

# Marys River Watershed Council Action Plan October 2003



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## Chapter 1: Introduction

**Goal:** The goal of this action plan is to establish and document a systematic approach to identify and prioritize specific actions that the Marys River Watershed Council will undertake to help protect, maintain, and maintain and restore watershed function and healthy aquatic and riparian resources as well as communicate, educate and reach out to watershed residents and other users.

### Background

The Marys River Watershed Council (MRWC) was chartered in January 1996 and formally recognized by the Benton County Commission in February 1998. The mission is to serve as a voluntary community forum for local watershed residents, landowners, managers, and users to: understand, educate, and exchange watershed ideas, investigate watershed needs and concerns, keep current on watershed plans and actions, solicit help on how to maintain and improve the local watershed environment, and facilitate the implementation of on-the-ground projects.

The Marys River Watershed is one of five major watersheds flowing into the Willamette River from the West. It drains 310 square miles of forested, agricultural, and urban lands on the east side of the coast range. These coastal draining tributaries to the Willamette River differ from those draining the Cascades in a number of ways. They are underlain by older more erosive geologic formations and the flow patterns tend to be driven by rainfall (rather than snowmelt or rain-on-snow) and usually result in sustained high winter flows and droughty low summer flow conditions. Coastal valleys tend to be wide and flat reflecting the less pronounced elevational extremes than are found in the Cascades (Ecosystem Northwest 1999).

About 5 miles upstream of the mouth of the Marys is the confluence with Muddy Creek. Muddy Creek drains 42% of the Marys River Watershed. The two areas upstream of this junction are distinct. The Marys River portion drains mostly upland forest with higher gradient tributaries. Muddy Creek drains the valley agriculture areas and the streams tend to be mostly low gradient (Ecosystem Northwest 1999).

In the 1999 Marys River Preliminary Watershed Assessment, land use patterns in the Marys River Watershed are described in terms of three distinct areas: an upland forest area, a valley agriculture area, and a downstream urban area. Forestry is the main land use in the upland zone, as well as the unincorporated rural communities of Wren, Blodgett, Summit, and Burnt Woods. Mixed agricultural and rural residential are the main land uses in the valley zone including the communities of Alpine and Bellfountain. The urban growth boundaries and communities of Philomath and Corvallis represent the urban zone. Ninety-five percent of the watershed is contained within Benton County.

The MRWC has completed other evaluations and assessments in addition to the Preliminary Marys River Watershed Assessment. An annotated bibliography of these project reports is provided in Appendix A. Most of the project reports are available at the Corvallis and Philomath Public Libraries and on the Watershed Council web site: [www.marys-river-wc.peak.org](http://www.marys-river-wc.peak.org). Findings and

recommendations from these projects have in part directed the goals, objectives and actions described in this plan.

### **Action Planning**

Early in the action-planning process the MRWC recognized that all of the important issues in the watershed could not be addressed simultaneously because of limited resources. So the MRWC went through an initial process that would enable the group to prioritize and begin implementing on-the-ground activities and assessments while a long-term plan was being constructed. During this initial action-planning phase the MRWC identified four key issues and established committees to address those issues. The issues include: the importance of outreach and education; fish passage throughout the watershed; water quality parameters listed as undesirable by the Oregon Department of Environmental Quality (DEQ); and land, air, and water use. The MRWC continues to organize efforts through these four committees along with the addition of a fifth process: restoration planning. This action plan is organized around these five action categories described in chapters 2 - 6:

- ❑ Education and Outreach (Chapter 2): A standing committee promotes education within the watershed on the importance of and methods for improving watershed health through the objective and accurate dissemination of information.
- ❑ Fish passage (Chapter 3): A standing committee has been formed to identify barriers and prioritize their removal in critical areas of the Marys River Watershed.
- ❑ Water Quality (Chapter 4): A standing committee coordinated the completion of a water quality assessment and continues to develop and implement an action plan to improve water quality.
- ❑ Land, Air, and Water Use (Chapter 5): A standing committee has the primary goal to respond to land, air and water use issues and concerns brought up by watershed residents.
- ❑ Maintenance and restoration Planning (Chapter 6): The MRWC is developing a system to identify where maintenance and restoration opportunities in the watershed would have the greatest ecological returns. The council worked with the Environmental Protection Agency (EPA) to develop a maintenance and restoration opportunities screening map and evaluate the map in the field.

Chapter 7 describes how the council makes decisions and conducts business. Appendix A summarizes watershed studies and sites other references and Appendix B describes the maintenance and restoration planning process and products currently used by the council.

This plan is intended to articulate and prioritize council activities to meet the goals and objectives that support the mission of the council. Of all the issues initially identified in the action-planning process, the issues surrounding low flows and water use have had the least attention. There are a number of reasons for this including the challenges of changing existing water use patterns. Future revisions of this action plan will investigate the possibilities of maintenance and restoration projects that would improve the low flow conditions in the Marys River. This action plan can be updated and modified at any time, but at a minimum will be reviewed and revised as needed every two years. The current action items, time lines and status information are written as agreed to in October 2003.

## Chapter 2: Education and Outreach

**Goal: Promote education within the watershed on the importance of, and methods for maintaining and improving watershed health through the objective and accurate dissemination of information.**

Clearly the success of any watershed council depends on the involvement of a diversity of citizens from within the watershed. The education and outreach committee has the opportunity to facilitate the involvement of these watershed residents and users so they can learn about and share watershed concepts, issues, and community events. The committee identified three key objectives and multiple action items that will help achieve the desired goal. The objectives are described below, followed by a brief summary of the action items that will be taken to achieve the objectives. A complete list of action items, responsible parties, timelines, resources needed, and measures of success are detailed in Table 1.

**OBJECTIVE I: DEVELOP AND MAINTAIN WATERSHED COUNCIL VISIBILITY IN THE COMMUNITY AND ENCOURAGE ACTIVE PARTICIPATION IN COUNCIL ACTIVITIES.**

Summary of Action Items: The dissemination of information is an ongoing and critical component of achieving Objective I. The committee has identified multiple action items and avenues to achieve this including the use of community displays, exhibits, festivals, the MRWC Internet web site, and media lists. Examples of the types of information to create and disseminate include Marys River Watershed maps (e.g. land use, land cover, projects), Marys River Oral History, and a "Classroom on the Marys River" curriculum. The committee has and will continue to participate in and organize community events geared towards sharing information about watershed issues and processes and keep the MRWC visible to watershed residents and users. This also includes celebrating council successes and soliciting input from landowners regarding educational or information needs. Additionally, the committee is in the process of facilitating public access to watershed GIS data and organizing workshops geared towards training residents and users on how to use the GIS data access systems.

**OBJECTIVE II: FACILITATE EDUCATION FOR WATERSHED COUNCIL PARTICIPANTS.**

Summary of Action Items: The education and outreach committee has and will continue to schedule speakers, workshops, tours, and other events for monthly MRWC meetings, watershed residents and users. The committee has and will continue to support other MRWC committees. The committee has and will continue to encourage watershed council members to participate in the Watershed Stewardship Education Program as a means of learning more about watershed processes, functions, and issues. In addition, the committee will help people understand their connection with the watershed in part by showing them where they live within or near the watershed and what is known about that part of the watershed.

OBJECTIVE III: FACILITATE TECHNICAL ASSISTANCE TO WATERSHED RESIDENTS TO MAINTAIN AND IMPROVE WATERSHED CONDITION.

Summary of Action Items: The education and outreach committee has organized an accessible technical team to promote and assist in the accurate dissemination of information that fosters community understanding and involvement in the watershed. The committee will develop self-evaluation cards that landowners can use to confidentially assess their property. Public information on watershed issues have and will continue to be identified, collected, and made available to communities in the watershed. This includes handouts, brochures, and white papers on watershed issues and available technical assistance. Finally, the committee has and will continue to assist the MRWC and coordinator in fundraising to help achieve the education and outreach goal and objectives.

**Implementation of Education and Outreach Action Items**

The education and outreach committee is currently comprised of 3-5 members. Members volunteer to take the lead on individual action items. The resources, time frames, status and criteria for evaluating the success of each action item have been identified. These implementation strategies are unique to each action item and are detailed in Table 1. A summary of accomplishments and priorities is provided below.

Accomplishments: A summary of recently completed or ongoing action items for the education and outreach committee include:

- ❑ The first Solstice Celebration (June 21, 2003) was well attended by a diverse group and was a financial success. The committee has commenced plans for next year's annual celebration.
- ❑ The committee established a protocol for selecting speakers and has been coordinating speakers for monthly council meetings for several years. These speakers are highly qualified and articulate and address a diverse set of relevant topics to the council.
- ❑ The committee has created maps to display important watershed characteristics for use in workshops, council meetings and community events.
- ❑ The committee updates the MRWC Web Site regularly with information about council activities and products.
- ❑ Media and brochure lists have been compiled for disseminating information about council activities and products.
- ❑ The committee has a list of landowner education requests.
- ❑ The committee works with the council to identify landowners doing maintenance and restoration who would welcome tours of their projects.
- ❑ A technical team has been established to foster community understanding and involvement in the Marys River Watershed.
- ❑ Some members of the MRWC have gone through the Watershed Stewardship Education Program and others are encouraged to do so.
- ❑ The committee is in the process of completing the Oral History project in collaboration with Philomath High School.
- ❑ The committee is in the process of facilitating public access to watershed GIS data & providing data access workshops.

- Priority: The top action item priority for the education and outreach committee is:
- To plan and hold the Solstice 2004 Celebration.



*Table 1. Education and outreach goals, objectives and actions.*

<b>Goal: Promote education within the watershed on the importance of, and methods for, improving watershed health through the objective and accurate dissemination of information.</b>					
<b>Objective I: Develop and maintain watershed council visibility in the community and encourage active participation in council activities.</b>					
Actions	Responsible Party	Resources Needed	Time Frame	Evaluation Criteria	Status
1. Develop an efficient process to participate in community events related to the Marys River Watershed.	<input type="checkbox"/> Mark Taratoot	<input type="checkbox"/> Time to draft plan and present to council.	By end of 2003	Plan in place	In progress
2. Disseminate information about the MRWC using community media opportunities such as displays, exhibits, & community festivals. Assure brochures are in public places and remain "in-stock".	<input type="checkbox"/> E&O and MRWC volunteers	<input type="checkbox"/> Committee time to develop outreach strategy <input type="checkbox"/> Volunteer time to participate in events and prepare displays.	Ongoing	Regular participation at community festivals throughout watershed. Diversity of membership.	See media and brochure list
3. Keep web site up-to-date.	<input type="checkbox"/> Mark Taratoot <input type="checkbox"/> All committee chairs supply minutes to Mark <input type="checkbox"/> Coordinator supply council minutes to Mark	<input type="checkbox"/> Time. Maybe a cup of coffee, too	Ongoing	Web site up-to-date (updated monthly or better)	See web site
4. Create and maintain watershed wide media list and conduct general announcements in free media related to watershed interests. Where possible, also use advertising. Announcements to include meeting times and locations, volunteer opportunities, report availability, etc. Update media list as needed.	<input type="checkbox"/> Coordinator or media volunteer	<input type="checkbox"/> An hour or two each month to make submissions	Ongoing	File of press releases, media article, etc.	See list of media contacts and list of submissions and PR file (MRWC_medialist2002.doc)

<p>5. Create a record of council activities that will be available over the web site. (If desired, compile as paper document (portfolio) to distribute to interested parties.)</p>	<p><input type="checkbox"/> Coordinator or E&amp;O volunteer</p>	<p><input type="checkbox"/> Time needed to post activities to web <input type="checkbox"/> Time to create portfolio</p>	<p>When information available</p>	<p>Web site up-to-date</p>	<p>See web site</p>
<p>6. Celebrate successes of the council</p>	<p><input type="checkbox"/> 2003: Sandra Coveny, Buchanans &amp; E&amp;O Committee, Mark Taratoot and others</p>	<p><input type="checkbox"/> Coordination time <input type="checkbox"/> Budget: Speaker, band, printing, and "party supplies"</p>	<p>Every other year (annual if possible)</p>	<p>Attendance at celebration events</p>	<p>June 2003: Solstice celebration at Tyee: DONE</p>
<p>7. Solicit landowner ideas for educational needs.</p>	<p><input type="checkbox"/> Coordinator &amp; E&amp;O committee volunteers</p>	<p><input type="checkbox"/> Room rental fee <input type="checkbox"/> Planning time</p>	<p>Every two to three years</p>	<p>1) Number of participants. 2) List of landowner education requests</p>	<p>Done. See list of education requests</p>
<p>8. Utilize maps to display important watershed characteristics (land use, land cover, member locations, project locations) for use at workshops, council meetings, and community events.</p>	<p><input type="checkbox"/> 2002-2003: council intern?</p>	<p><input type="checkbox"/> Map, mylar, dots, person responsible for keeping &amp; moving map <input type="checkbox"/> digitizer, <input type="checkbox"/> someone to update map regularly</p>	<p>Original map (Date?) Update quarterly?</p>	<p>1) It's been displayed at least one time in a year. 2) People believe the map has value.</p>	<p>Done, system for updating needs to be established.</p>
<p>9. Continue the Mary's River Oral History project, and publicize the end product.</p>	<p><input type="checkbox"/> Larry Merriam and Wade Trevathan</p>	<p><input type="checkbox"/> Volunteers <input type="checkbox"/> Interview scripts</p>	<p>2004</p>	<p>Completed project report</p>	<p>Project has been started. See online description</p>
<p>10. Facilitate public access to watershed GIS data &amp; provide data access workshops. Work with Land, Air, &amp; Water Use Committee (LAWUC) and (other organizations in Benton County and the Willamette Valley) to identify data and information needs.</p>	<p><input type="checkbox"/> Coordinator or E&amp;O volunteer</p>	<p><input type="checkbox"/> Dedicated computer terminals or data server <input type="checkbox"/> GIS software or ArcIMS interface, <input type="checkbox"/> Watershed specific interface, <input type="checkbox"/> Data updates, <input type="checkbox"/> Time for planning and hosting workshops</p>	<p>Initial work 2003, public access 2004, with quarterly data updates there after</p>	<p>GIS available to general public</p>	<p>Volunteers are working on this and the interfaces that have been created, presentation made at June 2003 council meeting</p>

