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DESCHUTES RIVER BASIN HABITAT CONSERVATION PLAN DRAFT STUDY REPORT

Studies 3, 4, 5, and 6 – Phase 1: Review of Existing Water Quality Data for the Deschutes River Basin

Prepared for:
Deschutes Basin Board of Control, and
City of Prineville, Oregon

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1. Introduction

A multi-species Habitat Conservation Plan (HCP) is being developed by the Deschutes Basin Board of Control and the City of Prineville for the upper Deschutes River basin (Deschutes basin). In part, the HCP will address water quality conditions specific to the survival of covered salmonid fish species within the basin. This will include a water quality assessment of certain pollutants (i.e., toxics, nutrients, pH, metals, contaminants, and biological oxygen demanding materials) in the streams and rivers in the basin. The covered activities that may carry these pollutants are tailwater, stormwater, and municipal discharge.

The Deschutes basin encompasses a large and diverse region located east of the Cascade Range in Oregon and consists of the following subbasins: Crooked River, Upper and Little Deschutes, Lower Deschutes, and Trout Creek and Willow Creek.

Within these subbasins, the data for the following parameters will be discussed:

- dissolved oxygen (DO)
- sediment and turbidity
- nutrients, pH, and algal growth
- contaminants, toxins, and metals.

1.1 Dissolved Oxygen

Within a stream or river, oxygen is both produced and consumed. Aeration, splashing, and plant photosynthesis all produce oxygen in a body of water. Oxygen is consumed through decomposition of organic matter, respiration of aquatic organisms, and through other oxygen-consuming chemical reactions in the water. A natural stream system both produces and consumes oxygen (Breuner 2004). Dissolved oxygen is essential for aquatic life, including fish and invertebrates. Certain fish species including salmonids are sensitive to lowered concentrations of DO, specifically during the early life stages of fish development. Typically, DO levels are subject to fluctuation due to changes in temperature and the photosynthesis of aquatic plants; therefore, the lowest concentrations of DO are found in the early part of the day. Nitrates, algae, and large quantities of organic matter can also lower DO concentrations (Breuner 2004). The DO levels in gravel beds (inter-gravel DO or IGDO) are important to the survival of salmonid embryos, and are influenced not only by the DO concentrations on the water column, but also the oxygen demand of the eggs and sediment, and the percentage of fine sediment in the gravel (Whitman 2002).

As stated in Breuner (2004), "ODEQ has set a minimum level of dissolved oxygen to protect the most sensitive beneficial uses (resident fish and aquatic life and salmonid fish rearing and spawning) throughout the entire Deschutes basin: for spawning: not less than 11 mg/L or 95 percent saturation during September 1 to June 30, for cold water: not less than 8 mg/L or 90 percent saturation during July 1 to August 31 and for cool water: not less than 6.5 mg/L during July 1 to September 30" (Whitman 2002).

1.2 Sediment and Turbidity

Turbidity is a measure of the clarity of water. Turbidity is quantified by how much light can pass through a water sample. Turbidity can be used as a surrogate measurement for suspended sediment in many streams and rivers. Suspended sediments can carry pollutants that can adversely affect the abilities of site-feeding fish and cause damage to gill tissues. Additional adverse impacts of suspended sediment include interference with irrigation and recreation. Deposition of sediment in gravel beds may impact the survival of salmonid eggs and invertebrate communities in the gravel.

Sources of turbidity caused by human activities can include irrigation activities; sediment runoff from roads, including sanding of roads and parking areas during winter; construction sites; denuded livestock areas that drain to streams; and slope failures (Whitman 2002).

1.3 Nutrients, pH, and Algal Growth

1.3.1 Nutrients

Nutrients in water bodies typically include phosphorous and nitrogen. These elements contribute to algae and plant growth in water bodies. The plants and algae, in turn, provide food for insects and invertebrates that are crucial members of an aquatic ecosystem. If the level of nutrients exceeds what is needed to support a healthy plant community, plant overgrowth can occur, increasing pH levels and oxygen demand, which can severely alter the natural balance of the water body communities. Primary sources for nutrients from human activities consist of runoff from agricultural practices and livestock operations, leaking septic systems, and wastewater discharge. There are no quantitative standards for nutrients (Whitman 2002).

1.3.2 pH

The pH levels in water are a measurement of the concentration of free hydrogen ions in solution, reported as the negative log of the concentration of hydrogen ions. Using this scale, pH levels from 0 to 7 are considered acidic, while levels of 7 to 14 are considered basic or alkaline. Spawning and rearing of salmonid species are sensitive to fluctuations

in pH levels. The pH values that fall outside of a range that a species has evolved to live in can result in toxic effects. The toxicity of other pollutants can intensify with an increase in pH, leading to fish kills (Whitman 2002).

1.3.3 Algal Growth

There are numerous species of algae, some of which produce toxins that can result in illness or death of livestock, pets, wildlife, and humans. The most well known of these toxin-producing species is the cyanobacteria, or blue green algae. Typically, these algal blooms are a result of nutrient imbalances and excesses in a water body. Algal blooms can also cause pH and DO impairments in certain circumstances (Whitman 2002). The State of Oregon does have a narrative guideline for weeds and algae that can be found on the Oregon Department of Environmental Quality (ODEQ) website under Statewide Narrative Criteria (http://www.deq.state.ur.us/regulations/rules.htm.

1.4 Contaminants, Toxins, and Metals

Contaminants, toxins, and metals are concerns for the health of a water body. Many types of contaminants exist, such as organic compounds, insecticides, herbicides, and industrial waste. Contaminants may also include naturally occurring compounds that are inappropriate for a given region. Toxins are substances that are considered poisonous to living organisms and can be human induced or naturally occurring. Metals, such as mercury and arsenic are also toxic to most organisms. Some other metals, such as iron, are crucial to life but are typically not found in high concentrations, and can become toxic at high concentrations.

2. Purpose of Study

There are basic water quality guidelines that normally apply to all water bodies and watersheds describing how certain criteria affect the flora and fauna native to a region.

The purpose of this study is to present both historical and current water quality data, allow for a comprehensive overview of the conditions in the Deschutes basin, identify areas lacking in sufficient data, and present the available data. To effectively assess the current conditions of the Deschutes basin a literature review of available reports and data was conducted and is presented here, including a discussion on areas lacking in data and recommendations for future monitoring and analysis of these areas.

3. Project Area

The Deschutes basin covers about 10,700 square miles of land in central Oregon. It is bounded on the west by the Cascade Mountains, on the south by lava plateaus, on the east by the Ochoco Mountains, and to the north by the Columbia River. The major tributaries to the Deschutes River above Lake Billy Chinook Reservoir include the Little Deschutes River, the Crooked River, Tumalo Creek, the Metolius River, and Squaw Creek. Below Lake Billy Chinook, the major tributaries are Shitike Creek, Trout Creek, Warm Springs River, White River, and Buck Hollow Creek. The Deschutes basin is a diverse geographical region and because of its varied historical and current social conditions is sub-divided into four subbasins to address the specific needs of various watersheds (Figure 1). Federal development and private expansion helped the area become one of the leading centers for agriculture in Oregon. The primary commercial crops are hay, potatoes, grains, and mint. Until recently, commercial agriculture, with an emphasis on crops and cattle was the major water user. In recent years, many irrigated lands have been converted from commercial agriculture to noncommercial farms (Reclamation 2003).

Figure 1. Subbasins of the Deschutes River basin.

4. Methods

Information and data pertaining to the water quality in the Deschutes basin was gathered from available literature, contributions from members of the Deschutes Basin Working Group, and from the web sites of various agencies involved in water quality issues (see Section 8 – Literature Cited). Additional data can be obtained from the Environmental Protection Agency (EPA) national water quality data storage and retrieval system (STORET), various irrigation districts, and the Deschutes basin Soil and Water Conservation District (SWCD).

5. Historic Conditions

5.1 Crooked River Subbasin

During the late 1800s, the Crooked River subbasin had more springs and water channels than is present today. Many of the streams flowed year round, providing good fishing for the inhabitants of the watershed. According to the *Crooked River Watershed*

Assessment (July 2002), because of the high spring flows and connecting flood plain, the Crooked River flooded nearly every year, resulting in a shifting main channel (Whitman 2002). The species of fish that are thought to have inhabited the subbasin include Chinook salmon, redband and bull trout, and steelhead (Whitman 2002).

From the 1870s until the 1930s, livestock grazing was the major land use in the Crooked River subbasin. Grazing was predominantly cattle with sheep being introduced in 1880. As a result of grazing, the grasslands were depleted and replaced by sage. Most of the damage to the rangelands in the South Fork Crooked River was due to horses (Whitman 2002). As grasslands vanished, the streams and rivers in the watershed suffered from a loss of riparian vegetation leading to stream incision during the late 1800s through the early 1900s. In combination with the high grazing in the region, there was also a loss of beaver and a series of drought years, all of which contributed to the damage to the watershed (Whitman 2002). As rangeland became damaged, ranchers turned to growing hay for feeding livestock. Grazing was not regulated until around 1905 with the creation of the Federal forest system. Nevertheless, uncontrolled grazing prevailed until the passing of the Taylor Grazing Act of 1934, and the subsequent passing of the grazing service in 1936 (Whitman 2002).

The water rights in the upper portion of the Crooked River subbasin were allocated in the 1880s (Whitman 2002). In 1908, diversion systems were built on the Crooked and Deschutes rivers, allowing for an increase in irrigated agriculture. The areas of Prineville, Post, and Powell Butte were served by the first of these systems on the Crooked River. Additional systems and reservoirs were also constructed during this time, such as the Horse Heaven Creek Dam in 1910. Ochoco Dam was built in 1921, following the establishment of the Ochoco Irrigation District in 1918 (Whitman 2002). Due to the extensive diversion, only the uppermost tributaries of the Crooked River and the North Fork typically contained water by fall (Whitman 2002).

Mining also impacted the water quality in the Crooked River subbasin. Though mining was limited, there was some shaft gold mining from the 1870s until around 1920. Additionally, cinnabar and mercury mining took place in the 1930s. Though mercury mining was limited, it resulted in more damage than the gold mining. The U.S. Forest Service (USFS) is still dealing with a few of these remaining sites (Whitman 2002).

Timber harvesting was another activity that occurred in the Crooked River subbasin, with small sawmills in Mill, Marks, and Ochoco Creek watersheds including the Post area. As the railroad came through central Oregon, access to better markets led to a boom in timber harvest (Whitman 2002).

5.2 Upper and Little Deschutes Subbasin

Most of the land in the Upper and Little Deschutes subbasin is owned by the Federal Government and predominantly managed by the USFS. Most of the vegetation in this subbasin includes mountain forest species, juniper, grasses, and shrub rangeland. Contributing to the characteristics of the area are deep canyons and rocky outcroppings. Additionally, there are several state and federally designated wilderness areas. Communities found in this subbasin include Crooked River Ranch, Sisters, Redmond, Bend, La Pine, and Crescent.

The climate of the Upper and Little Deschutes subbasin though typically dry, varies due to the topography of the region. Rain and heavy snowfall in the higher elevations can cause high stream and river flows contributing to erosion. Additionally, severe flooding can occur due to rapid snowmelt as a result of warm winds in the spring.

The soils in the watershed result from recent volcanic activity and consequently, are naturally high in phosphorus. Pumice, basalt flows, and cinders make up much of the soil and covers outwash gravel, breccias, glacial till, tuff, andesite, and hard basalt.

The creeks and rivers found within the subbasin include the Deschutes River and its tributaries and the Metolius River. The Metolius River, Whychus Creek, Tumalo Creek, and the Little Deschutes River and tributaries make up the major tributaries of the Deschutes in this area. Little Lava Lake, Lake Billy Chinook, Crane Prairie Lake, Crescent Lake, and Wickiup Reservoir are also located in this region.

After completion of Wickiup Reservoir, the flow characteristics downstream changed. The flows range from 20 to 30 cfs in the winter and up to 2,000 cfs during irrigation season. Most of the water released is diverted through six irrigation canals near the city of Bend. These canals, constructed through the volcanic soil, are mostly unlined and estimated seepage is approximately 50 percent. The irrigation districts in the region are working to reduce the water losses by lining the canals and implementing piping projects. Irrigation companies dug most of the irrigation canals and ditches in current operation during the period of early European settlement. These companies were later organized into irrigation districts.

The agricultural usage of land within the subbasin is varied, though irrigated pasture and hay lands are found throughout. Irrigated cropland is predominant around Lower Bridge and grazed timberland occurs near La Pine including sub-irrigated pasture.

Deschutes County is found within the Upper and Little Deschutes subbasin, and is one of the fastest growing counties in Oregon (Thalacker et al. 2009).

5.3 Lower Deschutes Subbasin

The Deschutes and Columbia rivers are the largest rivers within the Lower Deschutes subbasin and form the northern-most boundary of the region. The tributaries that feed into the Deschutes include White River, Buck Hollow Creek, and Bakeoven Creek. Other streams in this area are between Rufus, Mosier, and their associated drainages and include Spanish Hollow, Fifteenmile Creek, Threemile Creek, Mill Creek, Chenoweth Creek, and Mosier Creek. In addition to the rivers and streams, there are five reservoirs in the Lower Deschutes subbasin used for irrigation and municipal water supply. Badger Lake, Clear Lake, and Rock Creek Reservoir are within the Mount Hood National Forest. Crow Creek is owned by the city of The Dalles and is surrounded by National Forest. Pine Hollow Reservoir is used for irrigation.

Rapid snowmelt over frozen soils, heavy precipitation, and summer cloudbursts contribute to frequent and damaging run-off events within the subbasin.

The Lower Deschutes subbasin is part of the Columbia Plateau, a lava-based plain, uplifted due to molten basalt flows. The soils in this region consist of volcanic materials such as pumice and ash, and other materials such as clay silt and gravel that were transported by water. The weathering of bedrock also contributes to the composition of the soils.

Vegetation was mostly the native grasslands prior to agriculture becoming the major land use of the region (Bailey et al. 2006).

5.4 Trout Creek Subbasin

Beginning in the 1860s, the Trout Creek watershed was used as overwintering grounds for cattle to graze. Raising sheep and growing hay became popular. In 1877, Trout Creek began to be used for irrigation. Native species of wildlife included antelope, sage grouse, and trout. Gold was discovered in the late 1890s and mining was periodically conducted for quite some time. Prior to the discovery of gold, sulfate ores were discovered and mines were developed for the minerals. Homesteading followed around 1910, but the shortages of readily available water was problematic. The first dam on Pony Creek was built during this time. In the 1930s, a productive mercury mine was developed; it operated until the mid-1940s.

Due to the extensive human-made modifications, the Trout Creek watershed cannot be returned to its original condition. Restoration within the watershed will be based on the current conditions and effects of land usage (Runyon et al. 2002).

6. Existing Conditions

Information from reports prepared by various SWCDs, ODEQ, and other agencies is summarized and presented by way of introduction to each subbasin. There are many reports that were reviewed and not included as the information presented was old (before 2001), lacking dates of sample collection and analysis, methods of collection and analysis, or lacking other elements that allow for an accurate assessment of current conditions. These papers are listed by subbasin in the Appendix as they provide historical information.

To help provide a more current view of the water quality conditions in the Deschutes basin, raw data from STORET and LASAR from 2001 to 2012 were obtained, graphed, and compared to show conditions as close to current as possible to better ascertain where potential problems in water quality may be occurring. The criteria for choosing the data presented insured that at a given site, data were collected more than once, and at comparable times of the year. Sites with multiple collection dates were excluded if the collection dates were substantially different (e.g., July of one year and January of another). Further excluded were sites with multiple collection dates, but only cover one year. This would not present an accurate depiction of the water quality at a given site as too many factors influence water quality to make a judgment based on one year of data. Unfortunately, most of the data from LASAR had to be rejected because of failing to meet the simple requirement of multiple sampling dates. Additionally, though many sites were consistent with the parameters that were chosen, many sites have gaps in data for one or two parameters. Compiling data for a complete picture therefore becomes a serious challenge. For each subbasin, the data will be discussed and then presented in graphs for each site, starting with the most upstream sites, so that water quality trends can be more easily identified. Tables containing the raw data from STORET and LASAR follow the graphs.[1] Gaps in the data will be addressed in a later section of this report.

6.1 Crooked River Subbasin

6.1.1 Introduction

Although there are no streams or reservoirs on the 303(d) list for DO standard violations in the Crooked River subbasin, several water bodies are identified as having the potential for DO limitations (Whitman 2002). These include the main stem Crooked River in both the Lower and Upper Crooked River subbasin. This stretch reaches from the Prineville Reservoir to the mouth of the North Fork (Whitman 2002).

[1] The sites with the three-letter code (i.e., DES) were analyzed by Reclamation's STORET; the sites with the five digit numerical code (i.e., 10686) were analyzed by DEQ LASAR.

There are no Crooked River water bodies on the 1998 303(d) list for sediment and/or turbidity (Whitman 2002). There are several water bodies in the basin that have been identified as having the potential for limitations related to sedimentation, most of which are in the Upper Crooked subbasin (Whitman 2002). Areas in the watershed that have the potential for limitations due to turbidity are Ochoco Reservoir in the Lower Crooked River subbasin, and Antelope Flat and Prineville reservoirs in the Upper Crooked River subbasin (Whitman 2002).

There are no Crooked River water bodies on the 303(d) list for nutrients (Whitman 2002). However, five water bodies have been identified as having the potential for nutrient related limitations: the main stem Crooked River and Ochoco Reservoir in the Lower Crooked River subbasin; the main stem Crooked River between Prineville Reservoir and the North Fork; and Antelope Flat Reservoir in the Upper Crooked River subbasin (Whitman 2002).

The water bodies in the Crooked River subbasin that are on the 303(d) list for pH are the Lower Crooked River, from the mouth to Baldwin Dam and the Upper Crooked River, from Prineville Reservoir to the North Fork (Whitman 2002). Water bodies that have been reported as having the potential for pH related limitations include the main stem Crooked River in the Lower Crooked River subbasin and the main stem Crooked River between Prineville Reservoir and the North Fork in the Upper Crooked River subbasin (Whitman 2002).

Only two waterbodies in the Crooked River subbasin have data for algal blooms, Ochoco Reservoir and Prineville Reservoir. Both of these reservoirs have a potential for concern (ODEQ 2011).

Within the Crooked River subbasin, the Ochoco Reservoir is on the 303(d) list as being a potential concern for mercury; however, there have been no recommendations for fish consumption (Whitman 2002).

Although there are many toxic and hazardous waste sites in the subbasin, there are no other apparent 303(d) listings for water quality relating to contaminants, toxins, or metals. The *Crooked River Watershed Assessment* contains an extensive listing of the permitted facilities and locations, including the regulatory bodies involved (Whitman 2002).

Reservoir monitoring data for nutrients, DO, turbidity, pH, and trace metals have been collected from 2004 through 2012. During the irrigation season in 2010 through 2012, data was collected on numerous sites in the Crooked River subbasins by Reclamation. Two long-term ODEQ monitoring sites have also provided valuable data for this subbasin.

6.1.2 Current Data

The most current data available for the Crooked River subbasin were collected from April through November in 2010, 2011, and 2012 at multiple sites throughout the subbasins. There are also two years of long-term monitoring sites: one in the Upper Crooked River subbasin and one in the Lower Crooked River subbasin. The data from these long-term sites has been collected bi-monthly from 2001 through 2012. Reservoir data for the region were collected in July of 2004, 2007, 2009, 2011, and 2012 as part of ongoing reservoir monitoring by Reclamation.

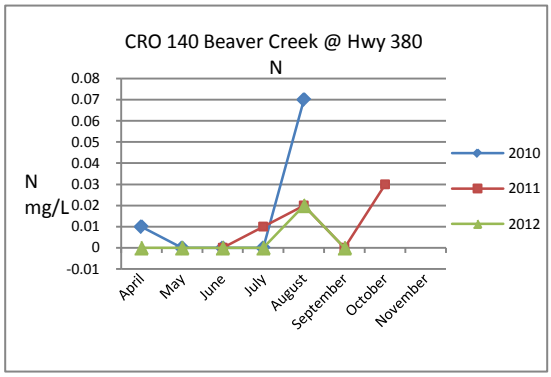
South Fork Subbasin

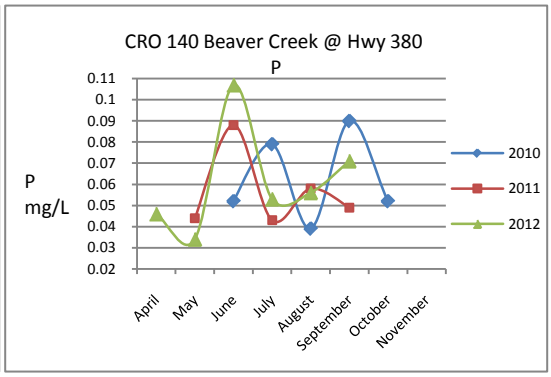
The water bodies of the South Fork Crooked subbasin (HUC 17070303) consist of South Fork, with Twelvemile Creek and Beaver Creek being the major tributaries. Data were available from two sampling sites, Beaver Creek at Hwy 380 (CRO 140) and South Fork at Hwy 380 (CRO 141) (Figure 2).

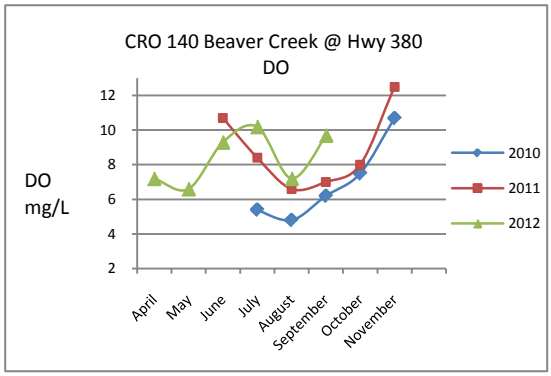
Figure 2. Data collection sites in the South Fork subbasin.

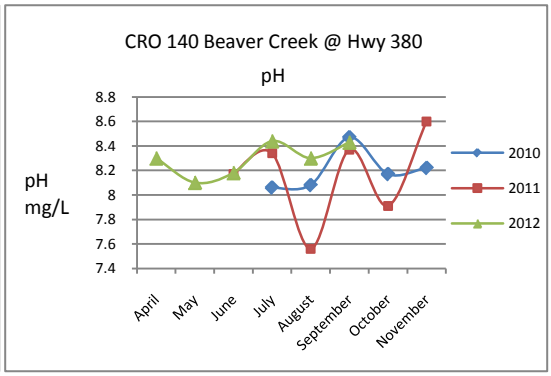
Site CRO 140

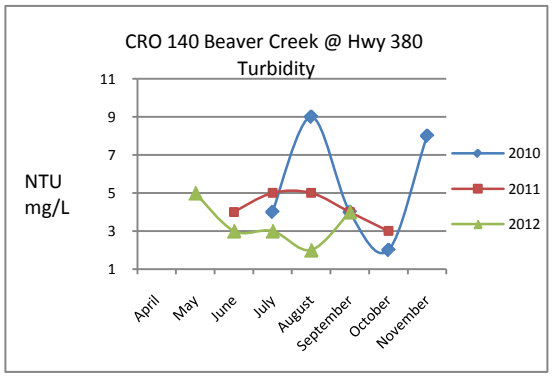
The Beaver Creek site is downstream from Paulina and just above the confluence with South Fork. Dissolved oxygen data for this site showed a low of 4.8 mg/L in late July 2010. Turbidity never reached above 9 NTU the 3 years of sampling. The Beaver Creek site reached a maximum of P of 0.107 mg/L in June of 2012. The P concentrations remained fairly stable, fluctuating by only 0.066 mg/L over the course of the 2-year sampling dates. Inorganic N concentrations ranged from below detection limits to 0.07 mg/L, with a dip in N levels in September. The values for pH ranged from 7.56 (July 2011) to 8.47 (September 2010). The following graphs show the overall trends in the data for the Beaver Creek site. There are no data available regarding contaminants, metals, or toxins at this site.







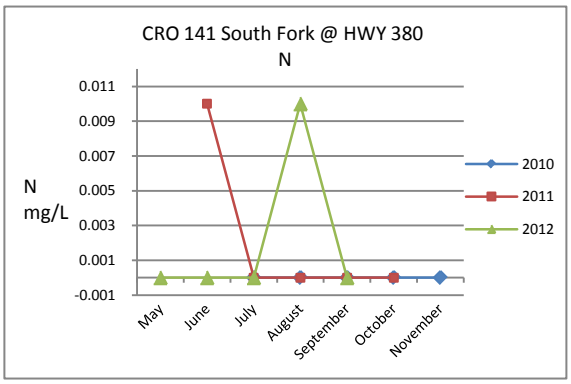


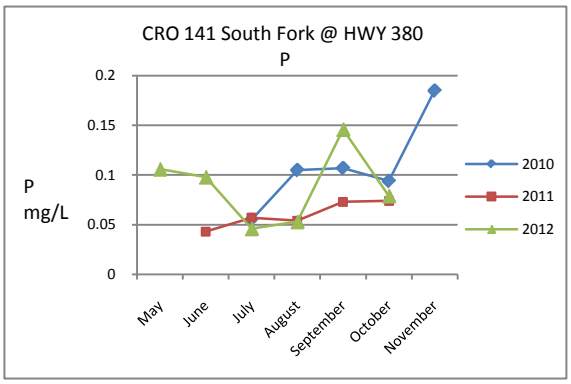


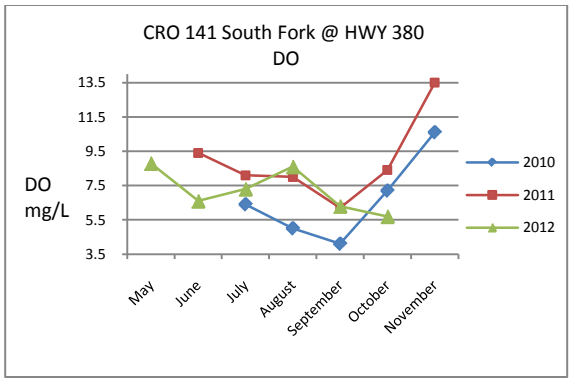
CRO 140					
Date	N (mg/L)	TP (mg/L)	NTU	DO (mg/L)	pH
07/07/10	0.01	0.052	4	5.4	8.06
07/27/10	< 0.01	0.079	9	4.8	8.08
08/10/10	< 0.01	0.039	4	6.2	8.47
08/23/10	< 0.01	0.1	2	7.7	8.45
10/05/10	< 0.01	0.079	2	7.3	7.89
10/27/10	0.07	0.052	8	10.7	8.22
06/01/11	< 0.01	0.044	4	8.4	8.17
06/29/11	0.01	0.088	5	6.6	8.34
07/28/11	0.02	0.043	5	7	7.56
08/31/11	< 0.01	0.058	4	7.8	8.37
10/05/11	0.03	0.049	3	923	7.91
11/08/11				12.5	8.6
04/24/12	< 0.01	0.046		7.2	8.3
05/09/12	< 0.01	0.034	5	6.6	8.1
05/31/12	< 0.01	0.107	3	9.3	8.18
06/20/12	< 0.01	0.053	3	10.2	8.44
08/20/12	0.02	0.056	2	7.2	8.3
09/27/12	< 0.01	0.071	4	9.7	8.43

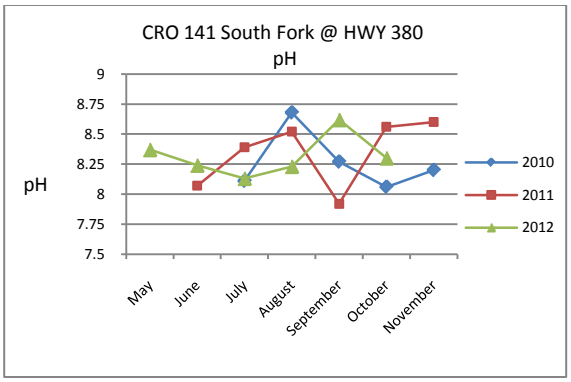
Site CRO 141

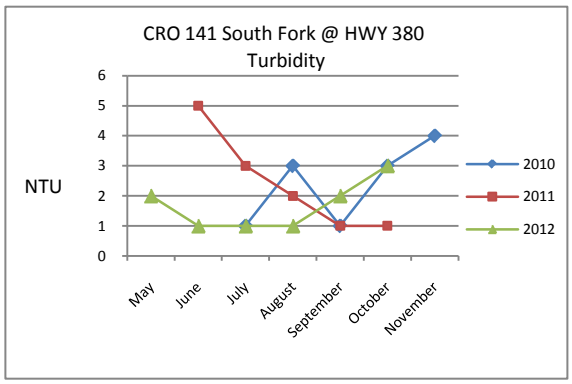
The South Fork site is just upstream on the South Fork from the confluence with Beaver Creek. The DO levels reached a low of 4.1 mg/L in August of 2010, but never fell below 6.0 mg/L in 2011 or 2012. Turbidity never went above 3 NTU in 2010 or 2012, but was recorded at 5 NTU in late June of 2011, before falling back down to 1 NTU by October. The inorganic N concentrations for the South Fork site ranged from below detection limits to 0.01 mg/L. June of 2011 and August of 2012, were the only sampling dates to record levels above detection limit during the 3 years of sampling. Phosphorous reached its maximum level in late October and early November of 2010 with a concentration of 0.185 mg/L, and was at a minimum in June of 2011 with a concentration of 0.043 mg/L. Over the course of the 3-year sampling, pH ranged from 7.98 to 8.68. There are no data available for this site with regards to metals, toxins, or contaminants.











CRO 141					
Date	**N (mg/L)**	**TP (mg/L)**	**NTU**	**DO (mg/L)**	**pH**
07/07/10	< 0.01	0.055	1	6.4	8.11
07/27/10	< 0.01	0.105	3	5	8.68
08/10/10	< 0.01	0.107	1	4.1	8.27
08/23/10	< 0.01	0.081	2	6.1	7.98
10/05/10	< 0.01	0.071	3	8.4	8.14
10/27/10	< 0.01	0.185	4	10.6	8.2
06/01/11	0.01	0.043	5	9.4	8.07
06/29/11	< 0.01	0.057	3	8.1	8.39
07/28/11	< 0.01	0.054	2	8	8.52
08/31/11	< 0.01	0.073	1	6.2	7.92
10/05/11	< 0.01	0.074	1	8.4	8.56
11/08/11				13.5	8.6
05/01/12	< 0.01	0.106	2	8.8	8.37
05/09/12	< 0.01	0.098	1	6.6	8.24
05/31/12	< 0.01	0.046	1	7.3	8.13
06/20/12	< 0.01	0.053	1	8.6	8.23
08/20/12	0.01	0.146	2	6.3	8.62
09/27/12	< 0.01	0.079	3	5.7	8.3

Upper Crooked River Subbasin

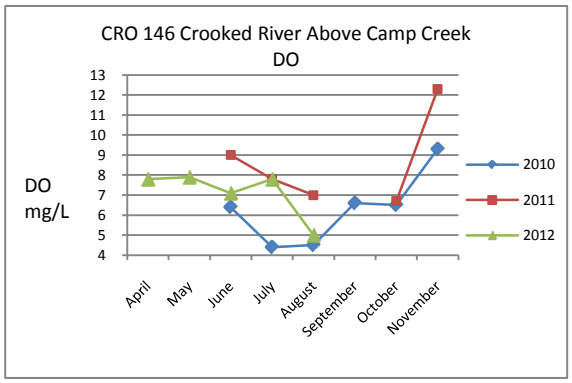
The water bodies of the Upper Crooked subbasin include Camp Creek, North Fork, Pine Creek, Newsome Creek, Conant Creek and Prineville Reservoir. The following Google Earth map shows the sample sites in proximity to one another in this subbasin (Figure 3).

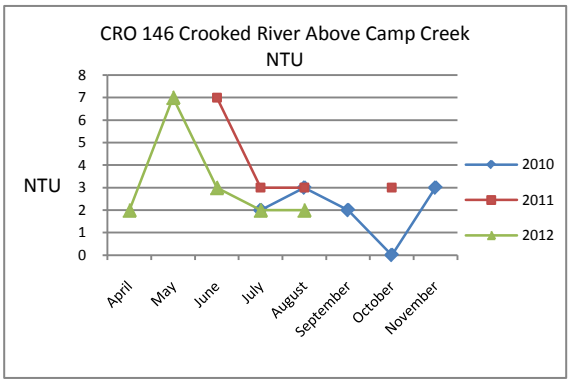
Figure 3. Data collection sites in the Upper Crooked subbasin.

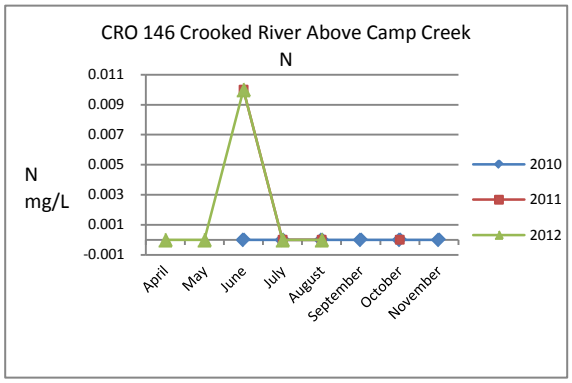
Site CRO 146

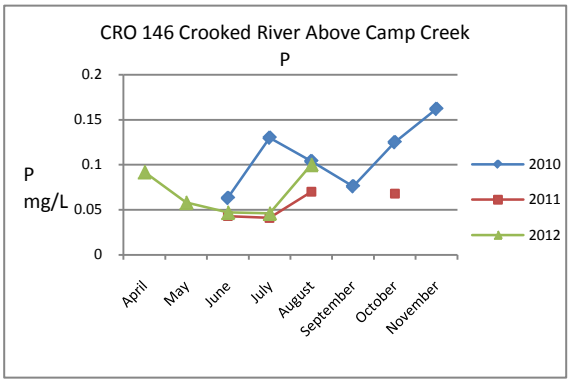
The most upstream sample site is just above the confluence of Camp Creek on the Crooked River, and below the confluence of the South Fork. This is an agricultural area, lying below Merwin Reservoir No. 3 and along the river valley floor. Water quality samples from 2010 through 2012 show DO levels that ranged from 4.4 mg/L in late July 2010 to 12.3 mg/L in early November 2012. Data indicates that DO levels never fell below 6.4 mg/L during the 3-year sampling period. Turbidity ranged from ,1 NTU in October of 2010 to 7 NTU in June of 2011 and late July of 2012. Inorganic N stayed below detection except for June of 2011 and 2012, similar to the site upstream. Concentrations of P peaked at 0.162 mg/L in October 2010, but in 2011 they never climbed above July's value of 0.07 mg/L; in 2012 P concentrations reached 0.1 mg/L, also in July. Values for pH at this site in 2010 ranged from 7.78 to 8.32, in 2011 from

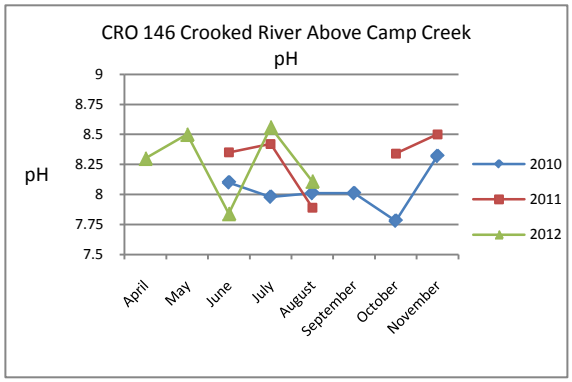
7.98 to 8.5, and in 2012 from 7.84 to 8.56. No data are available for toxins, metals, or contaminants at this site.







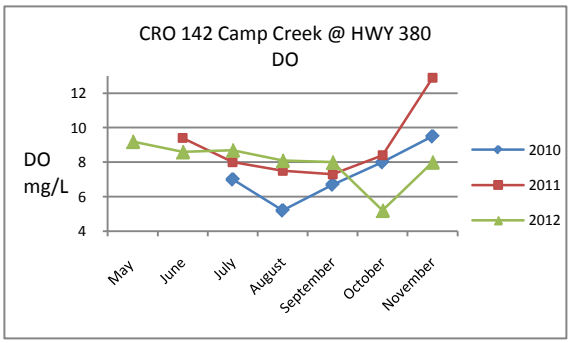


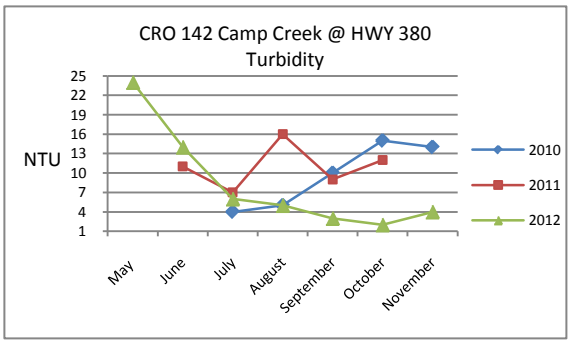


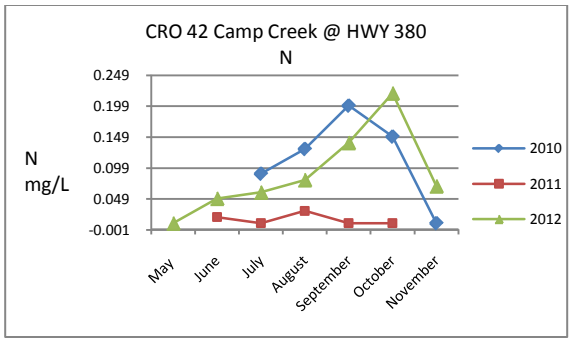
CRO 146					
Date	N (mg/L)	TP (mg/L)	NTU	DO (mg/L)	pH
7/7/2010	< 0.01	0.063		6.4	8.1
7/27/2010	< 0.01	0.13	2	4.4	7.98
8/10/2010	< 0.01	0.104	3	4.5	8.01
8/23/2010	< 0.01	0.076	2	6.6	8.01
10/5/2010	< 0.01	0.125	< 1	6.5	7.78
10/27/2010	< 0.01	0.162	3	9.3	8.32
6/1/2011	0.01	0.043	7	9	8.35
6/29/2011	< 0.01	0.041	3	7.8	8.42
7/28/2011	< 0.01	0.07	3	7	7.89
8/31/2011	< 0.01	0.068	3	6.7	8.34
11/8/2011				12.3	8.5
4/24/2012	< 0.01	0.092	2	7.8	8.3
5/9/2012	< 0.01	0.058	7	7.9	8.5
5/31/2012	0.01	0.047	3	7.1	7.84
6/20/2012	< 0.01	0.046	2	7.8	8.56
7/24/2012	< 0.01	0.1	2	5	8.11

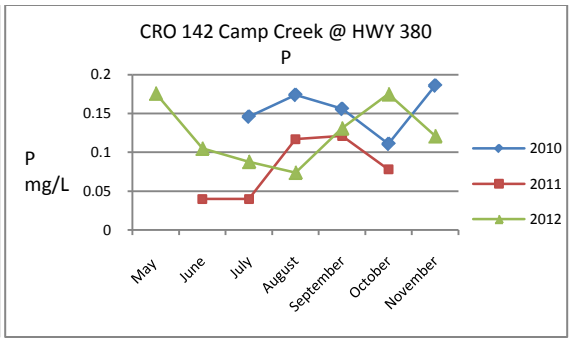
Site CRO 142

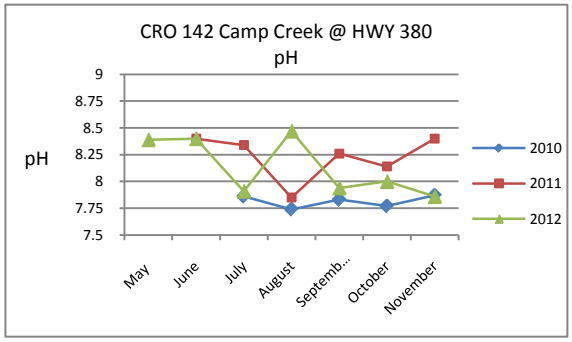
Samples were also taken just upstream from the confluence with the Crooked River on Camp Creek, where the minimums for DO were 5.2 mg/L in June 2010, 7.3 mg/L in August of 2011, and 5.2 in August of 2012. Turbidity rose sharply in August 2011, from 7 to 16 NTU, which was a change from 2010's nearly linear increase from 4 to 14 NTU over the summer months and a nearly linear decrease over the summer months in 2012. August 2010 had the highest concentration (0.29 mg/L) of inorgainc N for this site, and was well above detection the rest of the summer. Inorganic N in 2011 stayed between 0.02 mg/L and 0.03 mg/L (late July). The highest inorganic N concentration in October (22 mg/L) was in 2012. Phosphorous concentrations were higher overall in 2010, with the highest concentration recorded, 0.183 mg/L in October of that year. In 2011, concentrations fluctuated from 0.04 mg/L in June to 0.121 mg/L in August and in 2012 from 0.088 mg/L to 0.176 mg/L. Levels of pH at this site were lower in 2010, ranging from 7.68 to 7.87, whereas pH highs and lows followed nearly the same pattern as turbidity for this site with a low in July followed by a high in August. No data are available for toxins, metals, or contaminants at this site.









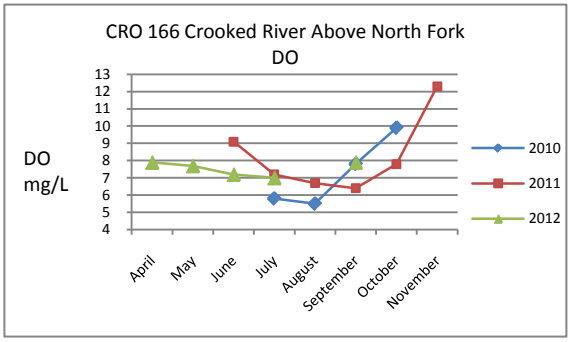


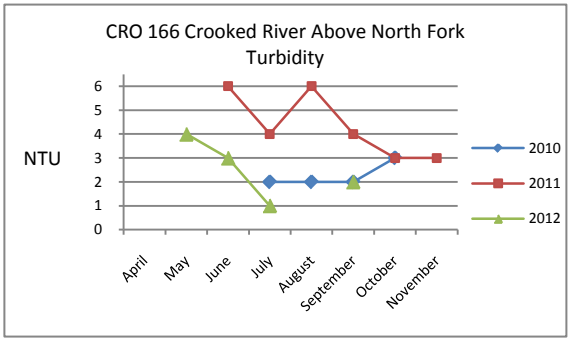
CRO 142					
Date	**N (mg/L)**	**TP (mg/L)**	**NTU**	**DO (mg/L)**	**pH**
7/7/2010	0.09	0.146	4	7	7.86
7/27/2010	0.13	0.174	5	5.2	7.74
8/10/2010	0.2	0.156	10	6.7	7.83
8/23/2010	0.29	0.129	10	7.1	7.68
10/5/2010	0.01	0.093	15	9	7.87
10/27/2010	0.01	0.186	14	9.5	7.87
6/1/2011	0.02	0.04	11	9.4	8.4
6/29/2011	0.01	0.04	7	8	8.34
7/28/2011	0.03	0.117	16	7.5	7.85
8/31/2011	0.01	0.121	9	7.3	8.26
10/5/2011	0.01	0.078	12	8.4	8.14
11/8/2011				12.9	8.4
5/1/2012	0.01	0.176	24	9.2	8.39
5/9/2012	0.05	0.105	14	8.6	8.4
5/31/2012	0.06	0.088	6	8.7	7.91
6/20/2012	0.08	0.074	5	8.1	8.47
7/24/2012	0.14	0.131	3	8	7.94
8/20/2012	0.22	0.175	2	5.2	8
9/27/2012	0.07	0.121	4	8	7.86

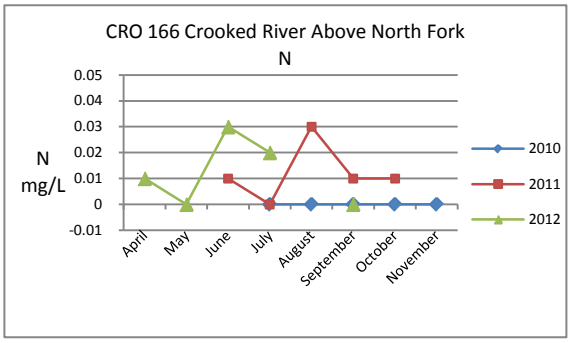
Site CRO 166

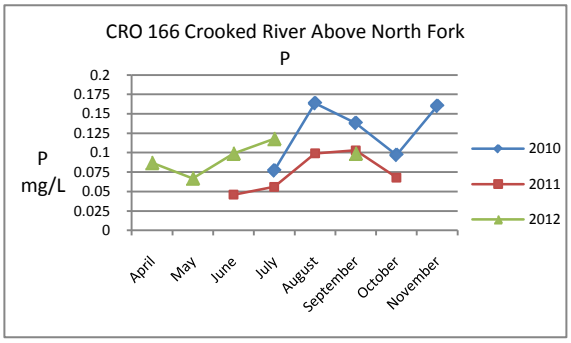
Data were collected on the Crooked River between Camp Creek and above the North Fork. This site is next to fields where crops are grown. The minimums for DO below Camp Creek were 3.8 mg/L in late July of 2010, 6.4 mg/L in late August of 2011, and 7.0 mg/L in late June of 2012. These concentrations are slightly lower than the site

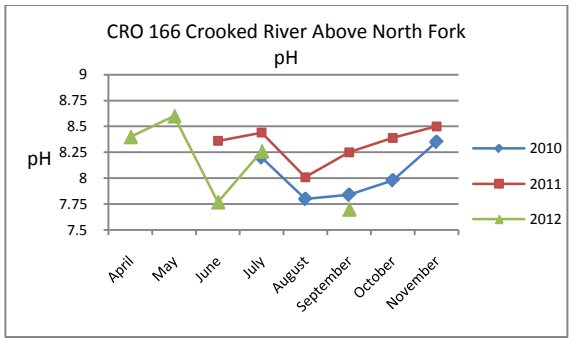
upstream from the Camp Creek confluence and lower than the concentrations on Camp Creek. Turbidity at this site was fairly low, and in 2010, stayed fairly constant with a slight dip in October. NTU levels were slightly higher in the early summer months of 2011, but then followed almost the same decreasing pattern as 2010, though 1 to 2 NTU greater. In 2012, turbidity was the greatest (4 NTU) in early May. Corresponding with the increase in turbidity was an increase in inorganic N in 2011, with a concentration of 0.03 mg/L and July followed by a drop to 0.01 mg/L. Inorganic N levels stayed below detection limits throughout 2010 and in 2012 N levels were greatest in late May through late June, with concentrations observed to be 0.03 mg/L and 0.02 mg/L, respectively. In the 3 years of sampling, P levels increased in the summer months, though in 2010 there was an increase again towards the end of October. The highest concentration in 2010 was 0.169 mg/L (late July), in 2011 it was 0.103 mg/L (late October), and in 2012 0.118 mg/L (late June). This was a departure from the trends seen at the upstream sites, but followed the trend on Camp Creek for 2011, with similar concentrations. In 2010, pH ranged from 7.73 to 8.35, with the low point occurring in August. The low point in 2011 was in July, at pH 8.01, and there were two high points, one in June of 8.36, and the other in October of 8.39. In 2012, ph values ranged from 7.70 to 8.60 mg/L. No data are available for toxins, metals, or contaminants at this site











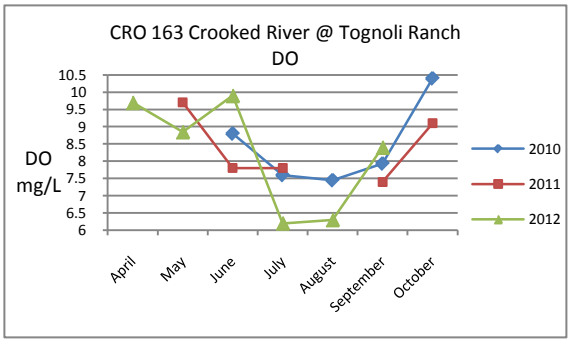
CRO 166					
Date	N (mg/L)	TP (mg/L)	NTU	DO (mg/L)	pH
07/07/10	< 0.01	0.077		5.8	8.2
07/27/10	< 0.01	0.169	3	3.8	7.73
08/10/10	< 0.01	0.158	4	6.3	7.86
08/23/10	< 0.01	0.138	2	7.5	7.84
10/05/10	< 0.01	0.097	2	7.8	7.98
10/27/10	< 0.01	0.16	3	9.9	8.35
06/01/11	0.01	0.046	6	9.1	8.36
06/29/11	< 0.01	0.056	4	7.2	8.44
07/28/11	0.03	0.099	6	6.7	8.01
08/31/11	0.01	0.103	4	6.4	8.25
10/05/11	0.01	0.068	3	7.8	8.39
11/08/11			3	12.3	8.5
04/24/12	0.01	0.087		7.9	8.4
05/09/12	< 0.01	0.067	4	7.7	8.6
05/31/12	0.03	0.099	3	7.2	7.77
06/20/12	0.02	0.118	1	7	8.26
09/27/12	< 0.01	0.099	2	7.9	7.7

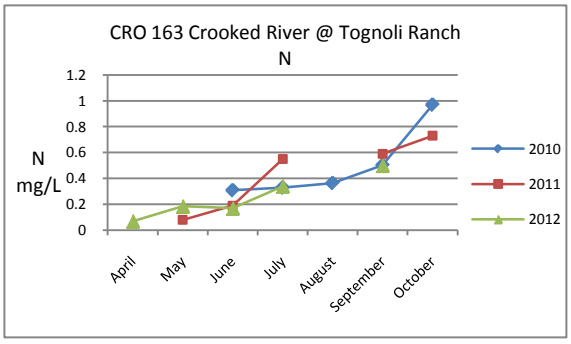
Continuing downstream, the next sampling sites are not on the Crooked River, but on the North Fork, and on Deep Creek, which feeds into the North Fork approximately 25 miles from the North Fork mouth. The first two sites are about 30 miles upstream from the confluence of the North Fork and Crooked River, followed by a site just 100 meters above the confluence on the North Fork.

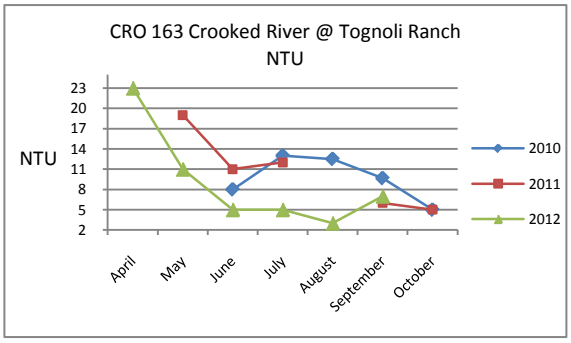
Site CRO 163

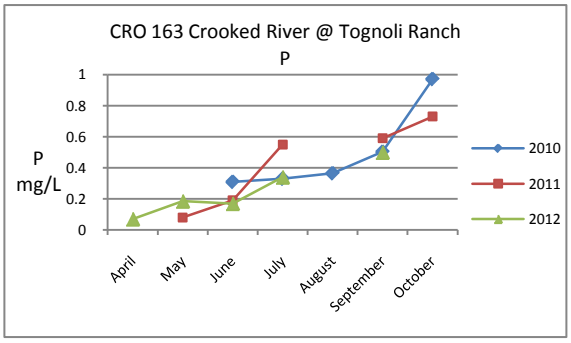
The upstream-most site had DO levels that never dropped below 6.3 mg/L during the 3 years of sampling. The minimums were observed in early August of 2010, late September of 2011, and July and August of 2012. Turbidity for this site in 2010 peaked in July at 13 NTU. In 2011, turbidity was highest early in the summer, with 19 NTU observed in mid-May. In 2012, the greatest turbidity was observed to be 23 NTU in late April. Late-summer months were not as high, and the lowest observed turbidity in 2012 was in early October with 3 NTU recorded. Inorganic N was at its highest concentrations all 3 years at the end of summer, with concentrations reaching nearly 1.0 mg/L in 2010, 0.73 mg/L in 2011, and 0.50 mg/L in 2012 . Concentrations of P peaked

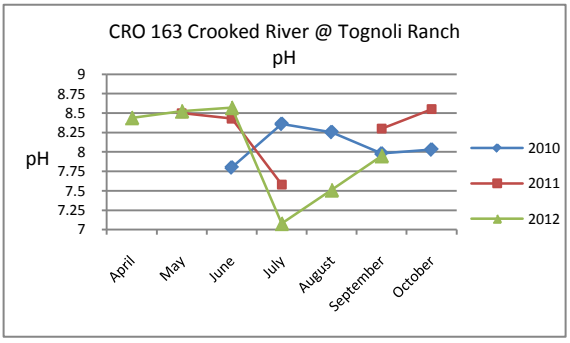
in October 2010, July 2011, and October of 2012. The greatest concentrations for the 3 years of sampling observed were 0.188 mg/L, 0.126 mg/L, and 0.162 mg/L, respectively. Reported pH for this site ranged from 7.08 (July 2012) to 8.53 (June 2012). In 2010, the highest pH was seen in the mid summer months, but the opposite was true of 2011 and 2012. No data are available for toxins, metals, or contaminants at this site.







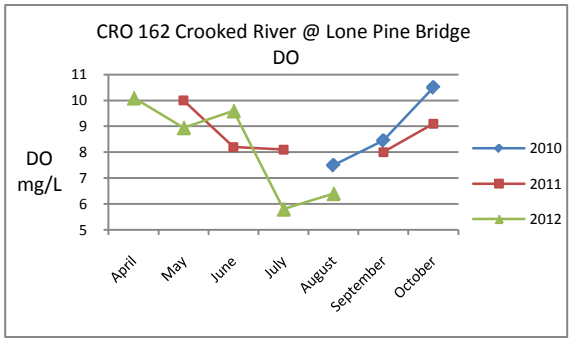


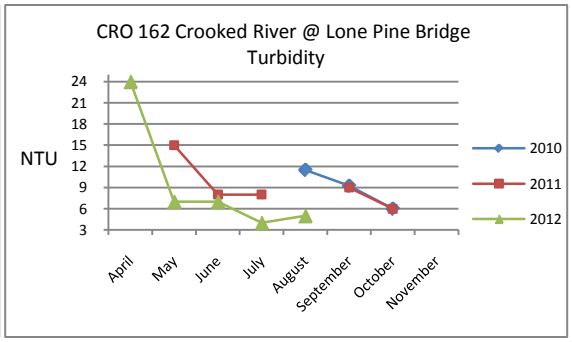


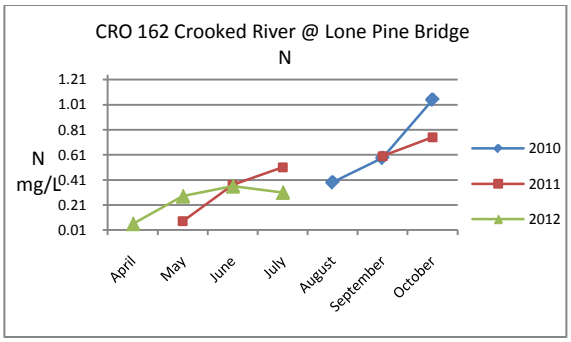
CRO 163					
Date	N (mg/L)	TP (mg/L)	NTU	DO (mg/L)	pH
06/22/10	0.31	0.099		8.8	7.8
07/19/10	0.33	0.133	8	7.6	8.36
08/04/10	0.37	0.136	13	8	8.41
08/18/10	0.36	0.126	12	6.9	8.1
09/01/10	0.52	0.132	10	8	8
09/16/10	0.4	0.12	11	8	7.9
09/29/10	0.59	0.133	8	7.8	8.04
10/26/10	0.97	0.188	5	10.4	8.03
05/18/11	0.08	0.102	19	9.7	8.5
06/21/11	0.19	0.11	11	7.8	8.43
07/20/11	0.55	0.126	12	7.8	7.58
09/29/11	0.59	0.113	6	7.4	8.3
10/31/11	0.73	0.063	5	9.1	8.55
04/23/12	0.07	0.144	23	9.7	8.44
05/08/12	0.16	< 0.01	11	9	8.8
05/30/12	0.21	0.098		8.7	8.25
06/19/12	0.17	0.087	5	9.9	8.57
07/10/12	0.34	0.129	5	6.2	7.08
08/07/12		0.162	3	6.3	7.51
09/25/12	0.5	0.151	7	8.4	7.95

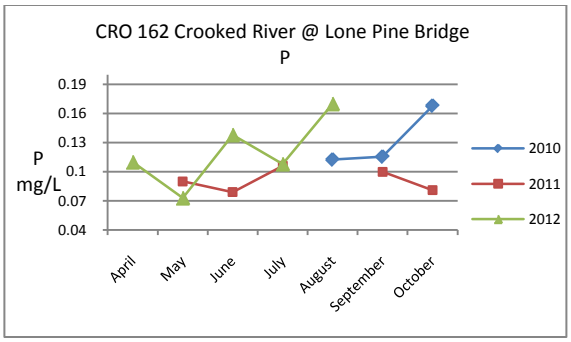
Site CRO 162

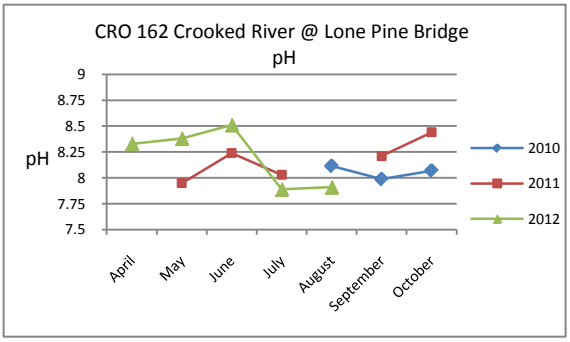
The Deep Creek sample site (CRO 162; Crooked River @ Lone Pine Bridge) had DO concentrations that never fell below 6 mg/L in the 3 years of sampling. Turbidity at this site was at its highest during the mid-summer months of 2010, but peaked in late spring-early summer of 2011 and 2012, as was the case with many of the other sites discussed in this report. Concentrations of inorganic N reached 1.05 mg/L in October of 2010, with a concentration dip in July and August; 0.75 mg/L in late October of 2011, and in 2012 the highest N concentration was 0.36 mg/L in June. Concentrations of P were highest (0.168 mg/L) at the end of October for 2010; in 2011, highest concentrations (0.106 mg/L) were observed in July and in 2012 highest concentrations (0.170 mg/L) were reported in August. Reported pH fluctuated from 7.81 to 8.51 over the course of the 3-year sampling period. No data are available for toxins, metals, or contaminants at this site.









