2010

Clark County Stream Health Report

Department of Environmental Services

CLARK COUNTY, WASHINGTON

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2010 Clark County Stream Health Report

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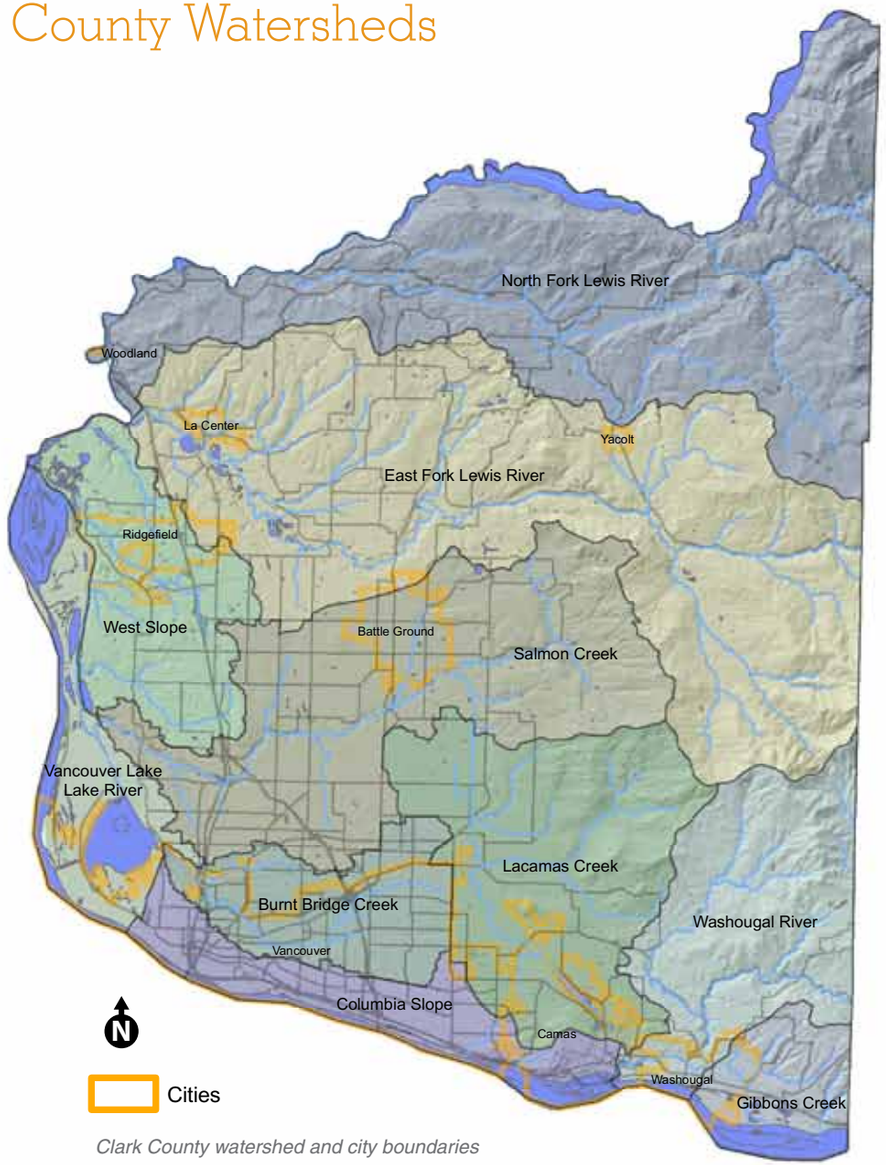


Clark County watershed and city boundaries

Introduction

Clark County's numerous streams and rivers play an important, often overlooked, role in our daily lives. They perform many valuable functions, such as collecting stormwater, buffering floodwaters, and providing habitat for fish and wildlife. They feed the lakes that we swim and sail in. They are a beloved scenic resource for recreating and relaxing. As the population within Clark County grows, it is becoming increasingly important to protect our water resources.

The 2010 Clark County Stream Health Report can help you find out more about stream health in your watershed, trends in stream health, and ways we can work together to make a difference.

Healthy streams in the Pacific Northwest have clean water, support a wide variety of native plant and animal life, and generally have stream flows that are not too high or too low. Unhealthy streams may be degraded by pollutants like harmful bacteria, heat, and sediment. They may have high stream flows during storms and little or no flow at other times. Unhealthy streams have fewer plants and animals, or they may have only undesirable types that are tolerant of poor stream conditions.

There is a significant relationship between our streams and the land that surrounds them [Figure 1]. Our activities in the watershed affect the streams that run through them.

In a forest or field, water falls on the ground and is absorbed into the soil. On a hard surface (such as a parking lot or driveway), water falls on the ground and quickly "runs off" as stormwater. Some runoff is normal, but too much creates water quantity problems such as flooding which can affect our safety, damage property, and harm fish and wildlife habitat. Runoff can also cause water quality problems. In a forest or field, soil cleans and cools the water that it absorbs, which slowly flows underground to the stream. Runoff flowing over hard surfaces can pick up bacteria, chemicals, nutrients, and sediment (from things like pet waste, oil leaks, exposed soil, and fertilizers), and carry this pollution to nearby streams.

Monitoring is one important way to determine whether our streams are healthy. We can collect information about the condition of our streams and compare it to scientific definitions of what is healthy. This creates a picture of where we have problems and what might be causing them.

Scientists from Clark County Environmental Services monitor our streams every year, funded by a portion of the Clean Water Fee. Regular monitoring helps us find and fix problems, and enables Clark County to comply with stormwater management regulations that protect water quality.

Watershed and Subwatershed

A watershed is an area of land that drains (sheds water) from its highest points to its lowest points, which is usually a stream or lake. Watersheds are made up of smaller drainage areas called subwatersheds. For this report, Clark County has been divided into 78 subwatersheds that make up 10 watershed areas.

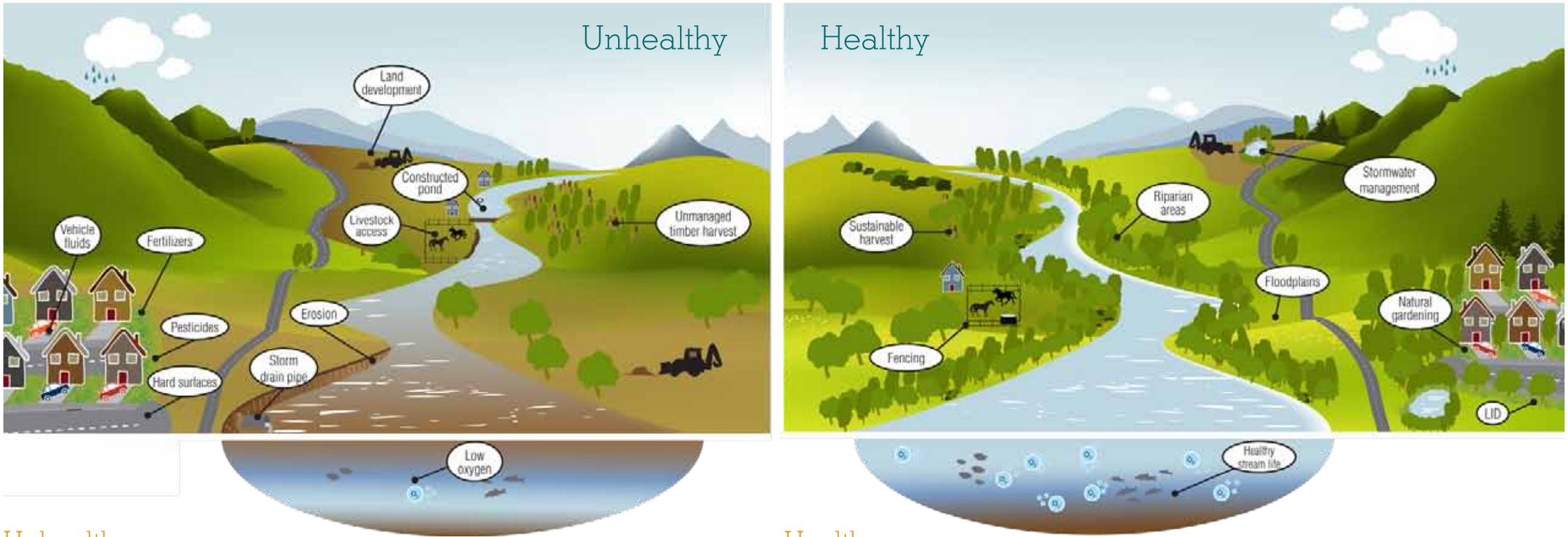
Our Vision

We envision a Clark County rich in natural resources, parklands, and open spaces, which sustain and support our local economy, while enhancing our high quality of life.

Our Mission

Environmental Services strategically protects and enhances our natural environment.

Introduction and Summary



Unhealthy

In-channel ponds change stream flows and absorb heat, which harms stream life.

Livestock access adds bacteria and causes bank erosion.

Erosion and sediment harm stream life.

Land development without effective stormwater management increases runoff, which causes erosion and affects water quality.

Unmanaged timber harvest increases runoff and causes erosion.

Pesticides and vehicle fluids are toxic and difficult to clean up from rivers and lakes.

Fertilizers are plant nutrients that cause algae blooms downstream, which can harm stream life, pets and people.

Hard surfaces such as roads and roofs, and pipes that remove stormwater, increase runoff and cause stream levels to rise quickly. Hard surfaces are especially harmful next to streams.

Low oxygen reduces diversity of stream life.

Healthy

Trees provide shade to cool water temperatures and wood for stream habitat.

Fencing livestock away from streams protects water quality and stream life.

Stormwater management controls and cleans runoff from hard surfaces before adding to streams.

Sustainable harvest leaves trees in place to protect soil and prevent erosion.

Natural gardening reduces need for pesticides and fertilizers.

Flood plains are open space along streams that allow high water flows to spread out and absorb runoff.

A healthy ***riparian area*** of native plants along the streambank filters runoff and controls bank erosion.

Low Impact Development (LID) leaves undisturbed areas of soil and vegetation, and reduces hard surfaces.

Figure 1: Signs of unhealthy and healthy watersheds

Summary

This report explains recent monitoring conducted between 2004 and 2009. Figure 2 summarizes overall stream health in Clark County watersheds. This general map shows that many of our streams are degraded and that our community faces challenges in improving and protecting these valuable resources.

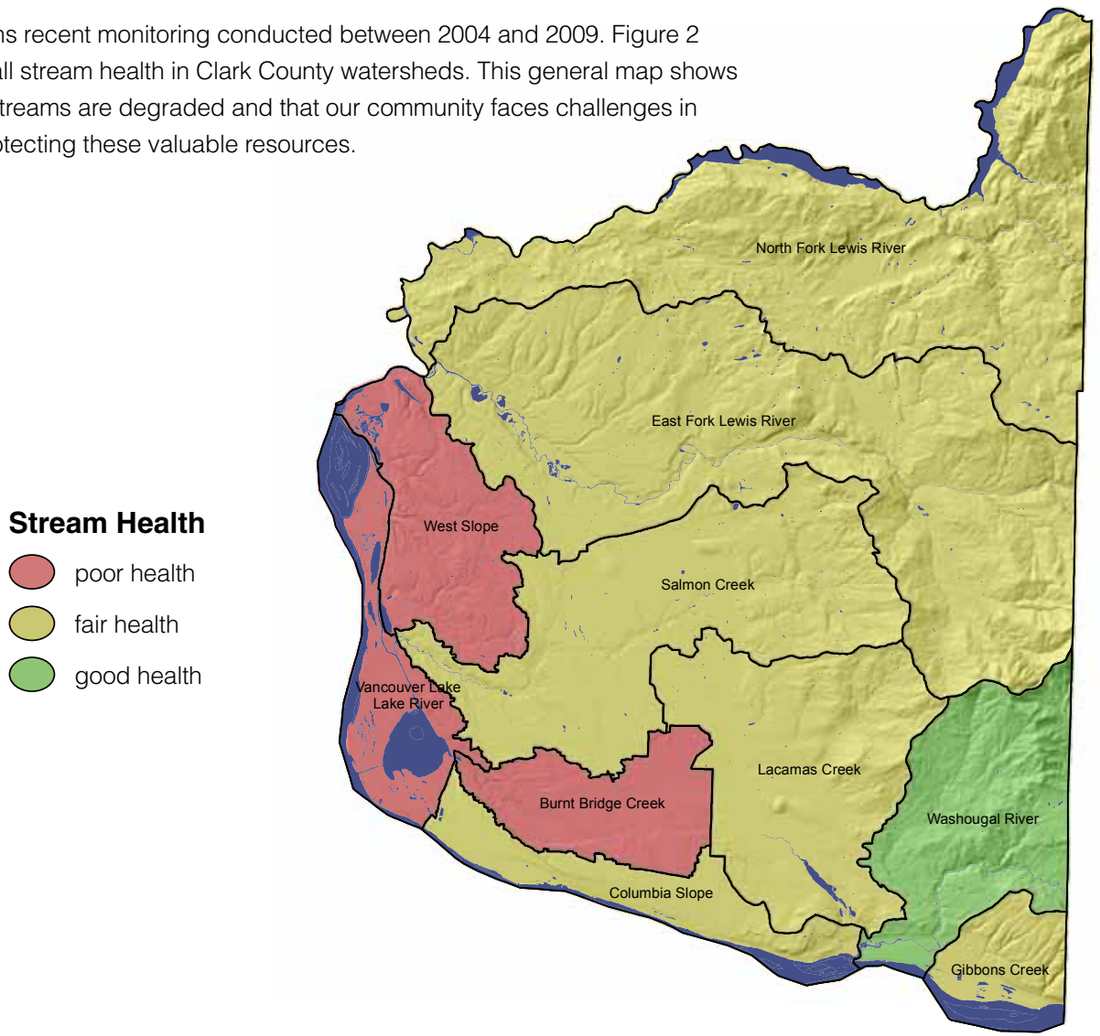


Figure 2: Summary of overall stream health in all Clark County watersheds

What is covered in this report?

Monitoring indicators and metrics: Learn about the measures used to determine stream health.

How to use this report: Find out how to read and interpret the stream health score cards.

Watersheds: See the stream health score card and maps for each watershed, summaries of special water quality studies, and land cover data and maps. Read about likely stream conditions, priority resources to protect, and suggested stream health strategies for each watershed. Also find out about the general health of major Clark County lakes.

Trends in stream health: Learn what we have found about long-term trends in stream health, and which areas are getting better or worse.

What Clark County is doing: Find out more about Clark County programs and how we are working to improve and protect stream health.

What you can do: Get involved and help improve our streams. Read about ideas you can use at home, local information resources, and volunteer opportunities.

Monitoring: Indicators

Good

Natural stream channel

Healthy forest

Stream rehabilitation

Stormwater management on site, not pipes

Natural stream systems are variable and complex, which enables them to recover from disturbances, if the disturbance ends. They are constantly changing and adjusting to a large number of factors. Geology, soil type, climate, food webs, chemical and physical properties, surrounding land cover, and human impacts all combine to determine how streams function.

In such a complex system, it would be too costly and time consuming to study every factor in detail. Instead, scientists often use indicators to describe stream conditions, identify and predict problems, and provide clues about how things might be improved. A good indicator is a stream component or feature that gives a reliable picture of current conditions. This report rates stream health based on three widely used stream health indicators:

- **Water quality** is an indicator of the chemical and physical condition of the water in our streams.
- **Biological health** is an indicator of how well the creatures living in our streams are doing.
- **Stream flow** is an indicator of whether our streams are getting the right amount of water to sustain healthy conditions.

Good indicators respond consistently and predictably to changes in stream condition. They must be able to represent very complicated processes, and yet be easily understood.

Since activities on land affect streams, current land cover is also useful for evaluating stream health. Research has shown that stream health responds predictably to changes in land cover. For example, stream health typically declines as trees are removed and hard surfaces like pavement, increase. Land cover is not used to rate stream health in this report; however, it provides context about how Clark County streams are likely to function. Land cover can be used to help explain observed stream conditions and to predict conditions in areas without monitoring data.

Poor

Untreated runoff and trash

Pollution draining to stormwater system

Urban streambank erosion

Monitoring: Metrics

What are metrics?

Stream health indicators are measured by specific calculations, collectively called metrics. The metrics used in this report were developed and tested in the Pacific Northwest on streams similar to those in Clark County. The calculations use data gathered in Clark County from many different sampling locations to determine ratings for each stream.

Water Quality

Water quality is scored based on a set of measures that includes temperature, dissolved oxygen, pH, sediment, nutrients, and bacteria (Cude 2001). The individual scores for each measure are combined to produce a single overall rating.

Why are these water quality measures important?

- **Water temperature, dissolved oxygen, and pH** affect fish health
- **Sediment** affects water color, carries pollutants, and smothers fish eggs
- **Nutrients** can increase the number of plants and algae in the water
- **Bacteria** cause health problems and indicate animal waste or leaks in human waste systems

Biological Health

Biological health is scored based on the number and kinds of macroinvertebrates found in the stream (Karr 1998). Macroinvertebrates are insects, or bugs, large enough to be seen by the unaided eye and which spend a large part of their life-cycle in streams. Because they are exposed to in-stream conditions for lengthy time periods during their development, macroinvertebrates are an excellent way to measure the combined effects of stream degradation.

Stream Flow

Stream flow is scored based on the amount of time stream flow is above the yearly average flow (United States Geological Survey 2002, Booth et. al. 2004). Unhealthy streams have too much flow that is quick to rise and fall with storms, and often too little flow during non-storm periods. The result is increased erosion during high flows, and decreased habitat during low flows, which negatively affects water quality, groundwater recharge, and stream life. Scores are higher in streams with a gradually changing, “natural” flow pattern during storms, and lower in streams with a rapid change in flow. Larger streams often have higher scores because they are less impacted by runoff than smaller streams.

Land Cover

Land cover is evaluated based on the amount of intact forest cover and “hard surface” (National Marine Fisheries Service 1996, 2003; Booth and Jackson 1997; Center for Watershed Protection 2003). Hard surface areas often increase the amount and speed of water flowing into streams, resulting in stream channel erosion and increased water pollution. Intact forest areas absorb large amounts of stormwater and allow the excess to soak into the ground, promoting healthy year-round stream flow. They also prevent erosion, provide shade to keep streams cool, supply food for macroinvertebrate bugs, and contribute wood debris for fish habitat. Historically, forest was the predominant land cover in Clark County. Changing the land cover changes how it manages rainfall. The greater the change, without creating new ways to mimic those lost natural processes, the greater the likelihood stream health will decline.

