Appendix C

SANDY BASIN WATER QUALITY RESTORATION PLAN

Bureau of Land Management; Salem District

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Executive Summary

The BLM is a Designated Management Agency (DMA) responsible for protecting and restoring water quality on BLM-administered lands. This WQRP contributes to BLM's responsibility as DMA to meet this requirement. The WQRP is integrated with the BLM Sandy River Basin Integrated Management Plan SRBIMP (2008, EA# OR-080-08-16) and outlines a comprehensive strategy for implementing, monitoring, and evaluating management on BLM lands in the basin to address water quality impairment. The *Forest Service and Bureau of Land Management Protocol for Addressing Clean Water Action Section 303(d) Listed Waters* (Protocol) (USDA, 1999), the ODEQ and BLM MOA (2007), and the 2008 Salem District Resource Management Plan direct CWA compliance on federal lands and guide development of WQRPs for BLM administered lands in Oregon. WQRPs are not BLM decisions that would be subject to a different level of public review and comment pursuant to requirements of the National Environmental Policy Act (NEPA). This WQRP serves as an update to information provided in the 2004 ODEQ WQMP (section 6.7.9) and is intended to be adaptive and modified, as necessary and appropriate, based on new and updated information.

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BACKGROUND SUMMARY

Section 303(d) of the 1972 Federal ***Clean Water Act***, as amended, requires states to develop a list of rivers, streams, and lakes that fail to meet water quality standards without additional controls on point and nonpoint source discharges of pollution or pollutants. These waters are referred to as "water quality limited" and are included on the State's 303(d) list of impaired waters. In Oregon, the Oregon Department of Environmental Quality (DEQ) develops this list for review and approval by the Environmental Protection Agency. The Oregon DEQ updates the list of impaired waters every two years. The 303(d) list includes waters for which Total Maximum Daily Loads (TMDL) must be developed. Those loads define the amount of pollution that can be discharged to a receiving waterbody without violating state water quality standards. The TMDL includes a Water Quality Management Plan that describes a strategy for reducing water pollution to levels which will move toward attainment of water quality standards. These levels or "load allocations" are prescribed in the TMDL and developed for the water body. The Water Quality Management Plan identifies Designated Management Agencies (DMA's) responsible for developing implementation plans. In the case of the Bureau of Land Management (BLM), these plans are referred to as Water Quality Restoration Plans (WQRPs). In March, 2005 the Oregon DEQ issued the Sandy River Basin TMDL as an order (OAR 340-042-0050). In December 2008, ODEQ notified the BLM of the agency's responsibility as a designated management agency to develop a Water Quality Restoration Plan for the BLM lands in the Sandy River Basin.

This Water Quality Restoration Plan is the "implementation plan" covering lands in the Sandy River Basin administered by the Salem District BLM. This basin-wide plan includes individual chapters for each watershed where BLM has jurisdiction over federal lands. The plan chapters are formatted similarly to the BLM Willamette Basin WQRP (2008) and incorporate by reference, pertinent information from that document. This Water Quality Restoration Plan fulfils the responsibility outlined in the BLM and Oregon DEQ Memorandum of Agreement signed July 10, 2003 which acknowledges BLM's overall direction to protect, restore and maintain water quality on BLM land so that Federal and State water quality standards are met or exceeded and support beneficial uses, in accordance with applicable laws and regulations. This Water Quality Restoration Plan addresses the Memorandum of Agreement responsibility to develop water quality restoration plans for BLM administered lands in coordination with Oregon DEQ (page 3, item 8).

WATER QUALITY RESTORATION PLAN OVERVIEW

OAR 340-042-0080(3)(a) provides specific guidance on the required components of a DMA implementation plan. OAR 340-042-0080(3)(a)(E) defers to any additional requirements that are included in the TMDL WQMP. Below is a listing of the requirements both in the OAR and those identified in the Sandy River WQMP. The formative components are provided in bold for comparison as some of these requirements overlap or have different references but similar meaning. The BLM also adheres to the USFS/ BLM Protocol for Addressing Clean Water Act Section 303(d) Listed Waters (1999) which documents the minimum requirements for a TMDL WQMP.

OAR 340-042-0080(3)(a) section requirements:

(A) Identify the **management strategies** which will be used to achieve load allocations and reduce pollutant loading.
(B) Provide a **timeline** for implementing management strategies and a **schedule** for completing measurable **milestones**.
(C) Provide for performance **monitoring** with a plan for periodic **review and revision** of the implementation plan.
(D) Provide evidence of **compliance** with applicable statewide land use requirements.
(E) Provide any other analysis or **information specified in the WQMP**.

In the Sandy River Basin WQMP, ODEQ specifies the DMA's to fulfill the following objectives (Section 6.3 page 125, ODEQ 2005):

- Develop **Best Management Practices (BMPs)** or other management methods to achieve load allocations and waste load allocations
- Give **reasonable assurance** that management measures will **meet load allocations**; through both quantitative and qualitative analysis of management measures.
- Adhere to measurable **milestones** for progress
- Develop a **timeline** for implementation, with reference to **costs and funding**
- Develop a **monitoring plan** to determine if:
  a. BMPs are being implemented
  b. BMPs are effective
  c. Load and waste load allocations are being met
  d. Water quality standards are being met

In the Sandy River Basin WQMP, ODEQ expects the DMA specific water quality implementation plans must address the following items (Section 6.7.4 page 135, ODEQ 2005):

1) Proposed management **measures tied to attainment of the load allocations** and/or established surrogates of the TMDLs, such as vegetative system potential or percent reductions.
2) **Timeline** for implementation.
3) Timeline for attainment of load allocations.
4) Identification of **responsible participants** demonstrating who is responsible for implementing the various measures.
5) **Reasonable assurance** of implementation.
6) **Monitoring** and evaluation, including identification of participants responsible for implementation of monitoring, and a plan and schedule for revision of implementation plan.
7) **Public involvement**.
8) **Maintenance** effort over time.
9) Discussion of **cost and funding**.
10) Citation of **legal authority** under which the implementation will be conducted.

In the Sandy River Basin WQMP, ODEQ specifies the Federal Forest DMA's responsibility (Section 6.7.8 144, ODEQ 2005):

All management activities on federal lands managed by the U.S. Forest Service (USFS) and the Bureau of Land Management must follow standards and guidelines as listed in the respective Land Use and Management Plans, as amended, for the specific land management units. In its review of these management plans, ODEQ stated that they met the requirements of a TMDL management as they contained management measures tied to attaining system potential shade.

In review of the OAR and WQMP direction, the BLM proposes to address the formative requirements in the following sections:

- **Best Management Practices**
- **Monitoring , Evaluation and Adaptive Management**
- **Public Involvement**
- **Reasonable Assurance**
- **Responsible Parties**
- **General Costs and Funding**
- **General Timeline for Implementation**
- **Citation to Legal Authority**

Requirements specific to each watershed chapter in this document include:

- **Condition Assessment including Timelines for Recovery**
- **Goals and Objectives**
- **Proposed Management Measures**

A summary of these requirements are provided in the comprehensive implementation strategy for the Sandy River Basin Integrated Management Plan (2009).

Best Management Practices

The District Resource Management Plan includes Best Management Practices that are important for preventing and controlling nonpoint source pollution to the "maximum extent practicable" (USDI 1995:149-177). Best management practices are the primary mechanism for meeting TMDL targets in each watershed of the Sandy River Basin. These practices are developed on a site-specific basis and presented for public review and comment during the BLM's planning process that is conducted pursuant to the National Environmental Policy Act. The National Environmental Policy Act process is a federal requirement necessitating public disclosure of the affects of actions proposed for federal lands.

As of the date of this Water Quality Restoration Plan, the BLM has just completed a revision of the resource management plan for the Salem District. As in the former RMP (1995, NWFP), the 2008 RMP recognizes protection and careful management of riparian areas as a foundational water quality best management practice. The revised management plan incorporates results and observations of BMP implementation over 10 years including updated best management practices in the design of Riparian Management Areas.[1] The revised Resource Management Plan (2008) includes riparian management that involves the implementation of the principles of shade retention for primary and secondary shade zones described in the TMDL Strategy (USDA – USDI, 2006).

Specific best management practices for water temperature, sediment, recreation and restoration are included in appendix C of the Salem District RMP (2008) and in Appendix 1 of the BLM Willamette Basin WQRP. These practices will be applied to all BLM lands in the Sandy River basin addressed by this Water Quality Restoration Plan.

Monitoring, Evaluation, and Adaptive Management

Monitoring, project evaluation and adjustment of best management practices will constitute the BLM process for updating the Sandy River Basin water quality restoration plan. The Districts will report on the results of this performance monitoring (OAR 340-042-0030 (7) on an annual basis as per the Memorandum of Agreement. This report, "BLM Water Quality Restoration Plan Annual Summary", will include monitoring results, projects completed, and best management practices modification or adjustments. As this reporting coincides with periodic Resource Management Plan monitoring summaries, the information will be included therein.

Implementation monitoring will be conducted in conjunction with Resource Management Plan monitoring. Information specific to completed restoration projects will be included along with erosion control and shade retention best management practices review. At a minimum, shade monitoring would include a review of riparian management area width, primary shade zone retention and canopy retention in the secondary shade zone.

Effectiveness monitoring will be conducted according to direction in the TMDL WQMP. At a minimum, effective shade will be sampled before and after project implementation on one channel or riparian restoration project in the basin. The West Creek long term water temperature effectiveness site will continue on an annual basis.

Restoration actions to benefit aquatic species and habitat will be entered into the Interagency Restoration Database (IRDA). This database was developed by the Forest Service and BLM to track all restoration accomplishments by federal agencies in western Oregon. This information is available via the internet (www.reo.gov). The database accommodates consistent reporting and accounting of federal restoration actions and provides a mechanism for

[1] Riparian Management Area is a zone adjacent to the stream channel where riparian best management practices are applied.

reporting on federal monitoring and restoration commitments. The IRDA includes information on in-stream structure, passage features, riparian treatments, road decommissioning and wetland treatments.

This Water Quality Restoration Plan is intended to be adaptive. Sampling methods, timing, frequency, and location will be refined as appropriate based on lessons learned, new information and techniques, and data analysis. As new site specific information indicates the potential for water quality restoration projects in the Plan area, these potential locations will be included in the annual update. As new Resource Management Plans are adopted, the narrative and references in this Water Quality Restoration Plan will be updated. Oregon DEQ reviews TMDL implementation on a five-year cycle. Pursuant to the Memorandum of Agreement between BLM and Oregon DEQ, BLM will participate in this review, providing trends in funding, implementation, and effectiveness of this Water Quality Restoration Plan. This approach ensures a formal mechanism for BLM to communicate with Oregon DEQ and exchange information regarding the effectiveness of TMDL implementation and attainment of water quality standards.

Public Involvement

The Federal Land Policy Management Act and the National Environmental Policy Act require public involvement in activities proposed on federal lands. Pursuant to these laws, the Salem District Resource Management Planning process includes public involvement. Many of the elements contained in this water quality restoration plan were derived from the Salem District RMP and were subject to this public review and comment. More specifically, the public provided comment to the Sandy River Basin Integrated Management Plan (SRBIMP, August 2008) EA# OR080-08-16 which outlined restoration and rehabilitation approaches and defines general management strategies of BLM administered lands for the next 15 years. The comprehensive plan which implements the selected alternative from the SRBIMP has been developed in concert with this WQRP. As a stand-alone document, the Sandy Water Quality Restoration Plan will not be distributed for public review or comment, unless the review is conducted as a function of an Oregon DEQ or Environmental Protection Agency's administrative proceeding.

Oregon DEQ's approach to TMDL implementation relies on cooperative efforts of all designated management agencies with responsibility for administering portions of an impaired watershed. In support of Oregon DEQ's efforts, the BLM will cooperate with all interested publics including but not limited to other designated management agencies. Problems affecting water quality derive from a number of land management activities, forest management among them. Coordination and partnering with other entities is critical to successful watershed protection and restoration. While partnerships with private, local, and state entities will be pursued as one element of water quality restoration plan implementation, the time devoted to public involvement and collaborative efforts outside of BLM's administrative purview will be limited based on available staff time and resources.

The BLM Sandy River Basin WQRP is provided to the Oregon DEQ for incorporation into subsequent revisions of the Sandy River Basin WQMP which will be updated and submitted by Oregon DEQ for public review and comment.

Reasonable Assurance

At the present time the BLM and ODEQ are updating their Memorandum of Agreement (2007) between the two agencies. The new MOA will continue BLM's role as a designated management agency responsible for preparing water quality restoration plans following the framework provided in the Forest Service and BLM protocol (1999) for waters included on the State's 303(d) list of impaired waters. This WQRP, the USFS and BLM protocol (1999) and the Salem District RMP (2008) provides the primary methods for BLM to communicate agency goals for water quality protection and restoration to Oregon DEQ. In developing the Riparian Management Direction in the 2008 RMP, the BLM incorporated the shade protection principles found in the TMDL Strategy (2005). This strategy was conditionally accepted by ODEQ in October 2005 as the basis for management of stream adjacent shade. The conditional approval provided that, as long as primary and secondary shade zone conditions were met, a set of shade nomographs (curves) could be used as the basis for concluding whether stream adjacent shade would meet targets specified by Oregon DEQ in a TMDL. The 2008 RMP provides retention of stream adjacent shade in the primary and secondary shade zones according to conditions of the Strategy. The Sandy River Basin WQRP provides

watershed scale analysis of current and future condition based on the TMDL shade curves as applied through the Rapid Stream Assessment Model[2].

The 2008 Resource Management Plan recognizes BLM's responsibilities as a designated management agency pursuant to the Clean Water Act which necessitates actions to achieve targets or surrogates established in TMDLs developed for impaired waters. The plan provides for retention of stream adjacent shade in the primary and secondary shade zone which along with BMP's controlling erosion should promote restoration of water quality as well as channel and riparian functioning condition. The 2008 RMP and upcoming Memorandum of Agreement with Oregon DEQ will provide assurance that water quality protection and restoration on lands administered by the BLM should progress toward attainment of standards.

Project planning and implementation requires analysis of system potential at the project scale. This analysis will include application of appropriate shade curves and target percent effective shade derived from the TMDL and in accordance with project-specific geomorphic relationships, natural conditions and existing disturbance regimes. The BLM will continue to notify Oregon DEQ and provide the opportunity to comment on all actions proposed for the planning area (e.g. Water Quality Restoration Plan area). Notification will be accomplished through the Quarterly District Planning Project Update, newsletters and formal notification of project environmental assessments. Restoration work on federal lands will be accomplished to improve water quality as quickly as possible by addressing the highest existing and at-risk management-related contributors to exceedance of water quality standards. When limited restoration funds are available, the emphasis will be placed on projects that accommodate water quality priorities while providing for other priority beneficial use needs, such as aquatic habit enhancement.

Responsible Parties

The BLM is a designated management agency responsible for implementing the Clean Water Act on BLM-administered lands in the Sandy River Basin. The BLM and Oregon DEQ Memorandum of Agreement defines the process by which the BLM will cooperate to meet the agency's responsibility pursuant to the Clean Water Act and identifies the BLM State Office Deputy for Resource Planning, Use, and Protection and the Oregon DEQ Water Quality Administrator and her designees as the primary administrators of this agreement.

The Cascade Resource Area field manager is responsible for water quality restoration plan implementation, review, and modification in Sandy River Basin area. The field manager will ensure coordination and consistency in plan implementation, monitoring, priority review, and revision as part of the SRBIMP (2008). These responsibilities can be influenced by funding and staffing constraints.

General Costs and Funding

The cost of restoration varies relative to project design, permitting, access, and the extent of the project footprint. Channel restoration, riparian silvicultural treatments and road crossing improvement are generally covered by base funding or appropriated funds above district base funding. Specific costs for individual restoration projects are provided in the specific watershed sections. The cost and funding of monitoring is only included in base funds. Collectively, the need for monitoring is increasing as the responsibility for monitoring under this plan will be combined with the 2008 Willamette Basin WQRP monitoring. Monitoring costs include Best Management Practices implementation monitoring, shade retention assessments, long term temperature monitoring, database entry, data analysis, and annual report preparation. The total annual monitoring cost for this WQRP including labor and equipment is estimated at $3000.

The development of this water quality restoration plan and restoration project planning and design is funded annually through District base funds or through one-time increases to the District budget that are directed from the BLM Oregon State Office and derived from discretionary program funds. The BLM riparian and soil, water, and air program has access to Clean Water and Watershed Restoration funds that can be applied to Water Quality Restoration Plan project implementation. In support of Clean Water and Watershed Restoration goals, the District is directed to coordinate actions funded by the riparian, fisheries, and soil, water, and air programs. Funds are directed to conserve and restore riparian and aquatic resources and specifically to improve water quality. Funding for these

[2] Rapid Stream Assessment Model (Park and Hawkins, 2007) is a stream network model developed to complete an "effective shade" assessment on a 5th field level and identify potential restoration sites.

projects varies on an annual basis according to Washington Office and State Director priorities. In Oregon, water quality protection and restoration are included among the State Director priorities.

In the past, the Secure Rural Schools and Community Self-Determination Act of 2000 (Public Law 106-393) funded a number of restoration projects. Title 2 funds (as these are referred to) provided a significant and reliable source of funding for restoration of federal lands. Projects funded by the Title 2 program are reviewed and approved by Resource Advisory Committees to determine whether they meet certain criteria. At least 50% of the project funds must be used for road maintenance, decommissioning, or obliteration; or restoration of streams and watersheds. Title 2 funds vary based on payments to counties derived from timber receipts.

