Aquatic Ecosystem Sciences LLC

TECHNICAL MEMORANDUM

Upper Klamath Lake Tributary Sampling: 2016 Data Summary Report

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INTRODUCTION

The Klamath Tribes have been monitoring nutrient concentration and loading in Upper Klamath Lake (UKL) tributaries since 1991. Data from 1991-1998 were summarized and incorporated into water and nutrient balances for UKL (Kann and Walker 1999). More recently the longer term 1991-2010 database was evaluated for seasonal and inter-annual dynamics, long term trends, and both water and nutrient balances were computed for UKL (Walker et al. 2012). This report serves as an annual update to the UKL tributary water quality database, including a summary of 2016 data (basic summary statistics and graphical analysis), and limited comparison of graphical time-series trends of tributary data collected for the 1991-2016 period. Included in this summary is an update of previous UKL tributary water quality databases with data collected during 2016, including appropriate quality assurance analyses (*see Excel spreadsheets: Klamath Tribes Inflow Nutrient Data 1991-2000.xls* and *Klamath Tribes Inflow Nutrient-Q Data 2001-2016.xls*).

METHODS

Methods followed the Klamath Tribes established procedures for field collection and laboratory analysis of water quality parameters (see Klamath Tribes QAPP and SOP; 2013 for a complete description of these methods). Beginning in 2008 for nutrient parameters, laboratory analyses transitioned from Aquatic Research, INC. in Seattle WA to the Sprague River Water Quality Laboratory (SRWQL) in Chiloquin OR. During the transition period duplicate samples were analyzed by both laboratories to confirm parameter reproducibility. Specific nutrient methodology and field collection protocol are contained in the SRWQL QAPP (Klamath Tribes 2013) and SOP (2013). Nutrient parameters (Table 1) were collected at seven tributary stations during the 2016 sampling season at an approximately biweekly frequency (Figure 1; Figure 2). Specific computation of nutrient loading is outlined in Kann and Walker (1999) and Walker et al. (2012), but is briefly summarized here.

Table 1. Nutrient parameters collected in Upper Klamath Lake tributaries, 2016.

Parameter	Abbreviation/Unit	Grab [a]
Total Phosphorus	TP (µg/L)	X
Soluble Reactive Phosphorus	SRP or PO_4 (µg/L)	X
Total Nitrogen	TN (µg/L)	X
Ammonia Nitrogen	NH_4-N (µg/L)	X
Nitrate-Nitrite Nitrogen	NO_3+ NO_2-N (µg/L)	X
Nitrite Nitrgen	NO_2-N (µg/L)	X
Silica	SiO_2 (µg/L)[1]	X
Total Suspended Sediments	TSS (mg/L)	X
Turbidity	NTU	X

[a]Grab = integrated water column sample and x-sectional sample collected with a Van-Dorn sampler.

[1] Silica measurements were initiated in 2008, NO_2 in 2013, and TSS and Turbidity in 2016 and are now included as a regularly measured parameter.

Table 3. Station location and Site ID Code for data collected in Upper Klamath Lake tributaries, 2016.

Location	Site ID Code	Latitude/Longitude
Sprague R. @ Kirchers Bridge	WR1000	N42.567806° W121.864472°
Annie Ck @ Snow Park	WR2000	N42.763685° W122.058362°
Wood R @ Weed Rd	WR3000	N42.646461° W121.994959°
Wood R @ Dike Rd	WR4000	N42.581460° W121.941536°
7-mile canal @ Dike Rd	WR5000	N42.581970° W121.970898°
Williamson R @ Bridge on Modoc Pt. Road	WR6000	N42.514355° W121.916714°
Upper Klamath Lake @ Pelican Marina/Fremont Bridge (UKL Outflow)	KL0001/KL0002	N42.238472° W121.805557°

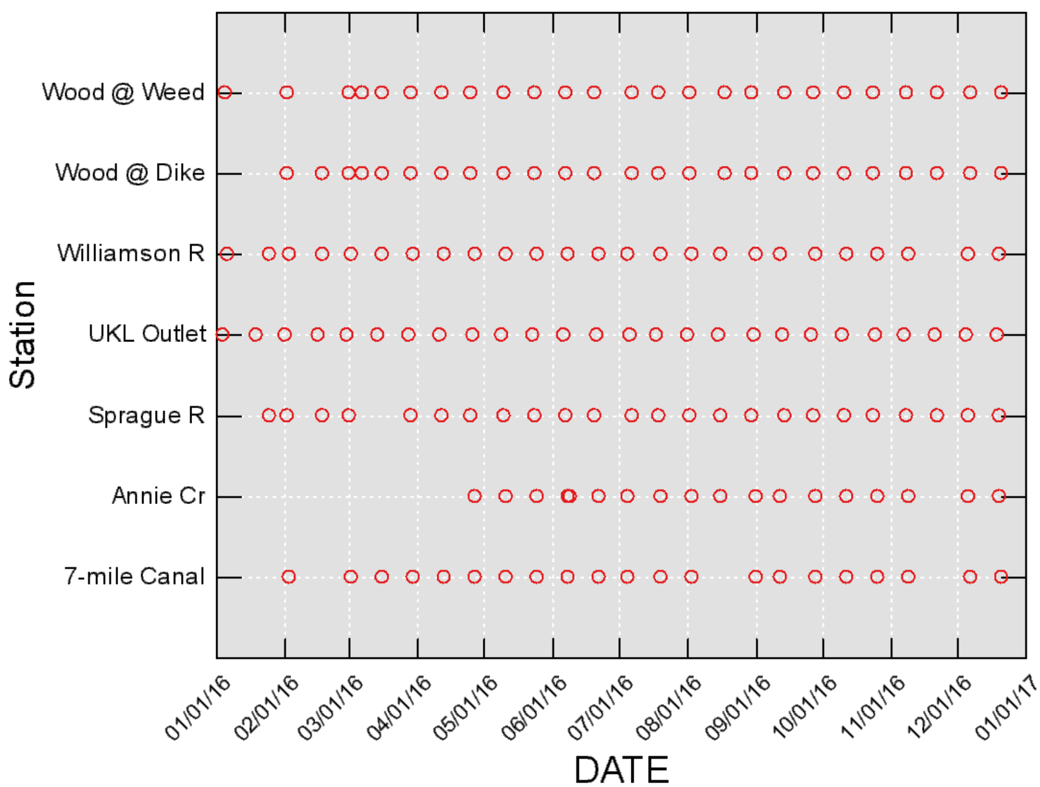

Figure 1. Spatial-temporal sampling matrix for Upper Klamath Lake tributaries, 2016.

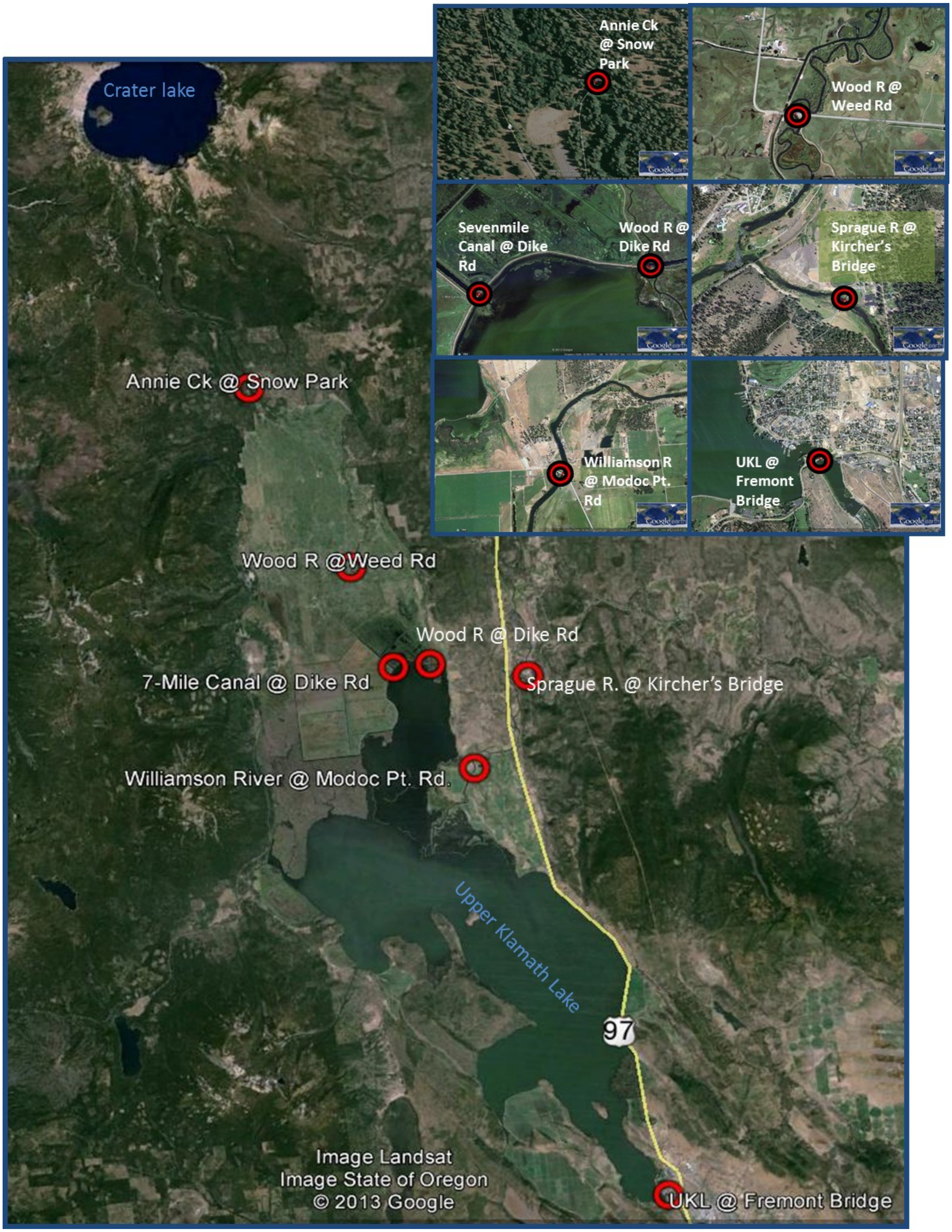

Figure 2. Location of Klamath Tribes Upper Klamath Lake tributary sampling stations.

Daily inflow volume for the Williamson and Sprague Rivers on a given sample date was extracted from continuous daily discharge data obtained from U.S. Geological Survey (USGS) stream-flow discharge stations. These data were obtained online for the Williamson River Gage 11502500[2] and Sprague River Gage 11501000[3]. Daily outflow volume for Upper Klamath Lake (UKL outflow) was computed from the sum of USGS discharge station at Link River 11507500[4] and USBR A-Canal[5] daily discharge measurements:.

For the Wood R. @ Weed and Wood R. @ Dike stations, continuous daily discharge measurements were generated by Graham Matthews and Associates (e.g., see GMA 2004) for 1992-2006, but these data were not available after 2006 for Dike Road. However, instantaneous discharge continued to be measured at Wood R. @ Weed, Wood R. @ Dike, 7-mile canal @ Dike Rd and Annie Cr. @ Snow Park stations by both the Klamath Tribes and GMA (2004a; 2011a). Beginning in 2013, USGS implemented a continuous flow monitoring station at Wood R. @ Dike (USGS 11504115 Wood River Near Klamath Agency, OR[6]), which aside from several outliers, generally showed good agreement with the Klamath Tribes instantaneous biweekly measurements (Figure 3; the regression line was not significantly different from the 1:1 line). Flow measurements coinciding with nutrient sample collection dates are shown in Figure 4. Although additional nutrient concentration data were collected by GMA (e.g., 2004b; 2011b) and these data were incorporated into tributary loading calculations for the overall 1991-2010 analysis (Walker et al. 2012), only data collected by the Klamath Tribes are presented in this annual data update report.

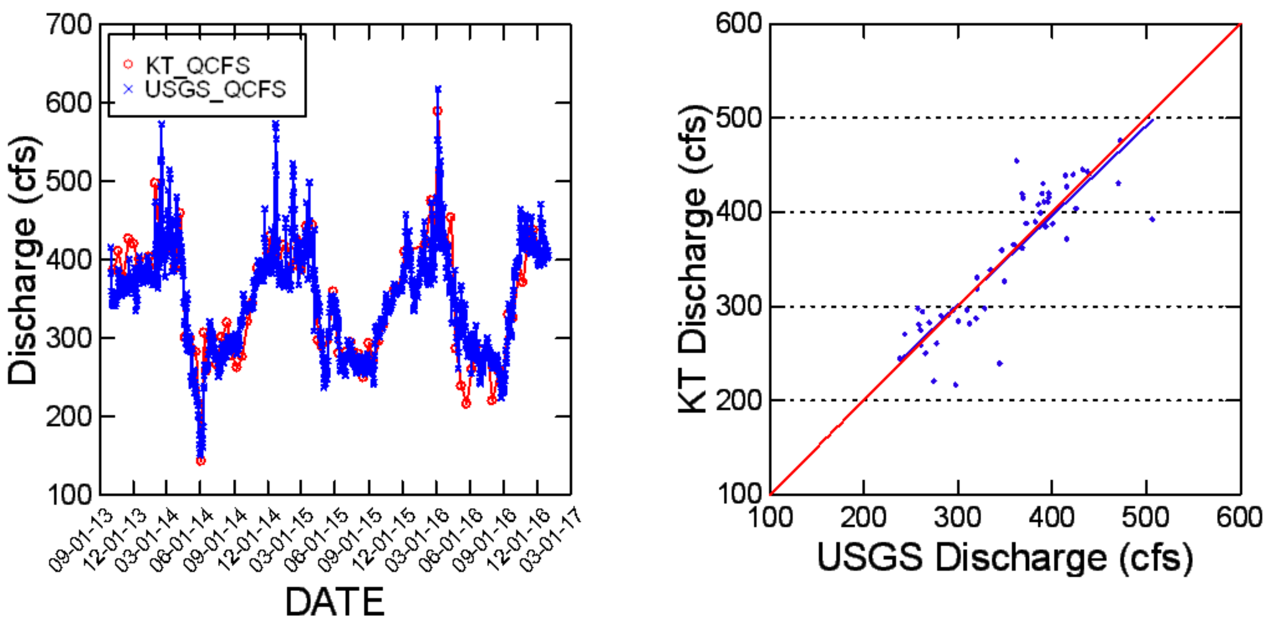

Figure 3. Comparison of USGS and Klamath Tribes discharge measurements at Wood River @ Dike Road. Red line on the scatter plot is the 1:1 line; blue line is the linear regression line.

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[2] http://waterdata.usgs.gov/nwis/dv/?site_no=11502500&agency_cd=USGS&referred_module=sw
[3] http://waterdata.usgs.gov/or/nwis/dv/?site_no=11501000&agency_cd=USGS&referred_module=sw).
[4] http://waterdata.usgs.gov/or/nwis/dv/?site_no=11507500&agency_cd=USGS&referred_module=sw
[5] http://www.usbr.gov/mp/kbao/operations/water/korep1.cfm?lakeid=ukldata3
[6] http://waterdata.usgs.gov/usa/nwis/uv?11504115

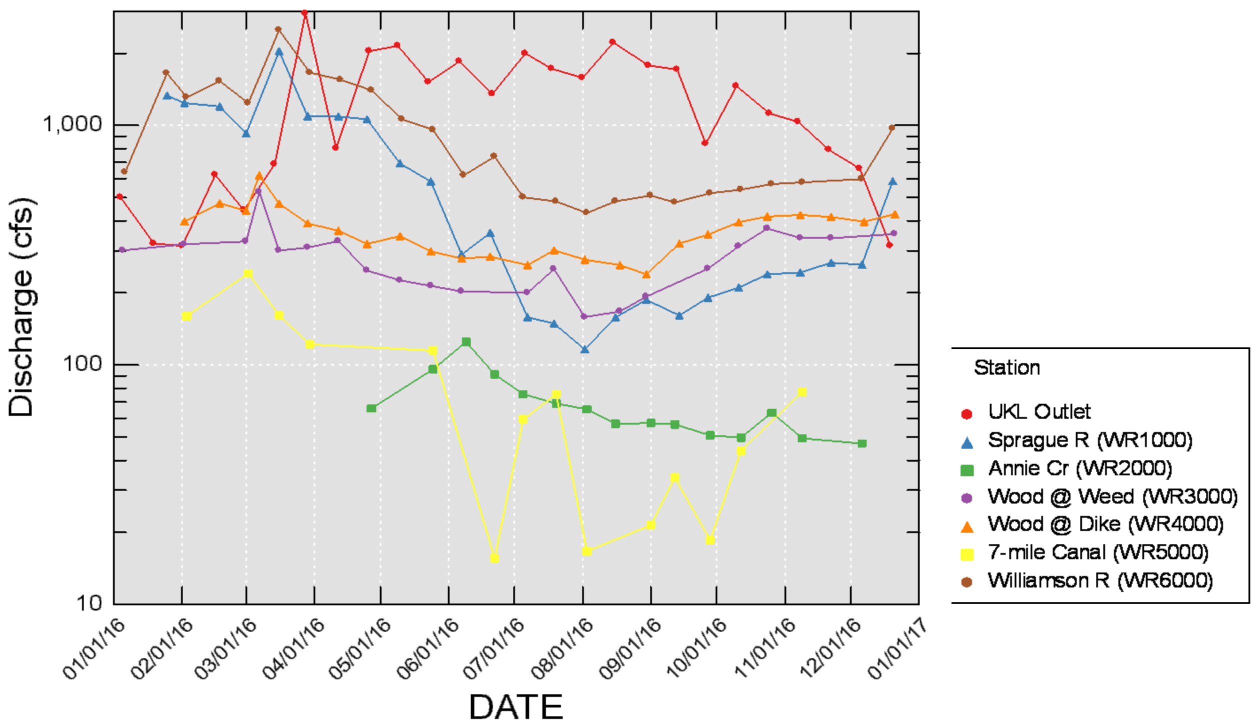

Figure 4. Flow (cfs) measurements coinciding with nutrient sample collection dates, 2016. Flow shown only for dates that nutrient data exist.

The total phosphorus (TP) and total nitrogen (TN) mass (kg/day) for each 2016 sample station and date were computed as the product of daily water volume and measured TP or TN concentration. Nutrient data collection at the UKL outflow station (Upper Klamath Lake @ Fremont Bridge) was discontinued by the Klamath Tribes during 2006-2011 due to funding reductions. Although the UKL sampling station PM is used as a surrogate for the UKL outflow for intervals when data for Upper Klamath Lake @ Fremont Bridge are not available, this caused data gaps for the October-March period during 2006 and 2007.

Beginning in 2008, the U.S. Bureau of Reclamation (USBOR) began monitoring nutrients during the winter months at Link River Dam and near the mouth of the Link River. These data were provided by USBOR along with limited data collected by PacifiCorp during the winter of 2009 and 2010 (Excel spreadsheets: *KRWQ2007-2010KLLD.xls* and *Pacificorpdata2009-2010.xlsx*). Outflow data provided by USBOR for 2011 and 2012 also included additional data for 2009 and 2010 that had not been previously provided (Excel spreadsheets: *KRWQ2007-2012KLLD.xls*[7]) In addition, the Klamath Tribes again began sampling Upper Klamath Lake @ Fremont Bridge in 2012. Additional nutrient data were incorporated from data provided by both USGS and USBR in 2013- 2016 leading to greater sampling frequency at this station. Only Klamath Tribes data for 2016 are included in this data summary report. Station names for the various outflow

[7] sources: http://www.kbmp.net/collaboration/klamath-hydroelectric-settlement-agreement-monitoring, and spreadsheet "UKL-FreemontBridge-WQ-2012-13-BOR.xlsx" provided by Rick Carlson, Physical Scientist, Bureau of Reclamation Klamath Basin Area Office, racarlson@usbr.gov. The latter file includes additional data collected at Fremont Bridge as part of a 3-year nutrient budget study of the Klamath Project.

stations were standardized by renaming them UKL-Outlet. When stations were sampled on the same date a mean was taken. Loading graphs and summaries are computed based on the October-September hydrologic water year (denoted HY in below plots).

Additional tributary sampling on the Sevenmile system funded by the Oregon Watershed Enhancement Board also took place in 2016. The intent of the additional sampling was to determine longitudinal nutrient concentrations and loads between Sevenmile Creek at Sevenmile Rd. and Sevenmile Creek just below the confluence of West Canal. A total of 5 stations were sampled with the intent to determine the influence West Canal, one of the Wood River Valley's main irrigation return flows, on nutrient concentrations and loads entering Agency Lake. These data are summarized below.

RESULTS/DISCUSSION

Nutrient Concentration

The 2016 nutrient concentration pattern compared among inflow stations was similar to that of the 1991-2015 sampling period (Figure 5); total P and PO4-P tended to be higher at the Wood River and Seven Mile stations (WR3000, WR4000, and WR5000); total N tended to be lower for the Wood River stations (WR3000 and WR4000) but higher for Seven Mile (WR5000); values for the Williamson River (WR6000) tended to be intermediate relative to other stations for most parameters, but values for the Sprague River (WR1000) tended to be lower for TP and PO4-P, and second highest for TN after Seven Mile. In addition, Annie Creek at Snow Park (previously sampled from 2003-2015) showed consistently lower concentrations for all nutrient parameters except nitrate/nitrite among the inflow stations (Figure 5; Table 2).

With the exception of Seven Mile Canal, the UKL outlet (KL0001) tended to be higher than inflow stations for TP, lower for PO4, and substantially higher for TN and ammonia (NH4-N). Long-term upper quartile values for NO3-N were also higher at the UKL Outlet station than for inflow stations, and were substantially higher in 2016. Outflow NO3-N was also notably higher than inflow stations during 2012-2015. Similar to some previous years (e.g., 2010 and 2013), when NH4-N at the UKL Outlet was notably higher than Seven Mile Canal, the pattern in 2016 also showed higher upper quartile (and median) values at UKL Outlet (Figure 5; Table 2). Whereas in 2009, 2011, and 2014, the UKL Outlet showed values more similar to Sevenmile Canal.

TP distribution in 2016 was noticeably lower for the Sprague River and Williamson River stations compared to the long-term 1991-2015 distribution (Figure 5). Unlike 2014 when UKL-Outflow TP was very similar to the long-term distribution, the 2016 (and 2015) distribution was lower. Annie Creek TP concentration was somewhat higher in 2016 than in previous years. Similar to 2011-2015, the 2016 distribution of Sprague River PO4-P concentration was noticeably lower when compared to the long-term distribution, whereas other inflow stations were similar to their respective long-term PO4-P distributions (Sevenmile showed an elevated upper quartile, however). Unlike 2014 when the UKL-Outflow PO4-P distribution was noticeably higher than the long-term distribution, the 2016 distribution was lower overall. Other notable departures from the long-term distributions include lower TN concentration at all inflow stations except Sprague River, somewhat lower NH4-N at the Outflow station (median and lower quartile), and higher NO3-N at all stations except Annie Cr. (Figure 5).

Comparisons of inflow ammonia and nitrate-nitrite between 2016 and the long-term distribution are confounded by levels near method detection limits and by a change in detection limits when the SRWQL began processing samples in 2008[8]. However, Outflow, Williamson River, and Sevenmile values for these parameters are affected to a lesser degree because values tend to be above method detection limits. Although beyond the scope of the annual data report, long-term comparisons can be facilitated by constraining values to be no less than the higher detection limits used prior to 2008. Higher Outflow nitrate values in 2013-2016 may be due to the increased sampling frequency during winter months when NO_3-N is usually higher overall than other seasons. A comparison of seasonal June-October distributions compared to the long-term distribution shows that all stations were generally lower for TN (Appendix III).

Similar to previous years, time series plots of the 2016 concentration data show Seven Mile Canal (WR5000) to have among the highest inflow values for TP, PO_4, PP (particulate P which equals TP minus PO_4), and TN, especially during the summer irrigation season (Figure 6). Phosphorus values typically tend to seasonally peak during both the spring runoff period and the summer irrigation season (Figure 6). With respect to PO_4, the Wood River stations also showed high values, followed by the Williamson and Sprague Rivers; a pattern similar to other years. Sprague River PP concentrations were among the highest in the spring and declined during the low-flow summer period, and Annie Creek also showed an elevated concentration during a December high flow event (Figure 6). TP, PP, and TN at the UKL Outflow station increased relative to the inflow stations during the summer algal growing season (primarily June-August; Appendix IV).

Ammonia (NH_4-N) and nitrate (NO_3-N) at the Outflow station also increased seasonally (mid to late summer), with values remaining high through the fall and winter before declining in the spring (Figure 7; Appendix IV). Summer Outflow ammonia was particularly low in 2016 compared to other years (Appendix IV). Outflow NH4-N and NO3-N patterns are tied to algal uptake and nitrogen fixation dynamics in UKL, as well as ammonification/nitrification (see Kann 2016). In general, ammonia in Sevenmile Cr. tends to be among the highest relative to other inflow stations, especially during the irrigation season.

Dissolved silica concentration at the Wood River and Annie Cr. Stations tended to be higher than the Sevenmile, Sprague, and Williamson stations during the spring; the Sprague River tended to show the lowest silica concentrations, followed by 7-Mile and the Williamson River (Figure 7; Appendix IV). The UKL Outflow station showed a clear seasonal pattern where silica values were depressed during the spring and early summer before increasing sharply in June to higher levels that remain high through the winter (Figure 7; Appendix IV). The spring silica depression at the Outflow station coincides with diatom blooms occurring in Upper Klamath Lake, summer increases are likely due to decline of diatoms as well as release of sediment P-bound silica due to high summer pH levels.

[8] Aquatic Research Inc. indicated a reporting limit of 10 µg/L for NH4 and NO23; the SRWQL utilizes a reporting limit of 6 µg/L for NH4 and 8 µg/L for NO23.

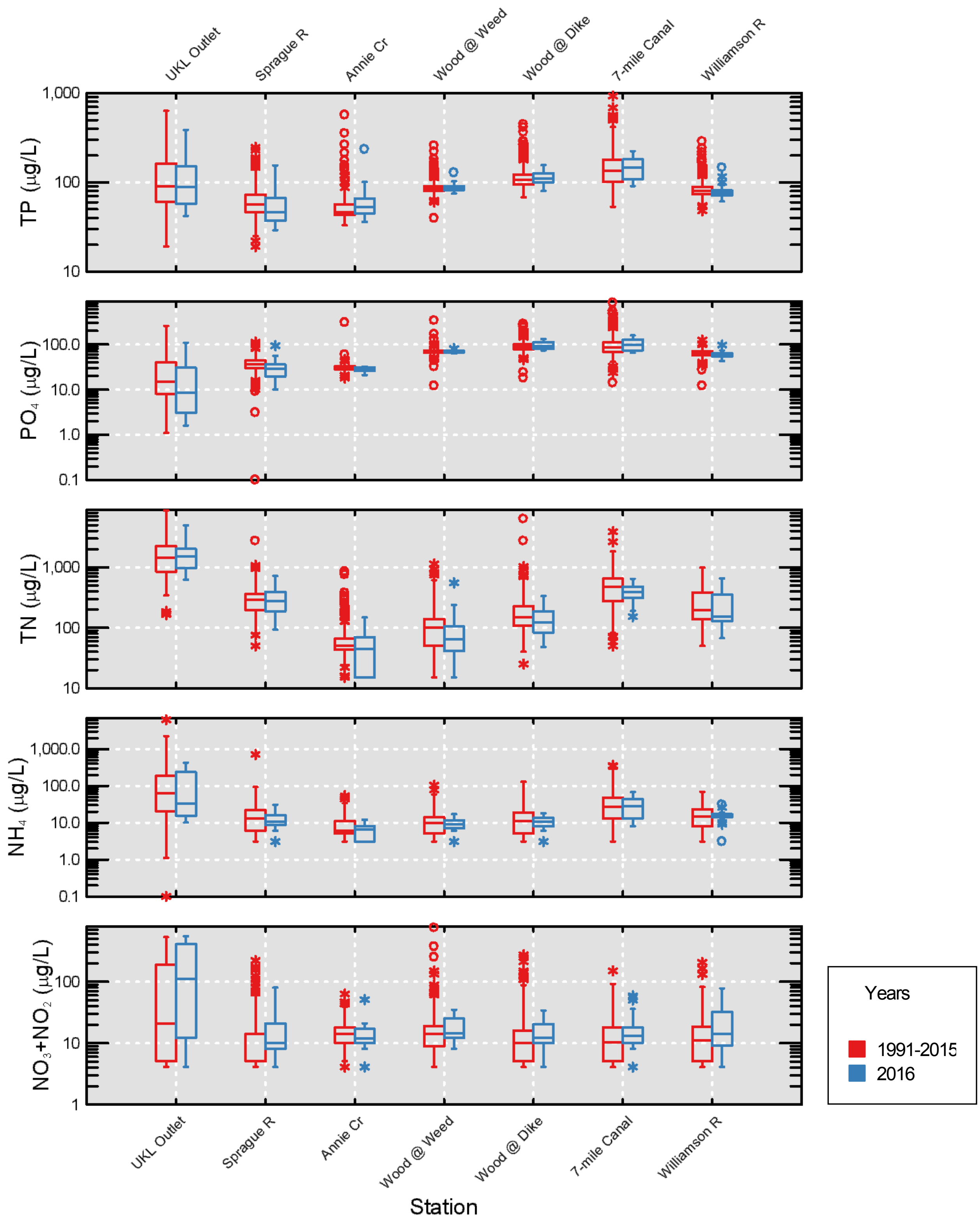

Figure 5. Station distributions of TP, SRP, TN, NH4-N, and NO3+ NO2-N concentration (µg/L) compared between 1991-2015 (red) and 2016 (blue).

Table 2. Basic statistics by station for TP, SRP, TN, NH_4-N, NO_3+ NO_2-N and SiO_2 concentration, and TP and TN load, Water Year 2016.

