points covered by either a tree, a leaf, or a high branch were counted. The value (0 to 17) was recorded in the “CenUp” field of the canopy cover measurement section of the Channel/Riparian Cross-section and Thalweg Profile Form. Canopy cover values were then determined for the left bank, downstream, and right bank and recorded in the appropriate spaces of the field data form.

Riparian Vegetation Structure

Riparian vegetation observations were made for a distance of 5 meters upstream and downstream of each of the 11 cross-section transects. The riparian vegetation observations were made for the visible area from the stream back a distance of 10m (30 ft.) shoreward from both the left and right banks, creating a 10 m × 10 m riparian plot on each side of the stream. The riparian plot dimensions were estimated and not measured.

Standing mid-channel at a cross-section transect, a 5-meter distance upstream and downstream was estimated for the purpose of assessing riparian vegetation cover. For one bank and then the other, a distance of 10 meters back into the riparian vegetation was estimated. Within this 10 m × 10 m area, the riparian vegetation was conceptually divided into three layers: a CANOPY LAYER (>5m high), an UNDERSTORY (0.5 to 5 m high), and a GROUND COVER layer (<0.5 m high), and the dominant vegetation type for the CANOPY LAYER (vegetation > 5 m high) was determined to be either Deciduous, Coniferous, broadleaf Evergreen, Mixed, or None.

The areal cover class of large trees (> 0.3 m [1 ft.] diameter at breast height [DBH]) and small trees (< 0.3 m DBH) within the canopy layer was determined separately, and the appropriate cover class was recorded on the field data form ("0"=absent: zero cover, "1"=sparse: <10%, "2"=moderate: 10-40%, "3"=heavy: 40-75%, or "4"=very heavy: >75%). Next, the dominant vegetation type for the understory layer was determined as described above for the canopy layer.

The areal cover class for woody shrubs and saplings was determined separately from non-woody vegetation within the understory. Similarly, the areal cover class for woody shrubs and seedlings, non-woody vegetation, and the amount of bare ground present in the ground cover layer was determined as described above.

In stream Fish Cover, Algae, and Aquatic Macrophysics

The areal cover of all of the fish cover and other listed features that are in the water and on the banks 5 meters upstream and downstream of the cross-section were recorded in the “Fish Cover/Other” section of the Channel /Riparian Cross-section Form.

Standing mid-channel at a cross-section transect, a 5-meter distance upstream and downstream (10 m total length) was estimated for the purpose of evaluating fish cover. The water and the banks within the 10-m segment of stream were examined for the following features and types of fish cover:

- filamentous algae - long streaming algae that often occur in slow moving waters;
- aquatic saprophytes - are water-loving plants, including mosses, in the stream that could provide cover for fish or macroinvertebrates;
- large woody debris – the larger pieces of wood that can influence cover and stream morphology (i.e., those pieces that would be included in the large woody debris tally);
- brush and small woody debris – smaller wood pieces that primarily affect cover but not morphology;
- in-channel live trees or roots - living trees that are within the channel -- estimate the areal cover provided by the parts of these trees or roots that are inundated;
- overhanging vegetation - includes tree branches, brush, twigs, or other small debris that is not in the water but is close to the stream (within 1 m of the surface) and provides potential cover;
- undercut banks;
- boulders - typically basketball- to car-sized particles; and
- artificial structures - include those designed for fish habitat enhancement, as well as in-channel structures discarded (e.g., cars or tires) or purposefully placed for diversion, impoundment, channel stabilization, or other purposes.

For each cover type, the areal cover was estimated as follows and recorded in the “FISH COVER/OTHER” section of the Channel/Riparian Cross-section Form. According to the EMAP-SW protocol the cover classes of in stream fish cover features were estimated as follows:

"0"=absent: zero cover,
"1"=sparse: <10%,
"2"=moderate: 10-40%,
"3"=heavy: 40-75%, or
"4"=very heavy: >75%.

Human Influence

For the left and right banks at each of the 11 detailed Channel and Riparian Cross-Sections, the presence/absence and the proximity of 11 categories of human influences were evaluated.

Standing mid-channel at each cross-section transect, a 5-meter distance was estimated upstream and downstream (10 m total length), and a distance of 10 meters back into the riparian zone from each bank was estimated to define a riparian plot area. The channel, bank and riparian plot area adjacent to the defined stream segment were examined for the following human influences:

- (1) walls, dikes, revetments, riprap, and dams;
- (2) buildings;
- (3) pavement/cleared lot (e.g., paved, graveled, dirt parking lot, foundation);
- (4) roads or railroads,
- (5) inlet or outlet pipes;
- (6) landfills or trash (e.g., cans, bottles, trash heaps);
- (7) parks or maintained lawns;
- (8) row crops;
- (9) pastures, rangeland, hay fields, or evidence of livestock;
- (10) logging; and
- (11) mining (including gravel mining).

For each type of influence, its presence or absence and its proximity to the stream and riparian plot area was determined. The human disturbance items were considered to be present if they were visible from the cross-section transect. For each type of influence, the appropriate proximity class was recorded in the “Human Influence” part of the “Visual Riparian Estimates” section of the Channel/Riparian Cross-section Form. The proximity classes are defined by the EMAP-SW protocol as follows:

B (“Bank”) - Present within the defined 10 m stream segment and located in the stream or on the stream bank.

C (“Close”) - Present within the 10 × 10 m riparian plot area, but away from the bank.

P (“Present”) - Present, but outside the riparian plot area.

O (“Absent”) - Not present within or adjacent to the 10 m stream segment or the riparian plot area at the transect

A particular influence may be observed outside of more than one riparian observation plot (e.g., at both transects “D” and “E”). In such situations, the influence was recorded as present at every transect from which it was observed without having to site through another transect or its 10 m × 10 m riparian plot.

Riparian “Legacy” Trees and Invasive Alien Plants

One tree was identified as a “legacy” tree at each transect, and at transect K, the legacy tree was identified as the largest tree within 4 channel widths upstream of the transect location. For each legacy tree, which was defined as the largest tree within sight of the transect, the following information was recorded:

- type of tree, and, the taxonomic group, as defined on the field data form and Table 7-13 of the EMAP-SW protocol;
- estimated height,
- diameter at breast height (dbh), and
- distance from the wetted margin of the stream.

At each transect, the presence of listed invasive plant species within the 10 m x 10 m riparian plots on either bank was recorded on the Riparian “Legacy” Trees and Invasive Alien Plants field form. In accordance with the EMAP-SW protocol, only the presence of plants which are targets in the state (as identified in the EMAP-SW protocol) were recorded, even though other invasive species may be present.

4.0 RESULTS AND DISCUSSION

4.1 Benthic Macroinvertebrate Sampling

Benthic macroinvertebrate sampling was conducted on May 15, 2013, and the benthic macroinvertebrate samples were processed by Aquatic Biology Associates, Inc. (ABA) in Corvallis, Oregon. Data and results from ABA’s analysis are provided in Appendix B. A summary of the results of the analysis are present in the following sections.

4.1.1 Benthic Index of Biological Integrity

Each sample was scored according to the Benthic Index of Biological Integrity (BIBI), modified from Karr 1998, which is a quantitative method for determining and comparing the biological condition of streams. The BIBI scoring system is composed of the 10 metrics:

- Total number of taxa;
- Number of Ephemeroptera taxa;
- Number of Plecoptera taxa;
- Number of Trichoptera taxa;
- Number of long-lived taxa;
- Number of intolerant taxa;
- Percent tolerant taxa;
- Percent predators;
- Number of clinger taxa; and
- Percent dominant taxa.

Each individual metric is given a score of 1 through 5, with higher numbers given to conditions representative of streams unaltered by anthropogenic influence and exhibiting higher biological integrity. These metrics are then added together for the single, integrated overall BIBI score.

The results of the BIBI scoring for each of the sample reaches are summarized in Table 1 and the text below. The descriptions of metrics that follow are summarized from The Puget Sound Stream Benthos website (www.pugetsoundstreambenthos.org).

Table 1. Benthic Invertebrate Index of Biological Integrity – BIBI (modified Karr 1998)

Metric	Clark Creek		East Fork Pringle Creek (PC1)		Pringle Creek (PC2)	
	Value	Score ^a	Value	Score ^a	Value	Score ^a
Total Number of Taxa ^b	28	3	39	3	31	3
Number of Ephemeroptera Taxa ^b	1	1	2	1	1	1
Number of Plecoptera Taxa ^b	0	1	0	1	0	1
Number of Trichoptera Taxa ^b	1	1	5	3	4	1
Number of Long-lived Taxa ^b	3	3	2	1	1	1
Number of Intolerant Taxa ^b	1	1	1	1	0	1
Percent Tolerant Taxa ^c	19.79	5	23.95	3	30.77	3
Percent Predators ^b	5.25	1	12.74	3	2.97	1
Number of Clinger Taxa ^b	6	1	14	3	8	1
Percent Dominance (3 Taxa) ^c	38.79	5	37.83	5	50.11	3
Total BIBI Score^d:	n/a	22	n/a	24	n/a	16
Biological Condition:	Low		Low		Low	

Notes: a. Each metric scored: 1 = Low; 3 = Moderate; 5 = High
b. Metric value generally decreases with declining biological integrity
c. Metric value general increases with declining biological integrity
d. Key to Total BIBI Scores:
BIBI scores 0 – 24 = Low biological integrity
BIBI scores 25 – 39 = Moderate biological integrity
BIBI scores 39 – 50 = High biological integrity

Total Number of Taxa

The total number of taxa, or total taxa richness, is the total number of unique taxa identified within the sample. All types of invertebrates (mayflies, caddisflies, stoneflies, true flies, midges, clams, snails, and worms) collected from the sampling reach are included in this metric. The biodiversity of a stream declines as flow regimes are altered, habitat is lost, chemicals are introduced, energy cycles are disrupted, and alien taxa invade. The moderate scores given for total number of taxa in each of the sampling reaches indicates some level of disturbance within the assessment reaches.

Number of Ephemeroptera Taxa

The number of Ephemeroptera taxa, or Ephemeroptera taxa richness, is the total number of unique mayfly (Family Ephemeroptera) taxa identified within the sample. Typically, the

diversity of mayflies declines in response to most types of human influence. Only one mayfly taxon was recorded within the Clark Creek and Pringle Creek sample reaches, while only two taxa were recorded in the East Fork Pringle Creek reach. Such low numbers are indicative of disturbed systems.

Number of Plecoptera Taxa

The number of Plecoptera taxa, or Plecoptera taxa richness, is the total number of unique stonefly (Family Plecoptera) taxa identified within the sample. In general, stoneflies are among the most sensitive benthic macroinvertebrates, and they are among the first macroinvertebrates to disappear from a stream as human disturbance increases. Many stoneflies are predators that stalk their prey and hide around and between rocks, and these hiding places are lost as sediment washes into a stream and the stream substrates become embedded. Like salmonids, most stoneflies require cool, well-oxygenated water, and increased stream temperatures adversely affect the stream's ability to support stoneflies. The absence of stonefly taxa recorded within the sampling reaches is indicative of disturbed systems.

Number of Trichoptera Taxa

The number of Trichoptera taxa, or Trichoptera taxa richness, is the total number of unique caddisfly (Family Trichoptera) taxa identified within the sample. Caddisflies are a diverse family of insect. Various caddisfly taxa feed in a variety of ways: some spin nets to trap food, others collect or scrape food from the tops of exposed rocks. Many caddisflies build gravel or wood cases to protect them from predators, and others are predators themselves. Although caddisflies are a diverse family, taxa richness of caddisflies declines steadily as the variety and complexity of stream habitats decline. The number of caddisfly taxa recorded in the East Fork Pringle Creek and Pringle Creek sampling reaches were higher than in Clark Creek. Even so, the low numbers of caddisfly taxa recorded within all of the sampling reaches are indicative of disturbed systems.

Number of Long-Lived Taxa

The number of long-lived taxa is the total number of unique taxa that require more than one year to complete their life cycles. Because of their longer life cycles, these taxa are exposed to cumulatively more stream disturbances than taxa with shorter life cycles. If the stream is dry part of the year or subject to flooding, taxa with longer life cycles may disappear from the stream. Loss of long-lived taxa from a system may indicate an on-going problem that repeatedly interrupts their life cycles. The moderate to low scores given for total number of long-lived taxa in each of the sampling reaches indicates some level of disturbance within the assessment reaches.

Number of Intolerant Taxa

The number of intolerant taxa is the total number of unique taxa that are intolerant of stream pollution. Chironomids are not included in this metric. Benthic macroinvertebrates identified as intolerant are the most sensitive taxa and represent approximately five to ten percent of the taxa present in the region. These taxa are the first to disappear as stream degradation increases. The low scores for the number of intolerant taxa in each of the sampling reaches indicate disturbance within the assessment reaches.

Percent Tolerant Taxa

The percent tolerant taxa is the total number of individuals belonging to taxa tolerant to stream degradation, divided by the total number of individuals within the sample, multiplied by 100. Chironomids are not included in this metric. Tolerant taxa are present within most streams, but as disturbance increases, tolerant taxa represent an increasingly large percentage of the total macroinvertebrate community. The moderate scores for the percent tolerant taxa in the East Fork Pringle Creek and Pringle Creek sampling reaches indicate some level of disturbance within the assessment reaches.

Percent Predators

The percent predators metric is the total number of predator individuals identified within the sample, divided by the total number of individuals within the sample, multiplied by 100. Predator taxa represent the peak of the food web and depend on a reliable source of other invertebrates that they can eat. The percentage of animals that are obligate predators provides a measure of the trophic complexity supported by a site. Less disturbed sites generally support a greater diversity of prey items and, therefore, a larger diversity of predators to feed on them. The low to moderate scores for percent predators in each of the sampling reaches indicates some level of disturbance within the assessment reaches.

Number of Clinger Taxa

This metric is the total number of unique clinger taxa within the sample. “Clingers” have physical adaptations that allow them to hold onto smooth substrates in fast water. These macroinvertebrates typically occupy the open areas between rocks and cobbles along the bottom of the stream; thus, they are particularly sensitive to fine sediments that fill these spaces and eliminate the variety and complexity of these small habitats. Sediment also prevents clingers from accessing the hyporheic zone of the stream bed. The low to moderate numbers of clinger taxa recorded within the assessment reaches are indicative of disturbed systems.

Percent Dominance

Percent dominance is the sum of the individuals of the three most abundant taxa in the sample, divided by the total number of individuals in the sample, multiplied by 100. In general, as diversity declines, a fewer number of taxa make up a larger percentage of the total macroinvertebrate community. In contrast to most other metrics examined, the scores for percent dominance within all of the sample reaches were within the “moderate” or “high” categories.

Total BIBI Score

Scores for all ten metrics are added together to arrive at a total BIBI score. The stream’s total BIBI score is a measure of the stream’s biological condition. Because there are ten metrics and each metric is scored 1 to 5, the total BIBI score can range from 10 to 50. A score closer to 50 indicates a high biotic condition similar to that found in a “natural” reference stream, which in the Willamette Valley Region is a relatively undisturbed Pacific Northwest montane stream. A score closer to 10 indicates a severely degraded stream with poor biological integrity. Total BIBI scores for the project area sampling reaches ranged from 16 to 24, in the low range for biological integrity.

4.1.2 Other Stream Assessment Metrics

ABA provided scores for thirteen other metrics that may be useful in assessing the biological integrity of the project area streams. Values and biological integrity scores for each of these metrics are provided in Table 2. For the first six metrics listed in Table 2 (total abundance, EPT taxa richness, predator richness, scraper richness, shredder richness, and percent intolerant taxa), the metric value generally decreases as biological integrity decreases. For the project-area sampling reaches, these metrics generally scored low overall, indicating low biological integrity for project area streams.

For the last seven metrics listed in Table 2 (percent *Baetis tricaudatus*, percent collector, percent parasite, percent Oligochaeta, number of tolerant taxa, percent Simuliidae, and percent Chironomidae), the metric value generally increases as biological integrity decreases. Though scores for these metrics were variable for the project-area sampling reaches, approximately half of the scores were in the moderate to high range, indicating impaired biological integrity for project-area streams.

Table 2. Other Community Composition Metrics that are Indicative of Biological Condition

Metric	Clark Creek		East Fork Pringle Creek (PC1)		Pringle Creek (PC2)	
	Value	Score ^a	Value	Score ^a	Value	Score ^a
Total Abundance ^b	1937	H	1132	H	2543	H
EPT Taxa Richness ^b	2	L	7	L	5	L
Predator Richness ^b	3	L	6	L	2	L
Scraper Richness ^b	1	L	7	L	6	L
Shredder Richness ^b	4	L	5	M	3	L
Percent Intolerant Taxa ^b	0.40	L	3.23	L	0.00	L
Percent <i>Baetis tricaudatus</i> ^c	16.36	M	3.23	H	16.56	M
Percent Collector ^c	77.58	L	60.27	L	64.12	L
Percent Parasite ^c	0.40	H	6.27	L	1.49	H
Percent Oligochaeta ^c	4.85	M	11.98	L	16.77	L
Number of Tolerant taxa ^c	6	H	11	L	11	L
Percent Simuliidae ^c	3.43	H	0.76	H	12.10	L
Percent Chironomidae	67.88	L	48.29	L	37.79	L

Notes: a. Low (L), moderate (M), and high (H) scores compared with a Pacific Northwest montane stream with high biological integrity.
b. Metric value generally decreases with declining biological integrity
c. Metric value generally increases with declining biological integrity

4.2 Fish Sampling

Table 3 summarizes the results of the fish sampling efforts within the project-sample reaches. As noted above, the purpose of this sampling was to document the types of fish inhabiting the project-area streams. The sampling effort was not designed to document the number of fish within the project-area reaches. As noted above, mainstem Pringle Creek was not sampled because it was not possible to get the necessary permits from the NMFS within the time constraints associated with this sampling effort.

Five fish taxa were identified within the two reaches in which fish were surveyed. All fish collected at both reaches were native to the Willamette River watershed, and all appeared healthy. Both cutthroat trout collected on East Fork Pringle Creek were adults. Two adult and five juvenile cutthroat trout were collected in the Clark Creek Reach, confirming that a breeding population is present in that stream.

Table 3. Results of Fish Sampling for Project Area Sampling Reaches

Fish Species	Sampling Reach		
	East Fork Pringle Creek	Clark Creek	Pringle Creek ^a
Sculpin	37	34	-
Redside Shiner	40	24	-
Largescale Sucker	1	-	-
Cutthroat trout	2	7	-
Speckled Dace	9	7	-
Total	89	82	-

Notes: a. Reach not sampled because necessary permit from NMFS could not be obtained in time to meet schedule constraints.

4.3 Physical Habitat Characterization

As in 2012, PHS collected data related to thalweg profile, stream and riparian cross sections, substrate type, and presence of large woody debris for each of the sampling reaches. These data are provided on data forms derived from those provided in the EMAP-SW protocol, and the data forms for each of the sampling reaches are in Appendices C, D, and E, respectively.

Because of the shallow slope of the project area streams, PHS determined the water surface slope using a level and surveyor's rods rather than a clinometer, as described in the methodology section above. Therefore, the EMAP-SW data sheet for slope measurement was not used. Slope data for the four sampling reaches are presented in Table 4, below.

Table 4. Water Surface Slopes for the Three Project-Area Sampling Reaches

Transect	Water Surface Slope (Percent)		
	Clark Creek	East Fork Pringle Creek	Pringle Creek
A to B	0.45	0.04	0.02
B to C	0.14	0.41	0.68
C to D	0.93	1.73	1.20
D to E	1.24	1.30	1.37
E to F	0.55	0.47	0.83
F to G	0.53	0.61	0.97
G to H	0.71	0.61	0.16
H to I	0.53	0.96	1.04
I to J	0.96	1.04	0.39
J to K	0.87	1.06	0.01
Reach Average	0.69	0.82	0.77

The slope of the stream reach may be useful in three different ways. First, the overall stream gradient gives an indication of potential water velocities and stream power, which are in turn important controls on aquatic habitat and sediment transport within the reach. Second, the spatial variability of stream gradient is a measure of habitat complexity, as reflected in the diversity of water velocities and sediment sizes within the stream reach. Lastly, the water surface slope allows computation of residual pool depths and volumes from the multiple depth and width measurements taken in the thalweg profile.

The EMAP-SW protocol for physical habitat characterization is useful for longitudinal studies of changes in channel morphology due to urban changes in the stream hydrograph. Water depths at regular intervals along the thalweg are provided on the “Thalweg Profile & Woody Debris Form” for each of the sampled reaches. With the assumption of linear water surface slope between the 11 sample transects within the reach, a detailed longitudinal profile of the stream bed thalweg can be drawn from the assessment data. Such a profile could be compared to profiles drawn from subsequent year’s data to assess changes in the stream profile over time. Downstream discharge can be correlated with mean water depths over the sample reach to yield an average relative rating curve for the reach. Thalweg and water surface slope profiles for each sampling reach are provided in Figures 5, 6, and 7.

Changes in the flow regime are likely to alter the longitudinal relations of bedforms within a sampled reach, so that repeated monitoring will record the changes in bed geometry as the stream bed is altered. Further analysis of the inferred relative bed elevations will reveal changes in the distribution of streambed features resulting from changes in the hydrograph.

Wetted width data are listed on the “Thalweg Profile & Woody Debris Form” and on the “Channel/Riparian Cross-Section Form” for each of the sampled reaches. Changes in the low-flow wetted width can be expected to result from hydrograph changes resulting from changes in surface properties of the watershed. While not so detailed as the bedform data, these data can be expected to show channel changes resulting from altered flow regimes. Comparison of the data contained in this report to data obtained in subsequent monitoring efforts can document changes in the stream over time. However, comparison of data collected in 2013 to that of 2012 was beyond the scope of this project.

Substrate size is one of the most important determinants of habitat character for fish and macroinvertebrates in streams. Substrate data for each transect within the sampled reaches are provided on the “Channel/Riparian Cross-Section Form”. Along with bedform (e.g., riffles and pools), substrate influences the hydraulic roughness and consequently the range of water velocities in the channel. It also influences the size range of interstices that provide living space and cover for macroinvertebrates, salamanders, and sculpins. Substrate characteristics are often sensitive indicators of the effects of human activities on streams. Within the sampled reaches, substrates were quite variable. Substrates in Clark and East Fork Pringle Creek were dominated by fine gravels, sands, and finer sediments. In portions of the Clark Creek reach, substrates were dominated by hardpan consisting of consolidated clay layers, with fine silt dominating the substrate composition in deeper, slower-moving portions of the stream. PHS noted that gravel bars appeared to be more extensive in Clark Creek in 2013 than in 2012. Additionally, rock/cobble “dams” presumably created by children playing in the stream were noted at several locations during earlier sight visits. Comparison of data collected in the two years would be needed to determine the extent of any such changes; however, such a comparison was beyond the scope of this project. Substrates in mainstem Pringle Creek were dominated by gravels and cobbles, with varying degrees of embeddedness throughout the reach.

Other channel morphology data, including bank angles, undercut measurements, bankfull heights, and incision heights are provided on the “Channel/Riparian Cross-Section Form” for each of the sampled reaches. The recorded bank angles from the edge of the low-flow wetted channel will show changes to the banks resulting from flows at or in excess of the bankfull discharge. If the channel is not greatly incised, bankfull channel height and incision height will be the same. However, if the channel is incised greatly, the bankfull level will be below the level of the first terrace of the valley floodplain, making bankfull channel height smaller than incision height. Throughout the East Fork Pringle Creek and Clark Creek reaches, the channels are relatively deeply incised under current conditions.

Qualitative assessments of riparian vegetation and land use characteristics along each of the sampled reaches are provided on the “Channel/Riparian Cross-Section Form” and the “Riparian ‘Legacy’ Trees and Invasive Alien Plants” forms. While these data cannot be used to directly describe hydromodification of the stream, the visual estimations of riparian condition are useful for evaluating the health and level of disturbance of the stream corridor. They also provide an indication of the present and future potential for various types of organic inputs and shading, which are important contributors to water quality and the aquatic ecosystem.

Riparian canopy cover over a stream is important not only in its role in moderating stream temperatures through shading, but also as an indicator of conditions that control bank stability and the potential for inputs of coarse and fine particulate organic material. Organic inputs from riparian vegetation become food for stream organisms and structure to create and maintain complex channel habitat.

The field evaluation of the presence and proximity of various important types of human land use activities in the stream riparian area may be used in combination with mapped watershed land use information to assess the potential degree of disturbance of the sample stream reaches.

4.4 Summary

This report presents the results of the second year of sampling on three reaches in the vicinity of existing monitoring stations operated by the City of Salem. PHS also sampled these three reaches (East Fork Pringle Creek, Pringle Creek, and Clark Creek) in 2012. These data will be compared against data collected in other sampling efforts to assess the changes and trends in water quality and hydromodification.

Benthic Invertebrate Index of Biological Integrity (BIBI) scores derived from the benthic macroinvertebrate sampling effort indicate some level of water quality degradation in each of the three sampled reaches. Low biological integrity scores are often recorded in streams located within urban environments. Fish species were recorded during fish sampling efforts of Clark Creek and East Fork Pringle Creek. The presence of adult and juvenile cutthroat trout in the Clark Creek reach indicates that cutthroat are breeding in the watershed. No non-native fish species were recorded.

Physical habitat characteristics of the three stream reaches appear largely similar to that observed during the 2012 monitoring effort. Comparison of data between the two years would be needed to detect specific changes in physical characteristics; however, such an analysis was beyond the scope of this project. All three of the reaches shows the effects of human influence. The East Fork Pringle Creek and Clark Creek reaches appear to have been channelized into the current alignments. Channels within both reaches show some degree of incision. A control structure downstream of the reach turns Clark Creek and the adjacent Gilmore Field into a detention facility, preventing flooding of downstream neighborhoods, during high-flow events. Mainstem Pringle Creek is less incised than the other two reaches; however, portions of the bank are constrained by concrete and block retaining walls where the stream occurs in close proximity to private residences. Rock/cobble “dams” presumably created by children playing in the stream were noted at several locations during earlier sight visits. These features were gone, however, at the last site visit of this monitoring effort, after rains had caused water levels in the stream to rise.

Substrates within the three reaches vary, as would be expected of streams of different sizes. Substrates within East Fork Pringle Creek and Clark Creek are dominated by fine gravel and other fine sediments. In portions of the Clark Creek reach, substrates were dominated by hardpan consisting of consolidated clay layers, with fine silt dominating the substrate composition in deeper, slower-moving portions of the stream. PHS noted that gravel bars appeared to be more extensive in Clark Creek in 2013 than in 2012. The substrate within mainstem Pringle Creek is dominated by coarse gravel and cobbles.

In addition to substrate size class, data was collected on water depth, wetted width, bankfull height, bankfull width, bank angle, surface water slope and other measurements, as described above. Comparison of the results of this monitoring effort with future monitoring events and data collected in 2012 is necessary to determine changes in the physical characteristics of the stream.

5.0 REFERENCES

Oregon Department of Environmental Quality. June 30, 2010. *Water Monitoring and Assessment Mode of Operations Manual (MOMs)*, Version 3.3, DEQ03-LAB-0036-SOP, Laboratory and Environmental Assessment Division, Hillsboro, Oregon.

Peck, D.V., J.M. Lazorchak, and D.J. Klemm (editors). Unpublished draft. *Environmental Monitoring and Assessment Program -Surface Waters: Western Pilot Study Field Operations Manual for Wadeable Streams*. EPA/XXX/X-XX/XXXX. U.S. Environmental Protection Agency, Washington, D.C.

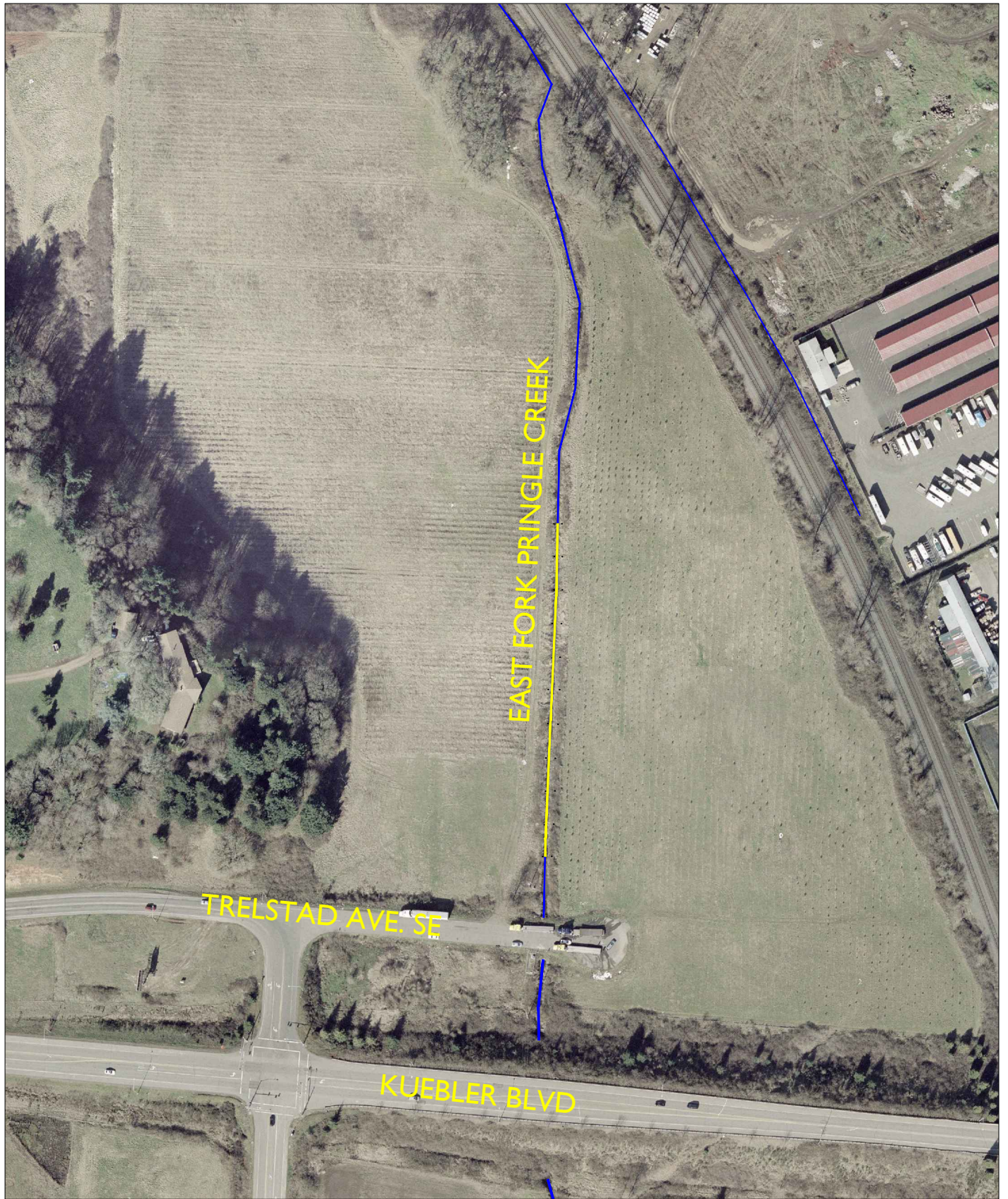
Pacific Habitat Services, Inc. March 21, 2011. *Technical Memorandum for the City of Salem's MS4 Permit Requirements for Benthic Macroinvertebrate Sampling and Hydromodification Assessment*

Puget Sound Stream Benthos Website. www.pugetsoundstreambenthos.org. Accessed February 2012.+

Appendix A

Figures





6/26/2013
PHS #5244

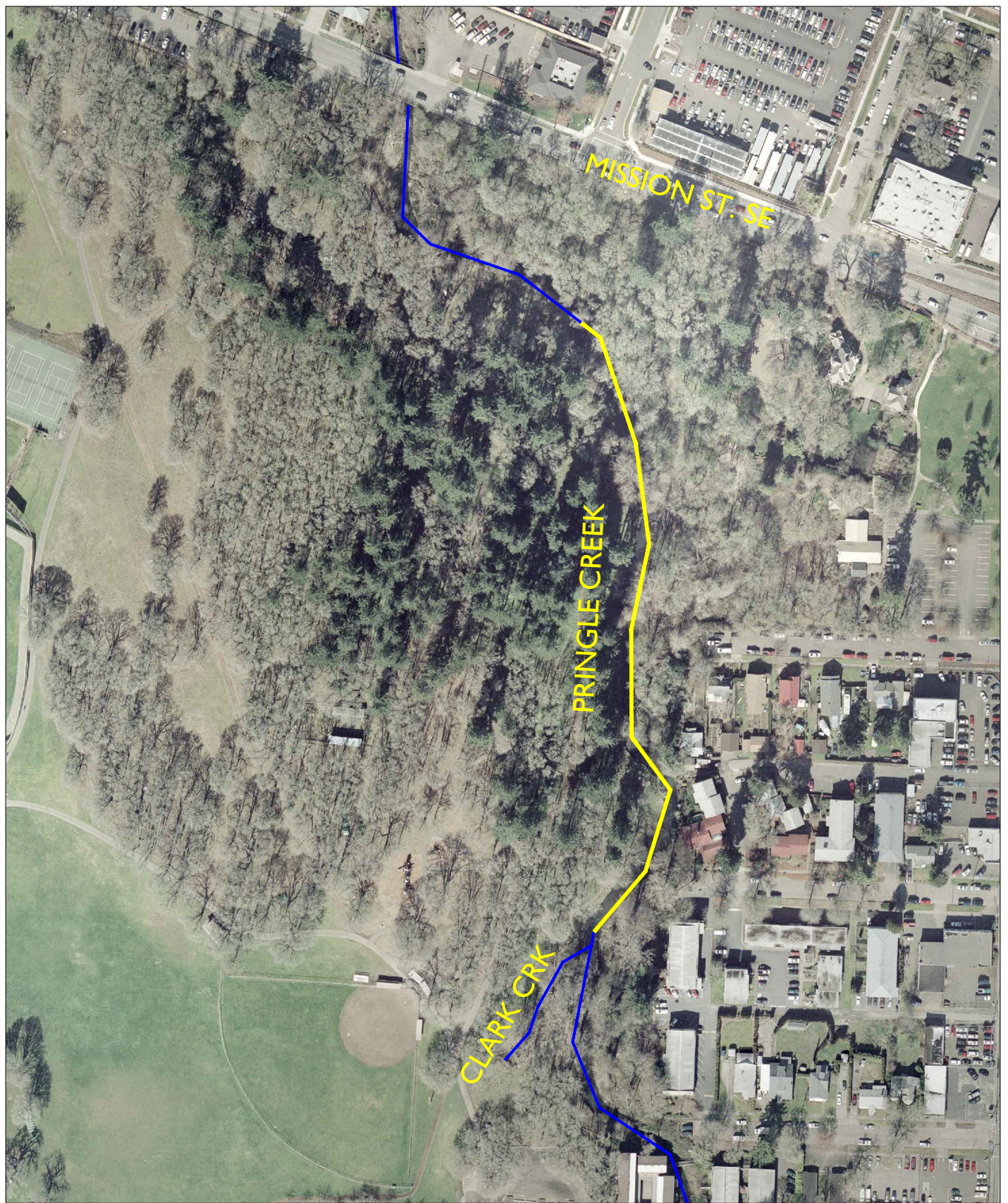


Location of East Fork Pringle Creek Sampling Reach,
Salem, Oregon.

Pacific Habitat Services, Inc.

FIGURE

1



6/26/2013
PHS #5244

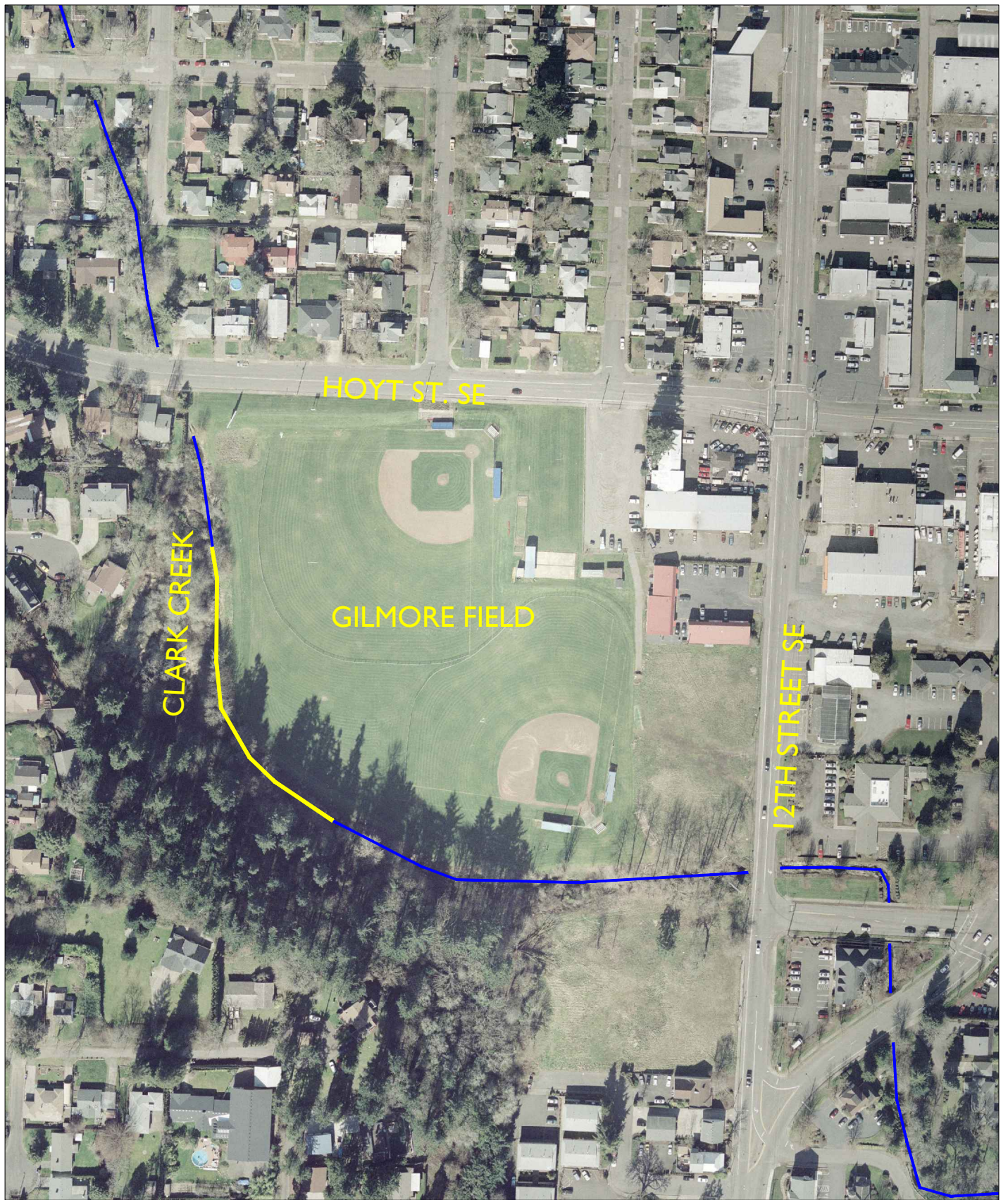


Pacific Habitat Services, Inc.

Location of Pringle Creek Sampling Reach, Salem, Oregon.

FIGURE

2



6/26/13
PHS #5244

Location of Clark Creek Sampling Reach, Salem, Oregon.



Pacific Habitat Services, Inc.

FIGURE

3



6/26/2013
PHS #5244

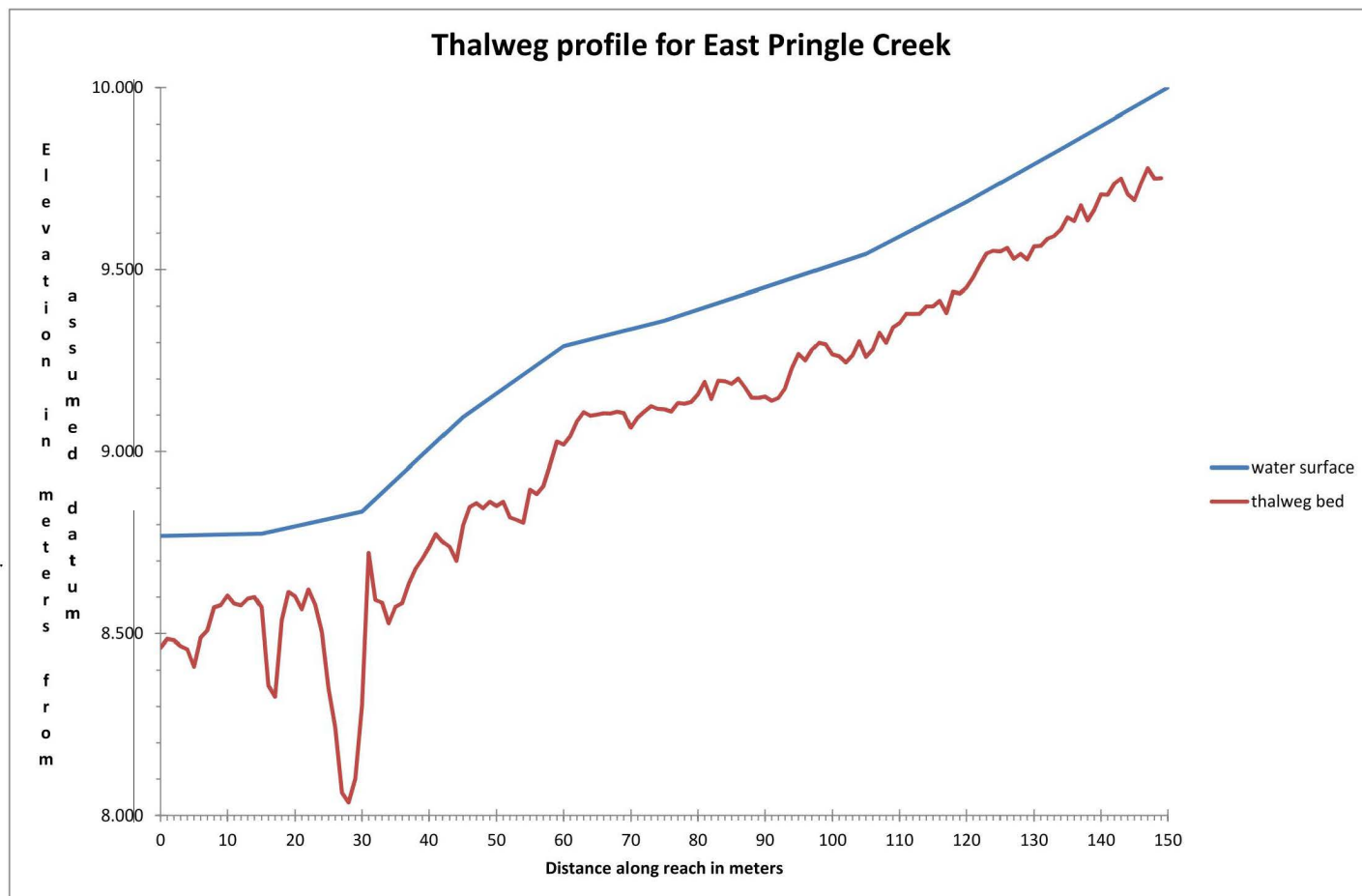


Transect Layout along East Fork Pringle Creek, Salem,
Oregon.

Pacific Habitat Services, Inc.

