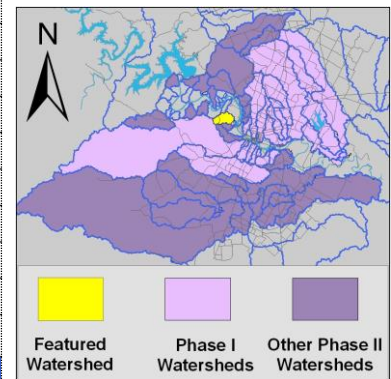


# Bee Creek Watershed

## Summary Sheet

Catchment	Total area	3.3 sq. miles					
	Area in recharge	none					
	Creek length	3 miles					
Demographics	Receiving water	Lake Austin					
	2000 population	2,037					
	2030 projected population	10,984					
Land Use	30 year projected % increase	439 %					
	Impervious cover (2003 estimate)	14.8 %					
Overall EII Scores	Impervious cover (2013 estimate)	12.5 %					
		2001	2004	2007	2010	2012	2014
		78	75	81	80	79	76



### Flow Regime\* for Sample Sites on Bee Creek

Site	Site Name	1999		2001				2004				2007				2010				2011				2012				2014						
		Jan	Jan	Mar	Mar	Jun	Sep	Dec	Mar	May	May	Jun	Oct	Dec	Feb	May	Jun	Sep	Dec	Mar	May	May	Oct	Dec	Mar	May	Jul	Sep	Jan	Apr	May	Jul	Sep	
		WQ	Bio	WQ	Bio	WQ	WQ	WQ	WQ	WQ	Bio	WQ	WQ	WQ	WQ	WQ	Bio	WQ	WQ	WQ	WQ	Bio	WQ	WQ	WQ	WQ	Bio	WQ	WQ	WQ	WQ	Bio	WQ	WQ
1104	HWY 360	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
322	Roadrunner	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	n
319	Lake Austin	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	n	B	B	B	B	n	

\* B = baseflow    n = no flow    S = storm flow    blue = Samples were taken    light blue = Samples were not taken    blank = not visited

