Upper Yakima River Basin Suspended Sediment, Turbidity and Organochlorine Pesticide Total Maximum Daily Load

Submittal Report

August 2002

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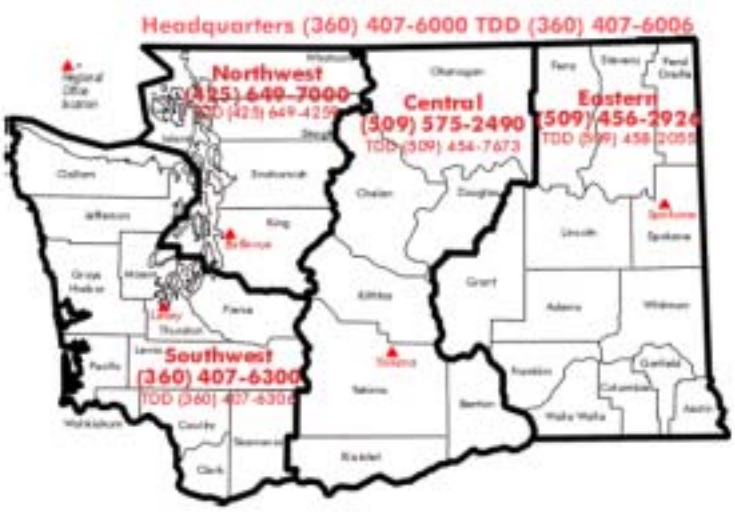

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Introduction

The Washington State Department of Ecology (Ecology) is establishing a total maximum daily load (TMDL) for the upper Yakima River basin, which covers the pollution parameters of turbidity, suspended sediment and organochlorine pesticides. This TMDL will address potential impairments of beneficial uses of the upper Yakima River and its tributaries, including waterbodies listed in the 1998 Section 303(d) list of Washington State's impaired surface waters and other related impaired waterbodies.

Section 303(d) of the federal Clean Water Act mandates that the State of Washington (State) establish Total Maximum Daily Loads (TMDLs) for surface waters that do not meet standards after application of technology-based pollution controls[1]. The U.S. Environmental Protection Agency (EPA) has established regulations (40 CFR Part 130) and developed guidance (EPA, 1991) for setting TMDLs.

Under the Clean Water Act, every state has its own water quality standards designed to protect, restore, and preserve water quality. Water quality standards consist of 1) narrative criteria (i.e. "characteristic uses"), such as protection of cold water biota and drinking water supplies, and 2) numeric criteria, which are set at levels sufficient to achieve the narrative criteria. When a waterbody fails to meet water quality standards after application of required technology-based controls, the Clean Water Act requires that the state place the waterbody on a list of "impaired" waterbodies and to prepare an analysis called a **TMDL**.

The goal of a TMDL is to ensure that the impaired waterbody will attain water quality standards within a reasonable period of time. A TMDL includes a written, quantitative assessment of the water quality problem and of the pollutant sources that cause the problem. The TMDL determines the amount of a given pollutant, called the **loading capacity**, which can be discharged to the waterbody and still meet water quality standards and, subsequently, allocates that load among the various sources. If the pollutant comes from a discrete source (referred to as a **point source**) such as an industrial facility's discharge pipe, that facility's share of the loading capacity is called a **wasteload allocation (WLA)**. If the pollution comes from a diffuse source (referred to as a **non-point source**), that share is called a **load allocation (LA)**.

The TMDL must also consider seasonal variations and include a **margin of safety (MOS)** that takes into account any lack of knowledge about the causes of the water quality problem or its loading capacity. The sum of the individual allocations and the MOS must be equal to or less than the loading capacity.

The general purposes of this submittal document are to:

- Provide suspended sediment, turbidity, and organochlorine pesticide data from historical sampling throughout the upper Yakima River basin, especially that data collected by

[1] Technology-based pollution controls are industry-specific effluent limitations applied to a discharge when it will not cause a violation of water quality standards at low stream flows. Note that the alternative type of effluent limitation is the water-quality based pollutions control, which is based on the receiving water quality and is generally more stringent than the technology-based pollution control.

Ecology, the United States Geological Survey (USGS), the US Bureau of Reclamation (USBR), the Kittitas County Conservation District (KCCD), and the Kittitas Reclamation District (KRD);

- Provide an analysis of such data;
- Identify potential point and non-point sources of such pollution;
- Summarize actions recommended for meeting water quality standards and ongoing monitoring to verify whether standards are being met; and
- Fulfill requirements of the federal Clean Water Act.

A detailed implementation plan (DIP) must be developed within one year after TMDL approval by EPA and will be based on the information presented in this document.

Components of the TMDL

The five components of any TMDL as required by the Clean Water Act are defined as:

Loading Capacity: The maximum amount of the pollutant parameter loading that a receiving water can absorb without violating the respective State water quality standard.

Wasteload Allocation: That portion of a receiving water's loading capacity that is allocated, or attributed, to existing or potential point sources of suspended sediment pollution. The only permitted point sources presently in the upper Yakima River basin are the Cle Elum, Kittitas and Ellensburg municipal wastewater treatment plants, and a minor number of Concentrated Animal Feeding Operations (CAFOs). Since the suspended sediment contributions from the treatment plants comprise less that 0.1% of the total loading to the mainstem Yakima River, no adjustments to the National Pollutant Discharge Elimination System (NPDES) effluent limitations of those municipal facilities is warranted. Similarly, the State's dairy NPDES general permit and individual CAFO permits do not allow any wastewater discharge except as a result of a greater than 25-year, 24-hour storm event. Discharge of organochlorine pesticides is not allowed, and these pollutants have not been detected at these permitted facilities.

Load Allocation: That portion of a receiving water's loading capacity that is attributed either to one of its existing or potential non-point source of pollution or to natural background sources. The load allocations for the various tributaries and the mainstem Yakima River will vary each year, because they are based on water supply, runoff, and other factors. The total DDT and dieldrin load allocations are subject to the same variability, but the load capacity for the pesticides is ultimately measured by fish tissue derived from the watershed's surface waters.

Margin of Safety: The size of the margin of safety (MOS) is inversely proportional to the confidence in the data utilized in the calculations of load allocations. Four conservative assumptions were identified that each provides an inherent MOS.

Seasonal Variation: Water quality data collected in the upper Yakima River basin, for this TMDL study and for other studies, shows a significant pattern of seasonal variation. The greatest suspended sediment and organochlorine pesticide pollution was measured during the period from April through October; therefore, the critical season for TMDL evaluation and compliance is considered to be April through October.

Background

The upper Yakima River basin is located in south-central Washington State and drains nearly half of Washington's eastern slope of the Cascade Mountains (2,139 square miles). Land uses in the basin vary from forestland, range, and intensively irrigated agriculture to urban and suburban areas. A network of supply canals, diversions, and irrigation return drains are located all along the upper Yakima River basin, but are especially concentrated in the lower Kittitas Valley. Water from the Yakima River and the streams flowing through the valley is directed through the irrigation network. The primary monitoring and assessment area consists of the mainstem Yakima River and its major tributaries from RM 121.7 (Harrison Bridge, near the town of Selah) upstream to RM 191 (4.5 miles northwest of Cle Elum on Interstate 90). The upper Yakima River basin is water resource inventory area (WRIA) 39.

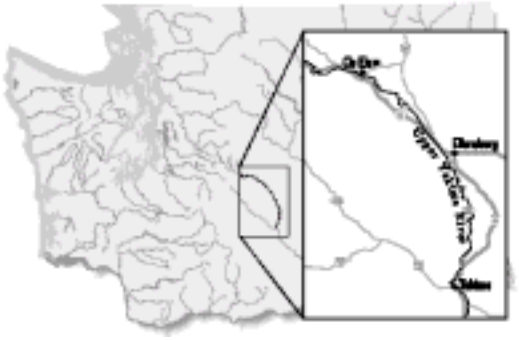

Figure 1: Location of upper Yakima River basin within Washington State

In 1994-1995, Ecology initiated a total maximum daily load (TMDL) evaluation of the Yakima River basin suspended sediment and persistent organochlorine pesticide problem. After conducting preliminary sampling throughout the basin in 1994, Ecology decided to focus its efforts in 1995 on the more severe problems in the lower basin. The lower Yakima River TMDL (Joy and Patterson, 1997) was designed to examine both suspended sediment and its associated pesticides. Based on results from the technical evaluation, Ecology established TMDLs for the main stem and for sub-basins in the lower basin to attain State water quality standards for turbidity, aquatic life criteria for pesticides, and to protect fish health and habitat. In 15 years (2012), TMDL targets will be modified to address human health issues from ingestion of organochlorine-contaminated fish in the lower basin.

Ecology continued its assessment of suspended sediment, organochlorine pesticides, bacteria, and metals in the upper Yakima River basin in 1999. Water quality and fish tissue monitoring were conducted from March 1999 to January 2000[2]. As a result of such monitoring, Ecology recommended that copper, cadmium, silver, and mercury be removed from the 303(d) list for the upper Yakima River (Johnson, 2000); whereas, total DDT (t-DDT= DDT+DDE+DDD) and dieldrin were recommended for continued listing (Rogowski, 2000).

The *Upper Yakima River Basin Suspended Sediment and Organochlorine Pesticide TMDL Evaluation* was completed by Ecology in April 2002 (Joy, 2002 – Appendix A). The evaluation was an extension of the lower Yakima River suspended sediment TMDL, and addressed several organochlorine pesticide 303(d) listings of water column and fish tissue in the upper basin. Turbidity and suspended sediment were included as transport mechanisms for the pesticides, and

[2] Water quality monitoring to re-assess pollution by cadmium, mercury, silver and copper in the main stem Yakima River occurred from March 1999 to January 2000. Water quality monitoring to re-assess organochlorine pesticides in the water column, as well as turbidity and suspended sediments, occurred from April 1999 to October 1999 throughout the upper Yakima River basin. Evaluation of main stem Yakima River fish tissue for organochlorine pesticides occurred in October 1999.

as pollutants themselves. Historical data and data collected during the 1999 critical season (April through October) were used for the TMDL. The data evaluation indicated that:

1) In many tributaries and in the main stem, turbidity and suspended sediment (as total suspended solids [TSS]) exceeded state water quality standards[3] for extended periods that could be harmful to salmon; dieldrin and total DDT had decreased in main stem fish, but some fish samples still exceeded total DDT and dieldrin criteria for human health; concentrations of the individual compounds 4,4'-DDT, 4,4'-DDE, 4,4'-DDD did not exceed fish tissue criteria;
2) Water column 4,4'-DDE, total DDT, and dieldrin exceeded chronic aquatic toxicity and human health criteria at two sites in the Cherry Creek sub-basin; organochlorine pesticide concentrations were not well correlated with suspended sediment, turbidity, or organic carbon in the water column; and
3) Upper basin water quality is improving and is less impaired than the lower basin, but non-point sources will require TMDL targets to protect aquatic communities and human health.