Station Code	Station Name	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
UKL Out	UKL Outlet	N of Cases	28.00	26.00	29.00	28.00	29.00	25.00	28.00	29.00
UKL Out	UKL Outlet	Median	88.25	8.50	1520.00	33.50	110.00	35300.00	319.30	4498.01
UKL Out	UKL Outlet	Arithmetic Mean	119.75	20.90	1668.71	128.23	211.07	35616.00	448.05	5539.31
UKL Out	UKL Outlet	Coefficient of Variation	0.72	1.34	0.54	1.15	0.94	0.20	0.96	0.86
UKL Out	UKL Outlet	Pct25	57.50	3.00	962.50	15.50	11.75	28937.50	102.22	1878.07
UKL Out	UKL Outlet	Pct75	153.00	30.50	2022.50	237.50	419.75	41625.00	555.02	7013.15
WR1000	Sprague R	N of Cases	23.00	23.00	23.00	24.00	24.00	24.00	23.00	23.00
WR1000	Sprague R	Median	46.00	29.00	274.00	10.50	10.00	27700.00	28.64	120.24
WR1000	Sprague R	Arithmetic Mean	56.30	30.57	309.57	12.21	17.38	27062.50	98.34	591.06
WR1000	Sprague R	Coefficient of Variation	0.53	0.57	0.52	0.53	1.04	0.12	1.30	1.33
WR1000	Sprague R	Pct25	37.00	19.25	185.25	8.50	8.00	24950.00	16.73	85.02
WR1000	Sprague R	Pct75	67.00	36.00	398.00	16.00	21.00	29450.00	170.23	1002.87
WR2000	Annie Cr	N of Cases	18.00	18.00	18.00	18.00	18.00	18.00	16.00	16.00
WR2000	Annie Cr	Median	52.50	29.00	44.00	6.50	12.00	40450.00	7.14	6.12
WR2000	Annie Cr	Arithmetic Mean	65.56	27.89	50.89	6.39	14.89	38172.22	10.60	8.41
WR2000	Annie Cr	Coefficient of Variation	0.68	0.13	0.69	0.41	0.68	0.13	0.90	0.87
WR2000	Annie Cr	Pct25	45.00	26.00	15.00	3.00	10.00	35400.00	5.59	2.31
WR2000	Annie Cr	Pct75	66.00	31.00	70.00	8.00	17.00	42000.00	11.64	11.45
WR3000	Wood @ Weed	N of Cases	24.00	24.00	24.00	24.00	24.00	24.00	22.00	22.00
WR3000	Wood @ Weed	Median	86.00	69.00	64.00	9.00	14.50	39150.00	51.74	39.14
WR3000	Wood @ Weed	Arithmetic Mean	87.92	69.42	100.17	9.25	18.54	38562.50	58.89	74.15
WR3000	Wood @ Weed	Coefficient of Variation	0.12	0.06	1.11	0.44	0.47	0.05	0.37	1.14
WR3000	Wood @ Weed	Pct25	82.00	67.00	41.00	7.00	12.00	38750.00	47.42	22.52
WR3000	Wood @ Weed	Pct75	91.00	72.00	106.50	11.50	25.00	39700.00	63.28	92.55
WR4000	Wood @ Dike	N of Cases	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
WR4000	Wood @ Dike	Median	111.00	93.00	123.50	10.50	12.00	37200.00	85.71	95.23
WR4000	Wood @ Dike	Arithmetic Mean	113.92	96.33	141.33	10.54	14.42	36483.33	99.94	133.71
WR4000	Wood @ Dike	Coefficient of Variation	0.18	0.18	0.54	0.37	0.57	0.06	0.36	0.83
WR4000	Wood @ Dike	Pct25	100.00	80.50	83.50	8.00	10.00	35200.00	70.32	55.69
WR4000	Wood @ Dike	Pct75	126.50	112.00	190.00	13.50	20.50	37950.00	126.08	174.70
WR5000	7-mile Canal	N of Cases	21.00	21.00	21.00	21.00	21.00	21.00	17.00	17.00
WR5000	7-mile Canal	Median	147.00	99.00	390.00	28.00	13.00	31300.00	16.60	55.03
WR5000	7-mile Canal	Arithmetic Mean	147.00	104.19	401.95	30.62	19.33	30971.43	25.99	84.77
WR5000	7-mile Canal	Coefficient of Variation	0.29	0.31	0.33	0.62	0.86	0.08	1.01	1.27
WR5000	7-mile Canal	Pct25	106.00	73.25	311.00	12.75	9.75	29925.00	6.95	16.66
WR5000	7-mile Canal	Pct75	183.50	129.00	481.75	45.00	20.00	32250.00	37.89	100.82
WR6000	Williamson R	N of Cases	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00
WR6000	Williamson R	Median	76.00	60.00	152.00	15.00	14.00	32600.00	113.78	235.36
WR6000	Williamson R	Arithmetic Mean	81.40	60.24	257.00	15.44	21.64	32364.00	197.34	800.11
WR6000	Williamson R	Coefficient of Variation	0.22	0.17	0.70	0.35	0.87	0.07	0.80	1.25
WR6000	Williamson R	Pct25	71.00	53.50	127.50	13.75	8.75	30675.00	92.44	147.46
WR6000	Williamson R	Pct75	81.75	64.00	376.50	17.25	32.25	33600.00	262.52	1265.15

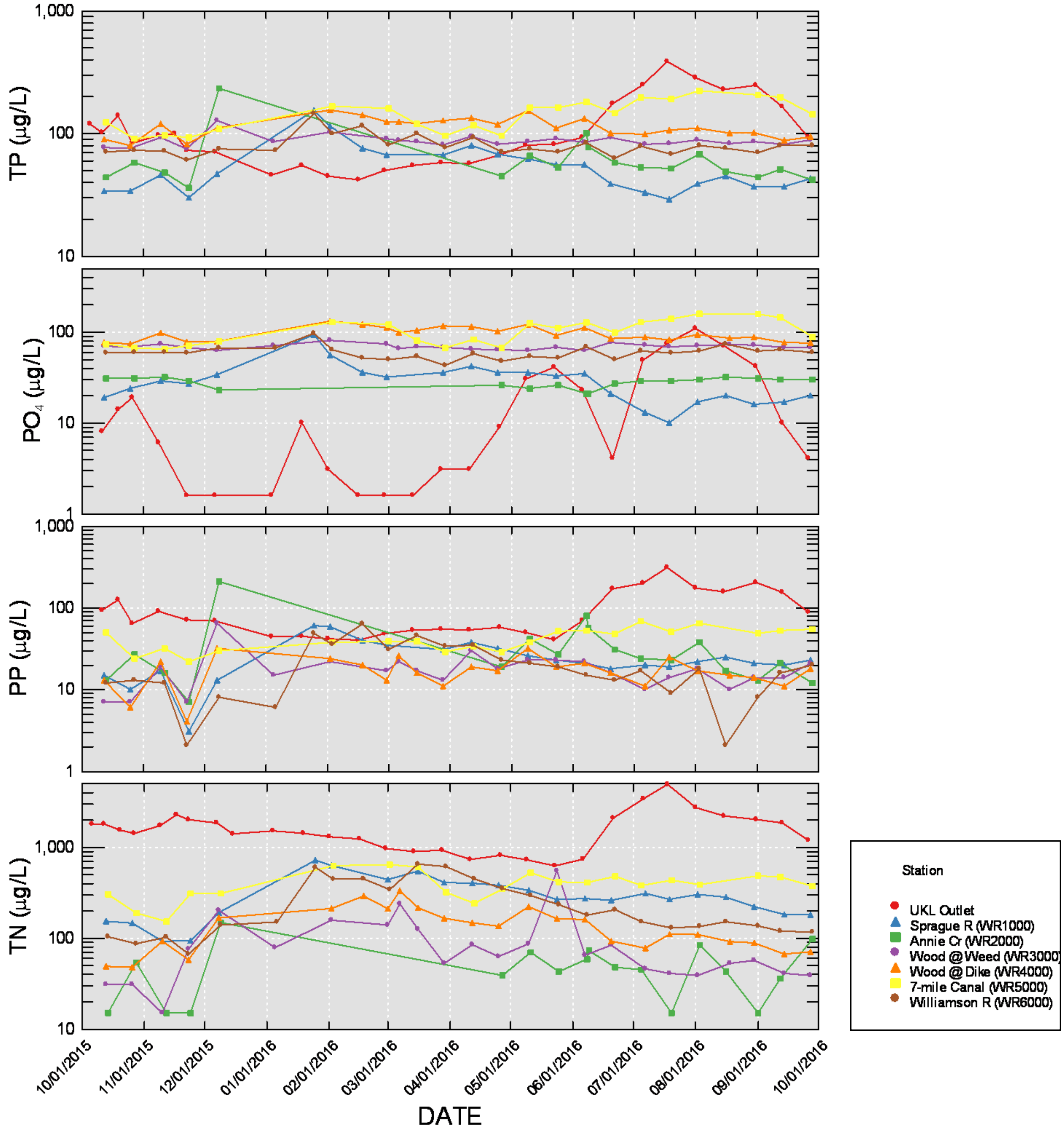

Figure 6. Time-series plot of TP, SRP, PP and TN concentrations for Upper Klamath Lake tributaries and outflow, HY 2016.

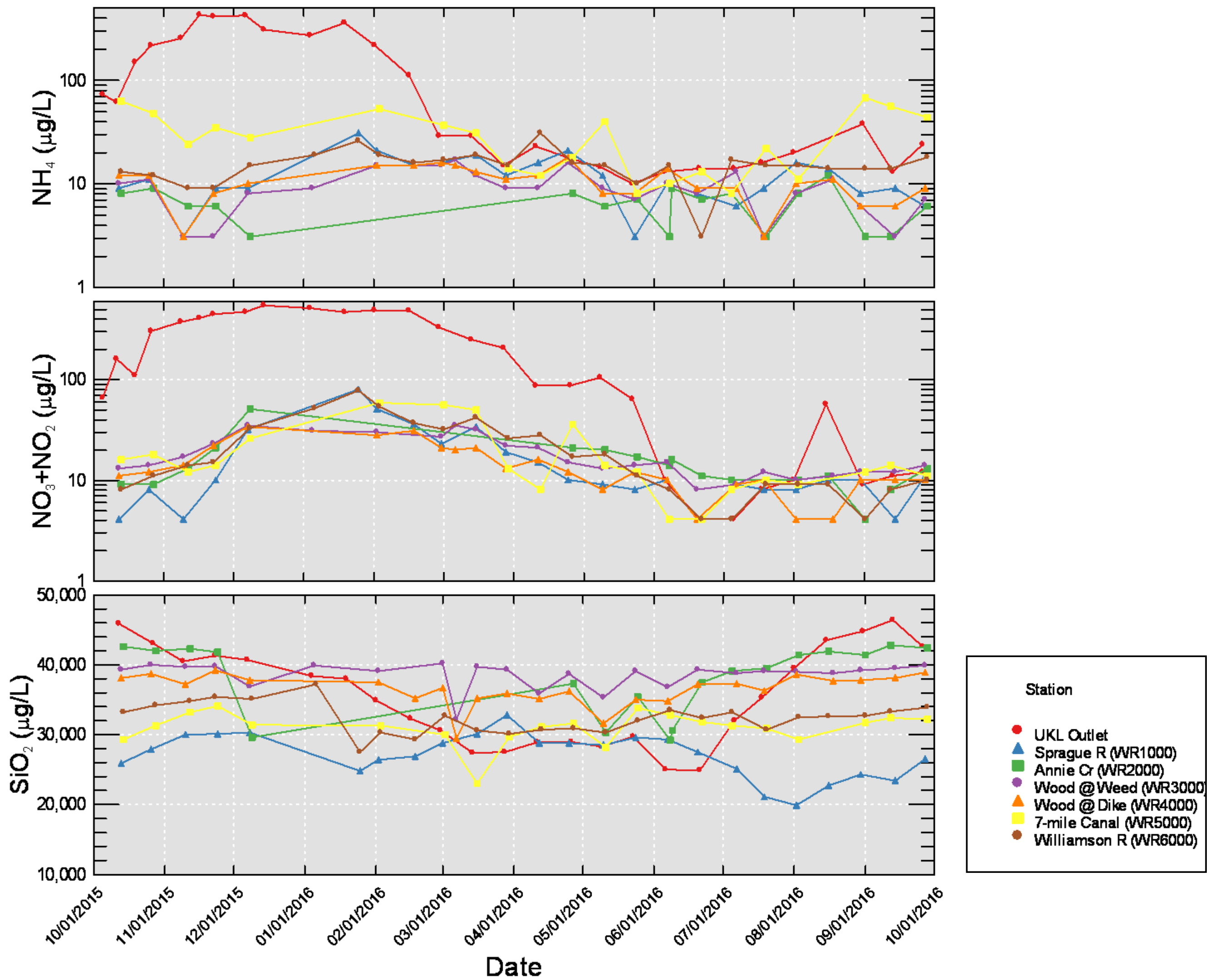

Figure 7. Time-series plot of NH_4-N, NO_3+ NO_2-N and SiO_2 concentrations for Upper Klamath Lake tributaries and outflow, HY 2016.

The TN:TP ratio at the UKL Outflow station was relatively high (TN:TP > ~15) during the late fall and early winter (2014-2016), and similar to earlier years (see Kann 2016), ratios then remained higher than tributary stations through the season (Figure 8). The lowest values of the year (~7) occurred during late-May and June. The overall pattern appears similar to earlier years when the TN:TP ratio at UKL Outflow was higher (TN:TP ≅ 10) than tributary stations in April, declined during May and June, increased during early summer UKL bloom development, and declined through the bloom decline period before increasing again in August (Figure 8). In 2016 the TIN:SRP ratio in the Outflow decreased from peak values of ~600 during winter-spring, to ~10 in mid-spring, and then to seasonal low values in June-July (~0.2), before increasing sharply into August and September (~10) (Figure 8). Winter and early-spring TIN:SRP in the UKL Outflow were an order of magnitude higher than in 2015. Both TN:TP and the majority of TIN:SRP values in the inflow tributary stations indicate nitrogen limiting conditions (<10 for TN:TP and <1 for TIN:SRP) that would tend to promote nitrogen-fixing algae such as the *Aphanizomenon* prevalent in UKL. The Wood River in particular showed very low TIN:SRP ratios (<0.3).

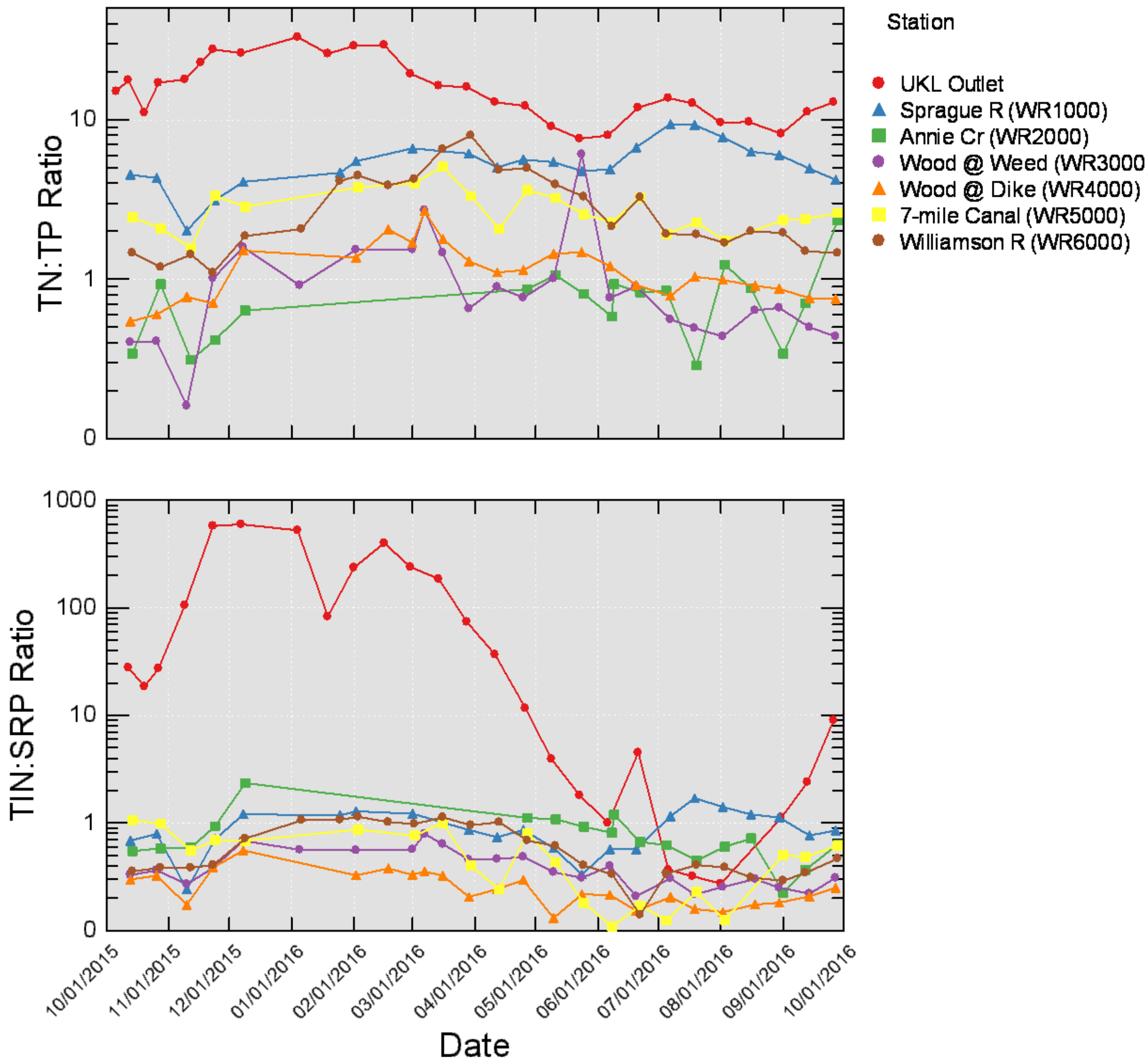

Figure 8. Total nitrogen to total phosphorus (TN:TP) and total inorganic nitrogen (NOx-N+NH_4-N) to PO_4 (TIN:SRP) ratios in Upper Klamath Lake tributaries and outflow stations, HY 2016.

Time-series plots of these ratio data comparing the Williamson River and UKL Outflow (summarized for the April-October period when data for both stations were consistently available) show that both ratios (TP:TN and TIN:SRP) were always higher leaving UKL than they were in the Williamson River inflow (Figure 9). Much of this increase is likely due to increases in UKL nitrogen due to both nitrogen-fixation by blue-green algae (particularly the dominant *Aphanizomenon flos-aquae*) and sediment regeneration of ammonia to the water column (although the ultimate source of the sediment nitrogen is also derived from settled algal biomass). Ratios rose in the outflow relative to inflow despite additional internal loading or sediment recycling of phosphorus (Walker et al. 2012), which would tend to drive ratios downward. There is also indication of cyclical sub-decadal trends, particularly for the TIN:SRP ratio, over the 1991-2016 period. Further analysis is required to explore these apparent trends.

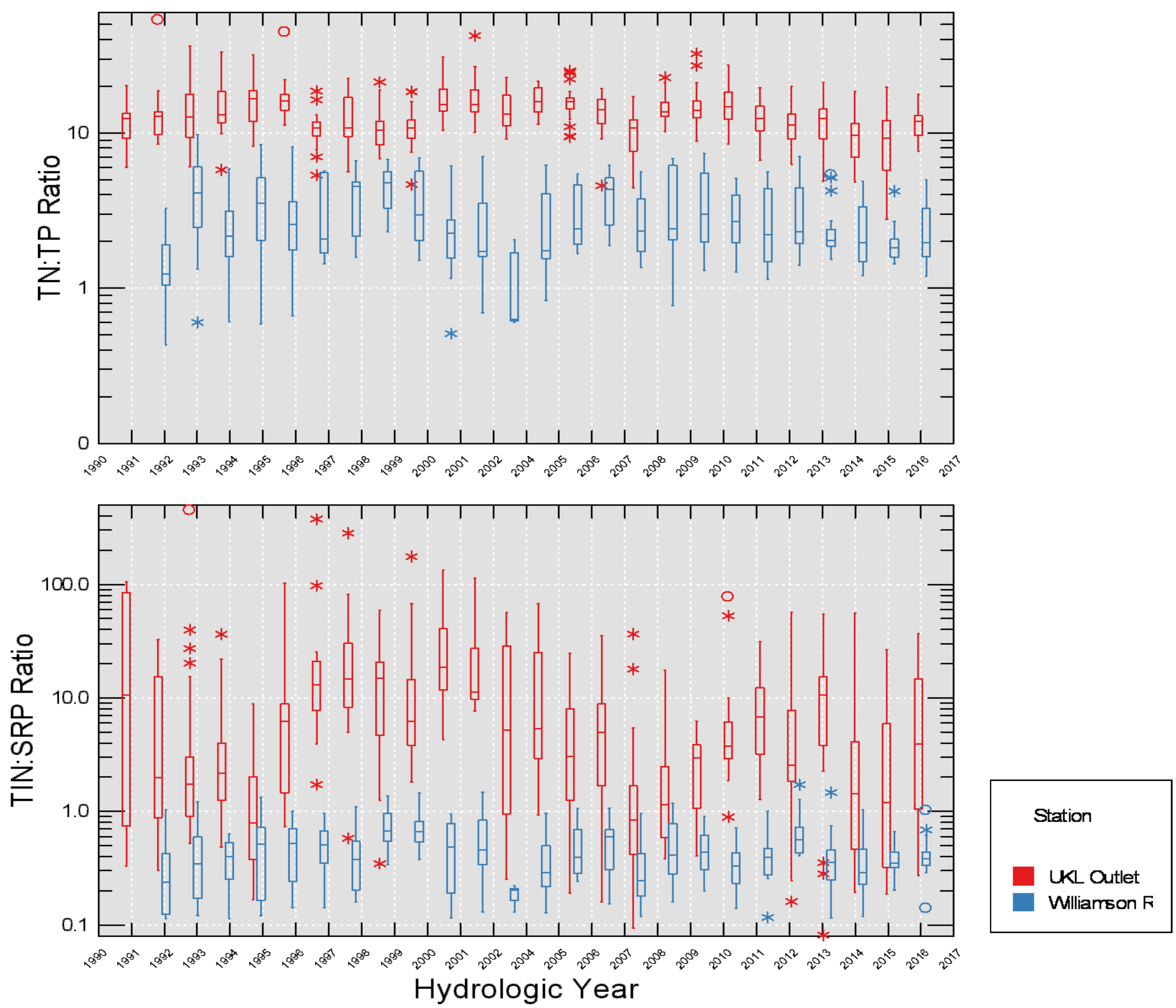

Figure 9. Total nitrogen to total phosphorus (TN:TP) and total inorganic nitrogen (NOx-N+NH_4-N) to PO_4 (TIN:SRP) ratios in the Williamson River and UKL outflow stations, April-October: 1991-2016.

TP and TN Loading

2016 Seasonal Pattern

Similar to previous years the 2016 seasonal TP and TN tributary loading pattern showed several peaks in the winter and spring, with loading generally increasing during the March-May period coinciding with peak discharge (Figure 4; Figure 10). This was in contrast to the previous two years when loading was relatively constant during that period [9]. Loads then remained relatively stable or declined during the late-spring to early-summer period, and continued to decline into the late-summer. UKL outflow loads of TN and TP declined in late-fall before increasing again late-spring, with a secondary and larger increase in mid-June that is tied to internal nutrient recycling from sediments and nitrogen fixation in UKL (e.g., see Kann 1998; Kann and Walker 1999; Walker et al. 2012). Outflow TP loads were similar to or lower than Williamson, Sprague, and Wood River loading during the late-winter to early-spring spring period, but were then higher through the remainder of the year, while outflow TN loads generally remained higher than those for the Williamson River over this same period (Figure 10).

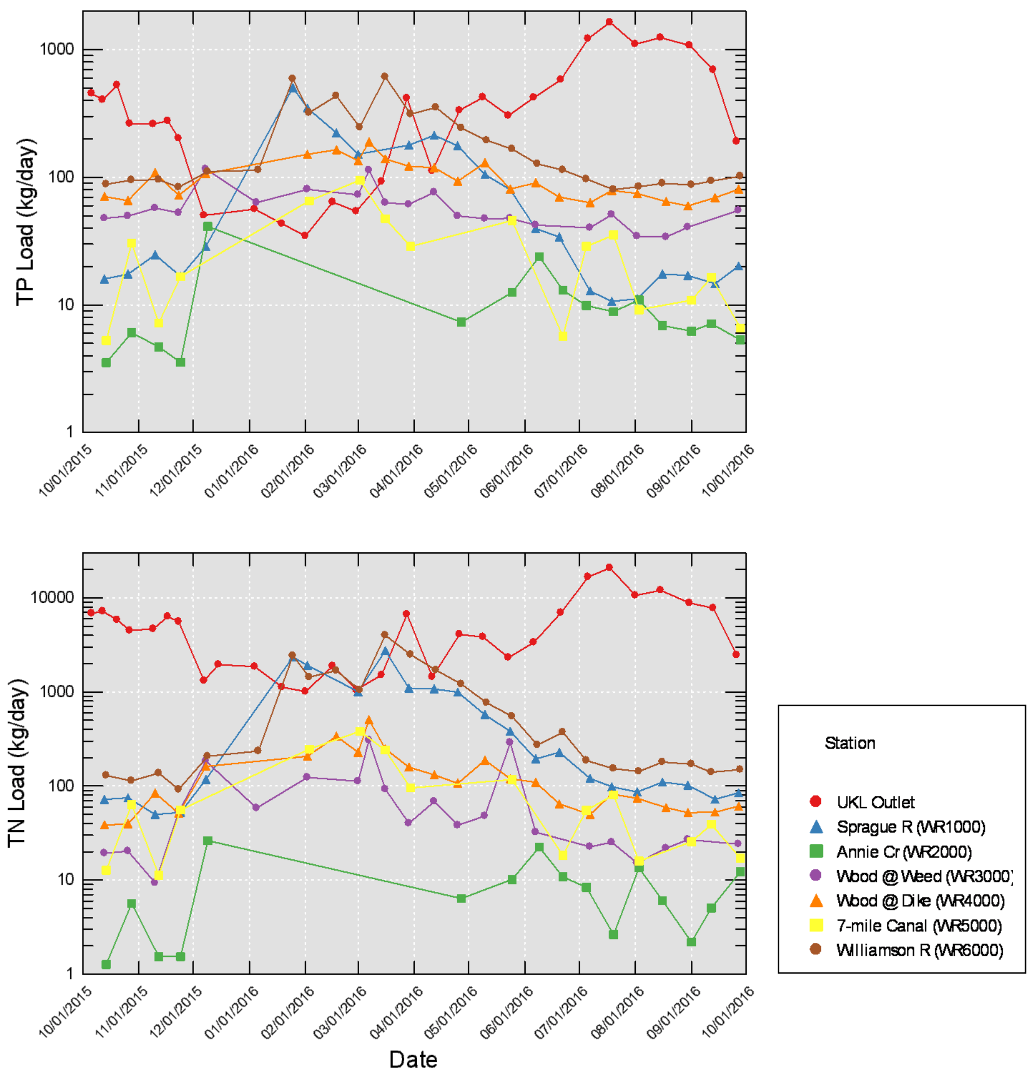

Figure 10. Seasonal TP and TN loading trends by station, HY 2016.

[9] 2014 was among the driest years on record with low precipitation and snowpack, and 2015 was also a dry year.

2016 Station Patterns

The 2016 nutrient loading pattern among stations was similar to that of the 1991-2015 sampling period (Figure 11). Also, as indicated above, TP and TN outflow loads tended to be higher than any individual inflow tributary loads during both 2016 and for the overall time period (1991-2015). Similar to 2013-2015, when outflow TP and TN loads were lower overall than they were for the previous long-term period, 2016 outflow loads were also lower than the long term distribution (a similar trend occurred in 2010). However, comparisons are somewhat confounded by the lack of consistent winter data for the outflow during earlier years, and a comparison of the core irrigation and summer algal growing season when measurements are consistent also shows that 2016 outflow loads were similar to the long term distribution (Appendix III). As noted above, high UKL outlet loads reflect sediment regeneration and nitrogen fixation processes taking place in UKL. The TP and TN loads were lower for all inflow stations relative to the outflow station.

Of the inflow tributaries, the Williamson River (WR6000) showed highest overall loading, with the 2016 TP and TN loading distributions similar to previous years (for the core irrigation season they were lower; see Appendix III). As with concentration, Annie Creek at Snow Park was consistently lower for both loading parameters (Figure 11). Sprague River TN load was more similar to the Williamson River TN load than it was for TP load (which was noticeably lower in the Sprague when compared to the Williamson), indicating that the Sprague River is contributing proportionally more nitrogen to the overall load. Both TP and TN loads in Sevenmile Canal were noticeably lower in 2016 (a similar trend occurred in 2015) than the long-term distribution, while Wood River TP was similar to the long-term distribution, but Wood River TN was noticeably lower (Figure 11). TP and TN loading patterns in both the Williamson and Sprague Rivers tended to follow the general pattern in discharge (although loading appears to be more closely linked to discharge in the Sprague River than in the Williamson River), and as noted above for Outflow concentration, there is indication of cyclical trending over the period of record (Figure 12). In addition, discharge and load in 2016 were notably higher than the previous four years (Figure 12).

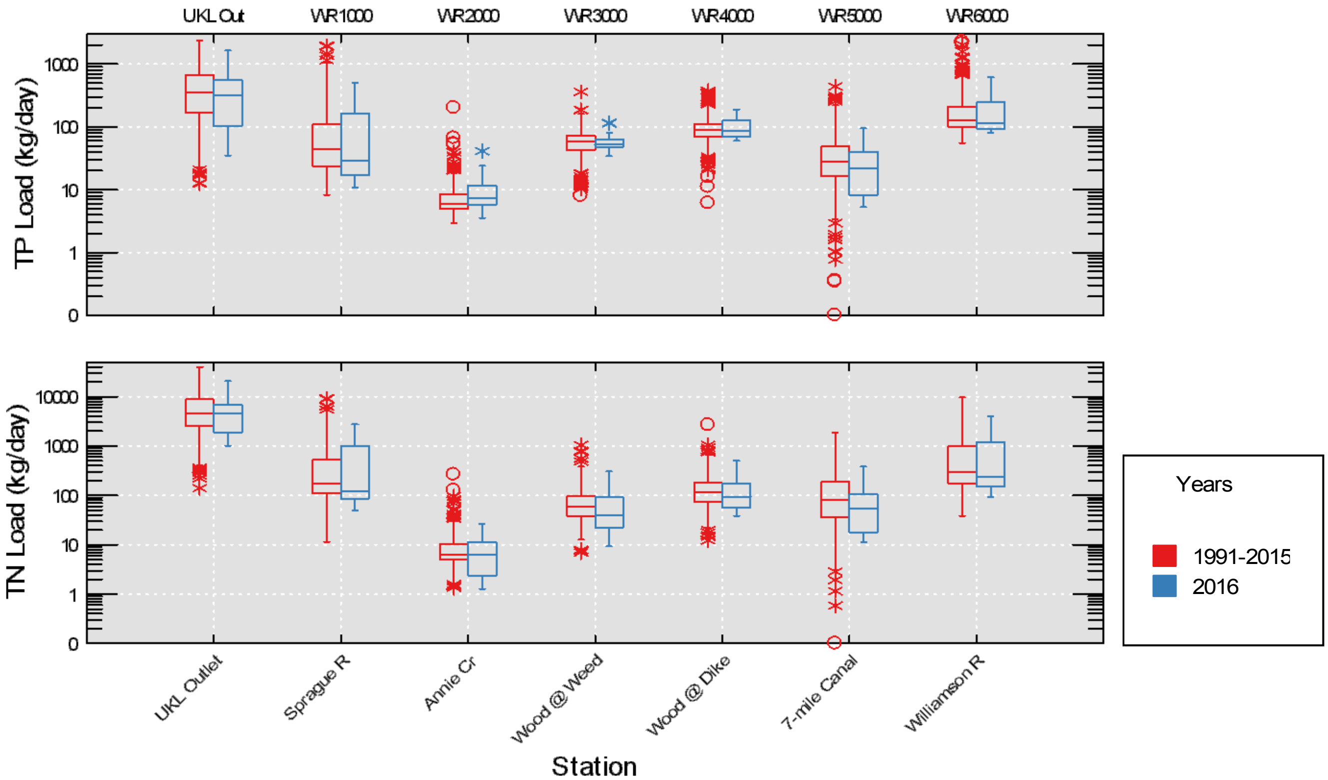

Figure 11. **Station distributions of TP and TN loading compared between 1991-2015 (red) and 2016 (blue). Note: for the outflow station KL0001 there are no samples from January to mid-April in HY2006, and for HY2007-2009 and HY2011 samples are missing between November and mid-April.**

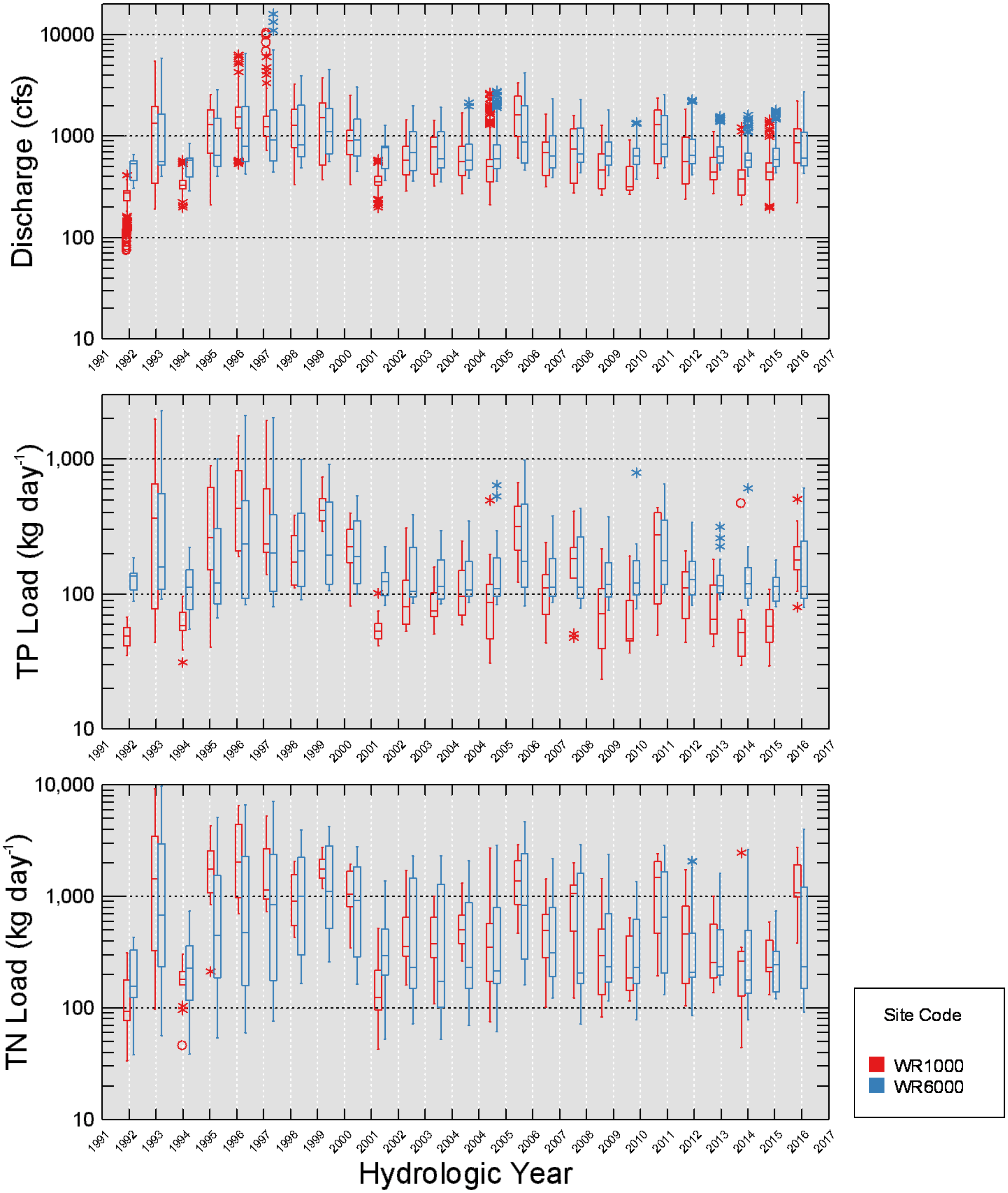

Figure 12. Distribution of Williamson River (WR6000) and Sprague River (WR1000) daily discharge (top panel), TP load (middle panel), and TN load (bottom panel) for the January-May inflow period, 1992-2016.

