Skamania County
Integrated Aquatic Vegetation Management Plan

v.6.15.04

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Acknowledgements

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Executive summary

The introduced, submersed, aquatic plant Eurasian watermilfoil has invaded and become established in Skamania County waterbodies confluent with the Columbia River mainstem. This species forms dense, underwater canopies which have adverse impacts on aquatic habitat as well as on human uses in these waterbodies. Three waterbodies that are infested with Eurasian watermilfoil are the focus of this Integrated Aquatic Vegetation Management Plan: Rock Cove, the mouth of the Wind River, and Drano Lake.

The overarching goal of the Skamania County Integrated Aquatic Vegetation Management Plan (IAVMP) is to control noxious aquatic vegetation in such a manner that human recreational and aesthetic use of these waterbodies is facilitated, acceptable water quality conditions are maintained, and natural functioning of aquatic systems is not impaired. This goal can best be met by preventing new weed introductions and a combination of physical, mechanical, and chemical treatment techniques.

The three focus waterbodies differ in the ways that each is used, as well as their physical characteristics and extent of milfoil infestation. Thus, the appropriate levels of control for each waterbody will also differ. Physical, mechanical, and chemical techniques are recommended for Rock Cove; physical techniques for the mouth of the Wind River; and physical and chemical for Drano Lake.

Once milfoil has been discovered in a lake, it generally requires continual maintenance to keep it at low levels. Even if milfoil appears to have been eradicated, it is often reintroduced by boaters. The Columbia River contains extensive beds of Eurasian watermilfoil. Plant fragments will likely be reintroduced from the mainstem into these waterbodies. Regular monitoring and surveying must be done so that new introductions can be quickly identified and treated before milfoil can reestablish to nuisance levels. All boat ramps should

have signs that aim to educate the public about transport of aquatic noxious species via boats and boat trailers. Aggressive public education should be done to educate and encourage boaters to clean boats and trailers before leaving or entering a waterbody.

While it is very difficult to totally eradicate milfoil from a waterbody forever, extensive, long-term follow-up activities make it possible to maintain extremely low levels of milfoil that will not impede recreational activities or impact native plant and animal communities.

Problem Statement and Management Goals

Problem Statement

Eurasian watermilfoil (*Myriophyllum spicatum* L.) is an introduced species of submersed*, perennial, aquatic plant which adversely impacts aquatic ecosystems by forming dense canopies that often shade out native vegetation. Eurasian watermilfoil is an extremely adaptable plant, able to tolerate and even thrive in a variety of environmental conditions. It grows in still to flowing waters, can tolerate salinities of up to 15 parts per thousand (half the salinity of Puget Sound in Washington), is able to tolerate pH values from 5.4 to 11, grows rooted in water depths from 1 to 10 meters, and can survive under ice.

Monospecific† stands of Eurasian watermilfoil provide poor habitat for waterfowl, fish, and other wildlife (Valley and Bremigan, 2002; Boylen et al, 1999; McKnight, 1995; Keast, 1984). Significant rates of plant sloughing and leaf turnover, as well as the decomposition of large amounts of biomass at the end of the growing season, increase the internal loading of phosphorus and nitrogen to the water column. Dense Eurasian watermilfoil mats alter water quality by raising pH, decreasing oxygen under the mats, and increasing temperature (Frodge et al, 1990). Eurasian watermilfoil impacts power generation and irrigation by clogging dam trash racks and intake pipes. Stagnant water created by Eurasian watermilfoil mats provides good breeding grounds for mosquitoes.

Eurasian watermilfoil interferes with recreational activities such as swimming, wind surfing, boating, fishing, and water skiing. This species regenerates readily from plant fragments which are easily transported on boats and boat trailers to other, uninfested waterbodies. Eurasian watermilfoil can degrade waterbody aesthetics by the formation of garbage "traps" along shorelines as well as its

* submersed – underwater
† monospecific – consisting of a single species

negative impact on native biota and general access to and enjoyment of waterbodies by humans (Newroth, 1985).

Eurasian watermilfoil has been present in the region since at least the 1970's. It was reported from Blue Lake, Troutdale, Oregon in 1979 (Beak, 1979), however, it was not detected in the Bonneville pool in 1983 (Scientific Resources Inc., 1983). The milfoil species present in Rock Cove in 1997 was identified as parrots feather (*Myriophyllum aquaticum*)(Fishman, 1997), another invasive milfoil species. Eurasian watermilfoil was documented in Drano Lake in 2001 (JD White Co., 2001).

Three waterbodies of particular concern in Skamania County are Rock Cove, the mouth of the Wind River, and Drano Lake. All of these waterbodies are located behind the Bonneville Pool and thus have fluctuating water levels due to Bonneville Dam operations. All three have been popular for fishing, boating, and wildlife viewing and Rock Cove has been used for windsurfing training and swimming. Dense stands of aquatic macrophytes in all three of these waterbodies have impeded human uses. Anglers complain of difficulty fishing in dense weed beds and boaters report fouling of motors by weeds. The use of Rock Cove for windsurf training has not been possible for several years due to the extensive surface mats of aquatic vegetation.

Eurasian watermilfoil is found throughout all of Rock Cove, in most of the eastern half of the Wind River mouth, and in shallow areas along the south, east, and northwest shores of Drano Lake. Other Skamania County waters are known, or suspected, to harbor Eurasian watermilfoil. Appendix A lists several of these waterbodies that are of potential concern, however, they are not directly addressed in this plan.

Management Goals

The overarching goal of the Skamania County Integrated Aquatic Vegetation Management Plan (IAVMP) for Rock Cove, the mouth of the Wind River, and Drano Lake is to control noxious aquatic vegetation in such a manner that human

recreational and aesthetic use of these waterbodies is facilitated, acceptable water quality conditions are maintained, and natural functioning of aquatic systems is not impaired. The management strategy should be adaptive, that is, it should be a process which integrates the lessons learned from outcomes of previous management activities into current and future activities. This type of strategy requires periodic monitoring for effectiveness and should be undertaken as a long term process rather than a one-time event.

The strategy should also have components which aim to educate and inform permanent residents and visitors about how noxious plants are transported, to prevent accidental and deliberate introductions of noxious species, to cooperate with watershed councils and agencies in a regional effort to manage Eurasian watermilfoil, and to raise public awareness so that public funding of management activities is possible.

Public Involvement

The curtailment of recreational opportunities in Rock Cove brought about by the Eurasian watermilfoil infestation prompted the Skamania County Community Events and Recreation Department to consult with the Skamania County Department of Planning and Community Development, the Board of the Skamania County Commissioners, the Skamania County Noxious Weed Board, the Wind River Watershed Council (WRWC), Washington Department of Ecology (WDOE), and the Portland State University (PSU) Center for Lakes and Reservoirs about possible strategies for aquatic weed management.

Charly Boyd (Watershed and Shorelines Planner, Skamania County) applied to the Washington Aquatic Weed Management Fund for a grant to fund the development of an Integrated Aquatic Vegetation Management Plan. Funding was awarded to Skamania County in 2002 and a contract between Washington Department of Ecology and the Skamania County Department of Planning and Community Development was signed in 2003. An interlocal agreement was made with the Underwood Conservation District (UCD) to provide facilitation and

coordination of WRWC meetings, which serve as the forum for steering committee meetings and the vehicle for public outreach. An interlocal agreement was also made with the PSU Center for Lakes and Reservoirs to write the Skamania County IAVMP.

The interlocal agreement with UCD provided the opportunity for any WRWC members to be steering committee members. Letters of invitation were also sent to the Washington Department of Fish and Wildlife (WDFW), the U.S. Geological Survey (USGS), the U.S. Forest Service (USFS), the WDOE, and the Yakama Indian Nation in March 2003. Steering Committee meetings were held during WRWC meetings every third Wednesday of the month. A total of 12 steering committee meetings were held, all of which were open and advertised to the public. Three of the 12 meetings were focused on presenting the plan components to and receiving comments from the public. The first of these public emphasis meetings was held in January 2004. All landowners adjacent to the three focus areas and all agencies were invited by letter to join the steering committee or comment on draft steering committee products (goals, maps, and problem statement). An April, 2004 letter to adjacent landowners and agencies invited review of the draft IAVMP and participation on the steering committee. Comments on the draft plan were received in April and May, 2004 and the final plan was presented to the public, landowners, agencies, and steering committee in June, 2004. Appendix B contains copies of letters to landowners, a list of steering committee members, and minutes of watershed council meetings.

The Skamania County website is being used as a public access site for dissemination of various steering committee products as well as to solicit public comment on those products. Products include the Problem and Goals Statements for the IAVMP, the maps showing the specific waterbody use areas and proposed control intensities in each waterbody, and draft versions of the IAVMP.

The IAVMP seeks to consider the needs of a diverse group of stakeholders in the watershed. This group includes citizens who own property adjacent to or underlying the three focus waterbodies; recreational users of the waterbodies; federal, state, county, and city governmental entities; the Columbia River Gorge Commission; and the Confederated Tribes and Bands of the Yakama Nation.

Watershed Characteristics

The Wind-White Salmon River Basin (Washington Water Resource Inventory Area 29 or WRIA 29) covers an area of more than 900 square miles in the Cascade Range of south central Washington. The Cascade Range is a volcanic arc stretching from southern British Columbia, Canada through Washington, Oregon, and northern California, USA. Volcanism, glaciation, and erosion have defined the geology and topography of the area. In recent times, humans have come to play a significant role in changing the landscape of the area. Completion of the Bonneville Dam in the 1930's is one of the most dramatic examples of human caused changes in the watershed.

The WRIA 29 basin comprises six subbasins (Table 1) and extends into the counties of Skamania, Klickitat, and Yakima (Figure 1). From west to east the four major subbasins are Rock Creek, Wind River, Little White Salmon River, and White Salmon River. The remaining two subbasins are the Jewett, Catherine, and Major Creeks area and the Interbasin, which contains all other interbasin drainage areas tributary to the Columbia River.

The major subbasins are oriented northwest to southeast with elevations ranging from 74 feet on the Columbia River to over 12,000 feet at the summit of Mt. Adams. Soils in the watershed are generally very deep and well drained (USDA, 1989). Basin slopes are heavily forested with Douglas fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), and grand fir (*Abies grandis*) as dominant species. Winter weather is typically wet and relatively mild, with more than three-fourths of the annual precipitation falling as rain or snow from October through March while summers are warm and dry (Washington State

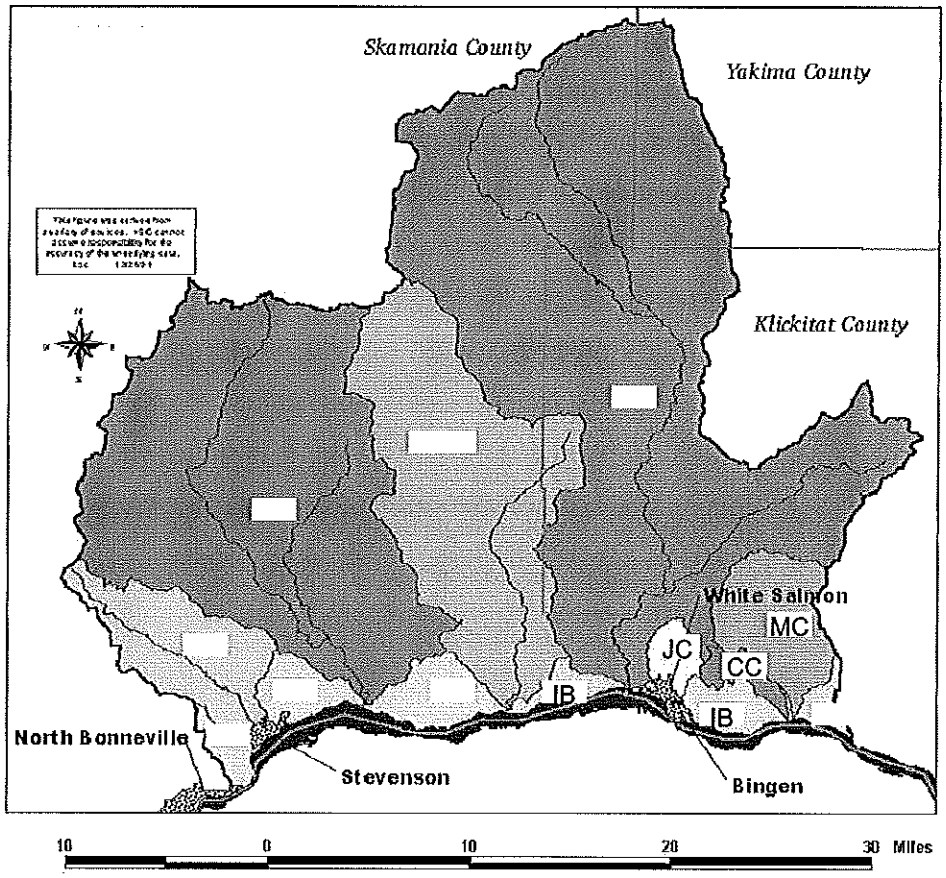
climatologist). Precipitation patterns are heavily influenced by moist, marine air masses from the west and drier air flowing from the east through the Columbia River Gorge. Consequently, the western portion of the watershed is typically much wetter, with over 100 inches of precipitation per year, than the eastern portion, with less than 40 inches of precipitation per year (Washington State climatologist).

Land use in the broader valleys of the watershed is primarily agricultural and rural residential. There are no large urban centers but rather smaller cities and unincorporated areas such as Stevenson, Carson, Bingen, and White Salmon. The upper forested portions of the WRIA 29 drainages have experienced logging activities with associated increases in road density. Much of the land in the watershed is in federal ownership (e.g., Gifford Pinchot National Forest) and much of the lower elevations is part of the Columbia River Gorge National Scenic Area. The gorge is a critical east-west transportation corridor (both road and water) linking the areas west of the Cascade Range with those to the east.

Table 1. WRIA 29 subbasins and subbasin areas

WRIA 29 Subbasin	Area (mi^2)
Rock Creek	42
Wind River	225
Little White Salmon	133
White Salmon	391
Jewett Cr.-Catherine Cr- Major Cr.	44
Interbasin	67

Figure 1. Map of WRIA 29 and subbasins. RC-Rock Creek, WR-Wind River, LWS-Little White Salmon, WS-White Salmon, MC-Major Creek, CC-Catherine Creek, JC-Jewett Creek, IB-Interbasin drainage (From Envirovision, 2003 with modifications)



Waterbody characteristics

Prior to construction of the Bonneville Dam, the lands underlying Rock Cove (River Mile 147), as well as those underlying the mouth of the Wind River (River Mile 155) and Drano Lake (River Mile 163), were emersed* lands drained by creeks or rivers flowing into the Columbia River mainstem. Completion of the dam resulted in waters of the Columbia River being impounded behind the dam, thus flooding these areas. State Route (S.R.) 14 and the Burlington Northern Railroad both pre-date the dam although they were relocated on top of a constructed dike to raise them above the impounded waters (WSDOT Public Information, pers. comm.).

The southern boundary of all three focus waterbodies is formed by a constructed dike on top of which are located State Route 14 and the Burlington Northern Railroad tracks. Each of the three focus waterbodies lies in a different subbasin of the WRIA 29 watershed: Rock Cove in the Rock Creek subbasin, the mouth of the Wind River in the Wind River subbasin, and Drano Lake in the Little White Salmon River subbasin.

Water levels in the lakes are determined to a great extent by water levels in the forebay of Bonneville Dam which are regulated by the U.S. Army Corps of Engineers and Bonneville Power Administration as part of the hydroelectric generation requirements for the region. Bonneville Dam is a run-of-river hydroelectric project, meaning that dam inflow is the same as dam outflow i.e., it has no significant storage capacity (Interagency Team, 1994). Unlike a pure run-of-river project, however, Bonneville Dam has a small amount of storage capacity (pondage) which provides some flexibility in short term operations. Normal forebay operating range for the dam is 71.5 feet to 76.5 feet with a maximum 24 hour fluctuation of four feet at the Stevenson gage (Interagency Team, 1994). Normal operating limits can be exceeded for short periods under certain conditions (G. Bower, Reservoir Control Center Bonneville Power Administration,

* emersed – rising above the waters surface

pers. comm.). The normal operating range in the forebay of the dam is fully capable of dewatering occupied Chinook and chum salmon redds* located along the shoreline of Bonneville pool (S. Wille, USFWS, pers. comm.).

Any fish species present in the mainstem Columbia River could potentially be present in any of these three waterbodies. Anadromous* fish species, such as hatchery stocks and federally listed, wild stocks of Chinook salmon and Snake River steelhead, use these lakes at various times in their life cycle. Juvenile fish typically will use the lakes for resting and rearing during the spring outmigration season. In late summer, when water temperatures in the Columbia River mainstem are high, adult fish use the cool waters as oxygen rich refuges while returning to their natal† streams. Endangered bull trout and white sturgeon are also present.

Wild anadromous salmon that occur in this stretch of the Columbia River above Bonneville Dam include: Lower and Middle Columbia River steelhead (both threatened), Upper Columbia River steelhead (endangered), Snake River Basin steelhead (threatened), Salmon River sockeye salmon (endangered), Snake River fall and spring/summer Chinook salmon (both threatened), Lower Columbia River Chinook salmon (threatened), and Upper Columbia River Chinook salmon (endangered). In general, salmon adults use the lower river principally as a migration corridor to spawning areas in the upper basin and tributaries. They are actively migrating and normally do not spend any time in the lower river testing or feeding. Steelhead will spawn in the mainstem Columbia River in gravels of appropriate size. Juveniles occur in the lower river during their out-migration to the ocean. Juveniles that have not become smolts, such as fall Chinook sub-yearlings, spend extended periods of time rearing in the lower river. They normally remain in the lower river or estuary until fall or the following spring when they become smolts and then migrate to the ocean. Rearing occurs primarily in shallow backwater areas. As stated previously, if these listed species may be

* redd – nest in which eggs are deposited
* anadromous – migrating from the ocean to fresh water to spawn
† natal – birth or origin

affected by any proposed action, the lead agency will be required to consult with NOAA-Fisheries.

Although not common, adfluvial* populations of federally listed bull trout (*Salvelinus confluentus*) are known to exist in this stretch of the Columbia River. Recent collections of bull trout have occurred in the Columbia River off the mouth of Hood River and Klickitat River, as well as in Drano Lake. Bull trout normally begin migrating upstream to spawning areas in the upper portions of tributaries in late spring or early summer and spawn in the fall. Fry hatch the following spring and may either remain in the vicinity of hatching or migrate downstream to rear in lakes or the main stems of the larger tributaries of the Columbia River. If threatened and endangered species and/or their critical habitat may be affected by a proposed action, and there is a federal nexus, the lead agency or their representative will be required to consult with the US Fish and Wildlife Service following the requirements of 50 CFR 402 which implements the Endangered Species Act.

Other fish species have been introduced into these waters either deliberately or accidentally. These include, among others: walleye, bluegill, carp, crappie, largemouth and smallmouth bass, sculpin, and shad. The Columbia River Gorge, in which these three waterbodies are located, is a well known stopover for migratory birds on the Pacific Flyway for a variety of neotropical migrants, waterfowl, passerine, and wading birds. Canada geese, sandhill cranes, and tundra swans are common on the quiet waters in the Gorge and are frequent visitors to Franz Lake and Pierce National Wildlife Refuge.

A Priority Habitat and Species (PHS) Report for the three focus waterbodies is contained in Appendix C. The PHS Program is the principal means by which WDFW provides important fish, wildlife, and habitat information to local governments, state and federal agencies, private landowners and consultants, and tribal biologists for land use planning purposes. PHS information is used to screen Hydraulic Project Applications and for review of State Environmental

* adfluvial – migratory between river mainstems and tributaries

Policy Act determinations, both of which are required for some of the management techniques recommended in this plan.

Rock Cove

Rock Cove is a 77 acre shallow cove located at the western edge of the town of Stevenson, Washington. The cove has a large littoral* area especially along the northern boundary which is composed of fill material. Bathymetric data from 1997 show the maximum depth as 14 feet (Fishman, 1997) although a 1979 map shows the maximum depth as 20 feet (Figure 2). This difference could be accounted for by different sampling methodology, different pool forebay elevation at the time of sampling, use of a different bench mark, or sediment deposition within the waterbody.

The major landholders along the north and northwest shores of the cove are Skamania County, which owns the land located between Rock Cove and Rock Creek as well as a parcel along the west shore, and the Columbia Gorge Interpretive Center, which owns the remainder of the land on the west shore as well as the four small islands in the cove (Skamania County Assessor). The county land is used for public recreation and gatherings i.e., county fairgrounds, Rock Creek Park, public swimming beach. Skamania County commissioned a comprehensive plan for the area in response to the change in economic focus from resource extraction (e.g., logging) to tourism and other non-extractive uses (Fishman, 1997).

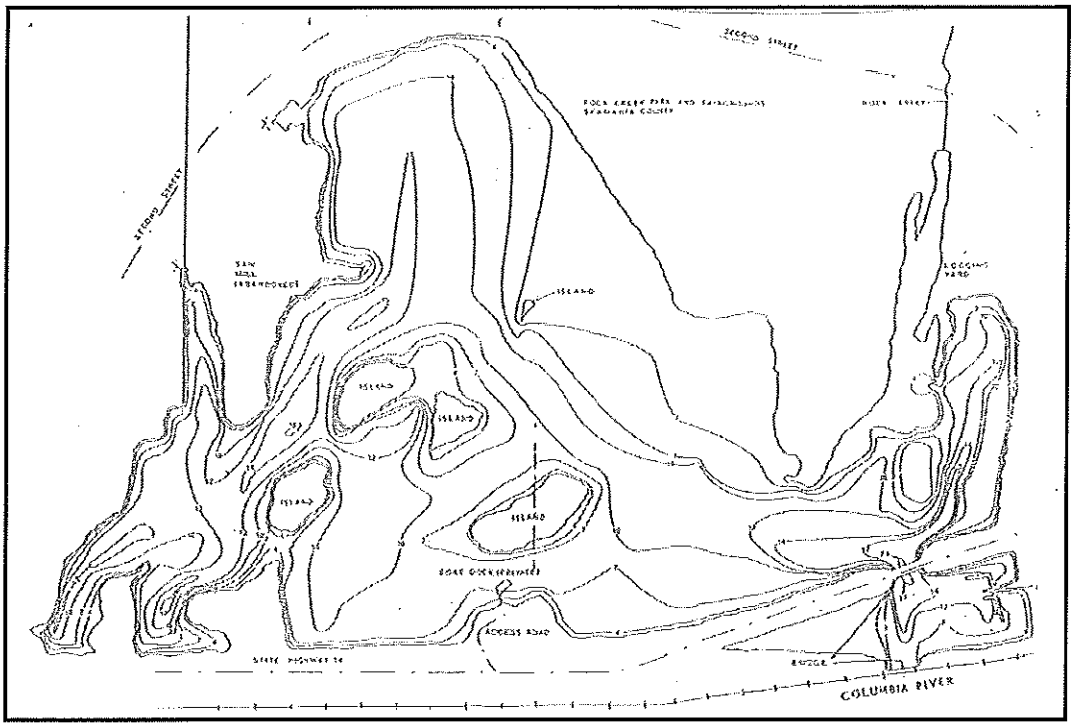
Inputs to the cove, other than direct precipitation inputs, are from Foster Creek, which enters at the western side of Rock Cove through a culvert under Rock Creek Dr.; Rock Creek which merges with the cove at its eastern side; several stormwater outfalls; and the Columbia River. No water quality data or water residence time data (i.e., flushing rates) were found for the waters within Rock Cove although water quality data does exist for Rock Creek. There are no water rights for surface withdrawals from the Cove itself (Appendix G).

* littoral – on or near a shore

Rock Cove supports abundant plant life as well as fish, invertebrates, birds, and mammals. Fishman (1997) reported largemouth bass, sculpin, steelhead, and sunfish as well as invertebrates such as mayfly, water boatman, and crayfish in samples taken from the cove in July 1997. The National Wetlands Inventory shows two palustrine, emergent wetlands in Rock Cove. One is located on the northernmost of the five islands within the Cove and the other lies at the confluence of Foster Creek and Rock Cove.

Rock Cove water is not used as a potable water supply although Le Bong Creek, a tributary of Rock Creek is the water supply for the City of Stevenson and Rock Creek itself is sometimes used to augment that supply. Recreational uses of the cove include swimming and wind surfing, fishing, kayaking, canoeing, and wildlife viewing. Swimming and windsurfing are concentrated near the north shore, while fishing, kayaking, canoeing, and wildlife viewing take place in all portions of the Cove (Figure 7). The location of the lower Columbia River gorge on the Pacific Flyway of migratory birds has resulted in the cove becoming a destination for birding enthusiasts from within and without the region. All of these activities have been curtailed to varying extents by the dense infestation of Eurasian watermilfoil.

Figure 2. Bathymetric map of Rock Cove, Skamania County, WA 1979 (from US Army Corps of Engineers.



Mouth of the Wind River

The Wind River confluence with the Columbia River is a drowned river mouth having a surface area of 21.5 acres. Although no bathymetry data for the waterbody are available, estimates of water depths were made during the summer 2003 when an aquatic plant survey was conducted in support of this management plan. Maximum depth is approximately ten feet and much of the mouth is filled by a large sediment bar lying between the county boat ramp and the S.R. 14 bridge. The bar is exposed during times of maximum drawdown.

No water quality data or water residence time data (i.e., flushing rates) were found for waters at the mouth of the Wind River although water quality data do exist for upstream locations. There are no water rights for surface water withdrawals from the mouth of the Wind River (Appendix G).

There is a tribal fishing site upstream which belongs to the Confederated Tribes and Bands of the Yakama Indian Nation. This site (among others) was transferred to the tribes in support of treaty fishing rights by Title IV of the

Columbia River Treaty Fishing Access Sites (CRTFAS) as compensation for traditional tribal fishing sites which were flooded by the dams on the Columbia River (USACE, 1995).

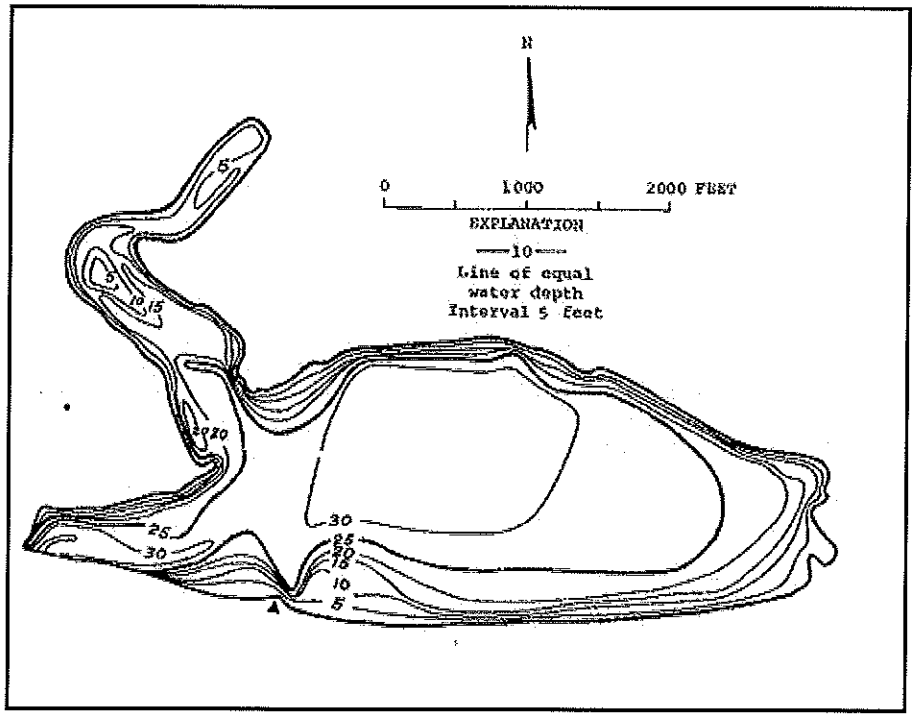
The majority of lands underlying, as well as adjacent to, this waterbody are in private ownership. These privately held lands are relatively undeveloped with no single family residences currently occupying them. Skamania County owns a small parcel on the north shore, on which are located a small parking area and public boat ramp. The county also owns a narrow parcel along the eastern shore (Skamania County Assessor). The National Wetlands Inventory shows no emergent wetlands at the mouth of the Wind River although a lacustrine, permanently flooded wetland is shown within the waterbody.

The public boat ramp is frequently congested during seasonal use by fishermen accessing the Columbia River mainstem and the bubble fishery located outside the mouth of the Wind River itself. Future plans include a general upgrade of the facilities (i.e., expanded boat launch and parking areas, transient boat docks) to accommodate increasing use. Sedimentation has formed a large bar which restricts boater use and is a safety concern for boats operating in the area. Excessive aquatic plant growth of both native species and Eurasian watermilfoil has exacerbates the problems.

Drano Lake

Drano Lake, with a surface area of approximately 235 acres and maximum depth of 30 feet, is the largest in volume of the three focus waterbodies. The Little White Salmon River enters Drano Lake at the northwest corner of the lake and waters of both merge with the Columbia River under the S.R. 14 bridge at Rivermile 162. Drano Lake has a small littoral area comprising a narrow strip of shallow water (5 to 15 ft depth) around the perimeter of the lake. The lake bottom drops off precipitously from this narrow shelf and most of the lake is 25 to 30 feet deep (Figure 3).

Figure 3. Bathymetric map of Drano Lake, Skamania County, WA 1974. (From US Geological Survey)



Ownership of land surrounding the lake is by federal, county, and private entities. The US Fish and Wildlife Service owns the land on both sides of the mouth of the Little White Salmon River in the northwest corner of the lake. The Columbia River Land Trust and Broughton Lumber Company own lands on the north and east shore of the lake none of which have been developed, and Skamania County owns the narrow parcel along the south shore containing a public parking area and boat ramp. The public boat ramp at Drano Lake is one of the most heavily used boater access points in the area. Skamania County is in the final stages of expanding the area to better accommodate the large number of recreational boaters.

Drano Lake has no water right withdrawals that are currently active, although Skamania County has applied for a water right for the purpose of irrigation (Department of Ecology, Water Resources, Southwest Regional Office, see Appendix G). No water quality data or flushing rates were found for waters within Drano Lake and no wetlands are shown adjacent to or within the lake by the

National Wetlands Inventory. Human use of the lake is primarily for recreational fishing. The boat ramp provides access to the lake, the mainstem Columbia River, and the mouth of the Little White Salmon River. The federal lands on the northwest end of the lake, below the fishing deadline, furnish one of the few areas in the entire Columbia River Gorge that is easily accessible to bank fishing.

There are two federal fish hatcheries on the lower reaches of the Little White Salmon River. The Little White Salmon National Fish Hatchery (LWSNFH), located at Rivermile 0.5 (approximately) on the Little White Salmon River, rears spring and fall Chinook salmon for release into the river. The Willard NFH (WNFH), located at Rivermile 5 (approximately) on the Little White Salmon River, rears coho salmon for transport and subsequent release into other streams. Juvenile salmon released in the spring from the LWSNFH migrate the short distance down the Little White Salmon River into Drano Lake where they rear for a brief period before entering the mainstem Columbia River on their way to the Pacific Ocean. Similarly, adult salmon returning from the ocean migrate into Drano Lake and then up the Little White Salmon river to the LWSNFH in spring and fall. Adult fish ultimately returning to the WNFH are trapped and spawned at LWSNFH, with subsequent incubation at WNFH, because fish passage to upper river reaches is blocked by a falls before the town of Willard.

Water temperatures exceeding 70 degrees Fahrenheit are common in the Columbia River during the late summer. Many migrating adult fish returning to upriver tributaries, particularly Idaho B-run steelhead, are attracted to the cool water and consequent high dissolved oxygen of Drano Lake during the summer. These fish provide a significant sport fishery as well as spring and fall tribal commercial fisheries, depending on fish returns.

Dense beds of Eurasian watermilfoil intermixed with native species impede boater access to the boat ramp, and make fishing difficult at the west end of the lake and into the mouth of the Little White Salmon River. Dense aquatic vegetation may be accelerating the process of sedimentation at the Little White Salmon River mouth. The reduced water depths caused by sediment deposition

create a barrier to fish migration into and out of the river (S. Doulos, USFWS, pers. comm.).

Vegetation survey

Methods

Aquatic vegetation surveys were made in each of the three waterbodies to determine the extent of the Eurasian watermilfoil infestations and the locations and identities of native aquatic plant species. Surveys were carried out by personnel from Portland State University Center for Lakes and Reservoirs and the USGS Western Fisheries Research Center Columbia River Research Laboratory in August and September of 2003. Access to the lakes was by small boat.

Sampling was done by tossing a plant rake from the boat, retrieving the rake, and identifying the plants brought up in the rake. Visual observations of plants in situ* were also made to supplement rake samples when water clarity allowed. A Global Positioning System (GPS) unit was used to locate sample points in Rock Cove and the mouth of the Wind River at 30 m intervals along transects spaced 30 m apart. Sampling points in Drano Lake were spaced 50 m apart.

Portions of Rock Cove had such dense macrophyte beds that it was not possible to get the boat into those areas. The plant rake was thrown into the macrophyte bed from the perimeter of the area. On the map, these areas are noted as "delimited vegetation areas." Samples in Drano Lake were made in the littoral zone and one transect was made approximately mid-lake from north to south. GPS coordinates and plant species were recorded for each sample point. Data collected were used to generate plant maps for each waterbody.

* in situ – in its original position

Results

Aquatic plant species found in samples from all three focus waterbodies are summarized in Table 2, and their distributions are shown in Figures 4, 5, and 6 (see Appendix D for complete plant survey data set, Appendix E for plant profiles). All species listed, with the exception of curlyleaf pondweed, were found in all of the lakes in varying abundances and distributions. No curlyleaf pondweed was found in the mouth of the Wind River. Fewer aquatic macrophyte species occur in these waterbodies as compared to other lakes in the region. Lakes on the southcentral coast of Oregon, for example, support a mean of six aquatic macrophyte species (Pfauth and Sytsma, 2004) with at least one lake supporting 18 different species. As noted above, none of the three focus waterbodies are "natural", i.e., all are drowned river mouths which have only been in existence since the 1930's.

Table 2. Aquatic macrophytes* found in Skamania County, WA lakes in summer 2003.

Scientific name	Common name	Code	Native/Introduced
Ceratophyllum demersum	Coontail	CEDE	Native
Elodea canadensis	American waterweed	ELCA	Native
Myriophyllum spicatum	Eurasian watermilfoil	MYSP	Introduced
Nitella sp.	Stonewort (alga)	NI	Native
Potamogeton crispus	Curlyleaf pondweed	POCR	Introduced

Rock Cove (Figure 4)

Eurasian watermilfoil was abundant throughout the entire cove and was intermixed with the native American waterweed, coontail, and stonewort. Curlyleaf pondweed, an introduced species, was present at very low levels (five of the 305 sample points). The true extent of the curlyleaf pondweed is probably higher than the estimate obtained from the late summer sampling because this species achieves peak biomass in spring.

* macrophytes – plant life in a waterbody excluding microscopic algae

Mouth of the Wind River (Figure 5)

Eurasian watermilfoil was intermixed with native species throughout the section of the lake to the east of the sandbar. Dense aquatic macrophyte growth was found adjacent to the boat ramp. Almost no plants were found on the sandbar and a limited amount was located in the western littoral zone.

Drano Lake (Figure 6)

Eurasian watermilfoil in Drano Lake was abundant in the littoral area near the boat ramp and parking area, at the far east end of the lake, and in scattered locations at the far west end and in the mouth of the Little White Salmon River. As in the two other waterbodies, the milfoil was intermixed with native aquatic plants. The deeper, central portions of the lake and the steep north shore had no aquatic vegetation. Curlyleaf pondweed was found only in the channel at the mouth of the Little White Salmon River although, since this species typically achieves maximum biomass much earlier in the growing season, the survey likely underestimated the extent of the infestation.

Figure 4. Aquatic macrophyte survey map of Rock Cove, Skamania County, WA, 2003.

