Component I
Start-Up and Identification of Watershed Issues

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THE ASSESSMENT START-UP PROCESS

Overview

Watershed assessments can be used to meet a wide variety of goals. An assessment can function as a catalyst to establishing a community-based watershed group. Or it can provide an already-established group with a structured compilation of available watershed data, along with a review of the existing watershed conditions.

The initial step of the watershed assessment process is identifying the assessment team and gathering basic watershed information. These tasks are described in the steps below. After putting together a team and gathering information, the key to a smooth and successful assessment is establishing effective communications between the community, the assessment team, and technical support specialists, and ensuring that each group understands the goals of the process. The project manager or coordinator plays an important role in establishing and facilitating these communications. Important to the assessment is involvement, from the start, of property owners and other stakeholders in the watershed. The property owners should understand the goals of the process and be engaged in the process at the beginning. In addition, property owners often have detailed local knowledge, which can provide valuable insights to understanding watershed condition. Ultimately, stakeholders need to have ownership in the assessment process in order to develop support for identified enhancement and protection opportunities.

Stakeholders (including property owners, local residents, agency and industry representatives) should understand that watersheds are complicated, and that they will need to invest time either completing the assessment or reviewing and understanding the assessment findings.

The project manager leads this Start-Up and Identification of Watershed Issues component, oversees completion of each assessment component, and facilitates communications between the assessment team, the community, and local landowners. The first task of the project manager is to identify how the assessment components will be completed. The team may consist of staff or volunteers who have the skills and time to complete one or more assessment components. The project manager needs to track the progress of the watershed assessment team to ensure the assessment components are completed in a timely manner. The project manager will also be responsible for gathering and compiling basic maps and data, which are needed throughout the entire assessment.

Informing landowners in the watershed about the proposed watershed assessment, and building their understanding and support for the process, will help ensure that the assessment findings will be utilized. The project manager needs to notify the community that the assessment is taking place and provide opportunities for community involvement and input. Notices can be posted in prominent locations; landowners in the watershed, as well as local agency representatives, should be mailed notices. Community meetings designed to obtain input and identify issues will engage interested parties in the process; the information gathered can be used to help focus the assessment. During

the Watershed Condition Evaluation phase at the end of the assessment, the start-up issues can be revisited to determine if these issues were adequately evaluated or if new issues were identified.

Necessary Skills

The project manager should have good organizational and communication skills. Meeting facilitation skills will help focus community meetings and build support for the assessment process.

Final Products of the Start-Up Component

The products of this component will be used in subsequent portions of the assessment. The following items need to be collected or developed:

- Base Map
- **Ecoregion**[1] locations and descriptions
- Refined Land Use Map: Map showing location of key land uses in the watershed
- Recent **stereo aerial photographs** covering the entire assessment area
- Issues Identification Form (Form SU-1)

Step 1: Identify Project Manager

The project manager will be responsible for assigning tasks, contacting stakeholders, and tracking and coordinating the completion of the assessment components. The project manager may also help with data acquisition and facilitate data transfer between the people working on individual components.

Step 2: Coordinate Community Input

There are a number of potential methods to solicit input from the local community for the purpose of building support for the project. The following tasks are recommended, although you may find it useful to structure them differently, depending on your knowledge of the community and your goals:

1. The project manager and assessment team should meet with the watershed council and technical advisors to review the list of potential issues. After this meeting, the watershed council should identify an appropriate forum for involving local property owners, local and community leaders, community action groups, and other stakeholders in the watershed in reviewing the list of issues. It is important that all parties understand that a watershed assessment cannot address all potential community concerns or issues.

2. Hold a series of informal meetings with community groups on their own ground. For example, presentations could be made at regularly scheduled meetings of the local Soil and Water Conservation District, small communities, industry associations, and interest groups.

Making the various entities comfortable with the process will take considerable time. A reasonable expectation is that the initial process of identifying issues and interacting with the community will

[1] Terms that appear in bold italic throughout this text are defined in a Glossary at the end of this component.

take several months. A number of data-gathering efforts, such as obtaining historical accounts and agency data records, can occur concurrently with the issue identification process.

Step 3: Identify Assessment Team

Completing an assessment is a big commitment in time and resources. We expect that it will take between 4 to 8 months to complete an assessment, depending on the watershed and the commitment of the assessment team. It would be very difficult for a single person to compile an entire watershed assessment in a timely manner. Hence, a team of people will usually be involved in completing the process. This watershed assessment process is designed for people who do not necessarily have specialized technical training. Each component lists specific skills which are either required or would be helpful in completing that component. You may be able to find staff on the watershed council, volunteers, students, consultants, or some mix of people who have the skills and can commit the time to completing one or more assessment components. The project manager needs to assign responsibility for specific components based on the person's skills, interests, and availability. Each potential team member should review the appropriate section of the manual to be certain they feel qualified to complete that portion of the assessment.

Step 4: Compile Initial Materials

Decide on Watershed

There are 1,063 5th field watersheds in the State of Oregon, with an average size of 58,218 acres. A geographic area of approximately 50,000 to 100,000 acres is an appropriate size to complete a watershed assessment. Watersheds of this size can usually be mapped at 1:24,000 scale (1 inch equals 2,000 feet) on standard plotter paper, and the scale provides adequate resolution for data display.

Obtain USGS Maps

A complete set of US Geological Survey (USGS) 7.5-minute topographic maps (also at 1:24,000 scale) for the entire watershed will be useful for initial orientation in the watershed, and for completing some assessment components. (See Contact Information sidebar for how to obtain copies of USGS and other maps.) The USGS also publishes a key to topographic map symbols, which will be useful for interpreting maps in some of the components. (Also see How to Interpret a Topographic Map sidebar.) In order to decide which maps are needed, you will need to locate an index map to identify names of map sheets (quads) covering your watershed. This information is usually available where you purchase maps. In addition, other maps used in the assessment will orient off of the USGS quad maps, so a list of quads covering the watershed will be useful for obtaining other background information.