Sonde, TSS and Turbidity

Seasonal and spatial patterns in temperature, specific conductance, dissolved oxygen, and pH are shown in Figure 13. Peak temperatures generally occurred in June and July for the tributaries, with the Annie Cr. and Wood River stations showing cooler overall temperatures than the Sevenmile, Sprague and Williamson stations. Among the inflows, dissolved oxygen decreased seasonally at several stations, but was most apparent at the Sevenmile Canal and Sprague River stations. Aside from UKL Outlet, pH was relatively constant over the season with the exception of a pronounced peak in July.

TSS concentrations and loads in the winter and spring were highest for the Sprague and Williamson stations in 2016; however, Annie Creek was not sampled during that period in 2016 (Figure 14). Annie Creek TSS concentrations tended to be higher than other stations, and TSS load was also higher in late-May and June. A pronounced peak in TSS concentration and load occurred at the Wood R. Weed Rd. station in late-May. Turbidity also tended to be higher in Annie Creek, and again the Sprague and Williamson stations showed highest seasonal turbidity concentrations in the winter and spring months (Figure 14). Peak snowmelt in May and June are likely driving the Annie Creek increases in TSS and Turbidity, especially given the loose pumice material that much of the Annie Creek streambed is composed of.

Sevenmile Creek Longitudinal Study

A study was instituted in 2016 to determine longitudinal nutrient concentrations and loads between Sevenmile Creek at Sevenmile Rd. (7M7R) and Sevenmile Creek just below the confluence of West Canal (7MBW). A total of 5 stations were sampled with the intent to determine the influence West Canal (WC), one of the Wood River Valley's main irrigation return flows, on nutrient concentrations and loads entering Agency Lake (Figure 15). These stations were sampled approximately biweekly between March and November, with the exception of 7M7R for which sampling began in April (Figure 16).

The biweekly time-series indicates pronounced seasonal increases in TP, PO4, PP, and SiO2 concentration at station WC, with subsequent concentration increases at 7MBW during the summer irrigation season (Figure 17; Figure 18). Seasonal increases were less pronounced for the nitrogen species, and both TSS and Turbidity tended to be higher during the spring than during the summer. Concentrations of TP, PP, PO4, TN, PN, NH4, SiO2, and turbidity were substantially higher in WC than they were at both upstream stations (7M7R and 7MAW), this translated to concentrations below the WC confluence at 7MBW that were highly elevated in comparison to stations upstream. For example, TP was ~2x higher at 7MBW compared to 7MAW, PO4 ~1.5x higher, TN ~4x higher (maximum 8x higher), PP 2-4x higher, and PN 2-8x higher. At times there was a slight increase between 7M7R and 7MAW for some parameters (PO4, TN, and PN) but they were smaller relative to the increase occurring downstream of WC. Due to mixing characteristics and dilution from Sevenmile Creek at the site of the WC confluence, concentrations declined in both 7MBW and 4C relative to WC, but not always at the same rate.

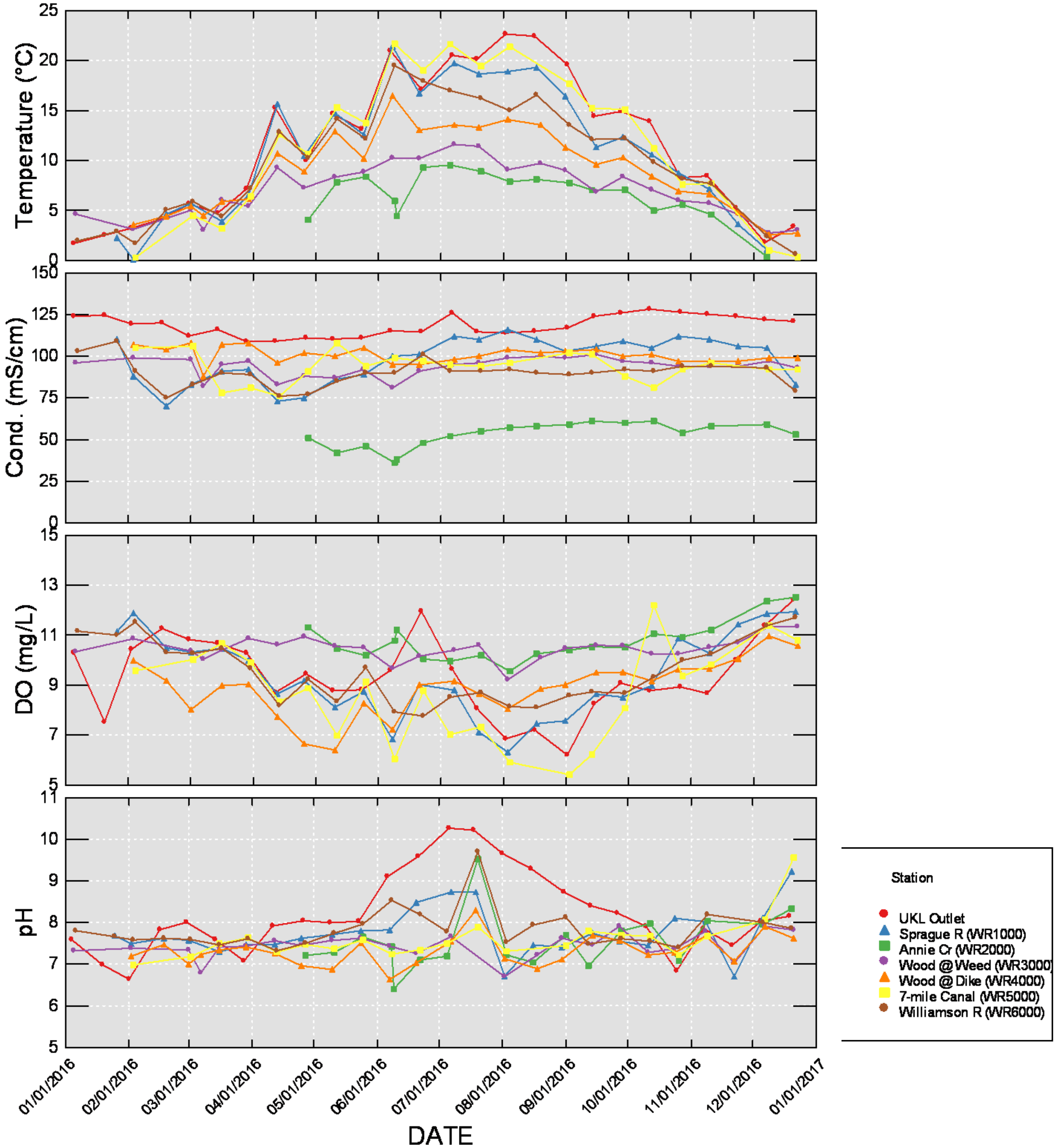

Figure 13. Time series plot of YSI multi-parameter probe water quality measurements for Upper Klamath Lake tributaries and outflow, 2016.

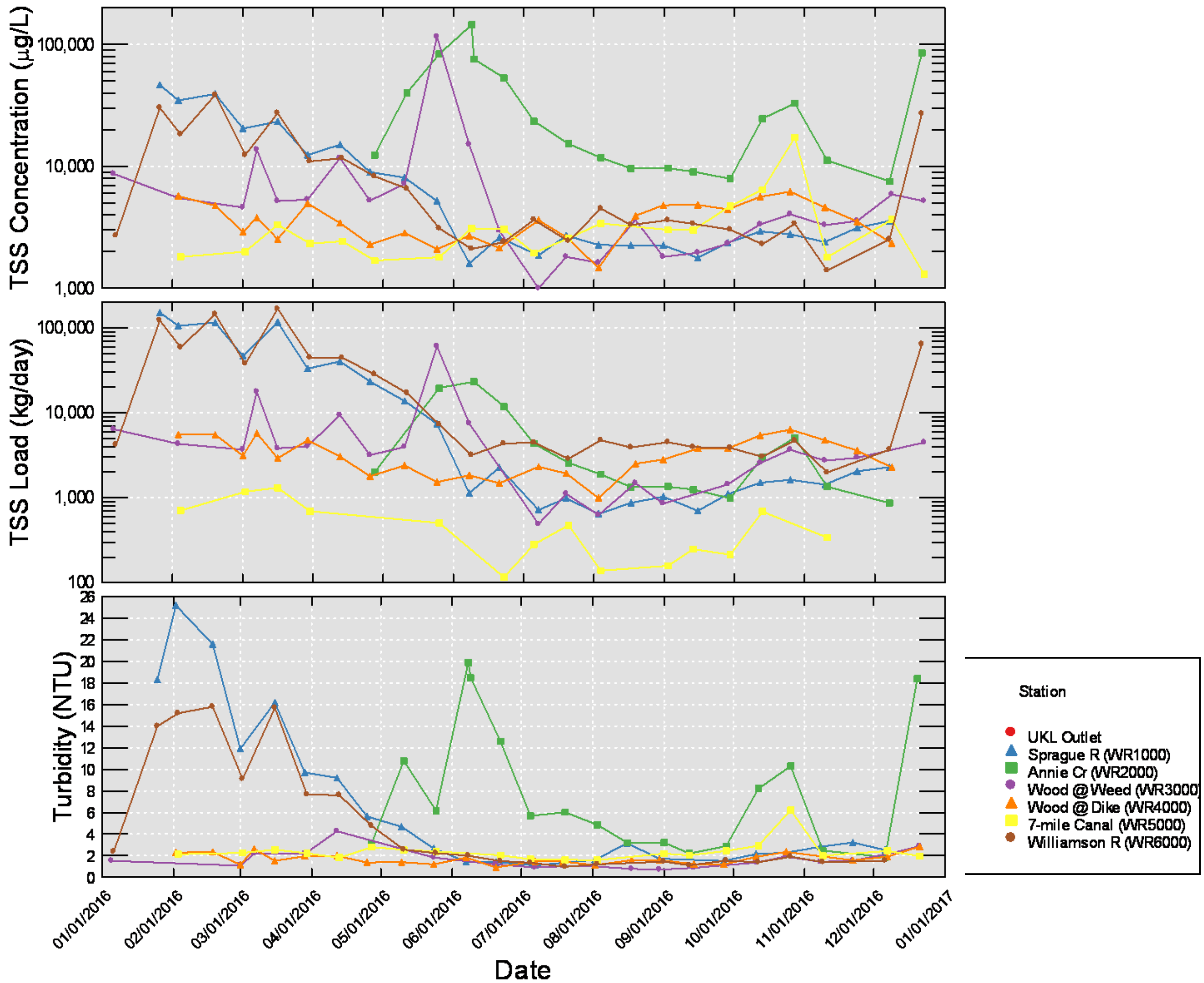

Figure 14. Time series plot of TSS Concentration, load and Turbidity for Upper Klamath Lake tributaries and outflow, 2016.

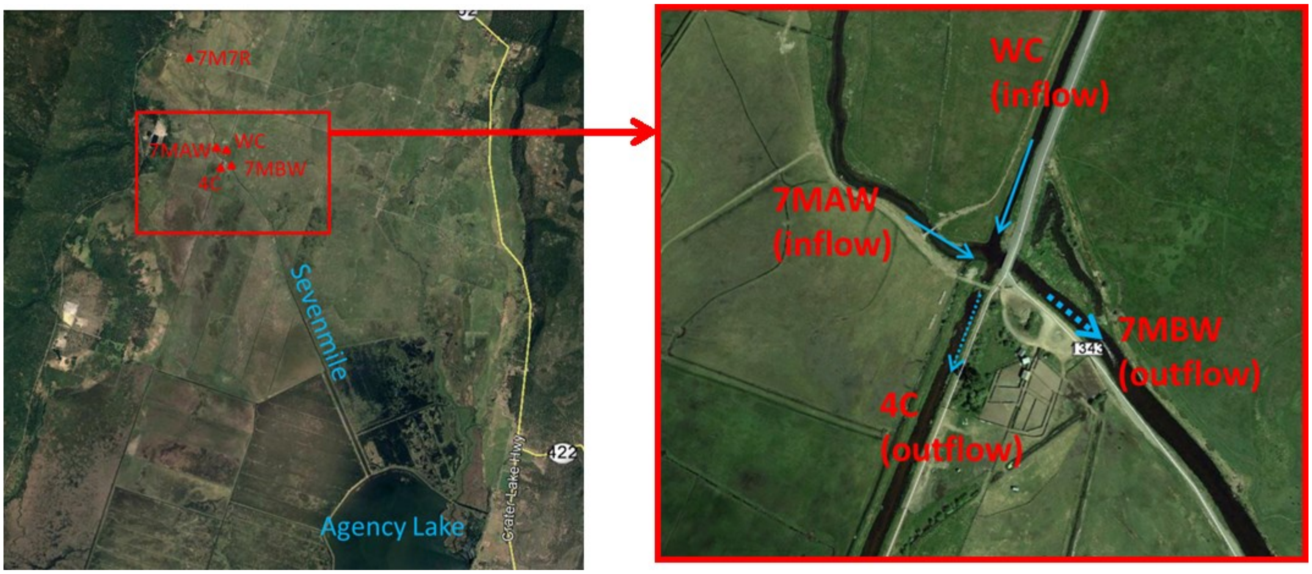

Figure 15. Sevenmile Creek sampling locations; Sevenmile Creek at Sevenmile Rd. (7M7R); Sevenmile above West Canal (7MAW); West Canal (WC); Fourmile Canal (4C); Sevenmile below West Canal (7MBW).

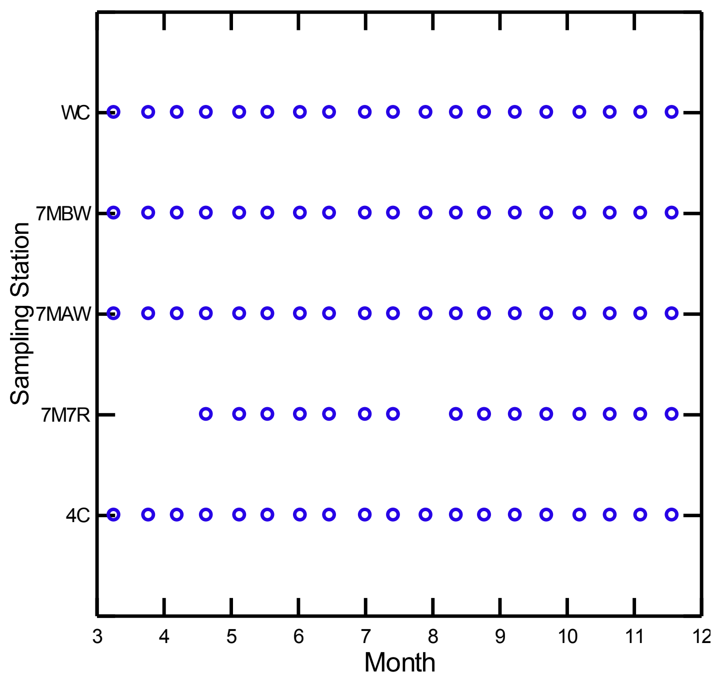

Figure 16. Sampling Frequency for Sevenmile Creek Stations, 2016.

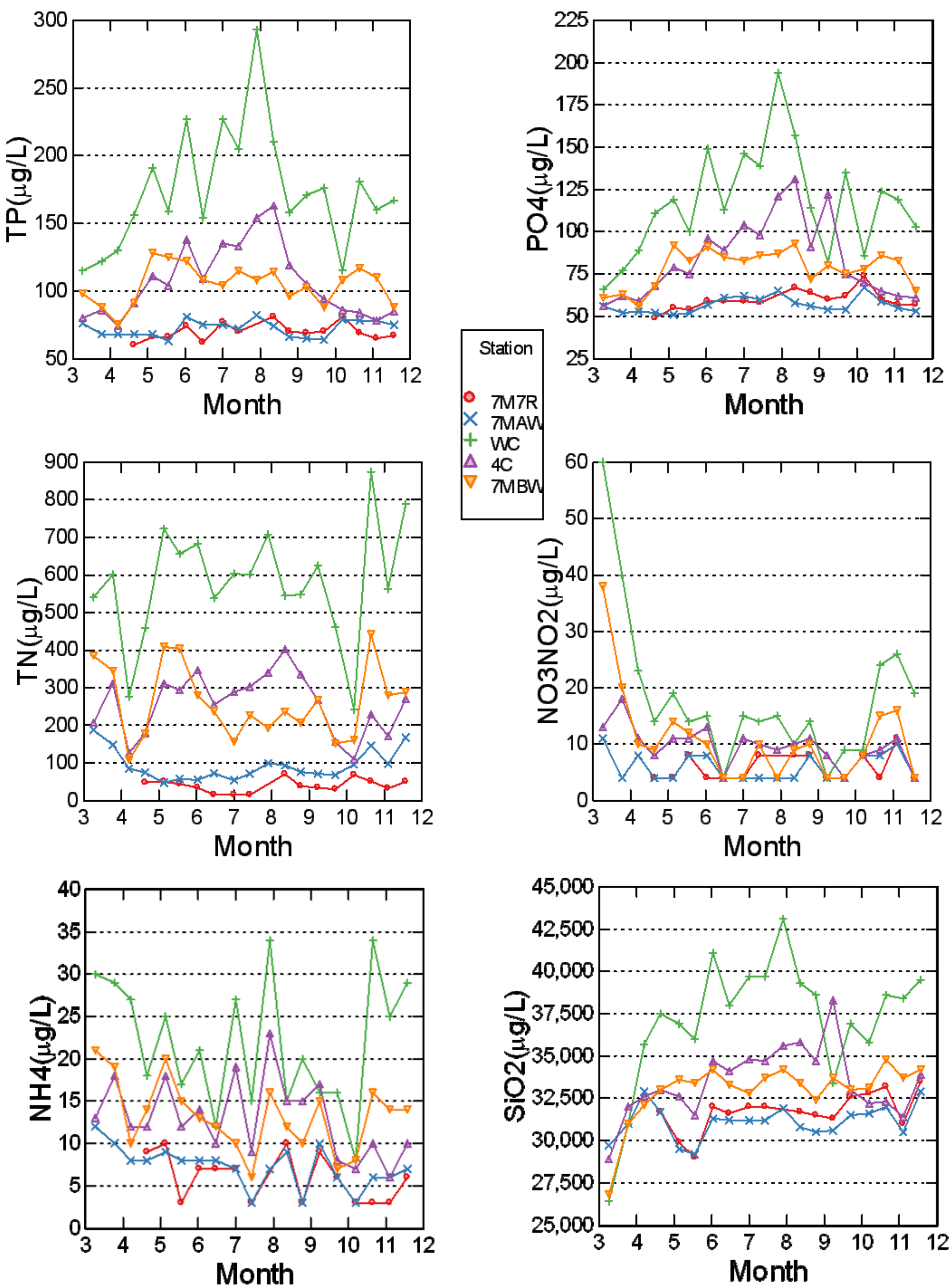

Figure 17. Biweekly time-series of TP, PO4, TN, NO3NO2, NH4, and SiO2 for Sevenmile Creek, 2016.

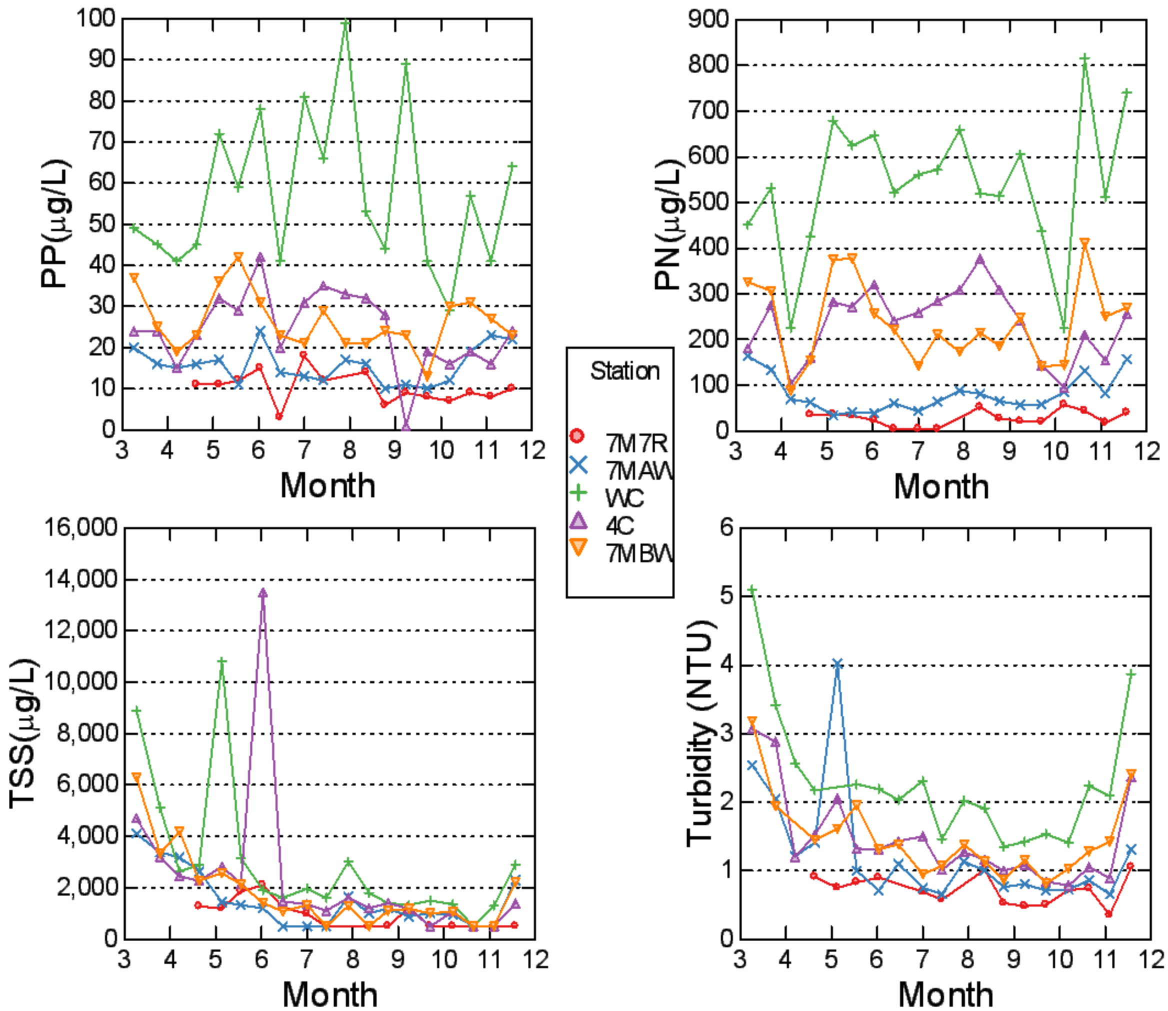

Figure 18. Biweekly time-series for particulate P (PP=TP-PO4), particulate N (PN=TN-(NO3NO2+NH4)), TSS, and Turbidity for Sevenmile Creek, 2016.

Although concentrations were lower in both 7MBW and 4C relative to WC, overall loads of TP and PO4 were substantially higher in 7MBW than they were in WC, while 4C loads were somewhat less than WC (Figure 19). Loads of TN and PN were also higher in 7MBW than in 4C; however both were lower than WC (Figure 20). Most importantly, with the exception of NO3NO2 and NH4, loads of all other N and P parameters were substantially higher at 7MBW than they were at 7MAW. These increased loads, especially for the upper quartile for TP and SRP and the inter-quartile range for TN and PN, clearly show the impact of West Canal on Sevenmile Creek loading characteristics, with remaining nutrient loads from WC entering Agency Lake separately via Fourmile Canal.

Although many of the TSS values were at the detection limit during the summer months (Figure 18), overall concentrations were higher in West Canal, with lowest concentrations occurring at 7M7R (Figure 21). An increase in the TSS load occurred between 7M7R and 7MAW, and further input from WC was associated with an increase in the TSS load downstream a t 7MBW (Figure 21). Turbidity concentration also increased between 7M7R and 7MAW, and below the confluence of WC, which showed the highest turbidity concentrations, both 4C and 7MBW had higher concentrations than 7MAW upstream (Figure 22).

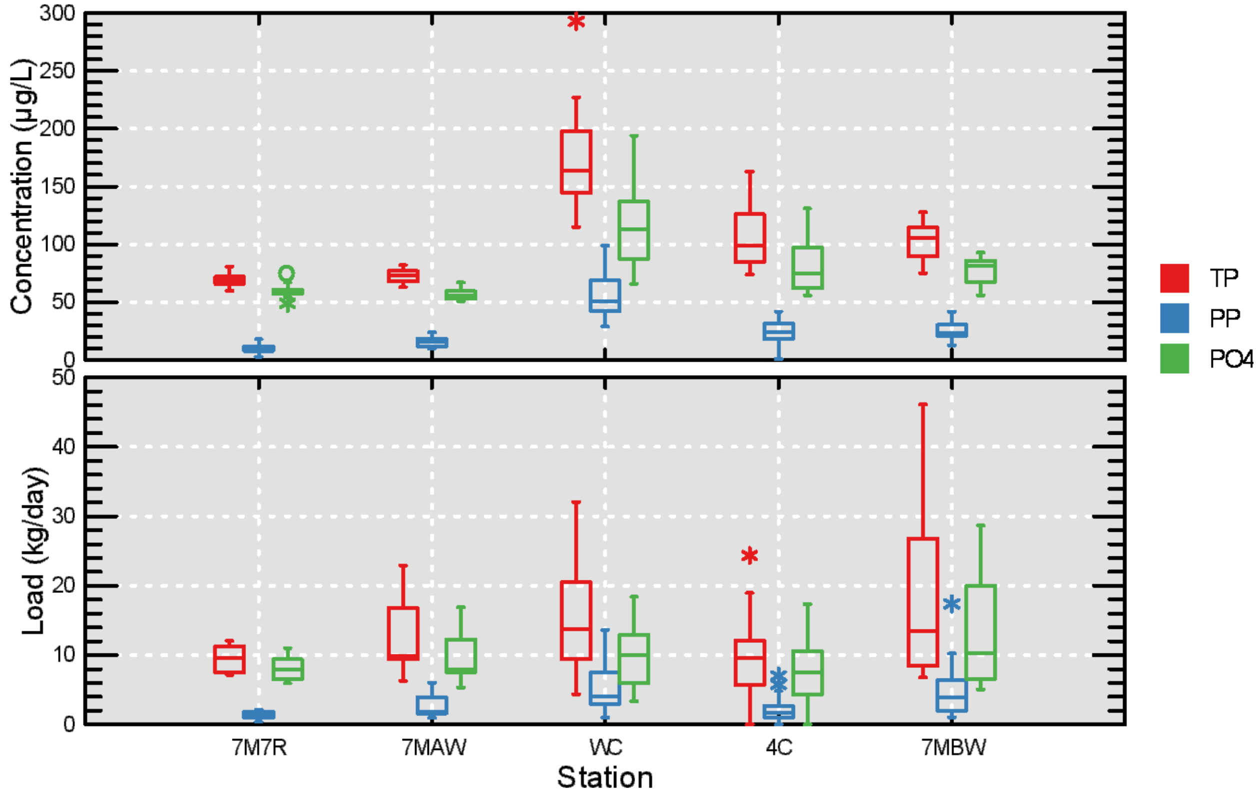

Figure 19. Overall longitudinal trend in phosphorus parameters in Sevenmile Creek during 2016.

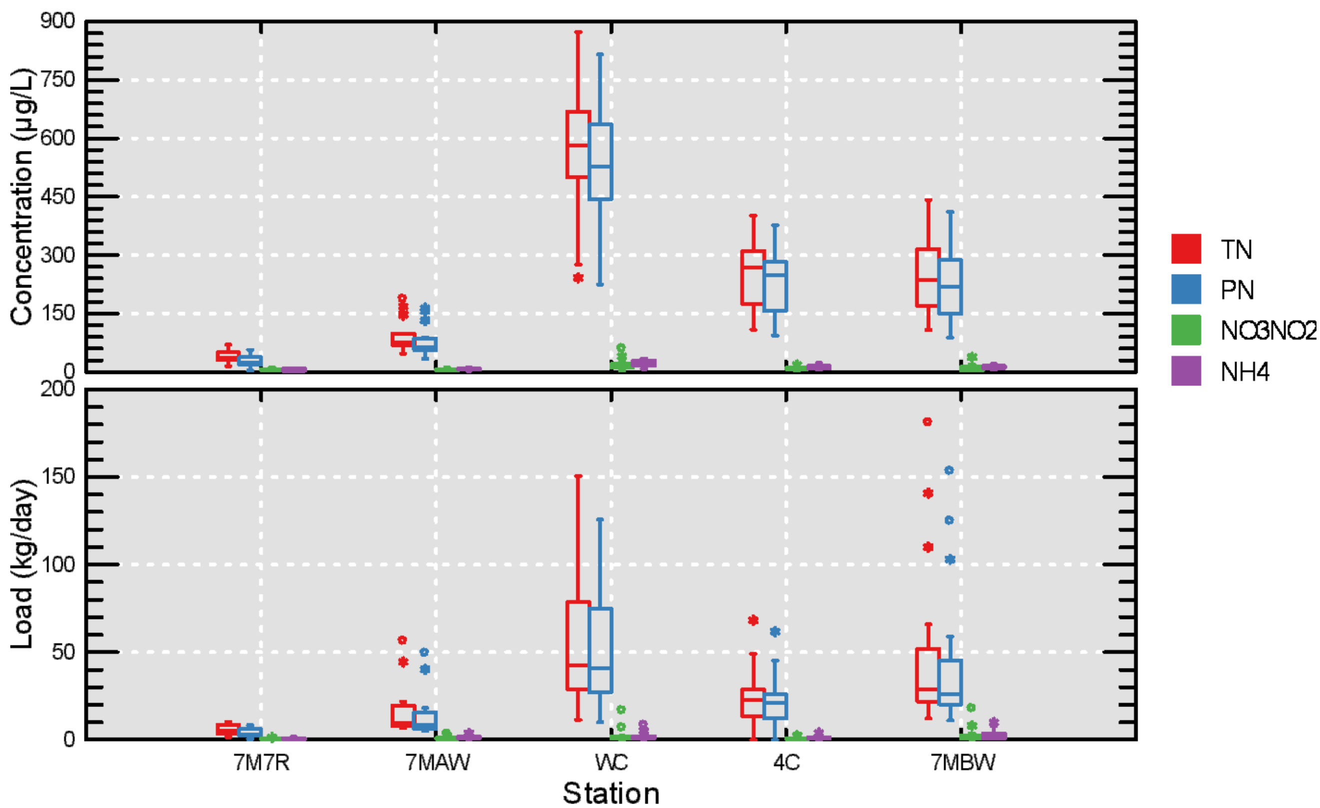

Figure 20. Overall longitudinal trend in nitrogen parameters in Sevenmile Creek during 2016.

