AUSTIN AREA PHOSPHORUS LEVELS

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ABSTRACT

Phosphorus is considered a common non-point source pollutant and its discharge is regulated primarily due to its potential to contribute to nuisance algae blooms through over-enrichment of the water column. Water quality data from creeks, stormwater runoff, springs, finished drinking water, and wells in Austin, Texas were summarized and compared in order to determine the magnitude of the phosphorus problems locally. In general, concentrations in tap water, or treated drinking water, are higher than the median creek levels. Rainwater in rural areas has lower PO4 concentrations than it does in urban locales. In rural areas, rainwater concentrations are equal to storm water concentrations but greater than some of the base flow creek concentrations. In urban areas, rainwater concentrations are less than storm water runoff concentrations. Storm water concentrations are higher than creek base flow concentration and correspond loosely to land use. The creeks were fairly low in dissolved phosphorus and fairly high in total phosphorus. This may be due to erosion of bank soils. Individual creek median concentrations vary widely, but the overall median PO4 concentration of 0.05 mg/L as P is greater than the 0.03 mg/L at which lakes become susceptible to eutrophication. Ground water currently has lower phosphorus concentrations than surface water. Most wells and springs are below the 0.03 mg/L of PO4 eutrophication threshold. Concentrations of both PO4 and TP have increased over time with one exception: Total phosphorus concentrations in storm water runoff have declined. This improvement may be due to better erosion controls on construction sites. The changes in ground water appear to lag the changes in surface water. Most Austin-area soils have excessive levels of available phosphorus. High soil levels may result in increased phosphorus in leachate and runoff, and may result in iron deficiency leading to poor plant growth.

INTRODUCTION

In order to understand the potential benefits of water quality initiatives such as fertilizer recommendations or best management practices (BMPs) on phosphorus in Austin-area water and soil, the current levels of phosphorus and how they have changed over time were reviewed. Water concentrations in City of Austin area tap water, rainwater, storm water runoff, creek base flow, springs, and wells were compiled. Area wide soil concentrations using Texas Agricultural Extension Service soil test data were also compiled. Phosphorus data were compared to land use, spatial patterns, and changes over time whenever the appropriate watershed data were available.

WATER CONCENTRATIONS

Current phosphorus levels in Austin-area water

Dissolved orthophosphorus (PO4) and total orthophosphorus are assumed to be approximately the same and have been lumped together for analyses. The mean difference between total and dissolved orthophosphorus for City of Austin water samples when both filter fractions were measured was 0.002 mg/L. In comparison to the median creek base flow level of 0.05 mg/L of PO4 as P, the difference between DOP and TOP was insignificant.

Tap water
Tap water from the Ullrich, Davis, and Green Water Treatment Plants in 1996 had average total phosphate (PO4 as PO4) concentrations of 1.04, 0.92 and 1.06 mg/L respectively, averaging 1 mg/L of PO4 as PO4. This is equivalent to 0.33 mg/L PO4 as P and is six times as high as the creek median concentration of 0.05 mg/L.

Water from the kitchen tap at 1908 Karen Avenue in north central Austin was tested in May 1996 and had 0.07 mg/L of PO4 as P and 0.18 mg/L of total phosphorus (TP). The tap concentration of PO4 is less than the concentrations at the treatment plants prior to travel through the distribution system. Little can be concluded on the basis of one data point, but the 0.07 mg/L of PO4 is near the creek median level of 0.05 mg/L of PO4 as P.

Rain
Rainwater was collected at two sites, one urban and one undeveloped, from 1995-1998. Dissolved phosphorus (DP) and total phosphorus levels in rainwater are shown in Table 1. Mean concentrations at the urban site were almost twice those at the rural site. The median level of DP in rainwater is 0.035, slightly less than the creek median of 0.05 mg/L of PO4 as P.

Table 1: Rainwater Nutrient Concentrations (mg/L) at Urban (SWR) and Rural (FWR) Sites

Site	Date	DP		NH3		NO3		TP	
Rural									
FWR	9/21/95				0.07		0.43		0.02
FWR	11/1/95		0.04		0.08		0.25	<	0.02
FWR	11/17/95		0.03		0.16		0.34		0.12
FWR	3/27/96		0.04		0.73		1.84		0.09
FWR	8/22/96		0.16		0.12		0.64		0.16
FWR	5/27/97		0.03		0.58		0.23		0.02
FWR	6/6/97		0.03		0.48		0.38		0.02
FWR	6/17/97	<	0.02		0.27		0.26		0.03
FWR	1/6/98	<	0.02		0.12		0.1	<	0.02
FWR	3/15/98	<	0.02	<	0.02		0.18	<	0.02
	Average		**0.04**		**0.26**		**0.47**		**0.05**
Urban									
SWR	4/20/95				0.73		0.34		0.14
SWR	4/22/95		0.03		1.33		0.88		0.1
SWR	5/8/95				0.43		0.26		0.07
SWR	5/18/95		0.06		1.14		0.53		0.08
SWR	5/30/95	<	0.02		0.03		0.28	<	0.02
SWR	6/11/95		0.06		0.13		0.46		0.21
SWR	6/29/95	<	0.02		0.26		0.33	<	0.02
SWR	7/6/95	<	0.02		0.22		0.44		0.03
SWR	7/30/95	<	0.02		0.16		0.54		0.09
SWR	9/7/95		0.11		0.46		0.81		0.06
SWR	9/13/95		0.12		1.11		2.65		0.08
SWR	9/20/95		0.16		0.11		0.26		0.18
SWR	10/2/95		0.26		0.34		1.28		0.3
SWR	11/1/95	<	0.02		0.1		0.18		0.02
SWR	11/17/95		0.03		0.21		1.66		0.03
SWR	3/27/96		0.13		0.71		2.15		0.13
SWR	1/6/98		0.06		0.3		0.25		0.03
	Average		**0.07**		**0.457**		**0.78**		**0.09**

Storm Water Runoff

Storm water runoff data are presented two ways in Table 2: sorted by dissolved phosphorus (DP) and sorted by total phosphorus (TP). The creek sites are highlighted. The levels from the Lost Creek golf course site for both dissolved and total phosphorus are significantly higher than others. Single family residential (SFR) sites also have high concentrations, while the undeveloped sites have the lowest concentrations of both DP and TP. Table 5 lists the individual SFR sites. Multiple reasons for the high phosphorus levels at the SFR sites have been proposed. In some cases, current lawn fertilization may be the cause while in others previous application of fertilizer to farm crops is more likely. Additional sampling would be necessary to investigate the potential causes. Creek sites are fairly low in dissolved phosphorus but high in total phosphorus. One reason for this may be the erosion of bank soils. All of the average concentrations of storm water DP, except from the undeveloped sites, are higher than the creek median base flow level of PO4 and likely higher than the creek median base flow concentrations of DP. The data on creek concentrations of DP is limited; therefore, this conclusion should be considered preliminary.

Table 2a: Storm Water Dissolved and Total Phosphorus Concentrations by Land use sorted by Dissolved Phosphorus. (Creek sites are highlighted.)

Volume Weighted MC (mg/L) - Sorted by DP								
	DP (mg/L)			TP (mg/L)				
	Average	Max	Min	Average	Max	Min	number of sites	DP/TP
Golf Course	0.52	1.58	0.24	0.80	2.00	0.64	1	0.64
SFR	0.19	0.27	0.11	0.49	1.36	0.22	8	0.39
Commercial	0.19	0.33	0.08	0.35	0.77	0.09	6	0.54
MFR	0.16	0.45	0.01	0.39	0.56	0.21	1	0.42
Waller	0.16	0.27	0.05	0.53	1.14	0.15	1	0.30
Industrial	0.15	0.22	0.11	0.48	0.75	0.25	3	0.32
Mixed	0.14	0.16	0.10	0.39	0.56	0.19	3	0.36
East Bouldin	0.12	0.14	0.07	0.48	1.62	0.21	1	0.26
Blunn	0.10	0.14	0.06	1.13	2.71	0.28	1	0.09
Roadway	0.09	0.26	0.01	0.24	0.60	0.03	1	0.37
Undeveloped	0.04	0.05	0.03	0.11	0.17	0.05	5	0.41

Table 2b: Storm Water Dissolved and Total Phosphorus Concentrations by Land use sorted by Total Phosphorus. (Creek sites are highlighted.)

