CHAPTER 2.0
EXISTING CONDITIONS

2.1 Natural Resources

2.1.1 Climate

The climate of the Scoggins Valley is relatively mild throughout the year, characterized by cool, wet winters and warm, dry summers. The climatic conditions closely resemble the Mediterranean climates that occur in California, although Oregon's winters are somewhat wetter and cooler. Similar to most of Oregon, the Scoggins Valley has a predominant winter rainfall climate. Typically about 50 percent of the annual total precipitation falls from December through February, with lesser amounts in the spring and fall, and with very little during the summer.

There is considerable variation in precipitation within the Willamette Valley ranging from annual totals below 40 inches in the Portland area to upwards of 80 inches in the Cascade and Coast Range foothills. Elevation is the most important determinant of precipitation totals. Extreme temperatures in Scoggins Valley are rare; only about 5 days on average per year are at or above 90 degrees (F) and about 51 days a year have temperatures below freezing. Snow fall is limited to about 5 inches per year (Oregon Climate Service 2002). Winters are likely to be cloudy with an average of 80 percent cloud cover during the coldest months. Twenty six days are generally cloudy in January for instance. During the summer sunshine is more abundant with average cloud cover less than 40 percent and more than half the days in July are clear. **

The Scoggins Valley area is in attainment with federal air quality standards (Oregon Department of Environmental Quality 2002). The general vicinity is rural and other than the nearby lumber mill there are few pollution generators. Henry Hagg Lake is outside of the nearby Portland Metropolitan Service District, which extends west as far as Forest Grove. This district is considered a maintenance area by the U.S. Environmental Protection Agency because it had a history of non-attainment of air quality standards but is currently meeting these standards.

2.1.2 Topography

Much of the land surrounding the reservoir is hilly and has slopes of 20 percent or greater (Figure 2.1-1) (Reclamation 1994). Elevations within the park range between 180 and 450 feet but adjacent features extend to above 1,000 feet. Level areas can be found adjacent to the reservoir particularly between Scoggins and Tanner Creeks and north of the Sain Creek cove. In many areas moderate slopes lead from the reservoir edge at full pool (Photo 2-1).

Photo 2-1. Aerial view of Henry Hagg Lake and surrounding foothills and Coastal Mountain Range.

The creeks leading into the reservoir flow through narrow, often steep canyons. Downstream of the dam Scoggins Creek flows through a wide, level valley dominated by agriculture.

2.1.3 Geology

Henry Hagg Lake and the Scoggins Creek drainage basin lie on the eastern side of the Coast Range. The geology in the area consists of Tertiary volcanic rocks and marine sediments. The volcanics consist of basaltic flows and the sediments are poorly indurated (cemented into a hard mass) marine sandstone, shale, siltstone, and claystone.

There are four distinguishable formations that comprise most of the drainage area. These include, in order of decreasing age, the Lower Eocene Siletz River Formation (pillow flows and breccia), the Middle Eocene Yamhill Formation (cemented siltstone and claystone), the Upper Eocene Tillamook Volcanics (basalt flows), and Tertiary Intrusive Rocks that consist primarily of dikes and sills of basalt (Reclamation 2000).

Extensive weathering of the Tertiary formations has occurred as the result of precipitation and time. Outcrops of unweathered rock are rare and the degree of weathering is more or less uniform in depth throughout the area. Weathering generally ranges from 20 to 30 feet in depth below ground surface. The residual soil is composed of soft, tan to brown, moist, lean to fat clay to clayey sand with scattered decomposed fragment of sedimentary and volcanic rock. A thin surface layer of topsoil mantles the residual soil. The topsoil consists of organic silt with lesser amounts of fine sand (Reclamation, 2000)

2.1.4 Soils

Soils in the vicinity of Henry Hagg Lake are derived from the weathered marine sediments and volcanic rocks that form the east slopes of the Coast Range. Soil profiles in the area generally consist of a thin layer of topsoil mantling a deeper layer of residual soils. Area topsoil is composed of organic silt with lesser amounts of fine sand. The underlying sediments consist of material formed from extensive weathering and mixing of the existing marine sediments with the Tertiary volcanic rock formations. This residual soil is generally well-drained and characterized by a soft, tan-to-brown, moist, clay-to-clayey sand with scattered decomposed fragments of sedimentary and volcanic rock (Reclamation 2000).

The moderately steep topography of the Scoggins Valley, coupled with the extensive annual precipitation, has resulted in area soil deposits created largely through alluvial processes. The 14 soil types that occur in the vicinity of Henry Hagg Lake are listed in Table 2.1-1 and illustrated in Figure 2.1-2 (USDA 1982). The specific locations of occurrence of soil types in and around Scoggins Valley Park are shown in Figure 2.1-1.

