

**FINAL
Water Year 2011
Bacteria Sampling Report
for the
Klamath River Estuary**



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Acknowledgements

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I. Introduction

Since time immemorial the Klamath River has been the source of life and the primary influence and focus of Yurok Culture. Though current reservation boundaries are confined to a strip of land a mile wide on either side of the Lower Klamath River, ancestral territory encompassed land many times this area. Because of the central role the river has always played in their life ways, the health and preservation of the river system has become an essential part of contemporary Yurok culture. Today the Yurok people continue to use local waters for ceremonial and subsistence activities that can be impacted by poor water quality. This report summarizes the bacteria sampling performed in the Klamath River Estuary in Water Year 2011 (WY2011).

Escherichia coli and Enterococci

Escherichia coli (*E. coli*) and enterococci are two types of fecal coliform bacteria. They reside in and originate from the intestinal tracts of warm-blooded animals with primary sources being human and livestock excrement. Contact with high levels of these bacteria can lead to a variety of health complications ranging from mild cramps to severe gastrointestinal distress and death in extreme, untreated cases. Primary sources of contamination on the Klamath River Estuary include human activity, failing septic systems and livestock that have free access to waterways within the watershed. In compliance with the Yurok Tribe Coastal Monitoring Program Sampling and Analysis Plan, if the level of *E. coli* exceeds 235 Most Probable Number (MPN), or 61 MPN for enterococci, per 100 ml sample, immediate retesting is to be performed. If further samples indicate elevated levels still exist the waterbody will be posted to advise the public avoid contact with surface waters in the Klamath River Estuary.

Total Coliforms

Coliform is a family of bacteria common to soils, plants and animals. It encompasses numerous genera, only some of which are a threat to human health. As fecal coliforms are a sub-group of total coliforms, the presence and concentration of total coliforms is used as a relative indicator of fecal coliform levels. Primary sources of total coliforms on the Klamath River Estuary include the degradation and decomposition of organic plant and animal matter in the surrounding environment. Normal bioprocessing occurring in local soils provides for the reproduction of non-fecal coliform bacteria, and thus an increase of total coliforms in the summer months is seen during this season of increased biological activity. In compliance with the Yurok Tribe Coastal Monitoring Program Sampling and Analysis Plan if the level of total coliform exceeds 10,000 MPN/100ml sample, immediate retesting is to be performed .

II. Methods

At each sampling site 100 milliliter (ml) grab samples were collected in sterile, sealed sample bottles provided by Humboldt County Department of Public Health Lab. While wearing sterile Nitrile gloves, the seal and lid were removed from the bottle ensuring that the inside of the lid and no portion of the threaded opening of the bottle came into contact with any surface other than the water being sampled. The sample bottle was then submerged one foot

below the surface while angled 45 degrees upstream. At one foot below the surface the bottle was rotated vertical and brought to the surface. The cap was replaced and the sample was placed on wet ice in an insulated cooler for same day transportation to the lab. Sample location, sampling time, and bottle number were recorded for lab records. Sampling location, name of sampler, number of bathers present at sampling location, runoff quantity, amount and type of debris present in the water, tide information, length of beach, time and any additional pertinent information were recorded for departmental records. Samples were delivered the same day to the Humboldt County Department of Public Health laboratory in Eureka, CA following appropriate and documented chain of custody procedures.

III. Site Selection

YTEP collected water samples for bacterial analysis at the following locations (Figure 1).

- **Klamath River Estuary (KE)**
- **Klamath River Above KCSD Waste Water Treatment Plant (KR>WTP)**
- **Klamath River Below KCSD Waste Water Treatment Plant (KR<WTP)**