CONTACT INFORMATION FOR MAP ACQUISITION

Topographic maps ($4 to $5/map)

- Nature of the Northwest Store, Oregon Building, Portland (503) 872-2750
- USGS Map Sales, Box 25286, Federal Center Building 810, Denver, CO 80225; (800) 872-6277
- Oregon State University, Valley Library http://www.orst.edu/dept/library/
- Local outdoor stores or bookstores

ODF stream classification maps

- ODF Fish Presence Coordinator (503) 945-7483. Cost $1.50/quad sheet + $2.35 shipping (up to 12 maps)

Obtain ODF Stream Classification Maps

These black-and-white maps produced by the Oregon Department of Forestry (ODF) are extremely useful and are available at a lower cost than USGS maps. You will need at least one complete set for the entire watershed, although you may want to order several sets. The ODF stream classification maps were developed from USGS quad maps, and have an enhanced stream network. The stream classification maps also show breaks between "large," "medium," and "small" streams; and upstream limit of fish use. The accuracy of fish distribution and stream size information on these maps varies across regions and watersheds. The analyst performing the Fish and Fish Habitat Assessment component will update the information on these maps. There is a current effort to digitize these maps into **Geographic Information System (GIS)** format, and digital versions should be available sometime in 1999.

Obtain Recent Stereo Aerial Photographs

Recent stereo aerial photographs covering the entire assessment area are essential for the Riparian/Wetlands Assessment component, and are useful for completing the Channel Habitat Type Classification and Sediment Sources assessment components, as well as others. Stereo aerial photographs allow the analyst to view the area of interest three-dimensionally. A scale of 1:12,000 is preferable, although smaller scales may suffice. Color or color-infrared photographs are preferred.

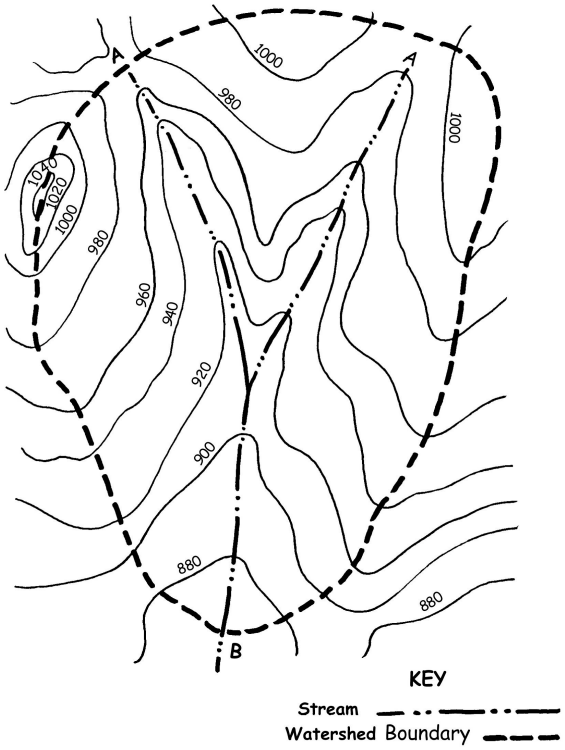
If stereo aerial photographs are not available **orthophotos** may be of some use. Orthophotos are aerial photos that have been corrected to remove displacement. Orthophotos are scale-correct but can only be viewed two-dimensionally.

HOW TO INTERPRET A TOPOGRAPHIC MAP*

Each contour line on a topographic map represents a vertical distance above a reference point such as sea level. All points along a contour line are at the same elevation. The difference between two adjacent contours is called the contour interval. It represents the vertical distance you would need to climb or descend from one contour elevation to the next.

The horizontal distance between contours is determined by the steepness of the landscape. On relatively flat ground, two 20-foot contours can be far apart horizontally. On a steep cliff, two 20-foot contours might be directly above and below each other. In both cases the vertical distance between contour lines is still 20 feet.

Water always flows downhill perpendicularly to the contour lines. As you go upstream, successively higher and higher contour lines first parallel then cross the stream. This is because the floor of a river valley rises as you go upstream. Likewise, the valley slopes upward on each side of the stream. A general rule is that topographic lines always point upstream. With that in mind, it is not difficult to make out drainage patterns and the direction of flow on the landscape. In the figure, the direction of streamflow is from Point A to Point B



* Adapted from the *Oregon Freshwater Assessment Methodology* (Roth et al. 1996).

The owner of the aerial photos for your watershed may not wish to loan out photos; however, you may be allowed to photocopy the set. Photocopies made using a high-quality machine (approximately $1/copy; cheaper sometimes for a large order) work well, and is a lower-cost alternative than buying your own set. Several possible sources for aerial photographs are listed in the Aerial Photos sidebar.

AERIAL PHOTOS

Training in Interpretation
Aerial photos are used for the Riparian/Wetlands Assessment component, and are very useful for the Sediment Sources and Channel Habitat Type Classification assessment components.

Examples of information gained from aerial photos include overall land use, riparian area width and species composition, evidence of historic changes, assistance in determining types of stream channels, identification of sediment sources, and evaluation of road networks. For someone without training in aerial photo interpretation and in working with stereo images, making sense of a series of aerial photos can be a daunting task. One approach is to find someone with experience reading aerial photos; perhaps an employee of a large landowner or a resource agency staff member may be able to help. That person may be willing to perform the aerial photo tasks, or to provide orientation and coaching to the person doing the interpretation. Consulting the Oregon State University (OSU) Extension Forester for your county may also help identify others who could provide expertise.

If training in aerial photo interpretation is desired, resources are available. The OSU College of Forestry periodically offers a short course on *Mapping from Aerial Photographs*. Contact the College of Forestry Conference Assistance Office at (541) 737-2329 (www.cof.orst.edu/cof or conference@cof.orst.edu).

Useful textbook resources include:
Paine, D.P, 1981. Aerial Photography and Image Interpretation for Resource Management. John Wiley and Sons, New York. 571 pp.

Avery, T.E. and G.L. Berlin, 1992. Fundamentals of Remote Sensing and Airphoto Interpretation, 5th edition. Macmillan Publishing Co., New York. 472 pp.