Many of the soil types located on the steeper slopes (>10%) in the study area represent moderate to severe erosion hazards. In general, the geologic process of sediment accumulation that resulted in the formation of the majority of study area soil types also resulted in soil characteristics conducive to erosion. Subsurface material formed from alluvial (related to surface water), colluvial (sediment deposited at the base of slopes), and eolian (wind-weathered) processes tend to be noncohesive and subject to slippage along steep slopes. However, these same soil types tend to be well-drained with slow runoff in more level areas, which may mitigate the potential for erosion.

Soil erosion in surrounding lands and the resulting deposition of sediments into Henry Hagg Lake have been long-standing concerns of land managers (Photos 2-2 and 2-3). In planning for park development prior to the construction of Scoggins Dam, potential sediment yield and lost reservoir capacity

Figure 2.1-1 Slope and Hydrography

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Figure 2.1-2 Soils

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Table 2.1-1: Soil types adjacent to Henry Hagg Lake.

Map Unit	Soil Type	Slope	Depth to Bedrock	Erosion Hazard	Soil Characteristics
6B	Carlton Silt Loam	0-7%	>65 in	slight-moderate	moderately well-drained silty clay loam; permeability is moderate to slow
8C	Chehalem Silty Clay Loam	3-12%	>50 in	slight-moderate	gently sloping to moderately steep on alluvial fans; runoff is slow to medium,
10	Chehalis Silt Loam	Nearly level	>60 in	slight	well-drained, silt loam surface with heavy silt loam subsoil; runoff slow
9	Chehalis Silty Clay Loam	Nearly level	>60 in	slight	deep, well-drained; runoff slow; located on smooth flood plains
19B,C,D,E	Helvetia silt loam	2-30%	>60 in	slight-severe (depending upon slope)	moderately well-drained; moderately slow permeability; slightly acid; four soil types and map units based on slope
29B,C,D,E,F	Laurelwood Silt Loam	3-60%	>70 in	slight-severe (depending upon slope)	deep, well-drained; moderate permeability; acidic, formed in silty eolian material overlying fine-textured uplands
30	McBee Silty Clay Loam	30-65%	>65 in	slight	moderately well-drained; moderate permeability; silty clay loam surface, dark clay loam subsoil
31B,C,D,E,F	Melbourne Silty Clay Loam	2-60%	>65 in	slight-severe (depending upon slope)	deep, well-drained; moderately slow permeability; silty clay loam, formed in residuum and colluvium weathered from sedimentary rock
35C,D,E,F,G	Olyic Silt Loam	5-90%	40-60 in	moderate –severe (depending upon slope)	well-drained; moderately slow permeability; silt loam surface layer; silty clay loam subsoil 30 inches thick
36C,D,E,F	Pervina Silty Clay Loam	7-60%	40-60+ in	moderate-severe (depending upon slope)	well-drained; moderately slow permeability, from sedimentary rock residuum and colluvium, over siltstone and shale at 40-60+ inches
38B,C,D,E,F	Saum Silt Loam	2-60%	50 in	slight-severe (depending upon slope)	well-drained; silt and silty clay loam; medium acid profile; slow runoff
39E,F	Tolke Silt Loam	5-60%	>60 in	moderate-severe	well-drained, from eolian materials in volcanic ash, moderate permeability
40	Udifluvents	nearly level	varies with subsoils	slight	heterogeneous mixture of soils deposited in concave streambeds, silt, loams, cobbles, pebbles; moderate permeability; runoff slow, often ponded
43	Wapato Silty Clay Loam	0-3%	varies with subsoils	slight	poorly drained; runoff slow; vernal ponding; bottomlands along streams

Source: USDA 1982.

were estimated. No formal written report is available documenting these sediment yield estimates. However, Table 2.1-2 presents data on estimated potential sediment yield and capacity reduction presumably based upon 1955 planning studies as reported by Water Resources Services to Reclamation (pers. comm., Ferrari 2000). The estimated sediment yields are slightly higher than estimates for other western reservoirs likely due to assumed local precipitation, surrounding steep topography, or actual data from sediment load sampling prior to park development (Reclamation 2000).

Photo 2-2. Shoreline erosion near Elks Picnic Area.

Actual rates of sediment deposition in Henry Hagg Lake are thought to be close to the pre-reservoir estimates identified above. Reclamation, in a report entitled Geologic Report on Sediment Accumulation and Distribution in Henry Hagg Lake (Reclamation 2000), documents the nature and extent of sediment deposits at the mouths of Scoggins, Sain, and Tanner Creeks. The investigation focused on exposed sediments during a mild drought period in November 1999. The majority of the lakebed sediment deposition was found to occur below elevation 270.0 feet, corresponding to the level at which the reservoir is maintained for flood storage during the winter storm period when the majority of the sedimentation occurs.