It is important to note that many of the activities proposed in this Water Quality Restoration Plan include Best Management Practice implementation during timber harvest, silvicultural treatment, fuels management, and other surface disturbing activities. Best Management Practice implementation is not dependent on restoration or other discretionary funds. Every attempt will be made to secure funds for restoration; however, it must be recognized that the federal agency budgets are subject to political and economic realities that often dictate the level and degree to which restoration can be pursued. Federal agencies are further limited in the ability to allocate funding for monitoring and restoration activities beyond the current fiscal year. Historically, restoration has been funded at a fraction of what has been projected to be necessary to accomplish more comprehensive restoration objectives. Thus it is often necessary to scale back and re-consider restoration priorities, some which would be incorporated in this Water Quality Restoration Plan.

The District's annual work plan and budget process will involve consideration of water quality restoration plan implementation including active restoration and monitoring. BLM will take advantage of opportunities for pursuing objectives of the Water Quality Restoration Plan through partnerships and collaboration. To that end, the BLM will work with Oregon DEQ and other designated management agencies to develop projects and a monitoring schedule. Technical teams consisting of state and federal agencies, academia, non-profit organizations, and watershed councils are convening to develop comprehensive and strategic approaches to Sandy Basin TMDL implementation. As budgets and staffing allow, BLM will participate in these technical teams and participate in opportunities for cost sharing restoration and monitoring projects. District input will focus on BLM priorities for water quality restoration but target the highest and best use for limited funds across the water quality restoration plan area.

General Time Line for Implementation and Recovery

Riparian protection BMPs have been included in BLM project actions since the original Timber Management EIS (1975), Management Framework Plans (1983), 1995 RMP / Northwest Forest Plan and continue under the 2008 Salem District RMP. Passive restoration of riparian shade from tree and understory growth continues to develop in stream adjacent buffers retained during the last 30 years. Since 1994, active restoration of watersheds has followed as a function of and in relation to watershed analysis, fish habitat assessment, timber harvest activities, and watershed council partnerships to name just a few. This water quality restoration plan identifies restoration projects anticipated to benefit water quality, in order to guide budget and project development timelines and priorities. The timing for implementation of active restoration projects would depend on funding, coincident with state and national priorities.

Water quality degradation is resultant of a number of factors including legacy conditions that have had cumulative effects over a prolonged period. Natural recovery and restoration, likewise, will occur over decades. Implementation will continue until the restoration goals, objectives, and management measures are achieved. While active restoration may result in immediate, site specific improvement to water quality or instream habitat conditions, recovery at the watershed scale is more likely to be measured or observed over the long term. Depending on factors such as the occurrence of major floods, designated management agency involvement in achieving TMDL targets, and the effectiveness of restoration, recovery may take decades to achieve.

Recovery of stream temperature is a function of riparian vegetation recovery. Projects implemented in the next five years may not begin to show returns in terms of reduced stream temperature or improved aquatic condition for many years. Full recovery may not occur for many decades in some drastically disturbed areas. These areas are often on the newly acquired BLM lands. Stream temperatures will begin to improve and recover before the riparian areas reach their system potential. The primary opportunity for active restoration is on the newly acquired lands where riparian areas need replanting with system potential species, weed control, competition control, and where channel / wetland areas are functioning at risk. Thinning young age class conifers adjacent to streams (secondary shade zones)

also presents an opportunity to accelerate system potential condition. Thinning is anticipated to release these trees that would grow more quickly, providing persistent long term shade and large wood for channel and floodplain function. These activities are anticipated to accelerate the timeline to reach system potential.

Stream channel and floodplain recovery may take longer to achieve than recovery of stream shade. Where stream conditions are limited for large woody debris, recovery will only occur after large wood is delivered to the stream as a function of blow down, wildfire, or debris flows. Tree growth from young conifers to mature age trees could take upwards of 200 to 250 years. Recovery over this timeframe is anticipated to represent full biological recovery of stream channels in Western Oregon. Temperature recovery and stabilization would be anticipated to occur over a much shorter timeframe.

Citation to Legal Authority

The Endangered Species Act and the Clean Water Act guide public land management, providing for the recovery and preservation of endangered and threatened species and beneficial uses of the nation's lands and waters, respectively. The BLM is required to comply with both laws and the 2008 RMP is the mechanism by which BLM implements actions to support compliance with them. The 2008 RMP provides the overall planning framework and management direction for the development and implementation of this Water Quality Restoration Plan. The 2008 Salem RMP provides for water quality and riparian management and is written to ensure attainment of the Sandy River Basin TMDL targets, protection of designated beneficial uses, and overall compliance with the Clean Water Act.

As stated in the Sandy River basin TMDL, Water Quality Management Plan (March 2005) (page 126 & 127), "The Federal Land Management Agencies" are DMAs for federal lands in the Willamette Basin. In July 2003, both the USFS and the BLM signed memoranda of agreement with ODEQ defining how water quality rules and regulations regarding TMDLs will be met. Future revision of the MOA is expected to continue outlining this responsibility.

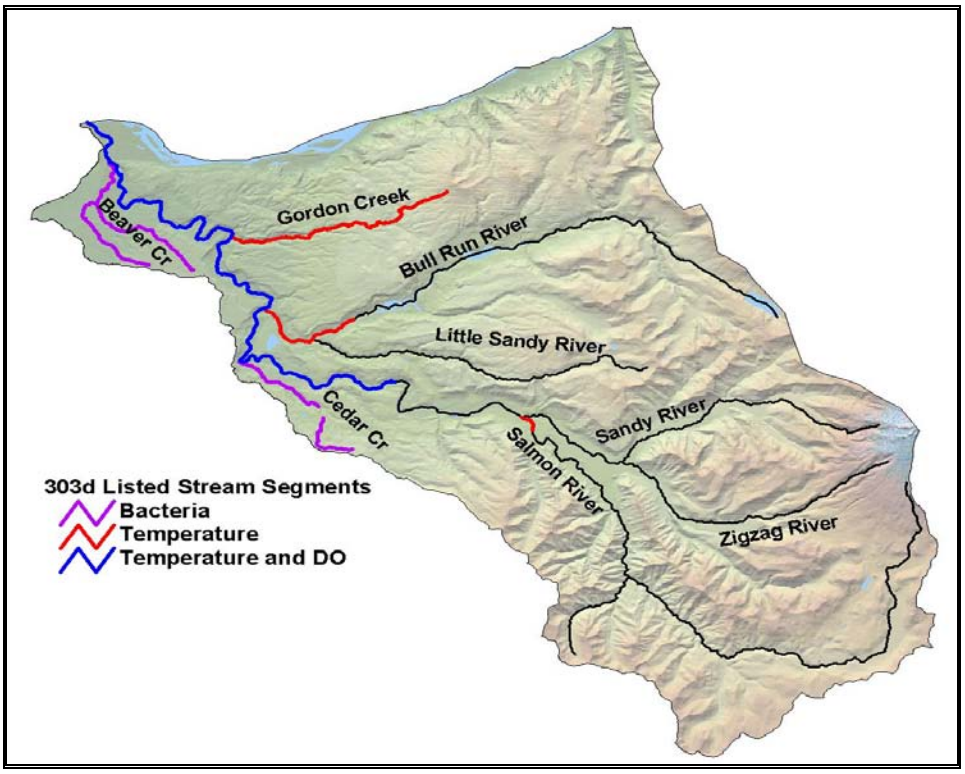
The Oregon DEQ has the primary responsibility for developing TMDLs and companion Water Quality Management Plans for addressing impaired waters in Oregon. As cited earlier, the OAR 340-042-0080(3)(a) and the Sandy Basin Water Quality Management Plan is the basis for this document and outlines BLM's responsibilities.

WATER QUALITY SUMMARY

Reason for Action

Various stream segments in the Sandy Basin (**Map 1.1)** were included on the 2002 State of Oregon's 303(d)[3] list of affected waters which failed to meet water quality standards for temperature, bacteria and dissolved oxygen. In 2004 the Oregon Department of Environmental Quality (ODEQ) developed Total Maximum Daily Loads (TMDLs) for temperature and bacteria in the basin. The ODEQ found the 303d listing for dissolved oxygen was unwarranted and did not establish a TMDL. The temperature and bacteria TMDLs provide a "written, quantitative plan and analysis for attaining and maintaining water quality standards in all seasons for a specific water body and pollutant" (40 CFR 130.2). The temperature TMDL provides a non-point source load allocation (surrogate) of effective shade to each potential vegetation zone in the Sandy River Basin. The bacteria TMDL provides a percent reduction to meet the numeric criteria. This water quality restoration plan (WQRP) describes how the Bureau of Land Management (BLM) will achieve the ODEQ's Sandy Basin load allocation for water temperature and bacteria thus complying with the Clean Water Act (CWA). The WQRP is organized to be consistent with ODEQ's Sandy Basin TMDL and Water Quality Management Plan (WQMP) (ODEQ 2004).

Map 1.1 2002 - 303(d) Listed Stream Segments and Watersheds in the Sandy River Basin



[3] The 303(d) list is a list of stream segments that do not meet water quality criteria.

Water Quality 303(d) Listed Waterbodies

OAR 340-042-0040(4)(a)

The 2002 303(d) listings addressed in the Sandy River Basin TMDL are presented in **Table 1.1**.
The majority of BLM lands in the basin are located in the Lower, Middle and Upper Sandy River, the Gordon Creek tributary and the Salmon River.

Table 1.1 303(d) Listed Stream Segments in the Sandy River Basin with BLM land upstream

Waterbody	Listed Reaches	Parameter	BLM Land Yor N
Sandy River	Mouth to Marmot Dam (RM 30)	Temperature	YES
Salmon River	Mouth to Boulder Cr. (RM 1)	Temperature	YES
Bull Run River	Mouth to Dam #2 (RM 6)	Temperature	NO
Gordon Creek	Mouth to Headwaters (RM 11)	Temperature	YES
Cedar Creek	Mouth to RM 4	Bacteria	YES
Unnamed Tributary to Cedar Creek	Mouth to Headwaters (RM 2)	Bacteria	NO
Beaver Creek	Mouth to Headwaters (RM 5)	Bacteria	NO
Kelly Creek	Mouth to Headwaters (RM 5)	Bacteria	NO

Water Quality 303(d) Parameters Addressed in this WQRP

- ODEQ established a stream temperature TMDL for all perennial streams in the Sandy River Basin. Water temperature is the only parameter addressed with specific allocations for the forestry sector (Table 6.1, ODEQ , 2004). The WQMP lists BLM as one of ten DMA's responsible for the temperature parameter in the Sandy River. Water temperature is addressed in this WQRP through specific effective shade targets and restoration opportunities.

- The criteria exceedance for bacteria in the listed segments of the Sandy River basin have no direct causal link to BLM actions, as there is little to no BLM land adjoining or upstream of these segments. The criteria addresses fecal coliform bacteria which are produced in the guts of warm-blooded vertebrate animals, and indicate the presence of pathogens that cause illness in humans. The sources of the bacteria violations in the basin may include residential septic systems, sewage treatment plants, livestock waste, wildlife waste, pet waste and urban runoff (ODEQ, 2004). Potential sources of fecal coliform bacteria from BLM lands in the basin overall are related to dispersed or intensive recreation and wild animal feces. There is no livestock grazing on BLM lands in the basin. The Oregon Department of Fish and Wildlife (ODFW) is responsible for managing wildlife populations, therefore BLM is not responsible for these sources. The Sandy River Basin Integrated Management Plan (2009) has identified existing and potential development of dispersed and concentrated recreations. The recreation development strategies and best management practices (BMP's) are the primary methods in which the BLM will meet the intent of the bacteria TMDL.

BASIN OVERVIEW

The Sandy River Basin (Hydrologic Unit Code 17080001) drains approximately 508 square miles (330,000 acres) in northwestern Oregon. The Sandy River originates from glaciers on the western slopes of Mt. Hood at an approximate elevation of 6200 feet above sea level and travels 56 miles before flowing into the Columbia River near the City of Troutdale. The Sandy River is the only major glacial river draining the western Cascades in Oregon. Glacially-derived fine particulate matter, known as "glacial flour", gives the Sandy its distinctive milky-grey color during the summer. Major tributaries to the Sandy River include the Zigzag, Salmon, and Bull Run Rivers. The Little Sandy River is the largest tributary to the lower Bull Run River. Political jurisdictions include portions of Multnomah and Clackamas counties and several small, incorporated cities, including Rhododendron, Zigzag and Government Camp. Portions of the cities of Gresham, Troutdale and Sandy also lie within lower portion of the basin.

Approximately 70% of the basin is owned and managed by the U.S. Forest Service (USFS) – Mt Hood National Forest, 22% is in private ownership, **4% is owned and managed by the Bureau of Land Management (BLM) approximately 14,850 acres**, 2% is owned by City of Portland and the remainder owned by State, local government or Portland General Electric (PGE). 19.5% is designated as Wilderness.

The Sandy River Basin Implementation Plan (2009), the revised Sandy Watershed Analysis (2007) and the Upper Sandy River Watershed Analysis (1996) provide a comprehensive description of the ecological structures, functions, processes and interactions within the Sandy River watershed. Refer to these documents for an in-depth description of flow regimes, geology, soils and vegetation that can contribute to overall water quality conditions in the basin. This WQRP will highlight those characteristics of BLM land that relate specifically to the TMDL.

The Sandy is home to 19 native and 14 introduced fish species (PGE 1998). The following fish species are listed by NOAA Fisheries: Chinook salmon (Threatened), Steelhead trout (Threatened) and Coho salmon (Candidate species) and occur in rivers and streams draining BLM lands.

Three river segments within the basin were given various National Wild and Scenic River designations by Congress in 1988 and are managed by the BLM:

1. Sandy River from Dodge Park (RM 18.5) to Dabney State Park (RM 6).
2. Sandy River from the headwaters to the National Forest boundary (12.5 miles).
3. Salmon River from the headwaters to the confluence with the Sandy River (33.5 miles).

The Bull Run watershed represents approximately 25% of the Sandy Basin (90,000 acres). Much of it is in the Bull Run Reserve, which was created by presidential proclamation in 1892 to protect Portland's Water Supply. The Bull Run supply consists of two storage reservoirs (Dam Numbers 1 and 2) along with an outlet structure on Bull Run Lake, a natural water body near the headwaters. The water supply is an unfiltered water source that serves over 800,000 people in the Portland Metropolitan area. BLM manages 1351 acres in the Bull Run watershed.

In 2008 Portland General Electric decommissioned the Bull Run Hydroelectric Project, which consisted of Marmot Dam on the Sandy River, Little Sandy Diversion Dam on the Little Sandy River, the powerhouse on the Bull Run River, Roslyn Lake, and associated flumes, canals and tunnels. Before decommissioning, the Bull Run

Hydroelectric Project diverted up to 600 cubic feet per second (cfs) of flow from the Sandy River and 200 cfs. from the Little Sandy River. Once the FERC decommissioning stipulations are completed, the expectations are that BLM will assume DMA responsibilities on this site.

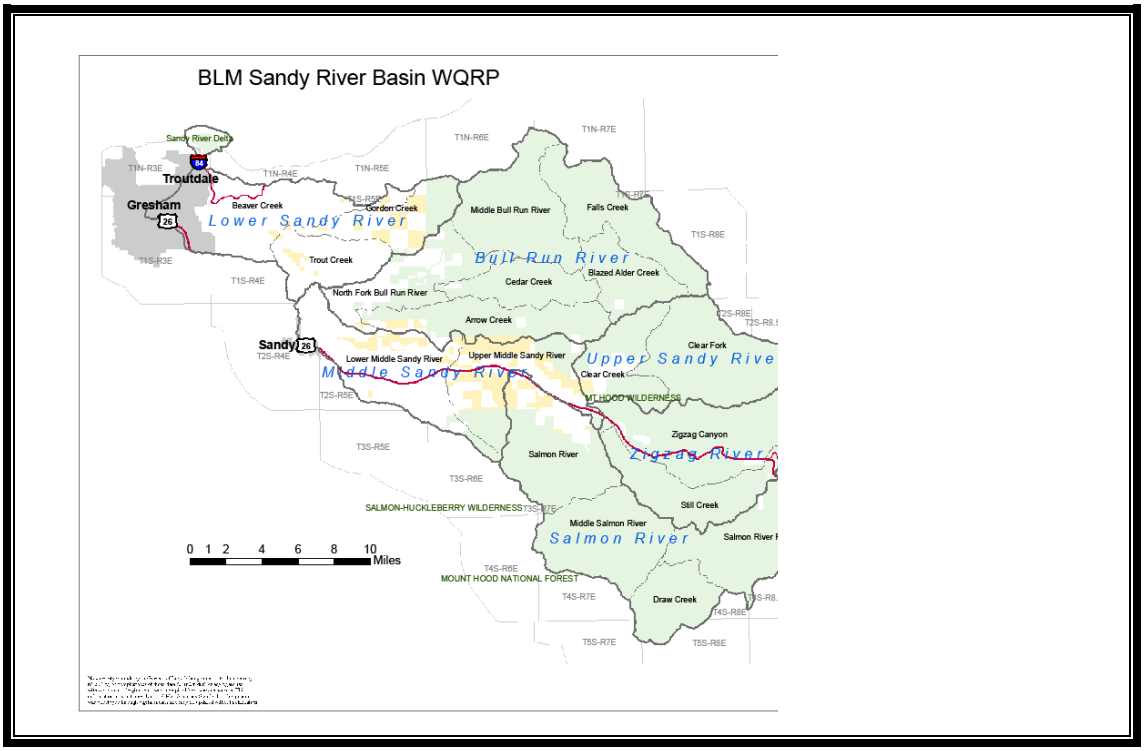
There are 6 watersheds in the Sandy River Basin (**Table 2.1**). Spatial distribution of land ownership in these watersheds is shown in **Map 1.2**. BLM management is limited to the Lower, Middle and Upper Sandy Watersheds, Salmon River Watershed and small ridgeline holdings in the Bull Run watershed therefore the remaining sections of this WQRP will only cover these watersheds.