Special Studies

In some areas, the county or other agencies have collected detailed information about one or two specific water quality measures in a special study. These measures are typically temperature, bacteria, or turbidity (water clarity). Special studies are usually short-term (one or two years), and are conducted to learn more about an area with a known water quality problem. Because they do not include the full set of water quality measures, special studies are not used to rate overall stream health. However, summary information is provided in boxes labeled ‘Special Study’.

Where does the data come from?

Each metric was calculated based on actual data collected in Clark County. The Clark County Clean Water Program (CWP) and citizen volunteers collected water quality samples, macroinvertebrate bugs, and stream flow measurements from many different sampling locations. The City of Vancouver, Washington Department of Ecology (Ecology), Clark Public Utilities (CPU) and the United States Geological Survey (USGS) also contributed data and analysis used in this report [Figure 3]. Land cover data was produced by Clark County, Ecology, and the National Oceanic and Atmospheric Administration (NOAA).

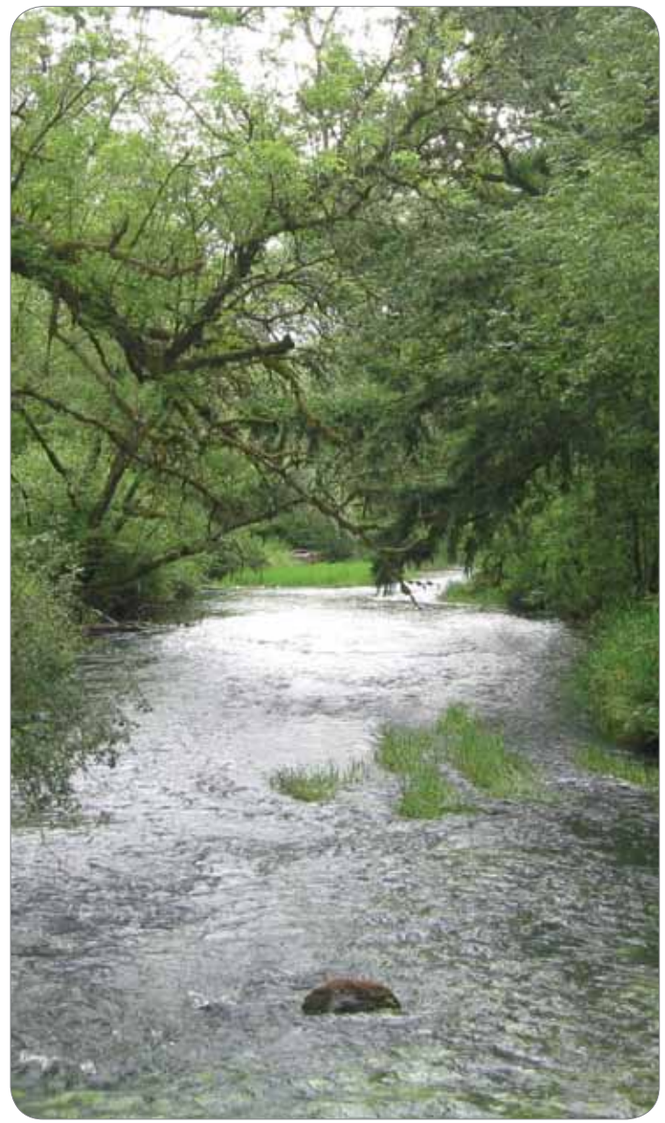
Samples were collected using widely accepted methods, and sent to certified laboratories to produce the data. All data were evaluated for quality by professional scientists.

Monitoring often focuses on areas where more intensive human activities take place, to track how they may change stream health. Thus for example, Salmon Creek has been studied more extensively than the Washougal River, in part because it is largely within the Urban Growth Boundary. Identifying potential problem areas enables Clark County Environmental Services to focus efforts, use staff and funding resources more effectively, and to collect the most informative data. This approach also results in slightly different data sets for each watershed.

The county's monitoring design determines what, where, when, how, and how often data are collected. The design balances the need to collect high quality, representative data, with the available staff and funding resources. Based on these needs, the county collects the best available information about current health and long-term trends, both of which are presented in this report.

Collecting data about biological health

Macroinvertebrate bug



Healthy stream

Steps Used To Determine Stream Health

Water Quality

Sampling: Scientists and volunteers collected 870 water quality samples at 81 sites since 2004. Data collected at 24 of these sites in 2008/2009 were used to score water quality in this report. The remaining sites were part of special studies.

Analysis: The samples provided data for the following measures of water quality: water temperature, dissolved oxygen, pH, sediment, nutrients, and bacteria.

Score: Data were used to score each measure.

Rating: Scores were combined into a rating for each sampling location. Ratings range from:

- = very poor to poor water quality
- = fair water quality
- = good to excellent water quality

Biological Health

Sampling: Scientists and volunteers collected over 125 macroinvertebrate bug samples at 50 sites from 2004-2009.

Analysis: For each sampling location, scientists sorted the bugs, classified them into 10 groups based on types, and counted the bugs in each group.

Score: The number of bugs in each of the ten groups was used to score the group.

Rating: Scores were added together to obtain a rating for each sampling location. Ratings range from:

- = low biological health
- = moderate biological health
- = high biological health

Stream Flow

Monitoring Clark County and agency partners collected hourly stream flow data from 19 sites.

Analysis: Scientists used the stream flow data to measure how stream levels rise due to storms.

Score: Data were used to assign scores for each location based on the amount of time stream flows were higher than the yearly average.

Rating: Scores were compared to data from streams similar to those in Clark County to obtain a rating for each location. Ratings range from:

- = unhealthy flow pattern
- = intermediate flow pattern
- = healthy flow pattern

Figure 3: Summary of the steps used to collect stream health information

How to use this report

How to read the score card

Stream health is presented in color-coded score cards, like the example on this page [Figure 4]. It is possible to read the score cards in several ways depending on the information desired:

Each watershed has its own score card. Ratings are assigned a color that corresponds to health quality:

= poor health

= fair health

= good health

By subwatershed

Reading the score card from left to right shows the subwatershed scores for each indicator. These are combined to give the Subwatershed Rating; this rating is shown in color on the accompanying map for each subwatershed. The Subwatershed Rating gives us our most complete picture of overall stream health by taking into account all of the available data for each subwatershed.

By indicator

Reading the score card from top to bottom shows the available scores by indicator for the whole watershed. These are combined to give the Indicator Rating. Use these ratings to find out about overall water quality, biological health, or stream flow.

By watershed

The Indicator Ratings are combined to provide the Overall Watershed Rating. This rating is shown at the bottom of the score card. Use this rating as a general estimate of stream health.

Example Watershed Score Card

Salmon Creek Stream Health Score Card

Subwatershed	Water Quality	Biological Health	Flow	Subwatershed Rating
Mill Creek	●	●	●	●
Cougar Creek	●	●	●	●
Salmon Creek (r.m. 03.83)	--	●	●	●
Salmon Creek (r.m. 08.96)	●	--	●	●
Salmon Creek (r.m. 14.66)	●	--	●	●
Curtin Creek	●	●	●	●
Woodin Creek	●	●	--	●
Rock Creek	--	●	--	●
Morgan Creek	●	●	--	●
Salmon Creek (r.m. 22.20)	●	●	●	●
Salmon Creek (r.m. 00.60)	●	--	--	●
Indicator Rating	●	●	●	
Overall Watershed Rating:				**Fair** ●

Figure 4: Watershed score card example, showing ratings for each indicator, each subwatershed, and the overall watershed

How accurate are the ratings?

Things to remember: Ratings are very accurate for the location where the samples were collected. However, stream health is dynamic and can change a lot in a short distance as land cover and other factors change from one location to another. Therefore, it becomes less accurate to apply the ratings further from their original sampling location, or to combine ratings from several locations together. The more the ratings are combined, the less certain we can be about the result. Thus the overall watershed rating is less accurate than a subwatershed rating, which in turn is less accurate than the rating for a particular indicator in a subwatershed.

How to read the land cover tables

Land cover tables are provided for each watershed. The tables show the amounts of forest and hard surface (such as pavement and rooftops) as percentages of the total land cover within each subwatershed. Compare the percentages to the following definitions to help predict stream conditions within the subwatersheds. This is particularly helpful for looking at areas that do not have monitoring data. The subwatershed boundaries are shown on the watershed health maps for reference.

Likely forest cover conditions:

< 50% forest cover =	Poor stream conditions likely
50 to 65% forest cover =	Fair stream conditions likely
> 65% forest cover =	Good stream conditions likely

Likely hard surface conditions:

> 15% hard surface =	Poor stream conditions likely
5 to 15% hard surface =	Fair stream conditions likely
< 5% hard surface =	Good stream conditions likely

West Slope Watershed

Description: Located in western Clark County, this watershed drains a 40 square mile area and encompasses seven subwatersheds: Cathlapotle, Allen Canyon, Flume, Upper and Lower Gee, and Upper and Lower Whipple creeks. Stream channels are typically confined to steep canyons and drain westward into Lake River.

Land Cover:

- *Forest*: Limited forest, primarily in stream corridors
- *Development*: Rapid developing, concentrated in north Vancouver, Ridgefield, and along Interstate-5 corridor
- *Agriculture*: Historically cleared for agricultural use
- *Water*: Mud Lake; extensive wetlands in Columbia River floodplain; most other wetlands drained

Likely Condition:

- The amounts of intact forest and hard surface suggest poor stream conditions are likely
- Significant additional development is expected; large areas of this watershed are within Ridgefield and Vancouver Urban Growth Areas

Resources to Protect:

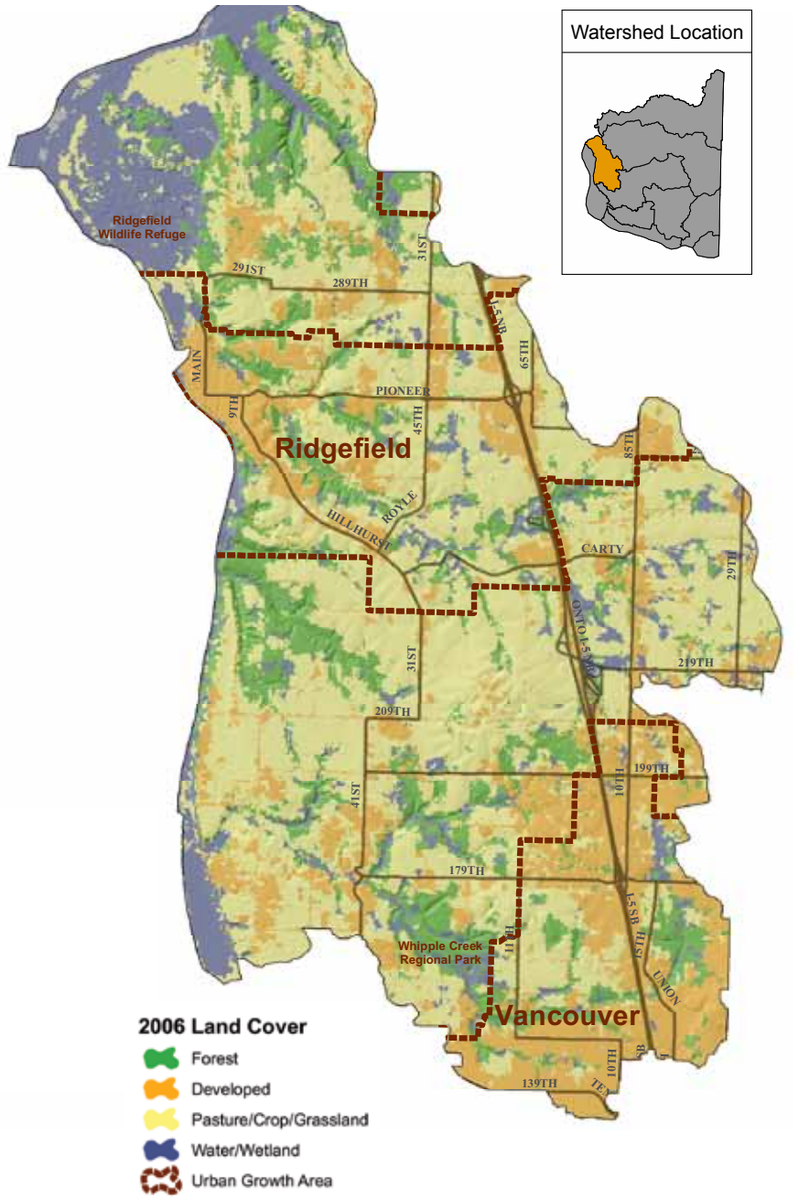
- Headwater wetlands
- Ridgefield National Wildlife Refuge
- Whipple Creek Regional Park
- Open space
- Forested stream corridors

Suggested Stream Health Strategies:

- Plant trees to increase amount of forest cover
- Implement development regulations to minimize impacts
- Protect and enhance wetlands in the upper watersheds
- Restore floodplain function and riparian habitat in lower watersheds
- Reduce amount of stormwater runoff discharged to tributary streams
- Work with property owners to eliminate pollution sources

Subwatershed	Forest %	Hard Surface %
Allen Canyon Creek	28	20
Cathlapotle	38	11
Flume Creek	23	18
Gee Creek (Lower)	29	19
Gee Creek (Upper)	18	16
Whipple Creek (Lower)	18	19
Whipple Creek (Upper)	25	25

This table shows the amount of land that is covered by forest and by hard surfaces in each subwatershed. The map on the facing page provides the subwatershed boundaries for reference.



West Slope Watershed: Stream Health

West Slope Stream Health Score Card

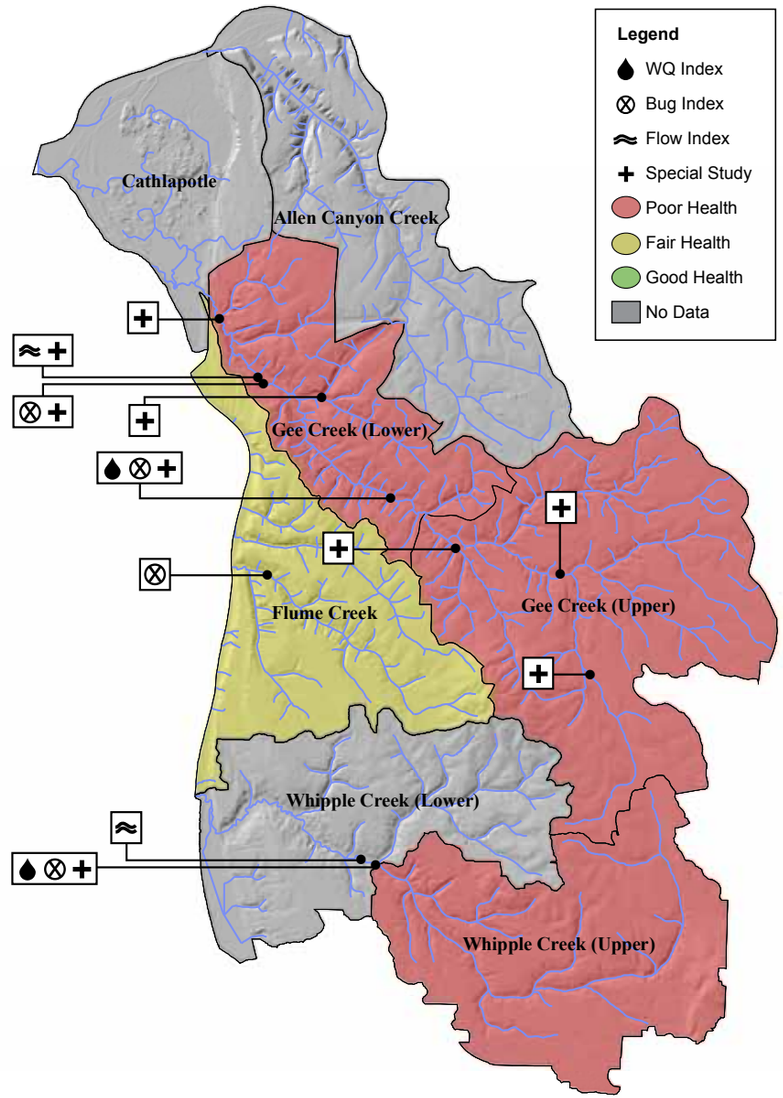
Subwatershed	Water Quality	Biological Health	Flow	Subwatershed Rating
Gee Creek (Upper)			--	
Gee Creek (Lower)	--			
Whipple Creek (Upper)				
Flume Creek	--		--	
Indicator Rating				

Overall Watershed Rating: **Poor**

Data were not collected from the following subwatersheds: Allen Canyon Creek, Cathlapotle, and Whipple Creek (lower).

Score Summary:

- There are no good ratings
- Poor water quality and biological health ratings are common in areas where agriculture and development are most prevalent
- Subwatersheds without data are largely cleared, rapidly developing, and likely have poor health



Special Study: Gee Creek Focused Bacteria and Turbidity Study

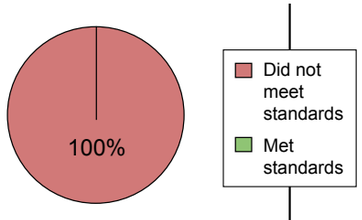
Study Description: 8 sites within Gee Creek subwatershed; 2007 – 2008

Report link: www.clark.wa.gov/waterresources/documents

Why is this important? The presence of fecal coliform bacteria indicates the stream has been contaminated with human or animal waste. Turbidity is a measure of cloudiness in water.

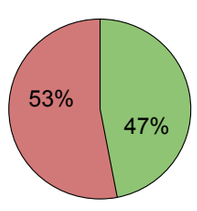
Bacteria Results

- No site met the state water quality criteria for bacteria levels.
- Wet season, wet weather had the highest bacteria levels.



Turbidity Results

- Over 50 percent of turbidity measurements were higher than background levels; the higher the turbidity, the more cloudy the water.