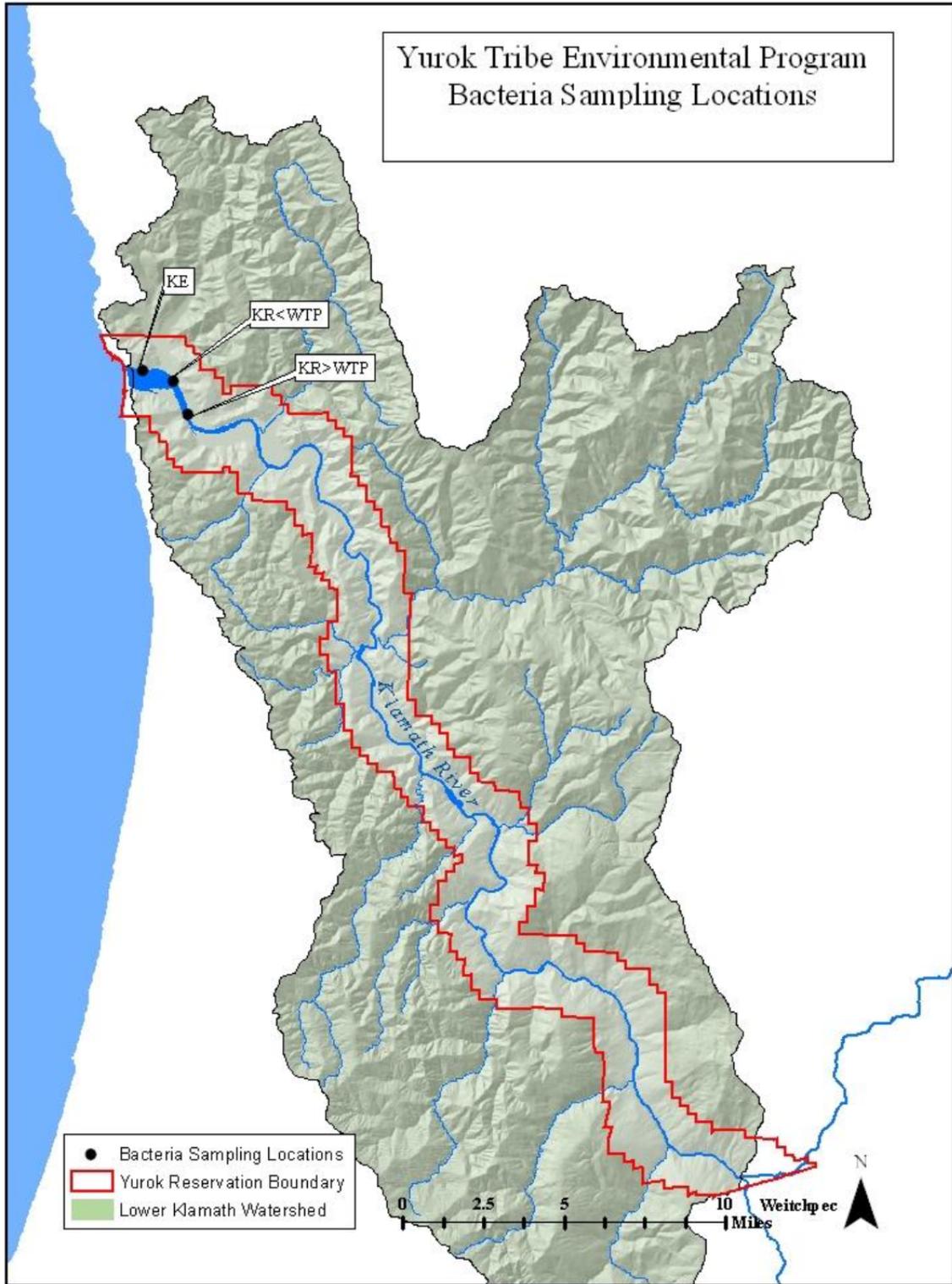


Figure 1. YTEP Bacteria Sampling Locations



Figure 2. Bacteria sample collection site at Klamath River below Water Treatment Plant (KR<WTP)



Figure 3. Bacteria sample collection site at Klamath River above Water Treatment Plant (KR>WTP)



Figure 4. Bacteria sample collection site at Klamath River Estuary (KE)