Turbidity targets were calculated for seven sub-basins to decrease suspended sediment loading[4]. Meeting these targets will move the main stem towards meeting a turbidity target of not more than a 5 NTU increase between Nelson (river mile 191) to Harrison Bridge (RM 121.7) by 2011. DDT and dieldrin targets were calculated so Cherry Creek will meet aquatic toxicity and human health criteria. A dieldrin target for the Cle Elum area, and DDT and dieldrin targets were calculated for the Yakima River at Umtanum Creek (near Wymer) based on fish tissue concentrations. Reductions in the availability of organochlorine pesticides to fish are needed to meet human health criteria.

The purpose of the *Upper Yakima River Basin Suspended Sediment, Turbidity and Organochlorine Pesticide TMDL* project is to evaluate the effect of suspended sediment loads on water quality in the upper main stem of the Yakima River during the critical season (April through October), and to recommend best management practices (BMPs) for reducing suspended sediment and organochlorine pesticides in order to meet the water quality targets outlined in this TMDL.

[3] Suspended sediment (as TSS) exceeded narrative criteria, and turbidity exceeded both numeric and narrative criteria, for extended periods that could be harmful to salmonids.

[4] Suspended sediment (measured as TSS) was found to be highly correlated with turbidity in the main stem Yakima River, with $r^2 = 0.951$. Similar values were found for the tributaries. See TMDL technical report (Appendix A) for more detail.

Applicable Water Quality Standards

Within the State, water quality standards are published pursuant to Chapter 90.48 of the Revised Code of Washington (RCW). Authority to adopt rules, regulations and standards as necessary to protect the environment is vested with Ecology. Under the federal Clean Water Act, the EPA Regional Administrator must approve the water quality standards adopted by the State (Section 303(c)(3)). Through adoption of these water quality standards, the State has designated certain characteristic uses to be protected and the standards necessary to protect these uses [Chapter 173-201A of the Washington Administrative Code (WAC)]. These standards were last adopted in November 1997.

All of the surface waters within the area of study of the *Upper Yakima River Basin Suspended Sediment, Turbidity and Organochlorine Pesticide TMDL* are designated either as Class AA or Class A waterbodies. The characteristic beneficial uses and water quality standards for these classifications are listed in Table 1 – note that the water quality standards for all pollutants addressed in this TMDL are the same for both Class A and AA. State law does not establish a ranking or priority among the beneficial uses, but individual waters are expected to support all uses within the classification. This TMDL is designed to address impairments of characteristic (beneficial) uses in the watershed's surface waters due to high suspended sediment, turbidity, and organochlorine pesticide levels.

Table 1: Class AA (extraordinary) and Class A (excellent) fresh water quality standards and characteristic uses (Chapter 173-201A WAC).

	Class AA	Class A
General Characteristic	Shall markedly and uniformly exceed the requirements for all, or substantially all uses.	Shall meet or exceed the requirements for all, or substantially all uses.
Characteristic Uses	Shall include, but not be limited to, the following: domestic, industrial, and agricultural water supply; stock watering; salmonid and other fish migration, rearing, spawning, and harvesting; wildlife habitat; primary contact recreation, sport fishing, boating, and aesthetic enjoyment; and commerce and navigation.	Same as AA.
Water Quality Criteria		
Fecal Coliform	Shall not exceed a geometric mean value of 50 organisms/100 mL, with not more than 10% of samples exceeding 100 organisms/100 mL.	Shall not exceed a geometric mean value of 100 organisms/100 mL, with not more than 10% of samples exceeding 200 organisms/100 mL.
Dissolved Oxygen	Shall exceed 9.5 mg/L.	Shall exceed 8.0 mg/L.
Total Dissolved Gas	Shall not exceed 110% saturation.	Same as AA.
Temperature	Shall not exceed 16.0°C due to human activities. When conditions exceed 16.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C. Increases from non-point sources shall not exceed 2.8°C.	Special condition – temperature shall not exceed 21 °C due to human activities. When conditions exceed 21.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C, nor shall such temperature increase at any time exceed t=34/(T+9). Increases from non-point sources shall not exceed 2.8°C.
pH	Shall be within the range of 6.5 to 8.5 with a man-caused variation with a range of less than 0.2 units	Shall be within the range of 6.5 to 8.5 with a man-caused variation with a range of less than 0.5 units.
Turbidity	Shall not exceed 5 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10% increase in turbidity when the background is more than 50 NTU.	Same as AA.
Toxic, Radioactive, or Deleterious Material (Narrative Criteria)	Shall be below concentrations which have the potential singularly or cumulatively to adversely affect characteristic uses, cause acute or chronic conditions to the most sensitive aquatic biota, or adversely affect public health.	Same as AA.
Aesthetic Values	Shall not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch, or taste.	Same as AA.

Table 2 illustrates that the concentrations for total DDT (t-DDT = 4’4’-DDT + 4’4’-DDE + 4’4’-DDD) and dieldrin in the water column should be less than the chronic and acute aquatic toxicity criteria, as well as less than the National Toxics Rule (40 CFR 131.36) human health criteria. The human health water quality criteria for DDT compounds and dieldrin are based on the carcinogenic risk from consuming fish and water contaminated with these pesticides. Edible tissue concentrations of 45 ug/Kg DDD, 32 ug/Kg DDE or DDT or t-DDT, and 0.65 ug/Kg dieldrin are the criteria calculated for a lifetime carcinogenic risk of 1:1,000,000 according to the National Toxics Rule (40 CFR 131.36). The water column human health criteria are back-calculated from the tissue carcinogenic risk criteria using average bioconcentration factors and tissue lipid content values.

Table 2: US Environmental Protection Agency water quality criteria for DDT, DDE, DDD and dieldrin

Parameter	Human Health Criteria[1]	Chronic Criteria[2]	Acute Criteria[3]
4,4'-DDT	0.00059 ug/L	0.001 ug/L	1.1 ug/L
4,4'-DDE	0.00059 ug/L	0.001 ug/L	1.1 ug/L
4,4'-DDD	0.00083 ug/L	0.001 ug/L	
Dieldrin	0.00014 ug/L	0.0019 ug/L	2.5 ug/L

[1] National Toxics Rule (40 CFR 131.36).

[2] Not to be exceeded as a 24-hour average.

[3] Not to be exceeded at any time.

The State of Washington has established numeric water quality criteria for turbidity, but not for suspended sediment or total suspended solids. Turbidity is easier to measure, and therefore is used as a surrogate measurement of suspended solids or sediment in the water column.

As noted previously, Washington State's water quality standards are based on characteristic uses of a waterbody. Included in the standards are numeric and narrative criteria, as well as antidegradation criteria set to protect the characteristic uses in different classifications of water. The narrative criteria for characteristic uses include salmonid and other fish migration, rearing, spawning and harvesting. These criteria were used to interpret TSS and turbidity data with respect to harm to sensitive aquatic biota. Scientific literature was reviewed, and duration and concentration data for TSS and turbidity were collected for salmonid species present in the upper Yakima River basin. Salmonids are considered among the most sensitive species for which adequate research data are available (Table 3, below). Because Washington State has a water quality standard for turbidity, and because turbidity can be approximately converted to suspended sediment, the data in Table 3 is used to support the numeric targets for turbidity in this TMDL.

Table 3: A summary of suspended sediment effects (as total suspended solids) on selected salmonids commonly present in the Yakima basin based on data collected by Newcombe and McDonald (1991).

Species	Concentration (mg/L)	Duration (hours or days)	Effect
Chinook Salmon	488	4 days	50% mortality of smolts
	6	60 days	Reduction of growth rate
	75	7 days	Harm to quality of habitat
	84	14 days	Reduction of growth rate
Rainbow Trout	157	72 days	100% egg mortality
	21	48 days	62% reduction in egg to fry survival
	37	60 days	46% reduction in egg to fry survival
	7	48 days	17% reduction in egg to fry survival
	90	19 days	5% mortality of sub-adults
	171	4 days	Histological damage to gills
	50	77 days	Reduction of growth rate
	100	1 hr.	Avoidance response
Salmon (general)	8	24 hr.	Sportfishing declines

Water Quality and Resource Impairments

As a consequence of monitoring (Appendix A) that indicated the State's Class AA and A water quality standards had been exceeded, various surface waters within the upper Yakima River basin were found to be impaired. Several of these waterbodies had been included on both the State's 1996 and 1998 Section 303(d) list. Tables 4 through 9 present descriptions of the specific impairments and 303(d) listings, and waterbodies and parameters addressed in this report. These tables are on based on the findings of the TMDL technical evaluation (Appendix A) and associated evaluations (Rogowski, 2000; Johnson, 2000).

Table 4: Water quality limited segments in the upper Yakima River basin that are on the 303(d) list and are addressed in this TMDL report.

Waterbody Name	Old Waterbody Number	New Waterbody Number	303(d)-Listed Parameters Addressed in this TMDL
Cherry Creek	WA-39-1032	FT68CJ	4,4'-DDE, DDT, dieldrin
Yakima River (Naches River to Ellensburg)	WA-39-1010	EB21AR	DDT, dieldrin,
Yakima River (Ellensburg to Cle Elum)	WA-39-1030	EB21AR	DDT

Levels of suspended sediment, turbidity and organochlorine pesticides were assessed in tributaries of the upper Yakima River in order to estimate reductions necessary to meet mainstem Yakima River TMDL targets. Table 5, below, includes waterbody/pollutant pairs that were addressed in this TMDL and did not meet state water quality standards for turbidity when compared to a conservative estimated tributary background value (see Appendices A and B). The remainder of the waterbody/pollutant pairs in Table 5 were found to violate water quality criteria for organochlorine pesticides. None of the waterbody/pollutant pairs in Table 5 currently appear on Washington State's list of impaired waterbodies (the 303(d) list).

Table 5: Water quality limited segments that are not on the 303(d) list but are covered in this TMDL.

Waterbody Name	Old Waterbody Number	New Waterbody Number	Parameters
Manastash Creek	WA-39-3000	AT33DI	Turbidity
Packwood Ditch			Turbidity
Sorenson Creek			Turbidity
Taneum Creek	WA-39-1500	WF36AI	Turbidity
Teanaway River	WA-39-2000	ZH39IA	Turbidity
Wenas Creek	WA-39-1012	RJ61TR	Turbidity
Wilson Creek	WA-39-1020	PY59BF	Turbidity
Wipple Wasteway			4,4'-DDE, t-DDT, dieldrin (water column)
Yakima River (from Naches River to Ellensburg)	WA-39-1010	EB21AR	Turbidity
Yakima River (from Ellensburg to Cle Elum)	WA-39-1030	EB21AR	Turbidity
Yakima River (from Cle Elum to Lake Easton)	WA-39-1060	EB21AR	Dieldrin (FT)

FT = fish tissue

Table 6: Water quality limited segments in the upper Yakima River basin that are on the 303(d) list that are NOT addressed in this TMDL.