Salmon Creek Watershed

Description: Located in central Clark County, this watershed drains an 89 square mile area and encompasses 12 subwatersheds: Cougar, Curtin, Mill, Morgan, Woodin (Weaver), and Rock creeks, and five subwatersheds along the main Salmon Creek channel. There are many smaller creeks throughout the watershed. Salmon Creek drains westward into Lake River.

Land Cover:

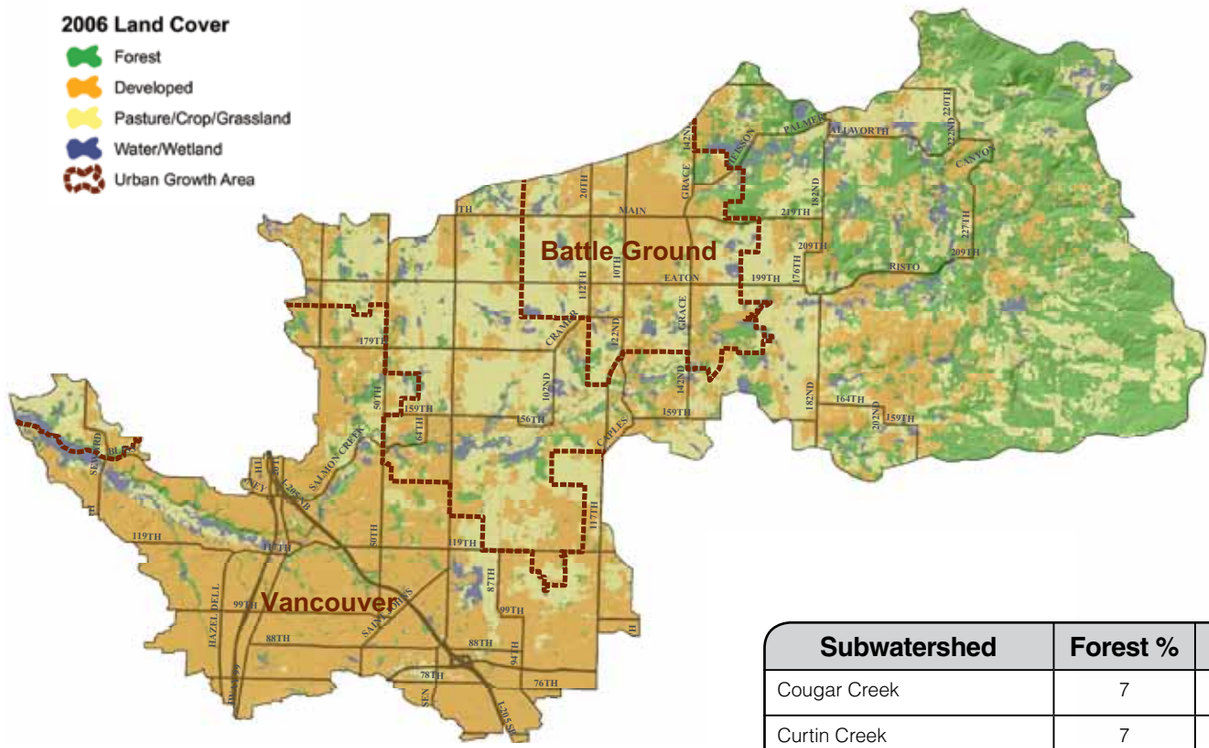
- *Forest:* Largely cleared for development and agriculture; some intact forest present in the uppermost watershed
- *Development:* Rapidly developing with growth concentrated in the Vancouver and Battle Ground Urban Growth Areas Includes some of the most heavily developed areas in Clark County
- *Agriculture:* Historical agriculture rapidly converting to development
- *Water:* Battle Ground Lake, Klineline Pond; historical wetlands largely drained

Likely Condition:

- The amount of intact forest suggests poor stream conditions are likely, except fair to good in the uppermost watershed
- The amount of hard surface suggests poor stream conditions are likely, except fair in the uppermost watershed
- Significant additional development and redevelopment are expected

Resources to Protect:

- The Salmon Creek Greenway and parks
- Open space
- Remaining intact forest
- Salmon and steelhead



Watershed Location

Suggested Stream Health Strategies:

- Increase infiltration and retention of stormwater runoff
- Restore stream channels and side channels in middle and upper watershed
- Implement development regulations to minimize impacts
- Minimize the impact of surface and groundwater withdrawals
- Promote good septic system maintenance practices
- Work with property owners to eliminate pollution sources

Subwatershed	Forest %	Hard Surface %
Cougar Creek	7	51
Curtin Creek	7	39
Mill Creek	16	23
Morgan Creek	34	18
Rock Creek	60	10
Salmon Creek (r.m. 00.60)	16	31
Salmon Creek (r.m. 03.83)	13	41
Salmon Creek (r.m. 08.96)	15	24
Salmon Creek (r.m. 14.66)	34	17
Salmon Creek (r.m. 22.20)	68	10
Woodin Creek	32	24

This table shows the amount of land that is covered by forest and by hard surfaces in each subwatershed. The map on the facing page provides the subwatershed boundaries for reference.

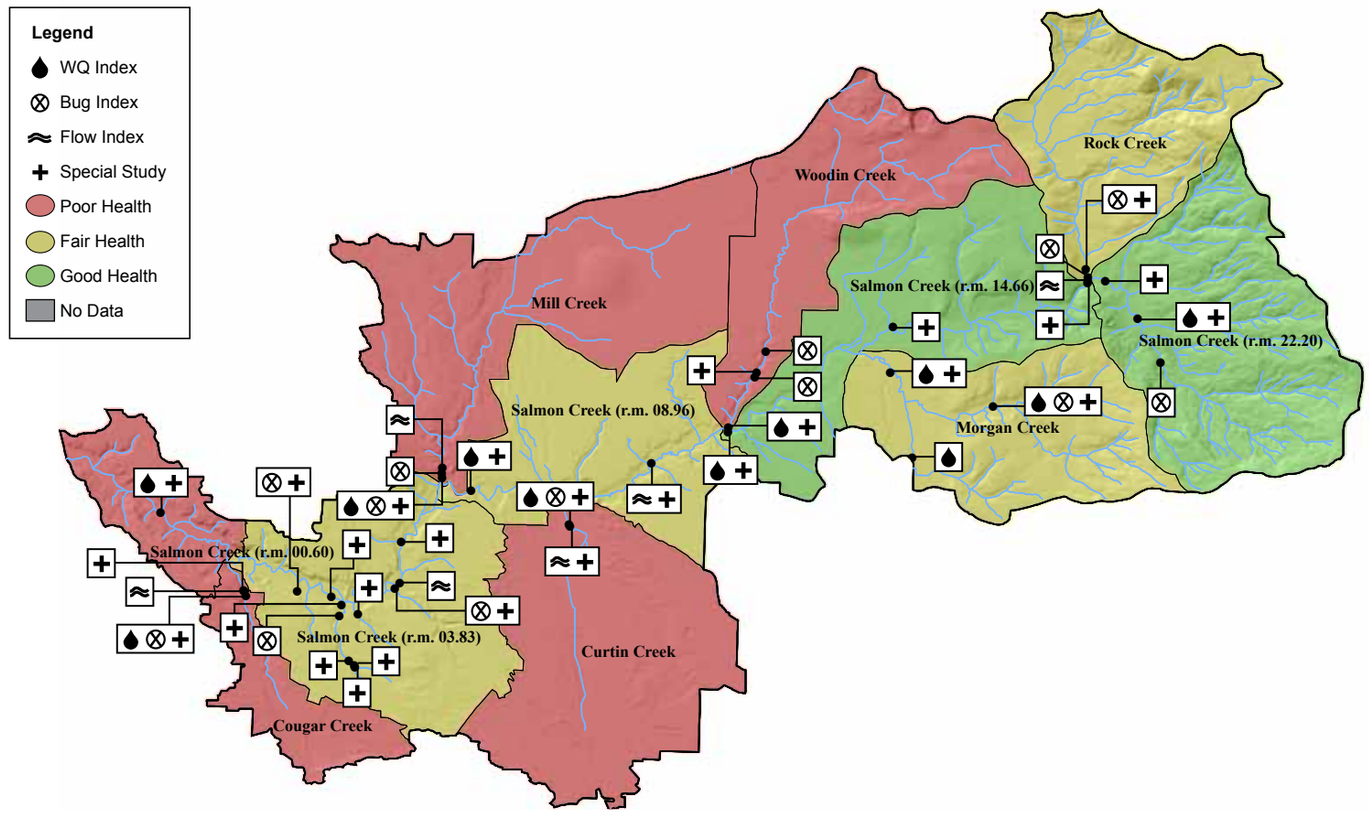
Salmon Creek Watershed: Stream Health

Salmon Creek Stream Health Score Card

Subwatershed	Water Quality	Biological Health	Flow	Subwatershed Rating
Mill Creek	Poor	Fair	Poor	Poor
Cougar Creek	Poor	Poor	Poor	Poor
Salmon Creek (r.m. 03.83)	--	Poor	Good	Fair
Salmon Creek (r.m. 08.96)	Poor	--	Good	Fair
Salmon Creek (r.m. 14.66)	Good	--	Good	Good
Curtin Creek	Poor	Poor	Good	Poor
Woodin Creek	Fair	Poor	--	Poor
Rock Creek	--	Fair	--	Fair
Morgan Creek	Fair	Fair	--	Fair
Salmon Creek (r.m. 22.20)	Good	Fair	Good	Good
Salmon Creek (r.m. 00.60)	Poor	--	--	Poor
Indicator Rating	Fair	Poor	Fair	
Overall Watershed Rating:			**Fair**	

Score Summary:

- Ratings range from poor to good
- Poor water quality and biological health ratings are common in areas where development is most prevalent
- This watershed includes some of the most healthy, and least healthy, streams in Clark County
- Local jurisdictions are implementing a state Water Cleanup Plan for bacteria, turbidity, and temperature



Special Study: Salmon Creek Focused Fecal Coliform and Turbidity

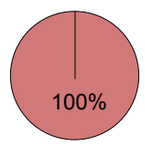
Study Description: 8 sites within the lower Salmon Creek Watershed; October 2007 – September 2008

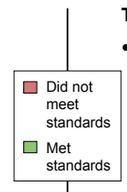
Report link: www.clark.wa.gov/waterresources/documents

Why is this important? The presence of fecal coliform bacteria indicates the stream has been contaminated with human or animal waste. Turbidity is a measure of cloudiness in water.

Bacteria Results

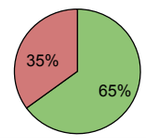
- No site met the state water quality criteria for bacteria levels.
- Dry season, wet weather had the highest bacteria levels.
- Bacteria levels increased from upstream to downstream.





Turbidity Results

- Thirty-five percent of turbidity measurements were higher than background levels; the higher the turbidity, the more cloudy the water.



East Fork Lewis River Watershed

Description: Located in north-central Clark County, this watershed drains a 212 square mile area and encompasses 20 subwatersheds. More than 75 percent of the watershed is within Clark County. The uppermost portion is in Skamania County and is part of the Gifford Pinchot National Forest. The East Fork Lewis drains westward into the North Fork Lewis River near Woodland, WA.

Land Cover:

- *Forest:* The upper watershed is primarily forested; the middle and lower watershed is largely cleared for agricultural use and development
- *Development:* Concentrated in the lower watershed, primarily within the Urban Growth Areas of Battle Ground, La Center, and Ridgefield, as well as the town of Yacolt and the I-5 corridor
- *Agriculture:* Much of the lower watershed is pasture and grassland with low density rural residential development
- *Water:* Extensive near-stream wetlands in the lower watershed; scattered intact headwater wetlands

Likely Condition:

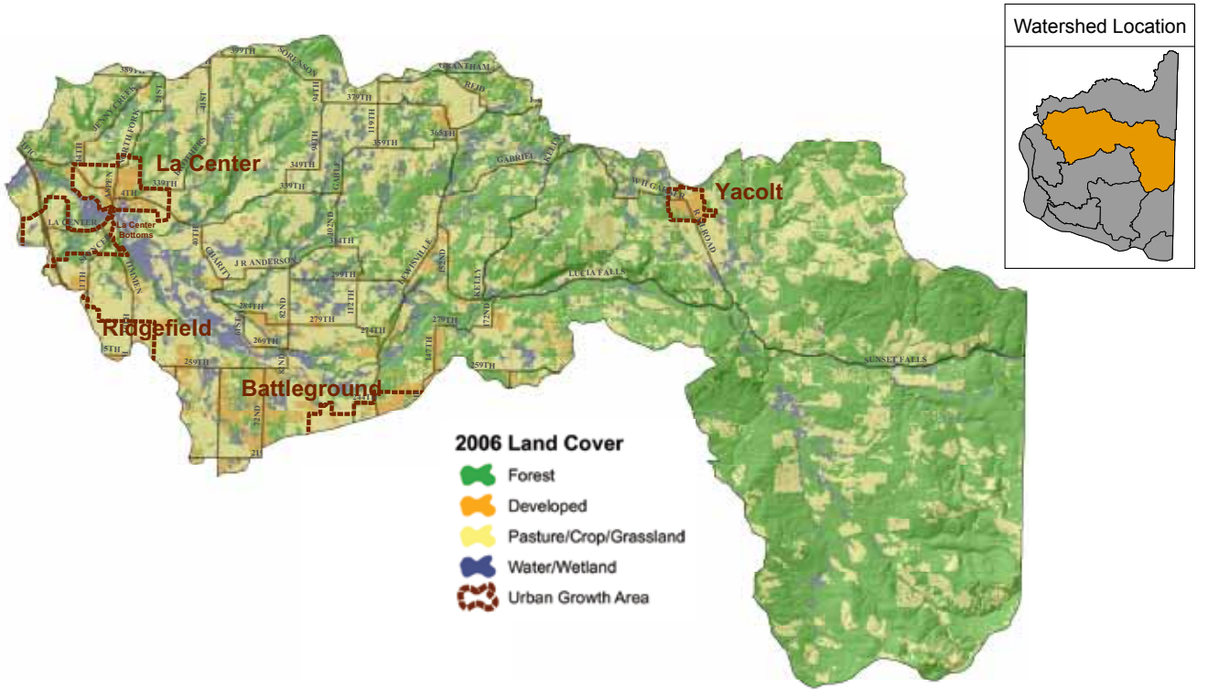
- The amounts of intact forest and hard surface suggest fair to good stream conditions are likely in the upper watershed; poor to fair in the middle and lower watershed
- Moderate additional development is expected, primarily in the lower watershed
- Continued timber management and harvest is expected

Resources to Protect:

- Salmon and steelhead
- Intact forest cover
- La Center Bottoms wildlife area
- East Fork Lewis River Greenway
- Recreational use
- Parks and open space
- Agricultural land

Suggested Stream Health Strategies:

- Improve wetlands and riparian forest in lower watershed
- Conserve agricultural and forest lands and promote healthy practices
- Plant trees to increase amount of forest cover
- Minimize the impact of surface and groundwater withdrawals in tributary streams
- Restore stream channels and side channels
- Work with rural property owners to eliminate pollution sources



Subwatershed	Forest %	Hard Surface %
Big Tree Creek	51	9
Brezee Creek	38	16
Cedar Creek (East Fork)	88	5
Dean Creek	37	13
East Fork Lewis (r.m. 00.00)	28	18
East Fork Lewis (r.m. 03.19)	23	15
East Fork Lewis (r.m. 07.25)	36	19
East Fork Lewis (r.m. 15.75)	89	9
East Fork Lewis (r.m. 21.40)	76	6
East Fork Lewis (r.m. 26.30)	84	5

Subwatershed	Forest %	Hard Surface %
Jenny Creek	40	12
King Creek	90	4
Lockwood Creek	45	10
Lower Rock Creek (South)	85	5
Mason Creek	41	11
McCormick Creek	20	19
Mill Creek (East Fork)	29	20
Rock Creek (North)	54	10
Upper Rock Creek (South)	85	5
Yacolt Creek	52	8

This table shows the amount of land that is covered by forest and by hard surfaces in each subwatershed. The map on the facing page provides the subwatershed boundaries for reference.