FIGURE

4

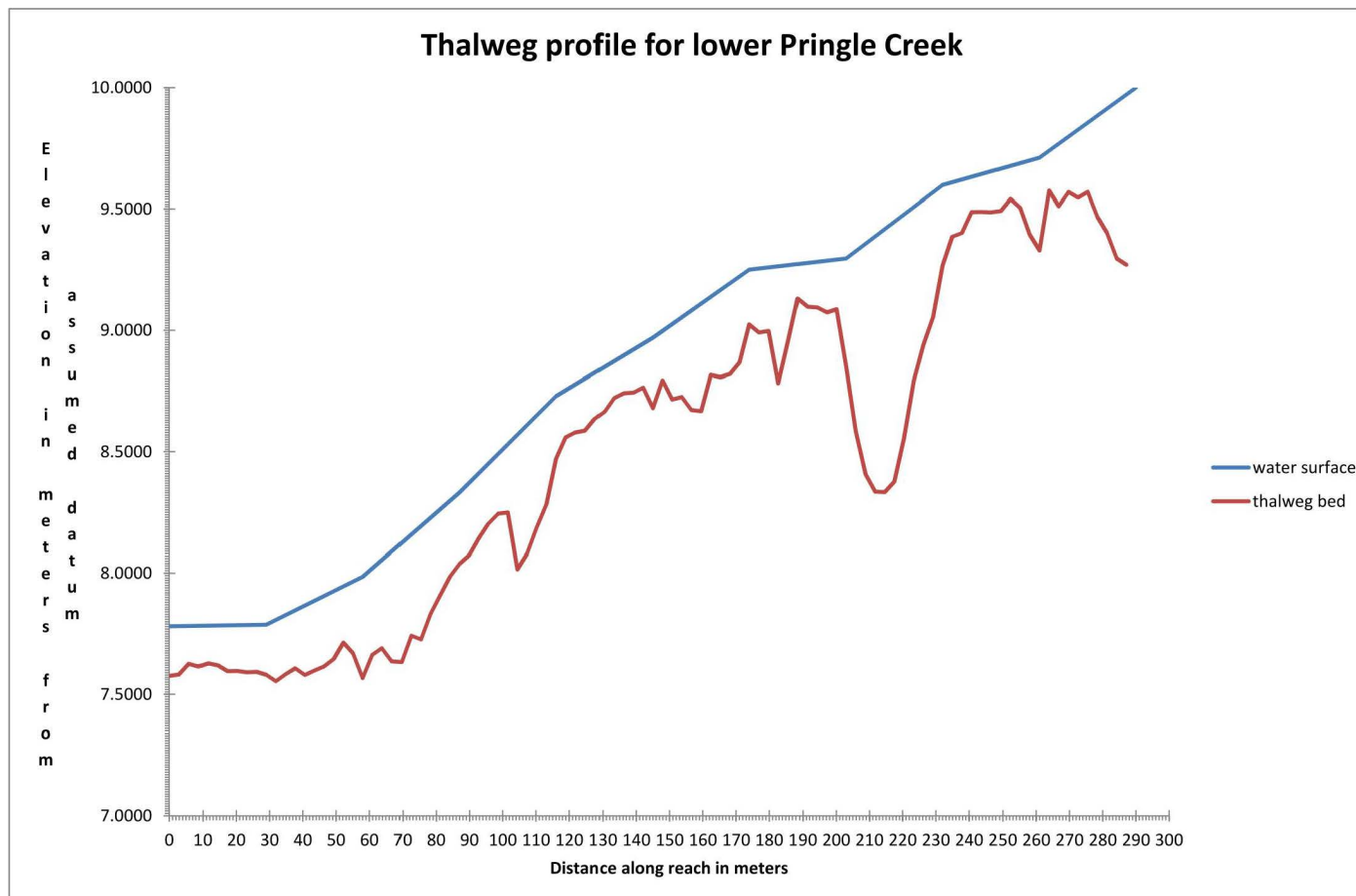


Pacific Habitat Services, Inc.
 9450 SW Commerce Circle, Suite 100 Wilsonville, Oregon 97070
 Phone: (503) 570-0800 Fax: (503) 570-0855

Thalweg and Water Surface Profile
 East Fork Pringle Creek Sampling Reach - Salem, Oregon

FIGURE
5

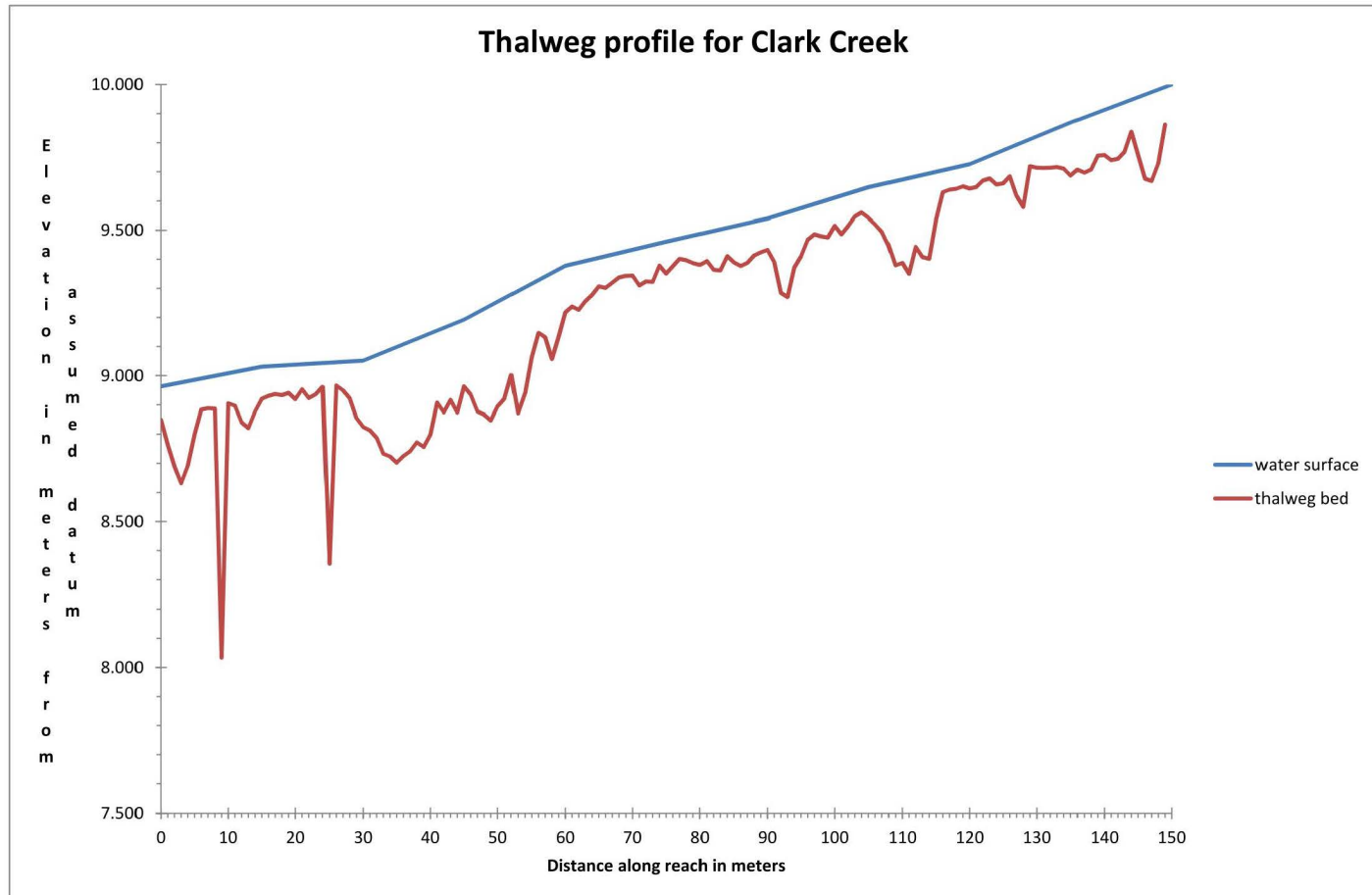
6/26/2013



Thalweg and Water Surface Profile
Pringle Creek Sampling Reach - Salem, Oregon

FIGURE
6

6/26/2013



Appendix B

Benthic Macroinvertebrate Sampling Data



Explanation of Sheets

- This explanation is included as a reference for the conventions used in the data analysis.
- Refer to the "Documentation" sheet for specifics about the project.
- Short descriptions will be written at the top of metrics and summary sheets where clarification is needed.
- Bolded titles in this document correspond to sheet names. The exact sheet names differ based on the type of analysis performed, whether or not replicates were present, and whether or not biomass was calculated.

Project Information

Documentation

- Includes project information, client and laboratory contact information, overview of specifications, notes on missing or empty samples, and any irregularities encountered.

Metrics and Summaries

Metrics

- Provides an overview of relevant sample descriptors broken down by site.
- If replicates are present in the data, then this sheet will use the mean values for a given site calculated from the total number of replicates present for that site.
- A replicate is considered present if it is listed as empty, in which case it will be included in the mean calculations as zeros for all taxa.
- A replicate that is missing, decayed, or otherwise damaged will be omitted from the mean calculations.

(Mean) Summary Sheets:

- Named with "Mean" if replicates are present in the data set.
- Provides summaries of all the taxa found at each site.
- The rules for calculating the means are the same as those for the metrics sheet.

Mean abundance or Abundance

- Abundances are converted to a full sample basis (if subsampled) and to a standard area or volume unless otherwise specified. Refer to the bolded header line at the top of the sheet for the units used to express abundances.
- For benthic analysis, the abundances will be expressed as per m².
- For drift analysis, the abundances will be expressed as per 100 m³ of water filtered.

Mean percent abundance or Percent abundance

- Summarizes the percentage of each taxa in the sample based on the abundance of the taxa.

Mean biomass or Biomass

- Biomass is calculated via length-weight regression of the form (dry mass in mg) = a*(body length in mm)^b.
- To verify the coefficients used for this particular analysis, see the "Traits" sheet columns "a" and "b".
- See the "Documentation" sheet for details on the length measurements.
- Biomass values are expressed in milligrams (mg) on a full sample basis (if subsampled) and converted to a standard area or volume unless otherwise specified. Refer to the bolded header line at the top of the sheet for the units used to express biomass.
- For benthic analysis, the biomass values are expressed as (mg) per m².
- For drift analysis, the biomass values are expressed as (mg) per 100 m³ water filtered.

Mean percent biomass or Percent biomass

- Summarizes the percentage of each taxon in the sample based on the biomass of the taxa.

If the data set includes replicates:

Replicate metrics

- Provides an overview of relevant sample descriptors broken down by site and replicate.
- Any site for which the entire column below the sample identification is blank represents a sample that was empty. It is included here for reference and to facilitate the checking of the mean calculations.

Replicate Summary Sheets:

- Included when replicates are present in the data set, except for the case of Diet analyses.
- Provides summaries of all the taxa found at each site broken down by the individual replicates.
- If a column is entirely blank below the site identification, then it represents a sample that was empty. It is included here for reference and to facilitate the checking of the mean calculations.
- Sheets are otherwise the same as the Summary Sheets listed above.

Replicate abundance

Replicate percent abundance

Replicate biomass

Replicate percent biomass

Formats for database importation

Long output

- Provides a format that is easier to import to a database than the summary sheets.
- The "Abundance" column here may represent a raw count, an abundance per m² in the case of a benthic analysis, or an abundance per 100 m³ water filtered in the case of a diet analysis. See the summary sheets for details.
- The "Biomass" column (if present) is reported in the same manner as the abundance (raw, per m², or per 100 m³) in milligrams (mg). See the summary sheets for details.
- No rounding is performed on this sheet other than the number of decimals Excel maintains.

Long mean output

- Virtually identical to the "Long output" sheet with the values reported being mean values for the site across all the replicates.
- "MeanAbun" is the mean abundance, and "MeanBiom" is the mean biomass value reported in the same manner as in "Long output". The standard deviations are included for both of these values.

Further documentation**Traits**

- Provides a snapshot of the coded life-history traits that were used to calculate the metrics for all of the taxa present in the data set.
- The "a" and "b" columns are the coefficients used to calculate biomass. See the explanation above for the "Mean Biomass" sheet for further details.

Metric explanation

- Provides a more detailed description of what each metric is calculating.

Record file

- This is the raw data as it was entered.
- Of note is the "Incidental" column (if present). This column denotes taxa that were identified in the sample yet omitted from the remainder of the analysis (these taxa will not appear on any other sheet in the file).
- Also of note is the "Unique" column (if present) indicating whether a taxa that was identified at a higher classification level is believed to represent a taxa that is already listed in the sample. If a taxa is marked as not unique (N), then it is not counted in any of the richness metrics.

Taxa notes

- Lists taxa identified in the sample that are excluded from the analysis (incidental taxa).
- Lists taxa identified to a higher classification level than the standard specification because of the specimen condition that are not believed to be unique from other taxa identified in the sample.
- May not be present in a data set.

Client

Client contact

Pacific Habitat Services

Craig Tumer, ct@pacifichabitat.com

Project

Pringle/Clark Creek Monitoring

Project location

Pringle and Clark Creek, Salem OR

Project objectives

Trend monitoring

Laboratory

Aquatic Biology Associates, Inc. (ABA)

3490 NW Deer Run Street, Corvallis, OR 97330

<http://www.aquaticbio.com/>

Contact

Robert Wisseman

James DiGiulio

Jon Lee

General taxonomy

Chironomidae taxonomy

Mite taxonomy

bobwisseman@mac.com

digiulio@peak.org

jlee@humboldt1.com

Sampling protocol

Sampling gear

D-frame net

Mesh size

500 micron

Square area sampled

8 square feet

Habitat sampled

erosional

Laboratory protocol

Mesh size

500 micron

Subsampling target count

500 organism minimum

Subsampling device

Caton tray

Sorting efficacy

95+%

Taxa abundances

converted to a full sample and 1 square meter basis

Identification protocol

Standard taxonomic effort

Pacific Northwest level 2 (unpublished)

Chironomidae (midges)

genus/species group

Oligochaeta (segmented worms)

class Oligochaeta

Acari (mites)

subclass Acari

Life stages:

U unknown (for non-insects)

L larvae

LE Larval exuvia

P pupae

PE pupal exuvia

A adult

E egg

Biomass determination

Published length weight regressions used to calculate biomass.

Length of all macroinvertebrates measured to nearest 0.5 mm if individual <5 mm, or nearest 1 mm if > 5 mm.

Reported as the biomass corresponding to the taxa abundances (see laboratory protocol above).

Data analysis

Standard taxonomic effort (STE)

Version 2 ABA

Taxa traits (e.g. feeding group, etc.)

Version 2 ABA (see "Traits" tab in this output for documentation)

Programmed in R by Adam and Robert Wisseman

Version 2 of ABA STE and taxa traits is a draft version still under development.

Abundances converted to a standard full sample (if subsampled) and one square meter basis.

Date run:

Thu Jun 6 11:46:48 2013

Analysis program in developmental phase.

Benthic Invertebrate Index of Biological Integrity-BIBI (modified Karr 1998)

OR: City of Salem, for Pacific Habitat Services, Inc., Wilsonville, OR. By Aquatic Biology Associates, Inc.

Sampling method: riffle habitat, D-frame net, composite sample, 8 square foot area, 500 micron mesh.

Subsampling: 500 organism minimum or entire sample. Level 2 PNW standard taxonomic effort.

Abundances adjusted to a full sample and square meter basis.

Site	Clark Creek CC1		EF Pringle Creek PC1		Pringle Creek PC2	
Date	5/14/2013		5/14/2013		5/14/2013	
METRIC	Value	Score	Value	Score	Value	Score
D Total number of taxa	28	3	39	3	31	3
D Number Ephemeroptera taxa	1	1	2	1	1	1
D Number Plecoptera taxa	0	1	0	1	0	1
D Number Trichoptera taxa	1	1	5	3	4	1
D Number of long-lived taxa	3	3	2	1	1	1
D Number of intolerant taxa	1	1	1	1	0	1
I % Tolerant taxa	19.79	5	23.95	3	30.77	3
D % Predator	5.25	1	12.74	3	2.97	1
D Number of clinger taxa	6	1	14	3	8	1
I % Dominance (3 taxa)	38.79	5	37.83	5	50.11	3

TOTAL SCORE		22		24		16
BIOLOGICAL CONDITION CATEGORY						

Maximum score of 50.

Each metric scored: 1=low, 3=moderate, 5=high

OTHER COMMUNITY COMPOSITION METRICS THAT ARE INDICATIVE OF BIOLOGICAL CONDITION

Total abundance (m2)	1937		1132		2543	
D EPT taxa richness	2		7		5	
D Predator richness	3		6		2	
D Scraper richness	1		7		6	
D Shredder richness	4		5		3	
D %Intolerant taxa	0.4		3.23		0	
I % <i>Baetis tricaudatus</i>	16.36		3.23		16.56	
I %Collector	77.58		60.27		64.12	
I %Parasite	0.4		6.27		1.49	
I %Oligochaeta	4.85		11.98		16.77	
I Number tolerant taxa	6		11		11	
I %Simuliidae	3.43		0.76		12.1	
I %Chironomidae	67.88		48.29		37.79	

L,M & H comparisons with a Pacific Northwest montane stream with high biological integrity.

I= Metric value generally increases with declining biological integrity.

D= Metric value generally decreases with declining biological integrity.

L= Low biological integrity.

M= Moderate biological integrity.

H= High biological integrity.



BIBI scores between 0-24.

BIBI scores between 25-39.

BIBI scores >40.

Abundances and biomass (mg) converted to a standard full sample (if subsampled) and one square meter basis.

Waterbody	Clark Creek	EF Pringle Creek	Pringle Creek
Station	CC1	PC1	PC2
Date	5/14/13	5/14/13	5/14/13
Subsample count	495	526	471
Subsample correction factor to full sample	2.91	1.6	4
Area correction factor to square meter	1.345	1.345	1.345
SUMMARY METRICS			
Total taxa richness	28	39	31
Total abundance	1937	1132	2534
EPT taxa richness	2	7	5
EPT abundance	399	62	473
Hilsenhoff Biotic Index (WY DEQ version)	5.86	5.95	5.94
DOMINANCE AND DIVERSITY			
% Dominant taxa	16.36	15.02	16.77
% Subdominant taxa	14.75	11.98	16.77
% Top 3 taxa	38.79	37.83	50.11
% Top 5 taxa	52.53	54.18	68.58
% Top 10 taxa	76.36	71.86	84.71
Shannon-Weaver Diversity (loge)	2.79	3.03	2.6
Shannon-Weaver Diversity (log2)	4.03	4.38	3.75
TOLERANT AND INTOLERANT TAXA			
% Total tolerant taxa	4.65	21.48	15.71
Total tolerant taxa richness	5	11	10
Total tolerant taxa abundance	90	243	398
% Highly tolerant taxa	1.82	0.95	0.85
Highly tolerant taxa richness	1	1	2
Highly tolerant taxa abundance	35	11	22
% Moderately tolerant taxa	2.83	20.53	14.86
Moderately tolerant taxa richness	4	10	8
Moderately tolerant taxa abundance	55	232	377
% Total intolerant taxa	0.4	3.23	0
Total intolerant taxa richness	1	1	0
Total intolerant taxa abundance	8	37	0
% Highly intolerant taxa	0	0	0
Highly intolerant taxa richness	0	0	0
Highly intolerant taxa abundance	0	0	0
% Moderately Intolerant taxa	0.4	3.23	0
Moderately intolerant taxa richness	1	1	0
Moderately intolerant taxa abundance	8	37	0
VOLTINISM (length of life cycle)			
% Semivoltine (> 1 year life cycle)	1.41	24.71	2.97
% Univoltine (1 year life cycle)	9.29	16.16	21.44
% Multivoltine (< 1 year life cycle)	89.29	59.13	75.58

Waterbody	Clark Creek	EF Pringle Creek	Pringle Creek
Station	CC1	PC1	PC2
Date	5/14/13	5/14/13	5/14/13
Semivoltine taxa abundance	27	280	75
Univoltine taxa abundance	180	183	543
Multivoltine taxa abundance	1730	669	1915
Semivoltine taxa richness	4	5	2
Univoltine taxa richness	3	8	5
Multivoltine taxa richness	21	26	24

GROWTH AND DEVELOPMENT

% Fast seasonal life cycle	87.88	53.8	66.45
% Slow seasonal life cycle	10.91	35.93	31.63
% Nonseasonal life cycle	1.21	10.27	1.91

OCCURRENCE IN DRIFT

% Rare in drift	11.92	40.87	31.21
% Common in drift	0.4	6.84	2.34
% Abundant in drift	87.68	52.28	66.45

SIZE AT MATURITY

% Small size at maturity	87.07	67.49	69.85
% Medium size at maturity	12.53	17.3	28.03
% Large size at maturity	0.4	15.21	2.12
Small size at maturity abundance	1687	764	1770
Medium size at maturity abundance	243	196	710
Large size at maturity abundance	8	172	54
Small size at maturity taxa richness	19	28	21
Medium size at maturity taxa richness	7	9	9
Large size at maturity taxa richness	2	2	1

RHEOPHILY AND HABITAT AFFINITY

% Depositional only	9.49	3.61	17.41
% Depositional and erosional	87.07	95.25	69.43
% Erosional	3.43	1.14	13.16

THERMAL PREFERENCE

% Cold stenothermal and cool eurythermal	2.63	3.42	0
% Cool/warm eurythermal	97.37	96.58	99.79
% Warm eurythermal	0	0	0.21

NON-INSECT AND INSECT ORDERS

% Non-insect invertebrates	7.27	43.35	31
% Ephemeroptera (mayflies)	16.36	3.8	16.56
% Odonata (damselfly- and dragonflies)	0	0	0.42
% Plecoptera (stoneflies)	0	0	0
% Hemiptera (true bugs)	0	0	0
% Megaloptera (dobsonflies and hellgramites)	0	0	0
% Trichoptera (caddisflies)	4.24	1.71	2.12
% Lepidoptera (moths)	0	0	0
% Coleoptera (beetles)	0.2	1.14	0
% Diptera (total)(true flies)	71.92	50	49.89

Waterbody	Clark Creek	EF Pringle Creek	Pringle Creek
Station	CC1	PC1	PC2
Date	5/14/13	5/14/13	5/14/13
% Chironomidae (true flies- midges)	67.88	48.29	37.79
Non-insect taxa richness	5	8	9
Ephemeroptera taxa richness	1	2	1
Odonata taxa richness	0	0	1
Plecoptera taxa richness	0	0	0
Hemiptera taxa richness	0	0	0
Megaloptera taxa richness	0	0	0
Trichoptera taxa richness	1	5	4
Lepidoptera taxa richness	0	0	0
Coleoptera taxa richness	1	3	0
Diptera (total) taxa richness	20	21	16
Chironomidae taxa richness	16	19	15
Non-insect abundance	141	491	785
Ephemeroptera abundance	317	43	420
Odonata abundance	0	0	11
Plecoptera abundance	0	0	0
Hemiptera abundance	0	0	0
Megaloptera abundance	0	0	0
Trichoptera abundance	82	19	54
Lepidoptera abundance	0	0	0
Coleoptera abundance	4	13	0
Diptera (total) abundance	1393	566	1264
Chironomidae abundance	1315	547	958

INDICATOR TAXA

Mollusca (snails and bivalves) taxa richness	1	4	5
Crustacea taxa richness	2	1	1
Baetidae (mayfly) taxa richness	1	2	1
Ephemerellidae (mayfly) taxa richness	0	0	0
Heptageniidae (mayfly) taxa richness	0	0	0
Nemouridae (stonefly) taxa richness	0	0	0
Rhyacophilidae (caddisfly) taxa richness	0	0	0
Hydropsychidae (caddisfly) taxa richness	0	1	1
Elmidae (riffle beetle) taxa richness	1	2	0
Oligochaeta (segmented worms) abundance	94	136	425
Mollusca abundance	16	280	199
Crustacea abundance	23	4	124
Acari (mites) abundance	8	56	27
Baetidae abundance	317	43	420
Baetis tricaudatus (mayfly) abundance	317	37	420
Ephemerellidae abundance	0	0	0
Heptageniidae abundance	0	0	0
Nemouridae abundance	0	0	0
Rhyacophilidae abundance	0	0	0
Hydropsychidae taxa abundance	0	4	22

Waterbody	Clark Creek	EF Pringle Creek	Pringle Creek
Station	CC1	PC1	PC2
Date	5/14/13	5/14/13	5/14/13
Elmidae abundance	4	11	0
Simuliidae abundance	67	9	307
Tanytarsini midge abundance	286	15	32
% Oligochaeta (segmented worms)	4.85	11.98	16.77
% Mollusca	0.81	24.71	7.86
% Crustacea	1.21	0.38	4.88
% Acari	0.4	4.94	1.06
% Baetidae	16.36	3.8	16.56
% Baetis tricaudatus	16.36	3.23	16.56
% Ephemerellidae	0	0	0
% Heptageniidae	0	0	0
% Nemouridae	0	0	0
% Rhyacophilidae	0	0	0
% Hydropsychidae	0	0.38	0.85
% Elmidae	0.2	0.95	0
% Simuliidae	3.43	0.76	12.1
% Tanytarsini	14.75	1.33	1.27

FEEDING GROUPS

Predator taxa richness	3	6	2
Parasite taxa richness	1	2	2
Collector-gatherer taxa richness	16	16	15
Collector-filterer taxa richness	2	4	3
Collector (total) taxa richness	18	20	18
Piercer herbivore taxa richness	0	1	1
Macrophyte herbivore taxa richness	1	1	1
Shredder taxa richness	3	3	1
Scraper taxa richness	1	5	5
Omnivore taxa richness	1	1	1
Unknown taxa richness	0	0	0
Predator abundance	102	144	75
Parasite abundance	8	71	38
Collector-gatherer abundance	1421	570	1275
Collector-filterer abundance	82	112	350
Collector (total) abundance	1503	682	1625
Piercer herbivore abundance	0	6	11
Macrophyte herbivore abundance	82	15	161
Shredder abundance	90	15	16
Scraper abundance	149	28	554
Omnivore abundance	4	170	54
Unknown abundance	0	0	0
% Predator	5.25	12.74	2.97
% Parasite	0.4	6.27	1.49
% Collector-gatherer	73.33	50.38	50.32
% Collector-filterer	4.24	9.89	13.8

Waterbody	Clark Creek	EF Pringle Creek	Pringle Creek
Station	CC1	PC1	PC2
Date	5/14/13	5/14/13	5/14/13
% Collector (total)	77.58	60.27	64.12
% Piercer herbivore	0	0.57	0.42
% Macrophyte herbivore	4.24	1.33	6.37
% Shredder	4.65	1.33	0.64
% Scraper	7.68	2.47	21.87
% Omnivore	0.2	15.02	2.12
% Unknown	0	0	0

HABIT

Skater taxa richness	0	0	0
Planktonic taxa richness	0	0	0
Diver taxa richness	0	0	0
Swimmer taxa richness	2	2	2
Clinger taxa richness	6	15	13
Sprawler taxa richness	15	15	10
Climber taxa richness	1	2	2
Burrower taxa richness	4	5	4
Unknowns taxa richness	0	0	0
Skater abundance	0	0	0
Planktonic abundance	0	0	0
Diver abundance	0	0	0
Swimmer abundance	27	60	151
Clinger abundance	904	325	1566
Sprawler abundance	697	448	291
Climber abundance	82	6	27
Burrower abundance	227	293	500
Unknowns abundance	0	0	0
% Skater	0	0	0
% Planktonic	0	0	0
% Diver	0	0	0
% Swimmer	1.41	5.32	5.94
% Clinger	46.67	28.71	61.78
% Sprawler	35.96	39.54	11.46
% Climber	4.24	0.57	1.06
% Burrower	11.72	25.86	19.75
% Unknown	0	0	0

STATE OF CALIFORNIA DESIGNATIONS

CA % Sensitive EPT	4.24	0.76	0.85
CA % Intolerant individuals	8.48	3.99	1.06
CA % Tolerant individuals	4.24	15.02	3.18
CA weighted tolerance value	5.84	5.96	5.86
CA % Predators	5.66	19.01	4.46
CA % Collector-gatherers	69.9	46.39	46.92
CA % Filterers	4.24	9.51	13.8
CA % Scrapers	7.68	17.3	23.99

Waterbody	Clark Creek	EF Pringle Creek	Pringle Creek
Station	CC1	PC1	PC2
Date	5/14/13	5/14/13	5/14/13
CA % Shredders	6.87	2.85	2.55
BIOTIC CONDITION INDEX			
CTQa- Community Tolerance Quotient actual	100.32	97.79	101.23
CTQd-Community Tolerance Quotient dominance	100.65	103.14	102.37

Abundances and biomass (mg) converted to a standard full sample (if subsampled) and one square meter basis.

Waterbody										Clark Creek	EF Pringle Creek	Pringle Creek
Station										CC1	PC1	PC2
Date										2013-05-14	2013-05-14	2013-05-14
Taxon	Stage	Insect?	Origin	Higher classification	Order	Family	Common name	Abundance	Abundance	Abundance	Abundance	Abundance
Pseudodiamesa	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Diamesinae	midges	43				16
Rheocricotopus	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	110				5
Synorthocladius	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	74				5
Thienemanniella	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	8			15	5
Thienemannimyia complex	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Tanypodinae	midges	94			90	65
Tveteria bavarica group	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges				22	

Abundances and biomass (mg) converted to a standard full sample (if subsampled) and one square meter basis.

	Taxon	Stage	Insect?	Origin	Higher classification	Order	Family	Comm
	Nemata	U	non-insect	Aquatic	Nemata	miscellaneous non-insect	x	round
	Oligochaeta	U	non-insect	Aquatic	Annelida: Oligochaeta	miscellaneous non-insect	x	segmente
	Fluminicola	U	non-insect	Aquatic	Mollusca: Gastropoda	x	Lithoglyphidae	snails
	Ferrissia	U	non-insect	Aquatic	Mollusca: Gastropoda	x	Planorbidae	snails
	Gyraulus	U	non-insect	Aquatic	Mollusca: Gastropoda	x	Planorbidae	snails
	Juga	U	non-insect	Aquatic	Mollusca: Gastropoda	x	Pleuroceridae	snails
	Pisidium	U	non-insect	Aquatic	Mollusca: Bivalvia	x	Sphaeriidae	snails
	Sphaerium	U	non-insect	Aquatic	Mollusca: Bivalvia	x	Sphaeriidae	pea cl
	Ostracoda	U	non-insect	Aquatic	Crustacea: Ostracoda	x	x	pea cl
	Crangonyx	U	non-insect	Aquatic	Crustacea: Amphipoda	x	Crangonyctidae	seed s
	Pacifastacus	U	non-insect	Aquatic	Crustacea: Decapoda	x	Astacidae	scuds
	Acari	U	non-insect	Aquatic	Arachnida: Acari	x	x	crayfis
	Argia	L	insect	Aquatic	Arthropoda: Insecta	Odonata	Coenagrionidae	mites
	Baetis tricaudatus	L	insect	Aquatic	Arthropoda: Insecta	Ephemeroptera	Baetidae	damsee
	Diphetor hageni	L	insect	Aquatic	Arthropoda: Insecta	Ephemeroptera	Baetidae	mayfli
	Glossosoma	L	insect	Aquatic	Arthropoda: Insecta	Trichoptera	Glossosomatidae	mayfli
	Cheumatopsyche	L	insect	Aquatic	Arthropoda: Insecta	Trichoptera	Hydropsychidae	caddis
	Hydroptila	L	insect	Aquatic	Arthropoda: Insecta	Trichoptera	Hydroptilidae	caddis
	Lepidostoma	L	insect	Aquatic	Arthropoda: Insecta	Trichoptera	Lepidostomatidae	caddis
	Lepidostoma-turret case larvae	L	insect	Aquatic	Arthropoda: Insecta	Trichoptera	Lepidostomatidae	caddis
	Dicosmoecus gilvipes	L	insect	Aquatic	Arthropoda: Insecta	Trichoptera	Limnephilidae	caddis
	Lara	L	insect	Aquatic	Arthropoda: Insecta	Coleoptera	Elmidae	rifle b
	Optioservus	L	insect	Aquatic	Arthropoda: Insecta	Coleoptera	Elmidae	rifle b
	Brychius	L	insect	Aquatic	Arthropoda: Insecta	Coleoptera	Halplidae	crawlin
	Ceratopogoninae	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Ceratopogonidae	no-see
	Hemerodromia	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Empididae	dance
	Simulium	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Simuliidae	black f
	Tipula	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Tipulidae	crane
	Chironomidae	P	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae	midge
	Brillia	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthoclaadiinae	midge
	Chironomus	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Chironominae	midge
	Corynoneura	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthoclaadiinae	midge
	Cricotopus	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthoclaadiinae	midge
	Cryptochironomus	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Chironominae	midge
	Eukiefferiella brehmi group	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthoclaadiinae	midge
	Eukiefferiella claripennis group	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthoclaadiinae	midge
	Heterotrissocladius	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthoclaadiinae	midge
	Limnophyes	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthoclaadiinae	midge
Water								
Station								
Date								

Waterbody	Station	Date	Taxon	Stage	Insect	Origin	Higher classification	Order	Family	Common name	Abundance
Clark Creek	CC1	2013-05-14	Simulium	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Simuliidae	black flies	66.53715
Clark Creek	CC1	2013-05-14	Lepidostoma	L	insect	Aquatic	Arthropoda: Insecta	Trichoptera	Lepidostomatidae	caddisflies	82.19295
Clark Creek	CC1	2013-05-14	Tipula	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Tipulidae	crane flies	3.91395
Clark Creek	CC1	2013-05-14	Padiastacus	U	non-insect	Aquatic	Crustacea: Decapoda	x	Ascladidae	crayfish	3.91395
Clark Creek	CC1	2013-05-14	Hemerodromia	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Empididae	dance flies	3.91395
Clark Creek	CC1	2013-05-14	Baetis tricaudatus	L	insect	Aquatic	Arthropoda: Insecta	Ephemeroptera	Baetidae	mayflies	317.02995
Clark Creek	CC1	2013-05-14	Chironomidae	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae	midges	78.279
Clark Creek	CC1	2013-05-14	Chironomus	P	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Chironominae	midges	35.22555
Clark Creek	CC1	2013-05-14	Phaenopsectra	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Chironominae	midges	148.7301
Clark Creek	CC1	2013-05-14	Polypedium	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Chironominae	midges	82.19295
Clark Creek	CC1	2013-05-14	Micropectra	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Chironominae: Tanytarsini	midges	285.71835
Clark Creek	CC1	2013-05-14	Pseudodiamesa	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Diamesinae	midges	43.05345
Clark Creek	CC1	2013-05-14	Brillia	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	43.05345
Clark Creek	CC1	2013-05-14	Corynoneura	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	117.4185
Clark Creek	CC1	2013-05-14	Eukiefferiella claripeensis group	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	23.4837
Clark Creek	CC1	2013-05-14	Heterotrissociadius	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	7.8279
Clark Creek	CC1	2013-05-14	Limnophyes	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	7.8279
Clark Creek	CC1	2013-05-14	Orthocladius complex	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	7.8279
Clark Creek	CC1	2013-05-14	Parametritiochenus	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	148.7301
Clark Creek	CC1	2013-05-14	Rheocricotopus	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	109.5906
Clark Creek	CC1	2013-05-14	Synorthocladius	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	74.36505
Clark Creek	CC1	2013-05-14	Thienemanniella	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	7.8279
Clark Creek	CC1	2013-05-14	Thienemannimyia complex	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Tanypodinae	midges	93.9348
Clark Creek	CC1	2013-05-14	Acari	U	non-insect	Aquatic	Arachnida: Acari	x	x	mites	7.8279
Clark Creek	CC1	2013-05-14	Ceratopogoninae	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Ceratopogonidae	no-see-um midges	3.91395
Clark Creek	CC1	2013-05-14	Pisidium	U	non-insect	Aquatic	Mollusca: Bivalvia	x	Sphaeriidae	pea clams	15.6558
Clark Creek	CC1	2013-05-14	Lara	U	insect	Aquatic	Arthropoda: Insecta	Coleoptera	Elmidae	rifle beetles	3.91395
Clark Creek	CC1	2013-05-14	Grangonyx	U	non-insect	Aquatic	Crustacea: Amphipoda	x	Grangonyctidae	scuds	19.56975
Clark Creek	CC1	2013-05-14	Oligochaeta	U	non-insect	Aquatic	Annelida: Oligochaeta	x	x	segmented worms	93.9348
EF Pringle Creek	PC1	2013-05-14	Simulium	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Simuliidae	black flies	8.608
EF Pringle Creek	PC1	2013-05-14	Cheumatopsyche	L	insect	Aquatic	Arthropoda: Insecta	Trichoptera	Hydropsychidae	caddisflies	4.304
EF Pringle Creek	PC1	2013-05-14	Hydroptila	L	insect	Aquatic	Arthropoda: Insecta	Trichoptera	Hydroptilidae	caddisflies	6.456
EF Pringle Creek	PC1	2013-05-14	Lepidostoma	L	insect	Aquatic	Arthropoda: Insecta	Trichoptera	Lepidostomatidae	caddisflies	4.304
EF Pringle Creek	PC1	2013-05-14	Lepidostoma-turret case larvae	L	insect	Aquatic	Arthropoda: Insecta	Trichoptera	Lepidostomatidae	caddisflies	2.152
EF Pringle Creek	PC1	2013-05-14	Dicosmoecus glivipes	L	insect	Aquatic	Arthropoda: Insecta	Trichoptera	Limnephilidae	caddisflies	2.152
EF Pringle Creek	PC1	2013-05-14	Brychius	L	insect	Aquatic	Arthropoda: Insecta	Coleoptera	Halpilidae	crawling water beetles	2.152
EF Pringle Creek	PC1	2013-05-14	Baetis tricaudatus	L	insect	Aquatic	Arthropoda: Insecta	Ephemeroptera	Baetidae	mayflies	36.584
EF Pringle Creek	PC1	2013-05-14	Diphelot hegeni	L	insect	Aquatic	Arthropoda: Insecta	Ephemeroptera	Baetidae	mayflies	6.456
EF Pringle Creek	PC1	2013-05-14	Chironomidae	P	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae	midges	21.52
EF Pringle Creek	PC1	2013-05-14	Cryptochironomus	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Chironominae	midges	6.456
EF Pringle Creek	PC1	2013-05-14	Paratendipes	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Chironominae	midges	21.52
EF Pringle Creek	PC1	2013-05-14	Phaenopsectra	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Chironominae	midges	10.76
EF Pringle Creek	PC1	2013-05-14	Polypedium	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Chironominae	midges	15.064
EF Pringle Creek	PC1	2013-05-14	Micropectra	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Chironominae: Tanytarsini	midges	15.064
EF Pringle Creek	PC1	2013-05-14	Brillia	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	17.216
EF Pringle Creek	PC1	2013-05-14	Corynoneura	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	43.04
EF Pringle Creek	PC1	2013-05-14	Cricotopus	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	25.824
EF Pringle Creek	PC1	2013-05-14	Eukiefferiella brehmi group	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	27.976
EF Pringle Creek	PC1	2013-05-14	Eukiefferiella claripeensis group	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	4.304
EF Pringle Creek	PC1	2013-05-14	Heterotrissociadius	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	36.584
EF Pringle Creek	PC1	2013-05-14	Orthocladius complex	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	15.064
EF Pringle Creek	PC1	2013-05-14	Parametritiochenus	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	122.864
EF Pringle Creek	PC1	2013-05-14	Thienemanniella	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	15.064
EF Pringle Creek	PC1	2013-05-14	Tvetenia bavarica group	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	21.52
EF Pringle Creek	PC1	2013-05-14	Macropelopia	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Tanypodinae	midges	10.76
EF Pringle Creek	PC1	2013-05-14	Nilotanytus	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Tanypodinae	midges	15.064
EF Pringle Creek	PC1	2013-05-14	Procladius	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Tanypodinae	midges	10.76
EF Pringle Creek	PC1	2013-05-14	Thienemannimyia complex	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Tanypodinae	midges	90.384
EF Pringle Creek	PC1	2013-05-14	Acari	U	non-insect	Aquatic	Arachnida: Acari	x	x	mites	55.952

Waterbody	Station	Date	Taxon	Stage	Insect	Origin	Higher classification	Order	Family	Common name	Abundance
EF Pringle Creek	PC1	2013-05-14	Ceratopogoninae	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Ceratopogonidae	no-see-um midges	10.76
EF Pringle Creek	PC1	2013-05-14	Pisidium	U	non-insect	Aquatic	Mollusca: Bivalvia	x	Sphaeriidae	pea clams	94.688
EF Pringle Creek	PC1	2013-05-14	Sphaerium	U	non-insect	Aquatic	Mollusca: Bivalvia	x	Sphaeriidae	pea clams	4.304
EF Pringle Creek	PC1	2013-05-14	Lara	L	insect	Aquatic	Arthropoda: Insecta	Coleoptera	Elmidae	riffle beetles	8.608
EF Pringle Creek	PC1	2013-05-14	Optioservus	L	insect	Aquatic	Arthropoda: Insecta	Coleoptera	Elmidae	riffle beetles	2.152
EF Pringle Creek	PC1	2013-05-14	Nemata	U	non-insect	Aquatic	Nemata	x	miscellaneous non-insect	round worms	15.064
EF Pringle Creek	PC1	2013-05-14	Ostracoda	U	non-insect	Aquatic	Crustacea: Ostracoda	x	x	seed shrimp	4.304
EF Pringle Creek	PC1	2013-05-14	Oligochaeta	U	non-insect	Aquatic	Annelida: Oligochaeta	x	x	segmented worms	135.576
EF Pringle Creek	PC1	2013-05-14	Fluminicola	U	non-insect	Aquatic	Mollusca: Gastropoda	x	Lithoglyphidae	snails	10.76
Pringle Creek	PC2	2013-05-14	Juga	U	non-insect	Aquatic	Mollusca: Gastropoda	x	Pleurocentridae	snails	170.008
Pringle Creek	PC2	2013-05-14	Simulium	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Simuliidae	black flies	306.66
Pringle Creek	PC2	2013-05-14	Glossosoma	L	insect	Aquatic	Arthropoda: Insecta	Trichoptera	Glossomatidae	caddisflies	5.38
Pringle Creek	PC2	2013-05-14	Cheumatopsyche	L	insect	Aquatic	Arthropoda: Insecta	Trichoptera	Hydropsychidae	caddisflies	21.52
Pringle Creek	PC2	2013-05-14	Hydroptila	L	insect	Aquatic	Arthropoda: Insecta	Trichoptera	Hydroptilidae	caddisflies	10.76
Pringle Creek	PC2	2013-05-14	Lepidostoma	L	insect	Aquatic	Arthropoda: Insecta	Trichoptera	Lepidostomatidae	caddisflies	16.14
Pringle Creek	PC2	2013-05-14	Argia	L	insect	Aquatic	Arthropoda: Insecta	Odonata	Coenagrionidae	damselflies	10.76
Pringle Creek	PC2	2013-05-14	Baetis tricaudatus	L	insect	Aquatic	Arthropoda: Insecta	Ephemeroptera	Baetidae	mayflies	419.64
Pringle Creek	PC2	2013-05-14	Chironomidae	P	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae	midges	26.9
Pringle Creek	PC2	2013-05-14	Chironomus	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Chironominae	midges	16.14
Pringle Creek	PC2	2013-05-14	Phaenopsectra	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Chironominae	midges	425.02
Pringle Creek	PC2	2013-05-14	Polypedium	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Chironominae	midges	161.4
Pringle Creek	PC2	2013-05-14	Micropectra	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Chironominae: Tanytarsini	midges	32.28
Pringle Creek	PC2	2013-05-14	Brillia	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	48.42
Pringle Creek	PC2	2013-05-14	Corynoneura	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	5.38
Pringle Creek	PC2	2013-05-14	Cricotopus	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	5.38
Pringle Creek	PC2	2013-05-14	Eukiefferiella claripennis group	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	37.66
Pringle Creek	PC2	2013-05-14	Orthocladus	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	5.38
Pringle Creek	PC2	2013-05-14	Orthocladus complex	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	16.14
Pringle Creek	PC2	2013-05-14	Parametricnemus	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	86.08
Pringle Creek	PC2	2013-05-14	Rheocricotopus	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	16.14
Pringle Creek	PC2	2013-05-14	Synorthocladus	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	5.38
Pringle Creek	PC2	2013-05-14	Thienemanniella	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	5.38
Pringle Creek	PC2	2013-05-14	Thienemanniella complex	L	insect	Aquatic	Arthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	64.56
Pringle Creek	PC2	2013-05-14	Acari	U	non-insect	Aquatic	Arachnida: Acari	x	x	mites	26.9
Pringle Creek	PC2	2013-05-14	Pisidium	U	non-insect	Aquatic	Mollusca: Bivalvia	x	Sphaeriidae	pea clams	21.52
Pringle Creek	PC2	2013-05-14	Nemata	U	non-insect	Aquatic	Nemata	x	miscellaneous non-insect	round worms	10.76
Pringle Creek	PC2	2013-05-14	Crangonyx	U	non-insect	Aquatic	Crustacea: Amphipoda	x	Crangonyctidae	scuds	123.74
Pringle Creek	PC2	2013-05-14	Oligochaeta	U	non-insect	Aquatic	Annelida: Oligochaeta	x	x	segmented worms	425.02
Pringle Creek	PC2	2013-05-14	Fluminicola	U	non-insect	Aquatic	Mollusca: Gastropoda	x	Lithoglyphidae	snails	80.7
Pringle Creek	PC2	2013-05-14	Ferrissia	U	non-insect	Aquatic	Mollusca: Gastropoda	x	Planorbidae	snails	37.66
Pringle Creek	PC2	2013-05-14	Gyraulus	U	non-insect	Aquatic	Mollusca: Gastropoda	x	Planorbidae	snails	5.38
Pringle Creek	PC2	2013-05-14	Juga	U	non-insect	Aquatic	Mollusca: Gastropoda	x	Pleuroceridae	snails	53.8