Waterbody Name	Old Waterbody Number	New Waterbody Number	Parameters
Cherry Creek	WA-39-1032	FT68CJ	Temperature
Cooke Creek	WA-39-1034	SZ58XV	Fecal coliform*, dissolved oxygen, temperature
Manastash Creek	WA-39-3000	AT33DI	Instream flow
Taneum Creek	WA-39-1500	WF36AI	Instream flow, temperature
Teanaway River	WA-39-2000	ZH39IA	Instream flow, temperature
Wenas Creek	WA-39-1012	RJ61TR	Instream flow
Wilson Creek	WA-39-1020	PY59BF	Fecal coliform*, temperature
Yakima River (from Ellensburg to Cle Elum)	WA-39-1030	EB21AR	Dissolved oxygen, temperature

* Assessed for this TMDL, but evaluation will appear in a subsequent document

Table 7: Water quality limited segments in the upper Yakima River basin, addressed in this TMDL and assigned load allocations*, but which contain pollutants for which the State does not have a numeric standard.

Waterbody Name	Old Waterbody Number	New Waterbody Number	Parameter
Manastash Creek	WA-39-3000	AT33DI	Suspended sediment
Packwood Ditch			Suspended sediment
Sorenson Creek			Suspended sediment
Taneum Creek	WA-39-1500	WF36AI	Suspended sediment
Teanaway River	WA-39-2000	ZH39IA	Suspended sediment
Wenas Creek	WA-39-1012	RJ61TR	Suspended sediment
Wilson Creek	WA-39-1020	PY59BF	Suspended sediment
Yakima River (from Naches River to Ellensburg)	WA-39-1010	EB21AR	Suspended sediment
Yakima River (from Ellensburg to Cle Elum)	WA-39-1030	EB21AR	Suspended sediment

*See Table 11 for sediment load allocations.

As part of the data collection for this TMDL, samples taken from the upper Yakima River mainstem were analyzed for cadmium, copper, mercury and silver in 1999 (Tables 8 and 9). No water quality violations were found for metals, and therefore, there is no longer an impairment from these parameters in the upper Yakima River. A separate technical report was written (Johnson, 2000) on the metals findings. Additionally, when Rogowski (2000) re-evaluated the fish tissue concentrations of DDT metabolites and dieldrin, he found that some levels of these compounds had dropped below criteria (Tables 8 and 9). Therefore in the next 303(d) listing process certain waterbodies will be proposed for de-listing, for certain parameters. Since other water quality impairments were identified following the analysis phase of this TMDL, additional waterbodies may be proposed for inclusion on the 303(d) list. Note that Table 9 includes pollutants analyzed as part of this TMDL (both pollutants that are currently 303(d)-listed and other pollutants that are not 303(d)-listed), as well as pollutants that are mentioned in this TMDL but are analyzed in other documents.

Table 8: Water quality limited segments in the upper Yakima River basin that are on the 303(d) list and for which current data indicates there is no longer an impairment (RECOMMEND DE-LISTING).

Waterbody Name	Old Waterbody Number	New Waterbody Number	Parameters
Yakima River (from Naches River to Ellensburg)	WA-39-1010	EB21AR	4,4'-DDE (FT), cadmium, silver, copper, mercury
Yakima River (from Ellensburg to Cle Elum)	WA-39-1030	EB21AR	4,4'-DDE (FT), cadmium, copper, mercury

FT = fish tissue

Table 9: A summary of waterbodies discussed in this TMDL, either addressed by the TMDL evaluation report (Joy, 2002) or related documents (Rogowski, 2000; Johnson, 2000).

Waterbody Name	Parameter	Town-ship	Range	Section	New ID Number	Old ID Number	1996 303(d) List	1998 303(d) List	Unlisted Impaired*	Recommend De-Listing
Cherry Creek	4,4'-DDE	17N	19E	29	FT68CJ	WA-39-1032	X	X		
Cherry Creek	DDT	17N	19E	29	FT68CJ	WA-39-1032	X	X		
Cherry Creek	Dieldrin	17N	19E	29	FT68CJ	WA-39-1032	X	X		
Manastash Creek	Turbidity/TSS				AT33DI	WA-39-3000			X	
Packwood Ditch	Turbidity/TSS								X	
Sorenson Creek	Turbidity/TSS								X	
Taneum Creek	Turbidity/TSS				WF36AI	WA-39-1500			X	
Teanaway River	Turbidity/TSS				ZH39IA	WA-39-2000			X	
Wenas Creek	Turbidity/TSS				RJ61TR	WA-39-1012			X	
Wilson Creek	Turbidity/TSS				EB21AR	WA-39-1020			X	
Wipple Wasteway	4,4'-DDE								X	
Wipple Wasteway	t-DDT								X	
Wipple Wasteway	Dieldrin								X	
Yakima River	4,4'-DDE	16N	19E	33	EB21AR	WA-39-1010	X	X		X
Yakima River	4,4'-DDE	20N	15E	27	EB21AR	WA-39-1030	X	X		X
Yakima River	Cadmium	16N	19E	20	EB21AR	WA-39-1010	X	X		X
Yakima River	Cadmium	19N	16E	04	EB21AR	WA-39-1030	X	X		X
Yakima River	Copper	16N	19E	20	EB21AR	WA-39-1010	X	X		X
Yakima River	Copper	18N	18E	33	EB21AR	WA-39-1030	X	X		X
Yakima River	DDT	16N	19E	33	EB21AR	WA-39-1010	X	X		
Yakima River	DDT	20N	15E	27	EB21AR	WA-39-1030	X	X		
Yakima River	Dieldrin	16N	19E	33	EB21AR	WA-39-1010	X	X		

Waterbody Name	Parameter	Town-ship	Range	Section	New ID Number	Old ID Number	1996 303(d) List	1998 303(d) List	Unlisted Impaired*	Recommend De-Listing
Yakima River	Dieldrin	20N	14E	36	EB21AR	WA-39-1060			X	
Yakima River	Mercury	16N	19E	20	EB21AR	WA-39-1010	X	X		X
Yakima River	Mercury	19N	16E	04	EB21AR	WA-39-1030	X	X		X
Yakima River	Silver	16N	19E	20	EB21AR	WA-39-1010	X	X		X
Yakima River	Turbidity/TSS				EB21AR	WA-39-1010			X	
Yakima River	Turbidity/TSS				EB21AR	WA-39-1030			X	

*Impaired = does not meet state water quality standards. For tributaries noted as impaired for turbidity, this indicates that the waterbody does not meet water quality standards for turbidity when compared to a conservative estimated background value.

Appendix A (Joy, 2002) also addresses the potential sources and transport mechanisms of suspended sediment and organochlorine pesticides throughout the upper Yakima River basin, as well as the appropriate best management practices (BMPs) for mitigation of that pollution. As noted previously, turbidity and suspended sediment are included in this TMDL as transport mechanisms for the pesticides as well as pollutants in their own right. Dieldrin and DDT compounds are widely dispersed through the basin, but are at high enough concentrations to pose a human health risk from bioaccumulation in fish.

Seasonal Variation

As described earlier in this report, water in the upper Yakima basin is managed for irrigation and flood control. Analyses performed on data from the upper Yakima basin indicated the months of greatest concern for human-caused turbidity, suspended sediment loading, and pesticide transport are April through October.. Turbidity and suspended sediment loads are usually lower outside of this period except during storm events described below. Therefore, the critical season for TMDL evaluation and compliance is the period April through October.

The period from April through October also is a critical time when several beneficial uses are potentially impaired by suspended sediment and pesticide transport in the upper Yakima basin. Various life-stages of several salmonid species are migrating upstream or downstream, holding in side-channel and tributary rearing areas, or spawning in main stem and tributaries of the upper Yakima River between March and October. The period of highest risk from exposure to suspended sediment and turbidity appears to be April through June, when the suspended sediment concentrations are high enough and for a long enough duration to potentially affect emerging chinook fry and incubating steelhead eggs. Potential risks from long-term exposure to suspended sediment and organochlorine pesticides also may occur in Wilson/Cherry creeks and in the mainstem Yakima River below Ellensburg into August. The highest organochlorine pesticide concentrations were also recorded from water samples collected from Cherry Creek and Wipple Wasteway in April through August.

The lower basin TMDL targets are keyed to upper Yakima River water quality during the same time period (April through October). Upper Yakima River basin turbidity and suspended sediment concentrations must be reduced so that water quality-related beneficial uses can be met in the lower basin, e.g., fishery resource protection, elimination of organochlorine pesticide transport, irrigation use, recreational use and aesthetic enjoyment. The upper Yakima water quality conditions must be adequate to ensure that TMDL targets are met within the entire Yakima River.

Modeling Approach

Several mathematical relationships were developed to evaluate the TMDL data. Total suspended solids and discharge data collected during the critical season in 1999 were used to develop a mass balance loading model of the river. TSS concentrations and turbidity were highly correlated during the critical season. Regression equations were used to convert between mg/L TSS and NTU turbidity. Many individual sites had high correlations between mg/L TSS and cfs discharge, or NTU turbidity and cfs discharge. The regression equations were used to develop estimates of continuous daily TSS and turbidity concentrations based on the observed discharge data. Duration and concentration could then be compared to reference criteria (Table 10).

A statistical theory of roll-back (STR) proposed by Ott (1995) was used to estimate the turbidity reductions required to meet the TMDL targets at the mouths of some tributaries for the *Upper Yakima River Basin Suspended Sediment and Organochlorine Pesticide TMDL Evaluation.* The STR relies on basic dispersion and dilution assumptions and their effect on the mean and standard deviation of sampling results at a monitoring site downstream of a source. This allows for calculating a statistical estimate of the future population of sampling results after a specific reduction factor has been applied to the existing sources of pollution.

For the TMDL, Ecology will use the EPA-approved procedure utilized in the lower Yakima River suspended sediment TMDL that allows a 90^{th} percentile background turbidity value at a selected control point for the mainstem Yakima River with 90^{th} percentile compliance of a specified NTU increase at all downstream points. Since the actual amount of control regarding turbidity at each tributary may be quite variable, a tributary-based control methodology was selected to be utilized with the *Upper Yakima River Basin Suspended Sediment and Organochlorine Pesticide TMDL Evaluation* in addition to the single site mainstem Yakima River STR methodology (Table 10).

The best methodology for the organochlorine pesticides is to set loading capacities to the human-health criteria for safe consumption of aquatic organisms and freshwater. This especially makes sense since these pesticides are highly bioaccumulative, and human-health criteria are readily available. Fish tissue concentrations of DDT metabolites and dieldrin were assumed to reflect water column concentrations in the area where the fish were collected. As with the NTR criteria development, fish tissue concentrations were converted to estimated water column concentrations using bioconcentration factors and tissue lipid levels. A simple mass balance loading equation was then used to estimate the t-DDT and dieldrin loads from monitored reaches and tributaries in the TMDL study area.

Loading Capacity

Identification of the loading capacity is an important step in developing TMDLs. By definition, a TMDL is the sum of the individual allocations that are defined as portions of a receiving water's loading capacity assigned to specific point and non-point sources. The *Upper Yakima River Basin Suspended Sediment and Organochlorine Pesticide TMDL Evaluation* establishes specific loading capacities for both pollutant parameters in order to control point and non-point pollution sources within the upper Yakima River basin. This method will correspondingly allow all of the surface waters within the upper Yakima River basin to meet the TMDL targets.