The area of accumulation around the mouths of Scoggins, Sain, and Tanner Creeks was estimated at 60 acres, 30 acres, and 10 acres respectively. The depth of post-reservoir deposits in these areas averaged 2.5 feet, ranging from 0.5 to 5 feet. Based upon this 2.5 feet average depth, the total volume of sediments exposed at low water during 1999 field studies was estimated at 250 af (Reclamation 2000).

Photo 2-3. Shoreline erosion control structure at Sain Creek Picnic Area (at low pool).

Using data collected from the exposed sediments investigated in November 1999, Reclamation was able to estimate the amount of submerged lakebed sediments accumulated since the construction of Scoggins Dam. The total area of sediment accumulation in the irregularly shaped, submerged depositional area was estimated at 100 acres. Based on an average thickness of 2.5 feet, the volume of submerged sediments was estimated at 250 af. Thus, Reclamation concluded that in 1999 the total volume of accumulated sediments (ex-

Table 2.1-2: Pre-reservoir estimated sediment yield and capacity reduction.

Original capacity	59,910 af
Drainage area	40.6 square miles
Projected annual sediment yield	0.51 af/square mile
Projected sediment inflow	2,000 af/100 years
Lost capacity in 100 years	3.3%

Source: Reclamation 2000.

posed at low water plus those submerged at low water) deposited in Henry Hagg Lake was approximately 500 af. A bathymetric survey has been scheduled for the near future to more precisely assess the actual sediment accumulation in Henry Hagg Lake since dam construction (Reclamation 2000).

The combination of underlying lithology and surface soils in the Scoggins Creek watershed makes the lands around Henry Hagg Lake highly susceptible to slumping and landslide activity. DLUT has monitored landslide activity in the vicinity of local access roads – in particular, Scoggins Valley Road and West Shore Drive – since prior to their development. Repair and mitigation for landslide activity along park roads are frequent and widespread (pers. comm., G. Clemmons, 2002). In the 1970s, extensive slide activity was noted on Scoggins Valley Road along the north shore of the reservoir and north of Nelson Cove, and on West Shore Drive near the current location of Recreation Area C. More recent land movements have been noted along West Shore Drive south of Scoggins Creek and along Scoggins Valley Road 0.75 mile north of the dam (pers. comm., G. Clemmons, 2002). In addition, extensive localized areas of slippage along Scoggins Valley Road north of the reservoir and on all park roads in general resulted from the extensive precipitation and associated flooding of 1996. In addition, Reclamation surveyed the landslide activity in 1999 (Reclamation 1999). Figure 2.1-3 shows the location of known major slides in Scoggins Valley Park recorded since the creation of Henry Hagg Lake.

Reclamation identified landslides in several areas as early as 1968. Slopes within slides vary in steepness from 5 to 60%. Since completion of the perimeter road in 1975, landslides have caused persistent maintenance problems for Washington County Road Operations and Maintenance personnel. The slides occur in both natural formation and man-placed fill materials and seem to be activated primarily by increases in precipitation and general raising of the local groundwater. In response to the landslides, a number of studies and corrective measures were initiated. Based on a 1980 engineering review, major road relocation was performed on critical areas, specifically Slides B, C, and F (Figure 2.1-3). In conjunction with this road work, horizontal drains were installed at most of the significant slide areas (Reclamation 1999).

Drains were installed at eight locations between 1974 and 1986. The 1999 inventory indicated that two of the eight sets of drains (Slides E and F) were still providing visible drainage. Of the remaining six sets, four could not be found and were assumed to have been sheared by subsequent slide movement, covered by slide debris and vegetation, or excavated during repair of the landslide-damaged road. The horizontal drains installed at Slides B and F were destroyed shortly after installation. Regular maintenance was recommended to keep the remaining drains functional.

Although all of the critical landslides along Scoggins Valley Road are active, it appears that most are not affecting safe operation of the road. Slide C, south of Scoggins Creek, has undergone steady deformation of the past few years and continues to be a road maintenance problem.

A number of landslides also occur outside of the park boundary on private timber lands. One notable slide is located about 2 miles north of the reservoir and was estimated at a volume of 50,000 cubic yards. While outside of the park, these slides have affected water quality in the reservoir as streams carry the mobile sediment.

2.1.5 Hydrology and Water Quality

2.1.5.1 Surface and Groundwater

Henry Hagg Lake is maintained by a watershed of 40.6 square miles located in the foot

hills of the northern Coast Range of Oregon. Water is conveyed to the reservoir via three primary tributaries: Scoggins Creek from the northwest, Tanner Creek from the northeast, and Sain Creek from the west. Combined inflow from these major tributaries ranges from more than 2,000 cfs during months of high precipitation to a flow of less than 10 cfs during the low-flow summer period of May through October (USGS 2002a, 2002b).