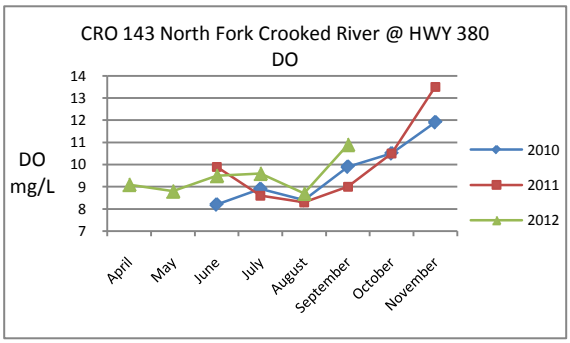


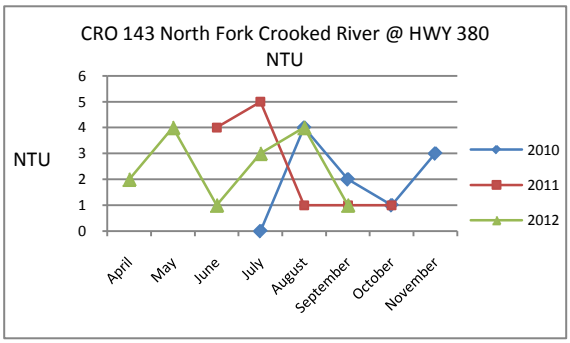
CRO 162					
Date	N (mg/L)	TP (mg/L)	NTU	DO (mg/L)	pH
07/19/10	0.39	0.092	6	9.8	8.2
08/04/10	0.39	0.115	10	8.3	8.15
08/18/10	0.39	0.11	13	6.7	8.08
09/01/10	0.55	0.112	13	8.3	7.81
09/16/10	0.44	0.111	10	8.6	7.92
09/29/10	0.68	0.119	7	8.5	8.14
09/29/10	0.67	0.12	7	8.4	8.08
10/26/10	1.05	0.168	6	10.5	8.07
05/18/11	0.08	0.09	15	10	7.95
06/21/11	0.37	0.079	8	8.2	8.24
07/20/11	0.51	0.106	8	8.1	8.03
09/29/11	0.6	0.1	9	8	8.21
10/31/11	0.75	0.081	6	9.1	8.44
04/23/12	0.06	0.11	24	10.1	8.33
05/08/12	0.21	0.069	7	9.1	8.4
05/30/12	0.35	0.077		8.8	8.36
06/19/12	0.36	0.138	7	9.6	8.51
07/10/12	0.31	0.108	4	5.8	7.89
08/07/12		0.17	5	6.4	7.91

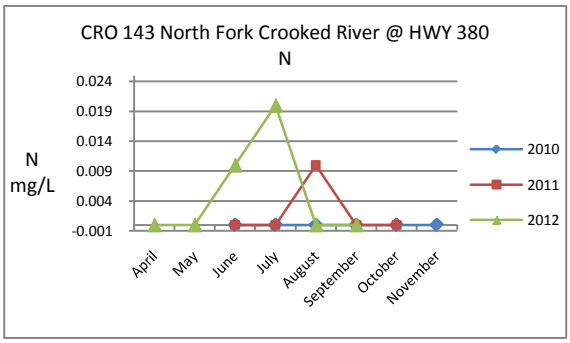
Site CRO 143

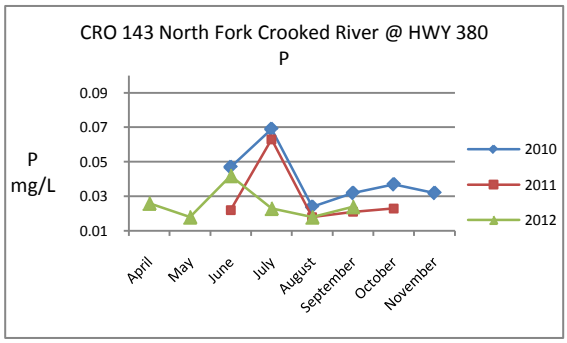
At the mouth of the North Fork is the last sample site on this water body. Minimum DO concentrations at this site never fell below 8.2 mg/L in 2010, 2011 or 2012. Turbidity at this site reached a maximum of 5 NTU in late June of 2011; however, in 2010 and 2012, never exceeded 4 NTU. Inorganic N stayed below detection limits in all of 2010 and all

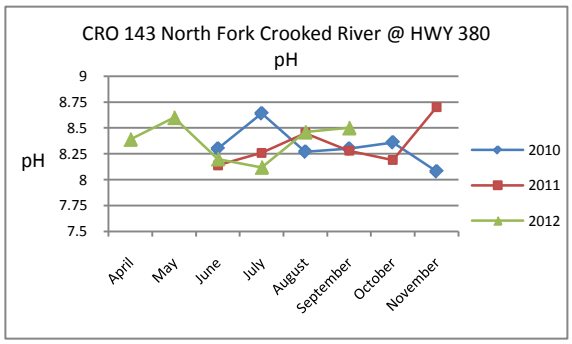
sampling dates of 2011, except for early June, when concentrations were observed to be 0.01 mg/L. In 2012, N concentrations in late May and late June were 0.01 mg/L and 0.02 mg/L, respectively, and all other sampling dates reported less than detection. The concentrations for P were higher in 2010, 2011, and 2012, with the greatest concentrations observed in 2010 at 0.069 mg/L in late July and in 2011, 0.063 mg/L was observed in late June. In 2012, the highest P concentration observed was 0.42 mg/L in late May. Reported pH levels fluctuated by 0.62 pH units over the three summers of sampling, staying between 8.08 and 8.70 mg/L. No data are available for toxins, metals, or contaminants at this site.







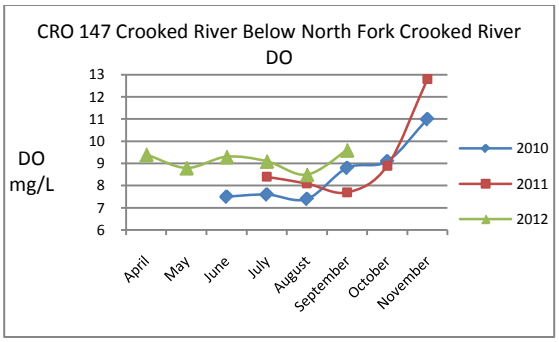


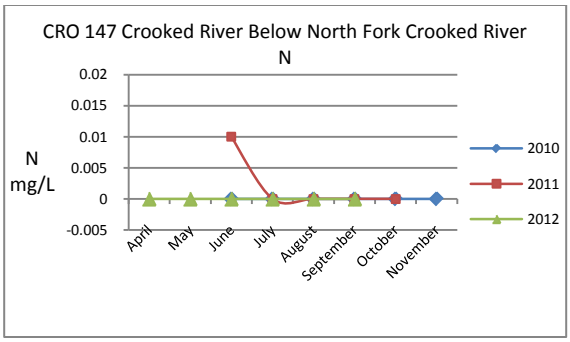


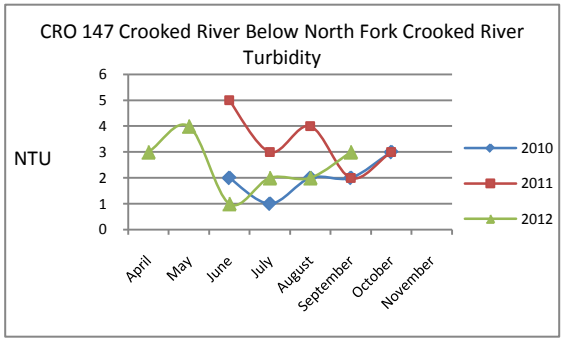
CRO 143					
Date	N (mg/L)	TP (mg/L)	NTU	DO (mg/L)	pH
7/7/2010	< 0.01	0.047		8.2	8.3
7/27/2010	< 0.01	0.069	< 1	8.9	8.64
8/10/2010	< 0.01	0.024	4	8.4	8.27
8/23/2010	< 0.01	0.032	2	9.9	8.3
10/5/2010	< 0.01	0.037	1	10.5	8.36
10/27/2010	< 0.01	0.032	3	11.9	8.08
6/1/2011	< 0.01	0.022	4	9.9	8.14
6/29/2011	< 0.01	0.063	5	8.6	8.26
7/28/2011	0.01	0.018	1	8.3	8.45
8/31/2011	< 0.01	0.021	1	9	8.28
10/5/2011	< 0.01	0.023	1	10.5	8.19
11/8/2011				13.5	8.7
4/24/2012	< 0.01	0.026	2	9.1	8.39
5/9/2012	< 0.01	0.018	4	8.8	8.6
5/31/2012	0.01	0.042	1	9.5	8.2
6/20/2012	0.02	0.023	3	9.6	8.12
8/20/2012	< 0.01	0.018	4	8.7	8.46
9/27/2012	< 0.01	0.024	1	10.9	8.5

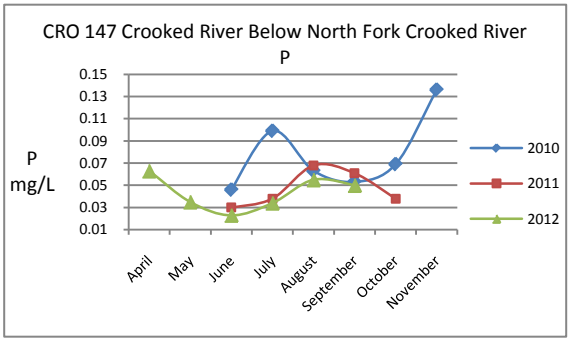
Site CRO 147

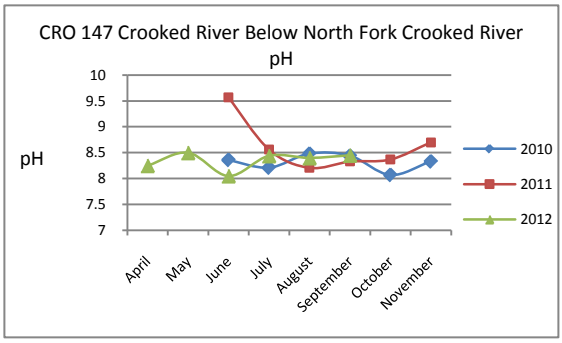
The next sample site is just downstream from the confluence of the North Fork with the Crooked River. Downstream from the North Fork, minimum DO concentrations never fell below 7.4 mg/L in 2010, 2011, or 2012 with the low points in each year occurring in August. Turbidity stayed between 1 and 3 NTU for 2010, reached 5 NTU in early June of 2011, and 4 NTU was observed in early May of 2012. Concentrations of inorganic N were below detection limits for all sampling dates in 2010, 2011, and 2012, except in early June of 2011, when concentrations were observed to be 0.01 mg/L. Concentrations of P in 2010 were lowest in August, and highest in October, with values ranging from 0.046 mg/L to 0.136 mg/L. The concentration of P in 2011 followed a dissimilar pattern, with a peak concentration in July of 0.068 mg/L and low concentrations recorded in June and October with values right around 0.03 mg/L. In 2012, P concentrations ranged from 0.063 mg/L (late April) to 0.023 mg/L (late May). In 2010, a peak of pH 8.48 was observed, and in October, a low pH of 8.07 was observed. The highest value for pH in 2011 was in June, with a value of 9.57, followed by the low for the year at the end of July of 8.19. In 2012, pH ranged from 8.05 to 8.50. No data are available for toxins, metals, or contaminants at this site.


CRO 147 Crooked River Below North Fork Crooked River
DO
DO
mg/L
13
12
11
10
9
8
7
6
April
May
June
July
August
September
October
November
2010
2011
2012


CRO 147 Crooked River Below North Fork Crooked River
N
N
mg/L
0.02
0.015
0.01
0.005
0
-0.005
April
May
June
July
August
September
October
November
2010
2011
2012


CRO 147 Crooked River Below North Fork Crooked River
Turbidity
NTU
6
5
4
3
2
1
0
April
May
June
July
August
September
October
November
2010
2011
2012

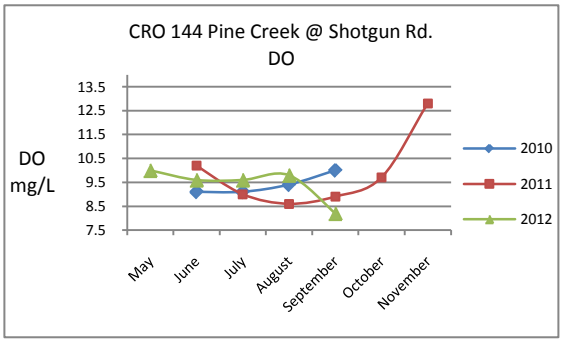

CRO 147 Crooked River Below North Fork Crooked River
P
P
mg/L
0.15
0.13
0.11
0.09
0.07
0.05
0.03
0.01
April
May
June
July
August
September
October
November
2010
2011
2012

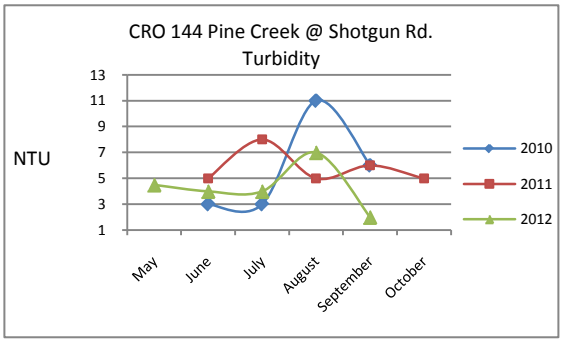

CRO 147 Crooked River Below North Fork Crooked River
pH
pH
10
9.5
9
8.5
8
7.5
7
April
May
June
July
August
September
October
November
2010
2011
2012

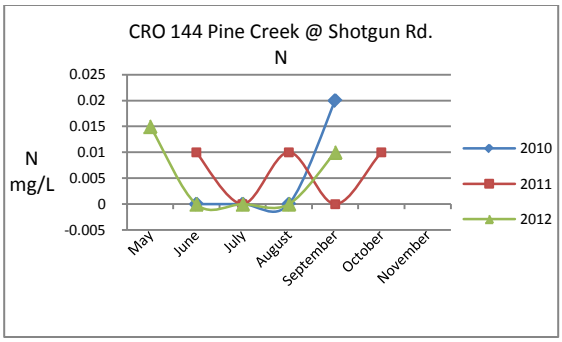
CRO 147					
Date	N (mg/L)	TP (mg/L)	NTU	DO (mg/L)	pH
7/7/2010	< 0.01	0.046		7.5	8.36
7/27/2010	< 0.01	0.099	2	7.6	8.21
8/10/2010	< 0.01	0.063	1	7.4	8.48
8/23/2010	< 0.01	0.053	2	8.8	8.44
10/5/2010	< 0.01	0.069	2	9.1	8.07
10/27/2010	< 0.01	0.136	3	11	8.33
6/1/2011	0.01	0.03	5	236	9.57
6/29/2011	< 0.01	0.038	3	8.4	8.56
7/28/2011	< 0.01	0.068	4	8.1	8.21
8/31/2011	< 0.01	0.061	2	7.7	8.33
10/5/2011	< 0.01	0.038	3	8.9	8.37
11/8/2011				12.8	8.7
4/24/2012	< 0.01	0.063	3	9.4	8.25
5/9/2012	< 0.01	0.035	4	8.8	8.5
5/31/2012	< 0.01	0.023	1	9.3	8.05
6/20/2012	< 0.01	0.034	2	9.1	8.44
8/20/2012	< 0.01	0.055	2	8.5	8.4
9/27/2012	< 0.01	0.05	3	9.6	8.45

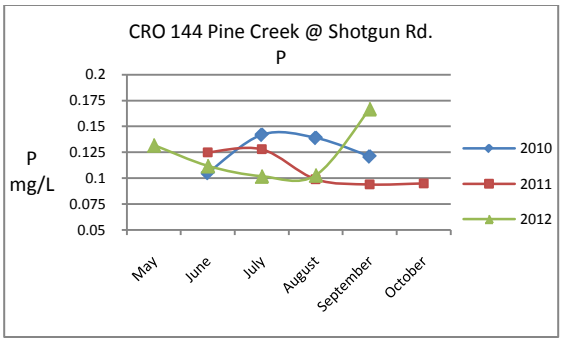
Site CRO 144

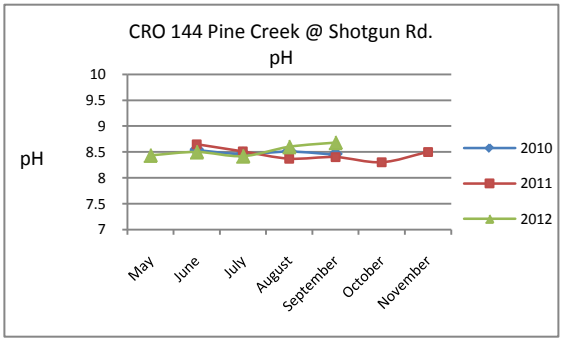
The next site that was monitored is not on the Crooked River, but just above the mouth of Pine Creek. Pine Creek flows through a mountainous area along Pine Creek Road. There is limited to no agriculture along this creek. Minimum DO for this site did not fall below 8.2 mg/L in 2010, 2011 or 2012. Turbidity for this site was greatest in September of 2010 (11 NTU), and in 2011 and 2012 turbidity was greatest in June (8 NTU) and July (7 NTU), respectively. Inorganic N stayed below detection in 2010 until late September when it increased to 0.02 mg/L. In 2011, N concentrations were no greater than 0.01 mg/L at any sampling date. In 2012, a high concentration of 0.02 mg/L was reported in May, but otherwise were at or below detection for all other sampling dates that year. Reported pH values ranged from 8.30 to 8.68. No data are available for toxins, metals, or contaminants at this site.









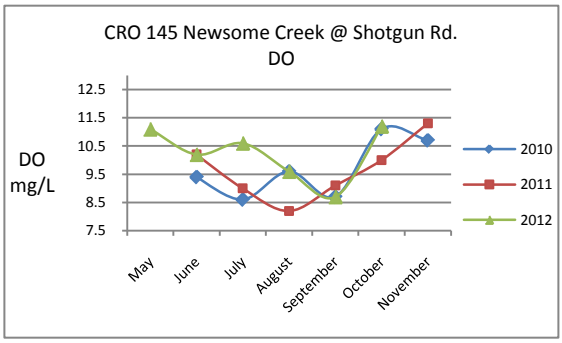


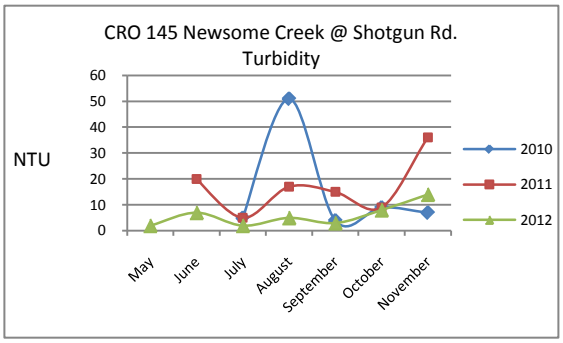
CRO 144					
Date	N (mg/L)	TP (mg/L)	NTU	DO (mg/L)	pH
7/7/2010	< 0.01	0.105	3	9.1	8.54
7/27/2010	< 0.01	0.142	3	9.1	8.46
8/10/2010	< 0.01	0.139	11	9.4	8.51
8/23/2010	0.02	0.121	6	10	8.45
6/1/2011	0.01	0.125	5	10.2	8.65
6/29/2011	< 0.01	0.128	8	9	8.51
7/28/2011	0.01	0.099	5	8.6	8.37
8/31/2011	< 0.01	0.094	6	8.9	8.4
10/5/2011	0.01	0.095	5	9.7	8.3
11/8/2011				12.8	8.5
5/1/2012	0.01	0.138	3	10.2	8.42
5/9/2012	0.02	0.126	6	9.8	8.45
6/4/2012	< 0.01	0.112	4	9.6	8.5
6/20/2012	< 0.01	0.102	4	9.6	8.42
7/24/2012	< 0.01	0.103	7	9.8	8.6
8/20/2012	0.01	0.167	2	8.2	8.68

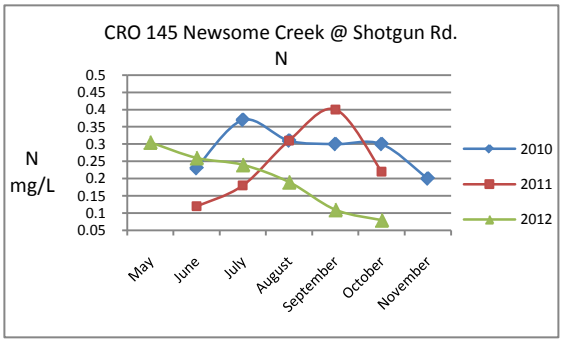
Site CRO 145

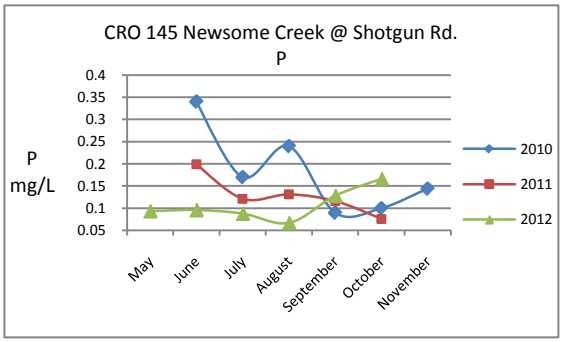
The next site is not on the Crooked River, but on Newsome Creek, just above the mouth along Shotgun Road. The land surrounding Newsome Creek is used to grow crops until the creek branches about 3 to 4 miles upstream from the mouth. Minimum DO concentrations above the mouth of Newsome Creek never fell below 8.2 mg/L during the three-year sampling period of 2010 through 2012. Turbidity for this site had a high of 51 NTU in early August of 2010, causing the average for the month to be 27.5 NTU,

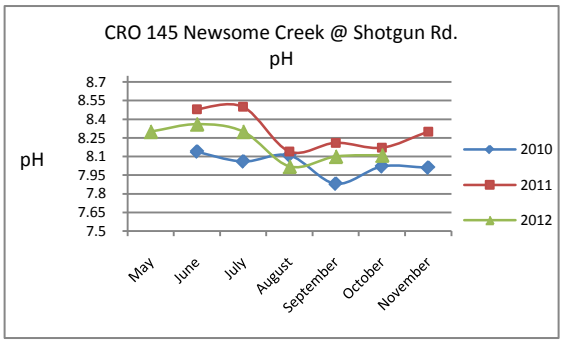
before dramatically falling to 4 NTU by the end of the month. In 2011, a value of 20 NTU was recorded in early June, followed by a decrease and then a raise again during July and August. In 2012, turbidity reached 14 NTU in late September. Inorganic N for this site in 2010 peaked in July with a value of 0.39 mg/L, but by October was at a low of 0.02 mg/L. In 2011, the lowest concentration of inorganic N was in June with at value of 0.12 mg/L, and the greatest concentration was observed in the end of August with a value of 0.40 mg/L, while in 2012 highest concentrations were in May (0.26 and 0.35 mg/L) and lowest in late September (0.08 mg/L). The greatest concentration of P in 2010 was 0.34 mg/L in early July, and the lowest concentration of 0.09 mg/L was observed in late August. Early June 2011 had the highest concentration of 0.199 mg/L for that year, while October has the lowest concentration of 0.076 mg/L. In 2012, the greatest concentration of P observed was 0.166 mg/L in late September. The pH for this site ranged from pH 7.88 to 8.5. No data are available for toxins, metals, or contaminants at this site.







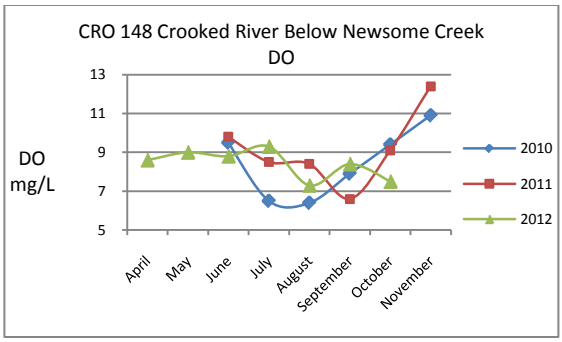


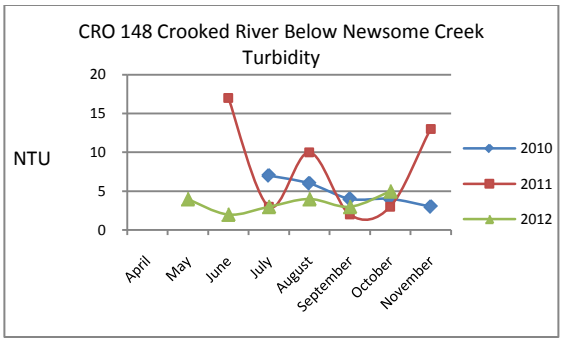


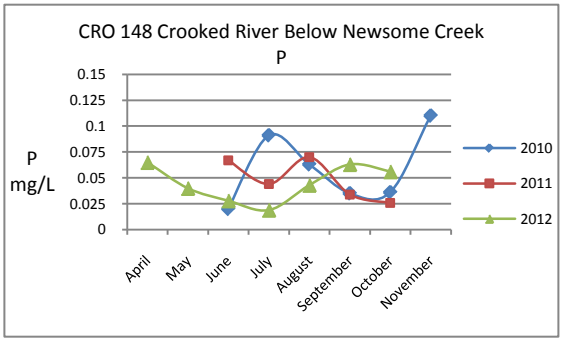
CRO 145					
Date	N (mg/L)	TP (mg/L)	NTU	DO (mg/L)	pH
7/7/2010	0.23	0.34		9.4	8.14
7/27/2010	0.37	0.17	5	8.6	8.06
8/10/2010	0.31	0.24	51	9.6	8.11
8/23/2010	0.3	0.09	4	8.7	7.88
10/5/2010	0.3	0.1	9	11.1	8.02
10/27/2010	0.2	0.144	7	10.7	8.01
6/1/2011	0.12	0.199	20	10.2	8.48
6/29/2011	0.18	0.121	5	9	8.5
7/28/2011	0.31	0.131	17	8.2	8.14
8/31/2011	0.4	0.116	15	9.1	8.21
10/5/2011	0.22	0.076	9	10	8.17
11/8/2011			36	11.3	8.3
5/1/2012	0.26	0.064	2	11.3	8.2
5/9/2012	0.35	0.123	7	10.9	8.4
6/4/2012	0.26	0.096	2	10.2	8.36
6/20/2012	0.24	0.088	5	10.6	8.3
7/24/2012	0.19	0.067	3	9.6	8.02
8/20/2012	0.11	0.128	8	8.7	8.1
9/27/2012	0.08	0.166	14	11.2	8.11

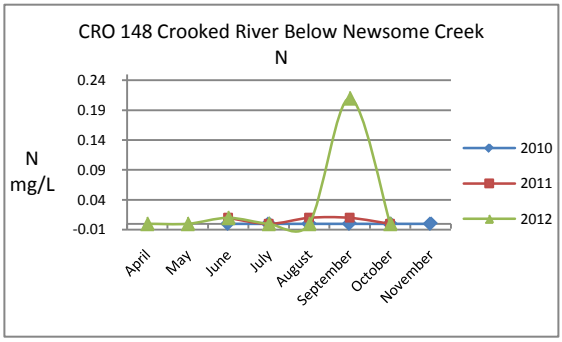
Site CRO 148

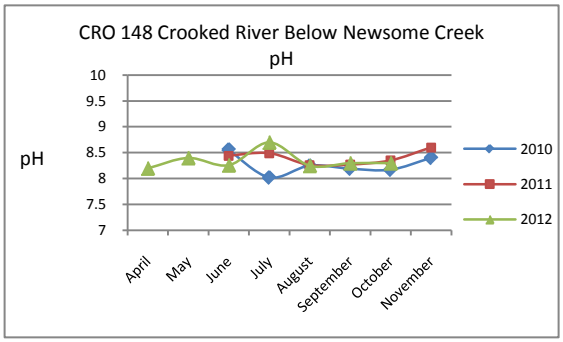
The next site is just downstream from the confluence of Newsome Creek on the Crooked River. The minimum DO for this site never dropped below 6.4 mg/L in 2010, 2011, or 2012. Overall, the DO is lower here than both the site on Newsome Creek and the site on the Crooked River upstream from both Newsome and Pine creeks, although for both years the trend is very similar for all three sites. Turbidity in 2010 fell from 7 NTU in late July to 3 NTU in late October, while in 2011 turbidity started out at 17 NTU, dipped to 2 NTU in late June, and rose again to 10 NTU in late July, dipped again and was observed to be 13 NTU in November. In 2012, turbidity was lower than the two previous years, with the greatest turbidity observed to be 5 NTU in late September. Inorganic N stayed below detection levels for all sampling dates in 2010, ranged between <0.01 mg/L and 0.01mg/L in 2011, as was the case in 2012, except for September, when concentrations were reported to be 0.21 mg/L. Concentrations of P ranged from 0.11 mg/L in late October 2010 to 0.019 in June of 2012. At this site, pH fluctuated from 8.02 to 8.7. The lowest observed was in late July 2010, and the highest observed pH value was in June 2012. No data are available for toxins, metals, or contaminants at this site.


CRO 148 Crooked River Below Newsome Creek
DO
DO
mg/L
13
11
9
7
5
April
May
June
July
August
September
October
November
2010
2011
2012


CRO 148 Crooked River Below Newsome Creek
Turbidity
NTU
20
15
10
5
0
April
May
June
July
August
September
October
November
2010
2011
2012


CRO 148 Crooked River Below Newsome Creek
P
P
mg/L
0.15
0.125
0.1
0.075
0.05
0.025
0
April
May
June
July
August
September
October
November
2010
2011
2012


CRO 148 Crooked River Below Newsome Creek
N
N
mg/L
0.24
0.19
0.14
0.09
0.04
-0.01
April
May
June
July
August
September
October
November
2010
2011
2012


CRO 148 Crooked River Below Newsome Creek
pH
pH
10
9.5
9
8.5
8
7.5
7
April
May
June
July
August
September
October
November
2010
2011
2012

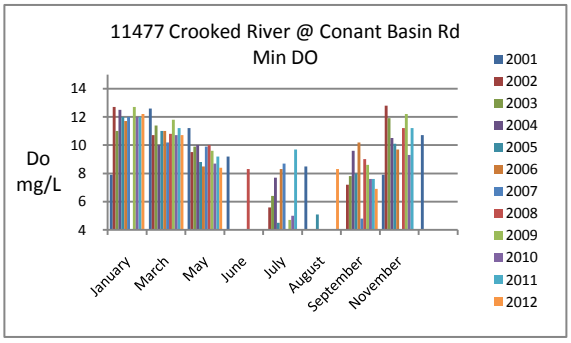
CRO 148					
Date	N (mg/L)	TP (mg/L)	NTU	DO (mg/L)	pH
7/7/2010	<0.01	0.02		9.5	8.56
7/27/2010	< 0.01	0.091	7	6.5	8.02
8/10/2010	< 0.01	0.063	6	6.4	8.25
8/23/2010	< 0.01	0.035	4	7.9	8.19
10/5/2010	< 0.01	0.036	4	9.4	8.17
10/27/2010	< 0.01	0.11	3	10.9	8.4
6/1/2011	0.01	0.067	17	9.8	8.44
6/29/2011	< 0.01	0.044	3	8.5	8.49
7/28/2011	0.01	0.07	10	8.4	8.26
8/31/2011	0.01	0.034	2	6.6	8.27
10/5/2011	< 0.01	0.026	3	9.1	8.35
11/8/2011			13	12.4	8.6
4/24/2012	< 0.01	0.065		8.6	8.2
5/9/2012	< 0.01	0.04	4	9	8.4
5/31/2012	0.01	0.028	2	8.8	8.26
6/20/2012	< 0.01	0.019	3	9.3	8.7
7/24/2012	< 0.01	0.043	4	7.3	8.25
8/20/2012	0.21	0.063	3	8.4	8.3
9/27/2012	< 0.01	0.056	5	7.5	8.3

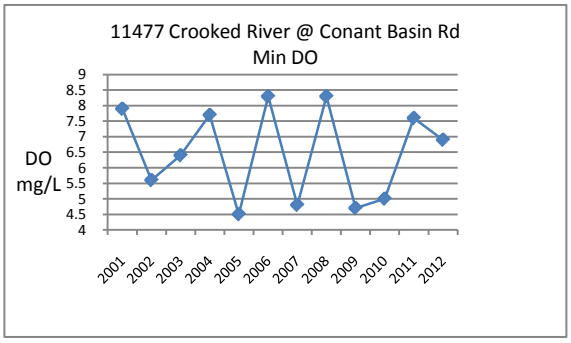
Site 11477

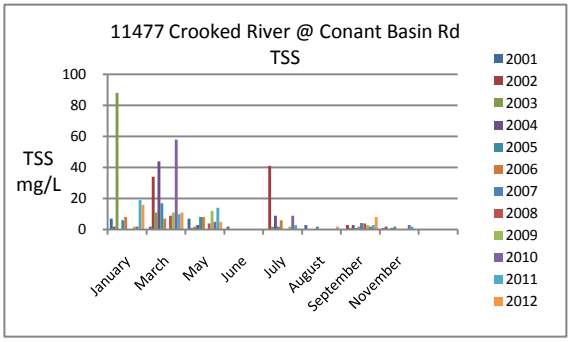
Downstream from Newsome Creek, and above the reservoir, sampling events took place over the course of several years. The site 11477 at Conant Basin Road is the first site on this stretch of river that has acceptable data for more than two consecutive years of sampling.

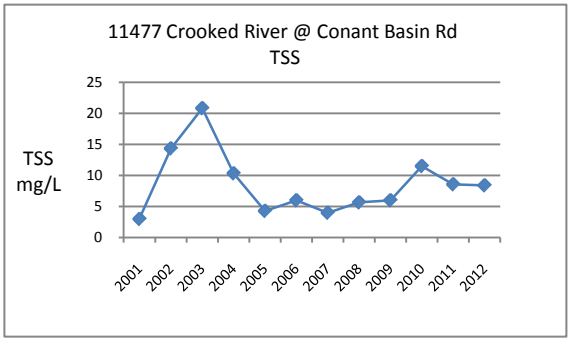
The DO for this site was monitored with data from 2001 through 2012 presented here. The data were collected every other month and as shown in the graph below, with a maximum value of 12.9 mg/L observed in November of 2002 and a minimum value of 4.5 mg/L in July of 2005. Values typically were observed to be lowest during the summer months from May until September. Sediment as total suspended solids (TSS) and turbidity were measured as well, as were total phosphorous (TP), orthophosphorous (OP), inorganic nitrogen (N), total kedjahl nitrogen (TKN), and pH. The data were graphed by monthly averages and yearly averages (which differs from DO, which is presented as minimums, monthly, and yearly). The highest TSS concentration (88 mg/L) was observed in January of 2003, and as shown on the monthly graph, January through March typically showed higher concentrations followed by a decrease, before increasing again in mid-summer. The maximum turbidity reported at this site was 50 NTU in March of 2004 and lowest turbidity was typically found in late spring through late fall ranging from 1 to 10 NTU. Data for both inorganic N and TKN was collected at this site. The final sample data for TKN analysis was in mid-September of 2006. January of 2006 had the highest observed TKN concentration of 0.047 mg/L. Overall, 2003 had the highest yearly average, 0.026 mg/L. Late winter and early spring generally had the highest concentrations of inorganic N, as did late summer and fall, though not as

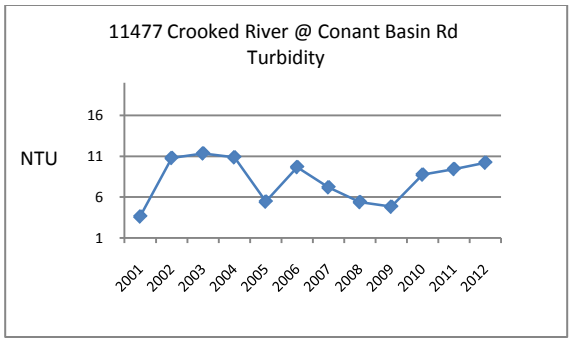
high. TKN was also highest on average in 2003 (0.560 mg/L), but reached monthly highs typically in July through August, with the exception of 2003 when the highest concentration (0.800 mg/L) was observed in late January. TKN concentrations in the summer months were between 0.700 mg/L and 0.800 mg/L. Both total phosphorous (TP) and ortho-phosphorous (OP) were analyzed at this site. Yearly average levels of both OP and TP peaked in 2006, and concentrations were typically highest in the early part of the year, though OP tended to peak during midsummer, as well. Reported pH ranged from 7.6 to 9.1, with the lower pH values being observed in January through May, and the higher pH values observed in August through September. Additional data were collected at this site in 2010 regarding metals. Samples were taken in March, May, September, and November. Levels were below detection limits for cadmium, beryllium, antimony, thallium, silver, and selenium. Lead was observed to be 0.47 µg/L in March, and between 0.20 and 0.30 µg/L in May through September. November was observed to be below detection. Magnesium levels were highest in July, with an observed value of 19.2 mg/L, and lowest in March, at 5.65 mg/L. Nickel was observed to be at its highest concentration (2.50 µg/L) in March and lowest in September (1.10 µg/L). Zinc also had its highest concentration in March (7.40 µg/L), and another peak in July (5.40 µg/L). Barium ranged from 14.5 µg/L (May) to 35.3 µg/L (July). The highest concentration of arsenic was observed in November (2.19 µg/L), July was the next highest measured concentration (1.82 µg/L), and the lowest concentration (0.56 µg/L) was observed in May. Chromium was below detection limits in all months except for March, with an observed concentration of 3.10 µg/L. No data are available for toxins, or contaminants at this site.

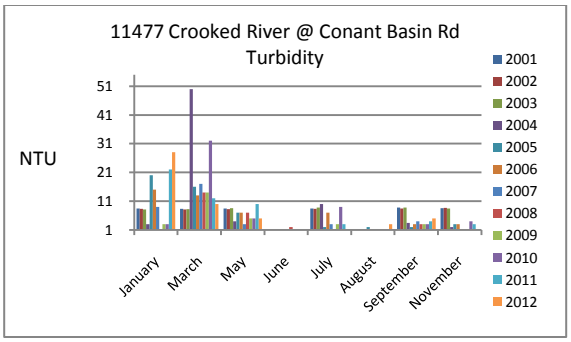


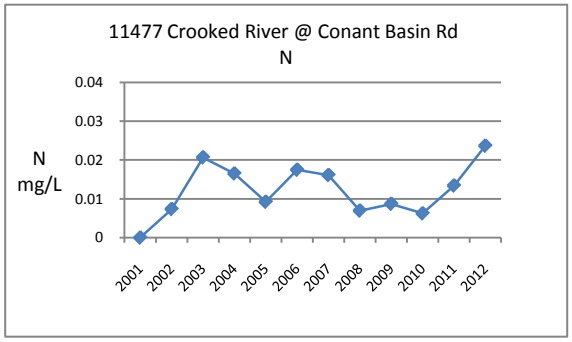


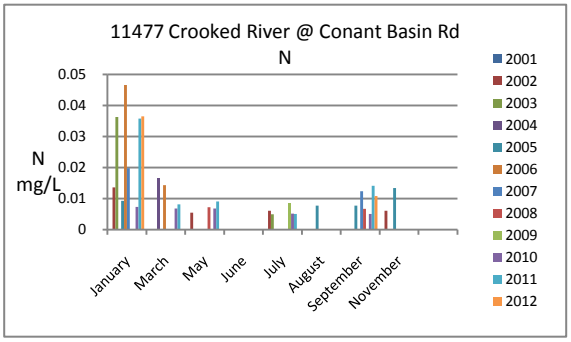


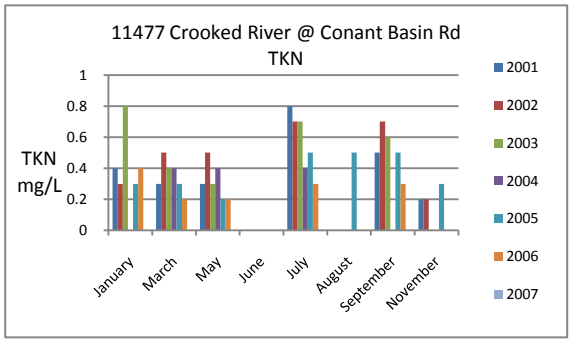


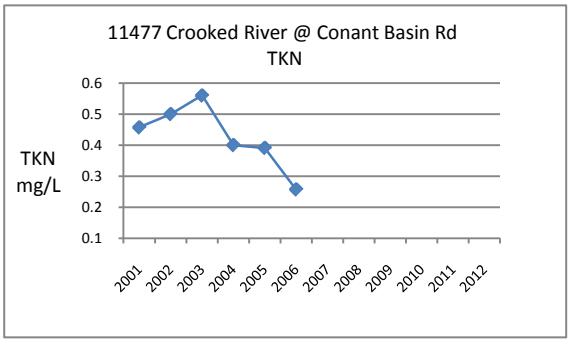

11477 Crooked River @ Conant Basin Rd
Turbidity
NTU
16
11
6
1
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012

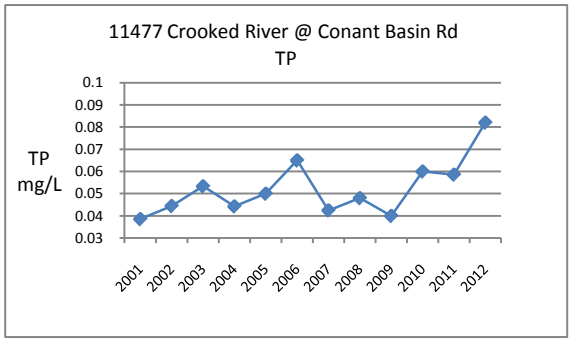

11477 Crooked River @ Conant Basin Rd
Turbidity
NTU
51
41
31
21
11
1
January
March
May
June
July
August
September
November
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012

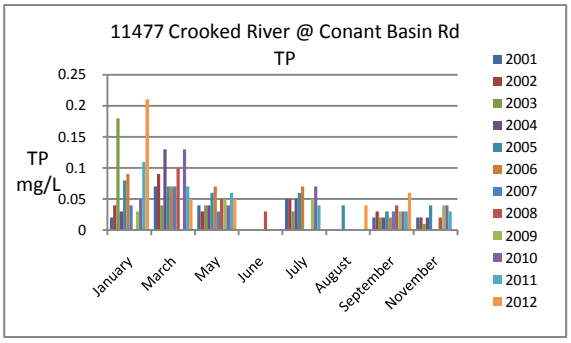

11477 Crooked River @ Conant Basin Rd
N
N
mg/L
0.04
0.03
0.02
0.01
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012

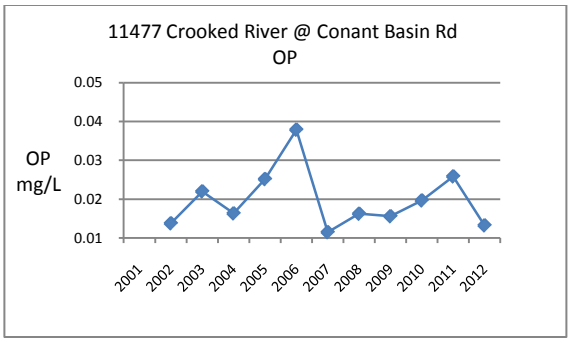

11477 Crooked River @ Conant Basin Rd
N
N
mg/L
0.05
0.04
0.03
0.02
0.01
0
January
March
May
June
July
August
September
November
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012

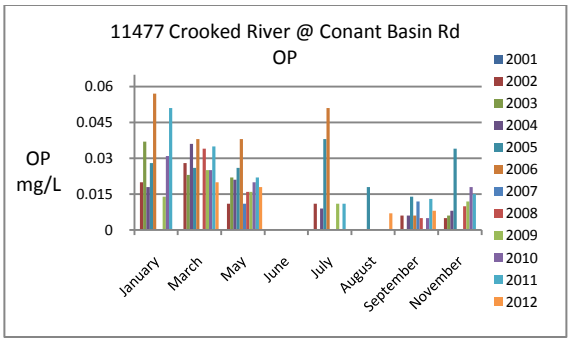

11477 Crooked River @ Conant Basin Rd
TKN
TKN
mg/L
1
0.8
0.6
0.4
0.2
0
January
March
May
June
July
August
September
November
2001
2002
2003
2004
2005
2006
2007

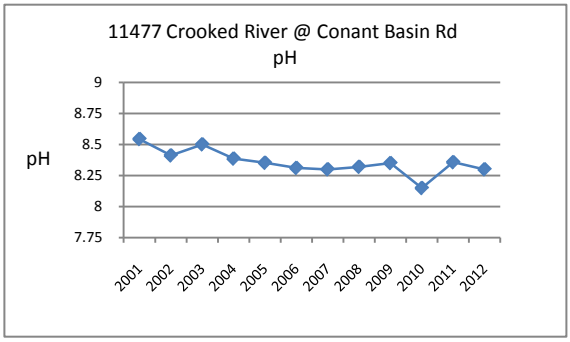

11477 Crooked River @ Conant Basin Rd
TKN
TKN
mg/L
0.6
0.5
0.4
0.3
0.2
0.1
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012

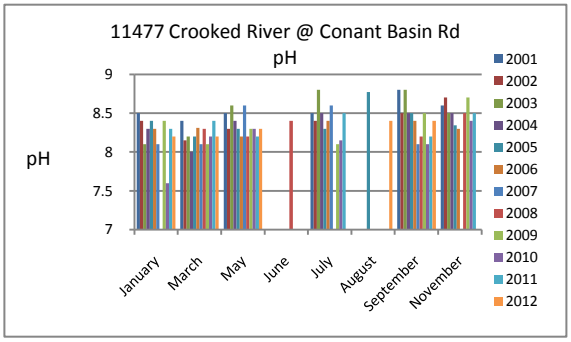

11477 Crooked River @ Conant Basin Rd
TP
TP
mg/L
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012


11477 Crooked River @ Conant Basin Rd
TP
TP
mg/L
0.25
0.2
0.15
0.1
0.05
0
January
March
May
June
July
August
September
November
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012









11477								
Date	**N(mg/L)**	**TKN(mg/L)**	**OP(mg/L)**	**TP(mg/L)**	**TSS(mg/L)**	**NTU**	**DO(mg/L)**	**pH**
1/22/2001	<0.0050	0.4		0.02	2	2	12.6	8.5
3/12/2001	<0.0050	0.3		0.07	7	12	11.2	8.4
5/7/2001	<0.0050	0.3		0.04	2	3	9.2	8.5
7/9/2001	<0.0050	0.8		0.05	3	3	8.5	8.4
7/9/2001	<0.0050	0.7		0.05	3	3	8.6	8.6
9/10/2001	<0.0050	0.5		0.02	1	1.5	7.9	8.8
11/5/2001	<0.0050	0.2		0.02	<1	1	10.7	8.6
1/28/2002	0.0136	0.3	0.02	0.04	2	4	12.7	8.4
3/28/2002	<0.0050	0.5	0.028	0.08	34	30	10.7	8.2
3/28/2002	<0.0050	0.4	0.028	0.09	32	31	10.7	8.1
5/28/2002	0.0055	0.5	0.011	0.03	1	1	9.5	8.3
7/25/2002	0.0055	0.7	0.011	0.05	41	16	5.6	8.4
7/25/2002	0.0061	0.7	0.01	0.04	12	9	5.8	8.4
9/23/2002	<0.0050	0.7	0.006	0.03	3	3	7.2	8.5
11/4/2002	<0.0050	<0.2	0.005	0.02	2	1	12.8	8.7
11/4/2002	0.0061	0.2	0.005	0.02	2	2	12.9	8.7
1/27/2003	0.0363	0.8	0.037	0.18	88	46	11	8.1
3/18/2003	<0.0050	0.4	0.023	0.04	11	13	11.4	8.2
5/22/2003	<0.0050	0.3	0.022	0.04	2	3	9.9	8.6
8/6/2003	0.005	0.7	<0.005	0.03	2	3	6.4	8.8
9/22/2003	<0.0050	0.6	<0.005	0.02	1	2	7.8	8.8

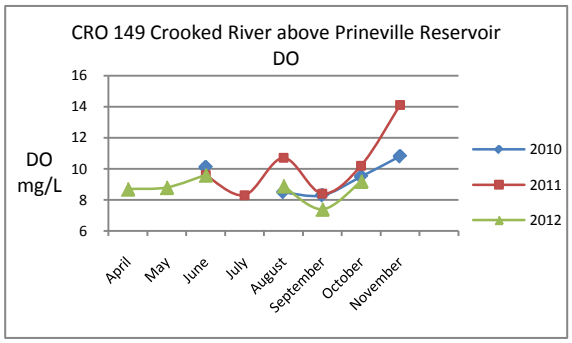
11477								
Date	N(mg/L)	TKN(mg/L)	OP(mg/L)	TP(mg/L)	TSS(mg/L)	NTU	DO(mg/L)	pH
11/17/2003	<0.0050	<0.2	0.006	0.01	<1	1	11.9	8.5
1/26/2004	<0.0050	<0.2	0.018	0.03	<1	3	12.5	8.3
3/22/2004	0.0165	0.4	0.036	0.13	44	50	10	8
5/24/2004	<0.0050	0.4	0.021	0.04	3	4	10	8.4
7/28/2004	<0.0050	0.4	0.009	0.05	9	10	7.7	8.5
9/13/2004	<0.0050	<0.2	0.006	0.02	2	3	9.8	8.5
9/13/2004	<0.0050	<0.2	<0.005	0.02	3	4	9.6	8.5
11/16/2004	<0.0050	<0.2	0.008	0.02	1	2	10.5	8.5
1/24/2005	0.0093	0.3	0.028	0.08	6	20	12	8.4
3/7/2005	<0.0050	0.3	0.026	0.07	17	16	11	8.2
5/16/2005	<0.0050	0.2	0.026	0.06	8	7	8.8	8.3
7/21/2005	<0.0050	0.5	0.038	0.06	2	2	4.5	8.2
7/21/2005	<0.0050	0.5	0.037	0.06	2	2	5.1	8.3
8/10/2005	0.006	0.5	0.012	0.04	1	2	7.6	8.9
8/10/2005	0.0077	0.5	0.018	0.04	2	2	8.9	8.7
8/11/2005		0.4	0.015	0.04	<1	2	9.2	8.9
9/12/2005	0.0077	0.5	0.014	0.03	1	2	8	8.5
11/7/2005	<0.0050	<0.2	0.026	0.04	2	3	10.1	8.5
11/8/2005	0.0112	0.3	0.028	0.04	2		11.2	8.3
11/9/2005	0.0134	0.3	0.034	0.04			12.1	8.4
1/9/2006	0.0466	0.4	0.057	0.09	8	15	11.7	8.3
3/14/2006	0.0143	<0.2	0.038	0.07	6	15	11.8	8.3
3/15/2006	0.012	0.2	0.037	0.07	7	14	11.9	8.4
3/16/2006	0.0087	0.2	0.038	0.07	6	12	11.3	8.4
3/16/2006	0.0057	0.2	0.038	0.06	5	11	11.4	8.4
5/22/2006	<0.0050	0.2	0.038	0.07	8	7	8.5	8.2
7/17/2006	<0.0050	0.3	0.051	0.07	6	7	8.3	8.4
9/18/2006	<0.0050	0.3	0.006	0.02	2	3	10.2	8.4
11/6/2006						3	9.7	8.3
1/22/2007	0.0198			0.04		9	12	8.1
3/19/2007	<0.0050			0.07		17	10.2	8.1
5/14/2007	<0.0050		0.011	0.03		3	9.9	8.6
7/23/2007						3	8.7	8.6
9/4/2007	0.0124		0.012	0.03	4	4	4.8	8.1
3/10/2008	<0.0050		0.034	0.1	9	14	10.8	8.3
5/4/2008	0.0072		0.016	0.05	4	7	10	8.2
6/30/2008	<0.0050		<0.005	0.03	<1	2	8.3	8.4
9/29/2008	0.0067		0.005	0.04	4	3	9	8.2
11/17/2008	<0.0050		0.01	0.02	<1	1	11.2	8.5

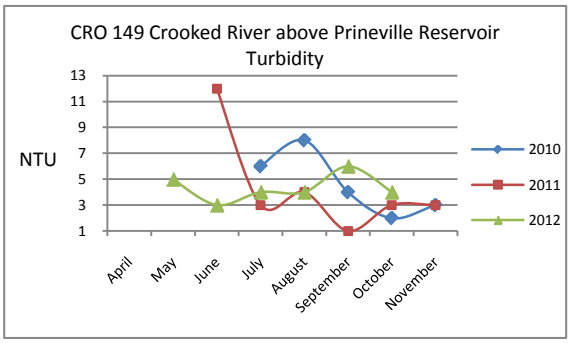
11477								
Date	N(mg/L)	TKN(mg/L)	OP(mg/L)	TP(mg/L)	TSS(mg/L)	NTU	DO(mg/L)	pH
1/26/2009	<0.0050		0.014	0.03	2	3	12.7	8.4
3/23/2009			0.025		11	14	11.8	8.1
5/11/2009	<0.0050		0.016	0.05	12	5	9.6	8.3
7/27/2009	0.0087		0.011	0.05	2	3	4.7	8.1
9/29/2009	<0.0050		<0.005	0.03	3	3	8.6	8.5
11/16/2009	<0.0050		0.012	0.04	<1	1	12.2	8.7
1/25/2010	0.0073		0.031	0.05	2	3	12	7.6
3/22/2010	0.0068		0.025	0.13	58	32	10.7	8.2
5/17/2010	0.0068		0.019	0.05	5	5	8.7	8.3
5/17/2010	<0.0050		0.02	0.04	5	5	8.8	8.3
7/26/2010	0.0052		<0.005	0.07	8	9	5.1	8.2
7/26/2010	<0.0050			0.07	9	9	5	8.1
9/20/2010	0.0051		0.005	0.03	2	3	7.6	8.1
11/1/2010	<0.0050		0.018	0.04	3	4	9.3	8.4
1/24/2011	0.0358		0.051	0.11	19	22	12	8.3
3/24/2011	0.0081		0.035	0.07	9	12	11.2	8.4
3/24/2011	0.0082		0.034	0.07	10	12	11.2	8.4
5/23/2011	0.0091		0.022	0.06	14	10	9.2	8.2
7/18/2011	0.0051		0.011	0.04	3	3	9.7	8.5
9/26/2011	0.0141		0.013	0.03	3	4	7.6	8.2
11/14/2011	<0.0050		0.015	0.03	2	3	11.2	8.5
1/23/2012	0.0365			0.21	16	28	12.2	8.2
3/26/2012	<0.0050		0.02	0.05	11	10	10.7	8.2
5/14/2012	<0.0050		0.018	0.05	5	5	8.4	8.3
7/23/2012	<0.0050		0.007	0.04	2	3	8.3	8.4
9/24/2012	0.0108		0.008	0.06	8	5	6.9	8.4

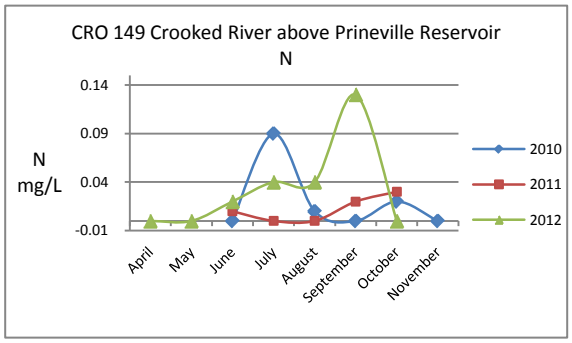
Site CRO 149

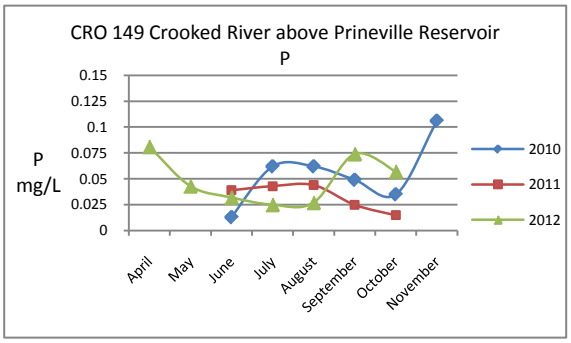
Crooked River becomes Prineville Reservoir approximately 6.5 miles downstream from the sampling site at Conant Basin Road. Here the river is sampled one last time as it heads into the reservoir. DO minimums at this site ranged from 7.4 to 14.1 mg/L. In 2010, the minimum for the year was in late August at 8.3 mg/L, in 2011, minimums of 8.3 mg/L and 8.4 mg/L occurred in late June and late August, respectively and in 2012 the minimum observed DO concentration was 7.4 mg/L in late August. In 2010, turbidity at this site ranged from 8 NTU in August to 2 NTU in October. In 2011, turbidity reached 12 NTU in June and fell back to 1 NTU by late August, and in 2012, turbidity was highest in May (5 NTU) and in late August (6 NTU). Inorganic N reached 0.09 mg/L in late July 2010, 0.03 mg/L in October of 2011 and 0.13 mg/L in August of 2012. The highest concentration of P in 2010 was 0.106 mg/L in late October, 0.044

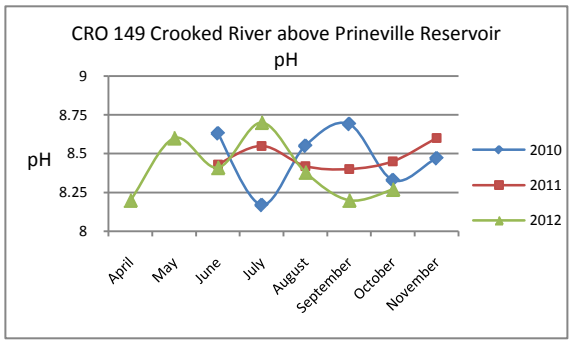
mg/L in late July of 2011, and 0.081 mg/L in late April of 2012. Reported pH at this sampling site ranged from 8.17 to 8.7, during the three summers of sampling.