IV. Results

Table 1. Bacteria sampling results: WY2011

Bacteria Sampling Results Table														
<i>E. Coli</i>														
Most Probable Number Report Limit: 10 YTWQCP: <i>E. coli</i> single sample maximum 235 MPN/100ml														
Site	10/20/10	11/17/10	12/15/10	12/21/10	1/26/11	2/16/11	3/16/11	4/13/11	5/25/11	6/22/11	7/20/11	8/24/11	9/21/11	
KE	ND	41	41	10	ND	75	41	10	ND	ND	ND	10	20	
KR<WTP	ND	ND	52	41	ND	75	ND	ND	ND	ND	ND	ND	31	
KR>WTP	20	41	63	20	ND	52	31	10	10	20	ND	20	ND	
<i>Strep. Faecalis (enterococci)</i>														
Most Probable Number Report Limit: 10 YTWQCP: <i>Strep. faecalis</i> single sample maximum 61 MPN/100ml														
Site	10/20/2010	11/17/2010	12/15/2010	12/21/2010	1/26/2011	2/16/2011	3/16/2011	4/13/2011	5/25/2011	6/22/2011	7/20/2011	8/24/2011	9/21/2011	
KE	ND	10	41	10	ND	41	31	ND	ND	ND	ND	ND	ND	
KR<WTP	ND	ND	31	10	ND	20	31	ND	ND	ND	ND	ND	ND	
KR>WTP	10	ND	10	10	ND	20	10	ND	ND	ND	ND	ND	ND	
Total Coliform														
Most Probable Number Report Limit: 10 CSWRCB: Total Coliform single sample maximum 10,000 MPN/100ml														
Site	10/20/2010	11/17/2010	12/15/2010	12/21/2010	1/26/2011	2/16/2011	3/16/2011	4/13/2011	5/25/2011	6/22/2011	7/20/2011	8/24/2011	9/21/2011	
KE	776	862	3076	644	435	959	631	285	279	852	1046	987	645	
KR<WTP	1050	455	1334	733	464	933	789	145	428	350	869	2613	1565	
KR>WTP	933	583	1250	738	231	689	565	292	327	275	2143	10462	1607	

*** ND (No Detect) = Samples collected were below the reporting limit of 10 MPN. For graphing purposes all results below the reporting limit were given a value of one half the reporting limit.**