Taxon	Stage	Insect	Origin	Higher classification	Order	Family	Common name	Range	Feeding Group	CA	Feeding group	Habitat	Tolerance	WY-HBI	FPSSB	bio/CA	tolerant	HDI	tolerant	TV	FPSSB	and/Colinism	Development	Occurrence	Size at mtd	Rheophil	Thermal	pa	a	b		
Oligochaeta	U	non-insect	Aquatic	Annelida: Oligochaeta	miscellaneous non-insect	x	Sphaeriidae	segmented worms	OCG	CG	CG	BU	0.0				5	0	5	0	108	0	2	2	2	1	2	2	2	0.0758	0.74	
Pisidium	U	non-insect	Aquatic	Mollusca: Bivalvia	x		pea clams	OCF	CG	CF	CG	BU	0.0				8	0	8	0	108	0	1	3	1	1	2	2	2	0.0163	2.477	
Crangonyx	U	non-insect	Aquatic	Crustacea: Amphipoda	x	Crangonyctidae	scuds	OCG	CG	CG	CG	SW	MT	11			0	4	0	108	0	3	2	2	1	2	2	2	2	0.0058	3.015	
Pedifacatus	U	non-insect	Aquatic	Crustacea: Decapoda	x	Astacidae	crayfish	OM	OM	OM	OM	SP	0.0				6	0	6	0	108	0	1	3	2	1	3	2	2	0.0147	3.626	
Acari	U	non-insect	Aquatic	Arachnida: Acari	x		mites	OPA	PR	PR	PR	SW	0.0				5	0	5	0	108	0	3	2	1	2	2	2	2	0.053	2.494	
Baetis tricaudatus	L	insect	Aquatic	Anthropoda: Insecta	Ephemeroptera	Belontiidae	mayflies	OCG	CG	CG	CG	CL	0.0				6	0	6	0	72	0	3	1	2	1	2	2	2	2	0.0053	2.875
Lepidostoma	L	insect	Aquatic	Anthropoda: Insecta	Trichoptera	Lepidostomatidae	cadisflies	OSH	SH	SH	SH	CM	0.0				1	0	1	0	18	0	2	2	1	2	2	2	2	0.0079	2.649	
Chironomus	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Chironomidae	midges	OCG	CG	CG	CG	SP	0.0				6	0	6	0	104	0	1	2	2	1	2	2	2	0.0074	2.649	
Ceratopogonidae	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Ceratopogonidae	no-sea-um midges	OPR	PR	PR	PR	SP	0.0				6	0	6	0	108	0	2	1	1	2	2	2	2	0.0025	2.469	
Hebertisoidae	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Epididae	dance flies	OPR	PR	PR	PR	SP	MT				6	0	6	0	95	0	3	2	1	2	2	2	2	0.0054	2.546	
Simuliidae	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Simuliidae	black flies	OCF	CF	CF	CF	BU	0.0				6	0	6	0	108	0	3	1	3	1	3	2	2	0.002	3.011	
Chironomidae	P	insect	Aquatic	Anthropoda: Insecta	Diptera	Chironomidae	midges	OSH	SH	SH	SH	BU	0.0				4	0	4	0	36	0	1	2	1	3	2	2	2	0.0029	2.881	
Brillia	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Chironomidae	midges	OCG	CG	CG	CG	SH	0.0				5	0	5	0	108	0	3	1	3	1	2	2	2	0.0018	2.617	
Chironomus	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Chironomidae	midges	OCG	CG	CG	CG	BU	HT				10	0	10	0	108	0	3	1	3	1	2	2	2	0.0018	2.617	
Corynoneura	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Chironomidae	midges	OCG	CG	CG	CG	SP	0.0				7	0	7	0	108	0	3	1	3	1	2	2	2	0.0018	2.617	
Eukiefferella clarpennisi group	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	OCG	OM	OM	OM	SP	MT				8	0	8	0	108	0	3	1	3	1	2	2	2	0.0018	2.617	
Heterotrichocladus	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	OCG	CG	CG	CG	SP	MT				8	0	8	0	108	0	3	1	3	1	2	2	2	0.0018	2.617	
Limnophyes	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	OCG	CG	CG	CG	SP	MT				8	0	8	0	108	0	3	1	3	1	2	2	2	0.0018	2.617	
Microsectra	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	OCG	CG	CG	CG	CL	0.0				7	0	7	0	108	0	3	1	3	1	2	2	2	0.0018	2.617	
Orthocladus complex	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	OCG	CG	CG	CG	SP	0.0				6	0	6	0	108	0	3	1	3	1	2	2	2	0.0018	2.617	
Psephenonemus	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	OCG	CG	CG	CG	SP	0.0				5	0	5	0	108	0	3	1	3	1	2	2	2	0.0018	2.617	
Phaenopsectra	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Chironomidae: Chironominae	midges	OCG	SC	SC	SC	CL	0.0				7	0	7	0	108	0	3	1	3	1	2	2	2	0.0018	2.617	
Polyptellum	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Chironomidae: Chironominae	midges	OCG	OMH	MH	MH	CL	0.0				6	0	6	0	108	0	3	1	3	1	2	2	2	0.0018	2.617	
Pseudolimnasia	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Chironomidae: Damesininae	midges	OCG	CG	CG	CG	SP	0.0				6	0	6	0	108	0	3	1	3	1	2	2	2	0.0018	2.617	
Rhyacotritopus	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	OCG	CG	CG	CG	SP	0.0				6	0	6	0	108	0	3	1	3	1	2	2	2	0.0018	2.617	
Syntherisma	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	OCG	CG	CG	CG	SP	0.0				2	0	2	0	108	0	3	1	3	1	2	2	2	0.0018	2.617	
Thienemania	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	OCG	CG	CG	CG	SP	0.0				6	0	6	0	108	0	3	1	3	1	2	2	2	0.0018	2.617	
Thienemania complex	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Chironomidae: Tanyptarini	midges	OPR	PR	PR	PR	SP	0.0				6	0	6	0	108	0	3	1	3	1	2	2	2	0.0018	2.617	
Nemata	U	non-insect	Aquatic	Nemata	miscellaneous non-insect	x	round worms	OPA	PR	PR	PR	BU	0.0				5	0	5	0	108	0	2	2	1	2	2	2	2	0.0758	0.74	
Sphaerium	U	non-insect	Aquatic	Mollusca: Bivalvia	x	Sphaeriidae	pea clams	OCF	CG	CG	CG	BU	MT				7	0	7	0	108	0	1	3	1	2	2	2	2	0.0163	2.477	
Juga	U	non-insect	Aquatic	Crustacea: Amphipoda	x	Pleuroceridae	snails	OM	SC	SC	SC	BU	MT				7	0	7	0	108	0	1	2	2	1	3	2	2	0.0208	3.03	
Ostracoda	U	non-insect	Aquatic	Crustacea: Amphipoda	x		seed shrimp	OCG	CG	CG	CG	SW	0.0				8	0	8	0	108	0	3	2	1	1	2	2	2	0.00753	2.27	
Fumicoda	U	non-insect	Aquatic	Crustacea: Amphipoda	x	Lithoglyptidae	snails	OCG	CG	CG	CG	CL	MT				4	0	4	0	108	0	2	2	1	1	2	2	2	0.0208	3.03	
Diplopter hageni	L	insect	Aquatic	Anthropoda: Insecta	Ephemeroptera	Chironomidae	midges	OCG	CG	CG	CG	CL	0.0				5	0	5	0	108	0	3	2	1	2	2	2	2	0.0053	2.875	
Chironomus	L	insect	Aquatic	Anthropoda: Insecta	Ephemeroptera	Chironomidae	midges	OCG	CG	CG	CG	CL	0.0				5	0	5	0	108	0	3	2	1	2	2	2	2	0.0053	2.875	
Hydroptila	L	insect	Aquatic	Anthropoda: Insecta	Trichoptera	Hydroptilidae	cadisflies	OCF	CF	CF	CF	CL	0.0				8	0	8	0	108	0	3	3	2	1	2	2	2	0.0046	2.839	
Lepidostoma-tureti case larvae	L	insect	Aquatic	Anthropoda: Insecta	Trichoptera	Lepidostomatidae	cadisflies	OPH	PH	PH	PH	CL	MT				6	0	6	0	108	0	3	2	2	2	2	2	2	0.0056	2.649	
Dicosmoecus glivies	L	insect	Aquatic	Anthropoda: Insecta	Trichoptera	Lepidostomatidae	cadisflies	OSH	SH	SH	SH	CM	0.0				1	0	1	0	18	0	2	2	1	2	2	2	2	1	0.0079	2.649
Optiosevus	L	insect	Aquatic	Anthropoda: Insecta	Coleoptera	Elmidae	cadisflies	OCG	SC	SC	SC	CL	0.0				2	0	2	0	24	0	2	2	1	2	2	2	2	0.004	2.933	
Brychius	L	insect	Aquatic	Anthropoda: Insecta	Coleoptera	Elmidae	cadisflies	OCG	CG	CG	CG	CL	MT				4	0	4	0	104	0	1	3	2	1	2	2	2	0.0074	2.879	
Cryptochironomus	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Chironomidae	midges	OCG	CG	CG	CG	CL	0.0				5	0	5	0	54	0	2	3	2	1	2	2	2	0.0077	2.91	
Cryptochironomus	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Chironomidae: Chironominae	midges	OCG	CG	CG	CG	CL	0.0				7	0	7	0	108	0	3	1	3	1	2	2	2	0.0018	2.617	
Eukiefferella clarpennisi group	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	OCG	CG	CG	CG	SP	0.0				8	0	8	0	108	0	3	1	3	1	2	2	2	0.0018	2.617	
Macropelopia	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Chironomidae: Tanyptarini	midges	OPR	PR	PR	PR	SP	0.0				6	0	6	0	108	0	3	1	3	1	2	2	2	0.0018	2.617	
Nikantopus	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Chironomidae: Chironominae	midges	OPR	PR	PR	PR	SP	0.0				6	0	6	0	108	0	3	1	3	1	2	2	2	0.0018	2.617	
Paratendipes	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Chironomidae: Tanyptarini	midges	OCG	CG	CG	CG	BU	MT				8	0	8	0	108	0	3	1	3	1	2	2	2	0.0018	2.617	
Procladius	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Chironomidae: Tanyptarini	midges	OPR	PR	PR	PR	SP	0.0				9	0	9	0	108	0	3	1	3	1	2	2	2	0.0018	2.617	
Tvetenia bavarica group	L	insect	Aquatic	Anthropoda: Insecta	Diptera	Chironomidae: Orthocladiinae	midges	OCG	CG	CG	CG	SP	0.0				5	0	5	0	108	0	3	1	3	1	2	2	2	0.0018	2.617	
Ferrisia	U	non-insect	Aquatic	Mollusca: Gastropoda	x	Planorbidae	snails	OCG	CG	CG	CG	CL	MT				6	0	6	0	108	0	3	2	1	1	2	2	2	0.0208		

Explanation of metrics	
Subsample count (raw)	All abundances and biomass converted to a full sample and 1 square meter basis. Total count of subsample prior to correction factors being applied for subsampling and conversion to a 1 square meter basis. Multiplier to convert subsample abundances to a full sample basis, e.g. if 1/2 the sample was sorted, then the subsample correction is .5 Converts abundances of full sample to a 1 square meter basis, e.g. if 8 square feet was sampled, then the conversion to 1 square meter is 8
Subsample correction factor to full sample	
Area correction factor to square meter	
SUMMARY METRICS	
Total taxa richness	Total count of unique taxa in sample.
Total abundance	Total abundance in sample converted to a full sample and 1 square meter basis.
Total biomass (mg)	Total biomass in full sample adjusted to a 1 square meter basis as calculated by length/mass regressions.
EPT taxa richness	Taxa richness in the insect orders Ephemeroptera+Plecoptera+Trichoptera, or mayflies+stoneflies+caddisflies.
EPT abundance	
EPT biomass (mg)	
DOMINANCE AND DIVERSITY	
% Dominant taxa	Metrics that examine how dominated the community is by a single or few taxa.
Biomass dominant taxa (mg)	The % contribution of the most numerous taxon.
% Top 3 taxa	The % contribution of the 3 most numerous taxa.
Biomass top 3 taxa (mg)	
Shannon-Weaver Diversity (loge)	Information theory index that examines how evenly abundance is allocated among the taxa present in the community.
Shannon-Weaver Diversity (log2)	
TOLERANT AND INTOLERANT TAXA	
% Total tolerant taxa	Based on habitat association and best professional judgement (Wiseman unpublished). Water temperature and dissolved oxygen are used to categorize taxa as tolerant or intolerant.
Total tolerant taxa richness	Sum of the moderately and highly tolerant taxa. Taxa found frequently in habitats with warm water temperature and low dissolved oxygen.
Total tolerant taxa abundance	
Total tolerant taxa biomass (mg)	
% Highly tolerant taxa	Taxa highly tolerant of warm water and very low dissolved oxygen. Found often in stagnant and highly eutrophic habitat.
Highly tolerant taxa richness	
Highly tolerant taxa abundance	
Highly tolerant taxa biomass (mg)	
% Moderately tolerant taxa	Taxa moderately tolerant of warm water and low dissolved oxygen.
Moderately tolerant taxa richness	
Moderately tolerant taxa abundance	
Moderately tolerant taxa biomass (mg)	
% Total intolerant taxa	Sum of moderately intolerant and highly intolerant taxa. Cool and cold water biota found in habitats with high dissolved oxygen.
Total intolerant taxa richness	
Total intolerant taxa abundance	
Total intolerant taxa biomass (mg)	
% Highly intolerant taxa	Taxa generally found in habitats with year-round cold water temperatures and very high dissolved oxygen. Indicative of bull trout zone.
Highly intolerant taxa richness	
Highly intolerant taxa abundance	

Explanation of metrics	All abundances and biomass converted to a full sample and 1 square meter basis.
Highly intolerant taxa biomass (mg)	Taxa generally found in cool water habitats, cold to cool water eurythermal. Indicative of general salmonid zone.
% Moderately intolerant taxa	
Moderately intolerant taxa richness	
Moderately intolerant taxa abundance	
Moderately intolerant taxa biomass (mg)	Modified from Poff et al. 2006 Taxa where a significant proportion of individuals require more than one year to complete their life cycle. Taxa where most individuals exhibit a one year life cycle. Taxa where a significant proportion of the population has more than one generation a year.
VOL TINI SM (length of life cycle)	
% Semivoltine (> 1 year life cycle)	
% Univoltine (1 year life cycle)	
% Multivoltine (< 1 year life cycle)	Modified from Poff et al. 2006 Taxa that grow and mature over a few months or a single season. Taxa where growth and maturation extends over several seasons. Taxa that exhibit asynchronous seasonal development, with multiple life stages present during most of the year. Modified from Poff et al. 2006 Found rarely in stream drift. Drift occurs during catastrophic events (e.g. floods). Found commonly in stream drift. Dominant in stream drift, behavioral drifters. Modified from Poff et al. 2006 <9 mm long at maturity 9-16 mm long at maturity > 16 mm long at maturity
Semivoltine taxa abundance	
Univoltine taxa abundance	
Multivoltine taxa abundance	
Semivoltine taxa richness	
Univoltine taxa richness	
Multivoltine taxa richness	
Semivoltine taxa biomass (mg)	
Univoltine taxa biomass (mg)	
Multivoltine taxa biomass (mg)	
GROW TH AND DEVELO PMENT	
% Fast seasonal life cycle	Taxa that grow and mature over a few months or a single season. Taxa where growth and maturation extends over several seasons. Taxa that exhibit asynchronous seasonal development, with multiple life stages present during most of the year.
% Slow seasonal life cycle	
% Nonseasonal life cycle	
OCCURRENCE IN DRIFT	Modified from Poff et al. 2006 Found rarely in stream drift. Drift occurs during catastrophic events (e.g. floods). Found commonly in stream drift. Dominant in stream drift, behavioral drifters. Modified from Poff et al. 2006 <9 mm long at maturity 9-16 mm long at maturity > 16 mm long at maturity
% Rare in drift	
% Common in drift	
% Abundant in drift	
SIZE AT MATURITY	
% Small size at maturity	
% Medium size at maturity	
% Large size at maturity	
Small size at maturity abundance	
Medium size at maturity abundance	
Large size at maturity abundance	
Small size at maturity taxa richness	Small size at maturity taxa richness
Medium size at maturity taxa richness	
Large size at maturity taxa richness	
Small size at maturity taxa biomass (mg)	

Waterbody	Station	Date	Taxon	Stage	Abundance	Subsample.correction.factor	Area.correction.factor	Unique	Incidental	Comments
Clark Creek	CC1	5/14/2013	Oligochaeta	U	24		2.91	1.345		
Clark Creek	CC1	5/14/2013	Psidium	U	4		2.91	1.345		
Clark Creek	CC1	5/14/2013	Crangonyx	U	5		2.91	1.345		
Clark Creek	CC1	5/14/2013	Pacifastacus	U	1		2.91	1.345		
Clark Creek	CC1	5/14/2013	Acari	U	2		2.91	1.345		
Clark Creek	CC1	5/14/2013	Baetis tricaudatus	L	81		2.91	1.345		
Clark Creek	CC1	5/14/2013	Lepidostoma	L	21		2.91	1.345		
Clark Creek	CC1	5/14/2013	Lara	L	1		2.91	1.345		
Clark Creek	CC1	5/14/2013	Ceratopogoninae	L	1		2.91	1.345		
Clark Creek	CC1	5/14/2013	Hemerodromia	L	1		2.91	1.345		
Clark Creek	CC1	5/14/2013	Simulium	L	17		2.91	1.345		
Clark Creek	CC1	5/14/2013	Tipula	L	1		2.91	1.345		
Clark Creek	CC1	5/14/2013	Chironomidae	P	20		2.91	1.345	N	
Clark Creek	CC1	5/14/2013	Brillia	L	11		2.91	1.345		
Clark Creek	CC1	5/14/2013	Chironomus	L	9		2.91	1.345		
Clark Creek	CC1	5/14/2013	Corynoneura	L	30		2.91	1.345		
Clark Creek	CC1	5/14/2013	Eukiefferiella claripennis group	L	6		2.91	1.345		
Clark Creek	CC1	5/14/2013	Heterotrissocladius	L	2		2.91	1.345		
Clark Creek	CC1	5/14/2013	Limnophyes	L	2		2.91	1.345		
Clark Creek	CC1	5/14/2013	Micropsectra	L	73		2.91	1.345		
Clark Creek	CC1	5/14/2013	Orthocladius complex	L	2		2.91	1.345		
Clark Creek	CC1	5/14/2013	Parametriochnemus	L	38		2.91	1.345		
Clark Creek	CC1	5/14/2013	Phaenopsectra	L	38		2.91	1.345		
Clark Creek	CC1	5/14/2013	Polypedium	L	21		2.91	1.345		
Clark Creek	CC1	5/14/2013	Pseudodiamesa	L	11		2.91	1.345		
Clark Creek	CC1	5/14/2013	Rheocricotopus	L	28		2.91	1.345		
Clark Creek	CC1	5/14/2013	Synorthocladius	L	19		2.91	1.345		
Clark Creek	CC1	5/14/2013	Thienemanniella	L	2		2.91	1.345		
Clark Creek	CC1	5/14/2013	Thienemannimyia complex	L	24		2.91	1.345		
EF Pringle Creek	PC1	5/14/2013	Nemata	U	7		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Oligochaeta	U	63		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Psidium	U	44		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Sphaerium	U	2		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Juga	U	79		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Ostracoda	U	2		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Fluminicola	U	5		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Acari	U	26		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Baetis tricaudatus	L	17		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Diphetor hageni	L	3		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Cheumatopsyche	L	2		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Hydroptila	L	3		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Lepidostoma	L	2		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Lepidostoma-turret case larvae	L	1		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Dicosmoecus gilvipes	L	1		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Lara	L	4		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Optioservus	L	1		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Brychius	L	1		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Ceratopogoninae	L	5		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Simulium	L	4		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Chironomidae	P	10		1.6	1.345	N	
EF Pringle Creek	PC1	5/14/2013	Brillia	L	8		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Corynoneura	L	20		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Cricotopus	L	12		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Cryptochironomus	L	3		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Eukiefferiella brehmi group	L	13		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Eukiefferiella claripennis group	L	2		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Heterotrissocladius	L	17		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Macropelopia	L	5		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Micropsectra	L	7		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Nilotanyus	L	7		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Orthocladius complex	L	7		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Parametriochnemus	L	57		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Paratendipes	L	10		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Phaenopsectra	L	5		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Polypedium	L	7		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Procladius	L	5		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Thienemanniella	L	7		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Thienemannimyia complex	L	42		1.6	1.345		
EF Pringle Creek	PC1	5/14/2013	Tvetenia bavarica group	L	10		1.6	1.345		
Pringle Creek	PC2	5/14/2013	Nemata	U	2		4	1.345		
Pringle Creek	PC2	5/14/2013	Oligochaeta	U	79		4	1.345		
Pringle Creek	PC2	5/14/2013	Psidium	U	4		4	1.345		
Pringle Creek	PC2	5/14/2013	Ferrissia	U	7		4	1.345		
Pringle Creek	PC2	5/14/2013	Gyraulus	U	1		4	1.345		
Pringle Creek	PC2	5/14/2013	Juga	U	10		4	1.345		
Pringle Creek	PC2	5/14/2013	Fluminicola	U	15		4	1.345		
Pringle Creek	PC2	5/14/2013	Crangonyx	U	23		4	1.345		
Pringle Creek	PC2	5/14/2013	Acari	U	5		4	1.345		
Pringle Creek	PC2	5/14/2013	Argia	L	2		4	1.345		
Pringle Creek	PC2	5/14/2013	Baetis tricaudatus	L	78		4	1.345		
Pringle Creek	PC2	5/14/2013	Glossosoma	L	1		4	1.345		
Pringle Creek	PC2	5/14/2013	Cheumatopsyche	L	4		4	1.345		
Pringle Creek	PC2	5/14/2013	Hydroptila	L	2		4	1.345		
Pringle Creek	PC2	5/14/2013	Lepidostoma	L	3		4	1.345		
Pringle Creek	PC2	5/14/2013	Simulium	L	57		4	1.345		
Pringle Creek	PC2	5/14/2013	Chironomidae	P	5		4	1.345	N	
Pringle Creek	PC2	5/14/2013	Brillia	L	9		4	1.345		
Pringle Creek	PC2	5/14/2013	Chironomus	L	3		4	1.345		
Pringle Creek	PC2	5/14/2013	Corynoneura	L	1		4	1.345		
Pringle Creek	PC2	5/14/2013	Cricotopus	L	1		4	1.345		
Pringle Creek	PC2	5/14/2013	Eukiefferiella claripennis group	L	7		4	1.345		
Pringle Creek	PC2	5/14/2013	Micropsectra	L	6		4	1.345		
Pringle Creek	PC2	5/14/2013	Nanocladius	L	1		4	1.345		
Pringle Creek	PC2	5/14/2013	Orthocladius complex	L	3		4	1.345		
Pringle Creek	PC2	5/14/2013	Parametriochnemus	L	16		4	1.345		
Pringle Creek	PC2	5/14/2013	Phaenopsectra	L	79		4	1.345		
Pringle Creek	PC2	5/14/2013	Polypedium	L	30		4	1.345		
Pringle Creek	PC2	5/14/2013	Rheocricotopus	L	3		4	1.345		
Pringle Creek	PC2	5/14/2013	Synorthocladius	L	1		4	1.345		

Waterbody	Station	Date	Taxon	Stage	Abundance	Subsample.correction.factor	Area.correction.factor	Unique	Incidental	Comments
Pringle Creek	PC2	5/14/2013	Thienemanniella	L	1		4	1.345		
Pringle Creek	PC2	5/14/2013	Thienemannimyia complex	L	12		4	1.345		

Incidental taxa rejected from the analysis, non-unique taxa omitted from richness metrics.

Waterbody	Station	Date	Taxon	Stage	Abundance	Subsample.correction.factor	Area.correction.factor	Unique	Incidental	Comments
Clark Creek	CC1	05/14/2013 00:00:00	Chironomidae	P	20	2.91		1.345 N		
EF Pringle Creek	PC1	05/14/2013 00:00:00	Chironomidae	P	10	1.6		1.345 N		
Pringle Creek	PC2	05/14/2013 00:00:00	Chironomidae	P	5	4		1.345 N		

**Abundances and biomass
(mg) converted to a
standard full sample (if
subsampled) and one
square meter basis.**

			% Tolerant taxa			
			Waterbody	Clark Creek	EF Pringle Creek	Pringle Creek
			Station	CC1	PC1	PC2
			Date	2013-05-14	2013-05-14	2013-05-14
Taxon	Stage	Common name		% abundance	% abundance	% abundance
Fluminicola	U	snails			0.95	3.18
Ferrissia	U	snails				1.49
Gyraulus	U	snails				0.21
Juga	U	snails			15.02	2.12
Crangonyx	U	scuds		1.01		4.88
Argia	L	damselflies				0.42
Baetis tricaudatus	L	mayflies		16.36	3.23	16.56
Cheumatopsyche	L	caddisflies			0.38	0.85
Hydroptila	L	caddisflies			0.57	0.42
Optioservus	L	rifle beetles			0.19	
Brychius	L	crawling water beetles			0.19	
Hemerodromia	L	dance flies		0.2		
Chironomus	L	midges		1.82		0.64
Cryptochironomus	L	midges			0.57	
Limnophyes	L	midges		0.4		
Paratendipes	L	midges			1.9	
Procladius	L	midges		19.79	0.95	
% Tolerant taxa					23.95	30.77

Appendix C

Physical Habitat Data – East Fork Pringle Creek



PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

		SITE ID: E. Fork Pringle Crk DATE: 6/17/13						TRANSECT:				A-B F-G				B-C G-H				C-D H-I				D-E I-J				E-F J-K	
THALWEG PROFILE								For Transect A-B ONLY			Increment (m)x.x:		1.0m		Total Reach Length (m)		150m												
STATI ON	THALWEG DEPTH (cm) (xx.x)	WETTED WIDTH (m) (XXX.X)	BAR WIDTH ¹		SOFT/ SMALL SEDIMENT (Y/N)	CHANNEL UNIT CODE	POOL FORM CODE	SIDE CHANNEL (Y/N)	BACK WATER (Y/N)	FLAG	COMMENTS																		
			Present (Y/ N)	XX.X																									
0	30.7	2.6	N		N	GL	N	N	N																				
1	28.4		N		N	GL	N	N	N																				
2	28.8		N		N	GL	N	N	N																				
3	30.4		N		N	GL	N	N	N																				
4	31.3		N		N	GL	N	N	N																				
5	36.1	-	N	-	N	GL	N	N	N																				
6	28.2		N		N	GL	N	N	N																				
7	26.3	2.06	N	N/A	N	GL	N	N	N																				
8	20.0		N		N	RI	N	N	N																				
9	19.4		N		N	RI	N	N	N																				
10	16.8		N		N	RI	N	N	N																				
11	19.1		N		N	RI	N	N	N																				
12	19.6		N		N	RI	N	N	N																				
13	17.8		N		N	RI	N	N	N																				
14	17.4		N		N	RI	N	N	N		Yellow jacket nest at transect B in dense vegetation.																		

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	7	FN	GF	GC	GC	FN	

FLAG	COMMENTS

SUBSTRATE SIZE CLASS CODES	POOL FORM CODES	CHANNEL UNIT CODES
RS = BEDROCK (SMOOTH)-(Larger than a car)	N= Not a pool	PP = Pool, Plunge
RR = BEDROCK (ROUGH)-(Larger than a car)	W= Large Woody Debris	PT = Pool, Trench
BL = BOULDER (250 to 400 mm)-(Basketball to car)	R = Rootwad	PL = Pool, Lateral Scour
CB = COBBLE (64 to 250 mm)-(Tennis ball to basketball)	B = Boulder or Bedrock	PB = Pool, Backwater
GC = COARSE GRAVEL (16 to 64mm)-(Marble to Tennis ball)	F = Unknown, fluvial	PD = Pool, Impoundment
GF = FINE GRAVEL (2 to 16mm)-(Ladybug to marble)	COMBINATIONS:	GL = Glide
SA = SAND (0.06 to 2mm)-(Gritty up to ladybug size)	Eg. WR, BR, WRB	RI = Riffle
FN = SILT/CLAY/MUCK-(Not gritty)		RA = Rapid
HP = HARDPAN-(Firm, Consolidated, Fine Substrate)		CA = Cascade
WD = WOOD-(Any Size)		FA = Falls
OT = OTHER (Write comment on back of form)		DR = Dry Channel

Flag Codes: K = no measurement made, U = suspect measurement F1, F2, etc. – flags assigned by each field crew. Explain all flags in comments. 1 = Measure Bar Width at Station 0 and mid-station (5 or 7)

LARGE WOODY DEBRIS (≥ 10 cm small end diameter; 1.5 m length)				CHECK IF ALL UNMARKED BOXES ARE ZERO		X	FLAG	
Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel				
	Length 1.5-5 m	5-15 m	>15 m	Length 1.5-5 m	5-15 m	>15 m		
0.1-<0.3 m								
0.3-0.5 m								
0.5-0.8 m								
>0.8 m								

PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

		SITE ID: E. Fork Pringle Crk DATE: 6/17/13						TRANSECT:		A-B F-G		B-C G-H		C-D H-I		D-E I-J		E-F J-K	
THALWEG PROFILE								For Transect A-B ONLY			Increment (m)x.x:		1.0m	Total Reach Length (m)		150m			
STATI ON	THALWEG DEPTH (cm) (xx.x)	WETTED WIDTH (m) (XXX.X)	BAR WIDTH ³		SOFT/ SMALL SEDIMENT (Y/N)	CHANNEL UNIT CODE	POOL FORM CODE	SIDE CHANNEL (Y/N)	BACK WATER (Y/N)	FLAG	COMMENTS								
			Present (Y/ N)	XX.X															
0	53.4	3.5	N		N	GL	N	N	N		Below concrete sluice								
1	13.1		N		N	GL	N	N	N		Concrete sluice								
2	27.8		N		N	GL	N	N	N		Immediately upstream of concrete sluice								
3	30.3		N		N	GL	N	N	N										
4	37.7		N		N	GL	N	N	N										
5	34.9	-	N	-	N	GL	N	N	N										
6	35.6		N		N	GL	N	N	N										
7	31.9	2.2	N		N	GL	N	N	N										
8	29.5		N		N	GL	N	N	N										
9	28.5		N		N	GL	N	N	N										
10	27.1		N		N	GL	N	N	N										
11	25.2		N		N	GL	N	N	N										
12	29.1		N		N	GL	N	N	N										
13	32.2		N		N	GL	N	N	N										
14	37.8		N		N	GL	N	N	N										

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	7	FN	FN	GF	GF	FN	

FLAG	COMMENTS

SUBSTRATE SIZE CLASS CODES	POOL FORM CODES	CHANNEL UNIT CODES
RS = BEDROCK (SMOOTH)-(Larger than a car)	N= Not a pool	PP = Pool, Plunge
RR = BEDROCK (ROUGH)-(Larger than a car)	W= Large Woody Debris	PT = Pool, Trench
BL = BOULDER (250 to 400 mm)-(Basketball to car)	R = Rootwad	PL = Pool, Lateral Scour
CB = COBBLE (64 to 250 mm)-(Tennis ball to basketball)	B = Boulder or Bedrock	PB = Pool, Backwater
GC = COARSE GRAVEL (16 to 64mm)-(Marble to Tennis ball)	F = Unknown, fluvial	PD = Pool, Impoundment
GF = FINE GRAVEL (2 to 16mm)-(Ladybug to marble)	COMBINATIONS:	GL = Glide
SA = SAND (0.06 to 2mm)-(Gritty up to ladybug size)	Eg. WR, BR, WRB	RI = Riffle
FN = SILT/CLAY/MUCK-(Not gritty)		RA = Rapid
HP = HARDPAN-(Firm, Consolidated, Fine Substrate)		CA = Cascade
WD = WOOD-(Any Size)		FA = Falls
OT = OTHER (Write comment on back of form)		DR = Dry Channel

Flag Codes: K = no measurement made, U = suspect measurement F1, F2, etc. – flags assigned by each field crew. Explain all flags in comments. 1 = Measure Bar Width at Station 0 and mid-station (5 or 7)

LARGE WOODY DEBRIS ((10 cm small end diameter; 1.5 m length)				CHECK IF ALL UNMARKED BOXES ARE ZERO		X	FLAG	
Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel				
	Length 1.5-5 m	5-15 m	>15 m	Length 1.5-5 m	5-15 m	>15 m		
0.1-<0.3 m								
0.3-0.5 m								
0.5-0.8 m								
>0.8 m								

PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

	SITE ID: E. Fork Pringle Crk DATE: 6/17/13							TRANSECT:			A-B		F-G	B-C		G-H	C-D		H-I	D-E		I-J		J-K	
THALWEG PROFILE								For Transect A-B ONLY			Increment (m) x.x:		1.0m	Total Reach Length (m)		150m									
STATI ON	THALWEG DEPTH (cm) (xx.x)	WETTED WIDTH (m) (XXX.X)	BAR WIDTH ^s		SOFT/ SMALL SEDIMENT (Y/N)	CHANNEL UNIT CODE	POOL FORM CODE	SIDE CHANNEL (Y/N)	BACK WATER (Y/N)	FLAG	COMMENTS														
			Present (Y/ N)	XX.X																					
0	27.1	1.7	N	-	N	RI	N	N	N																
1	25.2		N		N	RI	N	N	N																
2	21.6		N		N	RI	N	N	N																
3	19.6		N		N	RI	N	N	N																
4	21.0		N		N	RI	N	N	N																
5	21.2	-	N	-	N	RI	N	N	N																
6	21.3		N		N	RI	N	N	N																
7	21.8	2.5	N	-	N	RI	N	N	N																
8	21.8		N		N	RI	N	N	N																
9	22.6		N		N	RI	N	N	N																
10	27.1		N		N	RI	N	N	N																
11	24.8		N		N	RI	N	N	N																
12	23.6		N		N	RI	N	N	N																
13	22.6		N		N	GL	N	N	N																
14	23.8		N		N	GL	N	N	N																

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	7	FN	CB	CB	GC	FN	

FLAG	COMMENTS

SUBSTRATE SIZE CLASS CODES	POOL FORM CODES	CHANNEL UNIT CODES
RS = BEDROCK (SMOOTH)-(Larger than a car)	N= Not a pool	PP = Pool, Plunge
RR = BEDROCK (ROUGH)-(Larger than a car)	W= Large Woody Debris	PT = Pool, Trench
BL = BOULDER (250 to 400 mm)-(Basketball to car)	R = Rootwad	PL = Pool, Lateral Scour
CB = COBBLE (64 to 250 mm)-(Tennis ball to basketball)	B = Boulder or Bedrock	PB = Pool, Backwater
GC = COARSE GRAVEL (16 to 64mm)-(Marble to Tennis ball)	F = Unknown, fluvial	PD = Pool, Impoundment
GF = FINE GRAVEL (2 to 16mm)-(Ladybug to marble)	COMBINATIONS:	GL = Glide
SA = SAND (0.06 to 2mm)-(Gritty up to ladybug size)	Eg. WR, BR, WRB	RI = Riffle
FN = SILT/CLAY/MUCK-(Not gritty)		RA = Rapid
HP = HARDPAN-(Firm, Consolidated, Fine Substrate)		CA = Cascade
WD = WOOD-(Any Size)		FA = Falls
OT = OTHER (Write comment on back of form)		DR = Dry Channel

Flag Codes: K = no measurement made, U = suspect measurement F1, F2, etc. – flags assigned by each field crew. Explain all flags in comments. 1 = Measure Bar Width at Station 0 and mid-station (5 or 7)

LARGE WOODY DEBRIS (10 cm small end diameter; 1.5 m length)				CHECK IF ALL UNMARKED BOXES ARE ZERO		X	FLAG	
Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel				
	Length 1.5-5 m	5-15 m	>15 m	Length 1.5-5 m	5-15 m	>15 m		
0.1-<0.3 m								
0.3-0.5 m								
0.5-0.8 m								
>0.8 m								

PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

SITE ID: E. Fork Pringle Crk DATE: 6/17/13						TRANSECT:		☐ A-B ☐ B-C ☐ C-D ☐ D-E ☐ E-F ☒ F-G ☐ G-H ☐ H-I ☐ I-J ☐ J-K						
THALWEG PROFILE								For Transect A-B ONLY			Increment (m) x.x:	1.0m	Total Reach Length (m)	150m
STATION	THALWEG DEPTH (cm) (xx.x)	WETTED WIDTH (m) (XXX.X)	BAR WIDTH ⁶		SOFT/ SMALL SEDIMENT (Y/N)	CHANNEL UNIT CODE	POOL FORM CODE	SIDE CHANNEL (Y/N)	BACK WATER (Y/N)	FLAG	COMMENTS			
			Present (Y/ N)	XX.X										
0	24.4	1.7	N	-	N	GL	N	N	N					
1	25.6		N		N	GL	N	N	N					
2	23.9		N		N	GL	N	N	N					
3	24.7		N		N	GL	N	N	N					
4	24.8		N		N	GL	N	N	N					
5	23.3	-	N	-	N	GL	N	N	N					
6	20.5		N		N	GL	N	N	N					
7	25.8	2.1	N	-	N	GL	N	N	N					
8	21.4		N		N	GL	N	N	N					
9	22.1		N		N	GL	N	N	N					
10	23.5		N		N	GL	N	N	N					
11	22.6		N		N	GL	N	N	N					
12	25.7		N		N	GL	N	N	N					
13	29.1		N		N	GL	N	N	N					
14	29.9		N		N	GL	N	N	N					

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	7	FN	GC	GC	GC	FN	

FLAG	COMMENTS

SUBSTRATE SIZE CLASS CODES	POOL FORM CODES	CHANNEL UNIT CODES
RS = BEDROCK (SMOOTH)-(Larger than a car) RR = BEDROCK (ROUGH)-(Larger than a car) BL = BOULDER (250 to 400 mm)-(Basketball to car) CB = COBBLE (64 to 250 mm)-(Tennis ball to basketball) GC = COARSE GRAVEL (16 to 64mm)-(Marble to Tennis ball) GF = FINE GRAVEL (2 to 16mm)-(Ladybug to marble) SA = SAND (0.06 to 2mm)-(Gritty up to ladybug size) FN = SILT/CLAY/MUCK-(Not gritty) HP = HARDPAN-(Firm, Consolidated, Fine Substrate) WD = WOOD-(Any Size) OT = OTHER (Write comment on back of form)	N= Not a pool W= Large Woody Debris R = Rootwad B = Boulder or Bedrock F = Unknown, fluvial COMBINATIONS: Eg. WR, BR, WRB	PP = Pool, Plunge PT = Pool, Trench PL = Pool, Lateral Scour PB = Pool, Backwater PD = Pool, Impoundment GL = Glide RI = Riffle RA = Rapid CA = Cascade FA = Falls DR = Dry Channel

LARGE WOODY DEBRIS (10 cm small end diameter; 1.5 m length)				CHECK IF ALL UNMARKED BOXES ARE ZERO		X	FLAG	
Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel				
	Length 1.5-5 m	5-15 m	>15 m	Length 1.5-5 m	5-15 m	>15 m		
0.1-<0.3 m	☐	☐	☐	☐	☐	☐		
0.3-0.5 m	☐	☐	☐	☐	☐	☐		
0.5-0.8 m	☐	☐	☐	☐	☐	☐		
>0.8 m	☐	☐	☐	☐	☐	☐		

Flag Codes: K = no measurement made, U= suspect measurement F1, F2, etc. – flags assigned by each field crew. Explain all flags in comments. 1 = Measure Bar Width at Station 0 and mid-station (5 or 7)

PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

		SITE ID: E. Fork Pringle Crk DATE: 6/17/13						TRANSECT:			A-B F-G	☒	B-C G-H		C-D H-I		D-E I-J		E-F J-K
THALWEG PROFILE								For Transect A-B ONLY			Increment (m) x.x:		1.0m	Total Reach Length (m)		150m			
STATI ON	THALWEG DEPTH (cm) (xx.x)	WETTED WIDTH (m) (XXX.X)	BAR WIDTH ⁷		SOFT/ SMALL SEDIMENT (Y/N)	CHANNEL UNIT CODE	POOL FORM CODE	SIDE CHANNEL (Y/N)	BACK WATER (Y/N)	FLAG	COMMENTS								
			Present (Y/ N)	XX.X															
0	30.0	2.6	N	-	N	GL	N	N	N										
1	31.8		N		N	GL	N	N	N										
2	31.6		N		N	GL	N	N	N										
3	29.6		N		N	GL	N	N	N										
4	24.8		N		N	GL	N	N	N										
5	21.3	-	N	-	N	GL	N	N	N										
6	23.7		N		N	GL	N	N	N										
7	21.4	2.6	N		N	GL	N	N	N										
8	20.1		N		N	GL	N	N	N										
9	21.1		N		N	GL	N	N	N										
10	24.5		N		N	GL	N	N	N		Downstream of 12" RCP discharge, likely drain from field								
11	25.6		N		N	GL	N	N	N										
12	27.9		N		N	GL	N	N	N										
13	26.6		N		N	GL	N	N	N										
14	23.3		N		N	GL	N	N	N										

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	7	FN	GC	GC	GC	FN	

FLAG	COMMENTS

SUBSTRATE SIZE CLASS CODES	POOL FORM CODES	CHANNEL UNIT CODES
RS = BEDROCK (SMOOTH)-(Larger than a car)	N= Not a pool	PP = Pool, Plunge
RR = BEDROCK (ROUGH)-(Larger than a car)	W= Large Woody Debris	PT = Pool, Trench
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GF = FINE GRAVEL (2 to 16mm)-(Ladybug to marble)	COMBINATIONS:	GL = Glide
SA = SAND (0.06 to 2mm)-(Gritty up to ladybug size)	Eg. WR, BR, WRB	RI = Riffle
FN = SILT/CLAY/MUCK-(Not gritty)		RA = Rapid
HP = HARDPAN-(Firm, Consolidated, Fine Substrate)		CA = Cascade
WD = WOOD-(Any Size)		FA = Falls
OT = OTHER (Write comment on back of form)		DR = Dry Channel

Flag Codes: K = no measurement made, U = suspect measurement F1, F2, etc. – flags assigned by each field crew. Explain all flags in comments. 1 = Measure Bar Width at Station 0 and mid-station (5 or 7)

LARGE WOODY DEBRIS (10 cm small end diameter; 1.5 m length)				CHECK IF ALL UNMARKED BOXES ARE ZERO		X	FLAG	
Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel				
	Length 1.5-5 m	5-15 m	>15 m	Length 1.5-5 m	5-15 m	>15 m		
0.1-<0.3 m								
0.3-0.5 m								
0.5-0.8 m								
>0.8 m								

PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

		SITE ID: E. Fork Pringle Crk DATE: 6/17/13						TRANSECT:		A-B F-G		B-C G-H		☒ C-D H-I		D-E I-J		E-F J-K	
THALWEG PROFILE								For Transect A-B ONLY			Increment (m) x.x:		1.0m	Total Reach Length (m)		150m			
STATI ON	THALWEG DEPTH (cm) (xx.x)	WETTED WIDTH (m) (XXX.X)	BAR WIDTH ^a		SOFT/ SMALL SEDIMENT (Y/N)	CHANNEL UNIT CODE	POOL FORM CODE	SIDE CHANNEL (Y/N)	BACK WATER (Y/N)	FLAG	COMMENTS								
			Present (Y/ N)	XX.X															
0	28.2	2.9	N	-	N	GL	N	N	N										
1	27.1		N		N	GL	N	N	N										
2	23.5		N		N	GL	N	N	N										
3	27.2		N		N	GL	N	N	N										
4	24.0		N		N	GL	N	N	N										
5	23.7	-	N	-	N	GL	N	N	N										
6	22.1		N		N	GL	N	N	N										
7	23.1	2.4	N	-	N	GL	N	N	N										
8	24.0		N		N	GL	N	N	N										
9	22.9		N		N	GL	N	N	N										
10	23.9		N		N	GL	N	N	N										
11	23.3		N		N	GL	N	N	N										
12	27.6		N		N	GL	N	N	N										
13	22.8		N		N	GL	N	N	N										
14	24.2		N		N	GL	N	N	N										

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	7	FN	GC	GC	GC	FN	

FLAG	COMMENTS

SUBSTRATE SIZE CLASS CODES	POOL FORM CODES	CHANNEL UNIT CODES
RS = BEDROCK (SMOOTH)-(Larger than a car)	N= Not a pool	PP = Pool, Plunge
RR = BEDROCK (ROUGH)-(Larger than a car)	W= Large Woody Debris	PT = Pool, Trench
BL = BOULDER (250 to 400 mm)-(Basketball to car)	R = Rootwad	PL = Pool, Lateral Scour
CB = COBBLE (64 to 250 mm)-(Tennis ball to basketball)	B = Boulder or Bedrock	PB = Pool, Backwater
GC = COARSE GRAVEL (16 to 64mm)-(Marble to Tennis ball)	F = Unknown, fluvial	PD = Pool, Impoundment
GF = FINE GRAVEL (2 to 16mm)-(Ladybug to marble)	COMBINATIONS:	GL = Glide
SA = SAND (0.06 to 2mm)-(Gritty up to ladybug size)	Eg. WR, BR, WRB	RI = Riffle
FN = SILT/CLAY/MUCK-(Not gritty)		RA = Rapid
HP = HARDPAN-(Firm, Consolidated, Fine Substrate)		CA = Cascade
WD = WOOD-(Any Size)		FA = Falls
OT = OTHER (Write comment on back of form)		DR = Dry Channel

Flag Codes: K = no measurement made, U = suspect measurement F1, F2, etc. – flags assigned by each field crew. Explain all flags in comments. 1 = Measure Bar Width at Station 0 and mid-station (5 or 7)

LARGE WOODY DEBRIS (10 cm small end diameter; 1.5 m length)				CHECK IF ALL UNMARKED BOXES ARE ZERO		X	FLAG	
Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel				
	Length 1.5-5 m	5-15 m	>15 m	Length 1.5-5 m	5-15 m	>15 m		
0.1-<0.3 m								
0.3-0.5 m								
0.5-0.8 m								
>0.8 m								

PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

		SITE ID: E. Fork Pringle Crk DATE: 6/17/13						TRANSECT:		A-B F-G		B-C G-H		C-D H-I		☒ D-E I-J		E-F J-K	
THALWEG PROFILE								For Transect A-B ONLY			Increment (m) x.x:		1.0m	Total Reach Length (m)		150m			
STATI ON	THALWEG DEPTH (cm) (xx.x)	WETTED WIDTH (m) (XXX.X)	BAR WIDTH ^b		SOFT/ SMALL SEDIMENT (Y/N)	CHANNEL UNIT CODE	POOL FORM CODE	SIDE CHANNEL (Y/N)	BACK WATER (Y/N)	FLAG	COMMENTS								
			Present (Y/ N)	XX.X															
0	23.6	2.9	N	-	N	RI	N	N	N										
1	21.9		N		N	RI	N	N	N										
2	19.4		N		N	RI	N	N	N										
3	17.3		N		N	GL	N	N	N										
4	17.6		N		N	GL	N	N	N										
5	18.8	-	N	-	N	GL	N	N	N										
6	18.9		N		N	GL	N	N	N										
7	22.9	3.0	N		N	GL	N	N	N										
8	22.6		N		N	GL	N	N	N										
9	25.2		N		N	GL	N	N	N										
10	22.6		N		N	GL	N	N	N										
11	23.5		N		N	GL	N	N	N										
12	22.6		N		N	GL	N	N	N										
13	22.9		N		N	GL	N	N	N										
14	22.1		N		N	GL	N	N	N										

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	7	GC	GC	GC	GC	GC	

FLAG	COMMENTS

SUBSTRATE SIZE CLASS CODES	POOL FORM CODES	CHANNEL UNIT CODES
RS = BEDROCK (SMOOTH)-(Larger than a car)	N= Not a pool	PP = Pool, Plunge
RR = BEDROCK (ROUGH)-(Larger than a car)	W= Large Woody Debris	PT = Pool, Trench
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CB = COBBLE (64 to 250 mm)-(Tennis ball to basketball)	B = Boulder or Bedrock	PB = Pool, Backwater
GC = COARSE GRAVEL (16 to 64mm)-(Marble to Tennis ball)	F = Unknown, fluvial	PD = Pool, Impoundment
GF = FINE GRAVEL (2 to 16mm)-(Ladybug to marble)	COMBINATIONS:	GL = Glide
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HP = HARDPAN-(Firm, Consolidated, Fine Substrate)		CA = Cascade
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Flag Codes: K = no measurement made, U = suspect measurement F1, F2, etc. – flags assigned by each field crew. Explain all flags in comments. 1 = Measure Bar Width at Station 0 and mid-station (5 or 7)

LARGE WOODY DEBRIS (10 cm small end diameter; 1.5 m length)				CHECK IF ALL UNMARKED BOXES ARE ZERO		X	FLAG	
Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel				
	Length 1.5-5 m	5-15 m	>15 m	Length 1.5-5 m	5-15 m	>15 m		
0.1-<0.3 m								
0.3-0.5 m								
0.5-0.8 m								
>0.8 m								

PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

		SITE ID: E. Fork Pringle Crk DATE: 6/17/13						TRANSECT:		A-B F-G		B-C G-H		C-D H-I		D-E I-J		⊗ E-F J-K	
THALWEG PROFILE								For Transect A-B ONLY			Increment (m)x.x:		1.0m	Total Reach Length (m)		150m			
STATI ON	THALWEG DEPTH (cm) (xx.x)	WETTED WIDTH (m) (XXX.X)	BAR WIDTH ¹⁰		SOFT/ SMALL SEDIMENT (Y/N)	CHANNEL UNIT CODE	POOL FORM CODE	SIDE CHANNEL (Y/N)	BACK WATER (Y/N)	FLAG	COMMENTS								
			Present (Y/ N)	XX.X															
0	19.8	2.7	N	-	N	GL	N	N	N										
1	21.9		N		N	GL	N	N	N										
2	18.6		N		N	GL	N	N	N										
3	23.8		N		N	GL	N	N	N										
4	21.9		N		N	GL	N	N	N										
5	18.7	-		-	N	GL	N	N	N										
6	19.9		N		N	GL	N	N	N										
7	17.9		N		N	GL	N	N	N										
8	17.6		N		N	GL	N	N	N										
9	22.9		N		N	GL	N	N	N										
10	25.6		N		N	GL	N	N	N										
11	22.0		N		N	GL	N	N	N										
12	18.9		N		N	GL	N	N	N										
13	22.9		N		N	GL	N	N	N										
14	23.8		N		N	GL	N	N	N										

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	7	FN	GC	GC	GC	FN	

FLAG	COMMENTS

SUBSTRATE SIZE CLASS CODES	POOL FORM CODES	CHANNEL UNIT CODES
RS = BEDROCK (SMOOTH)-(Larger than a car)	N= Not a pool	PP = Pool, Plunge
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GF = FINE GRAVEL (2 to 16mm)-(Ladybug to marble)	COMBINATIONS:	GL = Glide
SA = SAND (0.06 to 2mm)-(Gritty up to ladybug size)	Eg. WR, BR, WRB	RI = Riffle
FN = SILT/CLAY/MUCK-(Not gritty)		RA = Rapid
HP = HARDPAN-(Firm, Consolidated, Fine Substrate)		CA = Cascade
WD = WOOD-(Any Size)		FA = Falls
OT = OTHER (Write comment on back of form)		DR = Dry Channel

Flag Codes: K = no measurement made, U = suspect measurement F1, F2, etc. – flags assigned by each field crew. Explain all flags in comments. 1 = Measure Bar Width at Station 0 and mid-station (5 or 7)

LARGE WOODY DEBRIS (10 cm small end diameter; 1.5 m length)				CHECK IF ALL UNMARKED BOXES ARE ZERO		X	FLAG	
Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel				
	Length 1.5-5 m	5-15 m	>15 m	Length 1.5-5 m	5-15 m	>15 m		
0.1-<0.3 m								
0.3-0.5 m								
0.5-0.8 m								
>0.8 m								

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: E. Fork Pringle Crk	DATE: 6/26/13	TRANSECT:	☒ A ☐ B ☐ C ☐ D ☐ E ☐ F	☐ G ☐ H ☐ I ☐ J ☐ K	X-tra Side Channel ☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	0.66	31.3	GF	30	
Ctr	1.32	30.4	GF	60	
RCtr	1.98	32.0	GF	10	
Right	2.64	0	FN	100	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	<u>0</u> 1 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	<u>0</u> 1 2 3 4	
Live Trees or Roots	<u>0</u> 1 2 3 4	
Overhanging Veg. = <1 m of Surface	0 1 <u>2</u> 3 4	
Undercut Banks	0 <u>1</u> 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	0 <u>1</u> 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	D C E M <u>N</u>	D C E M <u>N</u>	
Big Trees (Trunk >0.3 m DBH)	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Small Trees (Trunk <0.3 m DBH)	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Woody Shrubs and Saplings	<u>0</u> 1 2 3 4	0 1 2 <u>3</u> 4	
Non-Woody Herbs, Grasses, Forbs	0 1 2 3 <u>4</u>	0 1 2 <u>3</u> 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	<u>0</u> 1 2 3 4	0 1 2 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 2 <u>3</u> 4	0 1 2 3 4	
Barren, Bare Dirt or Duff	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	<u>0</u> P C B	<u>0</u> P C B	
Row Crops	0 P <u>C</u> B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	76	0	
Right	302	0.16	
Wetted Width xxx.x m		2.64	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		2.6	
Bankfull Height xx.x m		0.75	
Incised Height xx.x m		1.02	

CANOPY COVER MEASUREMENTS					
DENSIMETER (0-17 Max)					
Flag			Flag		
CenUp	3		CenR	2	
CenL	3		Left	K	
CenDwn	0		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: E. Fork Pringle Crk	DATE:	TRANSECT:	☐ A ☒ B ☐ C ☐ D ☐ E ☐ F	☐ G ☐ H ☐ I ☐ J ☐ K	X-tra Side Channel ☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	0.52	16.1	GC	90	
Ctr	1.04	16.1	GF	2	
RCtr	1.56	19.0	GC	2	
Right	2.08	0	FN	100	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	<u>0</u> 1 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	<u>0</u> 1 2 3 4	
Live Trees or Roots	<u>0</u> 1 2 3 4	
Overhanging Veg. = <1 m of Surface	0 1 <u>2</u> 3 4	
Undercut Banks	0 <u>1</u> 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	D C E M <u>N</u>	D C E M <u>N</u>	
Big Trees (Trunk >0.3 m DBH)	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Small Trees (Trunk <0.3 m DBH)	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Woody Shrubs and Saplings	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 2 3 <u>4</u>	0 1 2 3 <u>4</u>	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 2 3 <u>4</u>	0 1 2 3 <u>4</u>	
Barren, Bare Dirt or Duff	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	<u>0</u> P C B	<u>0</u> P C B	
Row Crops	0 P <u>C</u> B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	82	0.0	
Right	298	0.35	
Wetted Width xxx.x m		2.08	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		2.62	
Bankfull Height xx.x m		0.43	
Incised Height xx.x m		0.69	

CANOPY COVER MEASUREMENTS					
DENSIOMETER (0-17 Max)					
Flag			Flag		
CenUp	16		CenR	9	
CenL	15		Left	K	
CenDwn	11		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: E. Fork Pringle Crk	DATE: 6/25/13	TRANSECT:	☐ A ☐ G	☐ B ☐ H	☒ C ☐ I	☐ D ☐ J	☐ E ☐ K	☐ F ☐	X-tra Side Channel ☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	0.88	58.4	GC	80	
Ctr	1.76	50.4	GF	20	
RCtr	2.64	44.6	GC	95	
Right	3.52	0	FN	100	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	<u>0</u> 1 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	<u>0</u> 1 2 3 4	
Live Trees or Roots	<u>0</u> 1 2 3 4	
Overhanging Veg. = <1 m of Surface	0 1 <u>2</u> 3 4	
Undercut Banks	0 <u>1</u> 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	0 1 <u>2</u> 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	D C E M <u>N</u>	D C E M <u>N</u>	
Big Trees (Trunk >0.3 m DBH)	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Small Trees (Trunk <0.3 m DBH)	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Woody Shrubs and Saplings	0 <u>1</u> 2 3 4	0 1 <u>2</u> 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 2 <u>3</u> 4	0 1 2 <u>3</u> 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	0 <u>1</u> 2 3 4	<u>0</u> 1 2 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 2 <u>3</u> 4	0 1 2 <u>3</u> 4	
Barren, Bare Dirt or Duff	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	0 P C <u>B</u>	0 P C <u>B</u>	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	<u>0</u> P C B	<u>0</u> P C B	
Row Crops	0 <u>P</u> C B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	74	0.15	
Right	82	0.0	
Wetted Width xxx.x m		3.5	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		3.44	
Bankfull Height xx.x m		0.68	
Incised Height xx.x m		1.09	

CANOPY COVER MEASUREMENTS					
DENSIOMETER (0-17 Max)					
Flag			Flag		
CenUp	17		CenR	14	
CenL	17		Left	K	
CenDwn	9		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: E. Fork Pringle Crk	DATE: 6/25/13	TRANSECT:	☐ A ☐ B ☐ C ☒ D ☐ E ☐ F ☐ G ☐ H ☐ I ☐ J ☐ K	X-tra Side Channel ☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	0.54	17.2	FN	100	
Ctr	1.08	27.4	GF	20	
RCtr	1.62	28.1	FN	100	
Right	2.17	0	FN	100	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	<u>0</u> 1 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	<u>0</u> 1 2 3 4	
Live Trees or Roots	<u>0</u> 1 2 3 4	
Overhanging Veg. = <1 m of Surface	0 1 <u>2</u> 3 4	
Undercut Banks	0 <u>1</u> 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	D C E M <u>N</u>	D C E M <u>N</u>	
Big Trees (Trunk >0.3 m DBH)	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Small Trees (Trunk <0.3 m DBH)	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Woody Shrubs and Saplings	0 <u>1</u> 2 3 4	0 1 2 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	0 <u>1</u> 2 3 4	<u>0</u> 1 2 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 2 <u>3</u> 4	0 1 2 3 <u>4</u>	
Barren, Bare Dirt or Duff	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	<u>0</u> P C B	<u>0</u> P C B	
Row Crops	0 P <u>C</u> B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	76	0.0	
Right	56	0.0	
Wetted Width xxx.x m		2.2	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		2.71	
Bankfull Height xx.x m		0.66	
Incised Height xx.x m		1.07	

CANOPY COVER MEASUREMENTS					
DENSIOMETER (0-17 Max)					
Flag			Flag		
CenUp	11		CenR	10	
CenL	0		Left	K	
CenDwn	5		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments

RM

SITE ID: E. Fork Pringle Crk

DATE: 6/25/13

TRANSECT:

☐A

☐B

☐C

☐D

☒E

☐F

☐G

☐H

☐I

☐J

☐K

X-tra Side Channel

☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	0.42	26.4	GF	10	
Ctr	0.84	25.6	GC	40	
RCtr	1.26	22.1	FN	100	
Right	1.69	0	FN	100	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent 1=Sparse 2=Moderate 3=Heavy 4=Very Heavy (circle one)	(0%) (<10%) (10-40%) (40-75%) (>75%)	FLAG
Filamentous Algae	<u>0</u>	1 2 3 4	
Macrophytes	0	<u>1</u> 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u>	1 2 3 4	
Brush/Woody Debris <0.3 (Small)	<u>0</u>	1 2 3 4	
Live Trees or Roots	<u>0</u>	1 2 3 4	
Overhanging Veg. = <1 m of Surface	0	<u>1</u> 2 3 4	
Undercut Banks	0	1 2 3 4	
Boulders	<u>0</u>	1 2 3 4	
Artificial Structures	<u>0</u>	1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)				D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None				
RIPARIAN VEGETATION COVER	Left Bank				Right Bank				Flag
	Canopy (>5 m high)								
Vegetation Type	D C E M <u>N</u>				D C E M <u>N</u>				
Big Trees (Trunk >0.3 m DBH)	<u>0</u> 1 2 3 4				<u>0</u> 1 2 3 4				
Small Trees (Trunk <0.3 m DBH)	<u>0</u> 1 2 3 4				<u>0</u> 1 2 3 4				
	Understory (0.5 to 5 m high)								
Vegetation Type	<u>D</u> C E M N				<u>D</u> C E M N				
Woody Shrubs and Saplings	<u>0</u> 1 2 3 4				0 1 <u>2</u> 3 4				
Non-Woody Herbs, Grasses, Forbs	0 1 2 <u>3</u> 4				0 1 <u>2</u> 3 4				
	Ground Cover (<0.5 m high)								
Woody Shrubs and Saplings	0 <u>1</u> 2 3 4				0 <u>1</u> 2 3 4				
Non-Woody Herbs, Grasses, Forbs	0 1 2 <u>3</u> 4				0 1 2 3 <u>4</u>				
Barren, Bare Dirt or Duff	<u>0</u> 1 2 3 4				<u>0</u> 1 2 3 4				
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank								
	Left Bank				Right Bank				Flag
Wall/Dike/Revetment/ Riprap/Dam	<u>0</u> P C B				<u>0</u> P C B				
Buildings	<u>0</u> P C B				<u>0</u> P C B				
Pavement/Cleared Lot	<u>0</u> P C B				<u>0</u> P C B				
Road/Railroad	<u>0</u> P C B				<u>0</u> P C B				
Pipes (Inlet/Outlet)	<u>0</u> P C B				<u>0</u> P C B				
Landfill/Trash	<u>0</u> P C B				<u>0</u> P C B				
Park/Lawn	<u>0</u> P C B				<u>0</u> P C B				
Row Crops	<u>0</u> P <u>C</u> B				<u>0</u> P C B				
Pasture/Range/Hay Field	<u>0</u> P C B				<u>0</u> P C B				
Logging Operations	<u>0</u> P C B				<u>0</u> P C B				
Mining Activity	<u>0</u> P C B				<u>0</u> P C B				

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	64	0.0	
Right	61	0.0	
Wetted Width xxx.x m		1.69	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		2.19	
Bankfull Height xx.x m		0.56	
Incised Height xx.x m		1.11	

CANOPY COVER MEASUREMENTS					
DENSIOMETER (0-17 Max)					
Flag			Flag		
CenUp	7		CenR	7	
CenL	7		Left	K	
CenDwn	3		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: E. Fork Pringle Crk	DATE: 6/25/13	TRANSECT:	☐ A	☐ B	☐ C	☐ D	☐ E	☒ F	X-tra Side Channel
			☐ G	☐ H	☐ I	☐ J	☐ K		☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	0.43	19.0	GC	10	
Ctr	0.86	25.2	GF	10	
RCtr	1.29	22.4	GF	15	
Right	1.71	0	FN	100	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	0 <u>1</u> 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	<u>0</u> 1 2 3 4	
Live Trees or Roots	<u>0</u> 1 2 3 4	
Overhanging Veg. = <1 m of Surface	0 <u>1</u> 2 3 4	
Undercut Banks	<u>0</u> 1 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	D C E M <u>N</u>	D C E M <u>N</u>	
Big Trees (Trunk >0.3 m DBH)	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Small Trees (Trunk <0.3 m DBH)	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Woody Shrubs and Saplings	0 <u>1</u> 2 3 4	0 1 <u>2</u> 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 2 <u>3</u> 4	0 <u>1</u> 2 3 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	0 <u>1</u> 2 3 4	0 <u>1</u> 2 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 2 <u>3</u> 4	0 1 2 <u>3</u> 4	
Barren, Bare Dirt or Duff	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	<u>0</u> P C B	<u>0</u> P C B	
Row Crops	0 P <u>C</u> B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	66	0.0	
Right	58	0.0	
Wetted Width xxx.x m		1.71	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		2.62	
Bankfull Height xx.x m		0.58	
Incised Height xx.x m		0.96	

CANOPY COVER MEASUREMENTS					
DENSIMETER (0-17 Max)					
Flag			Flag		
CenUp	6		CenR	9	
CenL	10		Left	K	
CenDwn	5		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: E. Fork Pringle Crk	DATE: 6/25/13	TRANSECT:	☐ A	☐ B	☐ C	☐ D	☐ E	☐ F	X-tra Side Channel
			☒ G	☐ H	☐ I	☐ J	☐ K		☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	0.64	27.8	GF	10	
Ctr	1.28	30.0	GC	25	
RCtr	1.92	29.8	FN	100	
Right	2.57	0	FN	100	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	0 1 <u>2</u> 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	<u>0</u> 1 2 3 4	
Live Trees or Roots	<u>0</u> 1 2 3 4	
Overhanging Veg. = <1 m of Surface	0 1 <u>2</u> 3 4	
Undercut Banks	<u>0</u> 1 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	D C E M <u>N</u>	D C E M <u>N</u>	
Big Trees (Trunk >0.3 m DBH)	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Small Trees (Trunk <0.3 m DBH)	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Woody Shrubs and Saplings	<u>0</u> 1 2 3 4	0 1 <u>2</u> 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	0 1 <u>2</u> 3 4	0 1 2 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 2 <u>3</u> 4	0 1 2 3 4	
Barren, Bare Dirt or Duff	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	<u>0</u> P C B	<u>0</u> P C B	
Row Crops	0 P <u>C</u> B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	74	0.0	
Right	76	0.0	
Wetted Width xxx.x m		2.57	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		3.29	
Bankfull Height xx.x m		0.66	
Incised Height xx.x m		1.05	

CANOPY COVER MEASUREMENTS					
DENSIOMETER (0-17 Max)					
Flag			Flag		
CenUp	3		CenR	0	
CenL	13		Left	K	
CenDwn	5		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: E. Fork Pringle Crk	DATE: 6/25/13	TRANSECT:	☐ A ☐ B ☐ C ☐ D ☐ E ☐ F ☐ G ☒ H ☐ I ☐ J ☐ K ☐	X-tra Side Channel ☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	0.72	21.4	GF	60	
Ctr	1.44	25.8	GF	80	
RCtr	2.16	26.1	GF	90	
Right	2.87	0	FN	100	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	<u>0</u> 1 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	<u>0</u> 1 2 3 4	
Live Trees or Roots	<u>0</u> 1 2 3 4	
Overhanging Veg. = <1 m of Surface	0 1 2 <u>3</u> 4	
Undercut Banks	<u>0</u> 1 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	D C E M <u>N</u>	D C E M <u>N</u>	
Big Trees (Trunk >0.3 m DBH)	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Small Trees (Trunk <0.3 m DBH)	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Woody Shrubs and Saplings	<u>0</u> 1 2 3 4	0 1 2 <u>3</u> 4	
Non-Woody Herbs, Grasses, Forbs	0 1 <u>2</u> 3 4	<u>0</u> 1 2 3 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 2 <u>3</u> 4	0 1 2 <u>3</u> 4	
Barren, Bare Dirt or Duff	<u>0</u> 1 2 3 4	0 <u>1</u> 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	<u>0</u> P C B	<u>0</u> P C B	
Row Crops	0 P <u>C</u> B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	79	0.0	
Right	57	0.0	
Wetted Width xxx.x m		2.87	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		3.20	
Bankfull Height xx.x m		0.73	
Incised Height xx.x m		1.11	

CANOPY COVER MEASUREMENTS					
DENSIOMETER (0-17 Max)					
Flag			Flag		
CenUp	8		CenR	5	
CenL	11		Left	K	
CenDwn	1		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: E. Fork Pringle Crk	DATE: 6/25/13	TRANSECT:	☐ A ☐ B ☐ C ☐ D ☐ E ☐ F ☐ X-tra Side Channel	☐ G ☐ H ☒ I ☐ J ☐ K

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	0.73	20.3	FN	100	
Ctr	1.46	23.6	GC	30	
RCtr	2.19	18.3	GC	10	
Right	2.93	0	FN	100	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	<u>0</u> 1 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	<u>0</u> 1 2 3 4	
Live Trees or Roots	<u>0</u> 1 2 3 4	
Overhanging Veg. = <1 m of Surface	0 <u>1</u> 2 3 4	
Undercut Banks	<u>0</u> 1 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	D C E M <u>N</u>	D C E M <u>N</u>	
Big Trees (Trunk >0.3 m DBH)	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Small Trees (Trunk <0.3 m DBH)	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Woody Shrubs and Saplings	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	0 <u>1</u> 2 3 4	0 <u>1</u> 2 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 2 <u>3</u> 4	0 1 2 <u>3</u> 4	
Barren, Bare Dirt or Duff	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	<u>0</u> P C B	<u>0</u> P C B	
Row Crops	0 P <u>C</u> B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	61	0.0	
Right	59	0.0	
Wetted Width xxx.x m		2.93	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		2.87	
Bankfull Height xx.x m		0.57	
Incised Height xx.x m		1.26	

CANOPY COVER MEASUREMENTS					
DENSIOMETER (0-17 Max)					
Flag			Flag		
CenUp	15		CenR	11	
CenL	17		Left	K	
CenDwn	17		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: E. Fork Pringle Crk	DATE: 6/25/13	TRANSECT:	☐ A ☐ B ☐ C ☐ D ☐ E ☐ F ☐ G ☐ H ☐ I ☒ J ☐ K	X-tra Side Channel ☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	0.67	19.8	FN	100	
Ctr	1.34	19.3	GF	20	
RCtr	2.01	23.1	GC	10	
Right	2.66	0	FN	100	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	0 <u>1</u> 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	<u>0</u> 1 2 3 4	
Live Trees or Roots	<u>0</u> 1 2 3 4	
Overhanging Veg. = <1 m of Surface	0 <u>1</u> 2 3 4	
Undercut Banks	0 1 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	D C E M <u>N</u>	D C E M N	
Big Trees (Trunk >0.3 m DBH)	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Small Trees (Trunk <0.3 m DBH)	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Woody Shrubs and Saplings	<u>0</u> 1 2 3 4	0 1 2 <u>3</u> 4	
Non-Woody Herbs, Grasses, Forbs	0 1 <u>2</u> 3 4	<u>0</u> 1 2 3 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	0 1 2 <u>3</u> 4	0 <u>1</u> 2 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 2 <u>3</u> 4	0 1 <u>2</u> 3 4	
Barren, Bare Dirt or Duff	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	<u>0</u> P C B	<u>0</u> P C B	
Row Crops	0 P <u>C</u> B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	57	0.0	
Right	281	0.15	
Wetted Width xxx.x m		2.66	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		3.41	
Bankfull Height xx.x m		0.43	
Incised Height xx.x m		1.09	

CANOPY COVER MEASUREMENTS					
DENSIOMETER (0-17 Max)					
Flag			Flag		
CenUp	9		CenR	9	
CenL	14		Left	K	
CenDwn	4		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: E. Fork Pringle Crk	DATE: 6/25/13	TRANSECT:	☐ A	☐ B	☐ C	☐ D	☐ E	☐ F	X-tra Side Channel
			☐ G	☐ H	☐ I	☐ J	☒ K		☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	0.74	14.4	GF	20	
Ctr	1.48	18.2	GF	40	
RCtr	2.22	18.6	GC	20	
Right	2.96	0	FN	100	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	<u>0</u> 1 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	<u>0</u> 1 2 3 4	
Live Trees or Roots	0 1 <u>2</u> 3 4	
Overhanging Veg. = <1 m of Surface	<u>0</u> 1 2 3 4	
Undercut Banks	<u>0</u> 1 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	D C E M <u>N</u>	D C E M <u>N</u>	
Big Trees (Trunk >0.3 m DBH)	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Small Trees (Trunk <0.3 m DBH)	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Woody Shrubs and Saplings	0 1 2 <u>3</u> 4	0 1 2 <u>3</u> 4	
Non-Woody Herbs, Grasses, Forbs	0 <u>1</u> 2 3 4	0 <u>1</u> 2 3 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 2 <u>3</u> 4	0 1 2 <u>3</u> 4	
Barren, Bare Dirt or Duff	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	<u>0</u> P C B	<u>0</u> P C B	
Row Crops	0 P <u>C</u> B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	K	K	
Right	K	K	
Wetted Width xxx.x m		2.96	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		3.35	
Bankfull Height xx.x m		0.65	
Incised Height xx.x m		1.22	

CANOPY COVER MEASUREMENTS					
DENSIOMETER (0-17 Max)					
Flag			Flag		
CenUp	17		CenR	17	
CenL	17		Left	K	
CenDwn	17		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments

RIPARIAN "LEGACY" TREES AND INVASIVE ALIEN PLANTS

SITE ID: E. Fork Pringle Crk

DATE: 6/25/13

TRAN	LARGEST LEGACY TREE VISIBLE FROM THIS STATION						ALIEN PLANT SPECIES PRESENT IN LEFT AND RIGHT RIPARIAN PLOTS				
	Trees not Visible	DBH (m)	Height (m)	Dist. from wetted margin (m)	Type	Taxonomic Category	Check all that are present				
A	☐	☒ 0-0.1 ☐ .75-2 ☐ .1-.3 ☐ >2 ☐ .3-.75	☒ <5 ☐ 5-15 ☐ 15-30 ☐ >30	0	☒ Deciduous ☐ Coniferous ☐ Broadleaf Evergreen	Ash	☐ None	☒ RC Grass ☐ Engl Ivy ☐ Ch Grass	☐ Salt Ced ☐ Can This ☐ M This	☒ Hblack ☐ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol
B	☐	☒ 0-0.1 ☐ .75-2 ☐ .1-.3 ☐ >2 ☐ .3-.75	☒ <5 ☐ 5-15 ☐ 15-30 ☐ >30	0	☒ Deciduous ☐ Coniferous ☐ Broadleaf Evergreen	Ash	☐ None	☒ RC Grass ☐ Engl Ivy ☐ Ch Grass	☐ Salt CED ☒ Can This ☐ M This	☐ Hblack ☐ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol
C	☒	☐ 0-0.1 ☐ .75-2 ☐ .1-.3 ☐ >2 ☐ .3-.75	☐ <5 ☐ 5-15 ☐ 15-30 ☐ >30	0	☐ Deciduous ☐ Coniferous ☐ Broadleaf Evergreen		☐ None	☒ RC Grass ☐ Engl Ivy ☐ Ch Grass	☐ Salt Ced ☐ Can This ☐ M This	☐ Hblack ☒ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol

INSTRUCTIONS

Legacy trees are defined as the largest tree within your search area, which is as far as you can see, but within maximum limits as follows:

Wadeable Streams: Confine search to no more than 50 m from left and right bank and extending upstream to next transect (for 'K' look upstream 4 channel widths)

Non-wadeable Rivers: Confine search to no more than 100 m from left and right bank and extending both upstream and downstream as far as you can see confidently.

Alien Plants: Confine search to riparian plots on left and right bank

Wadeable Streams: 10 m x 10 m

Non-wadeable Rivers: 10 m x 20 m

Not all aliens are to be identified in all states. See Field Manual and Plant Identification Guide.

TAXONOMIC CATEGORIES

Acacia/Mesquite
Alder/Birch
Ash
Maple/Box elder
Oak
Poplar/Cottonwood
Sycamore
Willow
Unknown or Other Deciduous
Cedar/Cypress/Sequoia
Fir (including Douglas Fir and Hemlock)
Juniper
Pine
Spruce
Unknown or Other Deciduous
Unknown or Other Broadleaf Evergreen
Snag (Dead tree of any species)

ALIEN SPECIES

RC Grass	Reed Canarygrass	<i>Phalaris arundinacea</i>
Engl Ivy	English Ivy	<i>Hedera Helix</i>
ChGrass	Cheat Grass	<i>Bromus tectorum</i>
Salt Ced	Salt Cedar	<i>Tamarix spp.</i>
Can This	Canada thistle	<i>Cirsium arvense</i>
M This	Musk thistle	<i>Carduus nutans</i>
Hblack	Himalayan blackberry	<i>Rubus discolor</i>
Teasel	Teasel	<i>Dipsacus fullonum</i>
Spurge	Leafy spurge	<i>Euphorbia esula</i>
G Reed	Giant Reed	<i>Arundo donax</i>
C Burd	Common burdock	<i>Arctium minus</i>
Rus Ol	Russian-olive	<i>Elaeagnus angustifolia</i>

COMMENTS

Transects D to K continued on next page

RIPARIAN "LEGACY" TREES AND INVASIVE ALIEN PLANTS

SITE ID: E. Fork Pringle Crk

DATE: 6/25/13

TRAN	LARGEST LEGACY TREE VISIBLE FROM THIS STATION						ALIEN PLANT SPECIES PRESENT IN LEFT AND RIGHT RIPARIAN PLOTS				
	Trees not Visible	DBH (m)	Height (m)	Dist. from wetted margin (m)	Type	Taxonomic Category	Check all that are present				
D	☒	☐ 0-0.1 ☐ .75-2 ☐ .1-.3 ☐ >2 ☐ .3-.75	☐ <5 ☐ 5-15 ☐ 15-30 ☐ >30		☐ Deciduous ☐ Coniferous ☐ Broadleaf Evergreen		☐ None	☒ RC Grass ☐ Engl Ivy ☐ Ch Grass	☐ Salt Ced ☐ Can This ☐ M This	☒ Hblack ☐ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol
E	☒	☐ 0-0.1 ☐ .75-2 ☐ .1-.3 ☐ >2 ☐ .3-.75	☐ <5 ☐ 5-15 ☐ 15-30 ☐ >30		☐ Deciduous ☐ Coniferous ☐ Broadleaf Evergreen		☐ None	☒ RC Grass ☐ Engl Ivy ☐ Ch Grass	☐ Salt CED ☐ Can This ☐ M This	☒ Hblack ☐ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol
F	☐	☒ 0-0.1 ☐ .75-2 ☐ .1-.3 ☐ >2 ☐ .3-.75	☒ <5 ☐ 5-15 ☐ 15-30 ☐ >30	10m	☒ Deciduous ☐ Coniferous ☐ Broadleaf Evergreen	Cottonwood	☐ None	☒ RC Grass ☐ Engl Ivy ☐ Ch Grass	☐ Salt Ced ☐ Can This ☐ M This	☒ Hblack ☐ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol
G	☐	☒ 0-0.1 ☐ .75-2 ☐ .1-.3 ☐ >2 ☐ .3-.75	☒ <5 ☐ 5-15 ☐ 15-30 ☐ >30	20m	☐ Deciduous ☒ Coniferous ☐ Broadleaf Evergreen	Pine	☐ None	☒ RC Grass ☐ Engl Ivy ☐ Ch Grass	☐ Salt Ced ☐ Can This ☐ M This	☒ Hblack ☐ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol
H	☐	☒ 0-0.1 ☐ .75-2 ☐ .1-.3 ☐ >2 ☐ .3-.75	☒ <5 ☐ 5-15 ☐ 15-30 ☐ >30	10m	☐ Deciduous ☐ Coniferous ☐ Broadleaf Evergreen	Cottonwood	☐ None	☒ RC Grass ☐ Engl Ivy ☐ Ch Grass	☐ Salt Ced ☐ Can This ☐ M This	☒ Hblack ☐ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol
I	☐	☒ 0-0.1 ☐ .75-2 ☐ .1-.3 ☐ >2 ☐ .3-.75	☒ <5 ☐ 5-15 ☐ 15-30 ☐ >30	1	☒ Deciduous ☐ Coniferous ☐ Broadleaf Evergreen	Maple	☐ None	☒ RC Grass ☐ Engl Ivy ☐ Ch Grass	☐ Salt Ced ☐ Can This ☐ M This	☒ Hblack ☐ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol
J	☐	☒ 0-0.1 ☐ .75-2 ☐ .1-.3 ☐ >2 ☐ .3-.75	☐ <5 ☒ 5-15 ☐ 15-30 ☐ >30	2	☒ Deciduous ☐ Coniferous ☐ Broadleaf Evergreen	Oak	☐ None	☒ RC Grass ☐ Engl Ivy ☐ Ch Grass	☐ Salt Ced ☐ Can This ☐ M This	☒ Hblack ☐ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol
K	☐	☒ 0-0.1 ☐ .75-2 ☐ .1-.3 ☐ >2 ☐ .3-.75	☒ <5 ☐ 5-15 ☐ 15-30 ☐ >30	0	☒ Deciduous ☐ Coniferous ☐ Broadleaf Evergreen	Willow	☐ None	☒ RC Grass ☐ Engl Ivy ☐ Ch Grass	☐ Salt Ced ☐ Can This ☐ M This	☒ Hblack ☐ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol

Appendix D

Physical Habitat Data – Clark Creek



PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

		SITE ID: Clark Crk						DATE: 6/17/13		TRANSECT:				A-B F-G				B-C G-H				C-D H-I				D-E I-J				E-F J-K	
THALWEG PROFILE								For Transect A-B ONLY			Increment (m)x.x:		1.0m		Total Reach Length (m)		150m														
STATI ON	THALWEG DEPTH (cm) (xx.x)	WETTED WIDTH (m) (XXX.X)	BAR WIDTH ¹		SOFT/ SMALL SEDIMENT (Y/N)	CHANNEL UNIT CODE	POOL FORM CODE	SIDE CHANNEL (Y/N)	BACK WATER (Y/N)	FLAG	COMMENTS																				
			Present (Y/ N)	XX.X																											
0	11.4	2.0	N	-	N	GL	N	N	N																						
1	20.4		N		N	PL	F	N	N																						
2	28.2		N		N	PL	F	N	N																						
3	34.5		N		N	PL	F	N	N																						
4	28.9		N		N	PL	F	N	N																						
5	18.7	-	N	-	N	GL	N	N	N																						
6	10.6		N		N	RI	N	N	N																						
7	10.6	1.0	Y	1.1	N	RI	N	N	N																						
8	11.2		Y		N	RI	N	N	N																						
9	9.7		Y		N	RI	N	N	N																						
10	10.3		Y		N	RI	N	N	N																						
11	11.6		Y		N	GL	N	N	N																						
12	17.7		N		N	PL	F	N	N																						
13	20.1		N		N	PL	F	N	N																						
14	14.8		Y		N	RI	N	N	N																						

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	7	FN	GF	GF	GF	FN	

FLAG	COMMENTS

SUBSTRATE SIZE CLASS CODES	POOL FORM CODES	CHANNEL UNIT CODES
RS = BEDROCK (SMOOTH)-(Larger than a car)	N= Not a pool	PP = Pool, Plunge
RR = BEDROCK (ROUGH)-(Larger than a car)	W= Large Woody Debris	PT = Pool, Trench
BL = BOULDER (250 to 400 mm)-(Basketball to car)	R = Rootwad	PL = Pool, Lateral Scour
CB = COBBLE (64 to 250 mm)-(Tennis ball to basketball)	B = Boulder or Bedrock	PB = Pool, Backwater
GC = COARSE GRAVEL (16 to 64mm)-(Marble to Tennis ball)	F = Unknown, fluvial	PD = Pool, Impoundment
GF = FINE GRAVEL (2 to 16mm)-(Ladybug to marble)	COMBINATIONS:	GL = Glide
SA = SAND (0.06 to 2mm)-(Gritty up to ladybug size)	Eg. WR, BR, WRB	RI = Riffle
FN = SILT/CLAY/MUCK-(Not gritty)		RA = Rapid
HP = HARDPAN-(Firm, Consolidated, Fine Substrate)		CA = Cascade
WD = WOOD-(Any Size)		FA = Falls
OT = OTHER (Write comment on back of form)		DR = Dry Channel

Flag Codes: K = no measurement made, U = suspect measurement F1, F2, etc. – flags assigned by each field crew. Explain all flags in comments. 1 = Measure Bar Width at Station 0 and mid-station (5 or 7)

LARGE WOODY DEBRIS ((10 cm small end diameter; 1.5 m length)				CHECK IF ALL UNMARKED BOXES ARE ZERO		X	FLAG	
Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel				
	Length 1.5-5 m	5-15 m	>15 m	Length 1.5-5 m	5-15 m	>15 m		
0.1-<0.3 m								
0.3-0.5 m								
0.5-0.8 m								
>0.8 m								

PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

		SITE ID: Clark Crk						DATE: 6/17/13		TRANSECT:			A-B		F-G		B-C		G-H			C-D		H-I		I-J		D-E		J-K		E-F
THALWEG PROFILE								For Transect A-B ONLY			Increment (m)x.x:		1.0m		Total Reach Length (m)		150m															
STATI ON	THALWEG DEPTH (cm) (xx.x)	WETTED WIDTH (m) (XXX.X)	BAR WIDTH ³		SOFT/ SMALL SEDIMENT (Y/N)	CHANNEL UNIT CODE	POOL FORM CODE	SIDE CHANNEL (Y/N)	BACK WATER (Y/N)	FLAG	COMMENTS																					
			Present (Y/ N)	XX.X																												
0	22.7	2.2	N	-	N	PL	F	N	N																							
1	24.8		N		N	PL	F	N	N																							
2	28.3		N		N	PL	F	N	N																							
3	34.7		N		N	PL	F	N	N																							
4	36.5		N		N	PL	F	N	N																							
5	39.6	-	N	-	N	PL	F	N	N																							
6	38.3		N		N	PL	F	N	N																							
7	37.6	1.6	N	-	N	GL	N	N	N																							
8	35.4		N		N	GL	N	N	N																							
9	38.0		N		N	GL	N	N	N																							
10	34.6		N		N	GL	N	N	N																							
11	24.7		N		N	GL	N	N	N																							
12	28.9		N		N	PL	F	N	N																							
13	25.6		N		N	PL	F	N	N																							
14	30.9		N		N	PL	F	N	N																							

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	7	HP	HP	FN	FN	FN	

FLAG	COMMENTS

SUBSTRATE SIZE CLASS CODES	POOL FORM CODES	CHANNEL UNIT CODES
RS = BEDROCK (SMOOTH)-(Larger than a car)	N= Not a pool	PP = Pool, Plunge
RR = BEDROCK (ROUGH)-(Larger than a car)	W= Large Woody Debris	PT = Pool, Trench
BL = BOULDER (250 to 400 mm)-(Basketball to car)	R = Rootwad	PL = Pool, Lateral Scour
CB = COBBLE (64 to 250 mm)-(Tennis ball to basketball)	B = Boulder or Bedrock	PB = Pool, Backwater
GC = COARSE GRAVEL (16 to 64mm)-(Marble to Tennis ball)	F = Unknown, fluvial	PD = Pool, Impoundment
GF = FINE GRAVEL (2 to 16mm)-(Ladybug to marble)	COMBINATIONS:	GL = Glide
SA = SAND (0.06 to 2mm)-(Gritty up to ladybug size)	Eg. WR, BR, WRB	RI = Riffle
FN = SILT/CLAY/MUCK-(Not gritty)		RA = Rapid
HP = HARDPAN-(Firm, Consolidated, Fine Substrate)		CA = Cascade
WD = WOOD-(Any Size)		FA = Falls
OT = OTHER (Write comment on back of form)		DR = Dry Channel

Flag Codes: K = no measurement made, U = suspect measurement F1, F2, etc. – flags assigned by each field crew. Explain all flags in comments. 1 = Measure Bar Width at Station 0 and mid-station (5 or 7)

LARGE WOODY DEBRIS ((10 cm small end diameter; 1.5 m length)				CHECK IF ALL UNMARKED BOXES ARE ZERO		X	FLAG	
Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel				
	Length 1.5-5 m	5-15 m	>15 m	Length 1.5-5 m	5-15 m	>15 m		
0.1-<0.3 m								
0.3-0.5 m								
0.5-0.8 m								
>0.8 m								

PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

	SITE ID: Clark Crk				DATE: 6/17/13			TRANSECT:			A-B		F-G		B-C		G-H		C-D		H-I			D-E		I-J		E-F		J-K	
THALWEG PROFILE								For Transect A-B ONLY			Increment (m)x.x:		1.0m	Total Reach Length (m)		150m															
STATI ON	THALWEG DEPTH (cm) (xx.x)	WETTED WIDTH (m) (XXX.X)	BAR WIDTH ^d		SOFT/ SMALL SEDIMENT (Y/N)	CHANNEL UNIT CODE	POOL FORM CODE	SIDE CHANNEL (Y/N)	BACK WATER (Y/N)	FLAG	COMMENTS																				
			Present (Y/ N)	XX.X																											
0	22.9	1.7	N	-	N	PL	F	N	N																						
1	26.9		N		N	PL	F	N	N																						
2	33.9		N		N	PL	F	N	N																						
3	36.2		N		N	GL	N	N	N																						
4	39.5		N		N	GL	N	N	N																						
5	35.9	-	N		N	GL	N	N	N																						
6	34.6		N		N	GL	N	N	N																						
7	27.7	1.50	N		N	GL	N	N	N																						
8	42.0		N		N	GL	N	N	N																						
9	36.4		N		N	GL	N	N	N																						
10	25.2		N		N	GL	N	N	N																						
11	18.1		N		N	GL	N	N	N																						
12	20.9		N		N	GL	N	N	N																						
13	29.6		N		N	GL	N	N	N																						
14	23.2		N		N	GL	N	N	N																						

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	7	HP	HP	FN	FN	FN	

FLAG	COMMENTS

SUBSTRATE SIZE CLASS CODES	POOL FORM CODES	CHANNEL UNIT CODES
RS = BEDROCK (SMOOTH)-(Larger than a car)	N= Not a pool	PP = Pool, Plunge
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GF = FINE GRAVEL (2 to 16mm)-(Ladybug to marble)	COMBINATIONS:	GL = Glide
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Flag Codes: K = no measurement made, U = suspect measurement F1, F2, etc. – flags assigned by each field crew. Explain all flags in comments. 1 = Measure Bar Width at Station 0 and mid-station (5 or 7)

[illegible]

PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

		SITE ID: Clark Crk						DATE: 6/17/13		TRANSECT:			A-B		F-G		B-C		G-H		C-D		H-I		D-E		I-J			E-F		J-K
THALWEG PROFILE								For Transect A-B ONLY			Increment (m) x.x:		1.0m	Total Reach Length (m)		150m																
STATI ON	THALWEG DEPTH (cm) (xx.x)	WETTED WIDTH (m) (XXX.X)	BAR WIDTH ^s		SOFT/ SMALL SEDIMENT (Y/N)	CHANNEL UNIT CODE	POOL FORM CODE	SIDE CHANNEL (Y/N)	BACK WATER (Y/N)	FLAG	COMMENTS																					
			Present (Y/ N)	XX.X																												
0	16.0	1.8	N	N	N	RI	N	N	N	N																						
1	14.6		N		N	RI	N	N	N	N																						
2	16.3		Y		N	RI	N	N	N	N																						
3	13.8		Y		N	RI	N	N	N	N																						
4	12.2		Y		N	RI	N	N	N	N																						
5	9.8	-	Y		N	RI	N	N	N	N																						
6	10.9		Y		N	RI	N	N	N	N																						
7	9.7	2.2	Y	0.6	N	RI	N	N	N	N																						
8	8.4		N		N	RI	N	N	N	N																						
9	8.4		N		N	RI	N	N	N	N																						
10	8.9		N		N	RI	N	N	N	N																						
11	12.8		N		N	RI	N	N	N	N																						
12	12.0		N		N	RI	N	N	N	N																						
13	12.7		N		N	RI	N	N	N	N																						
14	7.6		N		N	RI	N	N	N	N																						

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	7	FN	GF	GF	GF	FN	

FLAG	COMMENTS

SUBSTRATE SIZE CLASS CODES	POOL FORM CODES	CHANNEL UNIT CODES
RS = BEDROCK (SMOOTH)-(Larger than a car)	N= Not a pool	PP = Pool, Plunge
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GC = COARSE GRAVEL (16 to 64mm)-(Marble to Tennis ball)	F = Unknown, fluvial	PD = Pool, Impoundment
GF = FINE GRAVEL (2 to 16mm)-(Ladybug to marble)	COMBINATIONS:	GL = Glide
SA = SAND (0.06 to 2mm)-(Gritty up to ladybug size)	Eg. WR, BR, WRB	RI = Riffle
FN = SILT/CLAY/MUCK-(Not gritty)		RA = Rapid
HP = HARDPAN-(Firm, Consolidated, Fine Substrate)		CA = Cascade
WD = WOOD-(Any Size)		FA = Falls
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Flag Codes: K = no measurement made, U = suspect measurement F1, F2, etc. – flags assigned by each field crew. Explain all flags in comments. 1 = Measure Bar Width at Station 0 and mid-station (5 or 7)

LARGE WOODY DEBRIS (10 cm small end diameter; 1.5 m length)				CHECK IF ALL UNMARKED BOXES ARE ZERO		X	FLAG	
Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel				
	Length 1.5-5 m	5-15 m	>15 m	Length 1.5-5 m	5-15 m	>15 m		
0.1-<0.3 m								
0.3-0.5 m								
0.5-0.8 m								
>0.8 m								

PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

SITE ID: Clark Crk						DATE: 6/17/13		TRANSECT:		☐ A-B ☒ F-G	☐ B-C ☐ G-H	☐ C-D ☐ H-I	☐ D-E ☐ I-J	☐ E-F ☐ J-K
THALWEG PROFILE								For Transect A-B ONLY			Increment (m) x.x:	1.0m	Total Reach Length (m)	150m
STATION	THALWEG DEPTH (cm) (xx.x)	WETTED WIDTH (m) (XXX.X)	BAR WIDTH ⁶		SOFT/ SMALL SEDIMENT (Y/N)	CHANNEL UNIT CODE	POOL FORM CODE	SIDE CHANNEL (Y/N)	BACK WATER (Y/N)	FLAG	COMMENTS			
			Present (Y/ N)	XX.X										
0	10.9	2.0	Y	0.3	N	RI	N	N	N					
1	8.9		N		N	RI	N	N	N					
2	6.9		N		N	RI	N	N	N					
3	7.9		N		N	RI	N	N	N					
4	9.4		N		N	RI	N	N	N					
5	10.6	-	N	-	N	GL	N	N	N					
6	9.8		N		N	GL	N	N	N					
7	13.3	2.8	N	-	N	GL	N	N	N					
8	14.1		N		N	GL	N	N	N					
9	9.7		N		N	GL	N	N	N					
10	12.4		N		N	GL	N	N	N					
11	14.1		N		N	GL	N	N	N					
12	13.6		N		N	GL	N	N	N					
13	11.6		N		N	GL	N	N	N					
14	11.0		N		N	GL	N	N	N					

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	7	FN	GF	GF	GF	FN	

FLAG	COMMENTS

SUBSTRATE SIZE CLASS CODES	POOL FORM CODES	CHANNEL UNIT CODES
RS = BEDROCK (SMOOTH)-(Larger than a car) RR = BEDROCK (ROUGH)-(Larger than a car) BL = BOULDER (250 to 400 mm)-(Basketball to car) CB = COBBLE (64 to 250 mm)-(Tennis ball to basketball) GC = COARSE GRAVEL (16 to 64mm)-(Marble to Tennis ball) GF = FINE GRAVEL (2 to 16mm)-(Ladybug to marble) SA = SAND (0.06 to 2mm)-(Gritty up to ladybug size) FN = SILT/CLAY/MUCK-(Not gritty) HP = HARDPAN-(Firm, Consolidated, Fine Substrate) WD = WOOD-(Any Size) OT = OTHER (Write comment on back of form)	N= Not a pool W= Large Woody Debris R = Rootwad B = Boulder or Bedrock F = Unknown, fluvial COMBINATIONS: Eg. WR, BR, WRB	PP = Pool, Plunge PT = Pool, Trench PL = Pool, Lateral Scour PB = Pool, Backwater PD = Pool, Impoundment GL = Glide RI = Riffle RA = Rapid CA = Cascade FA = Falls DR = Dry Channel

Flag Codes: K = no measurement made, U= suspect measurement F1, F2, etc. – flags assigned by each field crew. Explain all flags in comments. 1 = Measure Bar Width at Station 0 and mid-station (5 or 7)

LARGE WOODY DEBRIS (10 cm small end diameter; 1.5 m length)			CHECK IF ALL UNMARKED BOXES ARE ZERO			X	FLAG	
Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel				
	Length 1.5-5 m	5-15 m	>15 m	Length 1.5-5 m	5-15 m	>15 m		
0.1-<0.3 m	☐	☐	☐	☐	☐	☐		
0.3-0.5 m	☐	☐	☐	☐	☐	☐		
0.5-0.8 m	☐	☐	☐	☐	☐	☐		
>0.8 m	☐	☐	☐	☐	☐	☐		

PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

		SITE ID: Clark Crk						DATE: 6/17/13		TRANSECT:			A-B		F-G		B-C		G-H		C-D		H-I		D-E		I-J		E-F		J-K	
THALWEG PROFILE								For Transect A-B ONLY			Increment (m) x.x:		1.0m	Total Reach Length (m)		150m																
STATI ON	THALWEG DEPTH (cm) (xx.x)	WETTED WIDTH (m) (XXX.X)	BAR WIDTH ⁷		SOFT/ SMALL SEDIMENT (Y/N)	CHANNEL UNIT CODE	POOL FORM CODE	SIDE CHANNEL (Y/N)	BACK WATER (Y/N)	FLAG	COMMENTS																					
			Present (Y/ N)	XX.X																												
0	10.7	2.8	N	-	N	GL	N	N	N																							
1	15.6		N		N	PL	F	N	N																							
2	26.9		N		N	PL	F	N	N																							
3	29.1		N		N	PL	F	N	N																							
4	19.6		N		N	GL	N	N	N																							
5	16.5	-	N	-	N	GL	N	N	N																							
6	11.5		N		N	GL	N	N	N																							
7	10.4	2.6	N		N	GL	N	N	N																							
8	11.8		N		N	GL	N	N	N																							
9	12.9		N		N	GL	N	N	N																							
10	9.6		N		N	GL	N	N	N																							
11	13.2		N		N	RI	N	N	N																							
12	11.1		N		N	RI	N	N	N																							
13	8.6		N		N	RI	N	N	N																							
14	7.9		N		N	RI	N	N	N																							

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	7	FN	GF	GF	GF	FN	

FLAG	COMMENTS

SUBSTRATE SIZE CLASS CODES	POOL FORM CODES	CHANNEL UNIT CODES
RS = BEDROCK (SMOOTH)-(Larger than a car)	N= Not a pool	PP = Pool, Plunge
RR = BEDROCK (ROUGH)-(Larger than a car)	W= Large Woody Debris	PT = Pool, Trench
BL = BOULDER (250 to 400 mm)-(Basketball to car)	R = Rootwad	PL = Pool, Lateral Scour
CB = COBBLE (64 to 250 mm)-(Tennis ball to basketball)	B = Boulder or Bedrock	PB = Pool, Backwater
GC = COARSE GRAVEL (16 to 64mm)-(Marble to Tennis ball)	F = Unknown, fluvial	PD = Pool, Impoundment
GF = FINE GRAVEL (2 to 16mm)-(Ladybug to marble)	COMBINATIONS:	GL = Glide
SA = SAND (0.06 to 2mm)-(Gritty up to ladybug size)	Eg. WR, BR, WRB	RI = Riffle
FN = SILT/CLAY/MUCK-(Not gritty)		RA = Rapid
HP = HARDPAN-(Firm, Consolidated, Fine Substrate)		CA = Cascade
WD = WOOD-(Any Size)		FA = Falls
OT = OTHER (Write comment on back of form)		DR = Dry Channel

Flag Codes: K = no measurement made, U = suspect measurement F1, F2, etc. – flags assigned by each field crew. Explain all flags in comments. 1 = Measure Bar Width at Station 0 and mid-station (5 or 7)

LARGE WOODY DEBRIS (10 cm small end diameter; 1.5 m length)				CHECK IF ALL UNMARKED BOXES ARE ZERO		X	FLAG	
Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel				
	Length 1.5-5 m	5-15 m	>15 m	Length 1.5-5 m	5-15 m	>15 m		
0.1-<0.3 m								
0.3-0.5 m								
0.5-0.8 m								
>0.8 m								

PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

		SITE ID: Clark Crk						DATE: 6/17/13		TRANSECT:		A-B F-G		B-C G-H		⊗ C-D H-I		D-E I-J		E-F J-K	
THALWEG PROFILE								For Transect A-B ONLY			Increment (m) x.x:		1.0m	Total Reach Length (m)		150m					
STATI ON	THALWEG DEPTH (cm) (xx.x)	WETTED WIDTH (m) (XXX.X)	BAR WIDTH ^a		SOFT/ SMALL SEDIMENT (Y/N)	CHANNEL UNIT CODE	POOL FORM CODE	SIDE CHANNEL (Y/N)	BACK WATER (Y/N)	FLAG	COMMENTS										
			Present (Y/ N)	XX.X																	
0	10.4	2.6	N		N	GL	N	N	N												
1	13.2		N		N	GL	N	N	N												
2	16.3		N		N	GL	N	N	N												
3	21.6		N		N	PL	F	N	N												
4	28.8		N		N	PL	F	N	N												
5	28.5	-	N	-	N	PL	F	N	N												
6	32.8		N		N	PL	F	N	N												
7	24.1	2.4	N	-	N	PL	F	N	N												
8	28.1		N		N	PL	N	N	N												
9	29.2		N		N	PL	N	N	N												
10	16.3		N		N	GL	N	N	N												
11	7.5		N		N	RI	N	N	N												
12	7.2		N		N	RI	N	N	N												
13	7.4		N		N	RI	N	N	N												
14	7.1		N		N	RI	N	N	N												

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	7	FN	GF	GF	GF	FN	

FLAG	COMMENTS

SUBSTRATE SIZE CLASS CODES	POOL FORM CODES	CHANNEL UNIT CODES
RS = BEDROCK (SMOOTH)-(Larger than a car)	N= Not a pool	PP = Pool, Plunge
RR = BEDROCK (ROUGH)-(Larger than a car)	W= Large Woody Debris	PT = Pool, Trench
BL = BOULDER (250 to 400 mm)-(Basketball to car)	R = Rootwad	PL = Pool, Lateral Scour
CB = COBBLE (64 to 250 mm)-(Tennis ball to basketball)	B = Boulder or Bedrock	PB = Pool, Backwater
GC = COARSE GRAVEL (16 to 64mm)-(Marble to Tennis ball)	F = Unknown, fluvial	PD = Pool, Impoundment
GF = FINE GRAVEL (2 to 16mm)-(Ladybug to marble)	COMBINATIONS:	GL = Glide
SA = SAND (0.06 to 2mm)-(Gritty up to ladybug size)	Eg. WR, BR, WRB	RI = Riffle
FN = SILT/CLAY/MUCK-(Not gritty)		RA = Rapid
HP = HARDPAN-(Firm, Consolidated, Fine Substrate)		CA = Cascade
WD = WOOD-(Any Size)		FA = Falls
OT = OTHER (Write comment on back of form)		DR = Dry Channel

Flag Codes: K = no measurement made, U = suspect measurement F1, F2, etc. – flags assigned by each field crew. Explain all flags in comments. 1 = Measure Bar Width at Station 0 and mid-station (5 or 7)

LARGE WOODY DEBRIS (10 cm small end diameter; 1.5 m length)				CHECK IF ALL UNMARKED BOXES ARE ZERO		X	FLAG	
Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel				
	Length 1.5-5 m	5-15 m	>15 m	Length 1.5-5 m	5-15 m	>15 m		
0.1-<0.3 m								
0.3-0.5 m				1				
0.5-0.8 m								
>0.8 m								

PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

		SITE ID: Clark Crk						DATE: 6/17/13		TRANSECT:			A-B		F-G	B-C		G-H		H-I		C-D		I-J		D-E		J-K		E-F
THALWEG PROFILE								For Transect A-B ONLY			Increment (m) x.x:		1.0m	Total Reach Length (m)		150m														
STATI ON	THALWEG DEPTH (cm) (xx.x)	WETTED WIDTH (m) (XXX.X)	BAR WIDTH ^b		SOFT/ SMALL SEDIMENT (Y/N)	CHANNEL UNIT CODE	POOL FORM CODE	SIDE CHANNEL (Y/N)	BACK WATER (Y/N)	FLAG	COMMENTS																			
			Present (Y/ N)	XX.X																										
0	8.4	2.9	N	-	N	RI	N	N	N																					
1	8.8		N		N	RI	N	N	N																					
2	7.5		Y		N	GL	N	N	N																					
3	7.8		Y		N	GL	N	N	N																					
4	10.8		Y		N	GL	N	N	N																					
5	11.4	-	Y	-	N	GL	N	N	N																					
6	9.9		Y		N	GL	N	N	N																					
7	17.5	3.2	N	-	N	PL	N	N	N																					
8	22.3		N		N	PL	N	N	N																					
9	9.3		Y		N	GL	N	N	N																					
10	10.8		Y		N	GL	N	N	N																					
11	11.8		Y		N	GL	N	N	N																					
12	12.7		Y		N	GL	N	N	N																					
13	13.4		Y		N	GL	N	N	N																					
14	14.9		N		N	GL	N	N	N																					

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	7	FN	GF	GF	GF	HP	

FLAG	COMMENTS

SUBSTRATE SIZE CLASS CODES	POOL FORM CODES	CHANNEL UNIT CODES
RS = BEDROCK (SMOOTH)-(Larger than a car)	N= Not a pool	PP = Pool, Plunge
RR = BEDROCK (ROUGH)-(Larger than a car)	W= Large Woody Debris	PT = Pool, Trench
BL = BOULDER (250 to 400 mm)-(Basketball to car)	R = Rootwad	PL = Pool, Lateral Scour
CB = COBBLE (64 to 250 mm)-(Tennis ball to basketball)	B = Boulder or Bedrock	PB = Pool, Backwater
GC = COARSE GRAVEL (16 to 64mm)-(Marble to Tennis ball)	F = Unknown, fluvial	PD = Pool, Impoundment
GF = FINE GRAVEL (2 to 16mm)-(Ladybug to marble)	COMBINATIONS:	GL = Glide
SA = SAND (0.06 to 2mm)-(Gritty up to ladybug size)	Eg. WR, BR, WRB	RI = Riffle
FN = SILT/CLAY/MUCK-(Not gritty)		RA = Rapid
HP = HARDPAN-(Firm, Consolidated, Fine Substrate)		CA = Cascade
WD = WOOD-(Any Size)		FA = Falls
OT = OTHER (Write comment on back of form)		DR = Dry Channel

Flag Codes: K = no measurement made, U = suspect measurement F1, F2, etc. – flags assigned by each field crew. Explain all flags in comments. 1 = Measure Bar Width at Station 0 and mid-station (5 or 7)

LARGE WOODY DEBRIS (10 cm small end diameter; 1.5 m length)				CHECK IF ALL UNMARKED BOXES ARE ZERO		X	FLAG	
Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel				
	Length 1.5-5 m	5-15 m	>15 m	Length 1.5-5 m	5-15 m	>15 m		
0.1-<0.3 m								
0.3-0.5 m				2				
0.5-0.8 m								
>0.8 m								

PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

SITE ID: Clark Crk				DATE: 6/17/13				TRANSECT:		☐	A-B	☐	B-C	☐	C-D	☐	D-E	☐	E-F
										☐	F-G	☐	G-H	☐	H-I	☐	I-J	☒	J-K
THALWEG PROFILE								For Transect A-B ONLY			Increment (m)x.x:	1.0m	Total Reach Length (m)	150m					
STATION	THALWEG DEPTH (cm) (xx.x)	WETTED WIDTH (m) (XXX.X)	BAR WIDTH ¹⁰		SOFT/ SMALL SEDIMENT (Y/N)	CHANNEL UNIT CODE	POOL FORM CODE	SIDE CHANNEL (Y/N)	BACK WATER (Y/N)	FLAG	COMMENTS								
			Present (Y/ N)	XX.X															
0	18.2	2.5	N	-	N	GL	N	N	N										
1	17.1		N		N	GL	N	N	N										
2	19.0		N		N	GL	N	N	N										
3	18.8		N		N	GL	N	N	N										
4	14.9		N		N	GL	N	N	N										
5	15.5	-	N	-	N	GL	N	N	N										
6	18.2		Y		N	GL	N	N	N										
7	18.6	2.5	N		N	GL	N	N	N										
8	17.0		N		N	GL	N	N	N										
9	11.0		N		N	GL	N	N	N										
10	19.9		N		N	GL	N	N	N										
11	28.9		N		N	PL	R	N	N										
12	30.6		N		N	PL	R	N	N										
13	25.3		Y		N	PL	R	N	N										
14	12.9		Y		N	GL	N	N	N										

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	7	GF	GF	GF	GF	FN	

FLAG	COMMENTS

SUBSTRATE SIZE CLASS CODES	POOL FORM CODES	CHANNEL UNIT CODES
RS = BEDROCK (SMOOTH)-(Larger than a car) RR = BEDROCK (ROUGH)-(Larger than a car) BL = BOULDER (250 to 400 mm)-(Basketball to car) CB = COBBLE (64 to 250 mm)-(Tennis ball to basketball) GC = COARSE GRAVEL (16 to 64mm)-(Marble to Tennis ball) GF = FINE GRAVEL (2 to 16mm)-(Ladybug to marble) SA = SAND (0.06 to 2mm)-(Gritty up to ladybug size) FN = SILT/CLAY/MUCK-(Not gritty) HP = HARDPAN-(Firm, Consolidated, Fine Substrate) WD = WOOD-(Any Size) OT = OTHER (Write comment on back of form)	N= Not a pool W= Large Woody Debris R = Rootwad B = Boulder or Bedrock F = Unknown, fluvial COMBINATIONS: Eg. WR, BR, WRB	PP = Pool, Plunge PT = Pool, Trench PL = Pool, Lateral Scour PB = Pool, Backwater PD = Pool, Impoundment GL = Glide RI = Riffle RA = Rapid CA = Cascade FA = Falls DR = Dry Channel

LARGE WOODY DEBRIS ((10 cm small end diameter; 1.5 m length)			CHECK IF ALL UNMARKED BOXES ARE ZERO		X	FLAG
Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel		
	Length 1.5-5 m	5-15 m	>15 m	Length 1.5-5 m	5-15 m	>15 m
0.1-<0.3 m	☐	☐	☐	☐	☐	☐
0.3-0.5 m	☐	☐	☐	☐	☐	☐
0.5-0.8 m	☐	☐	☐	☐	☐	☐
>0.8 m	☐	☐	☐	☐	☐	☐

Flag Codes: K = no measurement made, U = suspect measurement F1, F2, etc. – flags assigned by each field crew. Explain all flags in comments. 1 = Measure Bar Width at Station 0 and mid-station (5 or 7)

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: Clark Crk	DATE: 6/25/13	TRANSECT:	☒ A	☐ B	☐ C	☐ D	☐ E	☐ F	X-tra Side Channel
			☐ G	☐ H	☐ I	☐ J	☐ K		☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	0.50	7.6	GF	20	
Ctr	1.00	6.5	GF	30	
RCtr	1.50	7.4	GF	100	
Right	2.00	0	FN	100	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	<u>0</u> 1 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	0 <u>1</u> 2 3 4	
Live Trees or Roots	<u>0</u> 1 2 3 4	
Overhanging Veg. = <1 m of Surface	0 <u>1</u> 2 3 4	
Undercut Banks	<u>0</u> 1 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Big Trees (Trunk >0.3 m DBH)	<u>0</u> 1 2 3 4	0 1 <u>2</u> 3 4	
Small Trees (Trunk <0.3 m DBH)	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Woody Shrubs and Saplings	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	0 1 <u>2</u> 3 4	0 <u>1</u> 2 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 2 <u>3</u> 4	0 1 2 <u>3</u> 4	
Barren, Bare Dirt or Duff	<u>0</u> 1 2 3 4	0 1 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	<u>0</u> P C B	<u>0</u> P <u>C</u> B	
Row Crops	<u>0</u> P C B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	48	0	
Right	62	0	
Wetted Width xxx.x m		2.00	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		3.54	
Bankfull Height xx.x m		0.81	
Incised Height xx.x m		1.05	

CANOPY COVER MEASUREMENTS					
DENSIMETER (0-17 Max)					
Flag			Flag		
CenUp	16		CenR	17	
CenL	16		Left	K	
CenDwn	15		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: Clark Crk	DATE: 6/25/13	TRANSECT:	☐ A ☒ B ☐ C ☐ D ☐ E ☐ F ☐ G ☐ H ☐ I ☐ J ☐ K	X-tra Side Channel ☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	0.69	2.2	GF	50	
Ctr	1.39	8.9	GF	20	
RCtr	2.07	6.6	GF	10	
Right	2.76	0	FN	100	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	<u>0</u> 1 2 3 4	
Woody Debris >0.3 m (Big)	0 1 <u>2</u> 3 4	
Brush/Woody Debris <0.3 (Small)	0 <u>1</u> 2 3 4	
Live Trees or Roots	<u>0</u> 1 2 3 4	
Overhanging Veg. = <1 m of Surface	0 <u>1</u> 2 3 4	
Undercut Banks	<u>0</u> 1 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Big Trees (Trunk >0.3 m DBH)	0 <u>1</u> 2 3 4	0 <u>1</u> 2 3 4	
Small Trees (Trunk <0.3 m DBH)	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Woody Shrubs and Saplings	0 1 2 <u>3</u> 4	0 <u>1</u> 2 3 4	
Non-Woody Herbs, Grasses, Forbs	0 <u>1</u> 2 3 4	0 1 <u>2</u> 3 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	<u>0</u> 1 2 3 4	0 <u>1</u> 2 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 2 <u>3</u> 4	0 1 2 <u>3</u> 4	
Barren, Bare Dirt or Duff	<u>0</u> 1 2 3 4	0 <u>1</u> 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	<u>0</u> P C B	0 P <u>C</u> B	
Row Crops	<u>0</u> P C B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	66	0	
Right	74	0	
Wetted Width xxx.x m		2.76	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		3.51	
Bankfull Height xx.x m		0.80	
Incised Height xx.x m		1.20	

CANOPY COVER MEASUREMENTS					
DENSIOMETER (0-17 Max)					
Flag			Flag		
CenUp	15		CenR	14	
CenL	17		Left		
CenDwn	17		Right		

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: Clark Crk	DATE: 6/25/13	TRANSECT:	☐ A ☐ G	☐ B ☐ H	☒ C ☐ I	☐ D ☐ J	☐ E ☐ K	☐ F X-tra Side Channel ☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	0.56	25.8	SA	100	
Ctr	1.12	21.3	GF	90	
RCtr	1.68	17.3	GF	50	
Right	2.23	0	HO	0	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	<u>0</u> 1 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	0 <u>1</u> 2 3 4	
Live Trees or Roots	0 <u>1</u> 2 3 4	
Overhanging Veg. = <1 m of Surface	0 <u>1</u> 2 3 4	
Undercut Banks	0 <u>1</u> 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Big Trees (Trunk >0.3 m DBH)	0 1 2 <u>3</u> 4	0 1 2 <u>3</u> 4	
Small Trees (Trunk <0.3 m DBH)	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Woody Shrubs and Saplings	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 <u>2</u> 3 4	0 <u>1</u> 2 3 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	0 1 <u>2</u> 3 4	0 <u>1</u> 2 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 2 <u>3</u> 4	0 1 2 <u>3</u> 4	
Barren, Bare Dirt or Duff	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	<u>0</u> P C B	0 P <u>C</u> B	
Row Crops	<u>0</u> P C B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	71	0	
Right	304	0.18	
Wetted Width xxx.x m		2.23	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		3.29	
Bankfull Height xx.x m		0.80	
Incised Height xx.x m		0.96	

CANOPY COVER MEASUREMENTS					
DENSIOMETER (0-17 Max)					
Flag			Flag		
CenUp	16		CenR	17	
CenL	17		Left		
CenDwn	17		Right		

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: Clark Crk	DATE: 6/25/13	TRANSECT:	☐ A ☐ B ☐ C ☒ D ☐ E ☐ F ☐ G ☐ H ☐ I ☐ J ☐ K	X-tra Side Channel ☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	0.43	24.8	GF	50	
Ctr	0.86	24.1	GF	50	
RCtr	1.29	22.8	HP	0	
Right	1.73	0	HP	0	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	<u>0</u> 1 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	0 1 <u>2</u> 3 4	
Live Trees or Roots	<u>0</u> 1 2 3 4	
Overhanging Veg. = <1 m of Surface	0 1 <u>2</u> 3 4	
Undercut Banks	0 <u>1</u> 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	<u>D</u> C E M N	D C E M <u>N</u>	
Big Trees (Trunk >0.3 m DBH)	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Small Trees (Trunk <0.3 m DBH)	0 <u>1</u> 2 3 4	<u>0</u> 1 2 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Woody Shrubs and Saplings	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	0 <u>1</u> 2 3 4	0 1 <u>2</u> 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 2 <u>3</u> 4	0 1 <u>2</u> 3 4	
Barren, Bare Dirt or Duff	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	<u>0</u> P C B	0 P <u>C</u> B	
Row Crops	<u>0</u> P C B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	284	0.17	
Right	57	0	
Wetted Width xxx.x m		1.73	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		2.59	
Bankfull Height xx.x m		0.66	
Incised Height xx.x m		1.17	

CANOPY COVER MEASUREMENTS					
DENSIOMETER (0-17 Max)					
Flag			Flag		
CenUp	10		CenR	10	
CenL	11		Left	K	
CenDwn	7		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: Clark Crk	DATE: 6/25/13	TRANSECT:	☐ A ☐ B ☐ C ☐ D ☒ E ☐ F ☐ G ☐ H ☐ I ☐ J ☐ K	X-tra Side Channel ☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	0.44	19.7	FN	100	
Ctr	0.88	16.5	GF	10	
RCtr	1.32	19.2	GF	70	
Right	1.76	0	FN	100	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	<u>0</u> 1 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	0 <u>1</u> 2 3 4	
Live Trees or Roots	<u>0</u> 1 2 3 4	
Overhanging Veg. = <1 m of Surface	0 1 2 <u>3</u> 4	
Undercut Banks	0 <u>1</u> 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	D C E M <u>N</u>	<u>D</u> C E M N	
Big Trees (Trunk >0.3 m DBH)	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Small Trees (Trunk <0.3 m DBH)	<u>0</u> 1 2 3 4	0 <u>1</u> 2 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Woody Shrubs and Saplings	0 1 2 3 <u>4</u>	0 1 <u>2</u> 3 4	
Non-Woody Herbs, Grasses, Forbs	<u>0</u> 1 2 3 4	0 1 2 <u>3</u> 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	<u>0</u> 1 2 3 4	0 <u>1</u> 2 3 4	
Non-Woody Herbs, Grasses, Forbs	<u>0</u> 1 2 3 4	0 1 <u>2</u> 3 4	
Barren, Bare Dirt or Duff	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	<u>0</u> P C B	0 P <u>C</u> B	
Row Crops	<u>0</u> P C B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	K	0	F1
Right	303	0.21	
Wetted Width xxx.x m		1.76	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		2.74	
Bankfull Height xx.x m		0.60	
Incised Height xx.x m		0.99	

CANOPY COVER MEASUREMENTS					
DENSIO METER (0-17 Max)					
Flag			Flag		
CenUp	14		CenR	15	
CenL	13		Left	K	
CenDwn	13		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments
F1	Dense blackberry on left bank

RM

SITE ID: Clark Crk

DATE: 6/25/13

TRANSECT:

☐A

☐G

☐B

☐H

☐C

☐I

☐D

☐J

☐E

☐K

☒F

☐

X-tra Side Channel

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	HP	0	
LCtr	0.49	12.5	GF	50	
Ctr	0.98	10.0	GF	30	
RCtr	1.47	11.0	GF	20	
Right	1.97	0	FN	100	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent 1=Sparse 2=Moderate 3=Heavy 4=Very Heavy (circle one)	(0%) (<10%) (10-40%) (40-75%) (>75%)	FLAG
Filamentous Algae	<u>0</u>	1 2 3 4	
Macrophytes	<u>0</u>	1 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u>	1 2 3 4	
Brush/Woody Debris <0.3 (Small)	<u>0</u>	1 2 3 4	
Live Trees or Roots	<u>0</u>	1 2 3 4	
Overhanging Veg. = <1 m of Surface	0	<u>1</u> 2 3 4	
Undercut Banks	<u>0</u>	1 2 3 4	
Boulders	<u>0</u>	1 2 3 4	
Artificial Structures	<u>0</u>	1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)		D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None		
RIPARIAN VEGETATION COVER	Left Bank		Right Bank		Flag
	Canopy (>5 m high)				
Vegetation Type	D C E M <u>N</u>		<u>D</u> C E M N		
Big Trees (Trunk >0.3 m DBH)	<u>0</u> 1 2 3 4		<u>0</u> 1 2 3 4		
Small Trees (Trunk <0.3 m DBH)	<u>0</u> 1 2 3 4		0 1 2 <u>3</u> 4		
	Understory (0.5 to 5 m high)				
Vegetation Type	<u>D</u> C E M N		<u>D</u> C E M N		
Woody Shrubs and Saplings	0 <u>1</u> 2 3 4		0 1 <u>2</u> 3 4		
Non-Woody Herbs, Grasses, Forbs	0 1 <u>2</u> 3 4		0 <u>1</u> 2 3 4		
	Ground Cover (<0.5 m high)				
Woody Shrubs and Saplings	0 <u>1</u> 2 3 4		0 <u>1</u> 2 3 4		
Non-Woody Herbs, Grasses, Forbs	0 1 2 <u>3</u> 4		0 1 2 <u>3</u> 4		
Barren, Bare Dirt or Duff	<u>0</u> 1 2 3 4		0 <u>1</u> 2 3 4		
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank				
	Left Bank		Right Bank		Flag
Wall/Dike/Revetment/ Riprap/Dam	<u>0</u> P C B		<u>0</u> P C B		
Buildings	<u>0</u> P C B		<u>0</u> P C B		
Pavement/Cleared Lot	<u>0</u> P C B		<u>0</u> P C B		
Road/Railroad	<u>0</u> P C B		<u>0</u> P C B		
Pipes (Inlet/Outlet)	<u>0</u> P C B		<u>0</u> P C B		
Landfill/Trash	<u>0</u> P C B		<u>0</u> P C B		
Park/Lawn	<u>0</u> P C B		0 P <u>C</u> B		
Row Crops	<u>0</u> P C B		<u>0</u> P C B		
Pasture/Range/Hay Field	<u>0</u> P C B		<u>0</u> P C B		
Logging Operations	<u>0</u> P C B		<u>0</u> P C B		
Mining Activity	<u>0</u> P C B		<u>0</u> P C B		

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	80	0	
Right	75	0	
Wetted Width xxx.x m		1.97	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		2.90	
Bankfull Height xx.x m		0.68	
Incised Height xx.x m		0.71	

CANOPY COVER MEASUREMENTS					
DENSIOMETER (0-17 Max)					
Flag			Flag		
CenUp	17		CenR	17	
CenL	17		Left	K	
CenDwn	17		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: Clark Crk	DATE: 6/25/13	TRANSECT:	☐ A ☐ B ☐ C ☐ D ☐ E ☐ F ☒ G ☐ H ☐ I ☐ J ☐ K	X-tra Side Channel ☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	0.70	19.3	GF	10	
Ctr	1.40	18.1	GF	20	
RCtr	2.10	14.0	GF	90	
Right	2.80	0	FN	100	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	<u>0</u> 1 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	0 <u>1</u> 2 3 4	
Live Trees or Roots	0 <u>1</u> 2 3 4	
Overhanging Veg. = <1 m of Surface	0 1 <u>2</u> 3 4	
Undercut Banks	0 <u>1</u> 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Big Trees (Trunk >0.3 m DBH)	0 1 2 <u>3</u> 4	0 1 <u>2</u> 3 4	
Small Trees (Trunk <0.3 m DBH)	0 1 <u>2</u> 3 4	0 1 2 <u>3</u> 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Woody Shrubs and Saplings	0 1 <u>2</u> 3 4	0 <u>1</u> 2 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Barren, Bare Dirt or Duff	0 <u>1</u> 2 3 4	<u>0</u> 1 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	<u>0</u> P C B	0 P <u>C</u> B	
Row Crops	<u>0</u> P C B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	291	0.12	
Right	69	0	
Wetted Width xxx.x m		2.80	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		2.56	
Bankfull Height xx.x m		0.67	
Incised Height xx.x m		1.01	

CANOPY COVER MEASUREMENTS					
DENSIOMETER (0-17 Max)					
Flag			Flag		
CenUp	17		CenR	14	
CenL	17		Left	K	
CenDwn	17		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: Clark Crk	DATE: 6/25/12	TRANSECT:	☐ A	☐ B	☐ C	☐ D	☐ E	☐ F	X-tra Side Channel
			☐ G	☒ H	☐ I	☐ J	☐ K		☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	0.64	14.8	GF	10	
Ctr	1.28	12.1	GF	30	
RCtr	1.92	4.8	GF	70	
Right	2.57	0	FN	100	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	<u>0</u> 1 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	0 <u>1</u> 2 3 4	
Live Trees or Roots	<u>0</u> 1 2 3 4	
Overhanging Veg. = <1 m of Surface	0 <u>1</u> 2 3 4	
Undercut Banks	0 <u>1</u> 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Big Trees (Trunk >0.3 m DBH)	0 1 <u>2</u> 3 4	<u>0</u> 1 2 3 4	
Small Trees (Trunk <0.3 m DBH)	0 1 2 <u>3</u> 4	0 1 <u>2</u> 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Woody Shrubs and Saplings	0 1 <u>2</u> 3 4	0 1 2 <u>3</u> 4	
Non-Woody Herbs, Grasses, Forbs	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	0 1 2 <u>3</u> 4	0 1 2 <u>3</u> 4	
Non-Woody Herbs, Grasses, Forbs	0 <u>1</u> 2 3 4	0 1 <u>2</u> 3 4	
Barren, Bare Dirt or Duff	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	0 P C B	0 P C B	
Buildings	0 P C B	0 P C B	
Pavement/Cleared Lot	0 P C B	0 P C B	
Road/Railroad	0 P C B	0 P C B	
Pipes (Inlet/Outlet)	0 P C B	0 P C B	
Landfill/Trash	0 P C B	0 P C B	
Park/Lawn	0 P C B	0 P <u>C</u> B	
Row Crops	0 P C B	0 P C B	
Pasture/Range/Hay Field	0 P C B	0 P C B	
Logging Operations	0 P C B	0 P C B	
Mining Activity	0 P C B	0 P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	56	0	
Right	65	0.06	
Wetted Width xxx.x m		2.57	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		3.20	
Bankfull Height xx.x m		0.66	
Incised Height xx.x m		1.08	

CANOPY COVER MEASUREMENTS					
DENSIOMETER (0-17 Max)					
Flag			Flag		
CenUp	17		CenR	17	
CenL	17		Left	K	
CenDwn	17		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: Clark Crk	DATE: 6/25/12	TRANSECT:	☐ A ☐ G	☐ B ☐ H	☐ C ☒ I	☐ D ☐ J	☐ E ☐ K	☐ F X-tra Side Channel ☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	0.72	7.6	GF	10	
Ctr	1.44	6.5	GF	30	
RCtr	2.16	7.4	GF	40	
Right	2.87	0	FN	100	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	<u>0</u> 1 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	0 <u>1</u> 2 3 4	
Live Trees or Roots	0 <u>1</u> 2 3 4	
Overhanging Veg. = <1 m of Surface	0 <u>1</u> 2 3 4	
Undercut Banks	0 <u>1</u> 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Big Trees (Trunk >0.3 m DBH)	0 1 <u>2</u> 3 4	<u>0</u> 1 2 3 4	
Small Trees (Trunk <0.3 m DBH)	0 1 <u>2</u> 3 4	0 1 2 <u>3</u> 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Woody Shrubs and Saplings	0 1 <u>2</u> 3 4	0 1 2 <u>3</u> 4	
Non-Woody Herbs, Grasses, Forbs	0 <u>1</u> 2 3 4	0 <u>1</u> 2 3 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	0 1 2 <u>3</u> 4	<u>0</u> 1 2 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Barren, Bare Dirt or Duff	<u>0</u> 1 2 3 4	0 1 <u>2</u> 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	<u>0</u> P C B	0 P <u>C</u> B	
Row Crops	<u>0</u> P C B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	61	0	
Right	301	0.14	
Wetted Width xxx.x m		2.87	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		3.75	
Bankfull Height xx.x m		0.46	
Incised Height xx.x m		1.08	

CANOPY COVER MEASUREMENTS					
DENSIMETER (0-17 Max)					
Flag			Flag		
CenUp	17		CenR	17	
CenL	17		Left	K	
CenDwn	17		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: Clark Crk	DATE: 6/25/13	TRANSECT:	☐ A ☐ G	☐ B ☐ H	☐ C ☐ I	☐ D ☒ J	☐ E ☐ K	☐ F X-tra Side Channel ☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	0.64	21.2	GF	20	
Ctr	1.28	20.4	GF	20	
RCtr	1.92	12.1	SA	100	
Right	2.54	0	HP	0	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	<u>0</u> 1 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	0 1 <u>2</u> 3 4	
Live Trees or Roots	<u>0</u> 1 2 3 4	
Overhanging Veg. = <1 m of Surface	0 1 <u>2</u> 3 4	
Undercut Banks	<u>0</u> 1 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	D C E <u>M</u> N	D C E M <u>N</u>	
Big Trees (Trunk >0.3 m DBH)	0 1 <u>2</u> 3 4	<u>0</u> 1 2 3 4	
Small Trees (Trunk <0.3 m DBH)	0 1 <u>2</u> 3 4	<u>0</u> 1 2 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Woody Shrubs and Saplings	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	0 <u>1</u> 2 3 4	0 1 <u>2</u> 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Barren, Bare Dirt or Duff	0 <u>1</u> 2 3 4	<u>0</u> 1 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	<u>0</u> P C B	0 P <u>C</u> B	
Row Crops	<u>0</u> P C B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	34	0	
Right	74	0	
Wetted Width xxx.x m		2.54	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		4.11	
Bankfull Height xx.x m		0.57	
Incised Height xx.x m		1.17	

CANOPY COVER MEASUREMENTS					
DENSIOMETER (0-17 Max)					
Flag			Flag		
CenUp	17		CenR	17	
CenL	17		Left	K	
CenDwn	17		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: Clark Crk	DATE: 6/25/13	TRANSECT:	☐ A ☐ G	☐ B ☐ H	☐ C ☐ I	☐ D ☐ J	☐ E ☒ K	☐ F ☐	X-tra Side Channel ☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	1.02	17.0	GF	0	
Ctr	2.04	0	GF	50	F1
RCtr	3.06	6.0	GF	70	
Right	4.06	0	HP	0	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	0 1 2 3 4	
Macrophytes	0 1 2 3 4	
Woody Debris >0.3 m (Big)	0 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	0 1 2 3 4	
Live Trees or Roots	0 1 2 3 4	
Overhanging Veg. = <1 m of Surface	0 1 2 3 4	
Undercut Banks	0 1 2 3 4	
Boulders	0 1 2 3 4	
Artificial Structures	0 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	D C E M N	D C E M N	
Big Trees (Trunk >0.3 m DBH)	0 1 2 3 4	0 1 2 3 4	
Small Trees (Trunk <0.3 m DBH)	0 1 2 3 4	0 1 2 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	D C E M N	D C E M N	
Woody Shrubs and Saplings	0 1 2 3 4	0 1 2 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 2 3 4	0 1 2 3 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	0 1 2 3 4	0 1 2 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 2 3 4	0 1 2 3 4	
Barren, Bare Dirt or Duff	0 1 2 3 4	0 1 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	0 P C B	0 P C B	
Buildings	0 P C B	0 P C B	
Pavement/Cleared Lot	0 P C B	0 P C B	
Road/Railroad	0 P C B	0 P C B	
Pipes (Inlet/Outlet)	0 P C B	0 P C B	
Landfill/Trash	0 P C B	0 P C B	
Park/Lawn	0 P C B	0 P C B	
Row Crops	0 P C B	0 P C B	
Pasture/Range/Hay Field	0 P C B	0 P C B	
Logging Operations	0 P C B	0 P C B	
Mining Activity	0 P C B	0 P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	90	0.15	F1
Right	62	0	
Wetted Width xxx.x m		4.06	
Bar Width xx.x m		0.80	
Bankfull Width xxx.x m		5.06	
Bankfull Height xx.x m		0.61	
Incised Height xx.x m		1.15	

CANOPY COVER MEASUREMENTS					
DENSIMETER (0-17 Max)					
Flag			Flag		
CenUp	17		CenR	17	
CenL	17		Left	K	
CenDwn	16		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments
F1	Gravel bar

RIPARIAN "LEGACY" TREES AND INVASIVE ALIEN PLANTS

SITE ID: Clark Crk

DATE: 6/25/13

TRAN	LARGEST LEGACY TREE VISIBLE FROM THIS STATION						ALIEN PLANT SPECIES PRESENT IN LEFT AND RIGHT RIPARIAN PLOTS			
	Trees not Visible	DBH (m)	Height (m)	Dist. from wetted margin (m)	Type	Taxonomic Category	Check all that are present			
A	☐	☐ 0-0.1 ☐ .75-2 ☐ .1-.3 ☐ >2 ☒ .3-.75	☐ <5 ☒ 5-15 ☐ 15-30 ☐ >30	1	☒ Deciduous ☐ Coniferous ☐ Broadleaf Evergreen	Cherry	☐ None	☒ RC Grass ☐ Salt Ced ☒ Hblack ☐ G Reed ☐ Engl Ivy ☐ CanThis ☐ Teasel ☐ C Burd ☐ Ch Grass ☐ M This ☐ Spurge ☐ Rus Ol		
B	☐	☐ 0-0.1 ☐ .75-2 ☒ .1-.3 ☐ >2 ☐ .3-.75	☐ <5 ☒ 5-15 ☐ 15-30 ☐ >30	0	☒ Deciduous ☐ Coniferous ☐ Broadleaf Evergreen	Maple	☐ None	☒ RC Grass ☐ Salt CED ☒ Hblack ☐ G Reed ☐ Engl Ivy ☐ Can This ☐ Teasel ☐ C Burd ☐ Ch Grass ☐ M This ☐ Spurge ☐ Rus Ol		
C	☐	☐ 0-0.1 ☐ .75-2 ☐ .1-.3 ☐ >2 ☒ .3-.75	☐ <5 ☒ 5-15 ☐ 15-30 ☐ >30	20	☒ Deciduous ☐ Coniferous ☐ Broadleaf Evergreen	Cherry	☐ None	☒ RC Grass ☐ Salt Ced ☒ Hblack ☐ G Reed ☐ Engl Ivy ☐ Can This ☐ Teasel ☐ C Burd ☐ Ch Grass ☐ M This ☐ Spurge ☐ Rus Ol		

INSTRUCTIONS

Legacy trees are defined as the largest tree within your search area, which is as far as you can see, but within maximum limits as follows:

Wadeable Streams: Confine search to no more than 50 m from left and right bank and extending upstream to next transect (for 'K' look upstream 4 channel widths)

Non-wadeable Rivers: Confine search to no more than 100 m from left and right bank and extending both upstream and downstream as far as you can see confidently.