Volume Weighted MC (mg/L) - Sorted by TP								
	DP (mg/L)			TP (mg/L)				
	Average	Max	Min	Average	Max	Min	number of sites	DP/TP
Blunn	0.10	0.14	0.06	1.13	2.71	0.28	1	0.09
Golf Course	0.52	1.58	0.24	0.80	2.00	0.64	1	0.64
Waller	0.16	0.27	0.05	0.53	1.14	0.15	1	0.30
SFR	0.19	0.27	0.11	0.49	1.36	0.22	8	0.39
East Bouldin	0.12	0.14	0.07	0.48	1.62	0.21	1	0.26
Industrial	0.15	0.22	0.11	0.48	0.75	0.25	3	0.32
Mixed	0.14	0.16	0.10	0.39	0.56	0.19	3	0.36
MFR	0.16	0.45	0.01	0.39	0.56	0.21	1	0.42
Commercial	0.19	0.33	0.08	0.35	0.77	0.09	6	0.54
Roadway	0.09	0.26	0.01	0.24	0.60	0.03	1	0.37
Undeveloped	0.04	0.05	0.03	0.11	0.17	0.05	5	0.41

Table 3: Single-Family Residential Stormwater Concentrations for Dissolved and Total Phosphorus

Volume Weighted DP Mean Concentrations (mg/L)				
Parameter	**Conc.**	**Site Type**	**Watershed**	**Site**
DP	0.268	SFR	Town Lake	Holly at Anthony
DP	0.223	SFR	Tannehill	Belfast at Ridgehaven
DP	0.218	SFR	Boggy	Mansell at Boggy Creek
DP	0.205	SFR	Waller	41st at Ave. C
DP	0.188	SFR	Barton	Travis Country near Canyon Wood
DP	0.149	SFR	Barton	Travis Country near Trail Crest
DP	0.144	SFR	Walnut	Carriage near Lamplight
DP	0.110	SFR	Barton	White Marsh near Lost Creek Blvd.
DP	No data	SFR	Town Lake	Stratford near Riley
DP	No data	SFR	Shoal	Hart Lane near Hidden Hollow
Volume Weighted TP Mean Concentrations (mg/L)				
Parameter	**Conc.**	**Site Type**	**Watershed**	**Site**
TP	1.360	SFR	Town Lake	Holly at Anthony
TP	0.758	SFR	Boggy	Mansell at Boggy Creek
TP	0.496	SFR	Tannehill	Belfast at Ridgehaven
TP	0.462	SFR	Walnut	Carriage near Lamplight
TP	0.455	SFR	Waller	41st at Ave. C
TP	0.408	SFR	Barton	Travis Country near Canyon Wood
TP	0.360	SFR	Barton	White Marsh near Lost Creek Blvd.
TP	0.297	SFR	Town Lake	Stratford near Riley
TP	0.249	SFR	Barton	Travis Country near Trail Crest
TP	0.224	SFR	Shoal	Hart Lane near Hidden Hollow

Creek Base flow Levels

Environmental Integrity Index (EII) base flow data from Austin area creeks were used to look for spatial patterns in orthophosphorus levels. Data are collected from each creek in Austin every third year. Sites that are known to be influenced by discharges from wastewater plants have been removed from the data set. (There are additional permitted discharges in Lake Creek and Harris Branch but impact of these discharges on creek water quality is unknown.) Figure 1 shows the site averages, while Figure 2 shows watershed averages. Watersheds with high PO4 averages include areas where lawn fertilization is high (eg. Shoal) and in the north-east portion of town. The high levels in the north-east may be due to farm crop fertilization.

Springs

Recent orthophosphorus data (1995-2002) for area wide springs were plotted (Figure 3). Only 16 springs have levels at or above .05 mg/L. These springs are listed in Table 4 in ascending order. The springs with the highest PO4 levels should be investigated to see if the cause for the high concentrations can be determined.

Figure 1: Site PO4 Concentrations (mg/L) in Creeks

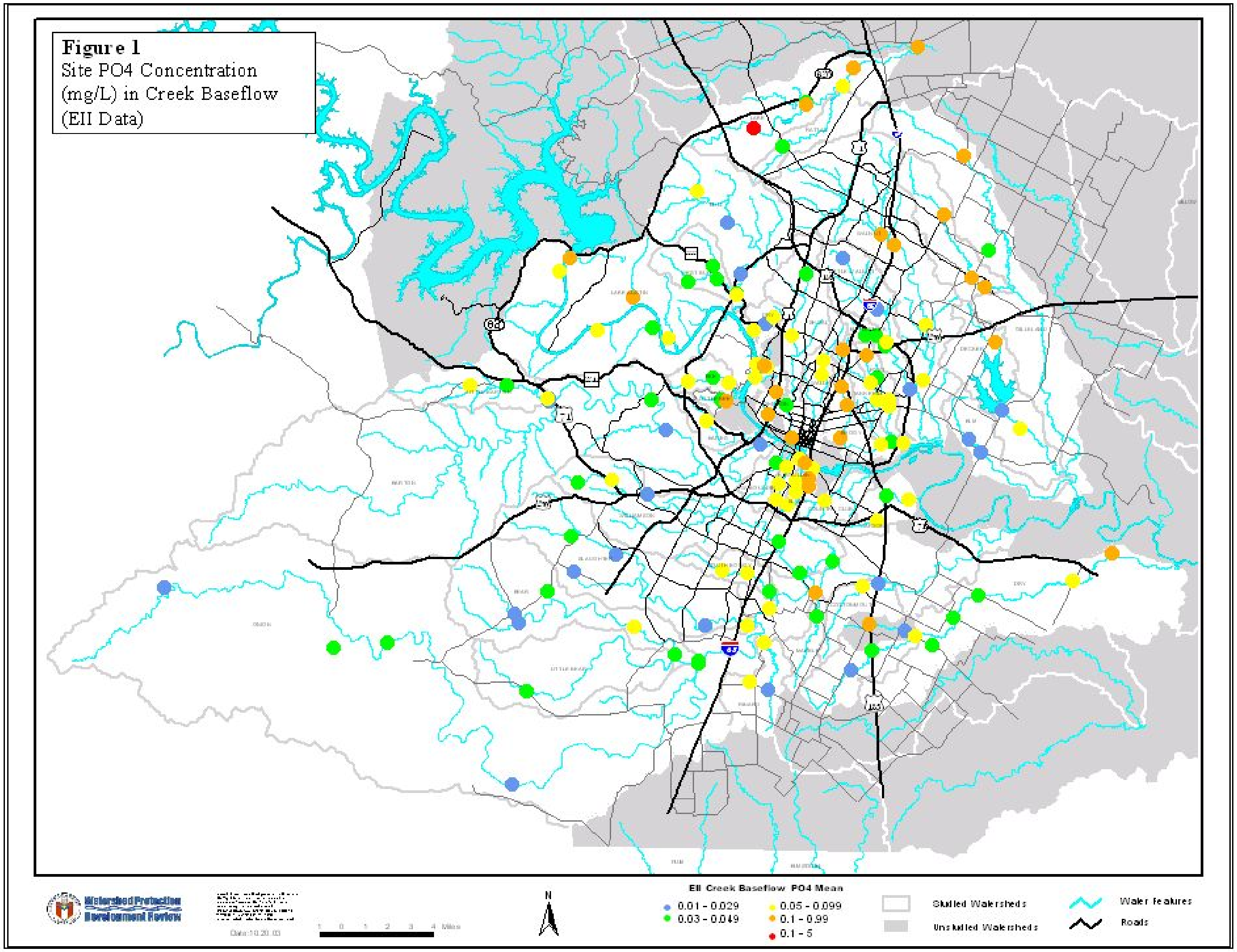


Figure 2: Watershed PO4 Concentrations (mg/L) in Creek Baseflow (EII data)