Suspended Sediment and Turbidity

A combination of concentration and duration terms is necessary to estimate the suspended sediment load capacity of the upper Yakima River during the critical season. Since the effects of suspended sediment and turbidity on aquatic organisms are concentration-based rather than load based, allowable concentration increases over an estimated background value and over an acceptable exposures period were used to estimate load capacities. The following steps were taken to include both terms in the load capacity estimates, and to determine the effects of load capacities of tributaries on the main stem load capacity:

- The 10 NTU criterion normally used for Class B waters was used as an interim guideline because natural background turbidity and non-anthropogenic generation and transport of turbidity along the water bodies are not well defined yet;
- The 5 NTU criterion normally used for Class AA and A waters was used as the final guideline; and
- The median and 90th percentile background turbidity statistics were compared to background instead of maximum values to be consistent with the lower Yakima River TMDL, and to allow for variation from natural short-term peak turbidity events.

Estimated suspended sediment load capacities are shown in Table 10. Note that these load capacities were calculated using an estimated background turbidity value for all tributaries. See Tables 14 and 15 in Appendix B for additional information on how the background turbidity values and load capacities were calculated; a more comprehensive discussion of this process is found in Appendix A. Also note that a thorough assessment of background turbidity levels in each of the subbasins is recommended as part of this TMDL (see monitoring strategy section).

Table 10: Suspended sediment load capacities (tons/day) during the critical season (April through October) for key mainstem sites and tributaries along the upper Yakima River, compared to 1999 loads

Site	1999 Load	Mainstem only Background + 5 NTU	Tributary-based Interim	Tributary-based Final
Yakima River at Nelson	14	14	14	14
Teanaway River	77	-	43	28
Taneum Creek	4.1	-	4.1	2.6
Packwood Ditch	1.2	-	1.2	1
Manastash Creek	4.4	-	4.2	2.7
Sorenson Creek	3.2	-	2.7	1.8
Wilson Creek	71	-	47	26
Yakima River at Umtanum Cr.	215	140	159	120
Yakima River at Harrison Br.	131	87	98	75
Estimated % Reduction		**35**	**26**	**44**

From analysis of Table 10, the following determinations can be made:

- When using the statistical rollback method (Ott, 1995), it was determined that to meet the 5 NTU final turbidity guideline the main stem would require a 35% reduction in suspended sediment (see "mainstem only" column in Table 10).
- However, the tributary-based methodology indicated that a cumulative suspended sediment reduction of 44% would be needed (see "tributary-based final" column in Table 10). Thus, the main stem reduction would be adequately achieved while cutting in half almost the TSS and turbidity concentrations in many upper Yakima River tributaries. Also, the duration of elevated turbidity and suspended sediments would be brought within more tolerable periods for aquatic biota when compared to research data (Table 3). For example, the peak TSS concentration at the Yakima River at Umtanum Creek would drop from 74 mg/L to 41 mg/L. Exposure to the two early pulses of suspended sediment concentrations above 20 mg/L for 20 and 16 days would drop to 14 and 10 days.

Organochlorine Pesticides

Based on the 1999 TMDL data results, neither the upper nor the lower Yakima River basins have additional capacity for organochlorine pesticide loading. These pesticides are no longer used in those basin areas, but legacy residuals remain in soils and bed sediments, are widely dispersed through the basin, and continue to contaminate water and biota. Specifically, the estimated total DDT and dieldrin load capacities of Cherry Creek and Wipple Wasteway combined to meet chronic aquatic toxicity criteria compliance is 0.4 g/day t-DDT and 0.68 g/day dieldrin; whereas, in order to protect human health from adverse health risk, such pesticide loadings would need to drop to 0.38 g/day t-DDT and 0.09 g/day dieldrin (see Table 12). The estimated 1999 total DDT and dieldrin loads would need to be reduced by 27% and 88%, respectively, to meet the human health criteria.

The total DDT and dieldrin reductions in Cherry Creek and Wipple Wasteway loads will help meet the target capacities at Wymer, but other reductions are also needed. The estimated 1999 dieldrin load at Cle Elum (1.51 g/day) needs to be reduced by 50% to meet the human health

criterion. Total DDT load reductions are not necessary at Cle Elum since the fish met the human health criterion in 1999. The calculated load reductions at Cherry Creek, and Wipple Wasteway are just adequate for the cumulative total DDT load (4.94 g/day) to meet the total DDT human health criterion load capacity at Wymer (5.08 g/day). The cumulative dieldrin load (2.57 g/day) does not meet the human health criterion load capacity at Wymer (1.24 g/day). An addition 50% dieldrin load reduction from undocumented sources would be necessary to meet this load capacity target.

The organochlorine concentrations were not well correlated with TSS, turbidity, or organic carbon concentrations at the Cherry Creek or Wipple Wasteway sites. This is contrary to the experience of past USGS and Ecology work with lower Yakima basin organochlorine problems (where the suspended sediment and organic carbon relationships have been more predictable even as pesticide concentrations have declined over time), but consistent with USGS data collected ten years ago from Cherry Creek (see Appendix A). However, a threshold for total DDT and dieldrin detection in Cherry Creek and Wipple Wasteway samples appeared to occur at TSS concentrations between 20 and 35 mg/L.

Margin of Safety

A requirement of a TMDL technical evaluation is a discussion of the margin of safety (MOS) to account for uncertainty in the calculated targets and recommendations. The *Upper Yakima River Basin Suspended Sediment and Organochlorine Pesticide TDML Evaluation* contains suspended sediment, turbidity, and organochlorine pesticide data with several gaps, which require conservative assumptions to create the TMDL targets. Most of these assumptions are considered implicit MOS factors, since no load allocation is explicitly assigned to them. The exceptions are the load allocations attributed to unidentified sources along the mainstem Yakima River, portions of which could be errors in calculation or analytical measurement. The following assumptions are implicit MOS factors utilized in the data evaluation:

- Background conditions were set only at a single control site on the Yakima River, below a reservoir (Lake Easton), to evaluate turbidity criteria. By using the 90^{th} percentile statistic, approximately 90% of suspended sediment loading and turbidity levels gained downstream of the control site were considered human-caused and, therefore, remediable. As yet, only 10% of the load was implicitly allocated for natural generation of turbidity or suspended sediment;
- Load allocations to the tributaries to meet their turbidity targets will reduce the total suspended sediment loading by more than necessary to meet the estimated mainstem Yakima River capacity. The final TMDL targets will reduce the loading to the main stem by an estimated 44%, when only an estimated 35% is needed to meet the loading capacity;
- Maximum organochlorine pesticide concentrations in fish samples were used to set loading capacities and TMDL targets in the mainstem Yakima River, and exposure of fish to pesticides was assumed to be through water contact rather than sediment and food routes; and
- The dieldrin and total DDT concentration used for Wilson/Cherry Creek in Table 13 of the *Upper Yakima River Basin Suspended Sediment and Organochlorine Pesticide TMDL Evaluation* as the seasonal average was the maximum concentration calculated from the combined discharge of the two branches.

Wasteload and Load Allocations

Wasteload Allocations

The only potential municipal point sources of suspended sediment and organochlorine pesticides in the upper Yakima River basin are the wastewater treatment plants for Cle Elum and Ellensburg. The *Upper Yakima River Basin Suspended Sediment and Organochlorine Pesticide TMDL Evaluation* determined that such municipal point sources were probably responsible for less than 0.1% of the TSS loading and that no adjustments to their present effluent limitations would be necessary. The Cle Elum wastewater treatment plant (WWTP) should reduce loads by keeping TSS concentrations below 75 mg/L (the allowed permit limit for lagoon systems) as much as possible. When a new plant is built in Cle Elum, NPDES permit limits for TSS should take the TMDL loads into account.

Load Allocations

Data evaluation as presented in the *Upper Yakima River Basin Suspended Sediment and Organochlorine Pesticide TMDL Evaluation* indicated that seven tributaries to the upper Yakima River need suspended sediment reductions to meet the final 5 NTU turbidity increase over background. Two of these tributaries, Teanaway River and Wilson Creek, contributed over 75% of the total seasonal load of suspended sediment to the mainstem upper Yakima River.

The relative suspended sediment load and wasteload allocations from April through October for the surface waters within the study area of the upper Yakima River basin are presented in Table 11. Note that wasteload allocations have been assigned to both the Cle Elum WWTP and the Ellensburg WWTP as stated in Table 11.

Table 11: Load and wasteload allocations (tons/day) of suspended sediment for the mainstem upper Yakima River and its tributaries.

Site	1999 Load	Interim LA[1] and WLA[2]	Final LA[1] and WLA[2]
Yakima River at Nelson	14	14	14
Cle Elum River	5.8	5.8	5.8
Crystal Creek	0.03	0.03	0.03
Cle Elum WWTP	0.12	0.16[3]	0.16[3]
Teanaway River	77	43	28
Swauk Creek	6.4	6.4	6.4
Taneum Creek	4.1	4.1	2.6
Dry Creek	0.11	0.11	0.11
Packwood Ditch	1.2	1.2	1.0
Manastash Creek	4.4	4.2	2.7
Ellensburg WWTP	0.05	0.44[3]	0.44[3]
Reecer Creek	0.5	0.5	0.5
Sorenson Creek at Fogerty	3.2	2.7	1.8
Wilson Creek	71	47	26
Wenas Creek	3.9	3.9	3.7

[1] LA = load allocation
[2] WLA = wasteload allocation
[3] Based on current NPDES permit effluent limitations

The load allocations for total DDT and dieldrin during the same period are given in Table 12. The organochlorine pesticide allocations are subject to the same variability as the suspended sediment concentrations (i.e., water supply, runoff, and other factors) but the load capacity for pesticides is ultimately measured through fish tissue samples.

Table 12: Load allocations (grams/day) of total DDT and dieldrin for the mainstem upper Yakima River and its tributaries.

Site	1999 Load		Interim LA[1]		Final LA[1]	
	Total DDT	Dieldrin	Total DDT	Dieldrin	Total DDT	Dieldrin
Wipple Wasteway	0.52	0.76	0.40	0.68	0.38	0.09
Cherry Creek	0.52	0.76	0.40	0.68	0.38	0.09
Yakima River near Cle Elum	2.08	1.51	2.08	1.51	2.08	0.75
Yakima River at Wymer	5.08	4.0	5.08	4.0	5.08	1.24

[1] LA = load allocation

The interim and final load allocations for organochlorine pesticides are shown in Table 12 and are based on meeting the aquatic toxicity criteria and meeting the human health criteria, respectively. The suspended sediment and organochlorine pesticide loads in the study area are almost certainly related to nonpoint sources, and an iterative approach is recommended. There are several reasons to propose this type of approach:

- The greatest increases in turbidity over background conditions in April through June, and the degree to which snowmelt and high background contributes to increases in the main stem and tributaries has not been determined;
- Adequate background turbidity and suspended sediment data from areas without "anthropogenic sources" should be collected in many tributaries;
- The effectiveness of nonpoint source controls on the wide variety of land uses cannot yet be quantified, e.g. the time necessary to stabilize stream banks with riparian vegetation;
- Organochlorine pesticides controls may not respond directly to soil and channel erosion controls if they are not applied to specific sites with high pesticide residues; and
- Unidentified loads of total DDT, dieldrin, and suspended sediment are significant portions of the total loads.

