Draft Assessment
Forest Plan Revision

Watershed Condition and Water Quality

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Watershed Condition and Water Quality

Introduction

The waters of the Blue Mountains national forests (Malheur, Umatilla, and Wallowa-Whitman National Forests) in northeastern Oregon and southeastern Washington provide many ecological, economic, and social benefits. Over 30,000 miles of rivers and streams and 2,000 lakes and ponds support diverse communities of aquatic species, including salmon and steelhead. Local human populations rely on the Blue Mountains for a variety of beneficial uses such as drinking water, recreation, agriculture, industry, and hydropower.

The Blue Mountains ecoregion has a range of climates driven by the complex topography of several mountain ranges (Omernik 1987, Halofsky and Peterson 2017). The southern portion of the ecoregion is within the rain shadow of the Cascade Range and is more influenced by climate of the Great Basin. The result is overall less precipitation and larger seasonal temperature swings when compared to the northern portion. The Columbia River Gorge provides a conduit for weather to flow into the northern portion resulting in higher overall precipitation (Ferguson 1999), and more stable temperatures than the southern portion. Extreme differences in elevations (267 to 3000 m) further influence precipitation and temperature regimes.

Most streamflow in the Blues Mountains national forests is derived from snowmelt. Spring runoff typically begins in late February at lower elevations and continues into August at highest elevations. Runoff is eventually routed to the Columbia River system or closed Harney-Malheur lakes basin of southeastern Oregon. Major tributary rivers of the ecoregion include the Burnt, Grande Ronde, Imnaha, John Day, Malheur, Powder, Silvies, and Umatilla in Oregon and the Tucannon and Walla Walla rivers in Washington. The Blue Mountains national forests contain most of the headwater tributaries, comprising about 25 percent of the area's river basins.

Increasing air and water temperatures and changing precipitation patterns, are already being seen in the Blue Mountains. The current warming trend is projected to continue throughout the 21st century (Halofsky and Peterson 2017). Less snowpack due to warmer temperatures and earlier snowmelt are projected to shift timing and magnitude of streamflow with higher peakflows in spring and lower summer flows. Snowpack at mid-elevations is projected to become largely absent in the future.

Scale

The terms subbasin, watershed, and subwatershed describe successively smaller hydrologic units. Subwatersheds are typically 10,000 to 40,000 acres, watersheds are about 40,000 to 250,000 acres, and subbasins are greater than 450,000 acres. This report mostly refers to subbasins and subwatersheds. Watershed conditions and priority watersheds are assessed at the subwatershed scale.

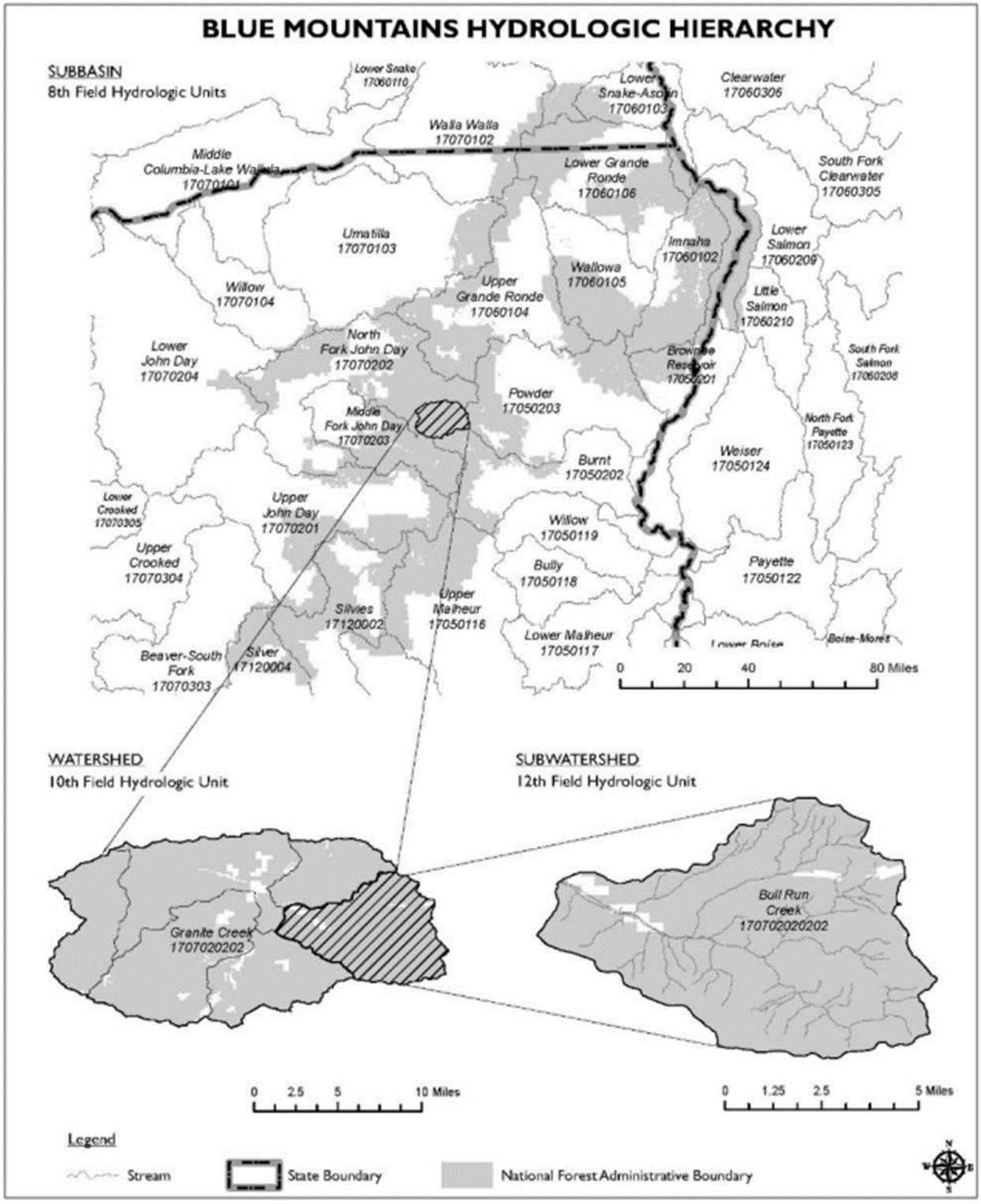

Figure 1 - Hydrologic hierarchy is displayed above for the Blue Mountains ecoregion. Each successively smaller hydrologic unit nested inside a given subbasin adds an additional 2-digit pair of numbers. For example, North Fork John Day River subbasin is 17070202, Granite Creek watershed is 1707020202 and Bull Run Creek subwatershed is 170702020202. This figure is from the USDA 2018.