Sources for Aerial Photos
- Oregon Department of Forestry
- Natural Resource Conservation Service (NRCS)
- Local Soil and Water Conservation District
- University of Oregon Map and Aerial Photography Library, 165 Condon Hall, Eugene, OR 97403-1251; (541) 346-4565; http://libweb.uoregon.edu/~map/
- Local US Forest Service district or Bureau of Land Management district
- Oregon State University, Valley Library http://www.orst.edu/dept/library/
- Other possible agencies include: US Army Corps of Engineers, USGS, Oregon Department of Transportation, Bonneville Power Administration (if watershed located near major transmission lines), and county government

Commercial sources for photos in Oregon:
- WAC Corporation, 520 Conger Street, Eugene, OR 97402-9817; (800) 845-8088
- Spencer B. Gross, Inc., 13545 NW Science Park Drive, Portland, OR 97229; (503) 646-1733

Other possible sources of photos:
- Large forest landowners

Step 5: Create the Base Map

After materials are compiled, your first big task is to create a base map for the assessment. If the watershed council has GIS support, the State Service Center for GIS (SSCGIS) can provide base maps of watersheds that include the stream network, watershed boundaries, subwatershed boundaries, estuary boundaries, roads, legal boundaries, and locations of major cities and towns. These maps are available to download off the SSCGIS World Wide Web site or the center can be contracted to provide initial GIS map products. (See sidebar, Some GIS Mapping Options, for more information.)

SOME GIS MAPPING OPTIONS

Free Data
You can obtain baseline information from the State Service Center for GIS (SSCGIS) Web site at www.SSCGIS.state.or.us. This information includes major roads, waterbodies, public land survey (Township, Range and Section lines), watershed boundaries, generalized zoning, land ownership, city limits, urban growth boundaries, and 1990 census information on population. Available data includes fish distribution, 303(d) listed streams, and watershed council boundaries. This information is available for the entire state and can be downloaded directly from the Web site. You will need some type of GIS browser to import and view the data, and must be able to cookie-cut the data to your watershed (data is in county or state-wide format). Local governments often have a wealth of digital information that they are willing to share with other groups. Contact the State of Oregon GIS Data Administrator for contacts with local government GIS groups in your watershed. The local governments may have technical resources to help you.

Additional data may be available for the area where the assessment is taking place. Contact the State of Oregon GIS Data Administrator for more information:

(503) 373-7461 or (503) 378-2166
data@SSCGIS.state.or.us
http://www.SSCGIS.state.or.us

Professional GIS Services
There are several methods of obtaining quality GIS services. Several consultants work with watershed councils and provide GIS support for a fee. A list of these consultants can be obtained from the Governor's Watershed Enhancement Board (503-378-3589).

The SSCGIS has provided base information to several watershed councils at the request of the Governor's Watershed Enhancement Board. Base maps of major roads, streams, waterbodies, ownership, generalized zoning, and the USGS quad maps of topography can be obtained for $1,500 per 5th field watershed. Additional GIS services are available. Contact the SSCGIS at (503) 378-4163 for additional information and price quotes.

Coordination of Digital Data
The state would like to coordinate the update of base information and the additional data collected during the assessment process. This digital data could then be used for regional or multiple basin assessments. Whatever the process you use to develop your base information, please contact the SSCGIS to make sure your results are incorporated into the Oregon Digital Map Library.

Numerous sources of GIS data are available, and deciding what data to use can be confusing. In addition, the usability of the data depends on the scale at which the data was collected and compiled, and the format and presentation of the data. Sorting through maps to determine the metadata (data about data) used to create them can be an overwhelming task. Then it takes a solid understanding of the mapping process and professional judgement to determine if the data accurately portrays conditions. GIS support requires professional expertise, which in itself can be time-consuming and expensive. For these reasons, this assessment process does not require GIS support to be completed. However GIS support can expedite creation of the base map, and allows for better-quality final maps and more options for summarizing results. We have described in the following subsections a process for developing your own base maps without GIS support.

Choose the Best Watershed Map

The ODF stream classification maps are the most informative maps and are usually the best-suited for use as base maps. The initial base map is made by cutting and pasting together the paper quad maps to produce a single map of the entire assessment area. Many photocopy shops have large-format copy machines that can reproduce several copies of this map for use in subwatershed delineation.

Identify Subwatersheds

You will need to partition the large watersheds into subwatersheds of roughly equal size to provide a framework for organizing and summarizing the data. There is currently no standard delineation of 6th field **Hydrologic Unit Codes** (HUCs) (subwatersheds), although in some portions of the state 6th field HUCs are mapped, and these established subwatersheds may be adequate for the assessment. If 6th field watersheds have not been mapped, the project manager, in consultation with the assessment team, will be responsible for deciding how to partition the watershed. Usually watersheds can be divided up into 6 to 12 subwatersheds depending on the overall geomorphology and land use patterns.

Delineation can be based on a combination of factors, including major changes in topography, land use, and stream size. (See Delineating Watersheds and Subwatersheds sidebar for mapping instructions.) Where some subwatersheds are dominated by different land uses, certain individuals or groups within the councils may take responsibility for specific uses (agriculture, forestry, a suburban stream) with which they are familiar, while still working to ensure consistency of analysis within the watershed. It may also be possible and desirable to separate out a tributary or sub-basin that has been highly impacted (greater than, say, 50%) by development. Subwatershed boundaries can be identified by following the major topographic features dividing drainage areas (tributaries). It may take several attempts to decide on an appropriate delineation for subwatershed boundaries. Subwatersheds should be named for the major tributary within the subwatershed so that references to the subwatersheds will be consistent through all assessment components. Once the subwatersheds have been identified and agreed upon, they should be delineated on all of the base maps. Because subwatersheds are so fundamental to watershed characterization and assessment, the watershed technical team should review and approve the proposed division of subwatersheds.

Delineate Ecoregions

The Level III and IV ecoregions of Oregon and Washington are mapped in the Ecoregion appendix of this manual. Locate your watershed on the map and identify the ecoregion(s) that occur in your watershed. If more than one ecoregion occurs in your watershed, draw the divisions between ecoregions on the map. Find the appropriate ecoregion descriptions in the Ecoregion appendix. These descriptions contain information useful for most components of the assessment. Make copies of the pertinent description for each member of the assessment team.