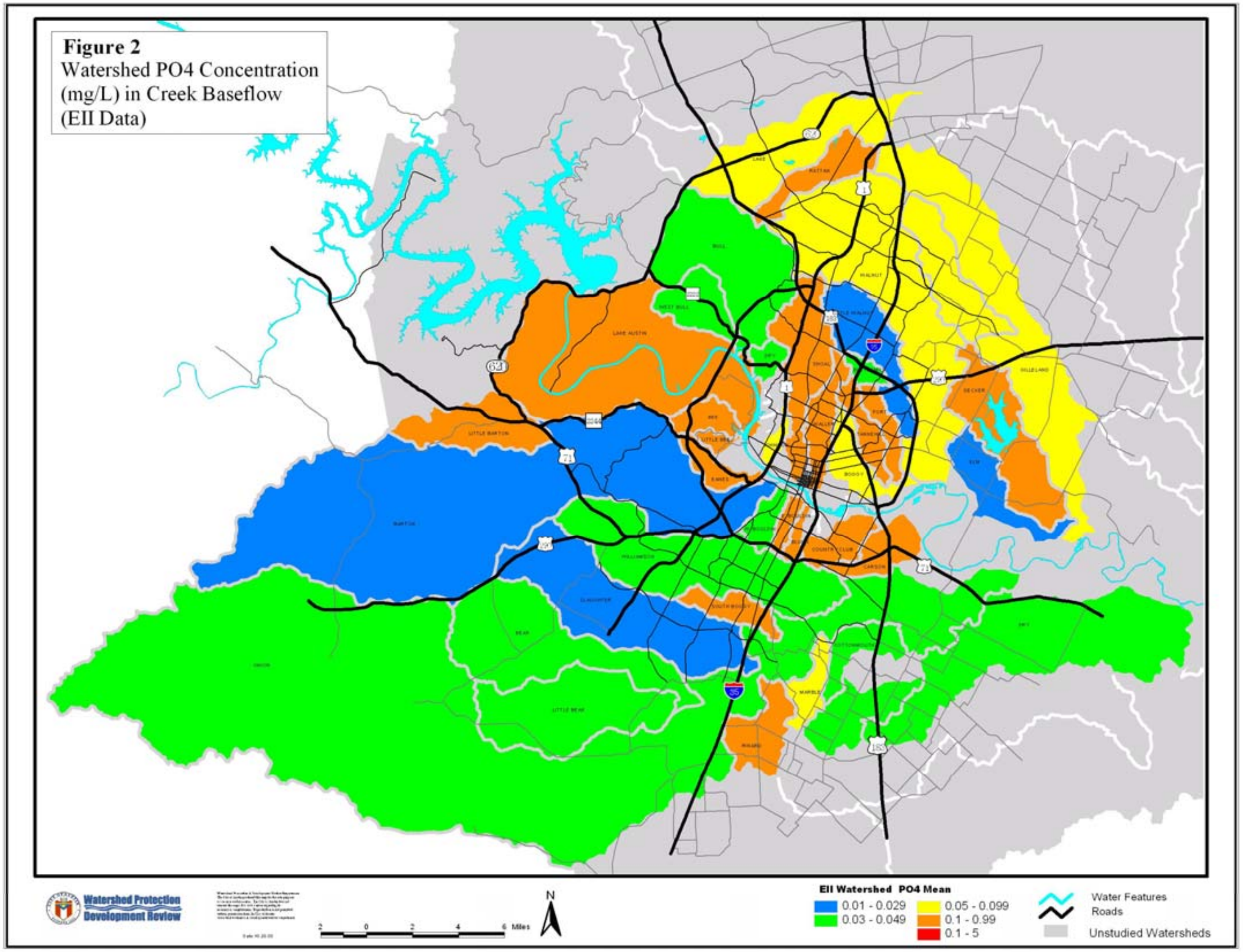


Figure 3: PO4 Concentrations (mg/L) in Springs (1995-2002)

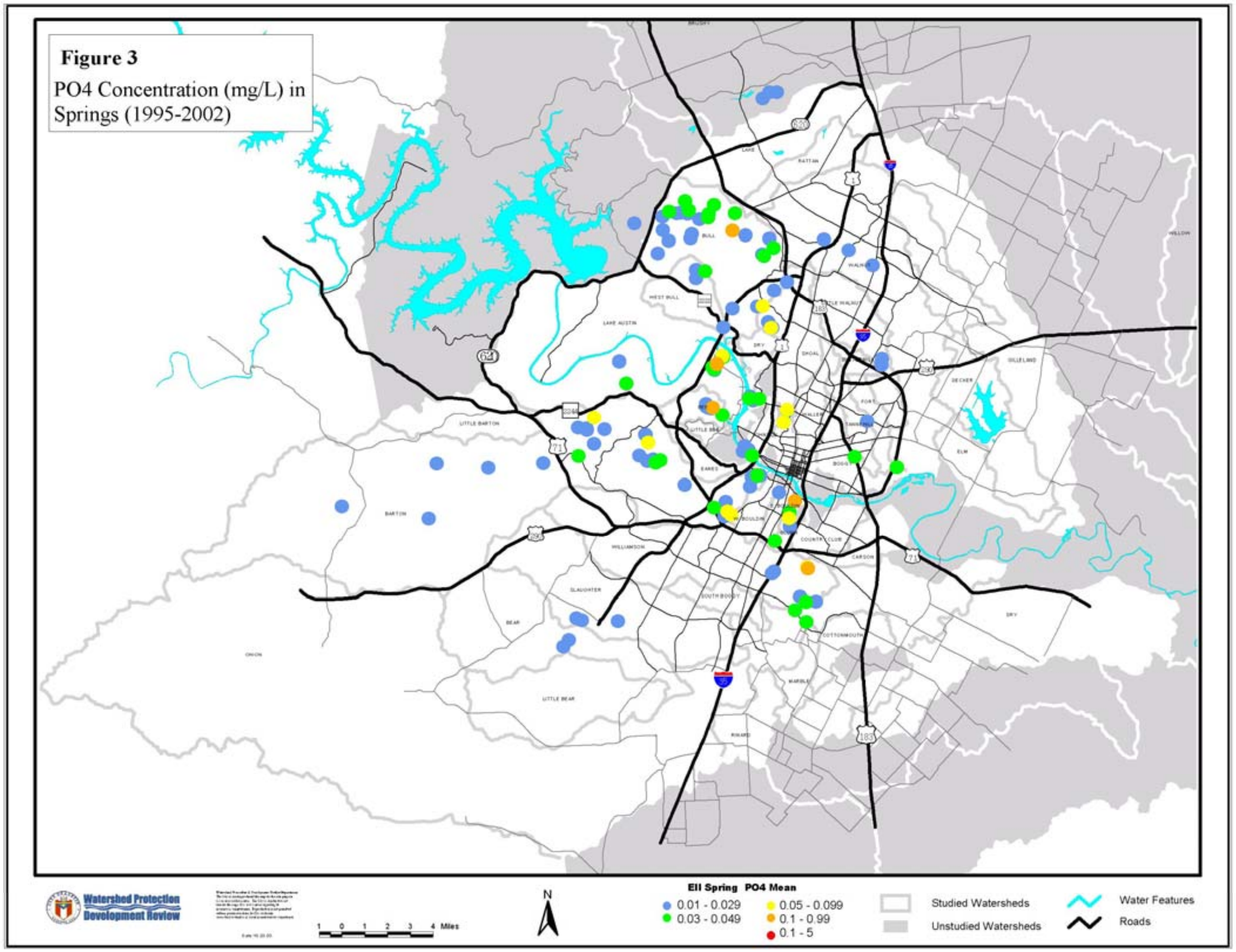


Table 4 Springs with PO4 Concentrations at or above 0.05 mg/L

Site no.	Site	Watershed	PO4Mean
939	Big Boulder Spring	SHOAL CREEK	0.05
972	Westlake-Davenport Spring #8	LAKE AUSTIN	0.05
1167	Oltorf Culvert Spring	BLUNN CREEK	0.05
578	Barton Scenic Bluff Spring	BARTON CREEK	0.05225
370	Crenshaw Spring	BARTON CREEK	0.05308
199	Big Rock Spring	BARTON CREEK	0.055
922	Barton Lodge Spring	BARTON CREEK	0.06
924	Jewish Temple Well 1	BARTON CREEK	0.06
24	Stillhouse Hollow Spring	BULL CREEK	0.06964
423	Seiders Spring	SHOAL CREEK	0.07
1144	Haynes Spring	WILLIAMSON CREEK	0.075
786	Stacy Hot Well	BLUNN CREEK	0.1
169	Shelf Spring	LITTLE BEE CREEK	0.10167
29	Bronc Spring	BULL CREEK	0.13
1143	Sloan Spring	WILLIAMSON CREEK	0.135
969	Westlake-Davenport Spring #5	LAKE AUSTIN	0.45

Wells

Orthophosphate concentrations in local wells are usually lower than the creek levels. Table 5 contains the means of the wells in the database. They are listed in ascending order of PO4 concentrations. Only two wells have PO4 concentrations above 0.03 mg/L. Notice that high nitrate levels show no relationship to high PO4 levels.