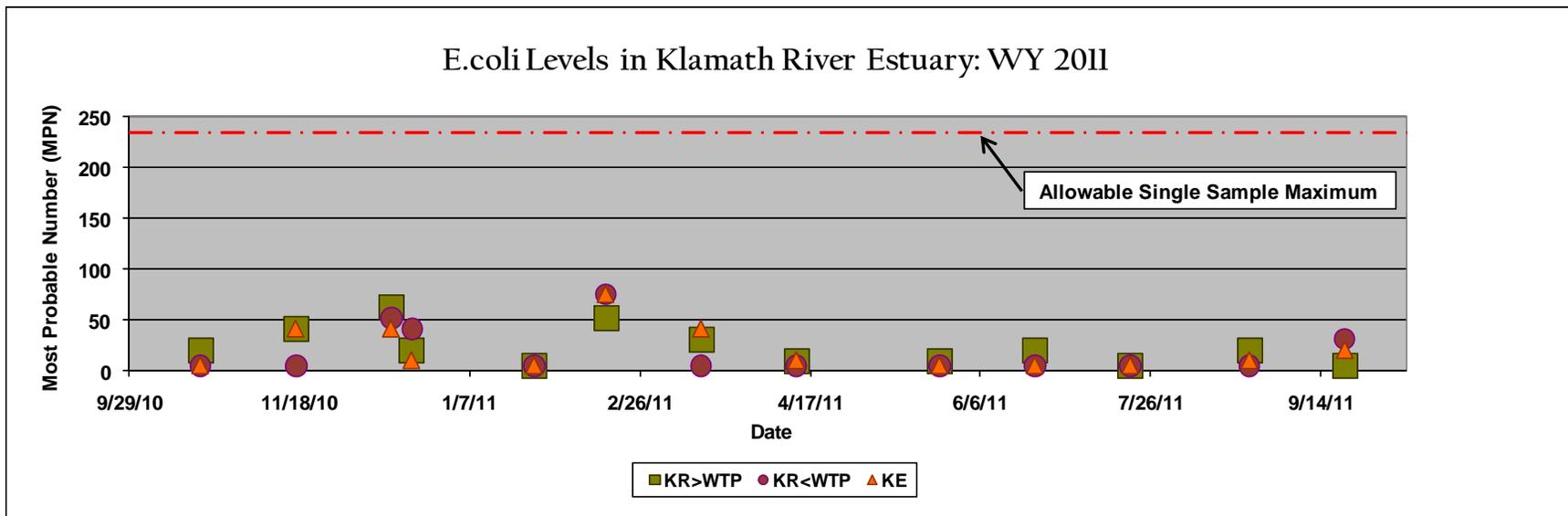


Figure 5. YTEP E. coli results: WY 2011

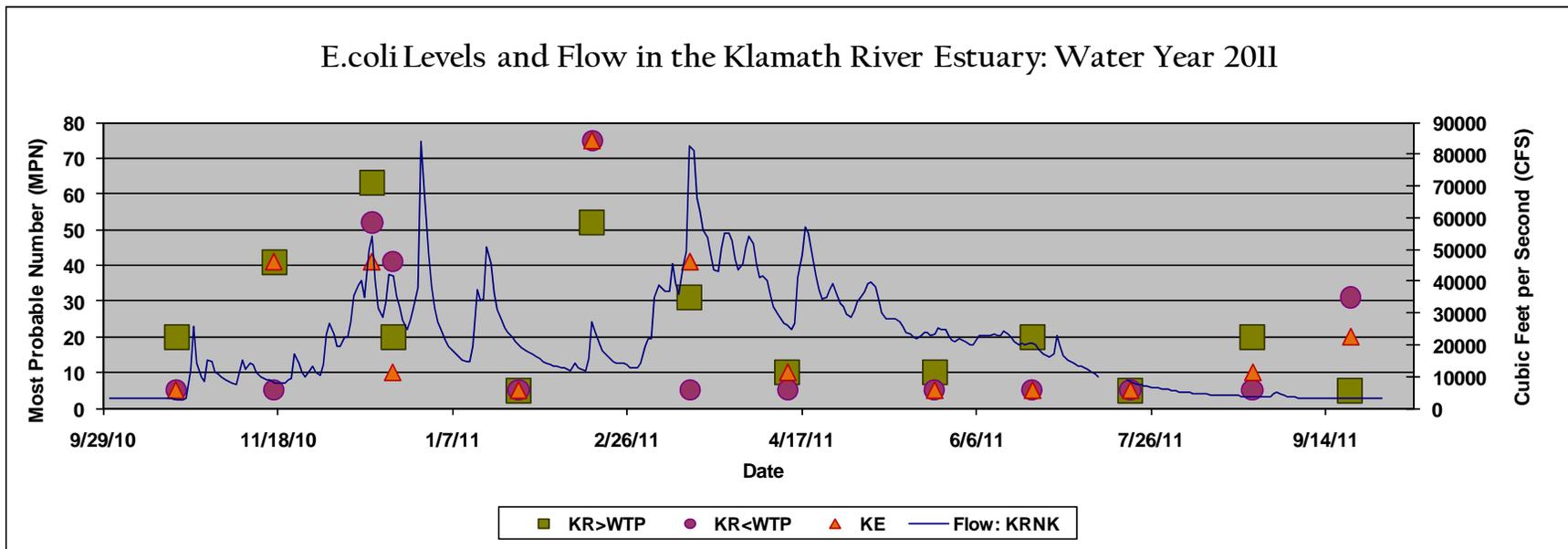


Figure 6. E. coli levels and Flow*: WY 2011

*Flow from USGS Gage: Klamath River Near Klamath (KRNK)

