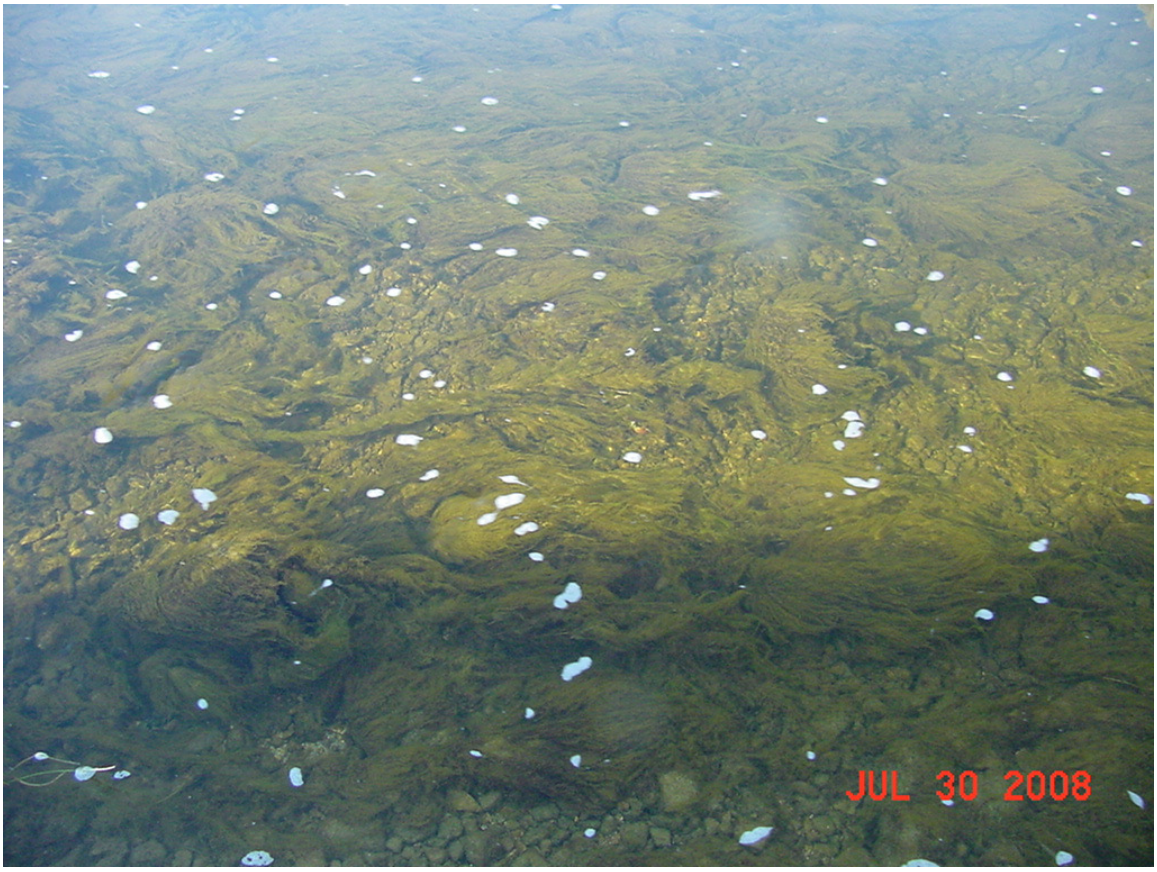
Upper Humboldt Basin Nutrient Investigations – 2008

April 2009



Algae in South Fork Humboldt River below Dixie Creek, July 2008

Prepared by:
Nevada Division of Environmental Protection
Bureau of Water Quality Planning

Upper Humboldt Basin Nutrient Screening Results - 2008

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Introduction

A number of stream reaches within the Upper Humboldt River basin are listed in 2006 303(d) List for exceedances of phosphorus standards. However, NDEP is not confident that these waters are actually experiencing eutrophication problems. As discussed by TetraTech (2005), the use of nutrient concentrations alone are poor predictors of assessing eutrophication impacts. Also, Dodds et al. (2002) examined data from over 600 streams and found that nutrients concentrations accounted for less than half of the variance in the benthic algae biomass. They speculated that other factors, such as flow, light availability, channel conditions, grazing, etc. were responsible for the remaining variability.

Before a large amount of resources are potentially devoted to developing TMDLs and control strategies for these Listed waters, NDEP believes it is advisable to undertake field investigations to evaluate their eutrophication status. This report presents the results of these 2008 nutrient screening activities of selected waters in the Upper Humboldt basin.

During the field activities, high algae levels were observed in the lower South Fork Humboldt River (below South Fork Reservoir). As this river is not on the 303(d) List for nutrients, further investigations were deemed appropriate in order to better understand and characterize the problem. The results of these preliminary investigations are also included in this report.

Background and Methods

Nutrient Assessment Protocols for Wadeable Streams in Nevada (2007) discusses a multi-tiered approach for assessing nutrient impairment status. In general, the assessment tiers are as follows. First, a Level I assessment can be performed to rather quickly identify possible problem areas. A Level I assessment is primarily qualitative in nature allowing for rapid assessments of numerous sites. If the Level I assessment indicates a possible nutrient problem, a Level II assessment is initiated which involves more quantitative measurements.

Level I Assessment

The Level I assessment relies primarily upon qualitative estimates of algal biomass as an indicator for possible next assessment steps. Under this assessment, reaches of interest are visually surveyed and the percentage of the stream bottom covered by filamentous algae, microalgae, and macrophytes are estimated by field personnel. Given the spatial and temporal variability of algal biomass, it is recommended that numerous locations be evaluated two or more times during the growing season. As water conditions can be highly variable, it may be necessary to visit the assessment site during two or more years. For this report, surveys have only been performed during the summer of 2008. It is also suggested that the field crews look for sites with the greatest potential for algae growth (limited shading, adequate substrate, etc.). However for the streams investigated for this study, land ownership greatly dictated survey locations.

It is recognized that there are no clear cut %cover levels at which impairment can be assumed to occur. However based upon the best available information, Nevada's Level I protocols currently recommend that Level II assessments be undertaken when the combined microalgae (>1 mm thick), macroalgae (filamentous, etc.), and macrophytes cover more than 50% of the stream. The appropriateness of the >50% threshold needs to be tested over time. Some researchers have identified algae cover levels of 20 to

40% as affecting recreation and aquatic life uses. Regardless of the result of the Level I assessment, it may be desirous to perform a Level II assessment to better understand the system under study.

Level II Assessment

Under the Level II assessment, more quantitative measurements of algal biomass along with measurements of daily minimum/maximum DO and pH levels are taken for comparison to the water quality standards or indicators. In addition to the parameters collected in Level I, the Level II assessment consists of collecting the following: algal characteristics (chlorophyll-a, ash free dry weight), DO, DO saturation, pH and temperature.

Summary of Sites Investigated

During the summer of 2008, a number of selected streams in the upper Humboldt watershed were investigated (Level I) for potential nutrient-related problems, such as excessive algae levels and depressed dissolved oxygen. Many of the waters were selected because of their inclusion on Nevada's 303(d) (See Table 1). It was desireable to determine whether or not eutrophic-type conditions actually existed in these waters. Other waters were included (such as the South Fork Humboldt River) as high algae levels were observed and were of interest in better understanding nutrient conditions in the watershed.

Table 1. Upper Humboldt Basin Waters on the 2006 303(d) List for Total Phosphorus

Stream	Reach Description
Humboldt River Mainstem	
Humboldt River	From the upstream source to Osino
Marys River Basin	
Marys River	From T42N, R59E to the Humboldt River
Conners Creek	
Maggie Creek Basin	
Maggie Creek	From where it is formed by tributaries to its confluence with Jack Creek
Pine Creek Basin	
Pine Creek	From its confluence with Dry Creek to the Humboldt River
NF Humboldt Basin	
NF Humboldt River	From the National Forest Boundary to its confluence with Beaver Creek
NF Humboldt River	From its confluence with Beaver Creek to the Humboldt River
Indian Creek	From its origin to the NF Humboldt River
SF Humboldt Basin	
SF Humboldt River	From Lee to South Fork Reservoir
Huntington Creek	From its confluence with Smith Creek to SF Humboldt River
Dixie Creek	From its origin to SF Humboldt River
SF Reservoir	The entire reservoir

Table 2 summarizes the selected upper Humboldt tributaries investigated for this study and the available nutrient data for various sites. The actual locations visited during the 2008 field activities are listed in Table 3. Figures 1 through 3 display the locations of the pertinent water quality monitoring sites and the nutrient investigation sites visited in 2008.