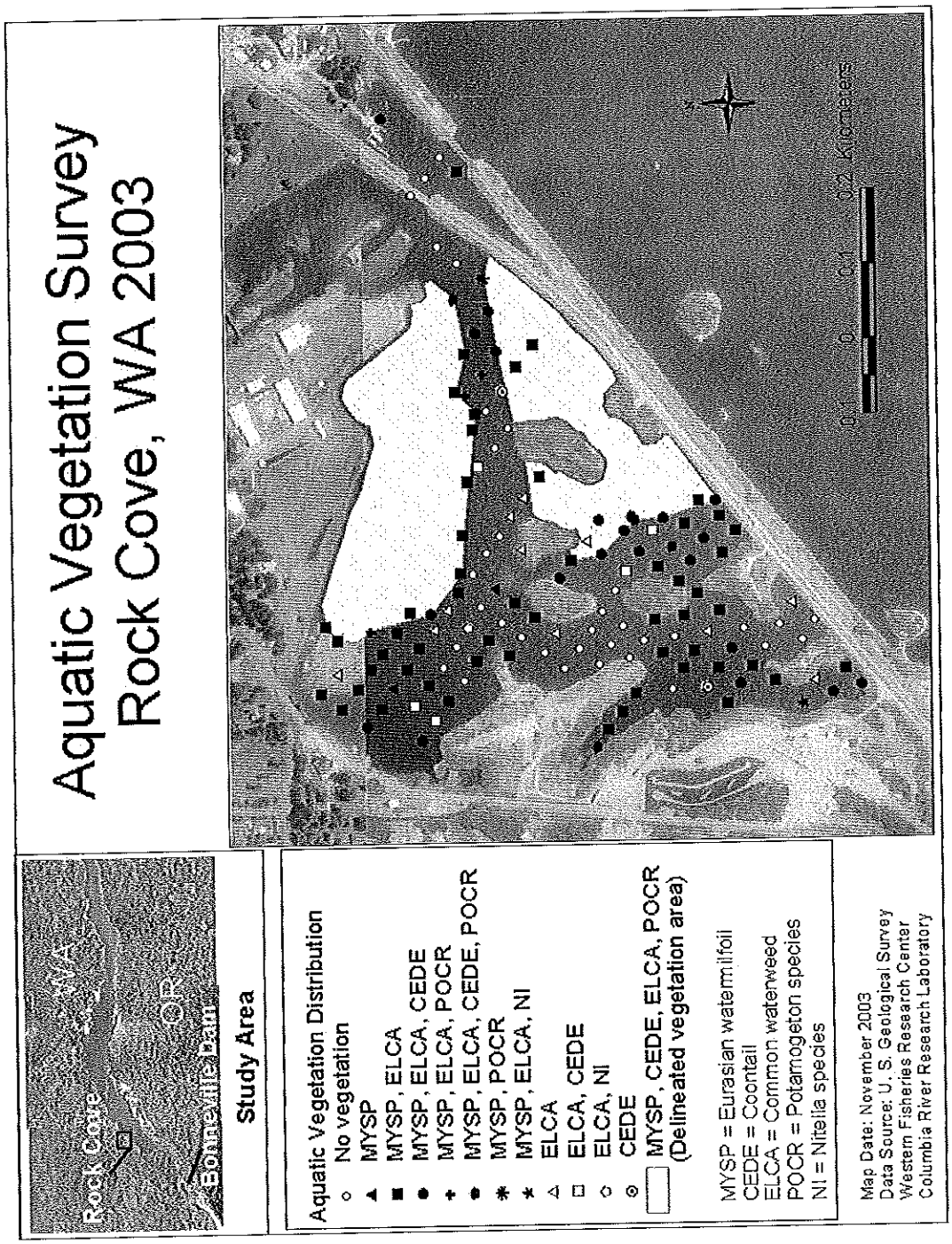


Figure 5. Aquatic macrophyte survey map of the mouth of the Wind River, Skamania County, WA , 2003.

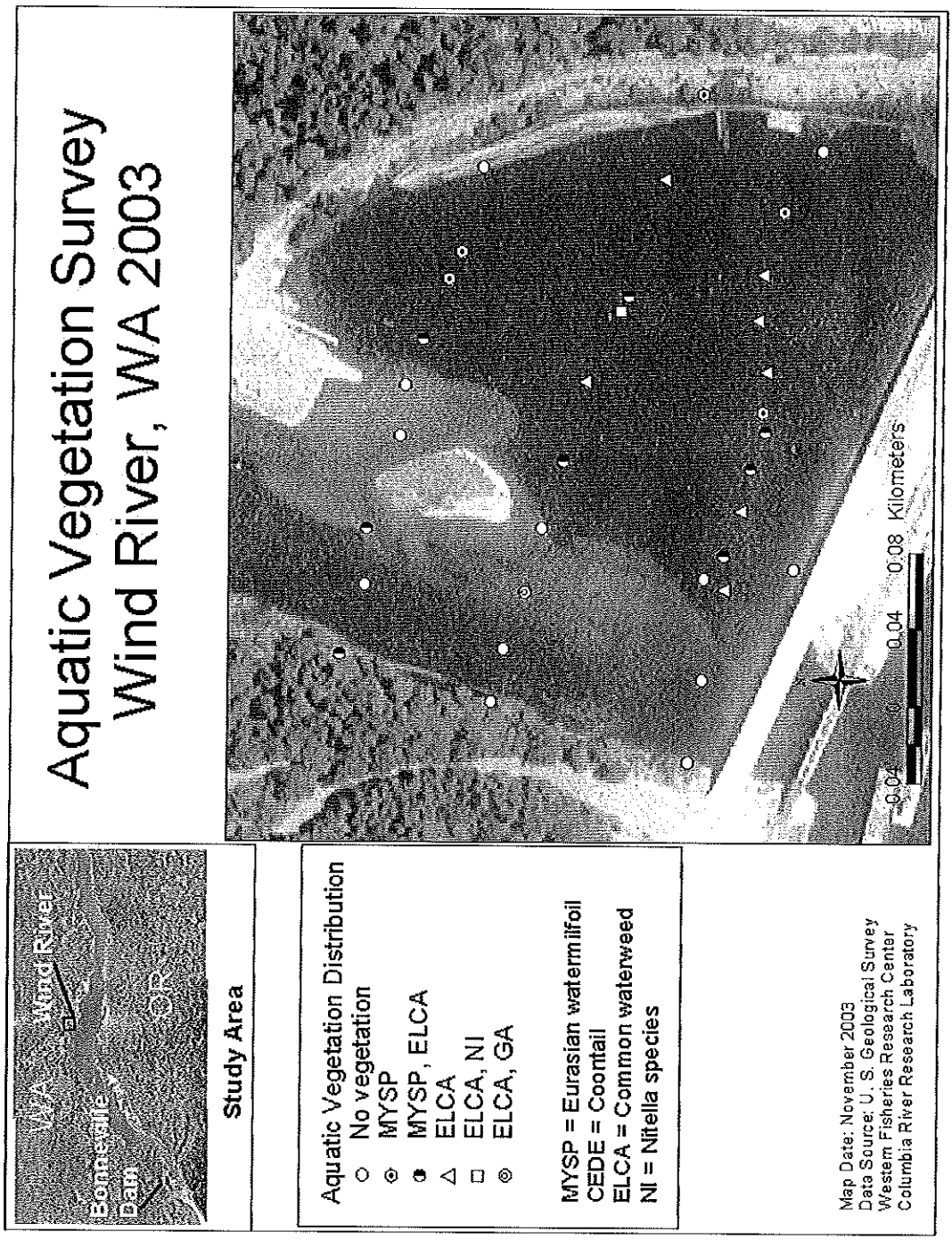
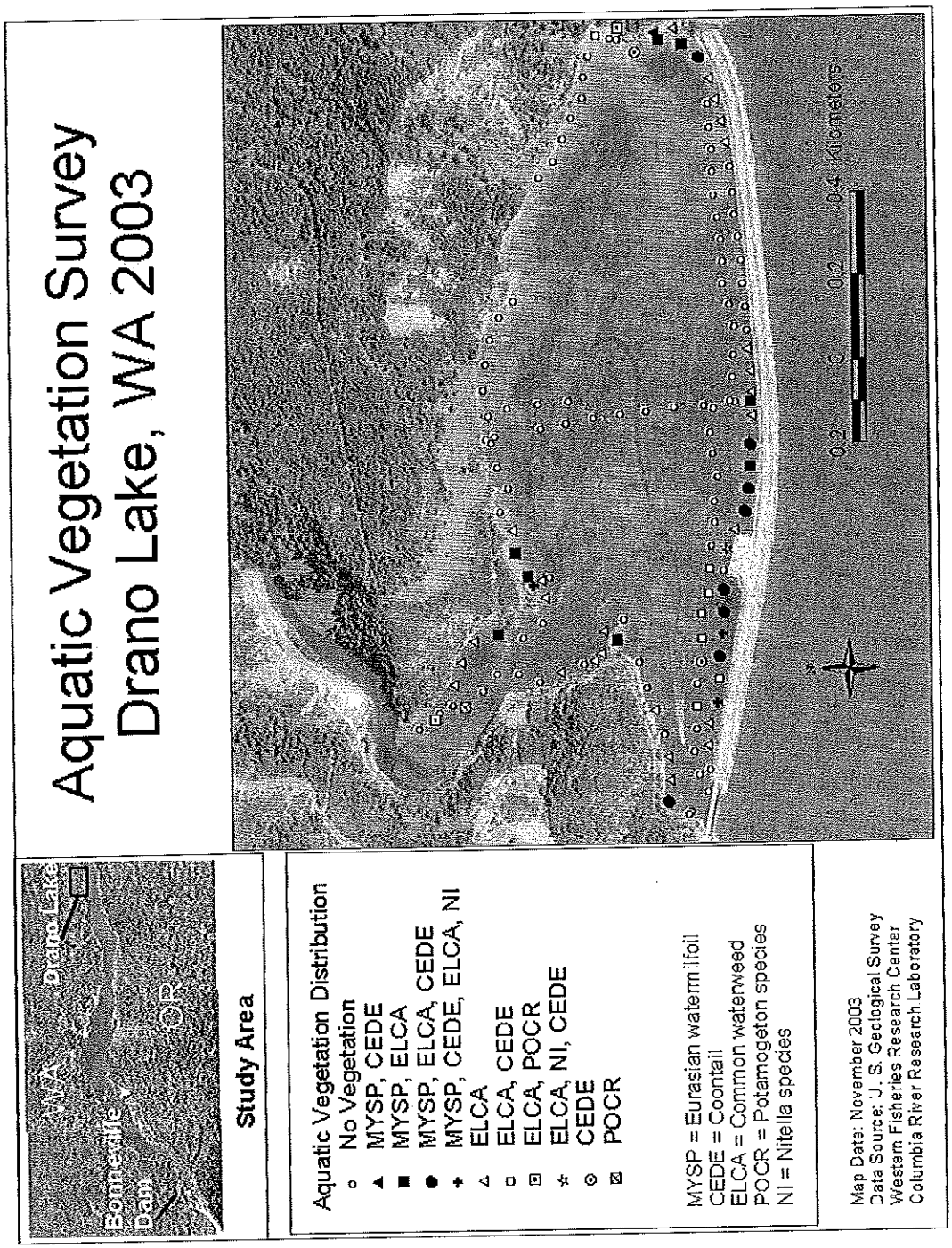


Figure 6. Aquatic macrophyte survey map of Drano Lake, Skamania County, WA, 2003.



Biology of target plant species

Eurasian watermilfoil

Eurasian watermilfoil (*Myriophyllum spicatum*) is a member of the dicot plant family Haloragaceae. It is a submersed, perennial, aquatic plant species with branching, leafy shoots having four (occasionally five) feather-like leaves arranged in whorls around its stem (Appendix E). Eurasian watermilfoil is native to Europe, Asia, and northern Africa and it is a problem plant mainly in North America. Its distribution in North America is from Florida to Quebec in the east and California to British Columbia in the west. It occurs throughout much of the Midwestern and Southwestern United States as well (USGS Non-indigenous Aquatic Species Database).

Eurasian watermilfoil's annual growth cycle starts in spring, when shoots grow rapidly from overwintering root crowns. Shoots branch profusely, once they reach the water surface, and form a dense canopy which can shade out potential competitors. Plants typically die back to root crowns with the onset of cooler temperatures and shorter days of fall, although in some areas Eurasian watermilfoil may be evergreen (Stanley et al, 1976). Flowers are small and inconspicuous and are borne in spikes held above the surface of the water. Flowers do set seeds although seed germination and seedling survival are reported to be rare in nature (Aiken et al, 1979).

The primary mode of reproduction in this species is vegetative rather than by seeds. The plant develops zones of specialized cells along its stems which eventually separate, resulting in numerous plant fragments (Sculthorpe, 1967). Each of these fragments is capable of developing into an independent plant and these fragments are what are typically responsible for colonization of new sites. Transport of these fragments on boats and boat trailers between waterbodies is an important vector for the spread of the plant (Johnstone et al, 1985).

The ease with which Eurasian watermilfoil regenerates from plant fragments influences management techniques. Techniques which result in plant fragmentation within the waterbody such as cutting, harvesting, and rotovation are not effective and usually result in further spread of the species, unless the milfoil already occupies all available niches within the waterbody. The more effective means of control are those that do not fragment the plant such as covering and herbicides.

Curlyleaf pondweed

Curlyleaf pondweed (*Potamogeton crispus* L.) is a member of the monocot family Potamogetonaceae. It is a submersed, perennial, aquatic species with leaves arranged spirally along the stems. Its "wavy" or undulate leaf margins are unlike those of other Potamogeton species found in North America, resulting in easy identification (Appendix E). Curlyleaf pondweed is native to Europe, Asia, and Africa and, since its introduction in North America in the mid-1800's, it has become a major nuisance aquatic weed on much of the continent (Bolduan et al, 1994).

Curlyleaf pondweed has an unusual annual growth cycle in that it achieves peak biomass and flowers in spring and early summer followed by a period of late summer dormancy. Turions,* which form and are dispersed in summer, germinate in fall. Young plants grow slowly during winter followed by rapid growth in spring (Sastroutomo, 1981). Population spread of this species is primarily by vegetative means.

The most effective strategy for management of curlyleaf pondweed is to interrupt the annual growth cycle of the plant before the seasons crop of turions are formed. Maximum control of large infestations has been achieved by whole lake application of herbicide in early spring (Netherland et al, 2000; Poovey et al, 2002).

* turion – a compressed plant shoot which is capable of resprouting after overwintering in sediments

Aquatic Plant Management Techniques

A variety of techniques are available for aquatic plant management, including physical, mechanical, biological, and chemical control methods. An integrated approach to aquatic vegetation management that produces the desired outcome and minimizes the possibility of unintended consequences requires consideration of the problem species, the management objective, and the possible impacts of management activities. Best management practices currently available for aquatic macrophytes have recently been published by the Aquatic Ecosystems Restoration Foundation (2003). Information on management techniques contained in the following section was taken from that report as well as from the Washington Department of Ecology (2003). Recommendations of specific techniques appropriate to each of the focus waterbodies follow the general overview and descriptions of management techniques.

Required Intensity of Control

When managing aquatic weeds, it is important to keep in mind the presence of native plants and animal species that may be harmed by the method of control used. This becomes especially important when there are listed threatened or endangered species present. Several of the weed management options available indiscriminately remove all plant species. This may be appropriate in irrigation canals or storage reservoirs where no vegetation is desired, but native vegetation is desirable in a natural system. To reduce impact on native vegetation and animal life it is necessary to decide the proper level of control for specific use areas in the lake. The options are no control, low level control, and high level control.

No Control

In some cases it may be necessary to leave special habitat areas within a waterbody untouched. This is especially true when the control techniques available may have a net negative impact on habitat quality. All salmonid-bearing waters should be treated with caution. If management techniques

degrade the function of shoreline wildlife conservancy areas, e.g., nesting and forage sites for waterfowl and other animals, no control may be possible. Native plant beds that function as fish spawning or rearing sites should be preserved or subjected to minimal treatment. In some cases, the presence of native plants may have aesthetic value to the surrounding community.

Low-level Control

Low level control usually involves a partial removal of vegetation. For instance, in lakes where a warm-water fishery is important, using mechanical means to develop fish lanes through vegetation can be quite valuable. Low-intensity control efforts are also important in shoreline treatments where emergent vegetation is to be protected. Low-level control maximizes enjoyment of a water body while minimizing plant removal. A benefit of low-level control using mechanical means is the low treatment cost per acre because only patches of vegetation are being removed. The disposal cost of the removed material is much less than if the entire plant population is removed.

High-level Control

The occurrence of certain aquatic plant growth situations may require aggressive control. The presence of invasive non-native plants may justify aggressive measures to remove plants, especially where critical salmonid habitat may be jeopardized. For safety reasons it may be necessary to clear all vegetation from swimming or wading areas. Other areas requiring intensive removal may include areas around docks or boat ramps. It is important to note that the latter two examples describe small-scale, localized treatments. Lake-wide control efforts affecting 100 percent of aquatic plants are not appropriate, except in lakes where invasive, non-native plants have been identified.

Control Level for Skamania County Waters

Since the three focus waterbodies differ in the ways that each is used, as well as their physical characteristics and extent of milfoil infestation, the appropriate levels of control will also differ.

Rock Cove (Figure 7)

The entire waterbody supports dense beds of aquatic macrophytes with Eurasian watermilfoil intermixed with native plant species. High intensity selective control of Eurasian watermilfoil with little impact to native plant species throughout most of the cove is the desired level of control. The exceptions to this are the swim area and the wind surf training area located in the north littoral zone. The swim area should have no vegetation and the wind surf training area should have no floating vegetation.

Mouth of the Wind River (Figure 8)

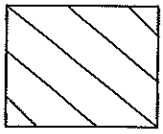
A deeper channel allowing unimpaired boater access between the county boat ramp and the Wind and Columbia Rivers is desired. High intensity control in a localized portion of the waterbody would achieve that goal without having to treat the entire waterbody. The eastern portion of the waterbody is not heavily used by people and no control in that section would provide fish and other organisms the plant cover needed for normal aquatic community functioning.

Drano Lake (Figure 9)

The high use littoral areas off the southern shore near the county boat ramp, off the northwest shore, and a short distance into the mouth of the Little White Salmon River need a high level of control for Eurasian watermilfoil. The boat ramp and the submersed area within ten feet of it should have no vegetation to allow for unobstructed access by boaters. The remainder of the southern littoral zone and the bank fishing areas off the northwest shore should be treated to control Eurasian watermilfoil while leaving native plant species. The mouth of the Little White Salmon River needs deepening to facilitate fish passage as well as to

remove aquatic macrophytes. The littoral area at the far eastern end of the lake can be left untreated.

Figure 7. Map showing aquatic vegetation in, and uses of, Rock Cove, Skamania County, WA. Grey shaded areas indicate presence of Eurasian watermilfoil and other aquatic plant species.



High intensity control area

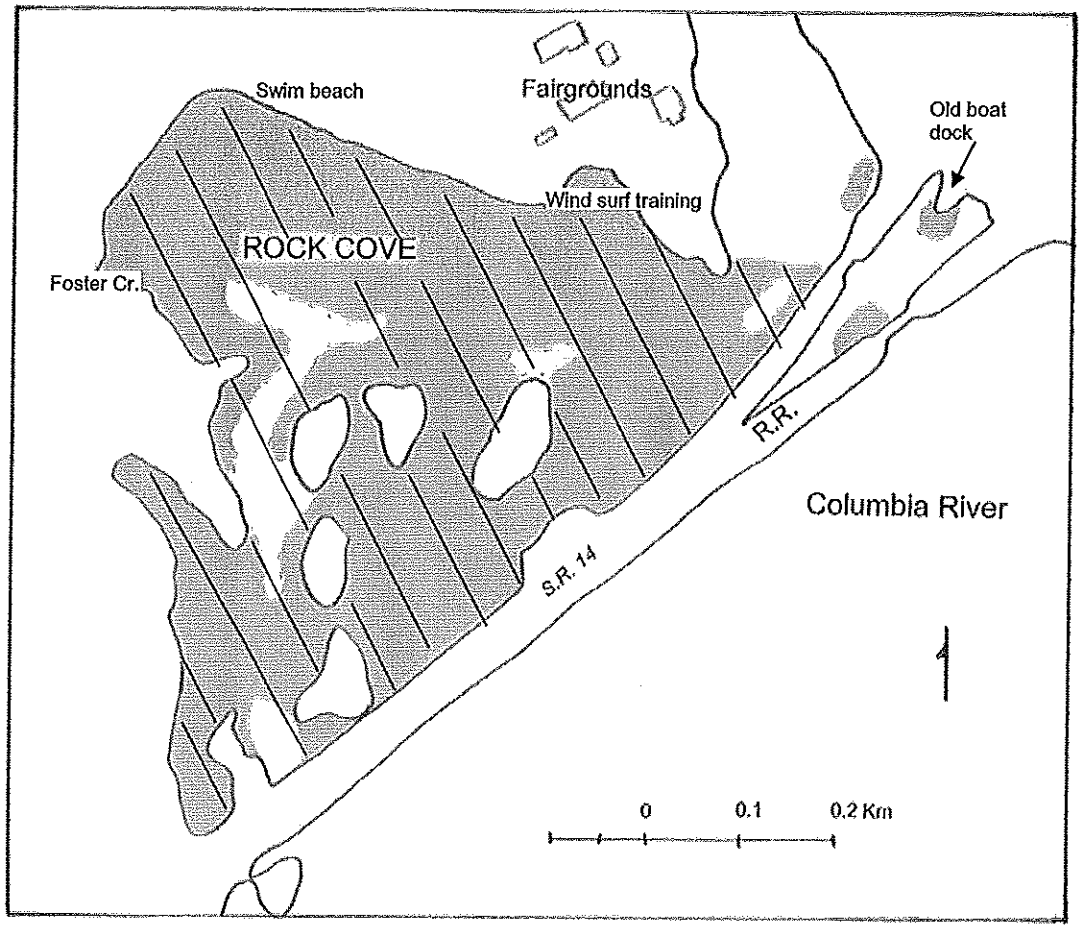


Figure 8. Map showing aquatic vegetation in, and uses of Rock Cove, Skamania County, WA. Grey shaded areas indicate presence of Eurasian watermilfoil and other aquatic plant species.

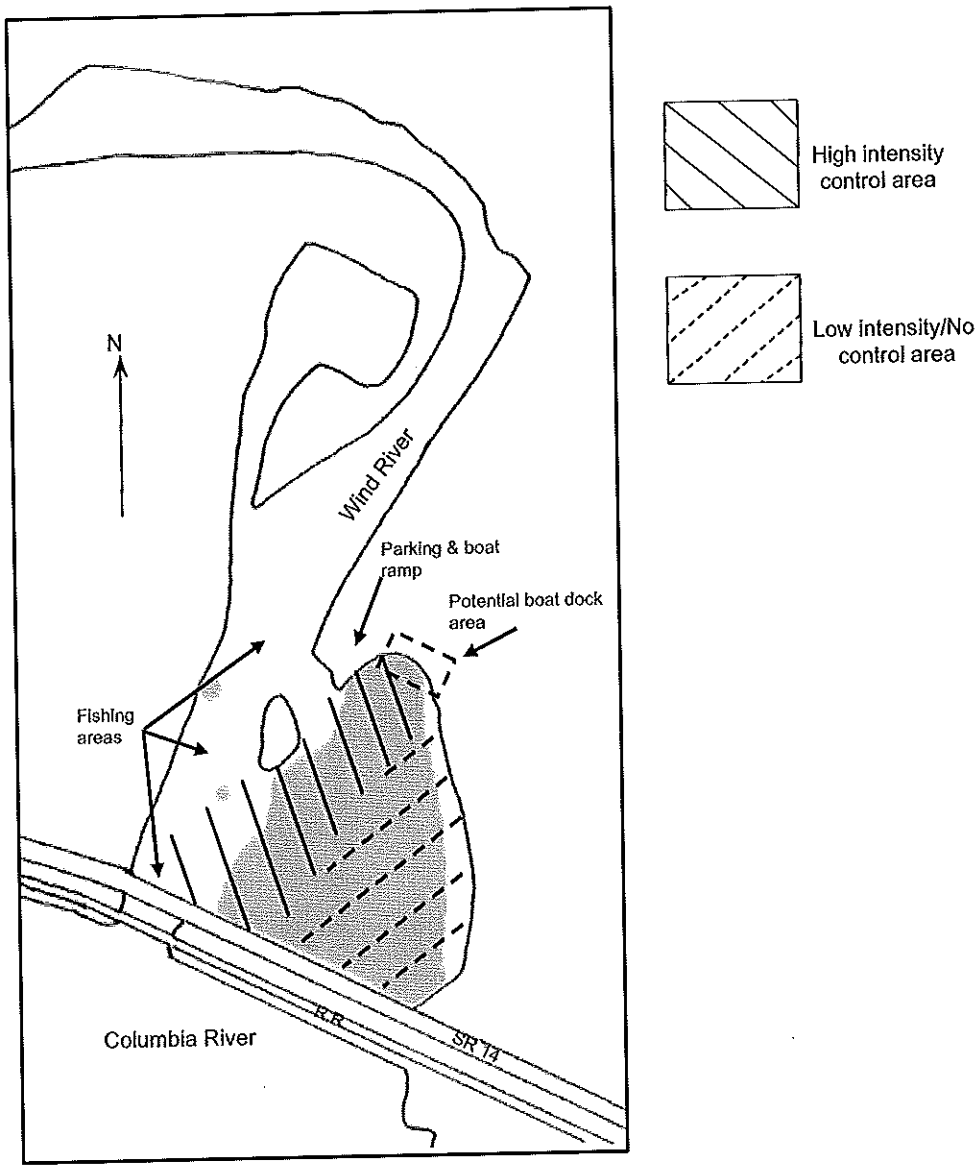
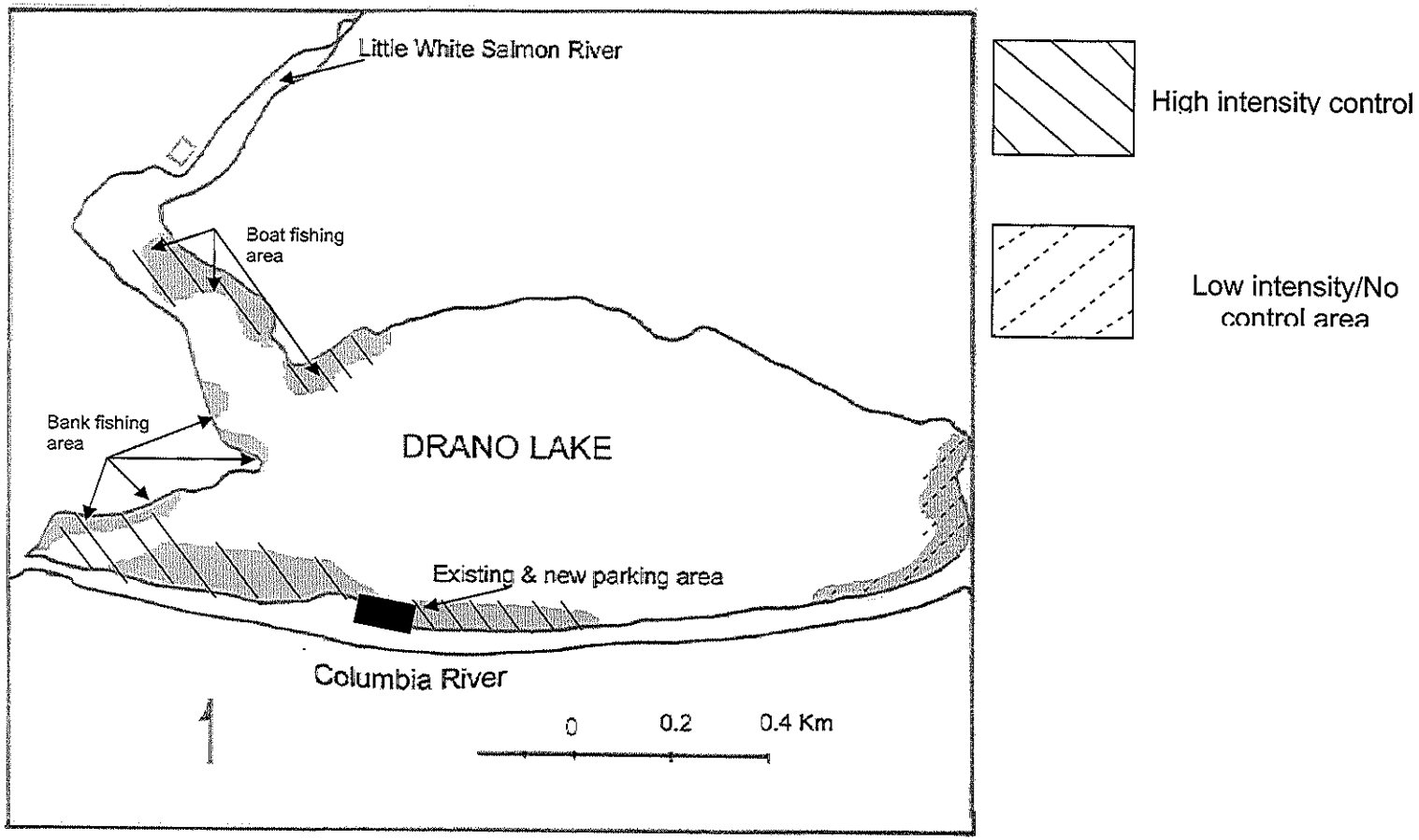


Figure 9. Map showing aquatic vegetation in, and uses of, Rock Cove, Skamania County, WA. Grey shaded areas indicate presence of Eurasian watermilfoil and other aquatic plant species.



Physical Controls

Physical control methods consist of manual methods (hand pulling or cutting, bottom barriers), dredging, and water level manipulation. Hand pulling and cutting are more appropriate for small areas in shallow water. Bottom barriers can be used around docks and in swimming areas, but are impractical and not cost-effective when large areas are to be treated. Dredging removes sediment and plant biomass, while water-level draw-down is used to control plants by drying them or exposing them to potentially freezing temperatures. For the most part, these control methods are non-selective in that they impact native and non-native, desirable and undesirable species indiscriminately.

Manual methods

Manual techniques of aquatic macrophyte control i.e., hand pulling/raking and bottom barriers, are time intensive. The time intensive nature and resulting expense of manual methods limits the sites for which these methods are suitable to waterbodies only lightly infested with Eurasian watermilfoil or to small scale, localized infestations such as around a small dock. These methods are most suitable for very early infestations of milfoil and for follow-up treatment after diver harvesting or aquatic herbicide treatment. Table 3 summarizes manual methods of aquatic plant control and lists advantages and disadvantages for each.

Hand pulling/raking

Pulling or raking aquatic plants is practical in small areas. This technique is especially effective when used in conjunction with bottom barriers. Using this method, existing macrophytes can be cleared from a small area before bottom barriers are installed. New plants arising from plant fragments or seeds can take root on top of the barriers, and sediment gradually builds up on them. Pulling and raking are an inexpensive way to keep bottom barriers free of plant growth on top of or around the barriers.

Tool requirements are minimal. Almost any type of rake will work although some are more practical than others. There are specialized aquatic weed rakes available which are similar to a landscapers rake. Both types are lightweight and have a wide head. Aquatic weed rakes have a hole in the end of the handle where a rope can be fastened so the rake can be easily retrieved from the water.

Freshly harvested biomass is quite heavy due to high water content in the plant tissues and to water clinging to the plant surfaces. Disposal of biomass is easier and less costly if weight and volume are reduced. Allowing harvested plant material to drain excess water and, if possible, drying down the tissues greatly reduces the total weight and volume. It also reduces the amount of physical labor needed to transfer the harvested plants to a disposal site. Residents at some lakes have used old fishing nets to haul plant harvestings. The nets allow water to drain and air to circulate. They also allow for a much larger plant volume to be handled than a wheelbarrow. In some places the harvested biomass has been composted for garden use or fed to livestock rather than disposed of in a landfill.

Permits:

- Hydraulic Project Approval, WDFW
- Natural Heritage Program Letter, WDNR (issued, see Appendix K)

Bottom barriers

Bottom barriers are relatively inexpensive, can be easily built, and are effective in suppressing aquatic plant growth in localized areas such as close to docks. Bottom barriers should be installed before spring plant regrowth begins. They can be installed later in the growing season, but existing vegetation would then have to be cut back and removed to allow installation of the barriers. Bottom barriers can be left in place all year long but removal and winter storage prolongs their effective life. Removal in late summer or early fall also allows them to be cleaned of accumulated sediment.

A number of different sheet materials will work in this application. Fiberglass, plastic sheeting, burlap, weed suppression cloth (used by landscapers and gardeners), and geotextile fabrics (used in estuarine weed control and in construction applications) can be used with varying degrees of effectiveness and durability. Directions for building bottom barriers, as well as case studies, can be viewed at *http://www.ecy.wa.gov/programs/wq/plants/management/aqua021.html*

Permits:

- Hydraulic Project Approval, WDFW
- Natural Heritage Program Letter, WDNR (issued, see Appendix K)

Table 3. Advantages and disadvantages of manual methods of aquatic macrophyte control

Advantages	Disadvantages
• easy to use around docks and swimming areas.	• treatment may need to be repeated several times each summer
• equipment is inexpensive	• labor intensive, they may not be practical for large areas or for thick weed beds
• Hand-pulling allows the flexibility to remove undesirable aquatic plants while leaving desirable plants.	• difficult to collect all plant fragments
• environmentally safe	• some plants, like water lilies which have massive rhizomes, are difficult to remove by hand pulling
	• pulling weeds and raking stirs up the sediment and makes it difficult to see remaining plants
	• hand-pulling and raking disturb bottom-dwelling animals
	• cutting tool is extremely sharp and must be only used with great care.

Diver harvesting

Diver harvesting is a method whereby SCUBA divers use hoses attached to small suction dredges to suck plant material from the waterbody. Divers experienced in aquatic macrophyte removal are able to pull target plants with little disturbance to the

sediments or to non-target plant species, although the amount of turbidity that may result from this activity varies with local sediment conditions, the equipment used, and the diver. The diver uses a suction hose to get the plant biomass to the surface and onto a barge for transport to shore and subsequent upland disposal. One benefit of using diver operated suction is the containment of plant fragments that are generated.

Sites suitable for diver harvesting include waterbodies that are lightly to moderately infested with milfoil. Because diver harvesting can be very expensive, this method is most suitable for moderate to early infestations of by a diver is more effective in lightly scattered patches of milfoil, whereas diver harvesting is more appropriate in denser milfoil beds. Diver harvesting is also applicable in waterbodies where no herbicide use can be tolerated.

Diver harvesting is not generally practical or economically feasible on a whole-lake scale. Costs depend on the size and depth of the target area and the density of the target plant species. Divers experienced in aquatic plant removal in the region charge a minimum of one to two dollars per square foot. A preliminary dive would have to be done in order to obtain an accurate estimate of the time and costs involved. Diver harvesting is useful as a means of clearing out localized areas in need of high levels of control and as a follow-up treatment to remove small, isolated patches of noxious aquatic plants which have regrown or were missed by earlier control activities. This technique has been used successfully at Silver Lake, Everett, WA and other lakes in the region for Eurasian watermilfoil control. Table 4 summarizes the advantages and disadvantages of diver harvesting for aquatic macrophyte control.

Permits:

- Hydraulic Project Approval, WDFW
- Shoreline Substantial Development Permit, Skamania County
- Natural Heritage Program Letter, WDNR (see Appendix K)

Table 4. Advantages and disadvantages of diver harvesting

Advantages	Disadvantages
• can be a very selective technique for removing pioneer colonies of Eurasian watermilfoil.	• very expensive.
• divers can remove plants around docks and in other difficult to reach areas.	• may stir up sediments, leading to the release of nutrients or long-buried toxic materials into the water column.
• can be used in situations where herbicide use is not an option for aquatic plant management.	• tops of plants growing in rocky or hard sediments may removed leaving a viable root crown behind to initiate growth.
	• in some states, acquisition of permits can take years.

Dredging

Lakes that are very shallow due to sedimentation can have excessive aquatic plant growth. Dredging (removal of sand, mud, silt, and gravel from under water) reduces aquatic plant problems directly by removing the plants, bottom sediment, and associated nutrients. Shallow dredging - one meter - has been found to be effective for a few months (Engel and Nichols, 1984), whereas deeper dredging - below the photic zone* - can be effective for at least 12 months (Collett et al, 1981; Tobiessen et al, 1992). This method is effective because it creates an area in the waterbody where light is severely limited by water depth and because it removes plant propagules, thus slowing down reinfestation. Dredging may result in more diverse habitats within the lake by creation of depth gradients (Nichols, 1984), however, dredging also results in problems with temporary suspended sediment and can harm benthic organisms and other wildlife that overwinter in the sediments.

Backwater areas behind the Bonneville Dam are considered to be part of the main stem of the Columbia River by WDFW. The in-water work window in Washington state (i.e., the time period of least abundance of outmigrating juvenile salmonids) for the main stem is November15 through February 15. Areas of flowing water are classified as

* photic zone – water depth at which there exists sufficient light for photosynthesis to occur

tributaries. The in-water work window for these areas (i.e., the time period after fry emergence) is late summer to early fall, typically after July 15 (S. Manlow, WDFW, pers. comm.) Exceptions to work outside of these dates can be granted on a case by case basis.

The backwater areas now existing behind the Bonneville Dam were originally emersed lands drained by tributaries to the Columbia River. Impounded waters of the river now deposit sediment into those areas. Other human activities, such as past forestry practices and road building in the watershed, have contributed to an increased amount and rate of surface runoff into streams

Dredging is usually not performed solely for aquatic plant management but rather in conjunction with other waterbody projects such as clearing boat channels or marinas, canals, or shipping or navigation lines.. Dredges will remove a large amount of sediment along with the vegetation and can be cost prohibitive if a suitable disposal site is not present nearby. In addition, toxics testing of spoils samples is required. Following dredging, other methods should be used to manage vegetation regrowth and prevent recurrence of excessive plant growth.

There are three basic types of dredges that are practical for use on smaller scale projects: clam shell dredges, small hydraulic dredges, and drag line dredges . The clam shell dredge is a type of bucket attached to the arm of a crane. The crane may be barge mounted or may be on shore. Dredged material is removed from the waterbody and deposited in trucks for upland disposal, or deposited on a barge for in-water disposal. This type of dredge is fairly large and it may not be possible for one to fit under bridges. Width of the barge carrying the crane and of dump barges (if they are to be used) must also be accommodated. Other problems that typically accompany clam shell dredging are: material fallback, high turbidity levels, spreading of plant fragments, and fuel and lubricant spillage.