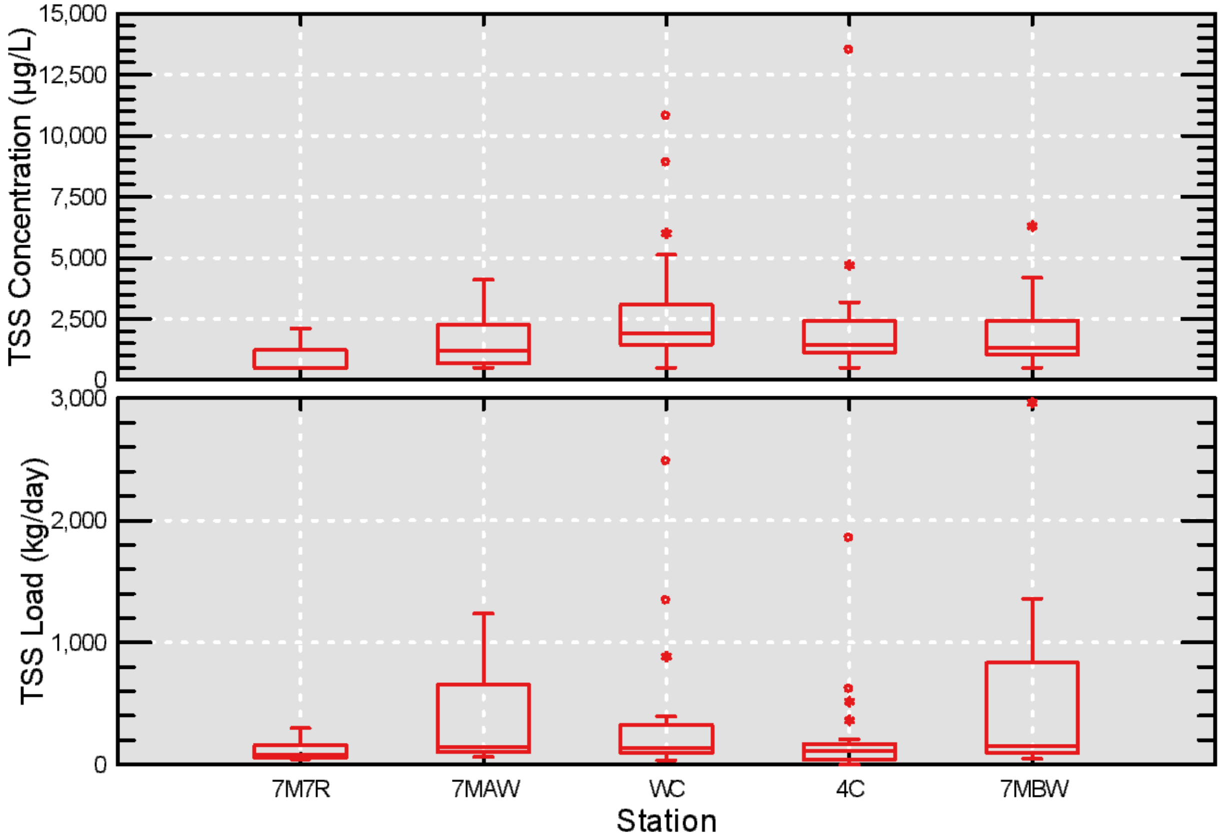

Figure 21. Overall longitudinal trend in TSS in Sevenmile Creek during 2016.

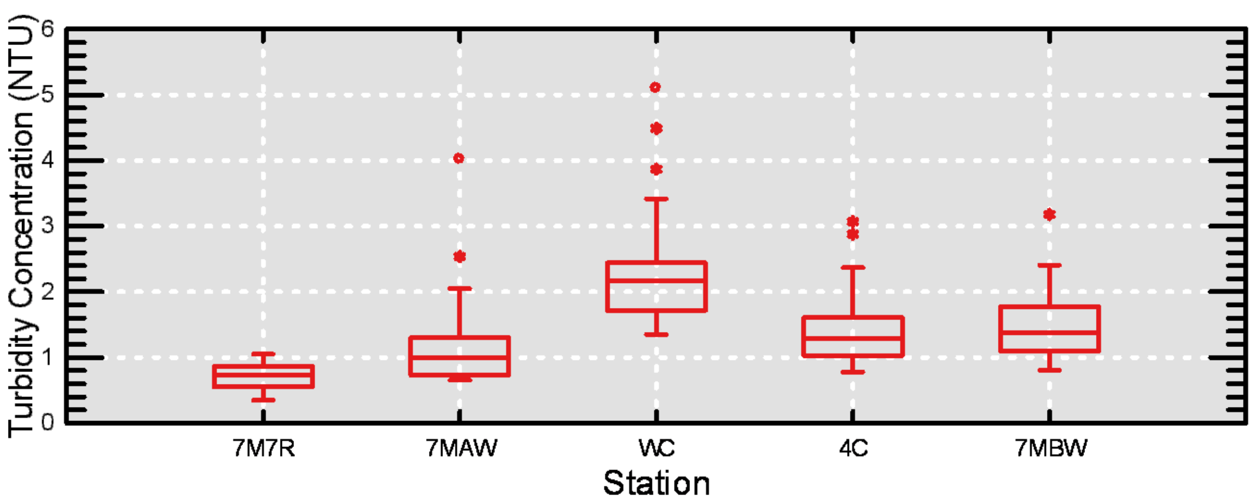

Figure 22. Overall longitudinal trend in Turbidity in Sevenmile Creek during 2016.

Temperature and conductivity were highest in West Canal while dissolved oxygen was lowest. (Figure 23). West Canal influenced both temperature and dissolved oxygen below its confluence with Sevenmile.

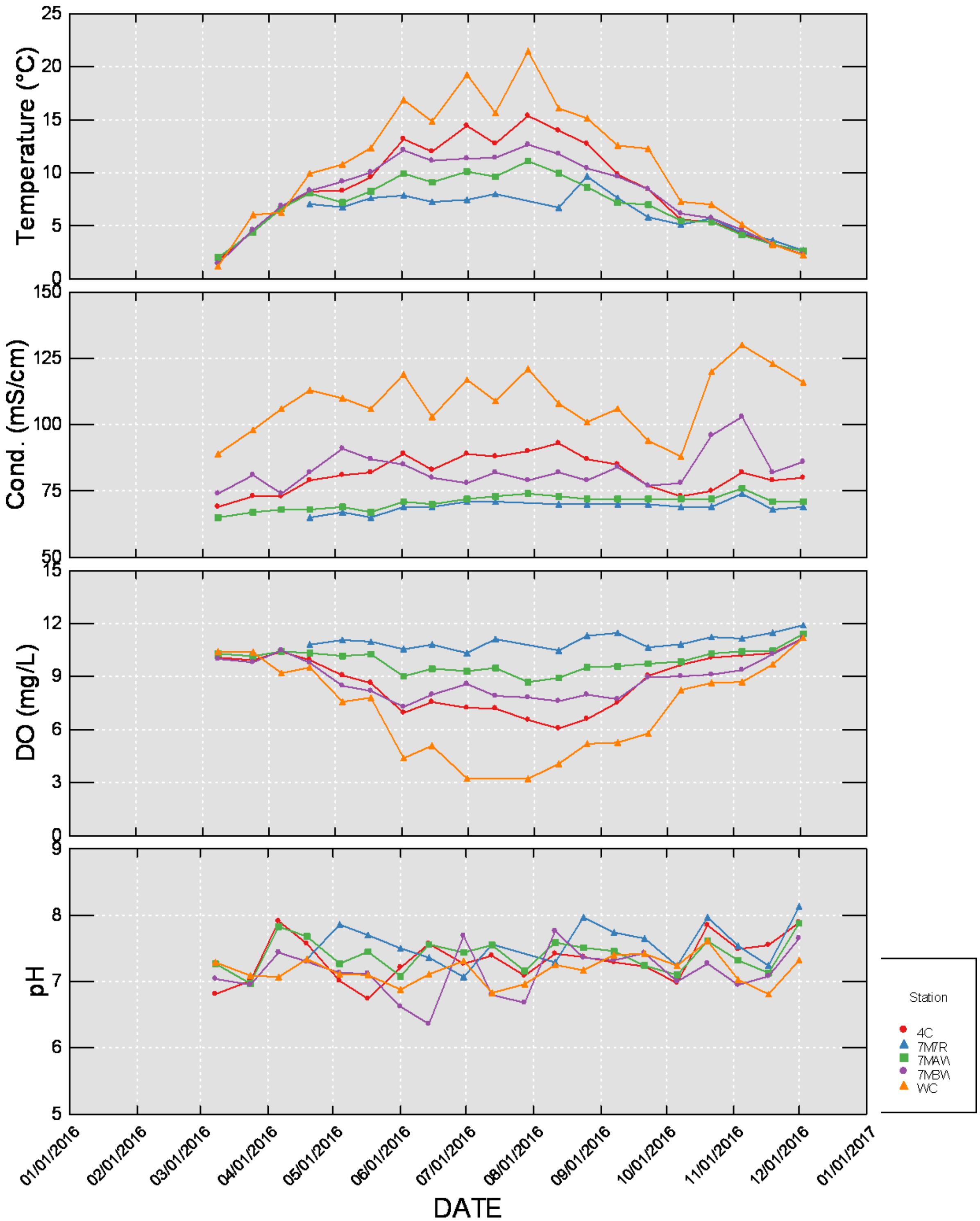

Figure 23. Time series plot of YSI multi-parameter probe water quality measurements for Sevenmile Creek, 2016.

Inter-annual Patterns, 1991-2016

Although it is beyond the scope of this 2016 data summary report to analyze the inter-annual trends in detail, 1991-2016 comparisons for all sampling stations for three periods (all dates, the June-September period, and the Jan-May period) are shown for reference in Appendix I. In addition, a series of tile plots (heat maps) showing monthly mean concentration over the period of record are shown in Appendix IV. Briefly, in 2016 Outflow TP loading for all dates was among the lowest for the period of record, and the June -September Outflow TP load was similar to the previous four years, although the lower quartile was higher than 2010-2014 (Appendix I Figure 1). A similar pattern was observed for TN load; the overall load was among the lowest for the period of record, and June-September TN loads were similar to the previous four years and were also lower than many previous years (Appendix I Figure 8). Note that for the UKL outlet station, the June-September period provides the most consistent inter-annual comparison due to changes in the winter and early spring sampling frequency over the period of record. While the distribution of overall loads (and concentrations) can be similar within a given time period among years, there is considerable variability in monthly timing among years (Appendix IV).

June-September TP and TN loading distributions for the Sprague River in 2016 were higher than 2012, which was an exceptionally low year, but were still low relative to many other years, and were similar to 2015 (Appendix I Figures 2 and 9). Similarly Williamson River TP and TN loading distributions were among the lowest for the period of record (Appendix I Figures 7 and 14). For all dates the upper quartile of the TP and TN loads was higher than the previous 4 dryer years, indicating higher spring inflow. TN loading distributions for the Wood River stations during 2016 tended to be low for the period of record (Appendix I Figures 11 and 12). The Wood River TP loading distribution for 2016 tended to be low to intermediate when compared to previous years. (Appendix I Figures 4 and 5). Seven Mile Canal TP and TN loading during June-September 2016 was similar to previous years (Appendix I Figures 6 and 13). Overall loads for Annie Creek were intermediate compared to previous years (Appendix I Figures 3 and 10).

Although the analyses described above provide a relative comparison among years, inter-annual comparisons of nutrient concentration and loading at the various UKL inflow stations requires refined estimation of loading using multiple regression based-algorithms that represent concentration variations associated with flow (i.e., magnitude as well as ascending/descending limb of hydrograph), season (i.e., Julian day), and year (e.g., see Walker et al. 2012; 2015). A comprehensive analysis of time-series trends as well as hydrologic and nutrient budgets based on estimated daily data were completed for UKL through 2010 (Walker et al. 2012). Future comprehensive analyses should be undertaken for additional data collected between 2011-2016.

SUMMARY

With the addition of 2016 data, the UKL tributary nutrient and loading database now includes 26 years of data and includes the years 1991-2016. As with the UKL water quality database, such a long-term monitoring program is essential for assessing change relative to management programs, as well as for understanding inter-annual dynamics. Also similar to recommendations for the UKL water quality database, continued monitoring is recommended to accommodate the restoration time-frame for Klamath Basin activities and to increase statistical power (sample size) for inter-variable analyses. While this data summary report is intended to provide an update of the long-term data base with 2016 tributary and outflow data, Walker et al. (2012) provide a more detailed and comprehensive analysis of the long-term UKL tributary database including statistical trend analyses and construction of hydrologic and nutrient budgets for UKL using the 1991-2010 dataset (Walker et al. 2012). A similar comprehensive treatment of the data is recommended at five year intervals, which is now at 6 years with the addition of 2016 data.

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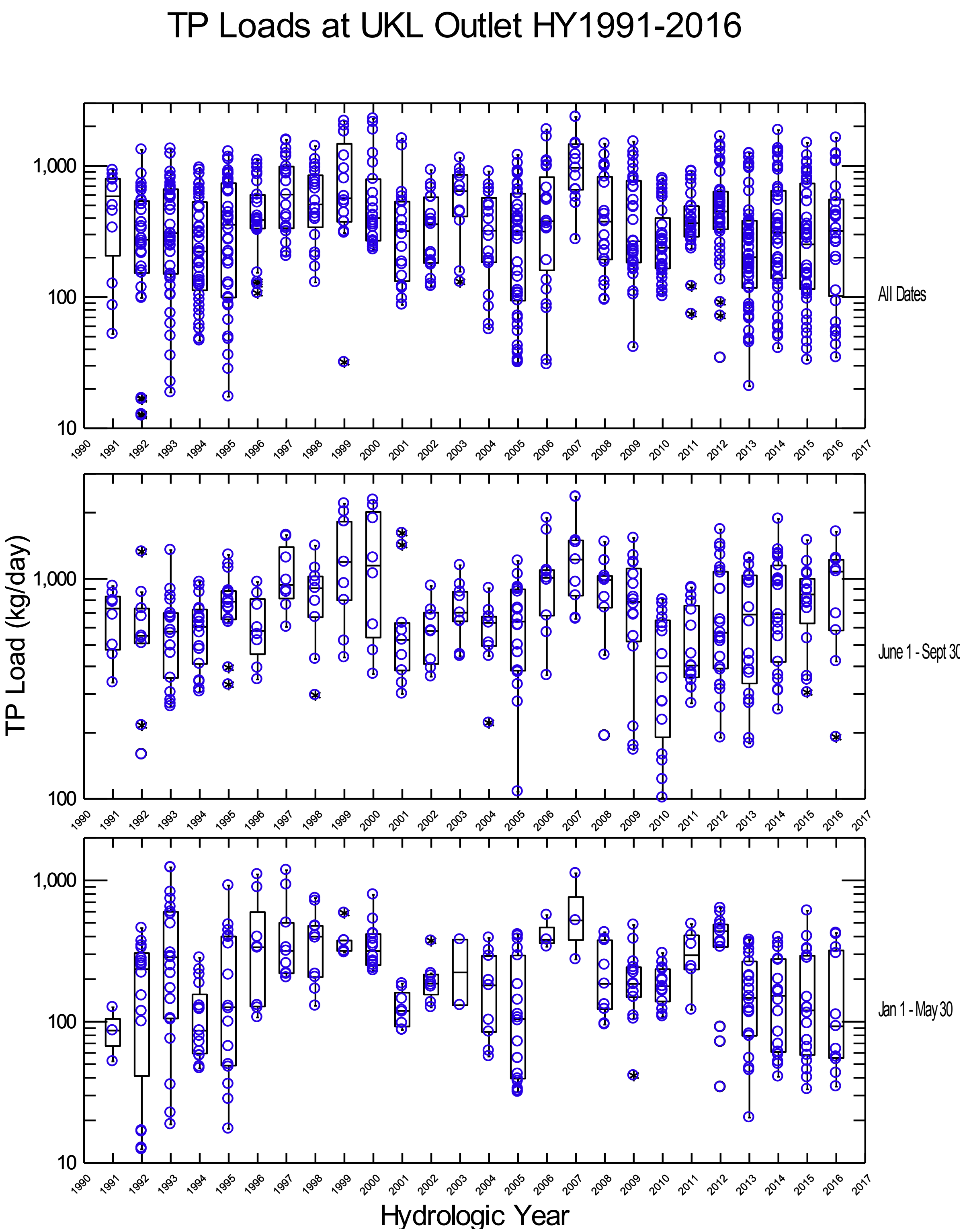
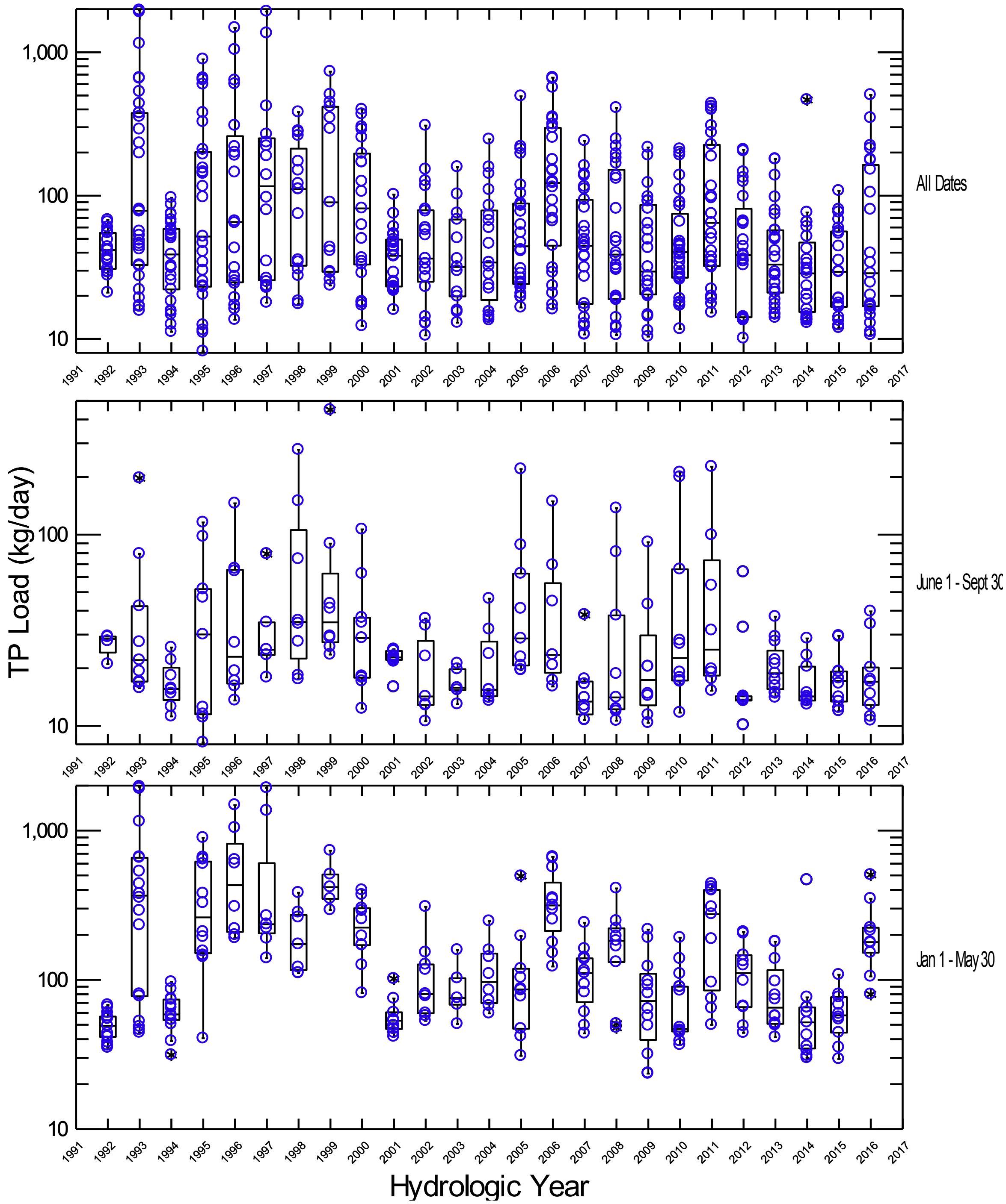
APPENDIX I: Annual and seasonal distributions of TP and TN loading of Upper Klamath Lake Tributaries and outflow.