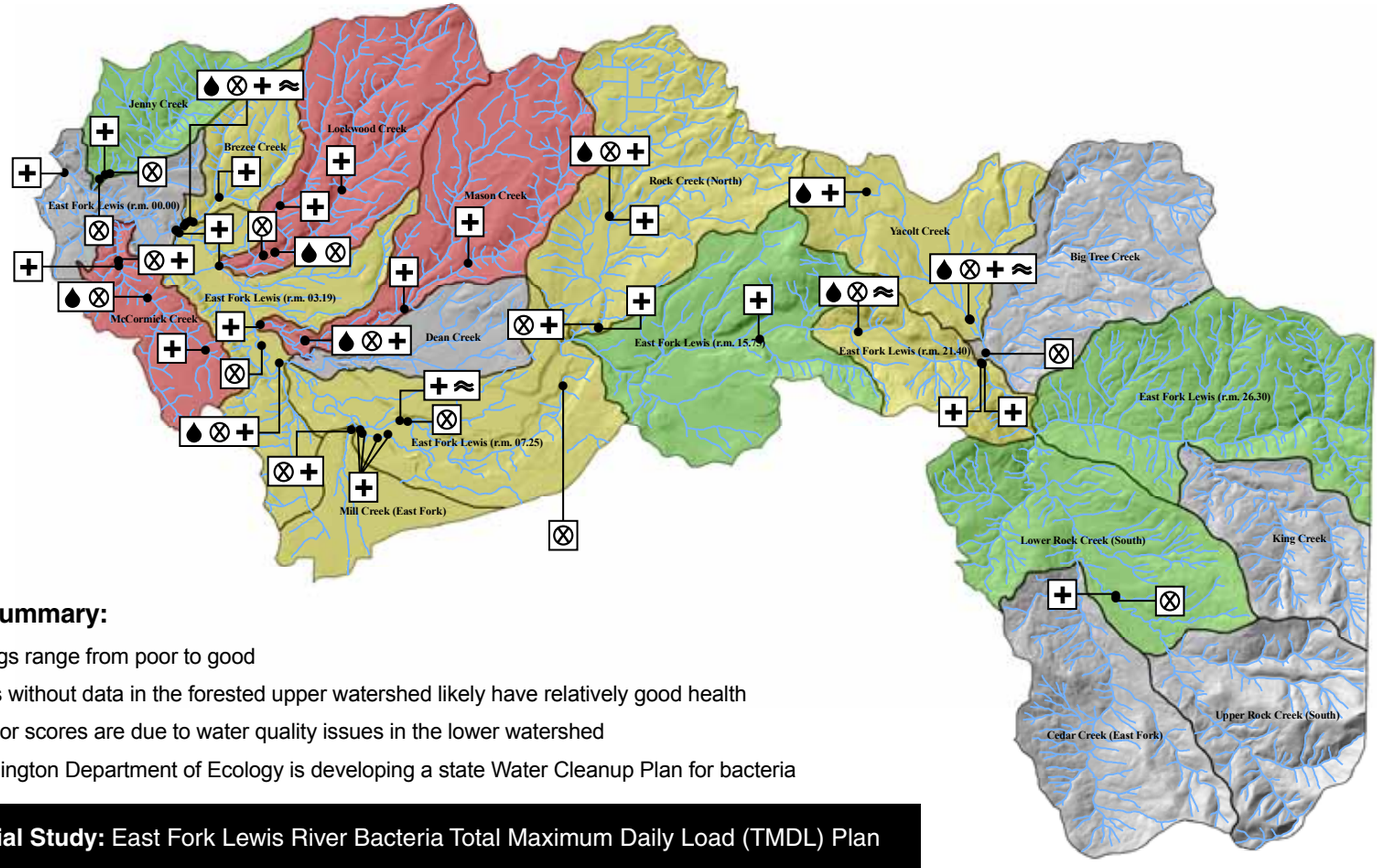
East Fork Lewis River Watershed: Stream Health

East Fork Lewis River Stream Health Score Card

Subwatershed	Water Quality	Biological Health	Flow	Subwatershed Rating
East Fork Lewis (r.m. 07.25)	--			
Brezee Creek				
Yacolt Creek				
East Fork Lewis (r.m. 21.40)				
McCormick Creek			--	
Lockwood Creek			--	
East Fork Lewis (r.m. 03.19)			--	
Mill Creek (East Fork)	--		--	
Mason Creek			--	
Rock Creek (North)			--	
Jenny Creek	--		--	
Lower Rock Creek (South)	--		--	
East Fork Lewis (r.m. 15.75)	--	--		
East Fork Lewis (r.m. 26.30)	--	--		
Indicator Rating				

Overall Watershed Rating: **Fair**

Data were not collected from the following subwatersheds: Big Tree Creek, Cedar Creek (east fork), Dean Creek, Upper Rock Creek (south), King Creek and East Fork Lewis River at rivermile 00.00.



Score Summary:

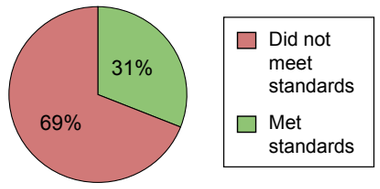
- Ratings range from poor to good
- Areas without data in the forested upper watershed likely have relatively good health
- All poor scores are due to water quality issues in the lower watershed
- Washington Department of Ecology is developing a state Water Cleanup Plan for bacteria

Special Study: East Fork Lewis River Bacteria Total Maximum Daily Load (TMDL) Plan

Study Description: 29 sites within East Fork Lewis River Watershed; May 2005 – August 2006

Report link:
http://www.ecy.wa.gov/programs/wq/tmdl/EForkLewis/technical.html

Why is this important? The presence of fecal coliform bacteria indicates the stream has been contaminated with human or animal waste. Bacteria TMDL (also called Water Cleanup Plan) efforts identify and recommend ways to reduce bacteria sources.



Results

- Only 31 percent of sites met the state water quality criteria for bacteria levels.
- In general, bacteria concentrations were worst during the dry season.

Legend

- WQ Index
- Bug Index
- Flow Index
- Special Study
- Poor Health
- Fair Health
- Good Health
- No Data

North Fork Lewis River Watershed

Description: This 847 square mile watershed covers parts of Skamania, Cowlitz, and Clark counties. The Clark County portion spans the northern edge of the county and encompasses 12 subwatersheds: Canyon, Upper/Middle/Lower Cedar, Chelatchie, Little Fly, Pup, and Siouxon creeks, Lake Merwin, Yale Lake, Yale Dam, and the Lower North Fork Lewis River. The North Fork Lewis River drains westward to the Columbia River near Woodland, WA.

Land Cover:

- *Forest:* The watershed is primarily forested and managed for timber production
- *Development:* Very limited and concentrated near the cities of Amboy and Woodland
- *Agriculture:* Limited pasture and grassland with low density, rural residential development
- *Water:* Yale Lake, Merwin Lake; near stream and headwater wetlands

Likely Condition:

- The amount of intact forest suggests fair to good stream conditions are likely, except in Little Fly Creek and the lower North Fork Lewis due to extensive timber harvest and clearing
- The amount of hard surface suggests fair to good stream conditions are likely
- Very little additional development is expected
- Continued timber management and harvest is expected

Resources to Protect:

- Salmon and steelhead
- Intact forest cover
- Lewis River reservoirs: Yale Lake and Lake Merwin
- Cedar Creek wildlife area
- Recreational use

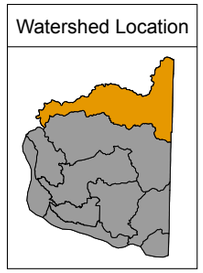
Suggested Stream Health Strategies:

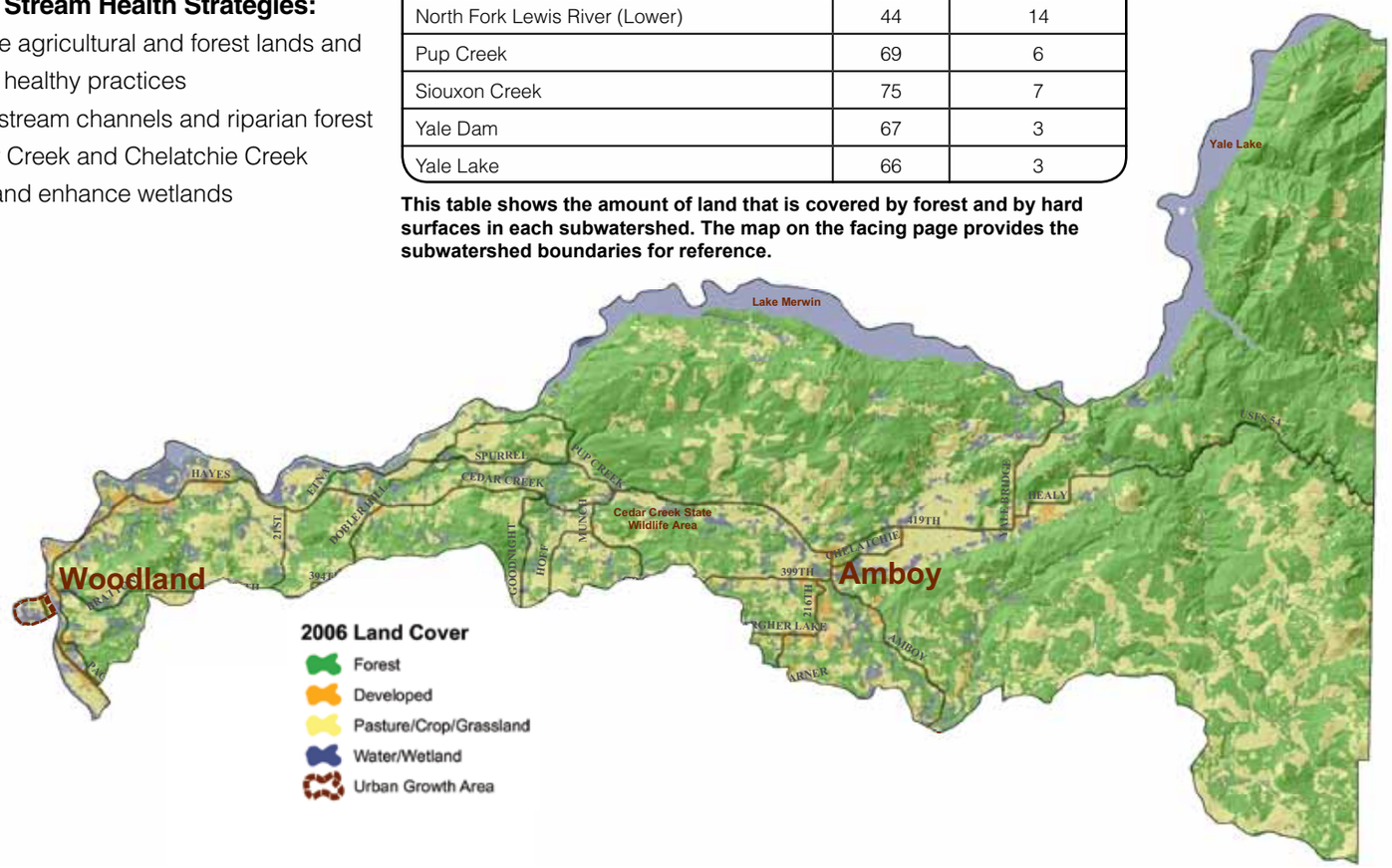
- Conserve agricultural and forest lands and promote healthy practices
- Restore stream channels and riparian forest in Cedar Creek and Chelatchie Creek
- Protect and enhance wetlands

Subwatershed	Forest %	Hard Surface %
Canyon Creek	69	7
Cedar Creek (Lower)	55	8
Cedar Creek (Middle)	57	7
Cedar Creek (Upper)	50	9
Chelatchie	50	9
Lake Merwin	56	3
Little Fly Creek	39	11
North Fork Lewis River (Lower)	44	14
Pup Creek	69	6
Siouxon Creek	75	7
Yale Dam	67	3
Yale Lake	66	3

This table shows the amount of land that is covered by forest and by hard surfaces in each subwatershed. The map on the facing page provides the subwatershed boundaries for reference.

Watershed Location





North Fork Lewis River Watershed: Stream Health

North Fork Lewis River Stream Health Score Card

Subwatershed	Water Quality	Biological Health	Flow	Subwatershed Rating
Cedar Creek (Upper)			--	
Chelatchie			--	
Cedar Creek (Middle)	--		--	
Pup Creek	--		--	
Little Fly Creek	--		--	
Indicator Rating			--	

Overall Watershed Rating: **Fair**

Data were not collected from the following subwatersheds: Siouxon Creek, Canyon Creek, Cedar Creek (lower), Lake Merwin, North Fork Lewis River (lower), Yale Dam and Yale Lake.

Special Study: Cedar Creek Subwatersheds
Summer 2006 Stream Temperature

Study Description: 7 stations within Cedar Creek Watershed; June 2006 – October 2006. Stream temperature data were analyzed using the state criterion.

Report link: www.clark.wa.gov/waterresources/documents

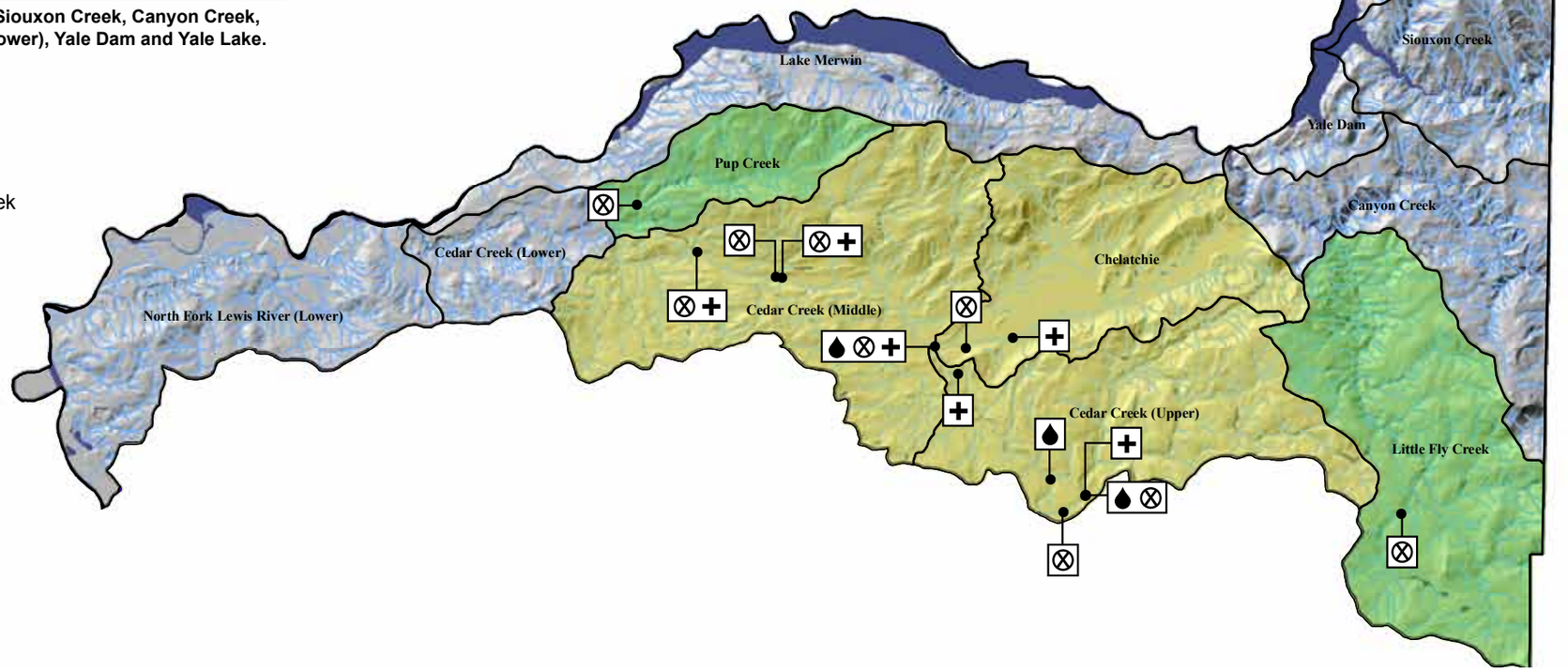
Why is this important? Salmon need cold water to survive. Prolonged exposure to stream temperatures above 63.5 °F can harm or kill salmon.

Results:

- Stream temperature did not meet the 2006 Washington state criterion at any site, for extended periods of time (1 - 8 weeks).
- The lower reaches of Cedar Creek were warmer than the upper reaches.

Score Summary:

- There are no poor ratings
- Most data and impacts are concentrated in Cedar Creek tributary
- Areas without data in the forested upper watershed likely have relatively good health



Lacamas Watershed

Description: Located in central Clark County, this watershed drains a 67 square mile area and encompasses nine subwatersheds: Upper and Lower Lacamas, Shanghai, Upper and Lower Fifth Plain, Dwyer, and Matney creeks, China Ditch, and Lacamas Lake. Stream channels drain generally southward into Lacamas Lake, then to the Washougal River in the City of Camas.

Land Cover:

- *Forest:* Historically cleared of forest; remaining forest is concentrated in the central and upper watershed, primarily in the Camp Bonneville area
- *Development:* Concentrated in the western and southern portions within the Vancouver and Camas Urban Growth Areas
- *Agriculture:* Historically drained for agricultural use; significant areas of pasture/grassland remain
- *Water:* Lacamas Lake; historical wetlands largely drained, pockets remain primarily in western portion

Likely Condition:

- The amount of intact forest suggests poor stream conditions are likely except in Upper Lacamas and Matney creeks
- The amount of hard surface suggests poor stream conditions are likely except in the uppermost watershed
- Significant additional development is expected within the Vancouver and Camas Urban Growth Areas

Resources to Protect:

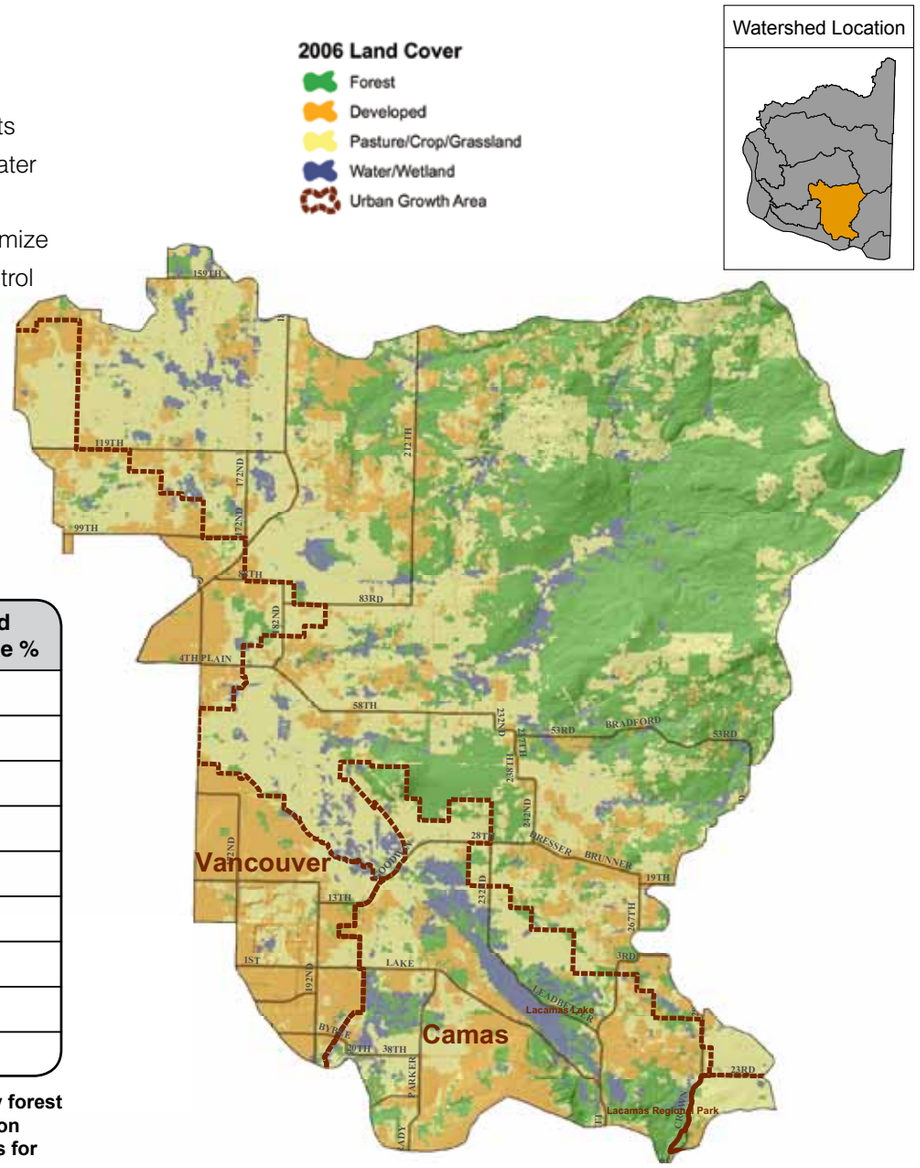
- Lacamas Lake
- Lacamas Lake park
- Agricultural lands
- Open space
- Intact forests and wetlands
- Camp Bonneville

Suggested Stream Health Strategies:

- Protect remaining forested areas in upper watershed and Camp Bonneville
- Restore stream channels and riparian forests
- Increase infiltration and retention of stormwater runoff from older developments
- Implement development regulations to minimize impacts, particularly enhanced nutrient control regulations to protect Lacamas Lake
- Conserve agricultural lands and promote healthy practices

Subwatershed	Forest %	Hard Surface %
China Ditch	15	18
Dwyer Creek	14	40
Lacamas Lake	32	19
Lower Fifth Plain Creek	12	32
Lower Lacamas Creek	23	26
Matney Creek	55	13
Shanghai Creek	42	17
Upper Fifth Plain Creek	47	15
Upper Lacamas Creek	83	6

This table shows the amount of land that is covered by forest and by hard surfaces in each subwatershed. The map on the facing page provides the subwatershed boundaries for reference.