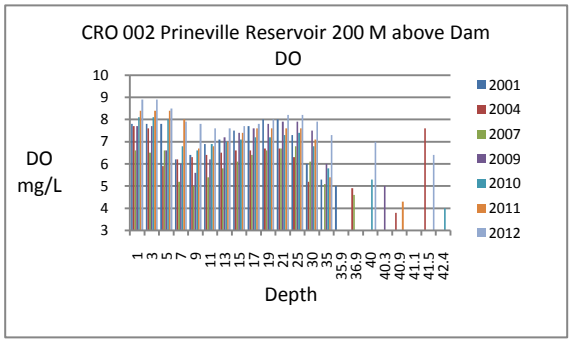


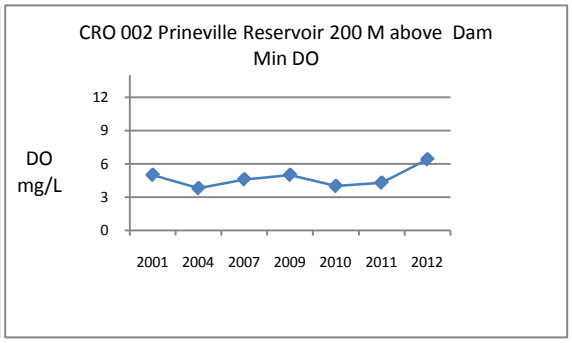
CRO 149					
Date	N (mg/L)	TP (mg/L)	NTU	DO (mg/L)	pH
7/7/2010	< 0.01	0.013		10.1	8.63
7/27/2010	0.09	0.062	6	71.8	8.17
8/10/2010	0.01	0.062	8	8.5	8.55
8/23/2010	< 0.01	0.049	4	8.3	8.69
10/5/2010	0.02	0.035	2	9.5	8.33
10/27/2010	< 0.01	0.106	3	10.8	8.47
6/1/2011	0.01	0.039	12	9.6	8.43
6/29/2011	< 0.01	0.043	3	8.3	8.55
7/28/2011	< 0.01	0.044	4	10.7	8.42
8/31/2011	0.02	0.025	1	8.4	8.4
10/5/2011	0.03	0.015	3	10.2	8.45
11/8/2011			3	14.1	8.6
4/24/2012	< 0.01	0.081		8.7	8.2
5/9/2012	< 0.01	0.043	5	8.8	8.6
5/31/2012	0.02	0.032	3	9.6	8.41
6/20/2012	0.04	0.025	4	110	8.7
7/24/2012	0.04	0.027	4	8.9	8.38
8/20/2012	0.13	0.074	6	7.4	8.2
9/27/2012	< 0.01	0.057	4	9.2	8.27

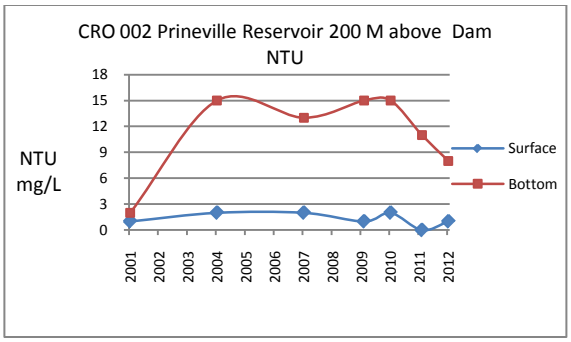
Site CRO 002

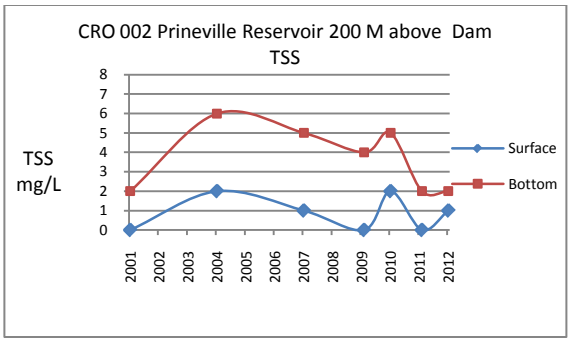
Sampling at Prineville Reservoir takes place about every other year as part of Reclamation's reservoir monitoring program. Samples were obtained in July of 2001, 2004, 2007, 2009 through 2012. The reservoir is approximately 40 meters deep, and samples for DO and pH were taken every 2 meters. The samples for the other parameters were at the surface and at the bottom. DO at this site fluctuated by depth, and showed little variation from year to year. Low concentrations were typically found at approximately 7 to 11 meters, and again at about 30 meters, with the lowest concentrations occurring at the bottom. Concentrations at 7 to 11 meters ranged from 5.0 mg/L to 8 mg/L, and at the bottom, concentrations were observed to be between 3.8 mg/L and 6.4 mg/L. Turbidity in the reservoir is less at the surface than at the bottom. Surface turbidity was no more than 2 NTU during the years of sampling, while bottom turbidity values ranged from 2 to 15 NTU. Reported TSS for the reservoir was also lower at the surface than at the bottom. The year 2004 had the highest observed concentration at the bottom depth (6 mg/L). The greatest surface concentration for TSS was 2 mg/L, and this was observed in both 2004 and 2010. Inorganic N concentrations at the surface were above detection limits in 2007, 2010, and 2011 with concentrations of 0.04 mg/L, 0.01 mg/L, and 0.02 mg/L, respectively. Inorganic N concentrations at the bottom of the reservoir stayed between 0.06 mg/L and0.11 mg/L. TKN concentrations ranged from 0.35 mg/L at the surface in 2010 to 0.12 mg/L at the bottom in 2009. Both TP and OP data were collected in the reservoir, and like the other parameters, at the surface and bottom depths. TP concentrations were consistently greater at the bottom than at the surface. Surface concentrations were right around 0.020 mg/L until 2009,

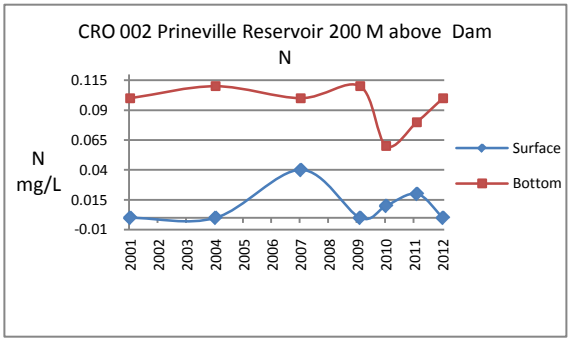
when concentrations were observed to be 0.040 mg/L. The years 2010 through 2012 showed a steady decrease in concentration, from 0.34 mg/l in 2010 to 0.22 mg/L in 2012. Bottom depth concentration also increased until 2009, when it was observed to be 0.11 mg/L. By 2012, bottom depth concentrations had decreased to 0.069 mg/L. Data for OP indicate that, like TP, surface concentrations are lower than bottom depth concentrations. Surface concentrations were at or near detection limits except for 2001, 2009, and 2011 when the concentrations at the surface were 0.013 mg/L, 0.004 mg/L, and 0.005 mg/l, respectively. Bottom concentrations were between 0.042 mg/L and 0.056mg/L. As shown in the graph, pH fluctuates over the course of change in depth. Surface pH values ranged from 8.40 to 8.29. At the bottom depths, pH ranged from 6.88 to 7.9. Data for certain metals have also been collected for this site. The following metals were determined to be less than detection limit each year: arsenic, cadmium, chromium, lead, mercury, and selenium. Concentrations of copper ranged at the surface ranged from below detection to four µg/L, and at the bottom were consistently below detection. The highest surface concentration (8.6 mg/L) of magnesium was observed in 2011, whereas highest concentration for the bottom of the reservoir was 8.5 mg/L in 2001. Concentrations of magnesium never fell below 5.3 mg/L doing the years of sampling at this site. Iron concentrations at the surface ranged from 50 µg/L to 280 µg/L, and at the bottom ranged from 710 µg/L to 1,600 µg/L. Manganese was below detection limits at the surface except in 2004 when the concentration was observed to be 20 µg/L. The bottom concentrations ranged from 50 µg/L to 107 µg/L, and did not follow a linear increase or decline over the years. Sodium concentrations ranged at the surface from 9.2 mg/L to 16.7 mg/L and from 11.2 mg/l to 17.7 mg/l at the bottom. Surface and bottom values for potassium were nearly identical to each other for each year, with values ranging from 1.8 µg/L to 2.6 µg/L. Concentrations of zinc were below detection limits except for the bottom sample in 2001, which was 6.0 µg/L.

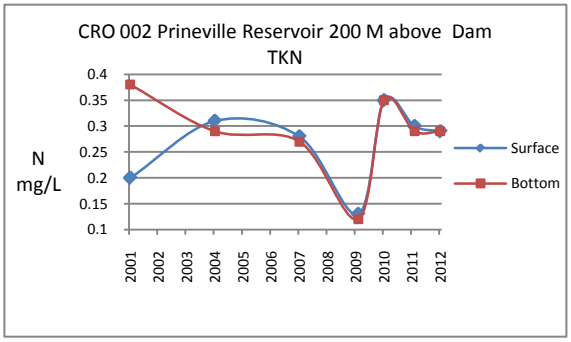


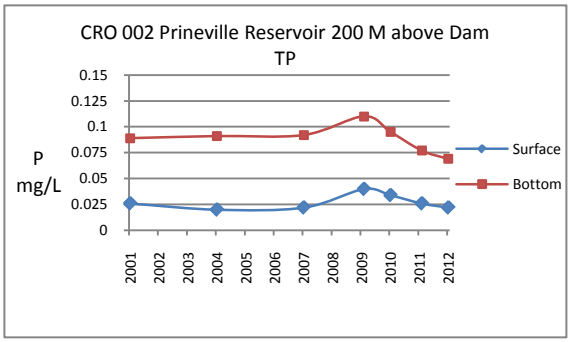


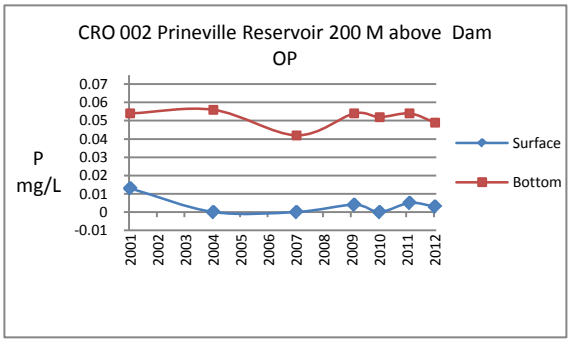

CRO 002 Prineville Reservoir 200 M above Dam
NTU
NTU mg/L
18
15
12
9
6
3
0
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012
Surface
Bottom

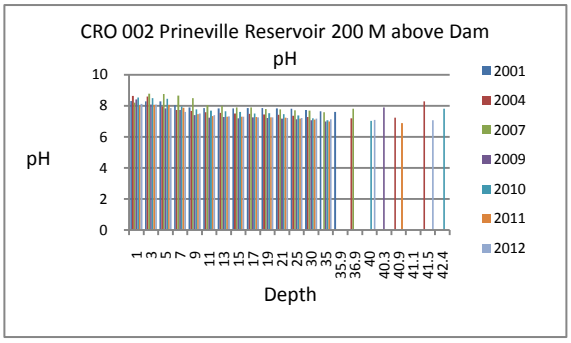

CRO 002 Prineville Reservoir 200 M above Dam
TSS
TSS mg/L
8
7
6
5
4
3
2
1
0
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012
Surface
Bottom

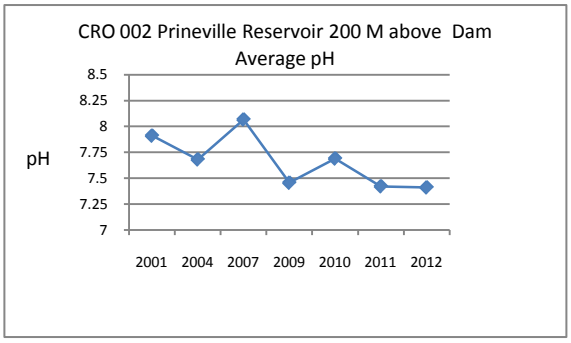

CRO 002 Prineville Reservoir 200 M above Dam
N
N mg/L
0.115
0.09
0.065
0.04
0.015
-0.01
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012
Surface
Bottom


CRO 002 Prineville Reservoir 200 M above Dam
TKN
N mg/L
0.4
0.35
0.3
0.25
0.2
0.15
0.1
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012
Surface
Bottom


CRO 002 Prineville Reservoir 200 M above Dam
TP
P mg/L
0.15
0.125
0.1
0.075
0.05
0.025
0
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012
Surface
Bottom


CRO 002 Prineville Reservoir 200 M above Dam
OP
P mg/L
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
-0.01
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012
Surface
Bottom


CRO 002 Prineville Reservoir 200 M above Dam
pH
pH
10
8
6
4
2
0
1 3 5 7 9 11 13 15 17 19 21 25 30 35 35.9 36.9 40 40.3 40.9 41.1 41.5 42.4
Depth
2001
2004
2007
2009
2010
2011
2012


CRO 002 Prineville Reservoir 200 M above Dam
Average pH
pH
8.5
8.25
8
7.75
7.5
7.25
7
2001 2004 2007 2009 2010 2011 2012

CRO 002	Depth (m)	Arsenic (µg/L)	Boron (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Copper (µg/L)	Iron (µg/L)	Lead (µg/L)
7/24/01	1	< 2	190	< 1	< 2	2	230	< 2
7/24/01	35.9	< 2	210	< 1	< 2	2	1160	< 2
7/13/04	1	< 2	130	< 1	< 2	< 2	280	< 2
7/13/04	41.1	< 2	90	< 1	2	2	1520	< 2
7/25/07	1	< 2		< 1	< 2	2	110	< 2
7/25/07	36.9	< 2		< 1	< 2	4	1290	< 2
8/3/09	1	< 2		< 1	< 2	< 2	120	< 2
8/3/09	40.3	< 2		< 1	< 2	3	1600	< 2
7/28/10	1	< 2		< 1	< 2	< 2	160	< 2
7/28/10	42.4	< 2		< 1	2	2	1590	< 2
8/2/11	1	< 2		< 1	< 2	< 2	50	< 2
8/2/11	40.9	< 2		< 1	< 2	3	1060	< 2
7/9/12	1	<2		<1	<2	<2	100	<2
7/9/12	41.5	<2		<1	<2	<2	710	<2

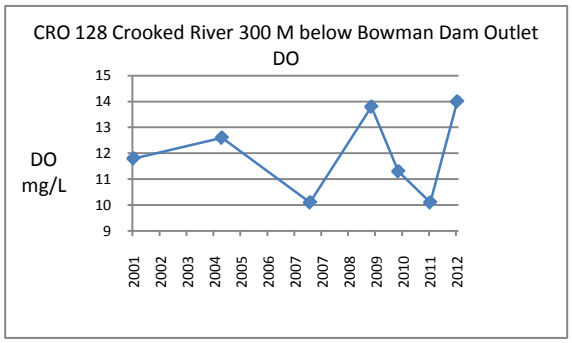
CRO 002	Depth (m)	Magnesium (mg/L)	Manganese (mg/L)	Mercury (µg/L)	Potassium (mg/L)	Selenium (µg/L)	Sodium (mg/L)	Zinc (µg/L)
7/24/01	1	8.4	< 10	< 0.2	2.6	< 2	16.7	< 5
7/24/01	35.9	8.5	50	< 0.2	2.6	< 2	17.7	6
7/13/04	1	6.5	20	< 0.2	1.8	< 2	11.0	< 5
7/13/04	41.1	5.3	100	< 0.2	1.8	< 2	11.2	< 5
7/25/07	1	7.3	< 10	< 0.2	2.1	< 2	9.2	< 5
7/25/07	36.9	6.9	50	< 0.2	2.1	< 2	12.9	< 5
8/3/09	1	7.1	< 10	< 0.2	2.2	< 2	13.0	< 5
8/3/09	40.3	7.5	107	< 0.2	2.4	< 2	12.6	< 5
7/28/10	1	7.1	< 10	< 5*	2	< 2	14.1	< 5
7/28/10	42.4	6.3	66	< 5*	2	< 2	12.2	< 5
8/2/11	1	8.6	< 10	< 5*	1.9	< 2	11.1	< 5
8/2/11	40.9	7.5	52	< 5*	1.8	< 2	13.9	< 5
7/9/12	1	7.3	<10	<5*	2	<2	12.2	<5
7/9/12	41.5	8.4	50	<5*	2.4	<2	15.7	<5

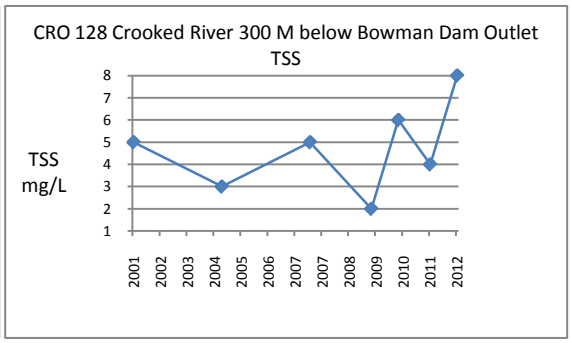
CRO 002								
Surface	**N (mg/L)**	**TKN (mg/L)**	**OP (mg/L)**	**TP (mg/L)**	**TSS (mg/L)**	**NTU**	**DO (mg/L)**	**pH**
2001	< 0.01	0.2	0.013	0.026	< 1	1	7.8	8.29
2004	< 0.01	0.31	< 0.003	0.02	2	2	7.6	8.6
2007	0.04	0.28	< 0.003	0.022	1	2	6.6	8.2
2009	< 0.01	0.13	0.004	0.04	< 1	1	7.7	8.4
2010	0.01	0.35	< 0.003	0.034	2	2	8.1	8.4
2011	0.02	0.3	0.005	0.026	< 1	< 1	8.4	8.5
2012	< 0.01	0.29	0.003	0.022	1	1	8.9	8.11
Bottom								
2001	0.1	0.38	0.054	0.089	2	2	5	7.6
2004	0.11	0.29	0.056	0.091	6	15	3.8	7.23
2007	0.1	0.27	0.042	0.092	5	13	4.6	7.8
2009	0.11	0.12	0.054	0.11	4	15	5	7.9
2010	0.06	0.35	0.052	0.095	5	15	4	7.8
2011	0.08	0.29	0.054	0.077	2	11	4.3	6.88
2012	0.1	0.29	0.049	0.069	2	8	6.4	7.8

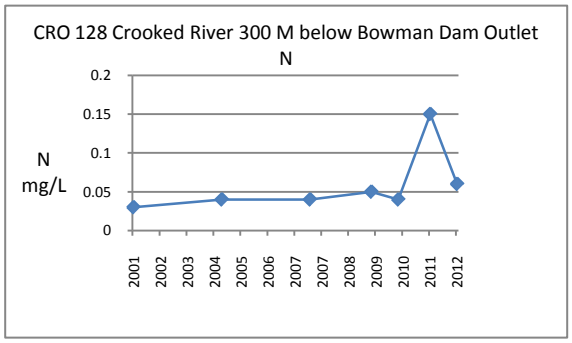
Site CRO 128

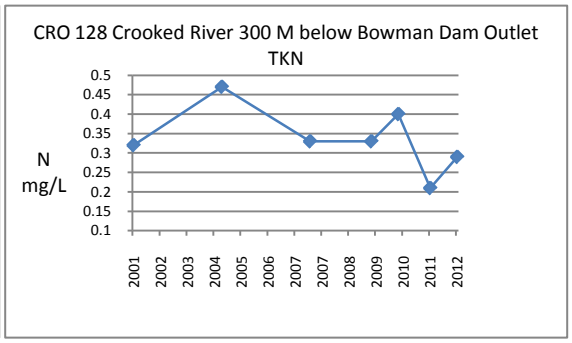
Below Prineville Reservoir, approximately 200 meters, is the last sampling site in the Upper Crooked River subbasin. Sampling at this site is done on the same schedule as the previous site, and is part of the reservoir monitoring program. DO at this site never fell below 10.1 mg/L. Turbidity at this site showed a general increase over the years of sampling, although in 2011 and 2012 turbidity was down to 9 NTU from 12 NTU in 2010. TSS is also monitored at this site and 2012 was the year with the highest TSS concentration (8 mg/L). The only other year in which TSS concentrations rose above 5 mg/L was in 2010 (6 mg/L). Inorganic N for all years, except 2011, was between 0.03 mg/L and 0.06 mg/L. The concentration in 2011 was observed to be 0.15 mg/L. However, TKN was at its highest concentration (0.4 mg/L) in 2010, and otherwise stayed between 0.21 mg/L and 0.33 mg/L. TP was at its highest concentration (0.096 mg/L) in 2009, while OP was highest in 2004 (0.06 mg/L). Recorded pH at this site ranged from 8.03 to 8.4. Data for certain metals exist for this site. The following metals were determined to be less than detection limit each year: arsenic, cadmium, chromium, lead, mercury, and selenium, which was the same as the sample site in the reservoir. Magnesium concentrations ranged from 5.3 mg/L to 8.9 mg/L. Iron concentrations ranged from 620 µg/L to 1,060 µg/L. Copper ranged from below detection limits to 3 µg/L. Manganese concentrations ranged from 10 µg/L to 40 µg/L. Potassium ranged from 1.81 µg/L to 2.7 µg/L, similar to concentrations found in the reservoir. Zinc was

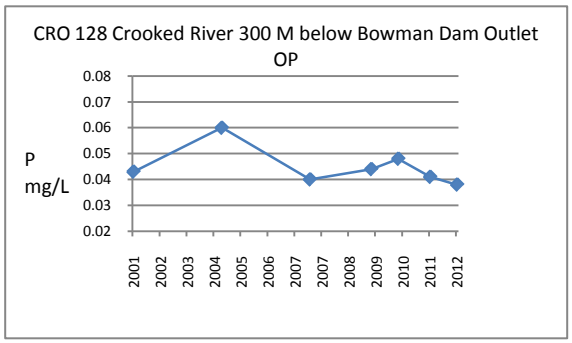
below detection limits consistantly, except for a concentration of 5 µg/L, observed in 2007.

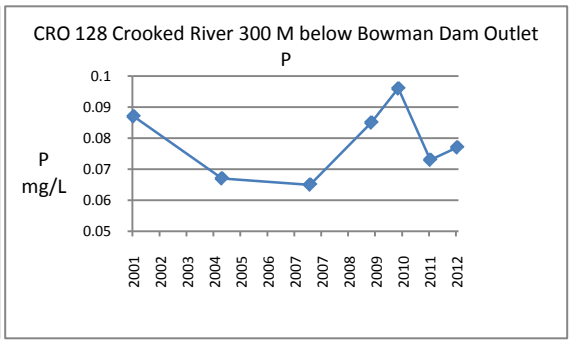


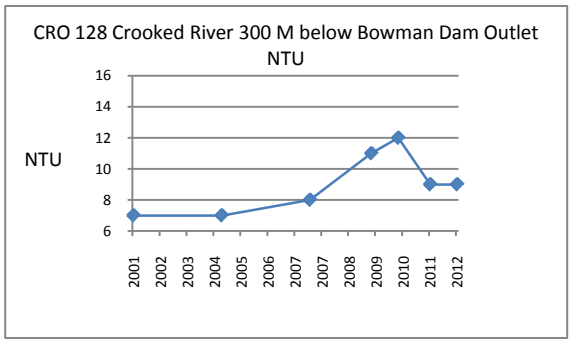


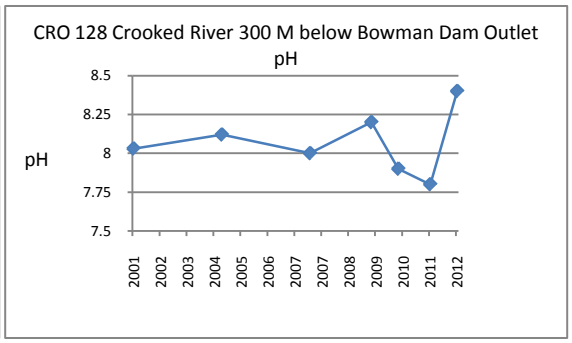












CRO 128	Arsenic (µg/L)	Boron (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Copper (µg/L)	Iron (µg/L)	Lead (µg/L)
2001	< 2	200	< 1	< 2	< 2	1040	< 2
2004	< 2	130	< 1	< 2	2	1060	< 2
2007	< 2		< 1	< 2	3	1050	< 2
2009	< 2		< 1	< 2	< 2	1050	< 2
2010	< 2		< 1	< 2	2	1310	< 2
2011	< 2		< 1	< 2	3	620	< 2
2012	<2		<1	<2	<2	670	<2

CRO 128	Magnesium (mg/L)	Manganese (mg/L)	Mercury (µg/L)	Potassium (mg/L)	Selenium (µg/L)	Sodium (mg/L)	Zinc (µg/L)
2001	8.9	40	< 0.2	2.7	< 2	18.5	< 5
2004	5.3	10	< 0.2	1.8	< 2	9.2	< 5
2007	6.9	40	< 0.2	2.1	< 2	12.9	5
2009	7.5	37	< 0.2	2.4	< 2	14.0	< 5
2010	6.4	32	< 5*	2.1	< 2	11.3	< 5
2011	7.3	26	< 5*	1.8	< 2	11.8	< 5
2012	8.4	40	<5*	2.4	<2	15.6	<5

CRO 128								
Date	**N (mg/L)**	**TKN (mg/L)**	**OP (mg/L)**	**TP (mg/L)**	**TSS (mg/L)**	**NTU**	**DO (mg/L)**	**pH**
2001	0.03	0.32	0.043	0.087	5	7	11.8	8.03
2004	0.04	0.47	0.06	0.067	3	7	12.6	8.12
2007	0.04	0.33	0.04	0.065	5	8	10.1	8
2009	0.05	0.33	0.044	0.085	2	11	13.8	8.2
2010	0.04	0.4	0.048	0.096	6	12	11.3	7.9
2011	0.15	0.21	0.041	0.073	4	9	10.1	7.8
2012	0.06	0.29	0.038	0.077	8	9	14	8.4

Prineville Reservoir marks the end of the Upper Crooked subbasin, and the beginning of the Lower Crooked subbasin (Figure 4).

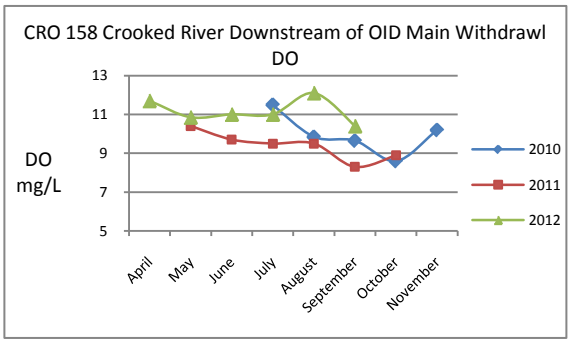
Lower Crooked River Subbasin

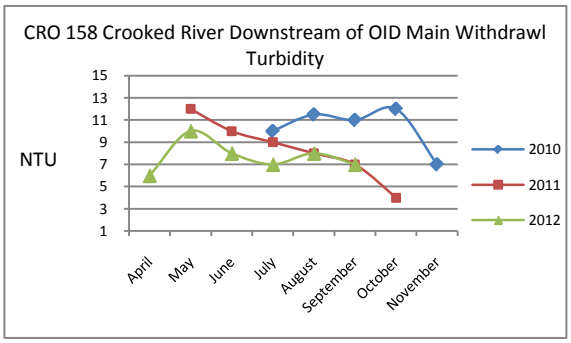
Figure 4. Sampling sites in the Lower Crooked subbasin.

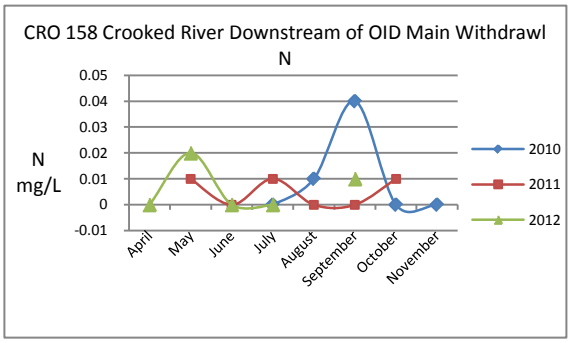
Site CRO 158

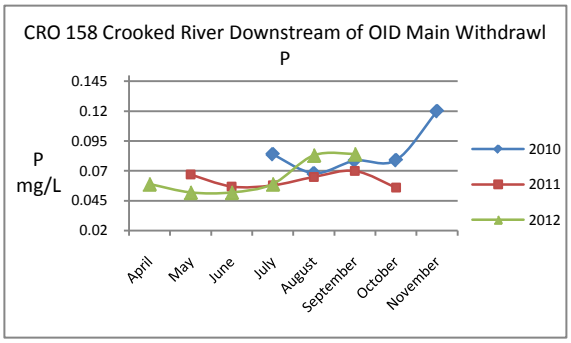
The first sampling site in the Lower Crooked subbasin is along the Crooked River, approximately 15 miles downstream from Prineville Reservoir, and about 40 meters downstream from the Ochocco Irrigation District main Crooked River Diversion. DO at this site ranged from 8.3 mg/L to 12.1 mg/L. Turbidity at this site ranged from 7 to 12 NTU in 2010. In 2011, turbidity was observed to be 12 NTU in May, then fell steadily to 4 NTU by the end of October of that year. In 2012, turbidity ranged from 6 to 10 NTU. Inorganic N was at or below the detection limit in 2010 except for September, when the concentrations reached 0.05 mg/L at the first of the month, and fell to 0.03 mg/L by the middle of the month. In 2011, inorganic N remained at or below detection limit, as was the case in 2012, except for late may, when the concntrations reached 0.02 mg/L. Observed P at this site reached its highest levels for 2010 in October, when concentrations were observed to be 0.124 mg/L. In 2011, concentrations of P reached 0.07 mg/L by the end of September, and in 2012 the highest concentration of P was 0.084 mg/L in late September. Reported pH ranged between 7.99 and 8.63 over the

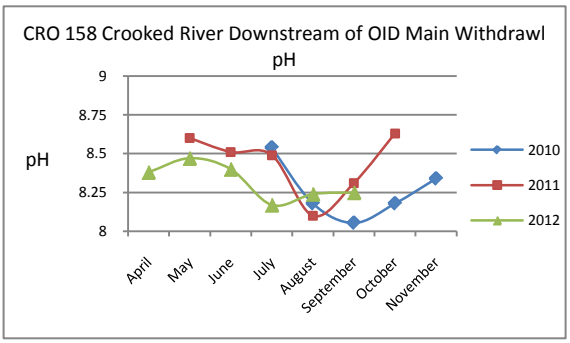
course of the three summers of sampling. No data are available for toxins, metals, or contaminants at this site.







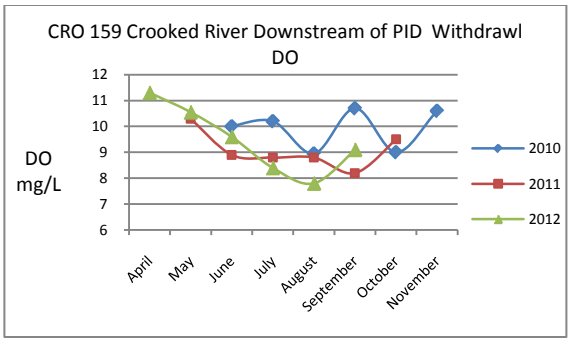


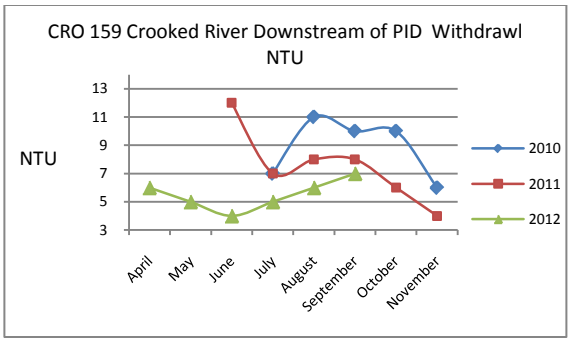


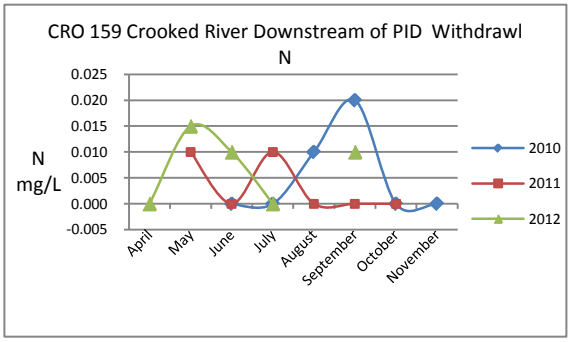
CRO 158					
Date	N (mg/L)	TP (mg/L)	NTU	DO (mg/L)	pH
7/19/2010	< 0.01	0.084	10	11.5	8.54
8/4/2010	< 0.01	0.068	11	11	8.37
8/18/2010	0.01	0.068	12	8.7	7.99
9/1/2010	0.05	0.081	11	9.5	8.02
9/16/2010	0.03	0.076	11	9.8	8.09
9/29/2010	< 0.01	0.079	12	8.6	8.18
10/26/2010	< 0.01	0.12	7	10.2	8.34
5/18/2011	0.01	0.067	12	10.4	8.6
6/21/2011	< 0.01	0.057	10	9.7	8.51
7/20/2011	0.01	0.058	9	9.5	8.49
8/30/2011	< 0.01	0.065	8	9.5	8.1
9/29/2011	< 0.01	0.07	7	8.3	8.31
10/31/2011	0.01	0.056	4	8.9	8.63
4/23/2012	< 0.01	0.059	6	11.7	8.38
5/8/2012	< 0.01	0.048	10	11	8.47
5/30/2012	0.02	0.056		10.7	8.47
6/19/2012	< 0.01	0.052	8	11	8.4
7/10/2012	< 0.01	0.059	7	11	8.17
8/7/2012		0.083	8	12.1	8.24
9/25/2012	0.01	0.084	7	10.4	8.25

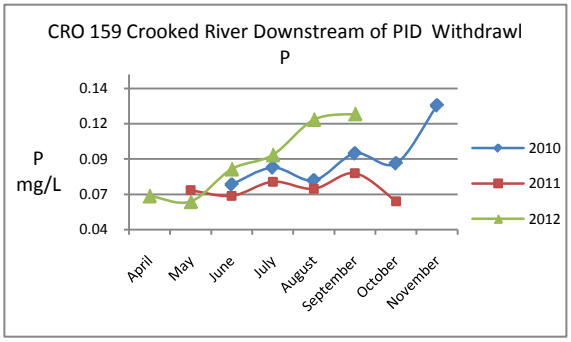
Site CRO 159

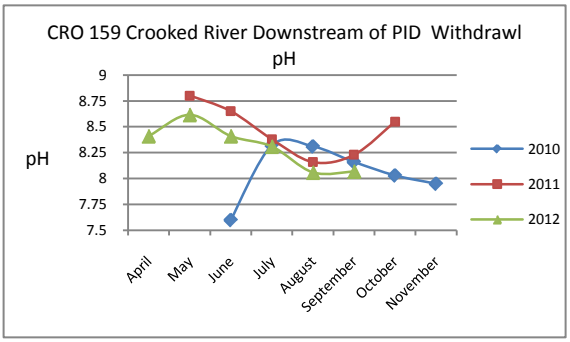
The next data sampling site is approximately 700 meters downstream from an irrigation withdrawal that is located just before Crooked River reaches Prineville. At this site in 2010, the lowest concentration of DO observed was 8.7 mg/L in mid-August. In 2011, the lowest concentration observed was 8.3 mg/L in late September and in 2012 the lowest concentration reported was 10.4 mg/l, in September. Overall, DO concentrations were higher at this site than the previous upstream site. Turbidity at this site reached a high of 13 NTU in mid-August of 2010, a high of 12 NTU in May of 201, and 7 NTU in September of 2012. Overall, turbidity levels decreased over the three summers of sampling. Inorganic N was 0.01 mg/L in August and 0.02 mg/L in September of 2010, but was below detection limits the rest of the sampling dates that year. In 2011, concentrations were below detection, and in 2012 concntrations were at a high of 0.02 mg/L in May and at or below detection for the rest of the sampling dates. The greatest concentrations of P were observed in October of 2010 (0.128 mg/L), September of 2011(0.08 mg/L), and September of 2012 (0.122 mg/L). Reported pH at this site was highest (8.8) in May of 2011, and lowest (7.6) in late June of 2010. No data were collected regarding metals, toxins, or other contaminants at this site.


CRO 159 Crooked River Downstream of PID Withdrawl
DO
DO
mg/L
12
11
10
9
8
7
6
April
May
June
July
August
September
October
November
2010
2011
2012


CRO 159 Crooked River Downstream of PID Withdrawl
NTU
NTU
13
11
9
7
5
3
April
May
June
July
August
September
October
November
2010
2011
2012


CRO 159 Crooked River Downstream of PID Withdrawl
N
N
mg/L
0.025
0.020
0.015
0.010
0.005
0.000
-0.005
April
May
June
July
August
September
October
November
2010
2011
2012

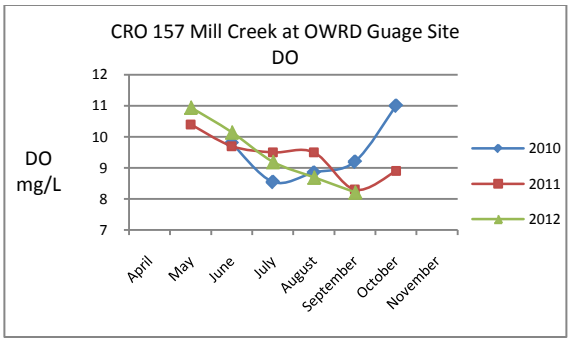

CRO 159 Crooked River Downstream of PID Withdrawl
P
P
mg/L
0.14
0.12
0.09
0.07
0.04
April
May
June
July
August
September
October
November
2010
2011
2012

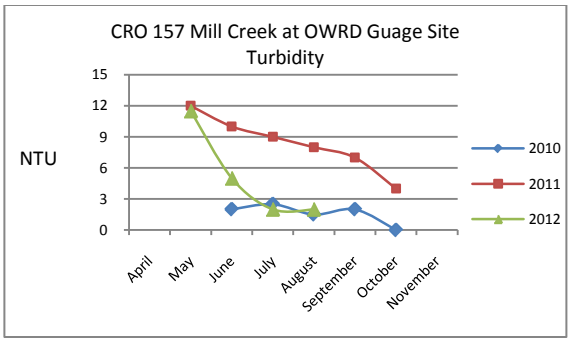

CRO 159 Crooked River Downstream of PID Withdrawl
pH
pH
9
8.75
8.5
8.25
8
7.75
7.5
April
May
June
July
August
September
October
November
2010
2011
2012

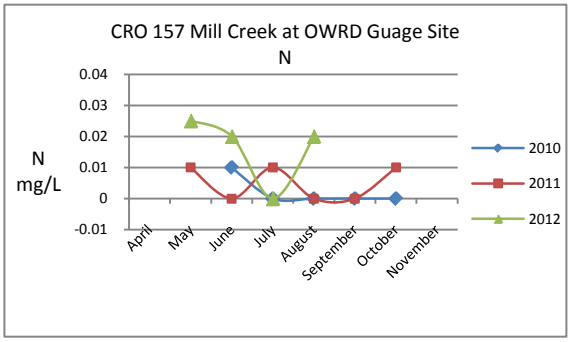
CRO 159					
Date	N (mg/L)	TP (mg/L)	NTU	DO (mg/L)	pH
6/22/2010	< 0.01	0.072		10	7.6
7/19/2010	< 0.01	0.084	7	10.2	8.32
8/4/2010	< 0.01	0.077	9	10.2	8.67
8/18/2010	0.01	0.073	13	7.7	7.95
9/1/2010	0.02	0.094	10	10.7	8.16
9/16/2010	< 0.01	0.082	11	8.8	8.13
9/29/2010	< 0.01	0.087	10	9	8.03
10/26/2010	< 0.01	0.128	6	10.6	7.95
5/18/2011	0.01	0.068	12	10.3	8.8
6/21/2011	< 0.01	0.064	7	8.9	8.65
7/20/2011	0.01	0.074	8	8.8	8.38
8/30/2011	< 0.01	0.069	8	8.8	8.16
9/29/2011	< 0.01	0.08	6	8.2	8.23
10/31/2011	< 0.01	0.06	4	9.5	8.55
4/23/2012	< 0.01	0.064	6	11.3	8.41
5/8/2012	0.02	0.054	5	10.5	8.8
5/30/2012	0.01	0.066		10.6	8.43
6/19/2012	< 0.01	0.083	4	9.6	8.41
7/10/2012	0.01	0.093	5	8.4	8.31
8/7/2012		0.118	6	7.8	8.06
9/25/2012	0.01	0.122	7	9.1	8.07

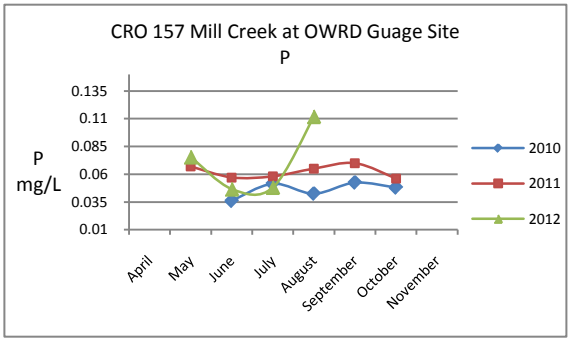
Site CRO 157

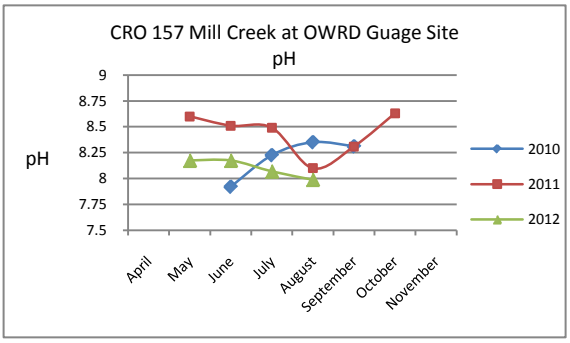
The next site on the Crooked River is downstream from the confluence with Ochoco Creek; however, there are several sites on Ochoco Creek itself, Ochoco Reservoir, and Mill Creek above the reservoir. The following site is nearly 10 miles above Ochoco Reservoir, on Mill Creek. DO at this site never fell below 8.1 mg/L during the three summers of sampling. Turbidity at this site never rose above 3 NTU in 2010, but in 2011, turbidity was measured at 16 NTU in late May. Turbidity was down to 1 NTU by October of 2011. In 2012, turbidity ranged from 13 NTU to 2 NTU, with the greatest turbidity occurring in early May. Inorganic N was at or below detection levels during 2010, and 2011, only rising to 0.02 mg/L twice in 2011 – once in late June, and again in late August. In 2012, inorganic N ranged from less than detection to 0.03 mg/L. The greatest concentrations of P were observed to be 0.061 mg/L in both early September of 2010 and late August 2011. In 2012, the greatest P concentration was 0.112, occurring in August. Reported pH at this site ranged from 7.85 to 8.53. No data are available for toxins, metals, or contaminants at this site.


CRO 157 Mill Creek at OWRD Guage Site
DO
DO
mg/L
12
11
10
9
8
7
April
May
June
July
August
September
October
November
2010
2011
2012


CRO 157 Mill Creek at OWRD Guage Site
Turbidity
NTU
15
12
9
6
3
0
April
May
June
July
August
September
October
November
2010
2011
2012


CRO 157 Mill Creek at OWRD Guage Site
N
N
mg/L
0.04
0.03
0.02
0.01
0
-0.01
April
May
June
July
August
September
October
November
2010
2011
2012

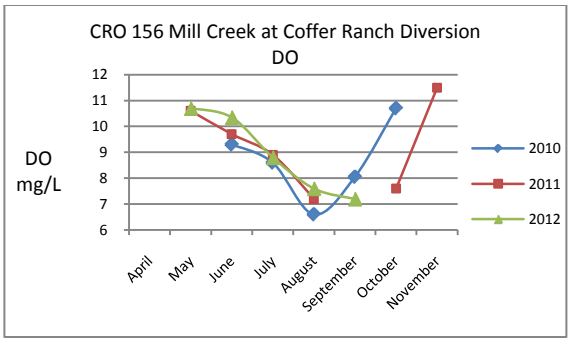

CRO 157 Mill Creek at OWRD Guage Site
P
P
mg/L
0.135
0.11
0.085
0.06
0.035
0.01
April
May
June
July
August
September
October
November
2010
2011
2012

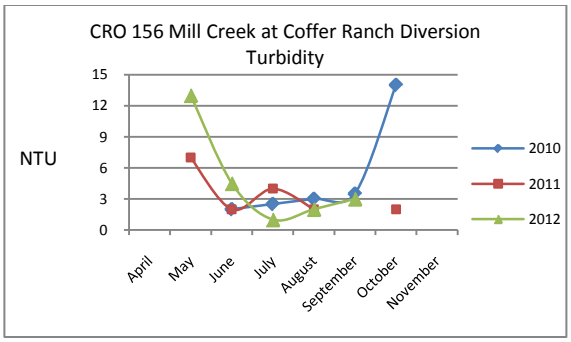

CRO 157 Mill Creek at OWRD Guage Site
pH
pH
9
8.75
8.5
8.25
8
7.75
7.5
April
May
June
July
August
September
October
November
2010
2011
2012

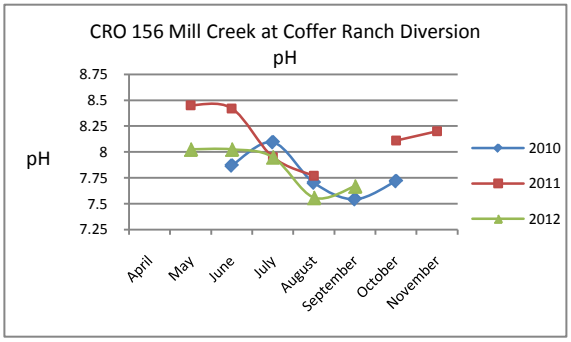
CRO 157					
Date	N (mg/L)	TP (mg/L)	NTU	DO (mg/L)	pH
6/30/2010	0.01	0.036	2	9.8	7.92
7/14/2010	< 0.01	0.055	2	8.1	8.06
7/28/2010	< 0.01	0.048	3	9	8.39
8/11/2010	< 0.01	0.049	2	8.4	8.38
8/25/2010	< 0.01	0.036	1	9.3	8.32
9/7/2010	< 0.01	0.061	2	8.6	8.44
9/28/2010	< 0.01	0.044	2	9.8	8.18
10/19/2010	< 0.01	0.048	< 1	11	8.22
5/25/2011	< 0.01	0.056	7	10.7	8.53
6/22/2011	0.02	0.045	3	9.8	8.6
7/21/2011	< 0.01	0.045	5	9.3	8
8/24/2011	0.02	0.061	1	8.6	7.92
10/4/2011	< 0.01	0.038	1	9.5	8.41
11/7/2011				12.3	8.42
5/2/2012	0.03	0.088	13	11.4	8.5
5/16/2012	0.02	0.063	10	10.5	7.85
6/5/2012	0.02	0.048	6	10.5	8.06
6/21/2012	< 0.01	0.045	4	9.8	8.29
7/11/2012	< 0.01	0.048	2	9.2	8.07
8/9/2012	0.02	0.112	2	8.7	7.99

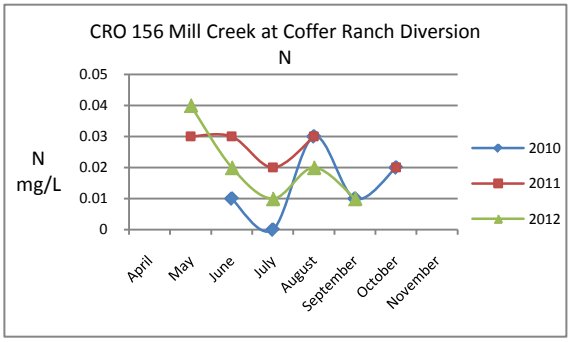
Site CRO 156

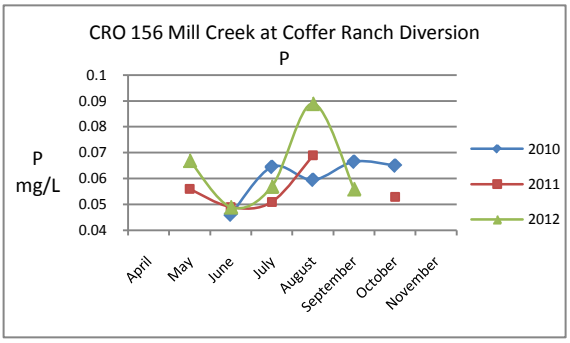
The next site is approximately 3 miles above Ochoco Reservoir. This part of Mill Creek is bounded on both sides by cropland. DO at this site stayed above 7.1 mg/L during all three summers of sampling, except in late August of 2010 when DO concentrations were observed to be 6.1 mg/L. Turbidity at this site never exceeded 4 NTU in 2010, until a turbidity of 14 NTU was observed October. The greatest turbidity recorded in 2011 was 7 NTU in May, and in 2012 turbidity reached 14 NTU, also in May. By October of 2011, turbidity was down to 2 NTU. In late August 2010, inorganic N concentrations were 0.03 mg/L, and during 2011, concentrations were observed to be 0.03 mg/L at every sampling date except in June and August, when the concentrations were 0.02 mg/L. Concentrations of inorganic N ranged from 0.05 mg/L to 0.01 mg/L in 2012, with the greatest concentrations occurring in May. The greatest concentrations of P were reported in September 2010 (0.078 mg/L), August 2011 (0.069 mg/L), and August 2012 (0.089 mg/L). Concentrations of P never fell below 0.046 mg/L during the 3 years of sampling. Reported pH at this site ranged from 7.54 to 9.3 pH. No data are available for toxins, metals, or contaminants at this site.


CRO 156 Mill Creek at Coffer Ranch Diversion
DO
DO
mg/L
12
11
10
9
8
7
6
April
May
June
July
August
September
October
November
2010
2011
2012


CRO 156 Mill Creek at Coffer Ranch Diversion
Turbidity
NTU
15
12
9
6
3
0
April
May
June
July
August
September
October
November
2010
2011
2012


CRO 156 Mill Creek at Coffer Ranch Diversion
pH
pH
8.75
8.5
8.25
8
7.75
7.5
7.25
April
May
June
July
August
September
October
November
2010
2011
2012

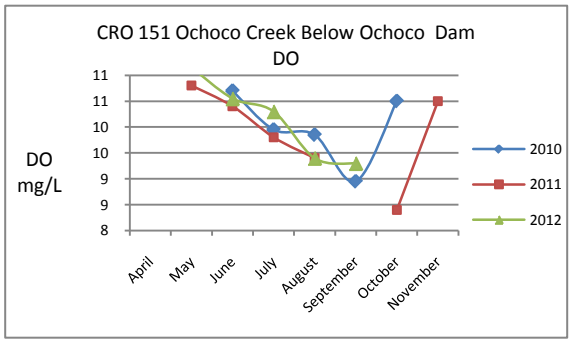

CRO 156 Mill Creek at Coffer Ranch Diversion
N
N
mg/L
0.05
0.04
0.03
0.02
0.01
0
April
May
June
July
August
September
October
November
2010
2011
2012

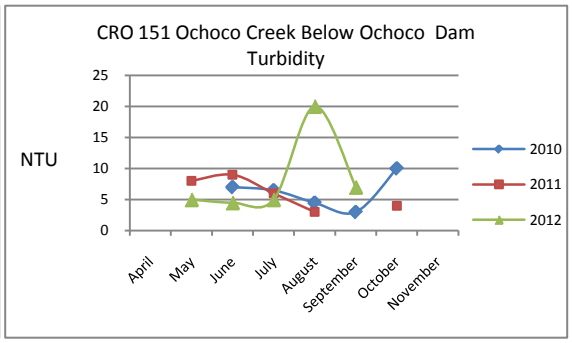

CRO 156 Mill Creek at Coffer Ranch Diversion
P
P
mg/L
0.1
0.09
0.08
0.07
0.06
0.05
0.04
April
May
June
July
August
September
October
November
2010
2011
2012

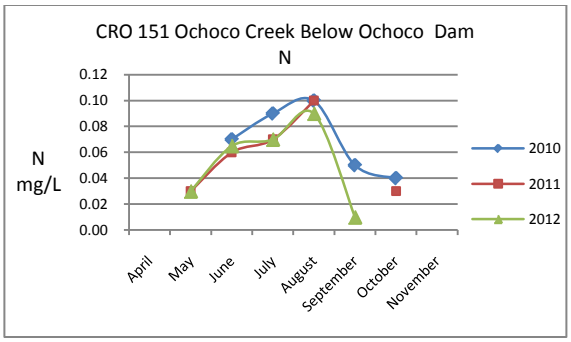
CRO 156					
Date	N (mg/L)	TP (mg/L)	NTU	DO (mg/L)	pH
6/30/2010	0.01	0.046	2	9.3	7.87
7/14/2010	< 0.01	0.065	3	8.5	8.13
7/28/2010	< 0.01	0.064	2	8.7	8.06
8/11/2010	< 0.01	0.064	2	7.1	7.89
8/25/2010	0.03	0.055	4	6.1	7.52
9/7/2010	0.01	0.078	4	7.3	7.55
9/28/2010	< 0.01	0.055	3	8.8	7.54
10/19/2010	0.02	0.065	14	10.7	7.72
5/25/2011	0.03	0.056	7	10.6	8.45
6/22/2011	0.03	0.049	2	9.7	8.42
7/21/2011	0.02	0.051	4	8.9	7.95
8/24/2011	0.03	0.069	2	7.2	7.77
10/4/2011	0.02	0.053	2	7.6	8.11
11/7/2011				11.5	8.2
5/2/2012	0.05	0.067	14	11	8.25
5/16/2012	0.03	0.067	12	10.4	7.8
6/5/2012	0.03	0.051	6	10.8	8
6/21/2012	0.01	0.047	3	9.9	8.05
7/11/2012	0.01	0.057	1	8.8	7.95
8/9/2012	0.02	0.089	2	7.6	7.56
9/27/2012	0.01	0.056	3	7.2	7.67

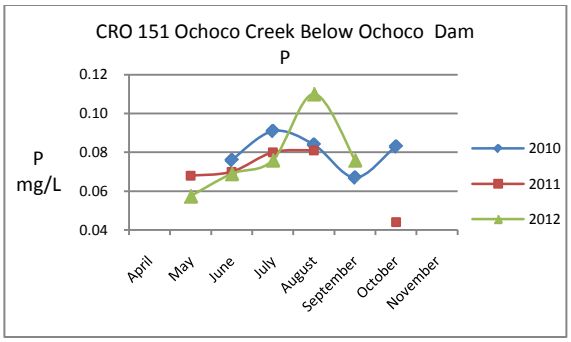
Site CRO 151

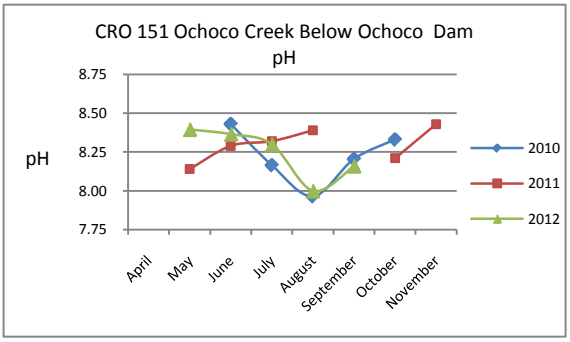
Approximately 100 meters below Ochoco Reservoir is another sample site. At this site, DO concentrations never fell below 8.4 mg/L in 2010, 2011, or 2012, and never exceeded 11.5 mg/L. Turbidity ranged from 5 NTU to 20, with the lowest values occurring during the mid summer months, and the higher values being observed during early and late summer sampling dates. Inorganic N reached 0.14 mg/L in August of 2010, 0.10 mg/L in August of 2011 and 0.09 mg/l in August of 2012. August was also the month that the greatest concentrations of P were observed, 0.104 mg/L, 0.081 mg/L, and 0.11 mg/L, in 2010, 2011, and 2012, respectively. Reported pH ranged from 7.94 to 8.49 pH units over the course of the three summers of sampling. No data are available for toxins, metals, or contaminants at this site.







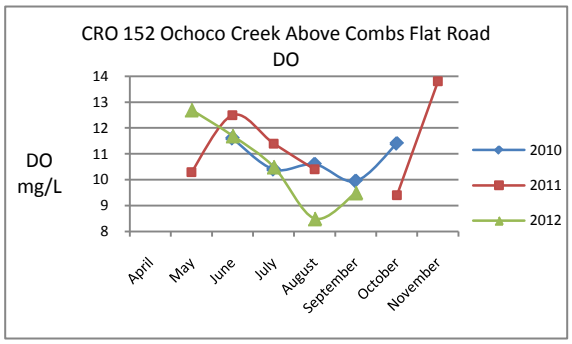


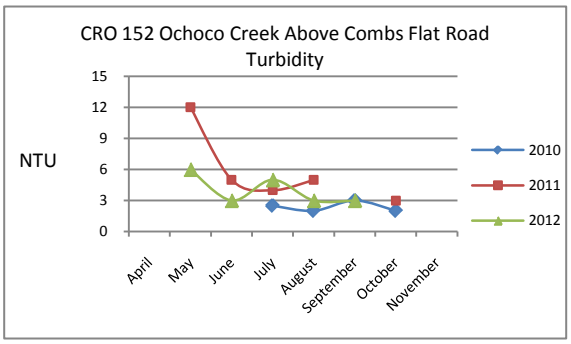


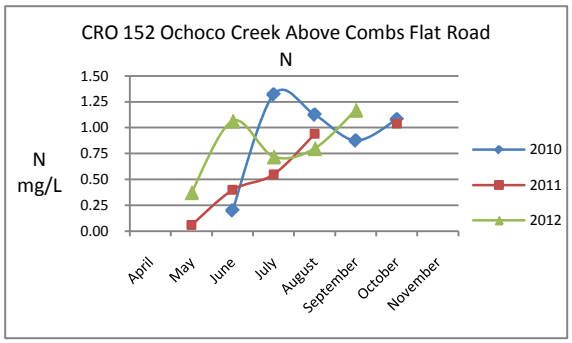
CRO 151					
Date	**N (mg/L)**	**TP (mg/L)**	**NTU**	**DO (mg/L)**	**pH**
6/30/2010	0.07	0.076	7	10.7	8.43
7/14/2010	0.08	0.094	6	10	8.37
7/28/2010	0.1	0.088	7	9.9	7.96
8/11/2010	0.14	0.104	4	10	7.94
8/25/2010	0.06	0.064	5	9.7	7.99
9/7/2010	0.05	0.085	3	8.5	8.42
9/28/2010	< 0.01	0.049	3	9.4	7.99
10/19/2010	0.04	0.083	10	10.5	8.33
5/25/2011	0.03	0.068	8	10.8	8.14
6/22/2011	0.06	0.07	9	10.4	8.29
7/21/2011	0.07	0.08	6	9.8	8.32
8/24/2011	0.1	0.081	3	9.4	8.39
10/4/2011	0.03	0.044	4	8.4	8.21
11/7/2011				10.5	8.43
5/2/2012	0.01	0.052	5	10.8	8.3
5/16/2012	0.05	0.063	5	11.5	8.49
6/5/2012	0.06	0.062	5	10.9	8.47
6/21/2012	0.07	0.076	4	10.2	8.26
7/11/2012	0.07	0.076	5	10.3	8.3
8/9/2012	0.09	0.11	20	9.4	8
9/27/2012	0.01	0.076	7	9.3	8.16

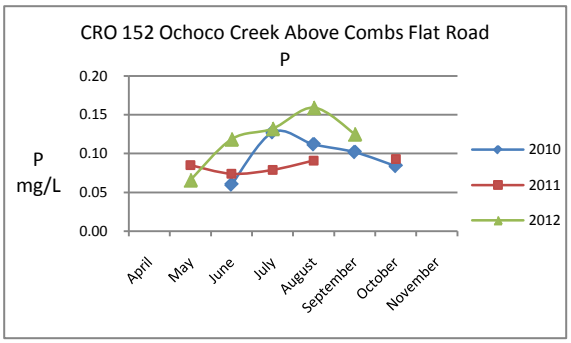
Site CRO 152

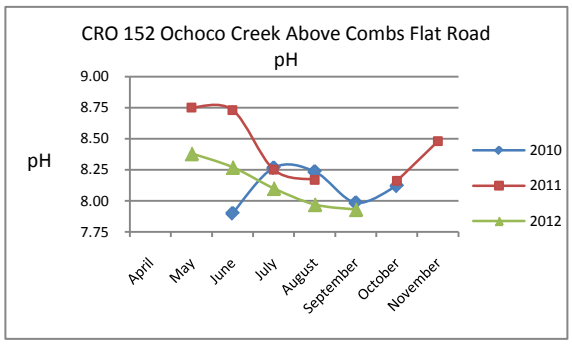
Ochoco Creek flows down from the reservoir through the city of Prineville and the next site is located on the outskirts of Prineville. At this site, DO concentrations were never observed to fall below 9.4 mg/L, which occurred in October of 2011. Turbidity at this site was between 2 and 3 NTU in 2010, reached 12 NTU in June of 2011, and reached 8 NTU in May of 2012. Inorganic N was highest in late July of 2010, when concentrations were observed to be 1.45 mg/L. In 2011, concentrations of N reached 1.08 mg/L in October. In 2012, concentrations of inorganic N reached 1.17mg/L in September. In early August 2010, concentrations of P were highest (0.147 mg/L), while in 2011; concentrations were highest in October (0.093 mg/L). The highest concentrations of p in 2012 were reported at 0.159 mg/l in August. Reported pH at this site ranged from 7.87 to 8.75. No data are available for toxins, metals, or contaminants at this site.