Table 2. Selected Waters in the Upper Humboldt Basin and Summary of TP and TN Levels at Monitoring Sites

Stream	Reach	Agency - Site ID	Site Description	TP Range (TP Median)	TN Range (TN Median)	On Draft 2006 303(d) List for TP?
Marys River Basin						
Marys River	From T42N R59E to Humboldt R.	NDEP – HS1	Marys River	0.02 – 0.24 (0.07)	0.07 – 1.27 (0.31 – 0.34)	Yes
		NDEP – HS1B	Near Deeth	0.08 – 0.13 (0.08)	0.27 – 0.42 (0.35)	
Conners Creek	Entire length	BLM – CC1	Conner (Upper)	0.09 – 0.14 (0.12)	No data	Yes
		BLM – CC2	Conner (Lower)	0.01 – 0.12 (0.09)	No data	
Maggie Creek Basin						
Maggie Creek	From where it is formed by tribs to Jack Creek	NDEP – HS17	Above Jacks Creek	0.21 – 0.33 (0.26)	0.14 – 0.45 (0.28)	Yes
	From Jack Creek to Humboldt River	NDEP – HS14	At SR 221	0.01 – 1.8 (0.08)	0.1 – 3.5 (0.4- 0.44)	No
Pine Creek Basin						
Pine Creek	From Dry Creek to Humboldt River	NDEP – PC3	South Tomera Ranch	0.12 – 0.58 (0.16)	0.15 – 2.13 (0.82)	Yes
		NDEP – PC2	At North Tomera Ranch	0.11 – 0.29 (0.21)	0.14 – 2.4 (1.24)	
		NDEP – HS13	Pine Creek	0.04 – 2.4 (0.14)	0.21 – 3.8 (0.67)	
NF Humboldt River Basin						
NF Humboldt	From Natl Forest Boundary to Beaver Creek	NDEP – HS15	At North Fork Ranch	0.01 – 0.27 (0.02)	0.1 – 2.37 (0.51 – 0.54)	Yes
		NDEP – HS29	At Haystack Ranch	0.11 – 0.35 (0.16)	0.5 – 1.5 (0.58 – 0.9)	
	From Beaver Creek to Humboldt River	NDEP – HS2B	below I-80	0.01 – 2.1 (0.1)	0.13 – 6.6 (0.45)	Yes
Indian Creek	Entire length	BLM – IC1	Indian Creek (Lower)	0.08 – 0.18 (0.15)	No data	Yes
SF Humboldt River Basin						
SF Humboldt	From Lee to South Fork Reservoir	NDEP – SF1	Below Hwy 228	0.01 – 0.02 (0.02)	0.1 – 0.7 (0.2 – 0.3)	Yes
		NDEP – HS23	At Twin Bridges	0.02 (0.02)	0.2 – 0.4 (0.25 – 0.35)	
	From South Fork Reservoir to Humboldt River	NDEP – HS22	Below Dam @ Gage	0.04 – 0.06 (0.04)	0.4 – 0.6 (0.5 -0.6)	No
		NDEP – HS26	Below Dixie at Bridge	0.03 – 0.2 (0.12)	0.3 – 0.9 (0.55 – 0.65)	
		NDEP – HS3A	Below Dixie Creek	0.01 – 1.07 (0.03)	0.1 – 2.16 (0.43 – 0.45)	
Ten Mile Ck.	Entire length	NDEP – HS21	Near Mouth	0.05 – 0.18 (0.06)	0.4 -0.9 (0.8)	No

Table 2. Selected Waters in the Upper Humboldt Basin and Summary of TP and TN Levels at Monitoring Sites (cont'd)

Stream	Reach	Agency - Site ID	Site Description	TP Range (TP Median)	TN Range (TN Median)	On Draft 2006 303(d) List for TP?
SF Humboldt River Basin						
Huntington Creek	From Smith Creek to SF Humboldt	NDEP – HC	4.2 Miles above Twin Bridges	0.12 – 0.14 (0.13)	0.4 – 1.1 (0.42 – 0.5)	Yes
		NDEP – HS24	At Twin Bridges	0.05 – 0.13 (0.09)	0.5 – 0.7 (0.55 – 0.65)	
Dixie Creek	Entire length	NDEP - DIXIEU	Dixie Creek (Upper)	0.19 (0.19)	0.3 – 1.0 (0.4 – 0.7)	Yes
		BLM – DC1	Dixie Creek (Upper)	0.06 – 0.17 (0.13)	No data	
		BLM – DC2	Dixie Creek (Lower, Culvert)	0.04 – 0.25 (0.19)	No data	
		BLM – DC3	Dixie Creek (RAWS)	0.34 (0.34)	No data	
		BLM – DC4	Dixie Creek (Lower, Sec. 14)	0.09 (0.09)	No data	
		NDEP – HS25	Dixie Creek Lower	0.04 – 0.58 (0.31)	0.1 – 1.7 (0.9 – 1.0)	
Little Porter Creek	Entire length	N/A	Little Porter Creek	0.13 – 0.14 (0.13)	0.47 – 2.0 (1.2)	No

Table 3. Locations of Nutrient Investigations

Stream Reach	Reach	Site No.	Site Description	UTM Zone 11 NAD 83		Elevation (ft)
				Northing	Easting	
Marys River Basin						
Marys River	From T42N R59E to Humboldt R.	NUT-MR1	At NDEP Site HS1	4568270	646185	5500
Conners Creek	Entire length	Not visited				
Maggie Creek Basin						
Maggie Creek	From where it is formed by tribs to Jack Creek	NUT-MC1	~4 miles above Jacks Creek	4535669	569840	5420
	From Jack Creek to Humboldt River	NUT-MC2	~1 mile below Jacks Creek	4527333	569423	5250
		NUT-MC3	Above Gold Quarry Mine	4518680	565740	5110
		NUT-MC4	On Highway east of Carlin	4508058	576495	4900
Pine Creek Basin						
Pine Creek	From Dry Creek to Humboldt River	NUT-PC1	~1.5 miles above Humboldt River	4493588	570276	4910
		NUT-PC2	~1 mile above Humboldt River	4494330	569516	4900
NF Humboldt River Basin						
NF Humboldt River	From Natl Forest Boundary to Beaver Creek	NUT-NFHR1	Haystack Ranch	4580413	601524	5900
		NUT-NFHR2	Lost Wallet Canyon	4574230	610244	5630
	From Beaver Creek to Humboldt River	NUT-NFHR3	Ranch	4564962	625435	5420
		NUT-NFHR4	Below I-80	4534100	623400	5080
Indian Creek	Entire length	NUT-IC1	Upper	4575604	628277	6300
		NUT-IC2	~1 mile above NF Humboldt River	4570503	624838	5740
SF Humboldt River Basin						
SF Humboldt	From Lee to South Fork Reservoir	NUT-SFHR1	At Highway 228	4495806	610739	5390
		NUT-SFHR2	At Twin Bridges	4497658	607672	5280
	From South Fork Reservoir to Humboldt River	NUT-SFHR3	~1 mile below South Fork Reservoir	4504615	600997	5140
		NUT-SFHR4	~2 miles below Dixie Creek	4506921	598277	5100
		NUT-SFHR5	~3 miles above Humboldt River	4511279	596931	5030
Ten Mile Creek	Entire length	NUT-TMC1	Near Mouth	4504734	602064	5150
Huntington Creek	From White Pine County to Smith Creek	NUT-HC1	Upper Huntington	4475277	609650	5410
	From Smith Creek to SF Humboldt	NUT-HC2	At Twin Bridges	4497122	607495	5280
Dixie Creek	Entire length	NUT-DC1	Upper Dixie	4477012	590541	6560
		NUT-DC2	~4 miles above SF Humboldt River	4498217	596161	5270
		NUT-DC3	~1 mile above SF Humboldt River	4502374	597072	5200
Little Porter Creek	Entire length	NUT-LPC1	Upper Little Porter	4472216	593929	6360