11. Create a "Classroom on the Marys River" for school groups modeled after the one on the Siletz River. (See <a href="http://www.orwww.org/PEAS/SZ-Day/AAA.htm">http://www.orwww.org/PEAS/SZ-Day/AAA.htm</a> for info)	<input type="checkbox"/> E&O committee, environmental education volunteer or staff member, other community education groups	<input type="checkbox"/> Curriculum, funding, trained volunteers	2010	The curriculum is used and revised as needed	None
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**Goal: Promote education within the watershed on the importance of, and methods for, improving watershed health through the objective and accurate dissemination of information.**

**Objective II: Facilitate education for watershed council participants.**

Actions	Responsible Party	Resources Needed	Time Frame	Evaluation Criteria	Status
1. Identify landowners who are doing maintenance and restoration and habitat enhancement projects in the watershed and facilitate project tours.	<input type="checkbox"/> May 2002: Tom Murphy, Sandra Coveny & E&O Committee <input type="checkbox"/> June 2002: Dave Buchanan	<input type="checkbox"/> Council members <input type="checkbox"/> Time <input type="checkbox"/> Bus rental	<input type="checkbox"/> Every two or three years	1) Completion of successful tours.	A list of tours has been established
2. Develop a protocol for identifying and scheduling speakers at council meetings. Review periodically.	<input type="checkbox"/> E&O volunteers	<input type="checkbox"/> Time	2a. Completed 2b. Ongoing	There is a diversity of topics & viewpoints.	Protocol Completed.
3. Schedule speakers, workshops and tours as needed.	<input type="checkbox"/> E&O Volunteer	<input type="checkbox"/> Speakers <input type="checkbox"/> Volunteer time	Ongoing	Applicable and varied topics are presented by qualified speakers and MRWC members.	See speaker/workshop list
4. Encourage watershed council members to participate in the series of 8 training's through the Watershed Stewardship Education Program (OSU Extension).	<input type="checkbox"/> E&O volunteer, coordinator	<input type="checkbox"/> WSEP training in watershed area.	Ongoing	Number of certified folks	Participants in 2002 and 2003

<p>5. Increase understanding of where people live within and near the Marys River Watershed. Bring a large map of the watershed to every meeting. Have people put up pushpins on where they live.</p>	<p><input type="checkbox"/> Coordinator or E&amp;O volunteer</p>	<p><input type="checkbox"/> Map</p>	<p>Ongoing</p>	<p>Use lesson plans from Oregon Plan Outreach Team and other sources when applicable.</p>	<p>In progress</p>
<p>6. Support other subcommittees: Fish Passage, Land, Air and Water Use, Water Quality)</p>	<p><input type="checkbox"/> 2002-2003: Fish Passage -- Mark Taratoot LAW Use -- Kim Bredensteiner</p>	<p><input type="checkbox"/> E&amp;O members willing to act as contact for requests</p>	<p>Ongoing</p>	<p>Other committees ask E&amp;O for help with their education and outreach objectives and tasks.</p>	<p>Need to establish process for other committees to know how E&amp;O can help them.</p>

**Goal: Promote education within the watershed on the importance of, and methods for, improving watershed health through the objective and accurate dissemination of information.**

**Objective III: Facilitate technical assistance to watershed residents to maintain and improve watershed.**

Actions	Responsible Party	Resources Needed	Time Frame	Evaluation Criteria	Status
<p>1. Organize an accessible technical team to promote and assist in the objective and accurate dissemination of information to foster community understanding and involvement in the Marys River Watershed.</p>	<p><input type="checkbox"/> Coordinator</p>	<p><input type="checkbox"/> Technical experts</p>	<p>2003</p>	<p>Residents who the technical team is available and contact them when applicable.</p>	<p>Done</p>
<p>2. Identify and collect brochures, handouts and white papers on watershed issues. Provide list/copies of resources at events and on web site.</p>	<p><input type="checkbox"/> Coordinator, E&amp;O volunteers <input type="checkbox"/> Web master</p>	<p><input type="checkbox"/> Web expertise and time <input type="checkbox"/> Awareness of available informations</p>	<p>Ongoing</p>	<p>Information is available on the web. There is a clearing house of applicable material.</p>	<p>In progress</p>
<p>3. Assist Council and Coordinator in fundraising. Highlight funding opportunities for various projects.</p>	<p><input type="checkbox"/> E&amp;O volunteers</p>	<p><input type="checkbox"/> Volunteer time <input type="checkbox"/> Awareness of projects and events that need funding</p>	<p>Ongoing</p>	<p>MRWC submits grant proposals at a rate that supports this action plan.</p>	<p>In progress</p>
<p>4. Develop a self-evaluation card for landowners to use to assess their property. No need for them to share results just let them determine their own needs.</p>	<p><input type="checkbox"/> E&amp;O volunteer <input type="checkbox"/> Action Planner</p>	<p><input type="checkbox"/> Evaluation methods</p>	<p>2005</p>	<p>Procedures are peer reviewed, distributed, used, and landowners provide feedback.</p>	<p>In progress: Use maintenance and restoration procedures described in Chapter 6 of this action plan</p>

## Chapter 3: Fish Passage

**Goal: Promote unobstructed movement of fish throughout the Marys River Watershed to support the life history needs of fish, including upstream spawning migrations, downstream migrations of juveniles and adults, and movements into off-channel rearing habitats during the winter.**

Movement of fish throughout a watershed is necessary for life history needs, including upstream spawning and migrations, downstream migrations of juveniles, and movements into off-channel rearing habitats during the winter. The 1999 Oregon Plan for Salmon and Watersheds states that recovery of salmonid populations depends, in part, on this adult and juvenile movement and access to entire watersheds. Furthermore, the report states that presently, throughout the state, many culverts, irrigation diversions, dams, and ineffective fish ladders limit fish passage. These impediments to fish passage are considered a significant factor in the recent decline of salmonids because they limit fish production in habitat that was once utilized and cause population fragmentation that decrease gene flow (Mirati 1999).

Culverts and road crossing structures often impede passage of fish. In 1995, for example, fish surveys in the coast range revealed that 96% of the barriers to fish passage were culverts associated with road crossings (Coastal Salmon Restoration Initiative 1997). Permanent dams and push-up dams are other barriers to fish passage. In addition, culverts that are undersized or blocked during high flows can initiate road failures and increase sedimentation. Dams may also be migration barriers during the late summer, low-flow conditions.

Juvenile and adult salmonids are also often entrained and killed from unscreened water intakes of diversion structures and can result in stranding fish in irrigated fields. Nichols et al. (1980) identified 55,000 surface water diversions statewide where surface water is removed from rivers and streams, primarily for agriculture. Unfortunately, the vast majority of these diversions are unscreened and may have significant impacts on fish populations in Oregon. Irrigation diversions amounted to 62% of these diversions.

Cutthroat trout are the only native salmonid that spawn and rear in the Marys River. They have been identified as a species of concern by ODFW because of a suspected decline that may be related to elevated water temperatures in the summer (ODFW 1993; Mamoyac et al. 1995). Stream temperature is thought to be important to their distribution. Cutthroat trout are found throughout the watershed but are probably most common in headwater tributaries during the summer. Some adults are adfluvial, migrating into the Marys River from the Willamette River during the winter and spring to spawn, and then retreating back to the Willamette River as water temperatures rise. The Marys River Watershed Assessment (Ecosystem Northwest 1999) also states that the Oregon chub (an endangered species) in Gray Creek, the sandroller, and Pacific lamprey also face threats from habitat loss and introduced warm-water species of fishes. Spring-run Chinook and upper Willamette steelhead may also enter the lower reaches of the Marys River during the winter and spring periods (Ecosystem Northwest 1999).

The Fish Passage Team has identified five objectives and multiple action items designed to help the MRWC achieve the stated goal. The objectives are listed below, with a brief summary of action items needed to achieve the objectives. A complete list of action items, responsible parties, timelines, resources needed, and measures of success are detailed in Table 2.

OBJECTIVE I: UNDERSTAND THE STATUS OF FISH PASSAGE BARRIERS THROUGHOUT THE MARYS RIVER WATERSHED AND HOW THEY AFFECT FISH MOVEMENT.

Summary of Action Items: The Benton SWCD Fish Passage and Habitat Inventory program is completing and collating culvert, stream crossing, and fish passage barrier information within the watershed including state, private, and county roads. The project leader will gather similar data from ODOT, ODF, ODF&W, and BLM as well as fish habitat and presence data. These data will be represented on a map that can be posted at council meetings. Benton Soil and Water Conservation District (SWCD) has provided the primary role in this effort with the cooperative support of Benton County GIS, Benton County Public Works Engineering, and Corvallis Public Works Engineering. All of these organizations are part of the Fish Passage Team

OBJECTIVE II: PRIORITIZE CULVERT REPLACEMENT AND FISH PASSAGE BARRIER REMOVAL PROJECTS.

Summary of Action Items: The Fish Passage Team will work with ODF&W to formalize criteria for prioritizing culvert replacement. These criteria will include fish barrier, fish distribution, and fish habitat data gathered to meet Objective I. The prioritization process will incorporate fish production capability above and below candidate replacement sites and an evaluation of sub-watersheds to focus culvert replacement efforts. Benton SWCD is presently prioritizing this GIS data base for the committee.

OBJECTIVE III: FUNDING FOR RESTORATION PROJECTS

Summary of Action Items: The committee will prepare and submit grant proposals to fund restoration projects to improve fish passage for crossings in the watershed that landowners cannot correct themselves

OBJECTIVE IV: REACH OUT TO LANDOWNERS IN THE WATERSHED TO HELP IDENTIFY FISH PASSAGE BARRIERS, TO EDUCATE THEM ON APPROACHES TO CULVERT MAINTENANCE, AND TO IDENTIFY THOSE WHO WANT TO REPLACE STREAM CROSSINGS OR REMOVE BARRIERS ON THEIR PROPERTY.

Summary of Action Items: This effort is primarily completed by the Benton SWCD with some assistance from Benton County Public Works. The fish passage committee has and will continue to develop and disseminate information about fish passage. The committee has and will continue to educate landowners on culvert maintenance and provide a method for landowners to assess their stream crossings and determine if they are providing fish passage. The committee will recruit volunteers to assist in stream crossing assessments. The committee has and will continue to identify willing landowners to participate in private lands culvert assessments. The success of this effort depends on building and maintaining partnerships with partners like Benton SWCD, City of Corvallis, state and federal agencies, and private landowners.

**OBJECTIVE V: IMPLEMENT BARRIER REMOVAL AND CULVERT REPLACEMENT AND MONITOR THE EFFECTIVENESS.**

Summary of Action Items: The fish passage committee will identify landowners who want to replace stream crossings on their property (ideally in priority locations). The committee will encourage landowners to implement crossing replacement projects. When necessary, the committee will help landowners prepare and submit grants to fund project design and replacement of high priority culverts. The committee will work with ODF&W to monitor the effectiveness of installations before and after fish barrier removal using both fish movement and physical criteria (culvert outlet jump, culvert grade, imbeddedness, etc.). The committee will also monitor status, distribution, habitat needs and threats from introduced species to native species such as sandroller, the Oregon chub, and the Pacific lamprey.

**Implementation of Fish Habitat and Passage Action Items**

The fish passage committee is currently comprised of 5 members. Members have volunteered to take the lead on individual action items. The resources, time frames, status and criteria for evaluating the success of each action item have been identified. These implementation strategies are unique to each action item and are detailed in Table 2. A summary of accomplishments and priorities is provided below.