Process and Methods

The primary sources of available, relevant information (*36 CFR 219.6(a)(1)*) for this assessment include a variety of reports and datasets produced by state and federal agencies. It is assumed these sources used best available scientific information. The following is a brief description of these sources.

The Watershed Condition Framework is a comprehensive approach for restoration of priority watersheds in our national forests (USDA 2011a). The Watershed Condition Framework includes an approach to classify watershed condition, using a comprehensive set of 12 indicators representing the underlying ecological, hydrological, and geomorphic processes. Indicators are grouped into four process categories: (1) aquatic physical, (2) aquatic biological, (3) terrestrial physical, and (4) terrestrial biological. Each indicator is evaluated using a defined set of attributes and receives a condition rating according to criteria in the watershed classification guide (USDA 2011b). Ultimately, each subwatershed is categorized into one of three conditions "Functioning Properly", "Functioning at Risk", and "Impaired Function".

Subsequent steps of the Watershed Condition Framework designate priority watersheds using an interdisciplinary team. Watershed restoration action plans are developed to identify essential projects to maintain or move priority watersheds into a properly functioning condition. The number of watershed restoration action plans completed and projected for completion suggests a trend in watershed condition improvement.

Water quality status is assessed with the Oregon Department of Environmental Quality 2022 integrated report (ODEQ 2022a) and Washington State Department of Ecology 2018 water quality assessment (WSDE 2022). The Clean Water Act (CWA) requires states to prepare water quality assessment reports every two years, including status (*CWA Section 305(b)*) and a list of impaired waterbodies (*CWA Section 303(d)*). These assessments use a network of monitoring sites throughout the state to determine if beneficial uses of water are supported. The Oregon Department of Environmental Quality also conducts a trend analysis on an annual basis (ODEQ 2022b). Trends in water quality are reported where monitoring data and information is of sufficient quality and quantity. Temperature is monitored throughout the Blue Mountains national forests. Dissolved oxygen, *Escherichia coli* concentration, pH, and total suspended solid concentration are also monitored at select locations.

The National Core Best Management Practices (BMPs) program consists of four components: 1) National Core BMPs, 2) standardized monitoring protocols, 3) national directives, and 4) a data management structure (USDA 2012). The National Core BMPs focus on "what to do", not "how to do it". Guidance is provided for 11 resource categories, such as vegetation management, recreation, or range. Best management practice prescriptions are developed on a project-by-project, site-specific basis. The monitoring protocol assesses a random selection of completed projects on an annual basis to determine if BMPs were implemented and are effective. This assessment will evaluate the composite rating over the last eight years to determine trends in BMP compliance. Table 1 illustrates the composite rating matrix.

Table 1. Best Management Practices monitoring composite rating matrix.

Combined Scoring Composite Rating		Implementation Rating				
		Fully Implemented	Mostly Implemented	Marginally Implemented	Not Implemented	No BMPs
Effectiveness Rating	Effective	Excellent	Excellent	Good	Good	No Plan
	Mostly Effective	Good	Good	Fair	Fair	No plan
	Marginally Effective	Fair	Fair	Poor	Poor	No plan
	Not Effective	Poor	Poor	Poor	Poor	No plan

This assessment uses the withdrawn 2018 Final EIS (USDA 2018) water uses analysis, supplemented by the United States Geologic Survey water use reports (Dieter et al. 2018). The United States Geologic Survey publishes reports on the estimated use of water in the United States on a five-year basis. The 2015 water uses report was the latest available analysis to assess trends in water use (Houston et al. 2022).

Current Management Direction

The land management plans for the Malheur, Umatilla, and Wallowa-Whitman Forests (1990) refer to state Best Management Practices to meet water quality standards and protect streams. The forest plans generally provide water quality protection using riparian management areas; a minimum of 100 feet adjacent to streams, lakes, and wetlands, as well as the extent of floodplains and riparian vegetation. The three Blue Mountains forest plans differ on management areas set aside for riparian area protection; the Malheur has a non-anadromous riparian (3A) and an anadromous riparian (3B) management area, the Umatilla has one riparian management area (C5), and the Wallowa-Whitman only has an anadromous management area (18). The Malheur and Umatilla have additional watershed-related management areas for municipal water supplies and fisheries.

All three Forest plans were amended by the interim strategies to protect anadromous and non-anadromous fish-producing watersheds (referred to as PACFISH/INFISH; USDA 1995/USDA and USDI 1995) which improved water quality protection as follows:

- Increased riparian management area widths from 100 feet for all water features to at least 150 feet for non-fish bearing perennial streams and lakes, and at least 300 feet for fish bearing streams.
- Identification of and increased protection of watersheds supporting listed species in good condition or ones that could be restored.
- Standards and guidelines intended to modify or limit adverse effects of land management activities.
- Monitoring.

Existing Condition

Watershed Condition

Status

Both the Malheur and Wallowa-Whitman National Forests have a lower proportion of watersheds in a properly functioning condition (less than 30 percent). This contrasts with the Umatilla National Forest, where 60 percent of the watersheds are in a properly functioning condition. Only the Wallowa-Whitman has watersheds classified with impaired functions, about 12 percent. See Figure 2 for a summary of watershed conditions. A map of watershed condition classification is located in Appendix A, figure 9.