Table 5: PO4 and NO3 Mean Concentrations (mg/L) in Wells

site no	site	watershed	Freq	PO4 Mean	NO3 Mean
703	USGS Well 302441097385601	Harris Branch	2	0.010	0.08
705	USGS Well 302652097430501	Walnut Creek	4	0.010	2.30
725	USGS Well 302817097430101	Rattan Creek	4	0.010	0.70
732	USGS Well 301148097503501	Williamson Creek	10	0.015	5.13
680	USGS Well 302546097455501	Walnut Creek	4	0.015	4.30
690	USGS Well 302734097414601	Walnut Creek	2	0.015	1.30
692	USGS Well 301423097495901	Barton Creek	12	0.016	1.97
687	USGS Well 301432097480001	Barton Creek	8	0.016	0.37
688	USGS Well 301031097515801	Slaughter Creek	12	0.017	1.58
727	USGS Well 300813097512101	Bear Creek	12	0.017	1.25
733	USGS Well 301226097480701	Williamson Creek	12	0.017	1.45
1617	USGS Well 300453097503301	Not Applicable	12	0.018	1.20
1615	USGS Well 300646097533202	Not Applicable	12	0.018	1.37
691	USGS Well 302316097430401	Little Walnut Creek	10	0.018	0.07
686	USGS Well 301356097473301	Williamson Creek	12	0.019	1.03
735	USGS Well 301526097463201 (Rabb Well)	Barton Creek	46	0.019	0.67
925	Jewish Temple Well 2	Barton Creek	1	0.020	1.31
1140	Yates Well	Slaughter Creek	2	0.020	0.04
1285	Well J17HQ	Slaughter Creek	1	0.020	0.03
1286	State Well #58-50-410 J17 Tract	Slaughter Creek	1	0.020	2.12
1372	UT-BFL Well #1	Town Lake	2	0.020	1.46
1373	UT-BFL Well #2	Town Lake	2	0.020	4.32
734	USGS Well 301339097483701	Williamson Creek	12	0.023	3.28
759	Deep Eddy Well	Town Lake	2	0.030	1.54
1614	USGS Well 301142097504701	Not Applicable	2	0.030	0.25
924	Jewish Temple Well 1	Barton Creek	1	0.060	1.53
786	Stacy Hot Well	Blunn Creek	4	0.088	0.16

Summary Information - Water Concentrations

Table 6 compares the orthophosphorus levels in all the water types. Creek water has higher concentrations than spring water and spring water has higher concentrations than well water.

Table 6 Orthophosphorus levels in different types of water

Water Type	PO4 mg/L
Tap	0.07, 0.33
Rain	0.04, 0.07
Creek Baseflow	median is 0.05, creek median range is 0.02 – 0.42
Storm flow	
undeveloped	0.04
creeks	0.10 - 0.16
SFR	0.19
Golf	0.52
Springs	most <= 0.05, 16 springs higher
Wells	most <= 0.03, 2 wells higher

TIME TRENDS IN WATER

In order to determine if phosphorus levels are getting worse with time, the levels of orthophosphorus and total phosphorus in ground water (wells + springs), surface baseflow and surface storm flow for three time periods (1967-1989, 1990-1996, and 1997-2002) were compared. The storm water data used in this comparison are from creeks or lakes and do not include the data presented above for stormwater from specified land uses. Conclusions from this large data set should be made with caution since sampling effort was not consistent, either in spatial distribution or in the number of samples across the different time periods. However, with this caveat, it appears that phosphorus levels are increasing, with the exception of TP in stormwater. The improvement in storm flow TP may be due to improved erosion controls on construction sites.

Plots of cumulative distribution functions (CDF) were used to compare the time periods as well as a table presenting a few of the points on the graphs. The lines on the CDF graphs indicate the percentage of samples in the data set that have concentrations below the concentration levels listed on the horizontal axis. Selected intersections on the graphs are identified to assist in interpretation of this graph. In Figure 4, 75 percent of the surface baseflow is below 0.05 mg/L, and 80 percent of the surface storm flow is below 0.05 mg/L; whereas 88 percent of the groundwater is below 0.05 mg/L. The higher the line the lower the concentrations since a larger percentage of the samples are below a lower concentration value.

Figures 4 and 5 compare ground water, surface non-storm (base flow) water and surface storm water during early and recent time periods for PO4 and TP. The differences in water types are readily identified in these graphs. The second set of graphs, Figures 6, 7 and 8, are designed to show the differences between time periods. Each water type is plotted separately for pollutants PO4 and TP.

Currently (Fig. 4a) ground water is cleaner than storm water runoff, which in turn is cleaner than base flow in area creeks in terms of PO4 concentration. However, before 1990 (Fig. 4b), base flow and storm flow were equivalent while ground water has slightly higher concentrations of PO4. In the most recent period (Fig. 4a), 75 percent of surface non-storm PO4 concentrations were below 0.05 and 63 percent were below 0.03 mg/L. However, before 1990 (Fig. 4b), 95 percent of the PO4 concentrations were below 0.05 and 92 percent were below 0.03 mg/L.

Total Phosphorus (Fig. 5) has approximately the same concentrations in ground water and creek baseflow, but is substantially worse in storm water runoff.

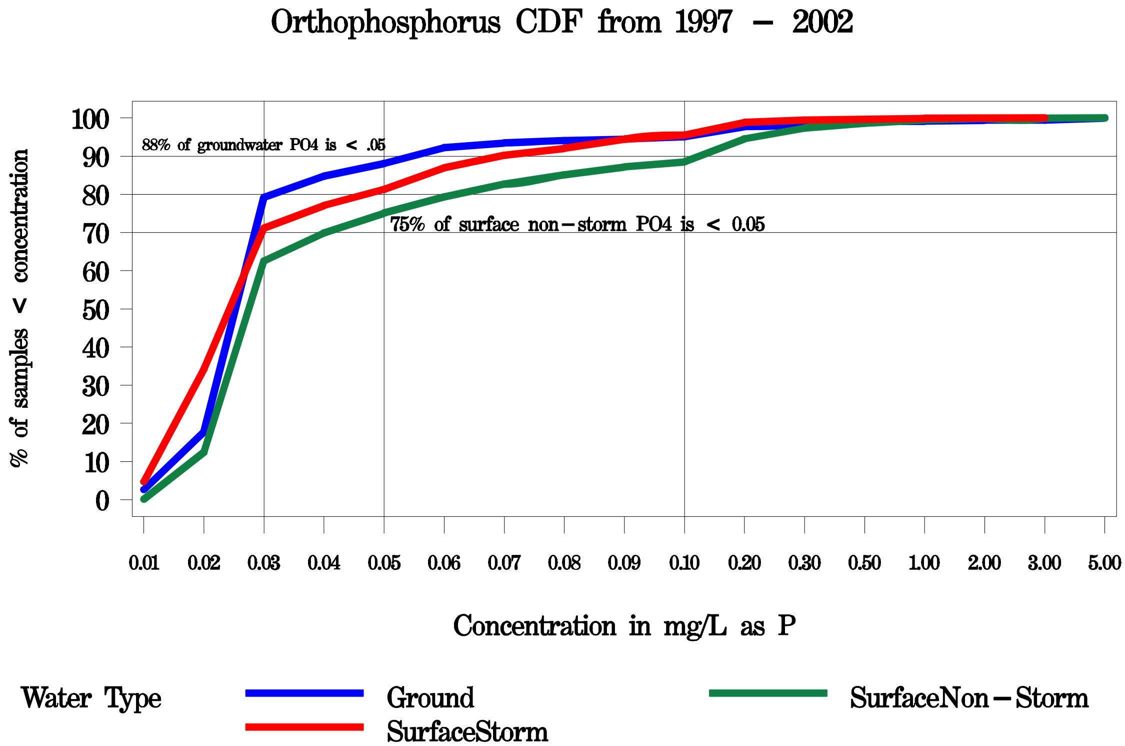
Ground water PO4 (Fig. 6) remained about the same for the first two periods and is just slightly worse in recent years (1997-2002). However, surface base flow PO4 (Fig. 7) degraded after the first period (up to 1990), and has not shown much change since. The change in ground water apparently lags the change in surface water. Storm water PO4 (Fig. 8) was the worst during the middle period (1990-1996) but storm water TP was the worst in the earliest period.