Accomplishments: A summary of recently completed or ongoing action items for the Fish Habitat and Passage committee include:

- ❑ The committee represents a partnership with Benton County GIS and Public Works, Benton SWCD, City of Corvallis, Starker Forests, Landowners and the MRWC. These partnerships have and will continue to be critical to the success of this committee.
- ❑ Culvert Map: Benton SWCD with Benton County GIS and Public Works completed draft map-book, intended to be a living document, that shows all the known federal, state, county, city, and private culverts in Benton County with associated fish passage status. This effort, spearheaded by the Benton SWCD, is ongoing pending new data. This map has been posted at the MRWC monthly meetings. Funding has been obtained to continue this effort until December 2004.
- ❑ The committee is collating data to quantify habitat quality above and below barriers to determine where to focus barrier removal.
- ❑ Technical Assistance Grant: In 2003 grant money was applied for and awarded to fund the design of 3 culvert replacements and 1 barrier removal. These were accomplished in 2003.
- ❑ Landowner Brochure: This brochure articulates the importance of fish passage, how to evaluate crossings, and offers assistance if so desired.

Priorities: The top action item priorities for the Fish Habitat and Passage committee during the next two years include:

- ❑ Continue to identify barriers to fish passage on all ownership.
- ❑ Encourage landowners to correct the problems.
- ❑ Develop projects to complete based on priority or other selection process.
- ❑ Work with the cooperative partners to develop, prepare, and submit individually or jointly culvert replacement and barrier removal grants.
- ❑ Implement several projects per year.

- ❑ Formalize the prioritization process in collaboration with Benton SWCD, Benton County and ODF&W.
- ❑ Combine fish passage data with fish distribution and habitat data.
- ❑ Identify landowners who want to participate in a culvert evaluation on their property and recruit volunteers to implement these evaluations.
- ❑ Educate landowners to evaluate their own stream crossings.
- ❑ Monitor stream crossing replacements and barrier removals.



*Table 2. Fish passage goals, objectives, and action items.*

<b>Goal: Promote unobstructed movement of fish throughout the Marys River Watershed to support the life history needs of fish, including upstream spawning migrations, downstream migrations of juveniles and adults and movements into off-channel rearing habitats during the winter.</b>					
<b>Objective I: Understand the status of fish passage barriers throughout the Marys River Watershed and how they affect fish movement.</b>					
<b>Actions</b>	<b>Responsible Party</b>	<b>Resources Needed</b>	<b>Time Frame</b>	<b>Evaluation Criteria</b>	<b>Status</b>
1. Complete culvert surveys within the watershed, including private lands to assess culvert conditions and problems (design, flows, blockages, fill stability, etc.).	<input type="checkbox"/> Benton SWCD FP Coordinator <input type="checkbox"/> FP Committee <input type="checkbox"/> Volunteers	<input type="checkbox"/> Volunteers <input type="checkbox"/> Landowner permission <input type="checkbox"/> Vehicle and equipment	Ongoing	Total inventory based on aerial photos and known road and stream crossings	% Completed in Marys River =
2. Collate information on the location of all culverts on state and county roads within the watershed from Benton County and key this information (GIS) to the county assessment of culvert condition and priority for replacement/repair	<input type="checkbox"/> Benton SWCD FP Coordinator	<input type="checkbox"/> Cooperation with Benton County PW <input type="checkbox"/> Benton County vehicle and equipment <input type="checkbox"/> BCPW GIS	Ongoing	Map is linked with barrier information, and there is a process established to keep map current.	In progress GIS overlay complete – need to GPS locations for quality control
3. Add data provided by ODOT, ODF, ODF&W, ODA, OWRD, USFS, and BLM.	<input type="checkbox"/> Benton SWCD Fish Passage Coordinator	<input type="checkbox"/> Agency personnel	On going	Process will be established to evaluate data.	Ongoing – pending new data.
4. Prepare map that includes all the above culverts, each one keyed to specific data on status and condition if available.	<input type="checkbox"/> Benton SWCD Fish Passage Coordinator <input type="checkbox"/> Benton County GIS	<input type="checkbox"/> GIS workstation	Ongoing	Complete map and procedures to keep map current.	Ongoing – pending new data.
5. Post culvert map at council meeting and ask members to identify culverts not included on all ownerships	<input type="checkbox"/> MRWC FP committee, <input type="checkbox"/> Benton SWCD Fish Passage Coordinator	<input type="checkbox"/> MR watershed map with known barriers <input type="checkbox"/> FP assessment forms	Begin in March	Map is posted and discussed at meetings.	Begin in March 2003

Objective II: Prioritizing Fish Passage Restoration Actions:					
Actions	Responsible Party	Resources Needed	Time Frame	Evaluation Criteria	Status
1. Evaluate the potential for fish production by assessing habitat quality and quantity above and below culverts that impede or block fish passage for spawning and rearing potential.	<ul style="list-style-type: none"> <li><input type="checkbox"/> ODFW</li> <li><input type="checkbox"/> All federal, state, local and private landowners</li> <li><input type="checkbox"/> SWCD Fish Passage Coordinator</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> ODFW aquatic inventories</li> <li><input type="checkbox"/> BCFP habitat surveys</li> <li><input type="checkbox"/> ODF fish presence surveys (contact Russ Anderson or Rick Ground, Philomath office)</li> </ul>	Ongoing	High quality habitat, stream crossing, and barrier data are combined	In progress
2. Identify sub watersheds that need to be prioritized for fish passage barrier replacement or retrofit.	<ul style="list-style-type: none"> <li><input type="checkbox"/> SWCD Fish Passage Coordinator</li> <li><input type="checkbox"/> FP committee</li> <li><input type="checkbox"/> Benton Co. PW</li> <li><input type="checkbox"/> ODFW</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> ODFW Fish Passage Prioritization Plan</li> <li><input type="checkbox"/> BCFP Prioritization plan</li> </ul>	Ongoing	Agreed upon and implemented prioritization process that provides the greatest ecological returns	In progress
3. Work with ODFW to formulate criteria for prioritizing culvert repair for county and state roads.	<ul style="list-style-type: none"> <li><input type="checkbox"/> SWCD Fish Passage Coordinator</li> <li><input type="checkbox"/> MRWC FP team</li> <li><input type="checkbox"/> ODFW</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Fish habitat in the Mary River expertise: Time from ODF&amp;W</li> <li><input type="checkbox"/> Time from SWCD coordinator</li> </ul>	2004-update annually	ODF&W understands, accepts and supports the prioritization process.	None
Objective III: Funding for Restoration Actions					
Actions	Responsible Party	Resources Needed	Time Frame	Evaluation Criteria	Status
1. Prepare and submit proposal to obtain funding. May be submitted prior to completing assessment.	<ul style="list-style-type: none"> <li><input type="checkbox"/> Benton SWCD</li> <li><input type="checkbox"/> MRWC FP committee</li> <li><input type="checkbox"/> Benton County, City, Federal and</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Engineering</li> <li><input type="checkbox"/> Fish passage technical expertise</li> </ul>	Ongoing	2-5 proposals are submitted each year.	Ongoing

	State partners.				
<b>Objective IV: Outreach to landowners in the watershed to help identify fish barriers and to educate on approaches to culvert maintenance and identify landowners who want to replace stream crossings on their property.</b>					
<b>Actions</b>	<b>Responsible Party</b>	<b>Resources Needed</b>	<b>Time Frame</b>	<b>Evaluation Criteria</b>	<b>Status</b>
1. Prepare a brochure to disseminate to landowners on the importance of culverts for fish passage, informing them of the procedures for assessment of culvert conditions or repair on their land, and asking them if they would like the council to assist in repair or replacement.	<input type="checkbox"/> Fish Passage Committee work with member of E&O committee.	<input type="checkbox"/> Evaluation forms	2003	Brochure is easy to understand and has utility for landowners.	1 <sup>st</sup> brochure completed 2/03
2. Identify willing landowners to participate in private lands barrier assessment	<input type="checkbox"/> MRWC, <input type="checkbox"/> SWCD and BC PW Fish Passage Coordinator	<input type="checkbox"/> Outreach effort	Ongoing	Established and periodically implemented process	Currently working with private landowners.
3. Recruit volunteers to assist in culvert assessments in coordination with Benton SWCD Fish Passage Coordinator.	MRWC, BSWCD	<input type="checkbox"/> Evaluation forms <input type="checkbox"/> Training for volunteers	Ongoing update yearly	5-10 volunteers are assisting in field evaluations	In progress. Training for the 4 volunteers that signed up was in July
4. Educate landowners about how to properly maintain culverts and identify fish passage barriers on their property.	<input type="checkbox"/> Committee volunteers	<input type="checkbox"/> Landowners <input type="checkbox"/> Trained field volunteers.	Ongoing	Every 2-3 years more sites are evaluated.	A brochure has been developed
5. Continue to work with and build on existing partnerships with local agencies (SWCD, City of Corvallis, Benton County, etc.) and community groups. These relationships provide technical expertise and opportunities to connect with private landowners.	<input type="checkbox"/> Fish Passage (FH&FP) volunteers <input type="checkbox"/> Benton SWCD Fish Passage Coordinator <input type="checkbox"/> MRWC <input type="checkbox"/> Benton County Public Works	<input type="checkbox"/> Participation from a variety of partners	Ongoing	A variety of partners are participating in implementing and revising the action plan.	Currently Benton County, SWCD, Private Landowners, and the City of Corvallis are on the committee. A number of action items are being implemented with huge contributions from Benton County and a technical assistance grant from OWEB.

Objective V: Implement fish barrier and culvert replacement removal projects and monitor the effectiveness.					
Actions	Responsible Party	Resources Needed	Time Frame	Evaluation Criteria	Status
1. Encourage landowners to implement crossing replacement projects. When necessary, the committee will help landowners prepare and submit grants to fund project design and replacement of high priority culverts.	<ul style="list-style-type: none"> <li><input type="checkbox"/> Partnership with Benton County works, SWCD, private landowners</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Engineering</li> <li><input type="checkbox"/> Fish passage technical expertise</li> </ul>	Ongoing	2-5 projects each year.	Ongoing
2. Cooperative effort with ODFW on fish surveys of stream reaches upstream and downstream and before and after culvert replacement to evaluate the effectiveness replacement/repair.	<ul style="list-style-type: none"> <li><input type="checkbox"/> FP Team volunteers</li> <li><input type="checkbox"/> Fish Passage Program Coordinator</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Fisheries and Fish Habitat expertise</li> <li><input type="checkbox"/> Knowledge of fish barrier locations</li> </ul>	2010	<ul style="list-style-type: none"> <li><input type="checkbox"/> Projects are being evaluated and results are informing future projects</li> <li><input type="checkbox"/> Quality assurance and control measures assure reliable data.</li> </ul>	None
3. As funding becomes available, monitor culvert replacements before and after installation using physical criteria (culvert grade, outlet jump, embeddedness, etc.) to determine likelihood to pass juvenile fish. Criteria for likelihood to pass fish will be the ODF&W state standards	<ul style="list-style-type: none"> <li><input type="checkbox"/> Volunteers</li> <li><input type="checkbox"/> SWCD Fish Passage Program Coordinator</li> <li><input type="checkbox"/> Benton County Public Works</li> <li><input type="checkbox"/> Landowners submit data toOWEB</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Fish passage expertise</li> <li><input type="checkbox"/> Technically trained volunteers</li> <li><input type="checkbox"/> Equipment</li> <li><input type="checkbox"/> Volunteers</li> </ul>	Linked with barrier removal projects	<ul style="list-style-type: none"> <li><input type="checkbox"/> Projects are being evaluated and results are informing future projects</li> <li><input type="checkbox"/> Quality assurance and control measures assure reliable data.</li> </ul>	Benton County public works does this on a project by project basis in their plans
4. As funding becomes available, perform surveys with ODFW on the status, distribution, habitat needs and threats from introduced species on sandroller, the Oregon chub, cutthroat, steelhead, chinook, and the Pacific lamprey.	<ul style="list-style-type: none"> <li><input type="checkbox"/> Volunteers</li> <li><input type="checkbox"/> Fish Passage Program Coordinator</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Fisheries expertise</li> <li><input type="checkbox"/> Grant money/funding</li> <li><input type="checkbox"/> Trained volunteers</li> </ul>	2010	<ul style="list-style-type: none"> <li><input type="checkbox"/> Quality assurance and control measures assure reliable data.</li> </ul>	None

## Chapter 4: Water Quality

*Goal: To provide the residents of the Marys River Watershed with information about water quality throughout the Marys River Watershed and use this information to identify areas where water quality might be improved.*

The DEQ considers the Marys River to have impaired water quality in terms of flow, temperature, dissolved oxygen, and bacteria. This conclusion is based on data collected at the Highway 99 bridge, near the mouth of the Marys River just upstream from its confluence with the Willamette River and at river mile 13 on the Marys River. The committee recognizes the relationship of water quantity to water quality. Namely, that low flow conditions exacerbate problems of water quality, beneficial uses and fish habitat and passage. However, currently the committee concentrates on other water quality parameters that can be readily quantified. The council identified a need to investigate the water quality conditions with a more holistic approach by monitoring a host of water quality parameters throughout the watershed. To meet this need the Water Quality Committee coordinated a study with E&S consultants (2003) to evaluate the water quality of the Marys River Watershed. The study found that the overall water quality of the Marys River is fair to good and identified areas within the watershed that warrant further study or represent opportunities for restoration activities. What follows is a summary of the key findings from this project (E&S Consultants 2002).