Of the twelve indicators driving watershed conditions, soil condition, forest health, and terrestrial invasive species have the least influence on overall watershed conditions. Aquatics (biota and habitat), riparian/wetland vegetation, water quality, and roads/trails indicators have the greatest influence. Water quantity, fire effects/fire regime, forest cover, and rangeland vegetation indicators have moderate influence.

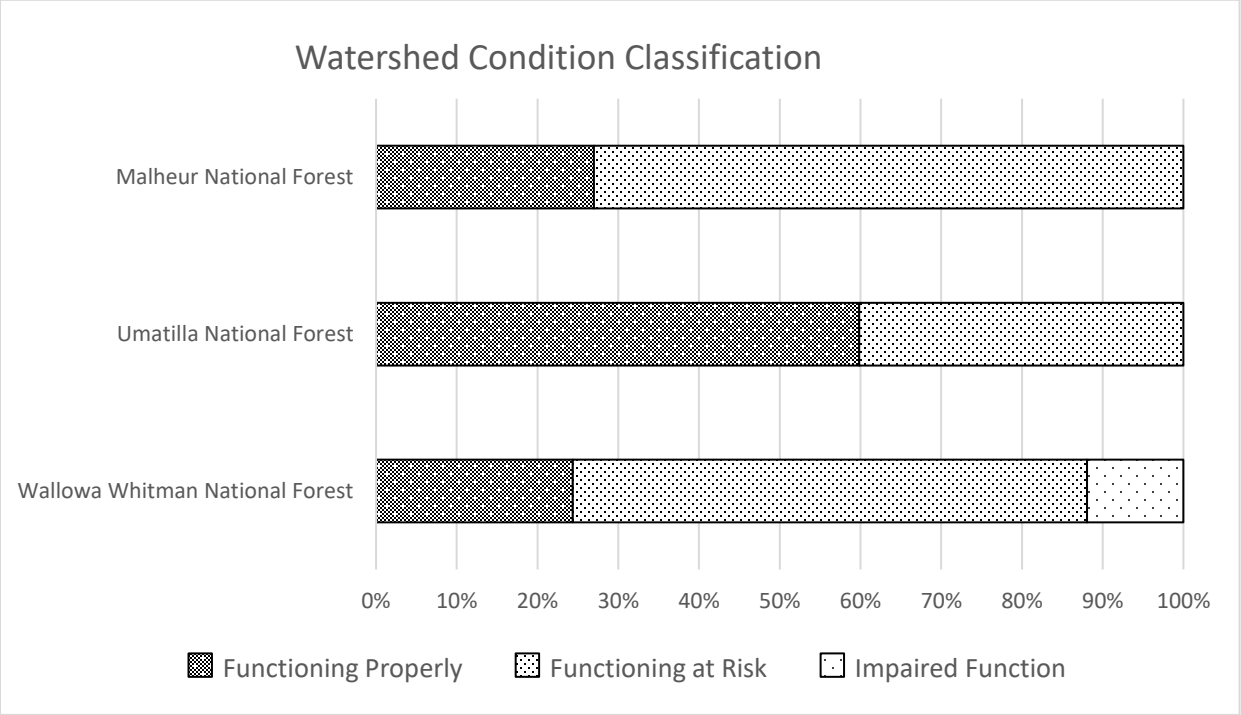

Figure 2 – Overall watershed conditions of the Blue Mountains national forests from the Watershed Condition Framework watershed condition classification dataset.

Trends

Completion of all essential projects identified within a watershed restoration action plan is assumed to result in an improved watershed condition (Figure 3). The Wallowa-Whitman has completed the most watershed restoration action plans of the Blue Mountains national forests and is projected to complete more into the foreseeable future. The Umatilla has completed two watershed restoration action plans and intends to complete two more by the end of 2027. The Malheur recently completed one watershed with plans to complete two more by 2026. The Aquatic, Wetland and Riparian Ecosystems assessment report includes more information on restoration occurring in the Blue Mountains national forests.

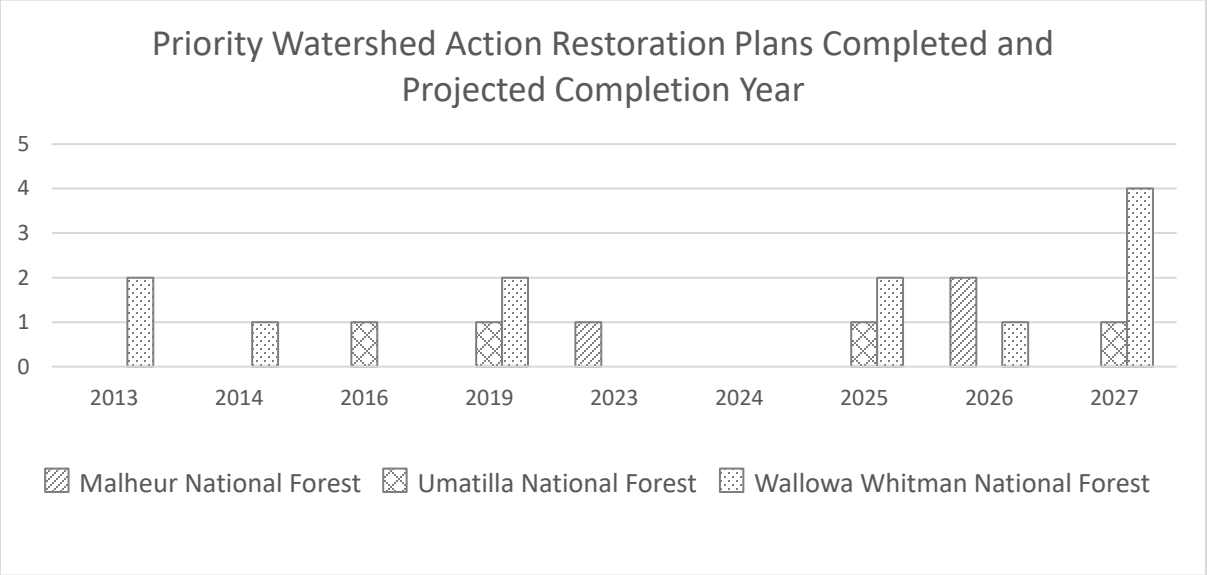

Figure 3 – Watershed restoration action plans completed and planned by year in the Blue Mountains national forests. Information is from the Watershed Condition Framework watershed condition classification dataset.