Lacamas Watershed: Stream Health

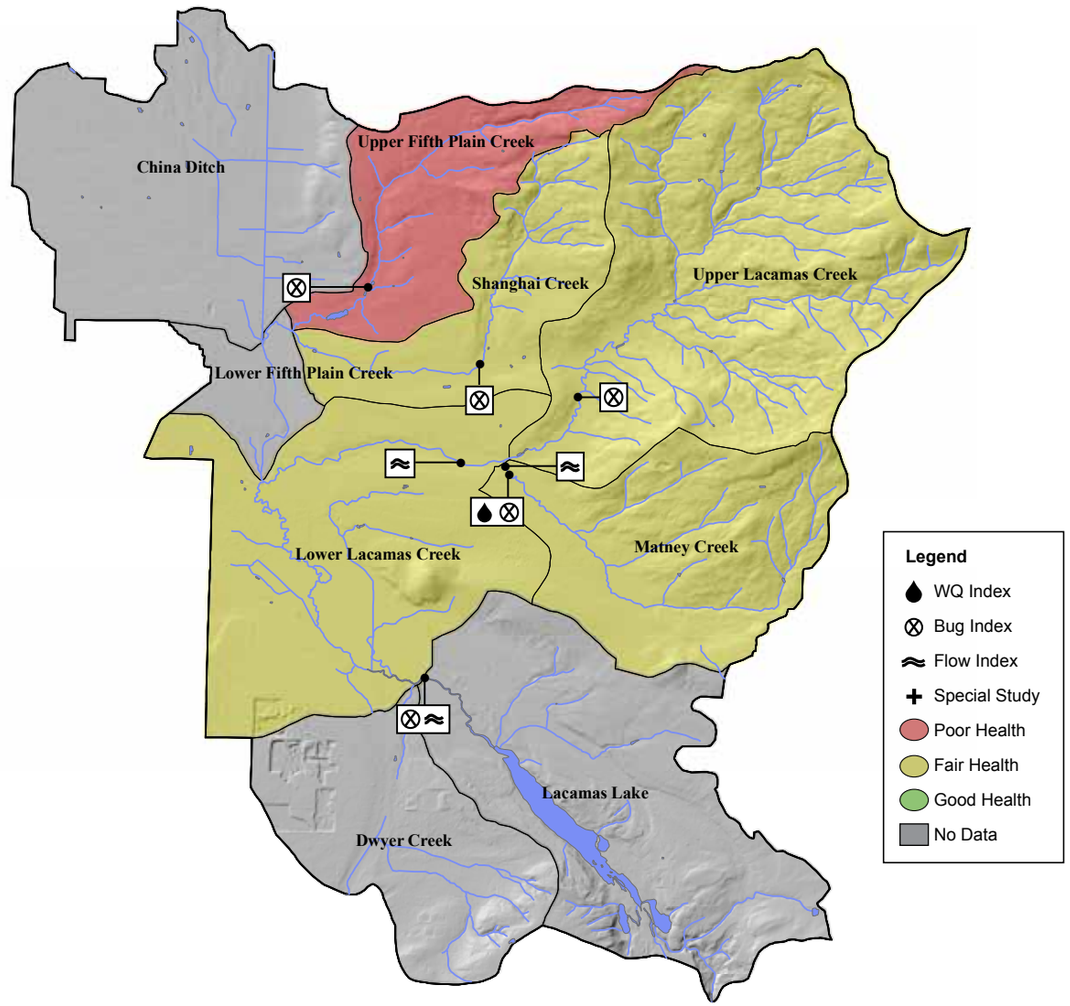
Lacamas Creek Stream Health Score Card

Subwatershed	Water Quality	Biological Health	Flow	Subwatershed Rating
Lower Lacamas Creek	--			
Matney Creek				
Upper Fifth Plain Creek	--		--	
Shanghai Creek	--		--	
Upper Lacamas Creek	--			
Indicator Rating				
Overall Watershed Rating:				**Fair**

Data were not collected from the following subwatersheds: China Ditch, Dwyer Creek, Lacamas Lake, and Lower Fifth Plain Creek.

Score Summary:

- Ratings range from poor to good
- Historical data suggest subwatersheds without recent data likely have poor health
- Washington Department of Ecology will perform water quality monitoring and begin developing a state Water Cleanup Plan in 2010 and 2011



Washougal River Watershed

Description: Located in southeastern Clark County, this watershed drains a 212 square mile area, 50 of which are within Clark County and the remainder in Skamania County. Within Clark County, the Washougal encompasses seven subwatersheds: Boulder, Cougar, and Jackson creeks, Upper and Lower Little Washougal River, and Lower and Middle Washougal River. Stream channels drain generally southward into the Columbia River.

Land Cover:

- *Forest*: Significant areas of intact forest cover are present, particularly in the middle and upper watershed
- *Development*: Primarily limited to the City of Washougal and eastern edge of the City of Camas
- *Agriculture*: Significant areas of pasture/grassland in the middle watershed
- *Water*: Scattered intact wetlands

Subwatershed	Forest %	Hard Surface %
Boulder Creek	62	9
Cougar Creek (Washougal)	80	6
Jackson Creek	88	5
Little Washougal (Lower)	48	13
Little Washougal (Upper)	91	5
Washougal (Lower)	18	28
Washougal (Middle)	49	13

This table shows the amount of land that is covered by forest and by hard surfaces in each subwatershed. The map on the facing page provides the subwatershed boundaries for reference.

Likely Condition:

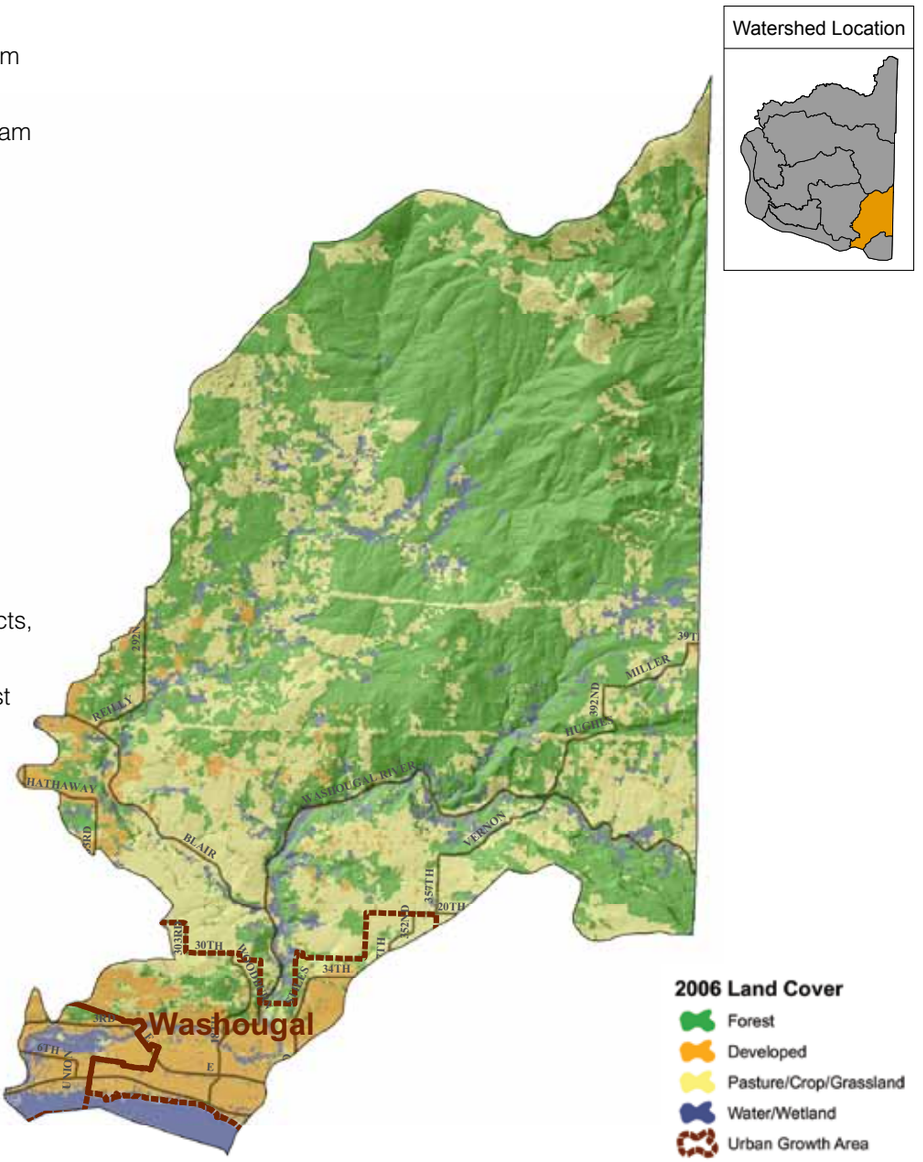
- The amount of intact forest suggests fair to good stream conditions are likely except in lower watershed areas
- The amount of hard surface suggests fair to good stream conditions are likely except in Lower Washougal
- Limited additional development is expected within the Washougal Urban Growth Area

Resources to Protect:

- Salmon and steelhead
- Intact forest areas
- Recreational use (boating, fishing, swimming)

Suggested Stream Health Strategies:

- Conserve agricultural and forest lands and promote healthy practices
- Implement development regulations to minimize impacts, particularly from clearing and grading
- Protect and restore stream channels and riparian forest in tributary streams
- Minimize the impact of surface and groundwater withdrawals in tributary streams



Washougal River Watershed: Stream Health

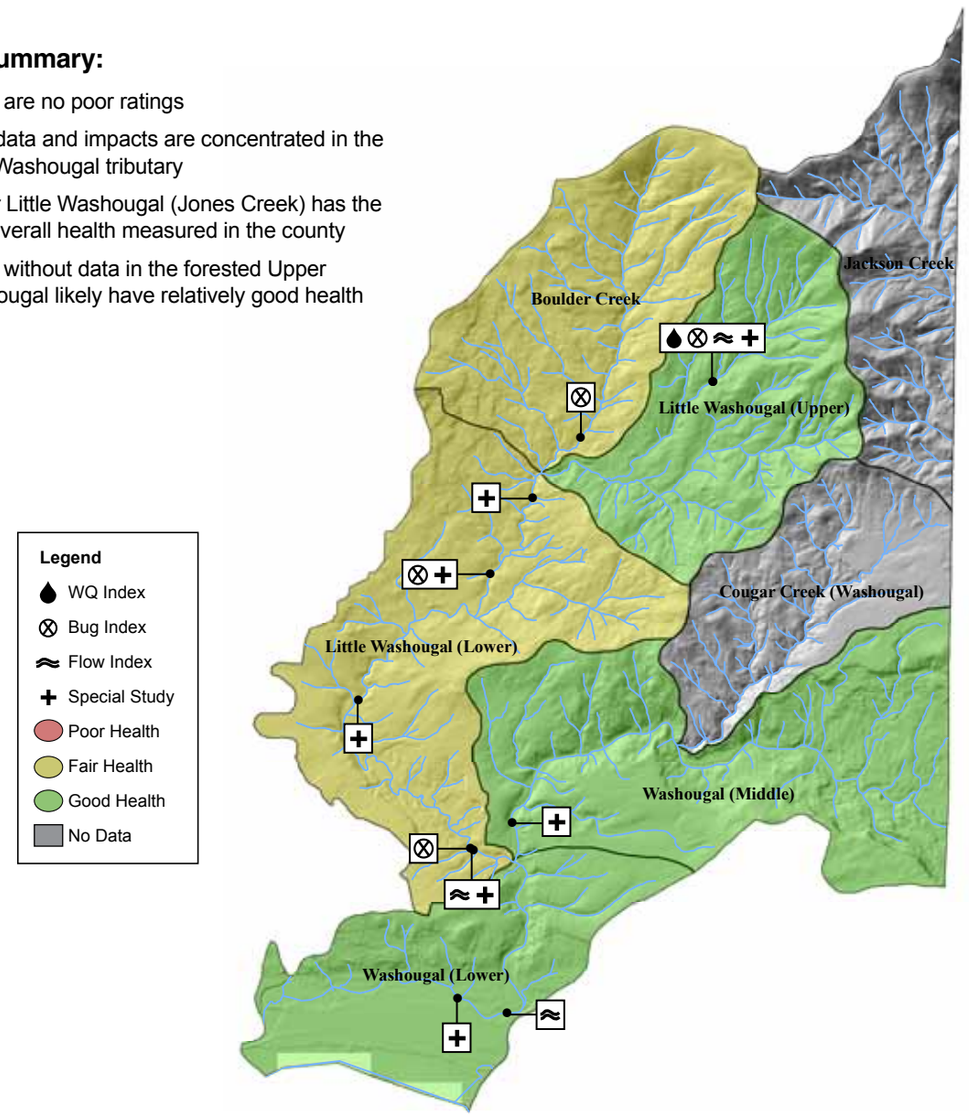
Washougal River Stream Health Score Card

Subwatershed	Water Quality	Biological Health	Flow	Subwatershed Rating
Washougal (Lower)	--	--	Good	Good
Little Washougal (Lower)	--	Fair	Good	Fair
Little Washougal (Upper)	Good	Good	Good	Good
Boulder Creek	--	Fair	--	Fair
Washougal (Middle)	--	--	Good	Good
Indicator Rating	Good	Fair	Good	Good
Overall Watershed Rating:				Good

Data were not collected from the following subwatersheds: Cougar Creek and Jackson Creek.

Score Summary:

- There are no poor ratings
- Most data and impacts are concentrated in the Little Washougal tributary
- Upper Little Washougal (Jones Creek) has the best overall health measured in the county
- Areas without data in the forested Upper Washougal likely have relatively good health



Special Study: Washougal River Watershed: Summer 2004 Stream Temperature

Study Description: Seven sites within the Washougal River Watershed; May 2004 – October 2004
Report Link: Benthic Macroinvertebrate and Water Temperature Monitoring for Clark County Watershed Assessments in 2004 (on file at Clark County)

Why is this important? Salmon need cold water to survive. Prolonged exposure to stream temperatures above 63.5 °F can harm or kill salmon.

Results:
- The lower reaches of the Little Washougal River were warmer than the upper reaches.
- Temperatures in the Washougal River were over 70 degrees for extended periods of time (5+ weeks).
- Jones Creek (a tributary to the Little Washougal) was the only station meeting the state criterion.

Gibbons Creek Watershed

Description: Located in southeast Clark County, this watershed drains a 13 square mile area at the western end of the Columbia River Gorge Scenic Area and encompasses three subwatersheds: Gibbons and Lawton creeks, and Steigerwald Lake. Stream channels typically flow through steep canyons and drain south to the Columbia River.