### Index scores\* for Bee Creek Sites by Year

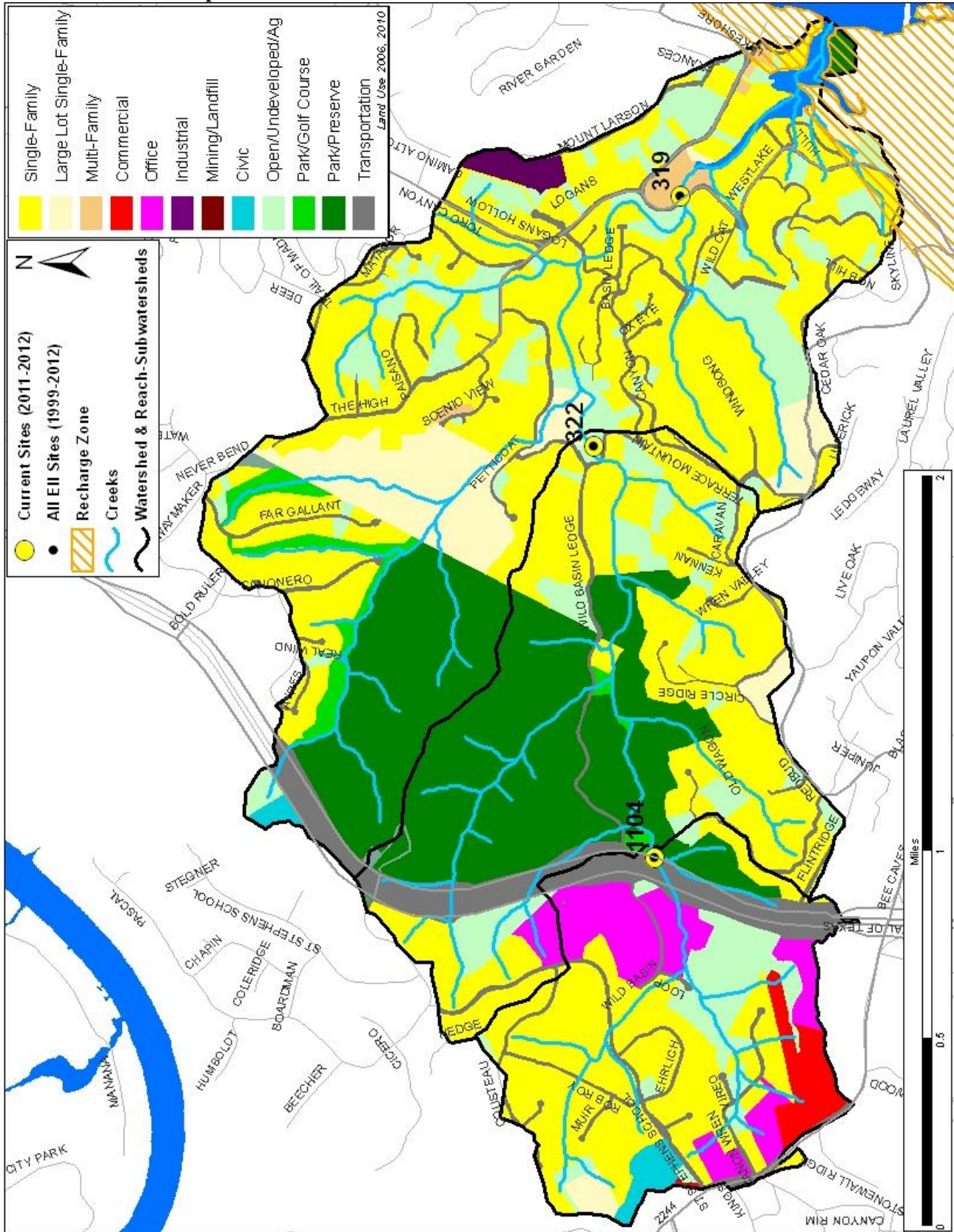
Reach	Site	Site Name	Year	Water Quality	Sediment**	Contact Rec.	Non-Contact Rec.	Physical Integrity	Aquatic Life	Benthic subindex	Diatom subindex	Total EII Score
BEE1	319	Bee Creek @ Lake Austin	1998	70	85	97	85	68	76	65	86	80
BEE2	322	Bee Creek @ Road Runner Rd	1998	63	85	83	92	86	87	74	100	83
BEE3	1104	Bee Creek @ Loop 360	1998	47	85	82	70	69	62	52	71	69
BEE1	319	Bee Creek @ Lake Austin	2001	60	94	93	84	70	64	43	85	74
BEE2	322	Bee Creek @ Road Runner Rd	2001	58	94	86	88	69	83	75	91	76
BEE3	1104	Bee Creek @ Loop 360	2001	59	94	81	94	84	54	37	70	74
BEE1	319	Bee Creek @ Lake Austin	2004	63	85	60	87	81	87	83	91	77
BEE2	322	Bee Creek @ Road Runner Rd	2004	61	85	62	94	79	76	54	97	76
BEE3	1104	Bee Creek @ Loop 360	2004	47	85	46	89	82	82	74	90	72
BEE1	319	Bee Creek @ Lake Austin	2007	68	88	81	95	80	90	84	96	84
BEE2	322	Bee Creek @ Road Runner Rd	2007	65	88	79	98	79	87	75	98	83
BEE3	1104	Bee Creek @ Loop 360	2007	57	88	76	95	82	60	68	51	76
BEE1	319	Bee Creek @ Lake Austin	2010	63	85	81	100	76	94	87	100	83
BEE2	322	Bee Creek @ Road Runner Rd	2010	66	85	85	91	77	85	72	97	82
BEE3	1104	Bee Creek @ Loop 360	2010	55	85	59	96	82	83	78	88	77
BEE1	319	Bee Creek @ Lake Austin	2012	58	86	79	89	67	81	72	90	77
BEE2	322	Bee Creek @ Road Runner Rd	2012	45	86	37	98	89	94	100	88	75
BEE3	1104	Bee Creek @ Loop 360	2012	57	86	73	98	98	98	96	99	85
BEE1	319	Bee Creek @ Lake Austin	2014	69	81	94	90	67	92	84	100	82
BEE2	322	Bee Creek @ Road Runner Rd	2014	58	81	78	93	71	80	76	83	77
BEE3	1104	Bee Creek @ Loop 360	2014	54	81	59	91	63	70	57	82	70

\* blank cells indicate parameter was not collected, blank row indicate site was dropped \*\*sediment samples only collected at the downstream site

100-87.5 Excellent    87.5-75 V. Good    75-62.5 Good    62.5-50 Fair    50-37.5 Marginal    37.5-25 Poor    25-12.5 Bad    12.5-0 V. Bad