Finalize Base Map

You should now have a paper map at 1:24,000 scale produced either by GIS or cutting and taping. The map should show the watershed partitioned into named subwatersheds of roughly equal size, the stream network, stream names along with watershed boundaries, estuary boundaries, section boundaries, present ecoregions, major roads, and the locations of cities and towns. Additional copies of this map can now be produced (either plotted from GIS or copied on a large-format copy machine) on paper or Mylar and given to the assessment team members to start their assessments. Paper maps can be laminated so that information can be added with a fine-tipped marker and erased if a correction is needed.

DELINEATING WATERSHEDS AND SUBWATERSHEDS*

The head of a watershed is the point where land slopes away into another watershed. Generally, this occurs at hill tops, ridge lines, or saddles. If you were to join all of the high points around a stream, you would have the watershed boundary. The following example shows how to locate and connect all of the high points around a watershed on a topographic map.

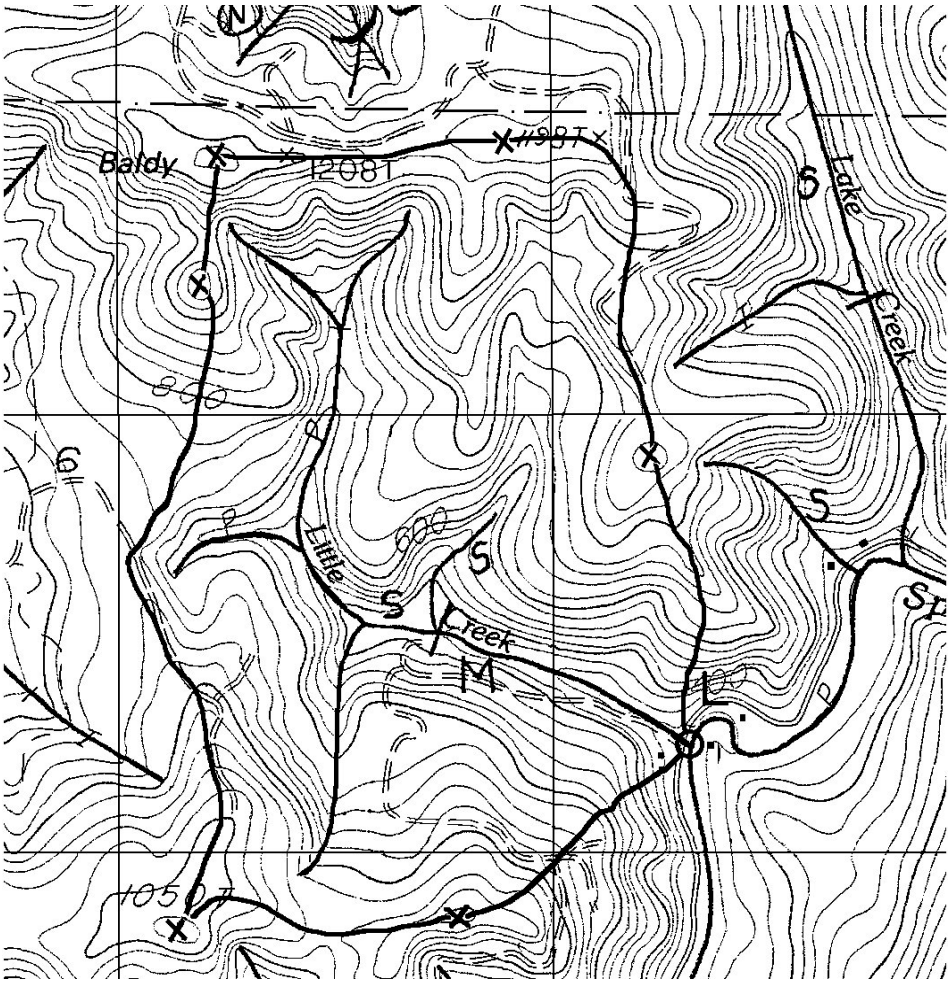
1. Draw a circle at the outlet or lowest point of the stream or tributary in question.

2. Put small x's on the high points along both sides of the stream, working your way upstream.

3. Starting at the circle, draw a line connecting the x's. This line should always cross the contours at right angles (i.e., it should be perpendicular to each contour line it crosses).

4. Continue the line until it circles the stream watershed.

The boundary will appear as a solid line around the stream or tributary. Generally, surface-water runoff from rain falling anywhere in this boundary flows into the subwatershed stream.



*Adapted from the *Oregon Freshwater Assessment Methodology* (Roth et al. 1996).

Step 6: Refine the Land Use Map

The Refined Land Use Map will be used in assessment components to identify the types and areas of potential land use impacts. Land use maps are available at 1:24,000 from the SSCGIS. In addition, users should request an ownership map to help with validation of the land uses within the mapped categories. The land use map provided by the SSCGIS is based on zoning designations and is produced at a larger scale than other maps used in the assessment. This means users will need to make some additions to create the Refined Land Use Map for use in the assessments.

For the assessment process the watershed land uses are placed into the four categories: (1) forestry, (2) agriculture, (3) rangeland, and (4) urban. Typically, stakeholders will have specific understanding of land uses in the watershed. The actual land uses should be validated using ownership maps, local knowledge, aerial photo validation, or field visits.

In this step, you inspect the land use map provided by the SSCGIS and identify the different land uses present in your watershed and in each of its subwatersheds. The land use map acquired from the SSCGIS is based on local zoning designations. These designations may not accurately represent the actual land uses in the watershed. First you need to validate the boundaries around the mapped land uses using aerial photographs or orthophoto quadrangle maps. Orient yourself to a landmark visible on both the photo or map (road and streams are often good points of reference). Visually compare the boundaries of observed land uses (i.e., fields, forests) to the mapped land uses. On the land use map, mark the corrected land use boundaries. Using this corrected, Refined Land Use Map, determine the area (acres or square miles) of forestry, agriculture, range land, and/or urban land uses in each subwatershed. The areas in each land use can either be estimated using GIS or calculated using either the rectangular grid method or a **planimeter** (see the How to Measure Watershed Area sidebar). The project manager should make an effort to ensure that the Refined Land Use Map represents the actual land uses as accurately as possible and make sure the stakeholders in the watershed agree with the maps at this stage.