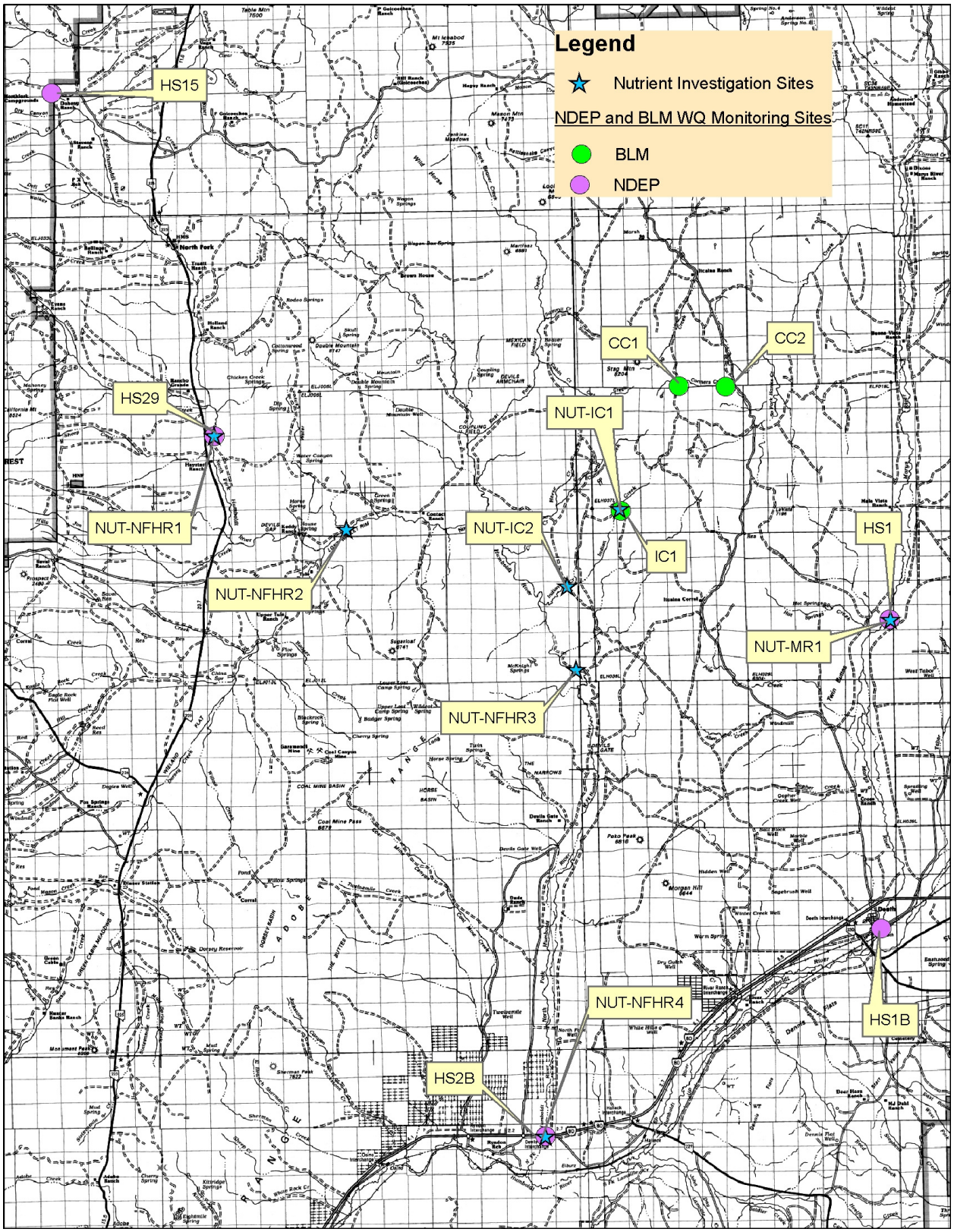


Figure 1. Location Map – Marys River and NF Humboldt Watershed
WQ Stations and Nutrient Investigation Sites

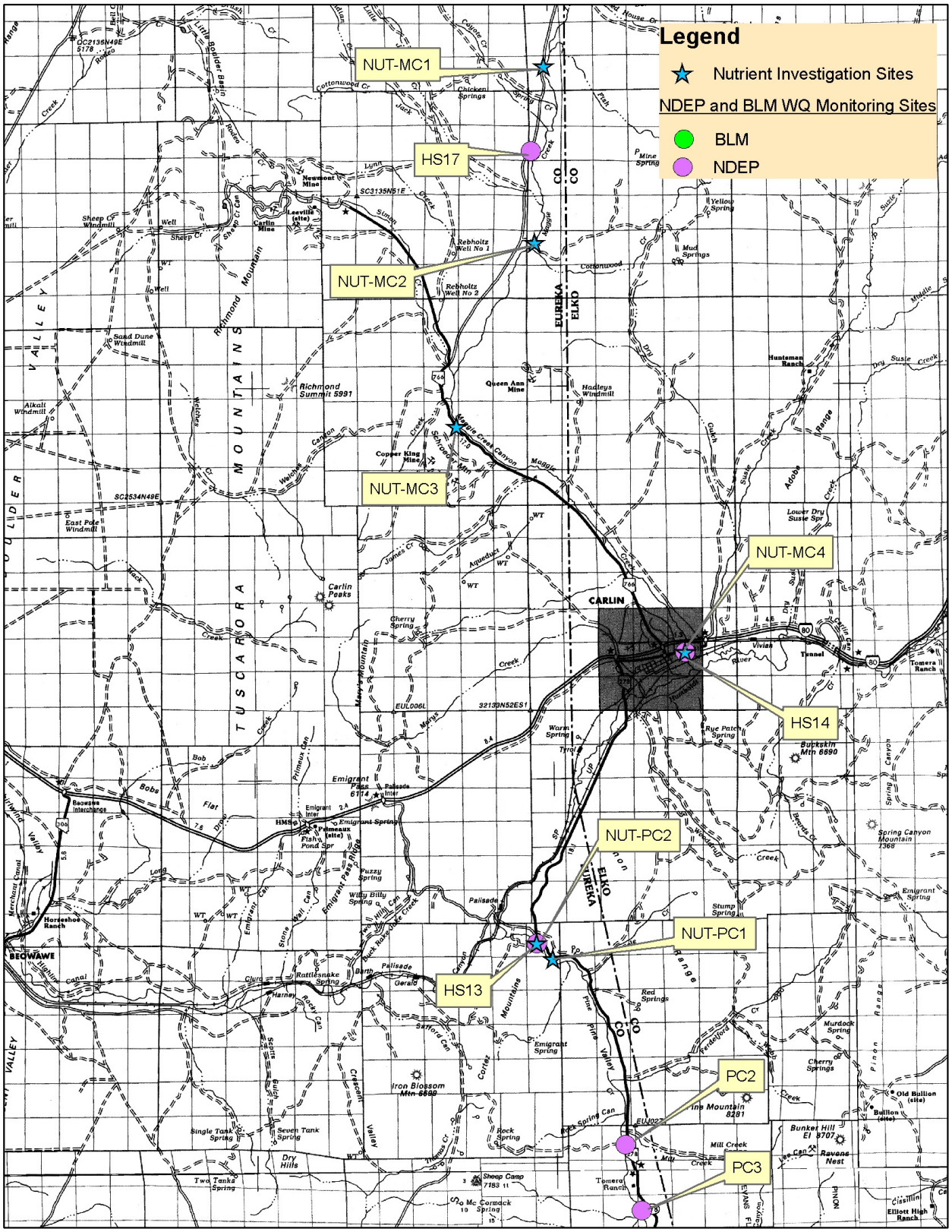


Figure 2. Location Map – Maggie Creek and Pine Creek WQ Stations and Nutrient Investigation Sites