Water Quality

Status

Most flowing surface waters in the Blue Mountains national forests attain state water quality standards with less than nine percent of total stream miles on the 303d list of impaired waters. However, about 28 percent of perennial stream miles are considered impaired. Most streams are impaired due to elevated water temperature. Other impairments include dissolved oxygen, pH, sediment, *Escherichia coli*, flow and habitat modifications, and biocriteria. In contrast, about 60 percent of non-flowing surface waters (lakes and reservoirs) are impaired, relative to surface area. Most impaired lakes and reservoirs are those greater than 25 acres. Lakes and reservoirs are impaired due to a variety of parameters including temperature, dissolved oxygen, sediment, arsenic, and methylmercury.

Causes of elevated temperature include loss of stream shade, altered channel morphology, loss of floodplain connectivity, and changes in streamflow. Sediment levels in streams vary significantly with

stream flows, with the highest levels during winter and spring runoff. Some stream reaches show evidence of sediment accumulation from varying sources, such as local stream bank erosion, more erodible geologic materials, and roads near streams. Sediment accumulation is a natural function in lower gradient streams, but some areas show evidence of excess sediment accumulation from past and ongoing management activities. Hazardous substances associated with mine discharge were identified in areas with past mining. Other water quality impairments include nutrient and bacteria from livestock, wildlife, and recreation. These impacts generally occur during times of concentrated use in localized areas.

Trends

Stream temperature monitoring performed by the Oregon Department of Environmental Quality, Forest Service, and partner agencies provides stream temperature trends over the last twenty years (ODEQ 2022b and associated data tables). Although there are many water quality monitoring locations in the Blue Mountain ecoregion, only monitoring sites with at least eight years of data are included in trend analyses. Overall trends indicate improved stream temperature (cooler) in many but not all subbasin streams of the Blue Mountains national forests (Figure 4). Trend monitoring of other less prevalent impairments such as dissolved oxygen, *Escherichia coli*, pH, and suspended sediment was only available for two subbasins, Upper Malheur and Silvies. Upper Malheur had no significant trends to report. Silvies had an improving trend in dissolved oxygen, but a degrading trend in pH. A map of water quality status and trends in located in Appendix A, figure 10.

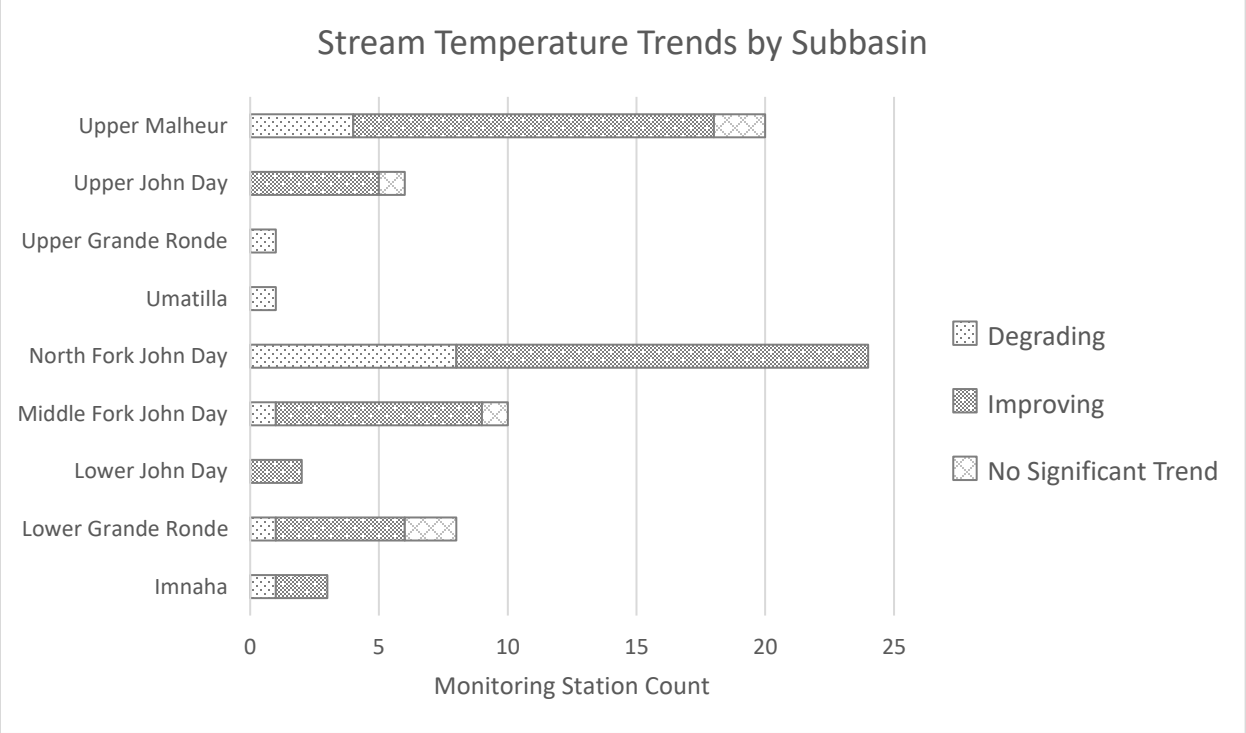

Figure 4 – Trends in stream temperature by subbasin from the Oregon DEQ water quality status and trends dataset.

Climate change is expected to affect water temperatures both by raising ambient air temperature as well as by reducing summer low flows (see Climate Change Assessment report). Climate change may also indirectly affect water quality via increased risk in severe fire behavior that could lead to removal of riparian vegetation cover and exposure of soils. In addition, earlier snowmelt would shift spring peak flows to occur earlier than before. More frequent rain-on-snow events would result in larger peak flow events that move more sediment.