A second type of dredge is a small hydraulic dredge (up to 8 inches in diameter), which uses powerful suction to remove sediment. The sediment can be pumped through a pipe to an appropriate in-water disposal site, or it can be deposited into a settling area on land with subsequent removal into trucks for upland disposal. In-water disposal is the most cost effective and fastest means of sediment disposal. Hydraulic dredges typically require a small crew of 2 or 3 for the whole operation.

The third type of dredge is the dragline dredge which comprises a digging bucket, cable, and boom. The bucket is used to excavate the sediment and a separate, floating, washing plant is used in conjunction with the dredge for washing the excavated gravels (Holland, 1942).

Costs for dredging projects vary with the amount of sediment removed, disposal, and other issues. A dredging project on two shallow New Jersey Lakes in 1985 cost $4.80/m^3$ to $8.26/m^3$; not including the engineering or administrative fees (Horstman and Copp, 1985). Holdren et al (2001) report total dredging costs of $40,000 to $80,000 per acre for a five foot dredging depth.

Dredging permits along the Lower Columbia River are administered by two different U.S. Army Corps of Engineers (USACE) offices, depending on the property ownership. Permits for dredging of non-port owned property are administered by the USACE Seattle District, while permits for dredging of port owned property are administered by the USACE Portland District. Table 5 summarizes the advantages and disadvantages of dredging as a method of aquatic macrophyte control.

Permits:

- Hydraulic Project Approval, WDFW
- Shoreline Substantial Development Permit, Skamania County
- State Environmental Policy Act determination, Skamania County
- Shoreline Variance and Critical Areas variance, Skamania County

- Floodplain Development Permit, Skamania County
- Natural Heritage Program Letter, WDNR (issued, see Appendix K)
- Clean Water Act Sec. 10 and 404, USACOE

Table 5. Advantages and disadvantages of dredging

Advantages	Disadvantages
• removes plants and plant propagules along with sediments and associated nutrients	• very expensive
• dredging to below the photic zone creates light limited habitat	• temporary problems with suspended sediment and associated toxics and nutrients
• creates depth gradients which may result in more diverse habitat types	• harms benthic organisms and other biota which overwinter in sediments
	• dredge spoils testing for toxics and subsequent disposal required
	• restricted in-water work windows in Columbia River
	• significant permitting requirements
	• possible mitigation costs

Water level manipulation - drawdown

Drawing down lake water levels exposes aquatic plants and lake sediments to possible freezing and desiccation if done in winter, and to high temperatures and desiccation if done in summer. The effectiveness of aquatic weed control is determined by several factors including the amount of the bottom sediments exposed, duration of exposure, presence of springs, and the weather at the time of drawdown. Vegetation managers attempt to time drawdown to maximize the depth of freezing in lake sediments, thereby freezing and killing both the vegetative plant stems and the roots, as well as using the frozen and cracked benthic surface to deepen the effective freeze and disrupt mature

root structure. As already noted, drawdown of Bonneville pool can also dewater chum and Chinook salmon redds, or create conditions across creek deltas whereby returning adult salmon are unable to access smaller tributaries to spawn. In Washington, milfoil control has usually been a side benefit of drawdown occurring in waterbodies and reservoirs for other purposes such as for power generation, irrigation, or flood control.

The same conditions that are detrimental to aquatic plants can also be detrimental to aquatic invertebrates, amphibians, and mammals. The impacts of fluctuating water levels are severe on a natural waterbody so this activity rarely occurs solely for aquatic macrophyte control in Washington.

Waterbodies suitable for water level drawdown are those with infestations of aquatic weeds where drawdown can be scheduled to occur on a prolonged and regular basis. Because western Washington is so much wetter and milder than eastern Washington, drawdown is generally less successful in controlling aquatic weed populations. However, in some western Washington reservoirs, such as Tapps Lake and Riffe Lake, prolonged annual drawdowns have helped control Eurasian watermilfoil infestations. Since milfoil survives in deeper water, drawdowns alone will not eradicate milfoil from areas that are not dewatered.

The three focus waterbodies of Skamania County do not have water control structures in place, thus, a complete and prolonged drawdown would require significant engineering as well as extended closures of the waterbody. Additionally, impacts to aquatic biota would be severe. Partial drawdown used in conjunction with herbicide treatment has been suggested as a means of reducing herbicide treatment costs. Drawdown is non-selective and impacts native and non-native species alike. It is possible that partial drawdown, if maintained for long enough with the right weather conditions, could result in significant mortality to target species. However, native plant species would also be severely impacted, which is not consistent with the stated goals of the IAVMP.

Table 6. Advantages and disadvantages of drawdown

Advantages	Disadvantages
• if a water control structure is in place, drawdown can be a very cost effective way of controlling plants like Brazilian elodea and Eurasian watermilfoil.	• to be cost effective, a water level control structure must be in place, otherwise high capacity pumps must be used.
• expansion of native aquatic plants in areas formerly occupied by exotic species can be enhanced by drawdown.	• growth of some aquatic plants may be enhanced by water level drawdowns
• game fish are reported to experience enhanced populations after drawdown.	• weather may influence the success in killing the target species: snow before a hard freeze may insulate the sediment and prevent freezing to a depth that will kill the roots; milder climates may not experience the freezing or dewatering conditions needed to kill the exposed plant roots and rhizomes.
• provide an opportunity to repair and improve docks and other structures.	• docks are left high and dry, water intakes may no longer be in the water, it may not be possible to launch boats, and some people will complain about aesthetics of the waterbody.
• loose, flocculent sediments can become consolidated after drawdown occurs.	• significant impacts to fish and aquatic wildlife by lowering the water and exposing the sediments.
	• algal blooms have been reported to occur after drawdowns have occurred.
	• water levels may be lower in wells during drawdowns.

Mechanical Controls

Plants may be managed using mechanical methods such as sediment agitation devices, rotovators/cultivators, and harvesters. Mechanical methods remove plants and cause varying degrees of fragmentation that can allow some plant species to become re-established or spread to other waters when the fragments drift and eventually settle to the bottom. The machinery used for mechanical treatment of aquatic weeds are potential sources of fuel or oil leaks and spills into the water. This possibility necessitates a spill containment plan if machinery is used.

Sediment Agitation

Sediment agitation is an automatic plant control method that mechanically disturbs the lake bottom to remove aquatic plants and prevent regrowth within a well-defined area. The machines sweep, roll or drag repetitively over the sediment and plants growing there. They need to be attached to a dock or post and require electricity. There are three main types of sediment agitation machines: weed rollers, lake sweepers, and beach groomers. Weed rollers consist of a long metal cylinder or pipe that rotates forward and backward in an arc along the bottom of the lake. It is powered by a low voltage motor and moves in an adjustable arc of up to 270 degrees. Fin-like projections on the roller help dislodge plants and roots from the sediment. Lake sweepers have two long poles with lightweight rakes attached to the poles. A submersed pump powers the rotating arms, causing the rakes to sweep along the bottom and remove plants within a radius of about 24 to 42 feet. The beach groomer consists of two seven foot arms that are rotated by a pump. The arms have chains attached to them which drag along the bottom to keep the area clear of plants.

The ease of installation and movement varies with the unit. It is best to install and begin using the systems early in the spring before active plant growth begins, as some units do not work well after plants have already grown up. After an area is cleared, the units can be used as little as one day per week to keep the plants from recolonizing. When the units are being used, signs should be posted in the area to prevent people from using the area and to prevent injuries. When not in use, the units should be stored where people cannot accidentally injure themselves.

Costs vary depending on the product. The price of a beach groomer starts at about $1,000 and the pump to power it costs an additional $300. Lake sweepers and weed rollers start at about $2,000. These devices are not suitable for use in the three focus waterbodies at this time (details in Recommendations Section).

Permits:

- Hydraulic Project Approval, WDFW
- Shoreline Substantial Development Permit, Skamania County
- Natural Heritage Program Letter, WDNR (issued, see Appendix K)
- State Environmental Policy Act determination, Skamania County

Table 7. Advantages and disadvantages of sediment agitation

Advantages	Disadvantages
• suppresses plant regrowth in areas of regular use	• disturbs some bottom dwelling animals, may interfere with fish spawning.
• open water adjacent to docks can be created and maintained	• will cause plant fragmentation if plants are present, which may increase the spread of some invasive weeds.
• the treatment area can be modified by adding additional cylinders or rakes or by adjusting the travel arc.	• can cause a depression to develop where the unit operates as the fine sediment is dispersed to other areas of the waterbody.
• some products can easily be moved and can be shared by neighbors.	• people may injure themselves if they step on the device; equipment should be unplugged from the power source and moved and stored under or along side a dock if area is to be used for activities such as swimming or wading
• operating costs are low - about the same as operating an ordinary pump	• should be removed in the winter from lakes that freeze

Rotovation

A rotovator is a barge-mounted rototilling machine that lowers a tiller head about eight to ten inches into the sediment to dislodge milfoil root crowns. Since the entire plant is removed, plant biomass reduction in the treatment area can last throughout the growing season and often longer. Rotovation often provides two full seasons of control (Gibbons et. al, 1987). Unlike harvesters, rotovators do not have the capability to collect the plants. Rotovation is used mainly in the winter and spring to control Eurasian watermilfoil. It has also been successfully used to remove the rhizomes of water lilies in Washington (WDOE, 2003)

This technique works best if plants have not reached their mature length as longer stems wrap around the spinning blades and may damage the equipment. If rotovation

is to be done later in the growing season, plants may have to be cut prior to that. Obstacles on the lake bottom (logs, large rocks, etc.) will have to be moved to avoid damage to the rotovator and underwater utilities (gas, water, sewer, telephone, water intake pipes, etc.) that occur within the work zone of the rotovator will need to be located and marked prior to rotovation. Plant fragments created by rotovation will have to be collected and disposed of at an appropriate upland disposal site to avoid regrowth of fragments and so that water quality is not degraded by decaying vegetation.

Rotovation removes roots and other plant structures from the sediment which can be advantageous, depending on the target plant species. Waterlilies, for example, form networks of thick rhizomes in lake sediments. Rotovation causes increased turbidity, plant fragmentation, and adverse effects to benthic organisms, fish spawning areas, and the habitats they require to survive. It can also result in the release of nutrients and other substances from sediments.

Waterbodies suitable for rotovation include larger lakes or rivers having widespread, well-established milfoil populations where eradication is not an option. Costs for a private contractor to harvest plants, remove obstacles, rototill, and collect and dispose of plants range from $1,500 to $2,000 per acre. As plant density decreases and obstacles are removed, costs and time needed to rotovate each acre will decrease. Rotovation is not recommended for any of the three focus waterbodies at this time (details in Recommendations Section).

Permits:

- Hydraulic Project Approval, WDFW
- Shoreline Substantial Development Permit, Skamania County
- Natural Heritage Program Letter, WDNR (see Appendix K)
- State Environmental Policy Act determination, Skamania County

Mechanical harvesting

Harvesting is a way to mechanically remove milfoil in order to provide open areas of water for recreational activities and navigation. Harvesting immediately removes surface milfoil mats, but since the cut plants grow back (sometimes within weeks), the same area may need to be harvested two or more times per growing season. Harvesting machines (harvesters) are specialized underwater mowing machines specifically designed to cut and collect aquatic plants. Cut plants are immediately removed from the water via a conveyer belt. The cut plants are stored on the machine to drain excess water until they can be off-loaded and properly disposed. Several manufacturers sell various sizes and models of harvesters, and there are firms that contract for harvesting operations. Harvesting is not recommended in waterbodies with early infestations of milfoil since the resulting fragments are never completely contained and harvesting may increase the spread of milfoil throughout the waterbody.

It is possible for fish to be collected along with plants during harvesting operations. This could potentially constitute a "take" of listed fish species. NOAA Fisheries Habitat Conservation Division should be contacted prior to such activities to determine if an informal or formal consultation is required.

Prior to harvesting, appropriate machinery launch sites (a paved ramp with deep water is best), and plant disposal off-loading sites need to be identified. An adequate graded and graveled access ramp can be built for approximately $3,000 (R. Michimoto, ODFW Sport Fish Restoration Program, pers. comm.).

The City of Tigard, Oregon has regularly contracted for mechanical harvesting to keep Summerlake clear of aquatic macrophytes. The cost for harvesting in June, 2003 was $7500 for approximately 4 acres and yielded 40 to 80 cubic yards of biomass. Harvested biomass was disposed of through a yard debris recycler at additional cost to the city (Steve Martin, City of Tigard Parks Div., pers. comm.). Cost estimates for harvesting in individual lakes are site specific and are based on a site visit by the contractor.

Purchase prices of new harvesters range from approximately $30,000 to $80,000, depending on size and attachments. Although used harvesters can be purchased for considerably less than new ones, annual operation, maintenance, insurance, operator training, and storage costs are substantial and it may be more cost effective to contract this service as needed.

Permits:

- Hydraulic Project Approval, WDFW
- Shoreline Substantial Development Permit, Skamania County
- Natural Heritage Program Letter, WDNR (see Appendix K)
- Shoreline Variance and Critical Areas Variance required for access construction - ramp construction, for example, Skamania County

Biological Control

Milfoil weevil

The native milfoil weevil, *Euhrychiopsis lecontei*, has been associated with declines of Eurasian watermilfoil in the United States (e.g. Illinois, Minnesota, Vermont, and Wisconsin). The milfoil weevil can negatively impact Eurasian watermilfoil by suppressing plant growth and reducing plant buoyancy (Creed and Sheldon 1995). There is a minimum number of weevils which need to be present in the milfoil population to cause decline. Based on observations made by researchers in Vermont, Ohio and Wisconsin it appears that having at least 1.5 to 2.0 weevils per stem is required for adequate control of Eurasian watermilfoil.

In Washington State, the milfoil weevil is present primarily in eastern Washington and occurs on both the introduced Eurasian and the native northern watermilfoil (*M. sibiricum*) (Tamayo et. al. 1999). A summer, 1999 survey of 11 Washington lakes by researchers from the University of Washington found that weevil abundance ranged from undetectable levels to 0.3 weevils (adults and larvae) per stem. Fan Lake, Pend

Oreille County had the greatest density per stem of 0.6 weevils (adults, larvae and eggs per stem). These abundance results are well below the recommendations made by researchers in Minnesota, Ohio, Vermont, and Wisconsin of having at least 1.5 to 2.0 weevils per stem in order to control Eurasian watermilfoil.

To date, there have not been any documented declines of Eurasian watermilfoil in Washington State that can be attributed to the milfoil weevil, although Creed speculated that declines of Eurasian watermilfoil in Lake Osoyoos and the Okanogan River may have been caused by the milfoil weevil. In Minnesota, Cenaiko Lake is the only lake in that state that has had a Eurasian watermilfoil crash due to the weevil. Other weevil lakes are yet to show declines in Eurasian watermilfoil.

Researchers in Minnesota have suggested that sunfish predation may be limiting weevil densities in some lakes (Sutter and Newman 1997). This may be true for Washington State as sunfish populations are present in many lakes in the state, including those with weevils. In addition, other environmental factors that may be keeping weevil populations in check in Washington but have yet to be studied, include weevil over-wintering survival and habitat quality and quantity (Jester et. al. 1997; Tamayo et. al. 2000). Although the milfoil weevil shows potential as a biological control for Eurasian watermilfoil, more work is needed to determine which factors limit weevil densities and what lakes are suitable candidates for weevil treatments. The use of milfoil weevils for controlling Eurasian watermilfoil in the three focus waterbodies is not recommended at this time (details in Recommendations Section).

Triploid grass carp

The grass carp (*Ctenopharyngondon idella* Val.) is an introduced species of fish which will eat many aquatic plant species and thus is considered a non-selective method of biocontrol. These fish do, however, have definite food preferences which can vary depending on the particular mix of aquatic plant species present. The carp are also sensitive to disturbance and generally do not feed in areas of high human disturbance

(e.g., boating, water skiing). They do not forage during winter but are typically active during the warmer months when human use of lakes is high. If nothing else is available, the carp will forage in the sediments for organic matter which can cause increased turbidity levels.

Grass carp are generally not recommended for milfoil control because milfoil is not a highly preferred food. Some research has indicated that grass carp will consume more palatable plant species, such as pondweeds and waterweed, before they will eat milfoil. As a result, they can enhance milfoil growth by removing competition from native plants and opening up more area for milfoil to colonize.

There can be significant impacts to the waterbody following grass carp stocking. Since native plants provide habitat, sediment stabilization, and many other important functions, removal of all submersed plants can have a severe impact on the waterbody (Bonar et al 2002). Most of the impacts due to grass carp stocking are attributed to the removal of the plants rather than direct impacts of the fish.

The Washington Department of Fish and Wildlife (WDFW) requires that all inlets and outlets to a lake be screened to keep grass carp from leaving the system. Therefore, grass carp are generally not allowed in waterbodies with salmon or steelhead since these fish need to pass freely between lakes and salt water. WDFW requires a lake-wide plan before allowing grass carp to be stocked in public lakes and they must issue a grass carp stocking permit before fish are allowed to be stocked. Only triploid grass carp, which are sterile, are legal to use for aquatic plant control. The use of triploid grass carp in the three focus waterbodies is not recommended (details in Recommendations Section).

Permits:

- Fish planting permit, WDFW
- Natural Heritage Program Letter, WDNR (see Appendix K)

Chemical

The use of chemicals for the control of noxious and nuisance plant species is one of the most cost effective management options available. In the last 15 to 20 years the use and review of herbicides has changed significantly in order to accommodate safety, health, and environmental concerns. The number of effective, and U.S. Environmental Protection Agency (EPA) approved, herbicides for aquatic weeds are limited. In most cases the cost and time of testing and registration, rather than environmental issues, limits the number of potentially effective compounds.

Herbicides labeled for aquatic use can be classified as either contact or systemic. Contact herbicides act immediately on the tissues contacted, causing extensive cellular damage at the point of uptake. These herbicides are typically faster acting but may not kill root crowns, roots, or rhizomes. In contrast, systemic herbicides are taken up by, and transported throughout, the plant. They are slower acting but typically result in death of the entire plant. The current federally approved compounds for aquatic plant use are complexed copper compounds; 2,4- D; diquat; endothall; fluridone; glyphosate; imazapyr, and triclopyr. Information on their characteristics, use suggestions, and restrictions are contained in Tables 3, 4, and 5.

Many of the herbicides labeled for aquatic use by the EPA provide good to excellent control of Eurasian watermilfoil, however, copper compounds are no longer allowed for aquatic use in Washington state waters except under the NPDES permit for Irrigation Districts.

Herbicide treatment of Eurasian watermilfoil can begin as soon as plants are actively growing. Effective treatment can be done as early as April or May and as late as September. However, timing of treatments must also take into account fish usage of waterbodies, water flow conditions, and water depth. WDOE prefers not to expose juvenile salmonids to chemicals, thus herbicide treatments in salmonid bearing waters must be coordinated with salmon usage windows which are provided for waterbodies by

the Washington Department of Fish and Wildlife (WDFW). High water flow conditions in western Washington caused by heavy rainfall can dilute the herbicide or wash it out of the system. Rainfall is typically lower after May and herbicide treatments may be more effective then.

Detailed discussion of specific herbicides can be found in the Recommendations section of the IAVMP.

Permits:

- Natural Heritage Program Letter, WDNR (see Appendix K)
- Noxious aquatic weed NPDES permit (good for 1 year), Washington Department of Agriculture (WDA)
- State Environmental Policy Act determination, Skamania County

Table 8. Characteristics of U. S. Environmental Protection Agency approved aquatic herbicides (Modified from Madsen 2000).

Compound	Trade Name	Company(s)	Formulation; Contact vs. Systemic	Mode of Action
Complexed Copper	Cutrine-Plus Komeen Koplex K-Tea Several others	Applied Biochemists (Cutrine) Griffin LLC	Various complexing agents with copper, superior to CuSO4; Systemic	Plant cell toxicant
2,4-D	Navigate Aqua-Kleen IVM 44 Many others	Applied Biochemists Cenexagri Dow AgroSciences LLC	BEE salt BEE salt DMA liquid; Systemic	Selective plant- growth regulator
Diquat	Reward Weedtrine	Syngenta Applied Biochemists	Liquid; Contact	Disrupts plant cell membrane integrity
Endothall	Aquathol K Hydrothol 191 Aquathol granular	Elf Atochem (All Formulations)	Liquid or granular; Contact	Inactivates plant protein synthesis
Fluridone	Sonar AS Sonar SRP Sonar PR Avast!	SePRO Griffin LLC	Liquid or granular; Systemic	Disrupts carotenoid synthesis, causing bleaching of chlorophyll
Glyphosate	Rodeo Eagre	Dow AgroSciences LLC Griffin LLC	Liquid; Systemic	Disrupts synthesis of phenylalanine
Imazapyr	Habitat	BASF Corp.	Liquid; Systemic	AHAS enzyme inhibitor
Triclopyr	Garlon 3A	Dow AgroSciences LLC	Liquid;	Selective plant growth regulator

	Renovate	SePRO	Systemic	

Table 9. Use suggestions for U. S. Environmental Protection Agency approved aquatic herbicides (Modified from Madsen 2000)

Compound	Exposure Time	Advantages	Disadvantages	Systems where used effectively	Plant species response
Complexed Copper	Intermediate (18-72 hours)	Inexpensive, rapid action, approved for drinking water	Does not biodegrade, but Biologically inactive in sediments	Lakes as algicide, herbicide in higher exchange areas Moving and still water	Broad-spectrum, acts in 7-10 days or up to 4-6 weeks
2,4-D	Intermediate (18-72 hours)	Inexpensive, systemic	Public perception	Lakes and slowflow areas Moving and still water	Selective to broadleaves, acts in 5-7 days, up to 2 weeks
Diquat	Short to intermediate (12-36 hours)	Rapid action, limited off –target movement	Does not affect underground portions; Should not be used in muddy water	Shoreline, localized treatments, higher exchange rate areas Moving and still water	Broad-spectrum, acts in 5-7 days
Endothall	Short to intermediate (12-36 hours)	Rapid action, limited off-target movement	Does not affect underground portions	Shoreline, localized treatments, higher exchange rate areas Moving and still water	Broad spectrum, acts in 7-14 days
Fluridone	Very long (45-60 days)	Very low dosage required, few label restrictions, systemic	Very long contact period	Small lakes, slow flowing systems Moving and still water	Broad spectrum, acts in 30-90 days
Glyphosate	Not Applicable on submersed plants	Few label restrictions, systemic	Very slow action, no submersed control	Nature preserves and refuges; Emergent and floating-leaved plants only Moving and still water	Broad spectrum, acts in 7-10 days, up to 4 weeks
Imazapyr	Not applicable on submersed plants	Low dosage, low volume required, systemic	Slow action,no submersed control, irritation water restrictions	Emergent and floating leaved plants only Moving and still water	Broad spectrum, acts in 2 to 4 weeks

Triclopyr	Intermediate (12-72 hours)	Selective, systemic	For still or quiescent waters only	Lakes and slow-flow areas	Selective to broadleaves, acts in 7-10 days, up to 2 weeks

Table 10. Application restrictions of U. S. Environmental Protection Agency-approved aquatic herbicides.

Compound	Persistence (halflife, in days)	Maximum water concentration	Recommended for
Complexed Copper	3	1.0 mg/L	Algae, Hydrilla, other submersed species.
2,4-D	7.5	2.0 mg/L	Eurasian watermilfoil, waterhyacinth, and others
Diquat	1-7	0.37mg/L	All
Endothall	4-7	5.0 mg/L	All submersed species
Fluridone	21	0.15 mg/L (150 ppb)	Most submersed species
Glyphosate	14	0.2 mg/L	Most emergent and floating species
Imazapyr	7	-	Shoreline, emergent and floating species
Triclopyr	3-7	2.5 mg/L	Eurasian watermilfoil, waterhyacinth, others

Recommendations for management of Eurasian watermilfoil in Skamania County

The management goal for all of the waterbodies is to control noxious aquatic vegetation in such a manner that:

- ❖ human recreational and aesthetic use of these waterbodies is facilitated,
- ❖ acceptable water quality conditions are maintained, and
- ❖ natural functioning of aquatic systems is not impaired.

This goal can best be met by :

- ❖ preventing new weed introductions and
- ❖ a combination of physical, mechanical, and chemical treatment techniques.

Prevention of reinfestation

Once milfoil has been discovered in a lake, it generally requires continual maintenance to keep it at low levels. Even if milfoil appears to have been eradicated, it is often reintroduced by boaters. The Columbia River contains extensive beds of Eurasian watermilfoil. Plant fragments will likely be reintroduced from the mainstem into Rock Cove, the mouth of the Wind River, and Drano Lake by unintentional transport on boats moving directly between the mainstem and backwater areas. Trailered boats putting in at boat ramps can also bring in plant fragments that can reestablish. The most likely source of reinfestation in Rock Cove, the mouth of the Wind River, and Drano Lake however, is via transport by water currents of plant fragments from established beds in the mainstem of the Columbia River. Regular monitoring and surveying must be done so that new introductions can be quickly identified and treated before milfoil can reestablish to nuisance levels.

While it is very difficult to totally eradicate milfoil from a waterbody forever, extensive, long-term follow-up activities make it possible to maintain extremely

low levels of milfoil that will not impede recreational activities or impact native plant and animal communities. As an example, Long Lake in Thurston County was treated with fluridone in 1991. In 1995, milfoil was discovered growing near the public boat launch. Since then the lake residents and Thurston County have been successfully maintaining extremely low levels of milfoil in the lake by surface and diver survey and hand pulling. These activities are not inexpensive, but are considered a necessary cost to maintain this lake in good condition for recreation and habitat. Should these management measures cease, milfoil would probably reinfest the lake within three to five years (WDOE, 2003).

All boat ramps should have signs that aim to educate the public about transport of aquatic noxious species via boats and boat trailers. Aggressive public education should be done to educate and encourage boaters to clean boats and trailers before leaving or entering a waterbody.

Recommended control techniques

Rock Cove

Rock Cove contains abundant Eurasian watermilfoil intermixed with other, native plant species. A high degree of control for this species is desired throughout the cove, particularly in high use areas such as the northern littoral zone which has been used for swimming and wind surf training. Control, rather than eradication, of Eurasian watermilfoil is a goal for this waterbody as propagules will be continually brought in from the Columbia River mainstem by water currents. A combination of physical, mechanical, and chemical techniques, summarized in Table 6, is recommended for aquatic plant management in Rock Cove. Treatment should be done in the summer after July 15. WDFW has determined that in-water work done after this date will have the least impact on threatened salmonids in this waterbody.

The swimming area is an area where no aquatic vegetation is desired. If herbicides were used here, it would require repeated treatments of both systemic and contact herbicides to maintain an unvegetated condition. An alternative to continued herbicide use, which is suitable for a smaller area such as the swimming area, is a bottom barrier. A bottom barrier should be installed in early spring before plants are in active growth. Some regrowth at the edges of the barriers is to be expected as is some regeneration of plant fragments on the sediment which accumulates on top of the barrier. Regular maintenance, i.e., hand pulling weeds and removing barriers in autumn for cleaning and winter storage, is essential to prolong their usefulness and maximize their effectiveness. Bottom barriers should last for many years with regular maintenance.

The wind surf training area is another area of the cove in which little or no vegetation is desired. Like the swimming area, it would require repeated treatments of both systemic and contact herbicides to maintain an unvegetated condition which is not desirable in an area of high contact use by people. However, removal of plant biomass from the upper portion of the water column (approximately 5 ft. depth), as can be done with a mechanical harvester, will allow for acceptable water conditions for wind surfing activities. A mechanical harvester will necessitate a launch ramp on the north shore. A

relatively small harvested area (one to two acres) should be adequate to allow for wind surf training.

There are two fast-acting selective herbicides which are available in aquatic formulations for treatment of noxious aquatic weeds: 2,4-D and triclopyr. While aquatic applications of 2,4-D may still be used in salmon-bearing waters for noxious weed treatment, its presence on the list of herbicides which have a court mandated buffer zone if used in riparian areas suggests caution in its use. Triclopyr, however, is not on this list.

Selective control of milfoil in the cove can best be achieved by chemical treatment with the triethylamine salt formulation of triclopyr (triclopyr TEA), trade name Renovate® (rather than 2,4,-D) for reasons noted above. Triclopyr TEA has been recently registered for aquatic use by the EPA and has been registered for use in the state of Washington. Triclopyr TEA is an auxin type of systemic herbicide, that is, an herbicide which interrupts the normal growth pattern of the plant. Effects on treated plants are typically evident immediately after application and include bending and twisting of stems and leaves.

Triclopyr TEA is water soluble and is degraded quickly in water by sunlight (photolysis) and by microbial action in aerobic soils. In general, triclopyr TEA dissipates rapidly from the water column and does not persist long in sediments. There are no label restrictions on treated water for recreational purposes such as swimming and fishing and no restrictions on livestock consumption of treated water. However, the Washington Department of Health recommends, and WDOE requires, a 12 hour waiting period for reentry by swimmers into triclopyr treated water (WDOE, 2004). There are setback restrictions for potable water intakes, however, since Rock Cove is not used as a potable water source, this should not be an issue.

Triclopyr TEA has been found to be effective on Eurasian watermilfoil and, depending on concentration, to have little or no effect on native species such as American waterweed (*Elodea canadensis*) and coontail (*Ceratophyllum demersum*). It has also been found to be generally safe to fish, free-swimming aquatic invertebrates, and

benthic invertebrates. Triclopyr TEA is in the EPA's ecotoxicological categories of slightly toxic to practically non-toxic. There have been no verified cases of toxicity to fish when triclopyr is used at the maximum use rate of 2.5 ppm. Preliminary results suggest that triclopyr TEA is unlikely to affect seawater adaptation in free-living juvenile Pacific salmon (WDOE, 2004).

Its use in Rock Cove would significantly reduce the total biomass of Eurasian watermilfoil with little or no harm to native, aquatic plant species. This treatment should open up the dense macrophyte beds now existing and result in a more "patchy" aquatic habitat. A more diverse habitat allows for greater species diversity within the aquatic communities in the cove. It would also allow for easier access to the waters of the cove by canoers and kayakers. The swimming and windsurfing areas should be included in the initial triclopyr treatment so that these areas do not function as sources for reinfestation of the remainder the cove by Eurasian watermilfoil.

Triclopyr TEA should be applied to achieve a concentration of 1.35 to 1.5 ppm in treated water, with areas of higher water exchange rates requiring a concentration closer to 2 ppm. The total application of triclopyr TEA should not exceed 2.5 ppm per treatment area per annual growing season. Subsurface application of liquid formulation by boat mounted distribution unit is the preferred method of application as it will eliminate spray drift to non-target areas.

At least 12 hours of contact time are needed for effective control of target plant species, but 24 to 48 hours of stable water levels are recommended for maximum efficacy. Maintaining stable water levels will require coordination with the US Army Corps of Engineers Reservoir Control Center (RCC). The RCC does this sort of special operation fairly frequently and does not foresee any problem (G. Bowers, USACE RCC, pers. comm.).

Herbicide contact with target plants can be facilitated by the use of a sediment curtain across the confluence of the cove and Rock Creek. The curtain will also function in restricting the herbicide to the target area. A sediment curtain is a temporary partition used in water bodies to contain sediment that has been generated by in-water activities.

The curtain can be made of either a water permeable material or an impermeable one. Sediment curtains comprise a skirt which has a pocket at the top for flotation devices and a pocket at the bottom for ballast. The flotation and ballast components prevent the skirt from collapsing. This barrier will prevent dilution of the treated water by water from the creek and from the Columbia River. Some inflow from Foster Creek and stormwater outfalls is to be expected but if treatment is done later in the summer (after July 15) then water flows will be at their minimum.

The cove treatment area should be subdivided and subdivisions treated one to two weeks apart. Each subdivision should comprise no more than 20 per cent of the targeted treatment area (Washington Dept. of Ecology Water Quality Program, 2004). This will allow for the possibility of low dissolved oxygen (DO) concentrations in the treated area resulting from the decomposition of a large amount of plant biomass in a short amount of time. By treating the cove in sections, fish and other biota will be able to move to untreated areas and thus avoid anoxic* or near anoxic conditions. (Note: (WDOE is planning a triclopyr treatment in Capitol Lake in summer, 2004. DO levels will be extensively monitored and, if they remain high during that treatment, it may prove unnecessary to treat in sections.)

Plant surveys should be done in spring of the second year and, if warranted, another treatment could be made. (See Appendix J for plant survey methods.) A second treatment should be made if plant surveys find infestations greater than one half acre. Subsequent years would be maintenance years in which some spot treatments of isolated plants would need to be done. Hand pulling and diver harvesting are appropriate methods for this. Additional whole lake treatments using triclopyr TEA will only need to be done if monitoring, early detection, and spot treatments of pioneer plants fail. (Note: Ground water or sediment monitoring is required prior to any third application of triclopyr on a previously treated site planned within a three year period. Evidence of persistence of triclopyr or TCP in sediment or ground water is basis for denial of the third application).

* anoxic – without oxygen

It is possible that curlyleaf pondweed, now present at low levels, could invade the areas cleared of Eurasian watermilfoil by control activities. Monitoring, detection and prompt treatment of pioneer infestations of this species are critical to preventing such an invasion. If such efforts fail, then the most cost effective treatment currently available for large infestations of curlyleaf pondweed is application of fluridone early in the growing season (Feb. or March). Curlyleaf pondweed, unlike Eurasian watermilfoil, is not sensitive to triclopyr TEA and, since this species is entering dormancy by the time of the in-water work window (July 15), herbicide treatment after this date is not likely to be effective.

Timing of fluridone application is critical to its success and should be done after turions* have germinated in early spring but before the plant has formed new turions. There are no published data on the timing of turion germination and growth in waterbodies west of the Cascades, however, a graduate student at the PSU Center for Lakes and Reservoirs is currently conducting this type of research. The data will be made available, if needed, to be used to inform the timing of fluridone application on curlyleaf pondweed.

If fluridone is to be applied after February 15 (i.e., outside the in-water work window), then impacts to aquatic resources could be minimized by isolating the treatment area with a barrier curtain installed before that date. Details would have to be worked out with the WDFW, the USFWS, and the USACE.

Monitoring for the purpose of early detection and eradication of pioneer infestations of noxious aquatic weeds must be done every year. Ideally, a survey focused on curlyleaf pondweed should be done in May and one focused on Eurasian watermilfoil should be done in August. Surveys should be conducted from a small boat using a rake and/or an underwater viewer (See Appendix J for plant survey methods). Any plants of Eurasian watermilfoil or curlyleaf pondweed detected should be treated by hand pulling or diver harvesting.

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* turion – specialized stem section which remains dormant in the sediment during winter and resprouts in spring

Table 11. Summary of recommended aquatic plant management techniques for Rock Cove, Skamania County, WA.

Technique	Recommend	Comments
Hand pulling	YES	Spot treatment around bottom barriers
Bottom barriers	YES	Alternative to repeated chemical treatments in swimming area
Diver	YES	Spot treatment only Not cost effective in such a large area
Dredging	NO	Deepening of cove not a goal; complete removal of vegetation not a goal
Drawdown	NO	Not effective in western WA; not able to completely dewater the cove
Sediment agitation	NO	No docks on which to mount devices,; too small an application for the area of control needed
Rotovation	NO	Increased turbidity ; release of nutrients and, possibly, toxics from sediment ; logs and rocks would have to be removed from cove bottom
Mechanical harvesting	YES	Alternative to repeated chemical treatments in wind surf area
Milfoil weevil	NO	Experimental
Triploid grass carp	NO	Milfoil not preferred food, cove does not meet stocking permit requirements
Chemical		
Triclopyr TEA	YES	Selective for milfoil, short contact time (12-72 hr); few labeled use restrictions
Fluridone	NO	Long contact time required (several weeks); cannot keep constant water level in lake for extended time periods due to BPA dam operations
Imazapyr	NO	Not applicable to submersed species
2,4-D	NO	Legal issues
Complexed copper	NO	Not allowed in WA lakes or rivers

Mouth of the Wind River

A combination of physical and chemical techniques, summarized in Table 7, is recommended for aquatic plant management in the mouth of the Wind River. The goal in this waterbody is not to eradicate Eurasian watermilfoil because propagules will be continually brought in from the Columbia River mainstem by water currents. The focus in this waterbody is to ensure boater access between the public boat ramp and in-water fishing areas. The mouth of the Wind River has accumulated sediment which forms a bar located north to south down the middle of the waterbody. Excessive growth of

aquatic plant species, among them abundant Eurasian watermilfioil, contributes to boater access problems and may be accelerating sedimentation.

Dredging a boater access channel will address both problems. Removal of sediment by dredging will create a clear channel for boats and will remove significant amounts of plant biomass. Plant regrowth will be greatly reduced if the channel is at least 15 feet deep. At this depth, some milfoil can regrow, however, it will not form the dense canopy that it will in shallower water. Hydraulic dredging is recommended as the most cost effective and logistically least complicated method of dredging. In-water work time will have to be scheduled to minimize impacts to threatened salmonids. The mouth of the Wind River is considered to be part of the mainstem Columbia River for which the in-water work window is November 15 through February 15 (S. Manlow, WDFW, pers. comm.).

If dredge spoils disposal is allowed, approved upland disposal area will need to be identified as a permitting requirement. If solely federal funding is being used, a stipulation is that the spoils cannot be used by a private party to enhance or economically improve their property. If this is the case, that landowner must reimburse the federal government the equivalent of their economic gain. However, the landowner can provide labor or equipment usage as their matching contribution of the funding to offset the gain.