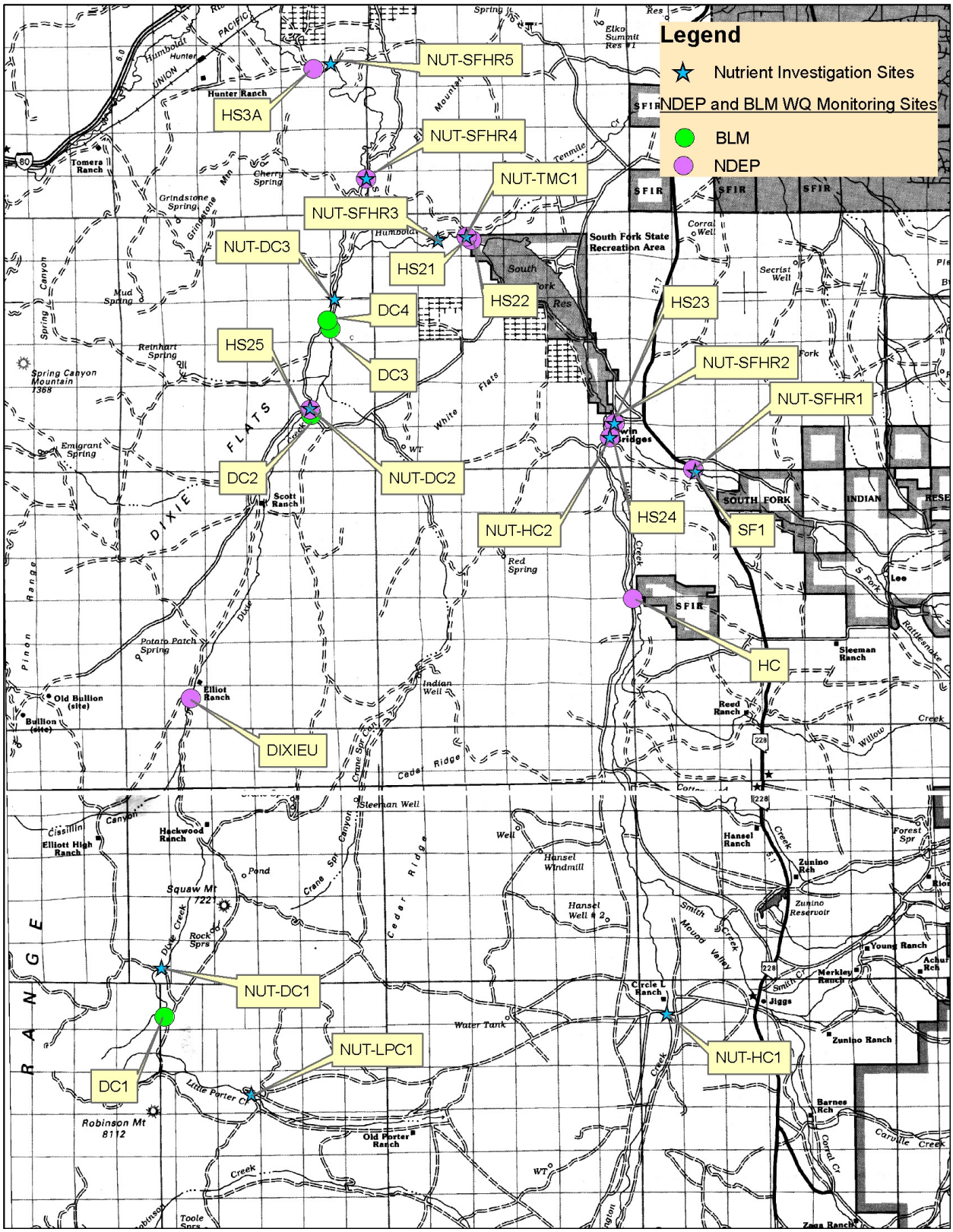


Figure 3. Location Map – Dixie Creek and SF Humboldt Watershed
WQ Stations and Nutrient Investigation Sites

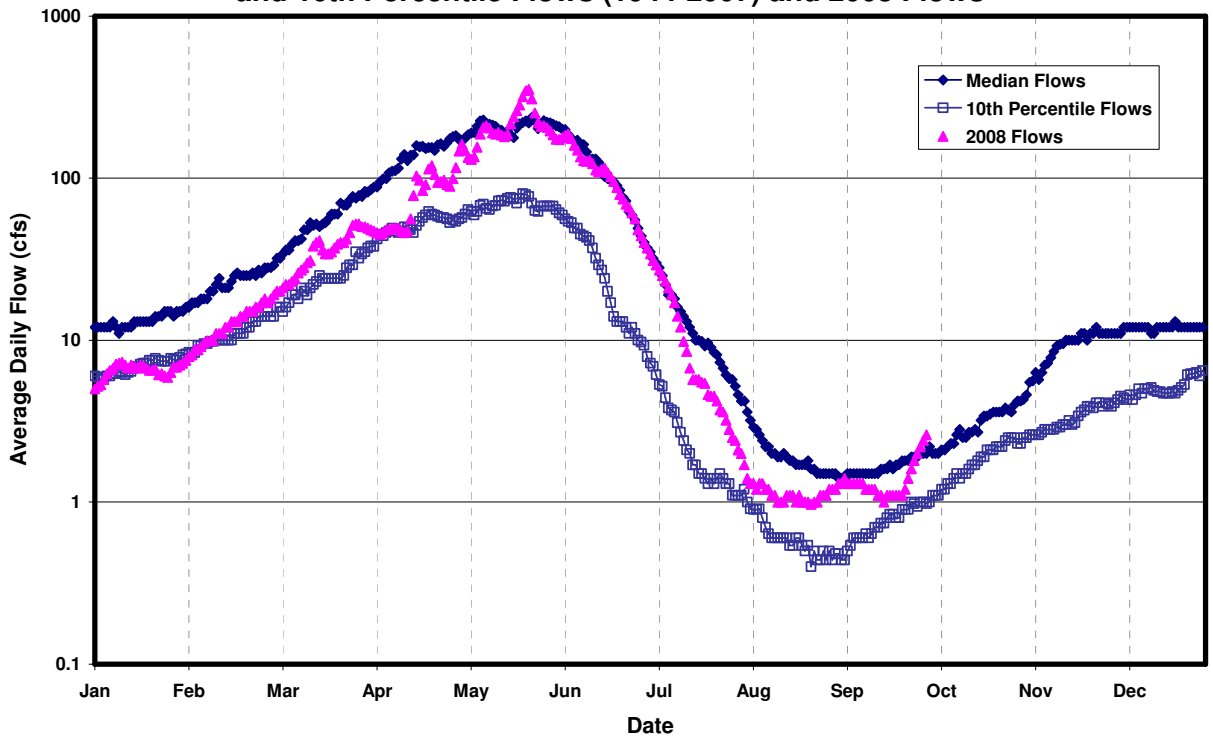
Results

The following discussions summarize the findings of the 2008 nutrient investigations. When available, flow data have been described for the selected waters. As discussed earlier, flow levels can have a great influence on algae levels, and need to be considered when drawing conclusions from these findings.

Marys River

The lower Marys River (below T42N, R59E) is on the Draft 2006 303(d) based upon exceedances of the TP standard (0.1 mg/l) at NDEP's Site HS1. However during an initial field visit on August 12, 2008, excessive algae levels were not observed at this particular site. The combined percent cover by filamentous algae, microalgae and macrophytes was less than 25% (Table 4). It is important to note that the summer streamflows at this site were low but could not be considered extreme, varying between median levels and the 10th percentile levels (Figure 4).

Figure 4. 10315500 - Marys River above Hot Springs Creek - Median and 10th Percentile Flows (1944-2007) and 2008 Flows



While the lower Marys River near the Humboldt River was not visited, a USGS gage in the area (10315600 – Marys River below Twin Buttes near Deeth, NV) indicated zero flows from 7/25/08 through to the end of the water year.

Table 4. Summary of Nutrient Investigations

Stream Reach	Site No.	Site Description	Date(s) of Invest.	% Cover Filamentous Algae	% Cover Microalgae > 1 mm thick	% Cover Macrophytes	Comments
Marys River Basin							
Marys River	Site 1	At NDEP Site HS1	8/12/08	< 25% cover by algae and macrophytes			
	Site 2	Near Humboldt River	8/12/08	This site was not visited but USGS gaging records show zero flows from 7/25/08 through 9/30/08			
Maggie Creek Basin							
Maggie Creek above Jacks Creek	Site 1	~4 miles above Jacks Creek	7/29/08	50 – 75% cover by algae and macrophytes			
Maggie Creek below Jacks Creek	Site 1	~1 mile below Jacks Creek	7/29/08	~75% cover by algae and macrophytes			
	Site 2	Above Gold Quarry Mine	7/29/09	---	---	---	Site was dry
	Site 3	On Highway east of Carlin	7/29/09	~75%	< 25%	< 25%	Surveyed from bridge
Pine Creek Basin							
Pine Creek	Site 1	~1.5 miles above Humboldt River	7/30/08	> 75% cover by algae and macrophytes			Surveyed from road
	Site 2	~1 mile above Humboldt River	7/30/08	50 – 75%	< 25%	<25%	
NF Humboldt River Basin							
NF Humboldt ab. Beaver Creek	Site 1	Haystack Ranch	8/12/08	---	---	---	Site was dry.
	Site 2	Lost Wallet Canyon	8/12/08	< 25%	50 – 75%	< 25%	
NF Humboldt bel. Beaver Creek	Site 1a	Ranch	8/12/08	< 25% cover by algae and macrophytes			
	Site 1b			< 25%	< 25%	50 – 75%	
	Site 2	Below I-80	8/12/08	---	---	---	No flow.
Indian Creek	Site 1	Upper	8/12/08	< 25%	< 25%	25 – 50%	Heavy cattle grazing apparent in the area.
	Site 2	~1 mile above NF Humboldt River	8/12/08	---	---	---	Site was dry.
SF Humboldt River Basin							
SF Humboldt	Site 1	At Highway 228	7/30/08	< 25% cover by algae and macrophytes			Surveyed from bridge.
	Site 2	At Twin Bridges	7/30/08	< 25% cover by algae and macrophytes			Surveyed from bridge.
	Site 3	~1 mile below South Fork Reservoir	7/30/08	> 75% cover by algae		< 25%	
	Site 4	~2 miles below Dixie Creek	7/30/08	> 75% cover by algae		< 25%	
	Site 5	~3 miles above Humboldt River	7/30/08	> 75% cover by algae		< 25%	
Ten Mile Creek	Site 1	Near Mouth	7/30/08	< 25%	< 25%	> 75%	
Huntington Creek	Site 1	Upper Huntington	8/12/08	---	---	---	Little to no flow.
	Site 2	At Twin Bridges	7/30/08	~50% cover by algae and macrophytes			Surveyed from bridge.
Dixie Creek	Site 1	Upper Dixie	8/12/08	< 25% cover by algae and macrophytes			
	Site 2	~4 miles above SF Humboldt River	8/12/08	< 25% cover by algae and macrophytes			Flow nearly stagnant.
	Site 3	~1 mile above SF Humboldt River	7/29/08; 8/12/08	---	---	---	Site was dry.
Little Porter Creek	Site 1	Upper Porter	8/12/08	< 25%	< 25%	> 75%	

Maggie Creek

Maggie Creek (from where it is formed by tributaries to the confluence with Jack Creek) is on the Draft 2006 303(d) List for exceedances of the TP standard (0.1 mg/l) based upon data collected by NDEP at its Site HS17. During an initial visit on July 29, 2008, rather high levels of algae and macrophytes (50 – 75% combined coverage) were observed at a site in this reach (Table 4). It is unknown if the flows at the time of field visit could be considered low due to the lack of flow data in this area. The nearest gaging station is about 12 miles downstream and is not representative of flows at this site.