Enterococcus Levels in the Klamath River Estuary: Water Year 2011

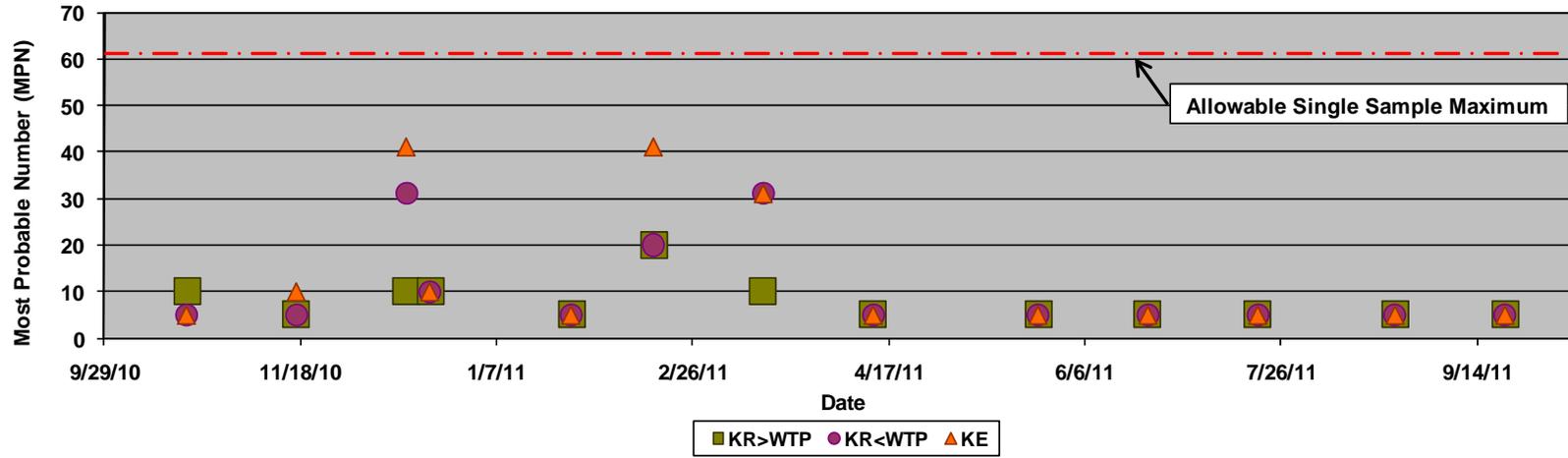


Figure 7. YTEP Enterococcus results: WY 2011

Enterococcus Levels and Flow in the Klamath River Estuary: Water Year 2011

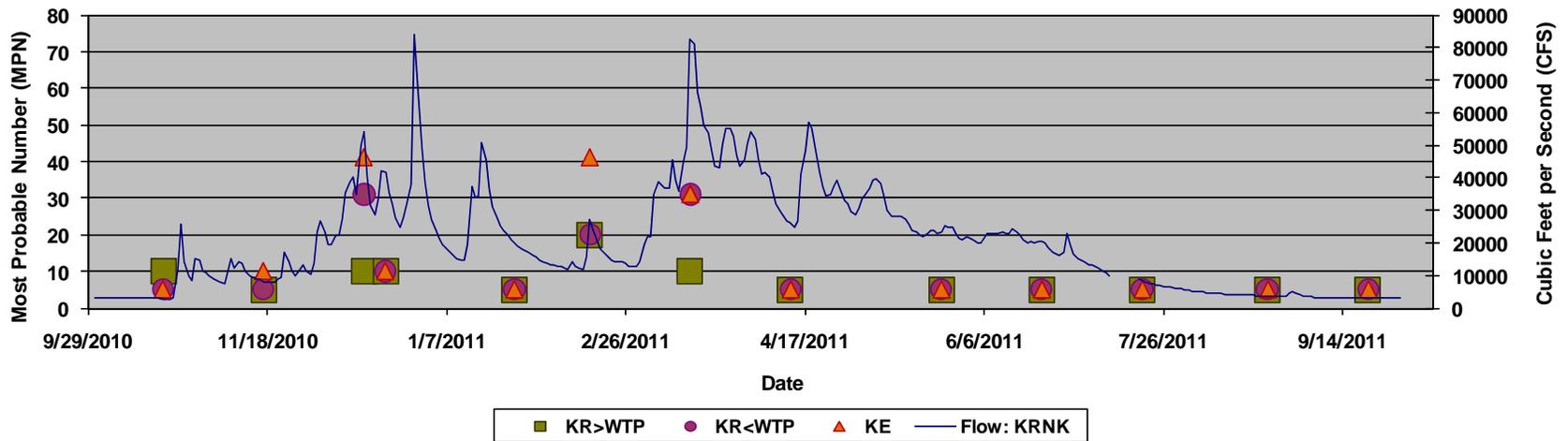


Figure 8. Enterococcus levels and Flow*: WY 2011

*Flow from USGS Gage: Klamath River Near Klamath (KRNK)