Table 7 presents time trends relative to 0.03 mg/L of PO4 and 0.05 mg/L of TP.

Table 7: Percentage of PO4 data ≤ 0.03 mg/L and percent of TP data ≤ 0.05 mg/L in three time periods

Water Type	Early (before 1990)	Middle (1990-1996)	Recent (1997-2002)	Trend
	Orthophosphorus mg/L			
Creek Base flow	92% ≤ 0.03	63% ≤ 0.03	63% ≤ 0.03	Worse - no change in recent years
Creek Storm flow	93% ≤ 0.03	57% ≤ 0.03	70% ≤ 0.03	Worse - but was worst in Middle period
Groundwater	82% ≤ 0.03	82% ≤ 0.03	79% ≤ 0.03	Slightly worse
	Total Phosphorus mg/L			
Creek Base flow	92% ≤ 0.05	75% ≤ 0.05	70% ≤ 0.05	Worse
Creek Storm flow	47% ≤ 0.05	55% ≤ 0.05	51% ≤ 0.05	Better - was best in middle period
Groundwater	90% ≤ 0.05	82% ≤ 0.05	65% ≤ 0.05	Worse

Figure 4: Surface Base and Storm Flow, and Groundwater Orthophosphorus CDFs for Early and Recent Time Periods



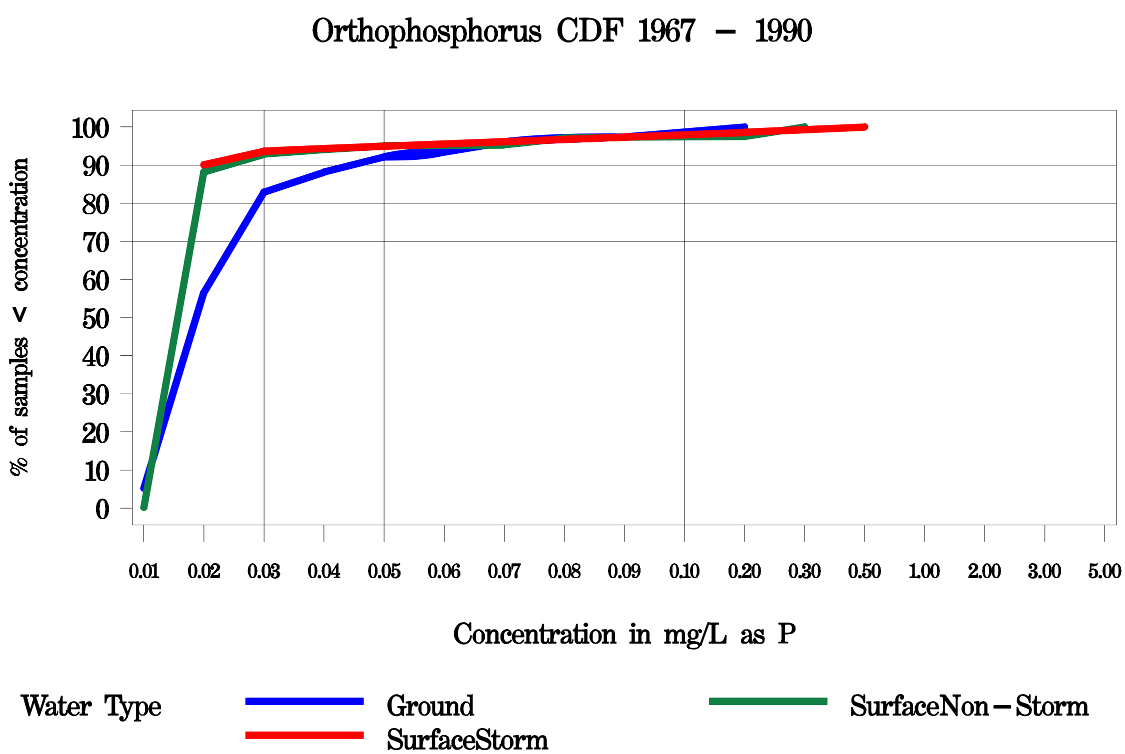
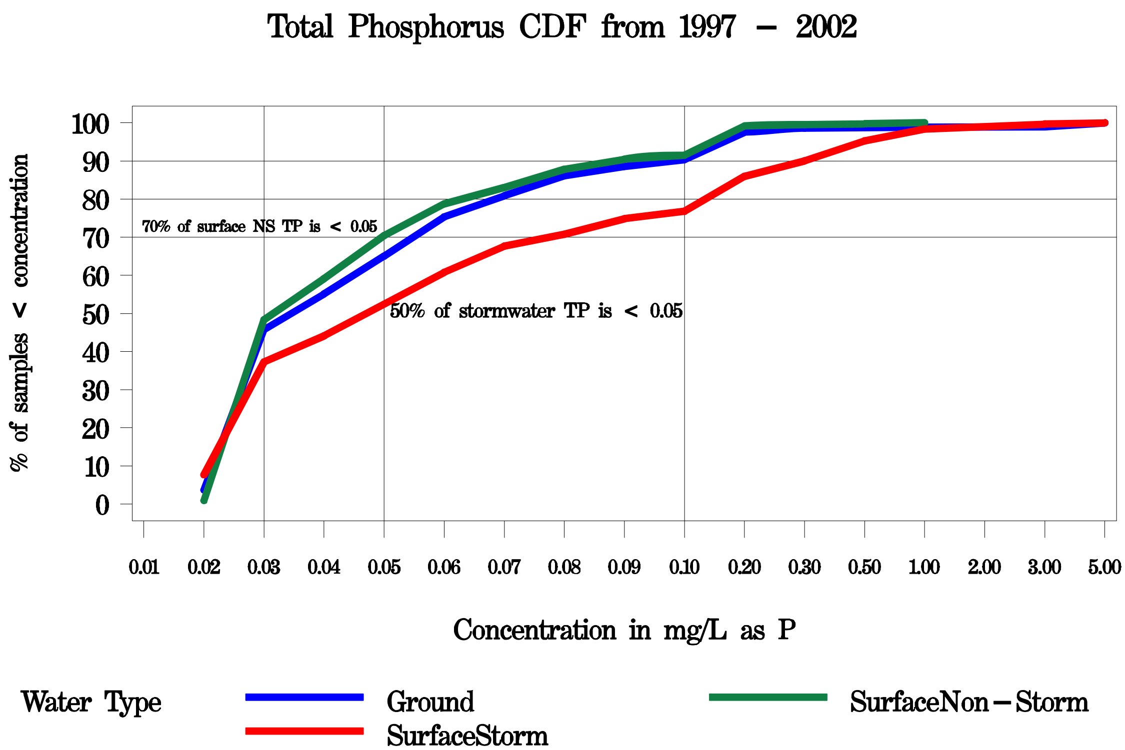


Figure 5: Surface Base and Storm Flow, and Groundwater Total Phosphorus CDFs for Early and Recent Time Periods