Summary Implementation Strategy

Introduction

Pursuant to the 1997 Memorandum of Agreement between Ecology and the EPA, a Summary Implementation Strategy (SIS) is included in this submittal report for the *Upper Yakima River Basin Suspended Sediment and Organochlorine Pesticide TMDL Evaluation*. This SIS presents a clear, concise and sequential concept of how suspended sediment, turbidity and organochlorine pesticide pollution will be reduced within the upper Yakima River basin in order to meet the turbidity targets for this TMDL, as well as the aquatic toxicity and human health criteria for DDT and dieldrin. It is anticipated that implementation of the TMDL will return this waterbody to conditions that meet the targets and criteria noted above by October 2011. The SIS complies with the federal mandate of the Clean Water Act, State laws to control point and non-point source pollution, and the 1997 Memorandum of Agreement between EPA and Ecology.

A citizen's workgroup was formed in late 2000 to guide development of the technical report and this implementation strategy. Groups represented in the TMDL workgroup include the timber industry, irrigated agriculture, ranchers, conservation districts and natural resource agencies, the Yakama Nation and the US military, as well as numerous other interested parties or stakeholders, agencies and organizations. There is a high level of cooperation and communication between project participants, and their continued active pursuit of the TMDL's goals will ultimately ensure the success of this TMDL.

The strategy to implement the TMDL is based upon the continuation of the many existing efforts already underway throughout the watershed to reduce suspended sediment in project area waterways, including best management practices (BMPs). The non-point sources (load allocations) will be addressed by the use of BMPs. The principal focus of the TMDL will be to continue the implementation of seasonal and year-round BMPs to prevent the entry of sediment into area waterbodies. Additionally, continued monitoring of implementation activities and water quality is essential in assessing the progress of the TMDL.

A detailed implementation plan (DIP) will be prepared within a year following EPA's approval of the TMDL submittal report. Continued workgroup support and additional public input will be sought to help prepare this plan. The DIP will identify specifically how, when, and where voluntary restoration activities will be implemented. A detailed monitoring plan will also be developed. Ecology and other entities will provide technical assistance and seek additional funding for these restoration activities and monitoring.

Implementation Plan Development

Several key milestones in the TMDL implementation effort are worth noting. In 1998, Ecology initiated the TMDL process by meeting with groups within the project area to determine the scope of the TMDL. Ecology staff completed a quality assurance project plan (QAPP) for the TMDL in 1999. Field studies were conducted April through October of 1999, and a preliminary technical analysis of the field data was completed in 2000. In late 2000, a technical advisory workgroup (TAW) formed to direct development of the TMDL, and several TAW meetings were held in 2001 and 2002. TAW subcommittees, representing irrigated agriculture and forestry interests, also met

in early 2001. Ecology staff made several additional presentations regarding this TMDL to interested groups. Drafts of the technical report were presented to the workgroup for comments in June and December of 2001, and the report was finalized in April 2002. The public comment period for this TMDL was April 24 through May 24, 2002, and two public workshops were held during the public comment period. Newspaper display ads and media advisories were released to the press prior to public comment period. Focus sheets explaining the TMDL were distributed in both 2001 and 2002.

As noted previously, Ecology will facilitate development of a DIP, which will be completed within a year after EPA's approval of the TMDL submittal. Many members of the TAW may choose to become members of the DIP workgroup, and Ecology will also seek to include other additional community members who will be actively involved in BMP implementation. As the DIP is developed, anticipated workgroup products may include commitments from stakeholders to pursue the TMDL targets, and each entity will be asked to commit to an implementation schedule which will be appended to the DIP. Specific BMPs for each type of land use will be described in the DIP.

Additionally, the DIP workgroup will be asked to help develop a detailed monitoring plan. The plan will include monitoring to determine specific background levels for many of the tributaries, further monitoring for organochlorine pesticides, assessment of success in meeting TMDL targets, and so on. A more complete description of proposed monitoring activities appears later in this document.

Point sources (wasteload allocations) will be addressed through reissuance or modification of National Pollutant Discharge Elimination System (NPDES) permits. The non-point sources (load allocations) will be addressed by the use of BMPs. Continued monitoring of implementation activities and water quality is essential in assessing the progress of the *Upper Yakima River Basin Suspended Sediment, Turbidity and Organochlorine Pesticide TMDL*.

Implementation Activities

Turbidity targets (interim and final) are set by the TMDL for the mainstem upper Yakima River, and the tributaries and drains entering the upper Yakima River. The principal focus of the TMDL will be to continue the implementation of BMPs to prevent the entry of sediment into these waterbodies.

Several major land use groups will continue to implement BMPs to reduce suspended sediment in upper Yakima Basin waterways. These groups include the timber industry; irrigated agriculture; ranchers; state, county and municipal governments; homeowners with waterfront property; and the US military.

The owners of the largest tracts of public forested land in the upper Yakima River basin are the US Forest Service and the Washington Department of Natural Resources. The largest private timber owners are the Plum Creek Timber Company, the Boise Cascade Corporation and the US Timberlands Company. Much timber acreage is also held in small tracts by numerous private landowners. All of these groups are participating in activities that will reduce amounts of suspended sediment entering tributaries of the upper Yakima River. The private and state

landowners are implementing improvements required by the Forests and Fish rules, and the US Forest Service is following the Memorandum of Agreement (MOA) with Ecology.

Within the area of this TMDL, most irrigated agriculture in the upper Yakima Basin occurs in lower Kittitas County, although some also occurs in upper Kittitas County and the Wenas Creek area of Yakima County. In recent years, irrigators have made great strides toward reduced suspended sediment and organochlorine pesticide levels in area waterbodies, and will continue to implement best management practices (BMPs) in these areas to meet TMDL targets. Local agricultural advisory groups (the Kittitas County Conservation District, the North Yakima Conservation District, the Natural Resources Conservation Service (NRCS), Solar$, and others) will continue to offer technical assistance and secure funding to assist irrigators. Additionally, the Kittitas County Water Purveyors (KCWP) – a consortium of area irrigation districts, companies and creek water rights holders – will offer outreach to members to enable them to meet TMDL goals.

Livestock managers will continue to implement appropriate BMPs appropriate for grazing operations. These practices will help protect riparian areas (thereby preventing streambank erosion) within the project area. Both the NRCS and KCCD will provide technical assistance to livestock managers to ensure correct installation of these BMPs.

Because eroding roads and roadside ditches can be sources of suspended sediment in area waterways, road maintenance departments of Kittitas County, Yakima County and Washington State have made both verbal and budgetary commitments to continue to maintain their roads in such a manner as to minimize erosion.

The US Army, Yakima Training Center (YTC) has an ambitious erosion prevention program aimed at minimizing the entry of sediment into Lmuma and Selah Creeks, which are tributaries of the upper Yakima River. This is a long-term funded program with dedicated resources, managed by staff trained in natural resource issues.

Kittitas County and Yakima County have developed and currently administer their respective sets of Critical Areas Ordinances and Shoreline Master Programs. In general, the enforcement of these laws helps to ensure that critical areas and shorelines will be protected throughout these counties, thereby also helping to attain the goals of this TMDL

A free agricultural pesticide turn-in event will be held in Kittitas County in 2003. Although the use of DDT was banned in the United States in 1973, and use of dieldrin was banned in 1974, these pesticides are still occasionally found in their manufactured form – and a penalty-free pesticide collection will help to remove remaining sources of these pollutants.

Responsible Entities, Actions and Timeline

Agriculture: The conservation agencies (the KCCD, NYCD and NRCS) are the entities responsible for technical assistance and financial support (where possible) to promote implementation of agricultural BMPs throughout the watershed. Individual irrigators are responsible for the implementation of irrigation BMPs. Ranchers and other livestock managers are responsible for implementing BMPs that prevent bank erosion. The KCWP is the entity

currently (2002-03) conducting water quality monitoring on agricultural lands in Kittitas County per grant agreement, and the NYCD is the entity currently conducting water quality monitoring in upper Yakima County – this may be modified in future years.

Forestry: Private and state timber owners are responsible for implementing appropriate BMPs (as specified in the Forests and Fish rules) on their lands. The Washington Department of Natural Resources (DNR) is responsible for oversight of the Forests and Fish rules. The Cooperative Monitoring Evaluation and Research (CMER) committee is responsible for evaluation of the Forests and Fish rules to support the adaptive management process. The US Forest Service is responsible for implementation of appropriate BMPs (as specified in the MOA with Ecology) on their lands.

Other: Kittitas County, Yakima County and Washington State Department of Transportation (WSDOT) are responsible for maintaining roads and roadside ditches within their various jurisdictions. The YTC is responsible for minimizing erosion resulting from military practice maneuvers. Individual homeowners who live adjacent to waterbodies within the project area are responsible for avoiding actions that cause destabilization and erosion of streambanks.

Ecology is the responsible entity for determining compliance of interim and final targets.

Table 13, below, organizes the responsible entities, and general actions and timelines, for the implementation of the TMDL. The information listed in the table is part of the overall strategy and may change as personnel and monetary resources are better defined during the development of the DIP.

*Note: Please refer to the list of acronyms and abbreviations (**Table 16, Appendix C**) for further assistance with **Table 13.***

Table 13: Organization of TMDL entities and their contributions

Entity	Responsibilities to be met	Year of TMDL									
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Technical Advisory Workgroup (TAW)	Identify future monitoring needs and funding sources, and develop strategy.	X									
Ecology	Distribute a brochure (in Spanish and English) regarding prevention of erosion from project area streambanks	X									
CMER	Monitoring of Forests and Fish rules in support of adaptive management	X	X	X	X	X	X	X	X	X	X
DNR	Administration and enforcement of Forests and Fish rules	X	X	X	X	X	X	X	X	X	X
Homeowners with waterfront property	Avoid actions that will cause streambank destabilization or erosion, or will otherwise add sediment to area waterways	X	X	X	X	X	X	X	X	X	X