Table 1.2 The Sandy River Basin watersheds and hydrologic unit codes.

Hydrologic Unit Codes	Watersheds
1708000102	Zigzag River *
1708000101	Upper Sandy River
1708000105	Bull Run River
1708000103	Salmon River
1708000107	Lower Sandy River
1708000104	Middle Sandy River

*No BLM ownership

Map 1.2. Land Ownership/Management Spatial Distribution



In the Sandy River basin BLM ownership ranges from 0.9% in the Upper Sandy River watershed to 19.5% in the Middle Sandy River Watershed (**Figure 1.1**). BLM lands are characterized by a scattered or "checkerboard" ownership pattern, with private and federal forest lands often occupying surrounding ownership boundaries. For a watershed summary of basin acres as they relate to BLM-administered lands refer to **Table 1.3**.

Figure 1.1 BLM Ownership in the Sandy River Basin

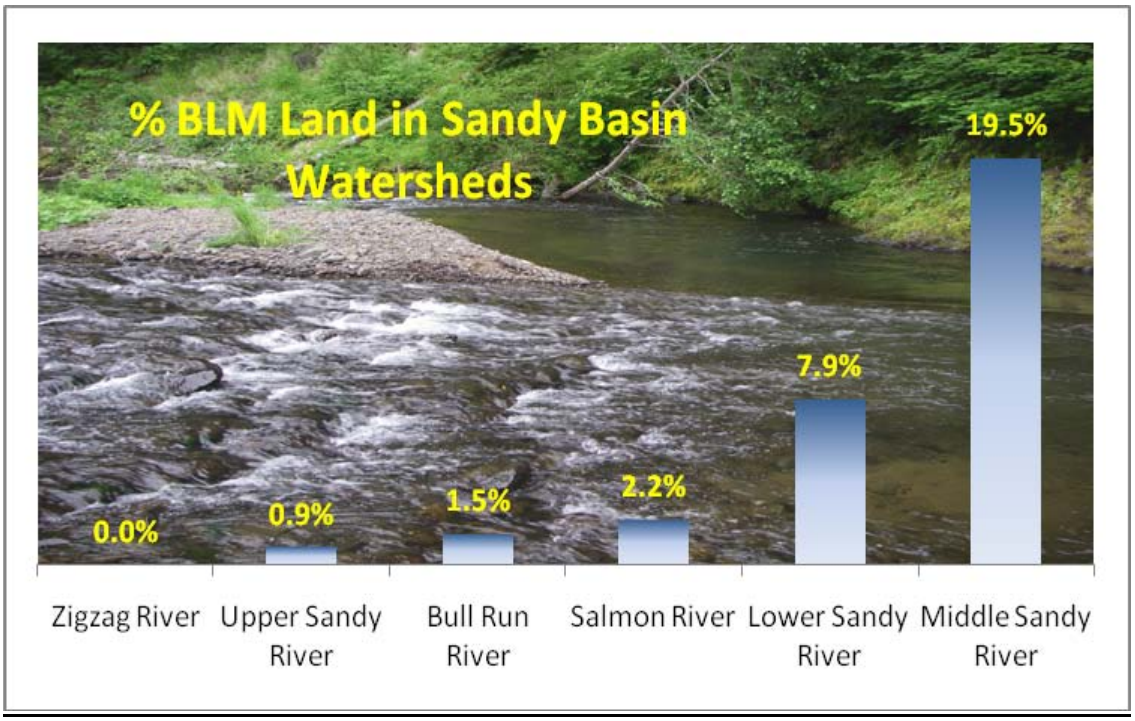


Table 1.3 BLM Ownership in the Sandy River Basin watersheds

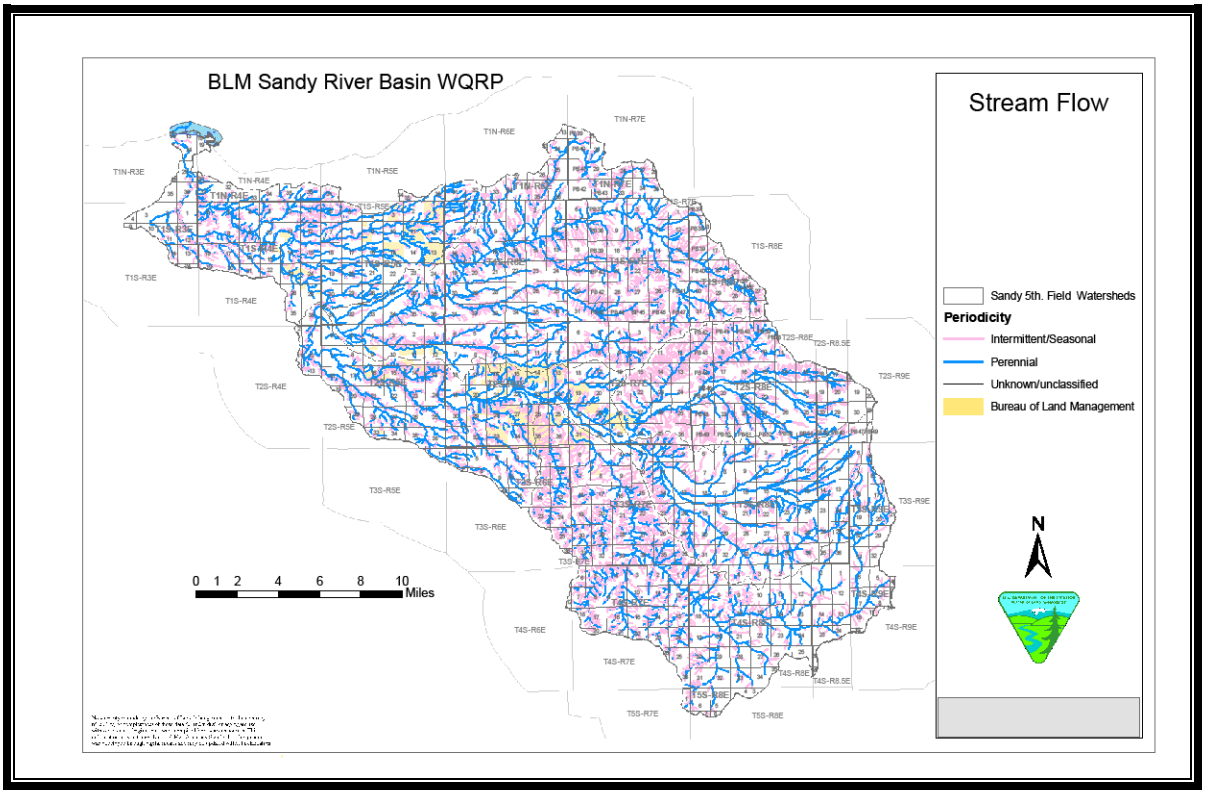
Sandy River Basin: Watersheds with BLM land				
5th Field HU	**Watershed**	**BLM Acres**	**TOTAL Acres**	**% BLM**
1708000101	**Upper Sandy River**	292	34160	**0.9%**
1708000105	**Bull Run River**	1351	88923	**1.5%**
1708000103	**Salmon River**	1593	73702	**2.2%**
1708000107	**Lower Sandy River**	3548	44648	**7.9%**
1708000104	**Middle Sandy River**	7950	40844	**19.5%**
1708000102	**Zig Zag River**	**0**	37758	**0.0%**

BLM managed streams are primarily located in upland forest headwaters of Gordon Creek in the Lower Sandy River Basin, along the main channel and headwater tributary locations of the Middle Sandy River and along the main stem of the lower Salmon River. Based on the stream coverage from the Washington and Oregon Framework Hydrography data layer (http://hydro.reo.gov/layers.html), there are approximately 72 miles of perennial flowing stream channel under BLM management in the Sandy River Basin. In terms of potential thermal loading, this represents 6.8 % of the estimated total perennial stream channel extent. **Table 1.4** provides a summary of BLM perennial stream miles by watershed and **Map 1.3** shows their relation to BLM lands.

Table 1.4 Sandy River Basin; BLM Perennial Streams

Sandy River Basin; BLM Perennial Streams				
	Watershed	BLM Perennial Miles	TOTAL Perennial Miles	% BLM Perennial Stream miles
1708000105	Bull Run River	6.7	305	0.3%
1708000101	Upper Sandy River	1.8	112	1.6%
1708000103	Salmon River	2.9	239	1.2%
1708000107	Lower Sandy River	18.9	210	9.0%
1708000104	Middle Sandy River	41.8	189	22.1%

Map 1.3 Sandy River Basin; Stream flow in relation to BLM lands



Condition Assessment and Problem description

Beneficial Use Identification
OAR 340-042-0040(4)(c)

Numeric and narrative water quality criteria are applied to protect the most sensitive beneficial uses. Oregon Administrative Rules (OAR 340 – 41 – 340, Table 286A) lists the beneficial uses occurring within the Sandy Basin tributaries and are applicable to streams within the Sandy Basin. Numeric and narrative water quality standards are designed to protect the most sensitive beneficial uses. The most sensitive beneficial uses to water temperature in the Sandy River Basin are resident salmonids and aquatic life and anadromous salmonid spawning, rearing and migration.

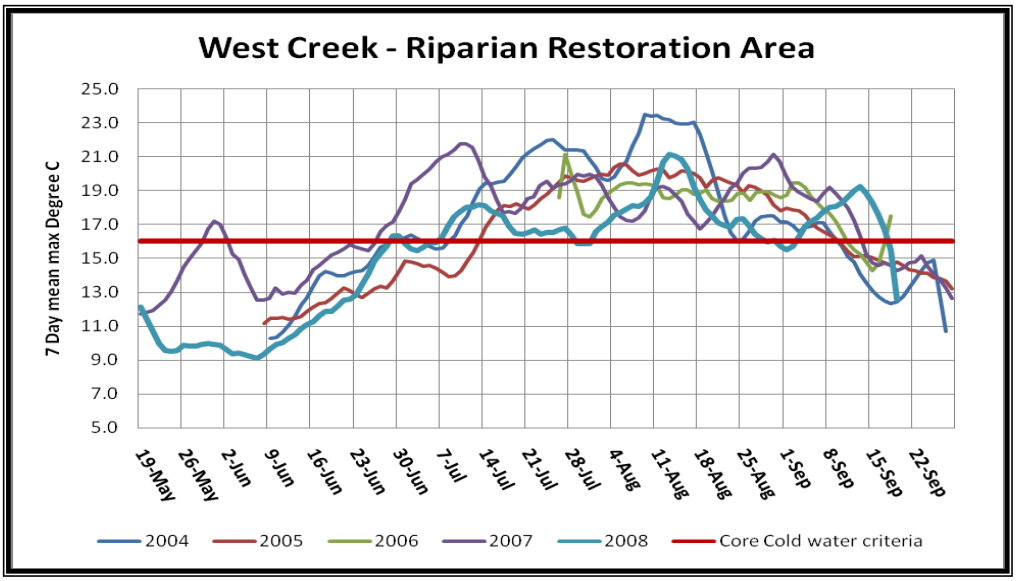
At a minimum, beneficial uses are considered attainable wherever feasible or wherever attained historically. The beneficial use for salmonid spawning, rearing, and migration, is based on fish use designations established by the ODFW. Maps depicting the extent of these beneficial uses are provided in the Goals and Objectives section.

Monitoring Results

The Sandy River Basin temperature TMDL is focused on the protection of the most sensitive beneficial uses; cold water salmonids, specifically steelhead, salmon and resident trout. Four stream segments (approximately 48 miles) in the Sandy River Basin were included on the 2002 303(d) list for exceeding numeric temperature criteria designed to protect these uses. During the summer of 2001, ODEQ temperature monitoring instruments recorded hourly stream temperatures at various locations throughout the Sandy River Basin. The TMDL provided a summary of results from the 2001 monitoring and showing that water temperatures in portions of the Sandy River Basin exceed the numeric rearing criteria (ODEQ, 2004). In some portions of the lower Sandy River Basin, the occurrence of temperatures in the mid-70°F range (mid- to high-20°C range) was observed during the summer of 2001. These temperatures can cause death of cold-water fish species during exposure times lasting a few hours to one day.

The BLM has not conducted basin wide monitoring to validate conditions due to the highly fragmented land pattern. Instead, the BLM has conducted long term monitoring of water temperature in West Creek, a tributary to the Sandy River at approximately RM 33. This stream drains newly acquired BLM lands in the Minsinger Bench area. The BLM has monitored water temperature and stream flow over the last 5 years as part of restoration effectiveness monitoring. The water temperature data (**Figure 1.1**) indicates numeric exceedance for resident salmonid rearing within the summer period. The BLM is tracking water temperature recovery rates as a function of riparian vegetation growth.

Figure 1.1 Long-term water temperature monitoring on BLM acquired land (seven day average max).



The temperature TMDL for the Sandy River Basin includes tributaries to the Sandy River within the HUC **17080001. As per OAR 340-042=0400 required components of the TMDL are listed in Table 1.5.**

Table 1.5. Sandy River Basin Temperature TMDL Components

Waterbodies OAR 340-042-0040(4)(a)	Perennial and/or fish bearing (as identified by ODFW, USFW or NFMS) streams within the HUC (hydrologic unit code) 17080001 (Sandy River and its tributaries).
Pollutant Identification OAR 340-042-0040(4)(b)	*Pollutants:* Human caused temperature increases from (1) solar radiation loading, (2) warm water discharge to surface waters and (3) reduced flow due to diversions.
Target Criteria Identification OAR 340-042-0040(4)(c) OAR 340-041-0028(4)(a) OAR 340-041-0028(4)(b) OAR 340-041-0028(4)(c) *OAR* 340-041-0028(8) *CWA §303(d)(1)*	OAR 340, Division 41 provides numeric and narrative temperature criteria. Figures 286 A and B, referenced in OAR 340-041-0286 and reproduced in **Figures 3.1** and **3.2** below, specify where and when the criteria apply. Biologically based numeric criteria applicable to the Sandy basin, as measured using the seven day average of the daily maximum stream temperature, include: 13.0°C during times and at locations of salmonid and steelhead spawning. 16.0°C in streams identified as having core cold water habitat use. 18.0°C during times and at locations utilized by salmon and trout for rearing and migration.
Seasonal Variation OAR 340-042-0040(4)(j) ***CWA §303(d)(1)***	Peak temperatures typically occur in late-July and early-August, impacting salmonid rearing life stage. Species-specific spawning occurs at various times throughout the basin.
Existing Sources OAR 340-042-0040(4)(f) ***CWA §303(d)(1)***	Forestry, Agriculture, Transportation, Rural Residential, Urban, Industrial Discharge, Waste Water Treatment Facilities, Management of River Flows Associated with Dams, Hydroelectric Power
TMDL **Loading Capacity and Allocations** OAR 340-042-0040(4)(d) OAR 340-042-0040(4)(e) OAR 340-042-0040(4)(g) OAR 340-042-0040(4)(h) ***40 CFR 130.2(f)*** ***40 CFR 130.2(g)*** ***40 CFR 130.2(h)***	*Load Allocations (Nonpoint Sources)*: System potential solar radiation loading. *Load Allocations (PGE Bull Run Hydroelectric Project)*: PGE will be assigned a load allocation of no more than a 0.3°C increase above background. The decommissioning plan will serve as the Temperature Management Plan.
Surrogate Measures OAR 340-042-0040(5)(b) 40 CFR 130.2(i)	Translates Nonpoint Source Load Allocations □ ***Effective Shade targets*** *translate the nonpoint source loading capacity.*
Margins of Safety and Reserve Capacity OAR 340-042-0040(4)(i) CWA §303(d)(1)	Implicit Margins of Safety are demonstrated in critical condition assumptions and are inherent to methodology for determination of nonpoint source loads. Reserve Capacity was provided by withholding 0.05°C from the Human Use Allowance
Standards Attainment & Reasonable Assurance OAR 340-042-0040(4)(l)(e) & (j)	□ *ODEQ* Analysis and modeling of TMDL loading capacities and required pollutant reductions demonstrates attainment of water quality standards. □ Standards Attainment and Reasonable Assurance are addressed in Section 6.7 of the Water Quality Management Plan.

Waterbodies Listed for Temperature

OAR 340-042-0040(4)(a)

303(d) listed water bodies in the Sandy River Basin are provided in **Table 1.6**. Since changes in stream temperature results from cumulative interactions between upstream and local sources, the TMDL considers all surface waters that affect the temperatures of 303(d) listed water bodies. For example, only the main stem of the Sandy River is 303(d) listed for temperature, but to address this listing, the TMDL assigned load allocations for all perennial tributaries in the watersheds. This concept applies throughout the basin.