Most streams in the Scoggins Creek watershed are perennial. However, flows vary with seasonal extremes, with high peaks in winter and very low flows during the summer months. The period from November to March accounts for 84% of annual flow in the gauged, unregulated streams of the Upper Tualatin-Scoggins Creek watershed (BLM 2000). Table 2.1-3 shows average streamflow both above and below Henry Hagg Lake for representative data year 2000. The percentage flow contribution for each significant tributary is estimated at 69% for Scoggins Creek, 28% for Sain Creek, and 3% for Tanner Creek (Reclamation 2000).

Scoggins Dam and Henry Hagg Lake are part of the Tualatin Project, a Reclamation project first conceptualized in the 1960s and developed in the mid 1970s specifically to provide water storage for municipal and industrial uses, water quality control in the downstream reaches of the Tualatin River, recreational opportunities, conservation of fish and wildlife resources, flood control, and irrigation. Of the 53,640 af of active capacity at Henry Hagg Lake, approximately 14,000 af are designated for supplemental municipal and industrial purposes, and 16,900 af of water are made available to improve water quality in the Tualatin River through scheduled releases to augment natural low flows (Reclamation 2002).

The original natural surface hydrology of the Scoggins Creek subbasin, a component of the larger Tualatin River drainage basin, directed water from the upper reaches of the subbasin above the Sain Creek and Tanner Creek tributaries through approximately 7 miles of relatively high gradient riffle habitat to enter the Tualatin River at river mile (RM) 62.8. From this point in the Tualatin River mainstem to its confluence with the Willamette River upstream of Oregon City, Oregon at Willamette RM 28.5, flows were generally slow moving, passing through wide reaches with peripheral wetland and riparian habitat.

Ecosystems within the Tualatin River watershed have been significantly affected by human development and encroachment with resultant changes to the natural Scoggins Creek and Tualatin River watercourses including: channel straightening and relocation, bank armoring, draining of peripheral and associated wetland habitat, riparian vegetation removal, general urbanization of adjacent lands, and the damming of the natural stream channels both at Scoggins Dam and Tualatin RM 3.4. Since the implementation of the Tualatin Project and construction of Scoggins Dam, flow not diverted for municipal and industrial or agricultural uses is conveyed downstream to augment Tualatin River flows to maintain a minimum monthly mean flow of 120 cfs from

Table 2.1-3: Scoggins, Tanner, and Sain Creek monthly flow data (2000).

	Monthly Average Flow in cfs											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**July**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
In-flow to Henry Hagg Lake												
Scoggins Creek	127	124	87.9	29.1	30.1	30.1	8.81	3.74	4.00	7.07	15.8	44.0
Tanner Creek	12.0	7.90	7.58	2.87	1.77	1.33	0.90	0.00	0.00	0.03	0.33	1.39
Sain Creek	70.9	60.2	53.7	20.4	17.6	14.9	6.46	2.13	1.82	3.45	7.09	25.5
Combined In-flow	210	192	149	52.4	49.5	46.3	16.2	5.87	5.82	10.6	23.2	70.9
Out-flow from Henry Hagg Lake												
Scoggins Creek	205	64.7	105	22.4	47.8	80.1	131	179	143	116	51.8	10.0

Source: Compiled from USGS Stream Gauge Records and USA 2000.

Figure 2.1-3 Landslides

[Fig 3.3-1 in EA]

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June to August and 150 cfs for September to November as measured at Tualatin RM 33.3 (Tualatin River Watershed Council 2002). Flow augmentation is not necessary December – May.

Precipitation within the Tualatin River watershed is characterized by a typical Mediterranean climate with prolonged winter rainfall and summer drought conditions. Higher elevation precipitation, such as found in the upper reaches of the Scoggins Creek subbasin, can amount to 100 to 120 inches annually, while lower elevations, such as the lower reaches of the Tualatin mainstem, typically receive 36 to 48 inches annually (ODEQ 2001). Surface flows conveyed through the Scoggins Creek and Tualatin River watercourses from Henry Hagg Lake travel a total distance of approximately 68 miles, from an elevation of 283.5 feet at the Scoggins Dam spillway crest to 49 feet above sea level where the Tualatin River flows into the Willamette River mainstem (Reclamation 2002; ODEQ 2001).