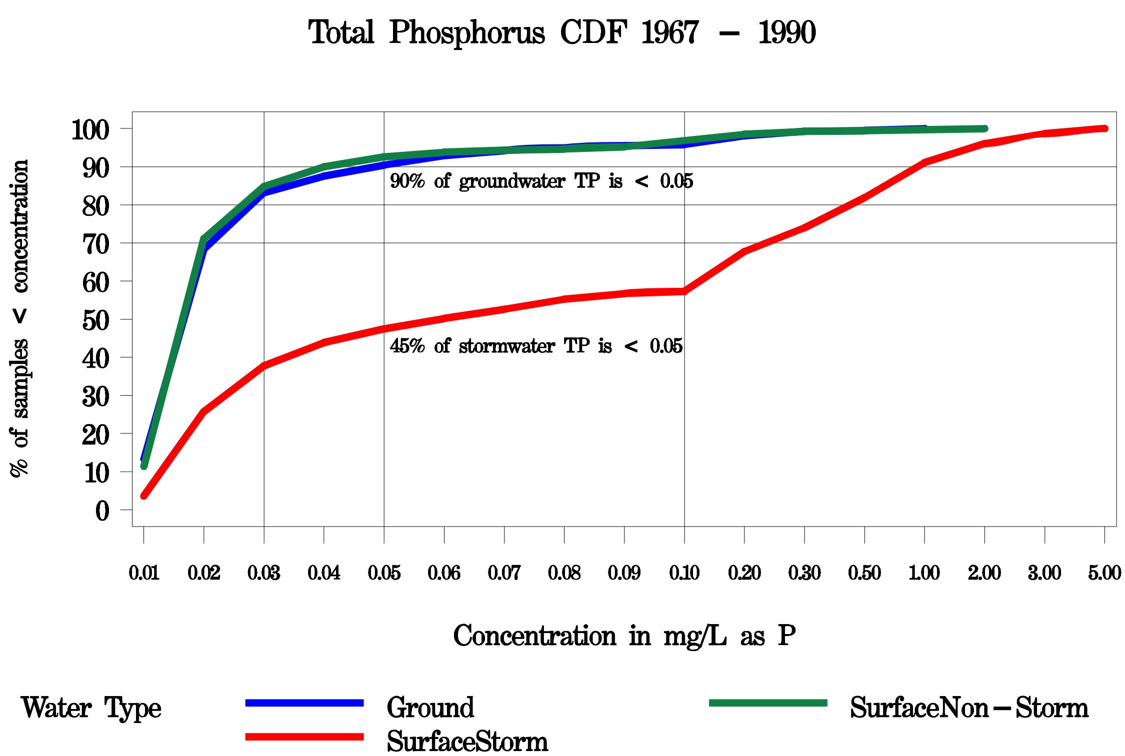
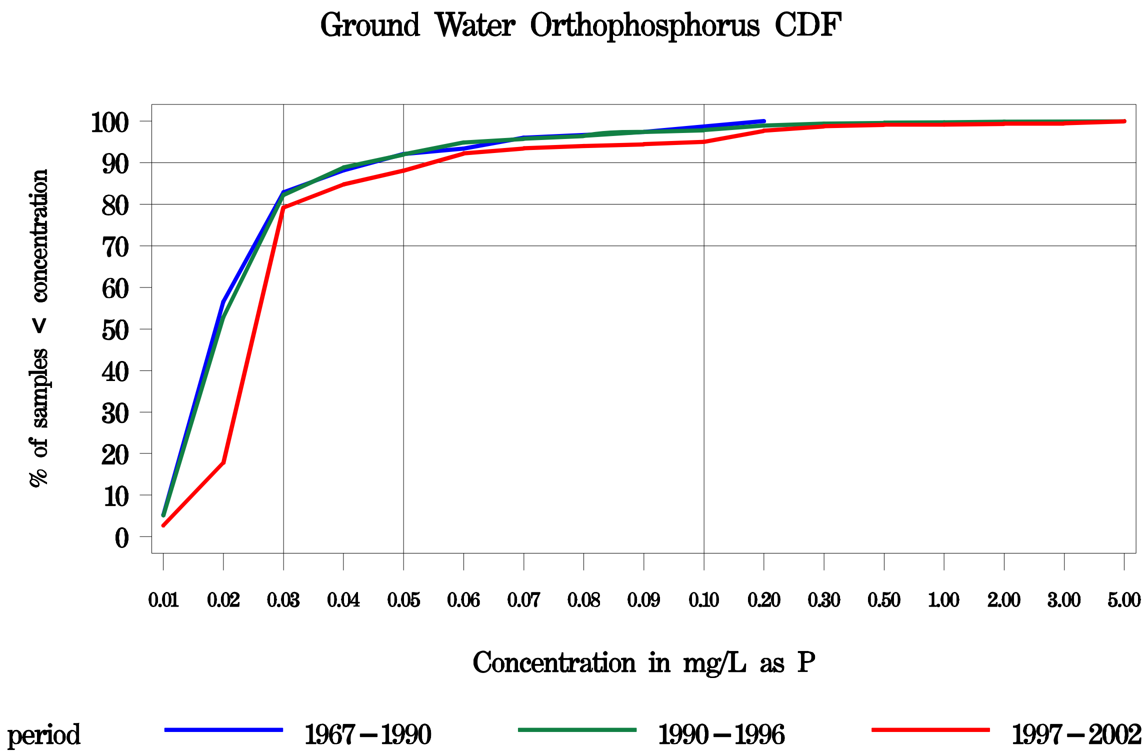


Figure 6: Early, Middle and Recent Time Periods Orthophosphorus and Total Phosphorus CDFs for Groundwater