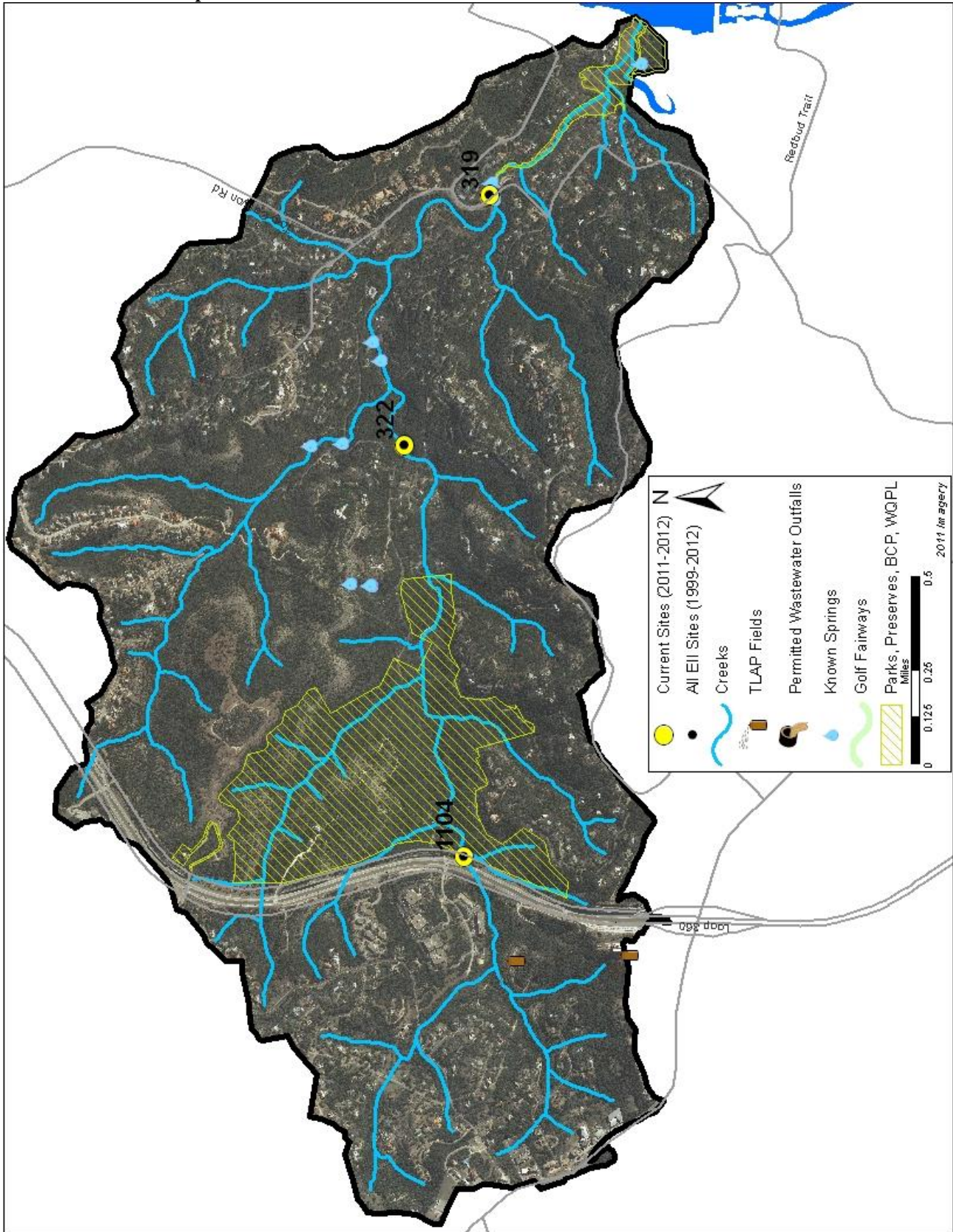
# Bee Creek Watershed

## Land Use Map



# Bee Creek Watershed

Aerial Map



# Bee Creek Watershed

## Water Quality Data – Temperature, Conductivity, pH, Dissolved Oxygen & *E. coli* for 2014 Sample Sites (Downstream to Upstream)

Qualifiers to the left of value:	>	greater than	Qualifiers to the right of value:	(blank)	Useable
	<	less than		S	Exceeds standard range
	< J	less than detection limit		R	Rejected, failed QC
	J	Estimated			

Site Name	Site #	Reach	Date	Temp. Value	Temp. flag	Cond. Value	Cond. flag	pH Value	pH flag	D.O. Value	D.O. flag	<i>E. coli</i> Value	<i>E. coli</i> flag
Bee @ Lake Austin	319	BEE1	01/15/2014	11.8		873		8.17		10.6		9.8	
Bee @ Lake Austin	319	BEE1	04/17/2014	17.0		920		7.98		8.9		14.5	
Bee @ Lake Austin	319	BEE1	05/09/2014	21.8		1062		7.45		5.7			
Bee @ Lake Austin	319	BEE1	07/02/2014	31.2		785		7.84		8.8		8.0	
<b>Site 319 Mean</b>				20.4		910		7.86		8.5		10.8	
Bee @ Road Runner Rd	322	BEE2	01/15/2014	12.7		981		8.08		11.6		14.8	
Bee @ Road Runner Rd	322	BEE2	04/17/2014	17.2		881		7.90		8.6		7.2	
Bee @ Road Runner Rd	322	BEE2	05/09/2014	22.4		1008		7.53		6.9			
Bee @ Road Runner Rd	322	BEE2	07/02/2014	30.5		817		7.96		10.6		140.8	
<b>Site 322 Mean</b>				20.7		922		7.87		9.4		54.3	
Bee @ Loop 360	1104	BEE3	01/15/2014	11.9		956		7.99		9.2		73.8	
Bee @ Loop 360	1104	BEE3	04/17/2014	15.9		959		7.87		9.8		74.9	
Bee @ Loop 360	1104	BEE3	05/09/2014	19.6		1006		7.37		7.9			
Bee @ Loop 360	1104	BEE3	07/02/2014	23.6		1009		7.61		7.8		16.2	
Bee @ Loop 360	1104	BEE3	09/10/2014	23.8		905		7.36		6.1		129.1	
<b>Site 1104 Mean</b>				19.0		967		7.64		8.2		73.5	
<b>Watershed Mean</b>				19.9		936		7.78		8.7		48.9	

Orange highlighting indicates that the value exceeds one standard deviation from the mean of all E.I.I. sites combined.