Spot treatment of patches of milfoil on the west bank and areas close to the boat ramp can be done by hand pulling or diver harvesting. The remainder of the waterbody (the eastern half) is not used for fishing, swimming, or boating and could be left untreated. This would lower the total management costs for the waterbody as well as provide necessary plant cover for fish and other aquatic organisms.

Monitoring for the purpose of early detection and eradication of pioneer infestations of noxious aquatic weeds must be done every year. Ideally, a survey focused on curlyleaf pondweed should be done in May and one focused on Eurasian watermilfoil should be done in August. Surveys should be conducted from a small boat using an underwater viewer (Survey methods in Appendix J).

Any Eurasian watermilfoil or curlyleaf pondweed plants detected should be pulled by hand or harvested by diver.

Table 12. Summary of recommended aquatic plant management techniques for the mouth of the Wind River, Skamania County, WA.

Technique	Recommend	Comments
Hand pulling	NO	Does not address need for deepened boat access channel; OK close to boat dock
Bottom barriers	NO	Does not address need for deepened boat access channel
Diver	YES	Spot treatment only; Does not address need for deepened boat access channel
Dredging	YES	Deepened boat access channel needed in addition to weed control
Drawdown	NO	Not effective in western WA; not able to completely dewater the lake
Sediment agitation	NO	May impede boater access to public boat ramp; does not address need for deepened boat access channel
Rotovation	NO	Does not address need for deepened boat access channel
Mechanical harvesting	NO	Does not address need for deepened boat access channel
Milfoil weevil	NO	Experimental
Triploid grass carp	NO	Milfoil not preferred food; waterbody does not meet stocking permit requirements; does not address need for deepened boat access channel
Chemical		
Triclopyr TEA	NO	Dredging preferred for boat access channel
Fluridone	NO	Dredging preferred for boat access channel
Imazapyr	NO	Dredging preferred for boat access channel
2,4-D	NO	Dredging preferred for boat access channel
Complexed copper	NO	Not allowed in WA lakes or rivers

Drano Lake

Eradication of Eurasian watermilfoil is not a goal for this waterbody because propagules will be continually brought in from the Columbia River mainstem by water currents. A combination of physical and chemical techniques, summarized in Table 8, is recommended for aquatic plant management in Drano Lake.

There are two fast-acting selective herbicides which are available in aquatic formulations for treatment of noxious aquatic weeds: 2,4-D and triclopyr. While aquatic applications of 2,4-D may still be used in salmon-bearing waters for noxious weed

treatment, its presence on the list of herbicides which have a court mandated buffer zone if used in riparian areas suggests caution in its use. Triclopyr, however, is not on this list. For this reason, triclopyr TEA is recommended rather than 2,4-D.

Selective control of milfoil in the southern littoral zone and the northwest littoral zones can best be achieved by chemical treatment with the triethylamine salt formulation of triclopyr (triclopyr TEA), trade name Renovate®. Triclopyr TEA has been recently registered for aquatic use by the EPA and has been registered for use in the state of Washington. Triclopyr TEA is an auxin type of systemic herbicide, that is, an herbicide which interrupts the normal growth pattern of the plant. Effects on treated plants are typically evident immediately after application and include bending and twisting of stems and leaves.

Triclopyr TEA is water soluble and is degraded quickly in water by sunlight (photolysis) and by microbial action in aerobic soils. In general, triclopyr TEA dissipates rapidly from the water column and does not persist long in sediments. There are no label restrictions on treated water for recreational purposes such as swimming and fishing and no restrictions on livestock consumption of treated water. However, the WA Department of Health recommends, and WDOE requires, a 12 hour waiting period for reentry into triclopyr treated water (WDOE, 2004). There are setback restrictions for potable water intakes, however, since Drano Lake is not used as a potable water source, this should not be an issue. The label requires a 120 day waiting period between triclopyr treatment and use of treated water for irrigation. Treated water may be used sooner if an immunoassay determines that intake water has no detectable level of triclopyr. There is no restriction on use of treated water to irrigate established grasses. There are no active irrigation water rights in Drano Lake, however, Skamania County has made application for one. Triclopyr TEA treatment in the lake will need to be coordinated with the County should the water right be granted.

Triclopyr TEA has been found to be effective on Eurasian watermilfoil and, depending on concentration, to have little or no effect on native plant species such as American waterweed (*Elodea canadensis*) and coontail (*Ceratophyllum demersum*). It has also been found to be generally safe to fish, free-swimming aquatic invertebrates, and

benthic invertebrates. Triclopyr TEA is in the EPA's ecotoxicological categories of slightly toxic to practically non-toxic. There have been no verified cases of toxicity to fish when triclopyr is used at the maximum use rate of 2.5 ppm. Preliminary results suggest that triclopyr TEA is unlikely to affect seawater adaptation in free-living juvenile Pacific salmon (WDOE, 2004).

Its use in localized areas in Drano Lake would significantly reduce the total biomass of Eurasian watermilfoil with little or no harm to native, aquatic plant species. This treatment should open up the dense macrophyte beds now existing and result in a more "patchy" aquatic habitat. A more diverse habitat allows for greater species diversity within the aquatic communities. It would also allow for easier access by boaters.

Triclopyr TEA should be applied to achieve a concentration of 1.35 to 1.5 ppm in treated water with areas of higher water exchange rates requiring a concentration closer to 2 ppm. The total application of triclopyr TEA should not exceed 2.5 ppm per treatment area per annual growing season. Subsurface application of liquid formulation by boat mounted distribution unit is the preferred method of application as it will eliminate spray drift to non-target areas.

At least 12 hours of contact time are needed for effective control of target plant species but 24 to 48 hours of stable water levels are recommended. Maintaining stable water levels will require coordination with the US Army Corps of Engineers Reservoir Control Center (RCC). The RCC does this sort of special operation fairly frequently and does not foresee any problem (G. Bowers, USACE RCC, pers. comm.).

Dilution of herbicide by inputs to the lake from the Columbia River and the Little White Salmon River can be minimized by the use of a sediment curtain around the treatment area. In addition, the partitioning of the waterbody in this manner will contain the herbicide to the target area only. A sediment curtain is a temporary partition used in water bodies to contain sediment that has been generated by in-water activities. The curtain can be made of either a water permeable material or an impermeable one. Sediment curtains comprise a skirt which has a pocket at the top for flotation devices and a pocket at the bottom for ballast. The flotation and ballast components prevent the

skirt from collapsing. This barrier will prevent dilution of the treated water and will also confine the herbicide to the treatment area. Treatment should be done in the summer after July 15. WDFW has determined that in-water work done after this date will have the least impact on threatened salmonids in this waterbody.

Spot treatment of the area within ten feet of the boat ramp after the triclopyr application will be needed to provide a clear, unvegetated area. Hand pulling and diver harvesting are suitable techniques. The spot treatment will likely have to be repeated during the growing season.

Plant surveys should be done in spring of the second year and, if warranted, another treatment could be made. (See Appendix J for plant survey methods.) A second, whole lake treatment should be made if plant surveys detect infestations larger than one half acre. Subsequent years would be maintenance years in which some spot treatments of isolated plants would need to be done. (Note: Ground water or sediment monitoring is required prior to any third application of triclopyr on a previously treated site planned within a three year period. Evidence of persistence of triclopyr or TCP in sediment or ground water is basis for denial of the third application). Subsequent large scale treatments will only need to be done if monitoring and early detection fail.

Hydraulic dredging of the Little White Salmon River channel would serve to enhance fish passage. Removal of sediment by dredging will create a clear channel for fish and will remove significant amounts of plant biomass. Plant regrowth will be greatly reduced if the channel is at least 15 feet deep. At this depth, some milfoil can regrow, however, it will not form the dense canopy that it will in shallower water. In addition, dredging would remove the curlyleaf pondweed plants growing in the channel. The in-water work window for this area is late summer to early fall, i.e. after July 15. Water flows are typically lowest and weather conditions generally good during this time, both of which could improve the efficiency of dredging operations.

There is a fishing closure zone from the fishing boundary markers at Drano Lake to the intake near the north boundary of the LWSNFH (WDFW, 2004). This was established to minimize disturbance to returning adult salmon that typically congregate near the

entrance to fish hatcheries before entering the facilities. Often the entrance to a hatchery will be closed to allow processing of fish already trapped within the facility, and timing will be based on the needs of the hatchery and available personnel. As already noted, a popular fishery takes place in this area during much of the summer months. Any large scale dredging taking place in this area should be timed to avoid conflicts with both the local sport and commercial tribal fisheries. A public notification and education effort is recommended.

An alternative method of aquatic weed control only (i.e., no channel deepening) in the channel is to treat with triclopyr TEA. Since the channel is an area of flowing water, maintenance of an effective concentration in the target area will be more difficult than in other areas of Drano Lake. A sediment curtain should be used in this area also, however, it may be necessary to use a curtain that is rated for higher flow rates. Curtains are available which are rated for current velocities of at least 2 knots.

If the herbicide option is chosen for this section of the waterbody, then the discrete clumps of curlyleaf pondweed that were observed growing in the channel should be harvested by diver. Curlyleaf pondweed is not sensitive to triclopyr TEA and herbicide treatments of any kind, if done after July 15 (the in-water work window), are not likely to be effective because this species is entering dormancy by then.

Monitoring for the purpose of early detection and eradication of pioneer infestations of noxious aquatic weeds must be done every year. Ideally, a survey focused on curlyleaf pondweed should be done in May and one focused on Eurasian watermilfoil should be done in August. Surveys should be conducted from a small boat using an underwater viewer (Appendix K). Any Eurasian watermilfoil detected should be pulled by hand or harvested by diver. Curlyleaf pondweed is not sensitive to triclopyr TEA and, since this species is entering dormancy by the time of the in-water work window (July 15), spot treatment with contact herbicides is not likely to be effective. Therefore, pioneer infestations of curlyleaf pondweed should be removed by hand pulling or diver harvesting.

It is possible that curlyleaf pondweed, now present at low levels, could invade the areas cleared of Eurasian watermilfoil by control activities. Monitoring, detection and prompt

treatment of pioneer infestations of this species are critical to preventing such an invasion. If such efforts fail, then the most cost effective treatment currently available for large infestations of curlyleaf pondweed is application of fluridone early in the growing season (Feb. or March). Curlyleaf pondweed, unlike Eurasian watermilfoil, is not sensitive to triclopyr TEA and, since this species is entering dormancy by the time of the in-water work window (July 15), herbicide treatment after this date is not likely to be effective. Timing of application is critical to the success of this method and should be done after turions have germinated in early spring but before the plant has formed new turions. Fluridone application in February or March would be problematic with smolt release and outmigration occurring during this same time frame. Juvenile fish have a tendency to congregate in the vicinity of their release site until full smoltification, at which time they begin to actively outmigrate.

There are no published data on the timing of turion germination and growth in waterbodies west of the Cascades, however, a graduate student at the PSU Center for Lakes and Reservoirs is currently conducting this research. This data will be made available upon request to be used to inform the timing of fluridone application to curlyleaf pondweed. Fluridone will also control American waterweed and will provide partial control of native, small leaved pondweeds, rate and timing dependent.

Table 13. Summary of recommended aquatic plant management techniques for Drano Lake, Skamania County, WA.

Technique	Recommend	Comments
Hand pulling	NO	Small scale; steep, rocky basin with hazardous slope
Bottom barriers	NO	Difficult to anchor barriers on steep,rocky slopes; rocks could puncture barrier material
Diver	YES	Not cost effective for such a large area; OK for spot treatment
Dredging of LWS channel SEE NOTE	YES	Deepened channel needed for fish passage in addition to weed control in Little White Salmon River
Drawdown	NO	Not effective in western WA; not able to completely dewater the lake
Sediment agitation	NO	Small scale, may impede boater access to public boat ramp, basin slope too steep and rocky
Rotovation	NO	Expense, turbidity problems, does not address need for deepened channel in LWS, basin slope too steep and rocky near boat ramp
Mechanical harvesting	NO	Not cost effective; does not address need for deepened channel in LWS
Milfoil weevil	NO	Experimental
Triploid grass carp	NO	Milfoil not preferred food; waterbody does not meet stocking permit requirements
Chemical		
Triclopyr TEA	YES	Selective for milfoil, short contact time (12 to 72 hrs); few labeled use restrictions
Fluridone	NO	Long contact time required (several weeks); cannot keep constant water level in lake for extended time periods due to BPA dam operations
Imazapyr	NO	Not applicable to submersed species
2,4-D	NO	Legal issues
Complexed copper	NO	Not allowed in WA lakes or rivers

NOTE: Two options for treatment of the weed infestation in the Little White Salmon River channel are provided. Option A is to dredge the channel, option B is to treat the channel with triclopyr TEA.

Estimated Costs

Table 14. Estimated annual costs for aquatic plant management in Rock Cove, Skamania County, WA.

Technique	Estimated cost	Note
Signs	$500	One time cost
Hand pulling	$450	Assumes $15/hr for 10 hr, 3 times/yr
Bottom barriers	$2150	Estimated cost of installation of 2000 sq. ft. @$1.00/sq. ft. (one time cost) + $150/yr ongoing maintenance
Diver harvest	$5400	Assumes 3 days @ $1800/day Use for spot treatments/surveys
Harvesting	$8000	Estimated cost for 2 acres @ $2000/acre @ minimum twice per year (by contractor). Disposal of biomass is extra
Grade & gravel ramp for harvester	$3000	One-time cost
Herbicide (triclopyr TEA,)	$50,000 to $60,000	~545 gal. @$92.50/gal Monitoring & surveys to determine subsequent treatments
Sediment curtain	$20,000*	One time cost; estimate based on curtain dimensions of 250 ft x 12 ft.. SEE NOTE
Monitoring & survey	$400	Assumes $20/hr for 8 hr (twice per year), Underwater viewer $80.00
TOTAL	$109,900 to $119,900	

NOTE: At least one licensed applicator in the region has a sediment curtain. If this applicator were used, then no purchase of curtain should be necessary.

Table 15. Estimated annual costs for aquatic plant management in the mouth of the Wind River, Skamania County, WA.

Technique	Estimated cost	Note
Signs	$500	One time cost
Hydraulic dredging	$250,000 to $400,000	One time cost; estimate based on removal of 10,000 cu. yds (1180 ft x 15 ft x 15 ft) using 8 in . cutter head suction dredge with upland disposal
Diver harvest	$3600	Assumes 2 days @$1800/day Use for spot treatment/surveys
Monitoring & survey	$4000	Assumes $20/hr for 8 hr (twice per year); Underwater viewer $80.00
TOTAL	$259,000 to $400,000	

Table 16. (Option A) Estimated annual costs for aquatic plant management in Drano Lake, Skamania County, WA.

Technique	Estimated cost	Note
Signs	$500	One time cost
Hydraulic dredging	$3,000,000 to $5,000,000	One time cost for Little White Salmon River channel; estimate based on removal of 500,000 cu. yd (500 yd x 200 yd x 5 yd) with in-water disposal
Herbicide (triclopyr TEA & diquat dibromide)	$60,000 to $70,000	~600 gal @$92.50/gal. For south littoral zone and northwest littoral zone; Monitoring & survey to determine subsequent treatments
Sediment curtain	$20,000	One time cost; estimate based on curtain dimensions of 250 ft x 12 ft. SEE NOTE
Diver harvest	$5400	Assumes 3 days @$1800/day Use for spot treatment/surveys
Monitoring & survey	$400	Assumes $20/hr for 8 hr (twice per year); Underwater viewer $80.00
TOTAL	$3,000,000 to $5,000,000	

NOTE: At least one licensed applicator in the region has a sediment curtain. If this applicator were used, then no purchase of curtain should be necessary.

Table 17. (Option B) Estimated annual costs for aquatic plant management in Drano Lake, Skamania County, WA.

Technique	Estimated cost	Note
Signs	$500	One time cost
Herbicide (triclopyr TEA , diquat dibromide)	$30,000 to $50,000	~400 gal.@$92.50/gal. For channel of Little White Salmon River, Monitoring & survey to determine subsequent treatments
Herbicide (triclopyr TEA , diquat dibromide)	$50,000 to $70,000	~600 gal @$92.50/gal. For south littoral zone and northwest littoral zone; Monitoring & survey to determine subsequent treatments
Sediment curtain	$20,000	One time cost; estimate based on curtain dimensions of 250 ft x 12 ft. SEE NOTE
Monitoring & survey	$400	Assumes $20/hr for 8 hr,(twice per year); Underwater viewer $80.00
TOTAL	$100,900 to $140,900	

NOTE: At least one licensed applicator in the region has a sediment curtain. If this applicator were used, then no purchase of curtain should be necessary.

Permits

Permitting for Hydraulic Project Approval for noxious weed removal projects is covered by the publication Aquatic Plants and Fish - APF-1-98 obtained free from regional Center for Lakes & Reservoirs, Portland State University

WDFW offices. If the provisions for each method are followed, then this publication serves as the HPA for many aquatic plant activities. The state of Washington has a streamlined permitting application, the Joint Aquatic Resource Permits Application (JARPA), which is suitable for dredging projects. JARPA combines applications for WDFW Hydraulic Project Approvals, local Shoreline Management and Critical Areas Permits, WDOE Water Quality Certifications, and U.S. Army Corps of Engineers Section 404 and Section 10 permits into a single application. JARPA forms are in Appendix F and can be accessed on-line at *www.ecy.wa.gov/programs/sea/pac/jarpa.html.* Permit applications for aquatic weed control methods other than dredging are more effective if made separately (K. Hamel, WDOE, pers.comm.). Permitting regulations and requirements are subject to change, thus applicants should check with the appropriate agencies for the most update information.

It is important to be aware that the application to the U.S. Army Corps of Engineers for Section 404 and Section 10 permits for projects affecting Endangered Species Act listed species or critical habitat (e.g., some salmonids) may trigger an ESA Consultation with the National Oceanic and Atmospheric Administration (NOAA-Fisheries; formerly National Marine Fisheries Service) and/or the US Fish and Wildlife Service. The consultation is the responsibility of the action agency. Mitigation may be required as part of the application.

The discharge of pollutants into the state's surface waters is regulated through NPDES permits. WDOE issues these permits under authority delegated by the U.S. Environmental Protection Agency (EPA). General permits are written to cover a category of dischargers instead of an individual facility. Application for coverage under a general permit for noxious weed control can be readily obtained from the Washington Department of Agriculture (WDA) NPDES permit for noxious weed control. General permits may place limits on the quantity and concentration of pollutants allowed to be discharged and typically require operational conditions called Best Management Practices. To ensure compliance with these limits and conditions, general permits may require monitoring and reporting. Coverage under the noxious weed permit is issued by the WDA on a no-fee basis. WDA only accepts applications that have been filled out on

line. NPDES application forms are included in Appendix F and can be accessed on-line at *http://apps.ecy.wa.gov/AquaticPestApp/applogin.asp.*

Funding

Potential sources of funding for plan implementation are listed in Table 18 below. Funding for implementation of weed control activities, other than dredging, are available from the WDOE Aquatic Weed Management Fund. The most likely potential source of funding for dredging activity is the National Scenic Area Economic Development Fund, which originates from a variety of sources and which are targeted for public improvement projects. The remaining sources listed in the table focus on outdoor recreation improvements, reduction of non-point source pollution reductions and aquatic restoration projects. Control of non-native, noxious weeds in the focus waterbodies could be considered an aquatic restoration project as well as serve to improve outdoor recreation access, especially for boating and fishing.

Table 18. Sources of potential funding for IAVMP implementation.

Funding Program	Administering Agency	Application Period	Funded activities
Aquatic Lands Enhancement Account (ALEA)	WA Interagency Committee for Outdoor Recreation *www.iac.wa.gov*	March - May	Purchase, improvement or protection of aquatic lands
Boating Infrastructure Grant (BIG)	WA Interagency Committee for Outdoor Recreation *www.iac.wa.gov*	Feb.-Mar.	Recreational, transient boating facilities for boats ≥ 26 ft.
Boating Facilities Program (BFP)	WA Interagency Committee for Outdoor Recreation *www.iac.wa.gov*	Mar. - May	Acquisition, development, planning, and renovation projects including launching ramps, transient moorage, and upland support facilities.
Land and Water Conservation Fund (LWCF)	WA Interagency Committee for Outdoor Recreation *www.iac.wa.gov*	Feb. – Mar.	To provide funding to assist in preserving, developing, and assuring accessibility to outdoor recreation resources including but not limited to parks, trails, wildlife lands, and other lands and facilities desirable for individual active participation.
Salmon Recovery Grant Program (SRGP)	WA Interagency Committee for Outdoor Recreation *www.iac.wa.gov*	Feb. – Mar.	Protection and/or restoration of salmon habitat. Also support feasibility assessments for future projects and other activities
Aquatic Weed Management Fund (AWMF)	WA Department of Ecology www.ecy.wa.gov/programs/wq/plants/grants/	Oct. – Nov.	Freshwater weed management projects; projects with submersed species receive funding priority over projects managing emergent species. (Dredging not funded)
Centennial Clean Water Fund (CCWF)	WA Department of Ecology www.ecy.wa.gov/programs/wqfunding	Dec. – Feb.	Projects which prevent and control water non-point sources of pollution.
Section 319 Nonpoint Source Grants Program (Section 319),	WA Department of Ecology www.ecy.wa.gov/programs/wqfunding	Dec. – Feb.	Projects to reduce nonpoint sources of water pollution.
State Revolving Loan Fund (SRF)	WA Department of Ecology www.ecy.wa.gov/programs/wqfunding	Dec. – Feb.	Low-interest loans for wastewater treatment facilities and related activities, or to reduce nonpoint sources of water pollution.
National Scenic Area Economic Development Funds	Skamania County Economic Development Council Peggy Bryan 509-427-5110	Year round	Loans and grants for public improvement projects

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Appendices

Appendix A. Other waterbodies of concern in Skamania County

Icehouse Lake
Ash Lake

Appendix B. Letter to landowners, Steering Committee Members, Wind River Watershed Council Minutes and Attendance

Skamania County
Department of Planning and
Community Development

Skamania County Courthouse Annex
Post Office Box 790
Stevenson, Washington 98648
509 427-9458 FAX: 509 427-8288

December 2, 2003

Dear:

As a landowner bordering Rock Creek Cove, Drano Lake, or the mouth of the Wind River in Skamania County I am writing to invite you to participate in developing a plan to control *Eurasian watermilfoil.* This plan will focus on selecting methods to control *Eurasian watermilfoil* and other invasive, non-native, aquatic weeds found in many of the water bodies within Skamania County. Projects to implement the plan and control this weed will be conducted in the future based on the direction in the plan. The plan will address the entire County, however, the primary focus will rest on three important areas, which are: Rock Creek Cove, Drano Lake, and the mouth of the Wind River.

In order to involve as many landowners, agencies, and members of the public as possible a Steering Committee consisting of Wind River Watershed Council Members and agency representatives was formed earlier this year to guide the planning process. The Committee met four times to begin work on the plan would like your input on the work completed to date, and your future participation. Landowners, agency representatives, and members of the public may participate in two ways: 1) by becoming a member of the Steering Committee, or 2) by reviewing and commenting on Steering Committee products.

Mary Pfauth of Portland State University's Center for Lakes and Reservoirs has been hired by the County to work with the Steering Committee to write the Aquatic Weed Plan. In cooperation with the US Geological Survey Columbia River Research Lab she has completed mapping of existing aquatic vegetation in the County's three focus areas. Mary is also working with the Steering Committee to identify a problem statement, mission statement, goals, list of uses for each water body, and to select desired control intensities and methods of control. Attached you will find a summary of the work completed by the Steering Committee to date, including maps showing the distribution of aquatic vegetation, uses, and proposed control intensity levels for Rock Creek Cove, Drano Lake, and the mouth of the Wind River. We will discuss these maps at the next Steering Committee meeting on January 21, 2003 from 6-8pm at the Skamania County PUD meeting room in Carson, Washington.

You are cordially invited to attend the January 21st Steering Committee meeting, become a Steering Committee member, or submit comments on the enclosed materials by the 21st. Further materials for your review and comment will be sent in the future as the County wants to ensure your interests are represented in this process. Please feel free to contact me at the address above, by phone at 509-427-9458, or through e-mail at boyd@co.skamania.wa.us if you have any questions. I look forward to your participation.

Sincerely,
Charly Boyd
Watershed & Shorelines Planner

Steering Committee Members

First Name	Last Name	Affiliation
		Broughton Lumber Company
Joe	Guerrero	Burlington Northern Railroad Co
Mike	Cowles	Burlington Northern Railroad Co
John	Granholm	City of Stevenson
Sharon	Tiffany	Columbia Gorge Interpretive Center
Ian	Sinks	Columbia Land Trust
Brad	Wilkins	High Cascade Veneer, Inc.
Jim	Mickel	High Cascade Veneer, Inc.
Jeff	Breckel	Lower Columbia Fish Recovery Board
Anita	Crow	Port of Skamania County
Al	McKee	Skamania County Commissioners
Bev	Majors	Skamania County Community Events and Recreation
Ole	Helgersen	Skamania County Cooperative Extension
Peggy	Bryan	Skamania County Economic Development Council
Bruce	Scherling	Skamania County Health Department
Dan	Wallenmeyer	Skamania County Noxious Weed Board
Charly	Boyd	Skamania County Planning and Community Development
Brent	Holman	Skamania County Public Works
Speros	Doulos	US Fish and Wildlife Service
Bengt	Coffin	US Forest Service
Tim	Counihan	US Geological Survey
Dave	Howard	Washington Department of Ecology
Bill	Weiler	Washington Department of Fish and Wildlife
Donna	Hale	Washington Department of Fish and Wildlife
Steve	Hartsel	Washington Department of Natural Resources
Bud	Wall	Washington State Department of Transportation
Don	Lane	Wind River Resorts International Inc.
Stephen	Klos	Wind River Resorts International Inc.
Lee	Carlson	Yakama Nation Fisheries
Eylan	Howell	
Frank	Cox	
Joe	Birkenfeld	
John	Wright	
Sam	Melonas	
Thomas and Patricia	Monaghan	
Toyoe and Sumi	Yoshida	
Dan	Gundersen	

Skamania County
***Eurasian watermilfoil* Control Plan**
9/17/03 Steering Committee Meeting Notes
(Wind River Watershed Council)

Attendees
Jim White – Underwood Conservation District
Dan Gunersen – Wind River Watershed Council Chair
Bill Thorson – Carson National Fish Hatchery
Al McKee - Skamania County Commissioner
Mary Pfauth – PSU Center for Lakes and Reservoirs
Charly Boyd - Skamania County Planning Department
Bruce Scherling - Skamania County Health Department
Diane Rubiaco – US Forest Service
Dave Howard – Department of Ecology

Problem Statement Notes
Where the problem is is Skamania County?
- Drano Lake
- Mouth of the Wind River
- Rock Creek Cove
- Sloughs and backwater areas along Highway 14
- Icehouse Lake
- Bonneville Pool
- Ashes Lakes (uncertain)

Who are the users affected by Eurasian watermilfoil?
- Fishermen
- Windsurfers
- Simmers
- Boaters
- Jet Skiers
- Fish (salmon habitat)

How Eurasian watermilfoil affects the users?
- Hazard to swimmers – entanglement, panic
- Transfer to other waterbodies by boats
- Can't fish from the shore
- Tangles lines when boat fishing
- Hides fish from fishermen
- Fouls props and jets
- Increases temperatures for fish
- Displaces native vegetation
- Windsurfers' centerboards get tangled up in it
- May increase pH swings during the day harming fish habitat
- Increases dissolved oxygen for fish

- Aesthetically displeasing
- Traps garbage in water along shorelines
- Displaces native insects (uncertain)

When did Eurasian watermilfoil become a problem in Skamania County?

- Within the last 5-6 years it has become a problem in areas near the Columbia
- May have been present in small numbers and then exploded in the last few years
- 5-6 years ago no one recalls it being present

Goals Notes

Worst Case Scenario if Nothing Is Done

- Entire habitable area for milfoil is infested
- We get a reputation for bad milfoil growth and recreationists avoid the area
- No more windsurfers on river and we lose the economic benefit they provide
- Somebody drowns in Skamania County because we didn't control the weeds
- Water doesn't support fish, recreation or anything and people can't use it
- Cost of mitigation at the 2 boat ramps and Rock Creek Park gets to the point where it costs too much to access the water and so the water becomes inaccessible
- Blocks or affects out-migration of fish from hatcheries
- People would hate to see things get to where the only things that live in our waters are turtles and muskrats
- Property values decrease
- Harm to paddle wheelers coming up the Columbia

Best Case Scenario if Something Is Done

- ✓ We find a way to get rid of it that is permanent and has no negative impact on anything that depends on the water
- ✓ The river is in balance and is a sustainable ecosystem
- ✓ We find we can compress milfoil into pellets and put it in the Wind River to solve the nutrient deficiency problem
- ✓ We get rid of it in all of the Columbia River
- ✓ We teach people how to eat it and sell it
- ✓ We figure out a way to remove it inexpensively based on peak seasons and then sell it
- ✓ Milfoil disappears

What the Steering Committee Would Like the Plan to Accomplish

- In the 3 main water bodies that are problem areas for the County (Mouth of the Wind River, Drano Lake, Rock Creek Cove) we get milfoil under control to the point where people can boat and surf and it is not a problem
- In places where people need to get, near shore and shallow water, we make sure they can get there and back safely at an affordable rate
- We control it so it is not impacting fish populations

- All of the above but we also establish some sort of regular monitoring once we get rid of it to keep it at a low level; and we increase the level of awareness about the problem possibly posting signs and getting people to clean their boats
- Get the County residents aware of the problem to the point where they support a small tax to control milfoil in the ongoing battle
- Along the lines of awareness is the scope – if we elevate people's local involvement to a high level, through the news, other watershed councils, the east side of the state, other sister lakes, they will realize the problem is a lot bigger than just here in Skamania County
- There is some need for a regional management approach to milfoil so we don't just nibble here and there at the problem and the stuff keeps coming back
- We control the plan in a way that fish habitat and water quality are not harmed
- Document our efforts to create a template others could use, we assist others in treating milfoil
- Keep milfoil from being a problem in the first place and get to it early, using signs to inform the public and keep milfoil out of areas where it isn't already saving money in the long term
- Figure out how we create the conditions in the water of its native habitat where it is not a problem and is under control naturally, as in European waters.

Skamania County
***Eurasian watermilfoil* Control Plan**
10/15/03 Steering Committee Meeting Notes
(Wind River Watershed Council)

Attendees
Jim White – Underwood Conservation District
Dan Gundersen – Wind River Watershed Council Chair
Bill Thorson – Carson National Fish Hatchery
Al McKee - Skamania County Commissioner
Charly Boyd - Skamania County Planning Department

Notes on Beneficial Use Areas

Rock Creek Cove
Uses identified apply to the entire cove area but the first 4 are concentrated near the boat launch and fairgrounds areas.

- Wind Surfing Training
- Swimming (some)
- Paddle Boats
- Canoe and Kayak Training
- Fish Habitat – Bass, Bluegill, Crappie, Perch, Salmonids
- Amphibians
- Other Aquatic Species and Wildlife
- Birds
- Scenery

Mouth of the Wind River
Uses identified apply to entire mouth area except for the first 3, which are concentrated near boat launch areas. The Steering Committee noted milfoil appeared to be on the west bank of the river mouth and on the east bank near the boat launch. The Committee was concerned milfoil could turn into a big problem in this area, such as at Rock Creek Cove, due to the mouth of the river rapidly filling with sediments from upstream decreasing water depth.

- Boating Access (at launch area)
- Kayaking and Canoeing (west side of river near old log storage area)
- In Lieu Site Access (boat launch area)
- Fishing
- Fish Habitat
- Anadromous Fish Passage
- Amphibians
- Other Aquatic Species and Wildlife
- Osprey

Drano Lake
Uses identified apply to entire lake except for the first two, which are located in the specific areas noted.

- Boat Launch and Parking Area (south side of lake, future expansion planned)
- Fish Hatchery (north end of lake)
- Fishing
- Water Quality for fish hatchery
- Tribal Fishery
- Anadromous Fish Passage to Hatchery
- Fish Habitat
- Amphibians
- Other Aquatic Species and Wildlife

Other
The Steering Committee noted Grant Lake may have milfoil in it but members were not sure of this.

WIND RIVER WATERSHED COUNCIL

Monthly Meeting Minutes For
January 21, 2004(Draft)

"A partnership, which encourages the use of land management practices which sustain and improve water quality, fish habitat, and other natural resources while contributing to long-term economic and community sustainability within the Wind River watershed"

The Wind River Watershed Council (WRWC) held its 69th meeting at the Skamania County PUD Meeting Room in Carson, WA.

Attendees:

Dan Gundersen, Landowner and WRWC Chair
Jim White, Underwood Conservation District
Al McKee, Skamania County Commissioner
Bill Thorson, Carson National Fish Hatchery
Charly Boyd, Skamania County Planning Department
Dave Howard, Washington Dept of Ecology
Greg Morris, Yakama Indian Nation
Larry Marchant, USFWL, Spring Creek National Fish Hatchery
Cheri Anderson, USFWL, Spring Creek National Fish Hatchery
Bruce Scherling, Skamania County Health Department
Bob Talent, Skamania County Commissioner
Ron McDonald, US Corps of Engineers, Bonneville Dam
Jennifer Rasor, Riparian Guardians
Emily Platt, Gifford Pinchot Task Force
Sherry Penney, Underwood Conservation District
Dan Wallenmeyer, Skamania County Weed Board
John Skaar, Skamania County Weed Board
Eylan Howell, Stevenson
Susan James, Carson
David Weiss, US Corps of Engineers, Bonneville Dam

Introductions and Announcements
Dan Gundersen welcomed the group. Since we had a large audience, Dan explained a bit about the Watershed Council, and read the vision statement for the group.

Minutes from November Meeting
We did not review the minutes. In February we should review the minutes from November.

Wind River Outdoor Education Class Presentation
The Wind River Middle School Outdoor Education class made a presentation of their findings from water quality sampling and other activities this past fall. These 7th and 8th graders told us about pH monitoring, dissolved oxygen monitoring, tree identification, invertebrates in stream ecosystems, temperature monitoring, and gave us a slide show of their activities. The class monitored Carson Creek, the lower Wind River, and the Wind River near Beaver Campground with the help of teacher Esther Holman and a host of volunteer assistants, including Jennifer Rasor, Sherry Penney, Cheri Anderson, Brooke LeBlanc, Brian Bair, Sarah Bercume, Meghan DeNiro, and David Weiss. The class did a great job in their presentation, even involving the audience through a multiple-choice quiz, and enjoyed a well-deserved round of applause!

Eurasian Milfoil – Charly Boyd
Charly continued public involvement efforts in Skamania County's work to develop a plan for controlling Eurasian milfoil in County Waters. Charly passed out maps of the three focus areas within the County, which are Rock Cove, Drano Lake, and the mouth of the Wind River. Charly's maps show the extent of milfoil infestation, areas proposed for treatment, and uses of the surrounding lands. She took comments and corrections regarding the maps.
Rock Cove: Bob Talent and Al McKee commented that the labeled boat launch was not a developed site, and is in the wrong place. It is located a bit further north than shown on the map. Charly will remove it from the map, since it is not a developed boat launch site.
Drano Lake: There was some discussion of the milfoil at the eastern end of the lake. Charly's map does not show any treatment planned for that end. Greg Morris noted that it may be an important area for fish rearing; the weeds may afford a place to get cover from predators.
A boat washing station was suggested for the new boat launch. There is a grant possibility for this, Mary Pfauth is checking into that per Charly. The group thought that the new boat launch may be a good place for an educational sign about milfoil.
Mouth of the Wind: Al McKee said that dredging may be an option here, since the County may do it anyway, to provide for boat passage. Dan Gundersen said that the native Americans may also support dredging, as they have trouble with boat passage at the in lieu site that is located a bit upstream. There may not be milfoil at that site though.
Finally, Charly passed out a draft copy of the problem statement and management goals for milfoil control. That draft is attached at the end of these notes. Comments should be sent to Charly (509-427-9458 or boyd@co.skamania.wa.us), or bring them next month. Next month's meeting may include a presentation on treatment options.

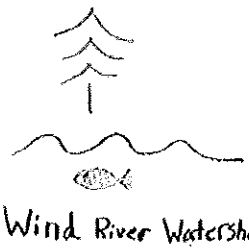
Underwood Conservation District Projects – Jim White
Jim discussed some ongoing and potential projects on the Wind River. The district has a contract with Bonneville Power Administration to do restoration work on the Wind River, and uses the Watershed Council as a stakeholder group to propose projects, and to prioritize work. A list of projects was developed several years ago, and partially prioritized. Jim went over some of the projects to update the audience, get input (including corrections to old project information). Some comments received:

Completed Projects:
Some completed and partially completed projects were described. Al McKee wanted to know what work the County had done on the Monaghan slide. Susan James, former UCD employee, said the County had put in a gabion wall, and UCD planted trees.
Wind River Watershed Enhancement Project (WRWEP) 14, Stabler Cutbank
Reforestation and scotch broom control is ongoing at this project. The project began with a large effort burying logs and rootwads into the bank, to minimize bank erosion. Jennifer Rasor noted that Stevenson High School has information from monitoring they have done on the bank erosion at this site. Dave Howard suggested good data and photos to document results. Jim noted that UCD already has photopoints on the site.
WRWEP 29, Price Properties
Jim noted that establishing tree seedlings on this site has been difficult
WRWEP 28, Birkenfeld property
Jim noted that the landowner is working on this project, which involves the Birkenfeld pond in the Middle Wind. Per Charly, the landowner has approached the County for a shoreline permit.
WRWEP 18, Jursik Property
UCD has surveyed this property owner's land, and provided him with some recommendations. Part of that includes a bank failure along the Wind River, WRWEP 18. Jim needs to have a fish biologist visit the site.
New Project, Little Wind River: Landowner Dan Gundersen is applying for a grant, to provide a summer steelhead spawing area. UCD is supportive, as are local fisheries biologists.