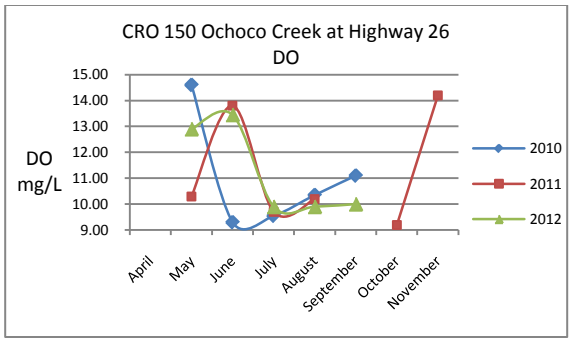


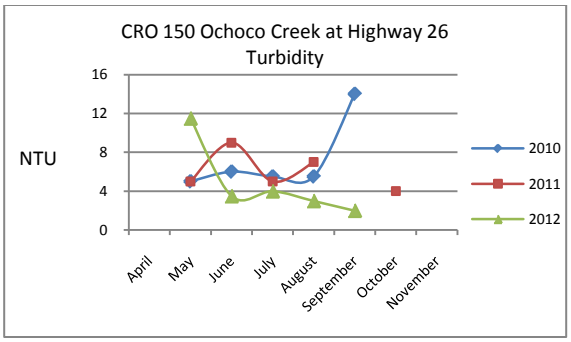


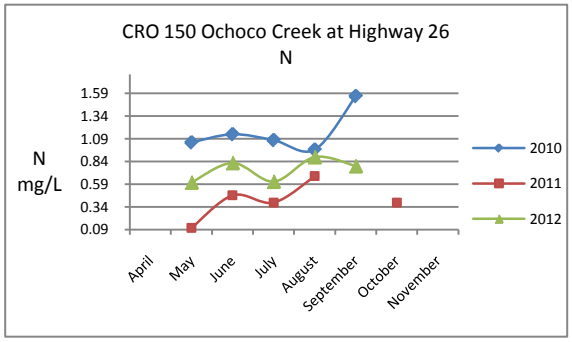
CRO 152					
Date	N (mg/L)	TP (mg/L)	NTU	DO (mg/L)	pH
6/22/2010	0.2	0.06		11.6	7.9
7/14/2010	0.83	0.099	3	9.6	8.1
7/28/2010	1.45	0.108	3	10.5	8.22
8/11/2010	1.19	0.147	2	10.3	8.31
8/25/2010	1.06	0.077	2	10.9	8.16
9/7/2010	0.75	0.098	3	10	8.1
9/28/2010	1	0.106	3	9.9	7.87
10/19/2010	1.08	0.084	2	11.4	8.12
5/18/2011	0.06	0.085	12	10.3	8.75
6/22/2011	0.4	0.074	5	12.5	8.73
7/21/2011	0.55	0.079	4	11.4	8.25
8/24/2011	0.94	0.091	5	10.4	8.17
10/4/2011	1.04	0.093	3	9.4	8.16
11/7/2011				13.8	8.48
5/2/2012	0.07	0.06	4	11.1	8.3
5/16/2012	0.68	0.072	8	14.3	8.46
6/5/2012	1.1	0.147	3	11.1	8.34
6/21/2012	1.03	0.09	3	12.3	8.2
7/11/2012	0.72	0.132	5	10.5	8.1
8/9/2012	0.8	0.159	3	8.5	7.97
9/27/2012	1.17	0.125	3	9.5	7.93

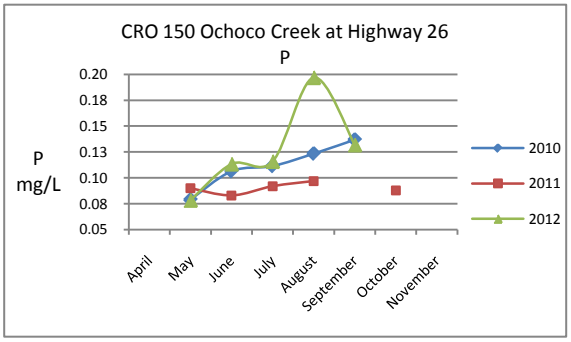
Site CRO 150

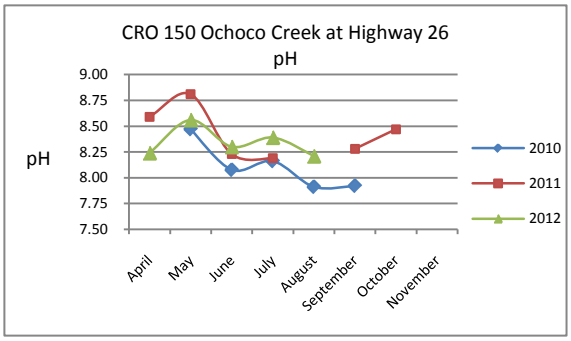
A little more than 0.5 mile upstream from the mouth of Ochoco Creek and downstream from Prineville is the last site on this tributary of the Crooked River. At this site, DO concentrations were not observed to be lower than 9.2 mg/L in 2010, 2011, or 2012. Turbidity averaged a little above 5 NTU in 2010, but in 2011 was observed to be 14 NTU in July, and was, on average, higher than the previous year for the other sample dates. In 2012, turbidity was reported to have reached 162 NTU in mid-May, but every other sampling date for that year was 7 NTU or below. Concentrations of inorganic N were consistently above 1.0 mg/L in 2010, except for late September, when concentrations decreased to 0.72 mg/L. In 2011, N concentrations were lower overall, with the highest concentration (0.68 mg/L) observed in August. Concentrations of inorganic N ranged from 1.06 mg/L (mid-May) to 0.16 mg/L (early-May) in 2012. Concentrations of P were above 0.10 mg/L in 2010, except for late June when concentrations were lower (0.079 mg/L). In 2011, concentrations were lower, never exceeding 0.097 mg/L, and in 2012 concentrations of P ranged from 0.069 mg/l to 0.197 mg/L. Reported pH ranged from 7.84 to 8.81. No data are available for toxins, metals, or contaminants at this site.


CRO 150 Ochoco Creek at Highway 26
DO
DO mg/L
15.00
14.00
13.00
12.00
11.00
10.00
9.00
April
May
June
July
August
September
October
November
2010
2011
2012


CRO 150 Ochoco Creek at Highway 26
Turbidity
NTU
16
12
8
4
0
April
May
June
July
August
September
October
November
2010
2011
2012


CRO 150 Ochoco Creek at Highway 26
N
N mg/L
1.59
1.34
1.09
0.84
0.59
0.34
0.09
April
May
June
July
August
September
October
November
2010
2011
2012

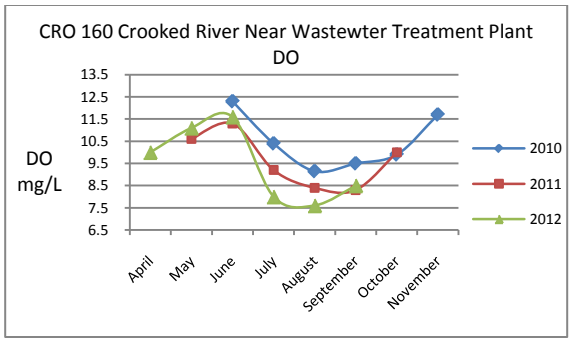

CRO 150 Ochoco Creek at Highway 26
P
P mg/L
0.20
0.18
0.15
0.13
0.10
0.08
0.05
April
May
June
July
August
September
October
November
2010
2011
2012

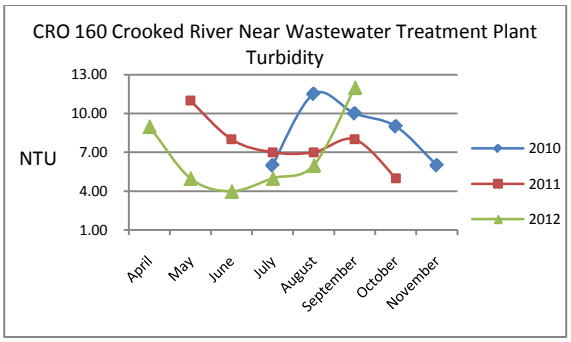

CRO 150 Ochoco Creek at Highway 26
pH
pH
9.00
8.75
8.50
8.25
8.00
7.75
7.50
April
May
June
July
August
September
October
November
2010
2011
2012

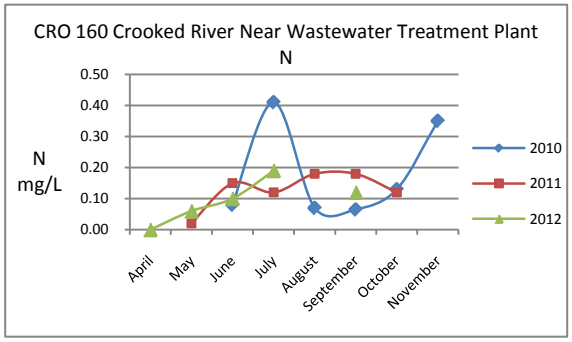
CRO 150					
Date	N (mg/L)	TP (mg/L)	NTU	DO (mg/L)	pH
6/30/2010	1.05	0.079	5	14.6	8.47
7/14/2010	1.06	0.101	6	9.3	8.09
7/28/2010	1.22	0.112	6	9.3	8.06
8/11/2010	1.02	0.114	6	9.4	8.22
8/25/2010	1.13	0.109	5	9.7	8.1
9/7/2010	1.22	0.136	7	11.6	7.98
9/28/2010	0.72	0.111	4	9.1	7.84
10/19/2010	1.56	0.137	14	11.1	7.92
5/18/2011	0.11	0.09	5	10.3	8.59
6/22/2011	0.47	0.083	9	13.8	8.81
7/21/2011	0.39	0.092	5	9.7	8.23
8/24/2011	0.68	0.097	7	10.2	8.19
10/4/2011	0.39	0.088	4	9.2	8.28
11/7/2011				14.2	8.47
5/2/2012	0.16	0.069	7	10.8	8.12
5/16/2012	1.06	0.088	162	15	8.36
6/5/2012	0.78	0.143	4	13.5	8.51
6/21/2012	0.87	0.084	3	13.4	8.61
7/11/2012	0.62	0.116	4	9.9	8.3
8/9/2012	0.89	0.197	3	9.9	8.39
9/27/2012	0.79	0.132	2	10	8.21

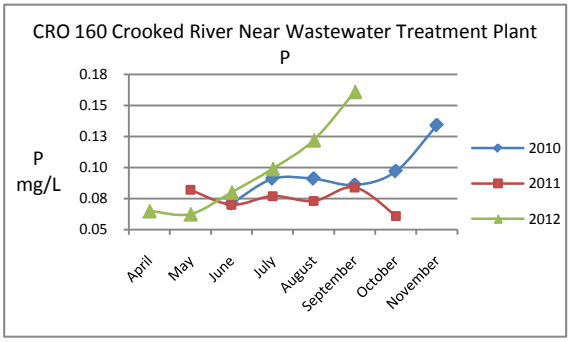
Site CRO 160

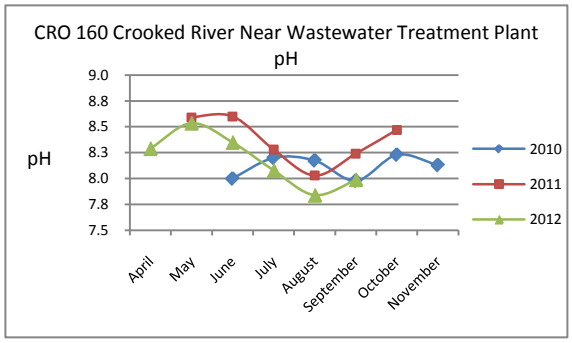
The next site is just downstream from the mouth of Ochoco Creek, and downstream from the Prineville wastewater treatment plant. DO levels at this site reached a low of 7.1 mg/L in mid-August of 2010, a low of 8.3 mg/L in late September of 2011, and in 2012, a low of 7.6 mg/l occurred in August. Turbidity in 2010 was highest in August and September, between 10 and 12 NTU. In 2011, turbidity was highest at 11 NTU in May, and in 2012, turbidity ranged from 12 NTU to 4 NTU, with the greatest turbidity measured occurring in September. Inorganic N concentrations were observed to be highest in July of 2010, at 0.42 mg/L, while in 2011 the highest concentrations were seen in August (0.15 mg/L) and September (0.18 mg/L). In 2012, inorganic N concentrations were highest in July (0.19 mg/L). Concentrations of P ranged from 0.071 mg/L to 0.134 mg/L in 2010, but were lower in 2011, ranging from 0.069 mg/L to 0.870 mg/L, and in 2012 concentrations ranged from 0.058mg/L to 0.161 mg/L. At this site, pH ranged from 7.84 to 8.6. No data are available for toxins, metals, or contaminants at this site.


CRO 160 Crooked River Near Wastewter Treatment Plant
DO
DO
mg/L
13.5
12.5
11.5
10.5
9.5
8.5
7.5
6.5
April
May
June
July
August
September
October
November
2010
2011
2012


CRO 160 Crooked River Near Wastewater Treatment Plant
Turbidity
NTU
13.00
10.00
7.00
4.00
1.00
April
May
June
July
August
September
October
November
2010
2011
2012


CRO 160 Crooked River Near Wastewater Treatment Plant
N
N
mg/L
0.50
0.40
0.30
0.20
0.10
0.00
April
May
June
July
August
September
October
November
2010
2011
2012

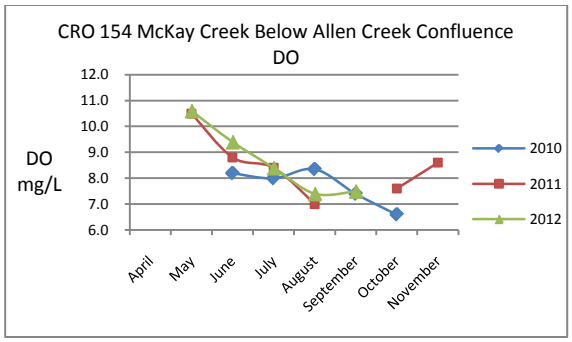

CRO 160 Crooked River Near Wastewater Treatment Plant
P
P
mg/L
0.18
0.15
0.13
0.10
0.08
0.05
April
May
June
July
August
September
October
November
2010
2011
2012

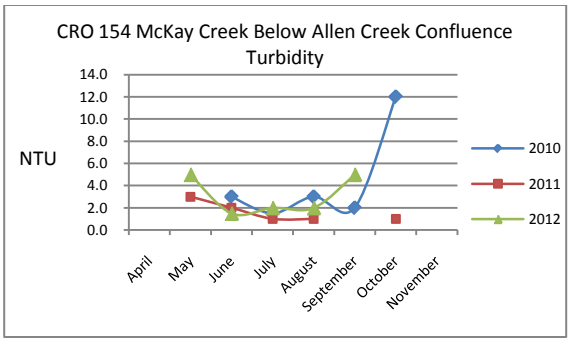

CRO 160 Crooked River Near Wastewater Treatment Plant
pH
pH
9.0
8.8
8.5
8.3
8.0
7.8
7.5
April
May
June
July
August
September
October
November
2010
2011
2012

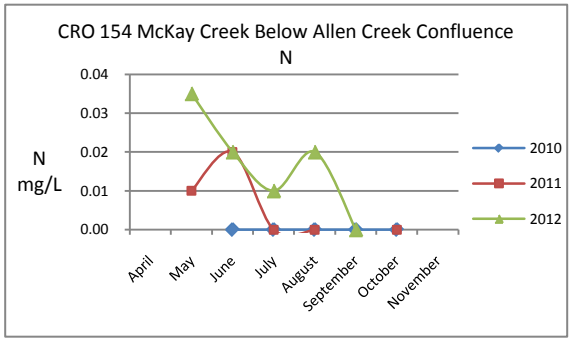
CRO 160					
Date	N (mg/L)	TP (mg/L)	NTU	DO (mg/L)	pH
6/22/2010	0.08	0.071		12.3	8
7/19/2010	0.41	0.091	6	10.4	8.2
8/4/2010	0.06	0.081	11	11.2	8.4
8/18/2010	0.08	0.101	12	7.1	7.95
9/1/2010	0.09	0.091	10	9	7.89
9/16/2010	0.04	0.081	10	10	8.07
9/29/2010	0.13	0.097	9	9.9	8.23
10/26/2010	0.35	0.134	6	11.7	8.13
5/18/2011	0.02	0.082	11	10.6	8.59
6/21/2011	0.15	0.07	8	11.3	8.6
7/20/2011	0.12	0.077	7	9.2	8.28
8/30/2011	0.18	0.073	7	8.4	8.03
9/29/2011	0.18	0.084	8	8.3	8.24
10/31/2011	0.12	0.061	5	10	8.47
4/23/2012	< 0.01	0.065	9	10	8.29
5/8/2012	0.01	0.058	5	9.8	8.7
5/30/2012	0.11	0.067		12.4	8.37
6/19/2012	0.1	0.08	4	11.6	8.35
7/10/2012	0.19	0.099	5	8	8.08
8/7/2012		0.122	6	7.6	7.84
9/25/2012	0.12	0.161	12	8.5	7.99

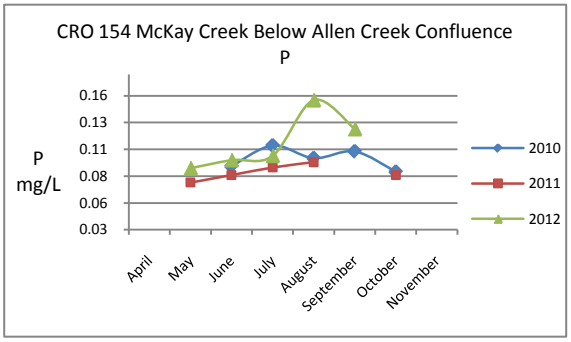
Site CRO 154

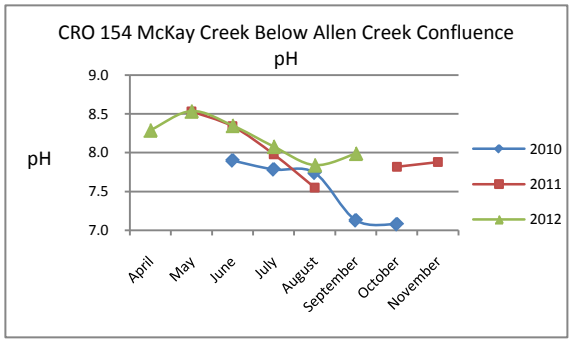
Just below the previous site is the mouth of the McKay Creek. There are several sample sites on this creek, with the most upstream site just below the confluence with Allen Creek. At this site, DO was observed to be below 7 mg/L only twice during the three summers of sampling: once in August of 2010 and then in late September 2010, with concentrations of 6.8 mg/L and 6.6 mg/L, respectively. Turbidity stayed below 3 NTU all of 2010, but in May 2011 was observed to be 12 NTU, before decreasing to 1 NTU. In 2012, turbidity ranged from 1 NTU to 7 NTU. Inorganic N stayed below detection for the sampling dates in 2010. June of 2011 had the highest reported concentration of 0.02 mg/L and in 2012 May was reported as the month having the highest concentration, 0.05 mg/L. Concentrations of P ranged from 0.084 mg/L and 0.112 mg/L in 2010, between 0.074 mg/L and 0.093 mg/L in 2011, and between 0.0875 mg/L and 0.151 mg/L in 2012. Reported pH ranged from 7.08 and 8.53. No data are available for toxins, metals, or contaminants at this site.


CRO 154 McKay Creek Below Allen Creek Confluence
DO
DO
mg/L
12.0
11.0
10.0
9.0
8.0
7.0
6.0
April
May
June
July
August
September
October
November
2010
2011
2012


CRO 154 McKay Creek Below Allen Creek Confluence
Turbidity
NTU
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
April
May
June
July
August
September
October
November
2010
2011
2012


CRO 154 McKay Creek Below Allen Creek Confluence
N
N
mg/L
0.04
0.03
0.02
0.01
0.00
April
May
June
July
August
September
October
November
2010
2011
2012

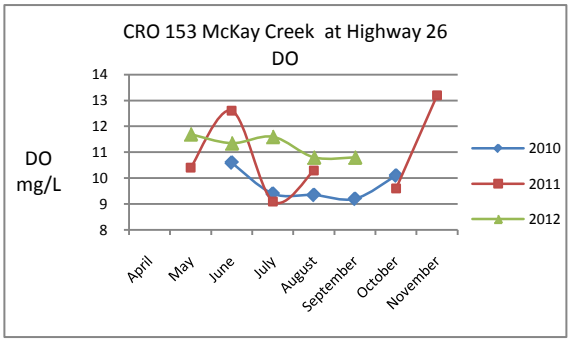

CRO 154 McKay Creek Below Allen Creek Confluence
P
P
mg/L
0.16
0.13
0.11
0.08
0.06
0.03
April
May
June
July
August
September
October
November
2010
2011
2012

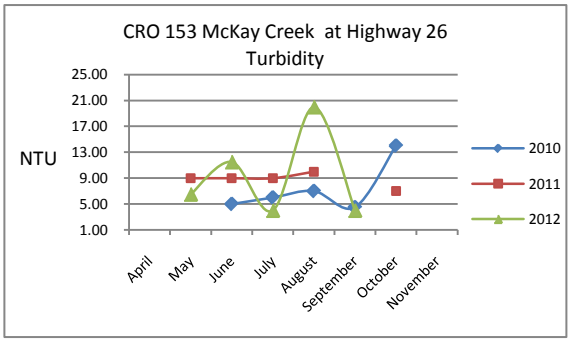

CRO 154 McKay Creek Below Allen Creek Confluence
pH
pH
9.0
8.5
8.0
7.5
7.0
April
May
June
July
August
September
October
November
2010
2011
2012

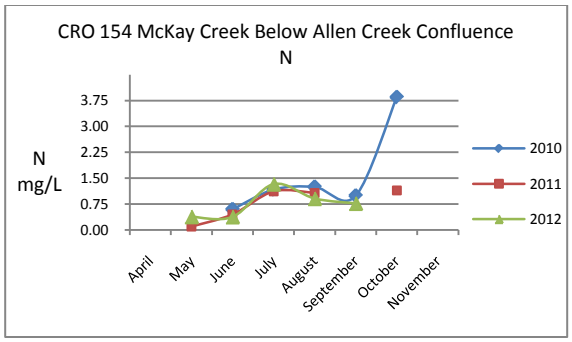
CRO 154					
Date	N (mg/L)	TP (mg/L)	NTU	DO (mg/L)	pH
6/30/2010	< 0.01	0.089	3	8.2	7.9
7/14/2010	< 0.01	0.106	1	8.3	7.81
7/28/2010	< 0.01	0.111	2	7.7	7.76
8/11/2010	< 0.01	0.112	< 1	7	7.65
8/25/2010	< 0.01	0.092	1	6.8	7.38
9/7/2010	< 0.01	0.103	2	7.4	7.13
9/28/2010	< 0.01	0.084	12	6.6	7.08
5/25/2011	0.01	0.074	3	10.5	8.53
6/22/2011	0.02	0.081	2	8.8	8.34
7/21/2011	< 0.01	0.088	1	8.4	7.98
8/24/2011	< 0.01	0.093	1	7	7.55
10/4/2011	< 0.01	0.081	1	7.6	7.82
11/7/2011				8.6	7.88
5/2/2012	0.05	0.084	7	10.9	8.06
5/16/2012	0.02	0.091	3	10.3	7.75
6/5/2012	0.02	0.087	2	10	7.68
6/21/2012	0.02	0.103	1	8.8	7.91
7/11/2012	0.01	0.099	2	8.4	7.65
8/9/2012	0.02	0.151	2	7.4	7.47
9/27/2012	< 0.01	0.124	5	7.5	7.74

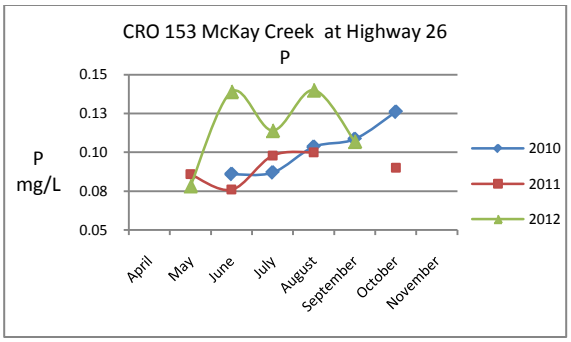
Site CRO 153

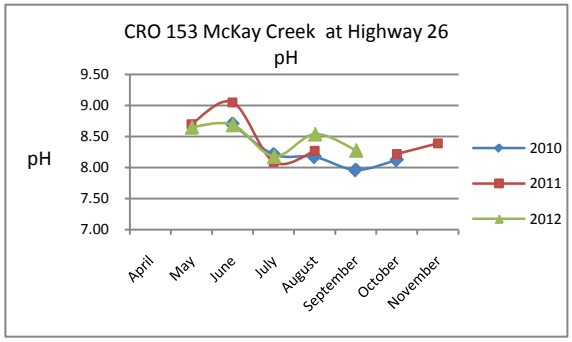
Just above the mouth of McKay Creek is the last site before the confluence with the Crooked River. At this site, DO concentrations were never observed to be less than 8.8 mg/L. Turbidity stayed between 5 NTU and 8 NTU in 2010; in 2011 turbidity was measured at 14 NTU in May. In 2012, turbidity reached 20 NTU in September. Inorganic N concentrations reached the highest observed value in October 2010 (3.85 mg/L), while in 2011 concentrations stayed between 1.07mg/L and 1.18 mg/L, and in 2012 concentrations ranged from 1.33 mg/L to 0.77 mg/L. Concentrations of P were between 0.059 mg/L and 0.126 mg/L in 2010, between 0.076mg/L and 0.101 mg/L in 2011 and between 0.072 mg/L and 0.179 mg/L. At this site, pH was between 7.88 and 9.05. No data are available for toxins, metals, or contaminants for this site.







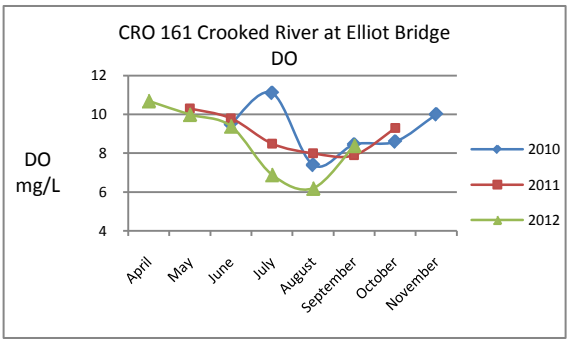


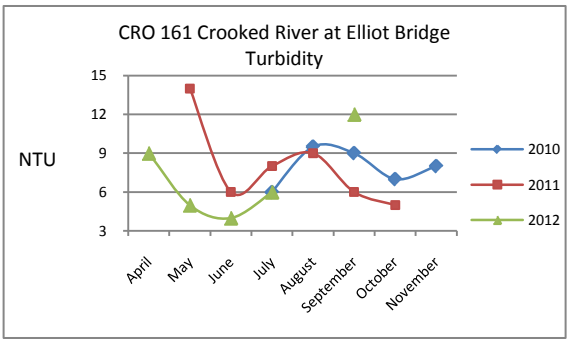


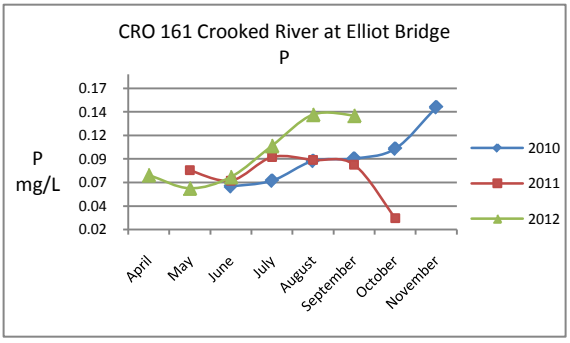
CRO 153					
Date	**N (mg/L)**	**TP (mg/L)**	**NTU**	**DO (mg/L)**	**pH**
6/30/2010	0.6	0.086	5	10.6	8.7
7/14/2010	1.3	0.115	7	9	8.18
7/28/2010	1.05	0.059	5	9.8	8.24
8/11/2010	1.28	0.11	6	9.2	8.27
8/25/2010	1.22	0.097	8	9.5	8.07
9/7/2010	0.97	0.116	7	9.6	8.04
9/28/2010	1.02	0.101	2	8.8	7.88
10/19/2010	3.85	0.126	14	10.1	8.12
5/18/2011	0.1	0.086	9	10.4	8.7
6/22/2011	0.45	0.076	9	12.6	9.05
7/21/2011	1.12	0.098	9	9.1	8.09
8/24/2011	1.07	0.1	10	10.3	8.27
10/4/2011	1.15	0.09	7	9.6	8.22
11/7/2011				13.2	8.39
5/2/2012	0.33	0.085	10	11	8.32
5/16/2012	0.44	0.072	3	12.4	8.98
6/5/2012	0.29	0.179	17	11.2	8.57
6/21/2012	0.47	0.099	6	11.5	8.81
7/11/2012	1.33	0.114	4	11.6	8.18
8/9/2012	0.91	0.14	20	10.8	8.54
9/27/2012	0.77	0.107	4	10.8	8.28

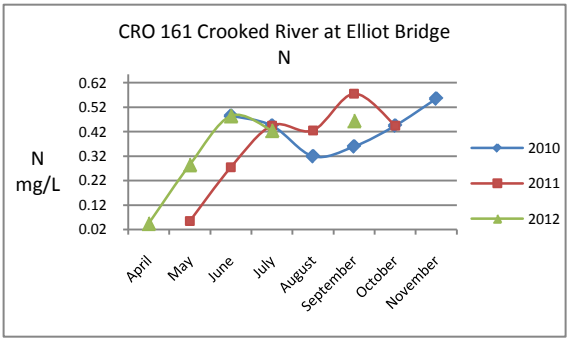
Site CRO 161

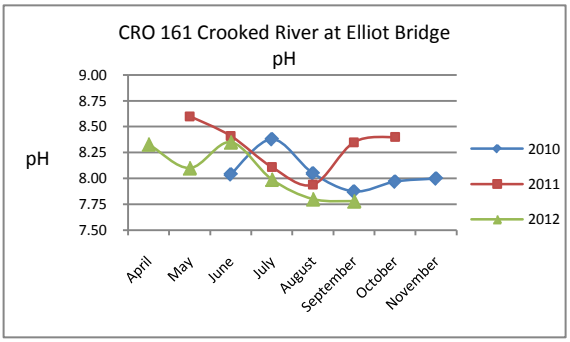
The next site is downstream from the confluence of Crooked River and McKay Creek, on the Crooked River. This site is surrounded by cropland on either side of the river. DO concentrations were at minimums in August 2010, (6.4 mg/L) and in late September of 2011 (7.9 mg/L). Turbidity at this site in 2010 stayed between 6 NTU and 9 NTU, with the exception of 11 NTU in August. In 2011, turbidity was highest in May at 14 NTU. The rest of the sampling dates in 2011 showed turbidity staying between 6 and 9 NTU. Concentrations of inorganic N for 2010 were highest (0.55 mg/L) in October, and lowest (0.28 mg/L) in early August. In 2011, the greatest concentration observed was 0.44 mg/L in July, and the lowest observed concentration was 0.05 mg/L in May. Concentrations of P rose fairly steadily from 0.061 mg/L in June to 0.145 mg/L in October 2010. In 2011, concentrations did not fluctuate as drastically, ranging from 0.067 mg/L to 0.089 mg/L. At this site, pH ranged from 7.9 to 8.41. No data are available for toxins, metals, or contaminants at this site.









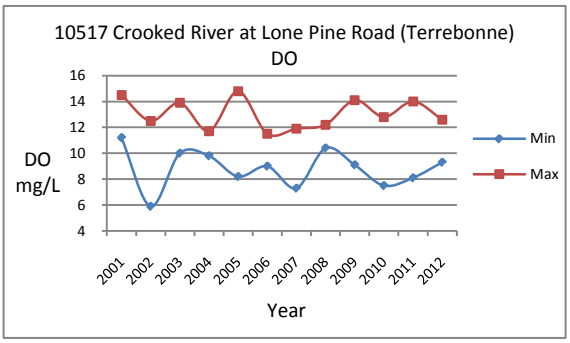


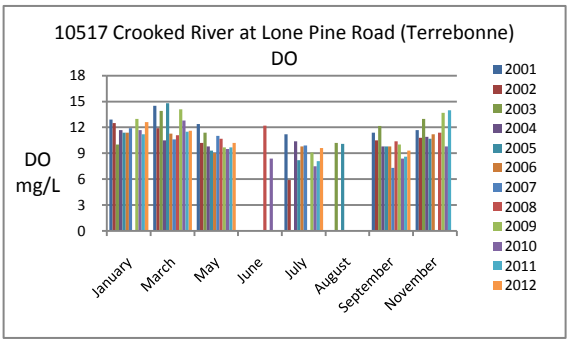
CRO 161					
Date	N (mg/L)	TP (mg/L)	NTU	DO (mg/L)	pH
6/30/2010	0.48	0.061		9.5	8.04
7/19/2010	0.44	0.067	6	11.1	8.38
8/4/2010	0.28	0.082	8	8.4	8.2
8/18/2010	0.35	0.094	11	6.4	7.9
9/1/2010	0.41	0.092	9	8.4	7.78
9/16/2010	0.3	0.089	9	8.5	7.97
9/29/2010	0.44	0.101	7	8.6	7.97
10/26/2010	0.55	0.145	8	10	8
5/18/2011	0.05	0.078	14	10.3	8.6
6/21/2011	0.27	0.067	6	9.8	8.41
7/20/2011	0.44	0.092	8	8.5	8.11
8/30/2011	0.42	0.089	9	8	7.94
9/29/2011	0.57	0.084	6	7.9	8.35
10/31/2011	0.44	0.027	5	9.3	8.4
4/23/2012	0.04	0.073	9	10.7	8.33
5/8/2012	0.15	0.06	5	9.8	8.45
5/30/2012	0.41	0.058	5	10.2	7.75
6/19/2012	0.48	0.071	4	9.4	8.35
7/10/2012	0.42	0.104	6	6.9	7.99
8/7/2012		0.137		6.2	7.8
9/25/2012	0.46	0.136	12	8.4	7.78

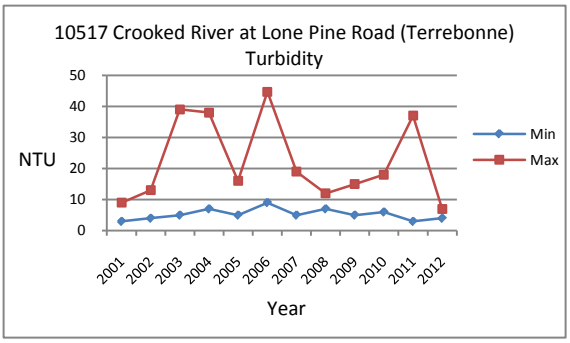
Site 10517

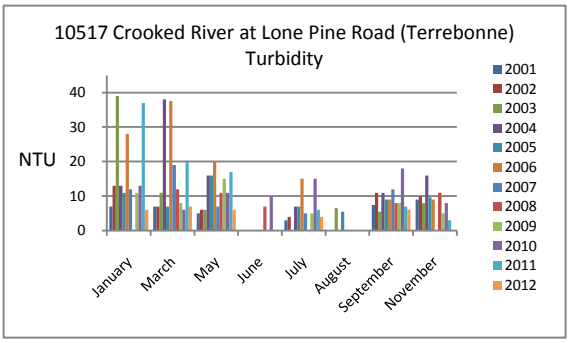
The last site on the Crooked River, before it joins the Deschutes at Lake Billy Chinook, is about 5 miles east of Terrebonne. Sampling events took place at this site every other month from 2001 through 2012. The minimums for DO typically occurred during the summer months, with 5.9 mg/L in September of 2002 being the lowest from the years of sampling. The data showed a slight decreasing trend in DO concentrations. Turbidity at this site was typically higher in the late winter and early spring months. Values ranged from 3 NTU to 44.7 NTU. TSS also was typically highest from January to March, followed by a leveling off throughout the rest of the year. On average, the years with the greatest TSS concentrations were 2006 and 2004. TSS concentrations ranged from 3 mg/L (November 2003, November 2011) to 120 mg/L (March 2006). Concentrations of inorganic N followed a yearly parabolic pattern, reaching lows in May and June. Concentrations ranged from 0.12 mg/L to 1.54 mg/L. Overall, there appeared to be a decreasing trend for inorganic N concentrations. TKN data, although not as complete as the data for inorganic N, also showed a decreasing trend, though monthly data showed typically only a moderate decrease in concentrations throughout the year. Concentrations ranged from a low of 0.30 mg/L to a high of 0.70 mg/L. The values of P concentrations ranged from 0.09 mg/L to 0.2 mg/L, with the majority of the data points falling between 0.10 mg/L and 0.15 mg/L. If a time of year exists when there are typically lower concentrations of P, it would be around May/June. Lowest concentrations of OP tended to occur around March. OP concentrations ranged from 0.023 mg/L to 0.13 mg/L. For both P and OP, there was a decreasing trend in concentration over the years of data collection. From 2001 through 2012, pH values

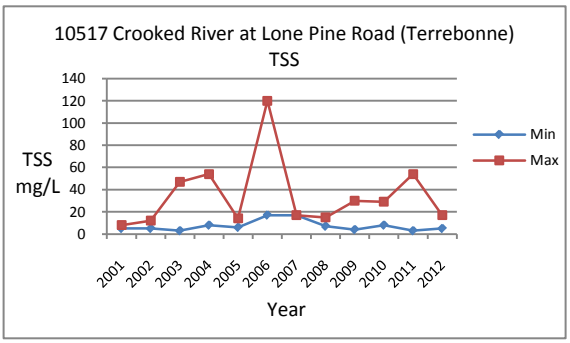
ranged from 8.0 to 8.9. No data are available for toxins, metals, or contaminants at this site.

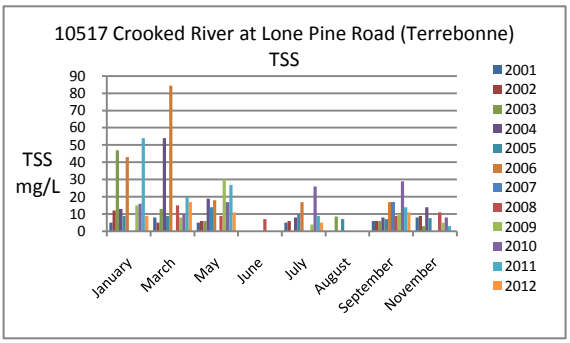


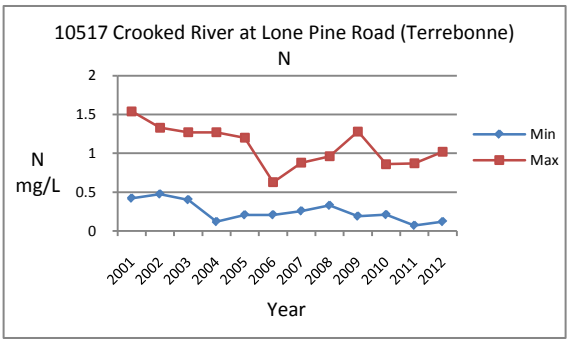


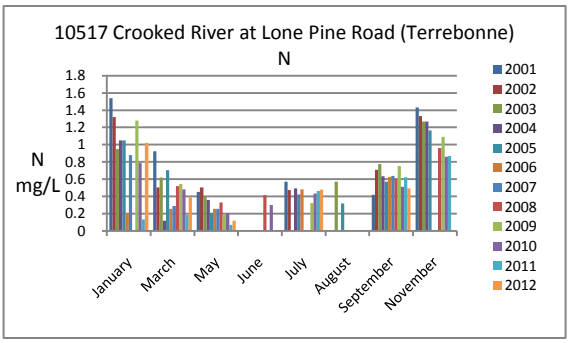


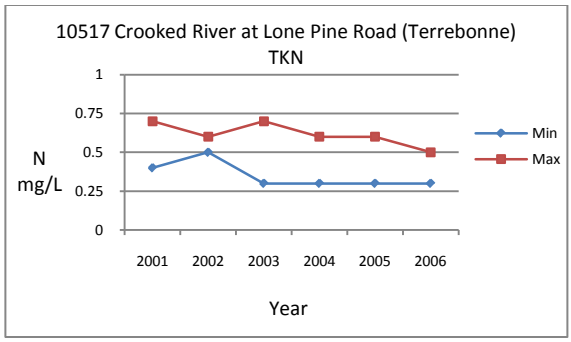


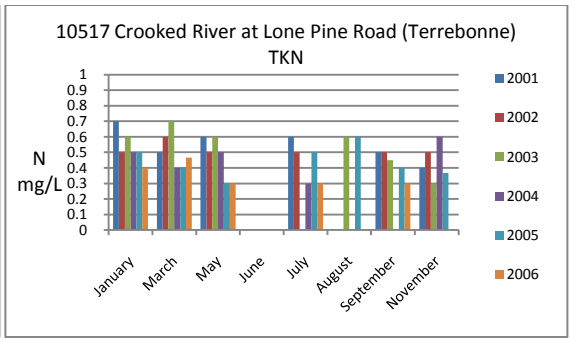


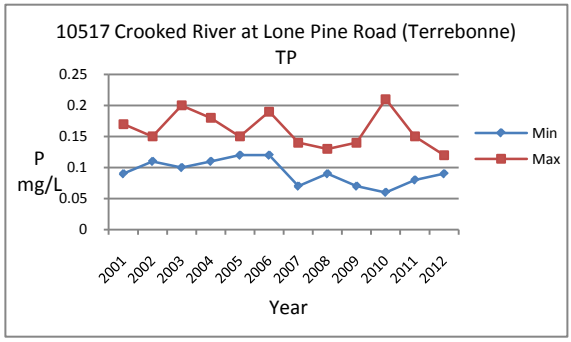


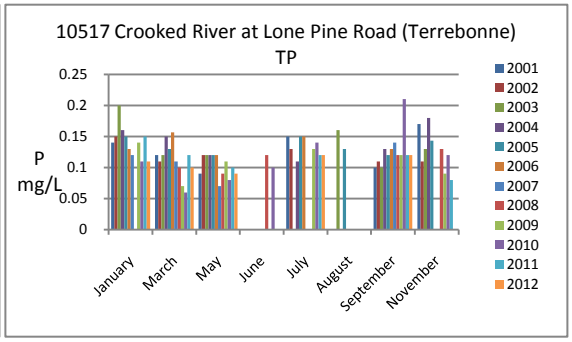


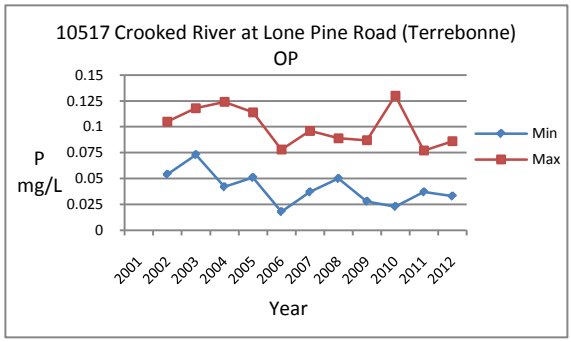


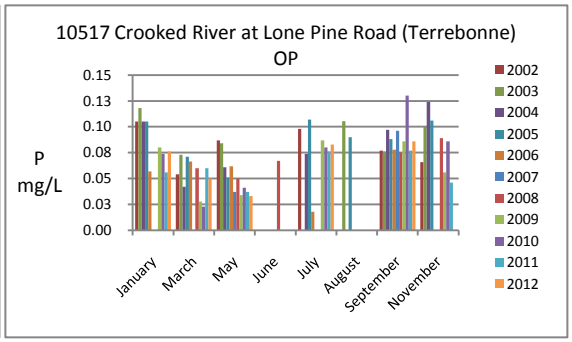

10517 Crooked River at Lone Pine Road (Terrebonne)
TKN
N
mg/L
Min
Max
Year

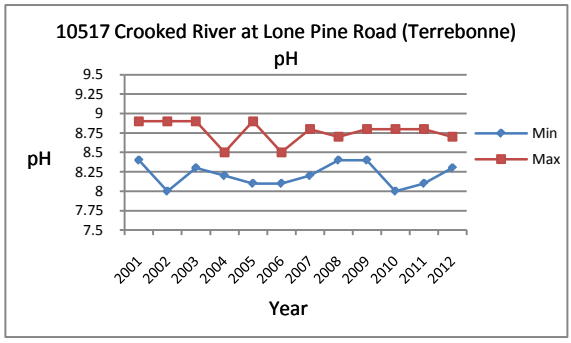

10517 Crooked River at Lone Pine Road (Terrebonne)
TKN
N
mg/L
January
March
May
June
July
August
September
November

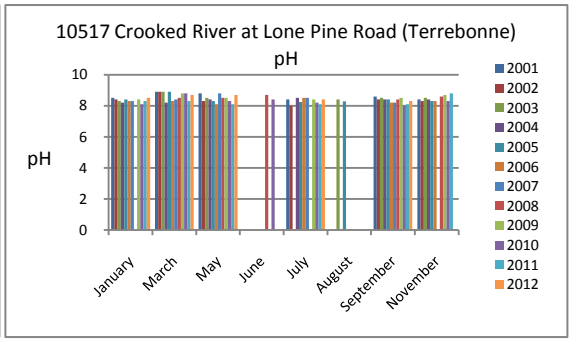

10517 Crooked River at Lone Pine Road (Terrebonne)
TP
P
mg/L
Min
Max
Year


10517 Crooked River at Lone Pine Road (Terrebonne)
TP
P
mg/L
January
March
May
June
July
August
September
November


10517 Crooked River at Lone Pine Road (Terrebonne)
OP
P
mg/L
Min
Max
Year


10517 Crooked River at Lone Pine Road (Terrebonne)
OP
P
mg/L
January
March
May
June
July
August
September
November


10517 Crooked River at Lone Pine Road (Terrebonne)
pH
pH
Min
Max
Year


10517 Crooked River at Lone Pine Road (Terrebonne)
pH
pH
January
March
May
June
July
August
September
November

10517								
Date	N (mg/L)	TKN (mg/L)	OP (mg/L)	TP (mg/L)	TSS (mg/L)	NTU	DO (mg/L)	pH (SU)
1/22/2001	1.54	0.7		0.14	5	7	12.9	8.5
3/12/2001	0.925	0.5		0.12	8	7	14.5	8.9
5/7/2001	0.452	0.6		0.09	5	5	12.4	8.8
7/9/2001	0.571	0.6		0.15	5	3	11.2	8.4
9/10/2001	0.421	0.5		0.1	6	7.4	11.4	8.6
11/5/2001	1.43	0.4		0.17	8	9	11.7	8.4
1/28/2002	1.32	0.5	0.105	0.15	12	13	12.5	8.4
3/28/2002	0.505	0.6	0.054	0.11	5	7	11.9	8.9
5/28/2002	0.504	0.5	0.087	0.12	6	6	10.2	8.3
7/25/2002	0.475	0.5	0.098	0.13	6	4	5.9	8
9/23/2002	0.71	0.5	0.077	0.11	6	11	10.5	8.4
11/5/2002	1.33	0.5	0.066	0.11	9	10	10.8	8.3
1/27/2003	0.95	0.6	0.118	0.2	47	39	10	8.3
3/18/2003	0.62	0.7	0.073	0.12	13	11	13.9	8.9
5/22/2003	0.402	0.6	0.084	0.12	6	6	11.4	8.5
8/6/2003	0.572	0.6	0.106	0.16	8	7	10.2	8.4
8/6/2003	0.572	0.6	0.105	0.16	9	6	10.2	8.4
9/22/2003	0.774	0.5	0.076	0.1	6	6	12.2	8.5
9/22/2003	0.774	0.4	0.076	0.1	6	5	12.1	8.5
11/17/2003	1.27	0.3	0.1	0.13	3	8	13	8.5
1/26/2004	1.05	0.5	0.105	0.16	13	13	11.7	8.2
3/22/2004	0.12	0.4	0.042	0.15	54	38	10.5	8.2
5/24/2004	0.362	0.5	0.061	0.12	19	16	9.8	8.4
7/28/2004	0.494	0.3	0.074	0.11	8	7	10.4	8.5
9/13/2004	0.636	<0.2	0.097	0.13	8	11	9.8	8.4
11/16/2004	1.27	0.6	0.124	0.18	14	16	10.9	8.4
1/24/2005	1.05	0.5	0.105	0.15	9	11	11.4	8.4
3/7/2005	0.704	0.4	0.071	0.13	9	7	14.8	8.9
5/16/2005	0.207	0.3	0.051	0.12	14	16	9.3	8.3
7/13/2005								8.4
7/20/2005								8.1
7/21/2005	0.424	0.5	0.107	0.15	10	7	8.2	8.3
7/25/2005								8.2
8/1/2005								8.3
8/9/2005						6	10.3	8.4
8/10/2005	0.321	0.6	0.09	0.13	7	5	9.9	8.4
8/16/2005								8.1
8/23/2005								8.2
9/12/2005	0.572	0.4	0.088	0.12	7	9	9.8	8.4

10517								
Date	N (mg/L)	TKN (mg/L)	OP (mg/L)	TP (mg/L)	TSS (mg/L)	NTU	DO (mg/L)	pH (SU)
11/7/2005	1.19	0.4	0.103	0.14	9	9	10.8	8.3
11/8/2005	1.2	0.3	0.101	0.14	6	10	10.6	8.3
11/9/2005	1.1	0.4	0.114	0.15	8	10	10.7	8.3
1/9/2006	0.208	0.4	0.057	0.13	43	28	11.4	8.3
3/14/2006	0.284	0.5	0.066	0.16	120	39	11.2	8.3
3/15/2006	0.226	0.5	0.07	0.19	110	44.7	11.5	8.3
3/16/2006	0.261	0.4	0.063	0.12	23	29	11.1	8.3
5/22/2006	0.258	0.3	0.062	0.12	18	20	9	8.1
7/17/2006	0.482	0.3	0.018	0.15	17	15	9.8	8.5
9/18/2006	0.627	0.3	0.078	0.13	17	9	9.8	8.2
11/6/2006						9	11.2	8.3
3/19/2007	0.289			0.11		19	10.6	8.4
5/14/2007	0.258		0.037	0.07		7	11	8.8
7/23/2007						5	9.9	8.5
9/4/2007	0.64		0.096	0.14	17	12	7.3	8.2
3/10/2008	0.519		0.06	0.1	15	12	11.1	8.5
5/4/2008	0.329		0.05	0.09	9	11	10.7	8.5
6/30/2008	0.416		0.067	0.12	7	7	12.2	8.7
9/29/2008	0.605		0.075	0.12	9	8	10.4	8.4
11/17/2008	0.961		0.089	0.13	11	11	11.4	8.6
1/26/2009	1.28		0.08	0.14	15	11	13	8.4
3/23/2009	0.544		0.028	0.07	8	8	14.1	8.8
5/11/2009	0.19		0.034	0.11	30	15	9.7	8.5
7/27/2009	0.322		0.087	0.13	4	5	9.1	8.4
9/29/2009	0.754		0.086	0.12	10	8	10	8.5
11/16/2009	1.09		0.056	0.09	5	5	13.7	8.7
1/25/2010	0.786		0.074	0.11	16	13	11.7	8.1
3/22/2010	0.481		0.023	0.06	10	6	12.8	8.8
5/17/2010	0.21		0.041	0.08	17	11	9.5	8.3
6/22/2010	0.3			0.1		10	8.4	8.4
7/26/2010	0.436		0.08	0.14	26	15	7.5	8.2
9/20/2010	0.511		0.13	0.21	29	18	8.4	8
11/1/2010	0.86		0.086	0.12	8	8	9.8	8.3
1/24/2011	0.136		0.056	0.15	54	37	11.2	8.3
3/24/2011	0.186		0.06	0.12	20	20	11.5	8.3
5/23/2011	0.0716		0.037	0.1	27	17	9.7	8.1
7/19/2011	0.464		0.076	0.12	9	6	8.1	8.1
9/26/2011	0.624		0.077	0.12	14	7	8.6	8.1
11/14/2011	0.87		0.046	0.08	3	3	14	8.8

10517								
Date	N (mg/L)	TKN (mg/L)	OP (mg/L)	TP (mg/L)	TSS (mg/L)	NTU	DO (mg/L)	pH (SU)
1/23/2012	1.02		0.076	0.11	9	6	12.6	8.5
3/26/2012	0.389		0.05	0.1	17	7	11.6	8.7
5/14/2012	0.12		0.033	0.09	11	6	10.2	8.7
7/23/2012	0.48		0.083	0.12	5	4	9.6	8.4
9/24/2012	0.493		0.086	0.12	11	6	9.3	8.3

The available water quality data for the Crooked River subbasin covers many of the water bodies in the region. For most of the data presented here, only 3 years of data collection have occurred. The South Fork Crooked subbasin has the least amount of available data, with only two sampling sites that could be put in with the Upper Crooked subbasin. The water bodies of the Upper and Lower Crooked subbasins are well represented, although more years of consistent data collection would ensure a more complete picture of the water quality.

6.2 Upper and Little Deschutes Subbasin

6.2.1 Introduction

The Deschutes River from the bottom of Wickiup Reservoir to the City of Bend is listed as 303(d) due to high water temperatures. Poor DO levels are found on the Little Deschutes River, from its confluence with the Deschutes River upstream to river mile (RM) 54. Due to the low gradient and the meandering nature of this river, there is poor water circulation; additionally stream temperatures are high, contributing to the poor DO levels (Bruener 2004).

There are 303(d) impairment listings for both sedimentation and turbidity along the Deschutes River between Wickiup Reservoir and the City of Bend. Both listings are based on USFS data from the mid-1990s. There is indication that the turbidity increases thirty-fold in early spring when irrigation water is released from Wickiup Reservoir. The Upper Deschutes River Instream Flow Assessment (ODEQ 2011) found a high percent of fine sedimentation in spawning gravels that adversely impact the survival rate of trout (ODEQ 2011).

The *Upper Deschutes Subbasin Assessment* (ODEQ 2011) identified 47 of 130 reaches with high to extreme bank erosion, contributing to turbidity issues. Data collected by ODEQ and the USFS indicated a relationship between the increase in streamflows during the months of March through May for irrigation purposes and higher TSS levels. Turbidity and TSS data in the reach between Wickiup Reservoir and Bend were collected during 2001. The summer and winter months had lower TSS levels.

Some of the other areas of potential concern were Lake Creek and Brush Creek (both tributaries to the Metolius River) and lower Whychus Creek. There are high percentages of fine sedimentation in the lower half of Whychus Creek due to erosion of unstable streambanks, possibly caused by past livestock grazing practices (ODEQ 2011).

Nitrogen limitations exist on the Upper and Little Deschutes subbasin, as do mesotrophic and eutrophic conditions due to high total phosphorus (TP) concentrations (Jones 2007).

The pH levels in the subbasin suggest there are impacts from water diversions, flow modifications, and nonpoint source pollution from urban runoff. The Lower Bridge site is 303(d) listed for pH and falls within a segment of river stretching from RM 126.4 Steelhead Falls, to RM 168.2 near Bend (Jones 2007). The pH levels in the subbasin suggest there are impacts from water diversions, flow modifications, and nonpoint source pollution from urban runoff. The Lower Bridge site is 303(d) listed for pH and falls within a segment of river stretching from RM 126.4 Steelhead Falls, to RM 168.2 near Bend (Jones 2007). On Willow Creek, elevated pH is due to algal growth from increased temperature, nutrients, and light (ODEQ 2007).

Water bodies in the Upper and Little Deschutes subbasin that have proposed 303(d) listings for algal bloom impairments are Odell Lake, Wickiup Reservoir, Crane Prairie Reservoir, and Paulina Lake. These lakes have had multiple years with health advisories. Lava Lake and Suttle Lake show a potential for concern, but need more data. The other lakes in the region that have been monitored, but are not impaired with regards to algal blooms, include Scout, Middle Green, Hosmer, Elk, South Twin, Crescent, Davis, and Todd lakes (ODEQ 2011).

6.2.2 Current Conditions

Figure 5 below shows the Upper Deschutes subbasin. The placeholders on the map indicate points where data have been collected. Six of the sites are ODEQ long-term monitoring sites, with data collection bi-monthly from 2001 through 2012. One of these sites (site 10696) is in the Little Deschutes subbasin. The other four sites are Reclamation reservoir monitoring sites with sampling events taking place every 3 years, none of which is in the Little Deschutes subbasin. Though not included in the following discussion, there are several sampling sites on tributaries of the Metolius River, including sites on Lake Creek, Canyon Creek, Jack Creek, and Link Creek. This data can be found on the Friends of The Metolius website (www.metoliusfriends.org). The conditions of the Metolius for aquatic habitat are considered relatively good (Davis and Kunkle 2010).

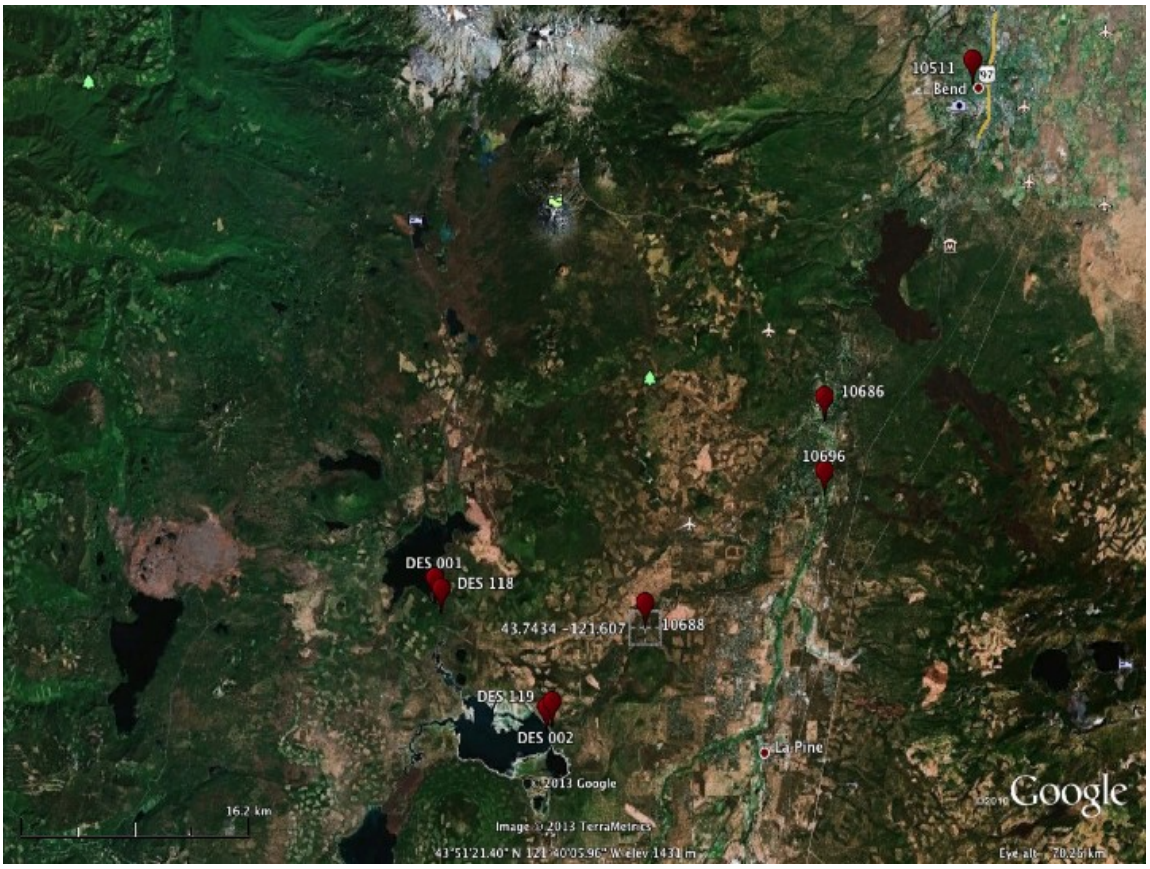
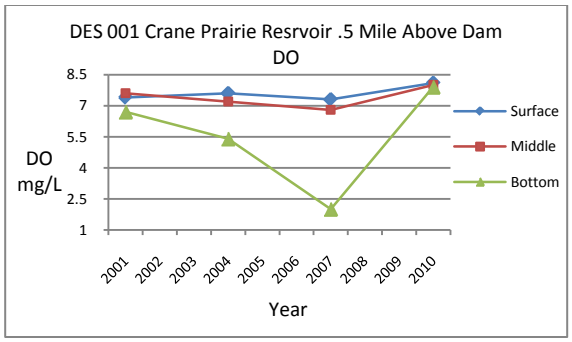


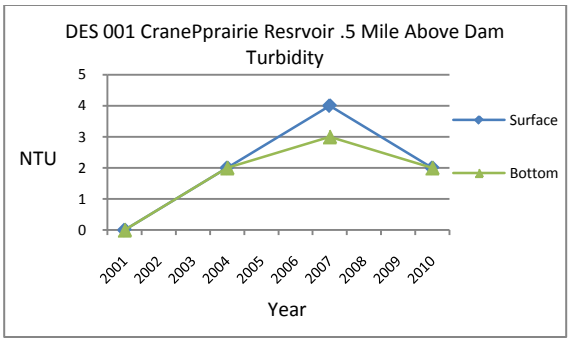
Figure 5. Sampling sites in the Upper Deschutes subbasin.