Summary Statistics for all 2013 – 2014 E.I.I. Sites Combined.					
Parameter	2013-2014 Average	2013-2014 Minimum	2013-2014 Maximum	1 Standard Deviation Above	1 Standard Deviation Below
Temperature (C°)	19.6	8.6	34.0	25.8	
Conductivity (uS/cm)	711	107	1783	942	
pH (Standard units)	7.86	6.96	8.97	8.19	7.52
D.O. (mg/l)	8.1	1.2	30.5	11.4	4.8
<i>E. coli</i> (col/100ml)	435	1	4840	1127	

# Bee Creek Watershed

## Water Quality Data – Ammonia, Nitrate / Nitrite, Ortho-Phosphorus, Total Suspended Solids & Turbidity for 2014 Sample Sites (Downstream to Upstream)

Qualifiers to the left of value:	>	greater than	Qualifiers to the right of value:	(blank)	Useable
	<	less than		S	Exceeds standard range
	< J	less than detection limit		R	Rejected, failed QC
	J	Estimated			

Site Name	Site #	Reach	Date	NH3-N		NO3/NO2		Ortho-P		T.S.S.		Turb.					
				<>	Value	flag	<>	Value	flag	<>	Value	flag	<>	Value	flag		
Bee @ Lake Austin	319	BEE1	01/15/2014	<J	0.008			1.71		<J	0.004		<J	1.0		0.6	R
Bee @ Lake Austin	319	BEE1	04/17/2014		0.061			0.17		<J	0.004		<J	1.1		0.7	R
Bee @ Lake Austin	319	BEE1	05/09/2014														
Bee @ Lake Austin	319	BEE1	07/02/2014	<J	0.008			0.06		<J	0.004		<J	1.1		0.4	
<b>Site 319 Mean</b>					0.026			0.65			0.004			1.0		0.5	
Bee @ Road Runner Rd	322	BEE2	01/15/2014		0.018			1.10		<J	0.004		<J	1.0		0.4	R
Bee @ Road Runner Rd	322	BEE2	04/17/2014		0.043			0.25		<J	0.004			48.5		2.5	R
Bee @ Road Runner Rd	322	BEE2	05/09/2014														
Bee @ Road Runner Rd	322	BEE2	07/02/2014	<J	0.008		<J	0.01		<J	0.004			9.0		0.8	
<b>Site 322 Mean</b>					0.023			0.45			0.004			19.5		1.2	
Bee @ Loop 360	1104	BEE3	01/15/2014		0.026			1.57		<J	0.004		<J	1.0		9.8	R
Bee @ Loop 360	1104	BEE3	04/17/2014		0.060			1.06		<J	0.004		<J	1.1		1.1	R
Bee @ Loop 360	1104	BEE3	05/09/2014														
Bee @ Loop 360	1104	BEE3	07/02/2014		0.033			0.16		<J	0.004		<J	1.1		0.9	
Bee @ Loop 360	1104	BEE3	09/10/2014		0.064			0.27		<J	0.004		<J	1.0		2.0	
<b>Site 1104 Mean</b>					0.046			0.77			0.004			1.0		3.4	
<b>Watershed Mean</b>					0.033			0.64			0.004			6.6		1.9	