HOW TO MEASURE WATERSHED AREA

Grid Method
The grid method entails constructing a rectangular grid and counting squares, estimating partial squares. Usually it is easiest to trace the basin outline onto a sheet of graph paper, and count the squares on that grid. Converting the number of squares to an area value depends on the scale of the map you are using. If you are using a USGS quad map, the scale is 1 inch equals 2,000 feet or 1 square inch equals 0.143 square miles (Dunne and Leopold 1978).

How many squares inches did you count in your drainage basin?

Multiply this number by 0.143 and the result is the area in square miles.

To convert to acres: 1 square mile = 640 acres.

Planimeter Method
A planimeter is a small device with a hinged mechanical arm. One end of the arm is fixed to a weighted base while the other end has an attached magnifying lens with a pointer. You trace around the area to be measured with the pointer. The planimeter readout registers the area being measured.

Planimeters cost between several hundred to a thousand dollars depending on the degree of sophistication. They are available from forestry or engineering supply companies.

Step 7: Acquisition and Compilation of Other Data

Table 1 lists basic data needs and identifies which assessment components utilize specific data products. The project manager may want to order additional data materials for other assessment components to facilitate the process. Directions for acquiring materials for a specific assessment component can be found in that component.

IDENTIFICATION OF WATERSHED ISSUES

Critical watershed issues should be identified early in the process to help focus the watershed assessment. Although all elements of the watershed characterization and assessment generally apply to a watershed, this step will help the council in understanding how the assessment products fit into current state and federal regulatory direction. In addition, early identification of important watershed issues may help direct where time will be spent.

Table 1. List of basic background materials needed for a watershed assessment.

	Historical Conditions	CHT	Hydrology & Water Use	Riparian/ Wetlands	Sediment Sources	Channel Modifi-cation	Water Quality	Fish & Fish Habitat
Watershed base map	√	√	√	√	√	√	√	√
Land use map			√	√			√	
USGS topo maps		√			√	√		
Aerial photographs		√	√	√	√	√		
Orthophoto quads			√		√	√		
Ecoregion summary			√	√	√			
Oregon Department of Fish and Wildlife and other physical stream habitat surveys		√		√				√*
CHT map		√		√		√		√
Historic condition summary table						√		√
Mean annual precipitation map			√*					
NRCS county soil surveys			√	√*				
USGS stream gage data			√*					
Division of State Lands wetland inventory maps				√*				
National Wetland Inventory maps				√*				

* Indicates that directions for obtaining this information are included in this component.

The issues to be addressed in a watershed assessment typically arise from local efforts to address concerns that often begin at federal and state levels. Listing of fish populations under the federal Endangered Species Act, for example, immediately focuses attention on evaluating habitat quality or hatchery production in the watershed. Water quality limited stream segments, listed under authority of the federal Clean Water Act, require that watershed management plans (or Total Maximum Daily Loads [TMDLs]) be developed at the state or local level. (See "Section 303[d] Requirements" in Appendix I-A.) These national- and state-level issues need to be integrated with local concerns expressed by watershed councils, communities, and other stakeholders in the watershed. Issue identification will be an iterative process, but can be initiated using a rational approach that answers the following critical questions. This Issue Identification component provides guidance on how to step through this process.

Critical Questions

1. What resource-condition issues that affect local decision making in the watershed arise from state and federal laws?

2. What are the potential effects of land management activities that affect these issues?

3. Are there additional aquatic resource issues that have been identified at the local level?

4. How does one use this set of issues in conducting a watershed assessment?

Identify Typical Issues Associated with Land Use

Regulatory listings and land use categories are a good way to organize potential watershed issues at the outset of the assessment. Table 2 identifies how to determine the regulatory status of fish and water quality conditions in your watershed. Appendix I-A provides more detailed background information on state and federal programs regulating water quality and fisheries. The Refined Land Use Map created during the start-up provides a means of spatially locating potential issues in the watershed. The list of typical issues associated with land uses (Table 3) provides a starting point for identifying the specific issues applicable in the watershed. This table is intended to help identify the typical major concerns with the land use related to fish habitat and water quality. The list is used to initiate discussion within the assessment team and the watershed council, and to focus the objectives and scope of the watershed assessment.

There are significant distinctions between the type of alteration for the same issue listed in the table resulting from different land uses. For example, most land use activities have the potential to alter basin hydrology with resulting effects on aquatic resources. In forestry, the primary consideration is with the potential for increase in peak flows due to rain-on-snow events and the alteration of runoff patterns associated with the road network. In crop-land and range-land areas, activities can reduce infiltration of runoff into the soil, increasing high flows and reducing summer baseflows. These distinctions will be addressed in the Hydrology and Water Use Assessment component. At this point in the process it is merely necessary to flag the issue of "flow alteration."

The project manager should initially identify the regulatory issues and the potential issues related to land management. Then during the community coordination phase of the start-up, the project manager should plan a meeting involving watershed council members and property owners in the watershed to discuss the list of potential issues and identify any other issues. The project manager

can then complete Form SU-1: Issues Identification form. Table 4 provides an example of a completed Issues Identification form.

The completed Issues Identification form is used to base discussions between the assessment team and the water council regarding approaches for addressing potential issues in the watershed. As illustrated in Table 4, conditions that warrant a regulatory status in Item 1 may conflict with landowner perceptions or local information (i.e., temperature). The information compiled in Items 1 to 3 is used for Item 4, identifying the relevance to the watershed assessment process. For example, a detailed temperature analysis and monitoring are recommended because there is potential conflict over whether temperature is an issue.

Table 2. Identifying regulatory issues in your watershed.