Table 1.6 303(d) Listed Stream Segments in the Sandy River Basin

Waterbody	Listed Reaches
Sandy River	Mouth to Marmot Dam (RM 30)
Salmon River	Mouth to Boulder Cr. (RM 1)
Bull Run River	Mouth to Dam #2 (RM 6)
Gordon Creek	Mouth to Headwaters (RM 11)

Existing Forest Sector Heat Sources

OAR 340-042-0040(4)(f), CWA 303(d)(1)

Riparian vegetation, stream morphology, hydrology (including groundwater), climate, and geography influence stream temperature. Of these, riparian condition, channel morphology and hydrology can be affected by forest management. Disturbance or removal of near stream vegetation can reduce stream shade as a function of decreased vegetation height, reduced riparian buffer width, and vegetation density. This results in greater solar radiation reaching the stream surface. The ability of riparian vegetation to provide stream shade throughout the day depends on vegetation height and position relative to the stream channel.

Timber harvest or road construction that reduces stream adjacent shade is the primary means by which BLM management could affect stream adjacent vegetation and thus water temperature. Historic management of federal forest lands left a mosaic of vegetation of varying age classes in riparian areas bordering perennial streams. Along some reaches large conifers have been replaced by young, small diameter conifer stands. In other areas hardwoods have replaced conifers as the dominant species or channels have been exposed due to land slides or flooding. In order to determine the existing condition of federal lands the BLM modeled effective shade for each watershed with BLM ownership in the Sandy River Basin.

The RAPID Effective Shade model (Park and Hawkins, 2007) was used to characterize the potential for temperature impacts to perennial streams from BLM land management. A product of the RAPID analysis is the condition of existing shade and a projection of potential future shade along perennial streams across the watershed. The probable shade values represent the maximum potential stream shade based on the system potential tree height. The analysis is based on regional shade curves (e.g. nomographs) (USDA 1993 – Shadow Model) which provide effective shade values based on stream width, tree height, channel orientation and stream adjacent slope. **Table 1.7** provides summary results of this modeling for the BLM watersheds in the Sandy River Basin. Based on the perennial flow modeling, BLM has a limited extent of perennial stream management in the Upper Sandy, Bull Run and Salmon rivers compared to the total perennial stream miles. Existing effective shade on BLM lands is relatively high compared to the probable shade levels (site capability) with approximately 1 to 4 % future shade gain expected in the watersheds. This validates over-all findings of ODEQ in the TMDL, where existing shade was close to potential in Heat Source modeled streams (ODEQ, 2005). The median existing shade for BLM land is approaching potential (TMDL shade targets **Figures 8.1 & 8.2**), depending on the dominance of larger channels. For further description the modeling and assumptions used for this analysis refer to Appendix 2 of the BLM Willamette Basin WQRP (2008).Over the last 3 decades, the amount of riparian area that could be considered at or trending toward system potential has increased as a function of passive restoration, vegetative re-growth and “active restoration” activities in the basin. Current condition results from individual watershed RAPID analysis are reported in each Watershed Condition section along with estimates of years to recovery. The projection of years to recovery use forest growth estimates for Douglas fir occurring on BLM land.

Table 1.7 Rapid Shade Assessment Results Sandy River Basin

Sandy River Basin							
Watershed	**Total Modeled Miles**	**BLM Modeled Miles**	**% BLM Managed Streams**	**Existing shade all modeled streams (%)**	**Existing shade BLM modeled streams (%)** Mean / Median	**Potential shade BLM modeled streams (%)** Mean / Median	**Shade Gain (%)** Mean / Median
Lower Sandy	**349.8**	**26.7**	**7.6**	**53.4**	**82 / 94**	**83 / 95**	**1 / 1**
Middle Sandy	**295.2**	**60.2**	**20.4**	**69.5**	**77 / 88**	**78 / 91**	**1 / 3**
Upper Sandy	**254.4**	**1.9**	**0.7**	**67.7**	**73 / 67**	**77/ 74**	**4 / 7**
Salmon River	**480.1**	**9.9**	**2.1**	**78.7**	**78 / 84**	**78 / 95**	**0 / 9**
Bull Run River	**636.0**	**10.2**	**1.6**	**81.4**	**78 / 84**	**78 / 85**	**1 / 1**

Stream temperature is affected by natural heating that can be influenced by wildfire, floods, windstorms and insect infestations that alter species presence, height and, density of riparian vegetation. These factors in turn influence the amount of solar radiation reaching a stream. Although the BLM-administered portions of the Sandy River Basin have not been subject to larger scale wildfires or insect infestation during the last century, the basin was impacted by the 1996 flood. The 1996 flood in Western Oregon and Washington imposed high stress on the riparian, floodplain and stream channels often damaging the system potential community of riparian vegetation. Although many of the effects of the flood were subtle, in certain areas such as the Sandy River in the Minsinger Bench area, riparian communities along stream banks were severely impacted (Salem District 1996 Flood Report, 1996). In some locations, woody vegetation that contributes to channel bank stability and accommodates maintenance flows (e.g., >2 yr return interval), increases stream bank roughness, influences sediment deposition, and promotes development of stream adjacent shade, is just beginning to return (over 10 years later).

Riparian vegetation provides an important function in maintaining stream channel morphology. Loss or disturbance of riparian vegetation may precede lateral stream bank erosion and channel widening, decreasing the effectiveness of remaining vegetation to shade the stream. The result is increased surface area exposed to heat exchange processes, particularly solar radiation. Changes in sediment input to streams can also influence channel morphology. When sediment input increases over the transport capability of the stream, sediment deposition can result in channel filling, thereby increasing the width and exposure of the stream channel. Forest management sources that could contribute to elevated sediment input to streams include use of haul roads and soil exposure on logging skid trails and harvest landings. Research has corroborated that roads, particularly the intersection of roads and stream channels appear to be a primary human-caused source of sediment input to streams. BLM project level monitoring has indicated that any changes to channel morphology as a function of road crossings are likely to be localized and are not likely to constitute a significant source of sediment input and thus temperature loading at the reach scale. Mass soil movement from debris flows and landslides can constitute a significant sediment source at the reach scale. Passive and active restoration following the 1964 and 1996 floods have contributed to an upward trend in riparian condition and return to system potential shade.

The presence of large wood is important for temperature regulation. The accumulation of gravel and development of pools as a consequence of in-channel large wood increases the potential for sub-surface flows that have a cooling and stabilizing effect on water temperature. Large wood extending over the stream channel reduces channel exposure to direct solar radiation. The lack of large wood in many headwater streams can be traced to the past practice of stream cleaning, historic flood events, and harvest of large conifers in the pre-1990 period. The extent and effect of these factors varies across the subbasin.

LOWER SANDY RIVER WATERSHED

The Cascades Resource Area in the BLM Salem District administers lands within the Lower Sandy River Watershed. The Lower Sandy River Watershed drains 69.8 square miles (44,648 acres), of which BLM manages 3548 acres (7.9%). These streams are predominately in the Gordon Creek tributary and headwater areas where the Western Hemlock shade curve applies (see Goals section). Approximately 842 acres occur in the Willamette Valley Shade curve zone. The BLM manages lands along approximately 18.9 miles of perennial streams, which is 9.0 % of the total mapped perennial stream network.

The watershed has been characterized in the "Sandy Watershed Analysis 2007 Revision" (BLM, 2007). **Table 2.1** is a summary gathered from the findings in the watershed analysis. Opportunities for restoration identified in the watershed analysis and pertinent to the WQRP are included.

Table 2.1 Watershed Analysis Summary

Riparian Vegetation
A majority of the lower Sandy Watershed forests consist of Douglas-fir amongst urban and urban-agricultural lands. In addition, mixed hardwood stands consisting of red alder, black cottonwood, big leaf maple and Oregon ash comprise a minor component at low to mid elevations and in riparian zones of larger streams. The invasive species of most concern within the watershed and with the highest priority for eradication are Japanese, Himalayan, and Giant knotweeds. Implement density management prescriptions in Riparian Reserves to develop and maintain older forest stand characteristics in younger age classes and to eradicate invasive species. Desirable stand characteristics are system potential vegetation recruitment of large standing/down dead for LWD, and multi-layered stands with well-developed understories and multiple species including hardwoods and other minor species.
Disturbance
Mainstem Sandy River is subject to significant bedload movement following debris flows associated with rainstorm events, glaciers in the upper Sandy. This can place stress on stream banks and channel margins impacting riparian vegetation.
Large Wood
Maintain and enhance the species composition and structural diversity of plant communities in riparian area and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, normal rates of soil erosion, bank erosion, and channel migration. Plant and maintain native species in riparian areas and wetlands to provide adequate stream shading. Maintain channel structure to provide energy dissipation. Provide adequate amounts and distribution of coarse woody debris in riparian areas to maintain physical stream complexity and stability.
Roads
Identify and replace failing and under designed drainage structures that represent high risk adverse impacts to water quality and aquatic and riparian habitat conditions. Plan to convert all culverts to those able to withstand 100 year flood events.

The Rapid Effective Shade model (Park and Hawkins, 2007) was used in the Lower Sandy River Watershed to characterize the condition of BLM administered lands, identify streams with the potential to affect water temperature and to calculate existing shade and probable future shade along those streams. **Table 2.2, Figure 2.1 and Map 2.1** include the results of the RAPID analysis for all BLM lands in the watershed. These results are considered conservative as the length of perennial streams predicted by the model is greater than those estimated in the BLM GIS streams layer.

Table 2.2 Rapid Shade Assessment results for the Lower Sandy River Watershed

Lower Sandy River - RAPID SHADE MODEL RESULTS									
Channel Size*	Total BLM modeled miles	BLM Miles meet or exceed Target Shade**	BLM Miles meet or exceed Target Shade %	BLM Miles below Target Shade**	BLM Miles below Target Shade %	Average "Below Target" % Existing Shade	Average Probable % Shade	Average Shade Gain %	Average Years to Shade Recovery
Small	16.6	15.9	95.8%	0.7	4.2%	65.9	82.2	16.3	44
Medium	3.9	3.89	99.5%	0.02	0.5%	64.1	95.0	30.9	46
Large	6.2	6.0	96.0%	0.3	4.0%	50.4	63.4	13.0	< 5
Total	26.8	25.8	96.4%	1.0	3.6%				

all averages are weighted averages for whole watershed classed by channel width.

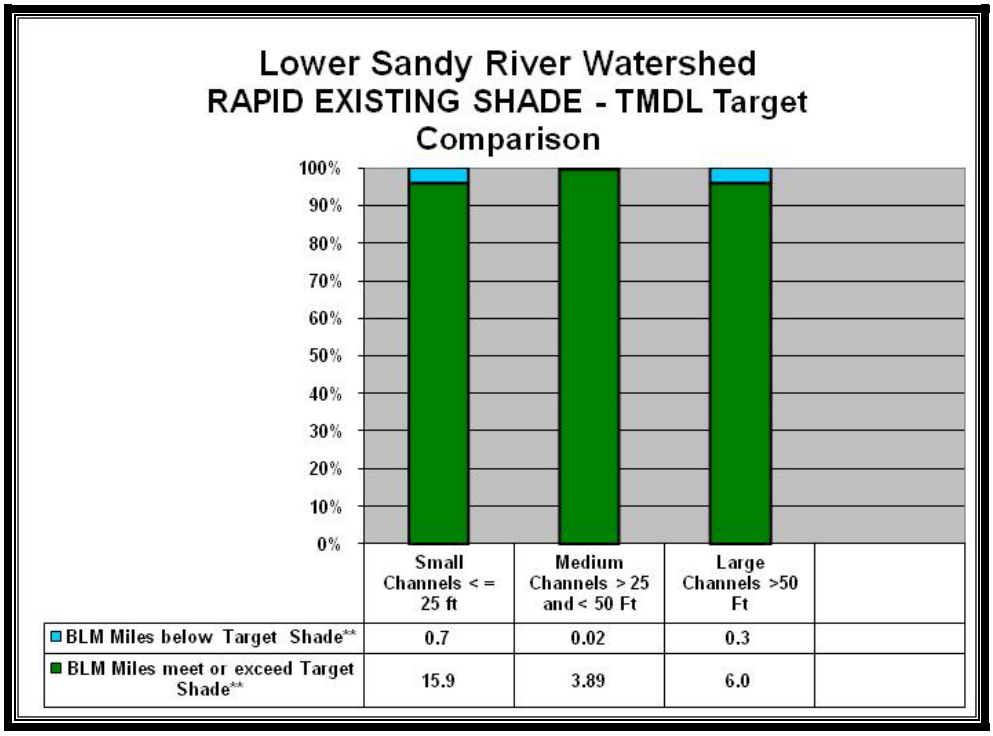
***channel sizes; small = < 25ft, medium 26 - 50 ft, large >50**

**** Target shade: based on average shade curves from TMDL and channel widths**

***** Based on growth curves for basin and average tree height at System potential in TMDL**

Miles are not contiguous miles

Figure 2.1 RAPID Shade Assessment, TMDL Target comparison for Lower Sandy River Watershed



The BLM compared the RAPID model results (see **Map 2.1**) to other GIS map layers including NAIP imagery in an effort to identify contiguous reaches where existing effective shade was less than the TMDL target and potential shade was greater than the existing condition. There were no contiguous reaches where these conditions were evident. In the Sand River Basin TMDL, the ODEQ attempted to identify specific areas in the Sandy River Basin where improvements in riparian vegetation would have a significant impact on stream shading conditions (**Figure 2.2**). An increase in effective shade of 8% on the main stem Sandy River and 15% on modeled tributary reaches was considered significant for the purposes of the TMDL analysis. Because many riparian areas in the Sandy River Basin contain mature vegetation, relatively few areas were identified as potentially providing shade benefit. The reaches identified as benefiting from increased riparian shading were delineated based on remotely sensed data. One of these reaches was identified in the Lower Sandy River on BLM land, River Mile 14.79-16.16. The BLM compared the RAPID model existing shade with the modeled potential shade and found little difference. Review of 2005 aerial photos also indicates system potential conditions in these areas.

Map 2.1 RAPID Shade Model Results and Potential Restoration Areas in the Lower Sandy River Watershed

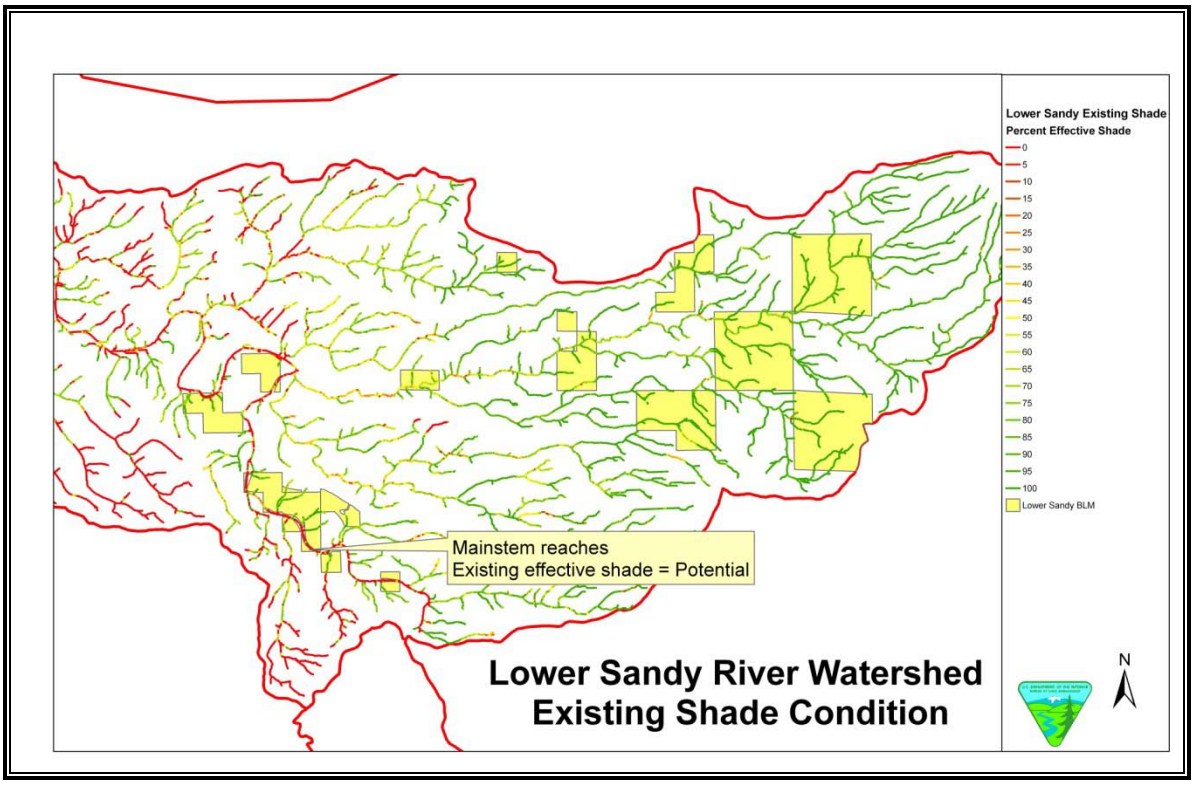
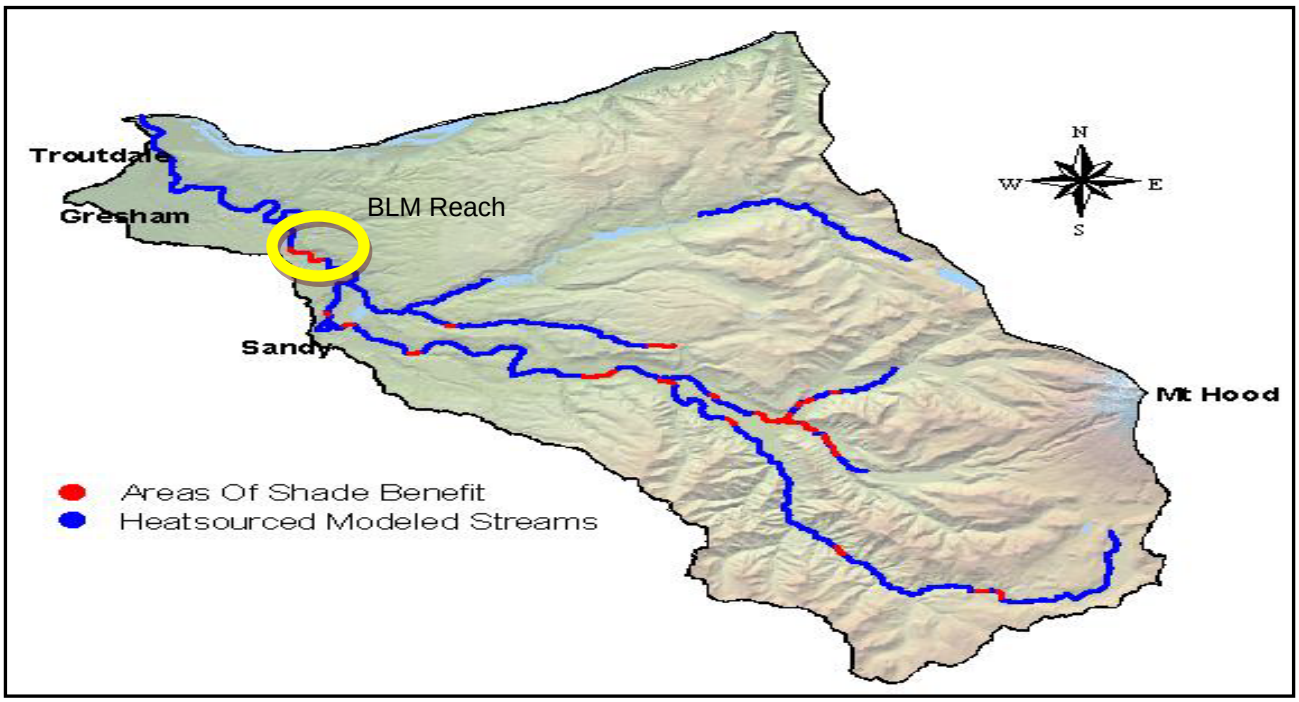


Figure 2.2. Streams Evaluated by ODEQ as Areas of Measureable Shade Benefit (ODEQ,2005).