Total Coliform Levels in Klamath Estuary vs. USGS Discharge in WY 2011

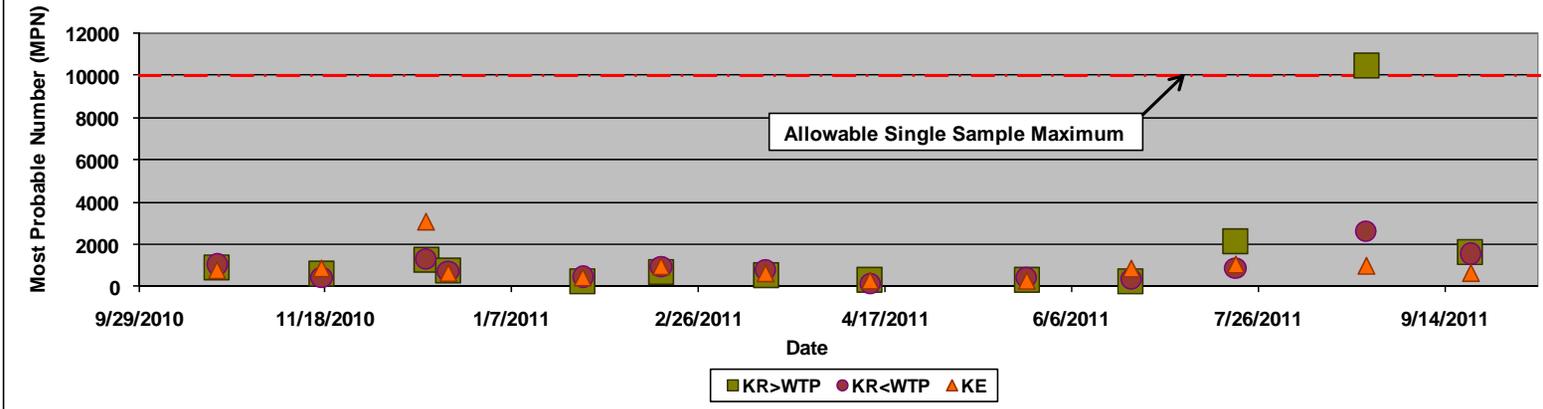


Figure 9. Total Coliform results: WY 2011

Total Coliform Levels and Flow in the Klamath River Estuary: Water Year 2011

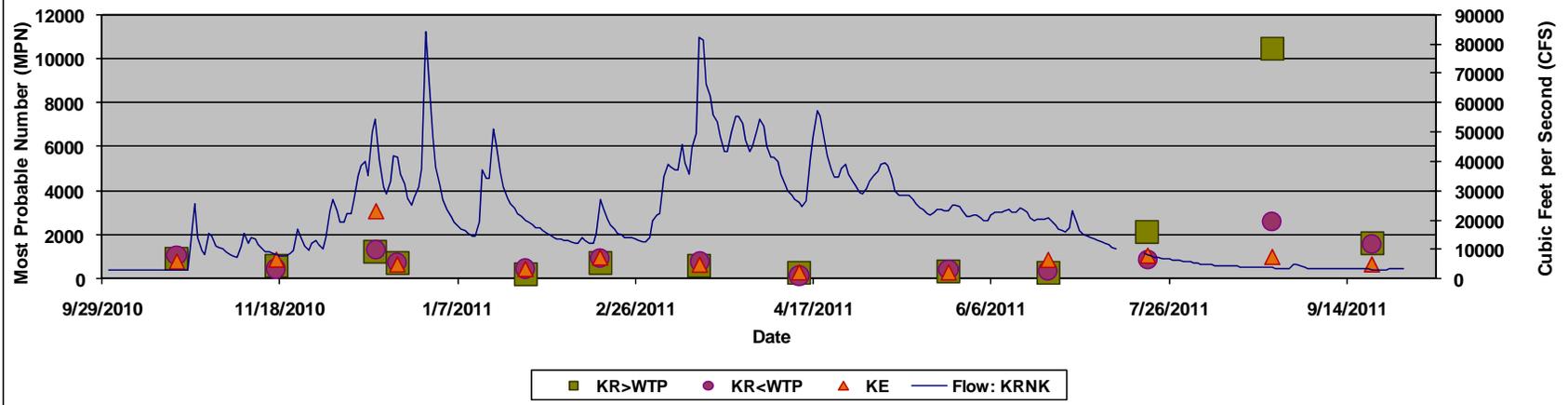


Figure 10. Total Coliform levels and Flow*: WY 2011
 *Flow from USGS Gage: Klamath River Near Klamath (KRNK)

V. Discussion

Escherichia coli

Throughout WY2011, all *E. coli* samples collected showed results were well below the water quality standard of 235 MPN/100 ml set forth by the Yurok Tribe's Water Quality Control Plan for the Yurok Reservation. 17 of the 39 samples collected, or approximately 44 percent, tested below the minimum detection limit of 10 MPN/100 ml (Figure 5, Table 1). The highest *E. coli* level, 75 MPN, was measured at KR<WTP and KE on 2/16/2011. The sampling event on 2/16/2011 seems to show a spike in *E. coli* levels. While detectable concentrations of *E. coli* averaged 33.36 MPN for the year, the sampling date of 2/16/2011 shows concentrations from 52 to 75 MPN. This is around twice the average. This spike could be explained by the first rain after an extended dry period (Figure 6).

Enterococcus

Throughout WY 2011, enterococci levels were well below the water quality standard of 61 MPN/100 ml set forth by the Yurok Tribe's Water Quality Control Plan for the Yurok Reservation. 25 of the 39 samples collected, or 64 percent, tested below the minimum detection level of 10 MPN/100 ml (Figure 7, Table 1). The highest enterococcus level, 41 MPN, was measured twice at KE on 12/15/2010 and 2/16/2011. The sampling events on these dates show a clear spike in enterococci levels. The spike on 12/15/2011 is likely due to the increased flow during the first major rain event of WY2011 (Figure 8). The first large precipitation events of the winter season have a high potential to flush enterococcus that has accumulated on land within the watershed during the dry summer months into the river system. The second spike collected on 2/16/2011 could be explained by the first rain after an extended dry period. As a whole, enterococci levels during WY2011 were proportional to flow (Figure 8).