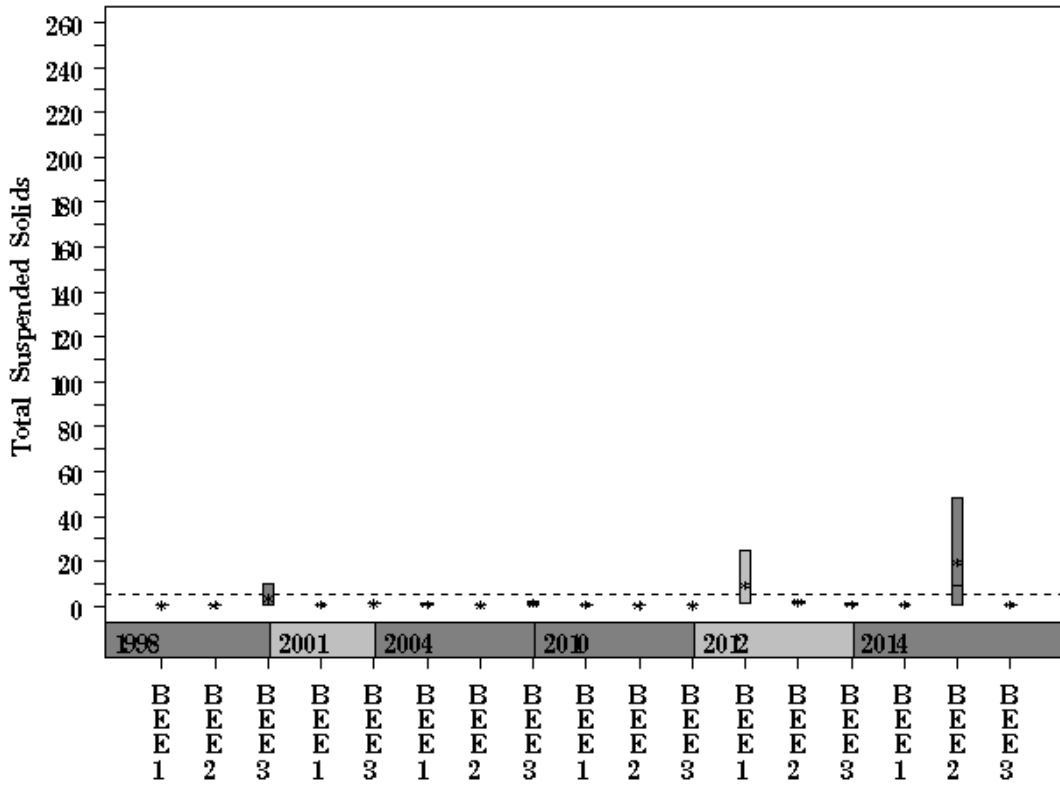
Orange highlighting indicates that the value exceeds one standard deviation from the mean of all E.I.I. sites combined.

Summary Statistics for all 2013 – 2014 E.I.I. Sites Combined.				
Parameter	2013-2014 Mean	2013-2014 Minimum	2013-2014 Maximum	1 Standard Deviation Above
NH3-M (mg/l)	0.031	0.008	2.250	0.150
NO3-N (mg/l)	1.16	0.01	16.30	4.02
Ortho-P (mg/l)	0.041	0.004	1.360	0.164
TSS (mg/l)	5.6	1.0	70.0	15.3
Turbidity (NTU)	4.5	0.0	97.1	13.2

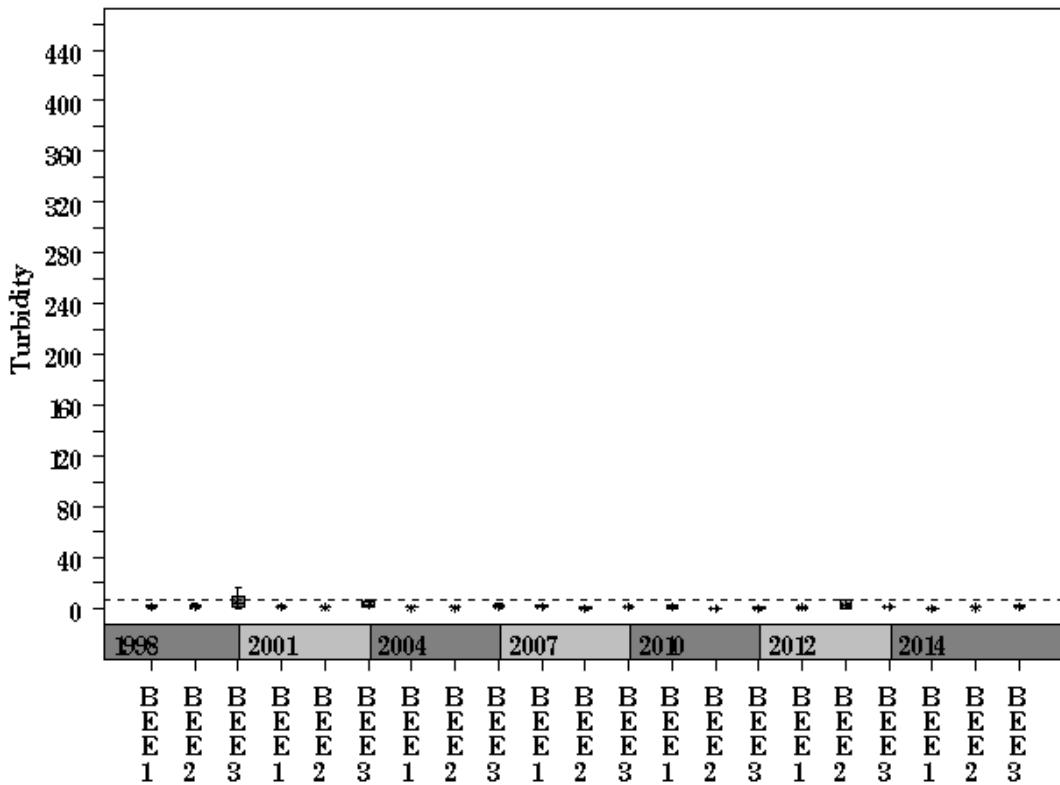
# Bee Creek Watershed

Data Summary Graphs – Total Suspended Solids and Turbidity (Downstream to Upstream by Year)