Alien Plants: Confine search to riparian plots on left and right bank

Wadeable Streams: 10 m x 10 m

Non-wadeable Rivers: 10 m x 20 m

Not all aliens are to be identified in all states. See Field Manual and Plant Identification Guide.

TAXONOMIC CATEGORIES

Acacia/Mesquite
Alder/Birch
Ash
Maple/Box elder
Oak
Poplar/Cottonwood
Sycamore
Willow
Unknown or Other Deciduous

Cedar/Cypress/Sequoia
Fir (including Douglas Fir and Hemlock)
Juniper
Pine

Spruce
Unknown or Other Deciduous

Unknown or Other Broadleaf Evergreen

Snag (Dead tree of any species)

ALIEN SPECIES

RC Grass	Reed Canarygrass	<i>Phalaris arundinacea</i>
Engl Ivy	English Ivy	<i>Hedera Helix</i>
ChGrass	Cheat Grass	<i>Bromus tectorum</i>
Salt Ced	Salt Cedar	<i>Tamarix spp.</i>
Can This	Canada thistle	<i>Cirsium arvense</i>
M This	Musk thistle	<i>Carduus nutans</i>
Hblack	Himalayan blackberry	<i>Rubus discolor</i>
Teasel	Teasel	<i>Dipsacus fullonum</i>
Spurge	Leafy spurge	<i>Euphorbia esula</i>
G Reed	Giant Reed	<i>Arundo donax</i>
C Burd	Common burdock	<i>Arctium minus</i>
Rus Ol	Russian-olive	<i>Elaeagnus angustifolia</i>

COMMENTS

Transects D to K continued on next page

RIPARIAN "LEGACY" TREES AND INVASIVE ALIEN PLANTS

SITE ID: Clark Crk

DATE: 6/25/13

TRAN	LARGEST LEGACY TREE VISIBLE FROM THIS STATION						ALIEN PLANT SPECIES PRESENT IN LEFT AND RIGHT RIPARIAN PLOTS				
	Trees not Visible	DBH (m)	Height (m)	Dist. from wetted margin (m)	Type	Taxonomic Category	Check all that are present				
D	☐	☐ 0-0.1 ☐ .75-2 ☒ .1-.3 ☐ >2 ☐ .3-.75	☐ <5 ☒ 5-15 ☐ 15-30 ☐ >30	20	☒ Deciduous ☐ Coniferous ☐ Broadleaf Evergreen	Ash	☐ None	☒ RC Grass ☐ Engl Ivy ☐ Ch Grass	☐ Salt Ced ☐ CanThis ☐ M This	☒ Hblack ☐ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol
E	☐	☐ 0-0.1 ☐ .75-2 ☒ .1-.3 ☐ >2 ☐ .3-.75	☐ <5 ☒ 5-15 ☐ 15-30 ☐ >30	1	☒ Deciduous ☐ Coniferous ☐ Broadleaf Evergreen	Ash	☐ None	☐ RC Grass ☐ Engl Ivy ☐ Ch Grass	☐ Salt CED ☐ Can This ☐ M This	☒ Hblack ☐ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol
F	☐	☐ 0-0.1 ☐ .75-2 ☒ .1-.3 ☐ >2 ☐ .3-.75	☐ <5 ☒ 5-15 ☐ 15-30 ☐ >30	1	☒ Deciduous ☐ Coniferous ☐ Broadleaf Evergreen	Maple	☐ None	☒ RC Grass ☐ Engl Ivy ☐ Ch Grass	☐ Salt Ced ☐ Can This ☐ M This	☒ Hblack ☐ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol
G	☐	☐ 0-0.1 ☐ .75-2 ☒ .1-.3 ☐ >2 ☐ .3-.75	☐ <5 ☒ 5-15 ☐ 15-30 ☐ >30	1	☐ Deciduous ☐ Coniferous ☐ Broadleaf Evergreen	Ash	☐ None	☒ RC Grass ☐ Engl Ivy ☐ Ch Grass	☐ Salt Ced ☐ Can This ☐ M This	☒ Hblack ☐ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol
H	☐	☐ 0-0.1 ☐ .75-2 ☐ .1-.3 ☐ >2 ☒ .3-.75	☐ <5 ☐ 5-15 ☒ 15-30 ☐ >30	25	☐ Deciduous ☒ Coniferous ☐ Broadleaf Evergreen	Douglas Fir	☐ None	☒ RC Grass ☐ Engl Ivy ☐ Ch Grass	☐ Salt Ced ☐ Can This ☐ M This	☒ Hblack ☐ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol
I	☐	☐ 0-0.1 ☐ .75-2 ☐ .1-.3 ☐ >2 ☒ .3-.75	☐ <5 ☐ 5-15 ☒ 15-30 ☐ >30	25	☐ Deciduous ☒ Coniferous ☐ Broadleaf Evergreen	Douglas Fir	☐ None	☒ RC Grass ☒ Engl Ivy ☐ Ch Grass	☐ Salt Ced ☐ Can This ☐ M This	☒ Hblack ☐ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol
J	☐	☐ 0-0.1 ☒ .75-2 ☐ .1-.3 ☐ >2 ☐ .3-.75	☐ <5 ☐ 5-15 ☐ 15-30 ☒ >30	10	☐ Deciduous ☒ Coniferous ☐ Broadleaf Evergreen	Douglas Fir	☐ None	☒ RC Grass ☐ Engl Ivy ☐ Ch Grass	☐ Salt Ced ☐ Can This ☐ M This	☒ Hblack ☐ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol
K	☐	☐ 0-0.1 ☐ .75-2 ☐ .1-.3 ☐ >2 ☒ .3-.75	☐ <5 ☐ 5-15 ☐ 15-30 ☒ >30	20	☐ Deciduous ☒ Coniferous ☐ Broadleaf Evergreen	Douglas Fir	☐ None	☒ RC Grass ☒ Engl Ivy ☐ Ch Grass	☐ Salt Ced ☐ Can This ☐ M This	☒ Hblack ☐ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol

Appendix E

Physical Habitat Data – Pringle Creek



PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

		SITE ID: Pringle						DATE: 6/19/13		TRANSECT:				A-B F-G				B-C G-H				C-D H-I				D-E I-J				E-F J-K	
THALWEG PROFILE								For Transect A-B ONLY			Increment (m)x.x:		2.9 m		Total Reach Length (m)		292.68 m														
STATI ON	THALWEG DEPTH (cm) (xx.x)	WETTED WIDTH (m) (XXX.X)	BAR WIDTH ¹		SOFT/ SMALL SEDIMENT (Y/N)	CHANNEL UNIT CODE	POOL FORM CODE	SIDE CHANNEL (Y/N)	BACK WATER (Y/N)	FLAG	COMMENTS																				
			Present (Y/ N)	XX.X																											
0	20.5	10.52	Y	4.27	N	RI	N	N	N																						
1	20.0		Y		N	RI	N	N	N																						
2	15.6		Y		N	RI	N	N	N																						
3	16.8		Y		N	RI	N	N	N																						
4	15.6		Y		N	RI	N	N	N																						
5	16.5	13.72	N	-	N	GL	N	N	N																						
6	18.9		N		N	GL	N	N	N																						
7	18.9	-	N	-	N	GL	N	N	N																						
8	19.5		N		N	GL	N	N	N																						
9	19.4		N		N	GL	N	N	N																						
10	-																														
11	-																														
12	-																														
13	-																														
14	-										Yellow jacket nest at transect B in dense vegetation.																				

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	5	FN	CB	CB	CB	FN	

FLAG	COMMENTS

SUBSTRATE SIZE CLASS CODES	POOL FORM CODES	CHANNEL UNIT CODES
RS = BEDROCK (SMOOTH)-(Larger than a car)	N= Not a pool	PP = Pool, Plunge
RR = BEDROCK (ROUGH)-(Larger than a car)	W= Large Woody Debris	PT = Pool, Trench
BL = BOULDER (250 to 400 mm)-(Basketball to car)	R = Rootwad	PL = Pool, Lateral Scour
CB = COBBLE (64 to 250 mm)-(Tennis ball to basketball)	B = Boulder or Bedrock	PB = Pool, Backwater
GC = COARSE GRAVEL (16 to 64mm)-(Marble to Tennis ball)	F = Unknown, fluvial	PD = Pool, Impoundment
GF = FINE GRAVEL (2 to 16mm)-(Ladybug to marble)	COMBINATIONS:	GL = Glide
SA = SAND (0.06 to 2mm)-(Gritty up to ladybug size)	Eg. WR, BR, WRB	RI = Riffle
FN = SILT/CLAY/MUCK-(Not gritty)		RA = Rapid
HP = HARDPAN-(Firm, Consolidated, Fine Substrate)		CA = Cascade
WD = WOOD-(Any Size)		FA = Falls
OT = OTHER (Write comment on back of form)		DR = Dry Channel

Flag Codes: K = no measurement made, U = suspect measurement F1, F2, etc. – flags assigned by each field crew. Explain all flags in comments. 1 = Measure Bar Width at Station 0 and mid-station (5 or 7)

LARGE WOODY DEBRIS (≥ 10 cm small end diameter; 1.5 m length)				CHECK IF ALL UNMARKED BOXES ARE ZERO		X	FLAG	
Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel				
	Length 1.5-5 m	5-15 m	>15 m	Length 1.5-5 m	5-15 m	>15 m		
0.1-<0.3 m								
0.3-0.5 m								
0.5-0.8 m								
>0.8 m								

PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

[illegible]

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	5	FN	CB	CB	CB	FN	

FLAG	COMMENTS

SUBSTRATE SIZE CLASS CODES	POOL FORM CODES	CHANNEL UNIT CODES
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Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel				
	Length 1.5-5 m	5-15 m	>15 m	Length 1.5-5 m	5-15 m	>15 m		
0.1-<0.3 m								
0.3-0.5 m								
0.5-0.8 m								
>0.8 m								

Flag Codes: K = no measurement made, U = suspect measurement F1, F2, etc. – flags assigned by each field crew. Explain all flags in comments. 1 = Measure Bar Width at Station 0 and mid-station (5 or 7)

PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

[illegible]

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	5	GF	GC	GC	CB	WD	

FLAG	COMMENTS

SUBSTRATE SIZE CLASS CODES	POOL FORM CODES	CHANNEL UNIT CODES
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HP = HARDPAN-(Firm, Consolidated, Fine Substrate)		CA = Cascade
WD = WOOD-(Any Size)		FA = Falls
OT = OTHER (Write comment on back of form)		DR = Dry Channel

Flag Codes: K = no measurement made, U = suspect measurement F1, F2, etc. – flags assigned by each field crew. Explain all flags in comments. 1 = Measure Bar Width at Station 0 and mid-station (5 or 7)

LARGE WOODY DEBRIS (≥ 10 cm small end diameter; 1.5 m length)				CHECK IF ALL UNMARKED BOXES ARE ZERO		X	FLAG	
Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel				
	Length 1.5-5 m	5-15 m	>15 m	Length 1.5-5 m	5-15 m	>15 m		
0.1-<0.3 m	1	1						
0.3-0.5 m								
0.5-0.8 m								
>0.8 m								

PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

[illegible]

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	5	GC	GC	GC	CB	GC	

FLAG	COMMENTS

SUBSTRATE SIZE CLASS CODES	POOL FORM CODES	CHANNEL UNIT CODES
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LARGE WOODY DEBRIS (≥ 10 cm small end diameter; 1.5 m length)				CHECK IF ALL UNMARKED BOXES ARE ZERO		X	FLAG	
Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel				
	Length 1.5-5 m	5-15 m	>15 m	Length 1.5-5 m	5-15 m	>15 m		
0.1-<0.3 m								
0.3-0.5 m								
0.5-0.8 m								
>0.8 m								

PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

SITE ID: Pringle						DATE: 6/19/13		TRANSECT:		☐	A-B	☐	B-C	☐	C-D	☐	D-E	☒	E-F
										☐	F-G	☐	G-H	☐	H-I	☐	I-J	☐	J-K

THALWEG PROFILE								For Transect A-B ONLY			Increment (m) x.x:		Total Reach Length (m)	
STATION	THALWEG DEPTH (cm) (xx.x)	WETTED WIDTH (m) (XXX.X)	BAR WIDTH ⁵		SOFT/ SMALL SEDIMENT (Y/N)	CHANNEL UNIT CODE	POOL FORM CODE	SIDE CHANNEL (Y/N)	BACK WATER (Y/N)	FLAG	COMMENTS			
			Present (Y/ N)	XX.X										
0	25.8	6.71	N	-	N	RI	N	N	N					
1	19.4		N		N	RI	N	N	N					
2	19.7		N		N	RI	N	N	N					
3	21.4		N		N	GL	N	N	N					
4	19.0		N		N	GL	N	N	N					
5	18.4	9.60	N	-	N	GL	N	N	N					
6	15.2		N		N	RI	N	N	N					
7	15.6	-	N	-	N	RI	N	N	N					
8	17.8		N		N	RI	N	N	N					
9	18.1		N		N	GL	N	N	N					
10	-													
11	-													
12	-													
13	-													
14	-													

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	5	GC	CB	CB	GC	CB	

FLAG	COMMENTS

SUBSTRATE SIZE CLASS CODES	POOL FORM CODES	CHANNEL UNIT CODES
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Flag Codes: K = no measurement made, U= suspect measurement F1, F2, etc. – flags assigned by each field crew. Explain all flags in comments. 1 = Measure Bar Width at Station 0 and mid-station (5 or 7)

LARGE WOODY DEBRIS (10 cm small end diameter; 1.5 m length)				CHECK IF ALL UNMARKED BOXES ARE ZERO		X	FLAG	
Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel				
	Length 1.5-5 m	5-15 m	>15 m	Length 1.5-5 m	5-15 m	>15 m		
0.1-<0.3 m	11	2						
0.3-0.5 m								
0.5-0.8 m								
>0.8 m								

PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

[illegible]

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	5	GF	GC	GC	GC	FN	

FLAG	COMMENTS

SUBSTRATE SIZE CLASS CODES	POOL FORM CODES	CHANNEL UNIT CODES
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FN = SILT/CLAY/MUCK-(Not gritty)		RA = Rapid
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Flag Codes: K = no measurement made, U = suspect measurement F1, F2, etc. – flags assigned by each field crew. Explain all flags in comments. 1 = Measure Bar Width at Station 0 and mid-station (5 or 7)

LARGE WOODY DEBRIS (10 cm small end diameter; 1.5 m length)				CHECK IF ALL UNMARKED BOXES ARE ZERO		X	FLAG	
Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel				
	Length 1.5-5 m	5-15 m	>15 m	Length 1.5-5 m	5-15 m	>15 m		
0.1-<0.3 m								
0.3-0.5 m								
0.5-0.8 m								
>0.8 m								

PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

SITE ID: Pringle					DATE: 6/19/13			TRANSECT:		☐	A-B	☐	B-C	☐	C-D	☐	D-E	☐	E-F
										☐	F-G	☒	G-H	☐	H-I	☐	I-J	☐	J-K
THALWEG PROFILE								For Transect A-B ONLY			Increment (m) x.x:		Total Reach Length (m)						
STATION	THALWEG DEPTH (cm) (xx.x)	WETTED WIDTH (m) (XXX.X)	BAR WIDTH'		SOFT/ SMALL SEDIMENT (Y/N)	CHANNEL UNIT CODE	POOL FORM CODE	SIDE CHANNEL (Y/N)	BACK WATER (Y/N)	FLAG	COMMENTS								
			Present (Y/ N)	XX.X															
0	22.6	8.69	Y	2.13	N	RI	N	N	N										
1	26.4		Y		N	RI	N	Y	N										
2	26.2		Y		N	GL	N	Y	N										
3	48.2		Y		N	GL	N	Y	N										
4	31.7		Y		N	RI	N	Y	N										
5	14.3	19.51	Y	12.34	N	RI	N	Y	N										
6	18.1		Y		N	RI	N	Y	N										
7	18.8	-	Y	*	N	RI	N	Y	N										
8	21.3		Y		N	RI	N	Y	N										
9	20.5		Y		N	GL	N	Y	N										
10	-																		
11	-																		
12	-																		
13	-																		
14	-																		

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	5	GC	CB	FN	CB	FN	

FLAG	COMMENTS

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LARGE WOODY DEBRIS (10 cm small end diameter; 1.5 m length)			CHECK IF ALL UNMARKED BOXES ARE ZERO		X	FLAG
Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel		
	Length 1.5-5 m	5-15 m	>15 m	Length 1.5-5 m	5-15 m	>15 m
0.1-<0.3 m	1					
0.3-0.5 m						
0.5-0.8 m						
>0.8 m						

PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

[illegible]

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	5	FN	GC	GC	GF	OT	

FLAG	COMMENTS

SUBSTRATE SIZE CLASS CODES	POOL FORM CODES	CHANNEL UNIT CODES
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LARGE WOODY DEBRIS (10 cm small end diameter; 1.5 m length)				CHECK IF ALL UNMARKED BOXES ARE ZERO		X	FLAG	
Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel				
	Length 1.5-5 m	5-15 m	>15 m	Length 1.5-5 m	5-15 m	>15 m		
0.1-<0.3 m								
0.3-0.5 m								
0.5-0.8 m								
>0.8 m								

PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

[illegible]

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	5	FN	CB	CB	CB	FN	

FLAG	COMMENTS

SUBSTRATE SIZE CLASS CODES	POOL FORM CODES	CHANNEL UNIT CODES
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RR = BEDROCK (ROUGH)-(Larger than a car)	W= Large Woody Debris	PT = Pool, Trench
BL = BOULDER (250 to 400 mm)-(Basketball to car)	R = Rootwad	PL = Pool, Lateral Scour
CB = COBBLE (64 to 250 mm)-(Tennis ball to basketball)	B = Boulder or Bedrock	PB = Pool, Backwater
GC = COARSE GRAVEL (16 to 64mm)-(Marble to Tennis ball)	F = Unknown, fluvial	PD = Pool, Impoundment
GF = FINE GRAVEL (2 to 16mm)-(Ladybug to marble)	COMBINATIONS:	GL = Glide
SA = SAND (0.06 to 2mm)-(Gritty up to ladybug size)	Eg. WR, BR, WRB	RI = Riffle
FN = SILT/CLAY/MUCK-(Not gritty)		RA = Rapid
HP = HARDPAN-(Firm, Consolidated, Fine Substrate)		CA = Cascade
WD = WOOD-(Any Size)		FA = Falls
OT = OTHER (Write comment on back of form)		DR = Dry Channel

LARGE WOODY DEBRIS (10 cm small end diameter; 1.5 m length)				CHECK IF ALL UNMARKED BOXES ARE ZERO		X	FLAG	
Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel				
	Length 1.5-5 m	5-15 m	>15 m	Length 1.5-5 m	5-15 m	>15 m		
0.1-<0.3 m								
0.3-0.5 m								
0.5-0.8 m								
>0.8 m								

Flag Codes: K = no measurement made, U = suspect measurement F1, F2, etc. – flags assigned by each field crew. Explain all flags in comments. 1 = Measure Bar Width at Station 0 and mid-station (5 or 7)

PHAB: THALWEG PROFILE & WOODY DEBRIS FORM STREAMS

SITE ID: Pringle				DATE: 6/26/12				TRANSECT:		☐ A-B ☐ F-G	☐ B-C ☐ G-H	☐ C-D ☐ H-I	☐ D-E ☐ I-J	☐ E-F ☒ J-K
THALWEG PROFILE								For Transect A-B ONLY			Increment (m)x.x:	1.0	Total Reach Length (m)	150
STATION	THALWEG DEPTH (cm) (xx.x)	WETTED WIDTH (m) (XXX.X)	BAR WIDTH ¹⁰		SOFT/ SMALL SEDIMENT (Y/N)	CHANNEL UNIT CODE	POOL FORM CODE	SIDE CHANNEL (Y/N)	BACK WATER (Y/N)	FLAG	COMMENTS			
			Present (Y/ N)	XX.X										
0	38.1	8.53	N	-	N	GL	N	N	N					
1	16.4		N		N	RI	N	N	N		Immediately down from manmade cobble dam			
2	25.7		N		N	GL	N	N	N					
3	22.8		Y		N	GL	N	N	N					
4	28.0		Y		N	GL	N	N	N					
5	28.6	7.77	N	-	N	PL	F	N	N					
6	41.6		N		N	PL	F	N	N					
7	51.1	-	N	-	N	PL	F	N	N					
8	64.6		N		N	PL	F	N	N					
9	70.1		N		N	PL	F	N	N					
10	-													
11	-													
12	-													
13	-													
14	-													

SUBSTRATE	Station (5 or 7)	LFT	LCTR	CTR	RCTR	RGT	FLAG
	5	GF	GC	CB	GC	FN	

FLAG	COMMENTS

SUBSTRATE SIZE CLASS CODES	POOL FORM CODES	CHANNEL UNIT CODES
RS = BEDROCK (SMOOTH)-(Larger than a car) RR = BEDROCK (ROUGH)-(Larger than a car) BL = BOULDER (250 to 400 mm)-(Basketball to car) CB = COBBLE (64 to 250 mm)-(Tennis ball to basketball) GC = COARSE GRAVEL (16 to 64mm)-(Marble to Tennis ball) GF = FINE GRAVEL (2 to 16mm)-(Ladybug to marble) SA = SAND (0.06 to 2mm)-(Gritty up to ladybug size) FN = SILT/CLAY/MUCK-(Not gritty) HP = HARDPAN-(Firm, Consolidated, Fine Substrate) WD = WOOD-(Any Size) OT = OTHER (Write comment on back of form)	N= Not a pool W= Large Woody Debris R = Rootwad B = Boulder or Bedrock F = Unknown, fluvial COMBINATIONS: Eg. WR, BR, WRB	PP = Pool, Plunge PT = Pool, Trench PL = Pool, Lateral Scour PB = Pool, Backwater PD = Pool, Impoundment GL = Glide RI = Riffle RA = Rapid CA = Cascade FA = Falls DR = Dry Channel

LARGE WOODY DEBRIS (10 cm small end diameter; 1.5 m length)				CHECK IF ALL UNMARKED BOXES ARE ZERO		X	FLAG
Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel			
	Length 1.5-5 m	5-15 m	>15 m	Length 1.5-5 m	5-15 m	>15 m	
0.1-<0.3 m	☐	☐	☐	☐	☐	☐	
0.3-0.5 m	☐	☐	☐	☐	☐	☐	
0.5-0.8 m	☐	☐	☐	☐	☐	☐	
>0.8 m	☐	☐	☐	☐	☐	☐	

Flag Codes: K = no measurement made, U = suspect measurement F1, F2, etc. – flags assigned by each field crew. Explain all flags in comments. 1 = Measure Bar Width at Station 0 and mid-station (5 or 7)

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: Pringle	DATE: 6/25/13	TRANSECT:	☒ A ☐ G	☐ B ☐ H	☐ C ☐ I	☐ D ☐ J	☐ E ☐ K	☐ F ☐	X-tra Side Channel ☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	2.63	23.4	CB	10	
Ctr	5.26	0	CB/GC	0	F1
RCtr	7.89	0	CB/GC	0	F1
Right	10.52	0	FN	100	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	<u>0</u> 1 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	<u>0</u> 1 2 3 4	
Live Trees or Roots	0 1 <u>2</u> 3 4	
Overhanging Veg. = <1 m of Surface	0 1 <u>2</u> 3 4	
Undercut Banks	0 <u>1</u> 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Big Trees (Trunk >0.3 m DBH)	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Small Trees (Trunk <0.3 m DBH)	0 <u>1</u> 2 3 4	0 1 <u>2</u> 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Woody Shrubs and Saplings	0 1 <u>2</u> 3 4	0 1 2 <u>3</u> 4	
Non-Woody Herbs, Grasses, Forbs	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 2 <u>3</u> 4	0 <u>1</u> 2 3 4	
Barren, Bare Dirt or Duff	0 <u>1</u> 2 3 4	<u>0</u> 1 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	<u>0</u> P C B	<u>0</u> P C B	
Row Crops	<u>0</u> P C B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	296	0.24	
Right	68	0	
Wetted Width xxx.x m		10.52	
Bar Width xx.x m		4.27	
Bankfull Width xxx.x m		10.82	
Bankfull Height xx.x m		0.67	
Incised Height xx.x m		1.04	

CANOPY COVER MEASUREMENTS					
DENSIMETER (0-17 Max)					
Flag			Flag		
CenUp	13		CenR	13	
CenL	12		Left	K	
CenDwn	12		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments
F1	Cobble bar

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: Pringle	DATE: 6/25/13	TRANSECT:	☐ A ☒ B ☐ C ☐ D ☐ E ☐ F ☐ G ☐ H ☐ I ☐ J ☐ K	X-tra Side Channel ☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	2.29	22.9	CB	0	
Ctr	4.58	19.8	CB	0	
RCtr	6.87	32.0	CB	0	
Right	9.14	0	FN	100	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	<u>0</u> 1 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	0 <u>1</u> 2 3 4	
Live Trees or Roots	<u>0</u> 1 2 3 4	
Overhanging Veg. = <1 m of Surface	0 <u>1</u> 2 3 4	
Undercut Banks	0 <u>1</u> 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Big Trees (Trunk >0.3 m DBH)	0 1 <u>2</u> 3 4	0 1 2 <u>3</u> 4	
Small Trees (Trunk <0.3 m DBH)	0 <u>1</u> 2 3 4	0 1 <u>2</u> 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Woody Shrubs and Saplings	0 1 2 <u>3</u> 4	0 1 2 <u>3</u> 4	
Non-Woody Herbs, Grasses, Forbs	0 1 <u>2</u> 3 4	0 <u>1</u> 2 3 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	0 <u>1</u> 2 3 4	0 <u>1</u> 2 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 2 <u>3</u> 4	0 1 2 <u>3</u> 4	
Barren, Bare Dirt or Duff	0 <u>1</u> 2 3 4	0 <u>1</u> 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	<u>0</u> P C B	<u>0</u> P C B	
Row Crops	<u>0</u> P C B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	67	0	
Right	74	0	
Wetted Width xxx.x m		9.14	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		9.91	
Bankfull Height xx.x m		0.67	
Incised Height xx.x m		0.67	

CANOPY COVER MEASUREMENTS					
DENSIO METER (0-17 Max)					
Flag			Flag		
CenUp	9		CenR	13	
CenL	11		Left	K	
CenDwn	13		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: Pringle	DATE: 6/26/12	TRANSECT:	☐ A ☐ G	☐ B ☐ H	☒ C ☐ I	☐ D ☐ J	☐ E ☐ K	☐ F X-tra Side Channel ☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	2.32	19.8	CB	0	
Ctr	4.65	19.8	CB	0	
RCtr	6.97	41.1	CB	0	
Right	8.89	0	FN	100	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	<u>0</u> 1 2 3 4	
Woody Debris >0.3 m (Big)	0 <u>1</u> 2 3 4	
Brush/Woody Debris <0.3 (Small)	0 <u>1</u> 2 3 4	
Live Trees or Roots	<u>0</u> 1 2 3 4	
Overhanging Veg. = <1 m of Surface	0 <u>1</u> 2 3 4	
Undercut Banks	0 <u>1</u> 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Big Trees (Trunk >0.3 m DBH)	0 1 2 <u>3</u> 4	0 1 2 <u>3</u> 4	
Small Trees (Trunk <0.3 m DBH)	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Woody Shrubs and Saplings	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Non-Woody Herbs, Grasses, Forbs	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	0 <u>1</u> 2 3 4	0 1 <u>2</u> 3 4	
Non-Woody Herbs, Grasses, Forbs	0 <u>1</u> 2 3 4	<u>0</u> 1 2 3 4	
Barren, Bare Dirt or Duff	0 1 <u>2</u> 3 4	<u>0</u> 1 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	<u>0</u> P <u>C</u> B	<u>0</u> P C B	
Row Crops	<u>0</u> P C B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	40	0	
Right	75	0	
Wetted Width xxx.x m		9.30	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		9.78	
Bankfull Height xx.x m		0.70	
Incised Height xx.x m		0.70	

CANOPY COVER MEASUREMENTS					
DENSIOMETER (0-17 Max)					
Flag			Flag		
CenUp	17		CenR	16	
CenL	17		Left	K	
CenDwn	15		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: Pringle	DATE: 6/26/12	TRANSECT:	☐ A	☐ B	☐ C	☒ D	☐ E	☐ F	X-tra Side Channel
			☐ G	☐ H	☐ I	☐ J	☐ K		☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	2.06	38.4	CB	0	
Ctr	4.12	36.9	CB	0	
RCtr	6.18	35.1	GC	0	
Right	8.23	0	FN	100	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	<u>0</u> 1 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	0 <u>1</u> 2 3 4	
Live Trees or Roots	<u>0</u> 1 2 3 4	
Overhanging Veg. = <1 m of Surface	0 1 <u>2</u> 3 4	
Undercut Banks	<u>0</u> 1 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	D C E M <u>N</u>	<u>D</u> C E M N	
Big Trees (Trunk >0.3 m DBH)	<u>0</u> 1 2 3 4	0 1 <u>2</u> 3 4	
Small Trees (Trunk <0.3 m DBH)	<u>0</u> 1 2 3 4	0 1 <u>2</u> 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Woody Shrubs and Saplings	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Non-Woody Herbs, Grasses, Forbs	<u>0</u> 1 2 3 4	0 1 <u>2</u> 3 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	0 <u>1</u> 2 3 4	0 <u>1</u> 2 3 4	
Non-Woody Herbs, Grasses, Forbs	<u>0</u> 1 2 3 4	0 1 <u>2</u> 3 4	
Barren, Bare Dirt or Duff	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	0 P <u>C</u> B	<u>0</u> P C B	
Row Crops	<u>0</u> P C B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	K	0	F1
Right	49	0	
Wetted Width xxx.x m		8.23	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		9.30	
Bankfull Height xx.x m		0.70	
Incised Height xx.x m		0.70	

CANOPY COVER MEASUREMENTS					
DENSIOMETER (0-17 Max)					
Flag			Flag		
CenUp	7		CenR	11	
CenL	10		Left	K	
CenDwn	17		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments
F1	Dense blackberries on left bank.

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: Pringle	DATE: 6/25/13	TRANSECT:	☐ A ☐ B ☐ C ☐ D ☒ E ☐ F X-tra Side Channel
			☐ G ☐ H ☐ I ☐ J ☐ K ☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	CB	50	
LCtr	1.68	35.1	GC	0	
Ctr	3.36	31.4	CB	0	
RCtr	5.04	26.2	GC	0	
Right	6.71	0	FN	100	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	<u>0</u> 1 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	<u>0</u> 1 2 3 4	
Live Trees or Roots	<u>0</u> 1 2 3 4	
Overhanging Veg. = <1 m of Surface	0 1 <u>2</u> 3 4	
Undercut Banks	0 <u>1</u> 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	D <u>C</u> E M N	<u>D</u> C E M N	
Big Trees (Trunk >0.3 m DBH)	0 1 <u>2</u> 3 4	0 1 2 <u>3</u> 4	
Small Trees (Trunk <0.3 m DBH)	0 <u>1</u> 2 3 4	0 1 2 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Woody Shrubs and Saplings	0 <u>1</u> 2 3 4	0 1 2 <u>3</u> 4	
Non-Woody Herbs, Grasses, Forbs	0 <u>1</u> 2 3 4	0 <u>1</u> 2 3 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	<u>0</u> 1 2 3 4	0 1 <u>2</u> 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 2 <u>3</u> 4	0 1 <u>2</u> 3 4	
Barren, Bare Dirt or Duff	0 <u>1</u> 2 3 4	<u>0</u> 1 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	0 P <u>C</u> B	<u>0</u> P C B	
Row Crops	<u>0</u> P C B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	85	0	
Right	283	0.17	
Wetted Width xxx.x m		6.71	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		7.62	
Bankfull Height xx.x m		0.73	
Incised Height xx.x m		0.79	

CANOPY COVER MEASUREMENTS					
DENSIOMETER (0-17 Max)					
Flag			Flag		
CenUp	12		CenR	12	
CenL	14		Left	K	
CenDwn	8		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments

RM

SITE ID: Pringle

DATE: 6/25/13

TRANSECT:

☐A

☐B

☐C

☐D

☐E

☒F

X-tra Side Channel

☐G

☐H

☐I

☐J

☐K

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	CB	50	
LCtr	1.94	25.9	GC	10	
Ctr	3.88	16.8	GC	0	
RCtr	5.82	22.9	CB/GC	0	
Right	7.77	0	GC	70	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent 1=Sparse 2=Moderate 3=Heavy 4=Very Heavy (circle one)	(0%) (<10%) (10-40%) (40-75%) (>75%)	FLAG
Filamentous Algae	<u>0</u>	1 2 3 4	
Macrophytes	<u>0</u>	1 2 3 4	
Woody Debris >0.3 m (Big)	0	1 <u>2</u> 3 4	
Brush/Woody Debris <0.3 (Small)	<u>0</u>	1 2 3 4	
Live Trees or Roots	<u>0</u>	1 2 3 4	
Overhanging Veg. = <1 m of Surface	0	<u>1</u> 2 3 4	
Undercut Banks	<u>0</u>	1 2 3 4	
Boulders	<u>0</u>	1 2 3 4	
Artificial Structures	<u>0</u>	1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)		D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None		
RIPARIAN VEGETATION COVER	Left Bank		Right Bank		Flag
	Canopy (>5 m high)				
Vegetation Type	D <u>C</u> E M N		<u>D</u> C E M N		
Big Trees (Trunk >0.3 m DBH)	0 1 <u>2</u> 3 4		0 1 2 <u>3</u> 4		
Small Trees (Trunk <0.3 m DBH)	0 1 <u>2</u> 3 4		0 <u>1</u> 2 3 4		
	Understory (0.5 to 5 m high)				
Vegetation Type	<u>D</u> C E M N		<u>D</u> C E M N		
Woody Shrubs and Saplings	0 <u>1</u> 2 3 4		0 1 <u>2</u> 3 4		
Non-Woody Herbs, Grasses, Forbs	<u>0</u> 1 2 3 4		0 1 <u>2</u> 3 4		
	Ground Cover (<0.5 m high)				
Woody Shrubs and Saplings	0 1 <u>2</u> 3 4		0 1 <u>2</u> 3 4		
Non-Woody Herbs, Grasses, Forbs	0 1 <u>2</u> 3 4		0 1 <u>2</u> 3 4		
Barren, Bare Dirt or Duff	0 <u>1</u> 2 3 4		0 <u>1</u> 2 3 4		
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank				
	Left Bank		Right Bank		Flag
Wall/Dike/Revetment/ Riprap/Dam	<u>0</u> P C B		<u>0</u> P C B		
Buildings	<u>0</u> P C B		<u>0</u> P C B		
Pavement/Cleared Lot	<u>0</u> P C B		<u>0</u> P C B		
Road/Railroad	<u>0</u> P C B		<u>0</u> P C B		
Pipes (Inlet/Outlet)	<u>0</u> P C B		<u>0</u> P C B		
Landfill/Trash	<u>0</u> P C B		<u>0</u> P C B		
Park/Lawn	0 P <u>C</u> B		<u>0</u> P C B		
Row Crops	<u>0</u> P C B		<u>0</u> P C B		
Pasture/Range/Hay Field	<u>0</u> P C B		<u>0</u> P C B		
Logging Operations	<u>0</u> P C B		<u>0</u> P C B		
Mining Activity	<u>0</u> P C B		<u>0</u> P C B		

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	23	0	
Right	54	0	
Wetted Width xxx.x m		7.77	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		9.24	
Bankfull Height xx.x m		0.70	
Incised Height xx.x m		0.76	

CANOPY COVER MEASUREMENTS					
DENSIOMETER (0-17 Max)					
Flag			Flag		
CenUp	14		CenR	14	
CenL	13		Left	K	
CenDwn	12		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: Pringle	DATE: 6/25/13	TRANSECT:	☐ A ☐ B ☐ C ☐ D ☐ E ☐ F ☒ G ☐ H ☐ I ☐ J ☐ K	X-tra Side Channel ☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	2.17	7.0	GC	0	
Ctr	4.34	18.3	GC	0	
RCtr	6.51	29.3	CB	0	
Right	8.69	0	FN	100	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	<u>0</u> 1 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	<u>0</u> 1 2 3 4	
Live Trees or Roots	<u>0</u> 1 2 3 4	
Overhanging Veg. = <1 m of Surface	0 <u>1</u> 2 3 4	
Undercut Banks	0 <u>1</u> 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	D <u>C</u> E M N	<u>D</u> C E M N	
Big Trees (Trunk >0.3 m DBH)	0 <u>1</u> 2 3 4	0 <u>1</u> 2 3 4	
Small Trees (Trunk <0.3 m DBH)	<u>0</u> 1 2 3 4	0 <u>1</u> 2 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Woody Shrubs and Saplings	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 <u>2</u> 3 4	0 1 2 <u>3</u> 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	0 <u>1</u> 2 3 4	0 <u>1</u> 2 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Barren, Bare Dirt or Duff	0 <u>1</u> 2 3 4	<u>0</u> 1 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	0 P <u>C</u> B	<u>0</u> P C B	
Row Crops	<u>0</u> P C B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	320	0.37	
Right	K	0	F1
Wetted Width xxx.x m		8.69	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		9.68	
Bankfull Height xx.x m		0.66	
Incised Height xx.x m		K	

CANOPY COVER MEASUREMENTS					
DENSIOMETER (0-17 Max)					
Flag			Flag		
CenUp	4		CenR	6	
CenL	6		Left	K	
CenDwn	4		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments
F1	Dense blackberry on left bank.