Entity	Responsibilities to be met	Year of TMDL									
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Irrigation Entities (Districts and Companies)	Where possible and appropriate, implement BMPs to prevent entry of suspended sediment into area waterways	X	X	X	X	X	X	X	X	X	X
Irrigators	Implement appropriate BMPs to prevent entry of sediment-laden agricultural return flows into area waterways	X	X	X	X	X	X	X	X	X	X
KCCD, NRCS and Ecology	Continue to fund agricultural BMP implementation: controlling agricultural runoff, reducing suspended sediment in drains and tributaries, preventing streambank destabilization and erosion	X	X	X	X	X	X	X	X	X	X
KCCD, NRCS, NYCD	Extend outreach efforts and technical assistance to all agricultural producers (irrigators, livestock managers, others) in the watershed	X	X	X	X	X	X	X	X	X	X
KCWP, NYCD, KCCD	Continue to monitor water quality of the watershed's surface waters (as possible given funding availability)	X	X			X				X	X
Kittitas County, Yakima County	Administration of Critical Area Ordinances and Shoreline Master Programs	X	X	X	X	X	X	X	X	X	X
Kittitas County, Yakima County, WSDOT	Continue to maintain roads and roadside ditches to prevent entry of sediment into area waterways	X	X	X	X	X	X	X	X	X	X
Private and state timber owners	Implement forest management practices as required by Forests and Fish rules	X	X	X	X	X	X	X	X	X	X
Ranchers	Implement livestock management BMPs to prevent streambank destabilization and erosion	X	X	X	X	X	X	X	X	X	X
YTC	Take actions to minimize erosion following military maneuvers at the US Army's Yakima Training Center	X	X	X	X	X	X	X	X	X	X
US Forest Service (USFS)	Implement forest management practices as required by MOA with Ecology.	X	X	X	X	X	X	X	X	X	X
Ecology, TAW	Complete the DIP		X								
TAW	Discuss results of new BMPs and determine appropriate locations for implementation.					X					
TAW	Review if interim target has been met, and if not, devise action plan.					X					
Ecology	Evaluate if the water quality samples at points of compliance meet the interim and final targets					X					X
TAW	If interim target was not met, implement action plan to meet target.						X	X	X	X	X
KCWP, KCCD, NYCD	Determine if changes in monitoring sites, tests or frequency are needed.						X				
Ecology, KCWP, KCCD	Determine if alternate outreach efforts are needed.						X				
DNR	Determine if private and state timber owners are meeting water quality requirements of Forests and Fish rules								X		
TAW	Review if final TMDL targets have been met, and if not, identify new timeline and BMPs needed.										X

Compliance Targets and Schedule

Interim Targets: October 2006

- Cherry Creek and Wipple Wasteway water column concentrations of individual DDT compounds, total DDT, and dieldrin will not exceed aquatic toxicity criteria (0.001 ug/L DDT compounds, or total DDT, and 0.0019 ug/L dieldrin).
- Concentrations of total DDT or individual DDT compounds will not exceed 32 ug/Kg wet weight in fish fillet samples collected from the upper Yakima River.
- Dieldrin concentrations in fish fillet samples will be monitored for progress toward meeting a compliance target of 0.65 ug/Kg wet weight. If progress has not been made relative to samples collected in 1999, studies will be undertaken to determine additional sources, transport, mechanisms, and uptake of dieldrin in the basin.
- The 90th percentile of the turbidity values collected at the mouths of the Teanaway River, Manastash Creek, Sorenson Creek at Fogerty Ditch, and Wilson Creek below Cherry Creek will not exceed 10 NTU over the 90th percentile background value established for the site.
- The 90th percentile of the turbidity values collected at the Yakima River at Umtanum Creek (RM 139.8) and the Yakima River at Harrison Bridge (RM 121.7) will not exceed 10 NTU over the 90th percentile turbidity value of samples collected from the Yakima River at Nelson (RM 191).

Final Targets: October 2011

- Cherry Creek and Wipple Wasteway water column concentrations of individual DDT compounds, total DDT, and dieldrin will not exceed human health criteria (0.00059 ug/L DDT or DDE compounds, or total DDT, 0.00083 ug/L DDD, and 0.00014 ug/L dieldrin). If progress has not been made relative to samples collected in 1999 and 2006, additional studies will be undertaken to determine the best ways to prevent transport of dieldrin from the basin soils.
- Dieldrin concentrations in fish fillet samples will make substantial progress toward meeting a compliance target of 0.65 ug/Kg wet weight in the upper Yakima basin.
- The 90th percentile of the turbidity values collected at the mouths of the Teanaway River, Manastash Creek, Sorenson Creek at Fogerty Ditch, Wilson Creek below Cherry Creek, Taneum Creek, and Wenas Creek will not exceed 5 NTU over the 90th percentile background value. The geometric mean turbidity at the mouth of Packwood Ditch will not exceed 5 NTU over the geometric mean turbidity of the background site.
- The 90th percentile of the turbidity values collected at the Yakima River at Umtanum Creek (RM 139.8) and the Yakima River at Harrison Bridge (RM 121.7) will not exceed 5 NTU over the 90th percentile turbidity value of samples collected from the Yakima River at Nelson (RM 191).

Reasonable Assurance

The ultimate goals of this TMDL are to meet the chronic aquatic toxicity and human health criteria for DDT and dieldrin, and to meet the TMDL targets for turbidity. Maintaining the TMDL goals will be required once compliance has been achieved. Ecology offers reasonable assurance that the TMDL goals will be met due to the following:

- A technical advisory workgroup (TAW) was formed to direct and support development of the *Upper Yakima River Basin Suspended Sediment, Turbidity and Organochlorine Pesticide TMDL*. In such capacity, the TAW has made many suggestions for modifications to the TMDL report. The majority of members of the TAW are key community members with interests in compliance, and who promote the success of implementation. The TAW has recommended and supports most of the activities in the preceding section. The TAW is a highly functional group, and is dedicated to meeting the goals of the TMDL.
- According to KCCD records, past BMP implementation for mitigating the runoff of suspended sediment from irrigated agriculture has reduced mean suspended sediment levels in the Wipple Wasteway by 43% between 1993 and 1999. Much of this success is due to the dedicated efforts of the KCCD and NRCS in Kittitas County. More recent monitoring results indicate this trend is continuing and will meet TMDL goals well within the recommended timeframe.
- The KCWP, a consortium of Kittitas County irrigation districts, irrigation companies, and creek diverters, has identified as one of its primary goals: "participation in local and regional efforts that support Clean Water Act compliance for water purveyors and irrigated agriculture." In order to reduce organochlorine pesticides and suspended sediment in project area waters that receive irrigation return flows, the KCWP has proposed a creative and assertive seven-point approach to water quality monitoring, outreach, BMP implementation, and resolution of water quality complaints. The active support of the KCWP will ensure success of this TMDL.
- Ecology has a Memorandum of Agreement (MOA) with the KCCD, signed in 1988, that allows Ecology to refer most verified agriculture-related water quality complaints to the KCCD for resolution of the problems. (However, Ecology will investigate and seek resolution of all complaints that appear to need immediate action.) When a complaint is referred to the KCCD by Ecology, the KCCD will meet with the owner/operator of the property where the violation occurred, assist the owner/operator in the development of a water quality management plan, provide technical assistance to complete the plan and monitor plan implementation, notify Ecology regarding the owner/operator's willingness to correct the problem and successful implementation of the water quality management plan, and annually submit to Ecology a formal summary of progress on referred water quality violations. While Ecology maintains lead enforcement responsibility for resolution of the referred complaints, this MOA expedites and streamlines correction of agricultural water quality violations, and is a key element in the reduction of sediment and organochlorine pesticides in project-area waterways.
- The KCCD also promotes water quality improvements in the upper Yakima River basin in many other ways, including: administration of cost-share funding for on-farm irrigation improvements; completion of water quality studies; publication of these water quality studies; publication and distribution of newsletters regarding water conservation and

irrigation upgrades; and they have held numerous local workshops regarding water issues. Additionally, the NRCS supports the actions of the KCCD, and provides comprehensive technical assistance and funding to irrigators and ranchers. The continued actions of the KCCD and NRCS further help ensure the success of this TMDL.

- The KCCD, NRCS, KCWP and Solar$ published a "*Small Ranch Manual*" in 2001, and they anticipate publication of an additional handbook summarizing BMPs for rural landowners. Both of these documents will help private homeowners find ways to comply with the TMDL.
- All owners of private and state timberland within the project area, in accordance with the Forests and Fish rules, are actively working to identify and improve problem roads, and to protect riparian areas to reduce bank erosion. Road maintenance and abandonment plans must be completed by 2006, using 303(d)-listings as one of the prioritization criteria. Water quality should improve quickly in the first years because landowners are required to address those roads causing the worst water quality problems and/or posing the greatest risk to beneficial uses first. An integral part of the Forests and Fish rules is the adaptive management process, which seeks to evaluate the effectiveness of these rules and modify them as necessary over time. Additionally, the private timber companies have enacted grazing programs and recreational use policies that will further protect riparian areas and protect bank erosion.
- In 2000, the USFS – Region 6 and Ecology signed a Memorandum of Agreement (MOA) addressing protection of water quality on federal forest lands in Washington State. As part of the required actions under this MOA, the USFS is actively working to maintain and improve roads that may cause the entry of sediment into area waterways. The USFS has also developed several programs to restore damaged riparian areas and to educate the public regarding respect for rivers and riparian areas. All of these efforts will directly support this TMDL and help to ensure its success.
- Kittitas County and Yakima County have developed and currently administer their respective sets of Critical Areas Ordinances and Shoreline Master Programs. In general, these laws require that riparian areas be protected from erosion and general destabilization, and that development along shorelines must be controlled. Enforcement of these laws helps to ensure that streambank erosion in much of the project area can be reduced, directly supporting this TMDL
- The *Teanaway Temperature TMDL*, which was recently approved by the EPA, recommends reduction of suspended sediment to expedite reduction of water temperatures. Activities recommended for sediment reduction under the TMDL include increased bank stabilization, and improvement and maintenance of roads. The dedicated Teanaway citizens' workgroup continues to plan and implement activities identified in the Teanaway TMDL. The activities that are being undertaken to study and, wherever possible, reduce sediment as a part of the Teanaway TMDL water quality restoration plan will improve the overall picture of suspended sediment in the upper Yakima River and its tributaries, since the Teanaway River is a major contributor of suspended sediment to the Yakima River. Therefore, compliance with sediment-reduction implementation activities required by the *Teanaway Temperature TMDL* will meet the requirements of this TMDL (i.e., *Upper Yakima River Basin Suspended Sediment, Turbidity and Organochlorine Pesticide TMDL*). The detailed implementation plan for the Teanaway TMDL will be written to support the requirements of this upper Yakima River basin suspended sediment and organochlorine pesticides TMDL.

- Whenever applicable BMPs are not being implemented and Ecology has reason to believe that individual sites or facilities are causing pollution in violation of RCW 90.48.080, Ecology may seek enforcement to gain compliance with the State's water quality standards.

Adaptive Management

Where new (not previously identified) sources of suspended sediment or organochlorine pesticides are discovered, they will be remedied through the appropriate jurisdiction. If or when planned implementation activities are not producing expected or required results, Ecology or other entities may choose to do additional studies to identify the significant sources of sediment or organochlorine pesticide input to the river system. If the causes can be determined, additional implementation measures may be needed. If the shortfall does not have an apparent cause (e.g., everyone is implementing required BMPs and all potential sources have been addressed, but targets are not being met), then more studies may be required. Conversely, should water quality standards be met prior to achieving the specific target allocations outlined here-in, the purpose of this TMDL shall be satisfied. Re-evaluation of the status of this TMDL will be conducted every five years.

For non-federal forested areas, the agreements in the Forests and Fish Report incorporate adaptive management as needed to ultimately meet state water quality standards. The USFS also has a policy of adaptive management.

Summary of Public Involvement

As noted previously, a citizen's workgroup was formed in late 2000 to guide development of the technical report and implementation strategy. Groups represented in the TMDL workgroup include the timber industry, irrigated agriculture, ranchers, conservation districts and natural resource agencies, the Yakama Nation and the US military, as well as numerous other interested parties or stakeholders, agencies and organizations. This workgroup met numerous times during the development of this TMDL.