Regulatory Program	**How to Determine Watershed Status**
Federal and state endangered species	The Oregon Natural Heritage Program (ONHP) provides standard data on endangered species and communities. This listing includes all species with state and/or federal listing status. To request data, write or fax to the address or number below, stating your data needs. Include the following information: Name, address, and phone number of user or organization Type of data needed Specific locations of data needed, if appropriate Explanation of how the information will be used Fees are charged to cover the cost of providing data services. The minimum charge is $30. Charges are based at the rate of $50 per hour of staff time required, plus a $0.50 per record printout fee, and a $20 computer access fee. A fee estimate can be given prior to initiating a search. Send data requests to: Oregon Natural Heritage Program 821 SE 14th Avenue Portland, OR 97214-2531 (503) 731-3070 ext. 335 or 338; fax (503) 230-9639 The ONHP publication *Rare, Threatened and Endangered Plants and Animals of Oregon* (March 1998, 92 pp.) has tables listing the status of species of concern in the state by counties. This listing will be adequate for an initial identification of key species. The principal tables from this document are available online at: http://www.heritage.tnc.org/nhp/us/or/index.html#publications
303(d) water quality listings	Information on beneficial uses, water quality criteria, and 303(d) listings are available on the Oregon Department of Environmental Quality (ODEQ) Internet site or by contacting the local office of ODEQ. The information can be obtained by following the hypertext links starting with the ODEQ Internet home page. ODEQ Home page: http://www.DEQ.state.or.us Web links: DEQ Home Page ⇒ Water Quality Program ⇒ 303(d) List *Section 303(d) List:* This list shows parameters, the basis, and supporting data. Query the list for the specific stream segments and download this information. *More 303(d) Information (optional):* The 303(d) List site contains additional information about water quality limited streams and TMDLs, including information on listing criteria, TMDL schedules, priorities, 303(d) database, fact sheets, guidance, and examples of TMDLs. **Phone Numbers** (800) 452-4011 ODEQ Public Information (503) 229-5279 Water Quality Division

Table 3. Typical issues organized by major land use activity.

Land Use Category	Habitat-Related Issues	Water Quality Issues
Forestry	Channel modification Pool quantity and quality Large wood abundance Shade and canopy Substrate quality Flow alteration Passage barriers	Temperature Turbidity Fine sediments Pesticides and herbicides
Crop-land grazing	Channel modification Pool quantity and quality Large wood abundance Shade and canopy Substrate quality Flow alteration	Temperature Dissolved oxygen Turbidity Fine sediments Suspended sediments Nutrients, bacteria Pesticides and herbicides
Feedlots and dairies	Channel modification	Suspended Sediments Nutrients Bacteria
Urban areas	Flow alteration Channel modification Pool quantity and quality Large wood abundance Shade and canopy Substrate quality Passage barriers	Temperature Dissolved oxygen Turbidity Suspended sediments Fine sediments Nutrients Organic and inorganic toxics
Mining	Channel modification Pool quantity and quality Substrate quality	Turbidity Suspended sediments Fine sediments Heavy metals
Dams and irrigation works	Flow alteration Channel modification Pool quantity and quality Substrate quality Passage barriers	Temperature Dissolved oxygen Fine sediments
Road networks	Flow alteration Channel modification Pool quantity and quality Substrate quality Passage barriers	Turbidity Suspended sediments Fine sediments

Table 4. Example of a completed Issues Identification Form (Form SU-1).

Location—Oregon Coast Watershed	
1. Identify aquatic resource issues based on state and federal laws.	Endangered Species Act Coho salmon – threatened Steelhead trout – candidate Chum salmon – state sensitive listing
	Clean Water Act – 303 (d) List Habitat modification Sediment Temperature – summer
2. Identify potential issues related to land management.	Land Use Designation 95 % – Forest lands 05 % – Mixed agriculture and rural residential
	Potential Issues Channel modification Pool quantity and quality Large wood frequency and recruitment potential Shade and canopy Substrate quality Flow alteration
3. Check these potential issues with the watershed council and local community.	Example Outcomes • Abandoned mines in headwaters. • Watershed assessment on federal lands indicated temperature violations. • Landowners believe that temperature is not a problem. • Landslides have frequently closed the county road at the bottom of the drainage.
4. Revise list of issues and identify relevance to watershed assessment process.	Focus Issues • Coho juveniles require habitat with deep pools and overhead cover supplied by large woody debris (LWD). • Investigate LWD potential and existing shade. • Since temperature may be an issue, plan on detailed analysis of continuous records (7-day averages); potential for summer monitoring. • Look for records on heavy metals. • Screen for forest harvest effects on peak flows. • Investigate landslides along lower road. Recruit agency specialist or hire technical consultant.

REFERENCES

Dunne, T. and L.B. Leopold. 1978. Water and Environmental Planning. W.H. Freeman and Co., New York.

Roth, E., R. Olsen, P. Snow, and R. Sumner. 1996. Oregon Freshwater Assessment Methodology. Second edition. Oregon Division of State Lands, Salem.

GLOSSARY

ecoregion: Land areas with fairly similar geology, flora and fauna, and landscape characteristics that reflect a certain ecosystem type.

Geographic Information System (GIS): A computer system designed for storage, manipulation, and presentation of geographical information such as topography, elevation, geology, etc.

Hydrologic Unit Codes (HUCs): US Geological Survey designations that correspond to specific watersheds, and are expressed in a hierarchical scale.

orthophoto: A combined aerial photograph and planimetric (no indications of contour) map without image displacements and distortions.

planimeter: An instrument for measuring the area of a plane (2-dimensional) figure by tracing its boundary line.

stereo aerial photo: Pairs of photos taken from the air that can be viewed through a stereoscope to reveal three-dimensional features of the landscape.

Appendix I-A
Background on State and Federal Regulatory Issues

APPENDIX I-A: BACKGROUND ON STATE AND FEDERAL REGULATORY ISSUES

The Oregon watershed assessment is targeted at "aquatic resource issues." Fish and water quality are the primary drivers for watershed assessment and restoration in Oregon. The assessment process focuses on evaluating watershed processes that influence the ability of the watershed to produce clean water and support fish populations. This appendix summarizes the regulatory policies that direct aquatic resource protection at the state and federal level. Numerous other laws regulate land management activities, such as the National Environmental Policy Act or local planning and zoning regulations, which are not discussed here. These other laws will influence what restoration actions can be taken and how they are conducted.