There are a number of projects that have not been prioritized, and for which it is difficult to locate with given information. Jim asked for volunteers in a group to help identify and prioritize projects. Susan James volunteered to help. Dan said we should discuss at our next meeting, too. Dave Howard suggested looking beyond private lands, and to include the National Forest. He also pointed out that proposals are due to the Forest Service RAC by April 1.

Potential Agenda Items for February
Charly Boyd will continue with Eurasian milfoil work; we may have a presentation and discussion of treatment methods. Jim will update the group on projects. Jim will pursue an additional topic based on the list we brainstormed in October.

Notes taken by Jim White



WIND RIVER WATERSHED COUNCIL

Monthly Meeting Minutes For
February 18, 2004

"A partnership, which encourages the use of land management practices which sustain and improve water quality, fish habitat, and other natural resources while contributing to long-term economic and community sustainability within the Wind River watershed"

The Wind River Watershed Council (WRWC) held its 70th meeting at the Skamania County PUD Meeting Room in Carson, WA.

Attendees:

Dan Gundersen, Landowner and WRWC Chair
Jim White, Underwood Conservation District
Bob Talent, Skamania County Commissioner
Bill Thorson, Carson National Fish Hatchery
Charly Boyd, Skamania County Planning Department
Dave Howard, Washington Dept of Ecology
Bruce Scherling, Skamania County Health Department
Ron McDonald, US Corps of Engineers, Bonneville Dam
Dan Wallenmeyer, Skamania County Weed Board
John Skaar, Skamania County Weed Board
Bengt Coffin, US Forest Service
Mary Pfauth, Botanist Contracting with Skamania County
Ian Jezorek, USGS, Columbia River Research Lab

Introductions and Announcements
Dan Gundersen welcomed the group and read the Wind River Watershed Council Mission statement.
Charly Boyd mentioned that there should soon be a SEPA document out regarding the proposed expansion of Carson Hot Springs. That work will include development of a new access road, and closing of the existing road. There was some question about mitigation of runoff from the old road, and no one knew the exact plans. Apparently the County does not have runoff regulations, but the Dept. of Ecology does have some rules that govern this.
Dave Howard announced that the state's Clean Water Act 303(d) list is out for public review. It can be viewed on the web at http://www.ecy.wa.gov/programs/wq/303d/2002/2002_list.html. Dave notes that the Wind River already has a total maximum daily load (TMDL) plan for temperature.
Jim White mentioned that the Underwood Conservation District will have an election on March 16 for one of the 5 Board positions. Interested candidates need to file by the end of February, and can get more information by calling the district. A special election will be held in the spring for another position, that is currently vacant. The Underwood CD includes all of Skamania County except Stevenson, and Klickitat County west of the Klickitat River, excepting White Salmon and most of Bingen.

Minutes from January Meeting
There were no corrections suggested to the January 2004 or November 2003 minutes.

Hemlock Dam Update – Bengt Coffin
Bengt discussed the planning work being done by the Forest Service regarding Hemlock dam. The agency is looking at options for providing fish passage and for improving fish habitat in general. Options from the status quo to dam removal are being considered. He explained some of the history of the dam and of Hemlock Lake behind it. The Dam is located on Trout Creek, about 1.5 miles upstream from the confluence of Trout Creek and the Wind

River. It was initially built (1930s) for nursery irrigation and power generation. Since power is no longer generated, and the Wind River Nursery is closed, those issues are not as important. Recreation is now a major issue to consider, since Hemlock Lake is very popular locally. Concerns include fish passage, and high temperatures in Trout Creek that the dam may exacerbate. Summer steelhead, which are threatened, are impacted, particularly smolt heading downstream in late summer. Those young fish may have difficulty finding their way in Hemlock Lake, and high summer water temperatures may be costly to fish. Fish heading upstream may not have as difficult a time, per cameras installed next to the dam's fish ladder.
Another concern that has been raised involves safety for downstream residents. A few residences downstream could be affected were the dam to break. A Corps of Engineers inspection indicated that the dam was stable, and this would not be a major concern.

Bengt described a series of alternatives the Forest Service is building for analysis. The alternatives are not final at this time:

1. No Action, leave the dam as-is.
2. Removal of Hemlock Dam. Currently this is the recommended action.
3. Dredge the sediments behind the dam, including re-use of an existing sluice on the dam to periodically flush sediments downstream.
4. The same actions as #3, plus rebuilding the existing fish ladder to standards.

Bengt said that the Hemlock dam evaluation process has undergone some starts and stops. A 2001 public meeting generated a lot of input. Budget cuts by BPA and the Forest Service later put the project on hold, but it was activated again last November (Bengt is the lead). Alternatives are being driven by Recreation and Cultural Resources as major issues. Cultural Resources is an important factor since both the dam and the fish ladder are considered cultural resources.
Currently, the plan is to get a draft Environmental Impact Statement (EIS) prepared by fall, and to have a final decision next February.
There were a number of questions from the audience. Bruce Scherling asked what pesticides are in the sediments under the lake, and also what percentage of the Wind River steelhead population is in the Trout Creek subbasin. A company analyzed the sediments, and did find some DDT 6 to 9 feet down in the sediments. It is not in high concentrations and should not present a concern with removing the materials, if that becomes part of the plan. As for steelhead use of Trout Creek, it is estimated to potentially support 10-20% of the fish for the Wind River system. Dan Wallenmeyer asked about water rights for irrigation of the old nursery fields, were they being transferred to the County, who now owns much of the old nursery? Bengt and Charly Boyd said that the transfer of water rights is being worked on now.
Charly Boyd pointed out that the Stabler Water Quality Study identified a large aquifer that lies behind Hemlock Dam. The consultants who did the Stabler study did not think dam removal would seriously impact the aquifer, since it is recharged mainly by watershed runoff, not by Hemlock Lake.
We discussed the high temperatures in Trout Creek. Bengt noted that Hemlock dam is not the only factor causing high water temperatures, Trout Lake flats (upstream from the dam) is very warm too. Dam removal, or deepening of the lake by removal of sediment would help the temperature situation but will not totally fix the problem.
Bob Talent mentioned the Osborn photos, a series of early photographs (early 1900s) from lookout towers. Photos from Bunker Hill and other nearby areas indicate that much of the surrounding land was burned by wildfire. Possibly streams like Trout Creek had periodically lacked shade to keep water cool. Bengt said they were trying to take that into account. He also noted that Yacolt burn, early in the 1900s, missed Trout Creek flat. Bengt also pointed out that Trout Creek has been warm for a long time. A water system from the 1930s was not as popular as one from Martha Creek, due to the warmer Trout Creek water.
Dave Howard asked how the Wind River Watershed Council could help the Forest Service. Bengt will consider the Council as one way to get input during the process.
Finally, Bengt touched on some other Forest Service work in the Wind River Watershed. There is a large-scale restoration effort being planned for the Trout Creek Flats, and a couple of timber sales are being considered. He also said the Wind River mine has been sold, and there is the possibility of some activity there.

Eurasian Milfoil – Charly Boyd and Mary Pfauth
Mary passed out some updated maps of Rock Cove, the mouth of the Wind, and Drano Lake. Mary and Charly wanted some additional input regarding high-priority areas in each of the three sites. We discussed the sites on-by-one.
Rock Cove:
This area generated the majority of discussion. The map showed an area of medium treatment priority around the islands in the Cove. Several people indicated that the entire cove was popular with kayakers and other boaters. Some also felt that the indicated swimming beach was not used that much for swimming, rather kayaks and (until milfoil really increased a few years ago) a practice area for beginning windsurfers.
The group had some input regarding treatments also. Since Rock Cove is relatively shallow, herbicide treatment may be cost effective. Per Dan Wallenmeyer, the milfoil and other weeds in the Cove are too thick for a diver to cut the plants. A coffer dam or other means to temporarily control water inflow and outflow to the Columbia would help make the treatment more effective.
Bengt suggested looking at priorities for all 3 areas. Possibly the highest priority treatment area in Rock Cove was lower than the treatment areas in the Wind River mouth, for example. That led to some discussion about the three areas. Rock Cove is used recreationally in Stevenson, but it was pointed out that the other areas are heavily used by fishermen, who pay to use boat launches and for licences. Bill Thorson mentioned a statistic that about there are about 35,000 fishing days per year on the Wind River, a lot of use. Dan Wallenmeyer said that Rock Cove is an important area for waterfowl.
Toward the end of the Rock Creek discussion, the group generally agreed that Rock Cove merited treatment over the entire area, although the intensity may vary.
Drano Lake:
The west end needs treatment. Fishing boats use this area a lot. The western bank gets a lot of bank fishing too. Also, the eastern shore of the north end of the lake (the eastern shore of the river bank where it widens out into Drano Lake) gets a lot of bank fishing.
Wind River Mouth:
The group agreed with the map as is. It emphasizes dredging or otherwise clearing of the channel from the boat launch out to the Columbia.

Potential Agenda Items for March
The group suggested (1) an update on the Salmon Recovery Funding Board (SRFB) grant cycle, and continued milfoil planning. Jim White will continue work on Wind River project planning as well (we dropped this topic tonight due to lack of time).

Notes taken by Jim White

Skamania County
***Eurasian watermilfoil* Control Plan**
3/17/04 Steering Committee Meeting Notes
(Wind River Watershed Council)

Attendees
Jim White – Underwood Conservation District (Director)
Dan Gundersen – Wind River Watershed Council (Chair)
Bill Thorson – Carson National Fish Hatchery
Charly Boyd - Skamania County Planning Department
Ron McDonald – US Army Corps of Engineers Bonneville
Mary Pfauth – Portland State University
Bengt Coffin – US Forest Service
Pat Connolly – US Geological Survey
Gary Wade – Lower Columbia Fish Recovery Board
Don Lane – Wind River Resorts

Notes on Draft Milfoil Control Plan

Rock Creek Cove
- Dan said he thought the group had discussed dredging the area at the moth of Rock Creek and placing the gravels at the swim beach to prevent milfoil. Mary explained that bottom barriers are more effective since the sediment that accumulates annually can be removed to prevent new infestations. She also said bottom barriers effectively block all weed growth if maintained properly. Mary also said dredging is complicated and expensive and the need for it, other than for weed control, was unclear.
- Mary said half the cove would be treated first, and the other half later to avoid suffocating fish from the die off.

Mouth of the Wind River
- Dredging of the boat access lane recommended, however, dredging needs to be at least 15 feet deep to control plants.
- Don Lane suggested the Wind River Resorts property could be used as a deposit site for the dredged materials to build up their beach area as long as the pond area in front of the property is also dredged. He said the pond contributes to very high water temperatures and is full of milfoil. He said dredging would benefit the property and the fish.
- Ron McDonald said the Corps has an expedited permit process for "beneficial dredging" and suggested someone look up this topic at the Corps' Portland website under the Regulatory program. He said similar work was done in Pablo Bay near San Francisco where dredge spoils were used to build up eroding beaches. Ron said the required sample testing for "beneficial dredging" could be much less than would be normally required. He said normal sample testing runs between $1500-$2000 per sample and multiple samples are usually required.

Drano Lake

- Ron McDonald suggested dredging on the north side of the lake where the river comes in might not be possible because of the presence of cultural resources that need to be protected.
- Mary said Speros Doulos at the USFWS hatchery on the Little White Salmon River is supportive of dredging to improve fish passage and control weeds.
- Mary said any herbicide treatment should be done at least two years in a row.
- Mary explained no cost estimates for dredging are included in the plan since they vary widely depending on several factors that must be assessed on a site-specific basis.
- Mary said a sediment curtain would be used to contain the herbicide to the south side of the lake. She said the cost of herbicide application depends on whether or not the applicator has a sediment curtain already or one needs to be purchased. She said these could run to $20,000.

Other

- Bengt Coffin suggested Mary develop a "Plan B" approach to the mouth of the Wind and Drano Lakes to provide a course of action in case dredging proves impossible or too expensive.
- Dan suggested herbicide treatment would probably be more cost-effective than dredging.
- Charly said all three areas are within the Columbia River Gorge National Scenic Area (NSA) and suggested this needs more discussion in the draft plan. She said NSA regulations might affect permitting for dredging. (*After speaking with Karen Witherspoon at the Planning Department on the 18th, there is an exception to the NSA review process for weed removal, however, dredging may not fit under this.)*
- Mary said annual monitoring of milfoil re-infestation is critical to the success of any milfoil control program. She said five years is too long an interval to wait. (*Is there a monitoring plan recommendation in the draft plan?)*

Skamania County
***Eurasian watermilfoil* Control Plan**
4/21/04 Steering Committee Meeting Notes
(Wind River Watershed Council)

Attendees
Jim White – Underwood Conservation District (Director)
Dan Gundersen – Wind River Watershed Council (Chair)
Bill Thorson – Carson National Fish Hatchery
Charly Boyd - Skamania County Planning Department
Mary Pfauth – Portland State University
Bengt Coffin – US Forest Service
Don Lane – Wind River Resorts
Scott Pineo – Skamania County Community Events and Recreation
Stephen Wille – US Fish and Wildlife Service
Joe Birkenfeld – Rock Creek Cove/Upper Wind River Landowner
Steve Barnes – Wind River Landowner
Eylan Howell – Drano Lake Landowner
Al McKee - Skamania County Commissioner
Dan Wallenmeyer - Skamania County Noxious Weed Board
John Skaar – Weed Board (Chair)
Dave Howard – WA Department of Ecology
Larry Marchant – Spring Creek National Fish Hatchery
Mary-Todd Haight – Wind River Landowner

Notes on Draft Skamania County IAVMP

General Notes
- Mary reviewed some of the major changes from the first draft IAVMP to the public review draft currently out for review. She said the costs section now includes estimates for dredging and the funding and history sections have been expanded.
- Charly said comments on this draft are due May 17 but asked for them earlier if possible.
- Mary said she would give a power point presentation on the plan at the next meeting on May 19th and asked Charly to get a public notice in the paper.
- Charly said she thought the final plan should be ready by the May meeting, or at least by the June meeting.

Rock Creek Cove
- Mary said the costs for herbicide application could be reduced if a contractor is employed who already has a sediment curtain. She said Terry McNab of Aquatechnix has one. She said the estimate in the draft was obtained from a Vancouver, Washington company named Port-A-Dam.
- Larry Marchant asked how many gallons of herbicide would need to be applied in Rock Cove and Drano Lake. Mary said she would add this to the cost estimate tables and text. Dan Wallenmeyer said it would be useful add the acre-feet of water

in these areas to the text (pg 52). Mary said purchasing the product is the most expensive part of herbicide application.

- Eylan Howell asked if herbicides could harm culverts by causing corrosion. Mary said no.
- Joe Birkenfeld said he would support dredging in Rock Creek and Rock Cove and he said he would offer his property along the east side of the Cove where the Creek enters for depositing the dredge materials.
- Jim White said informational signs are not listed in the cost estimates for Rock Cove and asked why they would not be placed there. Mary said this was a mistake. She intended to recommend signs at this location as well.
- Mary Todd asked why dredging is not recommended for Rock Cove. Mary explained this is not consistent with the Steering Committee's goals for this water body. She said dredging is very expensive, it causes a lot of disturbance and it is not a good way to control aquatic weeds if this is the only objective. Al McKee said that some members of the public would be supportive of dredging while others would not be; there are many different opinions for Rock Cove. Joe Birkenfeld said the Creek and the Cover were both dredged in the past for the old mill log yard. John Skaar said if the Cove and Creek continue to fill in with sediment steelhead passage up the Creek will be affected, temperatures will rise, and flood hazard will be increased. Al McKee said before the second powerhouse was built at Bonneville Dam the Cove water level used to fluctuate at lot more than it does not and it allowed the sediment to be flushed out more regularly.

Mouth of the Wind River

- Steve Barnes said he supports dredging the mouth of the Wind River but he pointed out this is not the most economical option to control milfoil. Mary agreed and said dredging is not a good way to control aquatic weeds unless there is another purpose and then weed control is a side benefit. She said, in this case, maintaining access to the boat ramp by dredging would also control milfoil in that specific area.
-

Drano Lake

- Mary said Dredging, with in-water dredge material disposal, is extremely expensive and so she developed an herbicide application option.
- Mary said she is concerned about curly leaf pondweed in Drano and Rock Creek exploding once the milfoil is removed because the two weeds have different growing seasons. She said the extent of the pondweed is most likely underestimated in the plan since the sampling time was so late in the year and it was already starting to die off.
- Mary said the optimum treatment time for curly leaf pondweed is February but she was concerned the fish work windows of the fish management agencies would not accommodate this. Stephen Wille said the three focus areas in the plan would all fall under the USFWS Columbia River work window, which runs from November 15 to February 15 and so herbicide applications to control pondweed may be possible.

- Mary said it is important to conduct monitoring sampling twice each year, once early in the spring and once later in the summer to capture both curly leaf pondweed and milfoil.

Other Comments

- Stephen Wille said many of the agency permits that would be required for dredging would probably require some sort of mitigation work and that would add to the cost of the project. He said the mitigation would be based on the amount of damage to, or loss of, watershed functions. He said planning costs would also be involved for permits such as the State Environmental Policy Act.
- Stephen Wille said dredging can sometimes be problematic upstream of the dredge location as the river tries to equilibrate. He said this may not happen right away but could happen later on.
- Dan Gundersen asked Mary how familiar she was with the various funding sources. Mary said some of the listed ones would be a good fit and some probably would be more of a stretch.

Appendix C. Priority Habitat and Species Report

PENDING

Appendix D. Plant survey data

Key to abbreviations used in the data tables:

CEDE = *Ceratophyllum demersum (coontail)*
ELCA = *Elodea canadensis* (American waterweed)
MYSP = *Myriophyllum spicatum* (Eurasian watermilfoil)
POCR = *Potamogeton crispus* (curlyleaf pondweed)
Nitella = *Nitella* sp.

0 or ND indicates none detected
1 indicates presence

Table 1. Rock Cove 9/30/03 Lat/long WGS-84

Longitude	Latitude	MYSP	ELCA	CEDE	POCR	Nitella
-121.88734	45.69025	ND	ND	ND	ND	ND
-121.88743	45.69062	ND	ND	ND	ND	ND
-121.88766	45.69042	1	1	1	0	0
-121.88788	45.69018	ND	ND	ND	ND	ND
-121.88808	45.68996	ND	ND	ND	ND	ND
-121.88832	45.68973	0	0	0	0	0
-121.88859	45.68951	1	1	0	0	0
-121.88887	45.68923	ND	ND	ND	ND	ND
-121.88866	45.6899	0	0	0	0	0
-121.88922	45.68987	ND	ND	ND	ND	ND
-121.88897	45.69009	0	0	0	0	0
-121.8886	45.69093	ND	ND	ND	ND	ND
-121.88891	45.69113	ND	ND	ND	ND	ND
-121.88925	45.69132	ND	ND	ND	ND	ND
-121.88966	45.69152	ND	ND	ND	ND	ND
-121.88941	45.69173	ND	ND	ND	ND	ND
-121.88975	45.69197	ND	ND	ND	ND	ND
-121.88999	45.69172	ND	ND	ND	ND	ND
-121.89039	45.69196	ND	ND	ND	ND	ND
-121.89117	45.69237	ND	ND	ND	ND	ND
-121.89147	45.6925	ND	ND	ND	ND	ND
-121.89136	45.69215	ND	ND	ND	ND	ND
-121.891	45.69191	ND	ND	ND	ND	ND
-121.89061	45.6917	ND	ND	ND	ND	ND
-121.89026	45.69149	ND	ND	ND	ND	ND
-121.8899	45.6913	ND	ND	ND	ND	ND
-121.88955	45.69109	ND	ND	ND	ND	ND
-121.88916	45.69089	ND	ND	ND	ND	ND
-121.88884	45.69071	ND	ND	ND	ND	ND
-121.88906	45.6905	ND	ND	ND	ND	ND
-121.8894	45.69068	ND	ND	ND	ND	ND
-121.88975	45.69085	ND	ND	ND	ND	ND
-121.89015	45.69107	ND	ND	ND	ND	ND
-121.89048	45.69127	ND	ND	ND	ND	ND
-121.89083	45.69148	ND	ND	ND	ND	ND
-121.89037	45.69086	ND	ND	ND	ND	ND

-121.89	45.69065	ND	ND	ND	ND	ND
-121.88964	45.69045	ND	ND	ND	ND	ND
-121.88931	45.69028	ND	ND	ND	ND	ND
-121.88953	45.69004	ND	ND	ND	ND	ND
-121.88989	45.69022	ND	ND	ND	ND	ND
-121.89022	45.69043	ND	ND	ND	ND	ND
-121.89019	45.68997	ND	ND	ND	ND	ND
-121.88985	45.68978	0	0	0	0	0
-121.89014	45.68955	0	0	0	0	0
-121.89047	45.68971	ND	ND	ND	ND	ND
-121.89077	45.68989	ND	ND	ND	ND	ND
-121.89118	45.69009	ND	ND	ND	ND	ND
-121.89153	45.69029	ND	ND	ND	ND	ND
-121.89187	45.69047	ND	ND	ND	ND	ND
-121.89222	45.69064	ND	ND	ND	ND	ND
-121.8919	45.69093	ND	ND	ND	ND	ND
-121.89347	45.69081	ND	ND	ND	ND	ND
-121.89314	45.69064	ND	ND	ND	ND	ND
-121.89284	45.69051	ND	ND	ND	ND	ND
-121.89253	45.69037	ND	ND	ND	ND	ND
-121.89219	45.69018	ND	ND	ND	ND	ND
-121.89186	45.69003	ND	ND	ND	ND	ND
-121.89146	45.68983	ND	ND	ND	ND	ND
-121.89109	45.68963	ND	ND	ND	ND	ND
-121.89076	45.68944	ND	ND	ND	ND	ND
-121.89042	45.68925	1	0	0	1	0
-121.89068	45.68901	ND	ND	ND	ND	ND
-121.891	45.68918	1	1	1	0	0
-121.89137	45.68935	1	1	1	0	0
-121.89175	45.68955	ND	ND	ND	ND	ND
-121.89214	45.68975	ND	ND	ND	ND	ND
-121.89246	45.68992	ND	ND	ND	ND	ND
-121.89281	45.6901	ND	ND	ND	ND	ND
-121.8931	45.69026	ND	ND	ND	ND	ND
-121.8934	45.69043	ND	ND	ND	ND	ND
-121.89373	45.69059	ND	ND	ND	ND	ND
-121.89403	45.69073	ND	ND	ND	ND	ND
-121.89472	45.69103	ND	ND	ND	ND	ND
-121.89597	45.69129	ND	ND	ND	ND	ND
-121.89565	45.69113	ND	ND	ND	ND	ND
-121.89532	45.69098	ND	ND	ND	ND	ND

-121.89498	45.69081	ND	ND	ND	ND	ND
-121.89465	45.69064	ND	ND	ND	ND	ND
-121.89435	45.69048	ND	ND	ND	ND	ND
-121.89404	45.69031	ND	ND	ND	ND	ND
-121.89372	45.69015	ND	ND	ND	ND	ND
-121.89343	45.69	ND	ND	ND	ND	ND
-121.89313	45.68984	ND	ND	ND	ND	ND
-121.89278	45.68967	ND	ND	ND	ND	ND
-121.89242	45.6895	1	1	0	1	0
-121.89205	45.6893	1	1	0	1	0
-121.89168	45.6891	1	1	1	0	0
-121.89132	45.68893	ND	ND	ND	ND	ND
-121.89097	45.68875	ND	ND	ND	ND	ND
-121.89123	45.68849	ND	ND	ND	ND	ND
-121.89159	45.68866	1	1	1	0	0
-121.89196	45.68886	1	1	1	0	0
-121.89235	45.68905	0	0	0	1	0
-121.89269	45.68925	0	0	0	0	0
-121.89302	45.6894	1	1	1	0	0
-121.89338	45.68958	ND	ND	ND	ND	ND
-121.89369	45.68974	ND	ND	ND	ND	ND
-121.89401	45.68989	ND	ND	ND	ND	ND
-121.8943	45.69006	ND	ND	ND	ND	ND
-121.89464	45.69021	ND	ND	ND	ND	ND
-121.89489	45.69038	ND	ND	ND	ND	ND
-121.89525	45.69055	ND	ND	ND	ND	ND
-121.89558	45.6907	ND	ND	ND	ND	ND
-121.89591	45.69089	ND	ND	ND	ND	ND
-121.89625	45.69104	ND	ND	ND	ND	ND
-121.89656	45.6912	ND	ND	ND	ND	ND
-121.89686	45.69136	ND	ND	ND	ND	ND
-121.89717	45.69153	ND	ND	ND	ND	ND
-121.89748	45.69131	1	1	1	0	0
-121.89714	45.69112	0	0	1	0	0
-121.89683	45.69096	ND	ND	ND	ND	ND
-121.89651	45.69082	ND	ND	ND	ND	ND
-121.89618	45.69065	ND	ND	ND	ND	ND
-121.89584	45.69048	ND	ND	ND	ND	ND
-121.89555	45.69031	ND	ND	ND	ND	ND
-121.89519	45.69014	ND	ND	ND	ND	ND
-121.8949	45.68997	ND	ND	ND	ND	ND

-121.89458	45.68983	ND	ND	ND	ND	ND
-121.89423	45.68964	ND	ND	ND	ND	ND
-121.89393	45.68949	1	1	0	0	0
-121.89366	45.68935	0	1	1	0	0
-121.89331	45.68916	0	0	0	0	0
-121.89299	45.68899	0	0	0	0	0
-121.89262	45.68881	ND	ND	ND	ND	ND
-121.89222	45.68861	ND	ND	ND	ND	ND
-121.89185	45.68841	ND	ND	ND	ND	ND
-121.89149	45.68824	ND	ND	ND	ND	ND
-121.89176	45.688	ND	ND	ND	ND	ND
-121.89211	45.68817	ND	ND	ND	ND	ND
-121.89249	45.68837	ND	ND	ND	ND	ND
-121.89288	45.68856	ND	ND	ND	ND	ND
-121.89325	45.68874	ND	ND	ND	ND	ND
-121.89359	45.6889	ND	ND	ND	ND	ND
-121.89392	45.6891	ND	ND	ND	ND	ND
-121.89422	45.68924	ND	ND	ND	ND	ND
-121.89453	45.68941	ND	ND	ND	ND	ND
-121.89483	45.68957	ND	ND	ND	ND	ND
-121.89514	45.68971	ND	ND	ND	ND	ND
-121.89548	45.68989	ND	ND	ND	ND	ND
-121.89579	45.69004	ND	ND	ND	ND	ND
-121.89613	45.69021	1	1	0	0	0
-121.89646	45.69038	1	1	0	0	0
-121.89682	45.69056	1	1	0	0	0
-121.89709	45.6907	1	1	0	0	0
-121.89741	45.69086	1	1	1	0	0
-121.89776	45.69106	1	1	1	0	0
-121.89806	45.69077	1	1	1	1	0
-121.89807	45.69032	ND	ND	ND	ND	ND
-121.89772	45.69018	0	1	1	0	0
-121.89738	45.69001	1	1	0	0	0
-121.89705	45.68984	0	0	0	0	0
-121.89671	45.68967	0	0	0	0	0
-121.8964	45.68953	0	1	0	0	1
-121.89604	45.68937	0	0	0	0	0
-121.89575	45.6892	1	0	0	0	0
-121.89543	45.68904	ND	ND	ND	ND	ND
-121.89508	45.68887	0	1	0	0	0
-121.8948	45.68873	ND	ND	ND	ND	ND

-121.89449	45.68856	ND	ND	ND	ND	ND
-121.89414	45.68839	ND	ND	ND	ND	ND
-121.8938	45.68822	ND	ND	ND	ND	ND
-121.89343	45.68805	ND	ND	ND	ND	ND
-121.89305	45.68786	ND	ND	ND	ND	ND
-121.89328	45.68763	ND	ND	ND	ND	ND
-121.89369	45.68781	ND	ND	ND	ND	ND
-121.89404	45.68801	ND	ND	ND	ND	ND
-121.8944	45.68818	ND	ND	ND	ND	ND
-121.89473	45.68834	ND	ND	ND	ND	ND
-121.89503	45.6885	ND	ND	ND	ND	ND
-121.89534	45.68864	ND	ND	ND	ND	ND
-121.89566	45.68881	ND	ND	ND	ND	ND
-121.89601	45.68895	1	1	0	0	0
-121.89631	45.68912	0	0	0	0	0
-121.89664	45.68928	1	1	0	0	0
-121.89698	45.68943	1	1	0	0	0
-121.89729	45.68959	0	0	0	0	0
-121.89765	45.68977	1	1	0	0	0
-121.89798	45.68993	0	1	1	0	0
-121.89832	45.6901	1	1	1	0	0
-121.8986	45.68985	ND	ND	ND	ND	ND
-121.89791	45.68954	ND	ND	ND	ND	ND
-121.89756	45.68934	ND	ND	ND	ND	ND
-121.89722	45.68919	ND	ND	ND	ND	ND
-121.89691	45.68903	1	1	0	0	0
-121.89657	45.68889	0	0	0	0	0
-121.89626	45.68872	1	1	0	0	0
-121.89594	45.68856	ND	ND	ND	ND	ND
-121.89561	45.6884	1	1	1	0	0
-121.89531	45.68826	1	1	0	0	0
-121.89498	45.68808	0	1	0	0	0
-121.89462	45.68793	1	1	1	0	0
-121.89429	45.68778	ND	ND	ND	ND	ND
-121.89393	45.68759	ND	ND	ND	ND	ND
-121.89352	45.68742	ND	ND	ND	ND	ND
-121.89349	45.687	ND	ND	ND	ND	ND
-121.89382	45.68716	ND	ND	ND	ND	ND
-121.89422	45.68736	ND	ND	ND	ND	ND
-121.89457	45.68753	1	1	1	0	0
-121.8949	45.68767	ND	ND	ND	ND	ND

-121.89526	45.68784	ND	ND	ND	ND	ND
-121.89557	45.68801	ND	ND	ND	ND	ND
-121.89587	45.68816	ND	ND	ND	ND	ND
-121.8962	45.68831	ND	ND	ND	ND	ND
-121.89654	45.68848	0	1	0	0	0
-121.89685	45.68862	0	0	0	0	0
-121.89714	45.68838	0	0	0	0	0
-121.8968	45.68821	0	0	0	0	0
-121.89649	45.68806	0	0	0	0	0
-121.89617	45.68792	0	0	0	0	0
-121.89582	45.68775	0	0	0	0	0
-121.89552	45.6876	0	1	1	0	0
-121.89519	45.68744	1	1	1	0	0
-121.89483	45.68727	0	1	1	0	0
-121.89448	45.6871	ND	ND	ND	ND	ND
-121.89407	45.68691	ND	ND	ND	ND	ND
-121.89433	45.68671	1	1	0	0	0
-121.89472	45.68689	1	1	0	0	0
-121.8951	45.68706	1	1	1	0	0
-121.89545	45.68722	1	1	0	0	0
-121.89578	45.68739	ND	ND	ND	ND	ND
-121.89612	45.68753	ND	ND	ND	ND	ND
-121.89644	45.68767	0	0	0	0	0
-121.89675	45.68782	0	0	0	0	0
-121.89707	45.68797	0	0	0	0	0
-121.89697	45.6876	0	0	0	0	0
-121.89668	45.68743	0	0	0	0	0
-121.89636	45.68728	1	1	0	0	0
-121.89605	45.68714	ND	ND	ND	ND	ND
-121.89571	45.68697	1	1	0	0	0
-121.89536	45.68683	1	1	1	0	0
-121.89498	45.68666	1	1	1	0	0
-121.89461	45.68646	1	1	0	0	0
-121.89487	45.68627	1	1	0	0	0
-121.89525	45.68644	1	1	0	0	0
-121.89564	45.68661	ND	ND	ND	ND	ND
-121.89592	45.68676	1	1	0	0	0
-121.89629	45.68692	1	1	0	0	0
-121.89663	45.68705	0	0	0	0	0
-121.89692	45.68719	1	1	0	0	0
-121.89761	45.68752	1	1	0	0	0

-121.89793	45.68769	1	1	0	0	0
-121.89822	45.68786	1	1	0	0	0
-121.8985	45.68801	1	1	1	0	0
-121.89754	45.6871	0	0	0	0	0
-121.8972	45.68694	1	1	0	0	0
-121.89691	45.68681	1	1	0	0	0
-121.89657	45.68666	0	1	0	0	0
-121.89622	45.6865	1	1	0	0	0
-121.89652	45.68621	0	0	0	0	0
-121.89688	45.68635	1	1	1	0	0
-121.89721	45.68652	1	1	0	0	0
-121.89753	45.68667	0	0	1	0	0
-121.89781	45.68642	1	1	0	0	0
-121.8975	45.68626	1	1	1	0	0
-121.8972	45.68611	1	1	0	0	0
-121.89685	45.68595	0	0	0	0	0
-121.89647	45.68578	0	0	0	0	0
-121.89612	45.68562	0	1	0	0	0
-121.89642	45.68537	0	0	0	0	0
-121.89674	45.68552	0	0	0	0	0
-121.89745	45.68583	1	1	0	0	0
-121.89783	45.68553	1	1	0	0	1
-121.89747	45.68538	0	1	0	0	0
-121.89728	45.68499	1	1	0	0	0
-121.89756	45.6848	1	1	1	0	0
-121.89768	45.68515	1	1	1	0	0
-121.89803	45.68531	ND	ND	ND	ND	ND
-121.89775	45.69058	1	1	1	0	0
-121.89741	45.69044	1	1	0	0	0
-121.8971	45.69027	1	1	1	0	0
-121.89674	45.69011	1	1	1	0	0
-121.89643	45.68994	0	0	1	0	0
-121.8961	45.68977	0	0	1	0	0
-121.8958	45.68962	1	1	1	0	0
-121.89547	45.68945	0	0	0	0	0
-121.89513	45.68929	0	0	0	0	0
-121.89484	45.68913	0	0	0	0	0
-121.89452	45.68899	0	0	1	0	0
-121.89421	45.68882	0	0	1	0	0
-121.89385	45.68862	1	1	1	0	0
-121.89354	45.68847	ND	ND	ND	ND	ND

-121.89316	45.6883	ND	ND	ND	ND	ND
-121.89279	45.6881	ND	ND	ND	ND	ND
-121.89242	45.68793	ND	ND	ND	ND	ND
-121.89206	45.68774	ND	ND	ND	ND	ND
-121.8952044	45.68789631	1	1	1	0	0
-121.8948244	45.68761805	1	1	1	0	0
-121.8946335	45.68749152	1	1	1	0	0
-121.8946245	45.68714404	1	1	1	0	0
-121.8943339	45.68651445	1	1	1	0	0
-121.8963126	45.691244	1	1	0	0	0
-121.8965792	45.69110305	1	1	0	0	0
-121.8964067	45.69071387	1	1	0	0	0
-121.8961497	45.68996893	1	1	1	0	0
121.8954719-	45.6895817	1	1	0	0	0
-121.8948159	45.68955744	1	1	0	0	0
-121.8938912	45.68948061	1	1	0	0	0
-121.8927565	45.68937285	1	1	0	0	0
-121.8923692	45.68960559	1	1	0	0	0
-121.8917119	45.6894758	1	1	0	0	0
-121.8907664	45.68959778	1	1	1	1	0
-121.8904474	45.6898687	0	0	0	0	0

Table 2. Mouth of the Wind River 9/24/03 Lat/long WGS-84

Longitude	Latitude	MYSP	ELCA	CEDE	POCR	Nitella
-121.7907255	45.7157771	0	0	0	0	0
-121.7907859	45.7161939	0	0	0	0	0
-121.7920048	45.7162764	0	0	0	0	0
-121.7914612	45.7162056	0	0	0	0	0
-121.7908494	45.7161042	0	1	0	0	0
-121.7906348	45.7160994	1	1	0	0	0
-121.7903327	45.7160244	0	1	0	0	0
-121.7900531	45.7159718	1	1	0	0	0
-121.7898039	45.7159036	1	1	0	0	0
-121.7896735	45.7159113	1	0	0	0	0
-121.7894006	45.7158982	0	1	0	0	0
-121.7890557	45.7159377	0	1	0	0	0
-121.7887508	45.7159107	0	1	0	0	0
-121.788335	45.7158053	1	0	0	0	0
-121.7879409	45.7156245	0	0	0	0	0
-121.7875444	45.7161847	1	0	0	0	0
-121.7881089	45.7163682	0	1	0	0	0
-121.7888863	45.7165378	1	1	0	0	0
-121.7889843	45.7165722	0	1	0	0	1
-121.7894531	45.7167431	0	1	0	0	0
-121.78998	45.7168473	1	1	0	0	0
-121.7904337	45.7169529	0	0	0	0	0
-121.7908578	45.7170312	0	1	0	0	0
-121.7912353	45.7171323	0	0	0	0	0
-121.791584	45.7171965	0	0	0	0	0
-121.7912497	45.7179068	1	1	0	0	0
-121.7907935	45.7177863	0	0	0	0	0
-121.7904123	45.7177741	1	1	0	0	0
-121.7898014	45.7176113	0	0	0	0	0
-121.789463	45.7175872	0	0	0	0	0
-121.7891543	45.7175015	1	1	0	0	0
-121.7887545	45.7173779	1	0	0	0	0
-121.788574	45.7173167	1	0	0	0	0
-121.7880193	45.7172121	0	0	0	0	0