The 2002 water quality study found that, in fact, summer stream temperatures in the middle and lower reaches of the Marys are clearly not within the preferred range for trout or salmon. Research and monitoring has demonstrated that temperatures tend to warm in a downstream direction. Therefore, the temperature issues identified in these middle and lower reaches of the Marys were attributed to the position of these reaches low in the basin. Temperatures in the upper reaches appear cool enough to support the life cycle needs of salmon and trout. Bacteria monitoring results suggest that the Marys River as whole is not seriously impaired for *E.coli*, but that portions of the basin (Oak Creek, West Fork of the Marys) are at risk for contamination. In contrast, the fecal coliform results suggest widespread issues throughout the basin (Oak, Beaver, Greasy, Woods, Upper and Lower Muddy Creek).

Nutrient concentrations were generally low (good) with the possible exception of Muddy Creek where phosphorus and nitrogen may be reaching the stream due to land management practices. However, the report recognized that coastal draining tributaries to the Willamette are known to naturally have high background levels of phosphorus so further investigation is warranted. Dissolved oxygen results suggest moderate impairment when analyzed based on the DEQ water quality standard with notable issues in Lower Muddy Creek. Chronic turbidity does not seem to be a problem, however episodic problems may exist as a result of heavy winter rainfall and runoff.

### *Summary*

Three sites Upper Muddy, Lower Muddy and Oak Creek appear to have poor water quality as indicated by nutrient content (phosphorus and nitrogen) and bacterial contamination.

- Upper and Lower Muddy Creek: There is evidence of nutrient input from agricultural activities and possible bacterial (fecal coliform) contamination.

- ❑ Lower Muddy creek also has low dissolved oxygen content.
- ❑ Oak Creek: *E. coli* content is in excess of the DEQ water quality standards.
- ❑ Problems with fecal coliform were present throughout the Marys River Watershed.

The Water Quality Committee has established two objectives and multiple action items designed to meet the stated goal. The objectives are listed below, with a brief summary of action items needed to achieve the objectives. A complete list of action items, responsible parties, timelines, resources needed, and measures of success are detailed in Table 3.

**OBJECTIVE I: OBTAIN BASELINE DATA ABOUT SUBWATERSHEDS OF THE MARYS RIVER AND INCORPORATE INTO FUTURE MONITORING AND RESTORATION PLANNING**

Summary of Action Items: The committee coordinated the Phase I Water Quality Monitoring Project to monitor several water quality parameters throughout the watershed. The council is combining these data with landuse data and land cover data to begin examining priorities for further monitoring and restoration projects. The council will coordinate further monitoring projects (bacteria, pesticides, nutrients) to evaluate causes of identified water quality problems. The council will link future monitoring with riparian and wetland monitoring and promote the use of project findings in restoration planning.

**OBJECTIVE II: DEVELOP A FRAMEWORK TO EVALUATE AND DISSEMINATE INFORMATION IN A TIMELY MANNER**

Summary of Action Items: The committee developed a quality assurance project plan (QAPP) to ensure high quality monitoring data. The committee will continue to disseminate information learned about the Mary River Water quality to the public and public officials.

**Implementation of Water Quality Action Items**

The water quality committee is currently comprised of 2 members. Members have volunteered to take the lead on individual action items. The resources, time frames, status and criteria for evaluating the success of each action item have been identified. These implementation strategies are unique to each action item and are detailed in Table 3. A summary of accomplishments and priorities is provided below.

Accomplishments: A summary of recently completed or ongoing action items for the Water Quality committee include:

- ❑ The committee completed a QAPP that was accepted by DEQ and EPA and establishes data standards and reporting formats.
- ❑ The committee coordinated the completion of a water quality monitoring report that evaluated stream temperature and other water chemistry parameters (E&S Consultants, 2002), a turbidity study (Glassman 2000), and a temperature study (Pearcy et al.1998).
- ❑ The committee is sharing information with the public. The water quality report is on the MRWC web site and these findings were presented at a MRWC monthly meeting.

Priorities: The top action item priorities for the Water Quality committee during the next two years include:

- ❑ Complete the combination of land use/land cover data with water quality data.

- ❑ Complete the bacteria-monitoring project.
- ❑ Incorporate the use of water quality monitoring results into maintenance and restoration planning for on-the-ground projects.
- ❑ Work with the city of Philomath and other interested parties to evaluate water quantity (flow) during summer low flow conditions.

Table 3. Water quality committee goals, objectives and action items.

<b>Goal: To provide the MRWC with information about water quality throughout the Marys River Watershed and use this information to identify areas where water quality might be improved.</b>					
<b>Objective I: Obtain baseline data about subwatersheds of the Marys River and incorporate into future monitoring and restoration planning.</b>					
<b>Actions</b>	<b>Responsible Party</b>	<b>Resources Needed</b>	<b>Time Frame</b>	<b>Evaluation Criteria</b>	<b>Status</b>
1. Purchase pH, temperature, DO monitoring equipment.	<input type="checkbox"/> A Shoener	<input type="checkbox"/> Renewable components	1997	NA	Done
2. Monitor Water Temperature. Establish baseline water quality data fro sub- basins and mainstem river.	<input type="checkbox"/> B. Percy, C. Andrus, J Dambacher	<input type="checkbox"/> Temperature recorders	1998	Quality Assurance Project Plan (QAPP) standard data and report	Done
3. Monitor turbidity	<input type="checkbox"/> Glassman	<input type="checkbox"/> Consultant, grant	2000	Final report, high quality data	Done
4. Monitor Basic Water Chemistry.	<input type="checkbox"/> E&S Consultants	<input type="checkbox"/> Grant money	2003	QAPP standard data and report	Done
5. Combine water quality data with landuse and land cover data.	<input type="checkbox"/> Water Quality (WQ) volunteer	<input type="checkbox"/> GIS expertise	2003	Accurate representation of land-use and cover	In progress
6. Monitor bacterial counts.	<input type="checkbox"/> M Panfil & OSU	<input type="checkbox"/> Grant money	ongoing	QAPP standard data and report	In progress
7. Investigate possible causes of poor water quality.	<input type="checkbox"/> WQ volunteer	<input type="checkbox"/> Grant money <input type="checkbox"/> Water quality expertise <input type="checkbox"/> Monitoring expertise	2010	QAPP standard data and report	Not started
8. Monitor legacy pesticides and nutrients.	<input type="checkbox"/> WQ volunteer	<input type="checkbox"/> Grant money <input type="checkbox"/> Water quality expertise <input type="checkbox"/> Monitoring expertise	2010	QAPP standard data and report	Not started



9. Link water quality monitoring with riparian and wetland monitoring.	<input type="checkbox"/> WQ volunteer	<input type="checkbox"/> Riparian and wetland data, GIS expertise	2010	Project Report	Not Started
10. Water quantity (flow) evaluation	<input type="checkbox"/> Volunteers <input type="checkbox"/> City of Philomath	<input type="checkbox"/> Training, flow meter <input type="checkbox"/> Communicate with City	2005	<a href="#">QAPP standard data and report</a>	Not Started
11. Promote the use monitoring data to help prioritize restoration projects.	<input type="checkbox"/> WQ Volunteer	<input type="checkbox"/> Develop a system that utilizes monitoring data in identifying restoration project opportunities.	2005	When possible, restoration projects are implemented in areas known to have low waters quality.	Not Started
<b>Objective II: Develop and implement a framework to evaluate and disseminate information in a timely manner.</b>					
<b>Actions</b>	<b>Responsible Party</b>	<b>Resources Needed</b>	<b>Time Frame</b>	<b>Evaluation Criteria</b>	<b>Status</b>
1. Develop a Quality Assurance Project Plan (QAPP) to ensure high quality monitoring data.	<input type="checkbox"/> A.Schoener	<input type="checkbox"/> Monitoring expertise	2000	EPA/DEQ approval	Done
2. Facilitate flow of information to the public and public officials	<input type="checkbox"/> WQ volunteer <input type="checkbox"/> E&O Committee support	<input type="checkbox"/> Web expertise, access to media and community functions <input type="checkbox"/> Information	Ongoing	Reports and information are available on the web and through other methods identified by the education and outreach committee.	Ongoing

## Chapter 5: Land, Air and Water Use

**Goal: Provide timely information to watershed residents and elected officials regarding the status and pending changes in land, air and water uses so that watershed residents can make informed decisions about proposed land, air, and water use changes.**

Land and water use, as well as pollutant release into air and water, have the potential to negatively impact the Marys River Watershed. Studies conducted in the Marys River Watershed indicate that land use practices may be having negative effects on water quality and quantity in parts of the watershed (Ecosystem Northwest 1999; Glassman 2000; and E&S Consultants 2002). The rapid rate of human settlement in the Marys River Watershed resulted in alterations or loss of aquatic and terrestrial habitat. Results of habitat loss could include loss or reduced abundance of species from the watershed. Soil erosion may be an issue in some portions of the watershed, partly as a result of poor soil management, use of the riparian area by livestock, loss of riparian forests, roads, and so forth.

Agricultural acreage has remained steady over time while timber harvest levels have fluctuated widely. There is increased demand for rural residential housing and increased rate of commuting out of the watershed (Ecosystem Northwest 1999). Although the Marys River flows through two areas that are becoming increasingly urbanized (Philomath and Corvallis), there are relatively few structures within the near stream or meander belt areas. Therefore, an opportunity still exists to minimize development and improve current land use practices within these zones (Ellis-Sugai 1998).

The Land, Air, and Water Use (LAWU) committee has established four objectives and multiple action items designed to meet the stated goal. The objectives are listed below, with a brief summary of action items needed to achieve the objectives. A complete list of action items, responsible parties, timelines, resources needed, and measures of success are detailed in Table 4.

### OBJECTIVE I: IDENTIFY CURRENT LAND, AIR AND WATER USES

#### Summary of Action Items:

The LAWU committee has developed a map of one sub-basin with overlays of zoning, water use, streams, and roads. The committee may create similar maps for other sub-basins in the watershed if/as needed after receiving reviews from the MRWC on the initial maps. The committee will also create overlays showing vegetation as depicted on aerial photographs as available.

### OBJECTIVE II: IDENTIFY PROPOSED CHANGES IN LAND, AIR, AND WATER USES

#### Summary of Action Items

The committee is researching land, air, and water use planning processes for Philomath, Corvallis, and Benton County. The committee will develop and implement a framework to identify proposed changes in land, air and water use and disseminate information on proposed changes to council members, watershed residents, and users (see Objective IV).

OBJECTIVE III: IDENTIFY SPATIALLY EXPLICIT INFORMATION ABOUT CURRENT AND HISTORIC ENVIRONMENTAL CHARACTERISTICS OF THE WATERSHED THAT AFFECT LAND AND WATERS USE.

Summary of Action Items

The committee will review the watershed assessment, combined with water quality reports, and landuse data. They will identify gaps in knowledge and ways to fill the gaps.

OBJECTIVE IV: FACILITATE THE FLOW OF INFORMATION BETWEEN WATERSHED RESIDENTS AND PLANNING AGENCIES, AND HELP PROVIDE RESOURCE INFORMATION TO WATERSHED RESIDENTS

Summary of Action Items

The committee will work with the E&O committee to provide general information about land and water uses. The committee has been monitoring public notices in the local newspaper (Gazette Times) and notifying the MRWC at monthly meetings of relevant information. The committee is coordinating with the E&O committee to establish public access to computers with GIS data from the Marys River Watershed.

**Implementation of Land, Air and Water Use Action Items**

The LA&W committee is currently comprised of 2-3 members. Specific members volunteer to take the lead on individual action items. The resources, time frames, status and criteria for evaluating the success of each action item have been identified. These implementation strategies are unique to each action item and are detailed in Table 4. A summary of accomplishments and priorities is provided below.

Accomplishments: A summary of recently completed or ongoing action items for the LA&W Use committee include:

- ❑ The committee developed land ownership and zoning maps showing sub-basin boundaries, surface water points of diversion, roads and streams for a sample sub-basin.
- ❑ The committee monitors public notices from the Gazette Times newspaper and notifies the council of significant findings at monthly meetings.
- ❑ The committee is coordinating with the E&O committee to establish public access terminals at Philomath and Corvallis libraries with available GIS data about the Marys River Watershed.

Priorities: The top action item priorities for LA&W Use committee during the next two years include:

- ❑ Disseminate information on proposed changes in land, air, and water uses to council members in a timely fashion.
- ❑ Complete the public access terminals making Marys River GIS data available.
- ❑ Complete sub-basin maps of land and water use with an overlay of digital aerial photographs (orthoquads).
- ❑ Organize the sub-basin maps for access by watershed residents and users.
- ❑ Complete research and documentation of land, air and water use planning processes for Corvallis, Oregon, Philomath and Benton County.

Table 4. Land, air and water use committee goal, objectives, and action items.