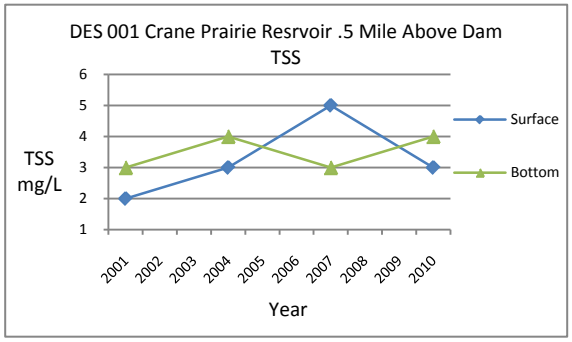
Upper Deschutes Subbasin

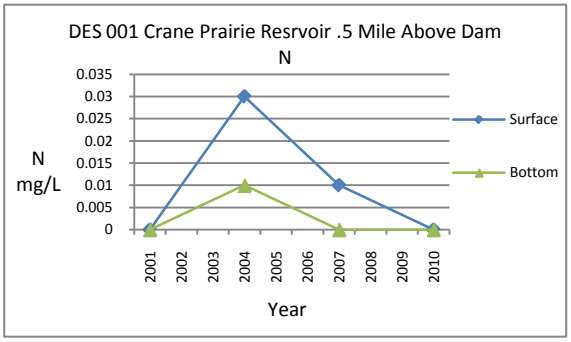
Site DES 001

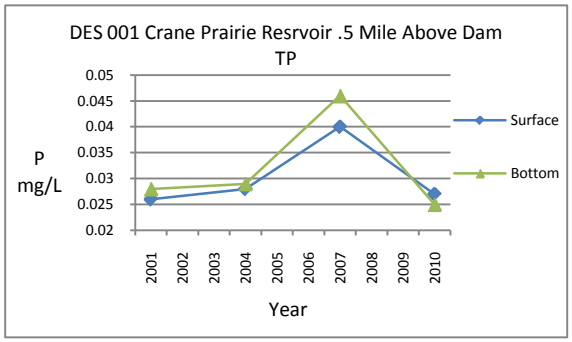
The first site from which data have been collected in the Upper Deschutes subbasin is at Crane Prairie Reservoir. This first site is above the dam approximately 0.5 miles. DO at the surface ranged from 7.4 mg/L to 8.1 mg/L. At the bottom, the lowest concentration observed was 2.0 mg/L in 2007. Turbidity at the surface ranged from less than detection to 4 NTU, while at the bottom values were observed to be between less than detection and 3 NTU. TSS values ranged from 2 mg/L to 4 mg/L at the surface and 3 mg/L to 5 mg/L at the bottom. Inorganic N was observed to be 0.01 mg/L or below in all years, except for 2004 when surface concentrations were measured at 0.03 mg/L and bottom depth concentrations were measured at 0.01 mg/L. Concentrations of P ranged from 0.026 mg/L to 0.040 mg/L at the surface. At the bottom, concentrations ranged from 0.25 mg/L to 0.46 mg/L. Reported pH at this site ranged from 8.1 to 9.1 at the surface, 8.82 to 9.48 pH, at 3 meters, and 8.0 to 8.73 pH at the bottom. Chlorophyll-a data were also available at this site, and values ranged from 15 mg/m3 in 2001 to 2.4 mg/m3 in 2004. Metals data were collected and are presented in the tables following the graphs.

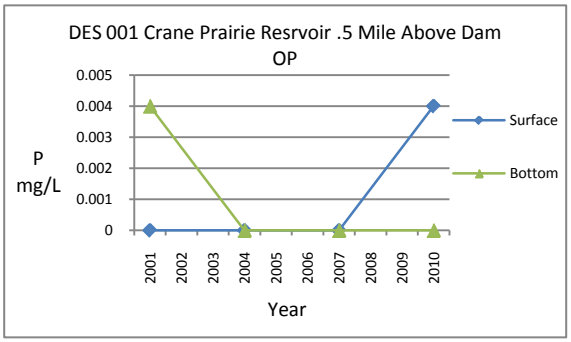

DES 001 Crane Prairie Resrvoir .5 Mile Above Dam
DO
DO mg/L
8.5
7
5.5
4
2.5
1
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year
Surface
Middle
Bottom

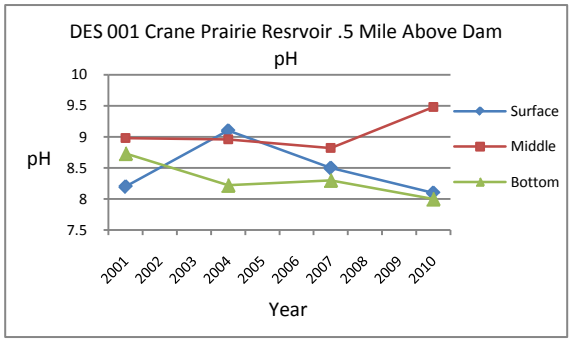

DES 001 CranePprairie Resrvoir .5 Mile Above Dam
Turbidity
NTU
5
4
3
2
1
0
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year
Surface
Bottom

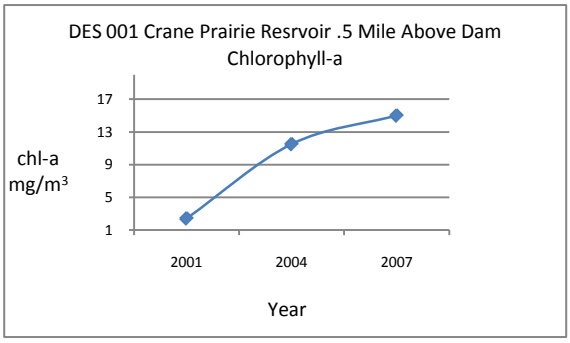

DES 001 Crane Prairie Resrvoir .5 Mile Above Dam
TSS
TSS mg/L
6
5
4
3
2
1
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year
Surface
Bottom


DES 001 Crane Prairie Resrvoir .5 Mile Above Dam
N
N mg/L
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year
Surface
Bottom


DES 001 Crane Prairie Resrvoir .5 Mile Above Dam
TP
P mg/L
0.05
0.045
0.04
0.035
0.03
0.025
0.02
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year
Surface
Bottom


DES 001 Crane Prairie Resrvoir .5 Mile Above Dam
OP
P mg/L
0.005
0.004
0.003
0.002
0.001
0
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year
Surface
Bottom


DES 001 Crane Prairie Resrvoir .5 Mile Above Dam
pH
pH
10
9.5
9
8.5
8
7.5
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year
Surface
Middle
Bottom


DES 001 Crane Prairie Resrvoir .5 Mile Above Dam
Chlorophyll-a
chl-a mg/m³
17
13
9
5
1
2001 2004 2007
Year

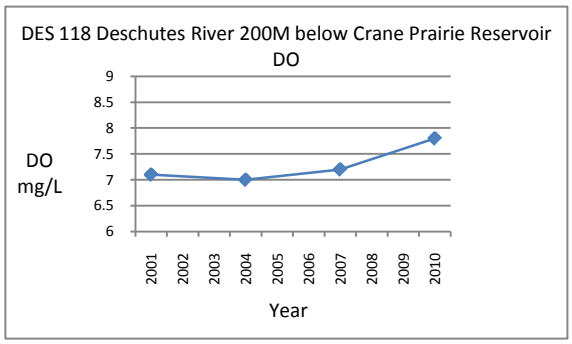
DES 001									
Date	Depth **(m)**	DO **(mg/L)**	pH	N **(mg/L)**	TKN **(mg/L)**	OP **(mg/L)**	P **(mg/L)**	TSS **(mg/L)**	NTU
7/25/2001	1	7.4	8.2	< 0.01	0.26	< 0.003	0.026	2	< 1
7/25/2001	3	7.6	8.98						
7/25/2001	4.1	6.7	8.73	< 0.01	0.27	0.004	0.028	3	< 1
7/14/2004	1	7.6	9.1	0.03	0.62	< 0.003	0.028	3	2
7/14/2004	3	7.2	8.96						
7/14/2004	4.1	5.4	8.22	0.01	0.53	< 0.003	0.029	4	2
7/24/2007	1	7.3	8.5	0.01	0.69	< 0.003	0.04	5	4
7/24/2007	3	6.8	8.82						
7/24/2007	4.4	2	8.3	< 0.01	0.7	< 0.003	0.046	3	3
7/27/2010	1	8.1	8.1	< 0.01	0.37	0.004	0.027	3	2
7/27/2010	3	8	9.48						
7/27/2010	4.1	7.9	8	< 0.01	0.4	< 0.003	0.025	4	2

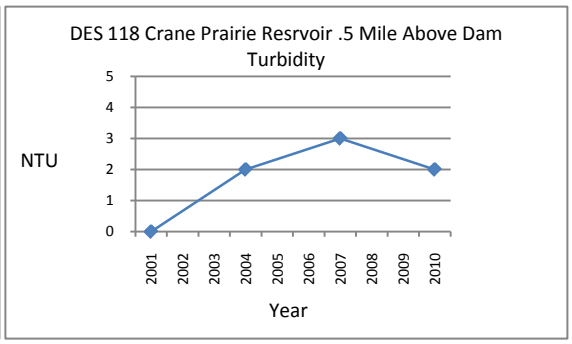
DES 001	**Depth (m)**	**Arsenic (µg/L)**	**Boron (µg/L)**	**Cadmium (µg/L)**	**Chromium (µg/L)**	**Copper (µg/L)**	**Iron (µg/L)**	**Lead (µg/L)**
2001	1	< 2	< 50	< 1	< 2	< 2	80	< 2
2001	4.1	< 2	< 50	< 1	< 2	< 2	100	< 2
2004	1	< 2	< 50	< 1	< 2	< 2	100	< 2
2004	4.1	< 2	< 50	< 1	< 2	< 2	100	< 2
2007		< 2		< 1	< 2	< 2	90	< 2
2007	1	< 2		< 1	< 2	< 2	90	< 2
2007	4.4	< 2		< 1	< 2	< 2	100	< 2
2010	1	< 2		< 1	< 2	< 2	150	< 2
2010	4.1	< 2		< 1	< 2	< 2	130	< 2

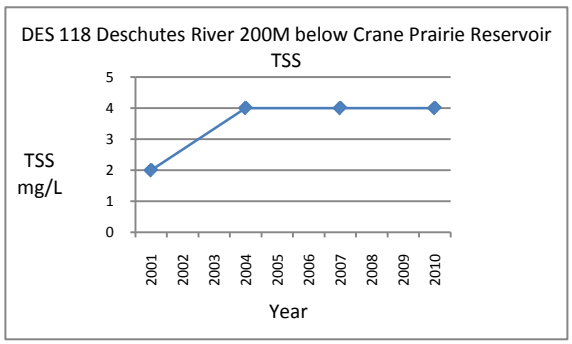
DES 001	**Depth (m)**	**Magnesium (mg/L)**	**Manganese (µg/L)**	**Mercury (µg/L)**	**Potassium (µg/L)**	**Selenium (µg/L)**	**Zinc (µg/L)**
2001	1	1.8	< 10	< 0.2	1	< 2	< 5
2001	4.1	1.8	< 10	< 0.2	0.9	< 2	6
2004	1	1.7	< 10	< 0.2	0.9	< 2	< 5
2004	4.1	1.8	< 10	< 0.2	1	< 2	< 5
2007		1.8	< 10	< 0.2	1.1	< 2	< 5
2007	1	1.8	< 10	< 0.2	1.1	< 2	< 5
2007	4.4	1.8	< 10	< 0.2	1.1	< 2	< 5
2010	1	1.8	< 10	< 5	1.1	< 2	< 5
2010	4.1	1.9	< 10	< 5	0.9	< 2	< 5

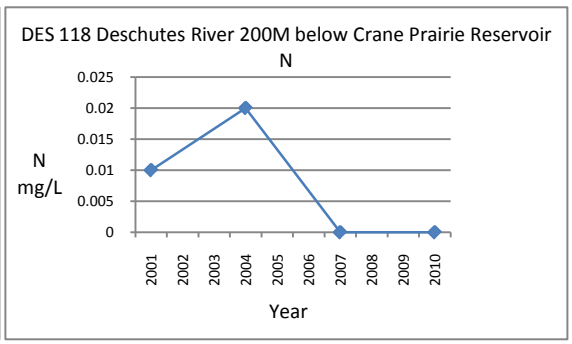
Site DES 118

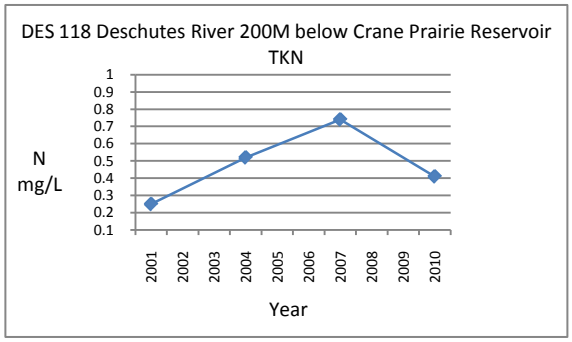
The next site for data collection is just below Crane Prairie Reservoir on the Deschutes River. At this site, DO concentrations never fell below 7.0 mg/L. Turbidity ranged from below detection to 3 NTU and TSS ranged from 2 mg/L to 4 mg/L. TKN concentrations ranged from 0.25 mg/l to 0.75 mg/L. Inorganic N concentrations ranged from below detection to 0.02 mg/L. Concentrations of P were observed to be between 0.047mg/L and 0.026 mg/L. OP at this site ranged from < 0.003 mg/L to 0.007 mg/L. Reported pH at this site ranged from 7.9 to 8.7. Metals data were collected and are presented in the tables following the graphs.

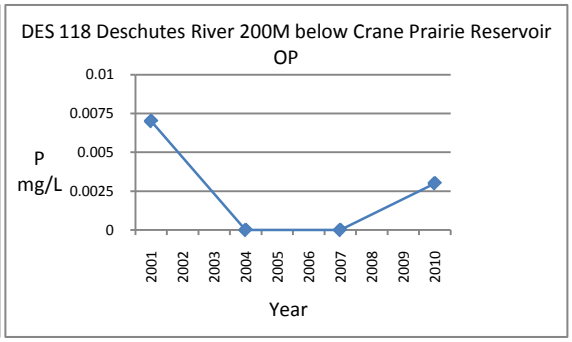


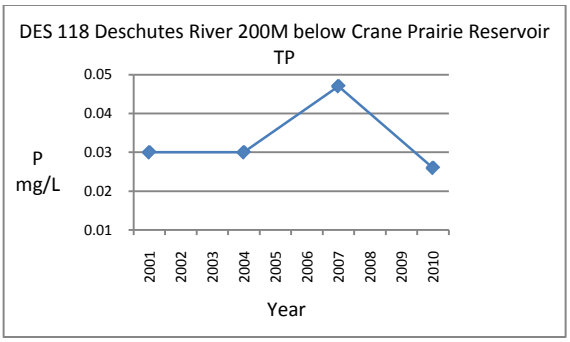


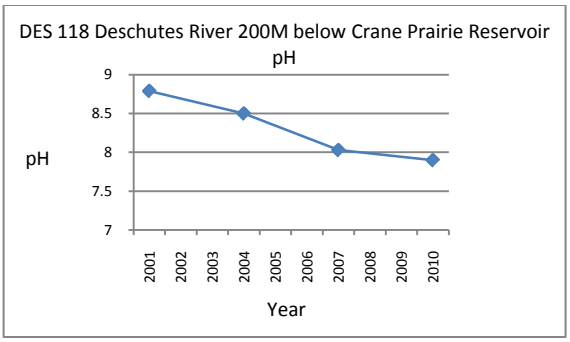












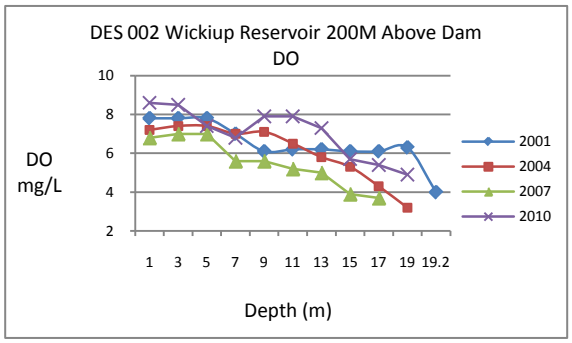
DES 118	Arsenic (µg/L)	Boron (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Copper (µg/L)	Iron (µg/L)	Lead (µg/L)
2001	< 2	< 50	< 1	< 2	< 2	90	< 2
2004	< 2	< 50	< 1	< 2	< 2	100	< 2
2007	< 2		< 1	< 2	< 2	110	< 2
2010	< 2		< 1	< 2	< 2	110	< 2

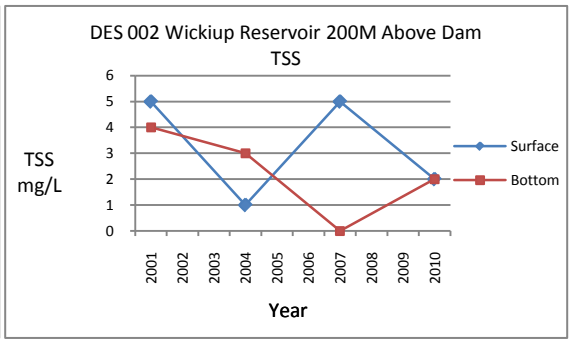
DES 118	Magnesium (mg/L)	Manganese (µg/L)	Mercury (µg/L)	Potassium (µg/L)	Selenium (µg/L)	Zinc (µg/L)
2001	1.8	< 10	< 0.2	1	< 2	< 5
2004	1.7	< 10	< 0.2	1	< 2	< 5
2007	1.8	< 10	< 0.2	1.1	< 2	< 5
2010	1.8	< 10	< 5	0.9	< 2	< 5

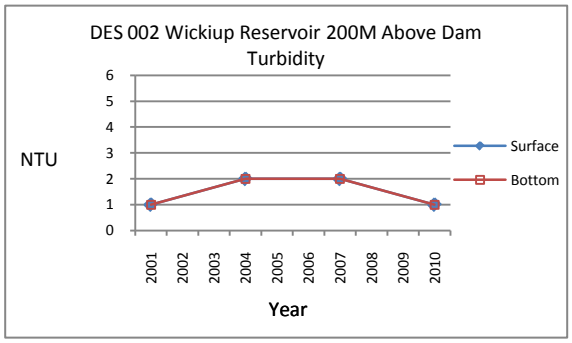
Site DES 002

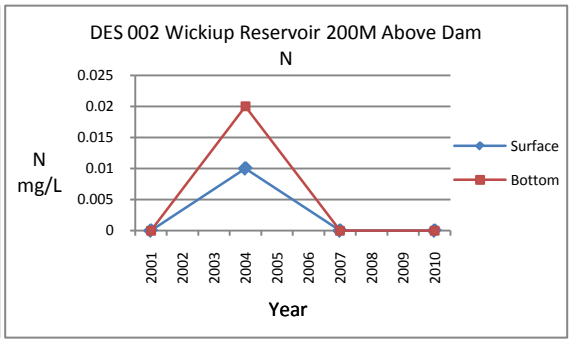
Below Crane Prairie Reservoir is Wickiup Reservoir. This site, DES 002 is above the dam in Wickiup Reservoir. DO at this site decreased in concentration as the depth increased to about 9 meters. From around 9 to 13 meters, there was a slight increase in concentrations, followed by a steady decrease with the increasing depth. At the surface, DO concentrations ranged from 6.8 mg/L to 8.6 mg/L. At 9 meters, concentrations ranged from 5.6 mg/L to 7.9 mg/L. At the bottom, concentrations ranged from 3.2 mg/L to 4.9 mg/L. Turbidity never increased above 2 NTU for either surface or bottom samples. Surface and bottom values were typically the same each year that sampling took place. TSS at the surface of Wickiup Reservoir ranged from 1 mg/L to 5 mg/L, and at the bottom from less than 1 mg/L to 4 mg/L. Inorganic N concentrations at both the surface and bottom were below detection levels except for 2001, when surface concentrations were observed to be 0.01 mg/L and concentrations at the bottom were observed to be 0.02 mg/L. Concentrations of P at the surface ranged from 0.018 mg/L to 0.022 mg/L, and at the bottom from 0.070 mg/L to 0.127 mg/L. Observed pH declined steadily as depth increased. Surface pH values ranged from 8.3 to 9.27; at 9 meters pH ranged from 8 to 8.4; and at the bottom depth values ranged from 7.5 to 7.7 pH.

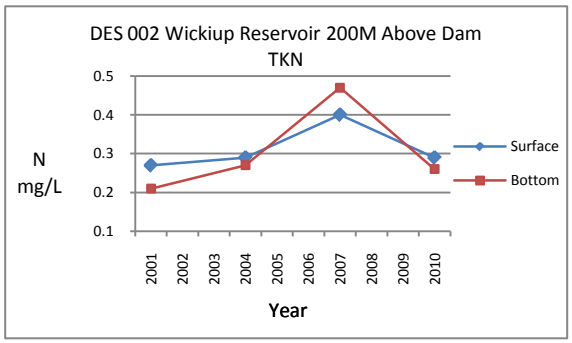
Chlorophyll-a values ranged from 3.1 mg/m3 in 2001 to 8.1 mg/m3 in 2003. Metals data were collected and are presented in the tables following the graphs.

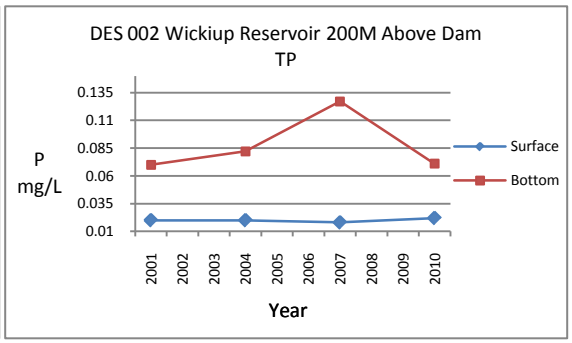


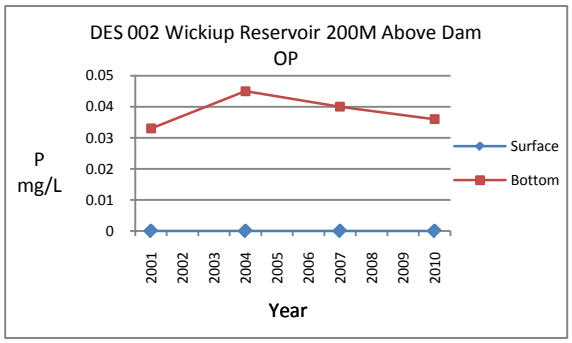


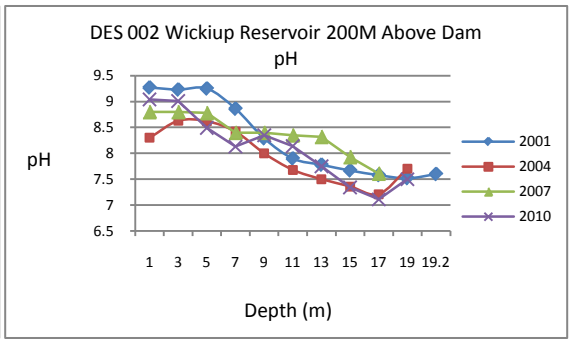


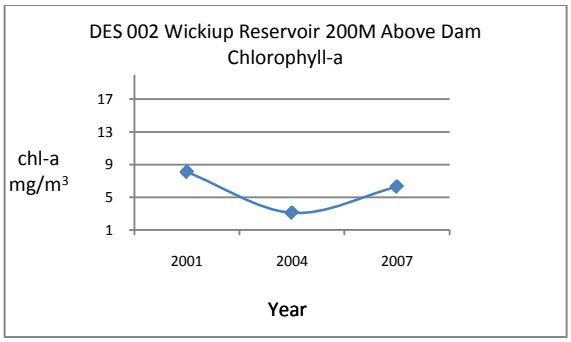












DES 002	Depth (m)	Arsenic (µg/L)	Boron (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Copper (µg/L)	Iron (µg/L)	Lead (µg/L)
2001	1	< 2	< 50	< 1	< 2	< 2	80	< 2
2001	19.2	< 2	< 50	< 1	< 2	< 2	200	< 2
2004	1	< 2	< 50	< 1	< 2	< 2	50	< 2
2004	19.2	< 2	< 50	< 1	< 2	< 2	160	< 2
2007	1	< 2		< 1	< 2	< 2	50	< 2
2007	16.7	< 2		< 1	< 2	< 2	400	< 2
2010	1	< 2		< 1	< 2	< 2	70	< 2
2010	19.3	< 2		< 1	< 2	< 2	110	< 2

DES 002	Depth (m)	Magnesium (mg/L)	Manganese (µg/L)	Mercury (µg/L)	Potassium (µg/L)	Selenium (µg/L)	Zinc (µg/L)
2001	1	2.1	< 10	< 0.2	1.3	< 2	< 5
2001	19.2	2.1	30	<0.2	1.3	<2	10
2004	1	1.7	< 10	< 0.2	1	< 2	< 5
2004	19.2	2	<10	<.02	1.3	<2	<5
2007	1	2.1	< 10	< 0.2	1.4	< 2	< 5
2007	16.7	2	50	<0.2	1.4	<2	<5
2010	1	2.1	< 10	< 5	1.3	< 2	< 5
2010	19.3	2	18	<5	1.2	<2	<5

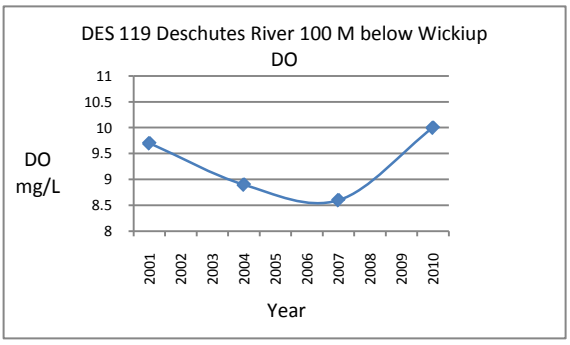
DES 002							
Date	Depth (m)	N (mg/L)	TKN (mg/L)	OP (mg/L)	P (mg/L)	TSS (mg/L)	NTU
7/25/2001	1	< 0.01	0.27	< 0.003	0.02	5	1
7/25/2001	19.2	< 0.01	0.21	0.033	0.07	4	1
7/14/2004	1	0.01	0.29	< 0.003	0.02	1	2
7/14/2004	19.2	0.02	0.27	0.045	0.082	3	2
7/24/2007	1	< 0.01	0.4	< 0.003	0.018	5	2
7/24/2007	16.7	< 0.01	0.47	0.04	0.127	< 1	2
7/27/2010	1	< 0.01	0.29	< 0.003	0.022	2	1
7/27/2010	19.3	< 0.01	0.26	0.036	0.071	2	1

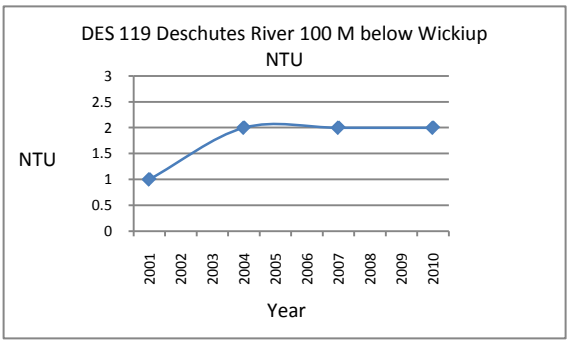
DES 002							
Date	Depth (m)	DO (mg/L)	pH	Date	Depth (m)	DO (mg/L)	pH
7/25/2001	1	7.8	9.27	7/24/2007	1	6.8	8.8
7/25/2001	3	7.8	9.23	7/24/2007	3	7	8.8
7/25/2001	5	7.8	9.25	7/24/2007	5	7	8.78
7/25/2001	7	7	8.86	7/24/2007	7	5.6	8.4
7/25/2001	9	6.1	8.29	7/24/2007	9	5.6	8.4
7/25/2001	11	6.2	7.9	7/24/2007	11	5.2	8.35
7/25/2001	13	6.2	7.78	7/24/2007	13	5	8.32
7/25/2001	15	6.1	7.67	7/24/2007	15	3.9	7.93
7/25/2001	17	6.1	7.58	7/24/2007	16.7	3.7	7.61
7/25/2001	19	6.3	7.52	7/27/2010	1	8.6	9.04
7/25/2001	19.2	4	7.6	7/27/2010	3	8.5	9.01
7/14/2004	1	7.2	8.3	7/27/2010	5	7.4	8.49
7/14/2004	3	7.4	8.63	7/27/2010	7	6.8	8.13
7/14/2004	5	7.4	8.62	7/27/2010	9	7.9	8.35
7/14/2004	7	7	8.42	7/27/2010	11	7.9	8.14
7/14/2004	9	7.1	8	7/27/2010	13	7.3	7.75
7/14/2004	11	6.5	7.68	7/27/2010	15	5.7	7.34
7/14/2004	13	5.8	7.5	7/27/2010	17	5.4	7.11
7/14/2004	15	5.3	7.36	7/27/2010	19.3	4.9	7.5
7/14/2004	17	4.3	7.21				
7/14/2004	19.2	3.2	7.7				

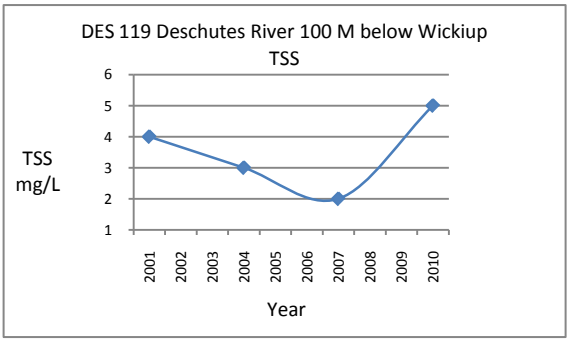
Site DES 119

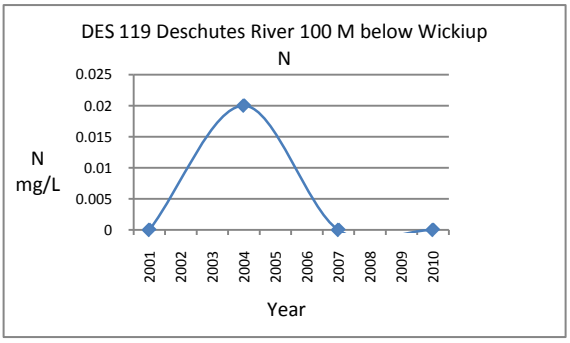
Approximately 100 meters below Wickiup Dam is the next site where water quality samples were obtained. At this site, DO concentrations were not observed to fall below 8.6 mg/L. Turbidity was between 1 NTU and 2 NTU. TSS ranged from 2 mg/L to 5 mg/L, also showed an overall increasing trend. Concentrations of inorganic N were below detection, except for the 2004 sampling event in which 0.02 mg/L was reported.

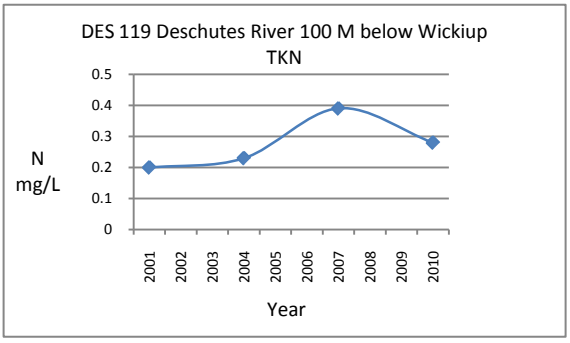
TKN concentrations ranged from 0.20 mg/L to 0.39 mg/L. Concentrations of TP ranged from 0.062 mg/L to 0.096 mg/L, with no significant increasing or decreasing trend. OP ranged from 0.027 mg/L to 0.035 mg/L. Reported pH values ranged from 7.34 to 7.84, fluctuating by 0.5 pH units, and showing a slight overall increasing trend. Metals data collected are presented in the tables following the graphs.

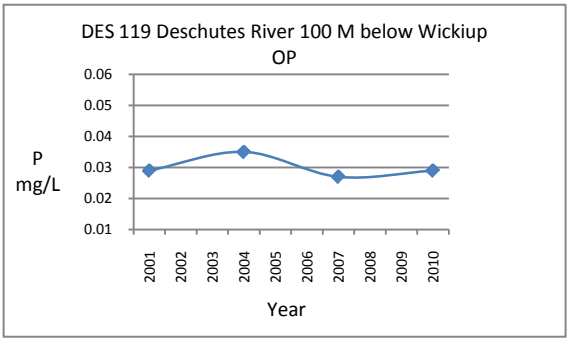


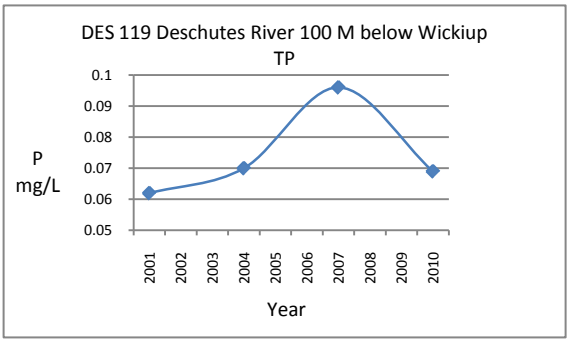


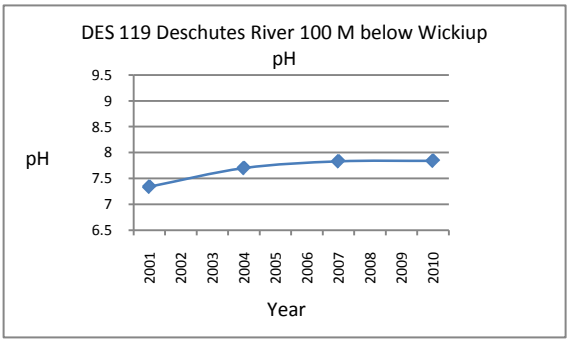












DES 119	Arsenic(µg/L)	Boron(µg/L)	Cadmium(µg/L)	Chromium(µg/L)	Copper(µg/L)	Iron(µg/L)	Lead(µg/L)
2001	< 2	< 50	< 1	< 2	< 2	160	< 2
2004	< 2	< 50	< 1	< 2	< 2	150	< 2
2007	< 2		< 1	< 2	< 2	310	< 2
2010	< 2		< 1	< 2	< 2	130	< 2

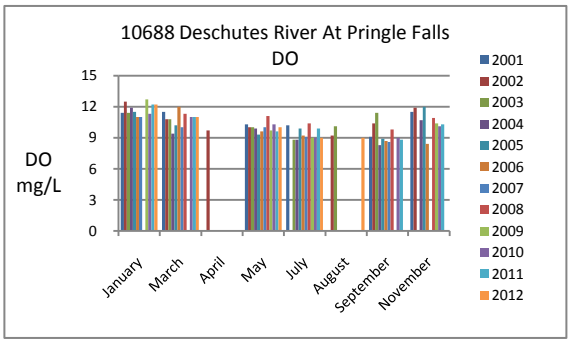
DES 119	Magnesium(mg/L)	Manganese(µg/L)	Mercury(µg/L)	Potassium(µg/L)	Selenium(µg/L)	Zinc(µg/L)
2001	2	20	< 0.2	1.3	< 2	< 5
2004	2	20	< 0.2	1.2	< 2	< 5
2007	2	30	< 0.2	1.4	< 2	< 5
2010	2.1	16	< 5	1.3	< 2	< 5

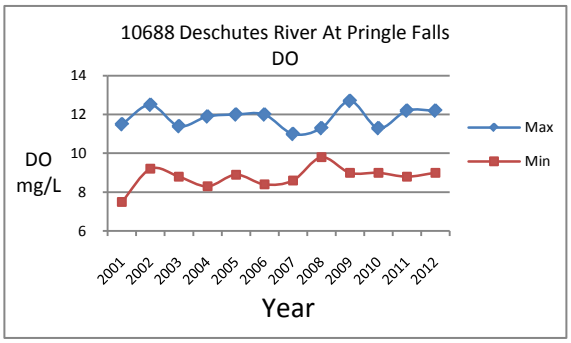
DES 119								
Date	**DO**	**N**	**TKN**	**OP**	**P**	**pH**	**TSS**	**NTU**
7/25/2001	9.7	< 0.01	0.2	0.029	0.062	7.34	4	1
7/14/2004	8.9	0.02	0.23	0.035	0.07	7.7	3	2
7/24/2007	8.6	< 0.01	0.39	0.027	0.096	7.83	2	2
7/27/2010	10	< 0.01	0.28	0.029	0.069	7.84	5	2

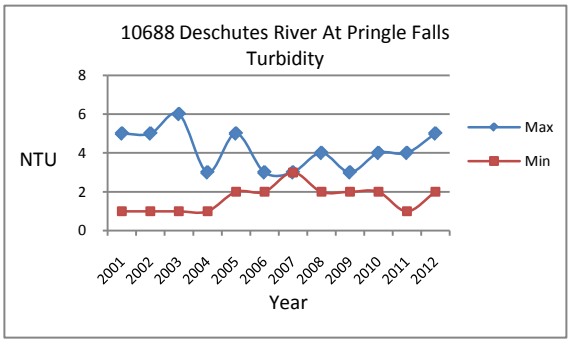
Site 10688

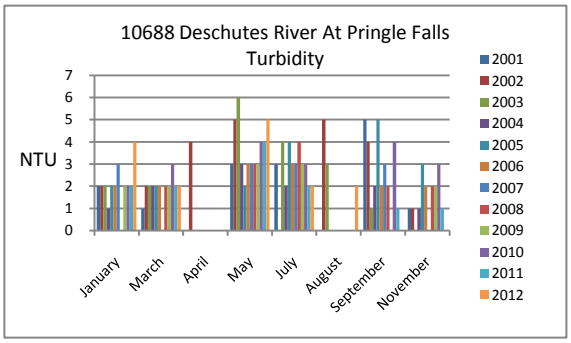
The next site downstream on the Deschutes River is at Pringle Falls. DO at this site had a minimum concentration of 7.5 mg/L in July of 2001, and then was not observed to fall below 8.3 mg/L at any other sampling date. Concentrations typically were lowest in July through September. Turbidity at this site had values that ranged from 1.0 NTU to 6.0 NTU, and appeared to peak during summer months. TSS at this site typically was at its highest concentrations in May through July, and lowest around December and January. Concentrations of TSS range from 1 mg/L to 10 mg/L. The data suggested a slight increasing trend. Inorganic N concentrations range from 0.0053 mg/L to 0.1910 mg/L. Concentrations were higher in January, and the overall trend (aside from the strong peak in 2006) was that concentrations of Inorganic N were slightly decreasing. Data for TKN ended in 2006, and there are multiple gaps in the sampling data for the years when data were collected. Consequently, data are presented in graphs, but will not be discussed. Concentrations of TP showed a slight increasing trend, and ranged from 0.02 mg/L to 0.11 mg/L. Concentrations typically rose during the summer months, and were lower in the fall through spring. Concentrations of OP ranged from 0.012 mg/L to 0.046 mg/L, with the greater concentrations often occurring in the summer months. Overall, yearly averages remained fairly consistent over the years of data collection. At

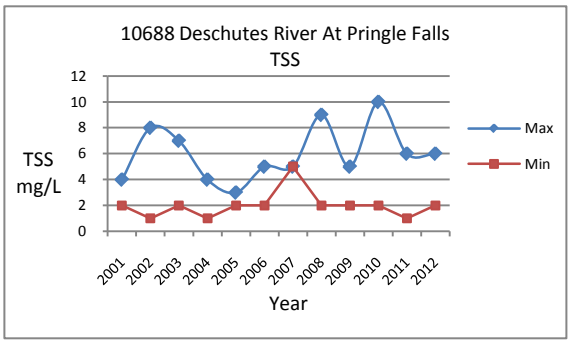
this site, pH ranged from 7.2 to 8.5. Metals data were collected only in 2010 and are available in LASAR.

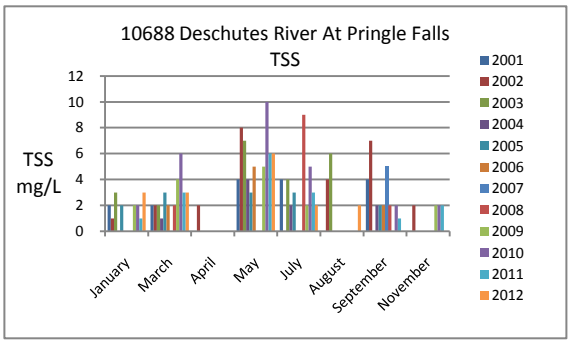


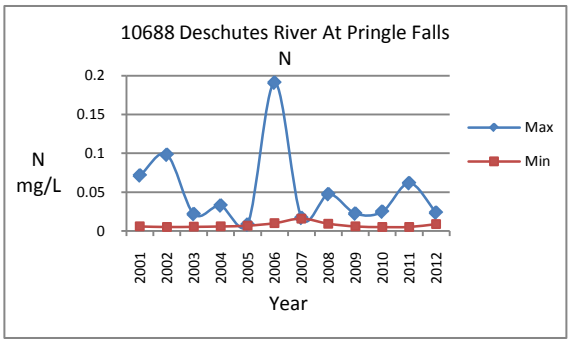


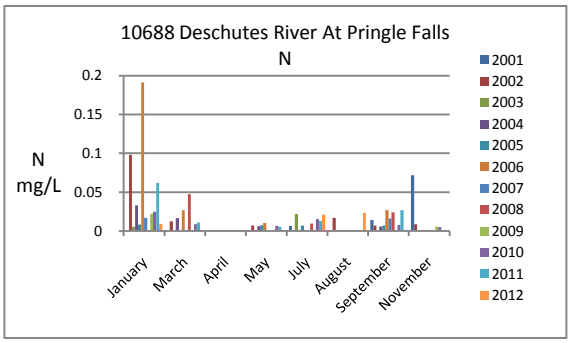


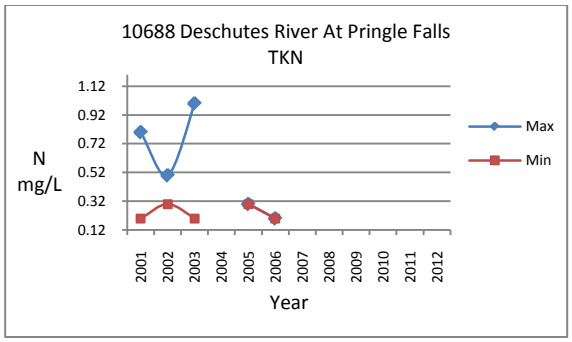


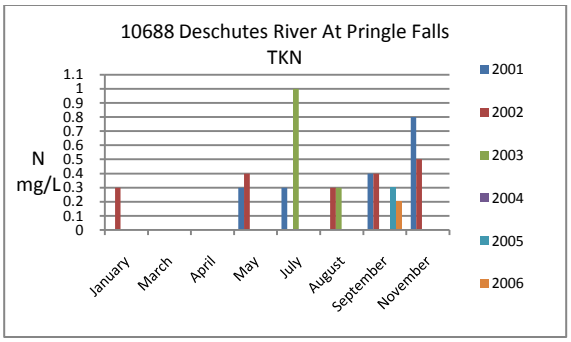


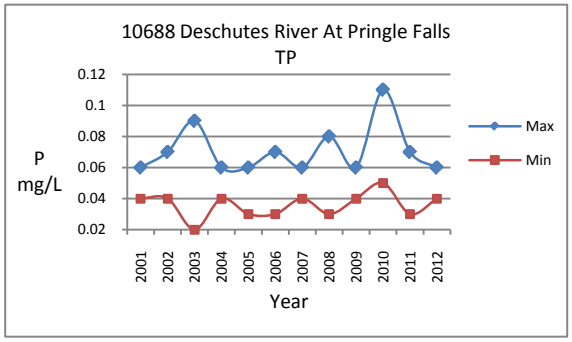


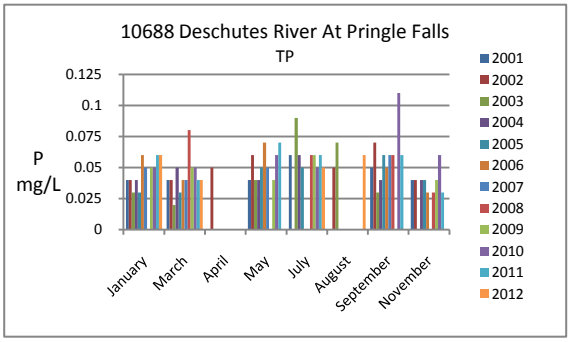


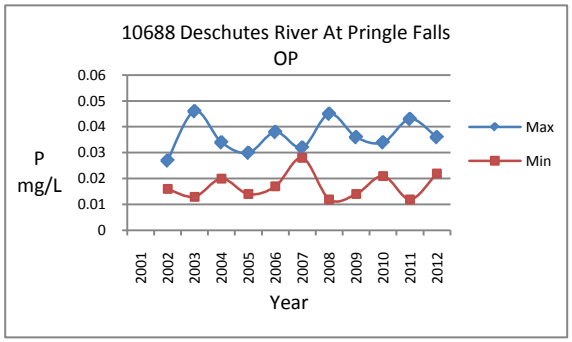


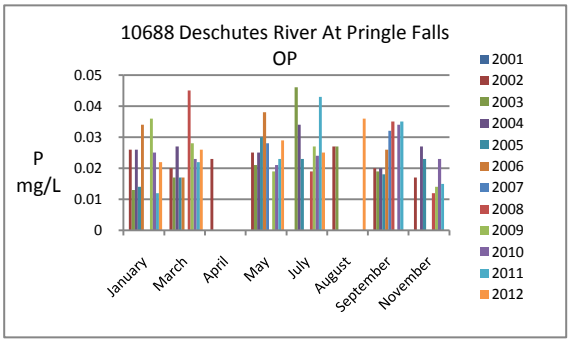

10688 Deschutes River At Pringle Falls
TKN
N
mg/L
1.12
0.92
0.72
0.52
0.32
0.12
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
Max
Min

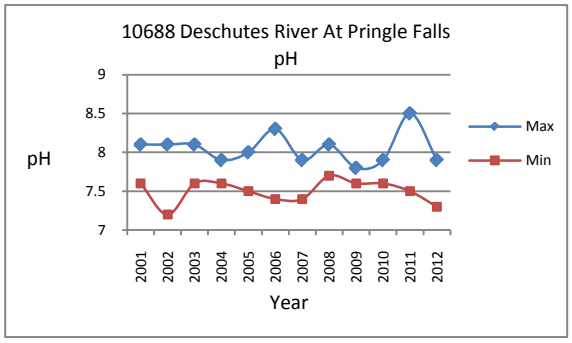

10688 Deschutes River At Pringle Falls
TKN
N
mg/L
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
January
March
April
May
July
August
September
November
2001
2002
2003
2004
2005
2006

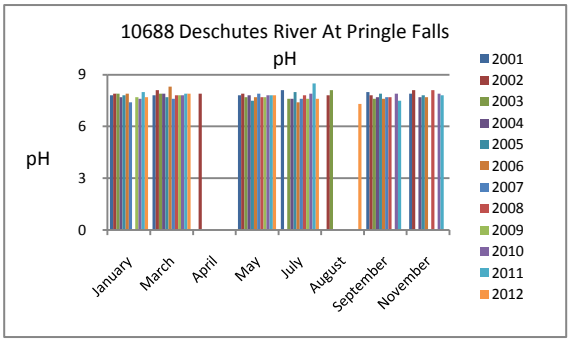

10688 Deschutes River At Pringle Falls
TP
P
mg/L
0.12
0.1
0.08
0.06
0.04
0.02
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
Max
Min


10688 Deschutes River At Pringle Falls
TP
P
mg/L
0.125
0.1
0.075
0.05
0.025
0
January
March
April
May
July
August
September
November
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012


10688 Deschutes River At Pringle Falls
OP
P
mg/L
0.06
0.05
0.04
0.03
0.02
0.01
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
Max
Min


10688 Deschutes River At Pringle Falls
OP
P
mg/L
0.05
0.04
0.03
0.02
0.01
0
January
March
April
May
July
August
September
November
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012


10688 Deschutes River At Pringle Falls
pH
pH
9
8.5
8
7.5
7
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
Max
Min


10688 Deschutes River At Pringle Falls
pH
pH
9
6
3
0
January
March
April
May
July
August
September
November
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012

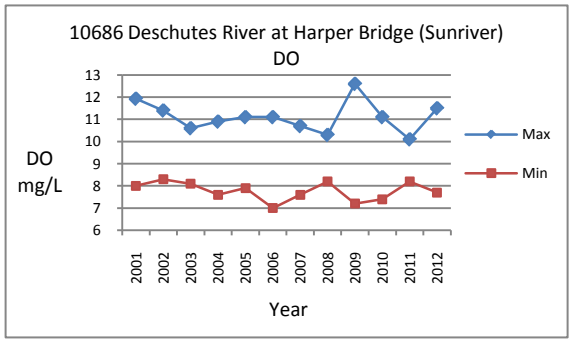
10688								
Date	OP (mg/L)	DO (mg/L)	pH	NTU	N (mg/L)	TKN (mg/L)	TP (mg/L)	TSS (mg/L)
1/23/2001		11.4	7.8	2	<0.0050	<0.2	0.04	2
1/23/2001		11.3	7.6	2	<0.0050	<0.2	0.04	2
3/13/2001		11.5	7.8	1	<0.0050	<0.2	0.04	2
5/8/2001		10.3	7.8	3	<0.0050	0.3	0.04	4
7/10/2001		10.2	8.1	2	<0.0050	0.3	0.06	4
7/17/2001		9.7	8.1	3	0.0065	0.2	0.06	4
7/18/2001		7.5	8	3	0.0064	0.3	0.06	4
7/19/2001		9.2	8	2	0.006	0.3	0.06	4
9/11/2001		9.1	8	5	0.0139	0.4	0.05	4
11/6/2001		10.6	7.9	1	0.0716	0.8	0.04	<1
11/7/2001		11.5	7.9	1	0.0648	<0.2	0.04	<1
1/29/2002	0.026	12.5	7.9	2	0.0982	0.3	0.04	1
3/27/2002	0.02	10.8	8.1	2	0.0124	<0.2	0.04	2
4/30/2002	0.023	9.7	7.9	4	<0.0050	<0.2	0.05	2
5/1/2002	0.023	10	7.9	5	0.0053	0.4	0.06	8
5/29/2002	0.025	9.8	7.2	3	0.0069	<0.2	0.05	5
7/24/2002	0.026	9.2	7.8	5	0.016	0.3	0.05	4
7/24/2002	0.027	9.2	7.7	4	0.0171	0.3	0.05	3
9/24/2002	0.02	10.4	7.8	4	0.0069	0.4	0.07	7
11/5/2002	0.017	11.9	8.1	1	0.0054	0.5	0.04	2
11/5/2002	0.016	11.8	8	1	0.0089	0.5	0.04	2
1/28/2003	0.013	11.4	7.9	2	0.0055	<0.2	0.03	3
3/19/2003	0.017	10.8	7.9	2	<0.0050	<0.2	0.02	2
5/21/2003	0.021	10	7.7	6	<0.0050	<0.2	0.04	7
8/6/2003	0.046	8.8	7.6	4	0.0219	1	0.09	4
9/23/2003	0.027	10	8.1	3	<0.0050	0.2	0.07	6
9/23/2003	0.027	10.1	7.8	3	<0.0050	0.3	0.07	6
11/18/2003	0.019	11.4	7.6	1	<0.0050	<0.2	0.03	<1
1/27/2004	0.026	11.9	7.7	1	0.0329	<0.2	0.04	<1
3/23/2004	0.027	9.4	7.9	2	0.0165	<0.2	0.05	1
5/25/2004	0.025	9.9	7.8	3	0.0063	<0.2	0.04	4
7/28/2004	0.034	8.8	7.6	2	<0.0050	<0.2	0.06	2
9/14/2004	0.02	8.3	7.7	2	0.006	<0.2	0.04	2
11/17/2004	0.027	10.7	7.7	1	<0.0050	<0.2	0.04	<1
1/25/2005	0.014	11.5	7.8	2	0.0084	<0.2	0.03	2
3/8/2005	0.017	10.2	7.7	2	<0.0050	<0.2	0.03	3
5/17/2005	0.03	9.3	7.5	2	0.0075	<0.2	0.05	3
7/20/2005	0.023	9.9	8	4	0.0072	<0.2	0.05	3
9/13/2005	0.018	8.9	7.9	5	0.007	0.3	0.06	2
11/8/2005	0.023	12	7.8	3	<0.0050	<0.2	0.04	<1
11/8/2005	0.022	12	7.6	2	<0.0050	<0.2	0.04	<1
1/10/2006	0.034	11	7.9	2	0.191	<0.2	0.06	<1
3/15/2006	0.017	12	8.3	2	0.0268	<0.2	0.04	2
5/23/2006	0.038	9.6	7.7	3	0.0102	<0.2	0.07	5
7/18/2006		9.2	7.4	3				
9/19/2006	0.026	8.7	7.6	2	0.027	0.2	0.05	2
11/7/2006		8.4	7.7	2	<0.0050		0.03	
1/23/2007		11	7.4	3	0.017		0.05	
3/20/2007		10	7.6	<1	<0.0050		0.04	
5/15/2007	0.028	10	7.9	3	<0.0050		0.05	

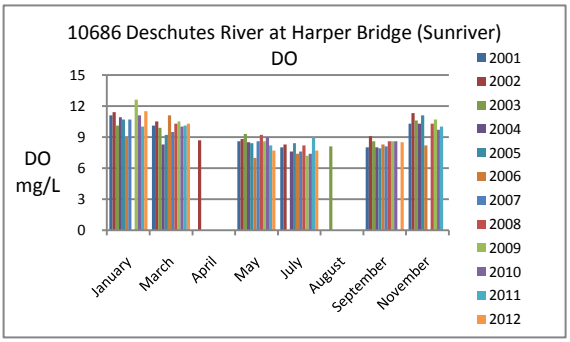
10688								
Date	OP (mg/L)	DO (mg/L)	pH	NTU	N (mg/L)	TKN (mg/L)	TP (mg/L)	TSS (mg/L)
7/24/2007		9.1	7.6	3				
9/5/2007	0.032	8.6	7.7	3	0.0161		0.06	5
3/11/2008	0.045	11.3	7.8	2	0.0475		0.08	2
5/5/2008		11.1	7.7	3				
7/1/2008	0.019	10.4	7.8	4	0.0095		0.06	9
9/30/2008	0.035	9.8	7.7	2	0.024		0.06	2
11/18/2008	0.012	10.9	8.1	2	<0.0050		0.03	<1
1/27/2009	0.036	12.7	7.7	2	0.0225		0.05	2
3/24/2009	0.028		7.8	2	<0.0050		0.05	4
5/12/2009	0.019	9.7	7.7	3	<0.0050		0.04	5
7/28/2009	0.027	9	7.6	3	<0.0050		0.06	2
11/17/2009	0.014	10.4		2	0.006		0.04	2
1/26/2010	0.025	11.3	7.6	2	0.025		0.05	2
3/23/2010	0.023	11	7.8	3	0.0086		0.05	6
5/18/2010	0.021	10.3	7.8	4	0.0065		0.06	10
7/27/2010	0.024	9	7.9	3	0.0153		0.05	5
9/21/2010	0.034	9	7.9	4	0.0078		0.11	2
11/2/2010	0.023	10.1	7.9	3	0.0052		0.06	2
1/25/2011	0.012	12.2	8	2	0.0617		0.06	1
3/22/2011	0.022	11	7.9	2	0.0109		0.04	3
5/24/2011	0.023	9.6	7.8	4	0.0054		0.07	6
7/19/2011	0.043	9.9	8.5	2	0.0128		0.06	3
9/27/2011	0.035	8.8	7.5	1	0.0269		0.06	1
11/15/2011	0.015	10.3	7.8	1	<0.0050		0.03	2
1/24/2012	0.022	12.2	7.7	4	0.009		0.06	3
3/27/2012	0.026	11	7.9	2	<0.0050		0.04	3
5/15/2012	0.029	10	7.8	5	<0.0050			6
7/24/2012	0.025	9	7.6	2	0.0212		0.05	2
9/25/2012	0.036	9	7.3	2	0.0237		0.06	2

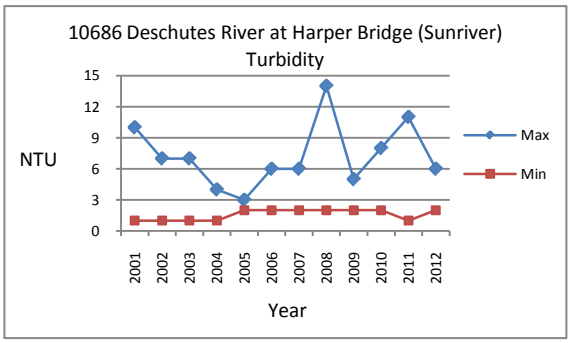
Site 10686

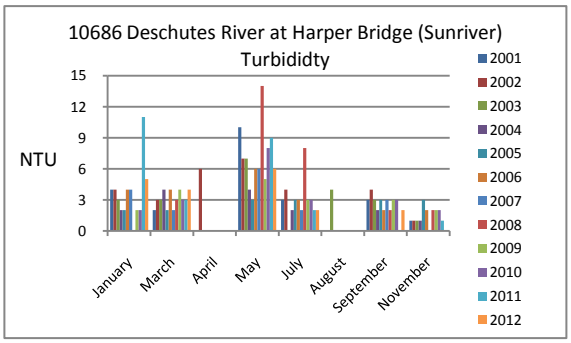
Just less than one mile downstream from the confluence of the Little Deschutes with the Deschutes River, is the next site in the Upper Deschutes subbasin. This site had DO concentrations that ranged from 7.0 mg/L to 12.6 mg/L. Concentrations here typically were at their lowest during June, July, and August. DO concentrations showed a slightly decreasing trend based on yearly minimums. Turbidity at this site ranged from 1 NTU to 11 NTU, with values typically higher in the early summer. The overall trend in turbidity appears to be one of increase. TSS concentrations ranged from less than 1 mg/L to 26 mg/L. Inorganic N at this site was observed to have concentrations ranging from 0.0050 mg/L to 0.0422 mg/L. Inorganic N appeared to have the lowest concentrations occurring in May. TKN data at this site had many gaps, and thus will not be discussed. The data are presented below in the graphs for this site. Concentrations of TP ranged from 0.05 mg/L to 0.13 mg/L. Highest concentrations were typically observed in the early part of the year, from January to May. OP concentrations at this site range from 0.022 mg/L to 0.084 mg/L. Data at this site suggest a decreasing trend in OP concentrations. OP concentrations were typically lowest in the summer months of

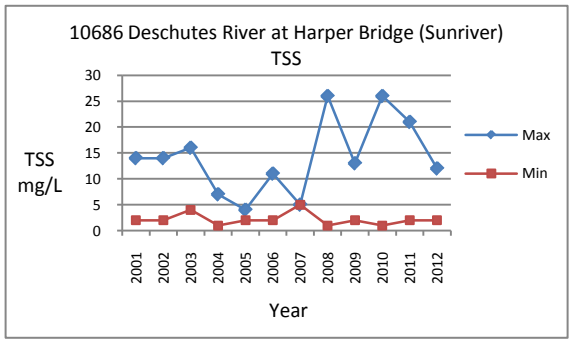
May through July. At this site, pH ranged from 7.1 to 8.18, and did not typically fluctuate more than 0.3 pH units from month to month. Metals data were collected only in 2010 and are available in LASAR.