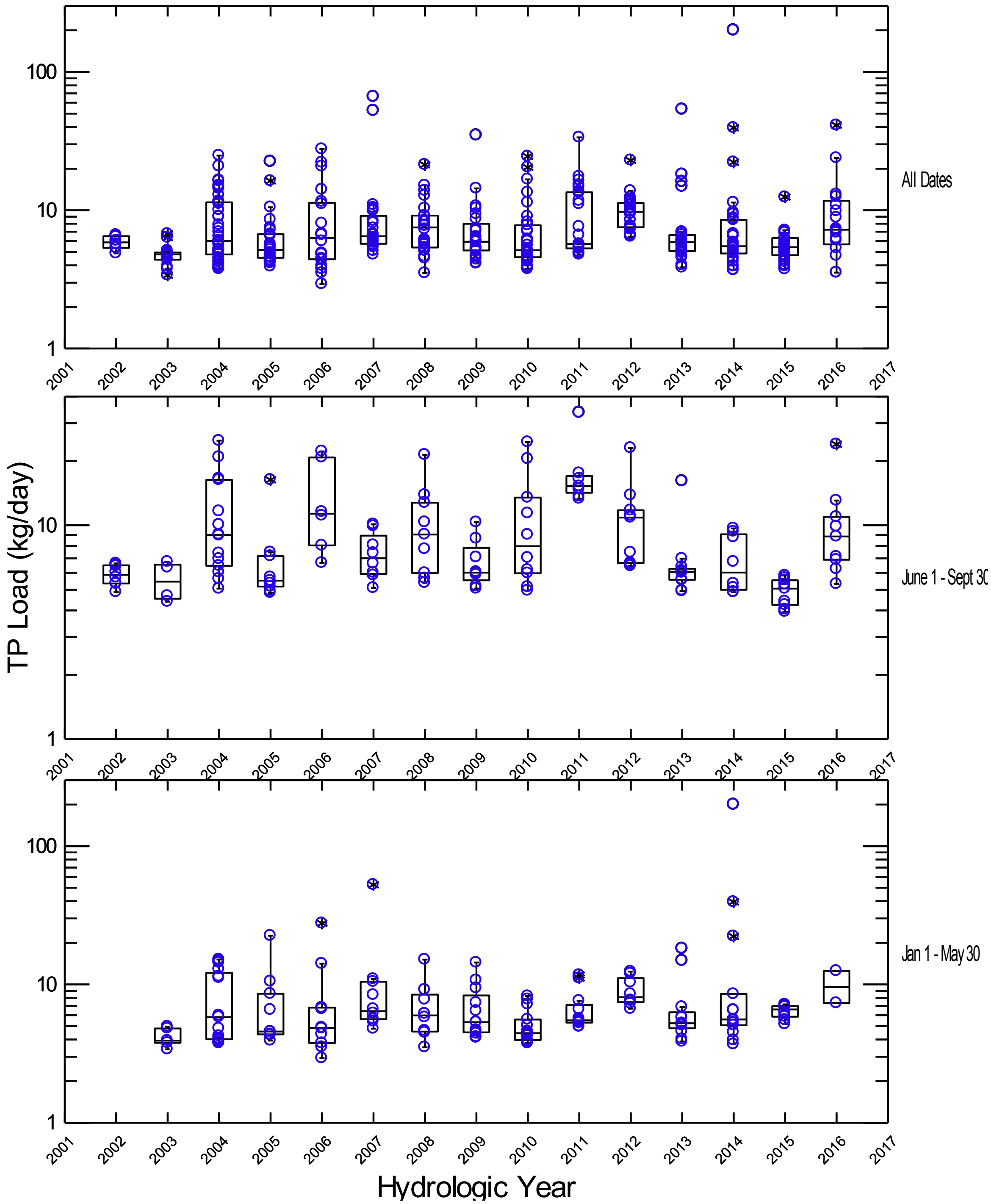
Appendix I Figure 1

TP Loads at Sprague R. @ Kirchers Bridge (W1000) HY1992-2016



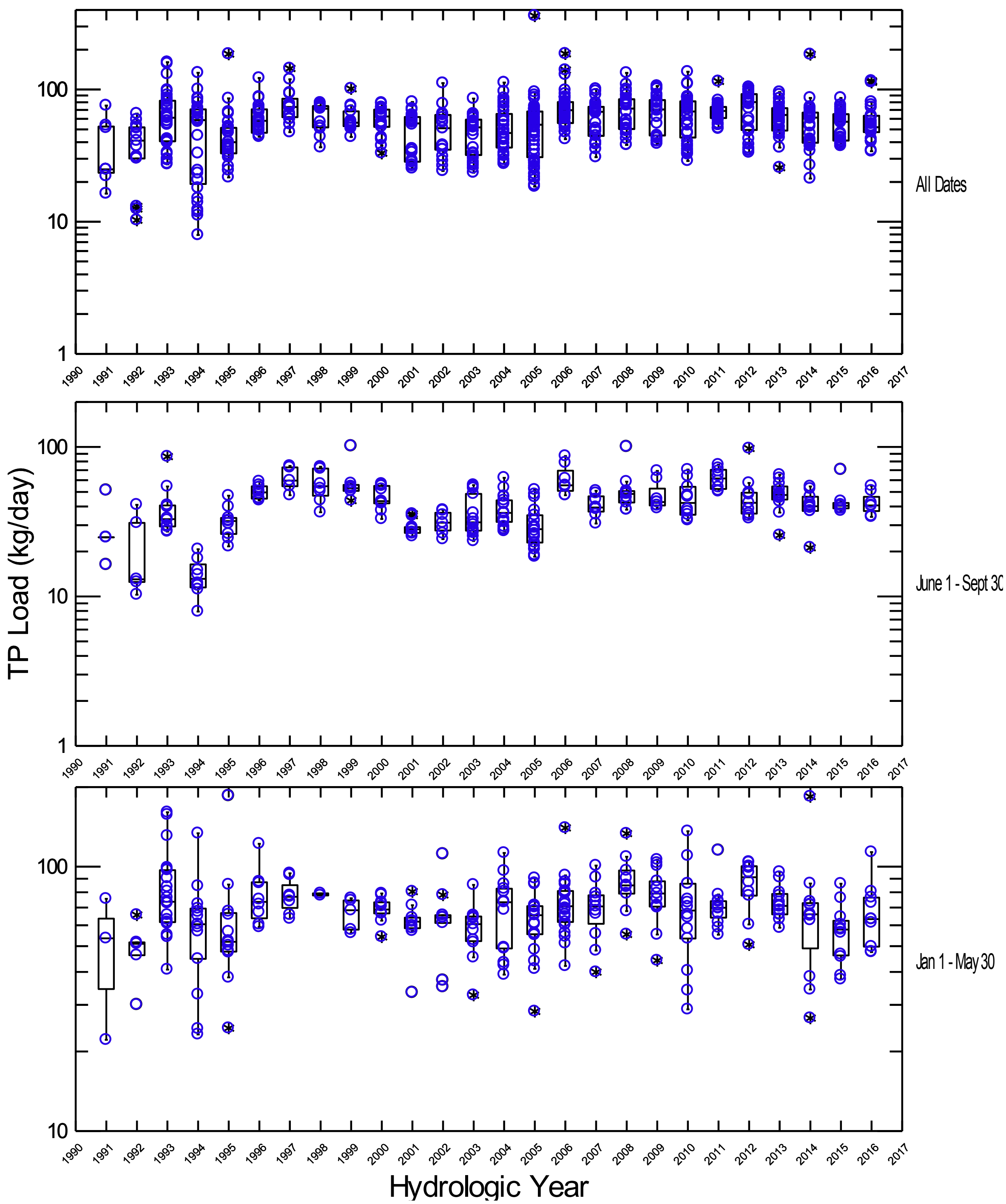
Appendix I Figure 2

TP Loads at Annie Cr at Snow Park (WR2000) HY1991-2016



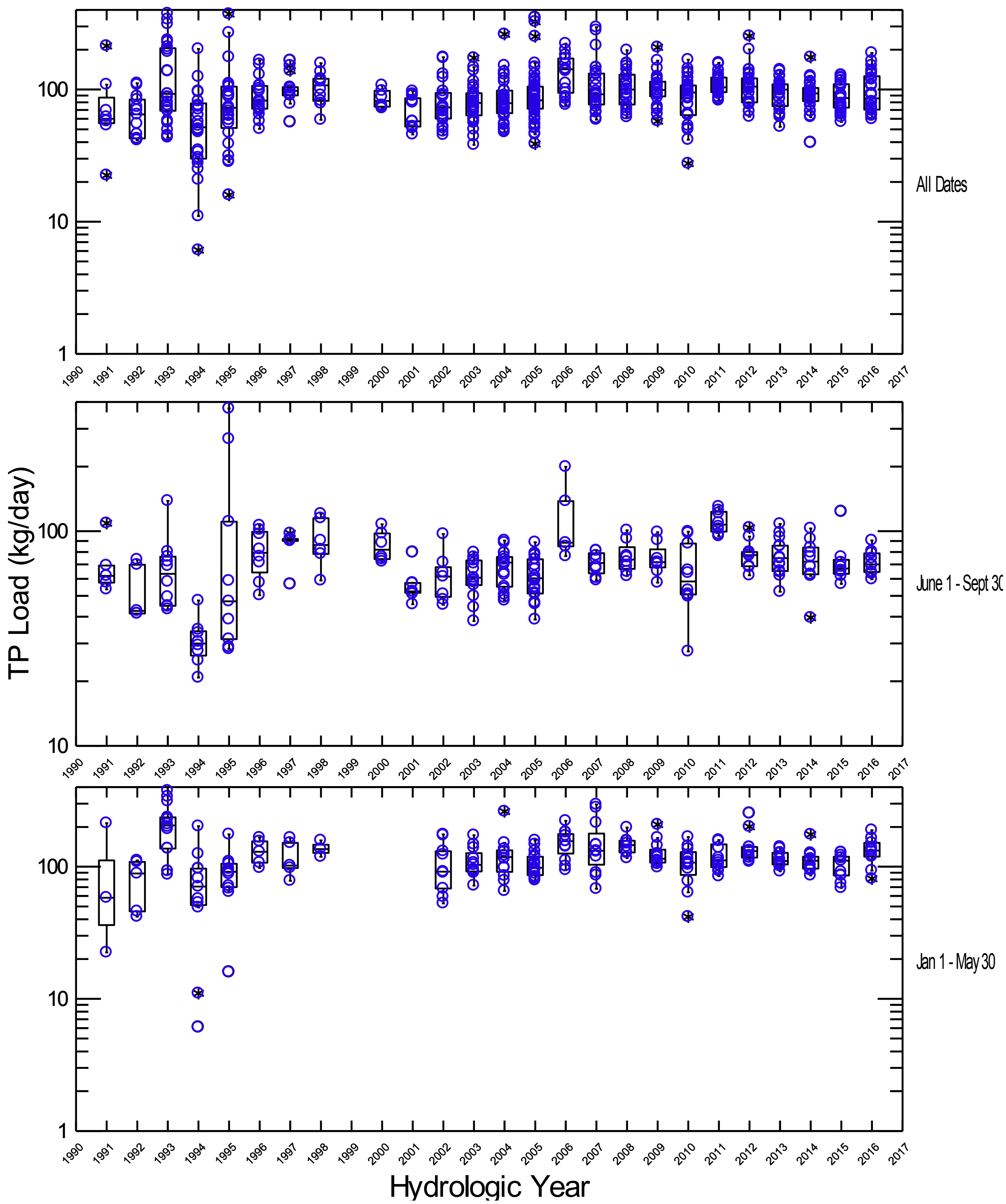
Appendix I Figure 3

TP Loads at Wood River at Weed Rd (WR3000) HY1991-2016



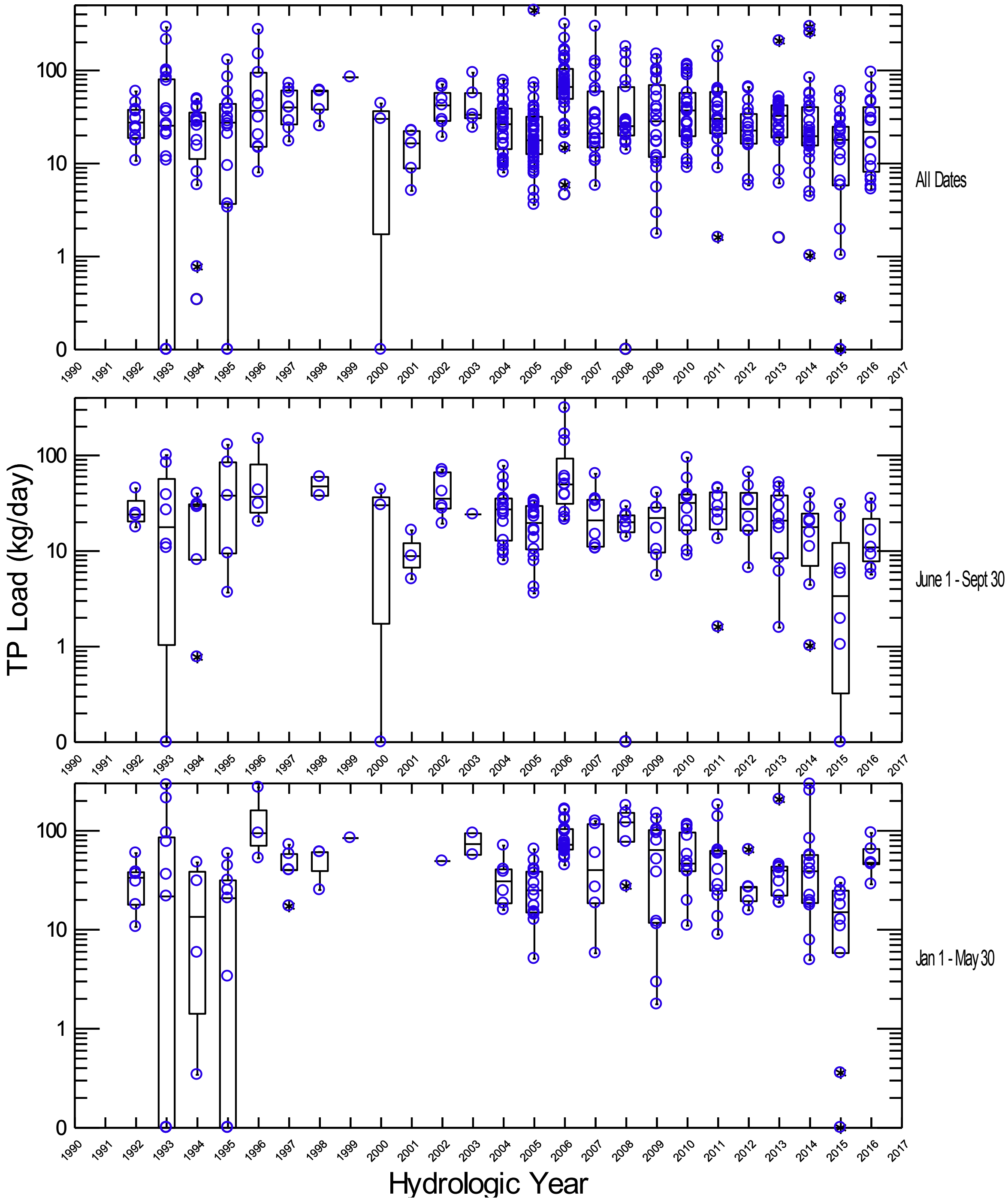
Appendix I Figure 4

TP Loads at Wood River at Dike Rd (WR4000) HY1991-2016



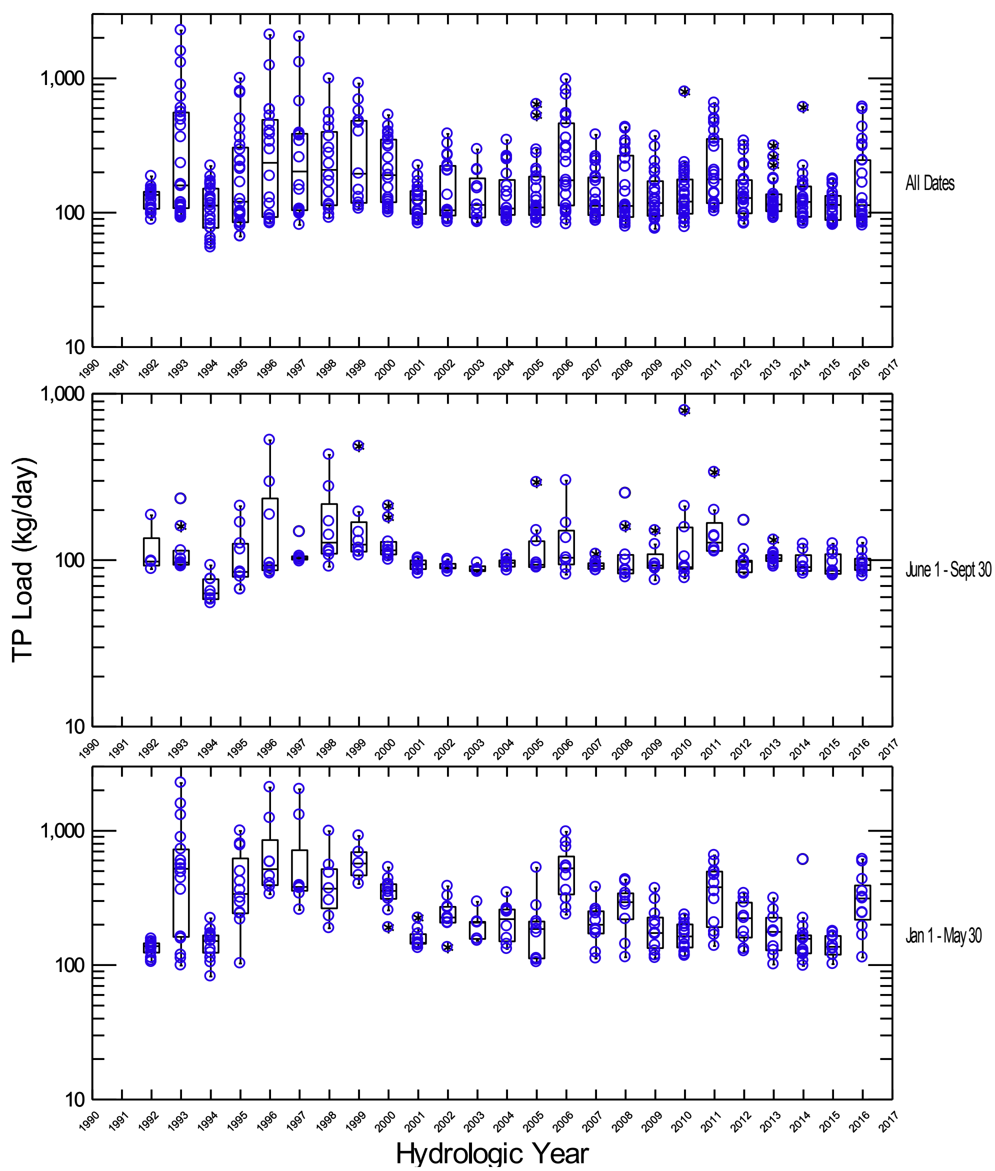
Appendix I Figure 5

TP Loads at Seven-Mile Canal at Dike Rd (WR5000) HY1991-2016

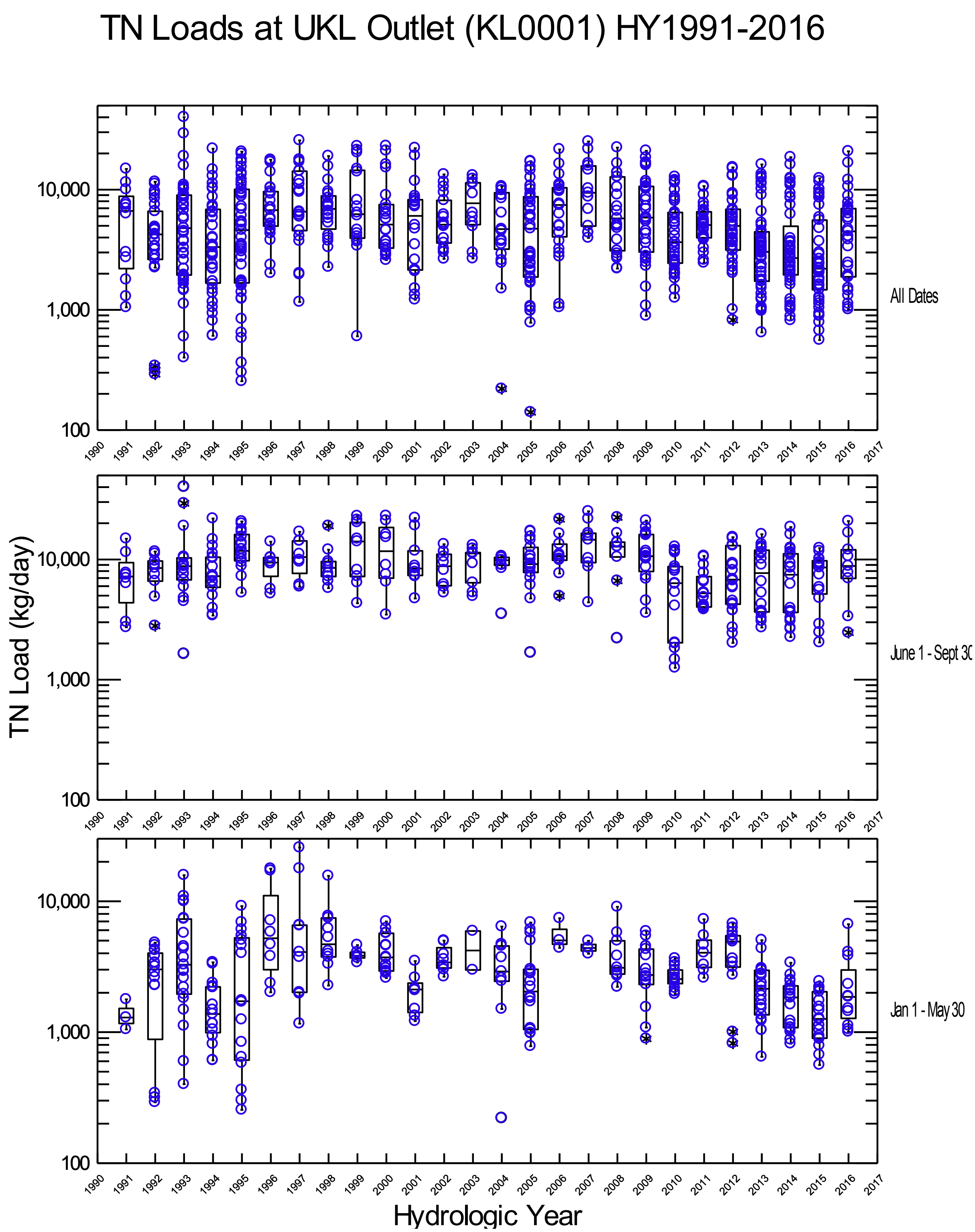


Appendix I Figure 6

TP Loads at Williamson R at Bridge on Modoc Pt. Road (WR6000) HY1991-2016

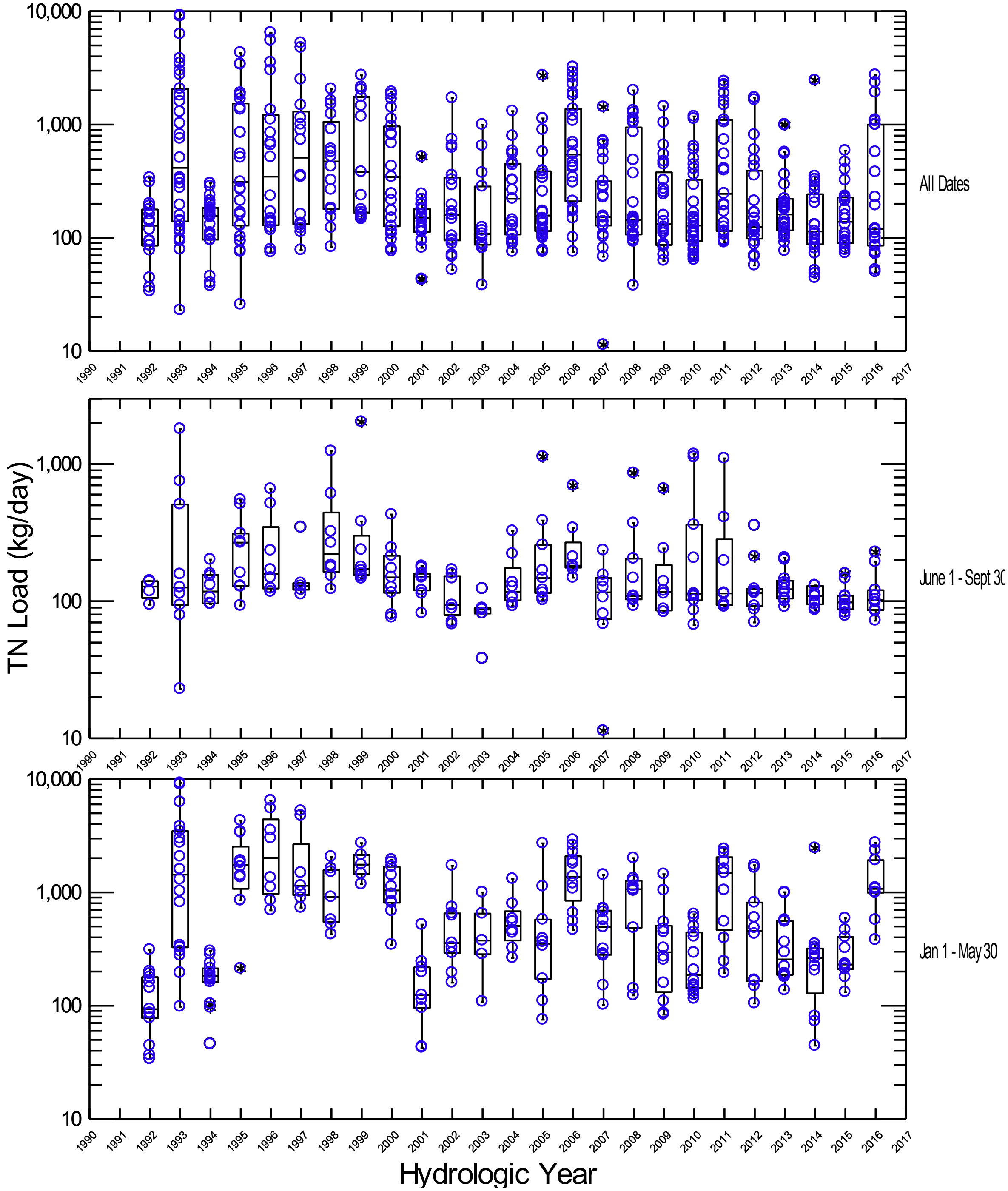


Appendix I Figure 7



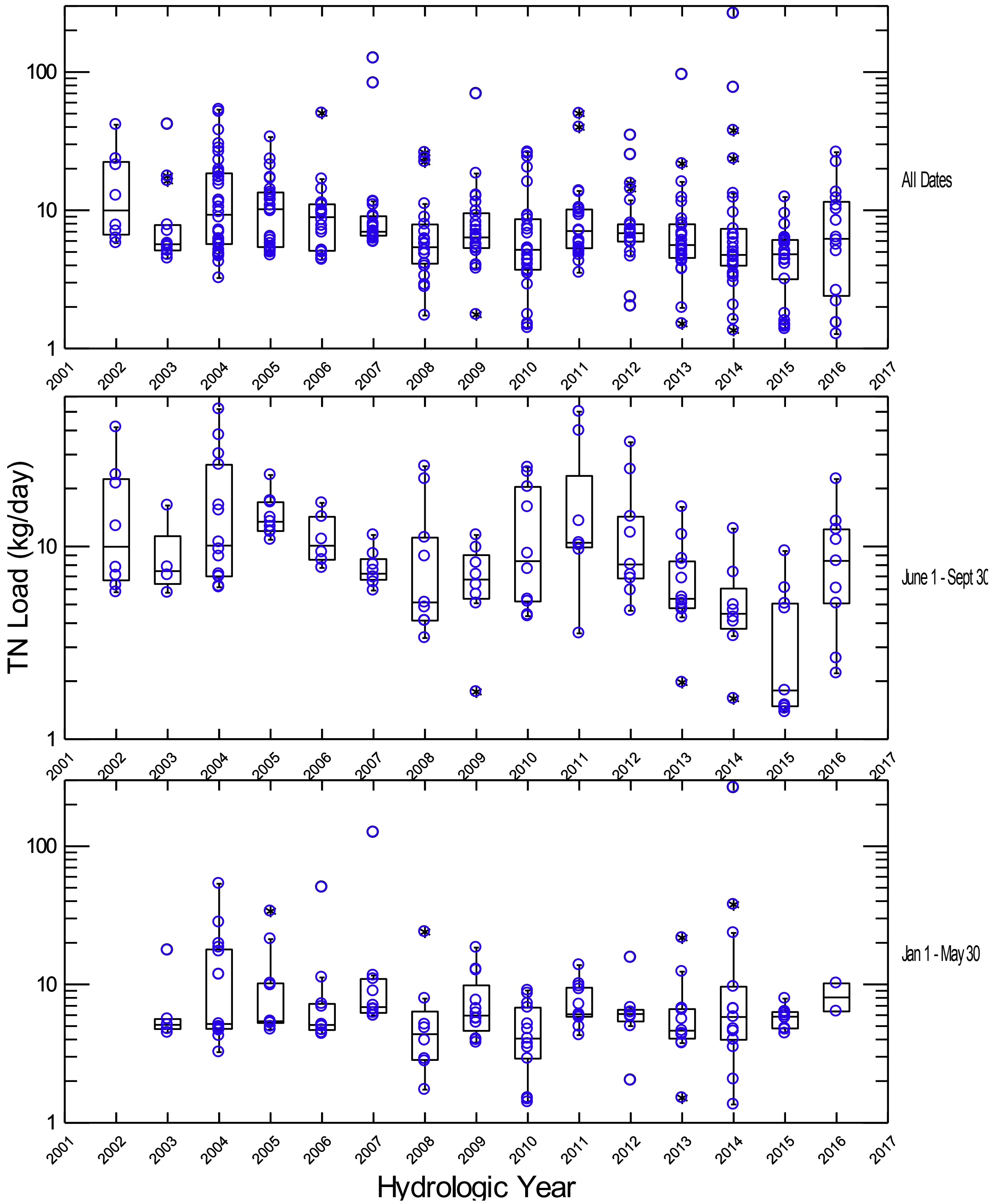
Appendix I Figure 8

TN Loads at Sprague R. @ Kirchers Bridge (W1000) HY1991-2016



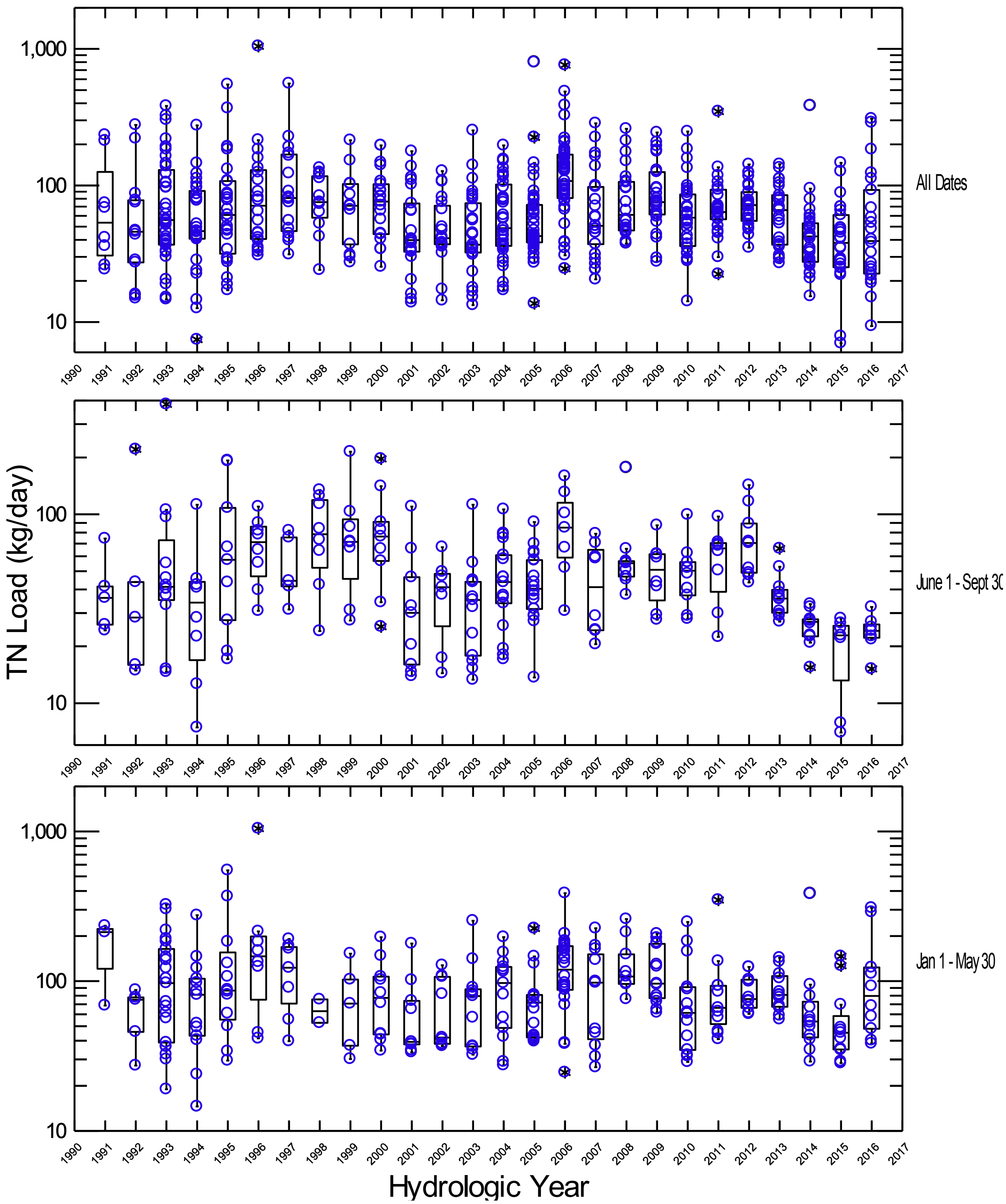
Appendix I Figure 9

TN Loads at Annie Cr at Snow Park (WR2000) HY1991-2016



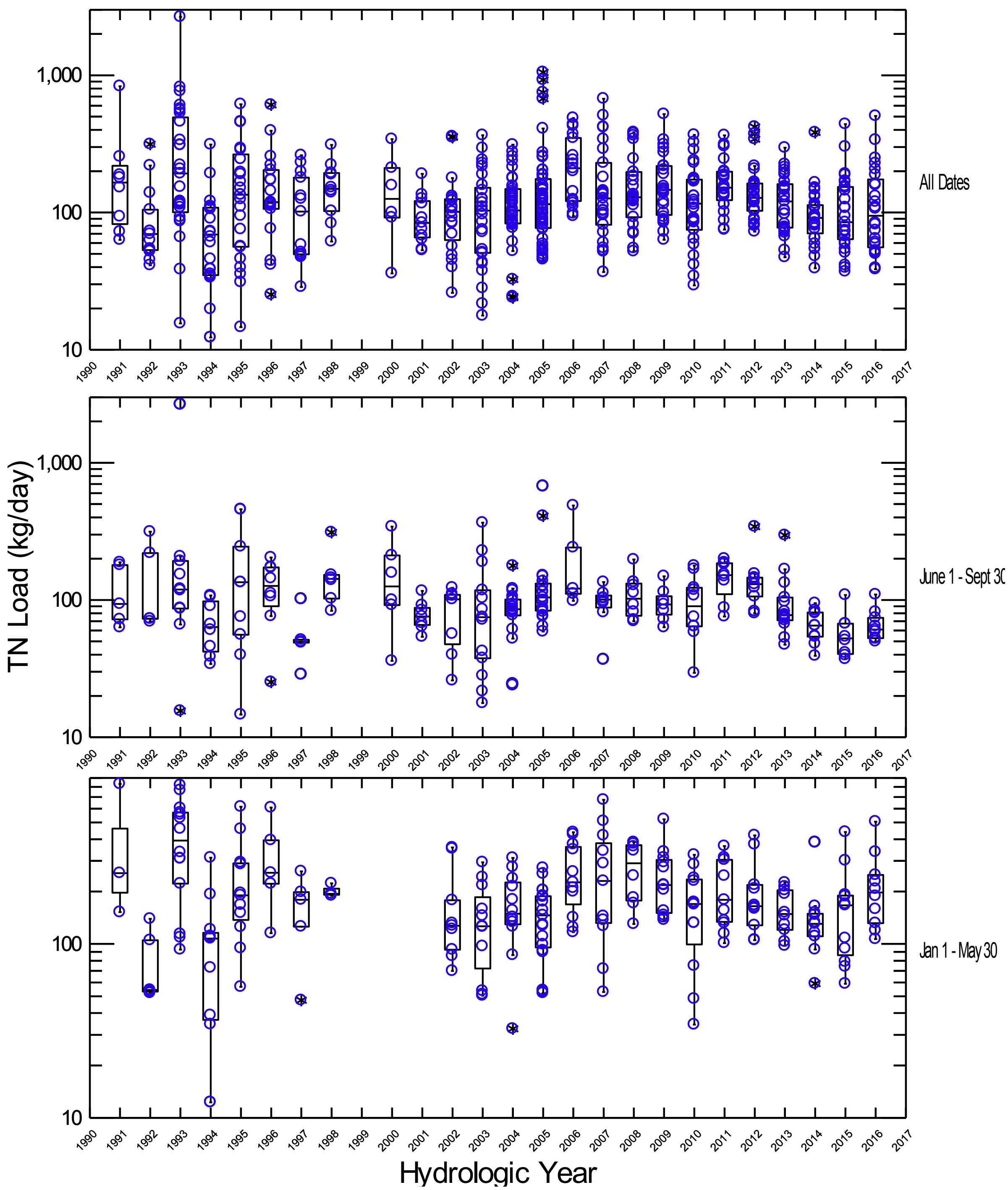
Appendix I Figure 10

TN Loads at Wood River at Weed Rd (WR3000) HY1991-2016



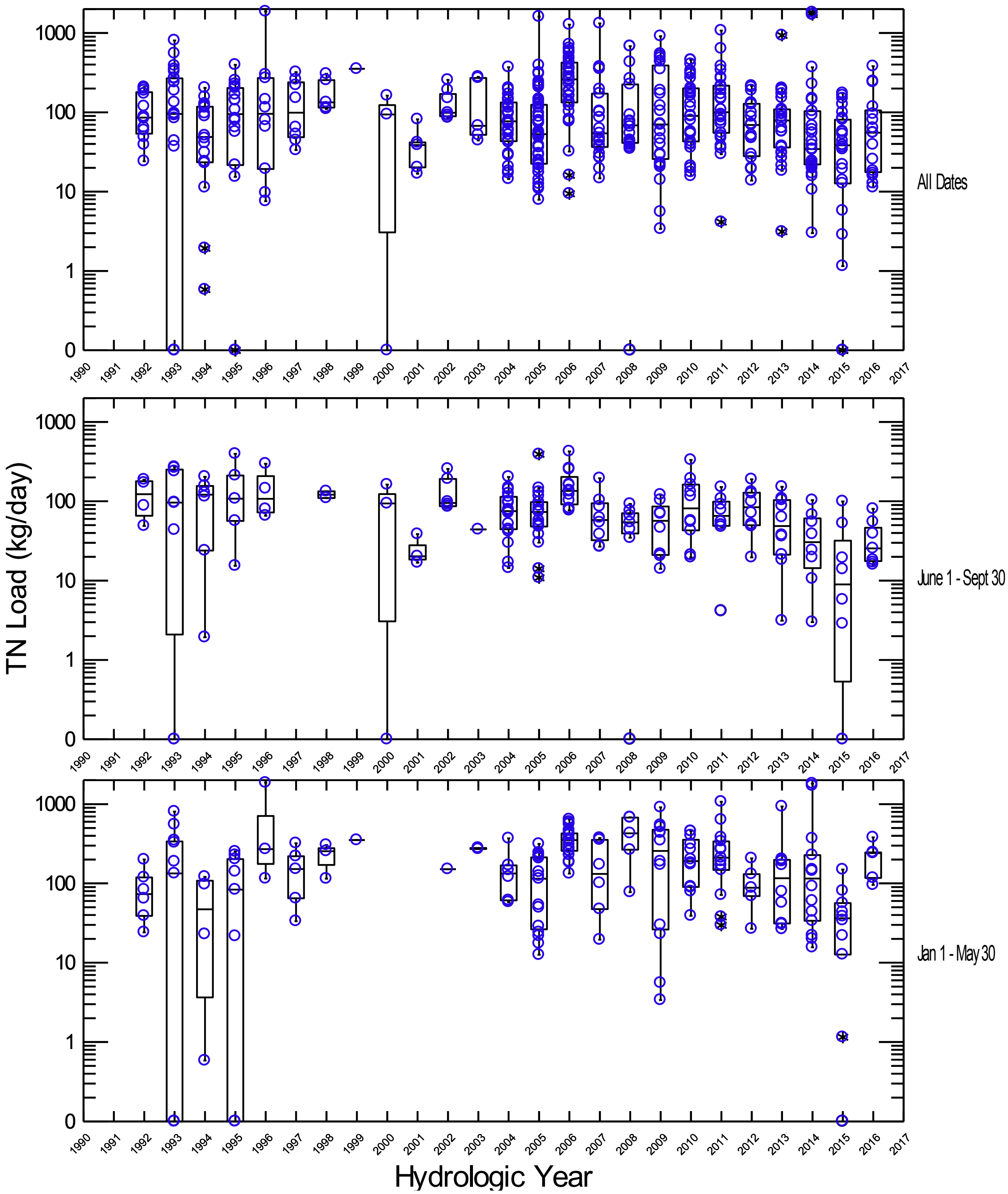
Appendix I Figure 11

TN Loads at Wood River at Dike Rd (WR4000) HY1991-2016



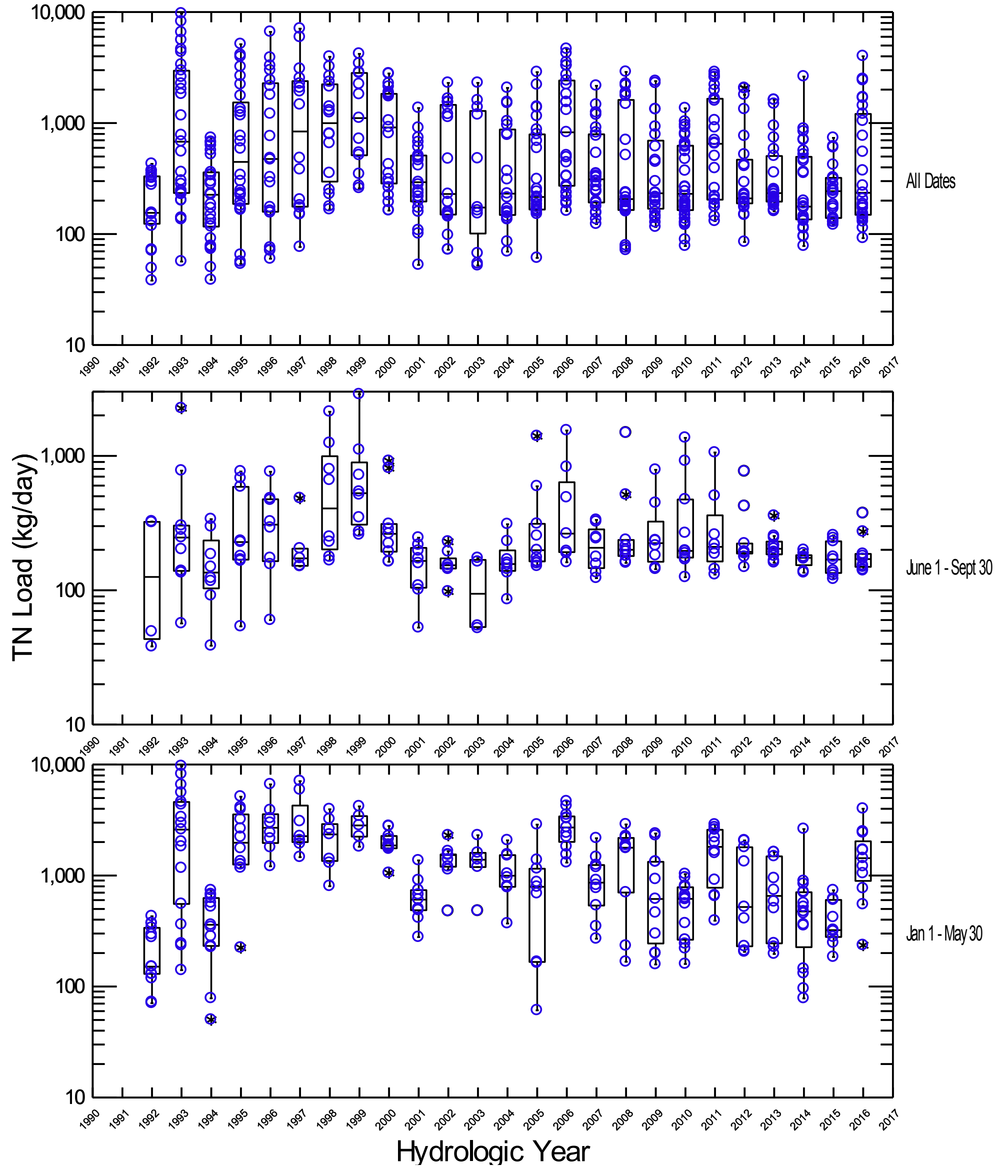
Appendix I Figure 12

TN Loads at Seven-Mile Canal at Dike Rd (WR5000) HY1991-2016



Appendix I Figure 13

TN Loads at Williamson R at Bridge on Modoc Pt. Road (WR6000) HY1991-2016



Appendix I Figure 14

APPENDIX II: Basic monthly statistics by station for TP, SRP, TN, NH_4-N, NO_3+ NO_2-N, SiO_2 concentration, and TP and TN load, Water Year 2016.