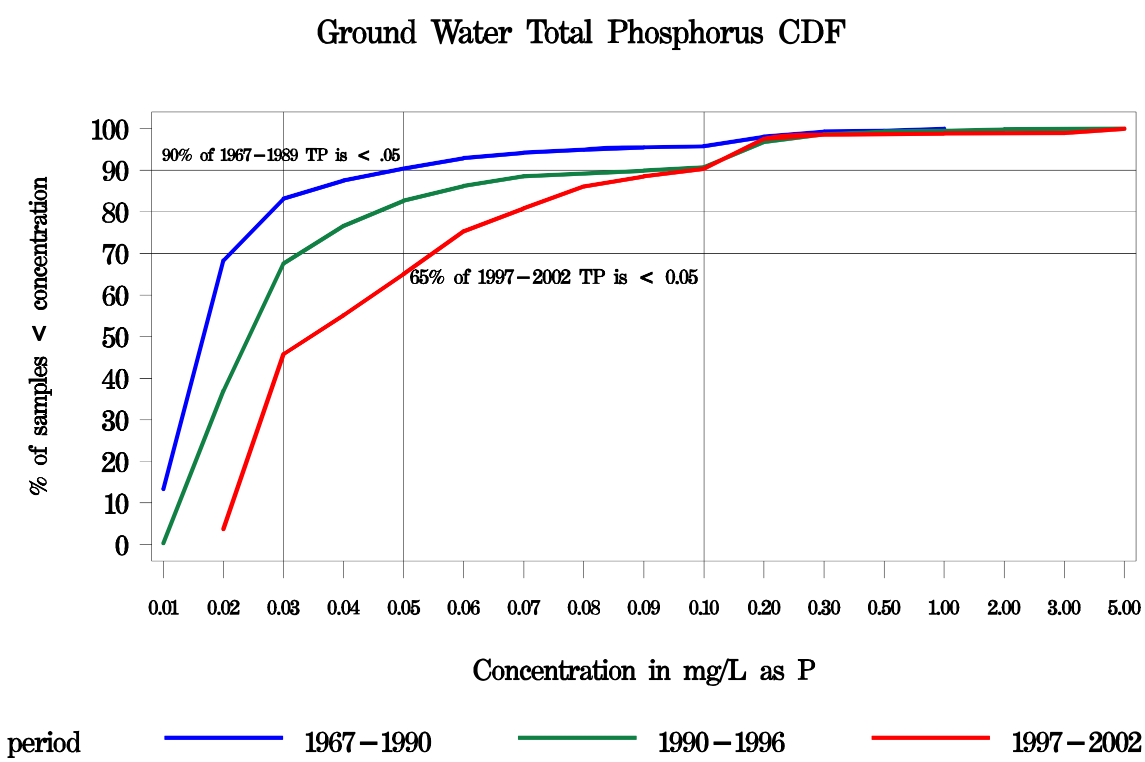
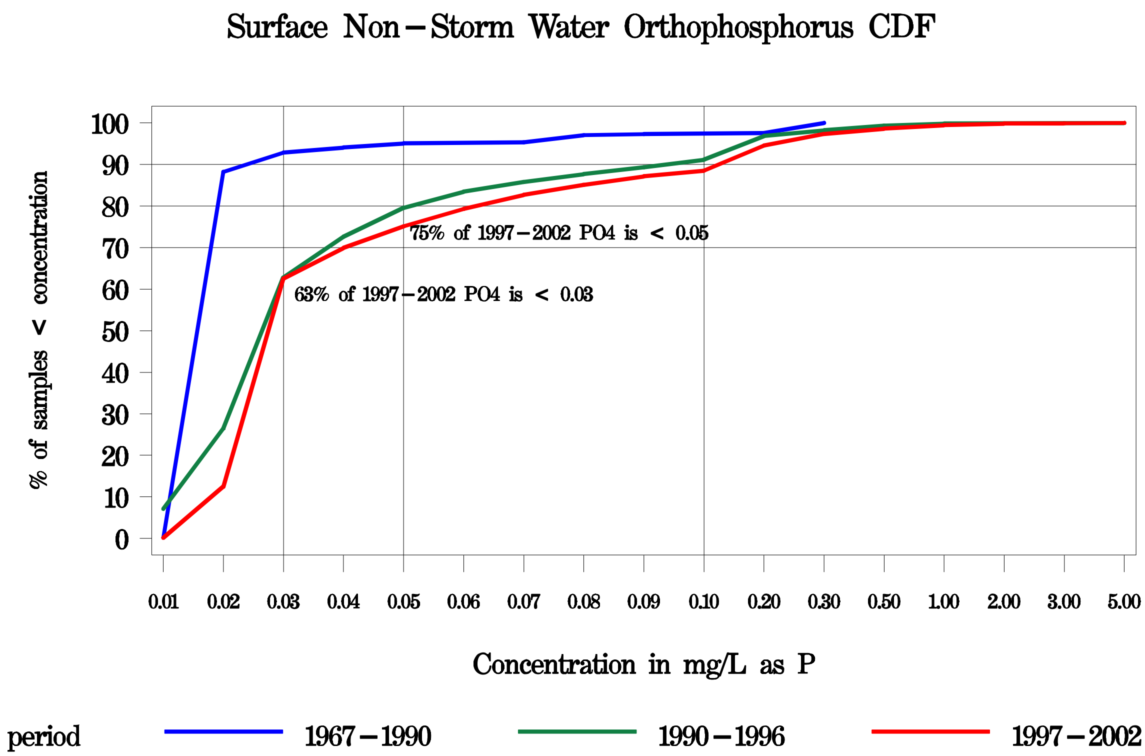


Figure 7: Early, Middle and Recent Time Periods Orthophosphorus and Total Phosphorus CDFs for Surface Base Flow



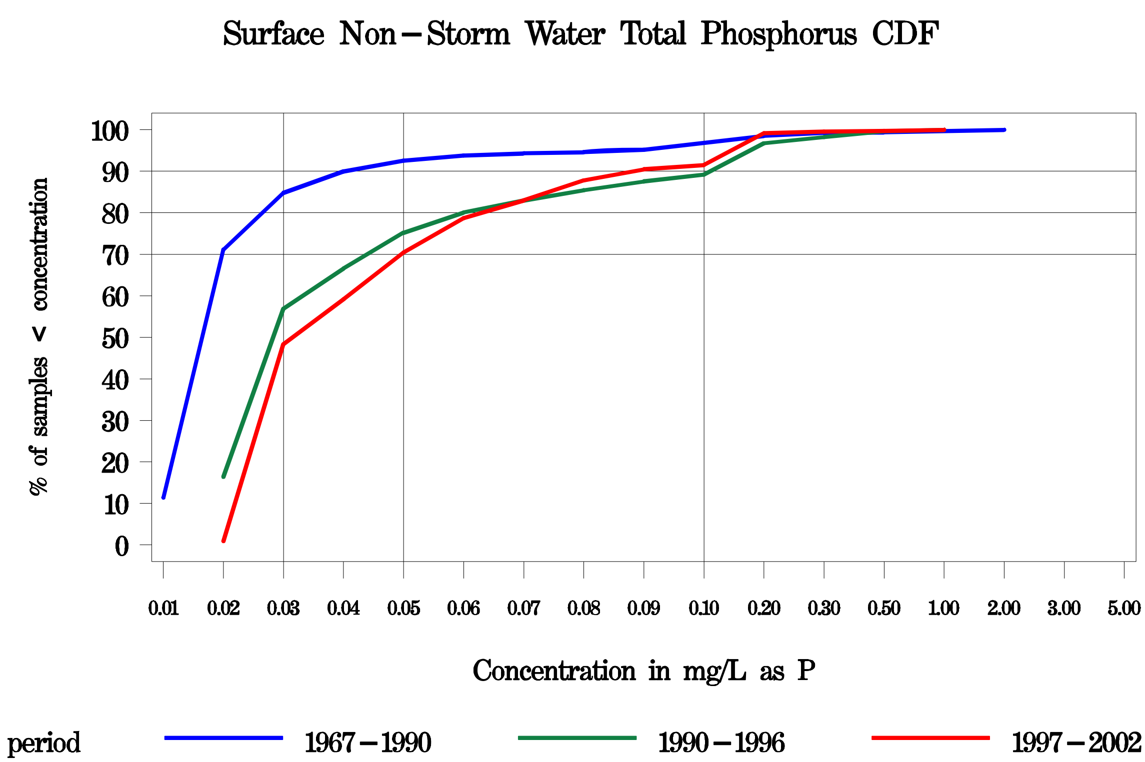
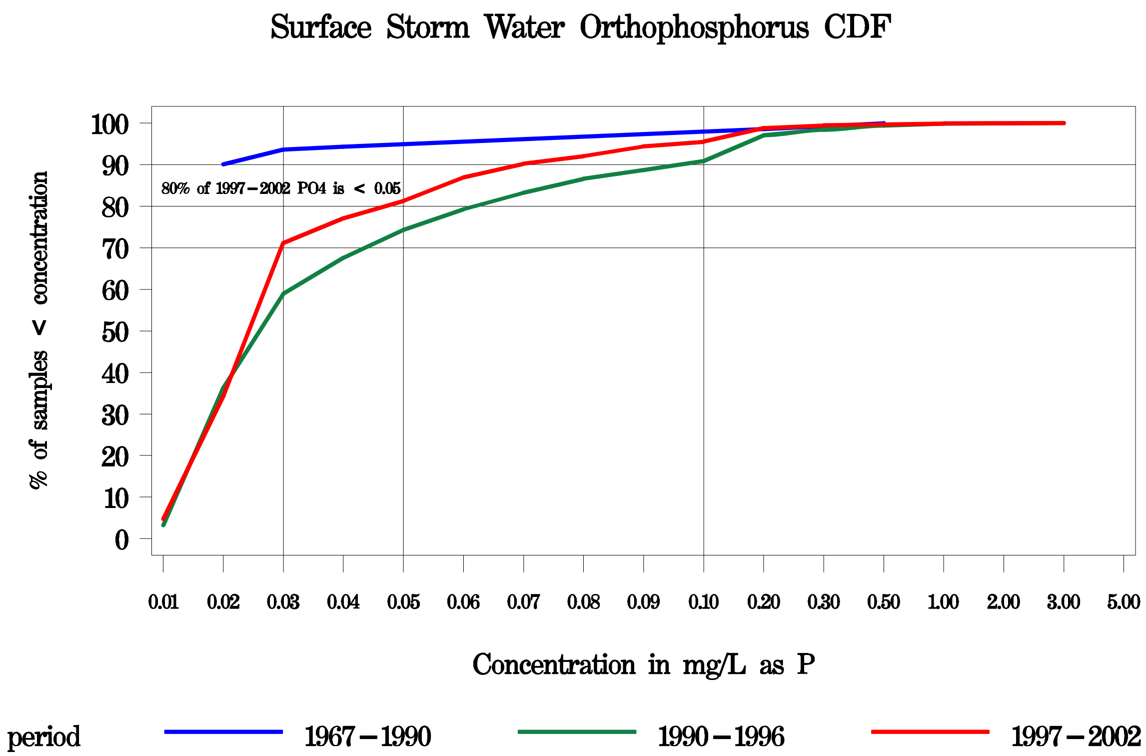
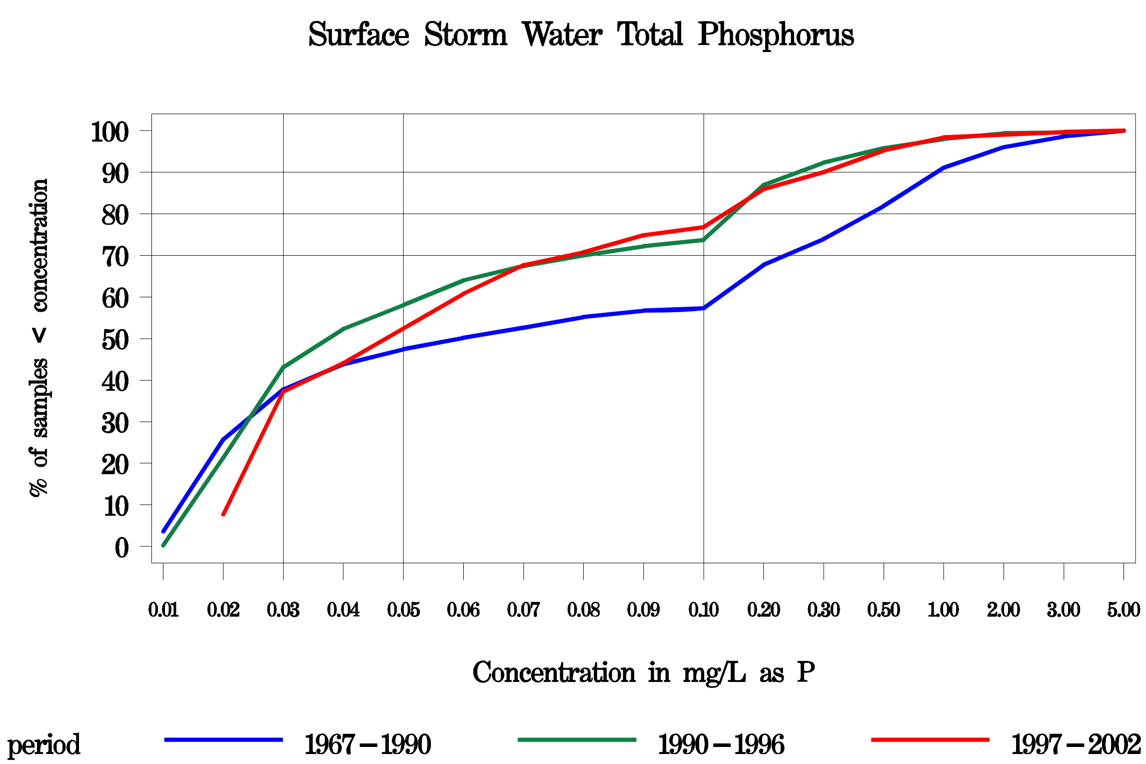