Best Management Practices Monitoring

At the project level, water quality impacts from non-point sources are minimized by prescribing best management practices (BMP). The National Core BMP monitoring program provides a composite rating of BMP evaluations (both effectiveness and implementation). The following bar charts illustrate trends in BMP composite ratings for each forest (figures 5, 6, and 7)

Figure 5 – Malheur National Forest composite rating trend from the National BMP monitoring dataset.

For the Malheur, a total of 53 evaluations were completed from 2015 through 2022, averaging 13 per year. Roads, range, and vegetation management evaluations account for most fair or poor ratings throughout the trend period. Water uses also contributed to poor ratings twice, with recreation and aquatics each being rated poor once. Fire management and minerals were rated excellent or good. The latest trend suggests an equal proportion of excellent, good, and poor ratings, with fair being the least frequent.

Figure 6 - Umatilla National Forest composite rating trend from the National BMP monitoring dataset.

For the Umatilla, a total of 27 evaluations were completed from 2015 through 2022, averaging seven per year. During the 2015/2016 cycle all ratings were good or excellent. The 2019/2020 and 2021/2022 biennial reports only had four and one evaluation completed, respectively. Roads were most frequently rated fair or poor, followed by recreation. Range, fire management, and water use were rated fair or poor during one of biennial reporting cycles. Aquatics, chemical, mineral, and vegetation management were all rated excellent or good. Due to the limited number of evaluations since 2019 the latest trends are uncertain for the Umatilla National Forest.

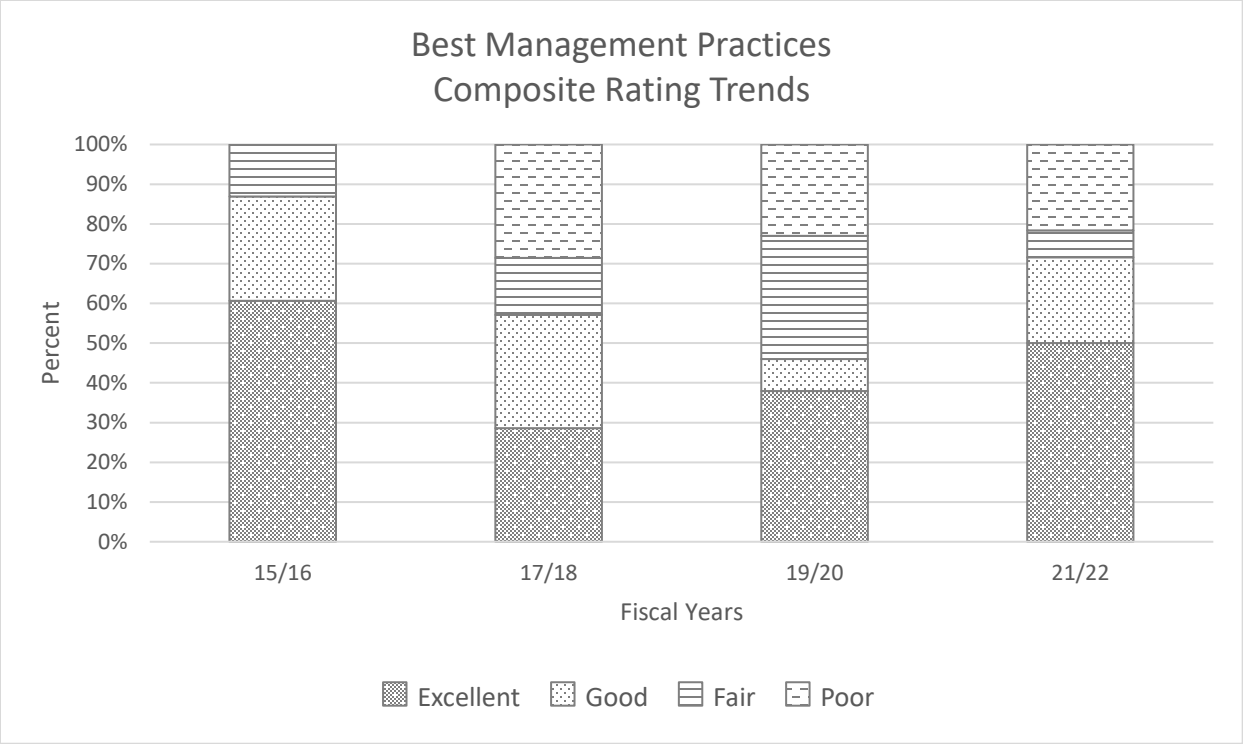

Figure 7 – Wallowa-Whitman National Forest composite rating trend from the National BMP monitoring dataset.

For the Wallowa-Whitman, a total of 48 evaluations were completed from 2015 through 2022, averaging 12 per year. Roads, range, and water uses were mostly rated fair or poor throughout the trend period. Minerals and vegetation management were rated fair or poor once. Aquatics, chemical, facility, fire management, and recreation were rated excellent or good. Excellent ratings are trending in a positive direction over the last six years.

Water Uses

Status

Within the Blue Mountains national forests, water is used for several purposes including habitat for anadromous and resident fish species, domestic and municipal uses, commercial and industrial uses, Forest Service management, mining, irrigation, and other uses. By volume, the largest water uses are instream flows to maintain freshwater habitats, water quality or recreation (greater than 40 percent of total streamflow), and irrigation (20 percent). Instream water rights are held by several State agencies in Oregon and Washington.

Most water diverted from the Blue Mountains national forests is for agricultural uses on private lands. Domestic and municipal uses account for less than two percent of total water use. Of the many points of diversion within the Blue Mountains (nearly 4,000), 74 percent of Forest Service owned water rights provide for livestock, the rest for wildlife. Water use by livestock in the Blue Mountains national forests equates to annual water consumption of about 1000 acre-feet or 0.02 percent of annual streamflow. Consumptive use of water for irrigation diverted to private lands downstream accounts for 15 to 22 percent of annual streamflow. In subbasins where irrigated agriculture is most developed, summer water use is 50 percent to more than 90 percent of available stream flow, and estimated consumptive use of water exceeds 90 percent of streamflow for one or more months of the growing season in six different subbasins.