A description of surface hydrology pertaining to Henry Hagg Lake would be incomplete without mention of the irrigable land affected by Scoggins Creek flow. Some 17,000 acres of land encompassing an area approximately 17 miles long and 15 miles wide located west of the metropolitan area of Portland receive irrigation water from Henry Hagg Lake (Reclamation 2002). By making a dependable water supply available throughout the growing season, the creation of Henry Hagg Lake has ensured increased agricultural production of a variety of crops. Irrigation water is released from the dam into Scoggins Creek and pumped into a gravity-fed distribution network of over 100 miles of pipe at the Patton Valley Pumping Plant on Scoggins Creek about 2.5 miles downstream of the dam and the Spring Hill Pumping Plant 9 miles downstream of the dam on the Tualatin River. In addition, 4,800 acres of land located nearby the watercourses are served by direct pumping of released storage water from Scoggins Creek and the Tualatin River (Reclamation 2002).

2.1.5.2 Water Quality

The Oregon Department of Environmental Quality (ODEQ) monitors and regulates the quality of Oregon's streams, lakes/reservoirs, estuaries, and groundwater. Water quality standards are established to protect the "Beneficial Uses" associated with a particular water body. In general, protected Beneficial Uses pertain to fisheries, aquatic life, drinking water, recreation, and irrigation. Oregon Administrative Rules (OAR Chapter 340, Division 41, Table 6) list specifically identified Beneficial Uses occurring within the Tualatin River watershed (Table 2.1-4) applicable to Henry Hagg Lake and the Scoggins Creek subbasin (ODEQ 2001). Water quality standards for individual pollutants are established to protect the Beneficial Use(s) most sensitive to potential impacts.

ODEQ is mandated according to Section 303(d) of the Federal Clean Water Act (CWA) to list water bodies within the state where one or more water quality standards are not being met. This 303(d) list includes the Tualatin River mainstem and many tributaries and/or stream reaches within the Tualatin River watershed. The Tualatin River mainstem is listed as *water quality limited* for not meeting water quality standards pertaining to ammonia, phosphorous, temperature, bacteria, and dissolved oxygen (DO), Scoggins Creek is listed only for seasonal DO insufficiencies in the lower reaches below Scoggins Dam (ODEQ 2001).

The portion of Scoggins Creek included on the 303(d) list for DO violations includes the lower reach from Scoggins Dam to its confluence with the Tualatin River. This listing pertains only to the time period from November 1 through April 30 when DO levels in the creek have been identified as dropping below DO water quality standards. The lower reach of Scoggins Creek is considered spawning habi-

Table 2.1-4: Beneficial uses identified by ODEQ as occurring in the Tualatin River subbasin.

Beneficial Uses most sensitive to DO insufficiency, as noted in lower Scoggins Creek, are shaded.

Beneficial Use	Occurring	Beneficial Use	Occurring
Public Domestic Water Supply	X	Salmonid Fish Spawning	X
Private Domestic Water Supply	X	Salmonid Fish Rearing	X
Industrial Water Supply	X	Resident Fish and Aquatic Life	X
Irrigation	X	Anadromous Fish Passage	X
Livestock Watering	X	Wildlife and Hunting	X
Boating	X	Fishing	X
Hydro Power	X	Water Contact Recreation	X
Aesthetic Quality	X	Commercial Navigation & Transportation	

Source: ODEQ 2001.

tat for cutthroat trout (*Oncorhynchus clarki*), coho salmon (*O. kisutch*), and steelhead (*O. mykiss*). Based on these Beneficial Uses identified as most sensitive to the effects of low DO, the DO water quality criterion is established at 11.0 mg/L (ODEQ 2001). For the years 1994-1998, DO concentrations were found to be below this water quality standard in 19 of 55 samples collected in the lower reach of Scoggins Creek. The median DO concentration for all samples collected during this time period is 11.4 mg/L, and the median DO percent saturation was 94% (ODEQ 2001).

Previous analyses of the DO levels in the lower reaches of Scoggins Creek have been complicated by the fact that no DO data had been collected in the reservoir itself. Prior to 1999, Scoggins Creek subbasin water quality information that included data on DO levels had only been collected at old Highway 47 (RM 1.5). Without specific information on DO levels in Henry Hagg Lake, the cause of the low DO levels in the downstream reaches of Scoggins Creek could not be confirmed. The low levels of DO were thought to result from either low DO levels in the water released from Henry Hagg Lake or from DO sinks downstream of the dam. DO sinks may develop from high biological oxygen demand (BOD) in runoff draining to Scoggins Creek; potentially high BOD discharges from the Forestex lumber mill located along Scoggins Creek downstream of the dam; and high sediment oxygen demand (SOD) resulting from decomposing organic material in creek bed sediment (ODEQ 2001).