Parameter= TOTAL SUSPENDED SOLIDS Unit= mg/L Watershed= Bee



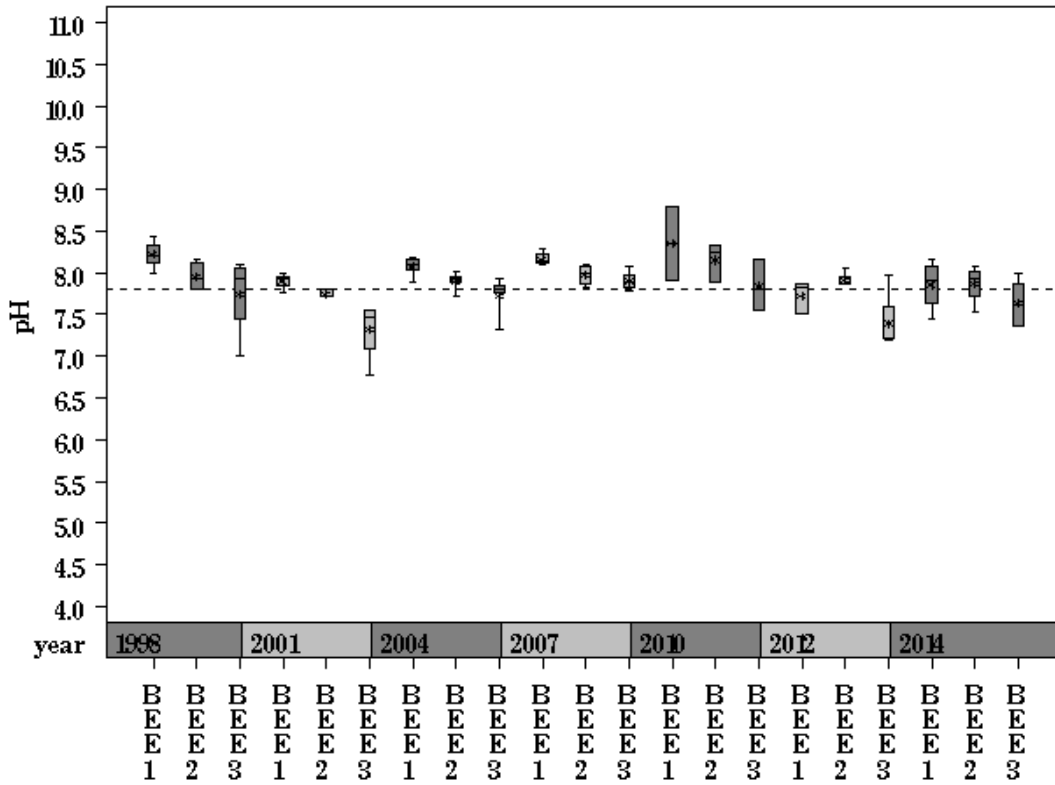
Parameter= TURBIDITY Unit= NTU Watershed= Bee