In addition to the numerous meetings of the technical workgroup, Ecology staff presented information about this TMDL to several interested groups.

The public comment period occurred from April 24 through May 24, 2002, and two public workshops were held during this period also. Copies of the newspaper display ads (and affidavits of publication) are included in Appendix D. Responses to public comments received during the public comment period can be found in Appendix E.

An Ecology "Focus Sheet" summary of this TMDL was published in April 2001, handed out to numerous interested persons, and distributed at several public meetings. In April 2002 the focus sheet was updated, mailed (as an irrigation district newsletter insert) to thousands of irrigators, and has also been distributed widely as handouts. A copy of the focus sheet is included in Appendix D.

Monitoring Strategy

Kittitas County Conservation District and Kittitas County Water Purveyors monitoring and studies in the Wilson Creek/Cherry Creek sub-basin have been helpful for identifying water quality problem areas. These two groups should continue to work together and may want to become the core of a monitoring clearinghouse in the basin. The clearinghouse would encourage close coordination with the US Bureau of Reclamation (USBR), Ecology, the US Geological Survey (USGS), and other monitoring performed by government or private groups. The clearinghouse should especially try to include groups working in the Teanaway and other headwater areas. Staff and projects from Central Washington University should also be encouraged to participate. Ties to lower Yakima or basin-wide monitoring efforts may be more efficient through such a clearinghouse.

The following are monitoring needs identified during the course of the TMDL evaluation and recommended for inclusion into the final TMDL monitoring plan:

- Siting background stations in each of the sub-basins with TMDL targets, and monitoring turbidity, total suspended solids, and discharge over two irrigation seasons; or selecting representative basins for monitoring based on land use, geology, or other analytical factors;
- Intensive site placement and monitoring between the Yakima River at Nelson and the USBR Yakima River at Ellensburg gage to identify sources of suspended sediment;
- Tracking and documenting obvious sources of excessive suspended sediment and turbidity in the Cherry Creek/Wilson Creek sub-basin, and in the Sorenson Creek sub-basin;
- Periodic monitoring of organochlorine pesticides from sites in Cherry Creek sub-basin, and monitoring fish tissue at historical main stem sites, and between Cle Elum and Wymer;
- Designing a monitoring project to better understand uptake rates of organochlorine pesticides by fish in the Yakima basin from various environmental compartments, e.g. food, water, and sediment;
- Designing a monitoring project to track dieldrin transport from contaminated field soils to nearby drains or creeks to better understand the chemodynamics involved;
- Collecting necessary data to construct a spatial model that simulates erosion, sediment and pesticide transport in irrigated and non-irrigated areas of the basin. May include non-irrigation season monitoring where appropriate to determine sources of sediment into the irrigation system outside the irrigation season; and
- Monitoring sediment levels, and identifying sediment sources, in the Teanaway Basin.

Potential Funding Sources

Potential funding sources available through Ecology's water quality grants program include the Centennial Clean Water Fund, Section 319 grants under the federal Clean Water Act, and the State Revolving Fund (SRF) grants. Funding for floodplain mapping also may be available.

The NRCS directs its Environmental Quality Incentives Program (EQIP). EQIP provides technical, educational, and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. The program is implemented through conservation plans that include structural, vegetative, and land management practices. Contracts are 5 to 10 years long.
The NRCS also sponsors the Conservation Reserve Enhancement Program (CREP), which is a voluntary cost share program designed to restore and enhance habitat and increase bank stability along waterways on private lands with a cropping history. The program offers payments for annual rental, signing, cost share, practice, and maintenance in exchange for removing land from production and grazing, under 10-15 year contracts.

Additionally, the NRCS can initiate funding under Public Law 83-566, the Watershed Protection and Flood Prevention Act. This federal law can fund watershed projects that include watershed protection, water quality improvements, soil erosion reduction, irrigation water management, sedimentation control, and fish and wildlife habitat enhancement.

The KCCD provides cost-share programs to irrigators and ranchers, including riparian restoration, farm plans, and sprinkler conversion projects.

Kittitas County, through the KCCD, provides cost-share money to irrigators to reduce suspended sediment in return flow. This program specifically helps supply polyacrylamide (PAM) to irrigators, which helps keep soil on-farm.

Because much of the upper Yakima River basin is considered critical salmon habitat, state and federal salmon restoration efforts and associated funding should support implementation under this TMDL.

The USBR also has been working with landowners in the upper Yakima Basin who are interested in selling conservation easements that could provide additional riparian protection. Funding is through the Yakima River Basin Water Enhancement Project (YRBWEP), Public Law 103-434.

Cost-share can and should be sought by all cooperating groups, but it should be recognized that implementation of BMPs (with or without cost share) requires that individual landowners make an investment in the practice.

References Cited

Johnson, A., 2000. Concentrations of 303(d) Listed Metals in the Upper Yakima River. Washington Department of Ecology Publication Number 00-03-024. Olympia, WA, 26 pgs.

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US Environmental Protection Agency (EPA). 1997. Memorandum of agreement between the United States Environmental Protection Agency and the Washington State Department of Ecology regarding the implementation of Section 303(d) of the Federal Clean Water Act.

US Environmental Protection Agency (EPA). 1991. Guidance for water quality-based decisions: the TMDL process. April 1991. EPA 444/4-91-001.

Appendix A: Technical Assessment Report

Bound separately as Ecology Publication No. 02-03-012:
Upper Yakima River Basin
Suspended Sediment and Organochlorine Pesticide
Total Daily Maximum Load Evaluation

Joe Joy
April 2002

Washington State Department of Ecology
Environmental Assessment Program

Available in hard copy on request or online at http://www.ecy.wa.gov/biblio/0203012.html

Appendix B: Supplementary Tables

Table 14: Turbidity control site values for the upper Yakima tributaries and mainstem in 1999 and estimates of 10 NTU and 5 NTU increases (from Table 14 in the TMDL technical evaluation (Joy, 2002).

Data Set	1999 Irrigation Season		+10 NTU		+5 NTU	
	Median	90th Percentile	Median	90th Percentile	Median	90th Percentile
Tributary background estimate* (Naneum, Caribou, Coleman, and Schnebly creeks)	2.6	7.5	13.4	18.6	8.2	13.2
Main stem estimate for the Yakima River at Nelson	1.6	7.5	11.6	17.5	6.6	12.5

*Tributary median and 90th percentile calculated on the z statistical distribution (Zar, 1984).
All values are in NTUs.

Table 15: Estimated turbidity reductions in upper Yakima River tributaries to meet the interim target of 10 NTU over background and the final 5 NTU over background (from Table 15 in the TMDL technical evaluation (Joy, 2002).

Tributary	Median (NTU)	90th Percentile (NTU)	Interim Target			Final Target		
			Median (NTU)	90th Percentile (NTU)	Estimated Reduction (%)	Median (NTU)	90th Percentile (NTU)	Estimated Reduction (%)
Cle Elum R.	0.9	1.2						
Crystal Cr.	1.8	3.7						
Teanaway R.	**1.1**	**26.0**	**0.8**	**18.6**	**28.5**	**0.6**	**13.2**	**49.2**
Swauk Cr.	2.0	9.5						
Taneum Cr.	2.9	15.9				**2.4**	**13.2**	**17.0**
Packwood D.	8.9	13.0				**8.2**	**12**	**7.9**
Manastash Cr.	**6.7**	**19.2**	**6.5**	**18.6**	**3.1**	**4.6**	**13.2**	**31.3**
Dry Cr.	1.4	2.5						
Reecer Cr.	4.0	7.7						
Sorenson Cr.	**9.8**	**21.8**	**8.3**	**18.6**	**14.7**	**5.9**	**13.2**	**39.4**
Wilson Cr.	**15.5**	**24.8**	**11.6**	**18.6**	**25.0**	**8.2**	**13.2**	**46.8**
Umtanum Cr.	1.2	3.4						
Wenas Cr.	3.5	13.4						

The estimated tributary background turbidity in Table 14 was used to calculate reductions.
Bold = Calculated statistics and reduction estimates.
Underline = Tributaries needing reductions to meet the final turbidity criterion.

Appendix C: Acronyms and Abbreviations

Table 16: List of acronyms and abbreviations

BMPs	best management practices
CAO	Critical Areas Ordinance
CMER	Cooperative Monitoring Evaluation and Research
CREP	Conservation Reserve Enhancement Program
CWA	Clean Water Act
DDE	dichlorodiphenylchloroethane
DDT	dichlorodiphenyltrichloroethane
DIP	detailed implementation plan
DNR	Washington Department of Natural Resources
Ecology	Washington Department of Ecology
EPA	US Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
ESA	Endangered Species Act
F&F	Forests & Fish (Agreement or Rules)
FREP	Forestry Riparian Easement Program
KCCD	Kittitas County Conservation District
KCWP	Kittitas County Water Purveyors
LA	load allocation
MOA	Memorandum of Agreement
NRCS	Natural Resources Conservation Service
NTU	nephelometric turbidity units
OCP	organochlorine pesticide
RCW	Revised Code of Washington
SIS	summary implementation strategy
SMA	Shoreline Management Act
STR	statistical theory of roll-back
TAW	technical advisory workgroup (for this TMDL)
TMDL	total maximum daily load
TSS	total suspended solids
USGS	US Geological Survey
USBR	US Bureau of Reclamation
USFS	US Forest Service
WDFW	Washington Department of Fish and Wildlife
WLA	wasteload allocation
WSDOT	Washington State Department of Transportation
YTC	US Army, Yakima Training Center

Appendix D: Summary of Public Participation Materials

1) Focus Sheet, subject: *Water Cleanup Plans: Upper Yakima River Restoration Plan – Targeting Sediments*, Pub. No. 01-10-003, revised March 2002, 2 pages. Available online at http://www.ecy.wa.gov/biblio/0110003.html .
2) Agenda and Meeting Summary from technical advisory workgroup (TAW) meeting held on January 30, 2001, 3 pages.
3) Agenda and Meeting Summary from TAW meeting, March 14, 2001, 3 pages.
4) Agenda and Meeting Summary from Irrigated Agriculture Subcommittee meeting, March 23, 2001, 2 pages.
5) Agenda and Meeting Summary from TAW meeting, June 28, 2001, 3 pages.
6) Agenda and Meeting Summary from Forestry Subcommittee meeting, July 31, 2001, 3 pages.
7) Agenda and Meeting Summary from TAW meeting, January 23, 2002, 3 pages.
8) Meeting Summary from TAW meeting, July 10, 2002, 1 page.
9) Newspaper Article, subject: *Plans call for Upper Yakima River cleanup*, The Daily Record (Ellensburg, WA), April 23, 2002.
10) Newspaper Article, subject: *Workshop reviews water standards: Plan is part of five-year effort*, The Daily Record (Ellensburg, WA), April 29, 2002.
11) Newspaper Article, subject: *Water cleanup meeting tonight*, The Daily Record, (Ellensburg, WA), May 15, 2002.
12) Display Advertisements and Affidavits Of Publication, for public comment period and public workshops, The Daily Record (Ellensburg, WA).
13) Display Advertisements and Affidavits Of Publication, for public comment period and public workshops, North Kittitas County Tribune (Cle Elum, WA).
14) Mailing List for *Upper Yakima River Basin Suspended Sediment, Turbidity and Organochlorine Pesticide TMDL*.