Table 3. Drano Lake 10/1/03 Lat/long WGS-84

Longitude	Latitude	MYSP	ELCA	CEDE	POCR	Nitella
-121.635918	45.7102158	1	1	0	0	0
-121.6358522	45.7105828	0	0	0	0	0
-121.6359646	45.7112801	0	0	0	0	0
-121.6359824	45.7118989	0	0	0	0	0
-121.6360684	45.7125218	0	0	0	0	0
-121.6361339	45.7130567	0	0	0	0	0
-121.6362441	45.7136411	0	0	0	0	0
-121.6363615	45.7142224	0	0	0	0	0
-121.6364936	45.7147727	0	0	0	0	0
-121.6367203	45.7157858	0	0	0	0	0
-121.6367808	45.7159668	0	0	0	0	0
-121.6360999	45.715957	0	1	0	0	0
-121.6358389	45.7154616	0	0	0	0	0
-121.6357674	45.7148086	0	0	0	0	0
-121.6357075	45.7141695	0	0	0	0	0
-121.6325911	45.7152796	0	0	0	0	0
-121.6330597	45.715589	0	0	0	0	0
-121.633759	45.7158254	0	0	0	0	0
-121.6345034	45.7159428	0	0	0	0	0
-121.6352757	45.7159828	0	0	0	0	0
-121.6360696	45.7158989	0	0	0	0	0
-121.6368904	45.7158449	0	0	0	0	0
-121.6376539	45.7157314	0	0	0	0	0
-121.6383015	45.7154945	0	0	0	0	0
-121.6389789	45.7157082	0	0	0	0	0
-121.639619	45.715414	0	1	0	0	0
-121.6403251	45.7153556	1	1	0	0	0
-121.6410464	45.715086	1	1	0	0	0
-121.64106	45.7146732	0	0	0	0	0
-121.6411513	45.7148231	0	1	0	0	0
-121.6413092	45.715017	1	1	1	0	1
-121.6416879	45.7147613	0	1	0	0	0
-121.6424312	45.7148416	0	0	0	0	0
-121.6428712	45.7152645	0	0	0	0	0
-121.6427815	45.7157766	1	1	0	0	0
-121.6429473	45.7163166	0	1	0	0	0
-121.6435726	45.7166068	0	1	0	0	0
-121.6442663	45.7167957	0	1	0	0	0

-121.6450761	45.7171447	0	0	0	0	0
-121.6455387	45.7175746	0	0	0	0	0
-121.645336	45.7171796	0	1	0	1	0
-121.6448539	45.7168554	0	0	0	0	0
-121.6449654	45.7165231	0	0	0	1	0
-121.6444538	45.7161866	0	0	0	0	0
-121.6439387	45.7158667	0	0	0	0	0
-121.6439613	45.7153785	0	0	0	0	0
-121.644215	45.7149351	0	0	0	0	0
-121.6439905	45.7144592	0	1	0	0	0
-121.6437166	45.7140046	0	0	0	0	0
-121.6436468	45.7137539	0	1	0	0	0
-121.6434178	45.7136043	0	1	0	0	0
-121.6427472	45.7135227	0	1	0	0	0
-121.6423995	45.7131029	0	0	0	0	0
-121.6430523	45.7132252	1	1	0	0	0
-121.6437072	45.7128016	0	0	0	0	0
-121.6445066	45.7126497	0	0	0	0	0
-121.645227	45.7124969	0	1	0	0	0
-121.6459461	45.7123156	0	0	0	0	0
-121.6466608	45.7122159	0	1	0	0	0
-121.6473745	45.7121939	0	1	0	0	0
-121.6480358	45.7122379	1	1	1	0	0
-121.6483059	45.7117966	0	0	0	0	0
-121.6477162	45.7114222	0	0	0	0	0
-121.6470506	45.7113654	0	0	0	0	0
-121.6463396	45.7113688	0	1	0	0	0
-121.6456725	45.7113348	0	1	0	0	0
-121.6450208	45.7111623	1	1	1	0	1
-121.6443243	45.711073	0	1	1	0	0
-121.6436443	45.7110472	1	1	1	0	0
-121.6429402	45.7109996	1	1	1	0	1
-121.6422863	45.7109387	1	1	1	0	0
-121.6416377	45.710933	1	1	1	0	0
-121.6409784	45.710931	0	0	0	0	0
-121.6403469	45.7108193	0	1	1	0	1
-121.6397812	45.7106624	0	1	0	0	0
-121.6392315	45.7104221	1	1	1	0	0
-121.6385624	45.7103346	1	1	1	0	0
-121.6378865	45.7102715	1	1	0	0	0
-121.6372116	45.7102648	1	1	1	0	0

-121.6363267	45.7102327	0	1	0	0	0
-121.6356199	45.7102169	0	1	0	0	0
-121.6349505	45.7102411	0	1	0	0	0
-121.6342763	45.7102728	0	1	0	0	0
-121.6336845	45.7102942	0	0	0	0	0
-121.6329598	45.71033	0	0	0	0	0
-121.6322492	45.7103611	0	0	0	0	0
-121.6315547	45.7103686	0	0	0	0	0
-121.630836	45.7104233	0	0	0	0	0
-121.63015	45.7104873	0	0	0	0	0
-121.6294684	45.7105138	0	0	0	0	0
-121.6287111	45.7105472	0	0	0	0	0
-121.6280017	45.7106169	0	1	0	0	0
-121.6273324	45.7106998	0	1	0	0	0
-121.62668	45.7108242	0	1	0	0	0
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-121.6254014	45.7111432	1	1	1	0	0
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-121.624472	45.7116982	0	1	0	0	0
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-121.6270862	45.7139342	0	0	0	0	0
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-121.6283702	45.7143338	0	0	0	0	0
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-121.6247171	45.7130488	0	0	0	0	0
-121.6248317	45.7119709	1	1	0	0	0
-121.6267886	45.7109987	0	0	0	0	0
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-121.6302455	45.71087	0	0	0	0	0
-121.6308941	45.7108024	0	0	0	0	0
-121.631585	45.7107863	0	0	0	0	0

-121.6322358	45.7107779	0	0	0	0	0
-121.6329053	45.7106489	0	0	0	0	0
-121.6335843	45.7105724	0	0	0	0	0
-121.6344363	45.7106048	0	0	0	0	0
-121.6351107	45.7106354	0	0	0	0	0
-121.6358053	45.7106891	0	0	0	0	0
-121.6360219	45.7110707	0	0	0	0	0
-121.636795	45.7111594	0	0	0	0	0
-121.6374127	45.7111159	0	0	0	0	0
-121.6381345	45.7110164	0	0	0	0	0
-121.6388646	45.7110919	0	0	0	0	0
-121.6395361	45.7111006	0	0	0	0	0
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-121.6409275	45.7112317	0	1	1	0	0
-121.6416824	45.7112568	0	1	1	0	0
-121.6423218	45.7114326	0	1	1	0	0
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-121.6437696	45.7114678	0	0	1	0	0
-121.6444311	45.711584	0	0	0	0	0
-121.6451306	45.7115921	0	1	1	0	0
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-121.6464923	45.7116753	0	0	0	0	0
-121.647194	45.7115831	0	0	0	0	0
-121.6483777	45.7118437	ND	ND	ND	ND	ND
-121.6476722	45.711969	ND	ND	ND	ND	ND
-121.6469534	45.7120257	ND	ND	ND	ND	ND
-121.6463162	45.7121343	ND	ND	ND	ND	ND
-121.64562	45.7121904	ND	ND	ND	ND	ND
-121.6449541	45.7122833	ND	ND	ND	ND	ND
-121.6442997	45.7123544	ND	ND	ND	ND	ND
-121.6436477	45.7124323	ND	ND	ND	ND	ND
-121.6429865	45.7124719	ND	ND	ND	ND	ND
-121.6423465	45.7125628	ND	ND	ND	ND	ND
-121.6417377	45.7126252	ND	ND	ND	ND	ND
-121.641137	45.7126825	ND	ND	ND	ND	ND
-121.6405825	45.7127328	ND	ND	ND	ND	ND
-121.6400229	45.7127019	ND	ND	ND	ND	ND
-121.639418	45.7126921	ND	ND	ND	ND	ND
-121.6388422	45.7127177	ND	ND	ND	ND	ND
-121.6382647	45.7126948	ND	ND	ND	ND	ND
-121.6376952	45.7126782	ND	ND	ND	ND	ND

-121.6371378	45.7126427	ND	ND	ND	ND	ND
-121.636577	45.712637	ND	ND	ND	ND	ND
-121.6360011	45.7126199	ND	ND	ND	ND	ND
-121.6353142	45.7125812	ND	ND	ND	ND	ND
-121.6347263	45.7125819	ND	ND	ND	ND	ND
-121.6341328	45.7125674	ND	ND	ND	ND	ND
-121.6335421	45.7125455	ND	ND	ND	ND	ND
-121.6329674	45.7125412	ND	ND	ND	ND	ND
-121.6323814	45.7125422	ND	ND	ND	ND	ND
-121.6318	45.7125634	ND	ND	ND	ND	ND
-121.6312236	45.7126089	ND	ND	ND	ND	ND
-121.6306607	45.7126043	ND	ND	ND	ND	ND
-121.6301009	45.7126785	ND	ND	ND	ND	ND
-121.6295608	45.7126918	ND	ND	ND	ND	ND
-121.6289136	45.7126838	ND	ND	ND	ND	ND
-121.6283452	45.712708	ND	ND	ND	ND	ND
-121.6277278	45.7127217	ND	ND	ND	ND	ND
-121.6271487	45.7127158	ND	ND	ND	ND	ND
-121.6265809	45.712707	ND	ND	ND	ND	ND
-121.6259964	45.7127137	ND	ND	ND	ND	ND
-121.6254061	45.7126788	ND	ND	ND	ND	ND
-121.6249729	45.7126326	ND	ND	ND	ND	ND

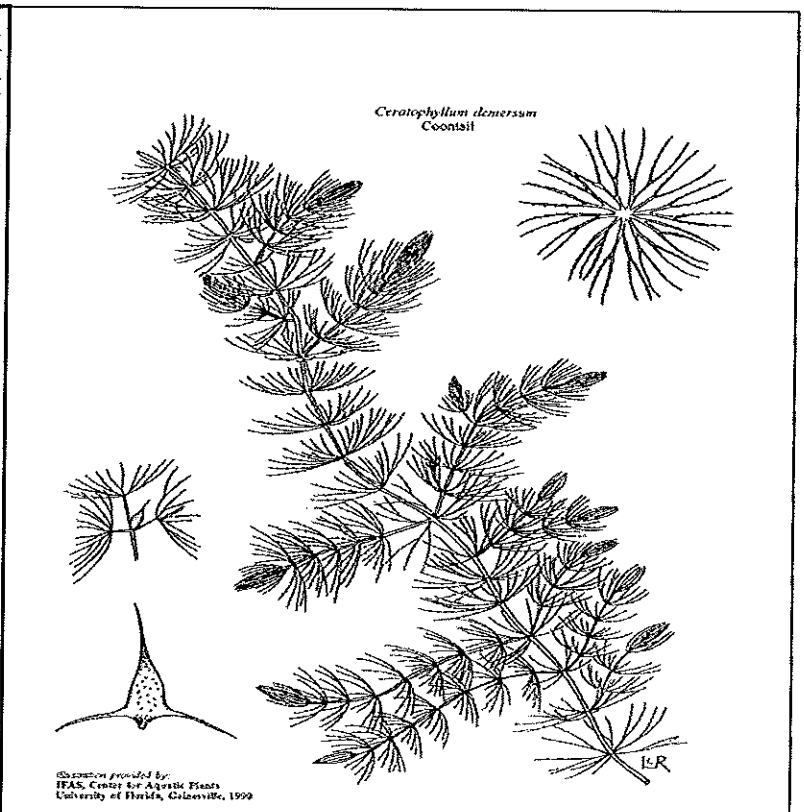
Appendix E. Plant Profiles

American waterweed

Common name: American waterweed
Scientific name: *Elodea canadensis* Rich.
Family: Hydrocharitaceae
Geographic origin: temperate North America
Growth form: Submersed, perennial flowering plant
Key features: Leaves arranged in whorls of 3 around stem

Similar species: Brazilian elodea, (*Egeria densa*), hydrilla (*Hydrilla verticillata*)

Coontail



Common name: Coontail
Scientific name: *Ceratophyllum demersum* L.
Family: Ceratophyllaceae
Geographic origin: Worldwide
Growth form: Submersed
Key characteristics: Forked, stiff leaves, lacks roots

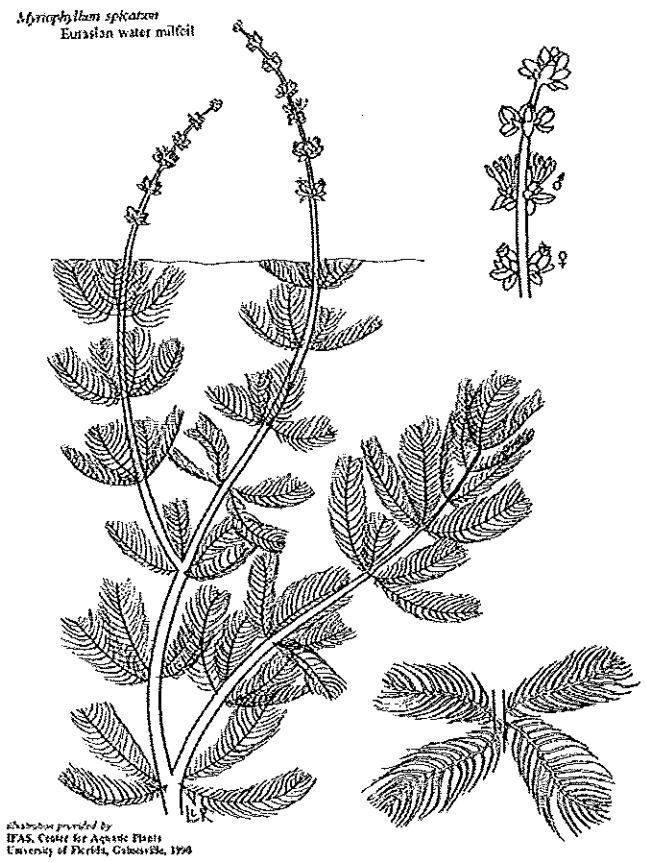
Similar species: Waterweeds (*Elodea* spp.), Milfoils (*Myriophyllum* spp.), Stonewort and Muskwort (*Nitella, Chara)*

Curly-leaf pondweed

Common name: Curly-leaf pondweed
Scientific name: *Potamogeton crispus* L.
Family: Potamogetonaceae
Geographic origin: Eurasia
Growth form: submersed, perennial flowering plant.
Key features:Elongate, slender leaves with crisply waved margins.

Similar species: *Potamogeton richardsonii*

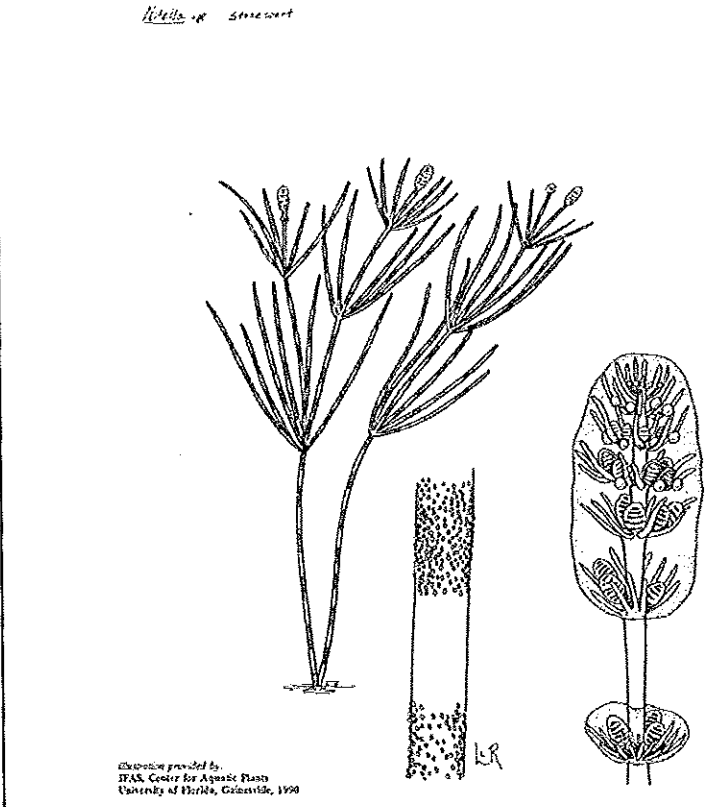
Eurasian milfoil



Common name: Eurasian watermilfoil
Scientific name: *Myriophyllum spicatum* L.
Family: Haloragaceae
Geographic origin: Eurasia
Growth form: Submersed
Key characteristics: Leaves arranged around stem in whorls of 4

Similar species: Other milfoil species

Stonewort



Common name: Stonewort
Scientific name: *Nitella*
Family: Characeae
Geographic origin: Worldwide
Growth form: Submersed
Key characteristics: Bright green, brittle, forked branchlets; is an alga so does not have true leaves.

Similar species:*Chara* (another alga), Slender water nymph (*Najas flexilis*)

Appendix F. JARPA Application

AGENCY USE ONLY	
Agency Reference #:	Date Received:
Circulated by: (local govt. or agency)	

JOINT AQUATIC RESOURCES PERMIT APPLICATION FORM (JARPA)

(for use in Washington State)

F ;E TYPE OR PRINT IN BLACK INK

☐ Application for a Fish Habitat Enhancement Project per requirements of RCW 77.55.290. You must submit a copy of this completed JARPA application form and the (Fish Habitat Enhancement JARPA Addition) to your local Government Planning Department and Washington Department of Fish & Wildlife Area Habitat Biologist on the same day.

NOTE: LOCAL GOVERNMENTS – You must submit any comments on these projects to WDFW within 15 working days.

Based on the instructions provided, I am sending copies of this application to the following: *(check all that apply)*

- ☐ Local Government for shoreline: ☐ Substantial Development ☐ Conditional Use ☐ Variance ☐ Exemption ☐ Revision ☐ Floodplain Management ☐ Critical Areas Ordinance
- ☐ Washington Department of Fish and Wildlife for HPA (Submit 3 copies to WDFW Region)
- ☐ Washington Department of Ecology for 401 Water Quality Certification (to Regional Office-Federal Permit Unit)
- ☐ Washington Department of Natural Resources for Aquatic Resources Use Authorization Notification
- ☐ Corps of Engineers for: ☐ Section 404 ☐ Section 10 permit
- ☐ Coast Guard for General Bridge Act Permit
- ☐ For Department of Transportation projects only: This project will be designed to meet conditions of the most current Ecology/Department of Transportation Water Quality Implementing Agreement

SECTION A - Use for all permits covered by this application. Be sure to ALSO complete Section C (Signature Block) for all permit applications.

1. APPLICANT			
MAILING ADDRESS			
WORK PHONE	E-MAIL ADDRESS	HOME PHONE	FAX #

If an agent is acting for the applicant during the permit process, complete #2. Be sure agent signs Section C (Signature Block) for all permit applications

2. AUTHORIZED AGENT			
MAILING ADDRESS			
WORK PHONE	E-MAIL ADDRESS	HOME PHONE	FAX #
3. RELATIONSHIP OF APPLICANT TO PROPERTY: ☐ OWNER ☐ PURCHASER ☐ LESSEE ☐ OTHER:			
4. NAME, ADDRESS, AND PHONE NUMBER OF PROPERTY OWNER(S), IF OTHER THAN APPLICANT:			
5. LOCATION (STREET ADDRESS, INCLUDING CITY, COUNTY AND ZIP CODE, WHERE PROPOSED ACTIVITY EXISTS OR WILL OCCUR)			
LOCAL GOVERNMENT WITH JURISDICTION (CITY OR COUNTY)			

WATERBODY YOU ARE WORKING IN IS THIS WATERBODY ON THE 303(d) LIST? YES ☐ NO ☐ IF YES, WHAT PARAMETER(S)?____ http://www.ecy.wa.gov/programs/wq/links/impaired_wtrs.html WEBSITE FOR 303d LIST	TRIBUTARY OF	WRIA #

¼ SECTION	SECTION	TOWNSHIP	RANGE	GOVERNMENT LOT	SHORELINE DESIGNATION	
LATITUDE & LONGITUDE:					ZONING DESIGNATION	
TAX PARCEL NO:					DNR STREAM TYPE, IF KNOWN	

6. DESCRIBE THE CURRENT USE OF THE PROPERTY, AND STRUCTURES EXISTING ON THE PROPERTY. HAVE YOU COMPLETED ANY PORTION OF THE PROPOSED ACTIVITY ON THIS PROPERTY? ☐ YES ☐ NO FOR ANY PORTION OF THE PROPOSED ACTIVITY ALREADY COMPLETED ON THIS PROPERTY, INDICATE MONTH AND YEAR OF COMPLETION.

IS THE PROPERTY AGRICULTURAL LAND? ☐ YES ☐ NO ARE YOU A USDA PROGRAM PARTICIPANT? ☐ YES ☐ NO

7a. DESCRIBE THE PROPOSED WORK THAT NEEDS AQUATIC PERMITS: COMPLETE PLANS AND SPECIFICATIONS SHOULD BE PROVIDED FOR ALL WORK WATERWARD OF THE ORDINARY HIGH WATER MARK OR LINE, INCLUDING TYPES OF EQUIPMENT TO BE USED. IF APPLYING FOR A SHORELINE PERMIT, DESCRIBE ALL WORK WITHIN AND BEYOND 200 FEET OF THE ORDINARY HIGH WATER MARK. IF YOU HAVE PROVIDED ATTACHED MATERIALS TO DESCRIBE YOUR PROJECT, YOU STILL MUST SUMMARIZE THE PROPOSED WORK HERE. ATTACH A SEPARATE SHEET IF ADDITIONAL SPACE IS NEEDED.

PREPARATION OF DRAWINGS: SEE SAMPLE DRAWINGS AND GUIDANCE FOR COMPLETING THE DRAWINGS. ***ONE SET OF ORIGINAL OR GOOD QUALITY REPRODUCIBLE DRAWINGS MUST BE ATTACHED.*** NOTE: APPLICANTS ARE ENCOURAGED TO SUBMIT PHOTOGRAPHS OF THE PROJECT SITE, BUT THESE DO NOT SUBSTITUTE FOR DRAWINGS. ***THE CORPS OF ENGINEERS AND COAST GUARD REQUIRE DRAWINGS ON 8-1/2 X 11 INCH SHEETS. LARGER DRAWINGS MAY BE REQUIRED BY OTHER AGENCIES.***

7b. DESCRIBE THE PURPOSE OF THE PROPOSED WORK AND WHY YOU WANT OR NEED TO PERFORM IT AT THE SITE. PLEASE EXPLAIN ANY SPECIFIC NEEDS THAT HAVE INFLUENCED THE DESIGN.

7c. DESCRIBE THE POTENTIAL IMPACTS TO CHARACTERISTIC USES OF THE WATER BODY. THESE USES MAY INCLUDE FISH AND AQUATIC LIFE, WATER QUALITY, WATER SUPPLY, RECREATION, and AESTHETICS. IDENTIFY PROPOSED ACTIONS TO AVOID, MINIMIZE, AND MITIGATE DETRIMENTAL IMPACTS, AND PROVIDE PROPER PROTECTION OF FISH AND AQUATIC LIFE. IDENTIFY WHICH GUIDANCE DOCUMENTS YOU HAVE USED. ATTACH A SEPARATE SHEET IF ADDITIONAL SPACE IS NEEDED.

7d. FOR IN WATER CONSTRUCTION WORK, WILL YOUR PROJECT BE IN COMPLIANCE WITH THE STATE OF WASHINGTON WATER QUALITY STANDARDS FOR TURBIDITY WAC 173.201A-110? ☐ YES ☐ NO (SEE USEFUL DEFINITIONS AND INSTRUCTIONS)

8. WILL THE PROJECT BE CONSTRUCTED IN STAGES? ☐ YES ☐ NO

PROPOSED STARTING DATE:

ESTIMATED DURATION OF ACTIVITY:

9. CHECK IF ANY TEMPORARY OR PERMANENT STRUCTURES WILL BE PLACED:

☐ WATERWARD OF THE ORDINARY HIGH WATER MARK OR LINE FOR FRESH OR TIDAL WATERS; AND/OR

☐WATERWARD OF MEAN HIGHER HIGH WATER LINE IN TIDAL WATERS

10. WILL FILL MATERIAL (ROCK, FILL, BULKHEAD, OR OTHER MATERIAL) BE PLACED:

☐ WATERWARD OF THE ORDINARY HIGH WATER MARK OR LINE FOR FRESH WATERS? IF YES, VOLUME (CUBIC YARDS) /AREA (ACRES)

☐ WATERWARD OF THE MEAN HIGHER HIGH WATER FOR TIDAL WATERS? IF YES, VOLUME (CUBIC YARDS) AREA (ACRES)

11. WILL MATERIAL BE PLACED IN WETLANDS? ☐ YES ☐ NO

IF YES:

A. IMPACTED AREA IN ACRES:

B. HAS A DELINEATION BEEN COMPLETED? IF YES, PLEASE SUBMIT WITH APPLICATION. ☐ YES ☐ NO

C. HAS A WETLAND REPORT BEEN PREPARED? IF YES, PLEASE SUBMIT WITH APPLICATION. ☐ YES ☐ NO

D. TYPE AND COMPOSITION OF FILL MATERIAL (E.G., SAND, ETC.):

E. MATERIAL SOURCE:

F. LIST ALL SOIL SERIES (TYPE OF SOIL) LOCATED AT THE PROJECT SITE, & INDICATE IF THEY ARE ON THE COUNTY'S LIST OF HYDRIC SOILS. SOILS INFORMATION CAN BE OBTAINED FROM THE NATURAL RESOURCES CONSERVATION SERVICE (NRCS):

G. WILL PROPOSED ACTIVITY CAUSE FLOODING OR DRAINING OF WETLANDS? ☐ YES ☐ NO

IF YES, IMPACTED AREA IS ___ ACRES OFDRAINED WETLANDS.

NOTE: If your project will impact greater than ½ of an acre of wetland, submit a mitigation plan to the Corps and Ecology for approval along with the JARPA form

NOTE: a 401 water quality certification will be required from Ecology in addition to an approved mitigation plan if your project impacts wetlands that are: a) greater than ½ acre in size, or b) tidal wetlands or wetlands adjacent to tidal water. Please submit the JARPA form and mitigation plan to Ecology for an individual 401 certification if a) or b) applies.

12. *STORMWATER COMPLIANCE FOR NATIONWIDE PERMITS ONLY:*

THIS PROJECT IS (OR WILL BE) DESIGNED TO MEET ECOLOGY'S MOST CURRENT STORMWATER MANUAL, OR AN ECOLOGY APPROVED LOCAL STORMWATER MANUAL ☐ *YES* ☐ *NO*

*IF YES – WHICH MANUAL WILL YOUR PROJECT BE DESIGNED TO MEET*_____.

If NO – FOR CLEAN WATER ACT SECTION 401 AND 404 PERMITS ONLY -- PLEASE SUBMITTO ECOLOGY FOR APPROVAL, ALONG WITH THIS JARPA APPLICATION, DOCUMENTATION THAT DEMONSTRATES THE STORMWATER RUNOFF FROM YOUR PROJECT OR ACTIVITY WILL COMPLY WITH THE WATER QUALITY STANDARDS, WAC 173.201(A)

13. WILL EXCAVATION OR DREDGING BE REQUIRED IN WATER OR WETLANDS? ☐ YES ☐NO

IF YES:

A. VOLUME: (CUBIC YARDS) /AREA (ACRES)

B. COMPOSITION OF MATERIAL TO BE REMOVED:

C. DISPOSAL SITE FOR EXCAVATED MATERIAL:

D. METHOD OF DREDGING:

14. HAS THE STATE ENVIRONMENTAL POLICY ACT (SEPA) BEEN COMPLETED? ☐ YES ☐ NO

SEPA LEAD AGENCY:_____ SEPA DECISION: DNS, MDNS, EIS, ADOPTION, EXEMPTION DECISION DATE (END OF COMMENT PERIOD): _____

SUBMIT A COPY OF YOUR SEPA DECISION LETTER TO WDFW AS REQUIRED FOR A COMPLETE APPLICATION

15. LIST OTHER APPLICATIONS, APPROVALS, OR CERTIFICATIONS FROM OTHER FEDERAL, STATE OR LOCAL AGENCIES FOR ANY STRUCTURES, CONSTRUCTION, DISCHARGES, OR OTHER ACTIVITIES DESCRIBED IN THE APPLICATION (I.E., PRELIMINARY PLAT APPROVAL, HEALTH DISTRICT APPROVAL, BUILDING PERMIT, SEPA REVIEW, FEDERAL ENERGY REGULATORY COMMISSION LICENSE (FERC), FOREST PRACTICES APPLICATION, ETC.) ALSO INDICATE WHETHER WORK HAS BEEN COMPLETED AND INDICATE ALL EXISTING WORK ON DRAWINGS. NOTE: FOR USE WITH CORPS NATIONWIDE PERMITS, IDENTIFY WHETHER YOUR PROJECT HAS OR WILL NEED AN NPDES PERMIT FOR DISCHARGING WASTEWATER AND/OR STORMWATER.

TYPE OF APPROVAL	ISSUING AGENCY	IDENTIFICATION NO.	DATE OF APPLICATION	DATE APPROVED	COMPLETED?

16. HAS ANY AGENCY DENIED APPROVAL FOR THE ACTIVITY YOU'RE APPLYING FOR OR FOR ANY ACTIVITY DIRECTLY RELATED TO THE ACTIVITY DESCRIBED HEREIN? ☐ YES ☐ NO IF YES, EXPLAIN:

SECTION B - Use for Shoreline and Corps of Engineers permits only:

17a. TOTAL COST OF PROJECT. THIS MEANS THE FAIR MARKET VALUE OF THE PROJECT, INCLUDING MATERIALS, LABOR, MACHINE RENTALS, ETC.

17b. IF A PROJECT OR ANY PORTION OF A PROJECT RECEIVES FUNDING FROM A FEDERAL AGENCY, THAT AGENCY IS RESPONSIBLE FOR ESA CONSULTATION. PLEASE INDICATE IF YOU WILL RECEIVE FEDERAL FUNDS AND WHAT FEDERAL AGENCY IS PROVIDING THOSE FUNDS. SEE INSTRUCTIONS FOR INFORMATION ON ESA**

FEDERAL FUNDING? ☐ YES ☐ NO IF YES, PLEASE LIST THE FEDERAL AGENCY _____

18. LOCAL GOVERNMENT WITH JURISDICTION:

19. FOR CORPS, COAST GUARD, AND DNR PERMITS, PROVIDE NAMES, ADDRESSES, AND TELEPHONE NUMBERS OF ADJOINING PROPERTY OWNERS, LESSEES, ETC...
PLEASE NOTE: SHORELINE MANAGEMENT COMPLIANCE MAY REQUIRE ADDITIONAL NOTICE --- CONSULT YOUR LOCAL GOVERNMENT.

NAME	ADDRESS	PHONE NUMBER

SECTION C - This section MUST be completed for any permit covered by this application

20. APPLICATION IS HEREBY MADE FOR A PERMIT OR PERMITS TO AUTHORIZE THE ACTIVITIES DESCRIBED HEREIN. I CERTIFY THAT I AM FAMILIAR WITH THE INFORMATION CONTAINED IN THIS APPLICATION, AND THAT TO THE BEST OF MY KNOWLEDGE AND BELIEF, SUCH INFORMATION IS TRUE, COMPLETE, AND ACCURATE. I FURTHER CERTIFY THAT I POSSESS THE AUTHORITY TO UNDERTAKE THE PROPOSED ACTIVITIES. I HEREBY GRANT TO THE AGENCIES TO WHICH THIS APPLICATION IS MADE, THE RIGHT TO ENTER THE ABOVE-DESCRIBED LOCATION TO INSPECT THE PROPOSED, IN-PROGRESS OR COMPLETED WORK. I AGREE TO START WORK ONLY AFTER ALL NECESSARY PERMITS HAVE BEEN RECEIVED.

SIGNATURE OF APPLICANT	DATE
SIGNATURE OF AUTHORIZED AGENT	DATE

DATE

I HEREBY DESIGNATE
TO ACT AS MY AGENT IN MATTERS RELATED TO THIS APPLICATION FOR PERMIT(S). I UNDERSTAND THAT IF A FEDERAL PERMIT IS ISSUED, . I MUST SIGN THE PERMIT.

_____
SIGNATURE OF APPLICANT DATE

SIGNATURE OF LANDOWNER (EXCEPT PUBLIC ENTITY LANDOWNERS, E.G. DNR)

THIS APPLICATION MUST BE SIGNED BY THE APPLICANT AND THE AGENT, IF AN AUTHORIZED AGENT IS DESIGNATED.

18 U.S.C §1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly falsifies, conceals, or covers up by any trick, scheme, or device a material fact or makes any false, fictitious, or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious, or fraudulent statement or entry, shall be fined not more than $10,000 or imprisoned not more than 5 years or both.

COMPLETED BY LOCAL OFFICIAL

A. Nature of the existing shoreline. (Describe type of shoreline, such as marine, stream, lake, lagoon, marsh, bog, swamp, flood plain, floodway, delta; type of beach, such as accretion, erosion, high bank, low bank, or dike; material such as sand, gravel, mud, clay, rock, riprap; and extent and type of bulkheading, if any)

B. In the event that any of the proposed buildings or structures will exceed a height of thirty-five feet above the average grade level, indicate the approximate location of and number of residential units, existing and potential, that will have an obstructed view:

C. If the application involves a conditional use or variance, set forth in full that portion of the master program which provides that the proposed use may be a conditional use, or, in the case of a variance, from which the variance is being sought:

These Agencies are Equal Opportunity and Affirmative Action employers.
For special accommodation needs, please contact the appropriate agency in the instructions.

WASHINGTON
JOINT AQUATIC RESOURCE PERMITS APPLICATION (JARPA)

INSTRUCTIONS, SAMPLE DRAWINGS & AGENCY CONTACTS

NOTE: DO NOT SUBMIT this Section with your application.

This Joint Application may be used to apply for Hydraulic Project Approvals, Shoreline Management Permits, Approvals for Exceedance of Water Quality Standards, Water Quality Certifications, Coast Guard Bridge Permits, Department of Natural Resources Use Authorization, and Army Corps of Engineers Permits. ***You must submit readable copies of the completed application form together with detailed drawings, prepared in accordance with the drawing guidance to the appropriate agencies. When applying, you do NOT need to send copies of the instructions.*** Remember, depending on the type of project you are proposing, other permits may be required that are not covered by this application.

☞ Use the following list to determine which permits to apply for. Your project may require some or all of these permits. If you have trouble deciding which permits you need, please contact the appropriate agency for questions. Agency telephone numbers are attached. **IF ANY OF THE BOXED ITEMS LISTED UNDER A PERMIT TITLE BELOW APPLY TO YOUR PROJECT, THEN YOU MUST CHECK THE BOX FOR THAT PERMIT ON THE TOP OF PAGE ONE OF THE JARPA FORM AND SEND A COMPLETED COPY OF THE APPLICATION FORM TO THE AGENCY RESPONSIBLE FOR ISSUING THAT PERMIT.** Complete Sections A & C for any of the permits listed below. Also complete Section B for Shoreline and Army Corps of Engineers permits. Detailed drawings are required for any of these permits (see attached drawing guidelines for drawing requirements).

❑ **Hydraulic Project Approval** from the Department of Fish and Wildlife under 77.55 RCW is required if your project includes construction or other work, that:
- will use, divert, obstruct, or change the natural flow or bed of any fresh or salt water of the state. This includes bed reconfiguration, all construction or other work waterward under and over the ordinary high water line, including dry channels, and may include projects landward of the ordinary high water line (e.g., activities outside the ordinary high water line that will directly impact fish life and habitat, falling trees into streams or lakes, dike construction etc.).

❑ **Shoreline Substantial Development, Conditional Use, Variance Permit, or Exemption** from Local Government (under the Shoreline Management Act, 90.58 RCW;) required for work or activity in the 100-year floodplain, or within 200 feet of the ordinary high water mark of Shorelines of the State (check with your local government); and which includes any one of the following:
- dumping;
- drilling;
- dredging;
- filling;
- placement or alteration of structures (whether temporary or permanent); or
- any activity which substantially interferes with normal public use of the waters regardless of cost.

❑ **Floodplain Management Permits and/or Critical Areas Ordinances** review by Local Government for:
- work in frequently flooded areas, geologically unstable areas, wildlife habitats, aquifer recharge areas, and wetlands.