To better understand the cause of the low DO levels in lower Scoggins Creek, the Unified Sewerage Agency (USA, now called Clean Water Services) developed the Henry Hagg Lake Watershed Monitoring Program, a 5-year comprehensive water quality monitoring program initiated in 1999. In addition to DO data, Clean Water Services now collects data on water temperature, pH, conductivity, turbidity, transparency, water chemistry, suspended solids, macroinvertebrates, and bacteria at various depths in Henry Hagg Lake and its three principal tributaries (USA 2000). A summary of water quality criteria for Henry Hagg Lake based upon these data is presented in Table 2.1-5.

Initial water quality data for Henry Hagg Lake collected by USA appear to confirm that the low DO levels in the downstream reaches of Scoggins Creek result from relatively low DO levels in the impounded waters of Henry Hagg Lake. However, because Scoggins Dam represents a fish passage barrier preventing the spawning of salmonids sensitive to decreased levels of DO, the reservoir and tributaries in the upper reaches of the Scoggins Creek subbasin are considered suitable for all identified Beneficial Uses as defined by ODEQ.

Table 2.1-5: Approximate range of Henry Hagg Lake water quality criteria based upon 2000 collection data.

	Water Temp (°C)	pH	DO (mg/L)	Conductivity (µS/cm)	Turbidity (NTUs)	Transparency (in.)	Total Coliform/100 ml (MPN)	NH_3, total N (mg/L)
Summer Months	10.0-25.0	5.8-7.2	0.5-8.0	50.0-60.0	2.0-10.0	80-150	20-200	<0.01-0.01
Winter Months	5.0-12.0	6.8-7.8	9.0-12.0	60.0-130.0	8.0-40.0	40-140	5-70	<0.01-0.01

Source: USA 2000.

Although Henry Hagg Lake and Scoggins Creek are not 303(d) listed for temperature violations, water temperature in the reservoir and the Scoggins Creek subbasin is an important water quality consideration. Water is released from Scoggins Dam to both augment flows and improve water quality in the Tualatin River, which is listed for temperature violations, with temperatures in the lower reaches of the Tualatin often exceeding the 64°F (17.8°C) temperature criterion during the summer months (ODEQ 2001). Like most reservoirs, Henry Hagg Lake undergoes seasonal thermal stratification and thus influences downstream temperatures differently depending on the time of the year. Henry Hagg Lake is a bottom release reservoir and draws from the deeper hypolimnion water layer, which is significantly cooler than Tualatin River flows during the early summer months. In the late summer when the reservoir has been drawn down, Scoggins Dam releases from the warmer epilimnion water which can, at times, exceed temperatures in the mainstem Tualatin.

Turbidity, suspended sediments, and sediment deposition into the reservoir are major water quality concerns in Henry Hagg Lake. The lithology and sedimentary soils of the Scoggins Creek watershed make the area highly susceptible to surface erosion. In addition, the sedimentary formations in the watershed are weak and susceptible to slumping and landslide activity. Eroded sediments are conveyed through surface waters to Henry Hagg Lake. This has resulted in the accumulation of approximately 500 af of sediments, which represents a total loss of 0.83% of reservoir volume (Reclamation 2000). Although the rate of sediment accumulation (estimated at 19.2 af per year) is approximately consistent with the pre-reservoir estimate of 20 af per year, the large amount of sediment entering Henry Hagg Lake may be largely responsible for problems with water quality. Specifically, this sediment contributes to BOD and the diminished DO levels in the reservoir and the lower reaches of Scoggins Creek.

2.1.6 Vegetation

2.1.6.1 Cover Types

Figure 2.1-4 shows the general vegetation cover types within the RMP study area and on the adjacent lands. During drawdown, the shoreline is dominated by extensive exposed mudflats. Exposed unvegetated mudflats consisting of the bathymetric sediment deposits of Henry Hagg Lake can extend from the high water shoreline over 1,000 feet (depending on topography) during periods of low precipitation and when the water level is lowered to provide storage for winter flood control (Reclamation 2000). When the water level is high, cover types along the immediate shoreline include emergent wetlands, riparian shrub, and areas where upland grassland and forested habitat extend to the waterline.

Cover types not directly associated with the waters of Henry Hagg Lake or its tributaries are generally upland mesic communities with low-to-moderate slopes ranging from 5 to 25%. Upland cover types in the RMP study area can be divided into two general descriptive categories: forested and grassland.

Forested areas account for more than 70% of the upland habitat in the RMP study area and include: conifer forest, mixed (coniferous/deciduous) forest, clearcuts less than 1 year old, clearcuts 1 to 5 years old, and managed tree farms (Photo 2-4). Grassland areas in the vicinity of Henry Hagg Lake include: general upland grassland (typically used for agriculture), upland grassland with mixed shrub, and those grassland areas designated as elk mitigation meadows. The following narrative describes the primary components of each vegetation category. Vegetation association acreages are listed in Table 2.1-6.