Item 1 available online (see above) or as hard-copy. Items 2-14 are hard-copy only, available on request from author.

Appendix E: Summary of Responses to Public Comments

(Note: The following comments and responses were made in regard to the *Upper Yakima River Basin Suspended Sediment and Organochlorine Pesticide TMDL Evaluation* (Appendix A). Citations noted below also refer back to this document)

Comments from the Kittitas County Water Purveyors

1) "This document does not demonstrate a strong link between organochlorine pesticides (OCP) and turbidity, total suspended solids (TSS), or suspended sediment (SS) in the upper Yakima River basin. If reductions in turbidity/sediment load do not reduce OCP, then the question for the majority of the basin, outside of the Wilson-Cherry Creek complex, is should any additional regulatory actions be considered."

Response: If the reduction of turbidity/sediment loads in sub-basins other than in the Wilson-Cherry Creek complex does not reduce OCP in fish in the upper Yakima basin, then Ecology will need to demonstrate why this is the case. A more sophisticated model of loading and bioaccumulation rates and ecological compartment contributions may be required by EPA. On the other hand, a simple statement about legacy pollutants and their longevity may be the only thing EPA requires. We don't know. We did document (page 26) that trace concentrations of OCP were detected by USGS in water and bed sediment samples collected in the late-1980s from several upper Yakima tributaries. Because of the chemical characteristics of OCP, limiting transport of sediment from those tributaries should reduce transport of OCP to the Yakima River even if the apparent "link" between OCP and TSS concentrations is not statistically "strong".

2) "An absolute standard (*not more than 5 NTU over background*) that is based on an assumed background does not account for this natural variability (*in turbidity and suspended sediment levels*). Even with a 90th percentile allowance, streams could be labeled out of compliance during periods of naturally high turbidity."

Response: Streams would only be labeled out of compliance with a 90th percentile value if they sustained elevated concentrations over a long period of time, or if several "snow melt or storm events" were sampled over the course of the season in question that did not affect background levels as well. From the historical and 1999 data presented in the TMDL document, these scenarios seem highly unlikely or could be shown to be highly unusual, e.g. the 1980 Mt. St. Helens eruption, or the 1995 Kittitas Reclamation District canal break. The goal of the turbidity and TSS targets is to reduce the number of extended duration events at elevated concentrations – for aquatic community health and to reduce the risk of organochlorine pesticide transport from affected soils to waterways. Please refer to the response to Mrs. Hanson (below) concerning variability and the iterative approach of this TMDL. As mentioned, the next round of monitoring after implementation of actions on the ground should give us a better idea if 10 NTU or 5 NTU are adequate to manage turbidity and suspended sediment loading in the upper Yakima River basin while taking into account natural variability.

3) "Using as background river mile 191, does not account for possible turbidity from a significant portion of the watershed, as river mile 191 is downstream of major water reservoirs that act as settling ponds."

Response: The turbidity control site was selected recognizing its placement relative to the reservoirs (page 35). The water quality at the control site adequately characterizes the water being delivered to the Cle Elum and lower Kittitas Valley areas via the Yakima River and the Kittitas Reclamation District canals. The TMDL plan allows for placement of a control site, or control sites, above the reservoirs in future monitoring programs. Even so, if the reservoirs are seasonally effective in removing sediment, how would Ecology justify significant increases in suspended sediment and turbidity from controllable sources between the reservoirs and the Roza Pool? Again, Ecology is attempting to reduce sources of sediment that can be controlled, and that are harmful to aquatic life.

4) "Suspended sediment cannot be assumed always to be a problem; it is a natural geologic occurrence, climatic conditions (precipitation, freeze-thaw events, wind) erode the earth. Data from 2000 and 2001 water quality sampling indicate turbidity levels in the mainstem and tributaries are, most of the time, within the range considered suitable for aquatic organisms."

Response: The TMDL assessment recognizes that some level of suspended sediment is natural. The TMDL is focused on reducing the number of extended duration events at elevated concentrations. Some elevated levels of suspended sediment are from non-anthropogenic sources during storm and snow melt events. However, some of the problems in the upper basin are apparent to anyone who has worked there. Some irrigation return drains are carrying loads of suspended sediment far beyond what would be expected if common erosion suppression practices were used. Some creeks and streams are without adequate bank protection or riparian areas, and so activities by machinery, livestock, and residential development contribute to excessive suspended sediment discharges. The referenced data collected in 2000 and 2001 will be helpful in interpreting variability and assessing the effectiveness of best management practices. Without seeing the report, it is difficult to respond to the comment that "turbidity levels in the mainstem and tributaries are, most of the time, within the range considered suitable for aquatic organisms."

5) "… no discussion is attempted at what range of turbidity and suspended sediment fish are routinely exposed to in this basin or others and have productive fish runs."

Response: The evaluation provides several lines of reasoning from credible scientific sources as to why suspended sediment is a concern for aquatic communities without doing original research for this TMDL. According to several fishery agency reports and the whole concept of the Yakima River Water Enhancement Program, the Yakima River is far below its potential productivity as a fish resource, so there is no example of a productive fish run in the Yakima River for such a comparison. In addition, the fourth paragraph of page 5 provides scientific literature references to suspended sediment problems in the upper Yakima basin. Also, USGS analysis of fish community condition found a direct correlation between turbidity and temperature, and tolerant fish species, i.e. salmonids and cottids were found in less turbid and cooler waters (Cuffney, et al., 1997). The data used in Table 4 of the technical evaluation are limited to the effects of suspended solids on species of salmon found in the Yakima River...even though salmon may not be the most sensitive species. Yes, this is primarily laboratory data, but that is what most water quality criteria are based upon.

6) "There is also no discussion of possible benefits of TSS in nutrient transport that might support fish or aquatic macroinvertebrates. What discussion there is regarding cause and effect

relative to turbidity and suspended sediment on fish productivity seems based on assumptions and promotion of some 'ideal environmental condition' that may occur only periodically in natural setting."

Response: As with TSS, some nutrient input is necessary to maintain a healthy, productive aquatic community. The upper Yakima River basin does not exhibit oligotrophic characteristics (i.e., low in accumulated nutrients) except in the highest headwaters of the basin, according to work performed by USGS (Cuffney, etal., 1997). In the USGS assessment, algal, macrobenthic, and fish communities at sites in the upper Yakima basin were not considered to be impaired because of lack of nutrients – but many appeared to be impaired because of the overabundance of nutrients.

The role of TSS in phosphorus transport has long been of concern in the entire Yakima River basin, especially in sub-basins with a larger agricultural land use like the Cherry/Wilson sub-basin. USGS reported that there was a factor of two increase in nitrogen and a factor of four in phosphorus between the Yakima River at Cle Elum and the Yakima at Umtanum Creek without significant increase in discharge. Cherry Creek accounted for 67% of the measured nitrogen load and 27% of the total phosphorus increases (Morace, etal., 1999). These increases cause concerns not because the Department of Ecology is in search of an 'ideal condition', but because they, like TSS and organochlorine pesticides, appear to be disproportionately large increases from a single sub-basin, and they occur more than 'periodically'. One of the side benefits of reducing the TSS loads from Cherry Creek by implementing soil and bank erosion activities should be a reduction of phosphorus loads to the river.

7) "This document does not state a strong case, nor provide key information to justify additional regulatory schemes for the Upper Yakima River Basin."

Response: We respectfully disagree.

Comments from the Teanaway TMDL Workgroup

1) "First, we would like to express our support for the position that the subject study takes regarding the TMDL water quality plan for the Teanaway. We do believe that the sediment reduction implementation activities embodied in the Teanaway TMDL will meet the requirements of the subject TMDL."

Response: Comment noted, we agree.

2) "References to sediment levels in the Teanaway are based on estimates and extrapolations unrelated to any actual scientific observations on the Teanaway. Accordingly, the conclusions reached in the subject TMDL regarding the Teanaway, even though they are estimates, are misleading and at best inaccurate."

Response: The turbidity samples, total suspended solids samples and stream discharge measurements collected near the mouth of the Teanaway River (at the Highway 10 bridge) by the Department of Ecology in 1999 *are* scientific observations. The sediment load estimates calculated from those measurements, as well as the conclusions about sediment levels discharged from the Teanaway River to the Yakima River in 1999, have a high degree of certainty and should not be considered either misleading or inaccurate. For example, the

discharge volumes and total suspended solids (TSS) concentrations were highly correlated so that the estimated concentration of TSS based on daily discharge measurements (Figure 12, page 39) match the observed data quite well. The goodness of fit measures in Appendix A also suggest a high degree of accuracy between the estimated and observed data on the Teanaway. Loads are calculated by combining these two highly correlated parameters, i.e. discharge multiplied by concentration. In addition, the turbidity values and TSS concentrations were also highly correlated ($r^2 = 0.97$), so that if reductions in turbidity are made, we can be fairly confident TSS concentrations will be reduced.

However, no reliable data were available in 1999 to estimate background turbidity values in the Teanaway basin, and resources were not available to do the sampling in 1999. When data are not available, Ecology's TMDL policy states that a conservative estimate must be used to protect the beneficial uses of the river until better data are available. Therefore, a surrogate background turbidity was used from data collected from sites with the least upstream disturbance. The decision to use the surrogate does not necessarily lead to misleading or inaccurate conclusions about what needs to be done in the Teanaway basin. Additional monitoring planned for the Teanaway River and other tributaries will be used to revise the estimated background turbidities on which to predict sediment load reductions.

Comments from Mrs. John J. Hanson

1) Mrs. Hanson generally asked how the TMDL will address variability in timing and intensity of activities in the tributaries based on a single year's monitoring. For example, mining along the Swauk, tillage cycles because of economic or agronomic considerations, logging cycles, and climatic events are not the same every year in a tributary.

Response: The TMDL targets are somewhat adjustable to events that affect an entire tributary's watershed because the turbidity target at the mouth of the tributary is based on a background turbidity value. Compliance with the TMDL target for a tributary will be compared to a background turbidity based on data collected for the year in which monitoring and compliance is conducted. The goals of the suspended sediment and turbidity targets are to reduce the number of extended duration events at elevated concentrations – for aquatic community health and to reduce the risk of organochlorine pesticide transport from affected soils to waterways. Mrs. Hanson is right that the possible sources of such events vary year to year depending on the activities in the sub-basin. Additional monitoring will be used to modify any targets that are off-the-mark in terms of source identification and impact after best conventional agricultural, forestry, residential building, and mining practices are installed or assured. The effects of some activities as a group (e.g. timothy growers in tributary A) or by an individual (e.g. timothy grower X on the west branch of tributary A) will be more apparent in one year than another, so documentation of water quality changes and sub-basin activities will be essential to interpret data. The TMDL process is iterative – as new data are collected, targets and implementation activities are adjusted to meet the beneficial uses of the waterways.