Storage water rights within the Blue Mountains national forests totals less than 120,000 acre-feet; 25 percent of reservoir storage distributed across seven different subbasins, not including the Snake River. For comparison, winter snowpack stores an estimated 3.5 to 4.2 million acre-feet of water that is released over a 3- to 6-month period beginning in February at low elevations and extending into August at high elevations. The total amount of water withdrawn for public, domestic, commercial and industrial, livestock watering, and agriculture was roughly 2.3 million acre-feet in 1995 and consumptive use (the amount not returned to streams) was roughly 1.3 million acre-feet, or 18 percent of annual stream flow from all area rivers.

Many communities rely on the Blue Mountains national forests for their drinking water. National Forest System lands are the primary source of drinking water for the cities of Walla Walla, Pendleton, La Grande, Baker City, Long Creek, and Canyon City. Some communities have municipal water rights in National Forest System lands but currently use other sources. By state law, in Oregon and Washington, municipal water rights do not lapse for non-use, and communities retain the right to develop these sites in the future. Many smaller community or individual water systems have sources within National Forest System lands. Various agencies have delineated surface water and groundwater source protection areas (see Appendix A, Figure 11).

Trends

Water use trends are informed by the United States Geological Survey (USGS) uses of water in the United States reports (Dieter et al. 2018, Houston et al. 2022). The counties included in the Socioeconomic Assessment report were used to assess trends in surface and groundwater use (Figure 8). Although these trends are not specifically for water use in the Blue Mountains national forest system lands, they are important because given the national forests are the major source areas for surface water and groundwater in the ecoregion. Observed trends are like those for the United States and Oregon with overall water use decreasing over the last decade. However, in the last decade groundwater use has increased relative to surface water use. This trend is likely due to less regulation and conservation measures on groundwater use when compared with surface water use as well as technological advances resulting in more efficient use (Dieter et al. 2018). According to the USGS, irrigation accounts for nearly all the estimated water use, with public supply and industry accounting for less than one percent (Houston et al. 2022).

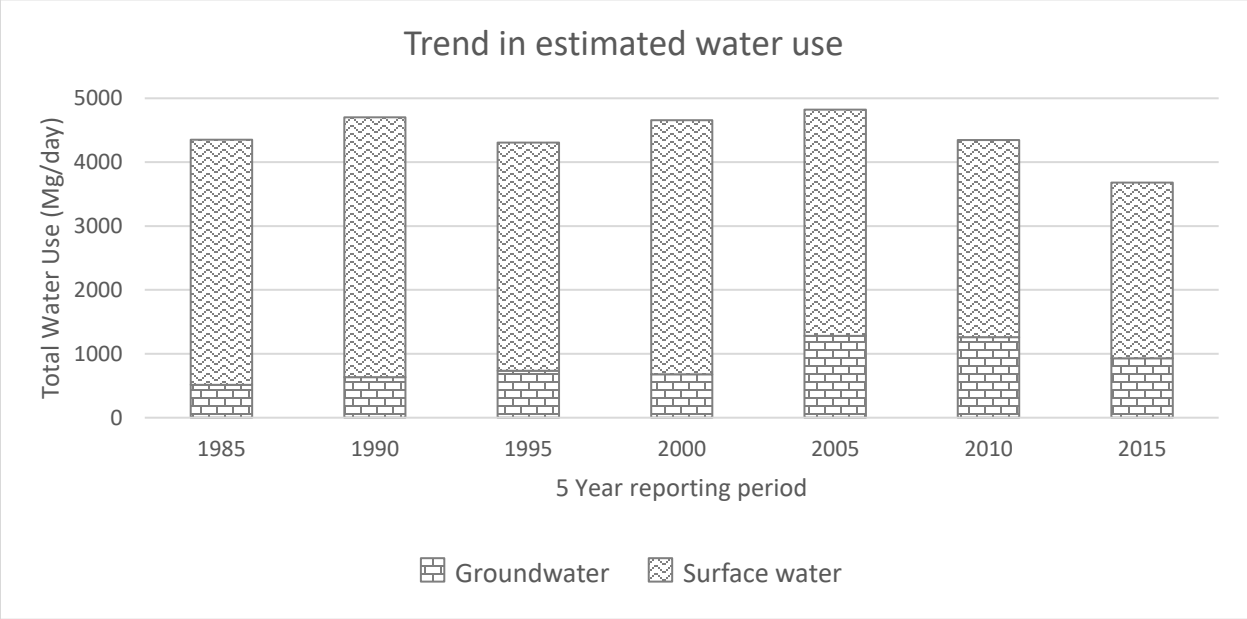

Figure 8 – trend in estimated water use by type for counties in the ecoregion. Total is from counties included in the socioeconomic assessment.

It is anticipated that climate change will bring warmer temperatures and decreased snowpack to the Blue Mountains (see Climate Change Assessment report). Decreasing snowpack due to climate change would alter timing and availability of water supply, affecting municipal and public uses downstream from and in national forests. There is anticipated to be increased spring high flows and lower summer low flows. Declining summer low flows would affect water availability during late summer, the period of peak demand.

Key Findings

Overall, watershed conditions in the Blue Mountains national forests are functional, but the majority of subwatersheds are at risk. The indicators are aquatics (biota and habitat), riparian and wetland vegetation, water quality, and roads. Water quantity, fire effects and fire regime, forest cover, and rangeland vegetation indicators also influence these conditions. Watershed restoration work is ongoing in the Blue Mountains national forests. Stream temperature is the primary water quality impairment in the Blue Mountains national forests, although monitoring suggests there is an overall improving trend in stream temperatures (cooler). Best management practices monitoring results are mixed; non-point source pollution from roads, range, and water use account for most fair to poor evaluations. Humans greatly depend on water of the Blue Mountains national forests for a variety of uses. Climate change is projected to impact watershed condition, water quality, and water availability.