Maggie Creek between Jack Creek and the Humboldt River has high TP levels but is not on the Draft 2006 303(d) List as the TP standard for this reach (0.33 mg/l) is higher than on the upper reaches. Nevertheless, high algae/macrophyte levels (~75% cover) were observed in the upper part of this reach of Maggie Creek. Again, it is unknown if flows at the site below Jacks Creek were low in late July 2008. However about 4 to 5 miles downstream (just above Maggie Creek Canyon), the stream was dry at the time of the field visit. Yet these dry conditions are not that uncommon in Maggie Creek Canyon. Flow records at Gaging Station 10321950 – Maggie Creek at Maggie Creek Canyon near Carlin, NV indicate that this stretch is dry about 25% of the years on July 29th.

High algae level (~75% cover) were also observed in the lower Maggie Creek just east of Carlin (Figure 5). Flows at this site are not natural due to dewatering discharges from the Gold Quarry Mine. At the time of the visit, flows at Station 10322000 were about 25 cfs which is above the median for this time of year.

Figure 5. High Algal Cover in Lower Maggie Creek east of Carlin

Pine Creek

Pine Creek (from Dry Creek to Humboldt River) is on the Draft 2006 303(d) List for exceedances of the TP standard (0.1 mg/l) based upon data collected by NDEP at 3 different sites - PC2, PC2, and HS13. High algal/macrophyte cover (50% to >75%) was observed in the lower Pine Creek (Figure 6; Table 4). A significant level of the cover was due to *Chara* (Muskgrass), which resembles a plant but is actually a type of algae (Figure 7).

No active gaging stations exist on Pine Creek so it is uncertain how the July 30, 2008 flow compared to historic levels. However, flows appeared to be near "normal" levels as no dry creek bottom or creek banks was observed in this reach.

Figure 6. High Algal and Macrophyte Cover in Lower Pine Creek

Figure 7. *Chara* (Muskgrass) in Lower Pine Creek

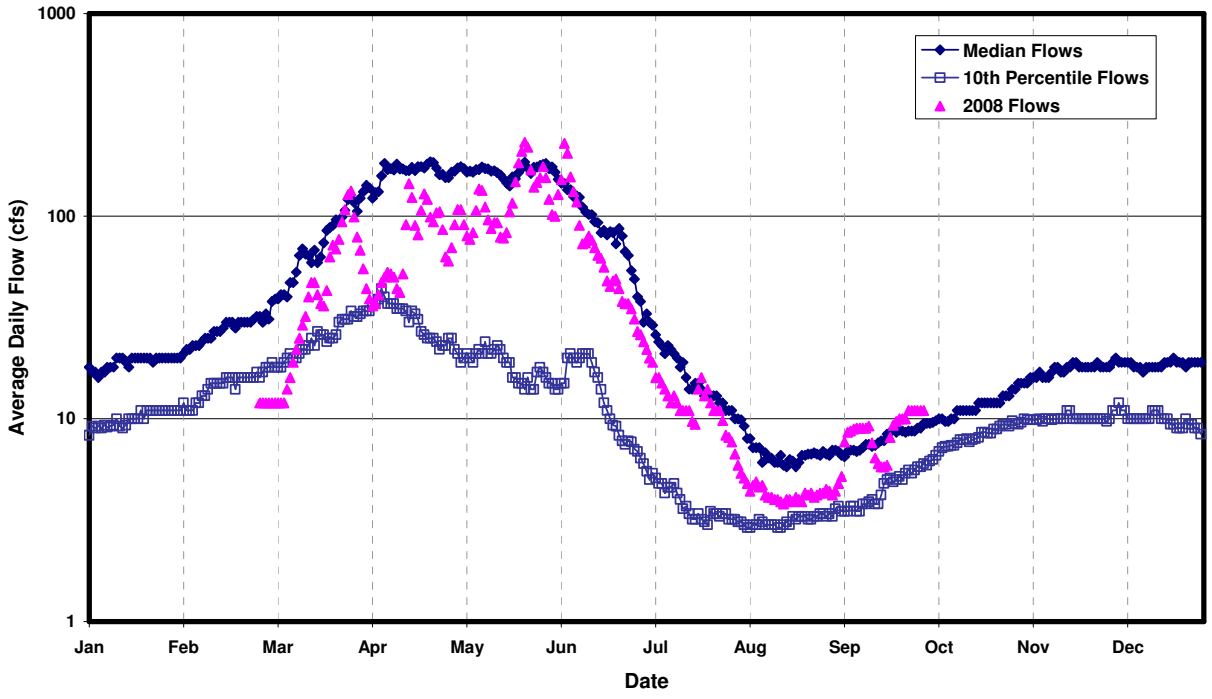
North Fork Humboldt River

Two reaches of the North Fork Humboldt River (from the national forest boundary to Beaver Creek; and from Beaver Creek to the Humboldt River) are on the Draft 2006 303(d) List due to exceedances of the TP standard (0.1 mg/l) based upon NDEP data collected at sites HS29 and HS2B. On August 12, 2008, 2 sites on the national forest boundary to Beaver Creek reach were visited, as were 2 sites on the Beaver Creek to Humboldt River reach.

National Forest to Beaver Creek: At the Haystack Ranch site, a dry stream was observed. It is unknown if this is an extreme condition for this site at this time of year. The only active gaging station on the North Fork (10317500 – NF Humboldt at Devil's Gate) is over 25 miles downstream with numerous tributaries entering the North Fork between Haystack Ranch and the gage.

At the Lost Wallet Canyon site, filamentous and macrophyte cover was low (<25%) however microalgae (>1 mm thick) covered about 50-75% of the stream bottom at this site (Table 4). While flows at the nearest gaging station (10317500) were not unusually low on August 12, 2008 (Figure 8), this station is over 15 miles downstream and may not be representative of flows in the Lost Wallet Canyon.

Figure 8. 10317500 - North Fork Humboldt River at Devil's Gate - Median and 10th Percentile Flows (1913-21, 1943-82, 2002-07) and 2008 Flows



Beaver Creek to Humboldt River: At the upper ranch site, low levels (<25% cover) of algae and macrophytes were observed on August 12, 2008. However a few hundred feet downstream, significant macrophyte growth (50 – 75% cover) was observed (Table 4). Based upon the Gaging Station 10317500 (located about 4 miles downstream, flows at this site were below median levels for August 12th but were not unusually low.