❑ **Section 401 Water Quality Certification** from the Department of Ecology Regional office under 33 USC § 1341 of the Clean Water Act is needed when a federal approval is required for a project, including the following:
- Corps of Engineers 404 Permit --Send to Ecology's Federal Permits Unit in the Regional Office;
- FERC hydropower license--Attach FERC exhibit E or an Applicant Prepared Environmental Assessment and send to the State of Washington's Office of Permit Assistance

❑ **Aquatic Resources Use Authorization Notification** from the Department of Natural Resources is required if your project:
- is on, crosses, or impacts the bedlands, tidelands or shorelands of a navigable water.

❑ **Section 404 Permit** from the Corps of Engineer under 33 USC § 1344 of the Clean Water Act is required if your project includes:

- placement of dredged or fill material waterward of the ordinary high water mark, or the mean higher high tide line in tidal areas, in waters of the United States, **including wetlands***;
- mechanized land clearing and sidecasting in waters of the United States, **including wetlands***.
- Endangered Species Act (ESA) Consultation**

☐ **Section 10 Permit** from the Corps of Engineer is required for:
- any work in or affecting navigable waters of the United States (e.g., floats, piers, docks, dredging, excavation, piling, buoys, overhead power lines, etc.).

☐ **General Bridge Act Permit** from the Coast Guard is required for:
- construction of a new bridge or modification to an existing bridge over a navigable waterway.

*Wetlands that are determined to be isolated by the Army Corp of Engineers are no longer regulated under Section 404 of the Clean Water Act. These wetlands are regulated by the Department of Ecology under the state Clean Water Act RCW 90.48. For further information please contact the Office of Permit Assistance at 1-800-917-0043 or at ecypac@ecy.wa.gov

** Endangered Species Act (ESA) Consultation with the National Marine Fisheries Service and/or U.S. Fish and Wildlife Service:
If your project is authorized, funded or carried out by a Federal agency and the Federal agency determines that the proposed project may affect ESA listed species or critical habitat, consultation under Section 7 of the ESA is required. ESA Consultation is the responsibility of the Federal agency, not the applicant. JARPA forms should be submitted directly to the responsible Federal agency, not to the National Marine Fisheries Service or the U.S. Fish and Wildlife Service. The responsible Federal agency may require additional information from the applicant to assess potential project impacts to listed species and their habitat.

Information on ESA - http://endangered.fws.gov/hcp/index.html http://endangered.fws.gov/whatwedo.html
http://offices.fws.gov/directory/ListOffices.cfm

USEFUL DEFINITIONS & INSTRUCTIONS

The following definitions are presented to help applicants in completing the JARPA. They may not necessarily represent specific language from the laws implemented through JARPA.

Ordinary High Water Mark or Line means the visible line on the banks where the presence and action of waters are so common as to leave a mark upon the soil or vegetation. In any area where the ordinary high water line cannot be found, the ordinary high water line adjoining saltwater shall be the line of mean higher high water, and the ordinary high water line adjoining freshwater shall be the elevation of the mean annual flood.

Mean Lower Low Water is the 0.0 tidal elevation, determined by averaging each day's lowest tide at a particular location over a period of 19 years. It is the tidal datum for vertical tidal references in the salt water area.

Mean High Water and Mean Higher High Water Tidal Elevations at any specific location can be found in tidal benchmark data compiled by the United States Department of Commerce, Environmental Science Services Administration, Coast and Geodetic Survey, dated January 24, 1979. This information can be obtained from the Corps of Engineers at (206) 764-3495. The determination of tidal elevation is obtained by averaging each day's highest tide at a particular location over a period of 19 years, measured from mean lower low water, which equals 0.0 tidal elevation.

Shorelands or shoreland areas means those lands extending landward for 200 feet in all directions as measured on a horizontal plane from the ordinary high water mark; floodways and contiguous floodplain areas landward 200 feet from such floodways; and all wetlands and river deltas associated with the streams, lakes, and tidal waters which are subject to the provisions of 90.58 RCW.

Shorelines means all water areas of the state, including reservoirs, and their associated wetlands, together with the lands underlying them, except stream segments upstream of the point where mean annual flow is less than 20 cubic feet per second, and lakes less than 20 acres in size.

Wetlands mean areas that are inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Bridge means any structure including pipelines and conveyor belts, which transports traffic or materials across a navigable water.

Aquatic Tidelands means the area between the ordinary high tide line and extreme low tide line, unless otherwise established.

Aquatic Shorelands means the shore areas of non-tidal navigable lakes or rivers between the ordinary high water line and the line of navigability unless otherwise established.

Aquatic Bedlands means the area waterward of and below the line of navigability on non-tidal rivers and lakes, or below the extreme low tide mark in navigable tidal waters, or below the outer harbor line where a harbor has been created.

Nationwide Permit issued by the Corps of Engineers for projects with minimal impacts. For a complete packet of nationwide permits and application information, contact the Corps Regulatory branch at (206) 764-3495 or visit their website http://www.nws.usace.army.mil

Section 303(d) listed waters These are water quality limited estuaries, lakes, and streams that fall short of state surface water quality standards, and are not expected to improve within the next two years.

Mixing zone means that portion of a water body adjacent to an effluent outfall where mixing results in the dilution of the effluent with the receiving water. Water quality criteria may be exceeded in a mixing zone as conditioned and provided for in WAC 173-201A-100.

Turbidity means the clarity of water expressed as nephelometric turbidity units (NTU) and measured with a calibrated turbidimeter.

Background conditions means the biological, chemical, and physical conditions of a water body, outside the area of influence of the discharge under consideration.

Instructions for question 7d.
Water Quality Standards – Compliance for turbidity mixing zone requirements.

The water downstream of the allotted mixing zone (100 ft, 200 ft, 300 ft, dependent on how fast the water is flowing and measured in cubic feet per second) must have the same visual clarity as the water upstream of the project impact site (the water cannot be greater than 5 NTUs above the background water). The following section from WAC 173-201A-110 authorizes the turbidity mixing zone.

All work in or near the water, and water discharged from the site shall meet the State's Water Quality Standards, WAC 173-201A. A mixing zone for turbidity is authorized within WAC 173.201A-030 during and immediately after necessary in-water or shoreline construction activities that result in the disturbance of in-place sediments. Use of a turbidity mixing zone is intended for brief periods of time (such as a few hours or days) and is not an authorization to exceed the turbidity standard for the entire duration of the construction. Use of the mixing zone is subject to the constraints of WAC 173-201A-100(4) and (6), requiring an applicant have supporting information that indicates the use of the mixing zone shall not result in the loss of sensitive or important habitat, substantially interfere with the existing or characteristic uses of the water body, result in damage to the ecosystem, or adversely affect public health. The mixing zone is authorized only after the activity has received all other necessary local and state permits and approvals, and after the implementation of appropriate best management practices to avoid or minimize disturbance of in-place sediments and exceedances of the turbidity criteria. Within the mixing zone, the turbidity standard is waived, and all other applicable water quality standards shall remain in effect. The mixing zone is defined as follows:

1) For waters up to 10 cfs flow at time of construction, the point of compliance shall be 100-feet downstream of project activities.
2) For waters above 10 cfs up to 100 cfs flow at time of construction, the point of compliance shall be 200-feet downstream of project activities.
3) For waters above 100 cfs flow at the time of construction, the point of compliance shall be 300 feet downstream of project activities.
4) For projects working within or along lakes, ponds, wetlands, estuaries, marine waters or other non-flowing waters, the point of compliance shall be at a radius of 150-feet from the activity causing the turbidity exceedance.

GUIDANCE FOR COMPLETION OF DRAWINGS

General Information. Three types of illustrations are needed to properly depict the proposed activity: Vicinity Map, Plan View, and Cross-Sectional View. Drawings to scale should be prepared using clear printing, black ink, and the fewest number of sheets possible. Include the scale. The importance of clear accurate drawings cannot be overstated. At a minimum, drawings must contain the following information; other information may be required depending on project type. If you have questions regarding completing the drawings, call the appropriate agency.

1. Vicinity Map. A copy of a county or city road map, or a U.S. Geological Survey topographic map may be used. Include:

a. North arrow.
b. Name of waterbody (and river mile if appropriate).
c. Location of the proposed activity (indicate with a circle, arrow, X, or similar symbol).
d. Provide latitude and longitude of the site to the nearest second.
e. Provide directions to the site.

2. Plan View. This drawing illustrates the proposed project area as if you were looking down at the site from overhead.

a. North arrow.
b. Name of waterbody and direction of water flow.
c. Location of existing shoreline.
Tidal Waters: Show the Ordinary High, Mean High, Mean Low, Mean Higher High, and Mean Lower Low Water Marks or Lines, and/or wetland boundaries. Indicate elevation above datum.
Non-tidal waters: Show the Ordinary High Water Mark or Line, Meander Line, and/or wetland boundary.
d. Dimensions of the activity or structure and impervious surfaces, distance from property lines, and the distance it extends into the waterbody beyond the Ordinary High, Mean High, Mean Higher High, and Mean Low Water Mark or Line, and/or wetland boundaries, as appropriate.
e. For Corps permits, indicate the distance to Federal projects and/or navigation channels (if applicable). To ascertain, call the Corps Regulatory Branch Office at (206) 764-3495.
f. Show existing structures on subject and adjoining properties.
g. Indicate adjoining property ownership.
h. If fill material is to be placed, identify the type of material, amount of material (cubic yards), and area to be filled (acres).
i. If project involves dredging, identify the type of material, amount of material (cubic yards), area to be dredged, method of dredging, and location of disposal site. Dredging in areas shallower than -10 feet needs to be clearly identified on drawings.
j. Identify any part of the activity that has been completed.
k. Indicate types and location of aquatic, wetland, riparian and upland vegetation.
l. Erosion control measures, stabilization of disturbed areas, etc.
m. Utilities, including water, sanitary sewer, power and stormwater conveyance systems (e.g., bioswales).
n. Indicate stormwater discharge points.
o. Proposed landscaping where applicable (for complex landscape plans, please attach a separate drawing).
p. Where applicable, plans for development of areas on or off site as mitigation for impacts associated with the proposal.
q. On all variance applications the plans shall clearly indicate where development could occur without approval of a variance, the physical features and circumstances on the property that provide a basis for the request, and the location of adjacent structures and uses.

3. Cross-Sectional View. This drawing illustrates the proposed activity as if it were cut from the side and/or front. Include:

a. Location of water lines.
Tidal Waters: Show the Ordinary High, Mean High, Mean Higher High, and Mean Lower Low Water Marks or Lines, and/or wetland boundary.
Non-tidal waters: Show the Ordinary High Water Mark or Line, and/or wetland boundary.
b. Water depth or tidal elevation at waterward face of project.

c. Dimensions of the activity or structure, and the distance it extends into the waterbody beyond the Ordinary High, the Mean High, the Mean Higher High and Mean Low Water Mark or Line, and/or wetland boundaries.
d. Indicate dredge and/or fill grades as appropriate.
e. Indicate existing and proposed contours and elevations.
f. Indicate types and location of aquatic, wetland, and riparian vegetation present on site.
g. Indicate type and location of material used in construction and method of construction.
h. Indicate height of structure.

4. Clearance and Elevations. Applies to Coast Guard Bridge Permits only.
a. Vertical clearance measured from Mean Higher (tidal waters) or Ordinary High (non-tidal water).
b. Horizontal clearance between piers or pilings.
c. Bottom elevation of the waterway at the bridge.

AGENCY CONTACTS

Below is a list of agencies to which a copy of the Joint Application may be sent, and which permit each agency issues. Technical assistance and information is also available from these offices.

State of Washington Office of Permit Assistance

Office of Permit Assistance
0043 or (360) 407-7037
300 Desmond Drive, Lacey
Post Office Box 47600
Olympia, WA 98504-7600

Telephone 1-800-917-

Fax (360) 407-6904

Department of the Army Permit (Section 404 or Section 10)

U.S. Army Corps of Engineers,
Seattle District
Regulatory Branch
Post Office Box 3755
Seattle, WA 98124-2255

Telephone (206) 764-3495
FAX (206) 764-6602

U.S. Army Corps of Engineers
Eastern Washington Information
P.O. Box 273
Chattaroy, WA 99003-0273

Telephone (509) 238-4570
FAX (509) 238-4570

U.S. Army Corps of Engineers
Central Washington Information
P.O. Box 2829
Chelan, WA 98816-2829

Telephone (509) 682-7010
FAX (509) 682-7710

U.S. Army Corps of Engineers

Southwest Washington Information
2108 Grand Blvd
Vancouver, WA 98661

Telephone (360) 750-9046
or (360) 694-1171
Fax (360) 750-9307

Department of Ecology Permits – 401 Water Quality Certification

Washington State Department of Ecology – Headquarters
300 Desmond Drive, Lacey
Post Office Box 47600
Olympia, WA 98504-7600

Telephone (360) 407-6000

Central Region
15 West Yakima Avenue, Ste 200
Yakima, WA 98902-3401

Telephone (509) 575-2490
FAX (509) 575-2809

Eastern Region
4601 North Monroe, Suite 202
Spokane, WA 99205-1295

Telephone (509) 456-2926
FAX (509) 456-6175

Northwest Region
3190 - 160th Avenue S.E.
Bellevue, WA 98008-5452

Telephone (425) 649-7000
FAX (425) 649-7098

Southwest Region
Mailing Address:
P.O. Box 47775

Telephone (360) 407-6300
FAX (360) 407-6305

Olympia, WA 98504-7775
Physical Address:
300 Desmond Drive
Lacey, WA 98504

Department of Fish and Wildlife (Hydraulic Project Approval) - Submit 3 copies of the JARPA application to Regional offices. Contact regional offices for questions or assistance.

Headquarters

Washington State Department of Fish and Wildlife
600 Capitol Way North
Olympia, Washington 98501-1091
Telephone (360) 902-2200
TDD (360) 902-2207
FAX (360) 902-2230

Region 1 (Pend Oreille, Ferry, Stevens, Spokane, Lincoln, Whitman, Columbia, Garfield, Asotin, and Walla Walla Counties)

Washington State Department of Fish and Wildlife
8702 North Division Street
Spokane, WA 99218-1199
Telephone (509) 456-4082
FAX (509) 456-4071

Region 2 (Okanogan, Douglas, Grant, Adams, and Chelan Counties)

Washington State Department of Fish and Wildlife
1550 Alder Street NW
Ephrata, WA 98823-9699
Telephone (509) 754-4624
FAX (509) 754-5257

Region 3 (Franklin, Kittitas, Yakima, and Benton Counties)

Washington State Department of Fish and Wildlife
1701 South 24th Avenue
Yakima, WA 98902-5720
Telephone (509) 575-2740
FAX (509) 575-2474

Region 4 (Whatcom, Skagit, Snohomish, King, Island, and San Juan Counties)

Washington State Department of Fish and Wildlife
16018 Mill Creek Boulevard
Mill Creek, WA 98012-1296
Telephone (425) 775-1311
FAX (425) 338-1066

Region 5 (Lewis, Wahkiakum, Cowlitz, Skamania, Clark, and Klickitat Counties)

Washington State Department of Fish and Wildlife
2108 Grand Blvd.
Vancouver, WA 98661-4624
Telephone (360) 696-6211
FAX (360) 906-6776

Region 6 (Pacific, Pierce, Thurston, Grays Harbor, Mason, Jefferson, Clallam, and Kitsap Counties)

Washington State Department of Fish and Wildlife
48 Devonshire Road
Montesano, WA 98563-9618
Telephone (360) 249-4628
FAX (360) 664-0689

Local Government (Shoreline Management Act Approval)

Appropriate City or County Planning, Building, or Community Development Department

Natural Resources Conservation Service (NRCS), formerly Soil Conservation Service (SCS) for information regarding activities on agricultural land

NRCS
West 316 Boone Avenue, Suite 450
Spokane, WA 99201-2348
Telephone (509) 323-2900

Coast Guard (Section 9 Bridge Permit)

Commander 13th Coast Guard District (OAN)
915 Second Avenue
Telephone (206) 220-7282

Seattle, WA 98174-1067
Attn: Austin Pratt

Department of Natural Resources, Aquatic Resources Authorization to use bedlands, tidelands, or shorelands of navigable waters.

Central Region	Telephone (360) 748-2383
Northwest Region	Telephone (360) 856-3500
Southwest Region	Telephone (360) 577-2025
South Puget Sound Region	Telephone (360) 825-1631
Northeast Region	Telephone (509) 684-7474
Southeast Region	Telephone (509) 925-8510
Olympic Region	Telephone (360) 374-6131
Headquarters	Telephone (360) 902-1000

Appendix G. Surface Water Rights

Rock Cove (T02NR07E Sections 01 and 42)

File #	Person	Purpose	Source
S2-057275CL	MONDA BEULAH M.	IR,DG	SPRING
S2-*17001CWRIS	MONDA E A	DS	UNNAMED SPRING
G2-24497GWRIS	JOSEPH LOUIS	IR,DS	WELL
G2-29915	Skamania Cnty	IR	WELL

Mouth of the Wind River (T03NR08E Sections 27 and 37)

File #	Person	Purpose	Source
G2-048237CL	ASH ROBERT P.	DG	WELL
G2-025647CL	STEVENSON CO PLY INC.	DG	
S2-020036CL	INTERLAKEN RESORT COMPANY		DG
G2-019851CL	INTERLAKEN RESORT CO	DG	
S2-20864CWRIS	Stevenson Co Ply Inc	FR,CI	COLUMBIA RIVER
S2-*00225CWRIS	BAUMEISTER M E	FS	BLUE CREEK
S2-301545CL	AUSTIN DOUG	DG	UNNAMED SPRING
S2-096491CL	BARNES ROBERT W	DG	SPRING
S2-096492CL	BARNES ROBERT W	DG	SPRING
S2-100047CL	BERRY DUANE B	DG	SPRING
S2-*07927CWRIS STREAM	BIRKENFELD F W	IR,DS	UNNAMED
G2-000928CL	CALLAHAN EDWARD	ST,IR	
G2-053385CL	CANFIELD JOHN C.	ST,DG	
S2-031980CL	CANFIELD JOHN C.	ST,DG	SPRING
G2-29836	Columbia Gorge Hot Springs	IR,DM	WELL
G2-30042	Columbia Hot Gorge Hot Springs	CI	WELL
S2-*08962CWRIS	CUMMINS C A	IR,FS	UNNAMED SPRING
S2-070544CL	HALLOCK GRAYDON	ST,DG	SPRING
G2-070545CL	HALLOCK GRAYDON	DG	A WELL
G2-20777CWRIS	HEGEWALD R M	DM	WELL
S2-*21809CWRIS	Hegewald Timber Co Inc	FR,EN	UNNAMED SPRING
S2-140468CL	HENDRICKSON LARRY	IR,DG	POND
S2-112802CL	HOLMES DAVID T	ST,IR	SPRING
S2-094386CL	HOLMES MAYNARD	IR,DG	SPRING
S2-22883CWRIS	HOLMES MAYNARD	DM	UNNAMED SPRING
S2-*12166CWRIS	HOUSE ELLIS	IR,DS	UNNAMED SPRING
S2-*18827CWRIS	International Paper Co	DM	UNNAMED SPRING
G2-056127CL	KNAPPTON TOWBOAT CO.	DG	WELL
S2-056128CL	KNAPPTON TOWBOAT CO.	No ID	WIND RIVER
S2-23877CWRIS	LYONS BILL D	DS	UNNAMED SPRING
G2-154408CL	LYONS BILLY D	DG	SPRINGS
G2-154409CL	LYONS BILLY D	DG	WELL

S2-*00977CWRIS	RAINEY E C	IR,DS	UNNAMED SPRING
S2-*21312CWRIS	RUDHE C W	DM	UNNAMED SPRING
G2-077138CL	TOMBLESON THELMA I	DG	WELL
S2-22422CWRIS STREAM	TOMBLESON THELMA I	DM	UNNAMED
S2-*10294CWRIS	WALDORF H L	DM	UNNAMED SPRING
S2-*07923CWRIS STREAM	WEDRICK M S	IR,DS	UNNAMED
S2-22446CWRIS	WILSON GEORGE G	DM,CI	UNNAMED SPRING

Drano Lake (T03NR09E Section 26)

File #	Person	Purpose	Source
S2-30161	Skamania Cnty	IR	DRANO LAKE

Purpose codes:
CI – Commercial/Industrial Manufacturing
DG – Domestic General
DM – Domestic Multiple
DS – Domestic Single
EN – Environmental Quality
FR – Fire Protection
FS – Fish Propagation
ST – Stock Watering

Appendix H. Triclopyr Questions & Answers

Triclopyr Questions and Answers

These questions were submitted by the public. The questions were answered by a team of experts.

1. **What is triclopyr?**

   Triclopyr *(pronounced tri–clo–peer)* is an herbicide that can control infestations of Eurasian watermilfoil and other broad-leaf water plants. Eurasian watermilfoil is more sensitive to triclopyr than many native aquatic species including coontail, rushes and cattails. Triclopyr can therefore be used at label concentrations to remove Eurasian watermilfoil without killing many native plants. One triclopyr product is currently registered and marketed for aquatic weeds - Renovate 3™.

2. **There are two types of triclopyr. Which one is registered for aquatic use? What distinguishes these two types of triclopyr from each other?**

   Renovate 3™ (triethylamine salt of triclopyr – 3 lb/gal acid equivalent) is the only formulation of triclopyr registered by the US EPA as an aquatic herbicide. The other formulation Garlon 4 is a butoxyethyl ester formulation with 4 lb/gal acid equivalent and this formulation is not registered for aquatic use.

3. **Has a full risk assessment been performed on triclopyr? If so, by whom?**

   An Environmental Impact Statement (EIS) has been completed by the Washington Department of Ecology and a full risk assessment was conducted by Ecology and formed the basis for the EIS.

4. **How toxic is triclopyr to humans?**

   Concentrated triclopyr products are corrosive and can cause skin irritation and irreversible eye damage if splashed in the eye. However, only dilute amounts of triclopyr are needed to kill Eurasian watermilfoil. These dilute concentrations have not been shown to cause skin irritation or other health effects. Triclopyr is not well absorbed through skin. If ingested, research has shown that low doses of triclopyr are rapidly excreted in humans and are unlikely to accumulate in human tissue or cause adverse effects.

   In natural waters, the initial breakdown products of triclopyr are TCP and TMP. Tests in laboratory animals on both these metabolites have shown that their toxicity to mammals is less than or equal to triclopyr. These metabolites are relatively short-lived in the environment. Complete breakdown of triclopyr results in carbon dioxide, oxamic acid, and other low molecular weight carboxylic acids.

   Triclopyr is not considered to be a cause of cancer, birth defects, or genetic

mutations. Nor is it considered likely to cause systemic, reproductive, or developmental effects in mammals at or near concentrations encountered during normal human use. However, Washington State Department of Health considers it prudent public health advice to minimize exposure to pesticides regardless of their known toxicity.

5. **Does triclopyr accumulate in human and animals?**

Triclopyr and its metabolites are excreted rapidly in humans and mammals. A study in human volunteers, given low doses showed that blood levels peaked two to three hours after ingestion and declined to undetectable levels within 48 hrs. A studies in rodents showed that triclopyr and metabolites have a short residence time in other bodily tissues (12-15 hours).

6. **Is there any relationship between triclopyr and cancer?**

Triclopyr was determined to be "not classifiable as to human carcinogenicity" by EPA reviewers. This means the EPA did not consider the animal evidence to be sufficient to list triclopyr as a possible human carcinogen. Nor did it find the evidence definitive enough to rule out carcinogenicity. EPA considered results of the a 22 month assay in mice, a 24 month assay in rat, and results from *in vitro* tests for mutations. There were marginal increases in some breast tumors (benign) but no consistent pattern across dose groups and no dose-response pattern. EPA does not consider this a data gap since the required studies were conducted and were acceptable to EPA.

7. Does triclopyr have impacts on reproduction?

EPA requires that pesticides be assessed for reproductive effects. In the reproductive tests two generations of rodents are fed the pesticide in their daily diet. It is common that pesticides have a positive response at the highest dose tested. This is because the test protocol requires the highest dose to be high enough to elicit a reproductive effect (unless the dose required causes death or severe suffering of the animal). Generally the highest dose must show an effect or the test is unacceptable to EPA. Impairment of reproduction by triclopyr was seen only at doses high enough to cause toxicity to the mothers. No reproductive effects were seen at lower doses. The high dose was very high relative to potential human exposure. It was 500 times the dose considered by EPA to be safe for daily exposure to humans and over 1400 times higher than the worst-case scenario for human exposure to triclopyr in lake treatments.

8. At what levels of application is there documented evidence of impacts to people, fish, wildlife, microorganisms etc? Will these levels be achieved in applications to lakes to control Eurasian watermilfoil?

Renovate 3™ is used at levels no greater than 2.5 ppm (maximum labeled rate) in lakes. These levels have been found to be safe to the environment and non-target species based upon testing conducted for US EPA Registration.

9. **If my lake is treated with triclopyr, will I be exposed to this herbicide?**

Residues of triclopyr and its metabolites should not be detectable in lake water more than a couple weeks past the application. If you do wade or swim in the lake, touch pets that have been in the lake, or eat fish from treated water shortly

after the treatment, you may be exposed to dilute concentrations of triclopyr and its metabolites.

There is little chance of exposure to bystanders during the herbicide application process. This is because liquid triclopyr herbicide is injected directly into the water column. The application method eliminates opportunity for drift of sprays onto bystanders or nearby residents during the application. Triclopyr has a low vapor pressure and is quite water-soluble so it will not volatilize from treated water and drift through air following the application.

10. Is it safe to swim or play in the water following the herbicide application?

There are no swimming restrictions on the Renovate 3™ label following application of triclopyr to water. This means that the federal EPA considers the treated water safe for swimming. However, to impose an additional layer of safety to swimmers (due to potential for eye irritation) the Washington Department of Ecology is imposing a twelve hour swimming restriction in Washington after treatment with triclopyr.

Washington State Department of Ecology recently contracted for an independent scientific assessment of triclopyr safety including this question of a swimmer's exposure. The most conservative scenario considered was a six-year-old who swims for three hours and inadvertently swallows 150 ml of water from a lake treated with the maximum allowable rate of triclopyr. The estimated amount the child would absorb in this scenario was still more than 100 times less than the daily dose animals were fed over their lifetime with no observable adverse effects.

Washington State Department of Health (DOH) has reviewed the data and agrees that skin contact with treated water at the dilute treatment concentration is unlikely to result in any adverse health effect in people. Triclopyr products are concentrated when initially injected into water during an application so, as a precaution, DOH advises people to avoid contact with water in treated areas for twelve hours following an application to allow the herbicide concentrate to disperse and reach the dilute treatment concentration.

11. Are fish from the treated area safe to eat?

One breakdown product of triclopyr, called TMP, can temporarily accumulate in fish and shellfish immediately following a triclopyr application. The EPA did not consider the concentration of this metabolite to be of health concern and requires no fishing restrictions.

Washington State Department of Ecology recently contracted for an independent scientific assessment of triclopyr safety including this question of eating fish from treated waters. Scenarios for children and adults consuming fish every day from treated water resulted in estimated exposures that were more than 1000 times less than the daily doses animals were fed over their lifetime with no observable adverse effects.

12. **Has triclopyr been tested for special sensitivity to children?**

The EPA is required to assess each pesticide for its potential to cause toxicity specifically to infants and young children. This is because children's bodies are still developing and they may be more susceptible to the action of a toxicant. EPA conducted this assessment using animal tests and concluded "Reliable pre-and post-natal data indicate no special sensitivity of young animals to triclopyr residues."

13. **What are the toxicity levels of triclopyr to aquatic organisms?**

For aquatic organisms, the acute toxicity values for triclopyr with rainbow trout, salmon species, bluegill sunfish, and the water flea (*D. magna*) are shown below in Text Table 1. Note: All testing done with laboratory water at pH of ~7-8, typical of conditions in the Pacific NW area, as demonstrated in Figure 1.

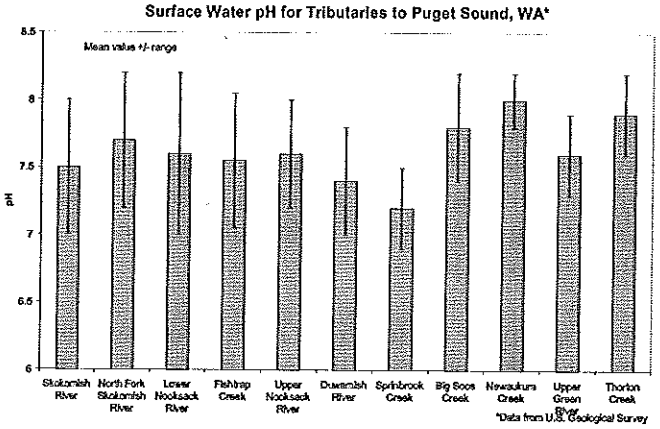


Figure 1. Surface water pH for Puget Sound tributaries (from U.S. Geological Survey)

Text Table 1. Acute toxicity data for aquatic species with Triclopyr

	R. Trout	Salmon sp.	Bluegill	Water Flea
Acute 96-hr LC50 (ppm)	86 to 117	82 to 182	148	133 (48-hr)

EPA Toxicity Rating: "Slightly toxic to Practically non-toxic"

The EPA classifies pesticides according to their acute toxicity responses. Compounds with acute values >100 ppm are classified "Practically non-toxic" (best rating), while compounds with acute values of 10-100 ppm are classified as "Slightly toxic" (second best classification). The overall weight of evidence indicates that triclopyr acute toxicity values average ~100 mg/L or greater with invertebrate and vertebrate species, indicating that a collective "Practically non-toxic" rating is most appropriate as a generic

classification.

14. **What does "practically non-toxic" mean?**

Practically non-toxic is an ecotoxicological category used to describe pesticides and other chemicals. In the chart below you will see that it is the lowest toxicological category.

Table II: Ecotoxicological Categories

Toxicity Category	Mammalian (Acute Oral)* mg/kg	Avian (Acute Oral)* mg/kg	Avian (Dietary)- ppm	Aquatic Organisms‡ ppm
very highly toxic	<10	<10	<50	<0.1
highly toxic	10-50	10-50	50-500	0.1-1
moderately toxic	51-500	51-500	501-1000	>1-10
slightly toxic	501-2000	501-2000	1000-5000	>10-100
practically non-toxic	>2000	>2000	>5000	>100

* Reflects dose given to test animals and is based on body weight of the test animal.
_Concentration in the diet. Unrelated to body weight of the test animal. Measure of environmental exposure.
‡Concentration in water. Unrelated to body weight of test animal. Measure of environmental exposure.

The words "pesticide" and "poison" are not synonymous. Relatively few pesticides are poisonous to humans according to the standard meaning of the term. "The dose makes the poison" is a saying all doctors understand. What it means, in essence, is that it's not simply *what* you come in contact with or ingest that determines risk, it's also *how much* you contact or ingest. This point is important because most pesticides are designed to control pests with amounts far smaller than the amount that would affect humans and pets. Contrary to popular belief, pesticides are not a uniquely toxic class of substances. They range from practically non-toxic to highly toxic—as with other classes of natural and manmade substances.

15. **Why does the Renovate 3™ label state to not apply to saltwater? Does it become toxic in a saltwater environment? Are salt water plants, creatures etc more susceptible to triclopyr than freshwater? If so how and why?**

A pesticide can only be directly applied to sites that it has been approved for through the US EPA label registration process. The label only indicates where a pesticide may be applied and does not restrict where residues may be discharged. Triclopyr does not become toxic in salt water. Salt water plants and animals should not be any more sensitive to triclopyr than the freshwater

organisms that have been tested with triclopyr.
As an example from the Renovate 3™ Material Safety Date Sheet (MSDS) the Acute LC50 for pink shrimp (*Penaeus duorarum*) is 895 mg/L. This is over 350 times higher than the maximum rate that is normally applied to lakes.

16. **What are the long term affects of triclopyr on mammal systems - if it accumulated in mammalian tissue 5 yr, 10 yr, 20 yr. later?**

Populations of several native mammals and birds were studied for several years following triclopyr, prescribed burning, and combination treatments in oak-savanna woodlands. Populations for all species showed either no change or increases following treatments. Thymus gland weights showed a statistically significant increase in burned areas both with and without triclopyr applications (Lochmiller et al. 1995). Recently published studies showed no impact of triclopyr applications on wildlife populations, relative to non-herbicide based vegetation management practices (Duchesne et al. 1999; Harpole and Haas 1999; Leslie et al. 1996; Leutenschlager et al. 1998; Lindgren et al. 1998; Nolte and Fulbright 1997). One study (Obenshain et al. 1997) reports that the combined use of triclopyr with 2,4-D and glyphosate may lead to concentrations of these herbicides in water that may cause adverse effects which are not detailed in the publication. In mammals, most triclopyr is excreted, unchanged, in the urine. Triclopyr was observed to concentrate slightly in ovaries of laboratory animals given repeated doses. No accumulation was observed in other tissues. The authors concluded that triclopyr and its metabolites are likely to have a low potential to accumulate upon repeated exposure (Timchalk et al. 1990). Data quoted from this website: http://www.fs.fed.us/r6/weeds/Triclopyr_Profile.PDF

17. **Could triclopyr possibly impact bats and or other mammals, especially bats that are pregnant or nursing their young?**

Renovate3™ has a low potential for bioaccumulation. Triclopyr is typically found at a concentration in animals many times less than what is present within the surrounding water and is eliminated relatively quickly. The LD50 for Rats has ranged from 630-729 mg/Kg (Tu et. al.). Since the material does not bioaccumulate bats would not be able to develop concentrations that would affect them or their offspring by drinking treated water or foraging on insects from the treated water.

18. **What are the inert ingredients in triclopyr?**

Garlon 3A™ and Renovate 3™ are identical products marketed under two names. Ingredients listed on either the pesticide label or Material Safety Data Sheet are:

- triclopyr TEA salt (44.4%)
- ethanol (amount not specified but more than 1%)
- triethylamine 3%,

- ethylenediamine tetraacetic acid 2.3%.

The regulatory manager at Dow Agrosciences (manufacturer of triclopyr) disclosed that the product is more than 45% water and contains small amounts of an antifoam product and a surfactant. He explained that triethylamine is used extensively in cosmetics and has an allowable level in food. He also explained that EDTA helps the product adjust to the hardness of the lake water. He confirmed that the ethanol was present at ~2% of the formulated product. Some of the other ingredients could contribute to the hazard of the product for pesticide applicators if direct skin or eye contact with the concentrated product occurs. The other ingredients listed do not pose a risk to the general public in contact with the diluted product. This is because the product is diluted in water more than 100,000–fold for control of Eurasian watermilfoil.

19. **Are there "gaps" in the data on triclopyr - things that we do not know the answers to?**

There are often site-specific endangered animals or rare plants that have not been tested. To avoid impacts, the Washington Department of Ecology requires that the applicant check with the Department of Natural Resource's Heritage Program for rare plant locations and to consult the lists for animals. Because some salmon stocks are listed as threatened and endangered in the Pacific Northwest, the Washington Department of Ecology has also contracted with the University of Washington to conduct tests for potential sub-lethal effects on salmon with various herbicides.

20. **Are there any "unknown" risks to the use of triclopyr?**

The world is full of potentially toxic substances and dangerous situations. However, separating the trivial and low level risks from the important environmental risks requires the application of sound scientific principles. Both the US EPA and the Washington Department of Ecology have examined the wealth of data and conducted risk assessments on triclopyr. They have both determined that triclopyr will have no significant acute or chronic impact on people, fish, or freshwater invertebrates when recommended rates are used.

21. **Is triclopyr one molecule away from Agent Orange?**

The health effects of Agent Orange are linked to its dioxin contamination. Triclopyr does not contain toxic dioxin impurities so we do not need to be concerned about health effects of dioxins in the use of triclopyr.

The molecule of triclopyr acid is structurally similar to the two herbicides in Agent Orange.

- Agent Orange was an herbicide used extensively in the Vietnam war to defoliate large tracts of forest.

- Agent Orange contained two active ingredients: 2,4-D and 2,4,5-T. Triclopyr acid is one atom different from 2,4,5-T and two atoms different from 2,4-D.
- Triclopyr acid differs in an important feature. Triclopyr is based on a pyridine ring and 2,4,5-T is based on a phenol ring.
- This ring difference prevents dioxin impurities from forming during production of triclopyr.
- The principle health issue with Agent Orange was contamination with a highly toxic dioxin impurity (2,3,7,8- TCDD) formed during the synthesis of 2,4,5-T.
- Health effects observed in Airforce mixers, loaders, and sprayers; who experienced heavy occupational exposure to Agent Orange; have generally been ascribed to dioxin exposure.
- 2,4,5-T is now banned, largely because of unavoidable dioxin impurities formed during its production.
- Dioxin impurities do not occur in the synthesis of triclopyr because of the difference in the ring structure.
- There is no natural pathway for triclopyr to chemically convert to 2,4,5-T or form dioxins in the environment.

22. **How many of the triclopyr studies have been funded - in whole or in part - by Dow Chemical or one of its subsidiaries? What is the level of potential conflict of interest here?**

Most of the studies required by EPA for the registration for triclopyr as an aquatic herbicide have been funded by its manufacturer. This is normal since companies typically spend 20-50 million dollars in testing to meet EPA registration requirements for aquatic herbicides. EPA has extremely rigorous testing standards called Good Laboratory Practices that the laboratories must comply with. This helps ensure quality results. Who else, besides the company selling the product would be willing to invest this sort of money in toxicity testing? However, government agencies and Universities often conduct their own field trials and other research and these published results are considered by the state when conducting risk assessments. For instance the University of Washington has published studies on using triclopyr to control purple loosestrife. The Washington Department of Ecology and the University of Washington are conducting research on the impacts of triclopyr (and other aquatic herbicides) on the smoltification of juvenile coho and chinook salmon.