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Appendix A – Maps

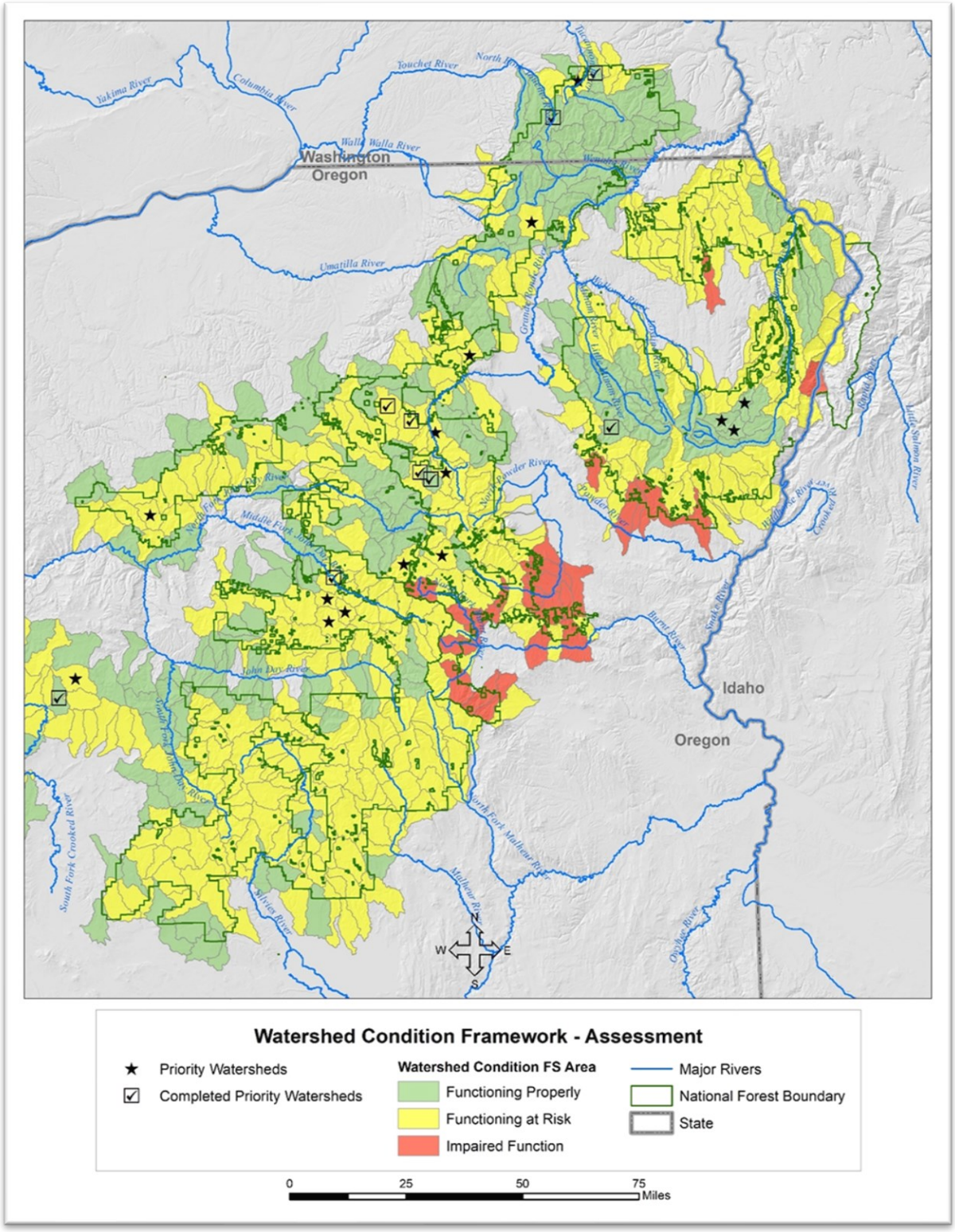

Figure 9. Watershed Condition Framework Assessment.