Middle Sandy River WATERSHED

The Cascades Resource Area in the BLM Salem District administers lands within the Middle Sandy River Watershed. The Middle Sandy River Watershed drains approximately 63.8 square miles (40,844 acres), of which BLM manages 7950 acres (19.5 %). These streams are predominately along the mainstem Sandy River and in headwater tributaries where the Western Hemlock Shade Curve applies (see Goals section). The BLM manages lands along approximately 42 miles of perennial streams, which is 22 % of the total mapped perennial stream network. The Middle Sandy River watershed contains the most BLM land in the Sandy River basin and the greatest existing opportunities in terms of restoration. The Marmot Dam restoration site and Minsinger Bench are located in this watershed.

The watershed has been characterized in the Sandy Watershed Analysis Revision (BLM, 2007). **Table 3.1** is a summary gathered from the findings in the watershed analysis. Opportunities for restoration identified in the watershed analysis and pertinent to the WQRP are included.

Table 3.1 Middle Sandy River Summary

Riparian Vegetation
A majority of the Sandy Watershed forests consist of Douglas-fir amongst urban and urban-agricultural lands. In addition, mixed hardwood stands consisting of red alder, black cottonwood, big leaf maple and Oregon ash comprise a minor component at low to mid elevations and in riparian zones of larger streams. The invasive species of most concern within the watershed and with the highest priority for eradication are Japanese, Himalayan, and Giant knotweeds. The riparian habitat in some of the lower reaches in the basin has been affected by recreation, residential, agricultural, and municipal activities. Situated within minutes of the Portland metropolitan area, the river is used heavily for recreation. Agricultural and residential development activities have altered or disturbed some riparian habitat areas, and have also caused instances of stream bank erosion, particularly when careful management practices were not followed.

Implement density management prescriptions in Riparian Reserves to develop and maintain older forest stand characteristics in younger age classes and to eradicate invasive species. Desirable stand characteristics are system potential vegetation recruitment of large standing/down dead for LWD, and multi-layered stands with well-developed understories and multiple species including hardwoods and other minor species.
Disturbance
An increased heating rate due to the diversion of flow below Marmot Dam has a significant impact on stream temperature in the lower Sandy and Bull Run Rivers.
Large Wood
Maintain and enhance the species composition and structural diversity of plant communities in riparian area and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, normal rates of soil erosion, bank erosion, and channel migration. Plant and maintain native species in riparian areas and wetlands to provide adequate stream shading. Maintain channel structure to provide energy dissipation. Provide adequate amounts and distribution of coarse woody debris in riparian areas to maintain physical stream complexity and stability.
Roads
Identify and replace failing and under designed drainage structures that represent high risk adverse impacts to water quality and aquatic and riparian habitat conditions. Plan to convert all culverts to those able to withstand 100 year flood events.

The Rapid Effective Shade model (Park and Hawkins, 2007) was used in the Middle Sandy River Watershed to characterize the condition of BLM administered lands, identify streams with the potential to affect water temperature and to calculate existing shade and probable future shade along those streams. **Table 3.2 , Figure 3.1 and Map 3.1** include the results of the RAPID analysis for all BLM lands in the watershed. These results are considered conservative as the length of perennial streams predicted by the model is greater than those estimated in the BLM GIS streams layer. Model results indicate that over 92% of BLM managed riparian areas are meeting target shade. Most of the channels not meeting target are small and in many cases may have intermittent flow, with less potential for significant contribution to heating .

Table 3.2 Rapid Shade Assessment results for the Middle Sandy River Watershed

Middle Sandy River - RAPID SHADE MODEL RESULTS									
Channel Size*	Total BLM modeled miles	BLM Miles meet or exceed Target Shade**	BLM Miles meet or exceed Target Shade %	BLM Miles below Target Shade**	BLM Miles below Target Shade %	Average "Below Target" % Existing Shade	Average Probable % Shade	Average Shade Gain %	Average Years to Shade Recovery
Small	45.2	41.7	92.4%	3.5	7.6%	69.9	84.5	14.6	44
Medium	7.0	6.7	95.7%	0.3	4.3%	58.0	86.6	28.6	43
Large	8.0	7.5	92.9%	0.6	7.1%	39.5	67.5	28.1	32
Total	60.2	55.9	92.8%	4.3	7.2%				

all averages are weighted averages for whole watershed classed by channel width.

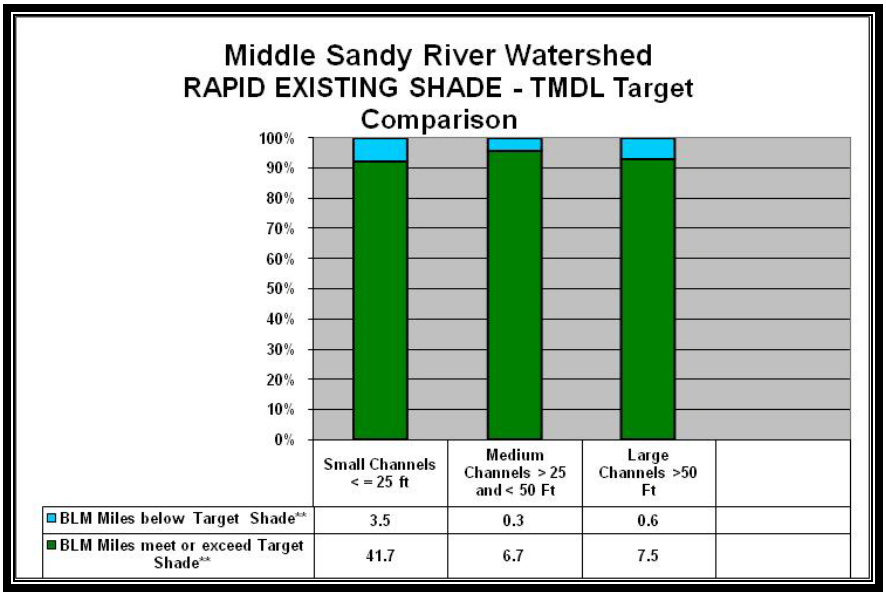
***channel sizes; small = < 25ft, medium 26 - 50 ft, large >50**

**** Target shade: based on average shade curves from TMDL and channel widths**

***** Based on growth curves for sub-basin and average tree height at System potential in TMDL**

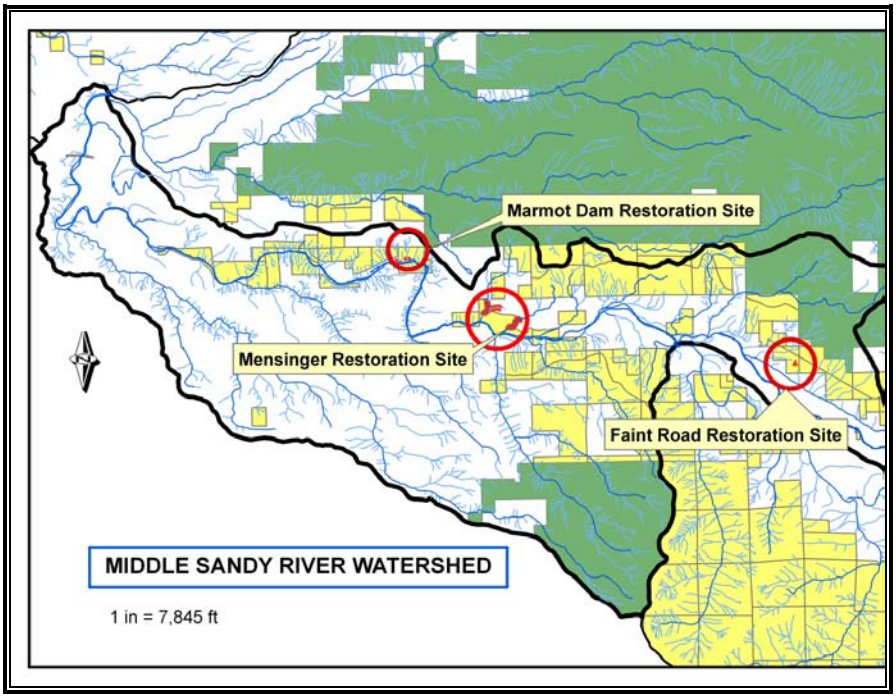
Miles are not contiguous miles

Figure 3.1 RAPID Shade Assessment, TMDL Target comparison for Middle Sandy River Watershed



The BLM interpreted the Rapid results in comparison to other GIS map layers and identified contiguous reaches where existing effective shade was less than the TMDL target and potential shade was greater than the existing condition. These reaches were identified as potential reaches for restoration. During 2008 these potential reaches were checked in the field and validated as needing active projects (see **Map 3.1**).

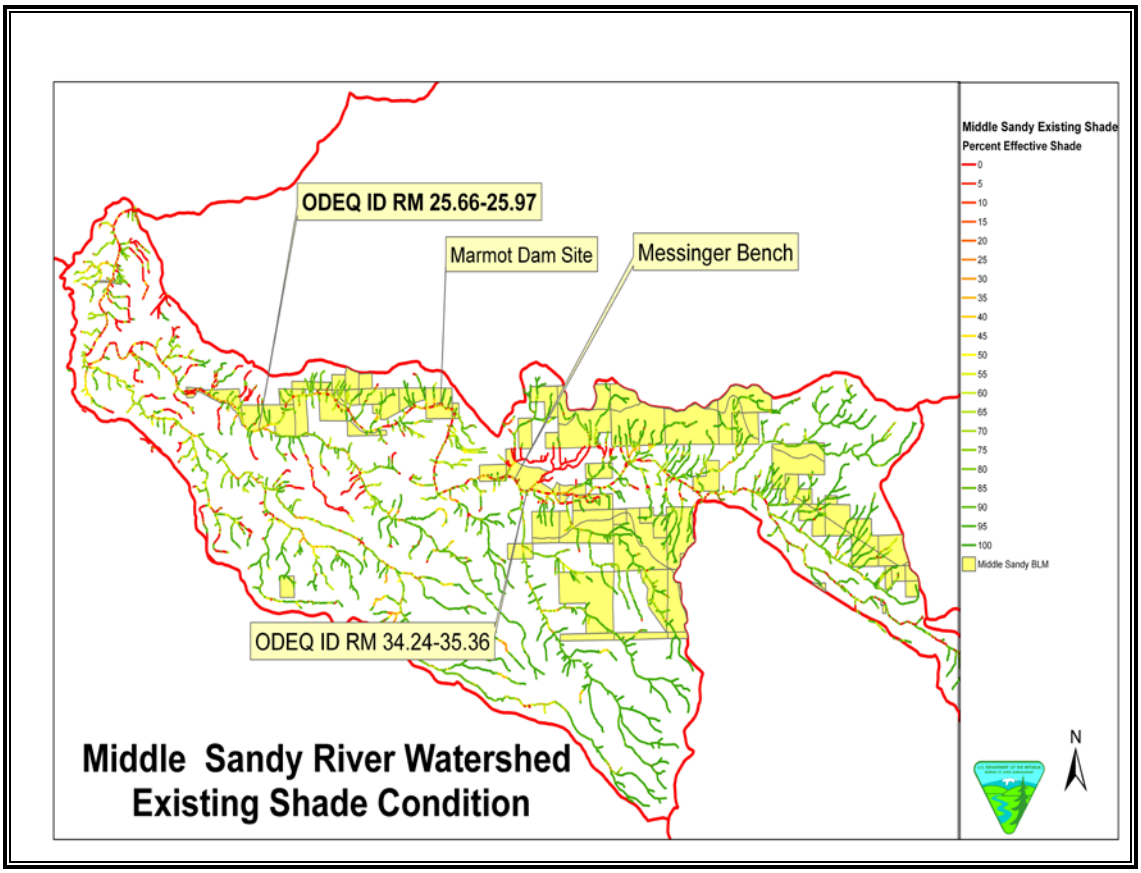
Map 3.1 BLM Restoration Areas in the Middle Sandy River



In the Sand River Basin TMDL, the ODEQ attempted to identify specific areas in the Sandy River Basin where improvements in riparian vegetation would have a significant impact on stream shading conditions. The reaches identified as benefiting from

increased riparian shading were delineated based on remotely sensed data. Two of these reaches were identified in the Middle Sandy River on BLM land, River Mile 25.66-25.97 and 34.24-35.36
14.79-16.16 (**Map 3.2**). The BLM compared the RAPID model existing shade with the modeled potential shade and found scattered differences. Some of the areas such as in the RM 25.66-25.97 are newly acquired lands that are in a young stand condition. Field review of these areas showed little potential for active restoration as there is desirable species composition to provide system potential shade in the future. The model was accurate in predicting approximately 30 years to the point of reaching potential effective shade.

Map 3.2 RAPID existing shade Middle Sandy River Watershed



Upper Sandy River WATERSHED

The Cascades Resource Area in the Salem District administers BLM lands within the Upper Sandy River Watershed. The Upper Sandy River Watershed drains approximately 53.3 square mile (34,160 acres) of which **BLM only manages 292 acres** (less than 1 %). The BLM manages lands along approximately 1.8 miles of perennial streams, which is 1.6% of the total mapped perennial stream network. These streams are predominately in the headwater areas where the Western Hemlock Shade Curve applies. Restoration opportunities on BLM lands are minimal and this watershed has been a low priority in comparison to the Middle Sandy River.

In an effort to provide consistency in the overall basin analysis for BLM lands, the RAPID model (Park and Hawkins, 2007) was used in the Upper Sandy River Watershed to characterize the effective shade condition of BLM administered lands, identify streams with the potential to affect water temperature and to calculate existing shade and probable future shade along those streams. **Table 4.1** includes the results of the RAPID analysis for all BLM lands in the watershed. The model identified approximately 1.7 miles of small perennial channels of which over 85% met the shade target identified on the Western Hemlock shade curve. These results are considered conservative as the length of perennial streams predicted by the model is greater than those estimated in the BLM GIS streams layer. Due to the position in the stream network, these streams are very likely to have intermittent flow in some years and very little contribution to downstream heating.

Map 4.1 provides the extent of BLM lands and the RAPID existing shade condition in relation to 2005 imagery. The map illustrates the headwater channel condition and the presence of power lines which can have a significant exposure effect.

Table 4.1 RAPID Shade Assessment results for the Upper Sandy River Watershed

Upper Sandy River - RAPID SHADE MODEL RESULTS									
Channel Size*	Total BLM modeled miles	BLM Miles meet or exceed Target Shade**	BLM Miles meet or exceed Target Shade %	BLM Miles below Target Shade**	BLM Miles below Target Shade %	Average "Below Target" % Existing Shade	Average Probable % Shade	Average Shade Gain %	Average Years to Shade Recovery
Small	1.9	1.7	85.9%	0.3	14.1%	75.7	95.6	19.9	45
Medium	0.0	0.0	0.0%	0.0	0.0%				
Large	0.0	0.0	0.0%	0.0	0.0%				
Total	1.9	1.7	85.9%	0.3	14.1%				

all averages are weighted averages for whole watershed classed by channel width.