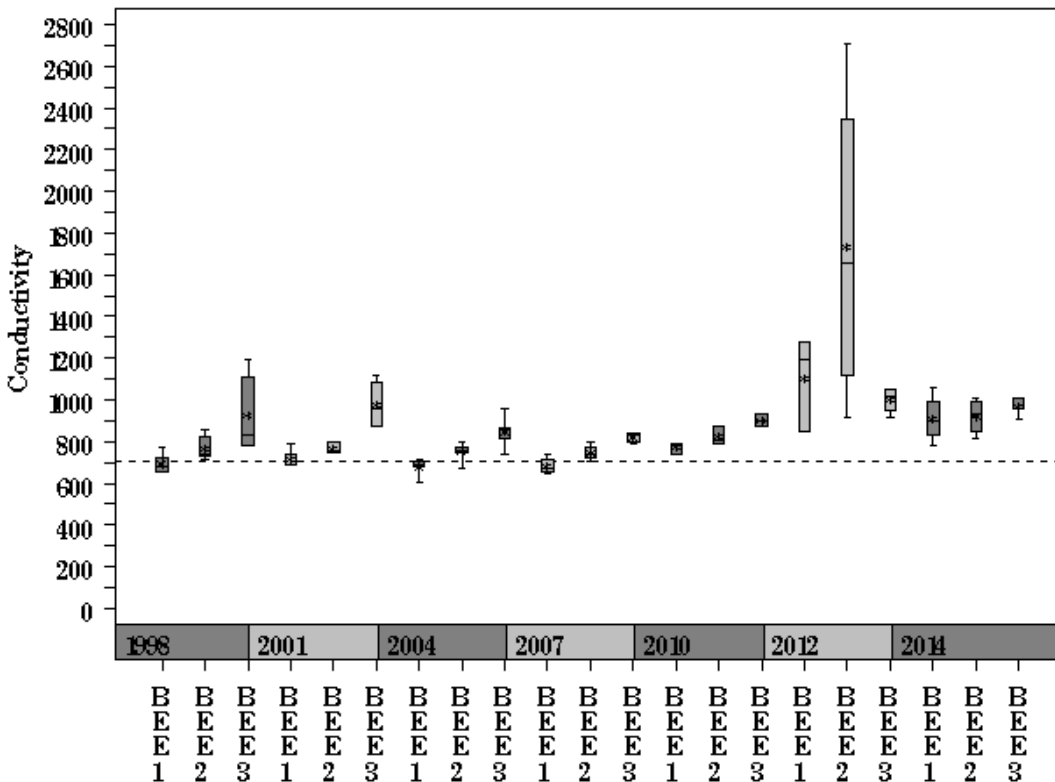
# Bee Creek Watershed

Data Summary Graphs – pH and Conductivity (Downstream to Upstream by Year)

Parameter= PH Unit= Standard units Watershed= Bee

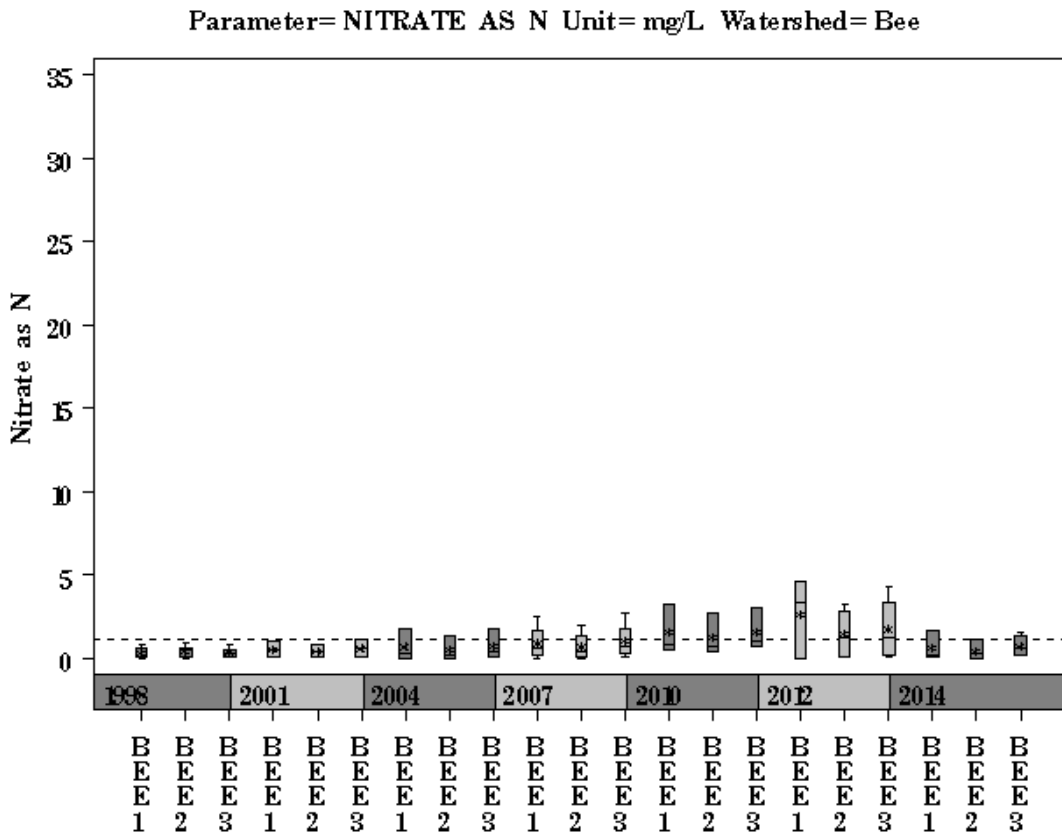
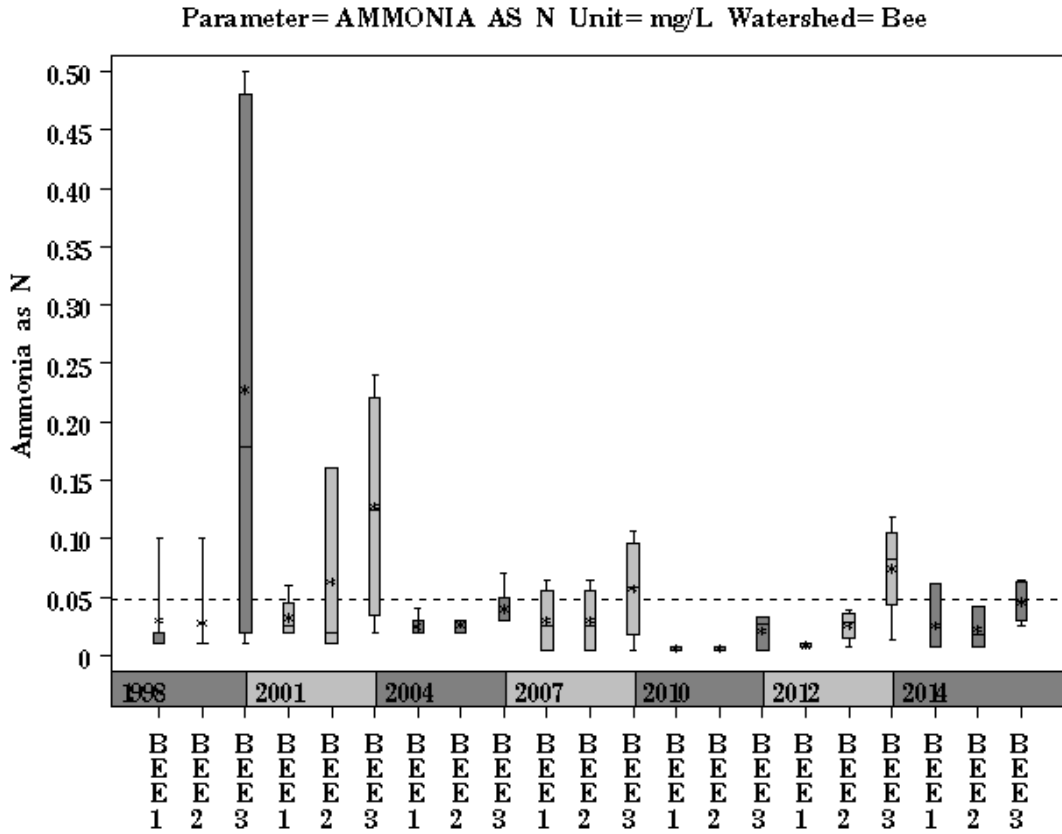