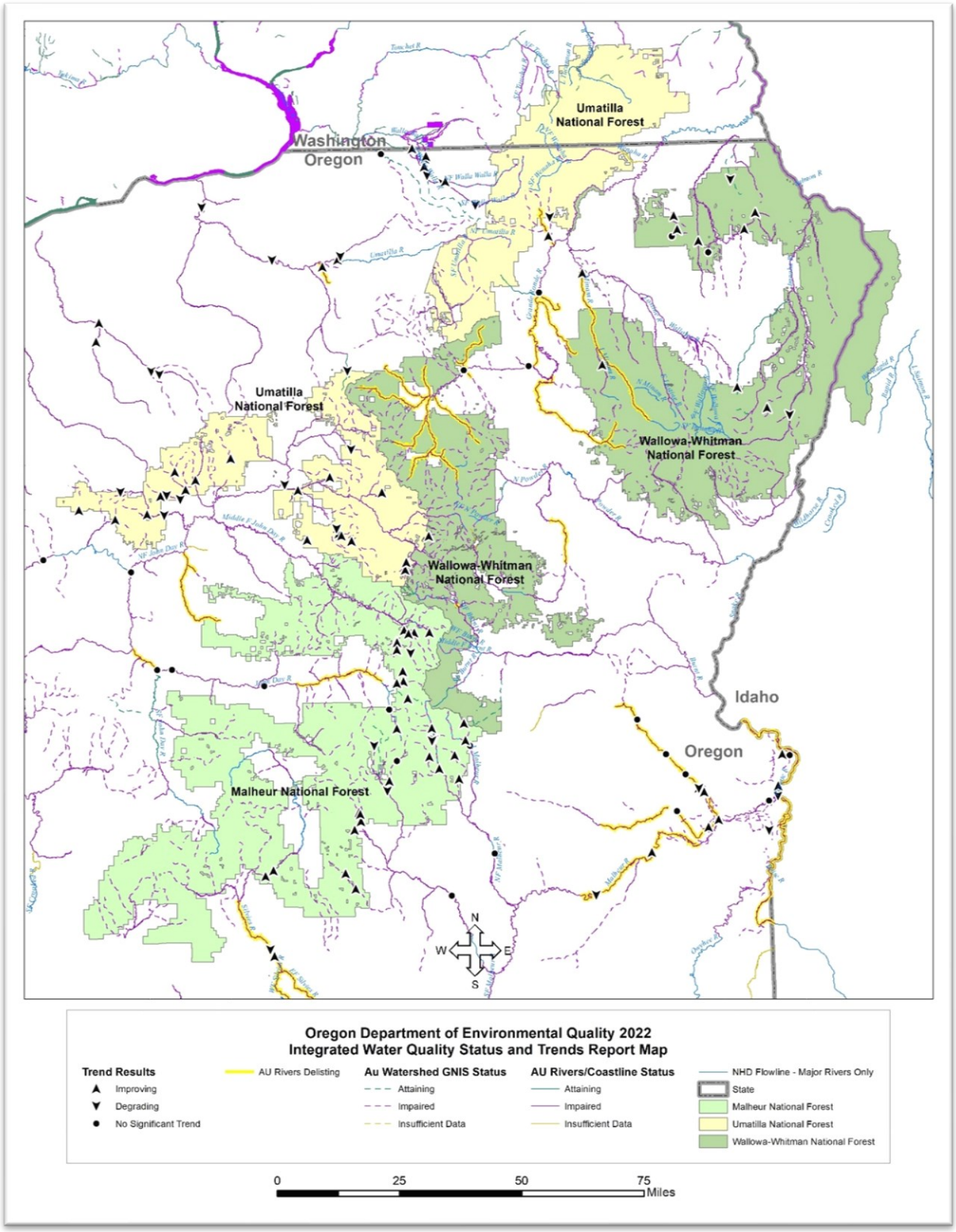

Figure 10. Oregon DEQ 2022 Water Quality Status and Trends Report Map.

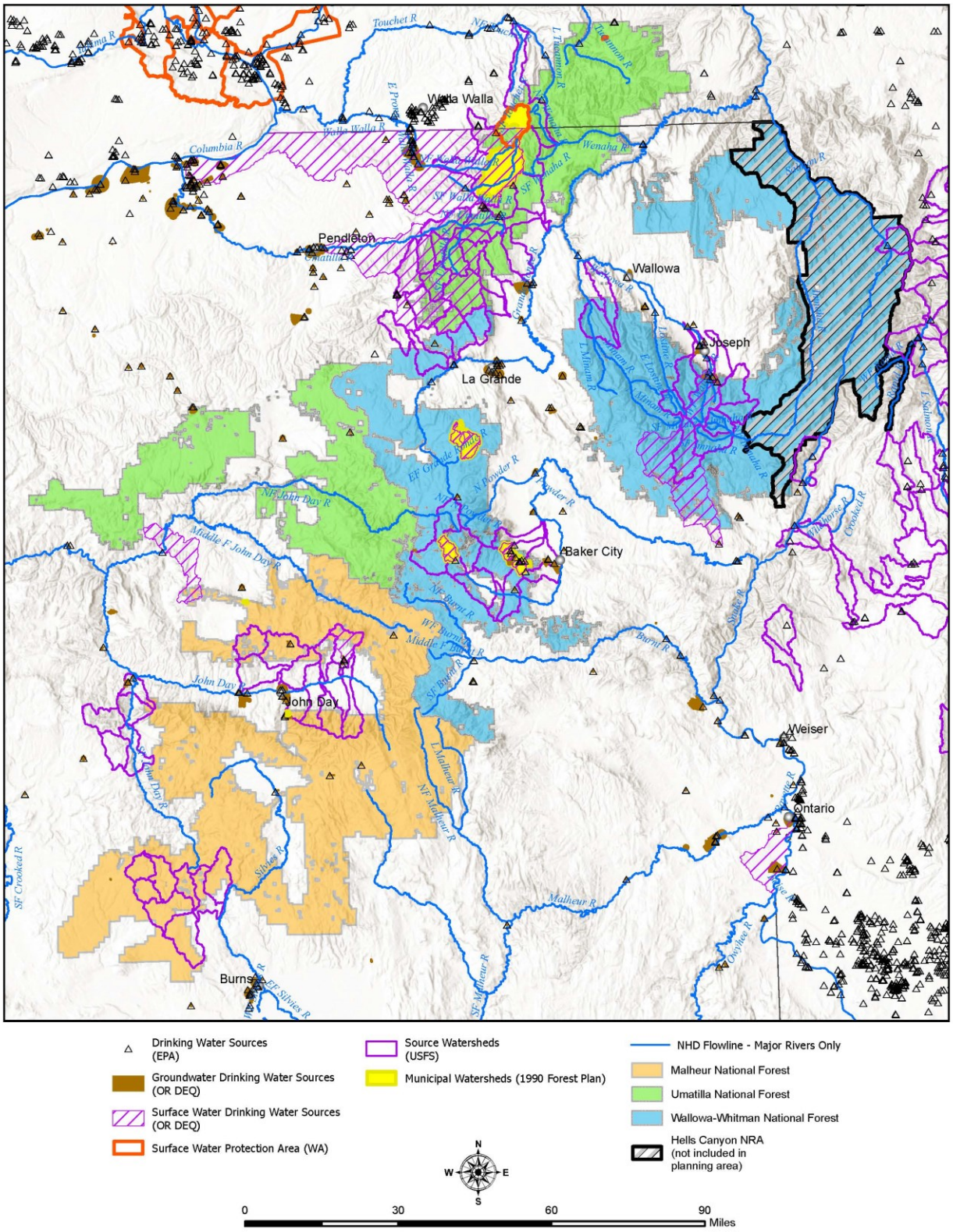

Figure 11. Surface water and groundwater protection areas from the Forest Service, State of Washington, State of Oregon, and the Environmental Protection Agency.