Figure 8: Early, Middle and Recent Time Periods Orthophosphorus and Total Phosphorus CDFs for Surface Storm Flow





SOIL CONCENTRATIONS

Soil data are available for undisturbed soils in the Bull Creek watershed, for lawns in the Stillhouse area, and for Austin-area soils with a variety of different cover crops, including lawns, that were sent to the Texas Agricultural Extension Service for testing. Concentrations in soil of available phosphorus (Soil Test P) are categorized as very low (0-5 mg/Kg), low (6-10 mg/Kg), moderate (11-41 mg/Kg), high (42-61 mg/Kg) and very high (>62 mg/Kg).

The data for the eight undisturbed sites is presented in Table 8. The undisturbed sites typically have concentrations of available phosphorus (Soil Test P) in the moderate and high categories, which is more than adequate for plant growth. The relationship between these undisturbed soils, yard soil samples collected in during the Stillhouse Fertilizer study, and area-wide soil samples sent to A&M for analysis is presented in Table 10. Most Austin-area soils have excessive levels of available phosphorus. More than 50% of Austin area soils, 75% of Austin-area lawns and 95% of the Stillhouse lawns are in the very high category. While the maximum values are found in the citywide data, Stillhouse has the highest values for the 25th, 50th, and 75th quartiles, and none of the Stillhouse values are in the low category.

Table 8: Soil Samples from Undisturbed Locations in the Austin Area

Undisturbed Site	Soil Test P (mg/kg)	P level
Stillhouse hollow Preserve above observation deck	47	High
Stillhouse hollow Preserve 150 feet above observation deck	47	High
St. Edwards Park (Uplands *1)	69	Very high
St. Edwards Park (Uplands *2)	60	High
St. Edwards Park 1	46	High
St. Edwards Park 2	34	Moderate
Stillhouse Preserve 1	23	Moderate
Stillhouse 7	28	Moderate
Mean	**44.25**	**High**

Table 9: Percentiles for Soil Test P for Undisturbed, Stillhouse and Austin Soils

	Soil Test P (mg/kg)			
	Undisturbe d	Stillhouse Lawns	Austin Lawns*	Austin Soils**
100% Maximum	69	1141	2094	2813
99%		1035	1075	1329
95%		719	692	769
90%		590	523	524
75% Q3	47	341	283	232
50% Median	46	210	165	71
25% Q1	34	141	66	16
10%		107	20	5
5%		90	3	2
1%		53	1	1
0% Minimum	23	39	1	1
Number of samples	9	372	529	1910

* does not include data from the Stillhouse Project

** includes lawns but not the data from the Stillhouse Project

CONCLUSIONS

The following conclusions are drawn from the summary of data presented in this report:

- Concentrations of phosphorus in tap water, or treated drinking water, are higher than the median creek levels. Thus, irrigation using treated drinking water is a potential source of PO4 in area creeks and lakes.
- Rainwater in rural areas has lower PO4 concentrations than in urban locales. In rural areas, rainwater concentrations are equal to storm water concentrations but greater than some of the base flow creek concentrations. In urban areas, rainwater concentrations are less than storm water concentrations. Rainwater is a potential source of PO4 in area creeks and lakes, but clearly not the major source in urban areas.
- Storm water concentrations are higher than creek base flow concentrations. Storm water PO4 and TP concentrations are higher in urban areas than in rural ones. In urban areas the highest concentrations of PO4 are from the Single-Family Residential and Golf Course land uses. The highest concentration of TP was found in Waller Creek with the golf course site coming in second. The creeks were fairly low in dissolved phosphorus and fairly high in total phosphorus. This may be due to erosion of bank soils. The storm water concentrations from the golf course land use need to be confirmed with future sampling, as there was only one site with this land use and fewer samples than normal were taken.
- Individual creek median concentrations vary widely but the overall median PO4 concentration of 0.05 mg/L as P is greater than the 0.03 mg/L at which lakes become susceptible to eutrophication. Thus, many of our creeks are already providing PO4 concentrations to Town Lake in excess of the amount needed to fuel algal blooms. The creeks with the highest median concentrations of PO4 are possibly those creeks with the highest levels of lawn and crop fertilization.
- Ground water currently has lower phosphorus concentrations than surface water. Most wells and springs are below the 0.03 mg/L of PO4 eutrophication threshold. Additional study is needed to determine the potential cause of the higher levels in some wells and springs.
- Concentrations of both PO4 and TP have increased over time with one exception. Total phosphorus concentrations in storm water runoff have declined. This improvement may be due to better erosion controls on construction sites. The changes in ground water appear to lag the changes in surface water
- Most Austin-area soils have excessive levels of available phosphorus. High soil levels may result in increased phosphorus in leachate and runoff, and may result in iron deficiency, which can lead to poor plant growth.