Fisheries

Federal Endangered Species Act

The Endangered Species Act (ESA) of 1973 provides for listing of native animal and plant species as endangered and provided means for their protection.[1] The US Fish and Wildlife Service (USFWS; responsible for inland fish, wildlife, and plants) and the National Marine Fisheries Service (NMFS; responsible for marine and anadromous fish and marine mammals) are the designated federal agencies responsible for administering the law. The key components of the ESA include the following:

1. Defining categories of "endangered" and "threatened," and listing populations.

2. Requiring all federal agencies to undertake programs for the conservation of endangered and threatened species.

3. Prohibiting these agencies from authorizing, funding, or carrying out any action that would jeopardize a listed species or destroy or modify its "critical habitat."

Before proceeding on any action that may affect endangered species, federal agencies must "consult" with the NMFS or USFWS. Consultation is a formal process that evaluates the effects of the action and determines if the activity needs to be modified to reduce the potential effect on the organism. In addition, the ESA applies broad "taking" prohibitions to all threatened or endangered animal species. In Oregon, there are 25 species of fish, 8 species of birds, 5 species of mammals, and 14 species of plants listed or proposed for listing under the ESA at the time of this writing.

Oregon State Endangered Species Programs

The Oregon Endangered Species Act of 1987 (ORS 496.172) gave the Oregon Department of Agriculture (ODA) responsibility and jurisdiction over threatened and endangered plants. The Oregon Department of Fish and Wildlife (ODFW) has responsibility for threatened and endangered fish and wildlife. Both of these agencies have entered into cooperative (Section 6) agreements with the USFWS to continue research and conservation programs for animal and plant species under the

[1] The ESA defines endangered as any species (except insects) "in danger of extinction throughout all or a significant portion of it range," and as threatened any likely to become endangered "within the foreseeable future throughout all or a significant portion of its range."

federal ESA. The Oregon Natural Heritage Program (ONHP) has a similar agreement with the USFWS for invertebrates.

The ODFW maintains a list of threatened and endangered species; currently 35 species of fish and wildlife are on the list. The Oregon act requires state agencies to develop programs for the management and protection of endangered species, and requires agencies to comply with guidelines adopted by the Oregon Fish and Wildlife Commission for threatened species. The Oregon Fish and Wildlife Commission has provided criteria for listing and delisting species, and for protecting listed species.

The Oregon Fish and Wildlife Commission has also adopted a rule requiring the department to develop and maintain a state list of sensitive species for vertebrates. Sensitive species constitute naturally reproducing native vertebrates that are likely to become threatened or endangered throughout all or a significant portion of their range in Oregon. The sensitive species list, which is divided into four categories (see sidebar), is for the express purpose of encouraging actions that will prevent further decline in species' populations and/or habitats, thus avoiding the need for listing.

OREGON STATE SENSITIVE SPECIES CATEGORIES

Critical (SC)—Species for which listing as threatened or endangered is pending; or those for which listing as threatened or endangered may be appropriate if immediate conservation actions are not taken.

Vulnerable (SV)—Species for which listing as threatened or endangered is not believed to be imminent and can be avoided through continued or expanded use of adequate protective measures and monitoring.

Peripheral or Naturally Rare (SP)—Peripheral species are those whose Oregon populations are on the edge of their range. Naturally rare species are those which had low population numbers historically in Oregon because of naturally limiting factors. Maintaining the status quo for the habitats and populations of these species is a minimum requirement.

Undetermined Status (SU)—Animals in this category are species for which status is unclear. They may be susceptible to population decline of sufficient magnitude that they could qualify for endangered, threatened, critical, or vulnerable status, but scientific study will be required before a judgement can be made.

Water Quality Laws and Programs

Federal Clean Water Act

The 1972 Federal Clean Water Act (CWA) as amended gives the state responsibility for setting water quality standards and developing water quality management programs which ensure that the goals of the CWA are met. Recent judicial actions have focused attention on listing of impaired waters under Section 303(d) of the CWA. States in the Pacific Northwest, including Oregon, have significantly increased the number of stream segments that are designated as water quality limited under the provisions of the act. Listing of the stream segment as water quality limited requires the state to prepare a Total Maximum Daily Load (TMDLs) plan or a water quality management plan that will function as a TMDL plan for nonpoint sources (e.g., forestry, agriculture, grazing, and untreated urban stormwater runoff). Information collected during a watershed assessment can be used to assist the state in evaluating the status for listing and in developing the management plans required under the act. In addition, Section 404 of this law regulates the discharge of fill material into wetlands and other "Waters of the United States."

Oregon Department of Environmental Quality

In Oregon, the Department of Environmental Quality (ODEQ) has the responsibility for developing standards that protect beneficial uses such as drinking water, cold-water fisheries, salmonid spawning, industrial water supply, recreation, and agriculture. The state must monitor water quality and review available data and information to determine if the standards are being met. Section 303(d) of the CWA requires the state to develop a list of waterbodies that do not meet standards, and to submit an updated list to the US Environmental Protection Agency (EPA) every 2 years. The list provides a way for Oregonians to identify problems and develop and implement watershed recovery plans to protect beneficial uses while achieving federal and state water quality standards. There are 1,067 streams and rivers, 32 lakes, and 1,168 stream segments on the 1998 303(d) list, which covers 13,892 miles of streams in Oregon.

The 303(d) list is a useful source for identifying water quality issues that are important in the watershed. The list identifies the parameter, the basis for the listing, and information that supported the listing. The watershed assessment can be useful in part to evaluate the basis for listing, evaluate the adequacy of supporting data, and establish a monitoring plan to fill data gaps. The programs described below and in the sidebars on pages 5 and 6 have been developed to provide solutions to these issues.

Relationship of Watershed Assessment to TMDL Requirements

Watershed assessment can be an important tool in completing the planning and assessment elements for TMDL plans required under the CWA. State agencies have developed watershed management plans to respond to these requirements for nonpoint source watersheds. Several of these initiatives led to watershed planning documents which have similar names, but may differ in their content and standing in fulfilling the requirements of the CWA. It is useful to review the intended purpose of these programs, then identify the potential role that watershed assessment can play in resolving these issues.