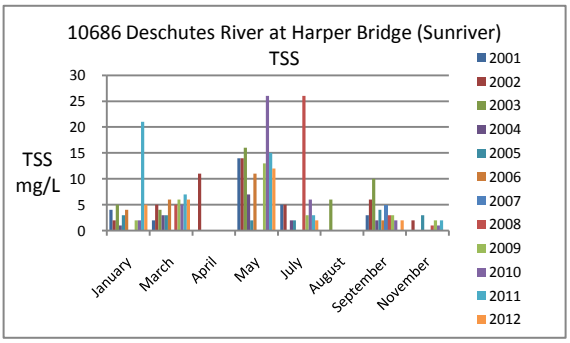


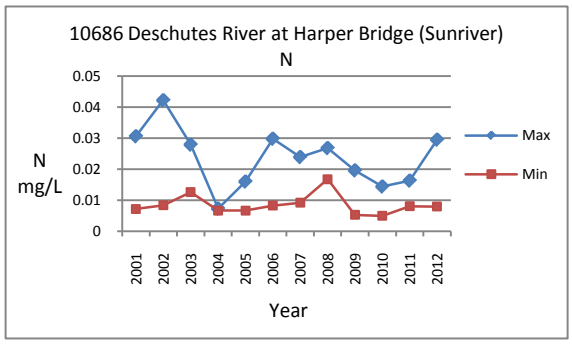


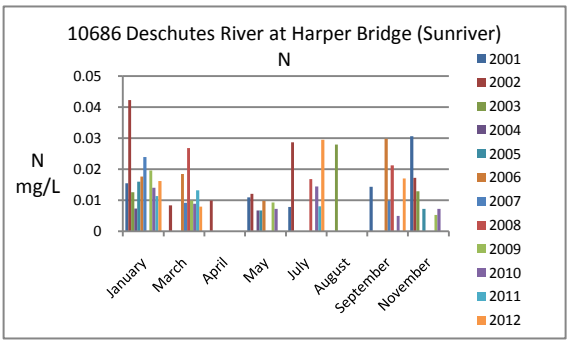


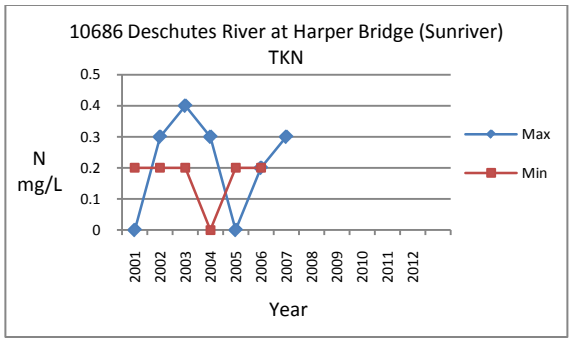


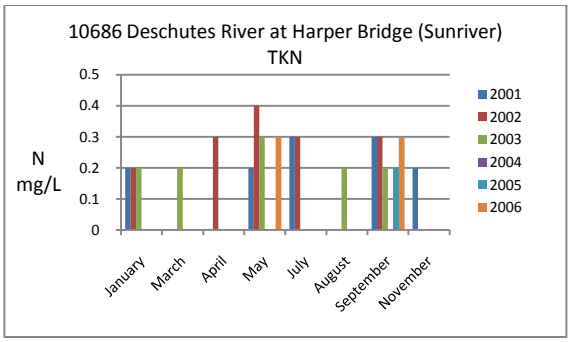


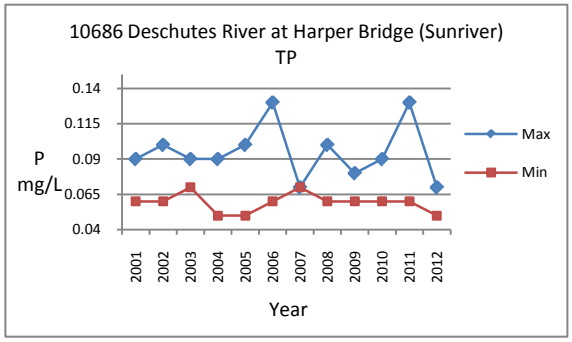


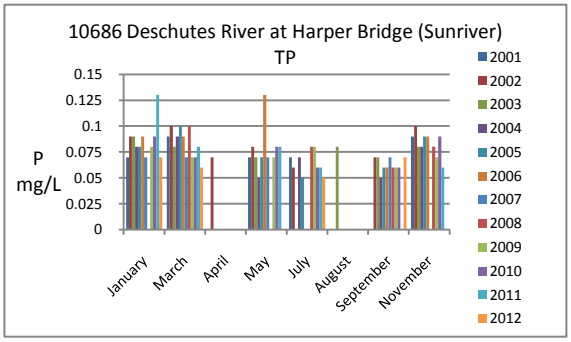


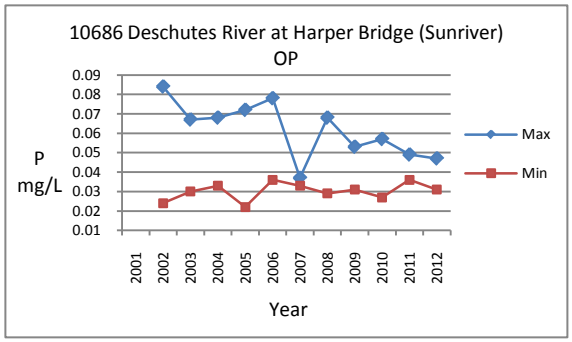


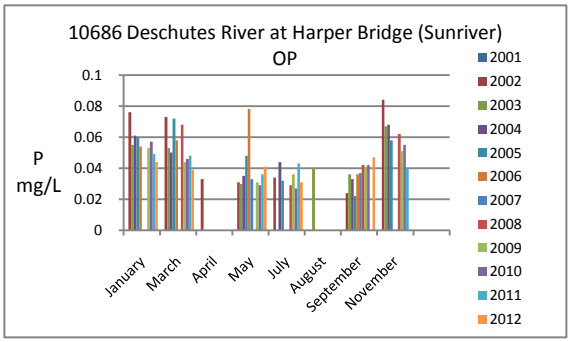

10686 Deschutes River at Harper Bridge (Sunriver)
TKN
N
mg/L
0.5
0.4
0.3
0.2
0.1
0
Max
Min
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year

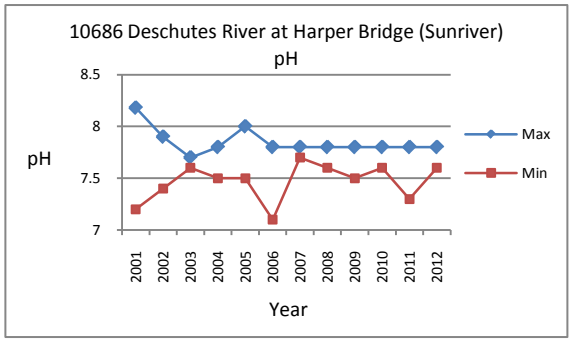

10686 Deschutes River at Harper Bridge (Sunriver)
TKN
N
mg/L
0.5
0.4
0.3
0.2
0.1
0
January
March
April
May
July
August
September
November
2001
2002
2003
2004
2005
2006

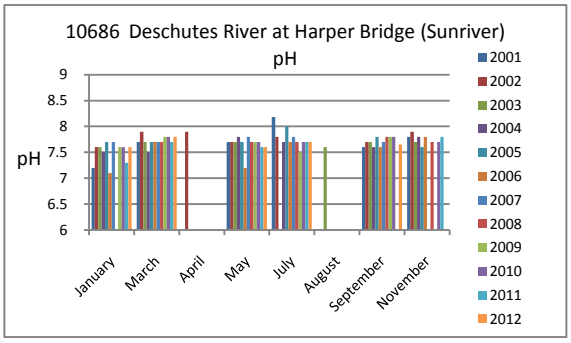

10686 Deschutes River at Harper Bridge (Sunriver)
TP
P
mg/L
0.14
0.115
0.09
0.065
0.04
Max
Min
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year


10686 Deschutes River at Harper Bridge (Sunriver)
TP
P
mg/L
0.15
0.125
0.1
0.075
0.05
0.025
0
January
March
April
May
July
August
September
November
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012


10686 Deschutes River at Harper Bridge (Sunriver)
OP
P
mg/L
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
Max
Min
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year


10686 Deschutes River at Harper Bridge (Sunriver)
OP
P
mg/L
0.1
0.08
0.06
0.04
0.02
0
January
March
April
May
July
August
September
November
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012


10686 Deschutes River at Harper Bridge (Sunriver)
pH
pH
8.5
8
7.5
7
Max
Min
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year


10686 Deschutes River at Harper Bridge (Sunriver)
pH
pH
9
8.5
8
7.5
7
6.5
6
January
March
April
May
July
August
September
November
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012

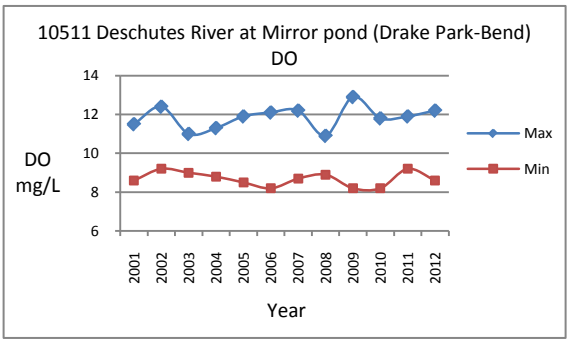
10686								
Date	OP (mg/L)	DO (mg/L)	pH	NTU	N (mg/L)	TKN (mg/L)	TP (mg/L)	TSS (mg/L)
1/23/2001		11.1	7.2	4	0.0155	0.2	0.07	4
3/13/2001		10.1	7.7	2	<0.0050	<0.2	0.09	2
5/8/2001		8.6	7.7	10	0.0109	0.2	0.07	14
7/10/2001		8	7.6	3	<0.0050	0.2	0.06	5
7/17/2001		8.8	8	2	0.0078	<0.2	0.06	4
7/18/2001		8.1	7.8	3	0.0072	0.3	0.07	4
7/19/2001		8.8	8	2	0.0077	0.2	0.07	4
9/11/2001		8	7.6	3	0.0143	0.3		3
11/6/2001		10.3	7.8	1	0.0306	<0.2	0.09	<1
11/6/2001		11.1	7.8	1	0.0246	0.2		<1
11/7/2001		10.8	7.7	1	0.0232	<0.2		<1
1/29/2002	0.076	11.4	7.6	4	0.0422	0.2	0.09	2
3/27/2002	0.073	10.5	7.9	3	0.0084	<0.2	0.1	5
4/30/2002	0.033	8.7	7.9	6	0.0099	0.3	0.07	11
5/1/2002	0.031	9.2	7.7	7	0.0121	0.4	0.08	14
5/29/2002	0.031	8.8	7.4	6	0.0089	<0.2	0.06	7
7/24/2002	0.034	8.3	7.8	4	0.0286	0.3	0.06	5
9/24/2002	0.024	9.1	7.7	4	<0.0050	0.3	0.07	6
11/5/2002	0.084	11.3	7.9	1	0.0172	<0.2	0.1	2
1/28/2003	0.055	10.1	7.6	3	0.0126	0.2	0.09	5
3/19/2003	0.053	9.9	7.7	3	<0.0050	0.2	0.08	4
5/21/2003	0.03	9.3	7.7	7	<0.0050	0.3	0.07	16
5/21/2003	0.03	9.4	7.7	7	<0.0050	0.3	0.07	12
8/6/2003	0.04	8.1	7.6	4	0.0279	0.2	0.08	6
9/23/2003	0.036	8.6	7.7	3	<0.0050	0.2	0.07	10
11/18/2003	0.067	10.6	7.7	1	0.0129	<0.2	0.08	<1
1/27/2004	0.061	10.9	7.5	2	0.0073	<0.2	0.08	1
3/23/2004	0.05	8.3	7.5	4	<0.0050	<0.2	0.09	3
5/25/2004	0.035	8.5	7.8	4	0.0067	<0.2	0.05	7
7/28/2004	0.044	7.6	7.7	2	<0.0050	<0.2	0.07	2
9/14/2004	0.033	8	7.6	2	<0.0050	<0.2	0.05	2
11/17/2004	0.068	10.3	7.8	1	<0.0050	<0.2	0.08	<1
1/25/2005	0.06	10.7	7.7	2	0.016	<0.2	0.08	3
3/8/2005	0.072	9.2	7.7	2	<0.0050	<0.2	0.1	3
3/8/2005	0.071	9.2	7.5	2	<0.0050	<0.2	0.09	3
5/17/2005	0.048	8.4	7.7	3	0.0067	<0.2	0.07	2
7/20/2005	0.032	8.4	8	3	<0.0050	<0.2	0.05	2
9/13/2005	0.022	7.9	7.8	3	<0.0050	0.2	0.06	4
11/8/2005	0.058	11.1	7.6	3	0.0072	<0.2	0.09	3
1/10/2006	0.054	9	7.1	4	0.0176	<0.2	0.09	4
3/15/2006	0.058	11.1	7.7	4	0.0185	<0.2	0.09	6
5/23/2006	0.078	7.2	7.2	6	0.0083	0.2	0.12	11
5/23/2006	0.076	7	7.2	6	0.0098	0.3	0.13	10
9/19/2006	0.036	8.3	7.6	2	0.0298	0.3	0.06	2
11/7/2006		8.2	7.8	2	<0.0050		0.09	
1/23/2007		10.7	7.7	4	0.0239		0.07	
3/20/2007		9.5	7.7	2	0.0092		0.07	
5/15/2007	0.033	8.6	7.8	6	<0.0050		0.07	
7/24/2007		7.6	7.8	2				
9/5/2007	0.037	8.1	7.7	3	0.0098		0.07	5
3/11/2008	0.068	10.3	7.7	3	0.0268		0.1	5

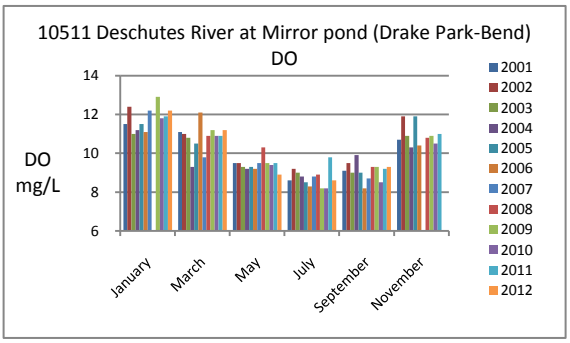
10686								
Date	OP (mg/L)	DO (mg/L)	pH	NTU	N (mg/L)	TKN (mg/L)	TP (mg/L)	TSS (mg/L)
5/5/2008		9.2	7.7	8				
7/1/2008	0.029	8.2	7.7	8	0.0168		0.08	26
9/30/2008	0.042	8.6	7.8	2	0.0212		0.06	3
11/18/2008	0.062	10.3	7.7	2	<0.0050		0.08	1
1/27/2009	0.053	12.6	7.6	2	0.0196		0.08	2
3/24/2009	0.044	10.5	7.8	4	0.0099		0.07	6
5/12/2009	0.031	8.6	7.7	5	0.0093		0.07	13
7/28/2009	0.036	7.2	7.5	3	<0.0050		0.08	3
9/29/2009	0.041	8.6	7.8	3	<0.0050		0.06	3
11/17/2009	0.051	10.7		2	0.0053		0.07	2
1/26/2010	0.057	11.1	7.6	2	0.014		0.09	2
3/23/2010	0.046	10	7.8	3	0.0089		0.07	5
5/18/2010	0.029	9	7.7	8	0.0072		0.08	26
7/27/2010	0.027	7.4	7.7	3	0.0144		0.06	6
9/21/2010	0.042	8.6	7.8	3	0.005		0.06	2
11/2/2010	0.055	9.7	7.7	2	0.0072		0.09	1
1/25/2011	0.049	10	7.3	11	0.0113		0.13	21
3/22/2011	0.048	10.1	7.7	3	0.0132		0.08	7
5/24/2011	0.036	8.2	7.6	9	<0.0050		0.08	15
7/19/2011	0.043	9	7.7	2	0.0081		0.06	3
9/27/2011	0.039	8.2	7.7	1	0.0163		0.06	2
11/15/2011	0.04	10	7.8	1	<0.0050		0.06	2
1/24/2012	0.044	11.5	7.6	5	0.0162		0.07	5
3/27/2012	0.039	10.3	7.8	4	0.008		0.06	6
5/15/2012	0.041	7.7	7.6	6	<0.0050			12
7/24/2012	0.031	7.7	7.7	2	0.0295		0.05	2
9/25/2012	0.047	8.5	7.65	2	0.017		0.07	2

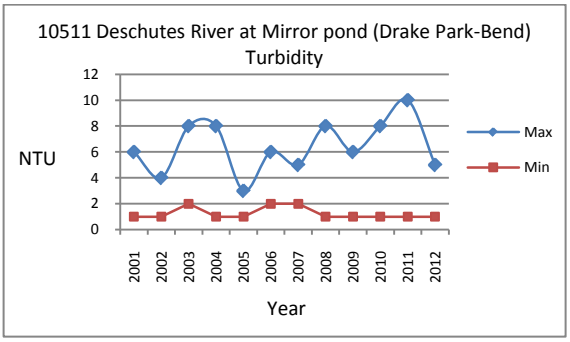
Site 10511

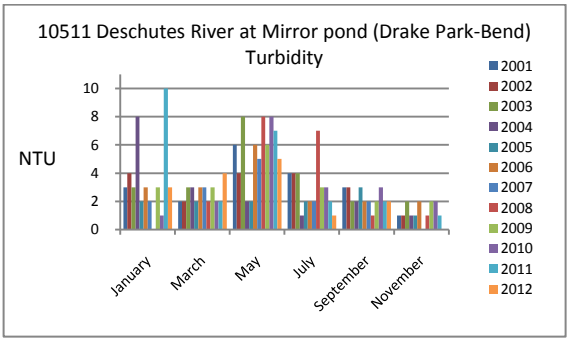
Continuing downstream on the Deschutes River, the next site where data have been collected is at Mirror Pond, near Bend. At this site, concentrations of DO ranged from 8.2 mg/L to 12.4 mg/L. Lowest concentrations typically occurred in the months of May through September. Typically, turbidity was greatest at this site in the months of March through May. Values ranged from 1 NTU to 10 NTU. TSS values ranged from <1 mg/L to 24 mg/L, with the greatest concentrations typically occurring in March through July. Inorganic N at this site ranged in concentrations from below detection limits to 0.0473 mg/L, with the highest concentrations typically observed in January. Overall, concentrations of inorganic N were decreasing, based on yearly averages. TKN data were only collected from 2001 until 2006, with values ranging from less than detection to 0.3 mg/L. Data suggest that concentrations follow a parabolic pattern yearly. Concentrations of TP typically dipped slightly in July, while greatest concentrations were observed in November through March; values at this site ranged from 0.05 mg/L to 0.16 mg/L. Concentrations of OP ranged from 0.032 mg/L to 0.090 mg/L, and overall appeared to be exhibiting a decreasing trend. Concentrations of OP at this site were generally highest from August through April, with lower concentrations observed in the mid-summer months. Reported pH at this site ranged from 7.0 to 8.0, without much

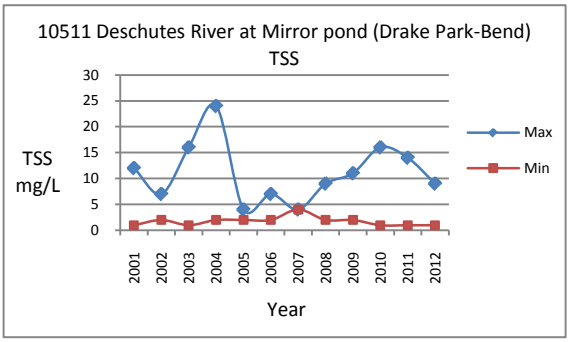
fluctuation from month to month. No data were available for toxins, metals, or contaminants at this site.

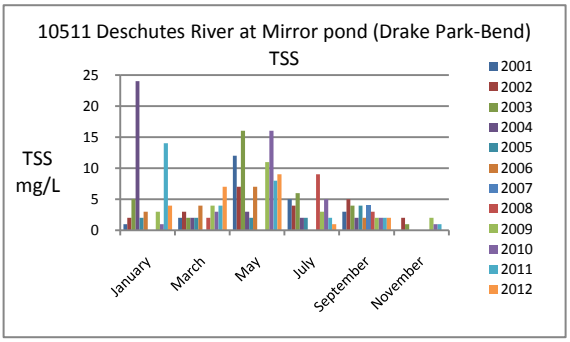


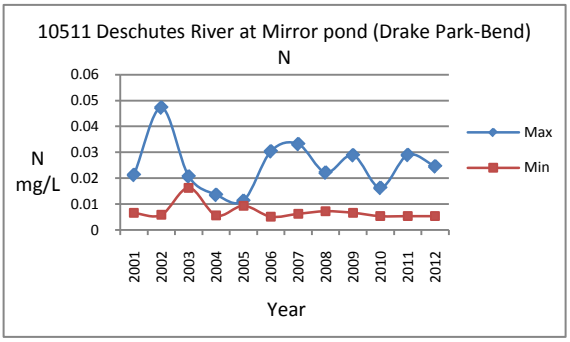


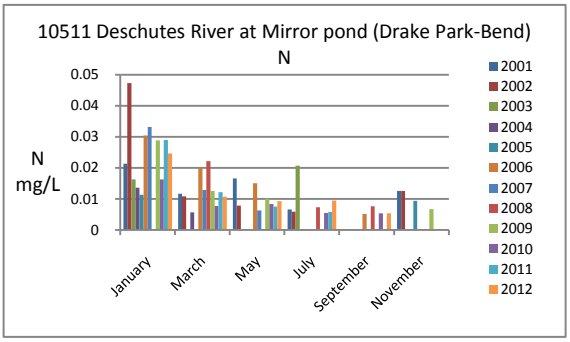


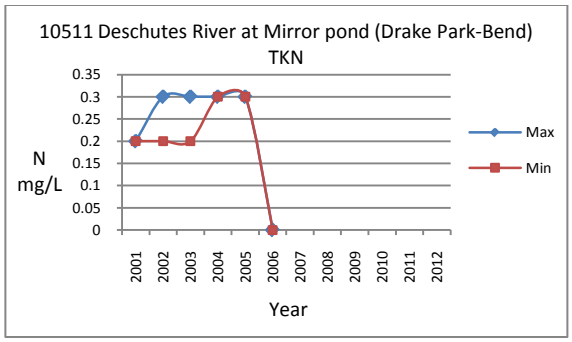


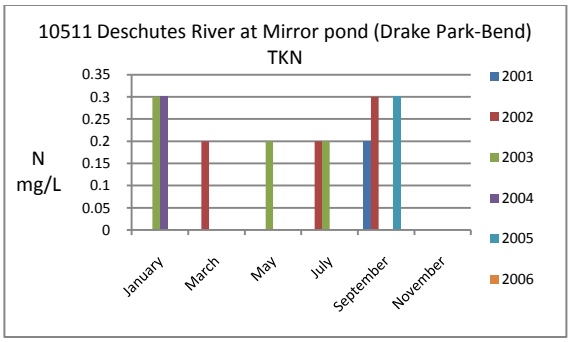


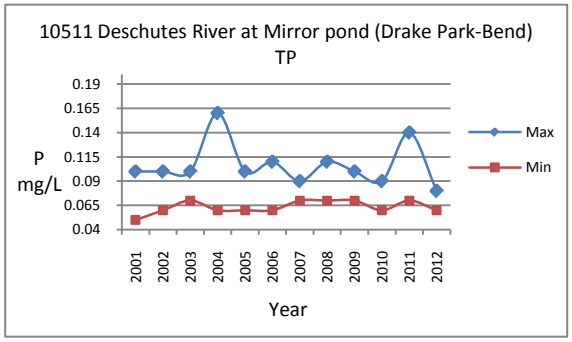


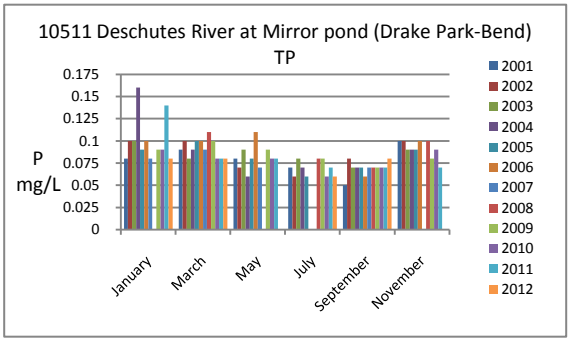


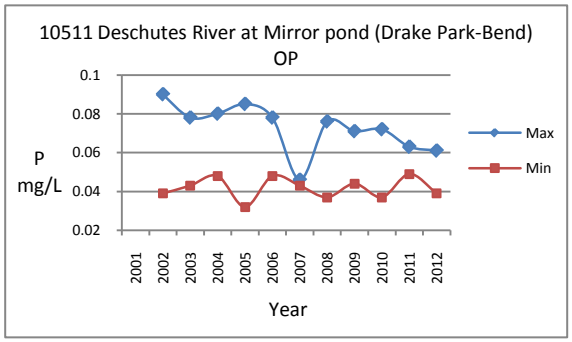


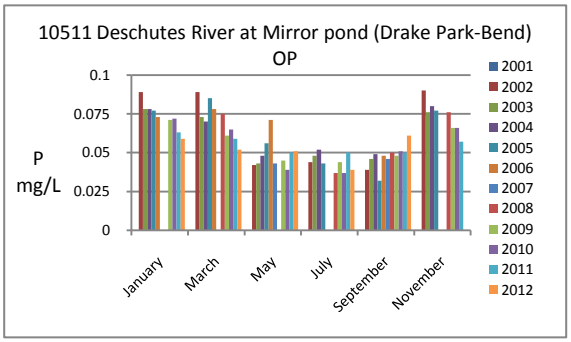

10511 Deschutes River at Mirror pond (Drake Park-Bend)
TKN
N
mg/L
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
Max
Min

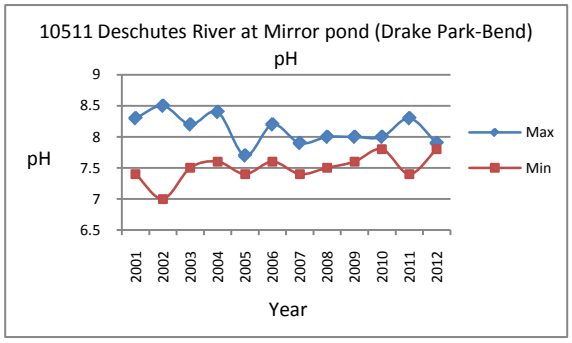

10511 Deschutes River at Mirror pond (Drake Park-Bend)
TKN
N
mg/L
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
January
March
May
July
September
November
2001
2002
2003
2004
2005
2006

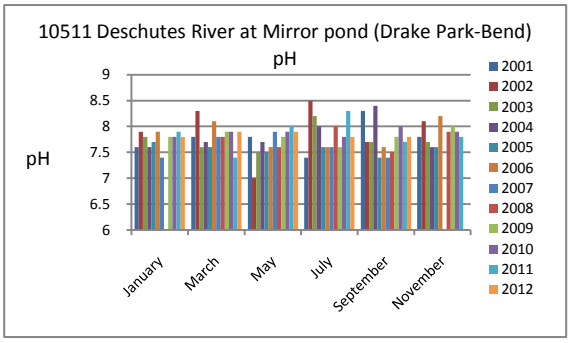

10511 Deschutes River at Mirror pond (Drake Park-Bend)
TP
P
mg/L
0.19
0.165
0.14
0.115
0.09
0.065
0.04
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
Max
Min


10511 Deschutes River at Mirror pond (Drake Park-Bend)
TP
P
mg/L
0.175
0.15
0.125
0.1
0.075
0.05
0.025
0
January
March
May
July
September
November
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012


10511 Deschutes River at Mirror pond (Drake Park-Bend)
OP
P
mg/L
0.1
0.08
0.06
0.04
0.02
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
Max
Min


10511 Deschutes River at Mirror pond (Drake Park-Bend)
OP
P
mg/L
0.1
0.075
0.05
0.025
0
January
March
May
July
September
November
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012


10511 Deschutes River at Mirror pond (Drake Park-Bend)
pH
pH
9
8.5
8
7.5
7
6.5
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
Max
Min

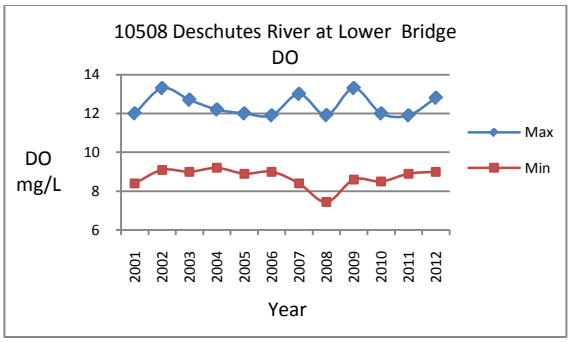

10511 Deschutes River at Mirror pond (Drake Park-Bend)
pH
pH
9
8.5
8
7.5
7
6.5
6
January
March
May
July
September
November
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012

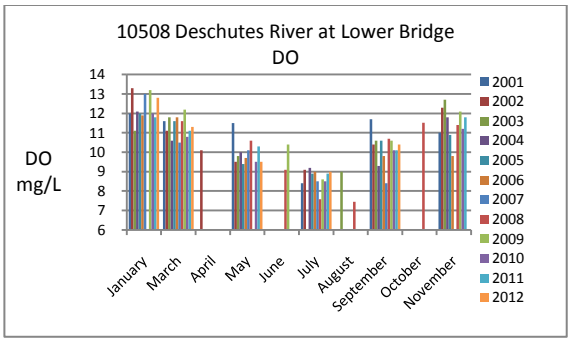
10511								
Date	OP (mg/L)	DO (mg/L)	pH	NTU	N (mg/L)	TKN (mg/L)	TP (mg/L)	TSS (mg/L)
1/23/2001		11.5	7.6	3	0.0213	<0.2	0.08	1
3/13/2001		11.1	7.8	2	0.0117	<0.2	0.09	2
5/8/2001		9.5	7.8	6	0.0166	<0.2	0.08	12
7/10/2001		8.6	7.4	4	0.0066	<0.2	0.07	5
9/10/2001		9.1	8.3	3	<0.0050	0.2	0.05	3
11/6/2001		10.7	7.8	1	0.0126	<0.2	0.1	<1
1/29/2002	0.089	12.4	7.9	4	0.0473	<0.2	0.1	2
3/27/2002	0.089	11.1	8.3	2	0.0101	0.2	0.1	2
3/27/2002	0.083	11	8.2	2	0.0108	<0.2	0.1	3
5/29/2002	0.042	9.5	7	4	0.0079	<0.2	0.07	7
7/24/2002	0.044	9.2	8.5	4	0.0059	0.2	0.06	4
9/24/2002	0.039	9.5	7.7	3	<0.0050	0.3	0.08	5
11/5/2002	0.09	11.9	8.1	1	0.0126	<0.2	0.1	2
1/28/2003	0.078	11	7.8	3	0.0163	0.3	0.1	5
3/19/2003	0.073	10.8	7.6	3	<0.0050	<0.2	0.08	2
5/22/2003	0.043	9.3	7.5	8	<0.0050	0.2	0.09	16
8/6/2003	0.048	9	8.2	4	0.0207	0.2	0.08	6
9/23/2003	0.046	9	7.7	2	<0.0050	<0.2	0.07	4
11/18/2003	0.076	10.9	7.7	2	<0.0050	<0.2	0.09	1
1/27/2004	0.078	11.3	7.6	2	0.0101	0.3	0.16	24
1/27/2004	0.077	11.2	7.6	8	0.0136	<0.2	0.11	8
3/23/2004	0.07	9.3	7.7	3	0.0057	<0.2	0.09	2
5/25/2004	0.048	9.2	7.7	2	<0.0050	<0.2	0.06	3
7/29/2004	0.052	8.8	8	1	<0.0050	<0.2	0.07	2
9/13/2004	0.049	9.9	8.4	2	<0.0050	<0.2	0.07	2
11/17/2004	0.08	10.3	7.6	1	<0.0050	<0.2	0.09	<1
1/25/2005	0.077	11.5	7.7	2	0.0113	<0.2	0.09	2
3/8/2005	0.085	10.5	7.6	2	<0.0050	<0.2	0.1	2
5/17/2005	0.056	9.3	7.5	2	<0.0050	<0.2	0.08	2
7/21/2005	0.043	8.5	7.6	2	<0.0050	<0.2	0.06	2
9/13/2005	0.032	9	7.4	3	<0.0050	0.3	0.07	4
11/8/2005	0.077	11.9	7.6	1	0.0094	<0.2	0.09	<1
1/10/2006	0.073	11.1	7.9	3	0.0304	<0.2	0.1	3
3/15/2006	0.078	12.1	8.1	3	0.0187	<0.2	0.1	4
3/15/2006	0.074	12.1	8	3	0.0199	<0.2	0.1	3
5/23/2006	0.071	9.2	7.6	6	0.0151	<0.2	0.11	7
7/18/2006		8.3	7.6	2				
9/19/2006	0.048	8.2	7.6	2	0.0052	<0.2	0.06	2
11/6/2006		10.4	8.2	2	<0.0050		0.1	
11/6/2006		10.4	8.2	2	<0.0050		0.1	
1/23/2007		12.2	7.4	2	0.0332		0.08	
3/20/2007		9.8	7.8	3	0.0129		0.09	
5/15/2007	0.043	9.5	7.9	5	0.0063		0.07	
7/24/2007		8.8	7.6	2				
9/5/2007	0.046	8.7	7.4	2	<0.0050		0.07	4
3/11/2008	0.075	10.9	7.8	2	0.0222		0.11	2
5/5/2008		10.3	7.6	8				
7/1/2008	0.037	8.9	8	7	0.0073		0.08	9
9/30/2008	0.05	9.3	7.5	1	0.0076		0.07	3
11/18/2008	0.076	10.8	7.9	1	<0.0050		0.1	<1

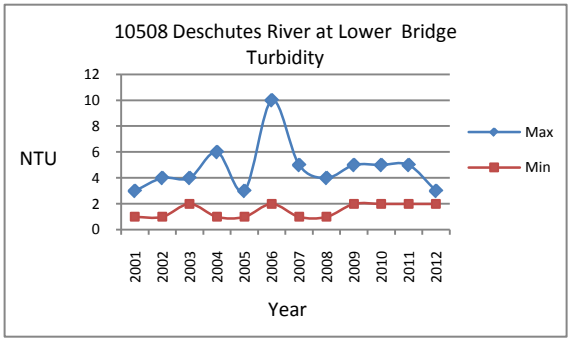
10511								
Date	OP (mg/L)	DO (mg/L)	pH	NTU	N (mg/L)	TKN (mg/L)	TP (mg/L)	TSS (mg/L)
1/27/2009	0.071	12.9	7.8	3	0.0289		0.09	3
3/24/2009	0.061	11.2	7.9	3	0.0126		0.1	4
5/12/2009	0.045	9.5	7.8	6	0.0101		0.09	11
7/28/2009	0.044	8.2	7.6	3	<0.0050		0.08	3
9/29/2009	0.048	9.3	7.8	2	<0.0050		0.07	2
11/17/2009	0.066	10.9	7.9	1	0.0067		0.08	2
11/17/2009	0.066	11.1	8	2	<0.0050		0.08	2
1/26/2010	0.072	11.8	7.8	1	0.0163		0.09	1
3/23/2010	0.065	10.9	7.9	2	0.0077		0.08	3
5/18/2010	0.039	9.4	7.9	8	0.0084		0.08	16
7/27/2010	0.037	8.2	7.8	3	0.0055		0.06	5
9/21/2010	0.051	8.5	8	3	0.0054		0.07	2
11/2/2010	0.066	10.5	7.9	2	<0.0050		0.09	1
1/25/2011	0.063	11.9	7.9	10	0.029		0.14	14
3/22/2011	0.059	10.9	7.4	2	0.0122		0.08	4
5/24/2011	0.05	9.5	8	7	0.0075		0.08	8
7/19/2011	0.05	9.8	8.2	2	0.0058		0.07	2
7/19/2011	0.049	9.8	8.3	2	0.0054		0.07	1
9/27/2011	0.05	9.2	7.7	2	<0.0050		0.07	2
11/15/2011	0.057	11	7.8	1	<0.0050		0.07	1
1/24/2012	0.059	12.2	7.8	3	0.0246		0.08	4
3/27/2012	0.052	11.2	7.9	4	0.0107		0.08	7
5/15/2012	0.051	8.9	7.9	5	0.0093			9
7/24/2012	0.039	8.6	7.8	1	0.0095		0.06	1
9/25/2012	0.061	9.3	7.8	2	0.0054		0.08	2

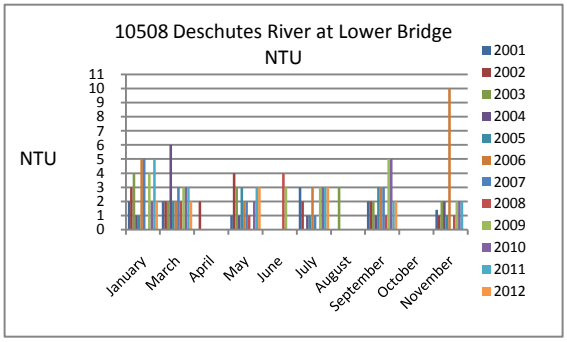
Site 10508

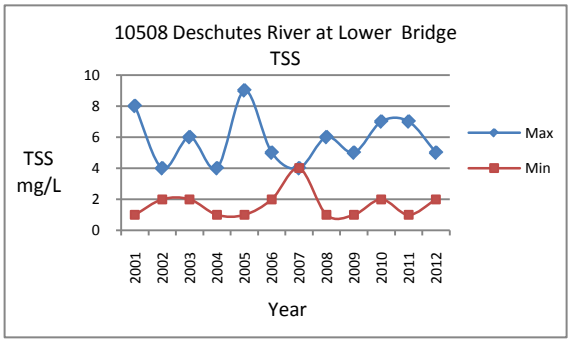
The next site in the Upper Deschutes subbasin is at Lower Bridge, downstream from Redmond, Oregon. This is the last site in the upper Deschutes subbasin on the Deschutes River. Data were collected here from 2001 through 2011. At this site, minimum DO concentrations were never observed to fall below 7.44 mg/L, and were typically lowest in July. Turbidity ranged from less than 1 NTU to 10 NTU. Month-to-month fluctuations were slight, and appeared to vary by year. The data suggest a slight overall increasing trend. TSS concentrations ranged from less than 1 mg/L to 9 mg/L, with concentrations appearing to be higher in January, May, and July, though there was not a strong year-to-year pattern. Inorganic N at this site varied in concentration from less than detection to 0.0598 mg/L. Greater concentrations seemed to occur often in the first half of the year, but not consistently. TKN data collection ended in 2006, and concentrations from the years of data collection ranged from below detection limits to 0.30 mg/L. Concentrations of P at this site ranged from 0.04 mg/L to 0.13 mg/L. In May and September, lower concentrations were consistently observed. Concentrations of OP ranged from 0.027 mg/L to 0.08 mg/L, with May typically having the lowest concentrations. The data suggested a slight overall decreasing trend. Reported pH at this site ranged from 7.6 to 9.5. Metals data were collected only in 2010 and are available in LASAR.

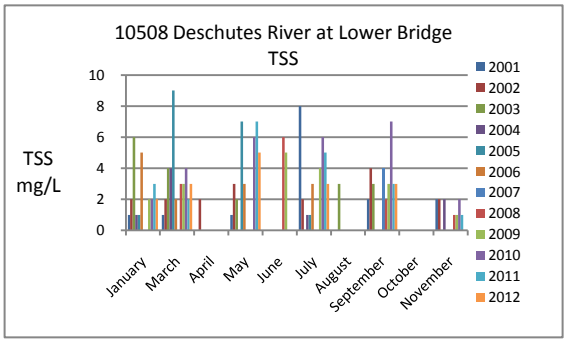

10508 Deschutes River at Lower Bridge
DO
DO mg/L
Year
Max
Min

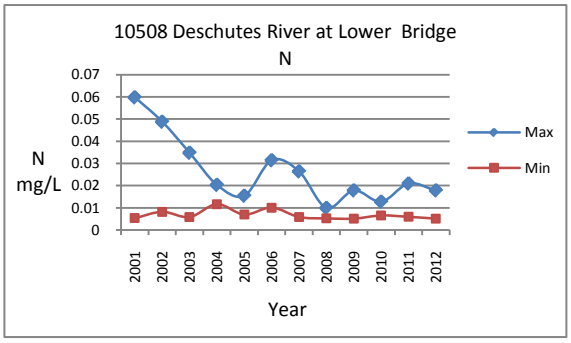

10508 Deschutes River at Lower Bridge
DO
DO mg/L
January
March
April
May
June
July
August
September
October
November

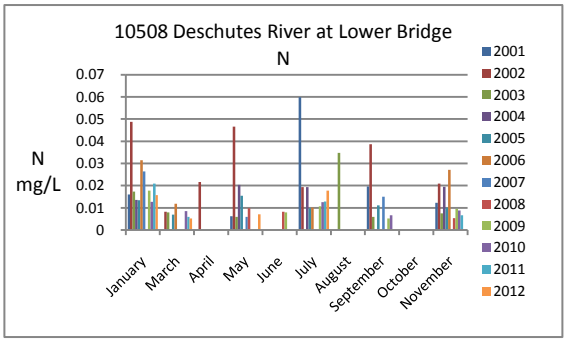

10508 Deschutes River at Lower Bridge
Turbidity
NTU
Year
Max
Min

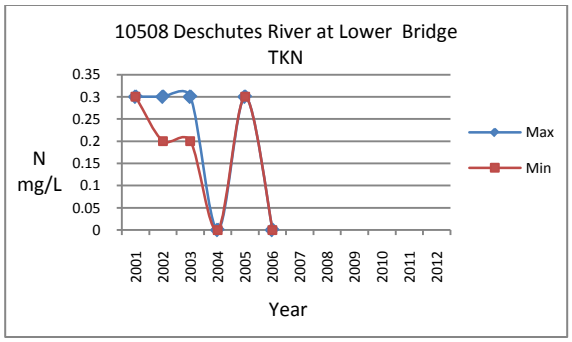

10508 Deschutes River at Lower Bridge
NTU
NTU
January
March
April
May
June
July
August
September
October
November

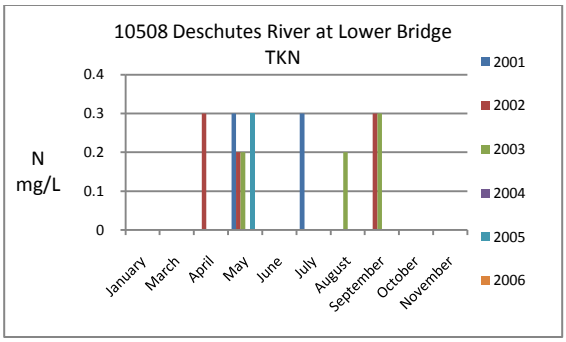

10508 Deschutes River at Lower Bridge
TSS
TSS mg/L
Year
Max
Min

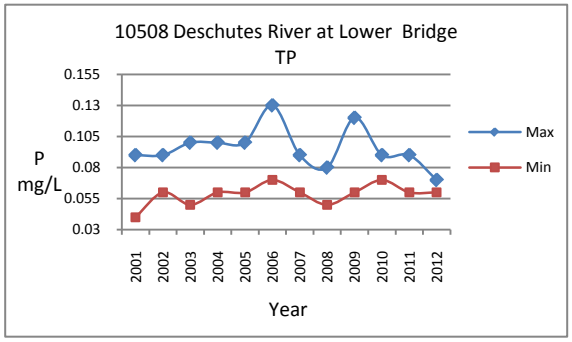

10508 Deschutes River at Lower Bridge
TSS
TSS mg/L
January
March
April
May
June
July
August
September
October
November

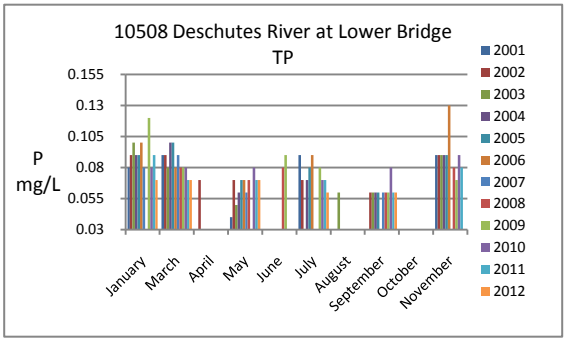

10508 Deschutes River at Lower Bridge
N
N mg/L
Year
Max
Min

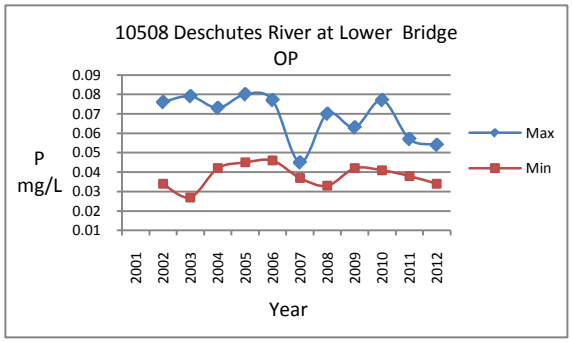

10508 Deschutes River at Lower Bridge
N
N mg/L
January
March
April
May
June
July
August
September
October
November

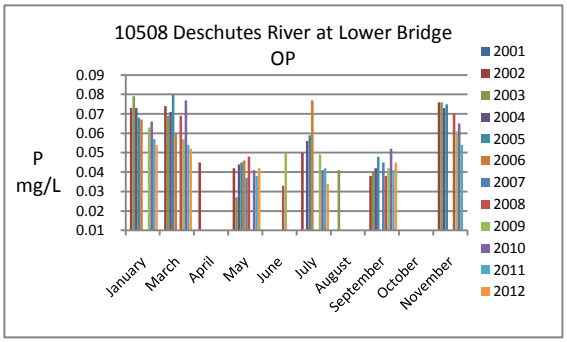

10508 Deschutes River at Lower Bridge
TKN
N
mg/L
Year
Max
Min

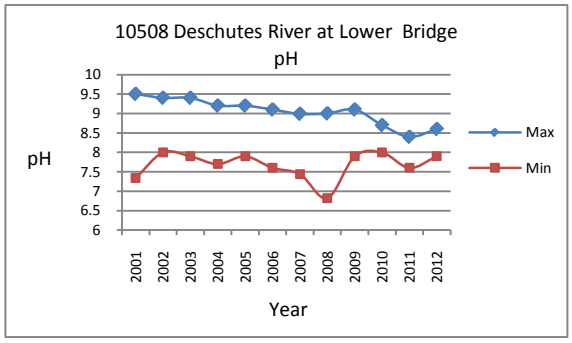

10508 Deschutes River at Lower Bridge
TKN
N
mg/L
January
March
April
May
June
July
August
September
October
November

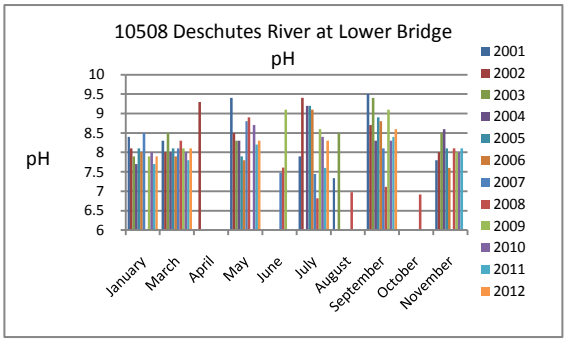

10508 Deschutes River at Lower Bridge
TP
P
mg/L
Year
Max
Min


10508 Deschutes River at Lower Bridge
TP
P
mg/L
January
March
April
May
June
July
August
September
October
November


10508 Deschutes River at Lower Bridge
OP
P
mg/L
Year
Max
Min


10508 Deschutes River at Lower Bridge
OP
P
mg/L
January
March
April
May
June
July
August
September
October
November


10508 Deschutes River at Lower Bridge
pH
pH
Year
Max
Min


10508 Deschutes River at Lower Bridge
pH
pH
January
March
April
May
June
July
August
September
October
November

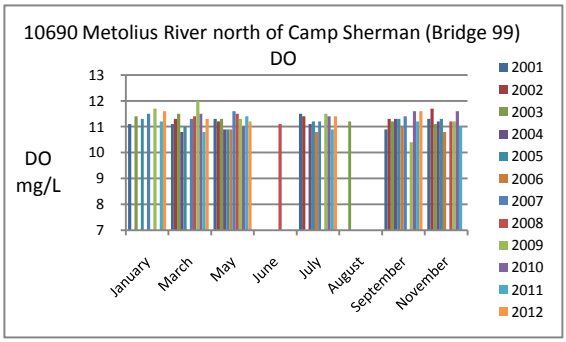
10508								
Date	N (mg/L)	TKN (mg/L)	OP (mg/L)	TP (mg/L)	TSS (mg/L)	NTU	DO (mg/L)	pH
1/22/2001	0.016	<0.2		0.08	1	2	12	8.4
3/12/2001	<0.0050	<0.2		0.09	1	2	11.8	8.4
3/12/2001	<0.0050	<0.2		0.08	1	1	11.6	8.3
5/7/2001	0.0062	0.3		0.04	1	1	11.5	9.4
7/9/2001	0.0598	0.3		0.09	3	2	9.1	9.1
7/17/2001	0.0364	0.3		0.09	6	2.5	9	9
7/18/2001	0.0386	0.3		0.07	8	3	8.4	7.9
7/19/2001	0.0243	0.3		0.07	4		8.8	9
9/10/2001	0.0196	<0.2			2	2	11.7	9.5
11/5/2001	0.0123	<0.2		0.09	2	1	11.8	8.3
11/6/2001	0.0054	<0.2			1	<1	11	7.8
11/7/2001	0.0056	<0.2			<1	1.4	11.6	8
1/28/2002	0.0488	<0.2	0.073	0.09	2	3	13.3	8.1
3/28/2002	0.0082	<0.2	0.074	0.09	2	2	11.1	8
4/30/2002	0.0216	0.3	0.045	0.07	2	2	10.1	9.3
5/1/2002	0.0466	0.2	0.034	0.06	2	1	11	8.5
5/28/2002	0.0275	0.2	0.042	0.07	3	4	9.5	8.6
7/24/2002	0.0193	<0.2	0.05	0.07	2	2	9.1	9.4
9/23/2002	0.0386	0.3	0.038	0.06	4	2	10.4	8.7
11/5/2002	0.021	<0.2	0.076	0.09	2	1	12.3	8
1/27/2003	0.0173	<0.2	0.079	0.1	6	4	11.1	7.9
3/18/2003	0.0065	<0.2	0.069	0.08	2	2	11.8	8.5
3/18/2003	0.008	<0.2	0.068	0.08	4	2	11.8	8.5
5/22/2003	0.0059	0.2	0.027	0.05	2	3	9.8	8.3
8/7/2003	0.0348	0.2	0.041	0.06	3	3	9	8.5
8/7/2003	0.034	<0.2	0.041	0.06	3	2	9.2	8.5
9/22/2003	0.006	0.3	0.04	0.06	3	2	10.6	9.4
11/17/2003	0.0075	<0.2	0.076	0.09	<1	2	12.7	8.5
1/26/2004	0.0136	<0.2	0.073	0.09	1	1	12.1	7.8
1/26/2004	0.0116	<0.2	0.073	0.08	<1	<1	12.2	7.7
3/22/2004	<0.0050	<0.2	0.071	0.1	4	6	10.6	8
5/24/2004	0.0203	<0.2	0.044	0.06	<1	1	10	8.3
7/28/2004	0.0193	<0.2	0.056	0.07	1	1	9.2	9.2
9/13/2004	<0.0050	<0.2	0.042	0.06	<1	1	9.3	8.3
11/16/2004	0.0195	<0.2	0.073	0.09	2	2	11.8	8.6
1/24/2005	0.0135	<0.2	0.068	0.09	1	1	12	8.1
3/7/2005	0.007	<0.2	0.08	0.1	9	2	11.6	8.1
5/16/2005	0.0154	0.3	0.045	0.07	7	3	9.4	7.9
7/20/2005	0.0098	<0.2	0.059	0.08	1	1	8.9	9.2
9/12/2005	0.0111	<0.2	0.048	0.06	<1	3	10.6	8.9
11/7/2005	0.0101	<0.2	0.075	0.09	<1	1	10.9	8.1
1/9/2006	0.0314	<0.2	0.067	0.1	5	5	11.9	8
3/16/2006	0.0118	<0.2	0.06	0.08	2	2	11.8	7.9
5/22/2006	<0.0050	<0.2	0.046	0.07	3	2	9.7	7.8
7/17/2006	0.0101	<0.2	0.077	0.09	3	3	9	9.1
9/18/2006						3	9.8	8.8
11/6/2006	0.0272			0.13		10	9.8	7.6
1/22/2007	0.0264			0.08		5	13	8.5
3/19/2007	<0.0050			0.09		3	10.5	8.1
5/14/2007	0.0059		0.037	0.06		2	10.1	8.8

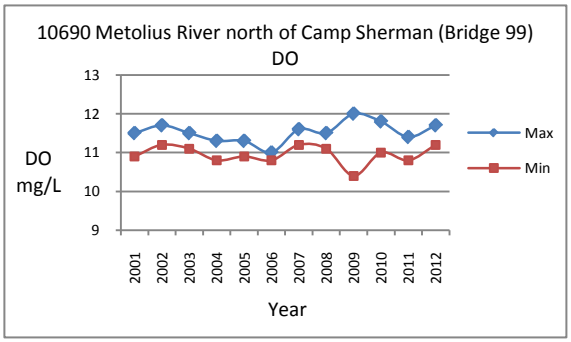
10508								
Date	N (mg/L)	TKN (mg/L)	OP (mg/L)	TP (mg/L)	TSS (mg/L)	NTU	DO (mg/L)	pH
7/24/2007							9.05	8.81
9/4/2007	0.015		0.045	0.06	4	3	8.4	8.1
3/10/2008	<0.0050		0.069	0.08	3	2	11.6	8.3
5/4/2008	0.0099		0.048	0.07	<1	1	10.6	8.9
6/30/2008	0.0083		0.033	0.08	6	4	9.1	7.8
9/29/2008	<0.0050		0.038	0.06	1	1	10.7	9
9/29/2008	<0.0050		0.038	0.05	2	1	10.8	9
11/17/2008	0.0053		0.07	0.08	1	1	11.4	8.1
1/26/2009	0.0165		0.063	0.12	1	4	13.3	8
1/26/2009	0.0178		0.062	0.11	2	2	13.2	7.9
3/23/2009	<0.0050		0.057	0.08	3	3	12.2	8.1
5/11/2009	0.0079		0.05	0.09	5	3	10.4	9.1
7/27/2009	0.0107		0.049	0.08	4	3	8.6	8.6
9/29/2009	0.0052		0.042	0.06	3	5	10.6	9.1
11/16/2009	0.0096		0.061	0.07	1	2	12.1	8
1/25/2010	0.0127		0.066	0.08	2	2	12	8
3/22/2010	0.0085		0.064	0.08	4	3	10.8	8.1
3/22/2010	0.0083		0.077	0.08	3	3	10.9	8
5/17/2010	<0.0050		0.041	0.08	6	2	9.5	8.7
7/26/2010	0.0126		0.041	0.07	6	3	8.5	8.4
9/20/2010	0.0066		0.052	0.08	7	5	10.1	8.3
11/1/2010	0.0088		0.065	0.09	2	2	11.2	8
1/24/2011	0.0208		0.056	0.09	3	5	11.8	7.8
1/24/2011	0.0209		0.057	0.08	3	4	11.9	7.7
3/24/2011	0.006		0.054	0.07	2	3	11.1	7.8
5/23/2011	<0.0050		0.038	0.07	7	3	10.3	8.2
7/19/2011	0.0129		0.042	0.07	5	3	8.9	7.6
9/26/2011	<0.0050		0.041	0.06	3	2	10.1	8.4
11/14/2011	0.0066		0.054	0.08	1	2	11.8	8.1
1/23/2012	0.0157		0.054	0.07	2	2	12.8	7.9
3/26/2012	0.0052		0.052	0.07	3	2	11.3	8.1
5/14/2012	0.0071		0.042	0.07	5	3	9.5	8.3
7/23/2012	0.0178		0.034	0.06	3	3	9	8.3
9/24/2012	<0.0050		0.045	0.06	3	2	10.4	8.6

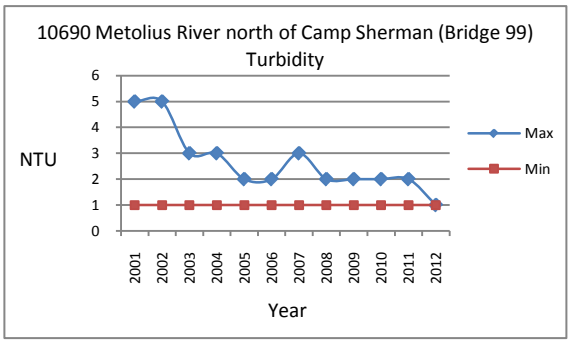
Site 10690

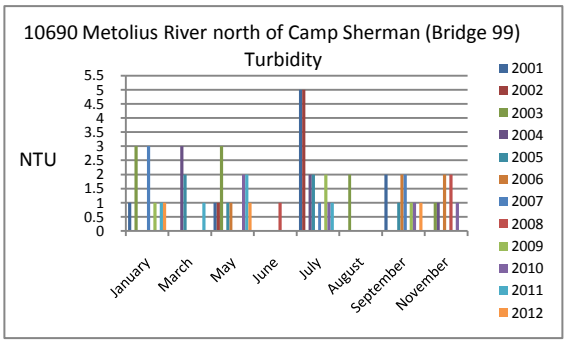
The last site in the Upper Deschutes subbasin is on the Metolius River. The Metolius River meets the Deschutes River at Lake Billy Chinook. Sampling events have taken place at this site every other month from 2001 through 2012. At this site, DO concentrations ranged from 10.4 mg/L to12.0 mg/L, with both the highest recorded concentration and the lowest concentration occurring in 2009. Turbidity ranged from 1 NTU to 5 NTU, and typically was highest in the earlier parts of the year. TSS at this site ranged from <1 mg/L to 4 mg/L. Inorganic nitrogen was sampled at this site and with concentrations ranging from 0.0102 mg/L to 0.0353 mg/L, often at their lowest from May to July, while TKN though sampled only from 2001 until 2006 was never above detection. TP concentrations ranged from 0.07 mg/L to 0.14 mg/L, showing little variation from month to month. OP concentrations as well showed little month-to-

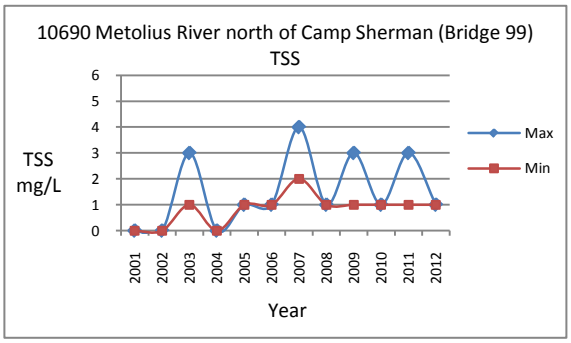
month variation, and concentrations ranged from 0.052 mg/L to 0.088 mg/L. Reported pH ranged from 7.5 to 8.5. No data were available for toxins, metals, or contaminants at this site.