Station Code	Station Name	Month	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
UKL Out	UKL Outlet	10	N of Cases	4.00	3.00	4.00	4.00	4.00	2.00	4.00	4.00
UKL Out	UKL Outlet	10	Median	111.00	14.00	1,680.00	111.50	135.50	44,475.00	429.77	6,343.09
UKL Out	UKL Outlet	10	Arithmetic Mean	111.38	13.67	1,648.75	125.63	160.13	44,475.00	412.63	6,095.45
UKL Out	UKL Outlet	10	Coefficient of Variation	0.22	0.40	0.12	0.58	0.64	0.05	0.27	0.20
UKL Out	UKL Outlet	10	Pct25	92.75	9.50	1,487.50	67.50	88.00	43,050.00	334.59	5,168.72
UKL Out	UKL Outlet	10	Pct75	130.00	17.75	1,810.00	183.75	232.25	45,900.00	490.68	7,022.18
UKL Out	UKL Outlet	11	N of Cases	3.00	2.00	3.00	3.00	3.00	2.00	3.00	3.00
UKL Out	UKL Outlet	11	Median	97.00	3.75	2,020.00	415.00	410.00	40,900.00	261.08	5,585.29
UKL Out	UKL Outlet	11	Arithmetic Mean	90.00	3.75	2,016.67	367.00	411.67	40,900.00	246.48	5,533.50
UKL Out	UKL Outlet	11	Coefficient of Variation	0.16	0.85	0.14	0.26	0.09	0.01	0.16	0.15
UKL Out	UKL Outlet	11	Pct25	79.00	1.50	1,810.00	295.75	384.50	40,500.00	216.65	4,908.85
UKL Out	UKL Outlet	11	Pct75	99.25	6.00	2,222.50	426.25	439.25	41,300.00	272.65	6,145.21
UKL Out	UKL Outlet	12	N of Cases	1.00	1.00	2.00	2.00	2.00	1.00	1.00	2.00
UKL Out	UKL Outlet	12	Median	71.00	1.50	1,635.00	367.00	511.50	40,700.00	50.21	1,634.04
UKL Out	UKL Outlet	12	Arithmetic Mean	71.00	1.50	1,635.00	367.00	511.50	40,700.00	50.21	1,634.04
UKL Out	UKL Outlet	12	Coefficient of Variation	1.00	1.00	0.19	0.22	0.11	1.00	1.00	0.28
UKL Out	UKL Outlet	12	Pct25			1,410.00	310.00	473.00			1,315.31
UKL Out	UKL Outlet	12	Pct75			1,860.00	424.00	550.00			1,952.77
UKL Out	UKL Outlet	1	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
UKL Out	UKL Outlet	1	Median	50.50	5.75	1,475.00	316.00	493.00	38,200.00	49.74	1,491.42
UKL Out	UKL Outlet	1	Arithmetic Mean	50.50	5.75	1,475.00	316.00	493.00	38,200.00	49.74	1,491.42
UKL Out	UKL Outlet	1	Coefficient of Variation	0.13	1.05	0.04	0.20	0.06	0.01	0.19	0.35
UKL Out	UKL Outlet	1	Pct25	46.00	1.50	1,430.00	272.00	471.00	38,000.00	43.20	1,123.20
UKL Out	UKL Outlet	1	Pct75	55.00	10.00	1,520.00	360.00	515.00	38,400.00	56.28	1,859.64
UKL Out	UKL Outlet	2	N of Cases	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
UKL Out	UKL Outlet	2	Median	45.00	1.50	1,240.00	112.00	488.00	32,300.00	54.08	1,052.33
UKL Out	UKL Outlet	2	Arithmetic Mean	45.67	2.00	1,174.33	120.00	437.00	32,600.00	50.82	1,314.35
UKL Out	UKL Outlet	2	Coefficient of Variation	0.09	0.43	0.15	0.79	0.21	0.07	0.29	0.38
UKL Out	UKL Outlet	2	Pct25	42.75	1.50	1,039.75	49.75	370.25	31,025.00	39.45	1,017.96
UKL Out	UKL Outlet	2	Pct75	48.75	2.63	1,292.50	192.25	491.00	34,250.00	61.38	1,676.24
UKL Out	UKL Outlet	3	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
UKL Out	UKL Outlet	3	Median	56.50	2.25	915.50	22.00	228.50	27,450.00	254.21	4,094.92
UKL Out	UKL Outlet	3	Arithmetic Mean	56.50	2.25	915.50	22.00	228.50	27,450.00	254.21	4,094.92
UKL Out	UKL Outlet	3	Coefficient of Variation	0.04	0.47	0.02	0.45	0.13	0.00	0.90	0.89
UKL Out	UKL Outlet	3	Pct25	55.00	1.50	900.00	15.00	207.00	27,400.00	92.59	1,515.12
UKL Out	UKL Outlet	3	Pct75	58.00	3.00	931.00	29.00	250.00	27,500.00	415.83	6,674.73

Station Code	Station Name	Month	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
UKL Out	UKL Outlet	4	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
UKL Out	UKL Outlet	4	Median	62.00	6.00	777.50	20.25	87.25	28,925.00	223.17	2,766.48
UKL Out	UKL Outlet	4	Arithmetic Mean	62.00	6.00	777.50	20.25	87.25	28,925.00	223.17	2,766.48
UKL Out	UKL Outlet	4	Coefficient of Variation	0.11	0.71	0.08	0.19	0.00	0.00	0.71	0.68
UKL Out	UKL Outlet	4	Pct25	57.00	3.00	736.00	17.50	87.00	28,900.00	111.86	1,444.34
UKL Out	UKL Outlet	4	Pct75	67.00	9.00	819.00	23.00	87.50	28,950.00	334.48	4,088.62
UKL Out	UKL Outlet	5	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
UKL Out	UKL Outlet	5	Median	81.25	35.75	678.25	12.25	84.50	29,000.00	363.63	3,080.73
UKL Out	UKL Outlet	5	Arithmetic Mean	81.25	35.75	678.25	12.25	84.50	29,000.00	363.63	3,080.73
UKL Out	UKL Outlet	5	Coefficient of Variation	0.01	0.21	0.11	0.26	0.34	0.03	0.23	0.35
UKL Out	UKL Outlet	5	Pct25	80.50	30.50	626.00	10.00	64.00	28,300.00	304.12	2,321.72
UKL Out	UKL Outlet	5	Pct75	82.00	41.00	730.50	14.50	105.00	29,700.00	423.13	3,839.75
UKL Out	UKL Outlet	6	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
UKL Out	UKL Outlet	6	Median	134.50	13.50	1,421.00	13.50	7.00	24,950.00	501.94	5,156.37
UKL Out	UKL Outlet	6	Arithmetic Mean	134.50	13.50	1,421.00	13.50	7.00	24,950.00	501.94	5,156.37
UKL Out	UKL Outlet	6	Coefficient of Variation	0.44	1.00	0.68	0.05	0.61	0.00	0.23	0.49
UKL Out	UKL Outlet	6	Pct25	93.00	4.00	742.00	13.00	4.00	24,900.00	421.27	3,361.07
UKL Out	UKL Outlet	6	Pct75	176.00	23.00	2,100.00	14.00	10.00	25,000.00	582.62	6,951.66
UKL Out	UKL Outlet	7	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
UKL Out	UKL Outlet	7	Median	319.00	62.00	4,180.00	15.00	6.00	33,650.00	1,428.66	18,768.09
UKL Out	UKL Outlet	7	Arithmetic Mean	319.00	62.00	4,180.00	15.00	6.00	33,650.00	1,428.66	18,768.09
UKL Out	UKL Outlet	7	Coefficient of Variation	0.31	0.30	0.26	0.09	0.47	0.07	0.21	0.16
UKL Out	UKL Outlet	7	Pct25	250.00	49.00	3,420.00	14.00	4.00	32,000.00	1,220.37	16,694.70
UKL Out	UKL Outlet	7	Pct75	388.00	75.00	4,940.00	16.00	8.00	35,300.00	1,636.94	20,841.47
UKL Out	UKL Outlet	8	N of Cases	3.00	3.00	3.00	2.00	3.00	3.00	3.00	3.00
UKL Out	UKL Outlet	8	Median	248.00	71.00	2,220.00	29.00	10.00	43,500.00	1,104.70	10,622.09
UKL Out	UKL Outlet	8	Arithmetic Mean	254.33	74.33	2,333.33	29.00	25.33	42,600.00	1,141.69	10,496.45
UKL Out	UKL Outlet	8	Coefficient of Variation	0.11	0.46	0.16	0.44	1.08	0.06	0.08	0.15
UKL Out	UKL Outlet	8	Pct25	233.75	49.25	2,077.50	20.00	9.25	40,500.00	1,085.02	9,276.35
UKL Out	UKL Outlet	8	Pct75	276.50	100.25	2,617.50	38.00	45.25	44,475.00	1,207.61	11,685.13
UKL Out	UKL Outlet	9	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
UKL Out	UKL Outlet	9	Median	129.50	7.00	1,530.00	18.50	11.50	44,500.00	442.55	5,120.55
UKL Out	UKL Outlet	9	Arithmetic Mean	129.50	7.00	1,530.00	18.50	11.50	44,500.00	442.55	5,120.55
UKL Out	UKL Outlet	9	Coefficient of Variation	0.40	0.61	0.31	0.42	0.06	0.06	0.81	0.73
UKL Out	UKL Outlet	9	Pct25	93.00	4.00	1,200.00	13.00	11.00	42,600.00	190.60	2,459.40
UKL Out	UKL Outlet	9	Pct75	166.00	10.00	1,860.00	24.00	12.00	46,400.00	694.50	7,781.70
WR1000	Sprague R	10	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR1000	Sprague R	10	Median	34.00	21.50	150.50	10.00	6.00	26,900.00	16.60	73.39
WR1000	Sprague R	10	Arithmetic Mean	34.00	21.50	150.50	10.00	6.00	26,900.00	16.60	73.39
WR1000	Sprague R	10	Coefficient of Variation	0.00	0.16	0.03	0.14	0.47	0.05	0.06	0.03

Station Code	Station Name	Month	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
WR1000	Sprague R	10	Pct25	34.00	19.00	147.00	9.00	4.00	25,900.00	15.89	71.97
WR1000	Sprague R	10	Pct75	34.00	24.00	154.00	11.00	8.00	27,900.00	17.30	74.82
WR1000	Sprague R	11	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR1000	Sprague R	11	Median	38.00	28.00	93.50	6.00	7.00	30,050.00	20.66	51.02
WR1000	Sprague R	11	Arithmetic Mean	38.00	28.00	93.50	6.00	7.00	30,050.00	20.66	51.02
WR1000	Sprague R	11	Coefficient of Variation	0.30	0.05	0.01	0.71	0.61	0.00	0.27	0.03
WR1000	Sprague R	11	Pct25	30.00	27.00	93.00	3.00	4.00	30,000.00	16.66	49.84
WR1000	Sprague R	11	Pct75	46.00	29.00	94.00	9.00	10.00	30,100.00	24.65	52.21
WR1000	Sprague R	12	N of Cases	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR1000	Sprague R	12	Median	47.00	34.00	192.00	9.00	32.00	30,300.00	28.64	116.98
WR1000	Sprague R	12	Arithmetic Mean	47.00	34.00	192.00	9.00	32.00	30,300.00	28.64	116.98
WR1000	Sprague R	12	Coefficient of Variation	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR1000	Sprague R	12	Pct25								
WR1000	Sprague R	12	Pct75								
WR1000	Sprague R	1	N of Cases	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR1000	Sprague R	1	Median	155.00	94.00	722.00	31.00	80.00	24,800.00	504.43	2,349.66
WR1000	Sprague R	1	Arithmetic Mean	155.00	94.00	722.00	31.00	80.00	24,800.00	504.43	2,349.66
WR1000	Sprague R	1	Coefficient of Variation	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR1000	Sprague R	1	Pct25								
WR1000	Sprague R	1	Pct75								
WR1000	Sprague R	2	N of Cases	2.00	2.00	1.00	2.00	2.00	2.00	2.00	1.00
WR1000	Sprague R	2	Median	95.50	46.00	633.00	18.00	43.50	26,650.00	286.04	1,920.62
WR1000	Sprague R	2	Arithmetic Mean	95.50	46.00	633.00	18.00	43.50	26,650.00	286.04	1,920.62
WR1000	Sprague R	2	Coefficient of Variation	0.29	0.31	1.00	0.24	0.24	0.01	0.31	1.00
WR1000	Sprague R	2	Pct25	76.00	36.00		15.00	36.00	26,400.00	223.16	
WR1000	Sprague R	2	Pct75	115.00	56.00		21.00	51.00	26,900.00	348.93	
WR1000	Sprague R	3	N of Cases	2.00	2.00	3.00	3.00	3.00	3.00	2.00	3.00
WR1000	Sprague R	3	Median	67.00	34.00	444.00	16.00	23.00	30,100.00	165.25	1,096.19
WR1000	Sprague R	3	Arithmetic Mean	67.00	34.00	468.00	15.67	25.33	30,566.67	165.25	1,614.22
WR1000	Sprague R	3	Coefficient of Variation	0.00	0.08	0.15	0.22	0.31	0.07	0.12	0.60
WR1000	Sprague R	3	Pct25	67.00	32.00	419.25	13.00	20.00	29,125.00	151.81	1,028.57
WR1000	Sprague R	3	Pct75	67.00	36.00	522.75	18.25	31.25	32,125.00	178.70	2,329.37
WR1000	Sprague R	4	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR1000	Sprague R	4	Median	74.00	39.00	393.00	18.50	12.50	28,800.00	194.87	1,034.12
WR1000	Sprague R	4	Arithmetic Mean	74.00	39.00	393.00	18.50	12.50	28,800.00	194.87	1,034.12
WR1000	Sprague R	4	Coefficient of Variation	0.11	0.11	0.04	0.19	0.28	0.00	0.13	0.06
WR1000	Sprague R	4	Pct25	68.00	36.00	383.00	16.00	10.00	28,800.00	176.37	993.39
WR1000	Sprague R	4	Pct75	80.00	42.00	403.00	21.00	15.00	28,800.00	213.37	1,074.85
WR1000	Sprague R	5	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR1000	Sprague R	5	Median	59.00	34.50	302.00	7.50	8.50	29,050.00	92.51	476.17

Station Code	Station Name	Month	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
WR1000	Sprague R	5	Arithmetic Mean	59.00	34.50	302.00	7.50	8.50	29,050.00	92.51	476.17
WR1000	Sprague R	5	Coefficient of Variation	0.07	0.06	0.16	0.85	0.08	0.03	0.19	0.28
WR1000	Sprague R	5	Pct25	56.00	33.00	267.00	3.00	8.00	28,500.00	79.89	380.89
WR1000	Sprague R	5	Pct75	62.00	36.00	337.00	12.00	9.00	29,600.00	105.13	571.45
WR1000	Sprague R	6	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR1000	Sprague R	6	Median	47.50	28.00	268.00	9.00	7.00	28,400.00	36.79	210.99
WR1000	Sprague R	6	Arithmetic Mean	47.50	28.00	268.00	9.00	7.00	28,400.00	36.79	210.99
WR1000	Sprague R	6	Coefficient of Variation	0.25	0.35	0.03	0.16	0.61	0.04	0.11	0.12
WR1000	Sprague R	6	Pct25	39.00	21.00	262.00	8.00	4.00	27,500.00	33.97	193.76
WR1000	Sprague R	6	Pct75	56.00	35.00	274.00	10.00	10.00	29,300.00	39.60	228.23
WR1000	Sprague R	7	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR1000	Sprague R	7	Median	31.00	11.50	290.00	7.50	8.50	23,100.00	11.67	109.15
WR1000	Sprague R	7	Arithmetic Mean	31.00	11.50	290.00	7.50	8.50	23,100.00	11.67	109.15
WR1000	Sprague R	7	Coefficient of Variation	0.09	0.18	0.10	0.28	0.08	0.12	0.13	0.14
WR1000	Sprague R	7	Pct25	29.00	10.00	269.00	6.00	8.00	21,100.00	10.57	98.07
WR1000	Sprague R	7	Pct75	33.00	13.00	311.00	9.00	9.00	25,100.00	12.76	120.24
WR1000	Sprague R	8	N of Cases	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
WR1000	Sprague R	8	Median	39.00	17.00	284.00	14.00	10.00	22,700.00	16.93	102.04
WR1000	Sprague R	8	Arithmetic Mean	40.33	17.67	270.33	12.67	9.33	22,300.00	15.13	99.37
WR1000	Sprague R	8	Coefficient of Variation	0.10	0.12	0.16	0.33	0.12	0.10	0.23	0.12
WR1000	Sprague R	8	Pct25	37.50	16.25	238.25	9.50	8.50	20,600.00	12.53	90.23
WR1000	Sprague R	8	Pct75	43.50	19.25	299.00	15.50	10.00	23,900.00	17.28	107.86
WR1000	Sprague R	9	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR1000	Sprague R	9	Median	40.00	18.50	182.00	7.50	7.50	24,950.00	17.34	78.34
WR1000	Sprague R	9	Arithmetic Mean	40.00	18.50	182.00	7.50	7.50	24,950.00	17.34	78.34
WR1000	Sprague R	9	Coefficient of Variation	0.11	0.11	0.01	0.28	0.66	0.09	0.23	0.11
WR1000	Sprague R	9	Pct25	37.00	17.00	181.00	6.00	4.00	23,400.00	14.58	72.09
WR1000	Sprague R	9	Pct75	43.00	20.00	183.00	9.00	11.00	26,500.00	20.10	84.59
WR2000	Annie Cr	10	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR2000	Annie Cr	10	Median	51.00	31.00	34.50	8.50	9.00	42,300.00	4.70	3.36
WR2000	Annie Cr	10	Arithmetic Mean	51.00	31.00	34.50	8.50	9.00	42,300.00	4.70	3.36
WR2000	Annie Cr	10	Coefficient of Variation	0.19	0.00	0.80	0.08	0.00	0.01	0.38	0.92
WR2000	Annie Cr	10	Pct25	44.00	31.00	15.00	8.00	9.00	42,000.00	3.44	1.17
WR2000	Annie Cr	10	Pct75	58.00	31.00	54.00	9.00	9.00	42,600.00	5.96	5.55
WR2000	Annie Cr	11	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR2000	Annie Cr	11	Median	42.00	30.50	15.00	6.00	17.00	42,050.00	4.03	1.44
WR2000	Annie Cr	11	Arithmetic Mean	42.00	30.50	15.00	6.00	17.00	42,050.00	4.03	1.44
WR2000	Annie Cr	11	Coefficient of Variation	0.20	0.07	0.00	0.00	0.33	0.01	0.20	0.00
WR2000	Annie Cr	11	Pct25	36.00	29.00	15.00	6.00	13.00	41,800.00	3.45	1.44
WR2000	Annie Cr	11	Pct75	48.00	32.00	15.00	6.00	21.00	42,300.00	4.60	1.44

Station Code	Station Name	Month	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
WR2000	Annie Cr	12	N of Cases	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR2000	Annie Cr	12	Median	234.00	23.00	149.00	3.00	51.00	29,600.00	41.12	26.18
WR2000	Annie Cr	12	Arithmetic Mean	234.00	23.00	149.00	3.00	51.00	29,600.00	41.12	26.18
WR2000	Annie Cr	12	Coefficient of Variation	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR2000	Annie Cr	12	Pct25								
WR2000	Annie Cr	12	Pct75								
WR2000	Annie Cr	4	N of Cases	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR2000	Annie Cr	4	Median	45.00	26.00	39.00	8.00	21.00	37,300.00	7.24	6.27
WR2000	Annie Cr	4	Arithmetic Mean	45.00	26.00	39.00	8.00	21.00	37,300.00	7.24	6.27
WR2000	Annie Cr	4	Coefficient of Variation	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR2000	Annie Cr	4	Pct25								
WR2000	Annie Cr	4	Pct75								
WR2000	Annie Cr	5	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	1.00	1.00
WR2000	Annie Cr	5	Median	59.50	25.00	56.50	6.50	18.50	32,850.00	12.43	10.09
WR2000	Annie Cr	5	Arithmetic Mean	59.50	25.00	56.50	6.50	18.50	32,850.00	12.43	10.09
WR2000	Annie Cr	5	Coefficient of Variation	0.15	0.06	0.34	0.11	0.11	0.11	1.00	1.00
WR2000	Annie Cr	5	Pct25	53.00	24.00	43.00	6.00	17.00	30,300.00		
WR2000	Annie Cr	5	Pct75	66.00	26.00	70.00	7.00	20.00	35,400.00		
WR2000	Annie Cr	6	N of Cases	3.00	3.00	3.00	3.00	3.00	3.00	2.00	2.00
WR2000	Annie Cr	6	Median	78.00	21.00	59.00	7.00	14.00	30,600.00	18.39	16.51
WR2000	Annie Cr	6	Arithmetic Mean	79.00	23.00	60.00	6.33	13.67	32,433.33	18.39	16.51
WR2000	Annie Cr	6	Coefficient of Variation	0.27	0.15	0.21	0.48	0.18	0.14	0.42	0.50
WR2000	Annie Cr	6	Pct25	63.00	21.00	50.75	4.00	11.75	29,550.00	12.96	10.72
WR2000	Annie Cr	6	Pct75	95.25	25.50	69.50	8.50	15.50	35,775.00	23.82	22.29
WR2000	Annie Cr	7	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR2000	Annie Cr	7	Median	52.50	29.00	30.00	5.50	10.00	39,300.00	9.28	5.42
WR2000	Annie Cr	7	Arithmetic Mean	52.50	29.00	30.00	5.50	10.00	39,300.00	9.28	5.42
WR2000	Annie Cr	7	Coefficient of Variation	0.01	0.00	0.71	0.64	0.00	0.01	0.08	0.75
WR2000	Annie Cr	7	Pct25	52.00	29.00	15.00	3.00	10.00	39,100.00	8.77	2.53
WR2000	Annie Cr	7	Pct75	53.00	29.00	45.00	8.00	10.00	39,500.00	9.78	8.31
WR2000	Annie Cr	8	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR2000	Annie Cr	8	Median	58.50	31.00	63.50	10.00	10.50	41,650.00	8.83	9.69
WR2000	Annie Cr	8	Arithmetic Mean	58.50	31.00	63.50	10.00	10.50	41,650.00	8.83	9.69
WR2000	Annie Cr	8	Coefficient of Variation	0.23	0.05	0.46	0.28	0.07	0.01	0.32	0.54
WR2000	Annie Cr	8	Pct25	49.00	30.00	43.00	8.00	10.00	41,400.00	6.80	5.97
WR2000	Annie Cr	8	Pct75	68.00	32.00	84.00	12.00	11.00	41,900.00	10.85	13.40
WR2000	Annie Cr	9	N of Cases	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
WR2000	Annie Cr	9	Median	44.00	30.00	36.00	3.00	8.00	42,400.00	6.15	4.97
WR2000	Annie Cr	9	Arithmetic Mean	45.67	30.33	49.67	4.00	8.33	42,200.00	6.13	6.41
WR2000	Annie Cr	9	Coefficient of Variation	0.10	0.02	0.87	0.43	0.54	0.02	0.15	0.81

Station Code	Station Name	Month	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
WR2000	Annie Cr	9	Pct25	42.50	30.00	20.25	3.00	5.00	41,650.00	5.45	2.81
WR2000	Annie Cr	9	Pct75	49.25	30.75	82.50	5.25	11.75	42,700.00	6.81	10.37
WR3000	Wood @ Weed	10	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR3000	Wood @ Weed	10	Median	76.50	69.50	31.00	10.50	13.50	39,650.00	48.62	19.71
WR3000	Wood @ Weed	10	Arithmetic Mean	76.50	69.50	31.00	10.50	13.50	39,650.00	48.62	19.71
WR3000	Wood @ Weed	10	Coefficient of Variation	0.01	0.01	0.00	0.07	0.05	0.01	0.03	0.04
WR3000	Wood @ Weed	10	Pct25	76.00	69.00	31.00	10.00	13.00	39,300.00	47.66	19.19
WR3000	Wood @ Weed	10	Pct75	77.00	70.00	31.00	11.00	14.00	40,000.00	49.59	20.23
WR3000	Wood @ Weed	11	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR3000	Wood @ Weed	11	Median	84.00	71.00	45.50	3.00	20.00	39,750.00	54.92	31.24
WR3000	Wood @ Weed	11	Arithmetic Mean	84.00	71.00	45.50	3.00	20.00	39,750.00	54.92	31.24
WR3000	Wood @ Weed	11	Coefficient of Variation	0.15	0.06	0.95	0.00	0.21	0.00	0.06	1.00
WR3000	Wood @ Weed	11	Pct25	75.00	68.00	15.00	3.00	17.00	39,700.00	52.54	9.24
WR3000	Wood @ Weed	11	Pct75	93.00	74.00	76.00	3.00	23.00	39,800.00	57.30	53.24
WR3000	Wood @ Weed	12	N of Cases	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR3000	Wood @ Weed	12	Median	128.00	63.00	203.00	8.00	35.00	36,900.00	115.87	183.77
WR3000	Wood @ Weed	12	Arithmetic Mean	128.00	63.00	203.00	8.00	35.00	36,900.00	115.87	183.77
WR3000	Wood @ Weed	12	Coefficient of Variation	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR3000	Wood @ Weed	12	Pct25								
WR3000	Wood @ Weed	12	Pct75								
WR3000	Wood @ Weed	1	N of Cases	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR3000	Wood @ Weed	1	Median	86.00	71.00	79.00	9.00	31.00	39,900.00	63.28	58.12
WR3000	Wood @ Weed	1	Arithmetic Mean	86.00	71.00	79.00	9.00	31.00	39,900.00	63.28	58.12
WR3000	Wood @ Weed	1	Coefficient of Variation	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR3000	Wood @ Weed	1	Pct25								
WR3000	Wood @ Weed	1	Pct75								
WR3000	Wood @ Weed	2	N of Cases	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR3000	Wood @ Weed	2	Median	103.00	81.00	158.00	15.00	30.00	39,100.00	80.40	123.33
WR3000	Wood @ Weed	2	Arithmetic Mean	103.00	81.00	158.00	15.00	30.00	39,100.00	80.40	123.33
WR3000	Wood @ Weed	2	Coefficient of Variation	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR3000	Wood @ Weed	2	Pct25								
WR3000	Wood @ Weed	2	Pct75								
WR3000	Wood @ Weed	3	N of Cases	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
WR3000	Wood @ Weed	3	Median	87.00	68.50	133.00	13.50	29.50	39,500.00	68.04	102.36
WR3000	Wood @ Weed	3	Arithmetic Mean	86.50	69.25	139.50	13.25	29.00	37,850.00	77.71	138.25
WR3000	Wood @ Weed	3	Coefficient of Variation	0.05	0.05	0.55	0.26	0.20	0.10	0.31	0.85
WR3000	Wood @ Weed	3	Pct25	83.50	67.00	89.50	10.50	24.50	35,750.00	62.22	66.32
WR3000	Wood @ Weed	3	Pct75	89.50	71.50	189.50	16.00	33.50	39,950.00	93.19	210.18
WR3000	Wood @ Weed	4	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR3000	Wood @ Weed	4	Median	88.50	64.50	74.00	12.50	18.00	37,300.00	63.01	53.23

Station Code	Station Name	Month	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
WR3000	Wood @ Weed	4	Arithmetic Mean	88.50	64.50	74.00	12.50	18.00	37,300.00	63.01	53.23
WR3000	Wood @ Weed	4	Coefficient of Variation	0.10	0.01	0.21	0.40	0.24	0.05	0.30	0.40
WR3000	Wood @ Weed	4	Pct25	82.00	64.00	63.00	9.00	15.00	35,900.00	49.69	38.18
WR3000	Wood @ Weed	4	Pct75	95.00	65.00	85.00	16.00	21.00	38,700.00	76.32	68.29
WR3000	Wood @ Weed	5	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR3000	Wood @ Weed	5	Median	88.50	65.50	320.00	8.00	13.50	37,200.00	47.51	168.59
WR3000	Wood @ Weed	5	Arithmetic Mean	88.50	65.50	320.00	8.00	13.50	37,200.00	47.51	168.59
WR3000	Wood @ Weed	5	Coefficient of Variation	0.04	0.05	1.03	0.18	0.05	0.07	0.00	1.01
WR3000	Wood @ Weed	5	Pct25	86.00	63.00	87.00	7.00	13.00	35,300.00	47.42	47.97
WR3000	Wood @ Weed	5	Pct75	91.00	68.00	553.00	9.00	14.00	39,100.00	47.59	289.21
WR3000	Wood @ Weed	6	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	1.00	1.00
WR3000	Wood @ Weed	6	Median	89.00	70.00	74.50	9.00	11.50	38,050.00	42.14	32.23
WR3000	Wood @ Weed	6	Arithmetic Mean	89.00	70.00	74.50	9.00	11.50	38,050.00	42.14	32.23
WR3000	Wood @ Weed	6	Coefficient of Variation	0.06	0.14	0.18	0.16	0.43	0.05	1.00	1.00
WR3000	Wood @ Weed	6	Pct25	85.00	63.00	65.00	8.00	8.00	36,800.00		
WR3000	Wood @ Weed	6	Pct75	93.00	77.00	84.00	10.00	15.00	39,300.00		
WR3000	Wood @ Weed	7	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR3000	Wood @ Weed	7	Median	82.50	70.50	43.50	8.00	10.50	38,950.00	45.54	23.84
WR3000	Wood @ Weed	7	Arithmetic Mean	82.50	70.50	43.50	8.00	10.50	38,950.00	45.54	23.84
WR3000	Wood @ Weed	7	Coefficient of Variation	0.01	0.03	0.08	0.88	0.20	0.01	0.17	0.08
WR3000	Wood @ Weed	7	Pct25	82.00	69.00	41.00	3.00	9.00	38,800.00	40.14	22.52
WR3000	Wood @ Weed	7	Pct75	83.00	72.00	46.00	13.00	12.00	39,100.00	50.93	25.16
WR3000	Wood @ Weed	8	N of Cases	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
WR3000	Wood @ Weed	8	Median	86.00	72.00	53.00	8.00	11.00	39,000.00	34.45	21.69
WR3000	Wood @ Weed	8	Arithmetic Mean	86.00	72.00	49.67	8.33	11.00	39,000.00	36.32	21.22
WR3000	Wood @ Weed	8	Coefficient of Variation	0.03	0.01	0.19	0.30	0.09	0.01	0.10	0.28
WR3000	Wood @ Weed	8	Pct25	83.75	71.25	42.50	6.50	10.25	38,850.00	34.09	16.75
WR3000	Wood @ Weed	8	Pct75	88.25	72.75	56.00	10.25	11.75	39,150.00	39.02	25.58
WR3000	Wood @ Weed	9	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	1.00	1.00
WR3000	Wood @ Weed	9	Median	85.50	68.00	40.00	5.00	13.00	39,700.00	54.89	24.05
WR3000	Wood @ Weed	9	Arithmetic Mean	85.50	68.00	40.00	5.00	13.00	39,700.00	54.89	24.05
WR3000	Wood @ Weed	9	Coefficient of Variation	0.06	0.00	0.04	0.57	0.11	0.01	1.00	1.00
WR3000	Wood @ Weed	9	Pct25	82.00	68.00	39.00	3.00	12.00	39,500.00		
WR3000	Wood @ Weed	9	Pct75	89.00	68.00	41.00	7.00	14.00	39,900.00		
WR4000	Wood @ Dike	10	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR4000	Wood @ Dike	10	Median	85.00	75.50	48.50	12.00	11.50	38,400.00	68.13	38.92
WR4000	Wood @ Dike	10	Arithmetic Mean	85.00	75.50	48.50	12.00	11.50	38,400.00	68.13	38.92
WR4000	Wood @ Dike	10	Coefficient of Variation	0.08	0.03	0.01	0.00	0.06	0.01	0.05	0.02
WR4000	Wood @ Dike	10	Pct25	80.00	74.00	48.00	12.00	11.00	38,100.00	65.58	38.49
WR4000	Wood @ Dike	10	Pct75	90.00	77.00	49.00	12.00	12.00	38,700.00	70.69	39.35