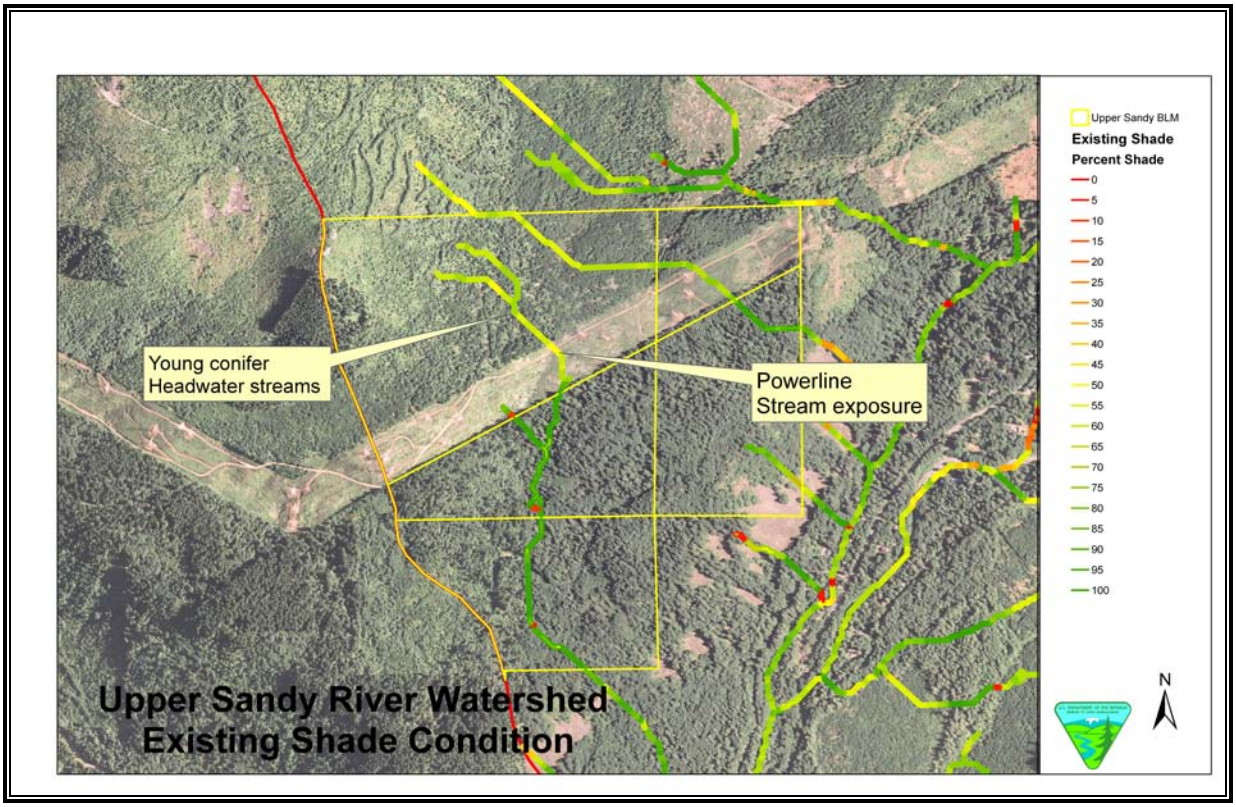
***channel sizes; small = < 25ft, medium 26 - 50 ft, large >50**

**** Target shade: based on average shade curves from TMDL and channel widths**

***** Based on growth curves for sub-basin and average tree height at System potential in TMDL**

Miles are not contiguous miles

Map 4.1 Rapid Shade Model Results, Upper Sandy River Watershed



Salmon River WATERSHED

The Cascades Resource Area in the BLM Salem District administers lands within the Salmon River Watershed. The Salmon River Watershed drains approximately 115 square miles (73,702 acres), of which BLM manages 1593 acres (approx. 2%). These streams are predominately along the lower main channel and headwater tributaries where the Western Hemlock Shade Curve applies.

The watershed has been characterized in the Sandy Watershed Analysis Revision (BLM, 2007). **Table 5.1** is a summary gathered from the findings in the watershed analysis. Opportunities for restoration identified in the watershed analysis and pertinent to the WQRP are included.

Table 5.1 Watershed Analysis Summary

Riparian Vegetation
Riparian conditions on forestlands in the Salmon River basin are generally maintained in good quality as a result of Forest Practices Act and National Forest lands protections. Stream shading is generally good in the upper reaches of the Sandy River, keeping temperatures down and providing habitat for fish and wildlife. Some of the Salmon River drainage is in wilderness areas where riparian zones are also protected. Protect system potential vegetation characteristics retain large standing/down dead as LWD. Maintain and enhance the species composition and structural diversity of plant communities in riparian area and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, normal rates of soil erosion, bank erosion, and channel migration. Plant and maintain native species in riparian areas and wetlands to provide adequate stream shading.
Disturbance
After the 1964 flood, the amount and quality of aquatic habitat was affected by the closing off of oxbows and side channels, and the in-stream clearing of large wood and boulders. On private lands many small streams and wetlands have been channelized, drained, and filled (USFS, 1995). Recreational activity and Highway 26 maintenance along the river has impacted stream banks and riparian vegetation (USFS, 1995).
Large Wood
Maintain channel structure to provide energy dissipation. Provide adequate amounts and distribution of coarse woody debris in riparian areas to maintain physical stream complexity and stability.

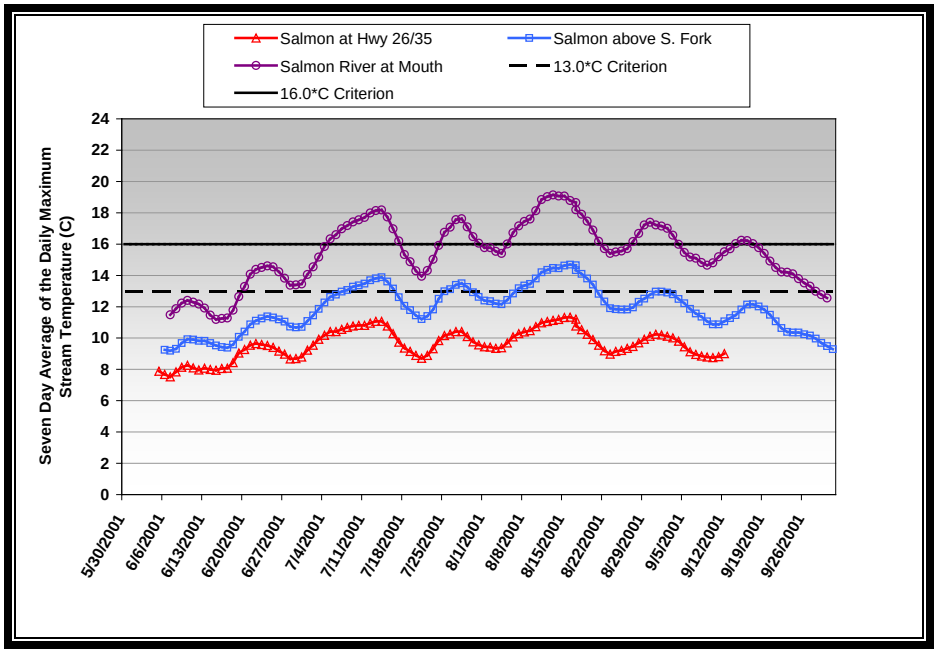
The RAPID model (Park and Hawkins, 2007) was used in the Salmon River Watershed to characterize the effective shade condition of BLM administered lands, identify streams with the potential to affect water temperature and to calculate existing shade and probable future shade along those streams. **Table 5.2 and Map 5.1** include the results of the RAPID analysis for all BLM lands in the watershed. The model identified approximately 9.9 miles of perennial stream channel all of which meet the shade target identified on the Western Hemlock shade curve. The model also identified the potential for 6.7 miles of small perennial channels which were not evident on the BLM GIS stream coverage.

Table 5.2 Rapid Shade Assessment results for the Salmon River Watershed

Salmon River - RAPID SHADE MODEL RESULTS									
Channel Size*	**Total BLM modeled miles**	**BLM Miles meet or exceed Target Shade****	**BLM Miles meet or exceed Target Shade %**	**BLM Miles below Target Shade****	**BLM Miles below Target Shade %**	**Average "Below Target" % Existing Shade**	**Average Probable % Shade**	**Average Shade Gain %**	**Average Years to Shade Recovery**
Small	**6.7**	**6.7**	**100.0%**	**0.0**	**0.0%**		**95 %**		**0**
Medium	**0.3**	**0.3**	**100.0%**	**0.0**	**0.0%**		**83 %**		**0**
Large	**2.8**	**2.8**	**100.0%**	**0.0**	**0.0%**		**42 %**		**0**
Total	**9.9**	**9.9**	**100.0%**	**0.0**	**0.0%**				

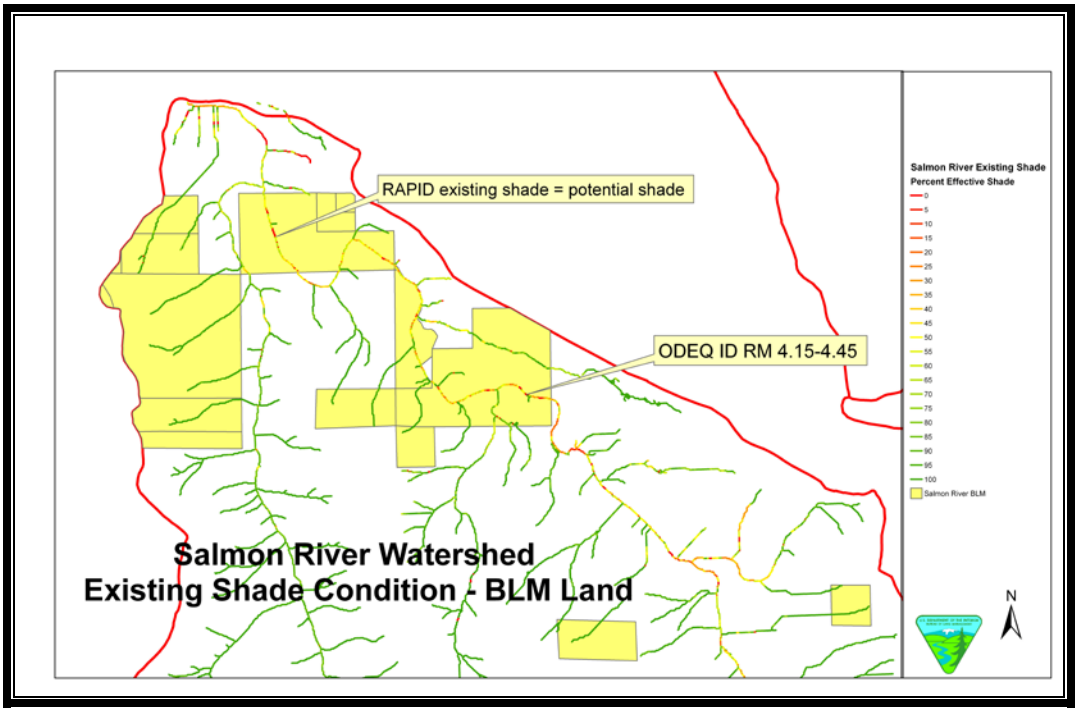
There are few BLM holdings that are directly associated with the listed segments in the Sandy River basin. An exception to this is the lower Salmon River where BLM manages approximately 3 miles along the listed channel and could acquire lands in the future that have restoration potential. **Figure 5.2** illustrates the exceedance of water temperature in the lower reaches of the Salmon River (ODEQ, 2005). The BLM conducted field validation of the Rapid model results on the main stem Salmon channel due to the TMDL emphasis and identification of heating in the lower Salmon River reaches. Riparian areas were found to be near system potential with a multi-specie and multilayered canopy. The model appears to under predict the effective shade providing a conservative estimate of existing condition.

Figure 5.2. 2001 ODEQ; Daily Maximum Temperatures in the Salmon River



In the Sand River Basin TMDL, the ODEQ attempted to identify specific areas in the Sandy River Basin where improvements in riparian vegetation would have a significant impact on stream shading conditions. The reaches identified as benefiting from increased riparian shading were delineated based on remotely sensed data. One of these reaches was identified in the Salmon River on BLM land, River Mile 4.15-4.45 (**Map 5.2**). The BLM compared the RAPID model existing shade with the modeled potential shade and found no appreciable differences. Photo and field review of the general area showed little potential for active restoration as there is desirable species composition to provide system potential shade in the future.

Map 5.1 Rapid Shade Model Results in the Salmon River Watershed



Map 5.2 Rapid Shade Model Results and Vegetation Condition

Bull Run River WATERSHED

The Cascades Resource Area in the Salem District administers BLM lands within the Bull Run River Watershed. The Bull Run River Watershed drains approximately 138.9 square mile (88,923 acres) of which BLM only manages 1351 acres which occur predominately along the Little Sandy River and small tributary channels. The majority of BLM lands provide system potential vegetation and shade in the riparian areas. This is validated by ODEQ field measurements and observations which indicate that many riparian areas in the Sandy Basin contain system potential vegetation, especially in the Bull Run watershed (ODEQ, 2005).

In an effort to provide consistency in the overall basin analysis for BLM lands, the RAPID model (Park and Hawkins, 2007) was used in the Bull Run River Watershed to characterize the effective shade condition of BLM administered lands, identify streams with the potential to affect water temperature and to calculate existing shade and probable future shade along those streams. **Table 6.1** and **Map 6.1** include the results of the RAPID analysis for all BLM lands in the watershed The model identified approximately 4.1 miles of medium and larger perennial channels (25 feet and wider at bank full) all of which met the shade target identified on the Western Hemlock shade curve. Over 95 % of the 6.1 miles of smaller perennial channels also met the shade target. These results are considered conservative as the length of perennial streams predicted by the model is greater than those estimated in the BLM GIS streams layer.

The BLM interpreted the RAPID results in comparison to other GIS map layers and identified no contiguous reaches where existing effective shade or vegetative conditions are less than the TMDL target (**Map 6.1**). Generally, the segments which did not meet target were very scattered, providing no indication of project potential. In the absence of any additional data, the BLM considers the current effective shade conditions on BLM in the Bull Run watershed to meet the TMDL target.

Table 6.1 RAPID Shade Assessment results for the Bull Run River Watershed

Bull Run River - RAPID SHADE MODEL RESULTS									
Channel Size*	**Total BLM modeled miles**	**BLM Miles meet or exceed Target Shade****	**BLM Miles meet or exceed Target Shade %**	**BLM Miles below Target Shade****	**BLM Miles below Target Shade %**	**Average "Below Target" % Existing Shade**	**Average Probable % Shade**	**Average Shade Gain %**	**Average Years to Shade Recovery**
Small	**6.1**	**5.8**	**95.1%**	**0.2**	**3.9%**	**76.3**	**87.3**	**11.0**	**48**
Medium	**0.5**	**0.5**	**100.0%**	**0.0**	**0.0%**		**81.9**		**0**
Large	**3.6**	**3.6**	**100.0%**	**0.0**	**0.0%**		**61.3**		**0**
Total	**10.2**	**9.9**	**97.1%**	**0.2**	**2.4%**				

all averages are weighted averages for whole watershed classed by channel width.