Indian Creek

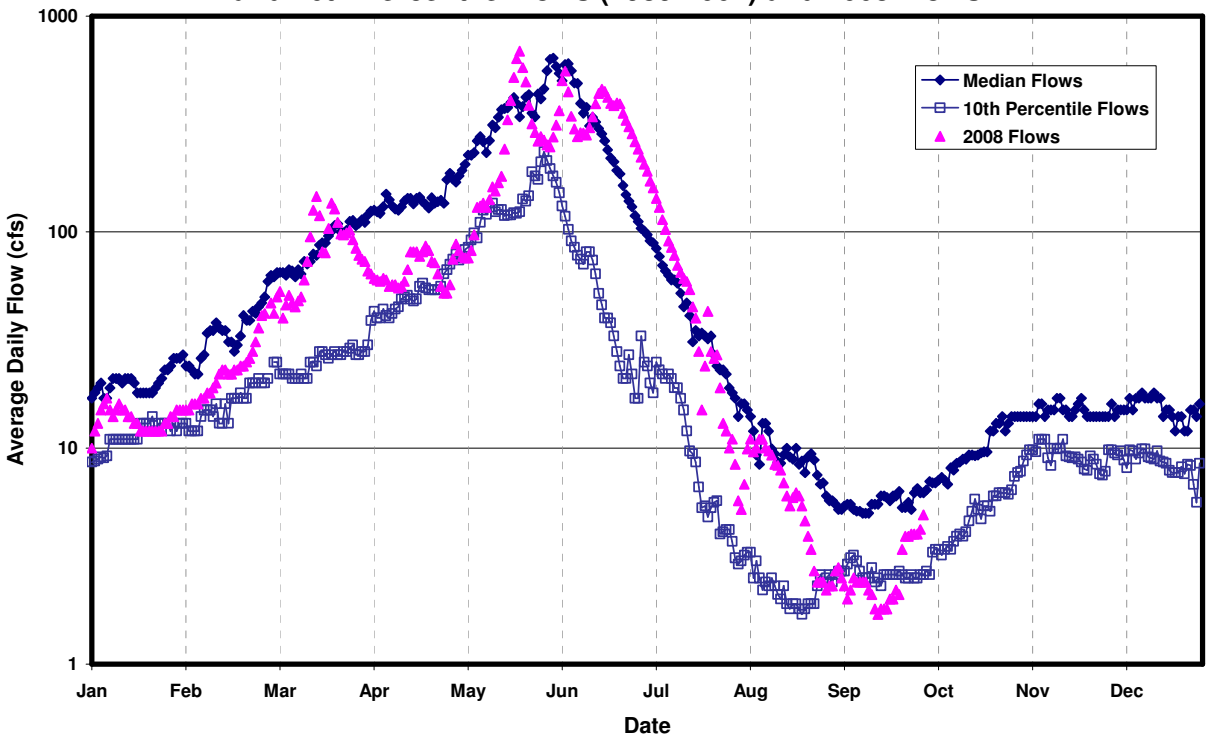
Indian Creek is on the Draft 2006 303(d) List for exceedances of the TP standard (0.1 mg/) based upon data collected by BLM. Field visits occurred on August 12, 2008 to look for visual evidence of excessive algal conditions. At the upper site, algae levels were low (<25%) while macrophyte levels were elevated (25 – 50%) (Table 4). The creek was dry at the lower site about 1 miles upstream of the North Fork Humboldt River. No active gaging stations exist on this stream so it is uncertain how August 12, 2008 flows compared to historic levels.

South Fork Humboldt River

Currently, the South Fork Humboldt River is not on the 303(d) List based upon compliance with the TP standard (0.1 mg/l). However during reconnaissance efforts in 2007, high algae levels were observed in the lower South Fork Humboldt River (below South Fork Reservoir) and it was deemed appropriate to include the South Fork Humboldt in the nutrient screening activities.

To better understand algal coverage within the system, Level I assessments were undertaken at various locations along the South Fork Humboldt River. As summarized in Table 4, algal coverage in the South Fork Humboldt River above South Fork Reservoir was minimal (<25%). River flows at the time of the survey (July 30, 2008) were near median levels so extreme flow conditions were not an issue (Figure 9). Some Level II-type investigations were undertaken with algal biomass samples collected twice during the summer. However, there were concerns about the accuracy of the laboratory data that remain to be resolved at this time.

Figure 9. 10319900 - SF Humboldt River ab. Ten Mile Creek - Median and 10th Percentile Flows (1989-2007) and 2008 Flows



While algae levels in the South Fork Humboldt River above the reservoir were low, levels on 10-mile stretch from the Reservoir to near the confluence to the Humboldt River were high at >75% cover (see Figure 10) (Table 4). During the summer of 2008, more detailed activities were also undertaken to quantify algal biomass and its impacts upon water quality. Algal activity leads to fluctuations in stream dissolved oxygen as photosynthesis and respiration occur. Typically, DO levels will be highest in the afternoon during peak photosynthesis and lowest near sunrise just prior to the restart of photosynthesis. In order to make detailed measurements of DO, a water quality datalogger was deployed for 2 brief periods of time (August 11-12, 2008 and September 9-11, 2008) at Site 5. The results for August 11-12 (Figure 11) indicated that the dissolved oxygen levels experienced a daily variation of about 9 mg/l, with levels below the water quality standard for about 11 hours and a low of 3.2 mg/l. This was not surprising given the high algal biomass present in the stream. However the September 9-11 results were quite different (Figure12) with low DO levels just slightly below the water quality standard of 5 mg/l, but the daily variation of 15 mg/l was higher than that experienced during August 11-12. The reason for this difference in results is uncertain. According to field crews, the algae biomass during September 9-11 appeared higher than observed in August, so one could have expected that the DO conditions would have worsened. During both periods, flow conditions were above median flows (Figure 13) for that time of year, however the September 9-11 flows (11 cfs) were about ½ of those during August 11-12 (23 cfs).

Again, lower flows in September could have been expected to lead to lower DO levels but that did not appear to be the case. It is not uncommon for minimum/maximum DO levels to vary greatly from one period to the next, as demonstrated by these 2 sampling events. Longer sonde deployments would be helpful in better characterizing the DO levels in this reach of the South Fork Humboldt River.

Figure 10. High Algal Biomass in South Fork Humboldt River – Site NUT-SFHR5

Figure 11. South Fork Humboldt River ~3 Miles Upstream of Humboldt River - DO, Temperature and pH - August 11-12, 2008

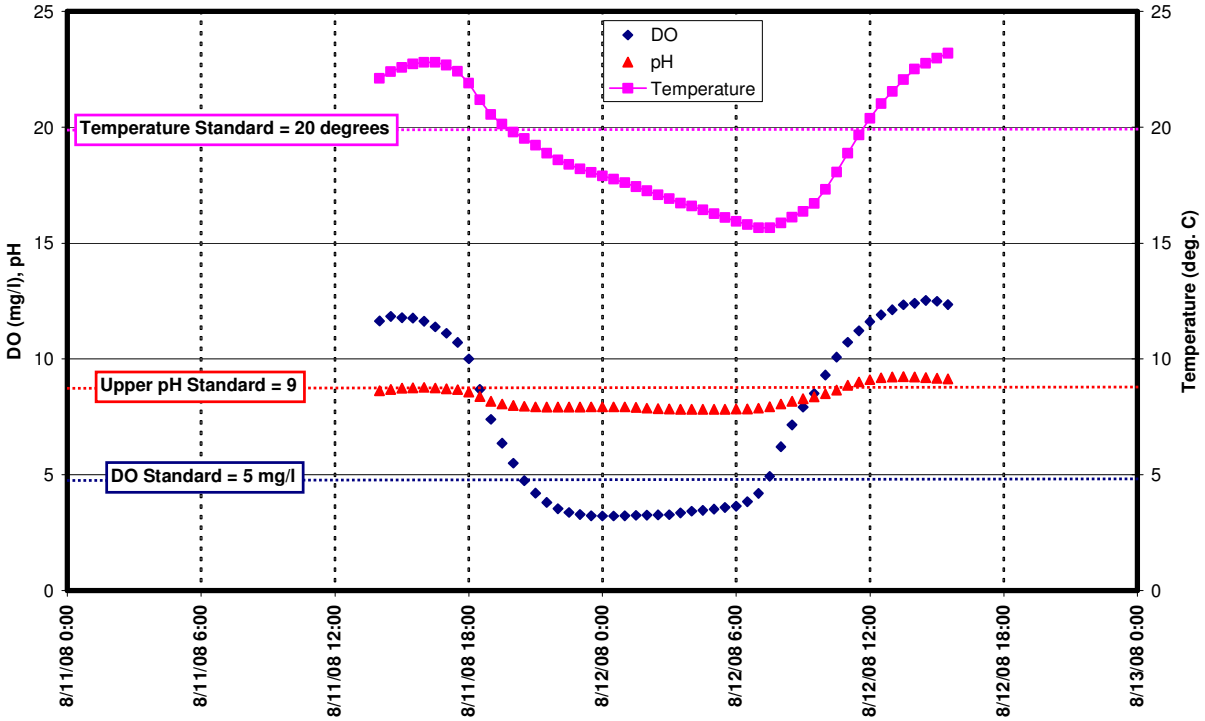


Figure 12. South Fork Humboldt River ~3 Miles Upstream of Humboldt River - DO, Temperature and pH - September 9-11, 2008