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: Pringle	DATE: 6/25/13	TRANSECT:	☐ A	☐ B	☐ C	☐ D	☐ E	☐ F	X-tra Side Channel
			☐ G	☒ H	☐ I	☐ J	☐ K		☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	2.90	15.2	GF	10	
Ctr	5.80	12.1	GC	20	
RCtr	8.70	38.1	CB	5	
Right	11.58	0	OT	0	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	<u>0</u> 1 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	<u>0</u> 1 2 3 4	
Live Trees or Roots	<u>0</u> 1 2 3 4	
Overhanging Veg. = <1 m of Surface	0 1 2 <u>3</u> 4	
Undercut Banks	0 <u>1</u> 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	D C E M <u>N</u>	<u>D</u> C E M N	
Big Trees (Trunk >0.3 m DBH)	<u>0</u> 1 2 3 4	0 1 <u>2</u> 3 4	
Small Trees (Trunk <0.3 m DBH)	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	D C <u>E</u> M N	
Woody Shrubs and Saplings	0 1 2 <u>3</u> 4	0 1 2 <u>3</u> 4	
Non-Woody Herbs, Grasses, Forbs	0 <u>1</u> 2 3 4	<u>0</u> 1 2 3 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	0 1 <u>2</u> 3 4	<u>0</u> 1 2 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 2 <u>3</u> 4	<u>0</u> 1 2 3 4	
Barren, Bare Dirt or Duff	0 <u>1</u> 2 3 4	<u>0</u> 1 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	0 P <u>C</u> B	<u>0</u> P C B	
Row Crops	<u>0</u> P C B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	294	0.16	
Right	90	0	
Wetted Width xxx.x m		11.58	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		11.58	
Bankfull Height xx.x m		0.85	
Incised Height xx.x m		0.85	

CANOPY COVER MEASUREMENTS					
DENSIOMETER (0-17 Max)					
Flag			Flag		
CenUp	12		CenR	15	
CenL	3		Left	K	
CenDwn	8		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments
F1	Concrete wall

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: Pringle	DATE: 6/25/13	TRANSECT:	☐ A ☐ B ☐ C ☐ D ☐ E ☐ F ☐ G ☐ H ☒ I ☐ J ☐ K	X-tra Side Channel ☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	2.06	24.4	CB/GC	0	
Ctr	4.12	30.5	CB	0	
RCtr	3.18	39.6	CB	0	
Right	8.23	0	OT	0	F1
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	<u>0</u> 1 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	<u>0</u> 1 2 3 4	
Live Trees or Roots	<u>0</u> 1 2 3 4	
Overhanging Veg. = <1 m of Surface	0 1 <u>2</u> 3 4	
Undercut Banks	<u>0</u> 1 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	<u>D</u> C E M N	D C E M <u>N</u>	
Big Trees (Trunk >0.3 m DBH)	<u>0</u> 1 2 3 4	0 1 2 3 4	
Small Trees (Trunk <0.3 m DBH)	0 1 <u>2</u> 3 4	0 1 2 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	D C <u>E</u> M N	
Woody Shrubs and Saplings	0 <u>1</u> 2 3 4	0 1 <u>2</u> 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 <u>2</u> 3 4	<u>0</u> 1 2 3 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	<u>0</u> 1 2 3 4	0 1 <u>2</u> 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 2 <u>3</u> 4	0 <u>1</u> 2 3 4	
Barren, Bare Dirt or Duff	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	0 P <u>C</u> B	0 P <u>C</u> B	
Row Crops	<u>0</u> P C B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	302	0.210	
Right	90	0	
Wetted Width xxx.x m		8.23	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		8.53	
Bankfull Height xx.x m		0.70	
Incised Height xx.x m		0.70	

CANOPY COVER MEASUREMENTS					
DENSIOMETER (0-17 Max)					
Flag			Flag		
CenUp	10		CenR	3	
CenL	9		Left	K	
CenDwn	1		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments
F1	Concrete and block wall

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: Pringle	DATE: 6/25/13	TRANSECT:	☐ A ☐ G	☐ B ☐ H	☐ C ☐ I	☐ D ☒ J	☐ E ☐ K	☐ F 	X-tra Side Channel ☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	GF	80	
LCtr	2.13	25.6	CB	5	
Ctr	4.26	24.4	GF	20	
RCtr	6.39	18.0	GC	40	
Right	8.53	0	FN	100	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	<u>0</u> 1 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	<u>0</u> 1 2 3 4	
Live Trees or Roots	0 <u>1</u> 2 3 4	
Overhanging Veg. = <1 m of Surface	0 <u>1</u> 2 3 4	
Undercut Banks	0 <u>1</u> 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Big Trees (Trunk >0.3 m DBH)	0 1 2 <u>3</u> 4	0 1 <u>2</u> 3 4	
Small Trees (Trunk <0.3 m DBH)	<u>0</u> 1 2 3 4	0 1 2 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Woody Shrubs and Saplings	0 <u>1</u> 2 3 4	0 1 2 <u>3</u> 4	
Non-Woody Herbs, Grasses, Forbs	0 <u>1</u> 2 3 4	0 1 <u>2</u> 3 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	<u>0</u> 1 2 3 4	0 1 <u>2</u> 3 4	
Non-Woody Herbs, Grasses, Forbs	0 1 <u>2</u> 3 4	0 1 <u>2</u> 3 4	
Barren, Bare Dirt or Duff	0 1 2 <u>3</u> 4	<u>0</u> 1 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	0 P <u>C</u> B	<u>0</u> P C B	
Row Crops	<u>0</u> P C B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	322	0.58	
Right	55	0	
Wetted Width xxx.x m		8.53	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		8.69	
Bankfull Height xx.x m		0.73	
Incised Height xx.x m		0.73	

CANOPY COVER MEASUREMENTS					
DENSIOMETER (0-17 Max)					
Flag			Flag		
CenUp	16		CenR	16	
CenL	17		Left	K	
CenDwn	17		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments

PHAB: CHANNEL/RIPARIAN CROSS-SECTION FORM – STREAMS

SITE ID: Pringle	DATE: 6/25/13	TRANSECT:	☐ A	☐ B	☐ C	☐ D	☐ E	☐ F	X-tra Side Channel
			☐ G	☐ H	☐ I	☐ J	☒ K		☐

SUBSTRATE CROSS-SECTIONAL INFORMATION					
	Dist LB xx.xx m	Depth xxx cm	Size Class Code	Embed. 0-100%	Flag
Left	0	0	FN	100	
LCtr	2.28	73.2	GF	80	
Ctr	4.56	71.9	GC	10	
RCtr	6.84	50.6	GC	20	
Right	7.49	0	FN	100	
SUBSTRATE SIZE CLASS CODES					Embed. (%)
RS = Bedrock(Smooth)-(Larger than a car)					0
RR = Bedrock (Rough)-(Larger than a car)					0
BL = Boulder (250 to 400 mm)-(Basketball to car)					
CB = Cobble (64 to 250 mm)-(Tennis ball to basketball)					
GC = Coarse Gravel (16 to 64mm)-(Marble to Tennis ball)					
GF = Fine Gravel (2 to 16mm)-(Ladybug to marble)					
SA = Sand (0.06 to 2mm)-(Gritty up to ladybug size)					100
FN = Silt/Clay/Muck-(Not gritty)					100
HP = Hardpan-(Firm, Consolidated, Fine Substrate)					0
WD = Wood-(Any Size)					
OT = Other (Write comment below)					

FISH COVER/OTHER	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%) (circle one)	FLAG
Filamentous Algae	<u>0</u> 1 2 3 4	
Macrophytes	<u>0</u> 1 2 3 4	
Woody Debris >0.3 m (Big)	<u>0</u> 1 2 3 4	
Brush/Woody Debris <0.3 (Small)	<u>0</u> 1 2 3 4	
Live Trees or Roots	<u>0</u> 1 2 3 4	
Overhanging Veg. = <1 m of Surface	0 1 <u>2</u> 3 4	
Undercut Banks	<u>0</u> 1 2 3 4	
Boulders	<u>0</u> 1 2 3 4	
Artificial Structures	<u>0</u> 1 2 3 4	

VISUAL RIPARIAN ESTIMATES	0=Absent (0%) 1=Sparse (<10%) 2=Moderate (10-40%) 3=Heavy (40-75%) 4=Very Heavy (>75%)	D=Deciduous C=Coniferous E=Broadleaf Evergreen M=Mixed N=None	
RIPARIAN VEGETATION COVER	Left Bank	Right Bank	Flag
Canopy (>5 m high)			
Vegetation Type	<u>D</u> C E M N	<u>D</u> C E M N	
Big Trees (Trunk >0.3 m DBH)	<u>0</u> 1 2 3 4	0 1 <u>2</u> 3 4	
Small Trees (Trunk <0.3 m DBH)	0 1 2 <u>3</u> 4	0 1 <u>2</u> 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	<u>D</u> C E M N	D C E M N	
Woody Shrubs and Saplings	0 1 2 <u>3</u> 4	0 1 <u>2</u> 3 4	
Non-Woody Herbs, Grasses, Forbs	0 <u>1</u> 2 3 4	0 1 2 <u>3</u> 4	
Ground Cover (<0.5 m high)			
Woody Shrubs and Saplings	0 <u>1</u> 2 3 4	0 1 <u>2</u> 3 4	
Non-Woody Herbs, Grasses, Forbs	<u>0</u> 1 2 3 4	0 1 <u>2</u> 3 4	
Barren, Bare Dirt or Duff	<u>0</u> 1 2 3 4	<u>0</u> 1 2 3 4	
HUMAN INFLUENCE	0= Not Present P= >10 m C= Within 10 m B= On Bank		
	Left Bank	Right Bank	Flag
Wall/Dike/Revetment/Riprap/Dam	<u>0</u> P C B	<u>0</u> P C B	
Buildings	<u>0</u> P C B	<u>0</u> P C B	
Pavement/Cleared Lot	<u>0</u> P C B	<u>0</u> P C B	
Road/Railroad	<u>0</u> P C B	<u>0</u> P C B	
Pipes (Inlet/Outlet)	<u>0</u> P C B	<u>0</u> P C B	
Landfill/Trash	<u>0</u> P C B	<u>0</u> P C B	
Park/Lawn	0 <u>P</u> C B	<u>0</u> P C B	
Row Crops	<u>0</u> P C B	<u>0</u> P C B	
Pasture/Range/Hay Field	<u>0</u> P C B	<u>0</u> P C B	
Logging Operations	<u>0</u> P C B	<u>0</u> P C B	
Mining Activity	<u>0</u> P C B	<u>0</u> P C B	

BANK MEASUREMENTS			
	Bank Angle 0-360	Undercut Dist. (m)	Flag
Left	K	-	F1
Right	39	0	
Wetted Width xxx.x m		7.49	
Bar Width xx.x m		-	
Bankfull Width xxx.x m		8.29	
Bankfull Height xx.x m		1.07	
Incised Height xx.x m		1.37	

CANOPY COVER MEASUREMENTS					
DENSIMETER (0-17 Max)					
Flag			Flag		
CenUp	12		CenR	14	
CenL	17		Left	K	
CenDwn	12		Right	K	

Flag Codes: K= Sample not collected; U= Suspect sample; F1, F2, etc.= misc. flag assigned by field crew. Explain all flags in comment sections.

Flag	Comments
F1	Dense blackberries

RIPARIAN "LEGACY" TREES AND INVASIVE ALIEN PLANTS

SITE ID: Pringle

DATE: 6/25/13

TRAN	LARGEST LEGACY TREE VISIBLE FROM THIS STATION						ALIEN PLANT SPECIES PRESENT IN LEFT AND RIGHT RIPARIAN PLOTS			
	Trees not Visible	DBH (m)	Height (m)	Dist. from wetted margin (m)	Type	Taxonomic Category	Check all that are present			
A	☐	☐ 0-0.1 ☐ .75-2 ☐ .1-.3 ☐ >2 ☒ .3-.75	☐ <5 ☐ 5-15 ☒ 15-30 ☐ >30	10	☒ Deciduous ☐ Coniferous ☐ Broadleaf Evergreen	Oak	☐ None	☒ RC Grass ☐ Salt Ced ☒ Hblack ☐ G Reed ☒ Engl Ivy ☐ CanThis ☐ Teasel ☐ C Burd ☐ Ch Grass ☐ M This ☐ Spurge ☐ Rus Ol		
B	☐	☐ 0-0.1 ☐ .75-2 ☐ .1-.3 ☐ >2 ☒ .3-.75	☐ <5 ☐ 5-15 ☒ 15-30 ☐ >30	5	☒ Deciduous ☐ Coniferous ☐ Broadleaf Evergreen	Ash	☐ None	☒ RC Grass ☐ Salt CED ☒ Hblack ☐ G Reed ☐ Engl Ivy ☐ Can This ☐ Teasel ☐ C Burd ☐ Ch Grass ☐ M This ☐ Spurge ☐ Rus Ol		
C	☐	☐ 0-0.1 ☒ .75-2 ☐ .1-.3 ☐ >2 ☐ .3-.75	☐ <5 ☐ 5-15 ☒ 15-30 ☐ >30	1	☒ Deciduous ☐ Coniferous ☐ Broadleaf Evergreen	Ash	☐ None	☒ RC Grass ☐ Salt Ced ☒ Hblack ☐ G Reed ☐ Engl Ivy ☐ Can This ☐ Teasel ☐ C Burd ☐ Ch Grass ☐ M This ☐ Spurge ☐ Rus Ol		

INSTRUCTIONS

Legacy trees are defined as the largest tree within your search area, which is as far as you can see, but within maximum limits as follows:

Wadeable Streams: Confine search to no more than 50 m from left and right bank and extending upstream to next transect (for 'K' look upstream 4 channel widths)

Non-wadeable Rivers: Confine search to no more than 100 m from left and right bank and extending both upstream and downstream as far as you can see confidently.

Alien Plants: Confine search to riparian plots on left and right bank

Wadeable Streams: 10 m x 10 m

Non-wadeable Rivers: 10 m x 20 m

Not all aliens are to be identified in all states. See Field Manual and Plant Identification Guide.

TAXONOMIC CATEGORIES

Acacia/Mesquite
Alder/Birch
Ash
Maple/Box elder
Oak
Poplar/Cottonwood
Sycamore
Willow
Unknown or Other Deciduous

Cedar/Cypress/Sequoia
Fir (including Douglas Fir and Hemlock)
Juniper
Pine
Spruce
Unknown or Other Deciduous

Unknown or Other Broadleaf Evergreen

Snag (Dead tree of any species)

ALIEN SPECIES

RC Grass	Reed Canarygrass	<i>Phalaris arundinacea</i>
Engl Ivy	English Ivy	<i>Hedera Helix</i>
ChGrass	Cheat Grass	<i>Bromus tectorum</i>
Salt Ced	Salt Cedar	<i>Tamarix spp.</i>
Can This	Canada thistle	<i>Cirsium arvense</i>
M This	Musk thistle	<i>Carduus nutans</i>
Hblack	Himalayan blackberry	<i>Rubus discolor</i>
Teasel	Teasel	<i>Dipsacus fullonum</i>
Spurge	Leafy spurge	<i>Euphorbia esula</i>
G Reed	Giant Reed	<i>Arundo donax</i>
C Burd	Common burdock	<i>Arctium minus</i>
Rus Ol	Russian-olive	<i>Elaeagnus angustifolia</i>

COMMENTS

Transects D to K continued on next page

RIPARIAN "LEGACY" TREES AND INVASIVE ALIEN PLANTS

SITE ID: Pringle

DATE: 6/25/13

TRAN	LARGEST LEGACY TREE VISIBLE FROM THIS STATION						ALIEN PLANT SPECIES PRESENT IN LEFT AND RIGHT RIPARIAN PLOTS				
	Trees not Visible	DBH (m)	Height (m)	Dist. from wetted margin (m)	Type	Taxonomic Category	Check all that are present				
D	☐	☐ 0-0.1 ☐ .75-2 ☐ .1-.3 ☐ >2 ☒ .3-.75	☐ <5 ☐ 5-15 ☐ 15-30 ☒ >30	7	☐ Deciduous ☒ Coniferous ☐ Broadleaf Evergreen	Douglas Fir	☐ None	☒ RC Grass ☐ Engl Ivy ☐ Ch Grass	☐ Salt Ced ☐ Can This ☐ M This	☒ Hblack ☐ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol
E	☐	☐ 0-0.1 ☒ .75-2 ☐ .1-.3 ☐ >2 ☐ .3-.75	☐ <5 ☐ 5-15 ☐ 15-30 ☒ >30	2	☒ Deciduous ☐ Coniferous ☐ Broadleaf Evergreen	Cottonwood	☐ None	☒ RC Grass ☐ Engl Ivy ☐ Ch Grass	☐ Salt CED ☐ Can This ☐ M This	☒ Hblack ☐ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol
F	☐	☐ 0-0.1 ☒ .75-2 ☐ .1-.3 ☐ >2 ☐ .3-.75	☐ <5 ☐ 5-15 ☒ 15-30 ☐ >30	10	☒ Deciduous ☐ Coniferous ☐ Broadleaf Evergreen	Cottonwood	☐ None	☒ RC Grass ☒ Engl Ivy ☐ Ch Grass	☐ Salt Ced ☐ Can This ☐ M This	☒ Hblack ☐ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol
G	☐	☐ 0-0.1 ☒ .75-2 ☐ .1-.3 ☐ >2 ☐ .3-.75	☐ <5 ☐ 5-15 ☒ 15-30 ☐ >30	10	☐ Deciduous ☒ Coniferous ☐ Broadleaf Evergreen	Douglas Fir	☐ None	☒ RC Grass ☒ Engl Ivy ☐ Ch Grass	☐ Salt Ced ☐ Can This ☐ M This	☒ Hblack ☐ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol
H	☐	☐ 0-0.1 ☒ .75-2 ☐ .1-.3 ☐ >2 ☐ .3-.75	☐ <5 ☐ 5-15 ☒ 15-30 ☐ >30		☒ Deciduous ☐ Coniferous ☐ Broadleaf Evergreen	Maple	☐ None	☒ RC Grass ☐ Engl Ivy ☐ Ch Grass	☐ Salt Ced ☐ Can This ☐ M This	☒ Hblack ☐ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol
I	☐	☐ 0-0.1 ☒ .75-2 ☐ .1-.3 ☐ >2 ☐ .3-.75	☐ <5 ☐ 5-15 ☐ 15-30 ☒ >30		☐ Deciduous ☒ Coniferous ☐ Broadleaf Evergreen	Douglas Fir	☐ None	☒ RC Grass ☒ Engl Ivy ☐ Ch Grass	☐ Salt Ced ☐ Can This ☐ M This	☐ Hblack ☐ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol
J	☐	☐ 0-0.1 ☒ .75-2 ☐ .1-.3 ☐ >2 ☐ .3-.75	☐ <5 ☐ 5-15 ☐ 15-30 ☐ >30	2	☒ Deciduous ☐ Coniferous ☐ Broadleaf Evergreen	Maple	☐ None	☒ RC Grass ☐ Engl Ivy ☐ Ch Grass	☐ Salt Ced ☐ Can This ☐ M This	☒ Hblack ☐ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol
K	☐	☐ 0-0.1 ☒ .75-2 ☐ .1-.3 ☐ >2 ☐ .3-.75	☐ <5 ☐ 5-15 ☐ 15-30 ☒ >30	15	☒ Deciduous ☐ Coniferous ☐ Broadleaf Evergreen	Cottonwood	☐ None	☐ RC Grass ☐ Engl Ivy ☐ Ch Grass	☐ Salt Ced ☐ Can This ☐ M This	☐ Hblack ☐ Teasel ☐ Spurge	☐ G Reed ☐ C Burd ☐ Rus Ol

ATTACHMENT C. City of Salem Surface Water and Stormwater Monitoring Plan Revision Packet (cover letter, revised monitoring plan, and approval email) (March 1, 2013).

March 1, 2013

Benjamin Benninghoff
Stormwater Coordinator
Oregon Department of Environmental Quality
811 SW Sixth Avenue
Portland, OR 97204-1390

SUBJECT: City of Salem National Pollutant Discharge Elimination System (NPDES)
Municipal Separate Storm Sewer System (MS4)
Permit No.101513; File No.108919
30-day Notice of Proposed Modification to the City of Salem Surface Water and
Stormwater Monitoring Plan

Dear Mr. Benninghoff:

The City of Salem has implemented a water quality sampling program on the Willamette River since 1990 at a number of sites within the greater Salem area. Data from this sampling effort have been submitted to the Department of Environmental Quality (DEQ) each year as part of the City's MS4 Annual Report because it is identified in the City's 2010 Stormwater Management Plan, (Best Management Practice MON1 Task 2, "continue the urban stream and Willamette River water quality sampling program...").

The Willamette River water quality sampling program began as part of a study of the mixing zone at the Willow Lake Water Pollution Control Facility (WLWPCF) outfall. The sampling program started in 1990 with eleven sites. Four sites were decommissioned in 1995 and one was decommissioned in 2005, leaving six sites distributed between downtown Salem and downstream to Wheatland Ferry. Data is no longer needed by the WLWPCF because needs for the study have been met. Additionally, due to budget reductions the City proposes revising this sampling program.

The City proposes the following program modifications:

1. Data will be collected and maintained by the Stormwater Services group instead of WLWPCF laboratory staff. Sample analysis will continue to be performed by the WLWPCF laboratory staff.
2. The sampling program will be combined with the Monthly Instream monitoring element identified in Table B-1 of the City's NPDES MS4 permit. Willamette River data will be collected once a month, at the same time -Monthly Instream samples are collected (previously the Willamette River samples were collected the week prior, and twice a month from May to November).
3. Sampling sites and methods will be revised:

February 12, 2013

Page 2

- a. Reduction from six sites to three (retaining two of the current sites and adding one upstream of the City's jurisdictional boundary).
- b. Instead of sampling by boat, samples will be collected from the east bank of the river. Due to safety concerns, the boat had not been used when the Willamette gauge at Salem surpassed 15 feet. Sampling from the bank is anticipated to allow sample collection up to a stage of 36 feet (the 100 year flood level).

These modifications to the existing program will ensure that the City's longest running set of water quality data continue to be collected, although slightly modified in methodology. By adding the upstream site to the program, collected data are anticipated to better describe the influence of MS4 discharges to the Willamette River, particularly during rain events. These modifications would also result in Willamette River sampling being conducted on the same day as Instream Monthly sampling, by the same staff, adding consistency to instrumentation use and sampling protocol.

The City's *Surface Water and Stormwater Monitoring Plan* has been revised to reflect changes summarized in this letter, specifically Section 4.0 Monthly Instream (see Enclosure). Revisions to the plan are underlined so they are readily identifiable.

Notification of these revisions to the City of Salem's monitoring program are being provided to the DEQ consistent with Schedule B.2.e of the City's NPDES MS4 Permit. The City requests written approval of the revisions from the DEQ. If you have any questions or request additional information please contact Anita Panko, Flow Monitoring Analyst, at ampanko@cityofsalem.net or 503-589-2188.

Sincerely,

Anita Panko
Flow Monitoring Analyst

Enclosures:

Attachment A. Surface Water and Stormwater Monitoring Plan

cc: Sam Kidd, Stormwater and Wastewater Collections Services Manager
Jon Nottage, Stormwater Quality Supervisor
Paul Mitchell, Willow Lake Laboratory Supervisor
Anita Panko, Flow Monitoring Analyst

File:

City of Salem
National Pollutant Discharge Elimination System (NPDES)
Municipal Separate Storm Sewer System (MS4)

Surface Water and Stormwater Monitoring Plan

Prepared by: City Salem Public Works Department
Stormwater Services

November 1, 2011
Revised February 20, 2013

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Attachments

Attachment 1:	City of Salem Surface Water and Stormwater Monitoring Matrix
Attachment 2:	Pesticide Screen Compound Lists

1.0 Introduction

On December 30, 2010, the Oregon Department of Environmental Quality (DEQ) issued the City of Salem a renewed National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit. As a condition of the renewed NPDES MS4 permit the City of Salem developed this "Surface Water and Stormwater Monitoring Plan". This plan implements multiple monitoring elements designed to meet the objectives identified in Schedule B of the NPDES MS4 permit.

Data collected through the implementation of this monitoring plan will undergo review and analysis before becoming an integral component of the NPDES MS4 Annual Reporting and Permit Renewal process. Statistical summaries of monitoring data will assist the City in an ongoing assessment of the effectiveness of the Best Management Practices (BMPs) that have been identified in the City's Stormwater Management Plan (SWMP). The City will ultimately utilize the collected data to evaluate and adaptively manage its Stormwater Management Program, thereby limiting the amount of pollutants entering receiving streams from the MS4 to the Maximum Extent Practicable (MEP). The long-term goal of this monitoring plan is to maintain permit compliance while providing high quality data to assist in decision making and the adaptive management process.

2.0 Permit Requirements

2.1 Monitoring Objectives

Requirements of the monitoring program are listed in Schedule B of the City's NPDES MS4 permit, and monitoring activities must address the following six objectives (Schedule B.1.a):

- i. Evaluate the source(s) of the 2004/2006 303 (d) listed pollutants applicable to the co-permittees' permit area;
- ii. Evaluate the effectiveness of Best Management Practices (BMPs) in order to help determine BMP implementation priorities;
- iii. Characterize stormwater based on land use type, seasonality, geography or other catchment characteristics;
- iv. Evaluate status and long-term trends in receiving waters associated with MS4 stormwater discharges;
- v. Assess the chemical, biological, and physical effects of MS4 stormwater discharges on receiving waters; and,
- vi. Assess progress towards meeting TMDL pollutant load reduction benchmarks.

This monitoring plan describes eight different monitoring elements the City of Salem will utilize to meet these objectives, including the following: Instream Storm, Monthly Instream, Continuous Instream, Macroinvertebrate, Stormwater, Pesticide, Stormwater - Mercury , and Dry Weather Outfall monitoring. The City of Salem Stormwater Monitoring Matrix (Attachment 1) identifies how each monitoring element will be used to address the objectives listed in Schedule B.1.a. The City will implement these monitoring elements during the current NPDES MS4 permit term (December 2010 - December 2015).

2.2 Adaptive Management

By adaptively managing (e.g., implementing, evaluating, and adjusting) its stormwater management program, the City of Salem continues to reduce the discharge of pollutants from its stormwater sewer system to the maximum extent practicable.

Stormwater quality data are characteristically highly variable, limiting the ability to conduct statistical analyses with small datasets. As a result, there is limited ability for data analyses to support short-term (*within* the NPDES MS4 permit cycle) decision making and adaptive management processes. However, the City recognizes that monitoring activities described in this plan may provide some opportunity to do so. For example, pesticide monitoring data may identify the presence of particular compounds only applied by particular users. That data could potentially be used to target outreach efforts to those identified users. Additionally, short-term trends in continuous water quality monitoring data could indicate the presence of discharges that potentially require follow-up through illicit discharge detection or erosion control investigation.

Data collected through implementation of this monitoring plan will largely contribute to the preparation of the City's NPDES MS4 permit renewal application (due July 1, 2015), where the City of Salem will evaluate the overall effectiveness of its Stormwater Management Program. Specifically, collected data will contribute to the following analyses: 1) an evaluation of 303(d) listed parameters (Schedule D.2), 2) preparation of a Total Maximum Daily Load (TMDL) wasteload allocation attainment assessment (Schedule D.3.b), 3) conducting a TMDL pollutant load reduction evaluation, including water quality trend analyses (Schedule D.3.c), and 4) if necessary, the establishment of TMDL benchmarks (Schedule D.3.d). These analyses will support decision-making and proposed improvements to the SWMP, and its BMPs, for the upcoming NPDES MS4 permit cycle.

Also, consistent with Schedule D.4 of the current NPDES MS4 permit, by November 1, 2011, the City of Salem will provide the DEQ with a description of the adaptive management approach/process that will be followed through expiration of the permit on December 29, 2015.

3.0 Instream Storm

3.1 Project / Task Organization

Instream Storm refers to the monitoring of MS4 receiving streams, where sampling is to occur during defined storm events ('storm event' criteria are discussed in Section 3.4.5). The City's Stormwater Monitoring Analyst will serve as the Project Manager and the Responsible Sampling Coordinator. The City's Stormwater Services workgroup will perform sampling and collect field data. The City's Willow Lake Laboratory will perform all analytical laboratory analyses.

3.2 Monitoring Objectives

Instream Storm monitoring will contribute, at least in part, to monitoring objectives i, ii, iii, iv, v, and vi, as identified in Schedule B.1 of the City of Salem's NPDES MS4 Permit. Refer to the City of Salem Surface Water and Stormwater Monitoring Matrix (Attachment 1) for a more detailed explanation of how this monitoring element addresses each objective.

3.3 Background

Instream Storm monitoring is a new monitoring strategy. It was developed to help the City expand its understanding of receiving waters within the Pringle Creek Watershed during storm events. Three separate sites were selected for sampling, as described in 3.4.3.

3.4 Study Design / Sampling Process

3.4.1 Study Design

The study design is a spatial layout of the three different sites that are to be monitored during storm events only. The name of each site, the receiving stream, and location are included in Table 1, and are identified in Figure 1. Relevant characteristics for each site are as follows:

- **PRI12-** This site is located at the City's jurisdictional boundary, where Pringle Creek enters city limits, and represents an upstream catchment area with little influence from the City's MS4 system.
- **CLK1-** This site on Clark Creek represents an older portion of town, with the majority of the catchment being built-out and having limited stormwater structural controls. As identified in the City's 2008 NPDES MS4 Permit Renewal Application, 0.7% of the CLK1 catchment had structural controls in 2008.
- **PRI13-** This site on Pringle Creek represents a portion of the city with a larger percentage of catchment being treated by stormwater structural controls. As identified in the City's 2008 NPDES MS4 Permit Renewal Application, 3.9% of the catchment area had structural controls in 2008, and the coverage was estimated to rise to 8.1% by 2013.

Data collected by way of this monitoring element will help guide Salem's stormwater management strategies in the Pringle Creek Watershed and watersheds throughout the city.

3.4.2 Frequency and Duration

Instream Storm monitoring will be conducted during twenty-five storm events at each of the three sites throughout the duration of the permit term.

3.4.3 Sites

The receiving streams to be monitored are East Fork Pringle Creek, Pringle Creek and Clark Creek. PRI12 is where the East Fork Pringle Creek enters the City's jurisdiction and PRI13 is located on Pringle Creek just before the confluence of Shelton Ditch with Pringle Creek. CLK1 is located on Clark Creek just upstream of the confluence with Pringle Creek. These sites are identified in Figure 1 and described in Table 1.

Table 1: Instream Storm Monitoring Sites

Site ID	Creek Name	Site Location
PRI13	Pringle Creek	Pringle Park
PRI12	East Fork Pringle Creek	Trelstad Ave SE
CLK1	Clark Creek	Bush Park

3.4.4 Sample Collection Method

Sample collection methods will include grab samples, field measurements, and flow-weighted composites¹ (Table 2). All grab samples will be collected and field measurements will be taken during the first three hours of the sampled storm event. Portable sampling units will be programmed to collect a flow-weighted composite sample based on the predicted rainfall depth. The predicted rainfall depth will be calculated prior to the sampling event using a local forecast, with cessation of the event being identified by the first predicted 6 hour dry period or at the end of 24 hours, whichever comes first. The portable sampling units will remain in the field until the program is completed or 24 hours from the start of the event, whichever comes first.

Table 2: Instream Storm Parameter List and Collection Method

Instream (Storm Only) Parameters	Collection Method
TSS	Composite
BOD ('stream')	Composite
Total Phosphorus	Composite
Nitrate+Nitrite as Nitrogen	Composite
Ammonia Nitrogen	Composite
Copper (Total Recoverable & Dissolved)	Composite
Lead (Total Recoverable & Dissolved)	Composite
Zinc (Total Recoverable & Dissolved)	Composite
Hardness	Composite
Specific Conductivity	Field and Composite
Dissolved Oxygen	Field
Temperature	Field
pH	Field
E. coli	Grab

Note: BOD 'stream' analytical method is not identified in 40 CFR 136; however, this method has been identified as an acceptable method under Table B-1 Special Condition #5 in the City's NPDES MS4 permit.

3.4.5 Storm Event Criteria

The following criteria will be used to select storm events to conduct sampling (Schedule B.3):

- Storm event must be greater than 0.1 inch of rainfall
- A minimum of 50% of the water quality sample events must be collected during the wet season (October 1 to April 30)
- Each unique sample event must occur at a minimum of 14 days apart

3.5 Data Quality Criteria

3.5.1 Data Quality Objectives

The data quality objectives for field measurements are detailed in Table 3. Analytical methods for composite and grab samples analyzed at Willow Lake Laboratory will follow methods identified in 40 CFR 136 or otherwise identified in Table B-1 Special Conditions of the NPDES MS4 permit.

¹ If stream gauging equipment fails and it is infeasible to repair equipment before a targeted storm event starts, a time-composite sample will be collected in place of flow paced sample.

Table 3: Instream Storm Field Quality Objectives

Parameters	Accuracy	Precision	Analytical Methods
Temperature	± 0.5 °C	± 0.5 °C	NIST Temperature checks
pH	± 0.2 SU	± 0.3 SU	EPA-NERL 150.1
Dissolved Oxygen	± 0.2 mg/L	± 0.3 mg/L	ASTM D888-09
Specific Conductivity	± 7% of standard value	± 10%	EPA-NERL 120.1

3.5.2 Representativeness

All samples will be collected during storm events described in Section 3.4.5. Samples will be collected where the water is well mixed and representative of the ambient conditions. Grab samples will be collected and field measurements will be taken within the first three hours of the storm.

3.5.3 Comparability

Field, grab, and composite samples will utilize the same handling requirements and laboratory procedures that are used for the Stormwater, Monthly Instream, and Continuous Instream monitoring elements. This uniformity increases the validity of the data for analyses and comparisons with other data collected within the scope of this plan.

3.5.4 Completeness

It is anticipated that twenty-five samples from each of the three sites will be collected over the five year permit term. However, unanticipated circumstances including, but not limited to, personnel illness and turnover, vehicular malfunction, equipment malfunction, and various safety issues could prevent the collection of all of the samples. If such a situation exists, Oregon DEQ will be informed following notification procedures in Schedule B. 2.e of the NPDES MS4 permit.

3.6 Quality Assurance / Quality Control / Record Keeping

3.6.1 Duplicate and Blank Samples

Duplicates will be taken for a minimum of ten percent of the total number of grab samples and field measurements. For composite sampling, an equipment blank (involving suction line tubing, pump tubing, strainer, and sample container vessel) will be done prior to the first sampling event of each sampling season.

3.6.2 Instrument Calibration

Instrument calibration will be completed prior to each sampled storm event. Instrument calibration procedures are documented in the City's "Stormwater and Instream (Storm Only) Monitoring Standard Operating Procedures" (2011).

3.6.3 Instrument Inspection and Maintenance

Instrument inspection and maintenance procedures are documented and will be followed according to the City's "Stormwater and Instream (Storm Only) Monitoring Standard Operating Procedures" (2011).

3.6.4 Mobilization / Handling / Custody Procedures

The City contracts with a weather service that provides a detailed precipitation forecast that is updated daily. The Responsible Sampling Coordinator will monitor this weather forecast and make the final decision to sample. Once it has been decided to sample a storm, Willow Lake

Laboratory will be notified, a two person team will deploy portable samplers filled with ice, and all other relevant equipment and forms will be prepared. The contracted weather service will provide notification prior to the start of the storm event, ensuring the collection of grab samples and field measurements during the first 3 hours of the storm event.

The City has four staff that are trained on proper handling procedures to collect samples during a storm event. Field measurements will be taken using a sterilized beaker for sample collection. These measurements will be completed immediately after collection of the water sample. Grab samples will be collected using a sterilized beaker, transferred to appropriate bottles, put on ice, and transported immediately to Willow Lake Laboratory. As soon as the portable samplers have completed their programs, the flow-weighted composite sample(s) will be put on ice and taken to Willow Lake Laboratory. All grab and composite samples will have a chain of custody form associated with them.

3.6.5 Documentation and Records

A field data sheet will be filled out for each sampling event. All field measurements and pertinent information will be put on this sheet, including the details identified in Table 4.

Table 4: Instream Storm Field Data Sheet

Sampler's name	Number of samples collected by portable sampler
Project name	Total volume during sampling event
Site name	Baseline cfs at start of storm
Date/time of each field measurement	cfs when last sample was taken
Number of samples programmed	Total rainfall during event
Field measurement readings	Rainfall intensity during event
Current rating curve (equation)	Antecedent dry period (as defined in permit)
Portable sampler start and end date/time	Total rainfall in previous 7, 14, and 30 day periods

3.6.6 Data Management

All laboratory analytical results will be kept in Willow Lake Laboratory's Laboratory Information Management System (LIMS) database and Stormwater Services' Aquarius database. In addition, applicable data from the field sheet will be entered into the Aquarius database.

3.6.7 Data Validation and Verification

The Project Manager will review all field and laboratory data. It will be the responsibility of the Project Manager to perform the final review and verification of information on the field data sheets and chain of custody forms. In addition, the Project Manager will follow up with Willow Lake Laboratory on any laboratory-generated data that has fallen outside an expected range. Decisions to accept, qualify, or reject any data collected under this monitoring element will be made by the Project Manager.

3.7 Long-term Strategy

This monitoring element supports the long-term monitoring program strategy by providing data that will contribute to the understanding of the relationship between post-construction stormwater controls (stormwater design standards) and receiving stream water quality. The sites selected for sampling in this monitoring element have catchments with various levels of stormwater controls. Evaluating data by these catchment characteristics is intended to provide

the City a basis to assess the aggregate effectiveness of stormwater controls. Understanding this effectiveness will help the City prioritize its stormwater retrofit efforts and evaluate progress towards pollutant reduction in MS4 receiving streams. This is a new monitoring element, and it is expected that this element will continue beyond the current permit cycle; ultimately providing a dataset for long-term and spatial analyses.

4.0 Monthly Instream

4.1 Project / Task Organization

Monthly Instream refers to the monitoring of MS4-receiving streams, where sampling is to occur once a month on a schedule that is determined at the beginning of each calendar year. The City's Stormwater Administrative Analyst will serve as the Project Manager and Responsible Sampling Coordinator. The City's Stormwater Administrative Analyst and Flow Monitoring Technician will take the lead on sampling and collection of field and in-situ data. The City's Willow Lake Laboratory will perform all analytical laboratory analyses.

4.2 Monitoring Objectives

Monthly Instream monitoring will contribute, at least in part, to monitoring objectives i, ii, iii, iv, v, and vi, as identified in Schedule B.1 of the City of Salem's NPDES MS4 Permit. Refer to the City of Salem Surface Water and Stormwater Monitoring Matrix (Attachment 1) for a more detailed explanation of how this monitoring element addresses each objective.

4.3 Background

The Monthly Instream monitoring element was initiated in 2001 and has been implemented since then. Since 2001 there have been twenty-one sampling sites on local streams and all but one has remained at the same location. The exception is the upstream Battle Creek site which was moved in 2003 due to lack of access.

Beginning July 1st, 2013, the City added three sampling sites on the Willamette River to this monitoring element, thus bringing the total number of sites to twenty-four. The three new Willamette River sampling sites are described in Table 5, and are generally located at:

- upstream of the Salem city limits (new site)
- mid-way through Salem (since 1990)
- downstream of Salem city limits (since 1990)

Monthly sampling has been completed as part of a combined effort to assess the impacts of the city's wastewater effluent and MS4 discharges on receiving water bodies.

4.4 Study Design / Sampling Process

4.4.1 Study Design

The study design for this monitoring element is a paired design, where samples are collected monthly at upstream and downstream sites (except for on the Willamette River where there is a third, mid-way sampling point) on ten of Salem's local streams that receive MS4 discharges and the Willamette River. There is also a downstream monitoring site on the West Fork Little Pudding River. The Little Pudding River starts within Salem city limits, but runs dry during the summer months, so an upstream site was not selected. Dates for sampling are determined at the beginning of each calendar year and are therefore independent of weather conditions.

Due to the number of sites and limited personnel resources, a narrowed set of parameters were chosen for this monitoring element. When initiated in 2001, this monitoring element was intended to produce a dataset that could provide an index of stream quality, as well as spatial and trend analysis. For this permit cycle, 303(d) and TMDL listed parameters were added to the study design. Refer to Table 6 for a list of parameters for all sites.

4.4.2 Frequency and Duration

The sampling frequency will be once a month at twenty-four sites. Two of the sites (LPW1 and CGT5) typically run dry during the summer months resulting in fewer samples at these sites. Per Table B-1, the original twenty-one Monthly Instream sites must be monitored for a total of forty eight events per site; the three Willamette River sites will be in addition to this monitoring requirement and not be counted towards the monitoring frequency requirement.

4.4.3 Monitoring Sites

The receiving water bodies to be monitored include Glenn Creek, Gibson Creek, Croisan Creek, Pringle Creek, Clark Creek, Battle Creek, Mill Creek, Mill Race, Shelton Ditch, Claggett Creek, West Fork Little Pudding River, and the Willamette River. These sites are identified in Figure 1 and described in Table 5.

Table 5: Monthly Instream Monitoring Sites

Site ID	Creek Name	Site Location
PRI1	Pringle Creek	Riverfront Park
PRI5	Pringle Creek	Bush Park
SHE1	Shelton Ditch	Church St SE
SHE10	Shelton Ditch	State Printing Office
MRA1	Mill Race	High St SE
MRA10	Mill Race	Mill Race Park
MIC1	Mill Creek	Front St Bridge
MIC10	Mill Creek	Turner Rd SE
BAT1	Battle Creek	Commercial St SE
BAT12	Battle Creek	Rees Hill Rd SE
CRO1	Croisan Creek	Courthouse Athletic Club
CRO10	Croisan Creek	Ballantyne Rd S
CLA1	Clark Creek	Bush Park
CLA10	Clark Creek	Ewald St SE
CGT1	Claggett Creek	Mainline Dr NE
CGT5	Claggett Creek	Hawthorne St NE @ Hyacinth St NE
GLE1	Glenn Creek	River Bend Rd NW
GLE10	Glenn Creek	Hidden Valley Dr NW
GIB1	Gibson Creek	Wallace Rd NW
GIB15	Gibson Creek	Brush College Rd NW
LPW1	West Fork Little Pudding River	Cordon Rd NE
<u>WR1 (WR8104)</u>	<u>Willamette River</u>	<u>Sunset Park (Keizer)-River Mile 81</u>
<u>WR5 (WR8303)</u>	<u>Willamette River</u>	<u>Railroad Bridge-River Mile 83</u>
<u>WR10 (WR8602)</u>	<u>Willamette River</u>	<u>Halls Ferry-River Mile 91</u>

4.4.4 Sample Collection Method

The sample collection method will vary by parameter, as described in Table 6.

Table 6: Monthly Instream Parameter List and Collection Method

Monthly Instream Constituents	Collection Method	Site
BOD ('stream')	Grab	All
Nitrate+Nitrite as Nitrogen	Grab	All
E. coli	Grab	All
Total Phosphorus	Grab	WR1, WR5, WR10
Alkalinity	Grab	WR1, WR5, WR10
Ammonia	Grab	WR1, WR5, WR10
Copper (Total & Dissolved)	Grab	PRI1 ¹ , PRI5 ¹ , CLA1 ¹ , CLA10 ¹
Lead (Total & Dissolved)	Grab	PRI1 ¹ , PRI5 ¹ , CLA1 ¹ , CLA10 ¹
Zinc (Total & Dissolved)	Grab	PRI1 ¹ , PRI5 ¹ , CLA1 ¹ , CLA10 ¹
Hardness	Grab	PRI1 ¹ , PRI5 ¹ , CLA1 ¹ , CLA10 ¹
TSS	Grab	LPW 1 ¹ , WR1, WR5, WR10
TS	Grab	WR1, WR5, WR10
TDS, calc.	Grab	WR1, WR5, WR10
Dissolved Oxygen	In-Situ	All
Temperature	In-Situ	All
Specific Conductivity	In-Situ	All
pH	Field	All
Turbidity	Field	All

Note: BOD 'stream' analytical method is not identified in 40 CFR 136; however, this method has been identified as an acceptable method under Table B-1 Special Condition #5 in the City's NPDES MS4 permit.

¹New parameter for this location, added this permit term

4.5 Data Quality Criteria

4.5.1 Data Quality Objectives

The data quality objectives for field measurements are detailed in Table 7. Analytical methods for grab samples analyzed at Willow Lake Laboratory will follow 40 CFR 136.

Table 7: Monthly Instream Field and In-Situ Quality Objectives

Parameters	Accuracy	Precision	Analytical Methods
Temperature	± 0.5 °C	± 0.5°C	Standard Method 2500 B
pH	± 0.2 SU	± 0.3 SU	Standard Method 4500 H ⁺ B
Dissolved Oxygen	± 0.2 mg/L	± 0.3 mg/L	Standard Method 4500 O G
Turbidity	± 5%	± 5%	Standard Method 2130 B
Specific Conductivity	± 7% of standard value	± 10%	Standard Method 2510 B

4.5.2 Representativeness

For monitoring sites on local streams, sampling will be performed at or near the center of the stream channel where the water is well mixed and representative of the ambient conditions. For the three Willamette River sites, samples will be collected from within fifty feet of the bank of the Willamette River (west bank for new upstream site, east bank for the midway and downstream sites).

4.5.3 Comparability

Field and grab samples for this monitoring element will utilize the same handling requirements and laboratory procedures that are used for the Instream Storm, Stormwater, and Continuous

Instream monitoring. This uniformity increases the validity of the data for analyses and comparisons with other data collected within the scope of this plan.

4.5.4 Completeness

Per Table B-1 in the City's NPDES MS4 permit, a minimum of forty-eight samples, from each of the twenty-one stream sites, will be collected. However, Table B-1 Special Condition #3 states that the minimum number of samples may be reduced to thirty-six if insufficient flow does not allow for sample collection. In addition, personnel illness and turnover, vehicular malfunction, equipment malfunction, and various safety issues, including flooding and/or high flows and debris (in particular on the Willamette River) could prevent the collection of all of the samples. If such a situation exists, Oregon DEQ will be informed following notification procedures in Schedule B. 2.e of the NPDES MS4 permit.

4.6 Quality Assurance / Quality Control / Record Keeping

4.6.1 Duplicate Samples

Duplicate field measurements and duplicate grab samples will be taken at ten percent of the sites each month. These sites will be randomly selected prior to the sampling event.

4.6.2 Instrument Calibration

All field meters will be calibrated prior to collecting samples. Each meter will be calibrated according to procedures outlined in its user manual. Willow Lake Laboratory performs all required laboratory equipment calibrations following their QA/QC protocols to maintain lab certifications.

4.6.3 Instrument Inspection and Maintenance

Field equipment will be checked prior to each sampling event. Routine maintenance will be performed before going into the field. Basic replacement parts will be kept on hand or made available. Willow Lake Laboratory maintains and operates all laboratory test equipment in accordance with requirements to maintain laboratory certifications.

4.6.4 Handling / Custody Procedures

Field measurements will be collected using a sterilized beaker for sample collection. These measurements will be completed immediately after collection of the water sample. Grab samples will be collected using a sterilized beaker, transferred to appropriate bottles, and taken to Willow Lake Laboratory after each day's sampling event.

4.6.5 Documentation and Records

Field data sheets will be completed for each monthly sampling event. Information to be recorded on these field data sheets includes project name, time of sample collection, site ID, sampler's name, and sample date. Results obtained in the field will be recorded on the field data sheets.

4.6.6 Data Management

The sampling person is responsible for completion of the field data sheets. The Laboratory Manager at the Willow Lake Laboratory will provide laboratory results. Field and laboratory data will be entered into the Aquarius database managed by Stormwater Services.

4.6.7 Data Validation and Verification

The Project Manager will do a review of all information on field data sheets. Once the data have been entered into the database, the Project Manager will print a paper copy of the data and proofread it against the original field data sheets, and then have the secondary lead do the same. Errors in data entry will be corrected at that time. Outliers and inconsistencies will be flagged for further review. It is the responsibility of the Project Manager to investigate further and determine validity of the data. Data quality problems will be addressed as they occur, and will be identified in the final report to data users.