Land Cover:

- *Forest:* Primarily limited to stream corridors, with some intact forested uplands
- *Development:* Concentrated in the City of Washougal. Future development is likely limited due to Scenic Area designation, except for small areas within the Washougal Urban Growth Area
- *Agriculture:* Uplands historically cleared for agriculture; significant areas of pasture and grassland
- *Water:* Steigerwald Lake; extensive wetlands in Columbia River floodplain

Likely Condition:

- The amounts of intact forest and hard surface suggest poor stream conditions are likely in Gibbons Creek and Steigerwald Lake; fair conditions likely in Lawton Creek

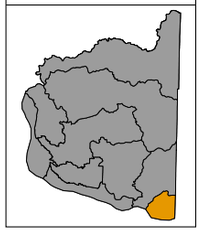
Resources to Protect:

- Columbia River Gorge Scenic Area
- Steigerwald Lake National Wildlife Refuge
- Open space
- Intact forest tracts and forested stream corridors

Suggested Stream Health Strategies:

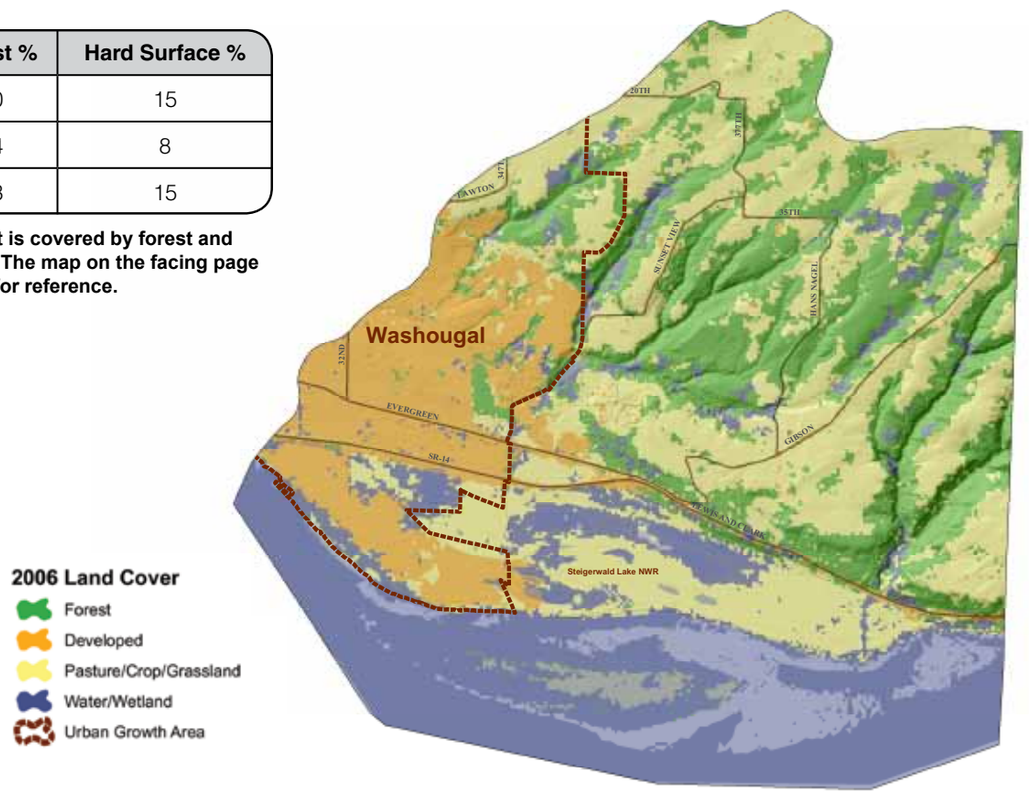
- Conserve agricultural lands and promote healthy practices
- Work with property owners to eliminate pollution sources
- Increase infiltration and retention of stormwater runoff in developed areas
- Restore riparian vegetation in lower watershed, particularly along Steigerwald channel

Watershed Location



Subwatershed	Forest %	Hard Surface %
Gibbons Creek	40	15
Lawton Creek	54	8
Steigerwald Lake	13	15

This table shows the amount of land that is covered by forest and by hard surfaces in each subwatershed. The map on the facing page provides the subwatershed boundaries for reference.



Gibbons Creek Watershed: Stream Health

Gibbons Creek Stream Health Score Card

Subwatershed	Water Quality	Biological Health	Flow	Subwatershed Rating
Gibbons Creek	--		--	
Lawton Creek	--		--	
Indicator Rating	--		--	

Overall Watershed Rating: Fair

Data were not collected from the following subwatersheds: Steigerwald Lake

Score Summary:

- There are no poor or good ratings
- Historical data and special studies indicate water quality issues are most significant in Campen Creek (tributary within City of Washougal)
- Local jurisdictions are implementing a state Water Cleanup Plan for bacteria

Special Study: Gibbons Creek Focused Bacteria and Turbidity Study

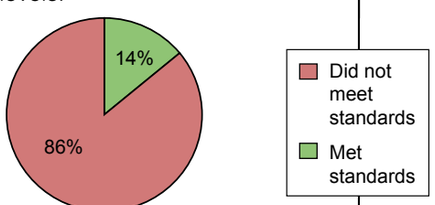
Study Description: 7 sites within Gibbons Creek subwatershed; April 2004 – April 2006

Report link: www.clark.wa.gov/waterresources/documents

Why is this important? The presence of fecal coliform bacteria indicates the stream has been contaminated with human or animal waste. Turbidity is a measure of cloudiness in water.

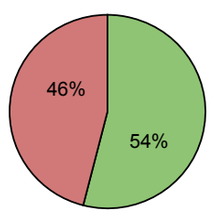
Bacteria Results

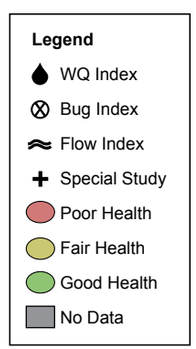
- Only 14% of sites met the state water quality criteria for bacteria levels.
- Wet season, wet weather had the highest bacteria levels.

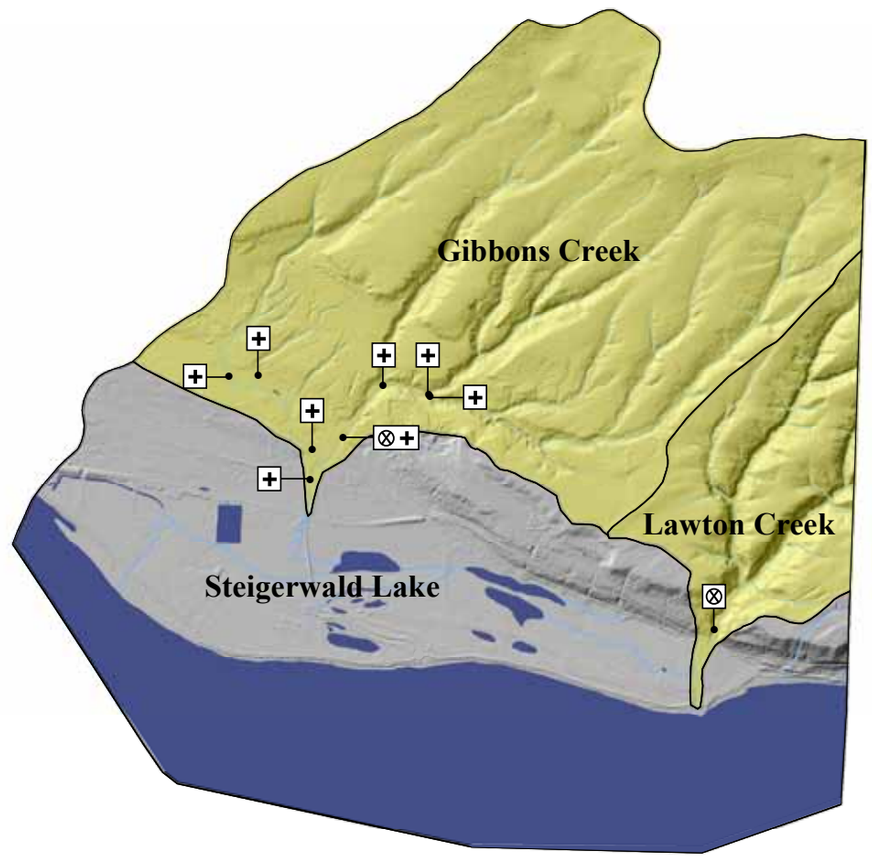


Turbidity Results

- Forty-six percent of turbidity measurements were higher than background levels; the higher the turbidity, the more cloudy the water.







Vancouver Lake/Lake River Watershed

Description: Located in western Clark County, this watershed drains a 31 square mile area and encompasses three subwatersheds: Lakeshore, Vancouver Lake, and Lake River. Most of the watershed lies within the Columbia River floodplain, with stream channels draining from the surrounding hills into Vancouver Lake and Lake River.

Land Cover:

- *Forest*: Nonexistent, but likely was never present in the Columbia floodplain
- *Development*: Concentrated in the Lakeshore subwatershed and the Port of Vancouver
- *Agriculture*: Lowlands historically diked and drained for agricultural use
- *Water*: Vancouver Lake, Lake River, and extensive wetlands in the Columbia River floodplain

Likely Condition:

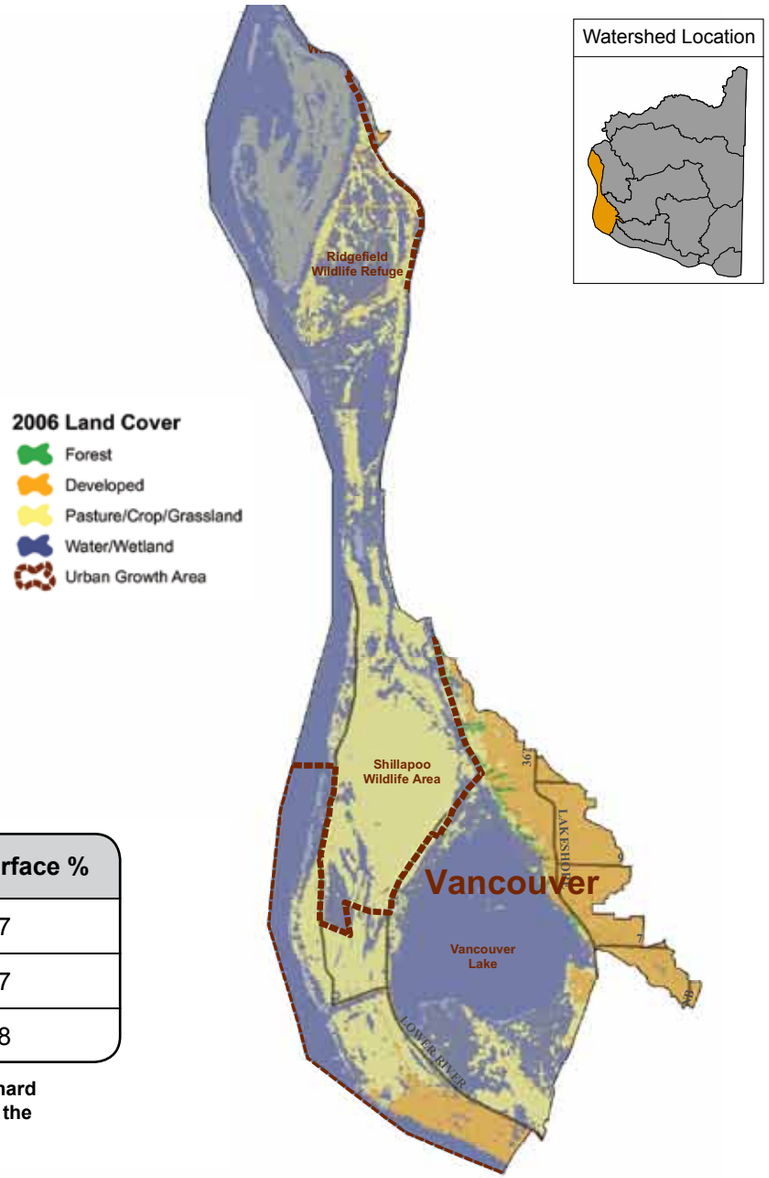
- The amounts of intact forest and hard surface suggest poor stream conditions are likely, particularly in Lakeshore area
- Limited additional development is expected, except for expansion at the Port of Vancouver

Resources to Protect:

- Recreational use
- Shillapoo wildlife area
- Wildlife habitat
- Agricultural lands
- Open space
- Vancouver Lake

Suggested Stream Health Strategies:

- Increase infiltration and retention of stormwater runoff in developed areas
- Improve treatment of stormwater discharged to Vancouver Lake
- Work with property owners to eliminate pollution sources
- Encourage healthy stream and riparian management in residential areas



Subwatershed	Forest %	Hard Surface %
Lake River	8	17
Lakeshore	8	47
Vancouver Lake	8	18

This table shows the amount of land that is covered by forest and by hard surfaces in each subwatershed. The map on the facing page provides the subwatershed boundaries for reference.

Vancouver Lake/Lake River Watershed: Stream Health

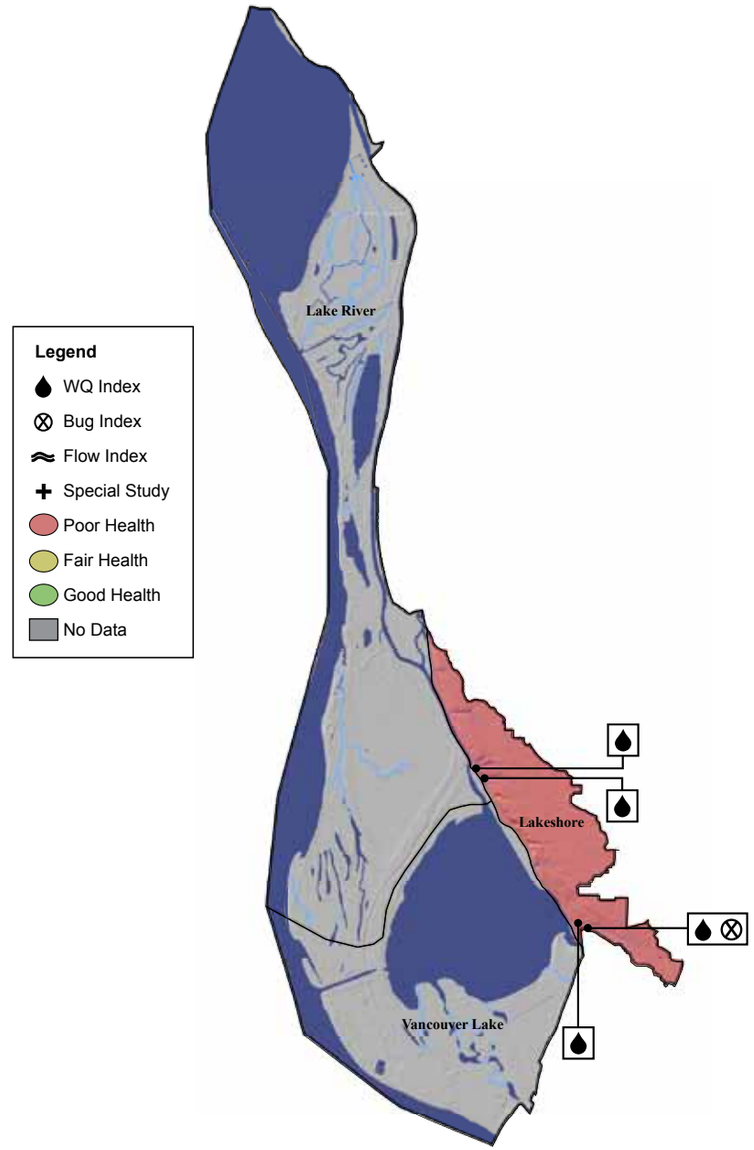
Vancouver Lake/Lake River Score Card

Subwatershed	Water Quality	Biological Health	Flow	Subwatershed Rating
Lakeshore			--	
Indicator Rating			--	
Overall Watershed Rating:			**Poor**	

Data were not collected from the following subwatersheds: Lake River and Vancouver Lake

Score Summary:

- There are no good or fair ratings
- Poor scores are in the heavily developed Lakeshore area



Burnt Bridge Creek Watershed

Description: Located in southwest Clark County, this watershed drains a 28 square mile area and encompasses four subwatersheds: Upper, Middle, and Lower Burnt Bridge Creek, and Burton Sink. Stream channels alternate between man-made ditches and natural channels and drain westward through the City of Vancouver into Vancouver Lake.

Land Cover:

- *Forest:* Almost entirely absent of forest cover except for park lands and isolated areas in lower watershed
- *Development:* The most heavily developed watershed in Clark County
- *Agriculture:* Pasture/grasslands confined to upper watershed and along greenway corridor
- *Water:* Vancouver Lake; a few intact headwater wetlands and near-stream wetlands present

Likely Condition:

- The amount of intact forest and hard surface suggest poor stream conditions are very likely

Resources to Protect:

- Headwater and stream corridor wetlands
- Greenway corridors
- Parks and open space
- Vancouver Lake

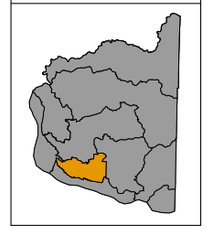
Suggested Stream Health Strategies:

- Increase infiltration and retention of stormwater runoff
- Encourage healthy stream and riparian management in residential areas
- Work with property owners to eliminate pollution sources
- Restore riparian forest and wetlands
- Promote good septic system maintenance practices

Subwatershed	Forest %	Hard Surface %
Burton Sink	--	--
Lower Burnt Bridge Creek	10	50
Middle Burnt Bridge Creek	4	50
Upper Burnt Bridge Creek	4	58

This table shows the amount of land that is covered by forest and by hard surfaces in each subwatershed. The map on the facing page provides the subwatershed boundaries for reference.

Watershed Location



Burnt Bridge Watershed: Stream Health

Burnt Bridge Steam Health Score Card

Subwatershed	Water Quality	Biological Health	Flow	Subwatershed Rating
Lower Burnt Bridge Creek		--	--	
Middle Burnt Bridge Creek		--	--	
Indicator Rating				
Overall Watershed Rating:			**Poor**	

Data were not collected from the following subwatersheds: Burton Sink and Upper Burnt Bridge Creek

Score Summary:

- There are no good or fair ratings
- Historical data suggest Burnt Bridge Creek is the least healthy stream in Clark County
- Washington Department of Ecology is developing a state Water Cleanup Plan for bacteria, temperature, dissolved oxygen, and pH

Special Study: Burnt Bridge Creek Stream Temperature Study

Study Description: Description: 19 sites within Burnt Bridge Creek Watershed; May – September 2008 and 2009. Stream temperature data were analyzed using the state criterion.

Report link: www.ecy.wa.gov/programs/wq/tmdl/burntbridge /BBC tmdlUpdateMtg062010.pdf

Why is this important? Salmon need cold water to survive. Prolonged exposure to stream temperatures above 63.5 °F can harm or kill salmon.

Results:

- Stream temperature did not meet Washington state standards at 18 of 19 stations for extended periods of time (1 – 12+ weeks).
- Stream temperatures in the upper watershed sites spent less time above 63.5 °F than the middle and lower watershed.