Photo 2-4. Grasslands, mixed forest, coniferous forest, and clearcuts as seen from Henry Hagg Lake.

Conifer Forests

Much of the forested land in the Scoggins Creek watershed is managed for timber harvest. Thus, all forested areas in the region are second-growth, with the most mature forested areas in the vicinity of the reservoir estimated at approximately 90 to 110 years old (Reclamation 1994). Within Scoggins Valley Park, where the forested areas are no longer managed for timber harvest, most stands have not been thinned, resulting in dense coniferous stands with a poorly developed understory. A recent exception is Recreation Area A East, where some marketable timber was removed and underbrush was thinned.

Conifer forest in and around Scoggins Valley Park is dominated by second growth Douglas fir (*Pseudotsuga menziesii*) with lesser components of western hemlock (*Tsuga heterophylla*) and western red cedar (*Thuja plicata*). Limited understory species in these dense stands often include a thin ground cover of trailing blackberry (*Rubus ursinus*), occasionally mixed with Pacific rhododendron (*Rhododendron macrophyllum*), vine maple (*Acer circinatum*), and red-osier dogwood (*Cornus stolonifera*).

Clearcuts

Much of the land surrounding the RMP study area is managed for logging. Two clearcut classifications were used in the vegetation cover map to provide information on the relative stage of regeneration and general habitat values for wildlife. These clearcuts were dominated by Douglas-fir before harvest. Clearcuts have been classified as < 1 year old or 1-5 years old. The < 1 year old clearcuts have minimal vegetative cover from regenerating trees and shrubs. The clearcuts that are classified as 1 to 5 years old have sapling trees and often dense upland shrubs such as ocean

Table 2.1-6: Area of vegetation associations on Reclamation lands at Henry Hagg Lake*.

Vegetation Association	Area in Acres
Conifer Forest	810
Mixed Forest	111
Upland Grassland	140
Elk Meadow	110
Mixed Shrub/Upland Grassland	195
Riparian	14
Wetland	34
Developed	35

*Other vegetation associations described below occur outside Reclamation boundary. Acreage is approximate.
Source: Provided by EDAW 2002.

Figure 2.1-4 Vegetation Associations

[Figure 3.5-1 in the EA]

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spray (*Holodiscus discolor*) and elderberry (*Sambucus* sp.), and young deciduous trees, particularly red alder (*Alnus rubra*).

Tree Farms

Several Christmas tree farms are located adjacent to the RMP study area. These differ from the young clearcuts because of the regular spacing of conifers up to 10 feet tall.

Mixed Forest

A deciduous overstory component is often evident in forested stands near the shores of Henry Hagg Lake. Red alder is a fast-growing hardwood species that is often first to establish in disturbed areas. This species can be found around the recreation facilities and reservoir shoreline in the park. Alder also dominates much of the riparian forest near the reservoir and its tributaries. Big-leaf maple (*Acer macrophylum*) is often a minor stand component in upland Douglas-fir forests and is prevalent in many of the forested stands rimming the periphery of the reservoir.

Upland Grasslands

Upland grassland areas in the RMP study area include a mixture of elk meadows and unmaintained grasslands within the park boundary. Outside the park, upland grassland are dominated by livestock pastures and private agricultural pastures. Elk meadows are sites maintained in upland grassland habitat as mitigation for habitat loss from the construction of Scoggins Dam and are discussed in a following subsection (2.1.6.2). Unmaintained grassland habitat in the park occurs along the northern margin of the reservoir.

Mixed Shrub/Upland Grassland

A shrub component consisting of native willow species (*Salix* sp.) and non-native invasive weedy species such as Scot's broom (*Cytisus scoparius*) and Himalayan blackberry (*Rubus discolor*) has established in some upland grassland areas. Himalayan blackberry is common along the north shore and other open areas. Scot's broom is a common vegetation component in the open areas such as the field near Recreation Area A West that is the septic field. This vegetation association is a small component of the vegetation at Henry Hagg Lake and generally occurs along the northern shoreline.

Wetland

Wetlands perform many important ecological functions. These include providing primary production in the food chain, stabilizing the shoreline, improving water quality, providing flood control, contributing to groundwater recharge and streamflows, and offering essential fish and wildlife habitat. Wetland and riparian communities in the RMP study area are generally located along the shores of Henry Hagg Lake at the mouth of tributaries of Scoggins Creek and Tanner Creek.