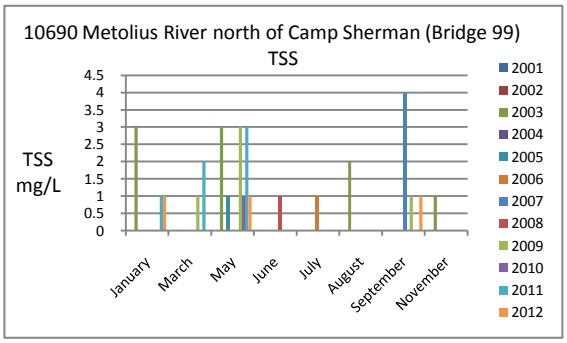


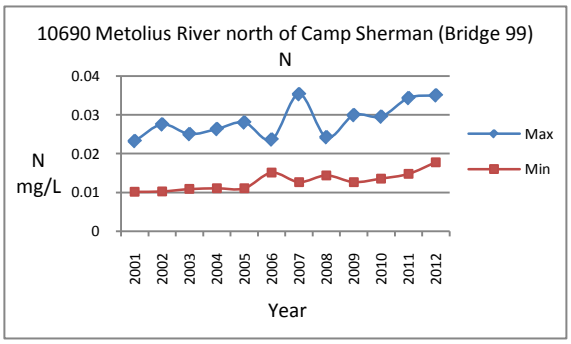


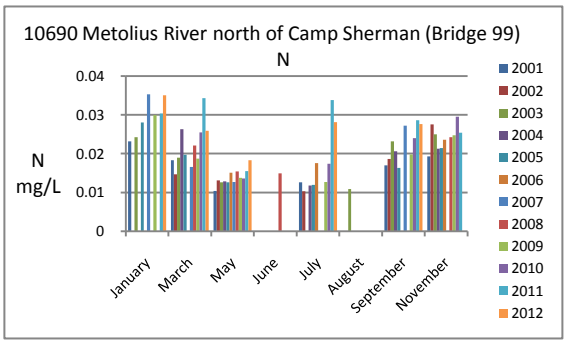


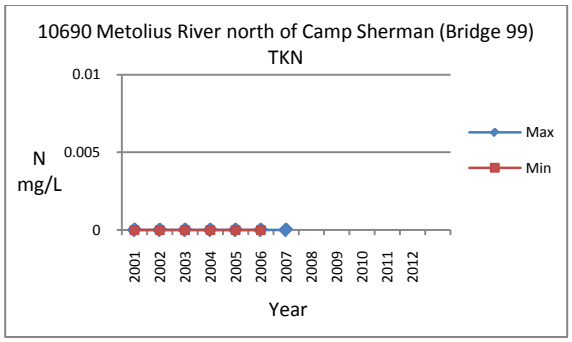


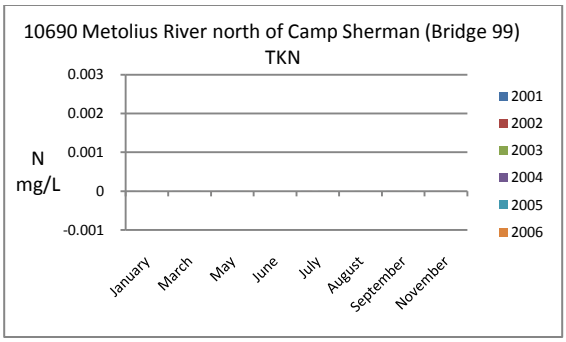


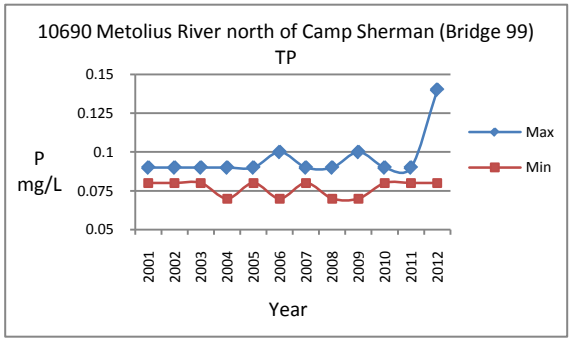


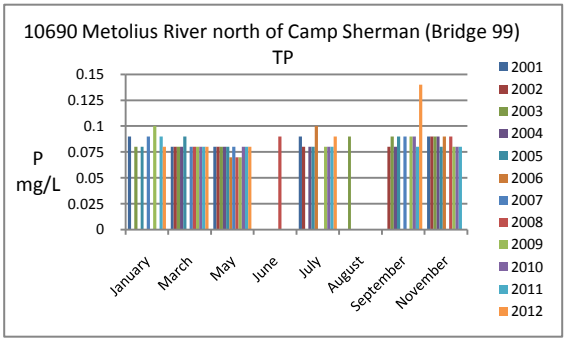


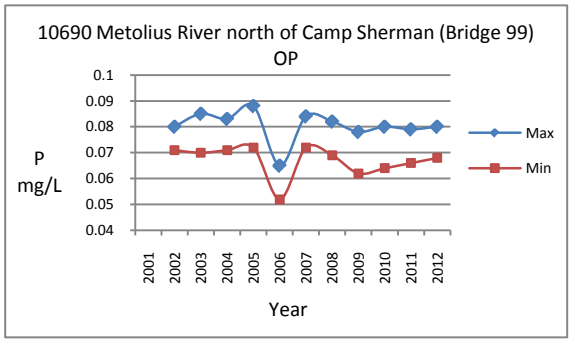


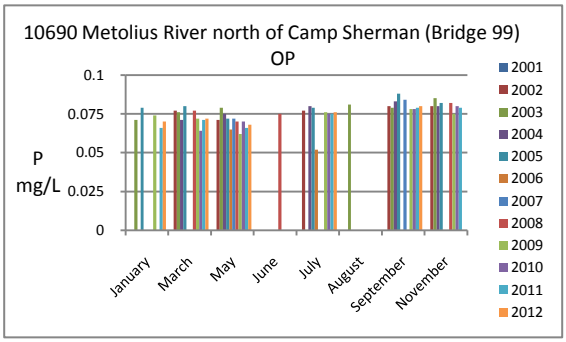

10690 Metolius River north of Camp Sherman (Bridge 99)
TKN
N
mg/L
0.01
0.005
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
Max
Min

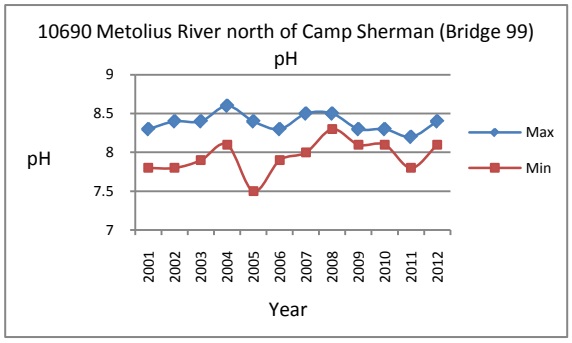

10690 Metolius River north of Camp Sherman (Bridge 99)
TKN
N
mg/L
0.003
0.002
0.001
0
-0.001
January
March
May
June
July
August
September
November
2001
2002
2003
2004
2005
2006

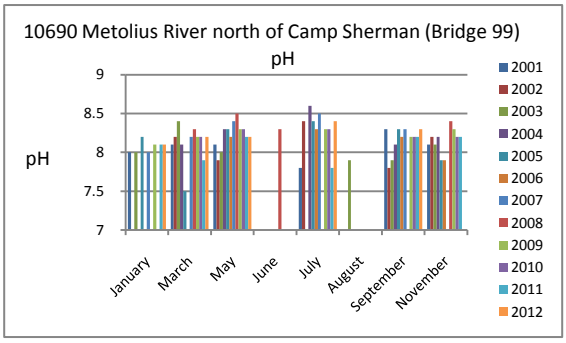

10690 Metolius River north of Camp Sherman (Bridge 99)
TP
P
mg/L
0.15
0.125
0.1
0.075
0.05
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
Max
Min


10690 Metolius River north of Camp Sherman (Bridge 99)
TP
P
mg/L
0.15
0.125
0.1
0.075
0.05
0.025
0
January
March
May
June
July
August
September
November
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012


10690 Metolius River north of Camp Sherman (Bridge 99)
OP
P
mg/L
0.1
0.09
0.08
0.07
0.06
0.05
0.04
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
Max
Min


10690 Metolius River north of Camp Sherman (Bridge 99)
OP
P
mg/L
0.1
0.075
0.05
0.025
0
January
March
May
June
July
August
September
November
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012


10690 Metolius River north of Camp Sherman (Bridge 99)
pH
pH
9
8.5
8
7.5
7
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
Max
Min


10690 Metolius River north of Camp Sherman (Bridge 99)
pH
pH
9
8.5
8
7.5
7
January
March
May
June
July
August
September
November
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012

10690								
Date	OP (mg/L)	DO(mg/L)	pH	NTU	N(mg/L)	TKN(mg/L)	TP(mg/L)	TSS(mg/L)
1/22/2001		11.1	8	1	0.0232	<0.2	0.08	<1
1/22/2001		11.1	7.8		0.023	<0.2	0.09	<1
3/12/2001		11.1	8.1	<1	0.0183	<0.2	0.08	<1
5/7/2001		11.3	7.9	1	0.0102	<0.2	0.08	<1
5/7/2001		11.3	8.1	1	0.0104	<0.2	0.08	<1
7/9/2001		11.5	7.8	5	0.0126	<0.2	0.09	<1
9/10/2001		10.9	8.3	2	0.017	<0.2		<1
9/10/2001		10.9	8.3	2	0.0169	<0.2		<1
11/5/2001		11.3	8.1	<1	0.0193	<0.2	0.09	<1
11/5/2001		11.4	8	<1	0.0184	<0.2	0.09	<1
3/27/2002	0.077	11.3	8.2	<1	0.0147	<0.2	0.08	<1
5/28/2002	0.071	11.2	7.9	1	0.0131	<0.2	0.08	<1
7/24/2002	0.077	11.4	8.4	5	0.0103	<0.2	0.08	<1
9/23/2002	0.08	11.3	7.8	<1	0.0186	<0.2	0.08	<1
11/5/2002	0.08	11.7	8.2	<1	0.0275	<0.2	0.09	<1
1/27/2003	0.07	11.4	8	3	0.022	<0.2	0.08	3
1/27/2003	0.071	11.4	8	1	0.0242	<0.2	0.08	3
3/18/2003	0.076	11.5	8.4	<1	0.019	<0.2	0.08	<1
5/22/2003	0.079	11.3	8	3	0.0126	<0.2	0.08	<1
8/7/2003	0.081	11.2	7.9	2	0.0109	<0.2	0.09	1
9/23/2003	0.079	11.2	7.9	<1	0.0232	<0.2	0.09	<1
11/17/2003	0.085	11.1	8.1	1	0.0213	<0.2	0.09	<1
11/17/2003	0.085	11.1	8	1	0.025	<0.2	0.09	<1
3/22/2004	0.071	10.8	8.1	3	0.0263	<0.2	0.08	<1
5/24/2004	0.074	11	8.3	<1	0.0129	<0.2	0.08	<1
5/24/2004	0.075	10.9	8.2	<1	0.0128	<0.2	0.07	<1
7/28/2004	0.08	11.2	8.6	2	0.0118	<0.2	0.08	<1
7/28/2004	0.078	11.1	8.6	<1	0.0111	<0.2	0.08	<1
9/13/2004	0.083	11.3	8.1	<1	0.0206	<0.2	0.08	<1
11/16/2004	0.079	11.2	8.2	1	0.0209	<0.2	0.09	<1
11/16/2004	0.08	11.2	8.1	1	0.0213	<0.2	0.08	<1
1/24/2005	0.079	11.3	8.2	<1	0.028	<0.2	0.08	<1
3/7/2005	0.08	11	7.5	2	0.0197	<0.2	0.09	<1
5/16/2005	0.072	10.9	8.3	1	0.0125	<0.2	0.08	1
5/16/2005	0.072	10.9	8.2	<1	0.0126	<0.2	0.08	1
7/20/2005	0.079	11.2	8.3	2	0.0111	<0.2	0.08	<1
7/20/2005	0.079	11.3	8.4	1	0.012	<0.2	0.08	<1
9/12/2005	0.088	11.3	8.3	1	0.0163	<0.2	0.09	<1

10690								
Date	OP (mg/L)	DO(mg/L)	pH	NTU	N(mg/L)	TKN(mg/L)	TP(mg/L)	TSS(mg/L)
11/7/2005	0.082	11.3	7.9	<1	0.0214	<0.2	0.08	<1
5/22/2006	0.065	10.9	8.2	1	0.0151	<0.2	0.07	<1
7/17/2006	0.052	10.8	8.3	<1	0.0176	<0.2	0.1	1
9/18/2006		11	8.2	2				
9/18/2006		11	8.2	1				
11/6/2006		10.8	7.9	2	0.0236		0.09	
1/22/2007		11.5	8	3	0.0353		0.09	
3/19/2007		11.3	8.2	<1	0.0166		0.08	
5/14/2007	0.072	11.6	8.4	<1	0.0127		0.08	
7/23/2007		11.2	8.5	1				
9/4/2007	0.08	11.5	8.2	2	0.0255		0.08	2
9/4/2007	0.084	11.4	8.3	1	0.0272		0.09	4
3/10/2008	0.077	11.4	8.3	<1	0.0221		0.08	<1
5/4/2008	0.07	11.5	8.5	<1	0.0154		0.07	<1
6/30/2008	0.069	11.1	8.3	1	0.0149		0.08	1
6/30/2008	0.075	11.2	8.3	1	0.0144		0.09	<1
11/17/2008	0.081	11.2	8.4	2	0.0209		0.08	<1
11/17/2008	0.082	11.3	8.4	<1	0.0242		0.09	<1
1/26/2009	0.074	11.7	8.1	1	0.0299		0.1	<1
3/23/2009	0.072	12	8.2	<1	0.0187		0.08	1
3/23/2009	0.072	12	8.2	<1	0.0182		0.08	1
5/11/2009	0.062	11.3	8.3	<1	0.0138		0.07	3
7/27/2009	0.076	11.5	8.3	2	0.0127		0.08	<1
9/29/2009	0.078	10.4	8.2	1	0.0198		0.09	1
11/16/2009	0.075	11.2	8.3	<1	0.0247		0.08	<1
3/22/2010	0.064	11.5	8.2	<1	0.0255		0.08	<1
5/17/2010	0.07	11	8.3	2	0.0136		0.08	1
7/26/2010	0.075	11.4	8.3	1	0.0174		0.08	<1
9/20/2010	0.078	11.6	8.2	1	0.0238		0.09	<1
9/20/2010	0.078	11.8	8.1	1	0.024		0.08	<1
11/1/2010	0.079	11.6	8.2	<1	0.0283		0.08	<1
11/1/2010	0.08	11.6	8.2	1	0.0295		0.08	<1
1/24/2011	0.066	11.2	8.1	1	0.0303		0.09	1
3/24/2011	0.071	10.8	7.9	1	0.0343		0.08	2
5/23/2011	0.066	11.4	8	2	0.0148		0.08	1
5/23/2011	0.066	11.4	8.2	2	0.0155		0.08	3
7/19/2011	0.075	10.9	7.8	1	0.0338		0.08	<1
9/26/2011	0.077	11.2	8.1	<1	0.0285		0.08	<1

10690								
Date	OP (mg/L)	DO(mg/L)	pH	NTU	N(mg/L)	TKN(mg/L)	TP(mg/L)	TSS(mg/L)
9/26/2011	0.079	11.2	8.2	<1	0.0286		0.08	<1
11/14/2011	0.079	11	8.2	<1	0.0254		0.08	<1
1/23/2012	0.07	11.6	8.1	<1	0.0336		0.08	1
1/23/2012	0.069	11.6	8.1	1	0.035		0.08	<1
3/26/2012	0.072	11.3	8.2	<1	0.0259		0.08	<1
5/14/2012	0.068	11.2	8.2	<1	0.0183		0.08	1
5/14/2012	0.068	11.3	8.2	1	0.0178		0.08	<1
7/23/2012	0.076	11.4	8.4	<1	0.0281		0.08	<1
7/23/2012	0.074	11.4	8.4	<1	0.0215		0.09	<1
9/24/2012	0.08	11.7	8.3	1	0.0276		0.14	1
9/24/2012	0.079	11.6	8.3	<1	0.0267		0.09	1

Little Deschutes Subbasin

The Little Deschutes subbasin has only one site with sufficient useful data (Figure 6). The Little Deschutes River is one of a few major water bodies in this region. The Little Deschutes passes through several towns and cities, in addition to being surrounded by agriculture.

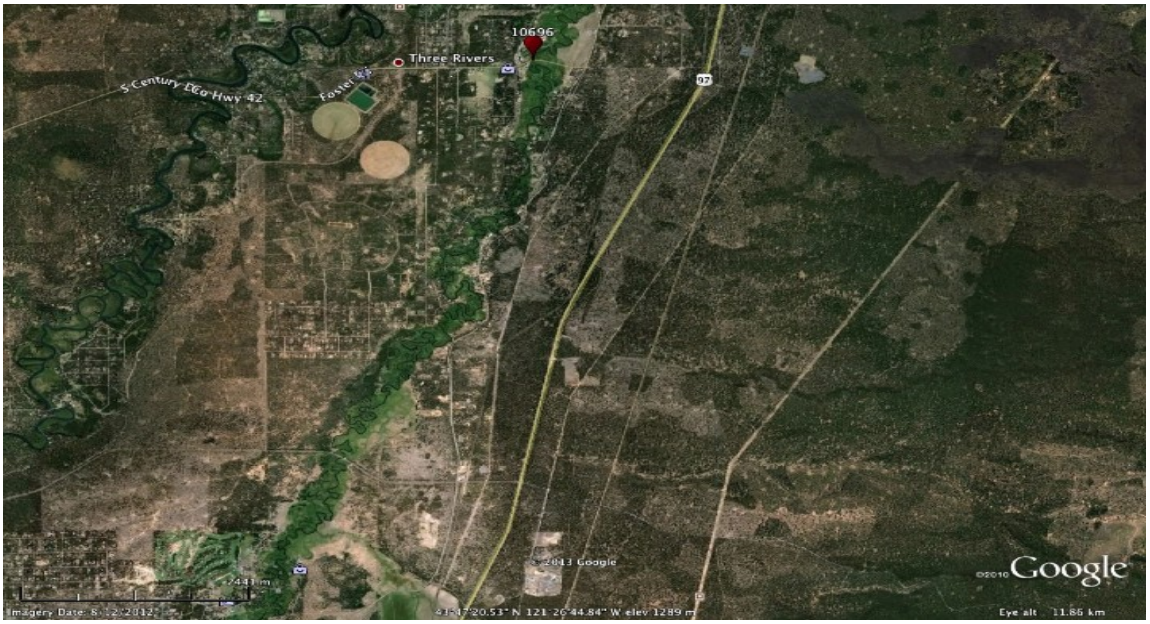
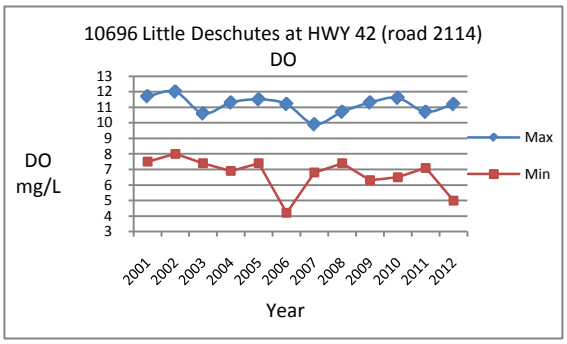


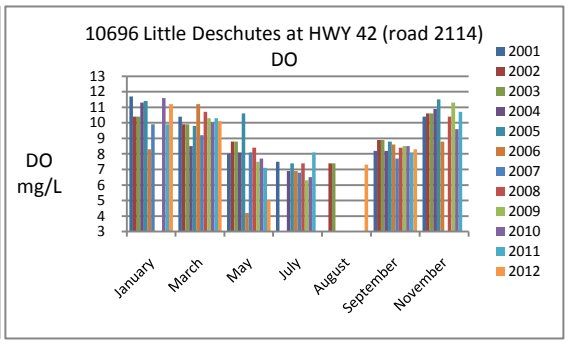
Figure 6. Sampling site in the Little Deschutes subbasin.

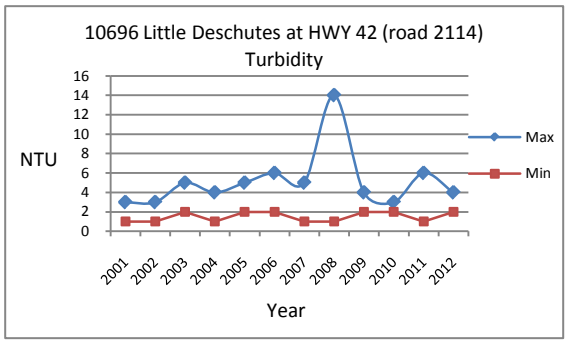
Site 10696

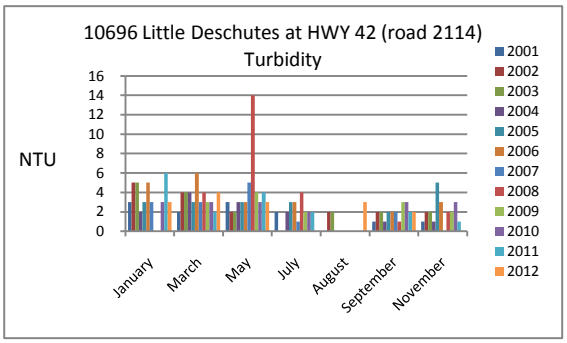
This site is located where the Little Deschutes winds its way past the City of Three Rivers, above the confluence with the Deschutes River. Data was collected at this site

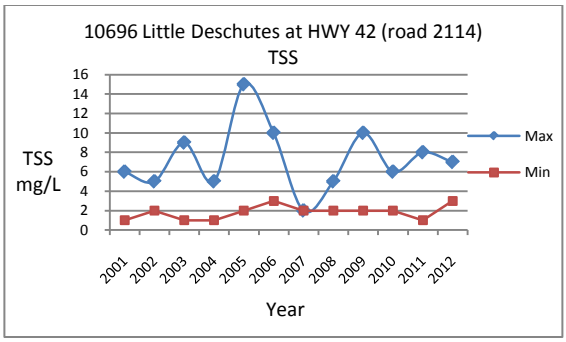
from 2001 until 2011. In general, DO at this site follow a pattern of lowest concentrations occurring between July and August. The lowest concentration observed concentration was 4.2 mg/L in May of 2006. With the exception of 2006, concentrations ranged from 5 mg/L to 11.7 mg/L. Suspended sediments and turbidity both exhibited increasing trends based on yearly data. Turbidity at this site tended to be highest in the early part of the year, January through March, and fluctuated between 1 NTU and 6 NTU. In May of 2008, turbidity was observed to be 14 NTU. TSS tended to be at higher concentrations in March through May. Concentrations of TSS ranged from below detection limits to 15 mg/L. Inorganic N at this site typically had highest concentrations in the first part of the year, and then tapered off to below detection limits in July through October. The yearly data at this site suggest an overall decreasing trend. Sampling for TKN ended in 2006. Monthly data suggest that towards the end of summer, concentrations fell below detection limits, and were higher in the first half of the year. Concentrations ranged from below detection limits to 0.60 mg/L. Concentrations of TP ranged from 0.04 mg/L to 0.19 mg/L, and showed an overall increasing trend. Monthly data suggest that concentrations stayed fairly level over the course of the year, decreasing slightly in September and October. Concentrations of OP showed an overall decreasing trend, based on the yearly averages, and like TP, concentrations did not fluctuate greatly over the course of a year, only dipping slightly in September and October. Concentrations ranged from 0.021 mg/L to 0.121 mg/L, but typically stayed between 0.03 mg/L and 0.04 mg/L. Reported pH at this site ranged from 7.2 to 8.2. Metals data were collected only in 2010 and are available in LASAR.

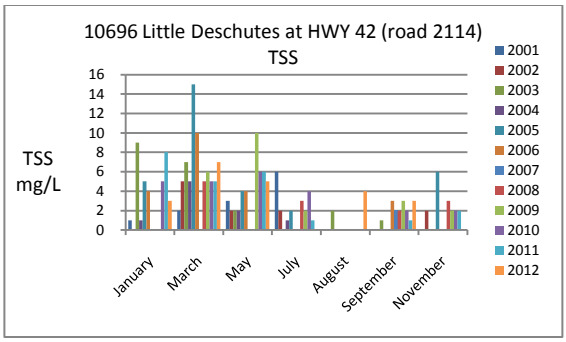


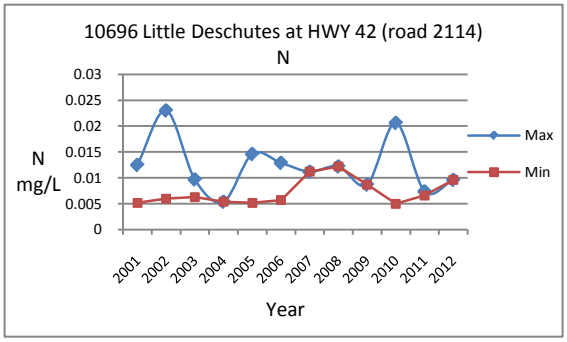







10696 Little Deschutes at HWY 42 (road 2114)
TSS
TSS mg/L
Max
Min
Year


10696 Little Deschutes at HWY 42 (road 2114)
TSS
TSS mg/L
January
March
May
July
August
September
November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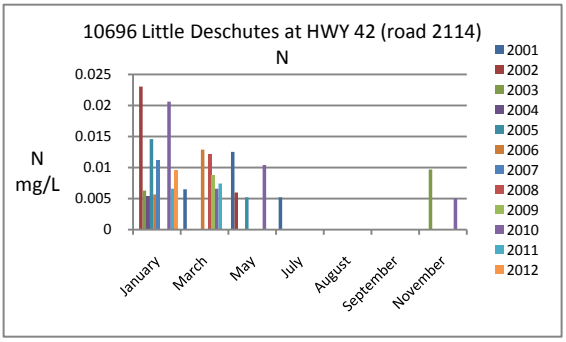
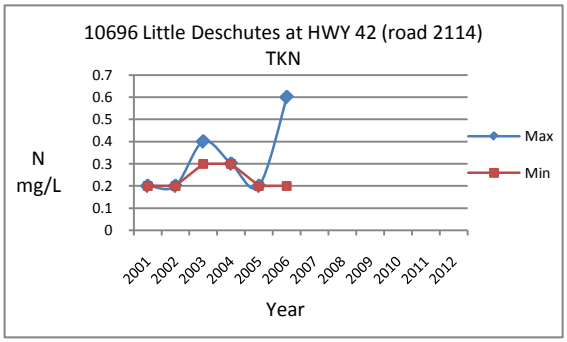
N
N mg/L
Max
Min
Year


10696 Little Deschutes at HWY 42 (road 2114)
N
N mg/L
January
March
May
July
August
September
November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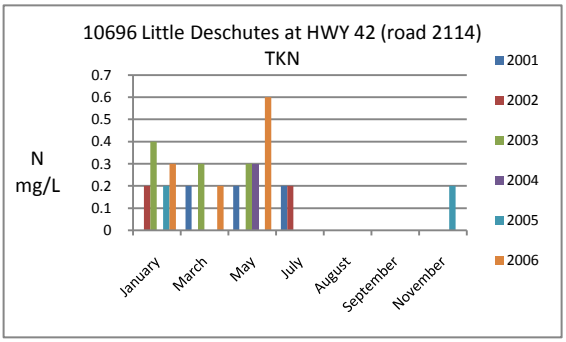
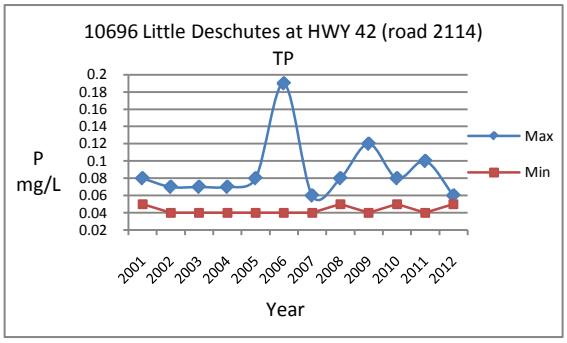
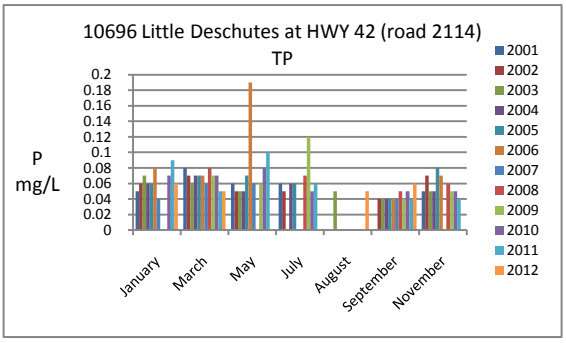
TKN
N mg/L
Max
Min
Year


10696 Little Deschutes at HWY 42 (road 2114)
TKN
N mg/L
January
March
May
July
August
September
November


10696 Little Deschutes at HWY 42 (road 2114)
TP
P mg/L
Max
Min
Year


10696 Little Deschutes at HWY 42 (road 2114)
TP
P mg/L
January
March
May
July
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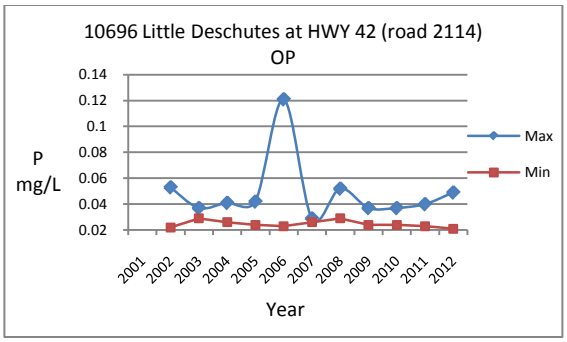
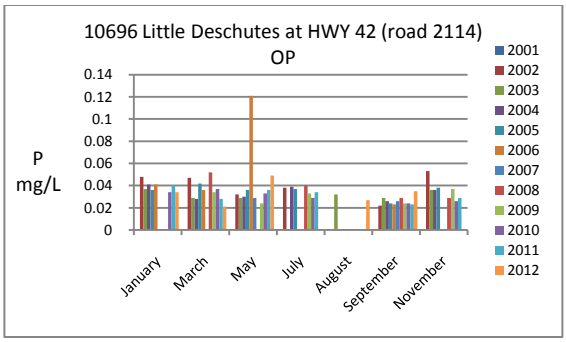
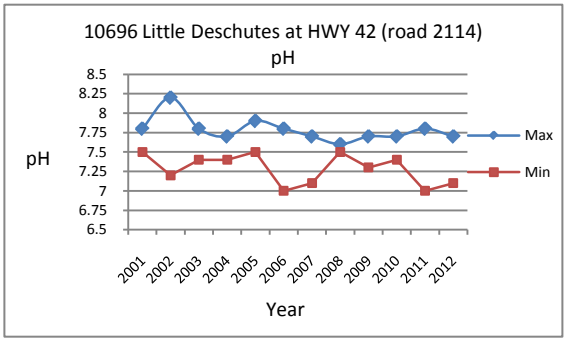
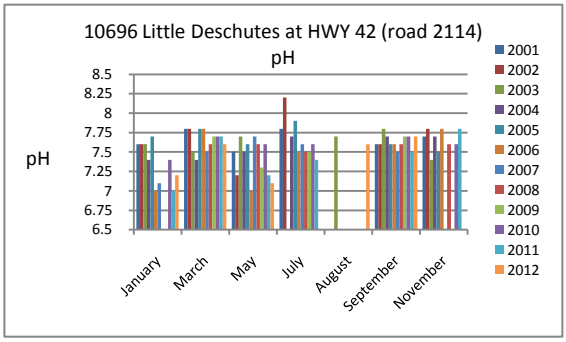
September
November









10696									
Date	**Year**	**DO (mg/L)**	**OP (mg/L)**	**pH**	**NTU**	**N (mg/L)**	**TKN (mg/L)**	**TP (mg/L)**	**TSS (mg/L)**
1/23/2001	2001	11.7		7.6	3	<0.0050	<0.2	0.05	1
3/13/2001	2001	10.4		7.8	2	0.0065	0.2	0.08	2
5/8/2001	2001	8		7.5	3	0.0125	0.2	0.06	3
7/10/2001	2001	7.5		7.8	2	0.0052	0.2	0.06	6
9/11/2001	2001	8.2		7.6	1	<0.0050	<0.2		<1
11/6/2001	2001	10.4		7.7	1	<0.0050	<0.2	0.05	<1
1/29/2002	2002	10.9	0.048	7.6	2	0.023	0.2	0.06	<1
3/27/2002	2002	10.5	0.047	7.8	3	<0.0050	<0.2	0.07	5
5/29/2002	2002	8	0.032	7.2	2	0.006	<0.2	0.05	2
7/24/2002	2002	8.1	0.038	8.2	2	<0.0050	0.2	0.05	2
9/24/2002	2002	9.3	0.022	7.6	1	<0.0050	<0.2	0.04	<1
11/5/2002	2002	12	0.053	7.8	1	<0.0050	<0.2	0.07	2
1/28/2003	2003	10.4	0.037	7.6	5	0.0063	0.4	0.07	9
3/19/2003	2003	9.9	0.029	7.5	4	<0.0050	0.3	0.06	7
5/21/2003	2003	8.8	0.029	7.7	2	<0.0050	0.3	0.05	2
8/6/2003	2003	7.4	0.032	7.7	2	<0.0050	<0.2	0.05	2
9/23/2003	2003	8.9	0.029	7.8	2	<0.0050	<0.2	0.04	1
11/18/2003	2003	10.6	0.036	7.4	2	0.0097	<0.2	0.05	<1
1/27/2004	2004	11.3	0.041	7.4	2	0.0054	<0.2	0.06	1
3/23/2004	2004	8.5	0.028	7.4	4	<0.0050	<0.2	0.07	5
5/25/2004	2004	8.1	0.03	7.5	3	<0.0050	0.3	0.05	2
7/28/2004	2004	6.9	0.039	7.7	2	<0.0050	<0.2	0.06	1
9/14/2004	2004	8.2	0.026	7.7	1	<0.0050	<0.2	0.04	<1
11/17/2004	2004	10.9	0.036	7.7	1	<0.0050	<0.2	0.05	<1
1/25/2005	2005	11.4	0.036	7.7	3	0.0146	0.2	0.06	5
3/8/2005	2005	9.8	0.042	7.8	3	<0.0050	<0.2	0.07	15

10696									
Date	Year	DO (mg/L)	OP (mg/L)	pH	NTU	N (mg/L)	TKN (mg/L)	TP (mg/L)	TSS (mg/L)
5/17/2005	2005	10.6	0.036	7.6	3	0.0052	<0.2	0.07	4
7/20/2005	2005	7.4	0.037	7.9	3	<0.0050	<0.2	0.06	2
9/13/2005	2005	8.8	0.024	7.6	2	<0.0050	<0.2	0.04	<1
11/8/2005	2005	11.5	0.038	7.5	5	<0.0050	0.2	0.08	6
1/10/2006	2006	8.3	0.041	7	5	0.0057	0.3	0.08	4
3/15/2006	2006	11.2	0.036	7.8	6	0.0129	0.2	0.07	10
5/23/2006	2006	4.2	0.121	7	3	<0.0050	0.6	0.19	4
7/18/2006	2006	6.9		7.5	3				
9/19/2006	2006	8.6	0.023	7.6	2	<0.0050	<0.2	0.04	3
11/7/2006	2006	8.8		7.8	3	<0.0050		0.07	
1/23/2007	2007	9.9		7.1	3	0.0112		0.04	
3/20/2007	2007	9.2		7.5	3	<0.0050		0.06	
5/15/2007	2007	8.1	0.029	7.7	5	<0.0050		0.06	
7/24/2007	2007	6.8		7.6	1				
9/5/2007	2007	7.7	0.026	7.5	2	<0.0050		0.04	2
3/11/2008	2008	10.7	0.052	7.6	4	0.0122		0.08	5
5/5/2008	2008	8.4		7.6	14				
7/1/2008	2008	7.4	0.04	7.5	4	<0.0050		0.07	3
9/30/2008	2008	8.4	0.029	7.6	1	<0.0050		0.05	2
11/18/2008	2008	10.4	0.029	7.6	2	<0.0050		0.06	3
3/24/2009	2009	10.3	0.034	7.7	3	0.0087		0.07	6
5/12/2009	2009	7.5	0.024	7.3	4	<0.0050		0.06	10
7/28/2009	2009	6.3	0.033	7.5	2	<0.0050		0.12	2
9/29/2009	2009	8.5	0.024	7.7	3	<0.0050		0.04	3
11/17/2009	2009	11.3	0.037		2	<0.0050		0.05	2
1/26/2010	2010	11.6	0.034	7.4	3	0.0206		0.07	5
3/23/2010	2010	10	0.037	7.7	3	0.0066		0.07	5
5/18/2010	2010	7.7	0.033	7.6	3	0.0104		0.08	6
7/27/2010	2010	6.5	0.029	7.6	2	<0.0050		0.05	4
9/21/2010	2010	8.5	0.024	7.7	3	<0.0050		0.05	2
11/2/2010	2010	9.6	0.026	7.6	3	0.005		0.05	2
1/25/2011	2011	9.9	0.04	7	6	0.0066		0.09	8
3/22/2011	2011	10.3	0.028	7.7	2	0.0074		0.05	5
5/24/2011	2011	7.1	0.036	7.2	4	<0.0050		0.1	6
7/19/2011	2011	8.1	0.034	7.4	2	<0.0050		0.06	1
9/27/2011	2011	8.1	0.023	7.5	2	<0.0050		0.04	1
11/15/2011	2011	10.7	0.029	7.8	1	<0.0050		0.04	2
1/24/2012	2012	11.2	0.034	7.2	3	0.0096		0.06	3
3/27/2012	2012	10.1	0.021	7.6	4	<0.0050		0.05	7
5/15/2012	2012	5	0.049	7.1	3	<0.0050			5
7/24/2012	2012	7.3	0.027	7.6	3	<0.0050		0.05	4
9/25/2012	2012	8.3	0.035	7.7	2	<0.0050		0.06	3

6.3 Lower Deschutes Subbasin

6.3.1 Introduction

DO levels in the Lower Deschutes subbasin are not well defined; however, Reclamation has collected data at selected sites from the 1990s until present. The data not presented in this report can be accessed through the EPA STORET web site.

Overall, there is a lack of data for water quality conditions relating to sediment in the Lower Deschutes subbasin. The water bodies identified as having a 303(d) listing for sedimentation are Rock Creek from the headwaters to the mouth (Bailey et al. 2006) and Gate Creek in the White River watershed (ODEQ 2011).

There is concern that return flows from agricultural irrigation could be entering the Lower Deschutes River and potentially impacting water quality with regard to nutrients (ODEQ 2011).

The water bodies that have a 303(d) listing due to pH limitations in the Lower Deschutes subbasin include the Deschutes River from RM 0.0 to 46.4 (summer) and the Deschutes River from RM 46.4 to 88.0 (winter, spring, and fall) (Bailey et al. 2006). The water bodies in the Lower Deschutes subbasin that have data concerning algal blooms include Clear Lake and Lake Simtustus, both with no limitations due to algal blooms; Lake Billy Chinook, which has a potential for concern; and Haystack Reservoir, which has a proposed 303(d) listing including multiple years of health advisories (ODEQ 2011).

There are limited data for this subbasin with regard to contaminants, toxins, and metals.

6.3.2 Current Conditions

The Lower Deschutes subbasin stretches from Lake Billy Chinook to the mouth. Data were available from two sites on the mainstem and two reservoirs. Each reservoir had two sampling sites, one above, and one below each dam. This stretch of the Deschutes River passes through several cities and much agricultural land before it reaches the Columbia River.

The following images show the points at which data have been collected in the Lower Deschutes subbasin ((Figure 7; Figure 8). Four of the collection sites are Reclamation reservoir monitoring sites. Data has been collected at these sites in mid-summer every 3 years. The other two sites are DEQ long-term monitoring sites, with data being collected nearly every other month from 2001 through 2012.

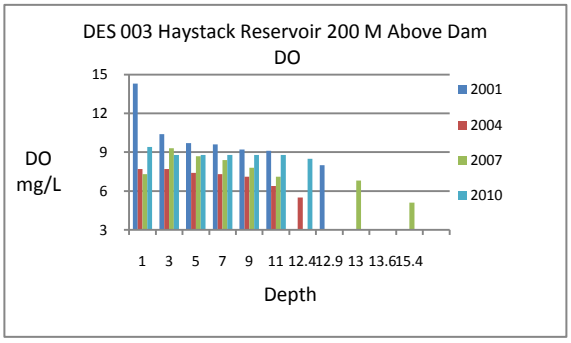
Figure 7. Sampling sites in the lower Deschutes subbasin.

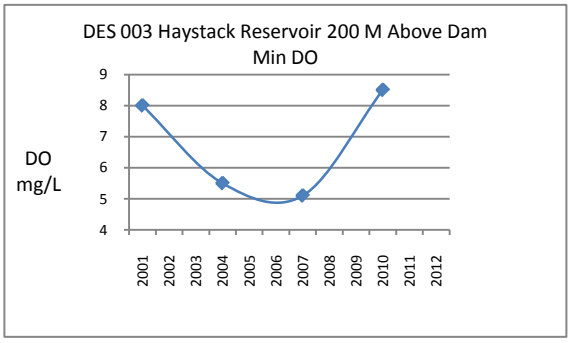
Figure 8. Additional lower Deschutes subbasin sampling sites.

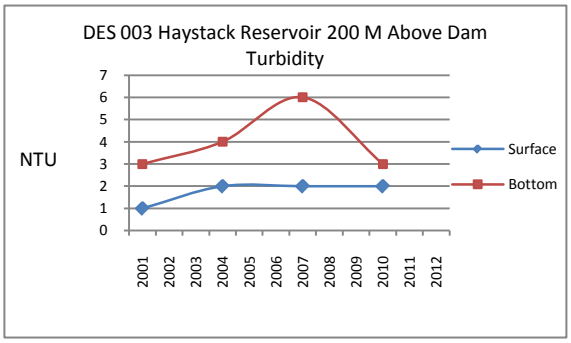
Site DES 003

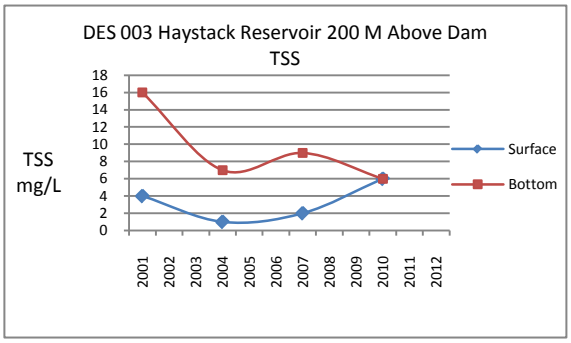
The first site that will be discussed in the Lower Deschutes subbasin is in Haystack Reservoir, 200 meters above the dam. Depths in the reservoir reach between 12 and 15 meters. Data were collected in July of 2001, 2004, 2007, and 2010. DO concentration at this site decreased as depth increased. Surface concentrations were never observed to be less than 7.3 mg/L; at 5 meters, the lowest concentration observed was 7.4 mg/L; and at the bottom depth, the lowest concentration was 5.1 mg/L. Turbidity at this site ranged from 1 to 2 NTU at the surface and from 2 to 4 NTU at the bottom. There appeared to be an overall increasing trend at both the surface and bottom for turbidity. TSS concentrations ranged from 1 mg/L to 4 mg/L at the surface and from 2 mg/L to 16 mg/L at the bottom. There was an overall increasing trend at the bottom and a decreasing trend at the surface. Inorganic N concentrations at the surface ranged from below detection limits to 0.02 mg/L, while at the bottom the concentrations were never observed to be above detection. Concentrations at the surface showed an increasing trend, while at the bottom a decreasing trend was observed. TKN concentrations at this site ranged from 0.29 mg/L to 0.45 mg/L at the surface and 0.25 mg/L to 1.32 mg/L at the bottom. Decreasing trends were suggested for both surface and bottom. Concentrations of P ranged from 0.043 mg/L to 0.075 mg/L at the surface and from 0.066 mg/L to 0.119 mg/L at the bottom. Surface data suggest a slight decreasing trend, while data from the bottom depths suggest an increasing trend. OP concentrations at this

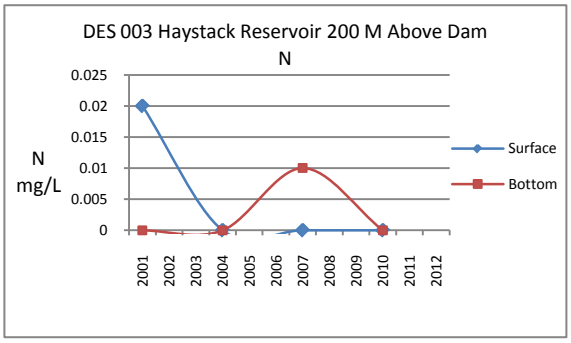
site ranged from 0.028 mg/L to 0.052 mg/L at the surface and 0.150 mg/L to 0.039 mg/L at the bottom. Data suggest decreasing trends at the surface and increasing trends at the bottom. Chlorophyll-a data have been collected from surface samples and values have been observed to range from 110 mg/m3 in 2001 to 1.8 mg/m3 in 2007. Reported pH at this site ranged from 8.00 to 9.16 at the surface, 8.15 to 8.72 at 5 meters, and 8.1 to 9.2 at the bottom. Metals data are presented in the tables below.

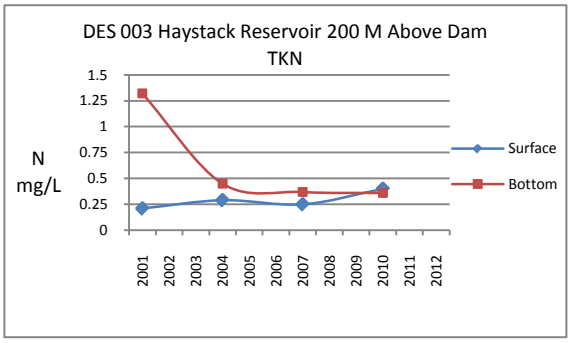


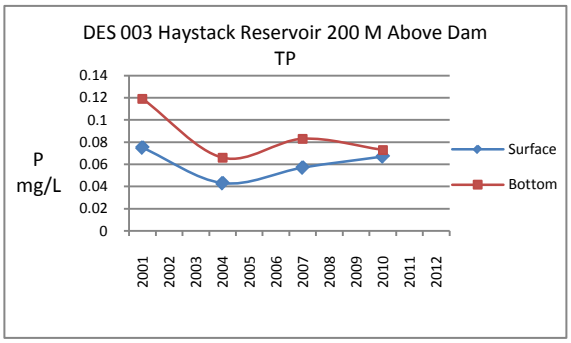


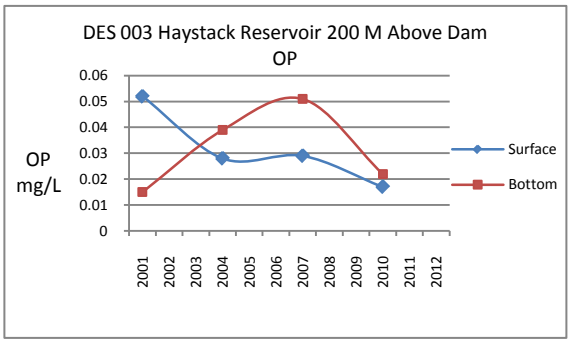


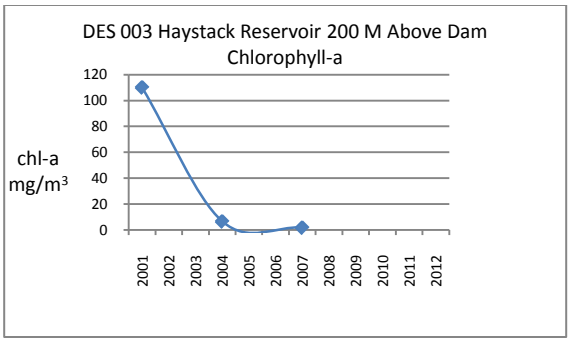


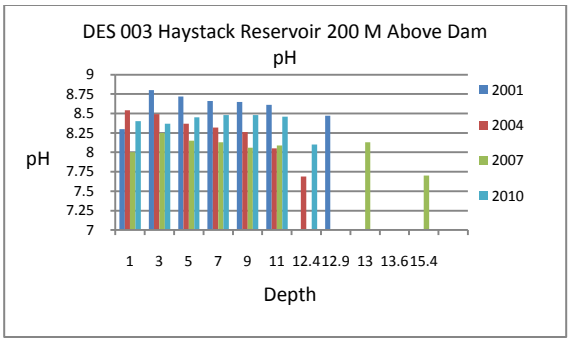












DES 003	Depth	Arsenic (µg/L)	Boron (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Copper (µg/L)	Iron (µg/L)
2001	1	< 2	70	< 1	< 2	< 2	120
2001	12.9	< 2	60	< 1	< 2	3	60
2004	1	< 2	< 50	< 1	< 2	< 2	100
2004	1	< 2	< 50	< 1	< 2	< 2	130
2004	12.4	< 2	< 50	< 1	< 2	< 2	290
2007	1	< 2		< 1	< 2	3	100
2007	15.4	< 2		< 1	< 2	4	290
2010	1	< 2		< 1	< 2	< 2	120
2010	13.6	< 2		< 1	< 2	< 2	210

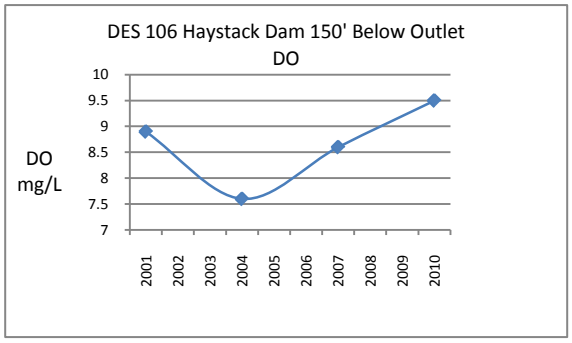
DES 003	Depth	Lead (µg/L)	Magnesium (mg/L)	Manganese (µg/L)	Mercury (µg/L)	Potassium (µg/L)	Selenium (µg/L)	Zinc (µg/L)
2001	1	< 2	4.8	20	< 0.2	1.7	< 2	< 5
2001	12.9	< 2	4.6	< 10	< 0.2	1.6	< 2	10
2004	1	< 2	3.2	20	< 0.2	1.4	< 2	< 5
2004	12.4	< 2	3.3	50	< 0.2	1.4	< 2	< 5
2007	1	< 2	3.8	10	< 0.2	1.6	< 2	< 5
2007	15.4	< 2	3.8	40	< 0.2	1.6	< 2	< 5
2010	1	< 2	3.4	< 10	< 5	1.4	< 2	< 5
2010	13.6	< 2	3.5	18	< 5	1.9	< 2	< 5

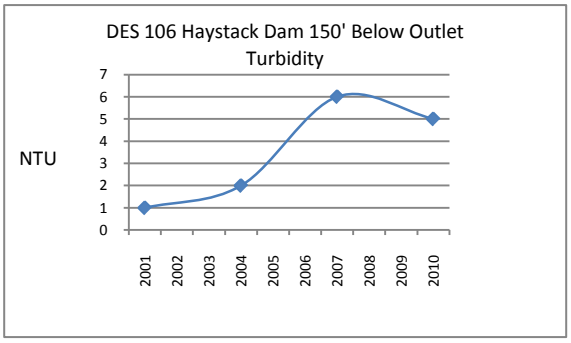
DES 003							
Date	Depth (m)	N (mg/L)	TKN (mg/L)	OP (mg/L)	TP (mg/L)	TSS (mg/L)	NTU
2001	1	0.02	0.21	0.052	0.075	4	1
2001	12.9	< 0.01	1.32	0.015	0.119	16	3
2004	1	< 0.01	0.29	0.028	0.043	1	2
2004	12.4	< 0.01	0.45	0.039	0.066	7	4
2007	1	< 0.01	0.25	0.029	0.057	2	2
2007	15.4	0.01	0.37	0.051	0.083	9	6
2010	1	< 0.01	0.4	0.017	0.067	6	2
2010	13.6	< 0.01	0.36	0.022	0.073	6	3

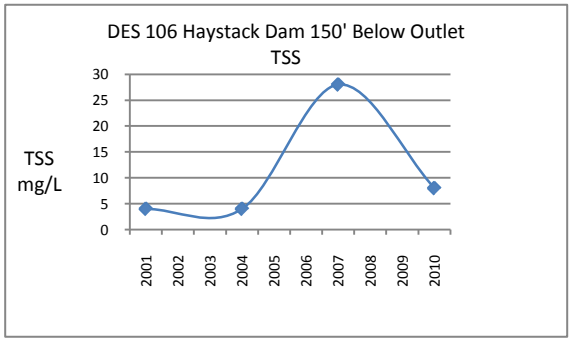
DES 003			
Date	**Depth (m)**	**DO (mg/L)**	**pH**
7/23/2001	1	14.3	8.3
7/23/2001	3	10.4	8.8
7/23/2001	5	9.7	8.72
7/23/2001	7	9.6	8.66
7/23/2001	9	9.2	8.65
7/23/2001	11	9.1	8.61
7/23/2001	12.9	8	8.47
7/15/2004	1	7.7	8.54
7/15/2004	3	7.7	8.49
7/15/2004	5	7.4	8.37
7/15/2004	7	7.3	8.32
7/15/2004	9	7.1	8.26
7/15/2004	11	6.4	8.05
7/15/2004	12.4	5.5	7.69
7/26/2007	1	7.3	8
7/26/2007	3	9.3	8.25
7/26/2007	5	8.7	8.15
7/26/2007	7	8.4	8.13
7/26/2007	9	7.8	8.06
7/26/2007	11	7.1	8.09
7/26/2007	15.4	5.1	7.7
7/29/2010	1	9.4	8.4
7/29/2010	3	8.8	8.37
7/29/2010	5	8.8	8.45
7/29/2010	7	8.8	8.48
7/29/2010	9	8.8	8.48
7/29/2010	11	8.8	8.46
7/29/2010	12.4	8.5	8.1

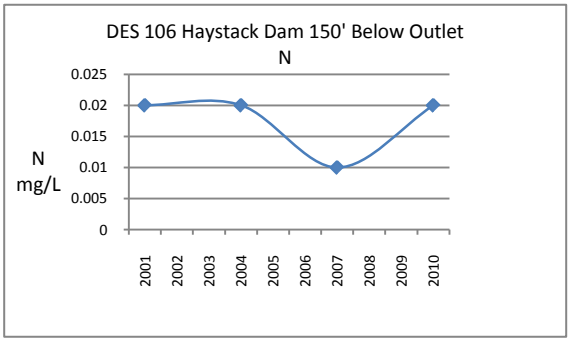
Site DES 106

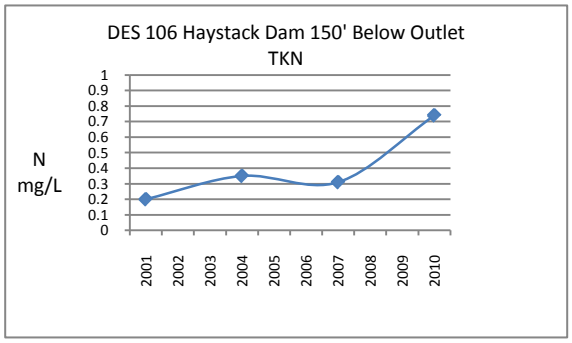
Approximately 50 meters below the outlet for Haystack Reservoir, in the North Unit Main Canal, is the next site in the Lower Deschutes subbasin. Here DO concentrations ranged from 7.6 mg/L to 9.5 mg/L. Turbidity at this site ranged from 1 NTU to 6 NTU. TSS concentrations ranged from 4 mg/L to 28 mg/L. Inorganic N concentrations were observed to be 0.02 mg/L except in 2007, when they were observed to be 0.01 mg/L. TKN concentrations ranged from 0.16mg/L to 0.36 mg/L. Concentrations of P ranged from 0.085 mg/L to 0.117 mg/L, and concentrations of OP ranged from 0.035 mg/L to 0.060 mg/L. Reported pH at this site ranged from 7.60 to 8.48. Metals data are presented in the tables following the graphs.