Total Coliform

Throughout WY 2011, most total coliform samples was measured at detectable levels that were well below the water quality standard of 10,000 MPN/100 ml set forth by the Yurok Tribe's Water Quality Control Plan for the Yurok Reservation. The highest concentration measured was 10,462 MPN on 8/24/2011 at KR>WTP (Figure 9, Table 1), which is the only sample that exceeded the single sample maximum. The lowest concentration of 231 MPN was recorded on 1/26/2011 at KR>WTP. Overall, total coliform concentrations were inversely proportional to flow (Figure 10). Total coliform levels tend to increase through the summer months due to increased biological activity and lower water volumes within the watershed, then decrease during the winter months as biological activity within the watershed decreases and water volume increases. From October 2010 through June 2011 total coliform levels were very low. They stayed very low throughout the rainy season and began to increase slightly in July 2011 as water flow in the Klamath River decreased.

On average, KR>WTP had the highest concentrations of total coliform. The average for this site was 1,546 MPN. KR<WTP had the second highest levels with an average of 902 MPN. KE had the lowest average at 883 MPN. The highest concentrations varied by month however. Even the site with the lowest average concentrations, KE, had the highest readings

for two of the thirteen sampling events and the site with the highest average concentrations, KR>WTP, showed the lowest reading (Figure 9, Table 1). This scattering of peak concentrations shows that there was no trend based on sample location during WY2011.