Section 303(d) Requirements

Section 303(d) of the 1972 federal CWA requires states to develop a list of waterbodies that cannot meet water quality standards without application of additional pollution controls. These waters are referred to as "water quality limited" and must be periodically identified in each state. In Oregon, this responsibility rests with the ODEQ. Water quality limited waters requiring the application of a TMDL plan are identified in the 303(d) list. This list, developed by the ODEQ, is subject to public review and must be approved by EPA.

The 303(d) list is really a subset of the larger list of water quality limited waters. These waters are defined **not** by whether they meet the standards, but by whether treatments above and beyond "best available technology" and normally applied "best management practices" are required to protect beneficial uses. In other words, a waterbody will retain its water quality limited status so long as the attainment of water quality standards requires a heightened level of treatment or watershed management, even if standards are currently being met or a TMDL plan is being implemented. Those waters that (1) don't meet standards and (2) haven't yet received TMDL plans or equivalents are placed on the 303(d) list. The other water quality limited waterbodies will still be identified in ODEQ's regular Water Quality Status Assessment (305[b]) report.

A full TMDL development process determines the pollutants causing water quality impairments, identifies maximum permissible loading capacities for the waterbody in question, and then, for each relevant pollutant, assigns load allocations to each of the different sources, point (e.g., sewage treatment plants, industrial facilities) and nonpoint, in the watershed. Different TMDL development processes will be used in different situations depending on the types of sources involved. More complex and lengthy processes are required where the contributions of both point sources and nonpoint sources make the situation complex. Where only nonpoint sources are involved, the TMDL development process will generally be less complex, although a thorough understanding of the watershed and its water quality are necessary in either case.

Water Quality Management Area Plans

In 1993, the state legislature approved Senate Bill (SB) 1010, which requires the Oregon Department of Agriculture (ODA) to help reduce water pollution from agricultural sources and improve overall watershed conditions in various areas throughout the state. SB 1010 directs ODA to work with farmers and ranchers to develop overall agricultural water quality management area plans for watersheds that are required by state or federal law to have such plans in place.

Landowners who conduct agricultural activities within areas delineated by ODA where an agricultural water quality management area plan is in place are required to perform activities in conformance with the plan. The goal of a plan is to improve the overall health of the watershed; specific practices will not be prescribed to landowners as long as the goal is being met. However, landowners contributing to water quality problems who do not take voluntary steps to address problems may be subject to specific compliance orders and/or enforcement action. Other regulatory and nonregulatory programs are explained in the following sidebars.

OTHER WATER QUALITY PROGRAMS

Comprehensive Land Use Plans

These plans, required for all areas of Oregon by state law, address the protection and management of a number of natural resource values, including water resources. Developed by cities and counties in accordance with statewide goals and guidelines, these plans are based on detailed inventories and are implemented through enforceable local ordinances which govern the location and execution of many land use and land management activities. Under these plans, local governments must develop storm water treatment plans.

Oregon Forest Practices Act (FPA)

The forestry practices resulting from this program have been conditionally approved by EPA as the "best management practices" (BMPs) for water quality protection on state and private forest lands within the boundary of the Coastal Nonpoint Source Control Program. Water quality protections in federal forest practices must meet or exceed the effectiveness of the FPA practices. The Oregon Department of Forestry has already served as the lead agency for TMDL development on state and private forest lands in several basins.

Public Land Management Plans

Between them, the US Forest Service and Bureau of Land Management manage over 50% of Oregon's land area, and federal lands in national parks, federal wildlife refuges, and military reservations are another 5% or 6%. These federal lands are a large majority of the area in many rural watersheds. Federal laws require detailed management plans for these lands, and the law also requires that the plans be consistent with the Clean Water Act and with state environmental protection programs.

NONREGULATORY STATE FISHERIES AND WATERSHED PLANS

Oregon Plan for Salmon and Watersheds (Oregon Plan)

The Oregon Plan originated in 1995 as an effort to address declining populations of coastal coho salmon. The plan has been expanded to include nonlisted coho populations and declining steelhead populations. The goal of the plan is to restore fish populations to productive and sustainable levels that will provide environmental, cultural, and economic benefits. While the Plan focuses on the needs of salmon, it is designed to conserve and restore crucial elements of natural systems that support fish, wildlife, and people. The Oregon Plan relies on four fundamental approaches to accomplish the goal of securing and protecting healthy fish habitat: (1) community-based action, (2) government coordination, (3) monitoring and accountability, and (4) making improvements over time. Watershed councils play a key role in developing watershed restoration plans and engaging landowners in restoration actions. This watershed assessment guide is being developed as a tool to assist watershed councils in conducting the assessment as a necessary first step to implementing meaningful restoration activities. The Healthy Streams Partnership described below is a component of the Oregon Plan.

Healthy Streams Partnership

The Healthy Streams Partnership was formed in an effort to find cooperative solutions to water quality problems. The partnership is made up of representatives from the agricultural community, forestry, environmental groups, local government and state agencies, and the governor's office. The partnership uses existing regulations under the departments of Agriculture, Forestry and Environmental Quality to address waterbodies that currently do not meet water quality standards. The partnership provides support to state agencies and, at the same time, ensures that landowners and other individuals will have extensive opportunity for input into decisions. Restoring Oregon's waters will meet the requirements of the federal Clean Water Act, settle lawsuits related to the act, and help ensure success of the Oregon Plan for Salmon and Watersheds to restore salmon and steelhead runs.

Governor's Watershed Enhancement Board (GWEB)

By providing grant funds, technical assistance, and information, GWEB supports the work of watershed councils and other parties and is the primary source of state funding for investment in a variety of watershed enhancement projects. GWEB is designed to work closely with the Healthy Streams Partnership and the Oregon Plan for Salmon and Watersheds.

Appendix I-B
Blank Form

Form SU-1: Issue Identification Form

Watershed Name:

Participants in Issue Identification:

1. Identify aquatic resource issues based on state and federal laws.	Endangered Species Act
	Clean Water Act – 303(d) List
2. Identify potential issues related to land management.	Land Use Designations in Watershed
	Potential Issues
3. Check these potential issues with the watershed council and local community.	
4. Revise list of issues and identify relevance to watershed assessment process.	Focus Issues