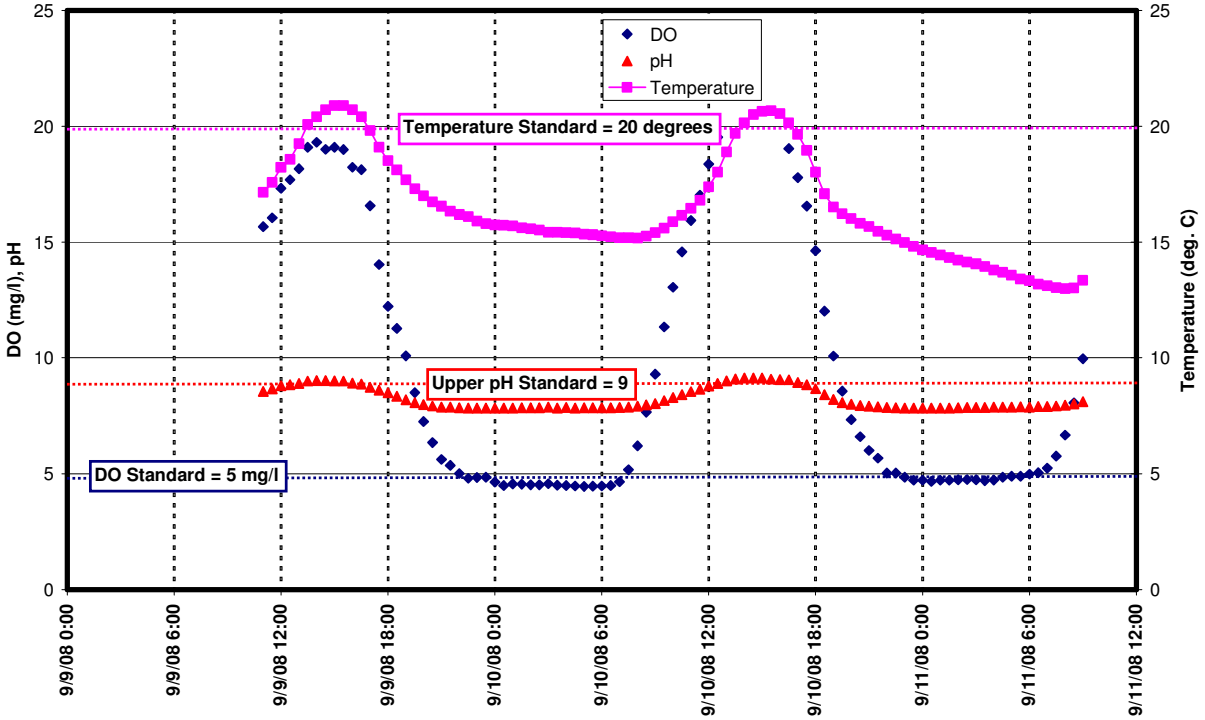
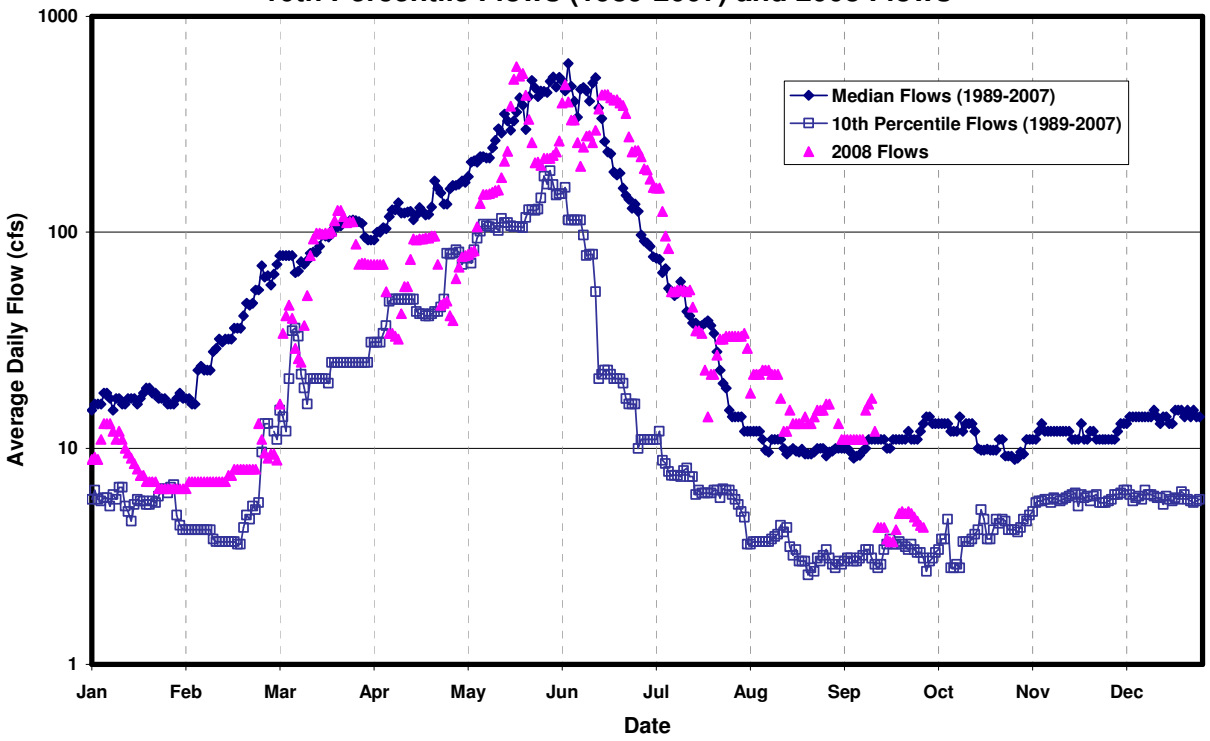


Figure 13. 10320000 - SF Humboldt River ab. Dixie Creek - Median and 10th Percentile Flows (1989-2007) and 2008 Flows



Huntington Creek

Above Smith Creek: This reach of Huntington Creek is not on the 303(d) List as no data are available. Nevertheless since the lower Huntington Creek is listed it seemed prudent to survey this reach as well. On August 12, 2008, the river was visited at a bridge crossing but was found to be dry. Given that there are no gaging records available, it is unknown whether or not this reach frequently goes dry in August.

Below Smith Creek: Huntington Creek (from Smith Creek to South Fork Humboldt River) is on the Draft 2006 303(d) List for exceedances of the TP standard (0.1 mg/) based upon data collected by NDEP at sites HC and HS24. A field visit occurred on July 30, 2008 to look for visual evidence of excessive algal conditions. However access to the stream is limited due to the dominance of private land. Nevertheless, observations from a public bridge (Twin Bridges) indicated that algae/macrophyte coverage could be around 50% at that site (Figure 14) (Table 4). Again, it is uncertain if the flow conditions at the time of the survey were "normal".

Figure 14. Algae and Macrophytes in Huntington Creek at Twin Bridges

Dixie Creek

Dixie Creek is on the Draft 2006 303(d) List due to exceedances of the TP standard (0.1 mg/1) based upon data collected by BLM and NDEP. Much of Dixie Creek is on private land so field surveys were limited to the upper watershed and the lower watershed near the mouth where flows are low or often zero. At both the upper site and the lower site, algae and macrophytes levels on 8/12/08 were low (<25% cover) (Table 4). However at the lower site, flows were very slowly with near stagnant conditions. A few mile below this site, the lower Dixie Creek was dry both times it was visited (July 29, 2008 & August 12, 2008). Based upon the limited period of record at a nearby discontinued gaging station (10320100 – Dixie Creek above South Fork Humboldt River), it appears that it is not uncommon for the lower Dixie Creek to go dry by late July in most years.

Little Porter Creek

Little Porter Creek is not on the 303(d) List as no data have been collected. However while crews were returning from surveying the remote upper Dixie Creek site, Little Porter Creek was on the way and high levels of macrophytes (>75%) (Table 4) were observed. Since the field survey, NDEP has obtained 2006 BLM data (2 samples) for Little Porter Creek which showed elevated nutrients in the stream with TP ranging from 0.13-0.14 mg/l, Nitrate ranging from 0.26-1.4 mg/l, and TN ranging from 0.47-2 mg/l. No flow data are available for this creek.

Nutrients Levels versus Algae Levels

The results of the 2008 screening work were evaluated to potentially discern any relationships between nutrient levels and algae levels (limited; excess). In Table 5, selected screening sites have been grouped into "Excess Algae" and "Limited Algae" categories. As shown in Figures 15 and 16, the median OP, TP, TKN and TN levels for the "Excess Algae" sites were found to generally be higher than those for the "Limited Algae" sites.