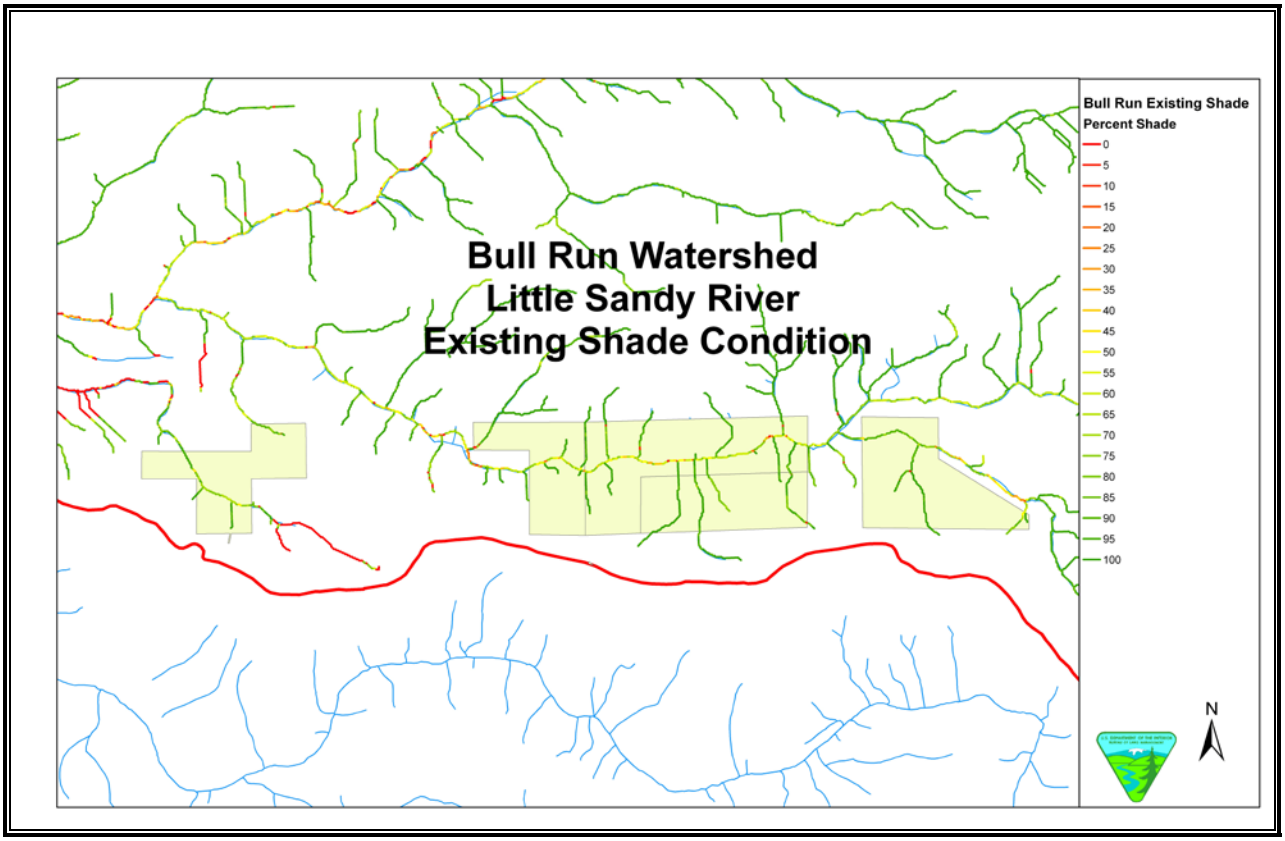
***channel sizes; small = < 25ft, medium 26 - 50 ft, large >50**

**** Target shade: based on average shade curves from TMDL and channel widths**

***** Based on growth curves for sub-basin and average tree height at System potential in TMDL**

Miles are not contiguous miles

Map 5.1 Rapid Shade Model Results on BLM land in the Bull Run River Watershed

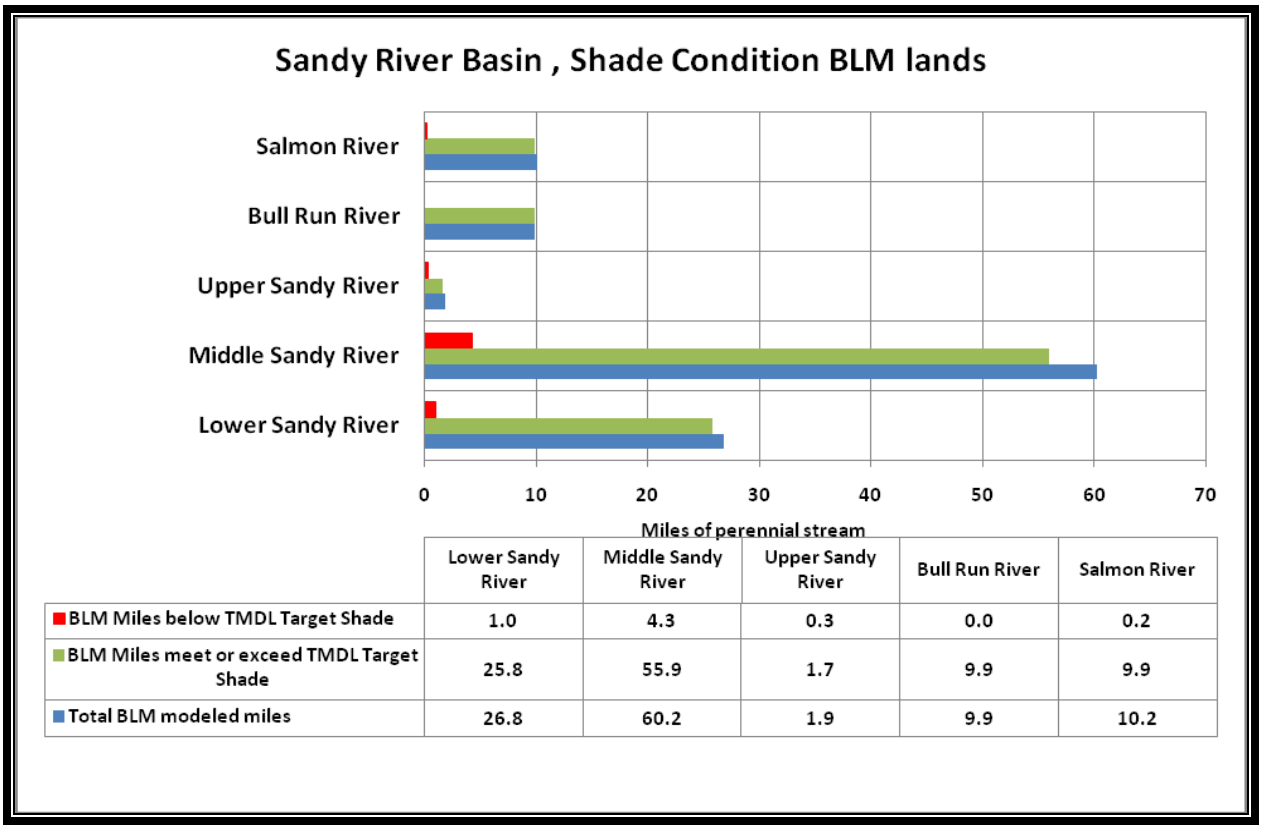


Basin and Watershed WQRP Summary

- The shade condition model assessments indicate that most BLM perennial streams are meeting the TMDL shade targets (**Figure 7.1**).
- Those modeled channels not meeting targets are generally scattered headwater channels, with minor flow contribution to heating. These are typically located in young conifer stands which have less than 50 years to system potential condition that will provide target shade.
- For the TMDL, ODEQ performed individual near stream vegetation and flow regime simulations for the major stream reaches. Results show that, on a basin scale, riparian condition is good and improvements in stream temperature are relatively modest under system potential conditions. BLM's shade analysis results validate this conclusion for riparian areas on BLM.
- The BLM checked the sites identified by the ODEQ as having "potential measurable shade benefit" which were in BLM management. Most of these sites have no active restoration potential although natural tree growth will reach potential effective shade in less than 30 years.
- Increased flow to the Middle Sandy River from the removal of Marmot Dam will likely have the most significant impact on reductions in temperature to the downstream previously 303d listed reaches.
- The greatest potential for BLM restoration of riparian areas is on recent acquired lands, such as the Marmot Dam site and Minsinger Bench.
- There is a general lack of large "in channel" wood, however it is not always predictable.
- Future recruitment of LWD will largely be through passive restoration. Active wood placement has and will occur where multiple benefits such as habitat enhancement, channel condition and water quality are possible.

- Perhaps the most significant process influencing riparian function for shade is the frequency, magnitude and duration of disturbance events. The Sandy Basin has experienced numerous floods over the last 150 years. Floods such as those 1964 and 1996 and more recent storm events have had significant influence on channel dimension, floodplain and riparian function throughout the stream network. These landscape altering events are not as infrequent as once believed with maximum annual peak flows exceeding the 1996 flood event 20 times in the last 150 years. In the decade between 1900 and 1910 the yearly maximum peak flows exceeded the 1996 flood event seven times (Hulse et al, 2002). The maximum flood of record at the Marmot Gage occurred on December 22,1964, with a recorded flow of 61,400 cfs. The maximum flood of record at the Sandy below Bull Run Gage occurred on the same day, with a recorded flow 84,400 cfs. These are significant events that have direct effect on riparian system potential vegetation and in some locations, the ability to reach TMDL shade targets.

Figure 7.1 Summary of Existing Condition Analysis on BLM Ownership by Watershed



	Lower Sandy River	Middle Sandy River	Upper Sandy River	Bull Run River	Salmon River
BLM Miles below TMDL Target Shade	1.0	4.3	0.3	0.0	0.2
BLM Miles meet or exceed TMDL Target Shade	25.8	55.9	1.7	9.9	9.9
Total BLM modeled miles	26.8	60.2	1.9	9.9	10.2

2. GOALS AND OBJECTIVES

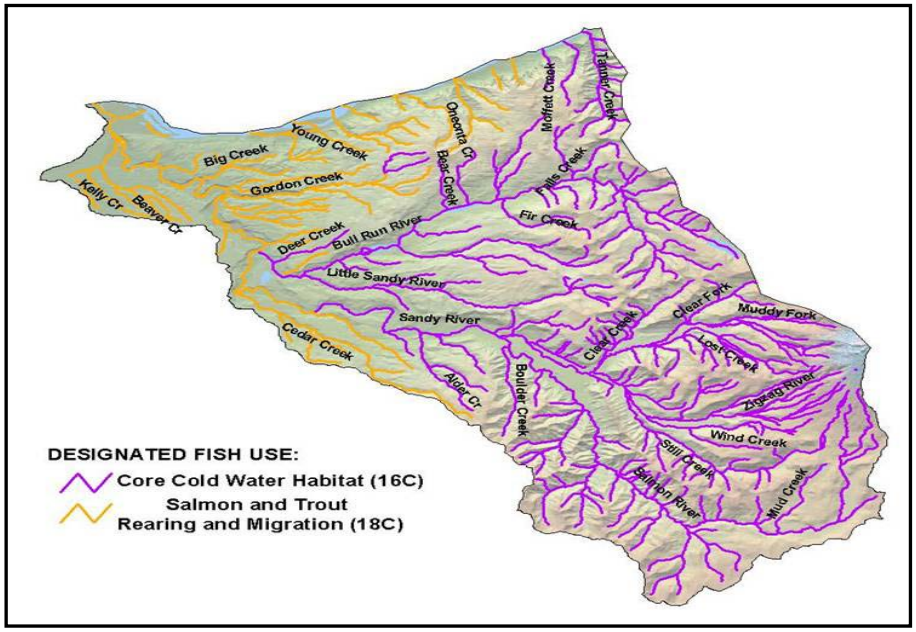
Oregon's water quality criteria for temperature are designed to protect beneficial uses, such as cold-water salmon and trout species, based on specific salmonid life stages. The temperature criteria include both narrative and numeric criteria**. Table 8.1** lists the temperature criteria that are applicable to the Sandy River Basin. **Maps 8.1 and 8.2** illustrate designated basin fish use and salmonid spawning use. The maps indicate where the salmonid spawning through fry emergence, core cold water habitat, and salmonid rearing and migration criteria apply. For streams on BLM administered lands where fisheries uses are not identified, the applicable criteria are the same as the nearest downstream waterbody that is identified in fish use maps. Most streams which are under BLM management which contain fish are included under the Salmon Steelhead spawning or Core Cold Water Habitat criteria.

Table 8.1 Oregon's Biologically Based Temperature Criteria

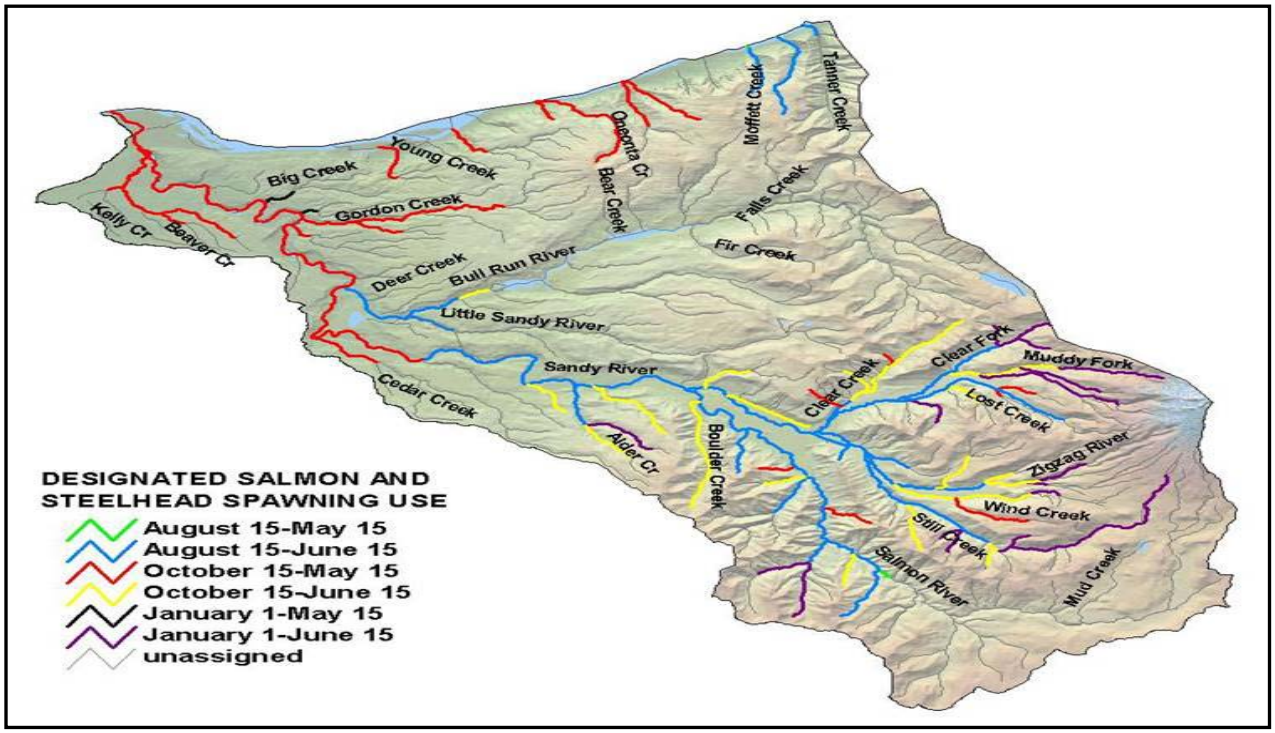
Beneficial Use	Temperature Criteria
Salmon and Steelhead Spawning	∗13.0°C (55.4°F)
Core Cold Water Habitat Identification	*16.0°C (60.8°F)
Salmon and Trout Rearing and Migration	∗18.0°C (64.4°F)

∗ Stream temperature is calculated using the average of seven consecutive daily maximum temperatures on a rolling basis (7-day calculation).

Map 8.1 Fish Use Designations and Associated Numeric Temperature Criteria for the Sandy River Basin



Map 8.2 Salmon and Steelhead Spawning Through Fry Emergence Use Designations for the Sandy River Basin.



Temperature TMDL Goals

The Sandy River Basin stream temperature TMDLs were developed at the watershed scale to protect beneficial uses described above. These TMDLs include all surface waters that affect the temperatures of 303(d) listed water bodies because stream temperature is affected by thermal loading from upstream as well as local sources. Removal or disturbance of riparian vegetation is the primary activity that could affect stream temperature on lands administered by the BLM. The current loading from non-point sources in the subbasin is much greater than that which would exist if these systems were not disturbed. The TMDL cannot restore the historic thermal regime to these systems; however, TMDL implementation can reduce thermal inputs and restore some naturalized thermal potential capable of supporting beneficial uses. The TMDL load allocation is the numeric target for determining whether the thermal reduction is being achieved.

Load Allocations

OAR 340-042-0040(h)

Load Allocations are portions of a total heat loading capacity that are partitioned among natural, current and future nonpoint pollution sources in a watershed. The Sandy River Basin TMDL requires nonpoint sources to reduce thermal inputs to reach natural thermal potential conditions through an effective shade surrogate (see surrogate measures section). This surrogate uses “shade curves” which are used to determine the site-specific load allocation.

A principle means for meeting the effective shade load allocation in the forestry sector, is through protection and restoration of mature riparian vegetation or system potential vegetation. The TMDL recognizes that additional measures may also become necessary to improve summer water temperature. For example, stream restoration that results in a narrowing of the stream channel will improve effective shade. It is expected that effective shade values would increase if stream channel widths decrease.

In addition to managing for system potential vegetation other methods for decreasing stream temperature and increasing effective shade might include:

- Decreasing sediment input where stream channel morphology is being affected
- Increasing stream channel complexity through development and input of large wood
- Road / Stream crossing replacement which is designed for natural bed load and debris movement.

In the TMDL, load allocations (including the forestry sector) were allowed 0.05˚C increase in temperature above criteria (1/6th of the Human Use Allowance, 0.3˚C). This heat allowance would accommodate activities that might increase thermal loading (such as riparian restoration) or for human disturbance that may not easily be addressed (e.g. presence of a road near a stream that would limit shading). This allocation would allow active riparian restoration projects using the management direction and BMP's contained in the Salem District RMP (2008).

Surrogate Measure: Percent Effective Shade

OAR 340-042-0040(5)(b), 40 CFR 130.2(i)

The Sandy River Basin TMDL incorporates measures other than daily heat loads when developing allocations for forestry related activities. These measures are termed surrogates and in the case of temperature the applied surrogate is percent effective shade which is derived from a shade curve.

Percent effective shade is defined as the percentage of direct beam solar radiation blocked and scattered before reaching the ground or stream surface. Commonly measured with a Solar Pathfinder, percent effective shade is perhaps the most straightforward stream parameter to monitor and calculate. It is easily translated into quantifiable water quality management and recovery objectives.

Shade curves represent general relationships between the percent effective shade reaching the stream surface, solar loading of the stream, system potential vegetation, stream aspect from north, and the width of the channel. The shade curves provide a quick and accurate estimate of the allocation necessary to eliminate temperature increases resulting from management impacts on stream shading. The shade curves have been calculated based on the average tree height for each vegetation unit as defined by system potential vegetation. The shade curves areas developed for the vegetation zones applicable to BLM lands in the Sandy Basin are provided in **Map 8.3** and the actual shade curves are provided in **Figure 8.1 and 8.2**.