Station Code	Station Name	Month	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
WR4000	Wood @ Dike	11	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR4000	Wood @ Dike	11	Median	101.00	88.00	75.50	5.50	18.00	38,200.00	90.29	67.53
WR4000	Wood @ Dike	11	Arithmetic Mean	101.00	88.00	75.50	5.50	18.00	38,200.00	90.29	67.53
WR4000	Wood @ Dike	11	Coefficient of Variation	0.27	0.16	0.33	0.64	0.31	0.04	0.28	0.34
WR4000	Wood @ Dike	11	Pct25	82.00	78.00	58.00	3.00	14.00	37,200.00	72.23	51.09
WR4000	Wood @ Dike	11	Pct75	120.00	98.00	93.00	8.00	22.00	39,200.00	108.35	83.97
WR4000	Wood @ Dike	12	N of Cases	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR4000	Wood @ Dike	12	Median	111.00	79.00	168.00	10.00	34.00	37,800.00	106.47	161.14
WR4000	Wood @ Dike	12	Arithmetic Mean	111.00	79.00	168.00	10.00	34.00	37,800.00	106.47	161.14
WR4000	Wood @ Dike	12	Coefficient of Variation	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR4000	Wood @ Dike	12	Pct25								
WR4000	Wood @ Dike	12	Pct75								
WR4000	Wood @ Dike	2	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR4000	Wood @ Dike	2	Median	149.00	127.00	252.50	15.00	29.50	36,350.00	157.94	272.43
WR4000	Wood @ Dike	2	Arithmetic Mean	149.00	127.00	252.50	15.00	29.50	36,350.00	157.94	272.43
WR4000	Wood @ Dike	2	Coefficient of Variation	0.07	0.06	0.22	0.00	0.07	0.04	0.06	0.34
WR4000	Wood @ Dike	2	Pct25	142.00	122.00	213.00	15.00	28.00	35,200.00	151.54	206.91
WR4000	Wood @ Dike	2	Pct75	156.00	132.00	292.00	15.00	31.00	37,500.00	164.35	337.96
WR4000	Wood @ Dike	3	N of Cases	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
WR4000	Wood @ Dike	3	Median	125.00	108.50	214.00	14.00	20.50	35,550.00	137.02	238.59
WR4000	Wood @ Dike	3	Arithmetic Mean	124.75	108.25	232.00	13.75	18.75	34,325.00	146.30	285.17
WR4000	Wood @ Dike	3	Coefficient of Variation	0.02	0.07	0.31	0.16	0.21	0.10	0.20	0.53
WR4000	Wood @ Dike	3	Pct25	123.00	102.00	189.00	12.00	16.50	32,350.00	128.36	193.33
WR4000	Wood @ Dike	3	Pct75	126.50	114.50	275.00	15.50	21.00	36,300.00	164.24	377.00
WR4000	Wood @ Dike	4	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR4000	Wood @ Dike	4	Median	126.50	108.50	142.00	15.00	14.00	35,650.00	106.10	118.97
WR4000	Wood @ Dike	4	Arithmetic Mean	126.50	108.50	142.00	15.00	14.00	35,650.00	106.10	118.97
WR4000	Wood @ Dike	4	Coefficient of Variation	0.08	0.08	0.06	0.28	0.20	0.02	0.17	0.15
WR4000	Wood @ Dike	4	Pct25	119.00	102.00	136.00	12.00	12.00	35,100.00	93.18	106.49
WR4000	Wood @ Dike	4	Pct75	134.00	115.00	148.00	18.00	16.00	36,200.00	119.02	131.46
WR4000	Wood @ Dike	5	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR4000	Wood @ Dike	5	Median	132.50	107.00	193.50	8.00	10.00	33,300.00	105.47	153.92
WR4000	Wood @ Dike	5	Arithmetic Mean	132.50	107.00	193.50	8.00	10.00	33,300.00	105.47	153.92
WR4000	Wood @ Dike	5	Coefficient of Variation	0.23	0.20	0.22	0.00	0.28	0.07	0.33	0.32
WR4000	Wood @ Dike	5	Pct25	111.00	92.00	164.00	8.00	8.00	31,600.00	80.94	119.58
WR4000	Wood @ Dike	5	Pct75	154.00	122.00	223.00	8.00	12.00	35,000.00	130.00	188.25
WR4000	Wood @ Dike	6	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR4000	Wood @ Dike	6	Median	117.00	98.50	127.00	11.50	7.00	36,000.00	80.21	86.96
WR4000	Wood @ Dike	6	Arithmetic Mean	117.00	98.50	127.00	11.50	7.00	36,000.00	80.21	86.96
WR4000	Wood @ Dike	6	Coefficient of Variation	0.19	0.19	0.38	0.31	0.61	0.05	0.18	0.37

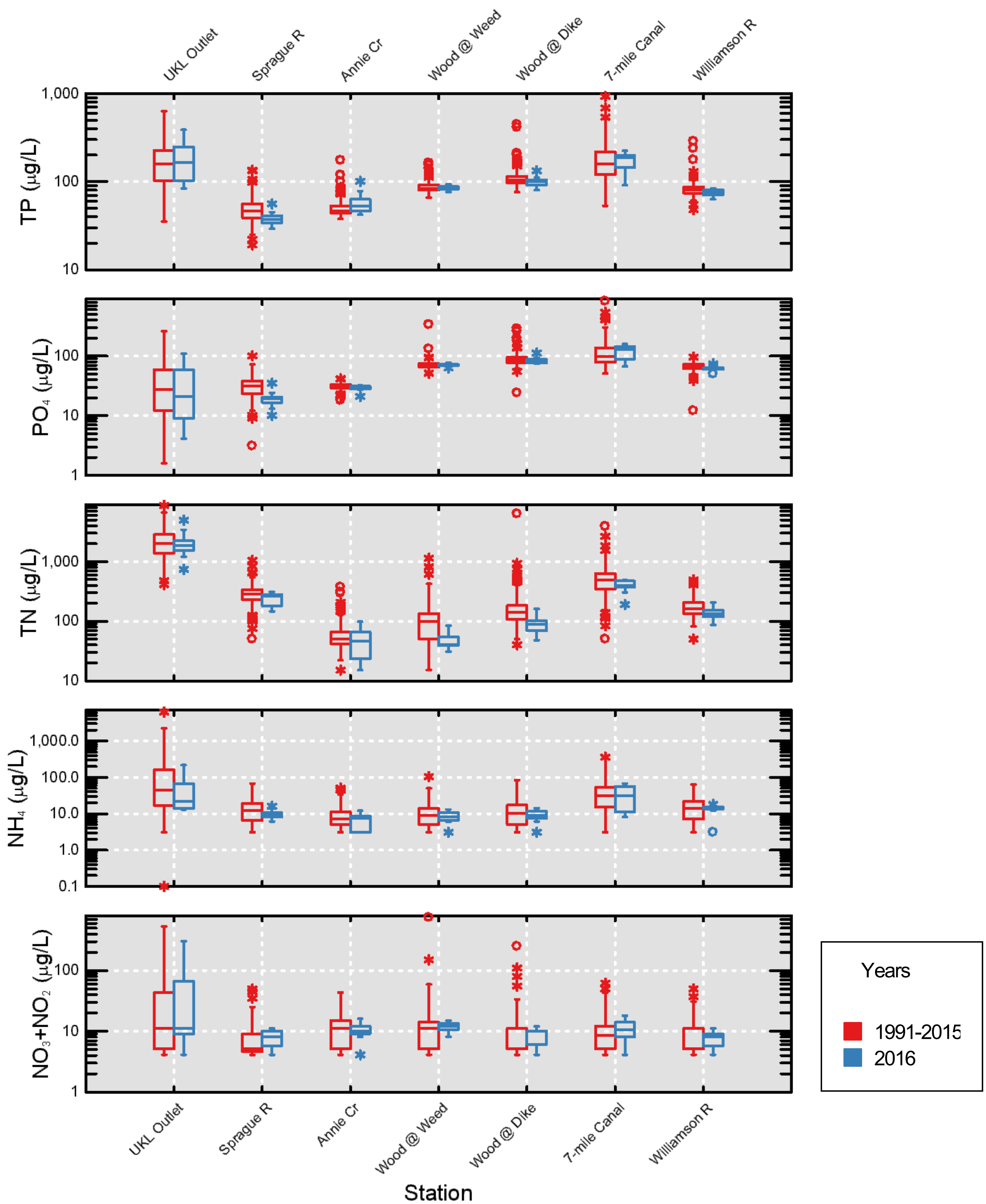
Station Code	Station Name	Month	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
WR4000	Wood @ Dike	6	Pct25	101.00	85.00	93.00	9.00	4.00	34,800.00	69.94	64.40
WR4000	Wood @ Dike	6	Pct75	133.00	112.00	161.00	14.00	10.00	37,200.00	90.47	109.52
WR4000	Wood @ Dike	7	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR4000	Wood @ Dike	7	Median	103.00	85.00	94.50	6.00	9.50	36,800.00	71.02	65.78
WR4000	Wood @ Dike	7	Arithmetic Mean	103.00	85.00	94.50	6.00	9.50	36,800.00	71.02	65.78
WR4000	Wood @ Dike	7	Coefficient of Variation	0.05	0.05	0.25	0.71	0.07	0.02	0.16	0.34
WR4000	Wood @ Dike	7	Pct25	99.00	82.00	78.00	3.00	9.00	36,300.00	63.23	49.81
WR4000	Wood @ Dike	7	Pct75	107.00	88.00	111.00	9.00	10.00	37,300.00	78.81	81.75
WR4000	Wood @ Dike	8	N of Cases	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
WR4000	Wood @ Dike	8	Median	102.00	88.00	92.00	10.00	4.00	37,800.00	64.50	58.75
WR4000	Wood @ Dike	8	Arithmetic Mean	104.67	89.33	97.00	9.00	6.00	38,033.33	66.28	61.61
WR4000	Wood @ Dike	8	Coefficient of Variation	0.05	0.05	0.12	0.29	0.58	0.01	0.12	0.18
WR4000	Wood @ Dike	8	Pct25	101.25	86.50	89.75	7.00	4.00	37,725.00	60.86	53.72
WR4000	Wood @ Dike	8	Pct75	108.75	92.50	105.50	10.75	8.50	38,400.00	72.14	70.20
WR4000	Wood @ Dike	9	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR4000	Wood @ Dike	9	Median	91.00	76.50	69.00	7.50	10.00	38,500.00	74.81	56.72
WR4000	Wood @ Dike	9	Arithmetic Mean	91.00	76.50	69.00	7.50	10.00	38,500.00	74.81	56.72
WR4000	Wood @ Dike	9	Coefficient of Variation	0.05	0.01	0.04	0.28	0.00	0.01	0.11	0.10
WR4000	Wood @ Dike	9	Pct25	88.00	76.00	67.00	6.00	10.00	38,100.00	69.12	52.63
WR4000	Wood @ Dike	9	Pct75	94.00	77.00	71.00	9.00	10.00	38,900.00	80.50	60.81
WR5000	7-mile Canal	10	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR5000	7-mile Canal	10	Median	107.50	70.50	247.00	55.50	17.00	30,300.00	17.76	38.03
WR5000	7-mile Canal	10	Arithmetic Mean	107.50	70.50	247.00	55.50	17.00	30,300.00	17.76	38.03
WR5000	7-mile Canal	10	Coefficient of Variation	0.22	0.07	0.33	0.19	0.08	0.05	1.00	0.94
WR5000	7-mile Canal	10	Pct25	91.00	67.00	190.00	48.00	16.00	29,300.00	5.16	12.66
WR5000	7-mile Canal	10	Pct75	124.00	74.00	304.00	63.00	18.00	31,300.00	30.37	63.40
WR5000	7-mile Canal	11	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR5000	7-mile Canal	11	Median	95.00	68.00	232.00	29.50	13.00	33,650.00	11.85	33.36
WR5000	7-mile Canal	11	Arithmetic Mean	95.00	68.00	232.00	29.50	13.00	33,650.00	11.85	33.36
WR5000	7-mile Canal	11	Coefficient of Variation	0.03	0.06	0.48	0.26	0.11	0.02	0.57	0.94
WR5000	7-mile Canal	11	Pct25	93.00	65.00	153.00	24.00	12.00	33,200.00	7.10	11.21
WR5000	7-mile Canal	11	Pct75	97.00	71.00	311.00	35.00	14.00	34,100.00	16.60	55.51
WR5000	7-mile Canal	12	N of Cases	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR5000	7-mile Canal	12	Median	109.00	79.00	311.00	28.00	26.00	31,400.00	-11.40	-32.53
WR5000	7-mile Canal	12	Arithmetic Mean	109.00	79.00	311.00	28.00	26.00	31,400.00	-11.40	-32.53
WR5000	7-mile Canal	12	Coefficient of Variation	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR5000	7-mile Canal	12	Pct25								
WR5000	7-mile Canal	12	Pct75								
WR5000	7-mile Canal	2	N of Cases	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR5000	7-mile Canal	2	Median	167.00	129.00	630.00	53.00	59.00	31,300.00	65.30	246.34

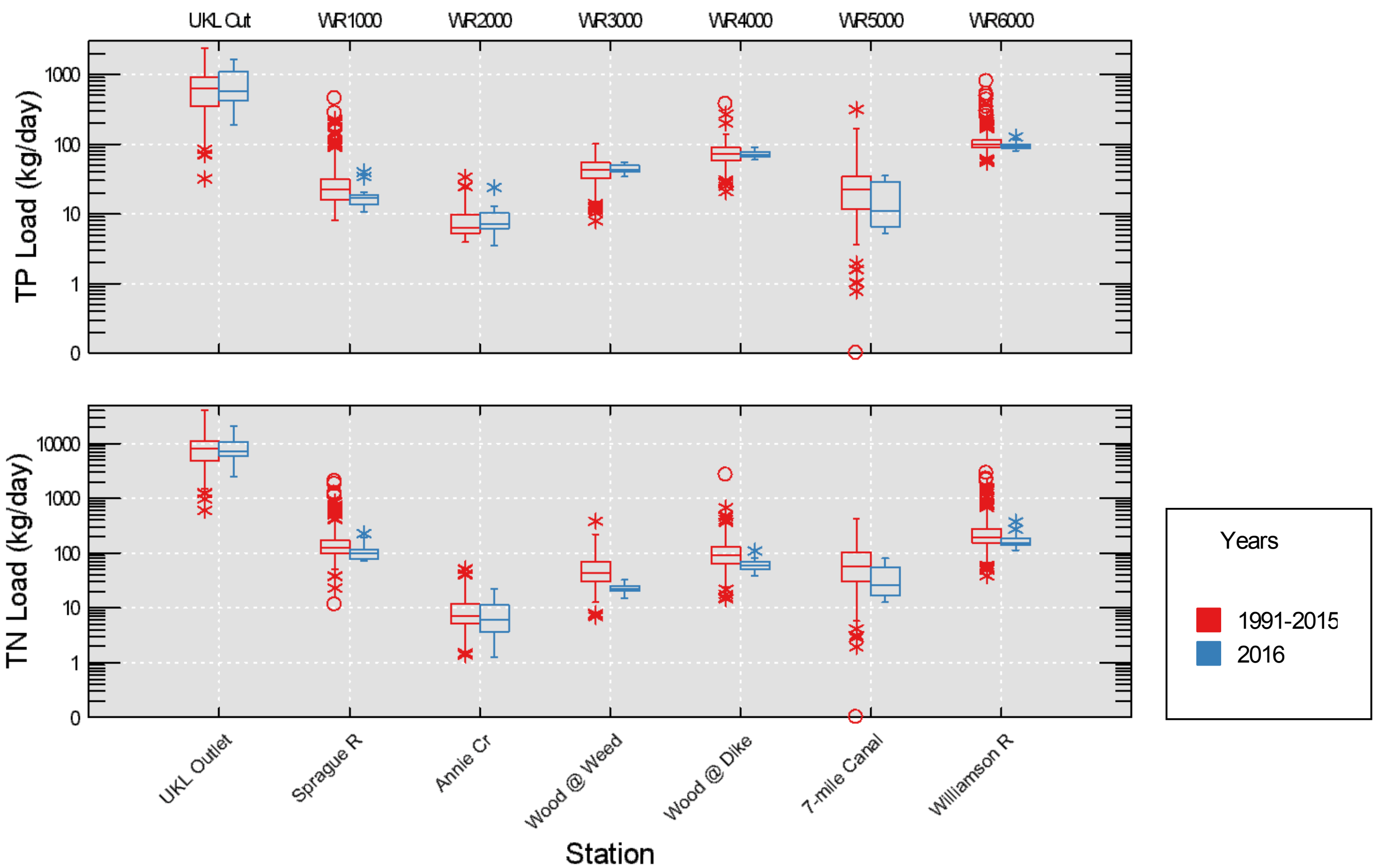
Station Code	Station Name	Month	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
WR5000	7-mile Canal	2	Arithmetic Mean	167.00	129.00	630.00	53.00	59.00	31,300.00	65.30	246.34
WR5000	7-mile Canal	2	Coefficient of Variation	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR5000	7-mile Canal	2	Pct25								
WR5000	7-mile Canal	2	Pct75								
WR5000	7-mile Canal	3	N of Cases	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
WR5000	7-mile Canal	3	Median	120.00	81.00	610.00	31.00	50.00	29,700.00	47.29	240.40
WR5000	7-mile Canal	3	Arithmetic Mean	125.67	90.00	525.33	27.33	39.67	27,566.67	56.94	238.87
WR5000	7-mile Canal	3	Coefficient of Variation	0.26	0.32	0.34	0.44	0.59	0.14	0.60	0.60
WR5000	7-mile Canal	3	Pct25	102.00	70.50	392.50	18.25	22.25	24,675.00	33.29	131.66
WR5000	7-mile Canal	3	Pct75	150.75	111.75	637.00	35.50	54.50	29,925.00	83.00	345.69
WR5000	7-mile Canal	4	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	0.00	0.00
WR5000	7-mile Canal	4	Median	106.50	75.00	295.00	15.00	22.00	31,350.00		
WR5000	7-mile Canal	4	Arithmetic Mean	106.50	75.00	295.00	15.00	22.00	31,350.00		
WR5000	7-mile Canal	4	Coefficient of Variation	0.14	0.15	0.25	0.28	0.90	0.01		
WR5000	7-mile Canal	4	Pct25	96.00	67.00	242.00	12.00	8.00	31,100.00		
WR5000	7-mile Canal	4	Pct75	117.00	83.00	348.00	18.00	36.00	31,600.00		
WR5000	7-mile Canal	5	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	1.00	1.00
WR5000	7-mile Canal	5	Median	163.00	118.00	472.00	24.00	13.00	31,000.00	45.76	117.06
WR5000	7-mile Canal	5	Arithmetic Mean	163.00	118.00	472.00	24.00	13.00	31,000.00	45.76	117.06
WR5000	7-mile Canal	5	Coefficient of Variation	0.00	0.08	0.16	0.94	0.11	0.13	1.00	1.00
WR5000	7-mile Canal	5	Pct25	163.00	111.00	417.00	8.00	12.00	28,200.00		
WR5000	7-mile Canal	5	Pct75	163.00	125.00	527.00	40.00	14.00	33,800.00		
WR5000	7-mile Canal	6	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	1.00	1.00
WR5000	7-mile Canal	6	Median	164.00	113.50	445.50	11.50	4.00	32,300.00	5.57	18.18
WR5000	7-mile Canal	6	Arithmetic Mean	164.00	113.50	445.50	11.50	4.00	32,300.00	5.57	18.18
WR5000	7-mile Canal	6	Coefficient of Variation	0.15	0.18	0.11	0.18	0.00	0.02	1.00	1.00
WR5000	7-mile Canal	6	Pct25	147.00	99.00	411.00	10.00	4.00	31,800.00		
WR5000	7-mile Canal	6	Pct75	181.00	128.00	480.00	13.00	4.00	32,800.00		
WR5000	7-mile Canal	7	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR5000	7-mile Canal	7	Median	194.50	134.50	408.00	15.00	9.00	31,100.00	31.94	67.68
WR5000	7-mile Canal	7	Arithmetic Mean	194.50	134.50	408.00	15.00	9.00	31,100.00	31.94	67.68
WR5000	7-mile Canal	7	Coefficient of Variation	0.03	0.06	0.09	0.66	0.16	0.01	0.15	0.26
WR5000	7-mile Canal	7	Pct25	191.00	129.00	381.00	8.00	8.00	30,900.00	28.60	55.03
WR5000	7-mile Canal	7	Pct75	198.00	140.00	435.00	22.00	10.00	31,300.00	35.27	80.33
WR5000	7-mile Canal	8	N of Cases	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR5000	7-mile Canal	8	Median	224.00	159.00	390.00	11.00	9.00	29,300.00	9.08	15.81
WR5000	7-mile Canal	8	Arithmetic Mean	224.00	159.00	390.00	11.00	9.00	29,300.00	9.08	15.81
WR5000	7-mile Canal	8	Coefficient of Variation	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR5000	7-mile Canal	8	Pct25								
WR5000	7-mile Canal	8	Pct75								

Station Code	Station Name	Month	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
WR5000	7-mile Canal	9	N of Cases	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
WR5000	7-mile Canal	9	Median	198.00	145.00	473.00	56.00	12.00	32,200.00	10.81	25.44
WR5000	7-mile Canal	9	Arithmetic Mean	183.00	130.67	445.00	56.00	12.33	32,100.00	11.22	27.14
WR5000	7-mile Canal	9	Coefficient of Variation	0.19	0.28	0.14	0.21	0.12	0.01	0.44	0.41
WR5000	7-mile Canal	9	Pct25	157.50	103.00	399.50	47.00	11.25	31,825.00	7.58	19.06
WR5000	7-mile Canal	9	Pct75	204.75	154.75	483.50	65.00	13.50	32,350.00	14.96	35.64
WR6000	Williamson R	10	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR6000	Williamson R	10	Median	72.00	59.50	95.50	12.50	9.50	33,700.00	91.64	121.26
WR6000	Williamson R	10	Arithmetic Mean	72.00	59.50	95.50	12.50	9.50	33,700.00	91.64	121.26
WR6000	Williamson R	10	Coefficient of Variation	0.02	0.01	0.13	0.06	0.22	0.02	0.05	0.09
WR6000	Williamson R	10	Pct25	71.00	59.00	87.00	12.00	8.00	33,200.00	88.25	113.25
WR6000	Williamson R	10	Pct75	73.00	60.00	104.00	13.00	11.00	34,200.00	95.03	129.27
WR6000	Williamson R	11	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR6000	Williamson R	11	Median	66.50	59.50	85.00	9.00	14.50	35,100.00	89.63	114.33
WR6000	Williamson R	11	Arithmetic Mean	66.50	59.50	85.00	9.00	14.50	35,100.00	89.63	114.33
WR6000	Williamson R	11	Coefficient of Variation	0.12	0.01	0.30	0.00	0.05	0.01	0.10	0.28
WR6000	Williamson R	11	Pct25	61.00	59.00	67.00	9.00	14.00	34,800.00	83.59	91.81
WR6000	Williamson R	11	Pct75	72.00	60.00	103.00	9.00	15.00	35,400.00	95.66	136.85
WR6000	Williamson R	12	N of Cases	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR6000	Williamson R	12	Median	75.00	67.00	140.00	15.00	33.00	35,100.00	110.84	206.91
WR6000	Williamson R	12	Arithmetic Mean	75.00	67.00	140.00	15.00	33.00	35,100.00	110.84	206.91
WR6000	Williamson R	12	Coefficient of Variation	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR6000	Williamson R	12	Pct25								
WR6000	Williamson R	12	Pct75								
WR6000	Williamson R	1	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR6000	Williamson R	1	Median	109.50	82.00	376.50	22.50	65.00	32,350.00	351.62	1,332.93
WR6000	Williamson R	1	Arithmetic Mean	109.50	82.00	376.50	22.50	65.00	32,350.00	351.62	1,332.93
WR6000	Williamson R	1	Coefficient of Variation	0.47	0.26	0.85	0.22	0.28	0.21	0.96	1.16
WR6000	Williamson R	1	Pct25	73.00	67.00	151.00	19.00	52.00	27,500.00	113.78	235.36
WR6000	Williamson R	1	Pct75	146.00	97.00	602.00	26.00	78.00	37,200.00	589.46	2,430.51
WR6000	Williamson R	2	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR6000	Williamson R	2	Median	108.00	58.00	448.50	17.50	45.50	29,800.00	377.41	1,558.76
WR6000	Williamson R	2	Arithmetic Mean	108.00	58.00	448.50	17.50	45.50	29,800.00	377.41	1,558.76
WR6000	Williamson R	2	Coefficient of Variation	0.10	0.15	0.00	0.12	0.26	0.02	0.21	0.11
WR6000	Williamson R	2	Pct25	100.00	52.00	447.00	16.00	37.00	29,300.00	320.54	1,432.83
WR6000	Williamson R	2	Pct75	116.00	64.00	450.00	19.00	54.00	30,300.00	434.28	1,684.69
WR6000	Williamson R	3	N of Cases	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
WR6000	Williamson R	3	Median	81.00	50.00	614.00	17.00	32.00	30,600.00	312.76	2,493.98
WR6000	Williamson R	3	Arithmetic Mean	86.00	49.00	537.67	17.00	33.33	31,133.33	390.08	2,514.84
WR6000	Williamson R	3	Coefficient of Variation	0.14	0.11	0.31	0.12	0.24	0.04	0.50	0.59

Station Code	Station Name	Month	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
WR6000	Williamson R	3	Pct25	78.00	44.75	411.50	15.50	27.50	30,225.00	262.52	1,406.31
WR6000	Williamson R	3	Pct75	95.25	53.00	644.75	18.50	39.50	32,175.00	536.98	3,628.59
WR6000	Williamson R	4	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR6000	Williamson R	4	Median	82.00	53.00	401.50	23.50	22.50	30,800.00	297.97	1,457.99
WR6000	Williamson R	4	Arithmetic Mean	82.00	53.00	401.50	23.50	22.50	30,800.00	297.97	1,457.99
WR6000	Williamson R	4	Coefficient of Variation	0.19	0.13	0.17	0.45	0.35	0.00	0.26	0.24
WR6000	Williamson R	4	Pct25	71.00	48.00	353.00	16.00	17.00	30,700.00	243.22	1,209.26
WR6000	Williamson R	4	Pct75	93.00	58.00	450.00	31.00	28.00	30,900.00	352.72	1,706.71
WR6000	Williamson R	5	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR6000	Williamson R	5	Median	73.00	53.00	264.50	12.50	14.50	31,150.00	180.57	657.12
WR6000	Williamson R	5	Arithmetic Mean	73.00	53.00	264.50	12.50	14.50	31,150.00	180.57	657.12
WR6000	Williamson R	5	Coefficient of Variation	0.04	0.03	0.16	0.28	0.34	0.04	0.11	0.23
WR6000	Williamson R	5	Pct25	71.00	52.00	234.00	10.00	11.00	30,300.00	166.61	549.10
WR6000	Williamson R	5	Pct75	75.00	54.00	295.00	15.00	18.00	32,000.00	194.53	765.15
WR6000	Williamson R	6	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR6000	Williamson R	6	Median	73.50	59.50	193.00	9.00	6.00	32,950.00	120.65	322.82
WR6000	Williamson R	6	Arithmetic Mean	73.50	59.50	193.00	9.00	6.00	32,950.00	120.65	322.82
WR6000	Williamson R	6	Coefficient of Variation	0.20	0.23	0.10	0.94	0.47	0.02	0.08	0.22
WR6000	Williamson R	6	Pct25	63.00	50.00	180.00	3.00	4.00	32,400.00	114.07	272.63
WR6000	Williamson R	6	Pct75	84.00	69.00	206.00	15.00	8.00	33,500.00	127.23	373.01
WR6000	Williamson R	7	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR6000	Williamson R	7	Median	73.50	60.50	141.00	16.00	6.50	31,950.00	88.44	169.67
WR6000	Williamson R	7	Arithmetic Mean	73.50	60.50	141.00	16.00	6.50	31,950.00	88.44	169.67
WR6000	Williamson R	7	Coefficient of Variation	0.11	0.04	0.11	0.09	0.54	0.06	0.13	0.14
WR6000	Williamson R	7	Pct25	68.00	59.00	130.00	15.00	4.00	30,700.00	80.03	153.00
WR6000	Williamson R	7	Pct75	79.00	62.00	152.00	17.00	9.00	33,200.00	96.85	186.34
WR6000	Williamson R	8	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR6000	Williamson R	8	Median	78.00	68.00	143.50	14.50	9.00	32,550.00	87.00	160.82
WR6000	Williamson R	8	Arithmetic Mean	78.00	68.00	143.50	14.50	9.00	32,550.00	87.00	160.82
WR6000	Williamson R	8	Coefficient of Variation	0.04	0.12	0.08	0.05	0.00	0.00	0.04	0.16
WR6000	Williamson R	8	Pct25	76.00	62.00	135.00	14.00	9.00	32,500.00	84.37	142.37
WR6000	Williamson R	8	Pct75	80.00	74.00	152.00	15.00	9.00	32,600.00	89.63	179.27
WR6000	Williamson R	9	N of Cases	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
WR6000	Williamson R	9	Median	80.00	62.00	120.00	14.00	8.00	33,300.00	93.37	149.16
WR6000	Williamson R	9	Arithmetic Mean	76.67	62.00	124.67	15.33	7.33	33,300.00	94.18	153.28
WR6000	Williamson R	9	Coefficient of Variation	0.08	0.03	0.09	0.15	0.42	0.02	0.08	0.10
WR6000	Williamson R	9	Pct25	72.50	60.50	117.75	14.00	5.00	32,850.00	88.73	142.33
WR6000	Williamson R	9	Pct75	80.00	63.50	132.75	17.00	9.50	33,750.00	99.83	165.26

APPENDIX III: Station distributions of TP, SRP, TN, NH4-N, NO3+ NO2-N concentrations (µg/L) and TP and TN loading (kg/day) during the irrigation season of June-October

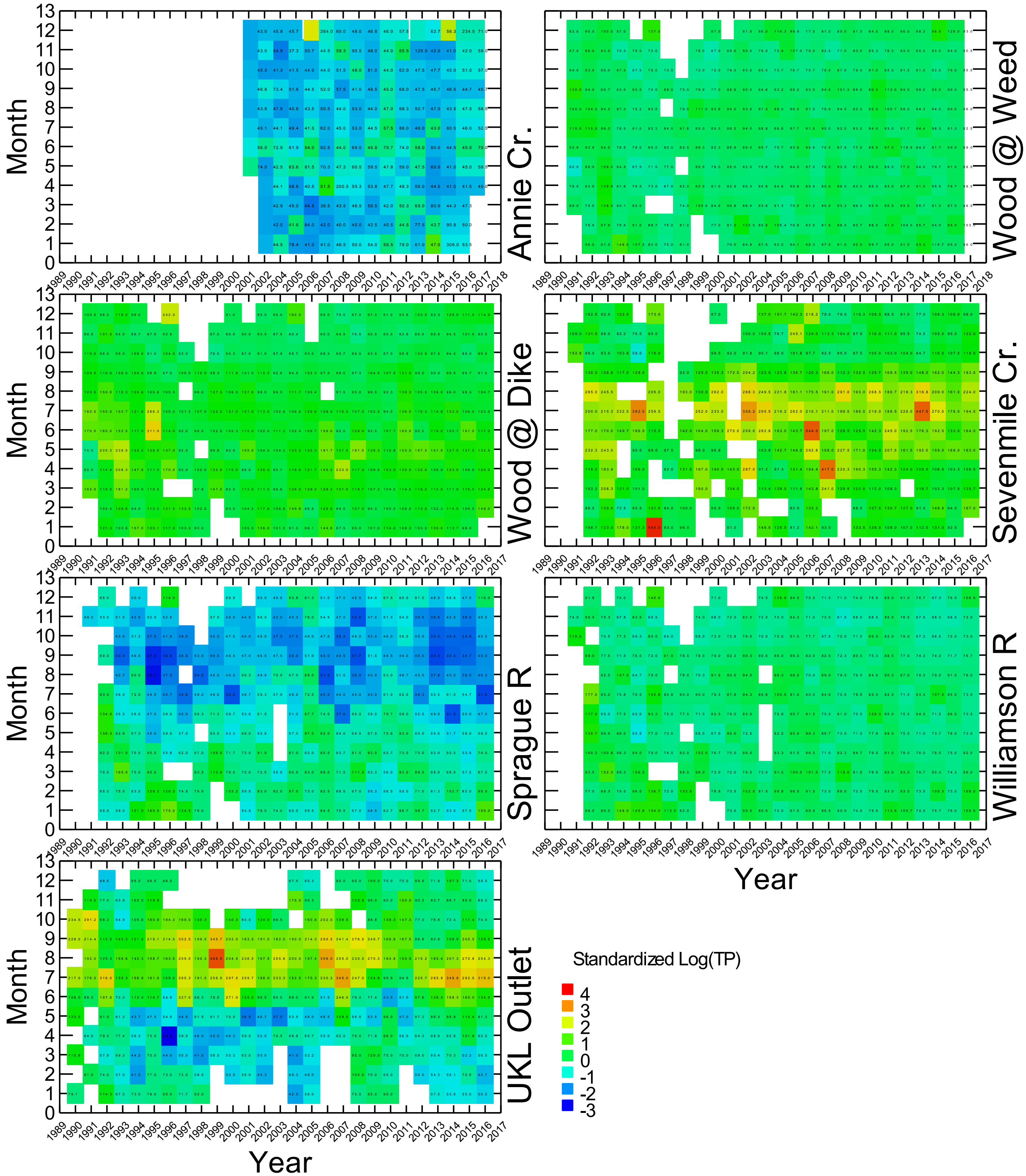


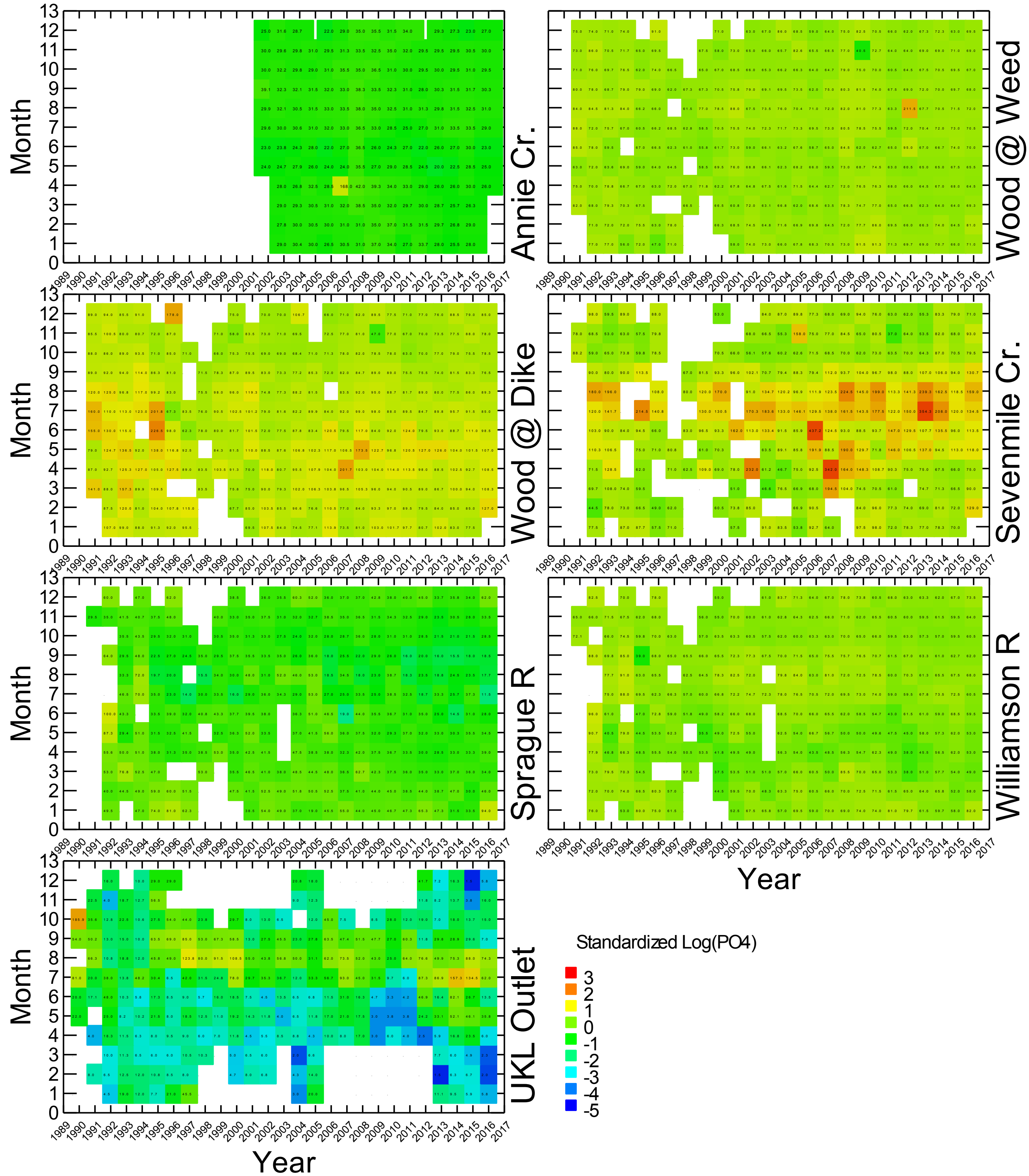

UKL Out
WR1000
WR2000
WR3000
WR4000
WR5000
WR6000
TP Load (kg/day)
1000
100
10
1
0
TN Load (kg/day)
10000
1000
100
10
1
0
UKL Outlet
Sprague R
Annie Cr
Wood @ Weed
Wood @ Dike
7-mile Canal
Williamson R
Station
Years
1991-2015
2016