<b>Goal: Provide timely information to watershed residents regarding the status and pending changes in land, air and water uses so that watershed residents can make informed decisions about proposed land and water use changes.</b>					
<b>Objective I: Identify current land, air and water uses</b>					
Actions	Responsible Party	Resources Needed	Time Frame	Evaluation Criteria	Status
1. Develop a list of information needs and sources, obtain the information, and update as needed.	<input type="checkbox"/> All	<input type="checkbox"/> Time, <input type="checkbox"/> GIS skills.	Ongoing	Acquisition and maintenance of information on land, air and water uses.	-Ongoing. Developing land ownership, zoning, and water use maps as described below.
2. Develop and document an initial land use map for a pilot sub basin with various overlays: sub-basin boundaries, zoning, surface water points of diversion, roads and streams.	<input type="checkbox"/> Kim: 11/02 to 04/03 (GIS) <input type="checkbox"/> Ken 4/03-present (GIS) <input type="checkbox"/> MRWC GIS interns: <input type="checkbox"/> All (documentation)	<input type="checkbox"/> Time, <input type="checkbox"/> GIS Skills <input type="checkbox"/> Relevant rectified coverages	2004	Feedback from Council, accurate and available data and maps.	Draft maps introduced to Council 5/03.
3. Develop layer with available digitized aerial photos for the sub-basin maps.	<input type="checkbox"/> 3 <input type="checkbox"/> Ken <input type="checkbox"/> MRWC GIS interns:	<input type="checkbox"/> Time, <input type="checkbox"/> GIS Skills, <input type="checkbox"/> Assistance from county planning staff (and others) to ID and acquire most recent aerial coverages <input type="checkbox"/> If coverage not already in orthophoto format, access to facilities to scan and rectify the image	2004	Feedback from Council, accurate and available data and maps (match between image and known watershed features)	Not begun

4. Develop land-use zoning maps for other sub-basins in the watershed as requested after feedback from initial map.	<input type="checkbox"/> Ken <input type="checkbox"/> MRWC GIS interns:	<input type="checkbox"/> Council feedback on first sub-basin map.	Ongoing	Feedback from Council, accurate and available data and maps (match between image and known watershed features)	Pending
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**Objective II: Identify proposed changes in land, air and water uses**

Actions	Responsible Party	Resources Needed	Time Frame	Evaluation Criteria	Status
1. Research and document Benton land, air, and water use planning processes.	<input type="checkbox"/> Land: Curt and Mary <input type="checkbox"/> Air: Jesse <input type="checkbox"/> Water: Curt	<input type="checkbox"/> Volunteer time	2005	Process is accurately documented and updated and available on the MRWC web site.	Pending
2. Research and document Philmoath land, air, and water use planning processes.	<input type="checkbox"/> Land: LA&WU volunteer <input type="checkbox"/> Air: Jesse <input type="checkbox"/> Water: LA&WU volunteer	<input type="checkbox"/> Volunteer time	2005	Process is accurately documented and available on the MRWC web site.	Pending
3. Research and document Corvallis land, air, and water use planning processes.	<input type="checkbox"/> Land: LA&WU volunteer <input type="checkbox"/> Air: LA&WU volunteer <input type="checkbox"/> Water: LA&WU volunteer	<input type="checkbox"/> Volunteer time	2005	Process is accurately documented and available on the MRWC web site.	None
4. Develop and implement a framework to evaluate land air, and water use information and disseminate it in a timely manner	<input type="checkbox"/> All	<input type="checkbox"/> Volunteer time	2005	Timely dissemination of land, air and water use information	In progress

**Objective III: Identify spatially explicit information about current and historic environmental characteristics of the watershed that affect land and water use (and are affected by land and water use?).**

Actions	Responsible Party	Resources Needed	Time Frame	Evaluation Criteria	Status
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1. Review draft watershed assessment and identify gaps	<input type="checkbox"/> All	<input type="checkbox"/> Time <input type="checkbox"/> Criteria for defining gaps	2005	Gaps are identified and agreed upon by council	In progress
2. Identify ways to fill gaps.	<input type="checkbox"/> All	<input type="checkbox"/> Time <input type="checkbox"/> Funding, <input type="checkbox"/> Coordination with other committees	2010	Data gaps are filled	In progress
<b>Objective IV: Facilitate the flow of information between watershed residents and planning agencies, and help provide resource information to watershed residents</b>					
<b>Actions</b>	<b>Responsible Party</b>	<b>Resources Needed</b>	<b>Time Frame</b>	<b>Evaluation Criteria</b>	<b>Status</b>
1. Work with MRWC E&O committee to provide general information about land, air, and water use.	All	<input type="checkbox"/> Time, <input type="checkbox"/> Communication tools and media avenues	2007 and ongoing	Accurate dissemination of information to broad audiences	None
2. Monitor public notices from the G-T and other sources for relevant land, air, and water issues, notifying the Council at monthly meetings as appropriate.	Jesse	<input type="checkbox"/> G-T subscription, <input type="checkbox"/> time, <input type="checkbox"/> good format to share information, <input type="checkbox"/> criteria for information council wants to hear	Ongoing	Information is shared and is valuable to committee	Begun; process being fine-tuned
3. Work with webmaster to establish links to relevant websites.	Curt	<input type="checkbox"/> Time	Ongoing	Relevant links are established on the MRWC web site	Established and ongoing

## Chapter 6: Maintenance and Restoration Planning

**Goal:** Identify, prioritize, and implement activities in the Marys River Watershed that will maintain or improve watershed condition and meet stated restoration goals. This process is iterative and will be revised over time as more is learned about watershed conditions.

### Background

The MRWC defines maintenance and restoration in the following way:

*Restoration is the process of initiating changes in ecological conditions that will maintain and enhance the health of the watershed.*

Typically, the places where restoration projects occur are determined by where landowners want to evaluate conditions and do a project on their land. This is practical and appropriate in that evaluations and projects can only take place when and where a landowner desires such activities. However, the MRWC recognizes the value of identifying areas where maintenance or restoration projects are likely to provide the “greatest ecological return”. Therefore, MRWC partnered with the Environmental Protection Agency (EPA) to create a tool that might help direct restoration efforts to those areas. The goal of this effort is to identify, prioritize, and implement activities in the Marys River Watershed that will maintain or improve watershed condition. This iterative process is expected to be improved over time as more is learned about watershed conditions. The first steps in creating this tool were (1) to define maintenance and restoration goals and then (2) establish how the council defined “greatest ecological return”.

### Maintenance and Restoration Goals

The goal of maintenance and restoration is to maintain and improve watershed condition as characterized by the Marys River water quality and water quantity, aquatic habitat and terrestrial habitat. The broad objectives are to improve water quality; increase summer low flows; and improve aquatic and terrestrial habitat and processes related to watershed condition. The maintenance goals are to provide incentives for landowners to protect areas of the watershed that are already in good condition. This approach emphasizes the importance of high-quality land and streams and the council's goal to support landowners who are managing these areas to maintain that quality.

### Greatest Ecological Return

The MRWC defined “greatest ecological return” it in the following way:

1. A focus on streams and wetlands with high habitat potential will yield greater ecological benefits for maintenance and restoration.
2. Preventing habitat and water quality degradation is more efficient than recovering degraded streams. High quality habitat should be maintained.

3. Moderately degraded stream reaches can usually be restored more cost effectively than highly degraded streams.
4. Contiguous areas of high quality habitat provide greater ecological benefits than isolated units.
5. Improvements that take advantage of natural processes and functions are often more sustainable.

The MRWC identified three objectives and multiple action items designed to identify, prioritize, and implement maintenance and restoration activities in the Marys River Watershed. The objectives are listed below, followed by a brief summary of action items planned to achieve the objectives. A complete list of action items, responsible parties, timelines, resources needed, and measures of success are detailed in Table 5.

OBJECTIVE I: CREATE AN ECOLOGICALLY BASED MAINTENANCE AND RESTORATION OPPORTUNITIES SCREENING MAP.

Summary of Action Items: The purpose of this objective is to identify maintenance and restoration opportunities in the watershed. The MRWC and EPA developed an *iterative* process for creating a Restoration Opportunities Screening Map. First, EPA and the MRWC partnered to develop a conceptual model depicting how maintenance and restoration projects will achieve goals and desired ecosystem functions, and the data that could be used as indicators of those functions. Then EPA and MRWC identified and digitally captured those data for the Marys River Watershed and defined the logic for identifying maintenance and restoration opportunities based on those data. These action items were used in the creation of the *first iteration* of the "Restoration Opportunities Screening Map" (Appendix B, Map 18). The *first iteration* of this map *focused on maintenance and restoration of fish habitat, riparian and wetland conditions*, recognizing that *future iterations* can include broader ecological watershed maintenance and restoration opportunities and be improved with new data. The council recognizes that the utility of the restoration opportunities screening map may be limited by the use of coarse scale data. The council will propose a project to test the applicability and accuracy of the data at smaller scales used for maintenance and restoration planning.

OBJECTIVE II: VALIDATE THE RESTORATION OPPORTUNITIES SCREENING MAP IN THE FIELD.

Summary of Action Items: The purpose of this objective is to evaluate the restoration opportunities screening map in the field. The MRWC developed peer-reviewed field procedures (Dent 2003A) that can be used by landowners and the council to evaluate maintenance and restoration potential in the field. In partnership with University of Oregon and council volunteers, the MRWC evaluated the restoration opportunities screening map *in the field* using the field procedures (Dent 2003B). Future iterations of the restoration opportunities screening map will consider results from this fieldwork. The MRWC will also employ other maintenance and restoration prioritization decision tools and compare results.



OBJECTIVE III: IMPLEMENT AND MONITOR TRENDS AND EFFECTIVENESS OF MAINTENANCE AND RESTORATION PROJECTS IN THE FIELD.

Summary of Action Items: The purpose of this objective is to implement and monitor maintenance and restoration projects in the field in collaboration with the LAWU, E&O, Water Quality and Fish Passage committees. These committees are in pursuit or have obtained information that is critical to the maintenance and restoration planning process. For example, Benton SWCD collected data on known blockages to fish passage throughout Benton County. The MRWC was awarded grants to provide technical assistance to landowners to develop proposals and implement maintenance and restoration projects. Once projects are implemented, the MRWC will monitor trends and effectiveness associated with the projects.

### **Implementation of Maintenance and Restoration Planning**

The MRWC partnered with the EPA and funded an action planning position to implement this portion of the action plan. EPA staff, the council coordinator and the action planner are taking the lead on individual action items. However, there are many opportunities to coordinate with members of other committees to accomplish the maintenance and restoration goals. The resources, time frames, status and criteria for evaluating the success of each action item have been identified. These implementation strategies are unique to each action item and are detailed in Table 5. A summary of accomplishments and priorities is provided below.

Accomplishments: A summary of recently completed or ongoing action items for maintenance and restoration planning include:

- ❑ Restoration Opportunities Screening Map: The *first iteration* was completed in May of 2003 and is shown in Appendix B (Map 18) along with a description of the data and logic used to create the map.
- ❑ Field procedures: These have been peer-reviewed, field tested, and are ready to use in the field (Dent 2003A). The test of their effectiveness will be if they adequately capture observations in the field and can be used by private landowners.
- ❑ Technical Assistance Grant: Received funds and assisted landowners in developing proposals for restoration projects.
- ❑ In partnership with landowners, private consultants, Benton SWCD District, and Benton County Public Works, implemented 2 riparian restoration projects, three culvert replacement projects, and a rock dam removal
- ❑ A pilot study was implemented to field verify the Restoration Opportunities Screening Map, to compare the map representation with what is on the ground. A final report is available (Dent 2003B). These findings will be incorporated into the next iteration and use of the restoration opportunities screening map.

Priorities: The top action item priorities for maintenance and restoration planning during the next two years include:

- ❑ Design maintenance and restoration projects proposals based on field evaluations of the restoration opportunities screening map.
- ❑ Implement and monitor maintenance and restoration projects in collaboration with the LAWU, Water Quality, Education and Outreach, and Fish Passage committees.

**Summary**

The MRWC has embarked on a systematic process by which to prioritize and evaluate maintenance and restoration activities within the watershed. This process is part of an overall action plan for the council. This is expected to be an iterative process by which the outcomes will inform both the mapping process as well as the action planning process. Ultimately the desired outcome is to provide an adjustable template by which to plan activities such that the combined effects of these activities serve to maintain and improve the overall ecological condition of the watershed. Clearly, this effort can be expanded beyond the stream network to include upland maintenance and restoration projects

This maintenance and restoration prioritization process is just one piece of the overall action plan in which the council endeavors to reach out to watershed residents and users and build a watershed-minded community of landowners and citizens.

Table 5. Maintenance and restoration planning goals, objectives, and actions.