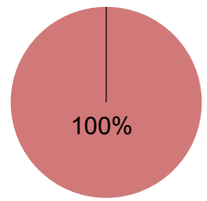
Special Study: Burnt Bridge Creek Bacteria Total Maximum Daily Load (TMDL) Plan

Study Description: 19 sites within Burnt Bridge Creek Watershed; May – September 2008 and 2009

Report link: http://www.ecy.wa.gov/programs/wq/tmdl/burntbridge /BBC tmdlUpdateMtg062010.pdf

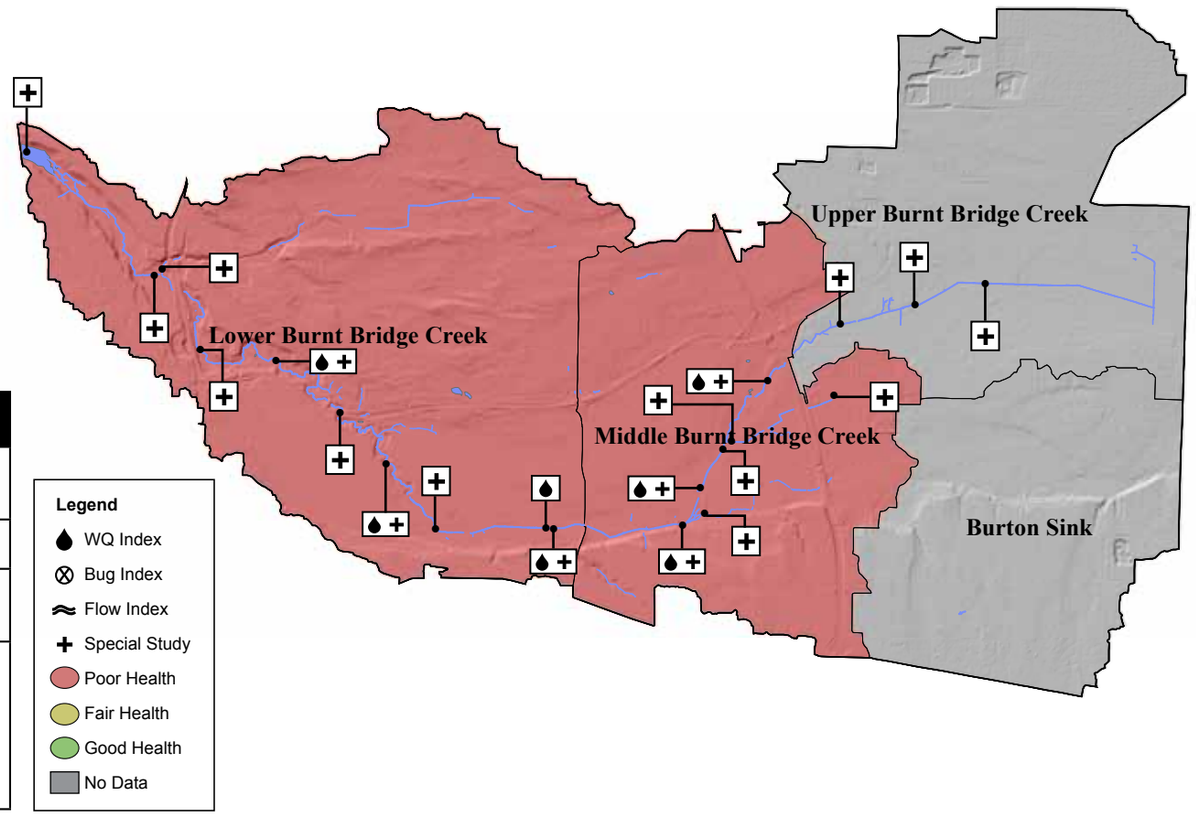
Why is this important? The presence of fecal coliform bacteria indicates the stream has been contaminated with human or animal waste. Bacteria TMDL (also called Water Cleanup Plans) efforts identify and recommend ways to reduce bacteria sources.

Did not meet standards



Results:

- No site met the state water quality criteria for bacteria levels



Columbia Slope Watershed

Description: This 25 square mile watershed, located in southern Clark County, consists of a narrow band of hillsides that drain to the Columbia River within the cities of Vancouver and Camas. There are only two named creeks in this watershed, Fisher and Joseph's Creeks, but the area has numerous springs in gravel deposits along the hillsides.

Land Cover:

- *Development:* Nearly the entire watershed is developed
- *Forest:* Scattered forest exists in parks and near hillside springs
- *Agriculture:* Pasture/grasslands almost nonexistent
- *Water:* Wetlands occur at the base of spring seeps and along drainage corridors

Likely Condition:

- The amount of intact forest and hard surface suggest poor stream conditions are very likely
- Open space is very limited

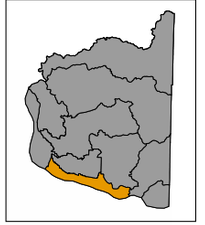
Resources to Protect:

- Biddle Nature Preserve
- Ellsworth Springs
- Parks and open space

Suggested Stream Health Strategies:

- Increase infiltration and retention of stormwater runoff
- Protect hillside springs and shoreline wetland areas
- Promote good septic system maintenance practices
- Encourage healthy stream and riparian management in residential areas

Watershed Location



Subwatershed	Forest %	Hard Surface %
Camas	15	28
Columbia Slope	5	54

This table shows the amount of land that is covered by forest and by hard surfaces in each subwatershed. The map on the facing page provides the subwatershed boundaries for reference.

Data were not collected in the Columbia Slope watershed during the 2004-2010 monitoring period; therefore, stream health scores are not available for this area.

Lakes in Clark County

Lakes are unique resources which provide a variety of recreational opportunities and diverse habitats. Lakes are not abundant in Clark County, but each of our lakes is heavily used and provides enjoyment to thousands of people every year. Vancouver Lake, Lacamas Lake, and Battle Ground Lake are discussed below. Yale Lake and Lake Merwin, two large reservoirs along the North Fork Lewis River, also provide recreational opportunities but have very limited water quality data.

Unfortunately, lakes are also easily degraded by human activities in their watersheds. Problems such as algae blooms, low oxygen levels, invasive plants, sediment, bacteria and toxic pollutants can be issues in our lakes. Careful lake and watershed management is required to protect these resources and maintain their benefits to our community.

Clark County Environmental Services and its partners, which include volunteers, Vancouver Lake Watershed Partnership, Washington State University, Clark County Public Health, Ecology, U.S. Army Corps of Engineers, Environmental Protection Agency, and the United States Geological Survey, are working to learn more about the lakes and improve lake management. You can find out more by visiting the websites below, or contacting Clark County Environmental Services at (360) 397-2121, or www.clark.wa.gov/water-resources.

Vancouver Lake

Size: 2,400 acres
General health: Poor

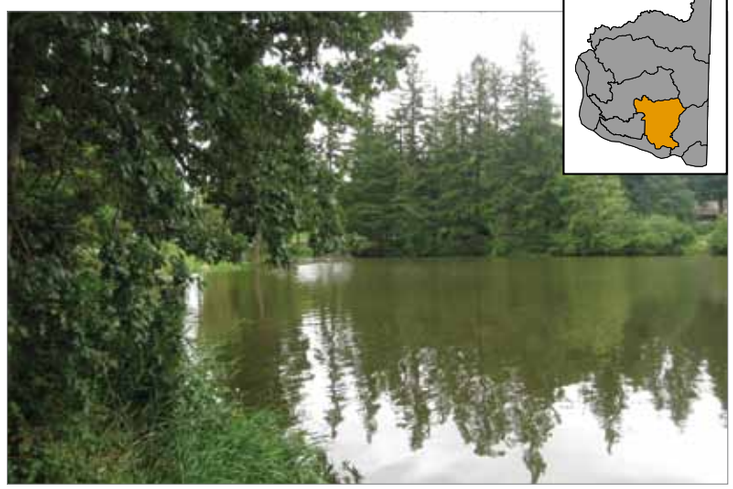
Uses to protect: sailing, rowing, swimming, paddling, fishing, wildlife habitat

Problems: algae blooms, sediment accumulation, nutrients, toxic pollutants

Years of data: 2005 to present

Contact: For information about ongoing research, planning and rehabilitation, see the Vancouver Lake Watershed Partnership website at http://www.ci.vancouver.wa.us/publicworks/vancouverlake/index.htm

Lacamas Lake



Size: 300 acres
General health: Fair

Uses to protect: power boating, skiing and boarding, fishing, paddling, wildlife habitat

Problems: algae blooms, low oxygen, invasive plants, sediment accumulation, nutrients

Years of data: 1995 to present

Contact: For water quality reports, ongoing research efforts, and citizen lake guides, see the Clark County Environmental Services' website at http://www.clark.wa.gov/water-resources/monitoring/lakemonitor.html

Battle Ground Lake

Size: 60 acres
General health: Fair

Uses to protect: swimming, fishing, paddling, scuba diving, wildlife habitat

Problems: invasive plants, nutrients

Years of data: 2003

Contact: For more information about Battleground Lake State Park, see http://www.cityofvancouver.us/parks-recreation/parks_trails/parks/battleground/battlegroundlake.htm or, contact Clark County DES at the website above

Trends in stream health

Current data provide a snapshot of stream health at one point in time. Trend data show long-term patterns, which increase our understanding of whether stream health is getting better or worse over time, and how streams are likely to be affected in the future.

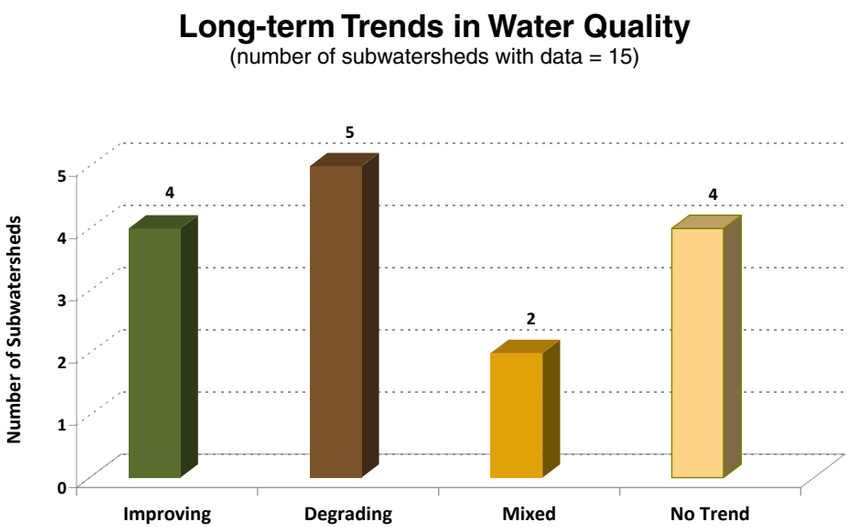
Trends in stream health are more difficult to identify than current conditions. Usually it takes a large amount of data, collected over a long time, in order to identify trends with confidence. Because of this, our ability to detect and report on trends is more limited.

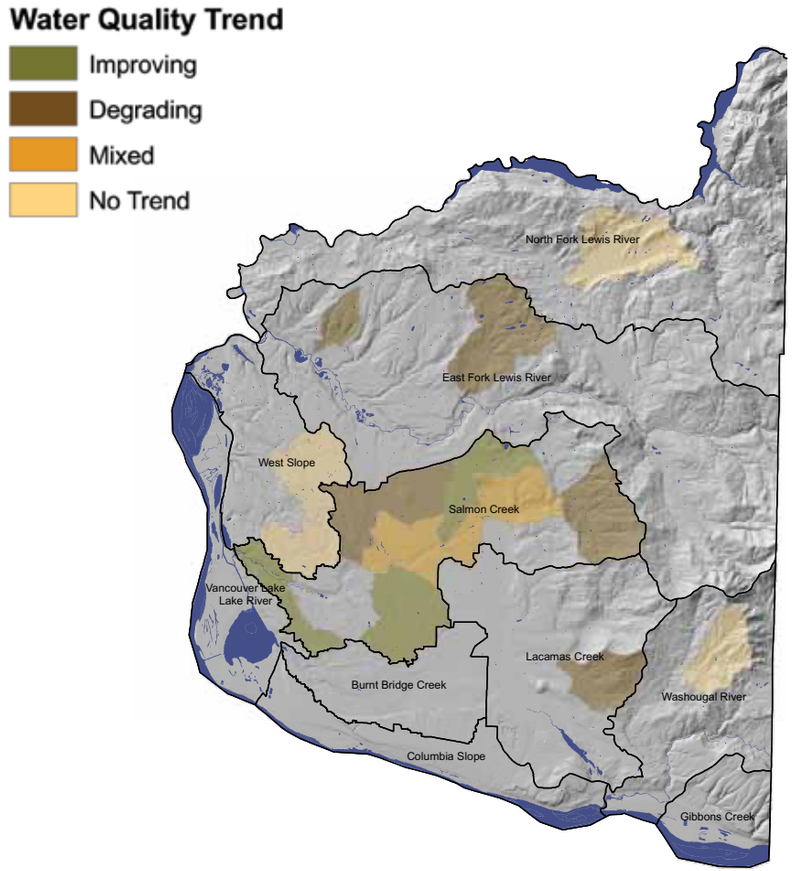
This section uses available data to discuss trends in water quality and biological health. For these indicators, current status is also summarized for comparison to the trend or likely future condition.

Water quality

Clark County's water quality dataset is the only one of the three metrics large enough to calculate mathematical trends. These trends have been calculated recently for 15 subwatersheds in Clark County by Environmental Services' staff and Washington Department of Ecology.

Of these 15 subwatersheds, calculated trends for water quality suggest that five subwatersheds are degrading, four are showing no change, four are improving, and two have mixed results, with some measures degrading and others improving.





More information

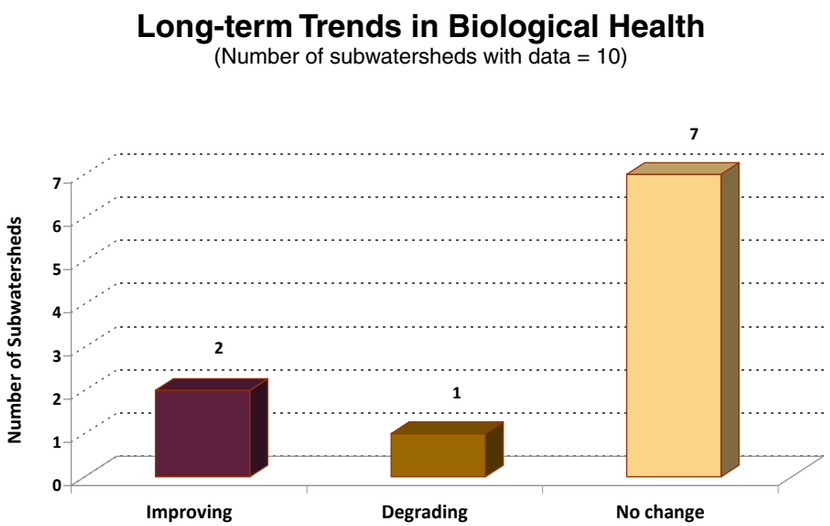
- Current water quality data show that, out of 24 subwatersheds scored, six have good water quality
- Improving trends are primarily in subwatersheds with poor current water quality that have been degraded for a long time
- Declining and mixed trends are primarily in subwatersheds that are seeing increased development

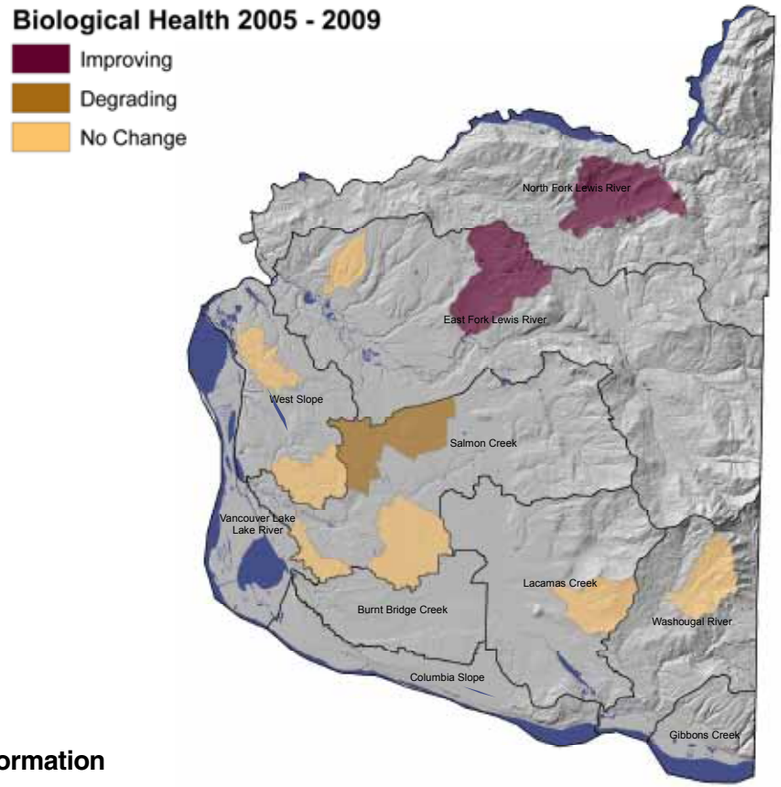
Trends in stream health

Biological health

Although the county has collected a large dataset of macroinvertebrate bugs to provide current biological health ratings, we do not have the amount of information needed to determine mathematical trends. Macroinvertebrate experts working with county staff compiled enough data for ten subwatersheds, from 2005-2009, to provide the county with a summary of data patterns discussed in this section.

Of these ten subwatersheds, the biological health data suggest that one subwatershed is degrading, two are improving, and seven are showing no change since 2005.





More information

- Among the seven subwatersheds showing no change in biological health since 2005, most (five) have had consistently low scores during that time.
- By comparison, current biological health data show that, out of 38 subwatersheds scored, five have high biological health; seven have low biological health, and 26 have moderate biological health.
- Subwatersheds with declining biological health or consistently low scores are in heavily developed and rapidly developing areas.
- Subwatersheds with improving biological health or consistently high scores are in relatively undeveloped areas with higher amounts of intact forest.

Data from the Pacific Northwest show that biological health (as measured by macroinvertebrate bugs) consistently declines as the amount of hard surface in an area increases. High biological health is very difficult to achieve once hard surfaces cover more than 25 percent of the land; moderate biological health is difficult to achieve once hard surfaces expand beyond 45 percent. Current data show that most Clark County streams have lower biological health than expected given the relatively low amount of hard surfaces around them. This means our streams can be improved; providing better stream habitat is likely to be successful at increasing bug scores and biological health. These are important building blocks toward protecting overall stream health and recovering wild salmon populations.