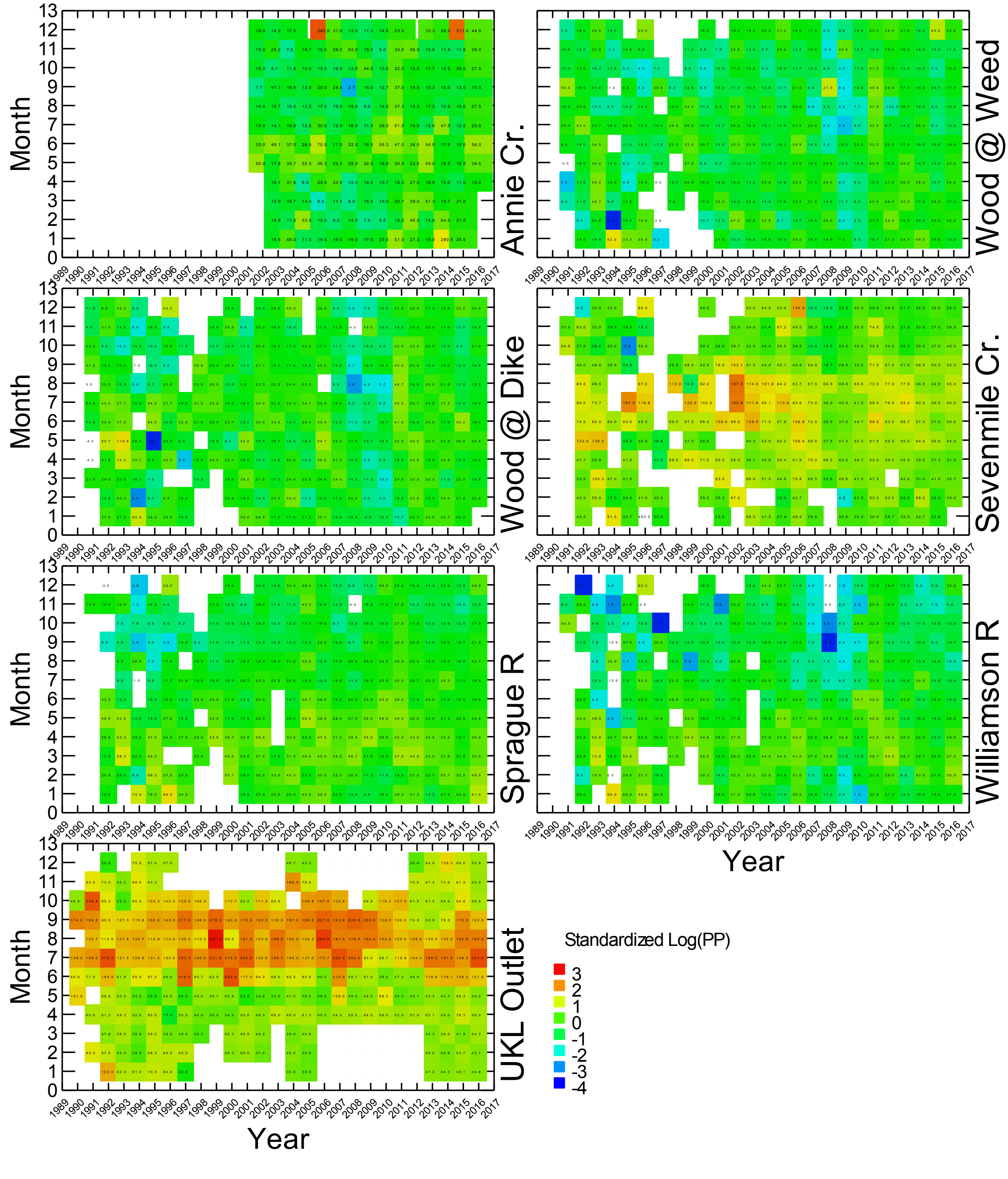
APPENDIX IV: Heat maps of monthly concentrations and loads, 1991-2016

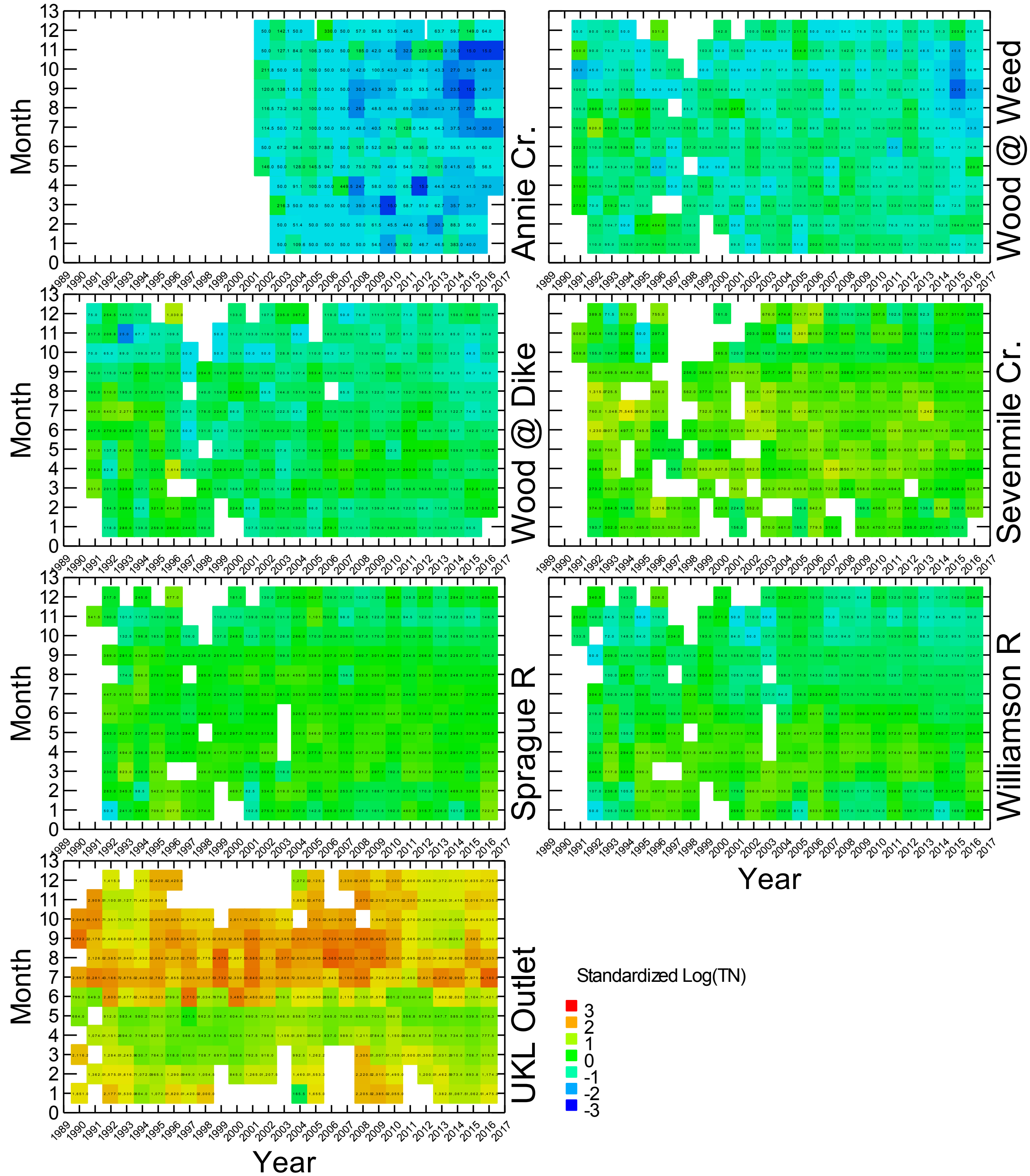
The color of each tile represents an individual value (in this case, monthly concentration). Because the range of values varies seasonally and among stations, the data are standardized in order to use a consistent color scale across all parameters. The values for each parameter were first transformed to a logarithmic scale and then normalized by subtracting the mean and dividing by the standard deviation of all values for that parameter across the stations. The result is a set of standardized monthly values for each water quality parameter which have roughly the same overall distribution (standard normal) and can thus be represented by a single color scale.

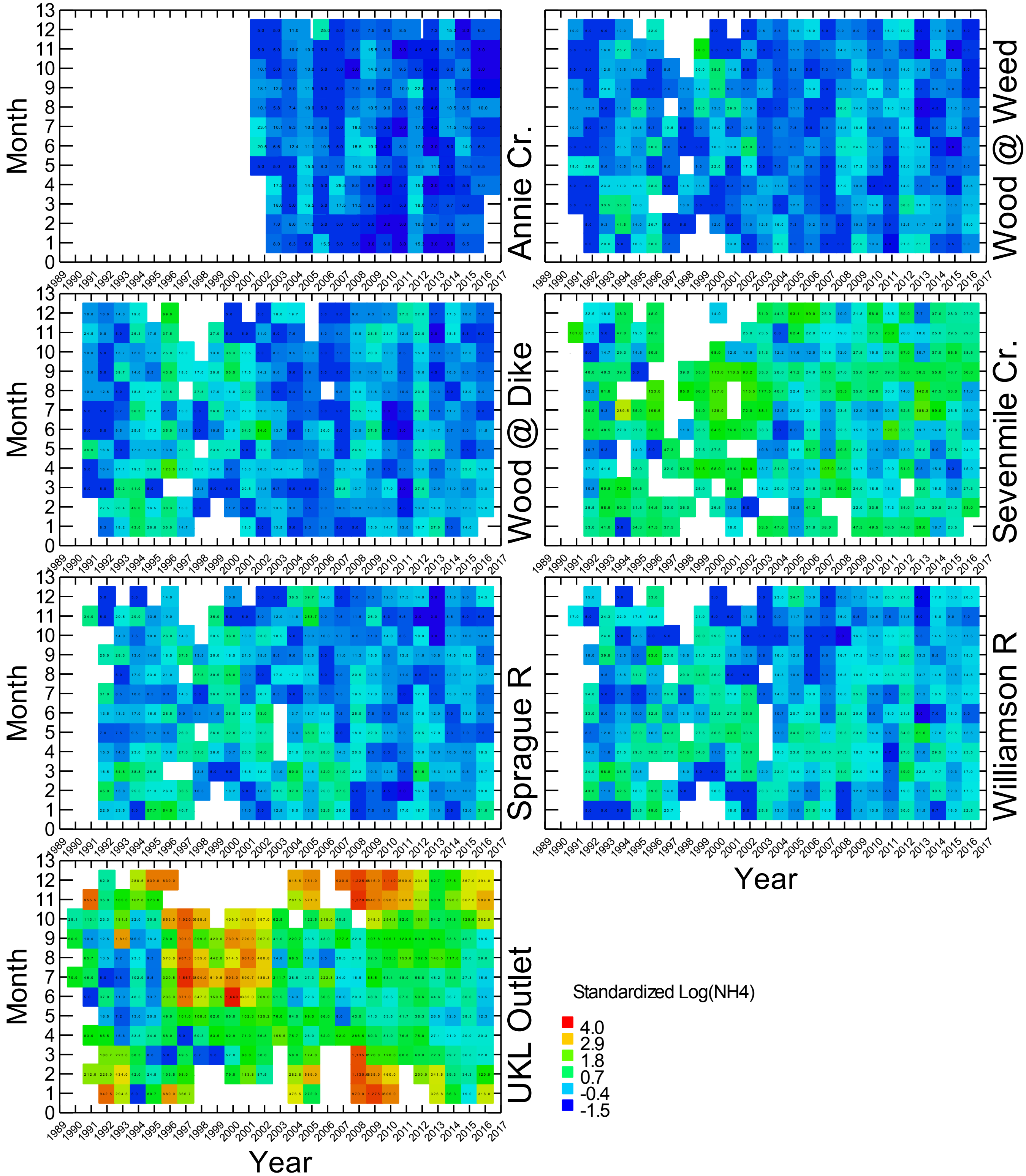
The legend for each page of plots indicates the parameter, and by zooming in on a tile one can see the actual non-transformed value for reference.

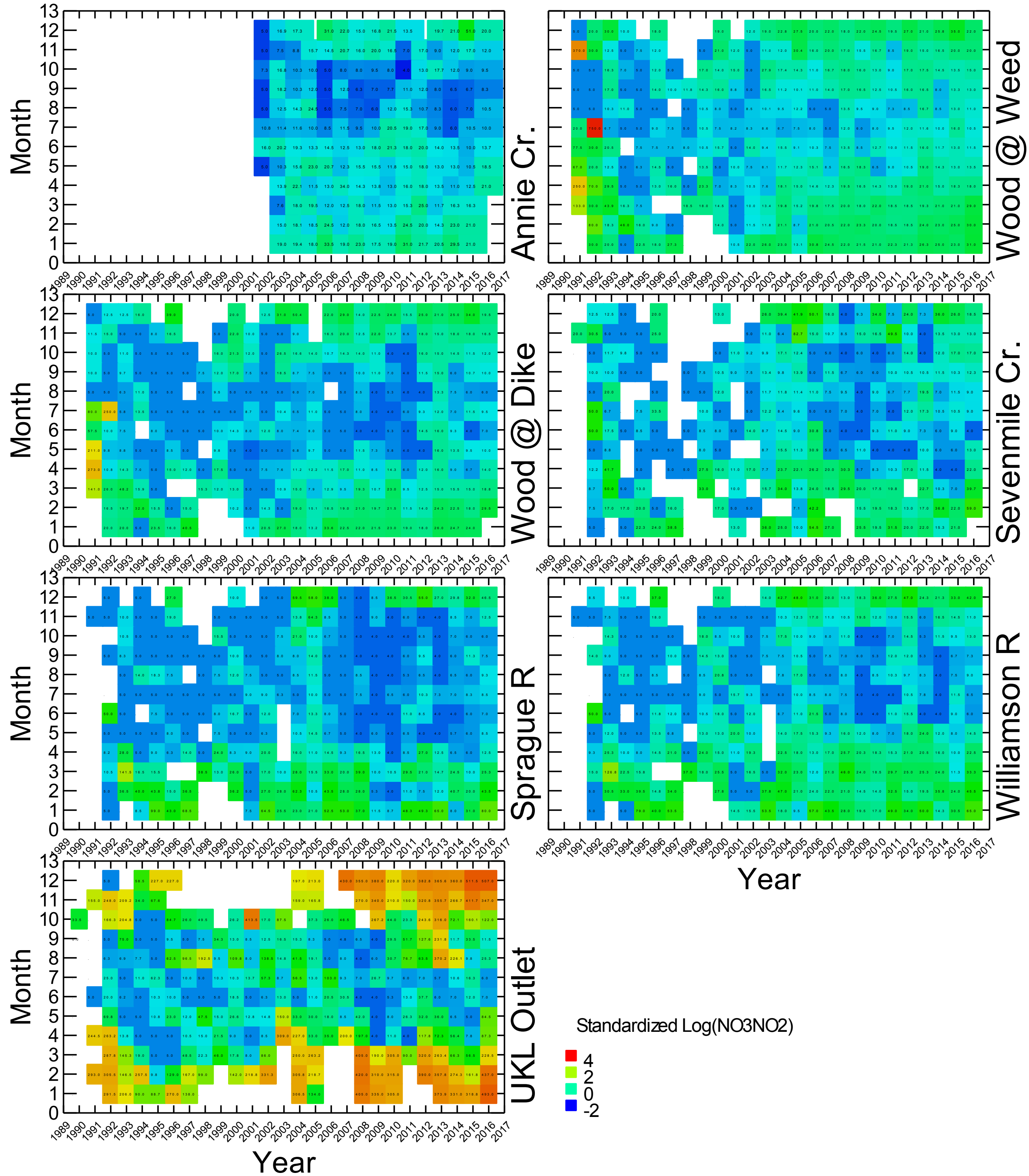

Month
Year
Annie Cr.
Wood @ Weed
Wood @ Dike
Sevenmile Cr.
Sprague R
Williamson R
UKL Outlet
Standardized Log(TP)
4
3
2
1
0
-1
-2
-3

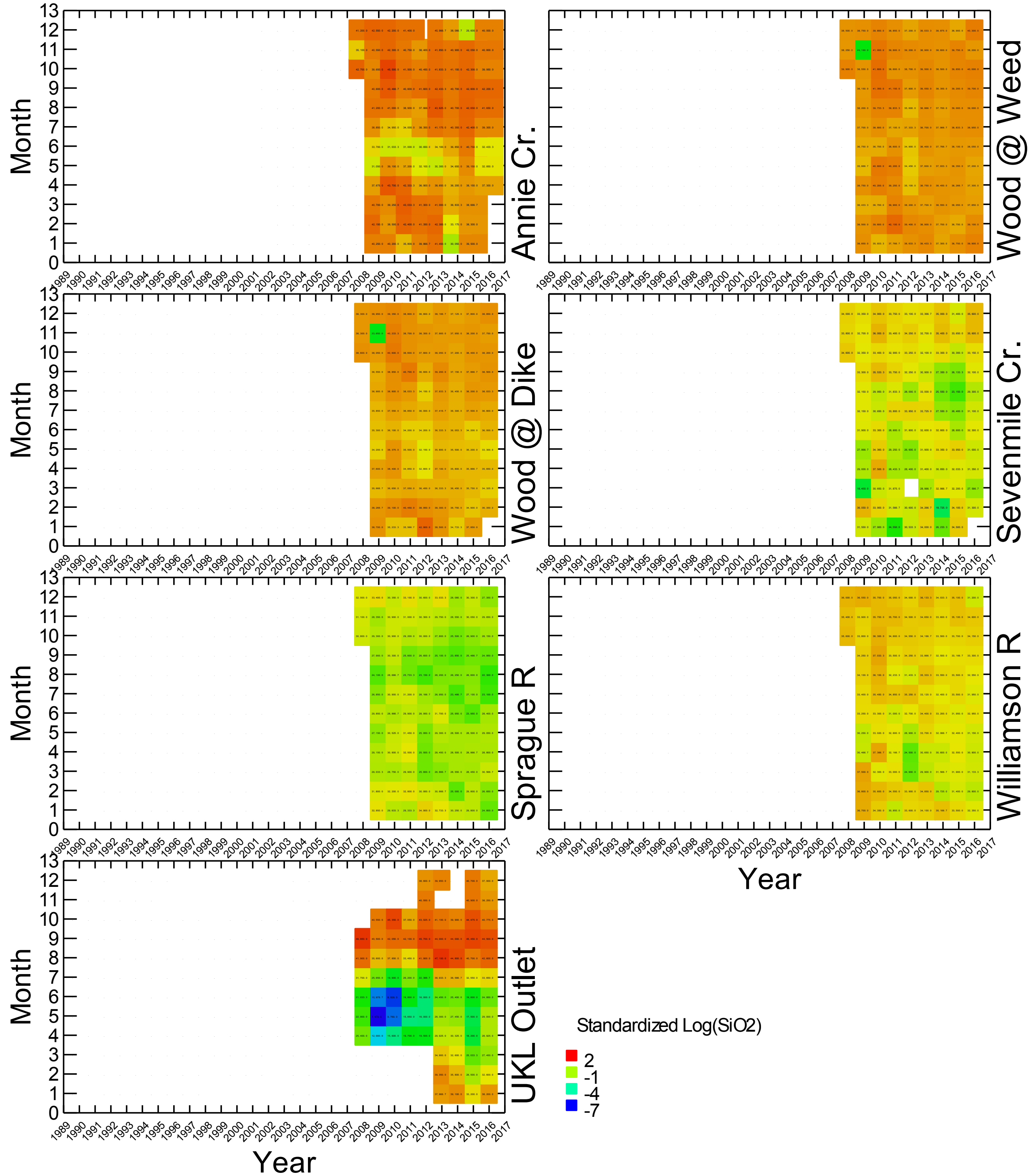

Month
Year
Annie Cr.
Wood @ Weed
Wood @ Dike
Sevenmile Cr.
Sprague R
Williamson R
UKL Outlet
Standardized Log(PO4)
3
2
1
0
-1
-2
-3
-4
-5

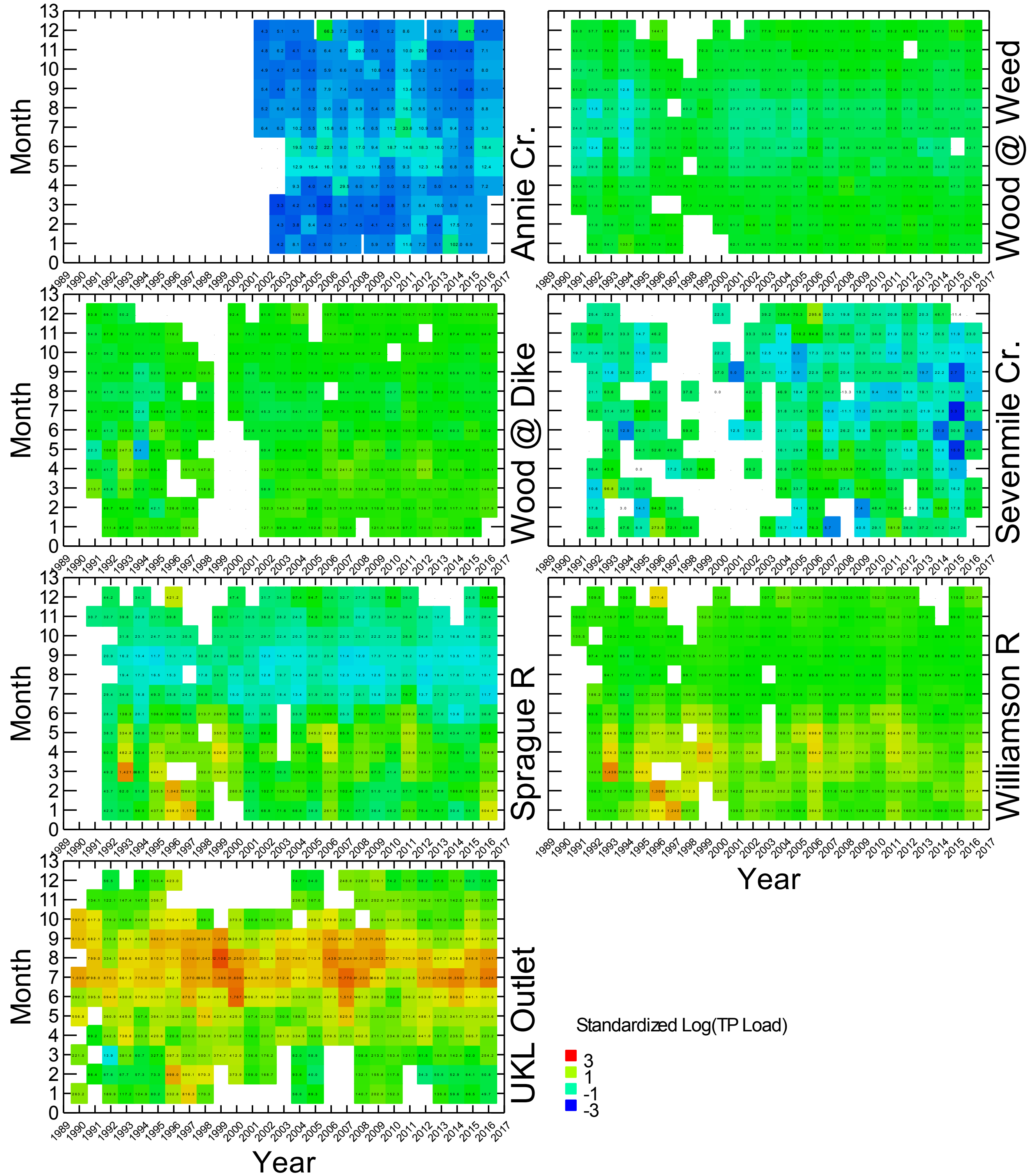

Annie Cr.
Wood @ Weed
Wood @ Dike
Sevenmile Cr.
Sprague R
Williamson R
UKL Outlet
Month
Year
Standardized Log(PP)
3
2
1
0
-1
-2
-3
-4

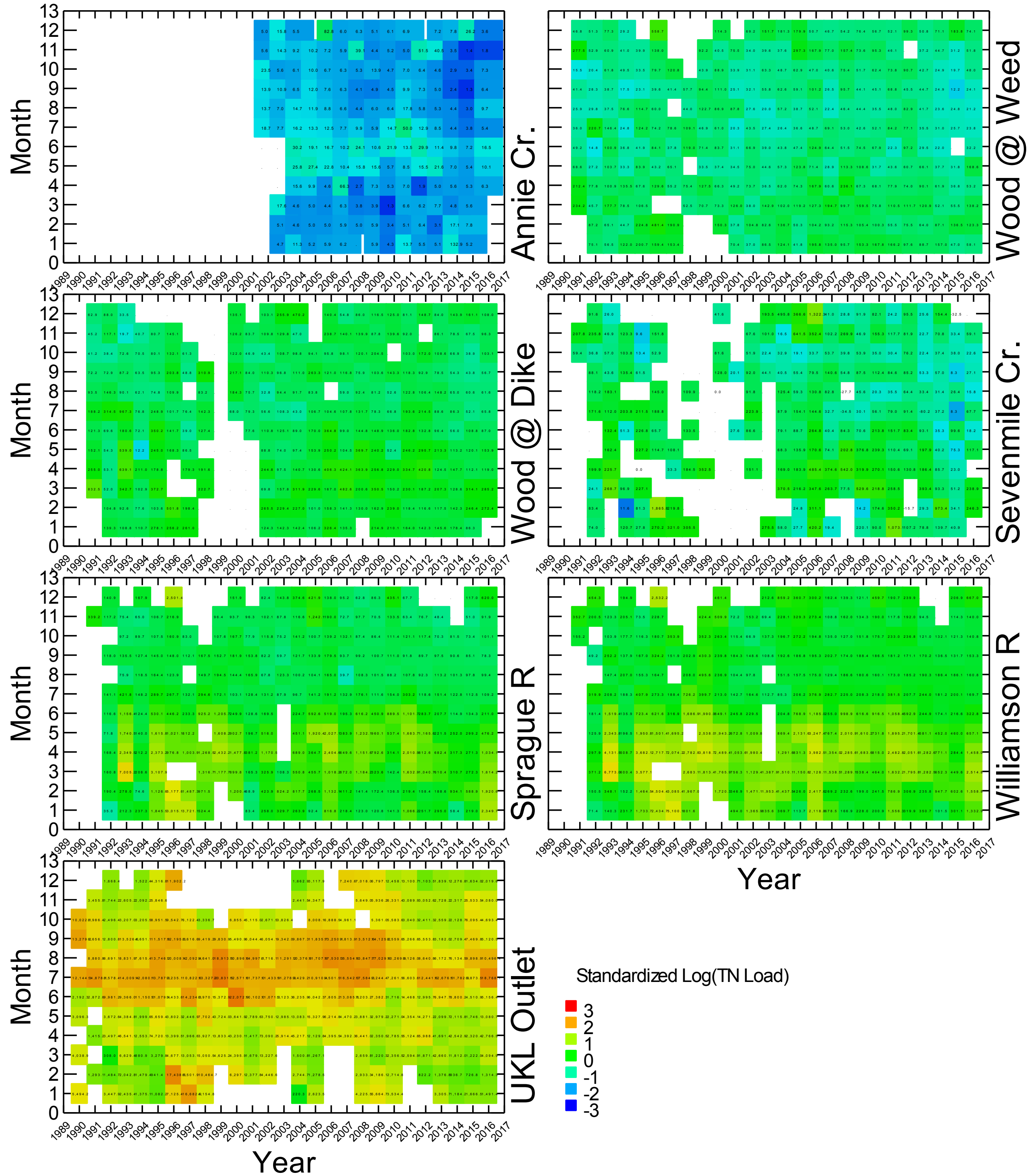

Annie Cr.
Wood @ Weed
Wood @ Dike
Sevenmile Cr.
Sprague R
Williamson R
UKL Outlet
Month
Year
Standardized Log(TN)
3
2
1
0
-1
-2
-3


Annie Cr.
Wood @ Weed
Wood @ Dike
Sevenmile Cr.
Sprague R
Williamson R
UKL Outlet
Month
Year
Standardized Log(NH4)
4.0
2.9
1.8
0.7
-0.4
-1.5


Annie Cr.
Wood @ Weed
Wood @ Dike
Sevenmile Cr.
Sprague R
Williamson R
UKL Outlet
Month
Year
Standardized Log(NO3NO2)
4
2
0
-2


Month
Year
Annie Cr.
Wood @ Weed
Wood @ Dike
Sevenmile Cr.
Sprague R
Williamson R
UKL Outlet
Standardized Log(SiO2)
2
-1
-4
-7


Annie Cr.
Wood @ Weed
Wood @ Dike
Sevenmile Cr.
Sprague R
Williamson R
UKL Outlet
Month
Year
Standardized Log(TP Load)
3
1
-1
-3


Annie Cr.
Wood @ Weed
Wood @ Dike
Sevenmile Cr.
Sprague R
Williamson R
UKL Outlet
Month
Year
Standardized Log(TN Load)
3
2
1
0
-1
-2
-3