<b>Goal: Ecologically identify and prioritize maintenance and restoration activities in the Marys River Watershed and implement projects.</b>					
<b>Objective I: Identify maintenance and restoration priorities in the Marys River Watershed.</b>					
Actions	Responsible Party	Resources Needed	Time Frame	Evaluation Criteria	Status
1. Establish maintenance and restoration goals.	MRWC	Stakeholder input, scientific data and monitoring	These will be re-evaluated through time.	Common understanding, acceptance and support on the part of stakeholders, responsive to new information or shifting values.	First set of goals completed in 2002.
2. Establish a process that links the maintenance and restoration planning with the work of the other committees.	MRWC	Volunteer time	Ongoing	Findings and priorities from the maintenance and restoration planning process are communicated and influence to other committees and visa versa.	Started. Needs more work. May need to establish a M&R committee.
3. Develop conceptual model to illustrate how maintenance and restoration goals will be achieved with given restoration activities and how existing data can be used to inform the council on where those activities would be beneficial.	EPA, Council Coordinator, and Action Planner	EPA Grant for Action Planner, EPA staff time	Dec-02	Incorporates and relates: goals, functions, maintenance and restoration actions, and indices.	Done
4. Develop the logic that will be used to map or model maintenance and restoration priorities.	EPA, Council Coordinator, and Action Planner	Technical expertise from EPA, Bolte model ( <i>Maintain and restore</i> )	May-03	(1) Ease of use, ability to adapt logic and rules. (2) Ability to account for upstream and/or watershed conditions.	First iteration done, possibility for grad students to further analyze or use the <i>Maintain and restore</i> Model. (May-03)
5. Create first iteration of restoration priorities map.	EPA, Council Coordinator, Action Planner	Watershed scale data, GIS and modeling expertise.	Jun-03	Ease of use, ability to adapt logic and rules. A sound tool that provides a relative measure of restoration potential between sites.	Done

6. Evaluate the accuracy of the data used in the mapping process.	To be determined	Grant money and technical expertise to implement statistically reliable study.	Complete by 2005	An accurate measure of how well the data represent watershed condition.	Not started
<b>Objective II: Evaluate the mapped restoration opportunities in the field.</b>					
Actions	Responsible Party	Resources Needed	Time Frame	Evaluation Criteria	Status
1. Develop field procedures that can be used by landowners and volunteers to evaluate the restoration potential of their site.	Action Planner (Liz Dent)	Existing and applicable methods, review committee	Jun-03	Repeatable and consistent, can be used by a wide range of users.	Done
2. Form a technical review committee to provide peer review of the procedures.	Action Planner	Expertise in: Riparian, wetland, fish habitat and life cycles, water quality, field method development, working with volunteers and existing methods.	Jun-03	Solicit input that improves the technical soundness of the procedures.	Done
3. Test the procedures in the field.	Action Planner	Volunteers, landowners willing to have MRWC on their property	Sep-03	Visit 10-15 number of sites.	Done
<b>Objective III: Implement and monitor maintenance and restoration Projects.</b>					
Actions	Responsible Party	Resources Needed	Time Frame	Evaluation Criteria	Status
1. Collaborate with the Water Quality LAWU, Fish Passage and E&O Committees to implement restoration projects.	Landowners, committee volunteers	Landowner understanding and support, funding	On going	Information from various committees is used in determining where projects will take place. On-the-ground project	Started
2. Identify landowners who are interested in implementing maintenance and restoration projects on their property.	Action Planner and Council Coordinator	Build relationships and partnerships with landowners and local agencies.	Sep-03	Increasing number of interested landowners.	In progress (Aug-Sept 2003).

<p>3. Seek funding to provide technical assistance for the development of maintenance and restoration project proposals.</p>	<p>Council Coordinator, Action Planner, Benton County, and SWCD</p>	<p>Technical assistance grant.</p>	<p>Sep-03</p>	<p>Develop 5 grant proposals to submit to OWEB and other sources for funding.</p>	<p>Done: Grant was awarded, worked with Benton SWCD, Benton County, and <i>Habitats</i> to visit sites, develop restoration plans, and grant proposals.</p>
<p>4. Implement maintenance and restoration projects.</p>	<p>To be determined (Landowners, Council coordinator?)</p>	<p>Funding, willing landowners, Benton SWCD, Benton County Public Works</p>	<p>Sep-04</p>	<p>Implementation of 2-5 projects/year;</p>	<p>Implemented two riparian projects; designed 3 culvert removals and one rock dam removal; designed Marys River Park Enhancement Project.</p>
<p>5. Monitor trends and effectiveness associated with maintenance and restoration projects.</p>	<p>ODF&amp;W, Landowners, Volunteers</p>	<p>Funding, willing landowners, technical expertise.</p>	<p>Before and after restoration projects.</p>	<p>Meets intended ecological goals of the projects.</p>	<p>Not started</p>

## Chapter 7: Implementation

**Goal:** The goal of this portion of the action plan is to describe how decisions in the council are made and how the action plan will be implemented.

### Business and Planning

Currently MRWC business and planning is managed by the steering committee. The steering committee acts as an advisory group to the council and other committees, oversees the activities of the coordinator and other paid staff, develops and monitors the long term action plan, periodically reviews the by-laws and carries out other tasks assigned by the council.

Membership of the steering committee consists of no fewer than six persons appointed by the council (see section 5 of the by-laws). Currently there are nine committee members. Members are chosen to provide a broad representation of the various interests within the watershed. Membership terms are voluntary and open. As council activities expand and intensify the committee may become more involved with financial, funding, strategic planning, and other business functions.

### Council Meetings and Memberships

The council meets once per month, on the first Wednesday, usually at the Philomath City Hall. To become a member of the council, interested persons must attend three meetings, and then submit a letter showing agreement with bylaws of MRWC (excepted are the members who have signed the original MRWC Charter prior to County recognition of the MRWC). Attendance of at least one meeting within the most recent 12-month period maintains membership. Signing in at a meeting extends membership for the next 12 months. Members will pay dues to the MRWC if they are required. The MRWC makes every effort to ensure that membership includes one or more persons representing each of the following interest in the watershed: Industrial timber representation; federal, city and state agencies, and other local governments with interests or holdings in the watershed; university representative or extension officers; environmental advocacy groups; agricultural interests; private landowners and residents of the watersheds; small woodland owners; tribes; and other general interests.

### Decision-Making Process

The council has adopted a consensus process by which decisions are made. Council structure follows a traditional non-profit organizational structure complete with officers (treasurer, scribe, chair and vice-chair) and bylaws. The council has five working committees, all with similar structures. All committees are created by the council, serve as recommending bodies on specific issues, and bring final recommendations to the full council for decision-making. While every effort is made to get representation from all watershed interests on various committees, the steering committee is the only committee that specifically seeks mandatory representation of watershed stakeholders. Therefore, they are ultimately responsible for oversight of all committees and council staff. All work of the council represents a diverse group of opinions and perspectives. Once an action is required of the council, the decision making process can start if there are members present who represent 2/3 of the watershed interests listed above. The council enjoys a wide diversity of partners, including local, state, and federal governments; university students; local high schools; and private industry.

## Funding

Currently the MRWC receives funding from OWEB for the council coordinator's salary. Additional money for operation expenses and projects is obtained through grants, partnerships, donations and other fund raising activities. Grant sources vary but typically include state and federal sources such as OWEB and EPA. Volunteers, partnerships, and donations from partners such as the Benton SWCD, Benton County Public Works, and the Cities of Philomath and Corvallis are critical for action plan implementation.

## Time Frame and Resources Needed for Implementation

The time frames and resources needed are described in the tables 1-5 of chapters 2-6. Most of the action items described in this action plan are due to be completed by 2005 with the exception of some items that are ongoing by nature (e.g. updating information, disseminating information). These ongoing action items represent the long-term activities of the council and will require re-evaluation as time passes. For example it will be important to incorporate changes in goals and/or objectives.

The resources needed for implementation of these action items vary from volunteer time and finding suitable project sites with willing landowners to grant money and technical expertise. The successful implementation of this action plan will depend on procuring these resources.

## Steering Committee Membership

Bill Percy	Larry Venell
Chuck Lane: Chair	Orin Nusbaum
Gary Blanchard	Tom Bedell
Janine Salwasser	Tom Murphy
Larry Merriam	

## MRWC Officers

<u>MRWC Coordinator:</u>	Sandra Coveny
<u>MRWC Treasurer:</u>	Marge Stevens
<u>Chair:</u>	Chuck Lane
<u>Co-Chair:</u>	Amy Shoener
<u>Scribes:</u>	Hugh Snook and Marcia Macomber

## MRWC Committee Chairs

<u>Fish Passage Chair:</u>	Chuck Knoll
<u>Education and Outreach Chair:</u>	Mark Taratoot
<u>Water Quality Co-Chairs:</u>	Amy Schoener and Thom Whittier
<u>Land Air, and Water, Use Co-Chairs:</u>	Jesse Ford and Curt Seeliger

## Appendix A: Marys River Watershed Studies and Other References

### Annotated Bibliography Of Marys River Watershed Studies

*Ecosystem Northwest*. 1999. Marys River Watershed Preliminary Assessment. 145 pages. <http://www.marys-river-wc.peak.org/>

#### *Purpose*

The purpose of the assessment was to describe what is known about the Marys River Watershed condition and present a list of prioritized issues for the MRWC to use in developing strategies for future assessments, protection, and restoration efforts.

#### *Conclusions*

The document describes the watershed in terms of watershed characteristics, history of human use, water quality and quantity, aquatic and terrestrial habitats, soils and social and economic consideration. By the end of the 1930s landscape changes included conversion of grass prairies, oak savannas, wetlands, and riparian forests to conifer forests, farmlands and other land uses. Portions of the Marys River are listed as water quality limited by the Oregon Department of Environmental Quality. Factors for listing include warm stream temperatures, high bacteria concentrations, over allocation of streamflow during the summer months. The rapid rate of settlement in the Marys River Watershed resulted in alterations or loss of aquatic and terrestrial habitat. Results of habitat loss include species loss from the watershed, species listed as sensitive by state, federal and other organizations, and reduced abundance of fish. Soil erosion appears elevated in some portions of the watershed as a result of poor soil management, use of the riparian area by livestock, loss of riparian forests, and roads. Agricultural acreage has remained steady over time while timber harvest levels have fluctuated widely. Changes in the economic structure of Benton County will have implications for the watershed. There is increased demand for rural residential housing and commuting out of the watershed.

#### *Recommendations*

The report lists 22 recommendations that stem from these conclusions. Most of the recommendations have been built into the action plan. The recommendations fall into four categories:

1. Perform additional assessments to remove uncertainties and improve understanding of fish passage issues, cutthroat and sandroller distributions, water withdrawal patterns, riparian conditions, landuse planning in riparian areas, and percent impervious area.
2. Monitor to track problems and assess change in land use, stream temperature, stream nutrients, water chemistry, bacteria, and bird populations.
3. Implement projects to enhance watershed condition and function such as improving fish passage and improving Oregon chub habitat where applicable.
4. Education of watershed residents on watershed resources, processes, and wetland protection.

*E&S Consultants and the Marys River Watershed Council*. 2002. Marys River Watershed Phase I Water Quality Monitoring. 60 pges. <http://www.marys-river-wc.peak.org/>

#### *Purpose*

The purpose was to obtain water quality data from key locations in the watershed that would be used to guide future long-term monitoring plans and restoration projects.



### *Conclusions*

The overall water quality of the Marys River watershed is fair to good. The river is listed by DEQ as having impaired water quality because it does not meet the temperature and bacteria standards near the confluence with the Willamette River at the highway 99 bridge. The 2002 water quality study found that, in fact, summer stream temperatures in the middle and lower reaches of the Marys are clearly not within the preferred range for trout or salmon but temperatures in the upper reaches appear cool enough to support the life cycle needs of salmon and trout. Bacteria monitoring results suggest that although the Marys River as a whole is not seriously impaired for *E.Coli*, portions of the basin (Oak Creek, West Fork of the Marys) are at risk for contamination. In contrast, the fecal coliform results suggest widespread issues throughout the basin (Oak, Beaver, Greasy, Woods, Upper and Lower Muddy Creek).

Nutrient concentrations were generally low (good) with the possible exception of Muddy creek where phosphorus and nitrogen may be reaching the stream due to land management practices. However, the report recognized that coastal draining tributaries to the Willamette are known to naturally have high background levels of phosphorus so further investigation is warranted. Dissolved oxygen results suggest moderate impairment when analyzed based on the DEQ water quality standard with notable issues in Lower Muddy Creek.

Chronic turbidity does not seem to be a problem in the Marys, however episodic problems may exist as a result of heavy winter rainfall and runoff. The Marys River is not considered impaired for pH.

### *Summary*

Three sites Upper Muddy, Lower Muddy and Oak Creek appear to have poor water quality as indicated by nutrient content (phosphorus and nitrogen) and bacterial contamination.

- ❑ Upper and Lower Muddy Creek: There is evidence of nutrient input from agricultural activities and possible bacterial contamination. Lower Muddy creek also has low dissolved oxygen content.
- ❑ Oak Creek: Bacterial content is in excess of the DEQ water quality standards.

***ELLIS-SUGAI, BARBARA. 1998. LATERAL CHANNEL MIGRATION AND BANK EROSION ALONG THE MARYS RIVER AND SELECTED TRIBUTARIES. SIUSLAW NATIONAL FOREST. 36 PAGES. CORVALLIS AND PHILOMATH PUBLIC LIBRARIES AND THE MARYS RIVER WATERSHED COUNCIL.***

### *Purpose:*

The purpose of this study was to document where lateral channel migration and bank erosion have occurred and possible causes for bank erosion along the Marys River and selected tributaries.