System potential vegetation is vegetation that can grow and reproduce at a near-stream site given climate, elevation, soil properties, plant community requirements and hydrologic processes. Streamside vegetation characteristics that determine effective shade include vegetation height, canopy density, overhang, setback or distance from the edge of the stream, and the width of the riparian buffer. Mature, well-stocked riparian stands generally provide more effective shade to a stream than sparsely stocked riparian stands or stands of early successional plant communities. System potential vegetation is an estimate of the riparian condition where land use activities that cause stream warming are minimized. It does not include considerations for resource management, human use, and other human disturbances. A natural disturbance regime has been incorporated into the riparian composition that includes provisions for fire, disease, wind-throw, and other natural occurrences. The Sandy River basin temperature TMDL is based on the identification of system potential vegetation for each impaired waterbody and the calculation of the amount of shade provided by that vegetation to the stream.

Vegetation zones are used to determine the appropriate effective shade target for lands in the Sandy River Basin TMDL (see TMDL section **3.11.2)**. **Map 8.3** illustrates the general location of vegetative units in the basin. Note that the Western Hemlock Zone is the largest zone and covers most of the BLM lands. BLM lands in the Lower Sandy River Watershed are included in the Willamette valley zone.

Map 8.3 ODEQ Vegetation Shade Curve Zones and BLM land in the Sandy River Basin

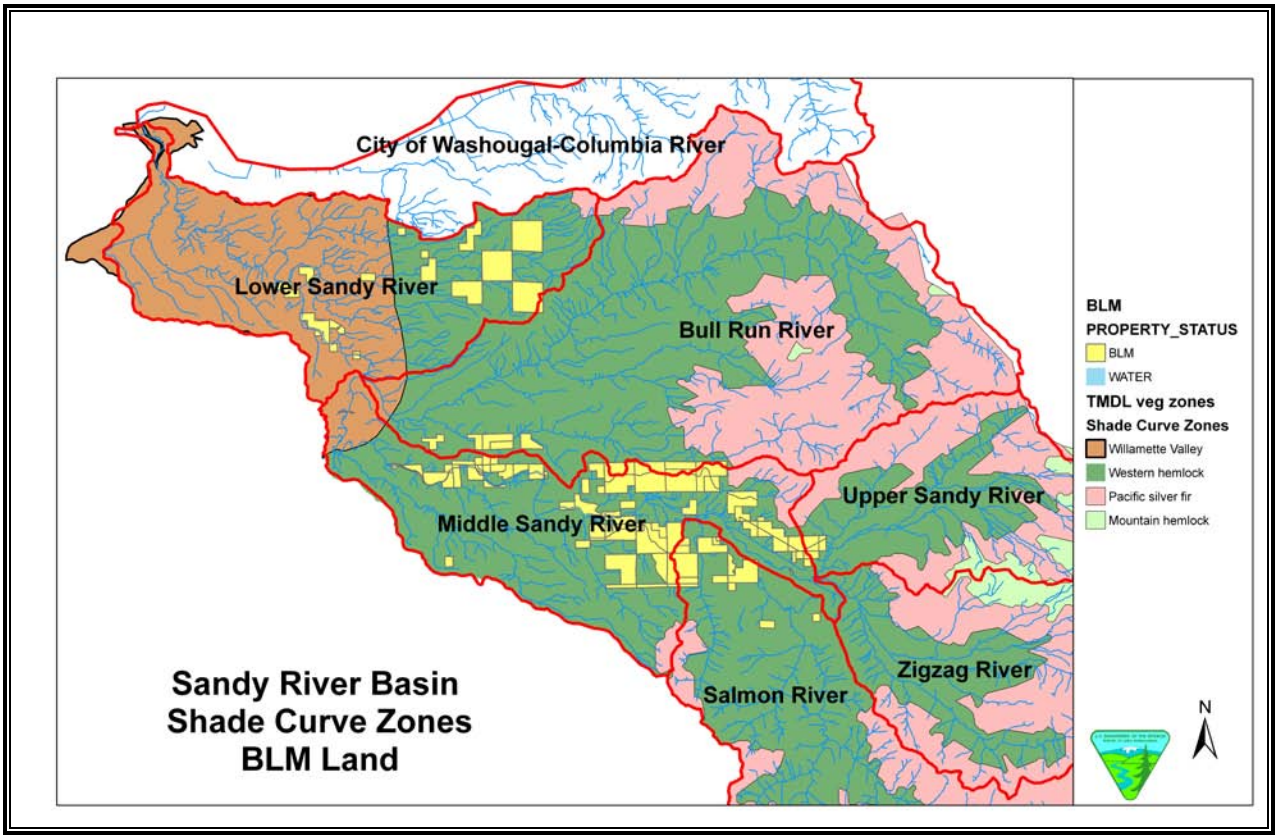


Figure 8.1 Effective Shade Curve – Western Hemlock Potential Vegetation Zone

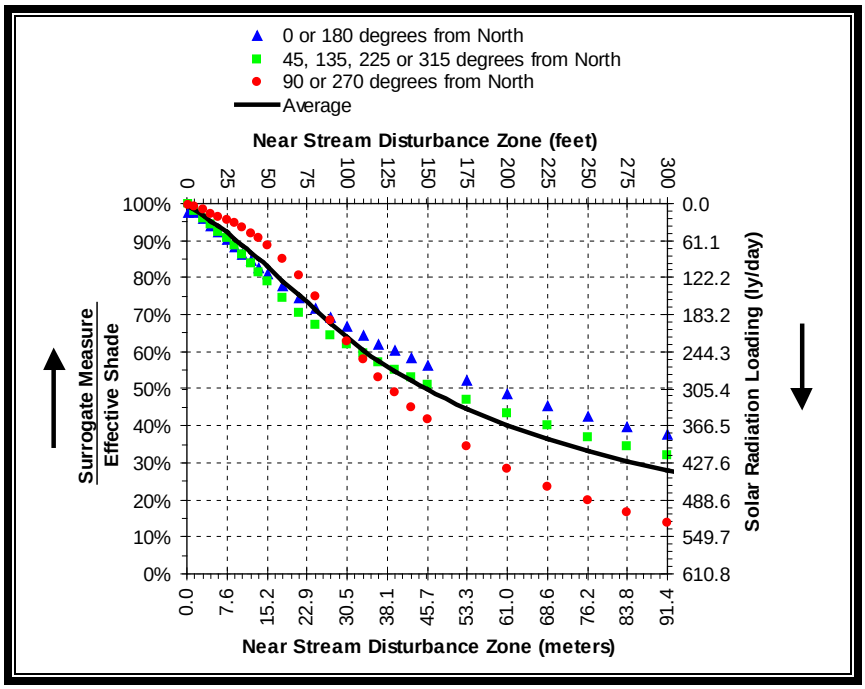
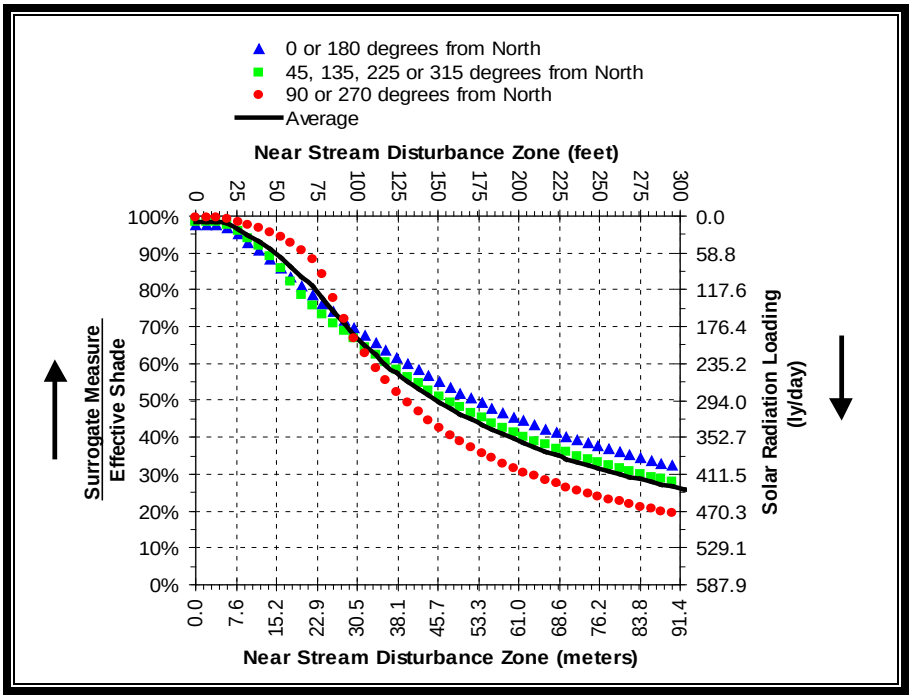


Figure 8.2 Effective Shade Curve – Willamette Valley Potential Vegetation Zone



BLM WQRP GOALS AND OBJECTIVES

The overall goal of the BLM Sandy Subbasin WQRP is to maintain or enhance riparian and channel condition contributing to compliance with water temperature standards and implement BMP's to avoid contributing to bacteria loading. The BLM objective is to achieve the TMDL effective shade targets where potential riparian and channel conditions allow. This objective will focus on protecting areas where effective shade meets current targets, avoiding future impairment of these areas, and restoring areas that are currently below the site potential effective shade. The recovery of water quality conditions on BLM-administered land in the Sandy Sub-basin will largely depend on implementation of Riparian Management Areas (RMA's), BMPs contained in the BLM Salem District 2008 RMP, and implementation of the Sandy River Basin Integrated Management Plan (2008). The ODEQ has recognized and acknowledged the utility of the BMP's in moving federal administered lands and water quality towards an improved condition. The 2008 Salem RMP include BMP's which are intended to prevent or reduce water pollution and to meet the goals of the Clean Water Act. These range from protection of existing riparian shade condition to active restoration including silvicultural treatments necessary to move riparian areas toward system potential shade. The BMPs also include sediment reduction and recreation development practices which will decrease the potential for bacteria transport and introduction to streams.

Table 9.1 provides a summary of restoration action benchmarks and schedule over the period of this plan. **Table 9.2** and **Map 9.1** provides potential water quality projects presented in the WQRP. After review of BLM modeled "temperature" reaches and follow-up field verification, the Middle Sandy River Watershed has been determined to have the highest potential for water quality restoration projects. Some of the project areas are recently acquired lands where conditions have been drastically altered to the point that the system potential vegetation and properly functioning channel conditions may not be attainable for many decades. The WQRP list of restoration projects will be updated periodically as newly acquired lands present opportunities for restoration.

Table 9.1 Water Quality Restoration Benchmarks and Schedule.

Project Implementation Schedule			
Water Quality Restoration Projects: Sandy River Basin			
Phase	**Responsible Agency**	**Action Benchmarks**	**Target Completion (FY)**
1	BLM	• Complete Water Quality Restoration Plan • Submit for approval to ODEQ	2009
2	BLM	• Continue to identify potential water quality restoration projects, prioritize and seek funding. • Complete field visits validating project potential. • Review newly acquired lands for restoration potential	2008 - 2011
3	BLM	• Complete NEPA and required design. • Identify partners and cooperators for cost-share. • Coordinate with Sandy Basin Partners , watershed councils and OWEB when possible • Implement emergency erosion control measures	2009 - 2012
4	BLM	• Complete “on the ground” lay-out of projects. • Write contracts for restoration projects.	2010 - 2013
5	BLM	• Restoration project construction and administration.	2010 - 2014
6	BLM	• Monitor completed restoration projects* *includes continued monitoring of existing effectiveness monitoring project.	2009 - 2015

Table 9.2 Potential and on-going WQRP restoration projects.

WQRP Potential Project List *Water Quality Restoration Projects: Sandy River Basin*			
Restoration site	**Type**	**Description**	**Target Completion (FY)**
Faint Road	• Road Storm proofing	• Storm proofing, protect stream crossings • Control erosion at stream crossings and road surfaces	2009 -2010
Faint Road	• Wetland Restoration	• Repair OHV damage to wetland and perennial stream. • Restore wetland and stream function • Plant native species • Control OHV access	2009 - 2010
Minsinger Bench	• Riparian vegetation restoration	• West Creek • Conifer riparian planting • Blackberry control in RMA and floodplain	2009 - 2011
Minsinger Bench	• Channel and Riparian restoration	• West Creek • Introduce channel complexity below County Bridge • Replanting native riparian shrubs under power corridor • Sediment control on upstream tributary	2009 -2011
Minsinger Bench	• Restoration of wetland flow regime	• Un-named tributary • Earthen Dam removal – wetland restoration • Planting of system potential species : Cottonwood, willow, wetland species	2011 - 2012
Marmot Dam	• Erosion control	• January 2009 flood damage • Erosion control on site and roads • Tributary 1 crossing upgrade or removal • Tributary 1 bank erosion control • Tributary 2 bank erosion control • Coordinate with revegetation plan efforts *See Recreation: Marmot Recreation Site*	2009 - 2010
Marmot Dam	• Channel and riparian restoration	• Tributary 1 • Channel re-design • Riparian planting of system potential species	2010 - 2011
Marmot Dam	• Channel and riparian restoration	• Tributary 2 • Riparian planting of system potential species • Boulder and Large wood placement •	2009 -2011
Middle Sandy-newly acquired lands	• Riparian vegetation restoration and maintenance	• Pre-commercial thinning and weed control • 200 riparian acres	2009

WQRP Potential Project List			
Water Quality Restoration Projects: Sandy River Basin			
Gordon Creek	• Riparian vegetation restoration and maintenance	• Commercial thinning • 400 acres riparian	2010-2015
Little Sandy	• Fish habitat	• Large wood structure placement	2008-2009
Salmon River	• Fish habitat	• large wood placement/side channel habitat recovery	2008-2011
Sandy basin	• Riparian vegetation restoration and maintenance	• Sandy Anchor Habitat restoration/noxious weed control (in collaboration with The Nature Conservancy)	2009-2015

3. PROPOSED MANAGEMENT MEASURES

The Salem District RMP describes general guidance for management of Riparian Management Areas (RMAs) that prevents or reduces water pollution contributing to the goal of CWA compliance. The RMA's contribute to meeting this goal through prevention and control of nonpoint source pollution to the "maximum extent practicable" (in review USDI 2008). Management direction for RMAs provide for full retention of primary shade zones and prohibit or regulate activities that could impact effective shade in the secondary shade zone. RMA widths are based on flow characteristics or the presence of fish and are determined on a site specific basis. The RMA management measures are designed to meet the principles of effective shade retention developed in the Temperature TMDL Implementation Strategy (2006). It is intended that RMA application, BMP implementation and WQRP restoration actions will collectively meet TMDL objectives.

RMA's and passive restoration will be the primary means for achieving shade targets (**Figure 8.1 and 8.2**). Active restoration will depend on interpretation of various data inputs including results of shade analysis, on-site determination of current condition and site potential, funding, environmental clearances and staff availability. The pool of restoration projects will be prioritized with the highest recommended for analysis pursuant to the National Environmental Policy Act (NEPA) and out year budget submission. Early in fiscal year 2008 the BLM initiated the WQRP process by interpreting RAPID shade model results, reviewing other data, and developing GIS coverage's for potential restoration sites. During the summer of 2008 many of these sites were visited and identified as having potential for either active or passive restoration. A majority of the active restoration actions involve replanting, weed control and channel and wetland restoration on newly acquired lands. Those active restoration sites identified were found to have the following characteristics:

- Current shade is less than the target effective shade identified from the TMDL shade curves.
- System potential effective shade is attainable under the expected site specific disturbance regime.
- Invasive weeds are encroaching and competing with native riparian vegetation.
- Road conditions are affecting channel conditions at stream crossings.
- Stream channels and wetlands are functioning at risk.
- Sites are accessible in terms of safety and logistics.

The primary means for achieving goals for channel morphology and in-stream structure on BLM-administered lands will be through passive restoration and protection of unstable areas. Active restoration will focus on promoting riparian conifer growth and large wood recruitment through silvicultural treatments, maintaining and improving road surfaces, and reducing road densities. The highest priority areas for road treatments will be in riparian and unstable areas. Large wood placement will occur where aquatic habitat improvement for fish is planned.

Management Actions

Potential treatments for development of system potential riparian and channel conditions to meet TMDL temperature targets:

- Where Western Red Cedar is lacking in the RMA but is the dominant system potential species, prioritize for re-establish in Riparian Management Areas.

- Conduct seedling and sapling thinning in the secondary shade zones along perennial and fish bearing stream Riparian Management Areas. Retain existing canopy cover in the primary shade zone (60 ft) and 50% cover in the secondary shade zone.

- Where mixed hardwood and conifer are the Riparian Management Area "system potential vegetation" but hardwood dominate, convert discrete hardwood areas to conifer species while retaining as much effective shade as possible.

- Manually release conifers from competitive vegetation in RMA's.

- Design large wood and boulder placement in channels and floodplains where these channel elements are lacking, to encourage capture of sediment, retention of flows and promotion of cool substrate flow during the summer season.
- Storm proof or decommission roads and minimize new permanent stream crossings.
- Restore wetland function where existing conditions promote solar heating.

Potential BMP's for minimizing bacteria introduction to basin waters:

- Sealed vault toilets will be used at all developed recreational facilities, unless a sewage system and drain field is approved by ODEQ.
- Construct and maintain refuse disposal sites to avoid water contamination.
- Site camps for permitted group overnight camping would be greater than 100 feet from surface water.

Monitoring; Provide results in District Annual Program summary;

- Continue long-term water temperature effectiveness monitoring at the West Creek restoration site.
- Annually conduct "effective shade retention" monitoring and RMA width monitoring as per the 2008 RMP and the 2008 Willamette Basin WQRP.
- Annually conduct BMP implementation monitoring in the basin. Re-assess the need, after 3 consecutive years of monitoring (2008 RMP).

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