Species in the emergent wetland communities along the reservoir shore include sedges (*Carex* sp.), rushes (*Juncus* sp.), and a variety of wetland grass species. In addition, many of the localized areas of emergent wetland have a component of shrubby hydrophytic vegetation including willow (*Salix* sp.), red-osier dogwood, and black cottonwood (*Populus balsamifera*) saplings. The limited emergent wetland communities along the shores of Henry Hagg Lake may go through periods of desiccation and re-establishment or relocation in response to the seasonal and extended cycles of reservoir fluctuation.

Riparian Vegetation

Riparian vegetative communities define the native structural vegetation developed along lake and creek shores (Photo 2-5). Within Scoggins Valley Park, this includes the non-upland vegetative communities shading the reservoir and its associated tributaries. Overstory species common to riparian communities in the RMP study area include red alder, black

cottonwood, willow, and Oregon ash (*Fraxinus latifolia*). Common riparian understory species include beaked hazelnut (*Corylus cornuta*), ocean spray (*Holodiscus discolor*), and vine maple. These species are also found in abundance along stand edges, canopy gaps, and moist draws. Riparian habitat in the RMP study area predominantly occurs along the stream channels of the three major tributaries: Sain, Scoggins, and Tanner Creeks.

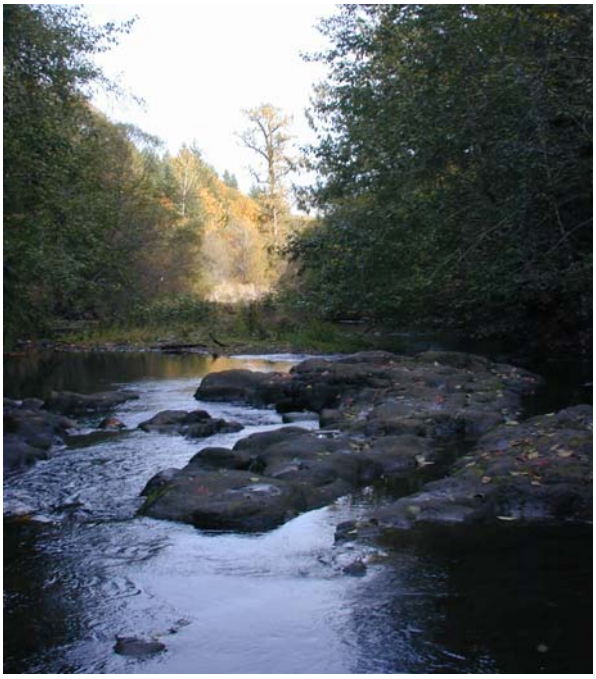

Photo 2-5. Riparian vegetation along Scoggins Creek.

Developed Areas

Areas in the RMP study area classified as developed are dominated by buildings, docks, boat ramps, and parking lots. Recreation Area A East was given a Developed/Forested classification because of the second-growth forest that remains around the existing roads and parking lot.

2.1.6.2 Elk Meadows

Construction of Scoggins Dam and the subsequent filling of the reservoir flooded agricultural fields used as wintering elk (*Cervus elaphus*) habitat. Originally, nine elk meadows were designated around the reservoir as mitigation for the loss of wintering forage in the valley behind the dam. While there does not appear to be a final written agreement between ODFW and Reclamation, notes from meetings indicate the direction for management of these parcels. In general, these parcels were to be fertilized and mowed to maintain healthy grass forage for wintering elk. Over the years, there were changes to the management and location of some of the elk meadows. Figure 2.1-5 illustrates the parcels currently being managed as elk meadows.

Currently there are 10 parcels within the park designated as elk meadows and maintained by WACO (Figure 2.1-5). These parcels total 110 acres in area. Five parcels that were originally designated as elk meadows along the northern half of the reservoir were not implemented and are not currently maintained by WACO. In addition, two parcels (#3 and 4) below the dam that were not originally designated as elk meadows are intensely managed for elk forage. Parcel 3 is managed by WACO, and Parcel 4 is managed by TVID through a lease agreement with a local farmer. The farmer is allowed to keep the hay cutting from the field in exchange for maintenance of this parcel.

Reclamation worked with ODFW and USFWS through the RMP process to develop an appropriate management plan for the elk meadows that satisfies the general goals for these parcels originally discussed between Reclamation and ODFW. The collaboration has resulted in an Elk Mitigation Meadows and Monitoring Plan (Appendix D). The plan calls for the rehabilitation and maintenance of the existing 110 acres of elk meadow with the addition of about 30 acres of elk meadow. This new meadow is proposed for a parcel of land between Recreation Area A East and Area A West that is currently the drainfield for Recreation Area A West. This site is currently infested with Scot's broom and Himalayan blackberry. The plan includes provisions for monitoring elk use of the meadows. If elk

Figure 2.1-5 Elk Meadows

[Figure 3.5-2 in the EA]

Back of Figure 2.1-5