Table 5. Upper Humboldt Basin Sites with Known Algal Levels during 2008 Surveys

Site ID	Site Name	OP Median	TP Median	DIN Median	TKN Median	TN Median
2008 Surveys Indicated Excess Algae/Macrophytes (50%-100% cover)						
HS21	Ten Mile Ck at SF Humboldt	0.02	0.06	<0.1	0.7	0.8
HS22	SF Humboldt R bel Dam at Gage	0.02	0.04	<0.1	0.5	0.5-0.6
HS26	SF Humboldt R bel Dixie Ck at Bridge	0.02	0.12	<0.1	0.55	0.55-0.65
HS3A	SF Humboldt R bel Dixie Ck	<0.01	0.04	<0.1	0.36	0.44-0.48
HS24	Huntington Ck at Bridge	0.05	0.09	<0.1	0.55	0.55-0.65
HC	Huntington Ck 4.2 miles upstream of Bridge	0.1	0.13	<0.1	0.4	0.42-0.50
LPC1	Little Porter Creek	---	0.13	0.83	---	1.23
HS17	Maggie Ck ab Jacks Ck	0.24	0.27	<0.1	0.24	0.26
BIO-007	Maggie Ck bel Cottonwood Ck	0.34	0.41	<0.1	0.2	0.2-0.3
HS14	Maggie Creek at Hwy 221	0.03	0.08	<0.1	0.37	0.39-0.43
HS13	Pine Creek	0.07	0.14	<0.1	0.59	0.72
2008 Surveys Indicated Limited Algae/Macrophytes (<25% cover)						
SF1	SF Humboldt R at Hwy 228	0.01	0.02	<0.1	0.2	0.2-0.3
HS23	SF Humboldt R at Twin Bridges	<0.01	0.02	<0.1	0.25	0.25-0.35
HS1	Marys River	0.04	0.06	<0.1	0.29	0.29-0.35

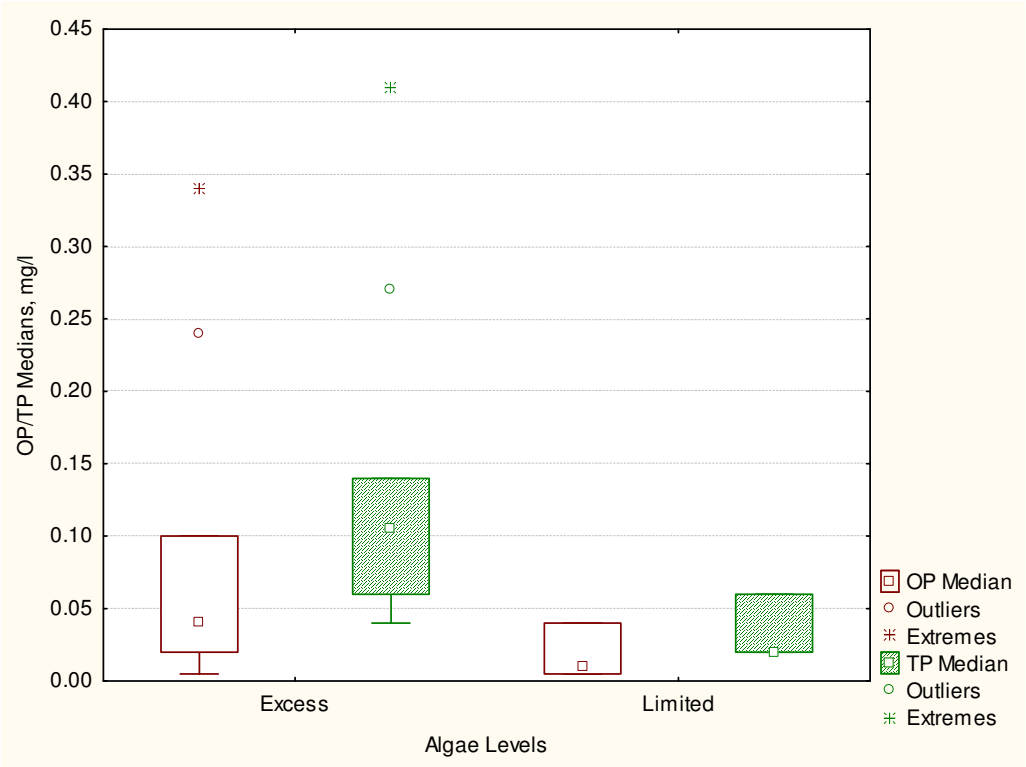


Figure 15. OP and TP Medians for "Excess Algae" vs. "Limited Algae" Sites

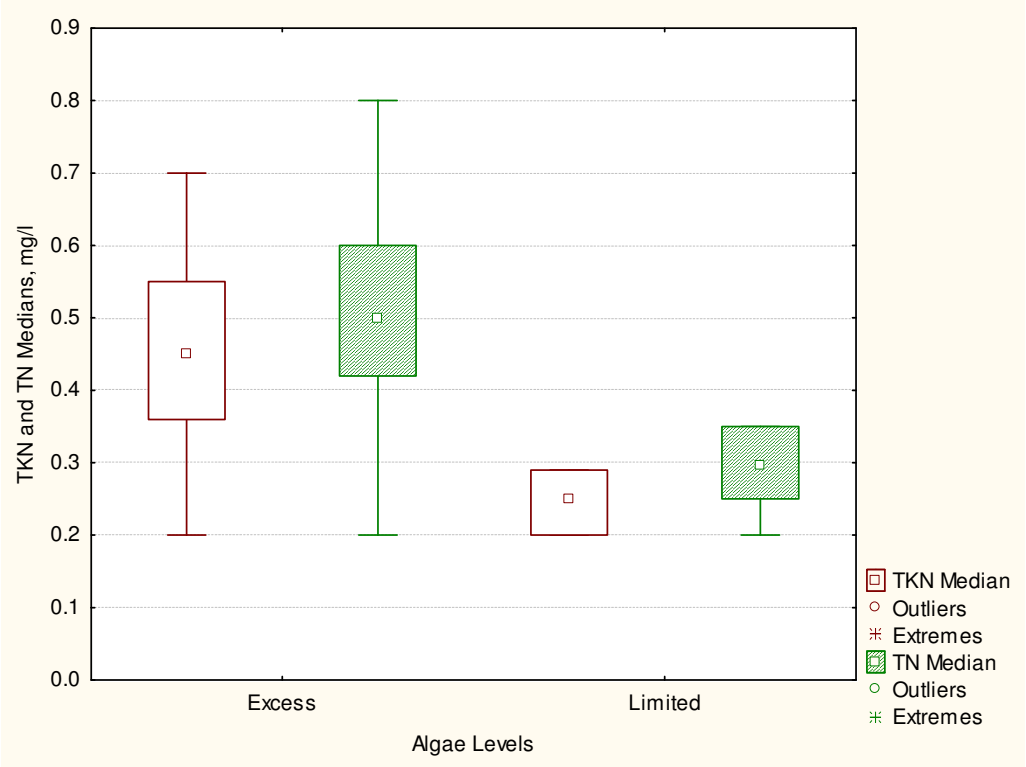


Figure 16. TKN and TN Medians for "Excess Algae" vs. "Limited Algae" Sites

Summary and Recommendations

Key purposes of these investigations were to check the nutrient impairment status of 303(d) listed waters in the upper Humboldt watershed, identify waters where additional investigations (additional Level I assessments; Level II nutrient assessments possibly) may be appropriate and to provide information for prioritizing potential future TMDL and nonpoint source management activities. Potential next steps include the following:

- Most of the waters investigated seem to be experiencing elevated algae levels. As discussed earlier, one season of nutrient screening may not be sufficient for an accurate Level I assessment. It may be appropriate (but not necessary) to revisit all of the assessment sites for at least another season (beginning earlier in the season) or more depending upon resources and expected uses for this information. However if the goal is to potential delist some waters, it is expected that more sites would need to be visited for each particular water. It is uncertain how much Level I/II data/information will be needed to delist waters, but it is likely to be more involved than the 2008 efforts.

- Another option is to focus our limited resources on selected waters with the highest algae/macrophyte levels (Maggie Creek, Pine Creek, and SF Humboldt River below SF Reservoir) for possible water quality standards refinements. The setting of appropriate standards for any of these waters could be a significant undertaking and it may be that a pilot project could be undertaken. Approaches:

    - Establish narrative algae criteria along with numeric chlorophyll-a standards based upon literature values for benthic algae. We may need to identify N and P criteria to accompany the chlorophyll-a standards?? Could be challenging in that many factors (other than N/P) influence algae growth.
    - Establish site-specific N/P and chlorophyll-a standards needed to maintain dissolved oxygen levels. This would require a significant data collection and modeling effort. It is uncertain how much data (one year vs. multiple years) are needed to develop an appropriate model.

- Pursue a TMDL on one of the waters with the highest algae/macrophyte levels (Maggie Creek, Pine Creek, and SF Humboldt River below SF Reservoir). Would need to identify N/P levels needed to meet algae target or DO standards? This would require a significant data collection and modeling effort.

  If a TMDL was deemed appropriate, a pilot project may be the best next step. However it must be remembered that these 3 streams are all impaired by nonpoint sources, and as such these sources are not regulated and will be difficult to control.

References

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