23. **What does "half-life" mean and what is the "half-life" of triclopyr?**

Half life is the period of time that must elapse for a pesticide to breakdown to ½ its original concentration. The half-life varies dependent upon where the triclopyr is found (i.e. water, hydrosoil, etc.) and other environmental factors. Half-lives for triclopyr and its breakdown products average six days or less in water and 8.4 days or less in sediment. (Citation: Letter to Kathleen Emmett, Dept. of Ecology, March 18, 2004: Comments on Environmental Impact Statement for Permitted Use of Triclopyr – Draft from Brian L. Bret, Ph.D.). Renovate 3™ has been shown to drop to non-detectable levels in 24 hours – 15 days (typically 3-7)

based upon immunoassay testing completed during the 2003 field season.

24. What does triclopyr "break down" into – are these elements harmful in any manner?

Triclopyr's eventual, final metabolite is carbon dioxide (CO_2). To get there, it typically breaks down into trichloropyridinol or TCP, a compound that itself is far less stable than triclopyr in aquatic systems, as seen in aquatic field studies. TCP itself has a comparable level of toxicity as triclopyr and is frequently found at low concentrations in early sampling points in field studies. The methoxypyridine or TMP metabolite is rarely observed but also has a comparable level of toxicity as triclopyr and TCP.

25. How long will the herbicide last in the lake water?

In natural water, sunlight and microorganisms rapidly degrade triclopyr. Triclopyr concentrations decline sharply over the first several days after treatment. Residues should be more than 95% degraded and dissipated from treated water in 1-2 weeks following treatment with triclopyr.

26. Will triclopyr, be found in the sediment of lakes after treatment?

Renovate3™ degraded in the sediment in a relatively short period of time

27. What are the impacts that triclopyr could have on ground water?

The limited mobility of triclopyr in soil, low absorption constant, and high rate of microbial and photolytic degradation in water and sediment would indicate that this compound would have little potential for the extensive mobility required to contaminate groundwater supplies. This assumption is supported by data collected by the US Geological Survey (USGS), as this federal agency has collected over 850 groundwater samples over a five-year period in the Pacific Northwest area and these samples have been examined for pesticide residues. Triclopyr has never been detected in any of the groundwater samples taken by the USGS, despite extensive use as an herbicide in this region in forestry applications over a 20-year timeframe.

28. What will be the positive impacts of utilizing triclopyr to control Eurasian watermilfoil?

Triclopyr (Renovate 3™) is selective to broad-leaved submersed aquatic plants such as Eurasian watermilfoil. Many native aquatic plants are not broad-leaved and are not significantly impacted by triclopyr. Significant reduction of Eurasian watermilfoil is a key component of improving and restoring the native aquatic plant community. If native species have less Eurasian watermilfoil to compete with they recover. There are additional benefits to the organisms that utilize these native species for food or shelter with the reduction of the Eurasian watermilfoil.

29. **What are the risks associated with a "Do Nothing Alternative" in lakes with Eurasian watermilfoil?**

Eurasian watermilfoil generally dominates the ecosystem to depths up to 20 feet (depending on the light conditions) and out-competes native submersed aquatic vegetation. The diversity of the aquatic vegetation community generally declines in Eurasian watermilfoil infested water bodies and this impacts the entire community within the lake. A plant such as Eurasian watermilfoil invades takes over and becomes a *keystone* species in a foreign environment/ecosystem. This changes and has negative impacts on the entire ecosystem.

30. **How can triclopyr kill only the milfoil and not other plants?**

Broad-leaf plants (dicots) have different biochemistry than monocots. Triclopyr affects the family of broad-leafed plants or dicots. Eurasian watermilfoil is a broad-leaf plant whereas most native aquatic plants are monocots and not susceptible to triclopyr.

31. **Is triclopyr a long term solution - or a short term fix?**

Eurasian watermilfoil is extremely difficult to eradiate. If diver hand pulling of Eurasian watermilfoil can be successfully accomplished in the water body after the triclopyr treatment to remove remaining milfoil, then the triclopyr treatment could offer some long-term results.

32. **How will the die off of Eurasian watermilfoil plants in lakes after triclopyr treatment impact the lake?**

Eurasian watermilfoil plants will slowly exhibit symptoms of herbicide damage (twisting of the stems due to the plant hormone (auxin-like) effect of triclopyr). The plants will gradually sink to the lake bottom and decompose. Systemic herbicides generally take a week to several weeks to entirely kill the plants so that you don't tend to get severe oxygen depletion that can sometimes occur when using contact herbicides. Native plants will fill in the areas left unoccupied by Eurasian watermilfoil.

33. **Are there any species "at risk" with the use of triclopyr?**

Broad-leaf aquatic plants, such as Eurasian watermilfoil, will be affected by triclopyr.

34. **Where else has triclopyr been used? Were any problems encountered with these applications – to the environment, fish, wildlife etc.?**

Renovate 3™ was labeled for use by the EPA in November of 2002. Prior to this triclopyr it had been used under an Experimental Use Permit as an aquatic

herbicide since 1988 (for small test plots around the country). Additional field trials have been completed by researchers since 1984). A number of scientific papers by independent researchers have been published about field studies including studies in the Pend Oreille River, Washington, and Lake Minnetonka Minnesota. Triclopyr has also been used for purple loosestrife control in Washington. In 2003 (Renovate 3™'s first field season after EPA registration) it was used in 27 states on hundreds of projects. There have not been any reported problems encountered with these applications.

35. **Is it true that some native plants take over a year to recover from an application of triclopyr?**

Triclopyr is a selective herbicide which means that it generally targets the broad-leaved aquatic plants. Although there are few aquatic broad-leaved plants, there are others beside Eurasian watermilfoil. These species could be expected to be impacted by triclopyr. Eurasian watermilfoil is not thought to have viable seeds or other reproductive structures (besides fragments), whereas native aquatic plants have seeds, and sometimes tubers and other over-wintering structures. Even if the mature native plants are impacted by triclopyr, these plants should recover from their seeds or tubers the next season. Triclopyr treatment should enhance native plant growth since Eurasian watermilfoil crowds out native species. Removing Eurasian watermilfoil opens up niches that native species will fill. A study done in the Pend Oreille River by the US Army Corps of Engineers with triclopyr documented that removing Eurasian watermilfoil markedly enhanced native plant growth in the treated areas.

36. **Can milfoil plants develop immunity to triclopyr?**

Short-term and long-term data collected by the U.S. Corps of Engineers Aquatic Plant Control Research Program (Vicksburg, MS) has not demonstrated that Eurasian watermilfoil is capable of developing immunity or "resistance" to triclopyr's mode of action. Work conducted by Dr. Kurt Getsinger and others with the Corps of Engineers indicates that "*control of this species is likely*" with appropriate dose regimes of triclopyr, which generally range from 0.5 to 2.5 ppm. The Corps of Engineers is particularly interested in the use of triclopyr to control milfoil for maintenance of waterways, as "*this herbicide shows a low order of toxicity to microbial communities and higher aquatic organisms and residue accumulation in sediment, shellfish, and fish is negligible**".

*Netherland, M. and Getsinger, K. 1992. Efficacy of triclopyr on Eurasian watermilfoil: Concentration and exposure time effects. J. Aquatic Plant Management 30: 1-5.

Appendix I. Renovate-3 Label and MSDS

Both are also available on-line at:

http://www.sepro.com/pdf_lit/aquatics/Renovate_Label.pdf

http://www.sepro.com/pdf_lit/aquatics/Renovate_MSDS.pdf

Specimen Label

Herbicide

Aquatic sites: For control of emersed, submersed and floating aquatic plants in aquatic sites such as ponds, lakes, reservoirs, non-irrigation canals and ditches which have little or no continuous outflow, marshes and wetlands, including broadleaf and woody vegetation on banks and shores within or adjacent to these and other aquatic sites.

Active Ingredient:
triclopyr: 3,5,6-trichloro-
2-pyridinyloxyacetic acid,
triethylamine salt.....44.4%
Inert Ingredients.....55.6%
Total.....100.0%
Acid equivalent triclopyr - 31.1% - 3 lb/gal

Keep Out of Reach of Children

DANGER PELIGRO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

Precautionary Statements

Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them. Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

FIRST AID	
In the eyes	• Hold eye open and rinse slowly and gently with water for 15 - 20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. • Call poison control center or doctor for treatment advice.
If on skin or clothing	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15 - 20 minutes. • Call a poison control center or doctor for treatment advice.
If swallowed	• Call a poison control center or doctor for treatment advice. • Have person sip a glass of water if able to swallow. • Do not induce vomiting unless told to do so by a poison control center or doctor. • Do not give anything by mouth to a unconscious person.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment.

Note to Applicator: Allergic skin reaction is not expected from exposure to spray mixtures of Renovate 3 herbicide when used as directed.

Note to Physician: Probable mucosal damage may contraindicate the use of gastric lavage.

Refer to inside of label booklet for additional precautionary information including Personal Protective Equipment (PPE), User Safety Recommendations and Directions for Use including Storage and Disposal.

3 Herbicide

Engineering Controls

When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in the WPS (40 CFR 170.240(d)(4-6)), the handler PPE requirements may be reduced or modified as specified in the WPS.

USER SAFETY RECOMMENDATIONS

Users should:

- Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet.
- Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

Environmental Hazards

Under certain conditions, treatment of aquatic weeds can result in oxygen depletion or loss due to decomposition of dead plants, which may contribute to fish suffocation. This loss can cause fish suffocation. Therefore, to minimize this hazard, do not treat more than one-third to one-half of the water area in a single operation and wait at least 10 to 14 days between treatments. Begin treatment along the shore and proceed outwards in bands to allow fish to move into untreated areas. Consult with the State agency for fish and game before applying to public water to determine if a permit is needed.

Physical or Chemical Hazards

Combustible. Do not use or store the product near heat or open flame.

Directions for Use

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. Read all Directions for Use carefully before applying.

Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any

NON-AGRICULTURAL USE REQUIREMENTS

The requirements in this box apply to uses of this product that are NOT within the scope of the Worker Protection Standard for Agricultural Pesticides (40 CFR Part 170). The WPS applies when this product is used to produce agricultural plants on farms, forests, nurseries, or greenhouses.

Entry Restrictions for Non-WPS Uses: For applications to non-agricultural areas, do not allow entry into areas until spray has dried, unless applicator and other handler PPE is worn.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage and disposal. Open dumping is prohibited.

Pesticide Storage: Store above 25° F or agitate before use.

Pesticide Disposal: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

Container Disposal for Refillable Containers: Seal all openings which have been opened during use. Return the empty container to a collection site designated by SePRO Corporation. If the container has been damaged and cannot be returned, contact SePRO Corporation at 1-800-419-7779 to obtain prior to handling instructions.

Container Disposal (Metal): Do not reuse container. Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by incineration or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

General: Consult federal, state, or local disposal authorities for approved alternative procedures.

General Information

Irrigation: Do not use treated water for irrigation for 120 days following application. As an alternative to waiting 120 days, treated water may be used for irrigation once the triclopyr level in the treated water is determined to be non-detectable by laboratory analysis (measurements). There is no restriction on use of water from the treatment area to irrigate established grasses.

Do not apply Renovate 3 directly to, or otherwise permit it to come into direct contact with grapes, tobacco, vegetable crops, flowers, or other desirable broadleaf plants, and do not permit spray mists containing it to drift onto them.

- Do not apply to salt water bays or estuaries.
- Do not apply directly to impounded rivers or streams.
- Do not apply to ditches or canals used to transport irrigation water. It is permissible to treat non-irrigation ditch banks.
- Do not apply where runoff water may flow onto agricultural land as injury to crops may result.
- When making applications to control emergent plants on banks or shorelines of moving water sites, minimize overspray to open water.
- The use of a mistblower is not recommended.

Grazing and Haying Restrictions
Except for lactating dairy animals, there are no grazing restrictions following application of this product.

- Grazing Lactating Dairy Animals: Do not allow lactating dairy animals to graze treated areas until the next growing season following application of this product.
- Do not harvest hay for 14 days after application.
- Grazed areas of non-cropland and forestry sites may be spot treated if they comprise no more than 10% of the total pasture area.

Slaughter Restrictions: During the season of application, withdraw livestock from grazing treated grass at least 3 days before slaughter.

Avoiding Injurious Spray Drift

Applications should be made only when there is little or no hazard from spray drift. Very small quantities of spray which may not be visible, may seriously injure susceptible plants. Do not spray when wind is blowing toward susceptible crops or ornamental plants near enough to be injured. It is suggested that a continuous smoke column at or near the spray site or a smoke generator on the spray equipment be used to detect air movement. Intervals when this is not a suitable piece of equipment protocol try or available from other parties is provided without consideration for use by the transfer of its operation and subject to the owner's interpretation circumstances, evaluation, and opinion. Such reliance by BASF Corporation is not intended as an endorsement of such equipment, and not constitute a warranty (express or implied) of such equipment, and is not intended to imply that other equipment is not available and equally suitable. Any discussion of methods of use of such equipment does not imply that the reader should use the equipment other than as listed in directions available from the equipment manufacturer. The reader is responsible for reading its own equipment and operation, or consulting with sources other than BASF Corporation, in selecting and determining how to use its equipment.

Spray Drift Management
Avoiding spray drift at the application site is the responsibility of the applicator. The interaction of many equipment and weather related factors determine the potential for spray drift. The applicator and the grower are responsible for considering all these factors when making decisions.

The following drift management requirements must be followed to avoid off target drift movement from aerial applications:

1. The distance of the outer most operating nozzles on the boom must not exceed 3/4 the length of the rotor.
2. Nozzles must always point backward parallel with the air stream and never be pointed downward more than 45 degrees.

Where states have more stringent regulations, they should be observed.

The applicator should be familiar with and take into account the information covered in the following Aerial Drift Reduction Advisory. [This information is advisory in nature and does not supersede mandatory label requirements.]

Aerial Drift Reduction Advisory

Information on Droplet Size: The most effective way to reduce drift potential is to apply large droplets. The best drift management strategy is to apply the largest droplets that provide adequate coverage and control. Applying larger droplets reduces drift potential, but will not prevent drift if applications are made improperly, or under unfavorable environmental conditions (see Wind, Temperature and Humidity, and Temperature Inversions).

Controlling Droplet Size:
- Volume - Use high flow rate nozzles to apply the highest

Boom Length: For some use patterns, reducing the effective boom length to less than 3/4 of the wingspan or rotor length may further reduce drift without reducing swath width.

Application Height: Applications should not be made at a height greater than 10 feet above the top of the largest plants unless a greater height is required for aircraft safety. Making applications at the lowest height that is safe reduces exposure of droplets to evaporation and wind.

Swath Adjustment: When applications are made with a cross-wind, the swath will be displaced downwind. Therefore, on the up and downwind edges of the field, the applicator must compensate for this displacement by adjusting the path of the aircraft upwind. Swath adjustment distance should increase, with increasing drift potential (higher wind, smaller drops, etc.).

Wind: Drift potential is lowest between wind speeds of 2-10 mph. However, many factors, including droplet size and equipment type determine drift potential at any given speed. Application should be avoided below 2 mph due to variable wind direction and high inversion potential. Note: Local terrain can influence wind patterns. Every applicator should be familiar with local wind patterns and how they affect spray drift.

Temperature and Humidity: When making applications in low relative humidity, set up equipment to produce larger droplets to compensate for evaporation. Droplet evaporation is most severe when conditions are both hot and dry.

Temperature Inversions: Applications should not occur during a visual, low-level temperature inversion because drift potential is high. Temperature inversions restrict vertical air mixing, which causes small suspended droplets to remain in a concentrated cloud. This cloud can move in unpredictable directions due to the light variable winds common during inversions. Temperature inversions are characterized by increasing temperatures with altitude and are common on nights with limited cloud cover and light to no wind. They begin to form as the sun sets and often continue into the morning. Their presence can be indicated by ground fog; however, if fog is not present, inversions can also be identified by the movement of the smoke from a ground source or an aircraft smoke generator. Smoke that layers and moves laterally in a concentrated cloud (under low wind conditions) [illegible]

coverage (without forming a mist). Do not apply with nozzles that produce a fine droplet spray.

High Volume Leaf-Stem Treatment: To minimize spray drift, do not use pressure exceeding 60 psi at the spray nozzle and keep sprays no higher than brush tops. A labeled thickening agent may be used to reduce drift.

Plants Controlled by Renovate 3

Woody Plant Species

alder	cascara	maples
arrowwood	ceanothus	mulberry
ash	cherry	oaks
aspen	Chinese Tallow	poison ivy
bear clover (beaumat)	chinquapin	poison oak
beech	choke cherry	poplar
birch	cottonwood	salt-bush (Baccharis spp.)
blackberry	crataegus (hawthorn)	sweetgum
blackgum	locust	wax myrtle
Brazilian pepper	Melaleuca (seedlings)	willow

Annual and Perennial Broadleaf Weeds

burdock	hydrilla	tropical soda apple
Canada thistle	plantain	vetch
curly dock	smartweed	wild lettuce
elephant ear	waxy myrtle	

Aquatic Weeds

alligatorweed	*Hydrilla* species	purple loosestrife
American lotus	*Lythrum* (*salicaria*/*virgatum*)	waterhyacinth
American frogbit	*Nymphoides*[1]	waterlily
Aquatic sodapple	pickerelweed	waterprimrose
Eurasian watermilfoil	pondweed	

[1] Tolerance may be marginal to achieve desired level of control.

Application Methods

Floating and Emerged Weeds

For control of waterhyacinth, alligatorweed (see specific directions below), and other susceptible emerged and floating herbaceous weeds and woody plants, apply 1 1/2 to 6 lb ae Habitat® 2 to 8 [illegible]

Aerial Application
Apply with a helicopter using a Micronair or Thru-Valve boom, or a drift control additive in the spray solution. Apply in a minimum of 10 gallons of total spray mix per acre. Do not apply when weather conditions favor drift to sensitive areas. See label section on aerial application directions and precautions.

Watershield (*Brasenia schreberi*)
Apply Renovate 3 at 1 1/2 to 6 lb ae Triclopyr (2 to 8 quarts of Renovate 3) per acre to control watershield. Apply when plants are actively growing. Use the higher rate in the rate range when the weed mass is dense. It is important to thoroughly wet all foliage with the spray mixture. Use of a non-ionic surfactant in the spray mixture is recommended. A repeat treatment may be needed to control regrowth or plants missed in the previous treatment.

Alligatorweed (*Alternanthera philoxeroides*)
Apply Renovate 3 at 2 to 6 lb ae Triclopyr (3 to 8 quarts of Renovate 3) per acre to control alligatorweed. It is important to thoroughly wet all foliage with the spray mixture. For best results, it is recommended that an approved non-ionic aquatic surfactant be added to the spray mixture. Alligatorweed growing outside the margins of a body of water can be controlled with this treatment. However, alligatorweed growing in water will only be partially controlled. Top growth above the water will be controlled, but the plant will likely regrow from tissue below the water surface.

Precautions for Potable Water Intakes - Lakes, Reservoirs, Ponds:
For applications of Renovate 3 to control floating and emergent weeds in lakes, reservoirs or ponds that contain a functioning potable water intake for human consumption, see chart below to determine the minimum setback distances of the application from the functioning potable water intakes.

Renovate 3 Application Rate (quarts/acre)				
	Setback Distance (ft)			
Area Treated (acres)	2 qts/acre	4 qts/acre	6 qts/acre	8 qts/acre
< 4	0	200	400	600
> 4 - 8	0	200	300	600

- Recreational Use of Water in Treatment Area: There are no restrictions on use of water in the treated area for recreational purposes, including swimming and fishing.
- Livestock Use of Water from Treated Area: There are no restrictions on livestock consumption of water from the treatment area.

Submerged Weeds

For control of Eurasian watermilfoil (*Myriophyllum spicatum*) and other susceptible submerged weeds in ponds, lakes, reservoirs, and in non-irrigation canals or ditches that have little or no continuous outflow, apply Renovate 3 as either a surface or subsurface application. Rates should be selected according to the rate chart below to provide a triclopyr concentration of 0.75 to 2.5 ppm ae in treated water. Higher rates in the rate range are recommended in areas of greater water exchange. These areas may require a repeat application. However, total application of Renovate 3 must not exceed an application rate of 2.5 ppm triclopyr for the treatment area per annual growing season.

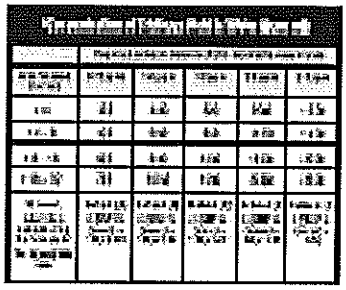
Apply in spring or early summer when Eurasian watermilfoil or other submersed weeds are actively growing.

Areas most susceptible to escape or other desirable broadleaf plants may be treated by subsurface injection applied by boat to avoid spray drift.

Subsurface Application
Apply the desired amount of Renovate 3 per acre directly into the water through boat-mounted distribution systems.

Surface Application
Apply the desired amount of Renovate 3 as either a concentrate or a spray mixture in water. However, use a minimum spray volume of 5 gallons per acre. Do not apply when weather conditions favor drift to sensitive areas.

Concentration of Triclopyr Acid in Water (ppm ae)					
	Gallons of Renovate 3 per surface acre at specified depth				
Water Depth (feet)	0.75 ppm	1.0 ppm	1.5 ppm	2.0 ppm	2.5 ppm
1	0.7	0.9	1.4	1.8	2.3
2	1.4	1.8	2.8	3.6	4.6
3	2.1	2.8	4.1	5.4	6.8



For best results, applications should be made when woody plants and weeds are actively growing. When hard to control species such as ash, blackgum, cedar, cherry, maples, or oaks are prevalent and during applications made in late summer when the plants are mature and during drought conditions, use the higher rates of Renovate 3.

When using Renovate 3 in combination with a 2,4-D herbicide approved for aquatic use, such as CMA 4 IVM, generally the higher rates should be used for satisfactory brush control.

Use the higher dosage rates when brush approaches an average of 15 feet in height or when the brush covers more than 60% of the area to be treated. If lower rates are used on hard to control species, resprouting may occur the year following treatment.

High Volume Foliage Treatment
For control of woody plants, use Renovate 3 at the rate of 3 to 6 lb ae triclopyr (1 to 2 gallons of Renovate 3) per 100 gallons of spray solution, or Renovate 3 at 3/4 to 3 lb ae triclopyr (1 to 4 quarts of Renovate 3) may be tank mixed with 1/4 to 1/2 gallons of 2,4-D 3 lb amine, like CMA 4 IVM, diluted to make 100 gallons of spray solution. Apply at a volume of 100 to 400 gallons of total spray per acre depending on size and density of woody plants. Coverage should be thorough to wet all leaves, stems, and root collars. (See General Use Precautions and Restrictions.) Do not exceed the maximum allowable use rate of 6 lb ae of triclopyr (2 gallons of Renovate 3) per acre per growing season.

Low Volume Foliage Treatment
To control susceptible woody plants, apply up to 15 lb ae triclopyr (5 gallons of Renovate 3) in 10 to 100 gallons of finished spray. The spray concentration of Renovate 3 and total spray volume per acre may be adjusted according to the size and density of target woody plants and kind of spray equipment used. With low volume sprays, use sufficient spray volume to obtain uniform coverage of target plants including the surfaces of all foliage, stems, and root collars (see General Use Precautions and Restrictions). For best results, a labeled aquatic surfactant should be added to all spray mixtures. Match equipment and delivery rate of spray nozzles to height and density of woody plants. When treating tall, dense brush, a truck mounted spray gun with spray tips that deliver up to 2 gallons per minute at 40 to 60 psi may be required. Backpack or other types of specialized spray equipment with spray tips that deliver less than 1 gallon of spray per minute may be appropriate for short, low to moderate density brush.

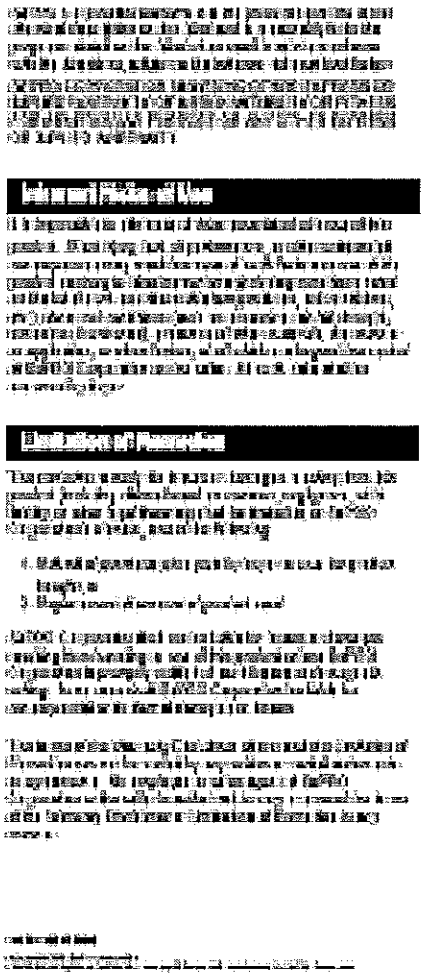
spray mixes into pressure to injected directly into plants.

With Hack and Squirt Method
Make cuts with a hatchet or similar equipment at intervals of 3 to 4 inches between cuts at a convenient height around the tree trunk. Spray 1/2 milliliter of undiluted Renovate 3 or 1 milliliter of the diluted solution into each cut.

With Frill or Girdle Method
Make a single girdle through the bark completely around the tree at a convenient height. Wet the cut surface with undiluted or diluted solution.

Both of the above methods may be used successfully at any season except during periods of heavy sap flow of certain species—for example, maples.

Stump Treatment
Spray or paint the cut surfaces of freshly cut stumps and shake with undiluted Renovate 3. The cambium area next to the bark is the most vital area to wet.



Material Safety Data Sheet

SePRO

Transportation and Medical Emergency Phone: 1-800-535-5053 (INFOTRAC)
General Phone: 317-580-8282

EPA Reg. Number: 62719-37-67690
Effective Date: 01/2008

Renovate® 3 Herbicide

SePRO Corporation Carmel, IN 46032

1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT: Renovate® 3 Herbicide

COMPANY IDENTIFICATION:
SePRO Corporation
11550 North Meridian Street, Suite 600
Carmel, IN 46032
www.sepro.com

2. COMPOSITION / INFORMATION ON INGREDIENTS

Triclopyr ((3,5,6-trichloro-2-pyridinyl)oxy)acetic acid), Triethylamine salt	CAS # 057213-69-1	44.4%
Inert Ingredients, Total, Including		55.6%
Ethanol	CAS # 000064-17-5	
Triethylamine (N,N-Diethylethanamine)	CAS # 000121-44-8	
Ethylenediaminetetraacetic Acid (EDTA)	CAS # 000060-00-4	

This document is prepared pursuant to the OSHA Hazard Communication Standard (29 CFR 1910.1200). In addition, other substances not 'Hazardous' per the OSHA standard may be listed. Where proprietary ingredient shown, the identity may be made available as provided in the standard.

3. HAZARDOUS IDENTIFICATION

EMERGENCY OVERVIEW
Hazardous Chemical. Light purple pink liquid, ammonia odor. May cause severe eye irritation with corneal injury which may not

smoky or halo vision. When tested on animals, dilutions of this material were less irritating to eyes than the undiluted product.

SKIN: Prolonged or repeated exposure may cause skin irritation, even a burn. When tested on animals, dilutions of this material were less irritating to skin than the undiluted product. Prolonged or frequently repeated skin contact may cause allergic skin reactions in some individuals. With the dilute mix, no allergic skin reaction is expected. A single prolonged exposure is not likely to result in the material being absorbed through the skin in harmful amounts. The LD_{50} for skin absorption in rabbits is >8000 mg/kg.

INGESTION: Single dose oral toxicity is low. The oral LD_{50} was 2974 mg/kg for male rats and 1847 mg/kg for female rats. Small amounts swallowed incidental to normal handling operations are not likely to cause injury; however, swallowing larger amounts may cause injury. Ingestion may cause gastrointestinal irritation or ulceration.

INHALATION: A single brief (minutes) inhalation exposure is not likely to cause adverse effects.

SYSTEMIC (OTHER TARGET ORGAN) EFFECTS: Excessive exposure may cause liver or kidney effects.

CANCER INFORMATION: Triclopyr did not cause cancer in laboratory animal studies. This material contains ethanol. Epidemiology studies provide evidence that drinking of alcoholic beverages (containing ethanol) is associated with cancer, and IARC has classified alcoholic beverages as carcinogenic to humans.

Material Safety Data Sheet

SePRO

Renovate® 3 Herbicide

4. FIRST AID

EYE: Wash immediately and continuously with flowing water for at least 30 minutes. Remove contact lenses after the first 5 minutes and continue washing. Obtain prompt medical consultation, preferably from an ophthalmologist.

SKIN: Wash skin with plenty of water.

INGESTION: Do not induce vomiting. Give one cup (8 ounces or 240 ml) of water or milk if available and transport to a medical facility. Do not give anything by mouth to an unconscious person.

INHALATION: No emergency medical treatment necessary.

NOTE TO PHYSICIAN: Due to irritant properties, ingestion may result in burns/ulceration of mouth, stomach and lower GI tract with subsequent stricture. Aspiration of vomitus may cause lung injury. Suggest endotracheal/ esophageal control if lavage is done. If burn is present treat as any thermal burn, after decontamination. Exposure to amine vapors may cause minor transient edema of the corneal epithelium (glaucopsia) with blurred vision, blue haze, and halos around bright objects. Effects disappear in a few hours and temporarily reduce ability to drive vehicles. No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.

5. FIRE FIGHTING MEASURES

FLASH POINT: 213° F (43° C)
METHOD USED: TCC
FLAMMABLE LIMITS: LFL: Not determined
UFL: Not determined

6. ACCIDENTAL RELEASE MEASURES

ACTION TO TAKE FOR SPILLS/LEAKS: Contain small spills and absorb with an inert material such as clay or dry sand. Report large spills to InfoTrac at 1-800-535-5053.

7. HANDLING AND STORAGE

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: HANDLING: Keep out of reach of children. Causes irreversible eye damage. Harmful if inhaled or absorbed through skin. Prolonged or frequently repeated skin contact may cause allergic skin reaction in some individuals. Avoid contact with eyes, skin, clothing, breathing vapor, or spray mist. Users should wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.

STORAGE: Store above 28°F or agitate before use. Store in original container. See product label for handling/storage precautions relative to the end use of this product.

8. EXPOSURE CONTROL/PERSONAL PROTECTION

These precautions are suggested for conditions where the potential for exposure exists. Emergency conditions may require additional precautions.

EXPOSURE GUIDELINE(S):
Ethanol (ethyl alcohol): ACGIH TLV and OSHA PEL are 1000 ppm. ACGIH classification is A4.
3,5,6-Trichloro-2-pyridyloxyacetic acid (Triclopyr), triethylamine salt: SePRO Corporation Industrial Hygiene Guideline is 2 mg/M^3 as acid equivalent; Skin.
Triethylamine: ACGIH TLV is 1 ppm TWA, 3 ppm STEL, Skin. OSHA PEL is 10 ppm TWA, 15 ppm STEL.

PELs are in accord with those recommended by OSHA

Material Safety Data Sheet

Transportation and Medical Emergency Phone: 1-800-535-5053 (INFOTRAC)
General Phone: 317-580-8282

EPA Reg. Number: 62719-37-67800
Effective Date: 07/22/03

DuPont Corporation Carmel, IN 46032

RECOMMENDATIONS FOR MANUFACTURING, COMMERCIAL BLENDING, AND PACKAGING WORKERS:

RESPIRATORY PROTECTION: Atmospheric levels should be maintained below the exposure guideline. When respiratory protection is required for certain operations, use a NIOSH approved air-purifying respirator.

SKIN PROTECTION: When prolonged or frequently repeated contact could occur, use protective clothing impervious to this material. Selection of specific items such as faceshield, gloves, boots, apron or full-body suit will depend on operation.

EYE PROTECTION: Use chemical goggles. Eye wash fountain should be located in immediate work area. If vapor exposure causes eye discomfort, use a NIOSH approved full-face respirator.

APPLICATORS AND ALL OTHER HANDLERS: Refer to the product label for personal protective clothing and equipment.

9. PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT: Not determined
VAPOR PRESSURE: Not determined
VAPOR DENSITY: Not applicable

11. TOXICOLOGICAL INFORMATION

MUTAGENICITY: For triclopyr and ethanol: In-vitro mutagenicity studies were negative. For triclopyr: animal mutagenicity studies were negative. For ethanol: animal mutagenicity studies were negative in some cases and positive in other cases.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL FATE:
MOVEMENT & PARTITIONING: Based largely or completely on information for triclopyr. Bioconcentration potential is low (BCF < 100 or Log Pow < 3).

DEGRADATION & PERSISTENCE: Biodegradation under aerobic static laboratory conditions is high (BOD20 or BOD28/ThOD > 40%). 20-Day biochemical oxygen demand (BOD20) is 0.30 p/p. Theoretical oxygen demand (ThOD) is calculated to be 0.75 p/p.

ECOTOXICOLOGY: Material is slightly toxic to aquatic organisms on an acute basis (LC_{50}/EC_{50} is between 10 and 100 mg/L in most sensitive species).
Acute EC_{50} for shell deposition inhibition in Eastern oyster (*Crassostrea virginica*) is 56-87 mg/L.
Acute LC_{50} for rainbow trout (*Oncorhynchus mykiss*) is 400 mg/L.
Acute LC_{50} for channel catfish (*Ictalurus punctatus*) is

Prodedure:

1. Tour the entire water body by boat, noting where plants are near or at the water surface. You may also find it helpful to walk around the shoreline, especially if near-shore areas are clogged by weeds and make boat passage difficult.

2. Before leaving shore, establish survey lines, called transect lines, at appropriate points along the shoreline. For a small lake, you can mark off transects, say every 300 feet, all the way around the shoreline. Draw these lines on the lake map extending them perpendicularly from shore out to where the water is about 20 feet deep (typically the outer limit of growth).

3. In a boat, follow each of these lines and collect plant samples at points along the survey transects (every 3 foot depth increment). From the boat or shoreline you can cast a weighted rake to the lake bottom and pull up aquatic plants. Be sure to note the transect line number, the location on the transect, and the depth from which the sample was taken (use your calibrated rope to measure depth). Specimens collected in this manner can be bagged,sealed, and kept cool for later shipment to a specialist for identification. You may also want to use the underwater viewer.

4. Be sure to keep all plant fragments on the boat for proper disposal later on, as many problem plant species can reproduce and spread by fragments.

How to Collect and Prepare an Aquatic Plant Sample for Verification

Step 1. Obtain an aquatic plant sample by dropping a weighted rake to the lake bottom and pulling up the vegetation snagged by the rake. Remove the plants from the rake, sorting out the different plant types. To keep the plants from drying out, sort them in a shallow pan filled with water.

Step 2. Rinse a few healthy specimens of the plant types of concern with water from the lake. Carefully lay the plants between two pieces of damp paper towel, place them in a plastic bag and seal the bag securely. Label the bag clearly with the date, name of the water body, location and depth of sample, and your name and telephone number.

Step 3. Mail the samples to a recognized aquatic botanist for identification as soon as possible. Damp plant specimens in a plastic bag can easily be mailed in a regular envelope.

Step 4. If delivering a fresh (wet) sample in person, store it in a plastic jar filled with lake water in the refrigerator in the interim, and then transfer it to a small cooler with an ice pack for transport to an aquatic plant expert. Plant samples can usually be kept fresh in this way for up to five days.

To whom do I send an aquatic plant sample for identification?

Contact Jenifer Parsons (509) 457-7136 or Kathy Hamel (360) 407-6562.

Appendix K. Natural Heritage Program Environmental Review

June 11, 2004

SUBJECT: Integrated Aquatic Vegetation Management Plans

I searched the Natural Heritage Information System for information on rare plant species and high-quality native ecosystems in the vicinity of your three sites in Skamania County: Drano Lake; mouth of the Wind River; and Rock Cove.

None of the above sites are known to contain rare plant species or high-quality wetland ecosystems. However, the Drano Lake site has upland forest/woodland ecosystems recorded as high-quality sites by our program, and a Priority 1 fungus species, *Dendriscocaulon intricatulum*,
in the SW quarter of Section 26, T03N R09E.

The information provided by the Washington Natural Heritage Program is based solely on existing information in the database. In the absence of field inventories, we cannot state whether or not a given site contains high quality ecosystems or rare plant species; there may be significant natural features in your study areas of which we are not aware.

The Washington Natural Heritage Program is responsible for information on the state's rare plants as well as high quality ecosystems. For information on animal species of concern, please contact Priority Habitats and Species, Washington Department of Fish and Wildlife, 600 Capitol Way N, Olympia WA 98501-1091, or by phone (360) 902-2543.

Please visit our internet website at http://www.dnr.wa.gov/nhp for more information. Lists of rare plants and their status, as well as rare plant fact sheets, are available for download from the site. Please feel free to call me at (360) 902-1667 if you have any questions, or by e-mail at sandra.moody@wadnr.gov.

Sincerely,

Sandy Swope Moody
Environmental Review Coordinator, WA Natural Heritage Program
Department of Natural Resources
PO Box 47014
Olympia WA 98504-7014
e-mail: sandra.moody@wadnr.gov