### *Conclusions*

The Marys River upstream from the confluence with Greasy Creek is down cut into relatively erosion-resistant volcanic bedrock and very little lateral migration has taken place. Evidence of historic lateral migration in the lower reaches of the Marys River includes meander belts such as one downstream of the Marys River Park in Philomath and upstream of Avery Park in Corvallis.

Current bank erosion along the Marys River occurred with similar frequency along both vegetated and un-vegetated banks. A possible explanation for this observation was that the river had down cut below the rooting zone of the riparian vegetation, decreasing the erosion-mitigation function of riparian vegetation. However, increased sediment load was associated with historic riparian vegetation removal in the upstream

reaches of the Marys River as well as south of Philomath. This process was also observed on Greasy Creek and associated with historic logging (turn of the century). Increases in sediment loads trigger gravel bar deposition, increased bank erosion, and lateral channel migration.

In summary the Marys River is building its floodplain through lateral migration, bank erosion, and gravel bar deposition, while maintaining sinuosity and gradient. The stream has stayed within a stable belt width. *An opportunity still exists to protect the meander belt width of the Marys River.* Although the river flows through two areas that are becoming increasingly urbanized, there are relatively few structures within this zone yet.

### *Recommendations*

Bank erosion and lateral migration are a natural part of a river's behavior. However, these processes tend to conflict with human activities. The study made 5 recommendations. In summary they are:

1. Well-vegetated riparian zones should cover the meander belt width with an additional buffer if possible.
2. Maintain and restore riparian vegetation where lacking.
3. Riprap and bank hardening measures should be discouraged or used as a last resort.
4. If bank hardening measures are used, maintain the channel cross sectional areas to reduce erosion of opposite bank, channel bed or downstream reaches.
5. If bank-hardening measures are used, evaluate the stream bank for sensitivity to erosion, off-site causes of erosion, and upstream and downstream consequences.

***GLASMANN, J. REED. 2000. STREAM TURBIDITY AND SUSPENDED SEDIMENT MINERALOGY DURING THE 1998/1999 AND 1999/2000 WINTER RAINY SEASONS, MARYS RIVER WATERSHED. WILLAMETTE GEOLOGICAL SERVICE. 41 PAGES. [HTTP://WWW.MARYS-RIVER-WC.PEAK.ORG/](http://www.marys-river-wc.peak.org/)***

### *Purpose*

The purpose of the study was to measure storm-related stream turbidity and identify the mineralogical nature of suspended sediment within sub-watersheds of the Marys River drainage. By combining mineralogical data with turbidity data, the study will identify the geologic sources of fine sediment entering the river system and assist in plans to improve water quality within the Marys River Watershed.

### *Conclusions*

The Marys River is prone to high turbidity during high winter streamflow. Mineralogical analysis of suspended sediment helps identify the kinds of processes that influence stream turbidity. Significant sediment contributions to the Marys River occur from Greasy, Woods, and Wren and Blakesly drainages. Sources of sediment causing turbidity are likely the result of deep erosional processes rather than shallow surface erosion such as rills, sheet wash or debris avalanches. This is likely a result of soil permeability and low to moderate rainfall intensities. Mineralogy characteristics of deep erosional processes can be associated with stream bank erosion, landslide reactivation, deep gullying or runoff from logging roads. Increases in turbidity along the lower reaches of the Marys highlight the importance of cutbank and lateral channel migration in meandering river systems.

### *Recommendations*

1. Efforts to reduce stream turbidity should be focused in the steep basaltic landscapes of Greasy, Woods, and Oak Creeks, and the lower eroding stream banks of the Marys River floodplain below Philomath.

2. Proper management of logging roads should include preventing road drainage to streams.
3. Because of natural variability in annual, monthly, or daily discharge and storm intensity future studies should be based on long-term observation.
4. There is a need for a more detailed turbidity-monitoring project at the sub-watershed scale.

### Other References

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Pearcy, W.G., C. Andrus, and J Dambacher. 1999. *Temperature monitoring and modeling of the Marys River Watershed. OWEB Project. No. 98-034*. Marys River Watershed Council. . [HTTP://WWW.MARYS-RIVER-WC.PEAK.ORG/](http://www.marys-river-wc.peak.org/)

## Appendix B: Restoration Planning: Data, Process, and Maps

### Data Used for Restoration Planning

The MRWC worked with the EPA to map a series of data for the Marys River (Maps 1-13-Appendix B). A detailed descriptions of the data used in the maps are provided in tables 6 through 9. These data were the basis for the restoration opportunities mapping process described below and shown in Map 18. **NOTE:** The most recent landuse land cover data that are available are from 1990.

*Table 6. PNW Ecosystem Research Consortium (PNW-ERC) Data Mapped for the Marys River Watershed Council.*

Data Layer	Description	Documentation
Land Use / Land Cover – Existing Conditions Circa 1990	65 land use/land cover classes mapped at 30-m pixel resolution; derived from thematic mapping (TM) imagery analysis combined with 15 sources of information on land use	Hulse et al. (2002), pp. 78-81 GIS coverage and associated metadata available at <a href="http://www.fsl.orst.edu/pnwerc/wrb/access.html">http://www.fsl.orst.edu/pnwerc/wrb/access.html</a>
Historic Vegetation Circa 1850 (Pre-EuroAmerican Settlement)	Derived from (a) 1850s General Land Office (GLO) surveys mapped for the valley by The Nature Conservancy (TNC), (b) the 1993 Oregon Actual Vegetation map developed by Oregon Natural Heritage Program, and (c) H.J. Andrews'1936 Oregon Forest map, converted into land use/land cover classes comparable to the Circa 1990 legend	Hulse et al. (2002), pp. 92-93
Streams	1:100,000 River Reach stream layer, with enhancements by PNW-ERC	RIVREACH_2 GIS coverage and associated metadata available at <a href="http://www.fsl.orst.edu/pnwerc/wrb/access.html">http://www.fsl.orst.edu/pnwerc/wrb/access.html</a>
Watershed Boundaries	Subwatershed boundaries derived from 6 <sup>th</sup> and 7 <sup>th</sup> order watershed delineations from CLAMS	GIS coverage and associated metadata available at <a href="http://www.fsl.orst.edu/clams/data_index.html">http://www.fsl.orst.edu/clams/data_index.html</a>
Cutthroat Habitat Suitability Index (HSI) by stream reach	Developed by Stan Gregory, OSU; derived from estimated land use/land cover in the upstream riparian area and watershed, stream gradient, annual mean flow, and valley floor width index. Mapped using both existing ca. 1990 and historical ca. 1850 land use/land cover	Hulse et al. (2002), p. 120 ReadMe.pdf file (pp. 3-6) distributed by John Van Sickle (EPA) with PNW-ERC stream modeling dataset
Wetlands ca. 1990	All areas (>0.5 ha in area) with wetland-like characteristics identified in PNW-ERC TM imagery analysis, National	Adamus et al. (2001), pp. 9-10

	Wetlands Inventory, or ODFW vegetation mapping	
Historical Wetlands ca. 1850	Wetland-like classes on Historic Vegetation map ca. 1850. Note that TNC used hydric soils, together with the GLO surveys, to delineate the historic distribution of wet prairie	See Historic Vegetation ca. 1850 coverage (above); also Hulse et al. (2002), pp. 38-39
Closed Forest in Riparian Buffer ca. 1990	% of area within 30-m buffer on both sides of stream with any closed forest vegetation class (n=7), as represented on PNW-ERC land use/land cover ca. 1990 coverage	See Land Use/Land Cover ca. 1990 coverage (above)
Natural Vegetation in Riparian Buffer ca. 1990	% of area within 30-m buffer on both sides of stream with any natural vegetation class(n=18), as represented on PNW-ERC land use/land cover ca. 1990 coverage	See Land Use/Land Cover ca. 1990 coverage (above)
Land Use/Land Cover ca. 1990 within Marys River Meander Belt	Meander belt delineation from MRWC; land use/land cover classes from PNW-ERC land use/land cover ca. 1990 coverage	See Land Use/Land Cover ca. 1990 coverage (above)
Prime Farm Land within Meander Belt	Prime farmland based on NRCS criteria and soil survey (SSURGO) data; meander belt delineated by MRWC and Siuslaw National Forest.	Bolte and Berger, in press; Hulse et al. (2002), p. 102-103
% Consumption of Natural Streamflow During Moderately Dry Summer ca. 1990	Moderately dry summer defined as 80 <sup>th</sup> exceedance flow for August and September from long-term flow records in Willamette River Basin (WRB). Natural streamflow estimated from watershed area and annual precipitation using an empirical model based on flow records at 32 small gaged watersheds in the WRB with minimal upstream water withdrawals. Consumption based on OWRD water rights database and water allocation model developed by David Dole	Dole and Niemi, in press; Hulse et al. (2002), pp. 114-116 Van Sickle et al., in press; ReadMe.pdf file (pp. 6-7) distributed by John Van Sickle (EPA) with PNW-ERC stream modeling dataset
Habitat for Wildlife Species of Concern	Number of species of concern (species with state conservation ranks of S1, S2, or S3 as determined by the Oregon Natural Heritage Program; see list Table 7) with habitat suitability score (for breeding) $\geq 5$ . Mapped using both existing ca. 1990 and Historical ca. 1850 land use/land cover	Hulse et al. (2002), pp. 124-125; Schumaker et al. in press; and Adamus et al. (2001), which can be downloaded together with habitat scoring tables as <a href="http://www.fsl.orst.edu/pnwerc/wrb/access.html">wrb.species.zip</a> at <a href="http://www.fsl.orst.edu/pnwerc/wrb/access.html">http://www.fsl.orst.edu/pnwerc/wrb/access.html</a>
Songbird Habitat	Number of songbird species (see list Table 8) with habitat suitability score (for breeding) $\geq 5$ out of 10 within each 30-	Hulse et al. (2002), pp. 124-125; Schumaker et al. in press; and Adamus et al. (2001), which can be

	<p>m pixel. Habitat suitability scores derived from expert-defined rules and land use/land cover classes. Scores greater than 5 describe habitats that, if sufficiently extensive and of a suitable spatial pattern and location, would be expected to serve as "sources" of potential breeders. Mapped using both Existing ca. 1990 and Historical ca. 1850 land use/land cover.</p>	<p>downloaded together with habitat scoring tables as <a href="http://www.fsl.orst.edu/pnwerc/wrb/species.zip">wrb.species.zip</a> at <a href="http://www.fsl.orst.edu/pnwerc/wrb/access.html">http://www.fsl.orst.edu/pnwerc/wrb/access.html</a></p>
<p>Migratory Waterfowl Habitat</p>	<p>Number of migratory waterfowl species (see list Table 9 ) with habitat suitability score (for breeding) &gt;=5 out of 10 within each 30-m pixel. Mapped using both Existing ca. 1990 and Historical ca. 1850 land use/land cover.</p>	<p>Hulse et al. (2002), pp. 124-125; Schumaker et al. in press; and Adamus et al. (2001), which can be downloaded together with habitat scoring tables as <a href="http://www.fsl.orst.edu/pnwerc/wrb/species.zip">wrb.species.zip</a> at <a href="http://www.fsl.orst.edu/pnwerc/wrb/access.html">http://www.fsl.orst.edu/pnwerc/wrb/access.html</a></p>

*Table 7. Wildlife Species of Concern*

Record	TNC Code	Common name	Record	TNC Code	Common name
1	ABNRB02020	Yellow-Billed Cuckoo	24	AMACC01070	Long-Eared Myotis
2	ABNKD06070	Peregrine Falcon	25	AMACC01090	Fringed Myotis
3	ABNUA01010	Black Swift	26	AMACC01110	Long-Legged Myotis
4	ABNKC06010	White-Tailed Kite	27	AMACC08010	Townsend's Big-Eared Bat
5	ABNNN06010	Marbled Murrelet	28	AMACC10010	Pallid Bat
6	ABPBXA0020	Grasshopper Sparrow	29	AMAFF10020	White-Footed Vole
7	ABNJB15010	Harlequin Duck	30	AMAJF01010	American Marten
8	ABNJB18030	Bufflehead	31	AMABA01090	Pacific Shrew
9	ABNJB11040	Ring-Necked Duck	32	AAABH01180	Oregon Spotted Frog
10	ABNKC12060	Northern Goshawk	33	ARAAD01010	Painted Turtle
11	ABNSB12010	Spotted Owl	34	AAAAD02100	Oregon Slender Salamander
12	ABNYF07090	Blackbacked Woodpecker	35	AAAAJ01020	Southern Torrent Salamander
13	ABNYF04050	Acorn Woodpecker	36	AAAAJ01030	Cascade Torrent Salamander
14	ABNNM10020	Black Tern	37	AAABA01010	Tailed Frog
15	ABPAU01010	Purple Martin	38	AAABH01060	Cascades Frog
16	ABNJB18020	Barrow's Goldeneye	39	ARAAD02030	Western Pond Turtle
17	ABNKC10010	Bald Eagle	40	ARADB09010	Sharptail Snake
18	ABNKC19030	Red-Shouldered Hawk	41	AAABH01050	Foothill Yellow-Legged Frog
19	AMAJH03010	Lynx	42	AAABH01020	Red-Legged Frog
20	AMACD01010	Brazilian Free-Tailed Bat			
21	AMAJF01020	Fisher			
22	AMAJF03010	Wolverine			
23	AMACC01020	Yuma Myotis			