4.7 Long-term Strategy

By providing the oldest continuous dataset of instream water quality, the Monthly Instream monitoring element is central to the long-term monitoring program strategy. Data collected through this monitoring element has been used (and will continue to be used) for long-term trending, spatial analysis, and observations of seasonal differences. It is expected that by the end of this permit term, there will be sufficient data to create a sub-dataset that represents stream conditions during storm events; thus, allowing for spatial analysis and long-term trending analyses based on storm conditions only.

5.0 Continuous Instream

5.1 Project / Task Organization

Continuous Instream monitoring refers to the continuous monitoring of MS4 receiving streams at fixed sites. The City's Stormwater Monitoring Analyst will serve as the Project Manager. The City's Stormwater Services workgroup will perform all operation/maintenance and quality assurance/quality control procedures.

5.2 Monitoring Objectives

Continuous Instream monitoring will contribute, at least in part, to monitoring objectives i, ii, iii, iv, v, and vi, as identified in Schedule B.1 of the City of Salem's NPDES MS4 Permit. Refer to the City of Salem Surface Water and Stormwater Monitoring Matrix (Attachment 1) for a more detailed explanation of how this monitoring element addresses each objective.

5.3 Background

Continuous Instream monitoring began in 2006 with a total of six sites, including: two on Mill Creek, two on Pringle Creek, and two on Clark Creek. In 2007, three sites were added, two on Glenn Creek, and one on Mill Creek. In 2008, two sites were added on Battle Creek. Due to concerns with data quality and maintenance, a site on Mill Creek, MIC1, is scheduled for removal in 2012 and therefore was not included as part this monitoring element.

5.4 Study Design / Sampling Process

5.4.1 Study Design

The study design is a paired design with two stations positioned in an upstream/downstream configuration on each monitored stream. The upstream sites are adjacent to where the stream enters the City, and the downstream sites are either above the confluence with another stream or where the stream exits the City's jurisdictional boundary. All monitoring equipment was installed to collect a representative dataset that describes the stream conditions during both

storm and non-storm conditions. This study design allows for both spatial analysis as well as long-term trend analysis.

An addition to the study design of this monitoring element was to aid in the Illicit Discharge Detection and Elimination (IDDE) program by utilizing the near real time monitoring capabilities. This was accomplished in 2008 through the development of a water quality alarm system designed to detect readings that may be a result from an illicit discharge.

5.4.2 Frequency and Duration

The City's network of ten continuous monitoring sites are designed to run 24 hours a day, 365 days a year. The data collection interval is every 15 minutes. Infrequent disruptions to data collection can result from power outages or equipment failures, creating 'gaps' in the continuous data time series record.

5.4.3 Sites

A total of ten continuous monitoring sites are currently installed on Pringle, Clark, Mill, Battle, and Glenn Creeks. The positioning of these sites are identified in Figure 1 and described in Table 8.

Table 8: Continuous Instream Monitoring Sites

Site ID	Creek Name	Site Location
PRI3	Pringle Creek	Pringle Park
PRI12	Pringle Creek	Trelstad Ave SE
MIC3	Mill Creek	North Salem High School
MIC12	Mill Creek	Turner Rd SE
BAT3	Battle Creek	Commercial St SE
BAT12	Battle Creek	Lone Oak Rd SE
CLK1	Clark Creek	Bush Park
CLK12	Clark Creek	Ewald St SE
GLE3	Glenn Creek	Wallace Rd NW
GLE12	Glenn Creek	Hidden Valley Dr NW

5.4.4 Collection Method

Data are collected in-situ using automated datasondes for the following water quality parameters: temperature, pH, dissolved oxygen, specific conductivity, and turbidity. Stage readings are measured in-situ. Provisional flow measurements will be computed using a polynomial equation in real time. Finalized flow measurements will be computed using proprietary rating curve software. Table 9 details each of the parameters and the sample collection method.

Table 9: Continuous Instream Parameter List and Collection Method

Continuous Instream Parameters	Collection Method
Temperature	In-situ
pH	In-situ
Dissolved Oxygen	In-situ
Specific Conductivity	In-situ
Turbidity	In-situ
Stage	In-situ

5.5 Data Quality Criteria

5.5.1 Data Quality Objectives

The data quality objectives for continuous in-situ measurements are detailed in Table 10.

Table 10: Continuous Instream In-Situ Quality Objectives

Parameters	Accuracy	Precision	Analytical Methods	
			In-Situ	YSI
Temperature	± 0.5 °C	± 0.5 °C	NIST Temperature checks	
pH	± 0.2 SU	± 0.3 SU	EPA-NERL 150.1	Standard Method 4500-H
Dissolved Oxygen	± 0.3 mg/L	± 0.5 mg/L	Method 1002-8-2009	ASTM D888-09
Turbidity	± 5% or 2 NTU (whichever is greater)	± 5% or 3 NTU (whichever is greater)	EPA-NERL 180.1	Standard Method 2130B
Specific Conductivity	± 7% of standard value	± 10%	EPA-NERL 120.1	Standard Method 2510

5.5.2 Representativeness

The datasondes are positioned to capture representative readings of ambient conditions for each site.

5.5.3 Comparability

In-situ measurements utilize the same type of instrumentation for all stations except for the two Glenn Creek sites (GLE3 and GLE12). Despite this difference in instrumentation, internal tests have shown that temperature, pH, dissolved oxygen, and specific conductivity readings are comparable. The one exception to this is turbidity. Turbidimeter comparison tests have shown a significant variation of the data at the upper range of sensor readings. In order to develop a comparable understanding of the data the City is working to develop a regression that explains the relationship between the two different types of turbidimeters. Once this regression has been established, data from all stations will be comparable.

5.5.4 Completeness

The continuous monitoring stations are maintained following the “Continuous Water Quality Monitoring Program Quality Assurance Project Plan (QAPP)”, revised in 2011. Power outages or unanticipated equipment malfunctions can occur and may contribute to data gaps within the continuous data sets.

5.6 Quality Assurance / Quality Control / Record Keeping

5.6.1 Instrument Calibration

All datasonde sensors will be calibrated according to documented procedures in the “Continuous Water Quality Monitoring Program QAPP”.

5.6.2 Instrument Inspection and Maintenance

Station instrumentation will be inspected and maintained according to the “Continuous Water Quality Monitoring Program QAPP”.

5.6.3 Documentation and Records

Separate field sheets will be completed for each station visit. Information to be recorded on these field sheets is described in the “Continuous Water Quality Monitoring Program QAPP”.

5.6.4 Data Management

Field technicians are responsible for completion of the field sheets. Data will be stored in the Stormwater Services Aquarius database.

5.6.5 Data Validation and Verification

The Stormwater Monitoring Analyst will do a review of all information provided on the field sheets following procedures documented in the “Continuous Water Quality Monitoring Program QAPP”. All collected data will be audited and assigned a grade value to describe the quality of each datum recorded. A verification process of all data collected between audit periods is completed on a quarterly basis. Once the verification process is complete, the data can be distributed to data users.

5.7 Long-Term Strategy

All monitoring sites for this element are at fixed locations that are either on City-owned property or locations where the City has obtained easements. This ensures that sites will continue to be operated and maintained for stream discharge and water quality monitoring into the future.

This monitoring element provides data that will support multiple long-term monitoring program strategies. Examples for intended use of the data include: aiding and showing progress in the IDDE program (by use of station alarms); studying the impacts relating to hydromodification and strategies to address hydromodification (stream flow/stage data); continued evaluation of receiving stream status (water quality data); examining the cumulative effects (chemical, physical, and biological) of the City’s MS4 stormwater runoff on receiving streams; and assessing progress towards meeting TMDL load reduction benchmarks.

6.0 Macroinvertebrate

6.1 Project / Task Organization

Macroinvertebrate monitoring will consist of sampling benthic macroinvertebrates at fixed sites in the Pringle Creek and/or Clark Creek subwatersheds. The City’s Stormwater Monitoring Analyst will serve as the Project Manager. The City’s Stormwater Services workgroup will be responsible for the completion of this monitoring effort.

6.2 Monitoring Objectives

Macroinvertebrate monitoring will contribute, at least in part, to monitoring objectives iv and v as identified in Schedule B of the City of Salem’s NPDES MS4 Permit. Refer to City of Salem Stormwater Monitoring Matrix (Attachment 1) for a more detailed explanation of how this monitoring element addresses each objective.

6.3 Background

Macroinvertebrate monitoring is a new environmental monitoring element of the City’s NPDES MS4 permit designed to help the City assess the biological effects of MS4 discharges on receiving waters. The City collected macroinvertebrate data within the Pringle Watershed in

2000 and 2001. To expand on these data, three targeted sites will be selected within the Pringle Creek and/or Clark Creek subwatersheds for monitoring during this permit cycle.

6.4 Study Design / Sampling Process

6.4.1 Study Design

The study design for this monitoring element is a targeted approach, where macroinvertebrates will be collected at three fixed sites within the Pringle Creek Watershed. Selected sites will be on Clark Creek, East Fork Pringle Creek, and the main stem of Pringle Creek. Sites selected for sampling will be in proximity to previous macroinvertebrate sampling sites (conducted in summer of 2000 and 2001) and, where possible, near other instream monitoring sites identified in this plan. The intent of this study design is to collect macroinvertebrate community data that can be compared with sites sampled in previous studies. Additionally, physical habitat data of the sampled stream site will be collected during macroinvertebrate sampling events. Data from other monitoring elements and the physical data collected will aid in the interpretation of the results and comparison analysis.

6.4.2 Frequency and Duration

Macroinvertebrate sample collection will be completed during two of the five permit years for a total of two samples per site. Sampling will occur at a similar time of year for each collection event.

6.4.3 Sites

Three targeted macroinvertebrate sampling sites will be selected in the Pringle and/or Clark Creek subwatersheds. Whenever possible, sites will be chosen that are in the vicinity of a continuous instream monitoring site.

6.4.4 Sample Collection Method

The Oregon DEQ Benthic Macroinvertebrate Protocol for Wadeable Rivers and Streams will be followed for each monitoring event. A qualified taxonomist will process all macroinvertebrate samples.

6.5 Quality Criteria

6.5.1 Representativeness

Targeted macroinvertebrate sites will be selected to represent MS4 receiving waters within the Pringle and/or Clark Creek subwatersheds.

6.5.2 Comparability

Targeted sampling at the same time of year at the same three sites using recognized sampling procedures will reduce the potential for spatial and temporal sample variation while increasing the comparability of data in the long term. Data collection methods used during this permit cycle will be comparable to those used in 2000 and 2001.

6.5.3 Completeness

Physical habitat data, including both quantitative and qualitative variables, will be collected at the same targeted sites. As applicable, water quality data collected from nearby continuous instream and/or monthly instream monitoring sites will supplement the data record. This

combined data set will provide information of stream conditions that will be used to assist in the identification of limitations and/or stressors to existing macroinvertebrate assemblages.

6.6 Quality Assurance / Quality Control / Record Keeping

6.6.1 Duplicate Samples

Field and laboratory duplicates will be collected for 10% of all samples.

6.6.2 Handling / Custody Procedures

All samples will be preserved in the field using a 70-95% ethanol concentration and labeled with sample collection information. This information will also be documented in pencil on waterproof paper and placed inside the preserved sample jar. If the sample is not immediately sent off to the lab for identification, the preservative will be replaced with fresh solution within one week of sample collection. Chain of custody forms will be completed for each monitoring event.

6.6.3 Documentation and Records

Field sheets documenting the site, date, and sampling personnel will be completed for each macroinvertebrate sampling event. This information will be combined with a set of additional field sheets designed to document the associated physical habitat data. It is the responsibility of the Project Manager to ensure that these documents are correctly completed during each monitoring event.

6.6.4 Data Management

All field documents and data received from the laboratory will be entered into the Stormwater Services Aquarius database by the Project Manager.

6.6.5 Data Validation and Verification

Macroinvertebrate samples will be preserved in the field, with sorting and identification conducted by a qualified taxonomist. Identification of organisms will be performed following the Oregon DEQ Benthic Macroinvertebrate Protocol for Wadeable Rivers and Streams.

6.7 Long-term Strategy

The macroinvertebrate monitoring that will be completed this permit term will provide a measure of the biological conditions at targeted sites within the Pringle Creek Watershed. This data will be compared with data collected during the summers of 2000 and 2001, providing a long-term assessment of changes in macroinvertebrate communities, and helping to evaluate the overall effectiveness of the City's Stormwater Management Program. Performing macroinvertebrate monitoring at or near the same sites during subsequent permit cycles will continue to be a key element of the long-term monitoring program strategy.

7.0 Instream Assessment

To fulfill the permit monitoring objectives and to help the City understand the effectiveness of its Stormwater Management Plan (SWMP); Instream Storm, Monthly Instream, Continuous Instream, and Macroinvertebrate data will be used to address the following assessment questions.

Question: (Trend Analysis, Spatial) What are the influences of City MS4 discharges on receiving stream water quality and flow during storm events?

Assumptions: City MS4 discharges are assumed to have some level of affect on water quality and flow of a receiving stream during storm events. The rationale is that the amount of impervious surface, differences in land use, and traffic volume will contribute to spatial changes in water quality parameters.

Question: (Trend Analysis, Time) Does data for the monitored water quality parameters change over time?

Assumption: The assumption is that water quality results will change over time. Through implementation of the City's SWMP, in-stream water quality results may change at different rates and at different points of SWMP implementation.

Question: (Seasonal Observation) Are there seasonal differences in the frequency that specific parameters exceed water quality criteria?

Assumption: The assumption is that certain water quality results will have more frequent exceedances of water quality standards during the dry season (summer), while others will have more frequent exceedances during the wet season (fall-winter-spring). The rationale is that some water quality parameters are more impacted by stormwater runoff while others are more subject to climatic conditions, flow volume, and land use activity outside of the City's jurisdictional area (e.g., agricultural land use adjacent to Mill Creek).

7.1 Analysis Methodology

Data mining will be used to organize the data to account for variables such as rainfall, stream levels, and seasonality. Once data have been organized into data sub sets, a normality test will be done to select a proper statistical hypothesis test to address trend analysis for both time and spatial questions. Seasonal observations will be addressed using descriptive statistics and graphical illustration.

8.0 Stormwater

8.1 Project / Task Organization

Stormwater monitoring refers to the monitoring of MS4 stormwater runoff during defined storm events. The City's Stormwater Monitoring Analyst(s) will serve as the Project Manager and the Responsible Sampling Coordinator. The Stormwater Services workgroup will perform sampling and collect field measurements. The City's Willow Lake Laboratory will perform all analytical laboratory analyses.

8.2 Monitoring Objectives

Stormwater monitoring will contribute, at least in part, to monitoring objectives i, ii, iii, iv, v, and vi, as identified in Schedule B.1 of the City of Salem's NPDES MS4 Permit. Refer to the City of Salem Surface Water and Stormwater Monitoring Matrix (Attachment 1) for a more detailed explanation of how this monitoring element addresses each objective.

8.3 Background

The City of Salem began collecting stormwater samples from four land use based monitoring sites (Redleaf, Edgewater, Cottage, Commercial) in January 1995. The City's first NPDES MS4 permit was subsequently issued in 1997. Annual stormwater sampling continued at these four sites through the winter of 2005. In 2006, the City discontinued these sites and began to

sample four new stormwater sites. These new sites were selected to represent stormwater discharges to 303(d) listed streams and have been identified by the associated stream name (Clark Storm, Mill Storm, Pringle Storm, Glenn Storm).

During this NPDES MS4 permit term (December 2010 - December 2015) the City will resume land use based stormwater sampling from three sites which represent residential, commercial, and industrial land use in Salem. Two of the sites, commercial and industrial, are new sites. These sites are discussed in Section 8.5.3 of this document.

8.4 Stormwater Assessment

Question: (Pollutant Concentrations) How does weather and/or other environmental conditions serve as a predictor of pollutant concentration levels in stormwater discharges from the MS4 system?

Assumptions: The assumption is that multiple factors contribute to the variability typically observed in stormwater pollutant data. Over time, it may be possible to identify key factors and further refine the SWMP to address those factors.

Question: (Comparison) Is there a statistical difference between the City's land use event mean concentrations (EMCs) and the Oregon Association of Clean Water Agencies (ACWA) EMCs that were used for the 2008 permit renewal process (ACWA data; modified 2008)?

Assumptions: The assumption is that there is a statistical difference between the City's land use EMCs and the ACWA land use EMCs. The rationale is that the ACWA EMCs are based on pre-SWMP data from all Oregon Phase 1 municipalities. While the City did contribute to the ACWA data set, the City has since collected a significant number of data points post implementation of the City's SWMP and therefore would expect to see a decreasing trend in the data.

8.4.1 Analysis Methodologies

To answer the assessment questions historic and data collected this permit term will be used for analyses. Regression analysis may be used to address the pollutant concentration question. To address the comparison question, analysis may include a non-parametric statistical test.

8.5 Study Design / Sampling Process

8.5.1 Study Design

The study design for this monitoring element provides for the characterization of MS4 stormwater runoff as a result of implementation of the City's SWMP. This will be done for commercial, industrial, and residential land uses. To acquire a more representative dataset for both commercial and industrial land use, the monitoring sites will differ from those sampled during the first two MS4 permit cycles. The residential land use monitoring will be at the same site sampled during the last MS4 permit cycle (2004 – 2010). Through this monitoring element, stormwater sampling data collected from similar land uses will be aggregated, with the intent to produce representative pollutant load concentration values.

8.5.2 Frequency and Duration

Stormwater monitoring will be conducted during fifteen storm events at each of the three sites throughout the duration of the permit term.

8.5.3 Sites

Three sites will be monitored over the course of the permit cycle. These sites are storm sewer manholes and represent residential, industrial, and commercial land use activity within the City. The residential and commercial catchments are within the Pringle Creek Watershed. The industrial catchment resides within the Upper Claggett Watershed. These sites are identified in Figure 1 and described in Table 11.

Table 11: Stormwater Monitoring Sites

Dominant Land Use	Residential	Industrial	Commercial
Site Identifier	Electric	Salem Industrial	Hilfiker
Manhole Number	D42466227	D51488226	D42456231
Number of Monitoring Events	3/year or 15/permit cycle	3/year or 15/permit cycle	3/year or 15/permit cycle
Watershed	Pringle Creek	Upper Claggett	Pringle Creek
Receiving Stream	Clark Creek	Claggett Creek	West Fork Pringle Creek

8.5.4 Sample Collection Method

Sample collection methods will include grabs samples, field measurements, and flow-weighted composites² (Table 12). All grab samples will be collected and all field measurements will be taken during the first three hours of the sampled storm event. Portable sampling units and flow modules will be programmed to perform a flow-weighted composite sample based on the predicted rainfall depth. The predicted rainfall depth will be calculated prior to the sampling event using a local forecast, with cessation of the event being identified by the first predicted 6 hour dry period or at the end of 24 hours, whichever comes first. The portable sampling units will remain in the field until the program is completed or 24 hours from the start of the event, whichever comes first

Table 12: Stormwater Parameter List

Pollutant Parameter	Collection Method
TSS	Composite
BOD _{5-day}	Composite
Total Phosphorus	Composite
Nitrate+Nitrite as Nitrogen	Composite
Ammonia Nitrogen	Composite
Copper (Total Recoverable & Dissolved)	Composite
Lead (Total Recoverable & Dissolved)	Composite
Zinc (Total Recoverable & Dissolved)	Composite
Hardness	Composite
Sp. Conductivity	Field and Composite
Temperature	Field
pH	Field
Dissolved Oxygen	Field
E. coli	Grab

² If flow equipment fails and it is infeasible to repair equipment before a targeted storm event starts, samplers will be programmed to take a time-composite sample in place of a flow paced sample.

8.5.5 Storm Selection Criteria

The following criteria will be used to select storm events for sampling:

- Storm event must be greater than 0.1 inch of rainfall
- When possible, samples must be collected after an antecedent dry period of a minimum of 24 hours

8.6 Data Quality Criteria

8.6.1 Data Quality Objectives

The quality objectives for field measurements are detailed in Table 13. Analytical methods for composite and grab samples analyzed at Willow Lake Laboratory will follow 40 CFR 136.

Table 13: Stormwater Field Measurement Quality Objectives

Parameters	Accuracy	Precision	Analytical Methods
Temperature	± 0.5 °C	± 0.5 °C	NIST Temperature checks
pH	± 0.2 SU	± 0.3 SU	EPA-NERL 150.1
Dissolved Oxygen	± 0.2 mg/L	±0.3 mg/L	ASTM D888-09
Specific Conductivity	± 7% of standard value	± 10%	EPA-NERL 120.1

8.6.2 Representativeness

All samples will be collected under a specific 'storm event' condition detailed in 8.5.5. Grab samples will be collected and field measurements will be taken within the first three hours of the storm.

8.6.3 Comparability

Field measurements and grab samples for this monitoring element will utilize the same handling requirements and laboratory procedures that are used for the Instream (Storm Only), Monthly Instream, and Continuous Instream monitoring elements. This uniformity increases the validity of the data for analyses and comparisons with other data collected within the scope of this plan.

8.6.4 Completeness

It is anticipated that fifteen samples from each of the three sites will be collected over the five year permit term. However, unanticipated circumstances including but not limited to; personnel illness and turnover, vehicular malfunction, equipment malfunction, and various safety issues could prevent collection of a hundred percent of the samples. If such a situation exists, Oregon DEQ will be informed following notification procedures in Schedule B.2.e of the NPDES MS4 permit.

8.7 Quality Assurance / Quality Control / Record Keeping

8.7.1 Duplicates and Blank Samples

Duplicate samples for grab samples and field measurements will be taken for a minimum of ten percent of the total number of samples. For composite sampling, an equipment blank (involving suction line tubing, pump tubing, strainer, and sample container vessel) will be done prior to the first sampling event of each sampling season.

8.7.2 Instrument Calibration

Calibration procedures are detailed in the City's "Stormwater and Instream (Storm Only) Monitoring Standard Operating Procedures" (2011).

8.7.3 Instrument Inspection and Maintenance

Instrument calibration will be completed prior to each sampled storm event. Instrument inspection and maintenance procedures will be followed according to the City's "Stormwater and Instream (Storm Only) Monitoring Standard Operating Procedures" (2011).

8.7.4 Mobilization / Handling / Custody Procedures

The City contracts with a weather service that provides a detailed precipitation forecast that is updated daily. The Responsible Sampling Coordinator will monitor this weather forecast and make the final decision to sample. Once it has been decided to sample a storm, Willow Lake Laboratory will be notified, a two person team will deploy portable samplers filled with ice, and all other relevant equipment and forms will be prepared. The contracted weather service will provide notification prior to the start of the storm event, ensuring the collection of grab samples and field measurements during the first 3 hours of the storm event.

The City has four staff that are trained on proper handling procedures to collect samples during a storm event. Field measurements will be taken using a sterilized beaker for sample collection. These measurements will be completed immediately after collection of the water sample. Grab samples will be collected using a sterilized beaker, transferred to appropriate bottles, put on ice, and transported immediately to Willow Lake Laboratory. As soon as the portable samplers have completed their programs, the flow-weighted composite sample(s) will be put on ice and taken to Willow Lake Laboratory. All grab and composite samples will have a chain of custody form associated with them.

8.7.5 Documentation and Records

A field data sheet will be filled out for each sampling event. All field measurements will be put on this sheet. Additional information recorded on the sheet is described in Table 14.

Table 14: Stormwater Field Data Sheet

Sampler's name	Predicted rainfall for sampling event
Project name	Predicted runoff volume for sampling event
Site name	Flow quantity interval
Date/time of each field measurement	Number of samples programmed
Portable sampler start and end date/time	Actual number of sample collected
Total volume during sampling event	Presence/absence of base flow before sampling
Presence of base flow after sampling	Total rainfall during event
Total rainfall prior to grab and field measurements	Average rainfall intensity during event
Rainfall intensity prior to grab collection and field measurements	Time of concentration
Antecedent dry period (as defined in permit)	Total rainfall in previous 7, 14, and 30 day periods
Field measurement reading(s)	Baseline CFS, start of storm

8.7.6 Data Management

All composite and grab sample data from each wet-weather sampling event will be entered into Willow Lake Laboratory's LIMS database. Stormwater personnel receive hard and electronic copies of these data. All data will be imported into Stormwater Services Aquarius database.

8.7.7 Data Validation and Verification

The Project Manager will review all field and laboratory data. It will be the responsibility of the Project Manager to perform the final review and verification of the data reported on the field data sheet. In addition, the Project Manager will follow up with Willow Lake Laboratory on any laboratory-generated data that has fallen outside an expected range. Decisions to accept, qualify or reject any data collected under this monitoring element will be made by the Project Manager.

8.8 Long-term Strategy

This element contributes to the long-term monitoring program strategy by providing data that characterizes the quality of MS4 discharges, and supports long-term evaluation of the effectiveness of the City's Stormwater Management Program. Datasets can be utilized for comparison between ACWA concentration values used for estimating total annual pollutant loads and benchmark analysis completed as part of the 2008 permit renewal package; thus, providing a gauge of the effectiveness of both structural and non-structural stormwater controls. Additionally, seasonal and geographic characterization will also be evaluated to help identify future stormwater control facility implementation priorities.

9.0 Pesticide

9.1 Project / Task Organization

Pesticide monitoring refers to the monitoring of pesticides in MS4 stormwater discharges during defined storm events. The City's Stormwater Monitoring Analyst(s) will serve as the Project Manager and the Responsible Sampling Coordinator. The Stormwater Services workgroup will perform sampling. The City will have a contracted laboratory perform all analytical laboratory analyses.

9.2 Monitoring Objectives

Pesticide monitoring will contribute, at least in part, to monitoring objectives ii, iii, iv, and v, as identified in Schedule B.1 of the City of Salem's NPDES MS4 Permit. Refer to the City of Salem Surface Water and Stormwater Monitoring Matrix (Attachment 1) for a more detailed explanation of how this monitoring element addresses each objective.

9.3 Background

This will be the first time the City has monitored for pesticides within MS4 discharges. This sampling will provide the City with information to determine if pesticides are present in the City's storm sewer system and discharging to receiving streams.

9.4 Pesticide Assessment

Question: (Presence) Are there pesticides present in residential, commercial, or industrial MS4 stormwater runoff in concentrations that are measureable using the identified pesticide screening method(s) in this plan? If so, does presence or type of pesticide vary by land use?

Assumptions: The assumption is that pesticide compounds will be found within MS4 stormwater runoff from the monitored sites in concentrations that are measureable using the identified pesticide screening methods in this plan. An additional assumption is that samples from the residential land use site will have more frequent detection of pesticide compounds at

higher concentrations—resulting from relatively uncontrolled pesticide application by household applicators and larger areas of green space.

9.4.1 Analysis Methodology

Analysis methodology will include graphical representation of pesticide compounds detected. If pesticides are detected a source review of the specific pesticide compound will be done to determine whether the pesticide was most likely applied by a commercial applicator or a household applicator.

9.5 Study Design / Sampling Process

9.5.1 Study Design

The study design for this monitoring element is a land use-based design that will identify the presence of specifically-identified pesticides (or lack of) in MS4 stormwater discharges. The land use types to be monitored include residential, commercial, and industrial. Following the collection of data through this monitoring element, the City anticipates being able to evaluate and potentially modify its outreach efforts based on various pesticide user groups.

9.5.2 Frequency and Duration

Pesticide sampling will be completed during two of the five permit years for a total of four storm events at each of the three sites.

9.5.3 Sites

The storm sewer sites to be monitored for this element are the same land use based sites as the Stormwater monitoring sites. The residential and commercial sites are within the Pringle Creek Watershed. The industrial catchment resides within the Upper Claggett Watershed. These sites are identified in Figure 1 and described in Table 15.

Table 15: Pesticide Monitoring Sites

Dominant Land Use	Residential	Industrial	Commercial
Site Identifier	Electric	Salem Industrial	Hilfiker
Manhole Number	D42466227	D51488226	D42456231
Number of Monitoring Events	4/permit cycle	4/permit cycle	4/permit cycle
Watershed	Pringle Creek	Upper Claggett	Pringle Creek
Receiving Stream	Clark Creek	Claggett Creek	West Fork Pringle Creek

9.5.4 Sample Collection Method

The sample collection method will be grab samples. The City will collect pesticide samples when application rates are assumed heaviest.

9.5.5 Pesticide Parameters

Two separate screens will be done for pesticide sampling events, including a halogenated pesticide screen and a chlorinated herbicide screen. There are sixty-two different compounds in the halogenated pesticide screen and sixteen different compounds in the chlorinated herbicide screen (Attachment 2).

9.5.6 Pesticide Storm Selection Criteria

The following criteria will be used to select storm events to conduct sampling:

- Storm event must be greater than 0.1 inch of rainfall
- When possible, samples must be collected after an antecedent dry period of a minimum of 24 hours

9.6 Quality Criteria

9.6.1 Measurement Quality Objectives

It is anticipated that analytical method EPA SW-846, 8081B (GC-ECD) will be used for the halogenated pesticide screen and analytical method EPA SW-846, 8321B (HPLC-MS) will be used for the chlorinated herbicide screen. The expected reporting limits for each compound within these screens are included in Attachment 2.

9.6.2 Representativeness

All pesticide monitoring will be done under defined storm events with a target of capturing a sample from the most intense period of the defined storm event. All grab samples will be collected from the middle of the water column of the inflow pipe.

9.6.3 Comparability

To ensure comparability between the different land use sites, attempts will be made to collect samples at all three sites during each pesticide monitored storm event. If possible, the same laboratory and analytical methods will be used for all sampling.

9.6.4 Completeness

It is anticipated that pesticide samples will be collected from one hundred percent of selected sites during a minimum four sampling events per site.

9.7 Quality Assurance / Quality Control / Record Keeping

9.7.1 Duplicate, Blank, and Replicate Samples

Duplicate, blank, and replicate samples will be done according to the contracted laboratory's specifications. Duplicate samples will be collected and analyzed for a minimum of ten percent of total samples. All results from these samples will be included within the data records.

9.7.2 Mobilization / Handling / Custody Procedures

The City contracts with a weather service that provides a detailed precipitation forecast that is updated daily. The Responsible Sampling Coordinator will monitor this weather forecast and make the final decision to sample. Once it has been decided to sample a storm, the contracted laboratory for pesticide analysis will be notified and all other relevant equipment and forms will be prepared. The contracted weather service will provide notification prior to the start of the storm event, ensuring the collection of grab samples and field measurements during the first 3 hours of the storm event.

The City has four staff that are trained on proper handling procedures to collect pesticide samples during a storm event. Grab samples will be collected using sterilized beakers and then transferred to bottles provided by the laboratory. A separate beaker will be used for each site.

Beakers will be triple rinsed before each sample is collected. All samples will have a chain of custody form.

9.7.3 Documentation and Records

A field data sheet will be filled out for each sampling event. Information to be recorded on the field sheet is described in the Table 16 below.

Table 16: Pesticide Field Data Sheet

Sampler's name	Rainfall intensity prior to grab sample
Project name	Time of concentration
Site name	Antecedent dry period (as defined in permit)
Date/time of each field measurement	Total rainfall in previous 7, 14, and 30 day periods
Total rainfall prior to grab sample	Field measurement readings

9.7.4 Data Management

All analytical results and applicable field measurements including field data sheet information will be stored in the Stormwater Services Aquarius database.

9.7.5 Data Validation and Verification

It will be the responsibility of the Project Manager to perform the final review and verification of the data reported on the field data sheet. In addition, the Project Manager will follow up with the contracted laboratory on any laboratory-generated data that has fallen outside an expected range. Decisions to accept, qualify, or reject any data collected under this monitoring element will be made by the Project Manager.

9.8 Long-term Strategy

This pesticide monitoring element will guide future pesticide monitoring and outreach efforts by first identifying the scope of pesticide use. With these data, trends of particular pesticides/compounds may be identified that can guide future pesticide monitoring efforts. Furthermore, data collected will help guide outreach efforts to target specific pesticide users. It is anticipated that pesticide monitoring will not continue in this same study design in upcoming MS4 permit cycles as trends are identified.

10.0 Stormwater – Mercury

10.1 Project / Task Organization

Stormwater – Mercury monitoring refers to the monitoring of low level mercury and methyl mercury (total recoverable and dissolved) in MS4 discharges during defined storm events. The City's Stormwater Monitoring Analyst will serve as the Project Manager and Responsible Sampling Coordinator. The City will have a contracted laboratory to perform all analytical laboratory analyses.

10.2 Monitoring Objectives

Stormwater – Mercury monitoring will contribute, at least in part, to monitoring objectives ii, iii, iv, and v, as identified in Schedule B.1 of the City of Salem's NPDES MS4 Permit.

10.3 Background

This will be the first time the City has monitored MS4 stormwater runoff for low level mercury and methyl mercury (total recoverable and dissolved).

10.4 Study Design / Sampling Process

10.4.1 Study Design

The study design for this monitoring element is to provide modeling efforts by the DEQ with low level total and dissolved mercury and methyl mercury data from MS4 discharges that is representative residential and commercial land use catchments. Storms to be sampled include one summer storm and one winter storm from each site for a minimum of two years.

10.4.2 Frequency and Duration

Stormwater– Mercury monitoring will be conducted at two sites two times per year, one summer and one winter storm event. Following NPDES MS4 permit Table B-1 Special Condition #6, after two years of monitoring the City may request from the DEQ that this monitoring element be eliminated.

10.4.3 Sites

The sampling sites are the same commercial and residential land use based sites identified in the Stormwater monitoring element. These sites are within the Pringle Creek Watershed and are identified in Figure 1 and described in Table 17.

Table 17: Stormwater – Mercury Monitoring Sites

Dominant Land Use	Residential	Commercial
Site Identifier	Electric	Hilfiker
Manhole Number	D42466227	D42456231
Number of Monitoring Events	2/year; one summer and one winter storm event	2/year; one summer and one winter storm event
Watershed	Pringle Creek	Pringle Creek
Receiving Stream	Clark Creek	West Fork Pringle Creek

Note: Per Table B-1 Special Condition #6 of the City's NPDES MS4 permit after two years of monitoring the City may request from the DEQ that this monitoring element be eliminated.

10.4.4 Sample Collection Method

The sample collection method will be grab samples. EPA method 1669 ultra clean sampling protocol will be used to collect samples under this monitoring element.

10.4.5 Stormwater- Mercury Storm Selection Criteria

The following criteria will be used to select storm events to conduct sampling:

- Storm event must be greater than 0.1 inch of rainfall
- When possible, samples must be collected after an antecedent dry period of a minimum of 24 hours

10.5 Quality Criteria

10.5.1 Measurement Quality Objectives

The analytical method for total recoverable and dissolved mercury is US EPA method 1631E with a quantitation limit of 0.5 ng/L. The analytical method for total recoverable and dissolved methyl mercury is US EPA method 1630 with a quantitation limit of 0.05 ng/L.

10.5.2 Representativeness

All samples will be collected under a specific storm criteria identified in Section 10.4.5 of this document. Sample collection will follow EPA Method 1669 ultra clean sampling protocol.

10.5.3 Comparability

If possible, the same laboratory will be used for all mercury sample analyses. Attempts will be made to collect samples from both sites during the same storm events. Rainfall data from the nearest applicable rain gauge station will accompany the data set for each monitoring event.

10.5.4 Completeness

Stormwater - Mercury monitoring will be conducted two times per year, one summer and one winter storm event, at two sites. However, unanticipated circumstances including but not limited to; personnel illness and turnover, vehicular malfunction, equipment malfunction, and various safety issues could prevent the collection of all of the samples. If such a situation exists, Oregon DEQ will be informed following notification procedures in Schedule B.2.e of the NPDES MS4 permit. Following NPDES MS4 permit Table B-1 Special Condition #6, after two years of monitoring the City may request from the DEQ that this monitoring element be eliminated.

10.6 Quality Assurance / Quality Control / Record Keeping

10.6.1 Duplicate and Blank Samples

Duplicate and blank samples will be collected according to EPA Method 1669 ultra clean sampling protocol and sent to the laboratory for analysis following methods identified in 10.5.1. All results from these samples will be included within the data records.

10.6.2 Mobilization / Handling / Custody Procedures

The City contracts with a weather service that provides a detailed precipitation forecast that is updated daily. The Responsible Sampling Coordinator will monitor this weather forecast and make the final decision to sample. Once it has been decided to sample a storm, the contracted laboratory for mercury analysis will be notified and all other relevant equipment and forms will be prepared. The contracted weather service will provide notification prior to the start of the storm event, ensuring the collection of grab samples and field measurements during the first 3 hours of the storm event.

The City has four staff that are trained on the collection procedures outlined in EPA Method 1669 ultra clean sampling protocol prior to sampling. All samples will be collected and handled according to EPA Method 1669 ultra clean sampling protocol. Samples will be put on ice immediately and shipped overnight to the laboratory. All samples will have a chain of custody form.

10.6.3 Documentation and Records

After each sample is collected, field documentation will be recorded in a sampling log and any unusual observations concerning the sample and sampling will be documented.

10.6.4 Data Management

All analytical results including field documentation recorded during sampling will be stored in the Stormwater Services Aquarius database.

10.6.5 Data Validation and Verification

It will be the responsibility of the Project Manager to perform the final review and verification of the data reported on the field data sheet. Decisions to accept, qualify, or reject any data collected under this monitoring element will be made by the Project Manager.

10.7 Long-term Strategy

The study design for monitoring of mercury in MS4 discharges is unlikely to be similar to this approach in future efforts. The current study design is largely driven by data needs for modeling by DEQ. Future mercury monitoring will likely be guided by Willamette River TMDL requirements that at this time are uncertain.

11.0 Dry Weather Outfall

In support of the IDDE program and to satisfy requirements of the City's NPDES MS4 permit (Schedule A.4.a), the City will continue to conduct annual dry-weather outfall inspections. These inspections will be based on a prioritization process following a standard operating procedure. Stormwater Services field staff will work cooperatively with Environmental Services Compliance Specialists for this monitoring element.

12.0 Coordinated Environmental Monitoring

The City's NPDES MS4 permit allows for the opportunity to coordinate environmental monitoring with other MS4-permitted municipalities (Schedule B.4). City staff recognizes that there are potential benefits to such a coordinated effort (e.g., cost savings, data set size, efficiency). If a coordinated environmental monitoring strategy is developed, the City would modify this monitoring plan and notify the DEQ in accordance with NPDES MS4 permit Schedule B.2.e.

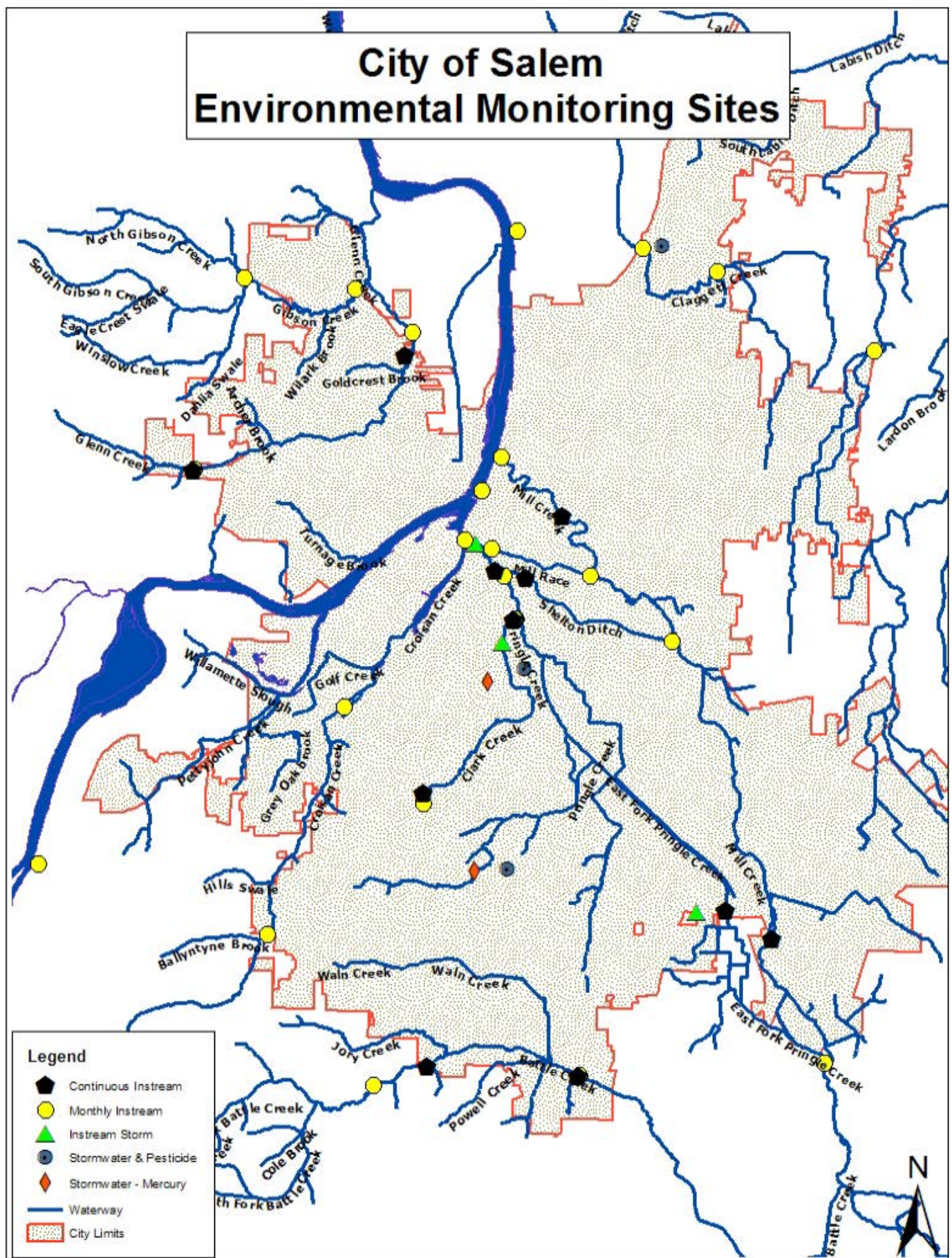


Figure 1: Surface Water and Stormwater Monitoring Sites

From: BENNINGHOFF Benjamin <BENNINGHOFF.Benjamin@deq.state.or.us>
To: 'Anita Panko' <ampanko@cityofsalem.net>
Date: 3/15/2013 8:20 AM
Subject: RE: Revision to City of Salem Surface Water and Stormwater Monitoring Plan

Anita-

Based on my review of the monitoring plan submittal and our discussion last week, the proposed modifications to the stormwater monitoring plan are acceptable. The modifications to the monitoring plan do not appear to trigger a permit modification, but please review the changes to ensure that the modifications do not alter Salem's BMP commitment in the Stormwater Management Plan.

Please do not hesitate to contact me if you have any questions. Thank you!

Ben

Benjamin Benninghoff | Municipal (MS4) Stormwater Coordinator
Oregon Department of Environmental Quality | 811 SW Sixth Ave., Portland, OR 97204
Phone: 503-229-5185 | Fax: 503-229-6037

-----Original Message-----

From: Anita Panko [mailto:ampanko@cityofsalem.net]
Sent: Thursday, March 14, 2013 2:06 PM
To: BENNINGHOFF Benjamin
Subject: Revision to City of Salem Surface Water and Stormwater Monitoring Plan

Benjamin,

After our phone discussion on Thursday, March 7th, I wanted to confirm that you were ok with all of the revisions the City of Salem has made to the Surface Water and Stormwater Monitoring Plan (attached to the letter sent to you dated March 1, 2013) and that we can move forward as expected.

These revisions included combining the Willamette River water sampling program (formerly done by Willow Lake Pollution Control Facility staff) with the Monthly Instream sampling (formerly done by Environmental Services staff) and having Stormwater Services take over the program. This would include 3 locations on the Willamette River being sampled at the same time as the Monthly Instream (once a month), and all samples will be collected from the bank.

Please respond to acknowledge the Department's approval of the proposed modifications.

Thank you,

Anita

Anita Panko
Flow Monitoring Analyst
City of Salem, Public Works
1410 20th St SE, Bldg #2
Salem, OR 97302

office PH: (503)-589-2188
cell PH: (503) 503-932-3644
FAX: 503.588-6480