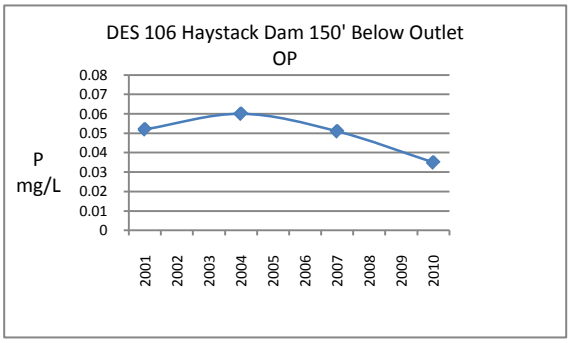


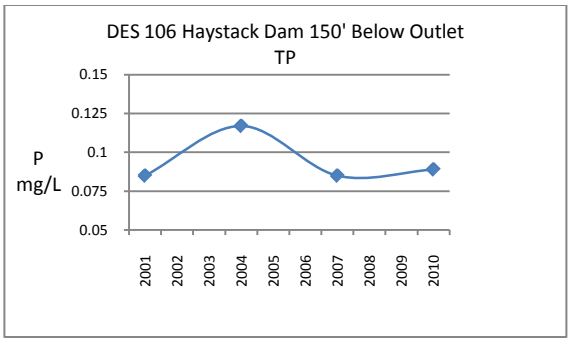


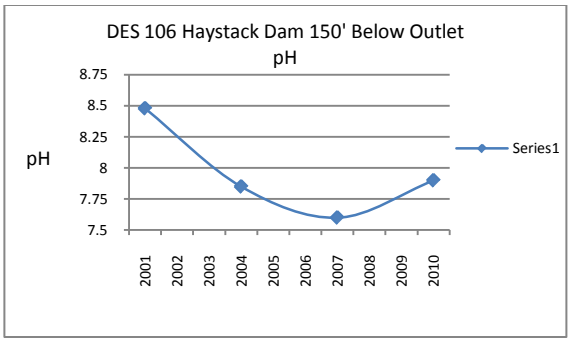












DES 106	Arsenic (µg/L)	Boron (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Copper (µg/L)	Iron (µg/L)
2001	< 2	60	< 1	< 2	< 2	140
2004	< 2	< 50	< 1	< 2	< 2	180
2007	< 2		< 1	< 2	4	350
2010	< 2		2	< 2	2	300

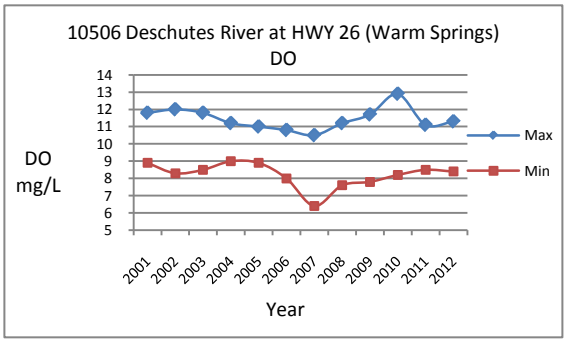
DES106	Lead (µg/L)	Magnesium (mg/L)	Manganese (µg/L)	Mercury (µg/L)	Potassium (µg/L)	Selenium (µg/L)	Zinc (µg/L)
2001	< 2	4.8	20	< 0.2	1.7	< 2	< 5
2004	< 2	2.9	40	< 0.2	1.8	< 2	< 5
2007	< 2	3.8	30	< 0.2	1.6	< 2	< 5
2010	< 2	3.8	20	< 5	1.6	< 2	8

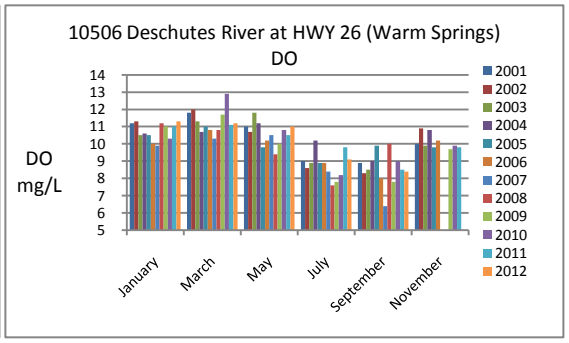
DES 106								
Date	DO (mg/L)	N(mg/L)	TKN(mg/L)	OP(mg/L)	pH	TP(mg/L)	TSS(mg/L)	NTU
2001	8.9	0.02	0.2	0.052	8.48	0.085	4	1
2004	7.6	0.02	0.35	0.06	7.85	0.117	4	2
2007	8.6	0.01	0.31	0.051	7.6	0.085	28	6
2010	9.5	0.02	0.74	0.035	7.9	0.089	8	5

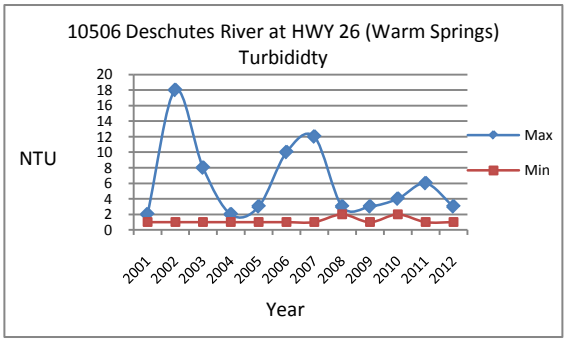
Site 10506

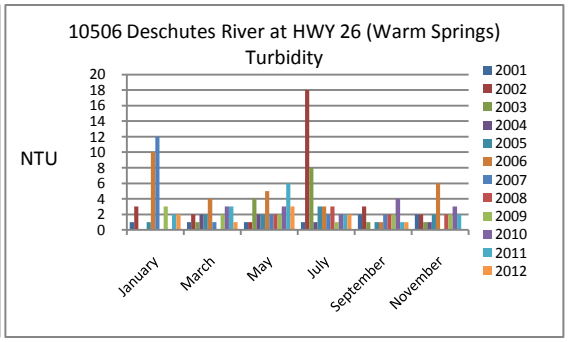
The next site is on the Deschutes River at Highway 26 near Warm Springs, and below Pelton Reregulating Reservoir. DO concentrations typically were lowest in July and ranged from 6.4 mg/L to 12.9 mg/L data suggest an overall decreasing trend in concentrations of DO. Turbidity at this site ranged from 1 NTU to 18 NTU, and typically increased from May to July. TSS concentrations ranged from less than 1 mg/L to 18 mg/L. Inorganic N ranged from 0.112 mg/L to 0.316 mg/L. Concentrations

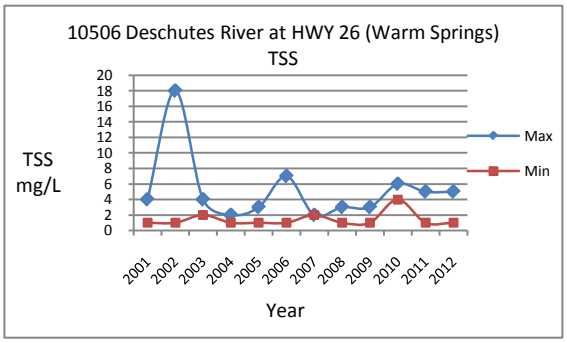
appeared to be lowest in May and July and higher in January through March. TKN data were collected through 2006, and concentrations remained below detection limits except for July and November of 2003 and May of 2004, when concentrations were observed to be 0.2 mg/L. Concentrations of TP ranged from 0.06 mg/L to 0.14 mg/L. Concentrations of OP ranged from less than 0.005 mg/L to 0.086 mg/L. Reported pH at this site ranged from 7.7 to 9.0. Metals data were collected only in 2010 and are available in LASAR.

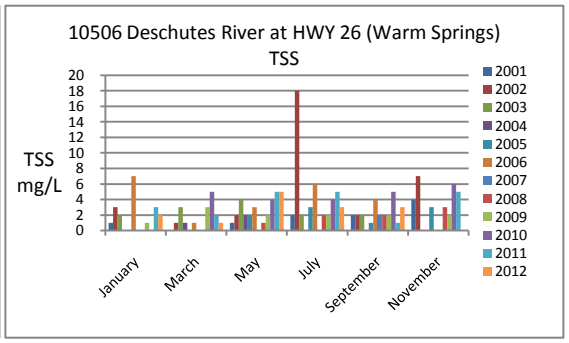


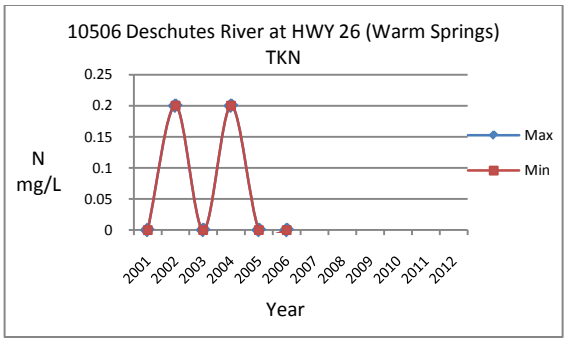


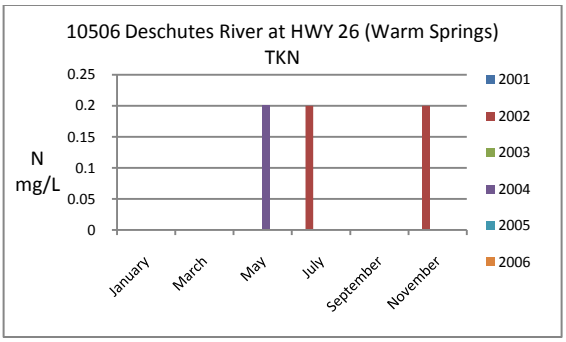


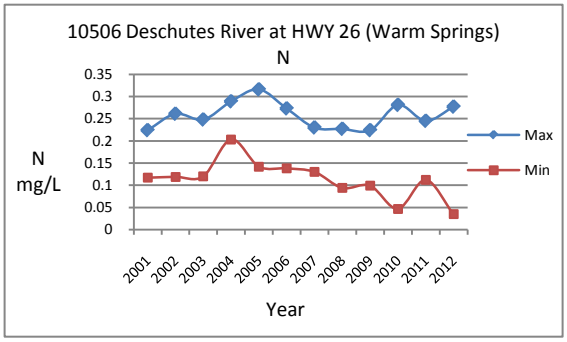


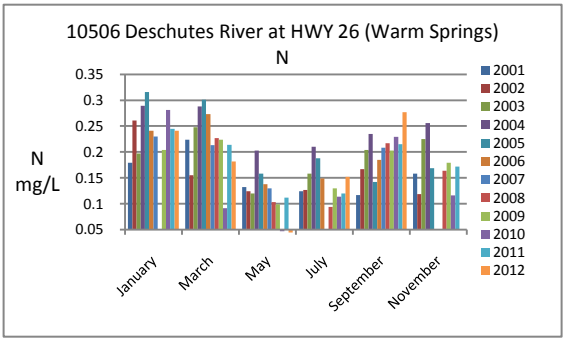


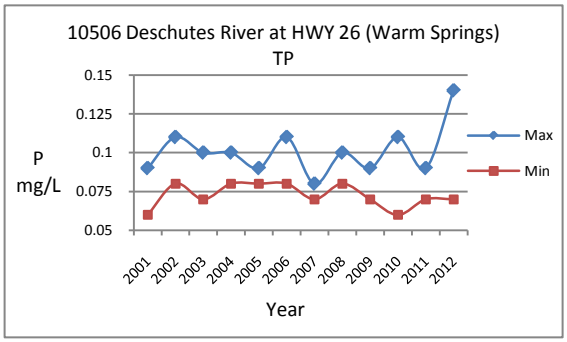


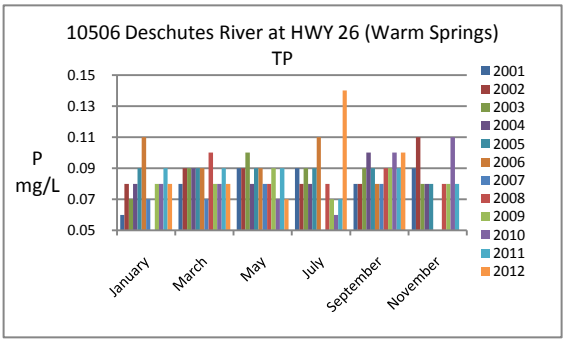

10506 Deschutes River at HWY 26 (Warm Springs)
TKN
N
mg/L
0.25
0.2
0.15
0.1
0.05
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
Max
Min

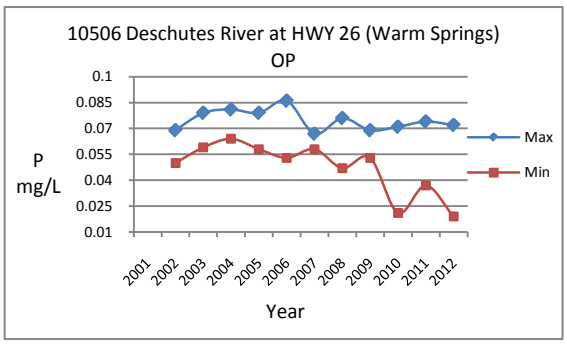

10506 Deschutes River at HWY 26 (Warm Springs)
TKN
N
mg/L
0.25
0.2
0.15
0.1
0.05
0
January
March
May
July
September
November
2001
2002
2003
2004
2005
2006

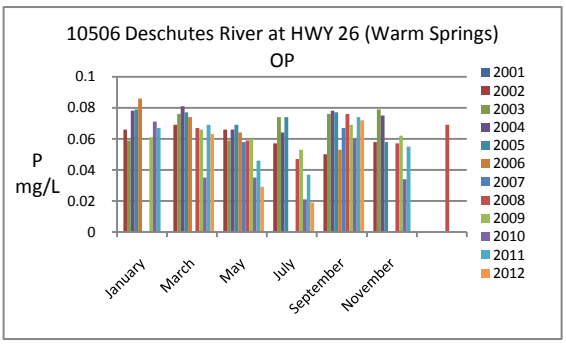

10506 Deschutes River at HWY 26 (Warm Springs)
N
N
mg/L
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
Max
Min

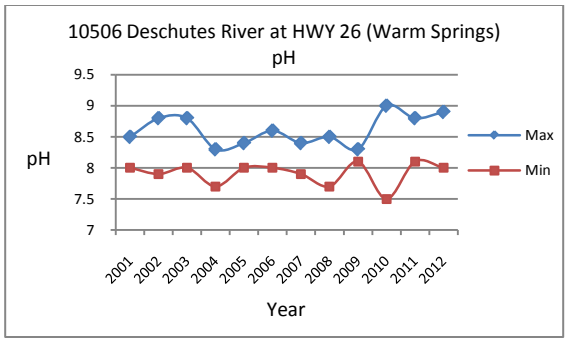

10506 Deschutes River at HWY 26 (Warm Springs)
N
N
mg/L
0.35
0.3
0.25
0.2
0.15
0.1
0.05
January
March
May
July
September
November
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012

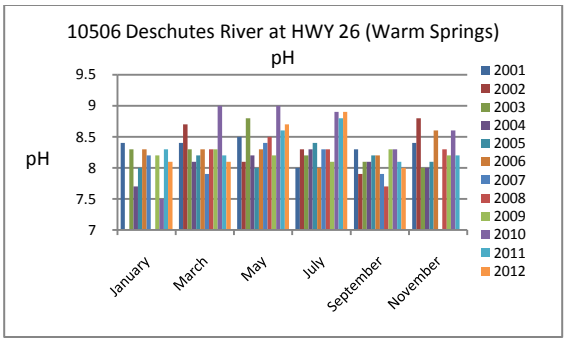

10506 Deschutes River at HWY 26 (Warm Springs)
TP
P
mg/L
0.15
0.125
0.1
0.075
0.05
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
Max
Min


10506 Deschutes River at HWY 26 (Warm Springs)
TP
P
mg/L
0.15
0.13
0.11
0.09
0.07
0.05
January
March
May
July
September
November
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012


10506 Deschutes River at HWY 26 (Warm Springs)
OP
P
mg/L
0.1
0.085
0.07
0.055
0.04
0.025
0.01
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
Max
Min


10506 Deschutes River at HWY 26 (Warm Springs)
OP
P
mg/L
0.1
0.08
0.06
0.04
0.02
0
January
March
May
July
September
November
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012





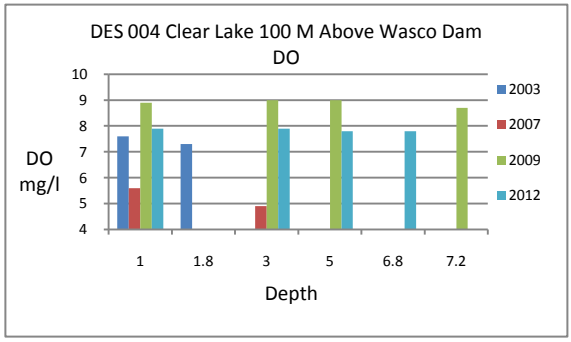
10506								
Date	**OP (mg/L)**	**DO (mg/L)**	**pH**	**NTU**	**N (mg/L)**	**TKN (mg/L)**	**TP (mg/L)**	**TSS (mg/L)**
1/22/2001		11.2	8.4	1	0.179	<0.2	0.06	1
3/12/2001		11.8	8.4	1	0.224	<0.2	0.08	<1
5/7/2001		11	8.5	1	0.132	<0.2	0.09	1
7/9/2001		9	8	1	0.124	<0.2	0.09	2
9/10/2001		8.9	8.3	2	0.117	<0.2	0.08	2
11/5/2001		10	8.4	2	0.158	<0.2	0.09	4
1/28/2002	0.066	11.3		3	0.261	<0.2	0.08	3
3/28/2002	0.069	12	8.7	2	0.155	<0.2	0.09	1
5/28/2002	0.066	10.7	8.1	1	0.124	<0.2	0.09	2
7/25/2002	0.057	8.6	8.3	18	0.127	0.2	0.08	18
9/23/2002	0.05	8.3	7.9	3	0.167	<0.2	0.08	2
11/4/2002	0.058	10.9	8.8	2	0.119	0.2	0.11	7
1/27/2003	0.059	10.5	8.3	<1	0.197	<0.2	0.07	2
3/18/2003	0.076	11.3	8.3	1	0.248	<0.2	0.09	3
5/22/2003	0.059	11.8	8.8	4	0.12	<0.2	0.1	4
8/7/2003	0.074	8.9	8.2	8	0.158	<0.2	0.09	2
9/22/2003	0.076	8.5	8.1	1	0.204	<0.2	0.09	2
11/17/2003	0.079	9.9	8	1	0.225	<0.2	0.08	<1
1/26/2004	0.078	10.6	7.7	<1	0.289	<0.2	0.08	<1
3/22/2004	0.081	10.7	8.1	2	0.288	<0.2	0.09	1
5/24/2004	0.066	11.2	8.2	2	0.203	0.2	0.08	2
7/29/2004	0.064	10.2	8.3	1	0.21	<0.2	0.08	<1
9/13/2004	0.078	9	8.1	<1	0.235	<0.2	0.1	<1
11/16/2004	0.075	10.8	8	1	0.256	<0.2	0.08	<1
1/24/2005	0.079	10.5	8	1	0.316	<0.2	0.09	<1
3/7/2005	0.077	11	8.2	2	0.301	<0.2	0.09	<1
5/16/2005	0.069	9.8	8	2	0.158	<0.2	0.09	2

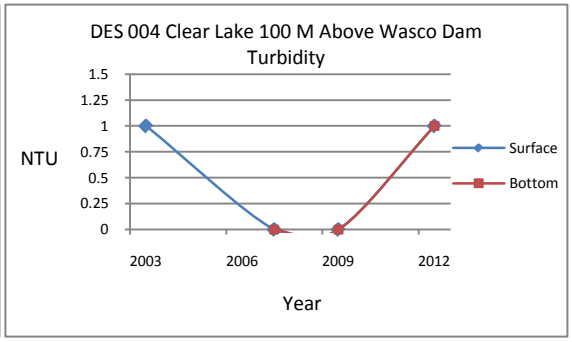
10506								
Date	OP (mg/L)	DO (mg/L)	pH	NTU	N (mg/L)	TKN (mg/L)	TP (mg/L)	TSS (mg/L)
7/21/2005	0.074	8.9	8.4	3	0.188	<0.2	0.09	3
9/12/2005	0.077	9.9	8.2	1	0.142	<0.2	0.09	1
11/7/2005	0.058	9.8	8.1	2	0.169	<0.2	0.08	3
1/9/2006	0.086	10	8.3	10	0.241	<0.2	0.11	7
3/16/2006	0.074	10.8	8.3	4	0.273	<0.2	0.09	1
5/22/2006	0.064	10.2	8.3	5	0.138	<0.2	0.09	3
7/17/2006	<0.005	8.9	8	3	0.149	<0.2	0.11	6
9/18/2006	0.053	8	8.2	1	0.185	<0.2	0.08	4
11/6/2006		10.2	8.6	6				
1/22/2007		9.9	8.2	12	0.23		0.07	
3/19/2007		10.3	7.9	1	0.213		0.07	
5/14/2007	0.058	10.5	8.4	2	0.13		0.08	
7/23/2007		8.4	8.3	2				
9/4/2007	0.067	6.4	7.9	2	0.208		0.08	2
3/10/2008	0.067	11.2	8.3	<1	0.227		0.1	<1
5/4/2008	0.059	10.8	8.5	2	0.103		0.08	1
6/30/2008	0.047	9.4	8.3	3	0.094		0.08	2
9/29/2008	0.076	7.6	7.7	2	0.217		0.09	2
11/17/2008	0.057	10	8.3	2	0.164		0.08	3
1/26/2009	0.061	11	8.2	3	0.204		0.08	1
3/23/2009	0.066	11.7	8.3	2	0.224		0.08	3
5/11/2009	0.06	10	8.2	2	0.099		0.09	2
7/27/2009	0.053	7.8	8.1	1	0.13		0.07	2
9/29/2009	0.069	7.8	8.3	2	0.203		0.09	2
11/16/2009	0.062	9.7	8.2	2	0.179		0.08	2
1/25/2010	0.071	10.3	7.5	<1	0.281		0.08	<1
3/22/2010	0.035	12.9	9	3	0.0914		0.08	5
5/17/2010	0.035	10.8	9	3	0.0469		0.07	4
7/26/2010	0.021	8.2	8.9	2	0.114		0.06	4
9/20/2010	0.06	9	8.3	4	0.229		0.1	5
11/1/2010	0.034	9.9	8.6	3	0.116		0.11	6
1/24/2011	0.067	11	8.3	2	0.245		0.09	3
3/24/2011	0.069	11.1	8.2	3	0.214		0.09	2
5/23/2011	0.046	10.5	8.6	6	0.112		0.09	5
7/18/2011	0.037	9.8	8.8	2	0.12		0.07	5
9/26/2011	0.074	8.5	8.1	1	0.215		0.09	1

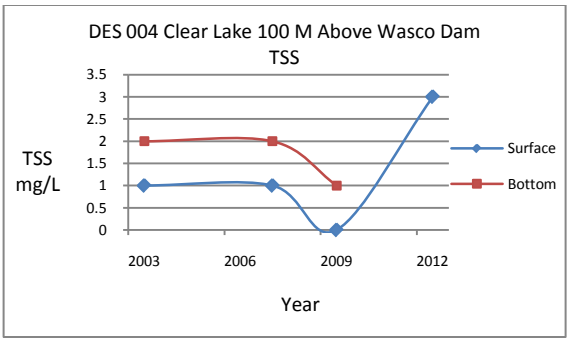
10506								
Date	OP (mg/L)	DO (mg/L)	pH	NTU	N (mg/L)	TKN (mg/L)	TP (mg/L)	TSS (mg/L)
11/14/2011	0.055	9.8	8.2	2	0.172		0.08	5
1/23/2012		11.3	8.1	2	0.241		0.08	2
3/26/2012	0.062	11.2	8.1	1	0.178		0.08	1
3/26/2012	0.063	11.2	8.2	1	0.182		0.08	1
5/14/2012	0.029	11	8.7	3	0.0348		0.07	5
7/23/2012	0.019	9.1	8.9	2	0.152		0.14	3
9/24/2012	0.072	8.4	8	1	0.277		0.1	3

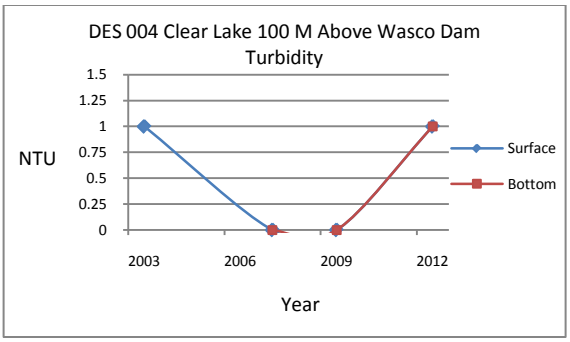
Site DES 004

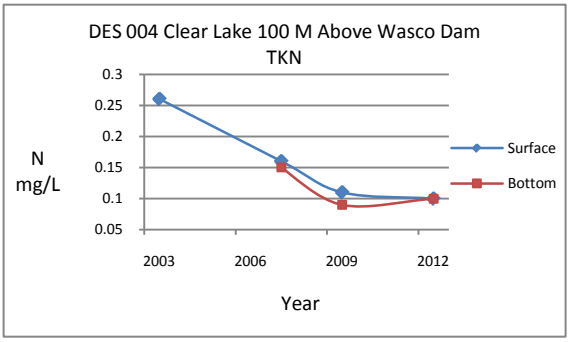
As part of the Lower Deschutes subbasin, Clear Lake is the next site with sufficient data. This lake reaches depths of only 2 to 5 meters. Data were collected approximately 100 meters above the dam in July of 2003, 2007, 2009, and 2012. DO concentrations at this site ranged from 5.6 mg/L to 8.9 mg/L at the surface and 4.9 mg/L to 8.7 mg/L at the bottom. Turbidity at this site was observed to range from less than 1 NTU to 1 NTU at and the same range was observed at the bottom. TSS concentrations were observed to be between <1 mg/L and 3.0 mg/L at the surface, and ranged from 1mg/L to 2 mg/L at the bottom. Inorganic N was less than 0.01 mg/L except for the 2003 surface sample, which was observed to be 0.01 mg/L. TKN concentrations ranged from 0.10 mg/L to 0.26 mg/L at the surface and 0.09 mg/L to 0.15 mg/L at the bottom. Concentrations of TP were observed to be less than 0.01 mg/L at both the surface and bottom for every sampling date. OP concentrations were also less than detection limits at every sampling date, and at both depths. Chlorophyll-a data was collected and values ranged from 0.9 mg/m3 to 2.1 mg/m3. Reported pH at this site ranged from 6.58 to pH 7.65. Metals data are presented in the tables following the graphs.

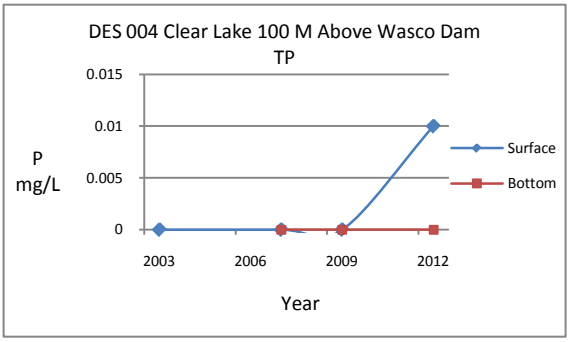


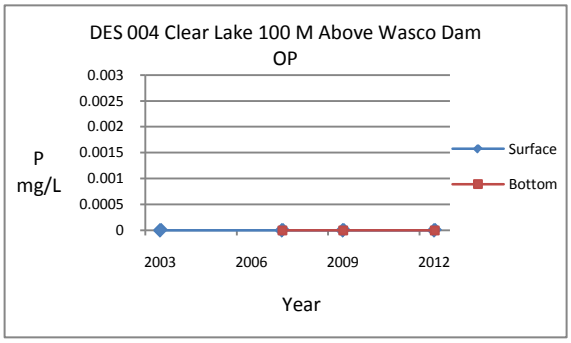


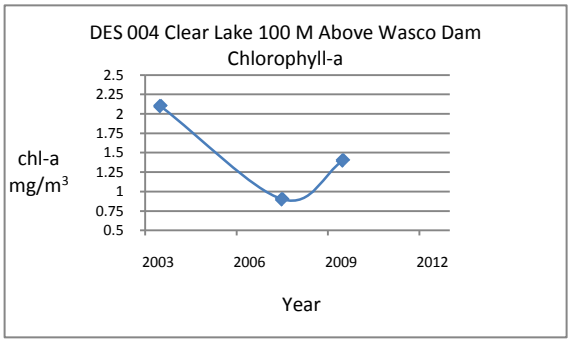

DES 004 Clear Lake 100 M Above Wasco Dam
TSS
TSS mg/L
3.5
3
2.5
2
1.5
1
0.5
0
2003
2006
2009
2012
Year
Surface
Bottom

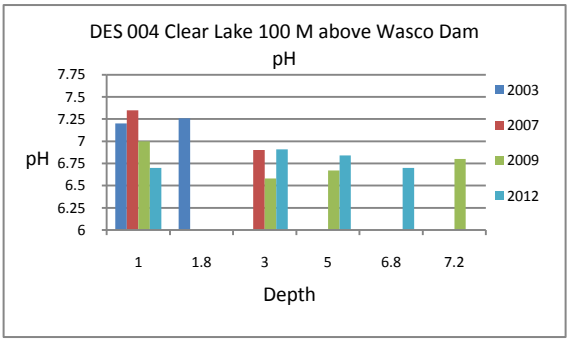

DES 004 Clear Lake 100 M Above Wasco Dam
Turbidity
NTU
1.5
1.25
1
0.75
0.5
0.25
0
2003
2006
2009
2012
Year
Surface
Bottom


DES 004 Clear Lake 100 M Above Wasco Dam
TKN
N mg/L
0.3
0.25
0.2
0.15
0.1
0.05
2003
2006
2009
2012
Year
Surface
Bottom


DES 004 Clear Lake 100 M Above Wasco Dam
TP
P mg/L
0.015
0.01
0.005
0
2003
2006
2009
2012
Year
Surface
Bottom


DES 004 Clear Lake 100 M Above Wasco Dam
OP
P mg/L
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
2003
2006
2009
2012
Year
Surface
Bottom


DES 004 Clear Lake 100 M Above Wasco Dam
Chlorophyll-a
chl-a mg/m3
2.5
2.25
2
1.75
1.5
1.25
1
0.75
0.5
2003
2006
2009
2012
Year


DES 004 Clear Lake 100 M above Wasco Dam
pH
pH
7.75
7.5
7.25
7
6.75
6.5
6.25
6
1
1.8
3
5
6.8
7.2
Depth
2003
2007
2009
2012

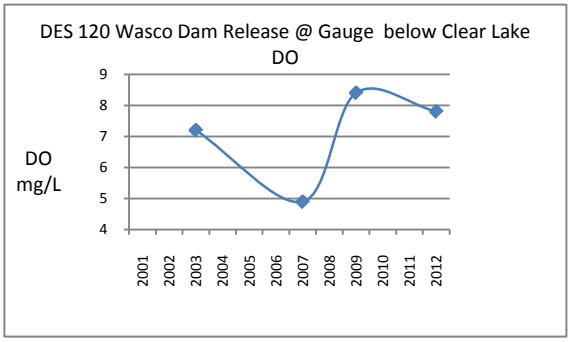
DES 004	Depth (m)	Arsenic (µg/L)	Boron (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Copper (µg/L)	Iron (µg/L)
2003	1	< 2	< 50	< 1	< 2	< 2	190
2003	1	< 2	< 50	< 1	< 2	< 2	190
2007	1	< 2		< 1	< 2	< 2	50
2007	3	< 2		< 1	< 2	< 2	50
2009	1	< 2		< 1	< 2	< 2	40
2009	7.2	< 2		< 1	< 2	< 2	80
2012	1	< 2		< 1	< 2	< 2	30
2012	6.8	< 2		< 1	< 2	< 2	50

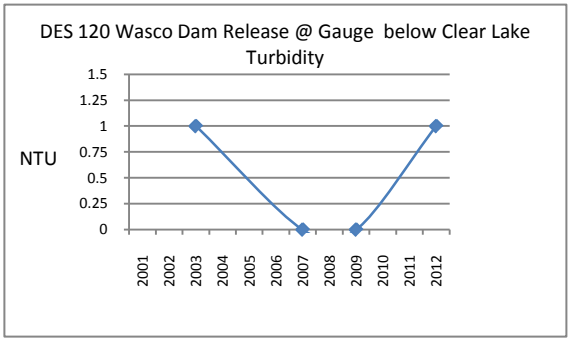
DES 004	Depth (m)	Lead (µg/L)	Magnesium (mg/L)	Manganese (µg/L)	Mercury (µg/L)	Potassium (µg/L)	Selenium (µg/L)	Zinc (µg/L)
2003	1	< 2	0.9	30	< 0.2	0.2	< 2	< 5
2003	1	< 2	0.8	20	< 0.2	< 0.2	< 2	< 5
2007	1	< 2	0.8	< 10	< 0.2	< 0.2	< 2	< 5
2007	3	< 2	0.8	10	< 0.2	< 0.2	< 2	< 5
2009	1	< 2	0.8	< 10	< 0.2	< 0.2	< 2	< 5
2009	7.2	< 2	0.8	< 10	< 0.2	< 0.2	< 2	< 5
2012	1	< 2	.08	< 10	8 ng/L	0.3	< 2	<5
2012	6.8	< 2	.08	< 10	<5 ng/ L	0.3	< 2	<5

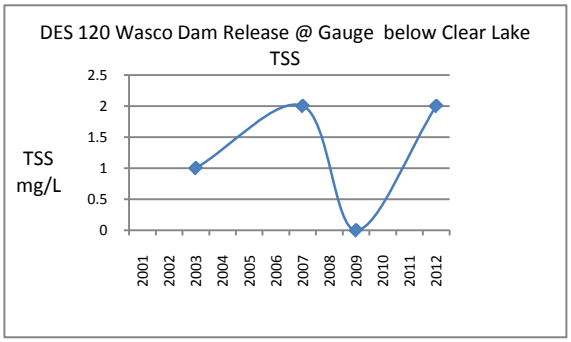
DES 004									
Date	**Depth (m)**	**DO (mg/L)**	**pH**	**N (mg/L)**	**TKN (mg/L)**	**OP (mg/L)**	**TP (mg/L)**	**TSS (mg/L)**	**NTU (mg/L)**
2003	1	7.6	7.2	0.01	0.26	< 0.003	< 0.01	1	1
2003	1.8	7.3	7.26						
2007	1	5.6	7.35	< 0.01	0.16	< 0.003	< 0.01	1	< 1
2007	3	4.9	6.9	< 0.01	0.15	< 0.003	< 0.01	2	< 1
2009	1	8.9	7	< 0.01	0.11	< 0.003	< 0.01	< 1	< 1
2009	3	9	6.58						
2009	5	9	6.67						
2009	7.2	8.7	6.8	< 0.01	0.09	< 0.003	< 0.01	2	< 1
2012	1			< 0.01	0.1	< 0.003	0.01	3	1
2012	1	7.9	6.7						
2012	3	7.9	6.91						
2012	5	7.8	6.84						
2012	6.8	7.8	6.7	< 0.01	0.1	< 0.003	< 0.01	1	1

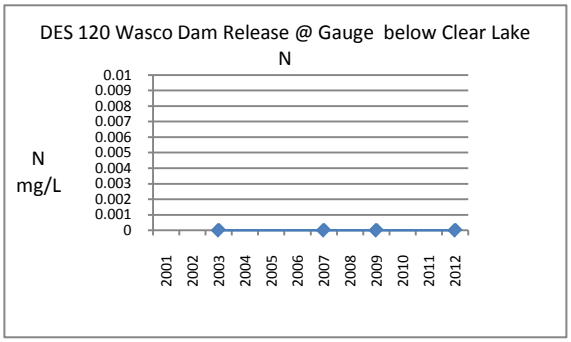
Site DES 120

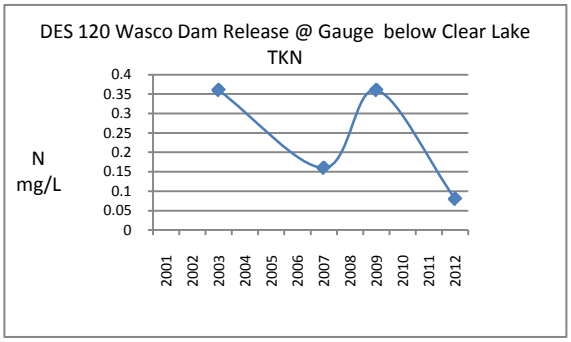
The next site is just below Clear Lake. DO at this site ranged from 7.6 mg/L to 9.5 mg/L. Turbidity was observed to be less than 1 NTU except for 2003 when it was observed to be 1 NTU. TSS concentrations ranged from less than 1 mg/L to 2 mg/L. Concentrations of inorganic N were observed to be less than detection at all three of the sampling dates. TKN concentrations ranged from 0.16 mg/L to 0.36 mg/L. Concentrations of P were less than detection all 3 years, as were OP concentrations. Values for pH were between 6.89 and 7.7 at this site. Metals data are presented in the tables following the graphs.

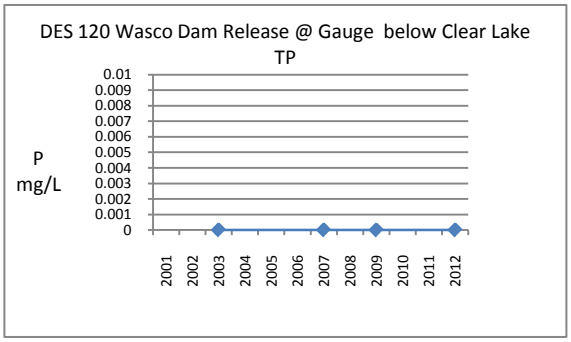


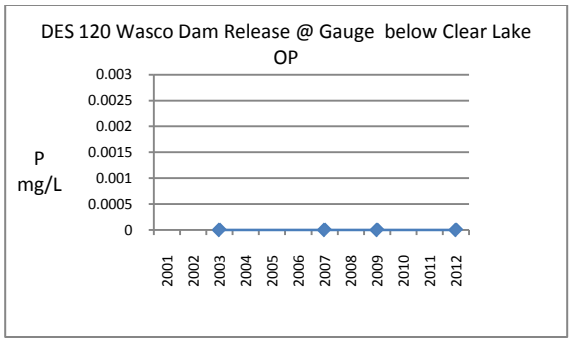


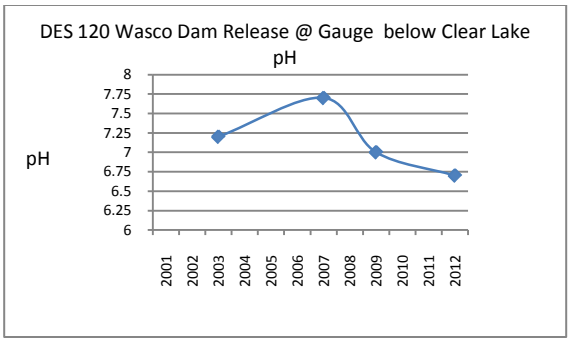












DES 120	Arsenic (µg/L)	Boron (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Copper (µg/L)	Iron (µg/L)
2003	< 2	< 50	< 1	< 2	< 2	200
2007	< 2		< 1	< 2	< 2	50
2009	< 2		< 1	< 2	< 2	40
2010	< 2		<1	< 2	< 2	80

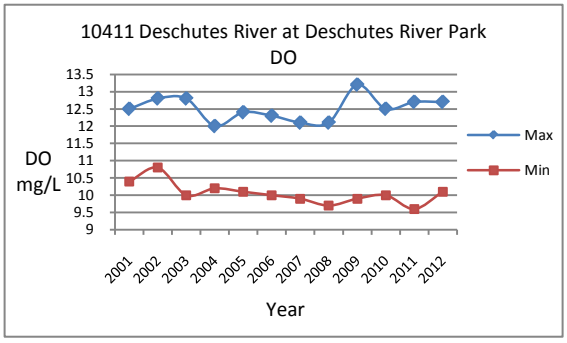
DES 120	Lead (µg/L)	Magnesium (mg/L)	Manganese (µg/L)	Mercury (µg/L)	Potassium (µg/L)	Selenium (µg/L)	Zinc (µg/L)
2003	< 2	0.9	30	< 0.2	0.2	< 2	< 5
2007	< 2	0.8	< 10	< 0.2	0.2	< 2	< 5
2009	< 2	0.8	< 10	< 0.2	0.4	< 2	< 5
2012	<2	0.8	13	<5 ng/L	0.3	<2	<5

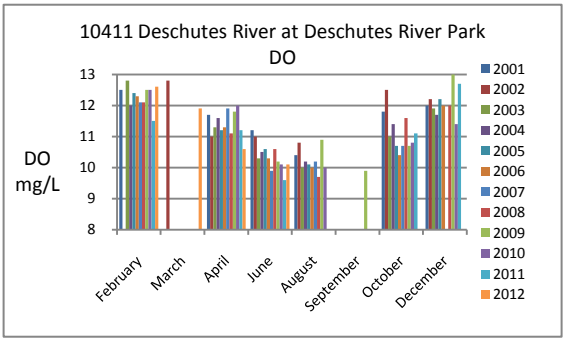
DES 120								
Date	DO (mg/L)	N (mg/L)	TKN (mg/L)	OP (mg/L)	pH	TP (mg/L)	TSS (mg/L)	NTU
2003	7.2	< 0.01	0.36	< 0.003	7.2	< 0.01	1	1
2007	4.9	< 0.01	0.16	< 0.003	7.7	< 0.01	2	< 1
2009	8.4	< 0.01	0.36	< 0.003	7	< 0.01	< 1	< 1
2012	7.8	< 0.01	0.08	< 0.003	6.7	< 0.01	2	1

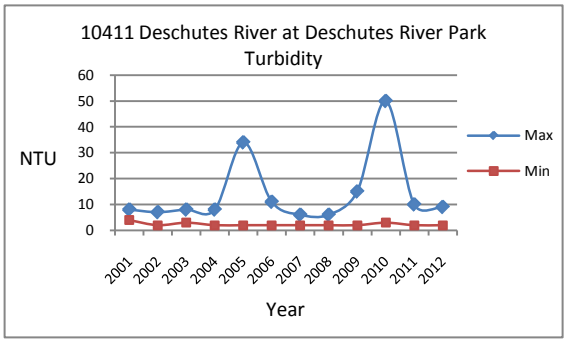
Site 10411

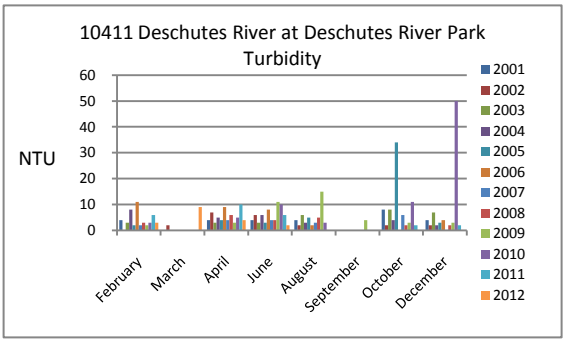
The last site on the Deschutes River is at the mouth, where it meets the Columbia River. At this site, DO concentrations ranged from 9.6 mg/L to 13.2 mg/L. Lowest concentrations were typically observed in June through September. Turbidity at this site ranged from 2 NTU to 50 NTU. In general, concentrations appeared to be higher during the first of the year, but the highest concentrations that were observed over the course of the sampling dates presented here, fell in October 2005 (33.5 NTU) and in December of 2010 (50 NTU). TSS concentrations ranged from 1 mg/L to 140 mg/L. Higher concentrations were typically observed from July through October, but like turbidity, the greatest concentration observed was in December of 2010 (140 mg/L). Inorganic N

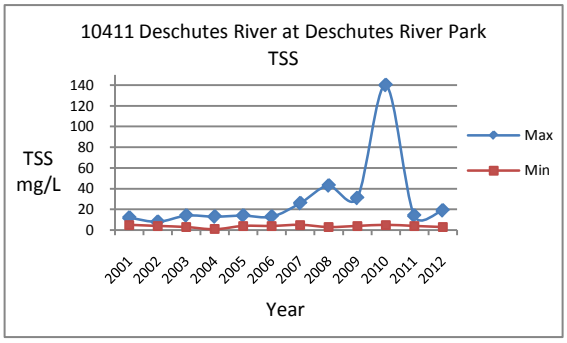
concentrations ranged from below detection limits to 0.276 mg/L. Concentrations were typically observed to be lowest in June, and highest in October through February. TKN data was collected from 2001 through 2006 and concentrations ranged from below detection limits to 0.35 mg/L, with no apparent annual patterns describing increases and decreases. Concentrations of P ranged from 0.060 mg/L to 0.165 mg/L. Concentrations fluctuated little from month to month, with a slight increase typically observable in October. Concentrations of OP ranged from 0.027 mg/L to 0.077 mg/L. Concentrations were typically observed to be lowest in April through June, and highest in October through February. Data suggest there was an overall decreasing trend for OP concentrations. Values for pH at this site ranged from 7.3 to 8.9. The data suggested that pH rises in June through September. Metals data were collected only in 2010 and are available in LASAR.

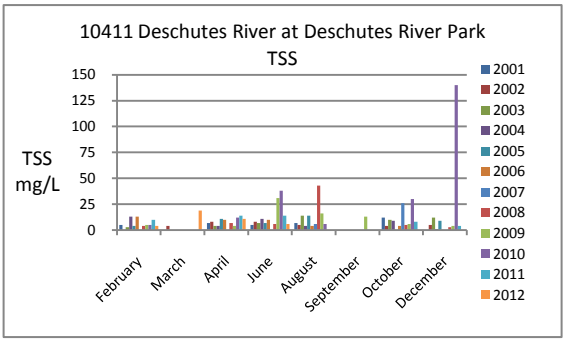


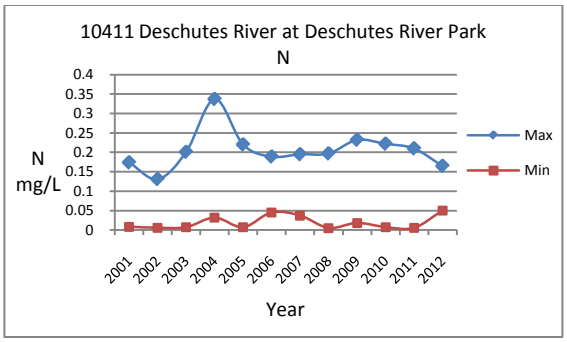


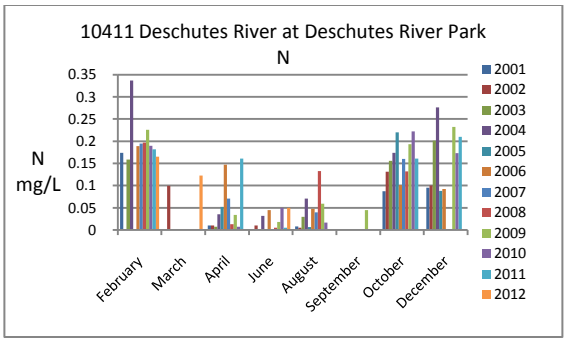


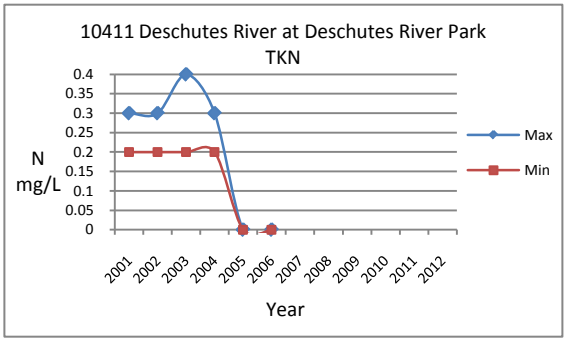


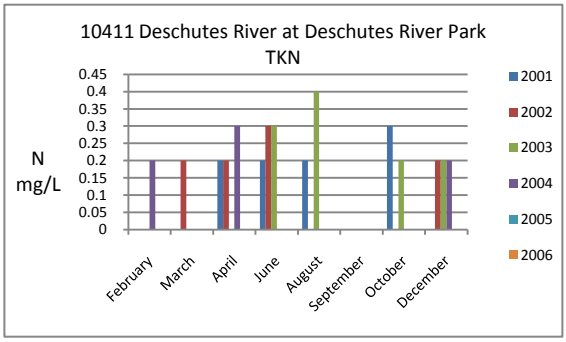


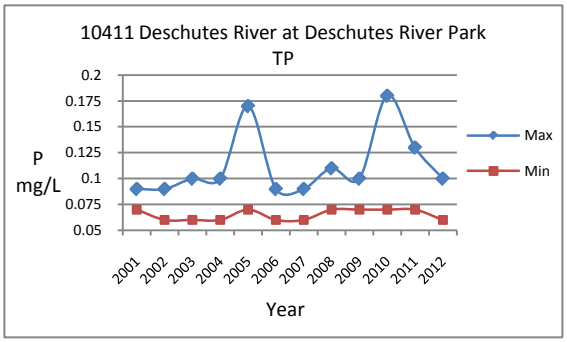


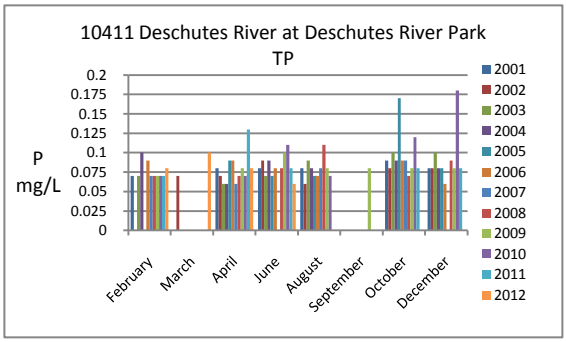

10411 Deschutes River at Deschutes River Park
N
N mg/L
Year
Max
Min

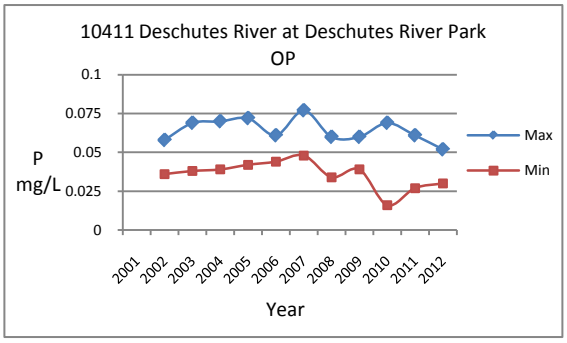

10411 Deschutes River at Deschutes River Park
N
N mg/L
February
March
April
June
August
September
October
December

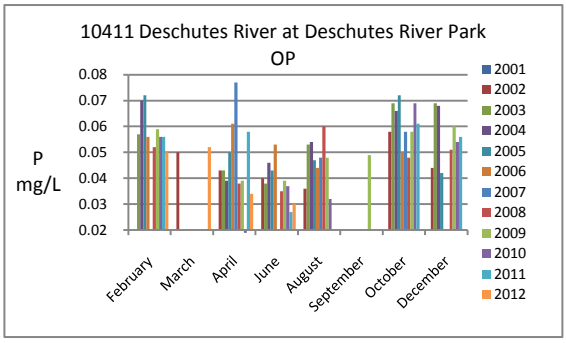

10411 Deschutes River at Deschutes River Park
TKN
N mg/L
Year
Max
Min

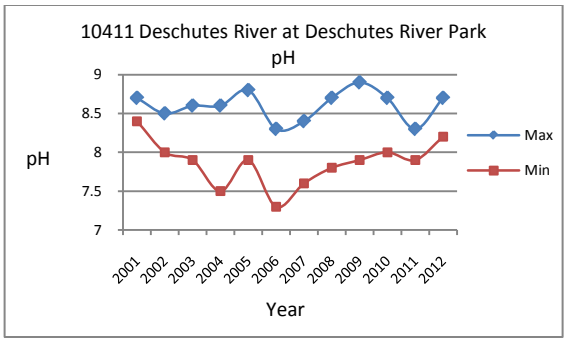

10411 Deschutes River at Deschutes River Park
TKN
N mg/L
February
March
April
June
August
September
October
December

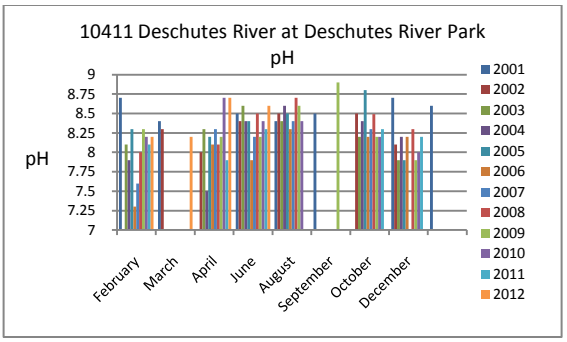

10411 Deschutes River at Deschutes River Park
TP
P mg/L
Year
Max
Min


10411 Deschutes River at Deschutes River Park
TP
P mg/L
February
March
April
June
August
September
October
December


10411 Deschutes River at Deschutes River Park
OP
P mg/L
Year
Max
Min


10411 Deschutes River at Deschutes River Park
OP
P mg/L
February
March
April
June
August
September
October
December





6.4 Trout Creek Subbasin

6.4.1 Introduction

There are limited data published for the Trout Creek subbasin; however, there are some data available in LASAR from the mid-2000s. The Jefferson SWCD has collected data in the past. There are limited data for turbidity and sedimentation for this subbasin, although the USFS has collected some sedimentation and turbidity data (Runyon et al. 2002).

Within the Trout Creek watershed, there are limited water quality data, with the exception of monitoring done by ODFW and the Ochoco National Forest (Runyon et al. 2002).

6.4.2 Current Conditions

This is a subbasin that has very little water quality data available such that no data were available that fit the criteria for inclusion in this report. There have been sampling projects, particularly on Mud Creek. Data were collected in 2007 and 2008, and are available in LASAR. These are possibly the most recent data. It is also possible that there are older data available. STORET contains one sample date for Trout Creek subbasin as well.

7. Summary

The Deschutes basin, with its corresponding subbasins, is a region that is diverse in its geography and land use. This report has attempted to identify the areas in which there are existing water quality data and areas that are lacking in data. It is apparent that more long-term water quality monitoring is needed to accurately assess the conditions in the region. Additionally, it will be vital to ascertain whether the conditions are a result of human activity, weather and climate patterns, or a natural part of the ecology of the region. Presently, only a few sites within the basin have had consistent long-term

monitoring. What underscores the necessity for consistent long-term monitoring sites are the Crooked River subbasin data. For example, the Crooked River data presented in this report are from late spring through early fall of three years. It is clear from these data that water quality can fluctuate year to year; however, it is unclear if these data are typical for the water bodies, or if it was an anomalous year for that region. In contrast, a site that has ten plus years of monitoring data, often year-round, such as the site at Harper Bridge on the Deschutes River, allows for a better understanding of the typical conditions in a given year. At a minimum, long-term data sets can be correlated with the shorter term monitoring projects. However, the spatial scale of the correlations should be closely scrutinized before such a correlation is made.

Large amounts of data have been collected over the years throughout the Deschutes basin; however, there is a lack of consistency in the parameters that have been analyzed. Similarly, there has been little consistency in the timing of sample procurement, and few, if any repeat sampling dates. Presentation and availability of water quality data is also inconsistent, with numerous SWCDs, irrigation districts, watershed alliances, and other entities all working (mostly) independent from each other. In order to achieve any measure of success in determining the health of the water bodies in this region, monitoring must be consistent, long term, and coordinated.

Presently, the following areas that are lacking either current data or have no data at all include:

- South Fork Crooked subbasin 1070303
  - Major waterbodies lacking data
    - Twelvemile Creek (and reservoirs)
    - South Fork (Logan Reservoir)
    - Beaver Creek
    - Grindstone Creek
- Upper Crooked subbasin 1070304
  - Major waterbodies lacking data
    - Bear Creek
    - North Fork near Gray Creek
- Lower Crooked subbasin 17070305
  - Major waterbodies lacking data
    - Dry River
    - Mill Creek
    - Ochoco Creek near Canyon Creek
    - McKay Creek upstream
    - Allen Creek
    - Dry Creek

- Upper Deschutes subbasin 17070301
  - Major waterbodies lacking data
    - Tumalo Creek
    - McKenzie Canyon
    - Squaw Creek
    - Fly Creek
- Little Deschutes subbasin 17070302
  - Major waterbodies lacking data
    - Crescent Creek
    - Paulina Creek
    - Paulina Reservoir
- Lower Deschutes subbasin 17070306
  - Major waterbodies lacking data
    - Seekseequa Creek
    - Willow Creek
    - Shitike Creek
    - Warm Springs River
    - Mill Creek
    - Badger Creek (Warm Springs river tributary)
    - Beaver Creek
    - Wapinita Creek
    - White River
    - Badger Creek (White River tributary)
    - Deep Creek
    - Bakoven Creek
    - Buck Hollow Creek
- Trout Creek subbasin 17070307
  - Major waterbodies lacking data
    - Trout Creek
    - Mud Springs Creek
    - Hay Creek
    - Wilson Creek
    - Antelope Creek
    - Ward Creek

Potential methods to address the data gaps include identifying waterbodies that have historically had bull trout populations, and implementing sampling programs in these areas. Because there is little data regarding metals and toxins, bull trout tissue samples, could be obtained, and sampling programs implemented based on any accumulations of toxins that might be present. If bull trout are not available, tissue samples from other large predatory fish species of the same trophic level could potentially be obtained.

In addition to areas with historic bull trout populations, implementing regular sampling events both above and below areas such as urban, recreation, and agricultural areas, along the Deschutes River and its major tributaries could help identify areas of concern. In addition, further sampling above and below the mouths of tributaries that run through urban, agricultural, recreational and mining (including historic areas that may not be active currently) areas, would further help to identify areas of concern including any factors that could be contributing to impairment. The parameters that would be beneficial to identify would be total and dissolved nutrients, dissolved oxygen, pH, turbidity, and sediment.

8. Literature Cited

Parenthetical Reference	Bibliographic Citation
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Davis and Kunkle 2010	Davis, Tom H. and Clair Kunkle. 2010. *Native Fish of the Upper Deschutes Status and Recommended Restoration Actions*.

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ODEQ 2007	Oregon Department of Environmental Quality. 2007. *Willow Creek Subbasin Temperature, pH, and Bacteria TMDL and WQMP.* Pendleton, Oregon.
Reclamation 2003	Bureau of Reclamation. 2003. *Operations Description of the Dechutes River Basin Projects.* U.S. Department of the Interior. Pacific Northwest Region. Lower Columbia Area Office. Portland, Oregon.
Runyon et al. 2002	Runyon, John, Ed Salminen, Nancy Napp, Bob Denman, and Jenny Allen. 2002. *Trout Creek Watershed Assessment.* Watershed Professionals Network.
Thalacker et al. 2009	Thalacker, Marc, Leonard Knott, Rex Barber, Gordon DeArmond, Bill Grafton, Bob Mullong, Larry Roofener, Dan Sherwin, and Terry Penhollow. 2009. *Upper Deschutes Agriculture Water Quality Management Plan.* Redmond: Deschutes Soil and Water Conservation District.
Whitman 2002	Whitman, Tina. 2002. *Crooked River Watershed Assessment.* Crooked River Watershed Council. Prineville, Oregon.

Appendix

Water quality reports not used as reference in the above report, but are potentially valuable for historical or background information are included here. These articles were not included for a variety of reasons, including non-specific data, data older than 2001, or data that has no listing of collection sites and/or dates. The websites listed can also provide additional information.

Non-subbasin specific reports and websites:

1. Biota Pacific Environmental Sciences, Inc., R2 Resource Consultants, Inc., Newton Consultants, Inc. 2011. *Assessment of Potential Gaps in Data Needed to Include Steelhead and Bull Trout as Covered Species in the Deschutes Basin Multi-species Habitat Conservation Plan*. Prineville, Oregon.
2. Biota Pacific Environmental Sciences, Inc., R2 Resource Consultants, Inc. 2011. *Assessment of the Potential Effects of Deschutes Basin Irrigation Activities and City of Prineville Activities on Federally-listed Fish Species*. Prineville, Oregon.
3. Oregon Department of Environmental Quality current 303(d) listings www.deq.state.or.us/assessment/assessment.htm
4. Environmental Protection Agency STORET database. www.epa.gov/storet/
5. Oregon Water Resources Department. http://www.oregon.gov/owrd/Pages/index.aspx
6. Oregon Water Resources Congress. http://www.owrc.org/index.php

Crooked River

1. Crooked River Local Advisory Committee. 2010. *Crooked River Agricultural Water Quality Management Area Plan*. Prineville, Oregon.

Upper Crooked River

1. Crooked County Soil and Water Conservation District. 2007. *Camp Creek Watershed Assessment*. Prineville, Oregon.

Upper and Little Deschutes

1. Yake, Kolleen E. 2003. *Upper Deschutes Subbasin Assessment*. Bend, Oregon.
2. Upper Deschutes Watershed Council. 2002. *Little Deschutes River Subbasin Assessment*. Bend, Oregon.
3. Breuner, Nancy. 2000-2002. *A Review of Water Quality Monitoring in the Upper Deschutes and Little Deschutes Subbasins*. Bend, Oregon.

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5. Jones, Lesley. 2007. *Upper Deschutes Watershed Council Water Quality Monitoring Program Technical Review*. Bend, Oregon.

6. Upper Deschutes Watershed Council. 2002. *Little Deschutes River Subbasin Assessment*. Bend, Oregon.

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