*Table 8. Songbirds used in MRWC mapping process.*

RECORD	TNCCODE	COMMON NAME	RECORD	TNCCODE	COMMON NAME
16	ABPAE32010	Olive-Sided Flycatcher	48	ABPBH01010	American Dipper
17	ABPAE32050	Western Wood-Pewee	49	ABPBJ05010	Golden-Crowned Kinglet
18	ABPAE33040	Willow Flycatcher	50	ABPBJ15020	Western Bluebird
19	ABPAE33080	Hammond's Flycatcher	51	ABPBJ16010	Townsend's Solitaire
20	ABPAE33090	Dusky Flycatcher	52	ABPBJ18100	Swainson's Thrush
21	ABPAE33120	Pacific-Slope Flycatcher	53	ABPBJ18110	Hermit Thrush
22	ABPAE52050	Western Kingbird	54	ABPBJ20170	American Robin
23	ABPAT02010	Horned Lark	55	ABPBJ22010	Varied Thrush
24	ABPAU01010	Purple Martin	56	ABPBJ26010	Wrentit
25	ABPAU03010	Tree Swallow	57	ABPBN01020	Cedar Waxwing
26	ABPAU03040	Violet-Green Swallow	58	ABPBT01010	European Starling
27	ABPAU07010	Northern Rough-Winged Swallow	59	ABPBW01160	Cassin's Vireo
28	ABPAU09010	Cliff Swallow	60	ABPBW01190	Hutton's Vireo
29	ABPAU09030	Barn Swallow	61	ABPBW01210	Warbling Vireo
30	ABPAV01010	Gray Jay	62	ABPBW01240	Red-Eyed Vireo
31	ABPAV02010	Steller's Jay	63	ABPBX01050	Orange-Crowned Warbler
32	ABPAV06040	Western Scrub-Jay	64	ABPBX01060	Nashville Warbler
33	ABPAV08010	Clark's Nutcracker	65	ABPBX03010	Yellow Warbler
34	ABPAV10010	American Crow	66	ABPBX03060	Yellow-Rumped Warbler
35	ABPAV10110	Common Raven	67	ABPBX03070	Black-Throated Gray Warbler
36	ABPAW01010	Black-Capped Chickadee	68	ABPBX03080	Townsend's Warbler
37	ABPAW01040	Mountain Chickadee	69	ABPBX03090	Hermit Warbler
38	ABPAW01070	Chestnut-Backed Chickadee	70	ABPBX11040	Macgillivray's Warbler
39	ABPAY01010	Bushtit	71	ABPBX12010	Common Yellowthroat
40	ABPAZ01010	Red-Breasted Nuthatch	72	ABPBX16020	Wilson's Warbler
41	ABPAZ01020	White-Breasted Nuthatch	73	ABPBX24010	Yellow-Breasted Chat
42	ABPBA01010	Brown Creeper	74	ABPBX45050	Western Tanager
43	ABPBG03010	Rock Wren	75	ABPBX61040	Black-Headed Grosbeak
44	ABPBG07010	Bewick's Wren	76	ABPBX64020	Lazuli Bunting
45	ABPBG09010	House Wren	77	ABPBX74080	Spotted Towhee
46	ABPBG09050	Winter Wren	78	ABPBX94020	Chipping Sparrow
47	ABPBG10020	Marsh Wren	79	ABPBX95010	Vesper Sparrow
			80	ABPBX96010	Lark Sparrow



81	ABPBX99010	Savannah Sparrow	92	ABPBXB7030	Brown-Headed Cowbird
82	ABPBXA0020	Grasshopper Sparrow	93	ABPBXB9190	Bullock's Oriole
83	ABPBXA2010	Fox Sparrow	94	ABPBY04020	Purple Finch
84	ABPBXA3010	Song Sparrow	95	ABPBY04040	House Finch
85	ABPBXA3020	Lincoln's Sparrow	96	ABPBY05010	Red Crossbill
86	ABPBXA4040	White-Crowned Sparrow	97	ABPBY06030	Pine Siskin
87	ABPBXA5020	Dark-Eyed Junco	98	ABPBY06090	Lesser Goldfinch
88	ABPBXB0010	Red-Winged Blackbird	99	ABPBY06110	American Goldfinch
89	ABPBXB2030	Western Meadowlark	100	ABPBY09020	Evening Grosbeak
90	ABPBXB3010	Yellow-Headed Blackbird	101	ABPBZ01010	House Sparrow
91	ABPBXB5020	Brewer's Blackbird			

*Highlighted species are not native to the Marys River Watershed and will be removed from the next iteration.*

**Table 9. Waterfowl species used for MRWC mapping process.**

RECORD	TNCCODE	COMMON NAME	RECORD	TNCCODE	COMMON NAME
1	ABNJB05030	Canada Goose	9	ABNJB11040	Ring-Necked Duck
2	ABNJB09010	Wood Duck	10	ABNJB15010	Harlequin Duck
3	ABNJB10010	Green-Winged Teal	11	ABNJB18020	Barrow's Goldeneye
4	ABNJB10060	Mallard	12	ABNJB18030	Bufflehead
5	ABNJB10110	Northern Pintail	13	ABNJB20010	Hooded Merganser
6	ABNJB10130	Blue-Winged Teal	14	ABNJB21010	Common Merganser
7	ABNJB10140	Cinnamon Teal	15	ABNJB22010	Ruddy Duck
8	ABNJB10150	Northern Shoveler			

## **Assumptions, Logic and Process Used to Identify Riparian, Stream, and Wetland Restoration Opportunities in the Mary River Watershed**

### **Restoration Goals, Objectives and Opportunities**

The goal of restoration is to improve watershed condition as characterized by the Marys River water quality, quantity, aquatic habitat and terrestrial habitat. The specific objectives are to decrease bacteria, summer time stream temperature, and turbidity and increase summer time low flows, and improve aquatic habitat. A number of restoration activities have been identified that would provide a functional response to achieve these objectives. A series of data parameters were identified that could be used to map locations of restoration priorities. These data are described above in this Appendix B.

A series of maps were generated using existing data from the ecological research Consortium (ERC), MRWC monitoring projects, Benton County, and the Siuslaw National Forest. The mapped data provide an index of current and historic condition of stream reaches within the watershed.

### **Matrices Used for the Restoration Opportunities Screening Map**

The first iteration of the Restoration Opportunities Screening Map is shown in Map 18. In partnership with EPA, the MRWC developed a conceptual model depicting how restoration projects will achieve restoration goals and desired ecosystem functions, and the data that could be used as indicators of those functions. EPA and MRWC identified and digitally captured those data for the Marys River Watershed and defined the logic for identifying restoration opportunities based on those data. These action items were used in the creation of the *first iteration* of the "Restoration Opportunities Screening Map". The *first iteration* of this map *focuses on fish habitat, riparian and wetland conditions*, recognizing that *future iterations* can include broader watershed restoration opportunities. The council recognizes that the utility of the restoration opportunities screening map may be limited by the use of coarse scale data. The council will propose a project to test the applicability and accuracy of the data at the smaller scales used for restoration planning. Stream restoration opportunities shown in Map 10 are drawn in red and were derived as described below.

#### CALCULATING THE HABITAT SUITABILITY INDEX

The first screen for a stream restoration opportunity was based on cutthroat habitat suitability index (HSI). The HSI is calculated from 10 metrics, each of which is estimated from landscape data and described below:

1. Percent of the riparian network (90m on both sides of the stream for the entire network upstream of the reach) with closed forest (used for upland streams only)
2. Percent of riparian network that is naturally vegetated (used for lowland streams only)
3. Large wood recruitment potential is calculated from the forest age structure in the riparian buffer immediately adjacent to the stream reach. The forest age is related tree height. Tree height and distance of the tree from the stream can be related to the likelihood that the tree will fall into the stream (Meleason 2001).
4. Percent of riparian network used for agriculture
5. Percent of riparian network used for human development (buildings, etc.)
6. Percent of watershed upstream of the reach with closed forest

7. Road density in the sub-watershed
8. Stream gradient (average for the entire reach, from Digital Elevation Models)
9. Valley floor width index (VFWI) (used for upland streams only).
10. Annual mean flow was estimated from watershed area and annual precipitation for the watershed (from PRISM). A regression model calibrated with long-term data from gauged watersheds in the basin (of comparable size).

Stream reaches were scored for each of the above matrices, on a scale of 0 to 1, with 1 being the best (higher values mean better habitat) and 0 being the worst. For metrics positively associated with habitat quality, 0 was assigned to the minimum value (treating lowland and upland stream separately) and 1 assigned to the maximum observed value. All other values for the metric were scored assuming a linear relationship between 0 and 1. For five metrics, the inverse was used, that is, 0 was assigned to the maximum observed value and 1 was observed to the minimum value. These "inverse metrics" included: % agriculture and % human development in the riparian network, road density in the watershed, annual mean flow for lowland streams, and stream gradient for upland streams. Thus, steeper gradients in upland streams indicate poorer habitat. In contrast, for lowland streams, those with steeper gradients are presumed to have better habitat, relative to other lowland streams. The final HSI step is to multiply each metric score by its weighting factor. The sum of these weighted metrics then equals the HSI. The weights used were as follows (different for upland and lowland streams):

Uplands: gradient (0.05), flow (0.10), VFWI (0.1), wood potential (0.25), % riparian in closed forest (0.35), % riparian in agriculture (0.025), % riparian in development (0.05), % watershed in closed forest= (0.025), and road density in watershed (0.05).

Lowlands: gradient (0.065), flow (0.065), wood potential (0.20), % riparian in natural vegetation (0.34), % riparian in agriculture (0.10), % riparian in development (0.10), % watershed in closed forest (0.065), and road density in watershed (0.065).

From this we generated the map of circa 1990 HSI for all 1st to 4<sup>th</sup> order stream reaches in the Mary's River watershed.

### Identifying Restoration Priorities

The first iteration of restoration planning focused on streams, fish habitat, and wetlands. The MRWC established that restoration priorities are those that provide the "greatest ecological return". The MRWC used the following assumptions to define "greatest ecological return":

1. A focus on streams and wetlands with high habitat potential will yield greater ecological benefits.
2. Preventing habitat and water quality degradation is more efficient than recovering degraded streams.
3. Moderately degraded stream reaches can be maintain and restored more cost effectively than highly degraded streams.
4. Contiguous areas of high quality habitat provide greater ecological benefits than isolated units.
5. Improvements that take advantage of natural processes and functions are often more sustainable.

On the restoration opportunities map, we shaded watersheds with streams with the "best" habitat (HSI >0.8,) in yellow and "good" habitat (HSI 0.7-0.8 or combination of streams with HSI 0.7-0.8 and 0.6-0.7) in pale green. These are areas more likely to have intact landscape functions, as they relate to streams. Thus, the streams may be high priority for protection OR if there are small-scale, on-the-ground problems, fixing them via a restoration project should yield a self-maintaining, functioning stream system with reasonably small effort because the overall landscape is in pretty good shape (assumptions 1 and 2).

Next, we looked for "HSI gaps," that is, streams with lower HSI interrupting longer reaches with fairly high HSI (shown in red on the restoration opportunities map). Improving (via some restoration action) the habitat quality in these gaps would not only benefit the reach itself, but also presumably benefit the larger network by resulting in longer contiguous stretches of high quality habitat (assumptions 3, and 4). We identified these gaps "by eye." Compare the red lines on the restoration map with the HSI map and notice this was fairly straightforward, although also somewhat subjective.

Stream and riparian habitat often overlap with wetland functions so we mapped all "wetlands" greater than 0.5 ha in area (in yellow as well as the two shades of green on the restoration opportunities map). We used several data layers to identify wetlands from the NWI, ODFW, as well as the PNW-ERC datasets. It is likely that some of these "wetlands" are not currently functioning wetlands, but they at least have some residual wetland features. So all of these sites would be worth visiting as potential sites for wetland restoration. Some we may find are in reasonably good condition (candidates for protection); others may have the potential to serve as functioning wetlands with some restoration effort. If MRWC wishes to prioritize among these "wetlands" (or, more appropriately, wetland-like areas), then one approach would be to give higher priority to wetland-like areas near either (a) streams with high-quality habitat (high HSI) or (b) gaps in the HSI network. In this way a landowner could do a joint riparian / wetland restoration in the same area).

The restoration opportunities map shows: wetland-like areas greater than 0.5 ha in area and close to HSI gaps in deep green (within 100 m of the gap) and green (within 1000 m). Wetland-like areas are colored yellow that are close to streams and within watersheds shaded as "best" and "good" habitat quality and thus may also be high priority areas to check for wetland restoration opportunities.

Chapter 6 and Table 5 of this action plan describe an objective to validate this map in the field. A pilot study was implemented in the Fall of 2003. The findings from the pilot study are available. More work is need to get broader participation by landowners. A separate more rigorous study is needed to validate the land use land cover data and models.

### ***References and Related Information***

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**Maps 1-18 described Above Appendix B.**