What Clark County is doing

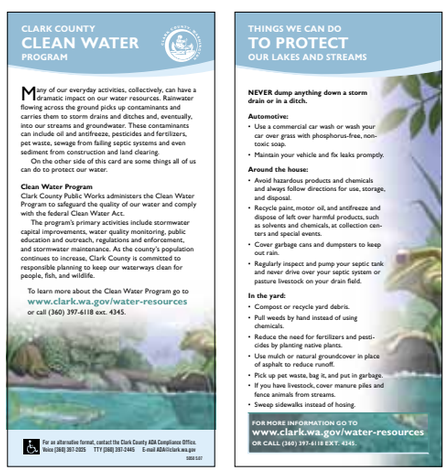
Clark County Environmental Services implements numerous programs that help strategically protect and enhance our natural environment, including the health of our streams. Some of the benefits and responsibilities of these programs are listed below. Contact the county for more information about any of our activities.

Protecting streams

- ***Stormwater treatment and detention.*** Inspection, maintenance, and upgrades ensure that stormwater facilities function as effectively as possible. Construction of new facilities helps protect developing areas.
- ***Pollution control.*** Working with property owners to remove illegal discharges to the stormwater system helps eliminate pollution sources.
- ***Erosion control.*** Enforcing regulations to control erosion reduces impacts to stream water quality.
- ***Development review.*** Reviewing development proposals for environmental compliance can eliminate problems before they start.
- ***Solid waste disposal and recycling.*** Managing trash wisely reduces streamside dumping and leaves a cleaner and healthier watershed.
- ***Conservation of high quality areas.*** Purchasing lands with high quality habitat protects sensitive streams and provides open space.
- ***Endangered species.*** Implementing policies that help protect threatened fish and other species often provides direct benefits to stream health as well.

Enhancing streams

- ***Weed control.*** Controlling invasive plants helps native plants thrive and protects the natural habitats of our region.
- ***Re-forestation.*** Re-planting previously cleared forest lands improves critical headwaters and stream function.
- ***Habitat restoration.*** Restoring natural streambanks and channels in degraded areas helps streams recover from damage and creates healthy floodplains.
- ***Educational outreach.*** Offering opportunities to learn about how we affect our watersheds helps build partnerships to improve stream health.


CLARK COUNTY
CLEAN WATER
PROGRAM

Many of our everyday activities, collectively, can have a dramatic impact on our water resources. Rainwater flowing across the ground picks up contaminants and carries them to storm drains and ditches and, eventually, into our streams and groundwater. These contaminants can include oil and antifreeze, pesticides and fertilizers, pet waste, sewage from failing septic systems and even sediment from construction and land clearing.

On the other side of this card are some things all of us can do to protect our water.

Clean Water Program

Clark County Public Works administers the Clean Water Program to safeguard the quality of our water and comply with the federal Clean Water Act.

The program's primary activities include stormwater capital improvements, water quality monitoring, public education and outreach, regulations and enforcement, and stormwater maintenance. As the county's population continues to increase, Clark County is committed to responsible planning to keep our waterways clean for people, fish, and wildlife.

To learn more about the Clean Water Program go to
www.clark.wa.gov/water-resources
or call (360) 397-6118 ext. 4345.

For an alternative format, contact the Clark County ADA Compliance Office.
Voice (360) 397-2075 TTY (360) 397-2445 E-mail ADA@clark.wa.gov
1000.507

THINGS WE CAN DO
TO PROTECT
OUR LAKES AND STREAMS

NEVER dump anything down a storm drain or in a ditch.

Automotive:
- Use a commercial car wash or wash your car over grass with phosphorus-free, non-toxic soap.
- Maintain your vehicle and fix leaks promptly.

Around the house:
- Avoid hazardous products and chemicals and always follow directions for use, storage, and disposal.
- Recycle paint, motor oil, and antifreeze and dispose of left over harmful products, such as solvents and chemicals, at collection centers and special events.
- Cover garbage cans and dumpsters to keep out rain.
- Regularly inspect and pump your septic tank and never drive over your septic system or pasture livestock on your drain field.

In the yard:
- Compost or recycle yard debris.
- Pull weeds by hand instead of using chemicals.
- Reduce the need for fertilizers and pesticides by planting native plants.
- Use mulch or natural groundcover in place of asphalt to reduce runoff.
- Pick up pet waste, bag it, and put in garbage.
- If you have livestock, cover manure piles and fence animals from streams.
- Sweep sidewalks instead of hosing.

FOR MORE INFORMATION GO TO
www.clark.wa.gov/water-resources
OR CALL (360) 397-6118 EXT. 4345.

More tips for protecting stream health

Engaging partners

Clark County Environmental Services cooperates with local agencies and organizations to monitor streams, carry out cleanup plans, and raise awareness about water quality issues. Recent partnerships include:

- Working with the six cities in Clark County (Battle Ground, Camas, La Center, Ridgefield, Vancouver, and Washougal) to show homeowners and businesses how to properly maintain their private stormwater treatment facilities.
- Maintaining outreach partnerships with the City of Vancouver, Washington State University Clark County Extension, and Columbia Springs Environmental Education Center to maximize resources and provide a common "clean water" message.
- Providing specialized monitoring to help the Clark Regional Wastewater District prioritize areas for sewer installation.
- Founding the Vancouver Lake Watershed Partnership with the Port of Vancouver and the City of Vancouver. The 20-member stakeholder group is dedicated to improving Vancouver Lake.

Washington State University brochure

What Clark County is doing

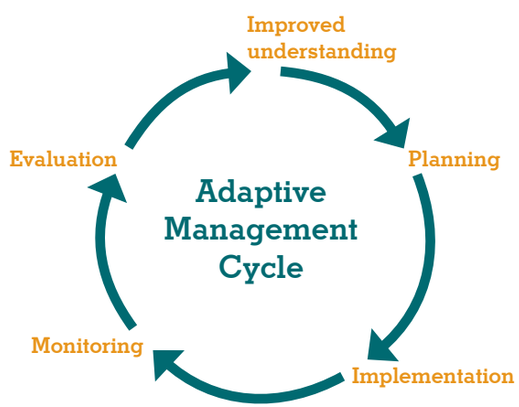
- Training and mentoring teachers and students in water quality monitoring as part of The Student Watershed Research Project.
- Contributing to the Regional Coalition for Clean Rivers and Streams, an educational partnership of agencies and municipalities in the Portland/Vancouver metro area. Member organizations pool resources annually to develop a regional stormwater public awareness campaign to reach more than 1.4 million people.
- Working with Ecology, Clark County Public Health, Clark Public Utilities, Cities, and the Clark Conservation District to implement state Water Cleanup Plans for polluted streams (*see sidebar*).
- Locating streamside trash dump sites and supporting cleanup through local organizations like the Salmon Creek Watershed Council and scout groups.

Helping citizens improve streams

All of us can help protect our streams. This report shows how actions in the watershed, at our businesses, farms, managed forests, and residences can affect streams. But the good news is that those potential effects can be reduced and even eliminated. Clark County offers many programs and resources to help you protect our streams. Available information includes tips for managing stormwater at your home or business, gardening without pesticides, managing your rural property, and conserving water. For more information, call Clark County Environmental Services at (360) 397-2121, or go to www.clark.wa.gov/water-resources. A list of additional helpful websites is provided in the next section.

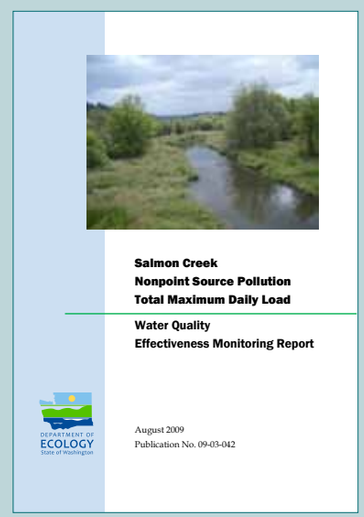
Improving decision making

Monitoring and evaluation are two steps in a larger adaptive management process. Adaptive management is a cycle that emphasizes using a learning process to make better decisions to achieve management goals. Information about a problem, such as declining stream health, is gained from monitoring and evaluation. This improved understanding is used to develop appropriate plans that can be implemented to address the identified problem. Over time, additional monitoring can determine whether the actions are effective or need to be modified.



Salmon Creek success!

Since 1995, Clark County's Clean Water Program, Clark County Public Health, Clark Public Utilities, the Clark Conservation District, and Ecology have partnered to improve turbidity and bacteria problems in Salmon Creek. In 2009, Ecology analyzed recent Clark County data and compared it to conditions in the 1990s. The result? All long-term monitoring locations in Salmon Creek now meet water quality standards for turbidity, and fecal coliform bacteria has decreased by up to 98% in some locations. Reduced nutrient levels (phosphorus and nitrogen) were also found in most locations. How did we do it? Improved stormwater management, streamside tree planting, habitat restoration, public education, monitoring, and improved septic system oversight have resulted in measurable improvements in water quality. With time, resources, and most importantly, the help of committed agencies, stakeholders, and residents, it can be done!



View the entire report at:
http://www.ecy.wa.gov/programs/wq/tmdl/SalmonCr/SalmonCr.html

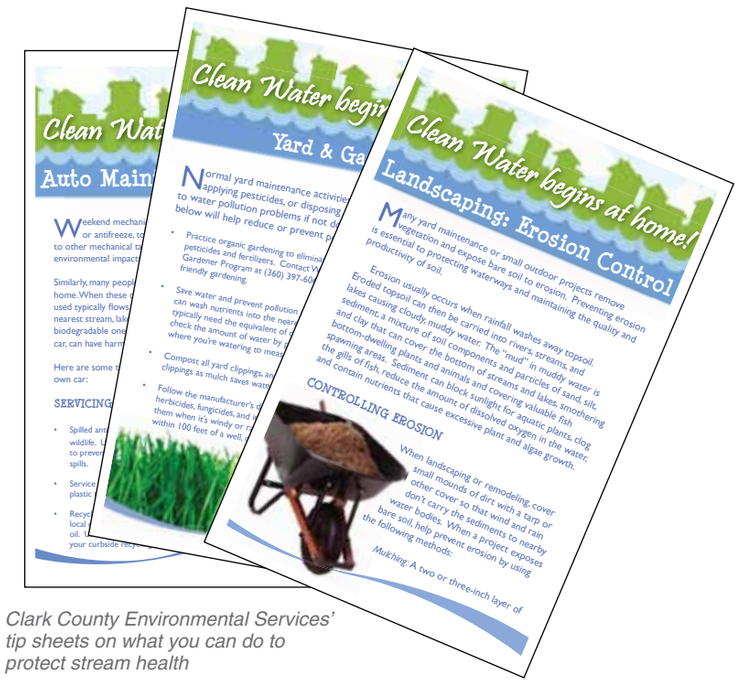
What you can do

Clark County Environmental Services wants to help you and your watershed neighbors protect stream health. Activities upstream affect our downstream neighbors, just as our upstream neighbors can affect us. Clark County has a collection of helpful information - from what you can do, to where you can find more information about your interests.

Things you can do at home

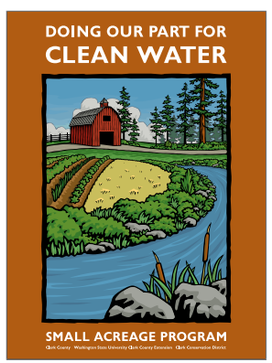
There are many things that you can do at your home or business to improve stream health. Here are several ideas:

- ***Natural gardening:*** Avoid pesticides or fertilizers. Clark County Environmental Services can provide information about natural alternatives to try, such as introducing ladybugs to control certain insects. If you have stubborn yard or garden problems, try to limit chemical use to problem areas, and follow directions carefully. Remember pesticides and fertilizer can be harmful to children and pets.
- ***Conserve water:*** Let at least part of your lawn go dormant in summer if you can. If you need to water, try a deep watering once per week, or drip irrigate. You can make your own drip irrigation with an old hose, hammer and nails. Adjust sprinklers to keep water off of the driveway. Better yet, remove part of your lawn and plant native plants which require less water, can attract birds and butterflies, and provide habitat.
- ***Don't pollute:*** Keep oil and grease off the streets by maintaining vehicles free of leaks. Cover the street or driveway with newspapers or old towels before changing your vehicle's oil to absorb drips. Wash your vehicle at a car wash or on the lawn. Properly dispose of waste in the trash; not in storm drains or on the ground. Recycle used oil.



Clark County Environmental Services' tip sheets on what you can do to protect stream health

- ***Maintain your septic system:*** Septic systems can leak harmful bacteria and nutrients, which make algae grow in water. Have your system pumped and cleaned regularly and watch for signs of failure, such as excessively tall plants and puddles.
- ***Leave streamside vegetation in place:*** Maintain plants and trees with deep roots near the top of the stream bank to prevent soil from eroding, keep runoff from entering the stream, and provide shade.
- ***Learn how to better manage your rural property:*** Attend a Small Acreage Program workshop or take the Living on the Land training: http://clark.wsu.edu/horticulture/smallAcreageProgram.html.



Yard sign recognizing landowners that manage their property to protect water

- ***Pick up trash:*** Most trash takes a very long time to break down, and can release pollutants such as chemicals and dyes. Trash that ends up in our streams can be carried to the ocean, where it accumulates in large patches. Trash also harms wildlife.
- ***Make a call:*** Let your elected officials know what you care about. Report water quality or erosion issues promptly to the Washington Department of Ecology

What you can do

24-hour Surface Water Quality and Spill Complaint Line: (800) 258-5990.

- ***Maintain your private stormwater facilities:*** This may include underground structures or above-ground swales and ponds owned by your homeowner's association. Remove trash and weeds that clog drains, and trapped sediment and overgrown plants that decrease capacity to hold stormwater. Repair fences, gates and pipes if damaged. If your facility has a filter, make sure it is cleaned or replaced on schedule.
- ***Disconnect:*** Keep stormwater out of pipes that lead to streams. Divert gutters and downspouts into a rain barrel or to your yard.
- ***"Doo something pawsitive":*** Enroll your dog in Clark County's Canines for Clean Water program (the blue bandana shows you care!) at www.CleanWaterDogs.com.

Accepting the Canines for Clean Water challenge

Replacing stormwater filters

Rain barrel contest winner: Washougal High School

Volunteer

Have a little more time? Volunteer to pull weeds or plant trees, monitor a creek, or learn how to help others protect stream health. The following local opportunities will allow you to learn, have fun with your family, and help your community:

- ***Watershed Stewards***
  http://clark.wsu.edu/volunteer/ws/index.html
- ***Master Gardeners***
  http://clark.wsu.edu/volunteer/mg/index.html
- ***Master Composter Recycle***
  www.clark.wa.gov/recycle/yard/MasterComposter.html
- ***Clean Water Program Monitoring Resource Center***
  http://www.clark.wa.gov/water-resources/monitoring/vol-resource-center.html
- ***Salmon Creek Watershed Council***
  http://www.salmoncreekwatershed.org/events.html
- ***Clark Public Utilities Stream Team and Stream Stewards***
  http://www.clarkpublicutilities.com/ourenvironment
- ***City of Camas Parks and Recreation***
  http://www.ci.camas.wa.us/parks/parkvol.htm
- ***Vancouver - Clark Parks and Recreation***
  http://www.cityofvancouver.us/parks-recreation/how_to_help/americorps.htm
- ***Vancouver Watersheds Council***
  http://www.vancouverwatersheds.org/
- ***Friends of Ridgefield National Wildlife Refuge / Gee Creek Enhancement Committee***
  http://www.ridgefieldfriends.org/index.php
  http://clark.wsu.edu/natural/geeCreek.html
- ***Friends of the East Fork Lewis River***
  http://www.eastforklewisriver.org/
- ***Vancouver Lake Watershed Partnership***
  http://www.cityofvancouver.us/PublicWorks/vancouverlake/
- ***Lower Columbia River Estuary Partnership***
  http://www.lcrep.org/

A sediment-filled stormwater vault

What you can do

General Resources

More resources to learn about things you can do include:

1. **WSU Clark County Extension**
   - ***Events Calendar***
     http://clark.wsu.edu/calendar/index.asp
   - ***Small Acreage Program Workshops and Training***
     http://clark.wsu.edu/horticulture/smallAcreageProgram.html
2. ***Clark Conservation District***
   www.clarkcd.org
3. ***Water Resources Education Center***
   http://www.cityofvancouver.us/watercenter.asp
4. ***Columbia Springs Environmental Education Center***
   http://www.columbiasprings.org/
5. ***Lower Columbia Fish Recovery Board***
   http://www.lcfrb.gen.wa.us/default1.htm
6. ***Washington Wildlife and Recreation Coalition***
   http://wildliferecreation.org/wwrp-projects/counties/Clark_county
7. ***Regional Coalition for Clean Rivers and Streams***
   http://www.cleanriversandstreams.org/

Partners in Resource Protection

Washington State University Clark County Extension

Clark Conservation District
Assisting Landowners with Natural Resource Conservation

Water Resources Education Center

Watershed Steward Program

Vancouver-Clark Parks & Recreation

Celebrating 10 Years of Fish Recovery — Lower Columbia Fish Recovery Board 1998 ~ 2008

Small Acreage Program

Columbia Springs
explore experience learn

Master Composter Recycler

Clark Public Utilities

Salmon Creek Watershed Council
Clark County, Washington

Stream Team
Clark Public Utilities

City of Camas
Parks and Recreation

Vancouver Watersheds Council

Lower Columbia River Estuary Partnership

Friends of Ridgefield National Wildlife Refuge

Vancouver Lake Watershed Partnership

Friends of the East Fork Lewis River
Working together to restore & conserve our waters

Washington Wildlife and Recreation Coalition

Vancouver Washington

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Clark County Department of Environmental Services

Street Address: 1300 Franklin Street, 1st Floor, Vancouver, WA 98660

Mailing Address: P.O. Box 9810 Vancouver, WA 98666-9810

Main phone: (360) 397-2121

Fax: (360) 397-2062

http://www.clark.wa.gov/environment/index.asp

For other formats, contact the Clark County ADA Office
Voice (360) 397-2000, **Relay** 711 or (800) 833-6388
Fax (360) 397-6165, **E-mail** ADA@clark.wa.gov.

CLARK COUNTY, WASHINGTON