Parameter= CONDUCTIVITY Unit= uS/cm Watershed= Bee



# Bee Creek Watershed

Data Summary Graphs – Ammonia and Nitrate/Nitrite (Downstream to Upstream by Year)

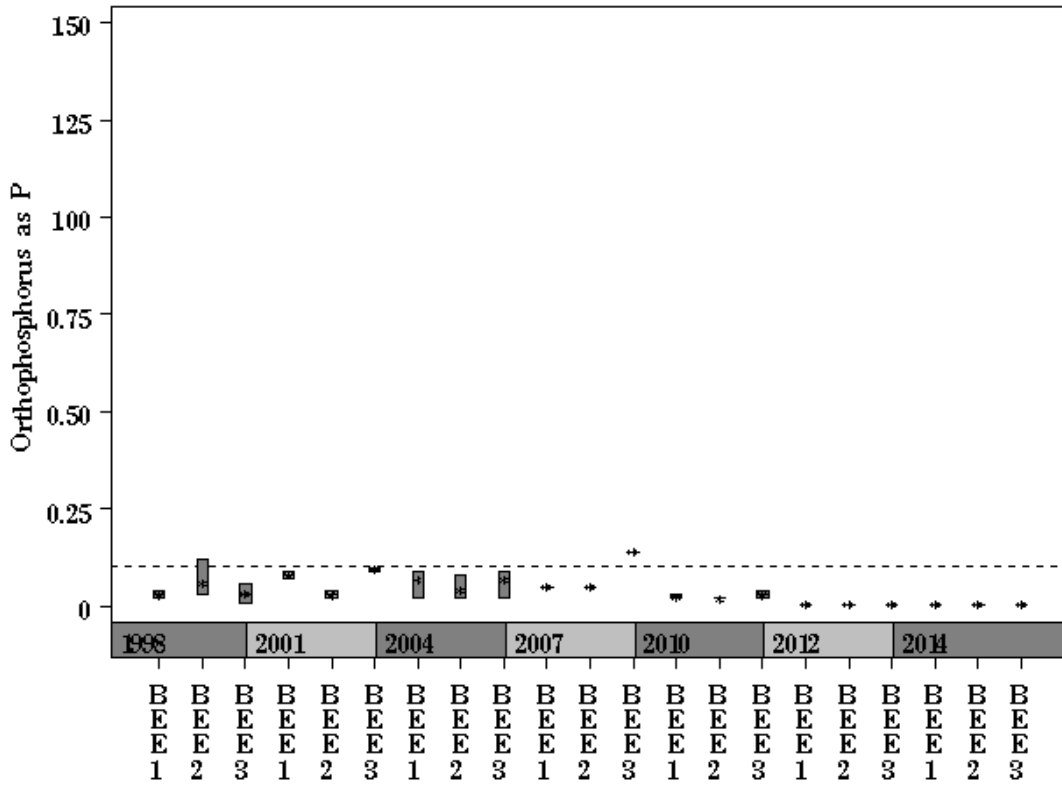




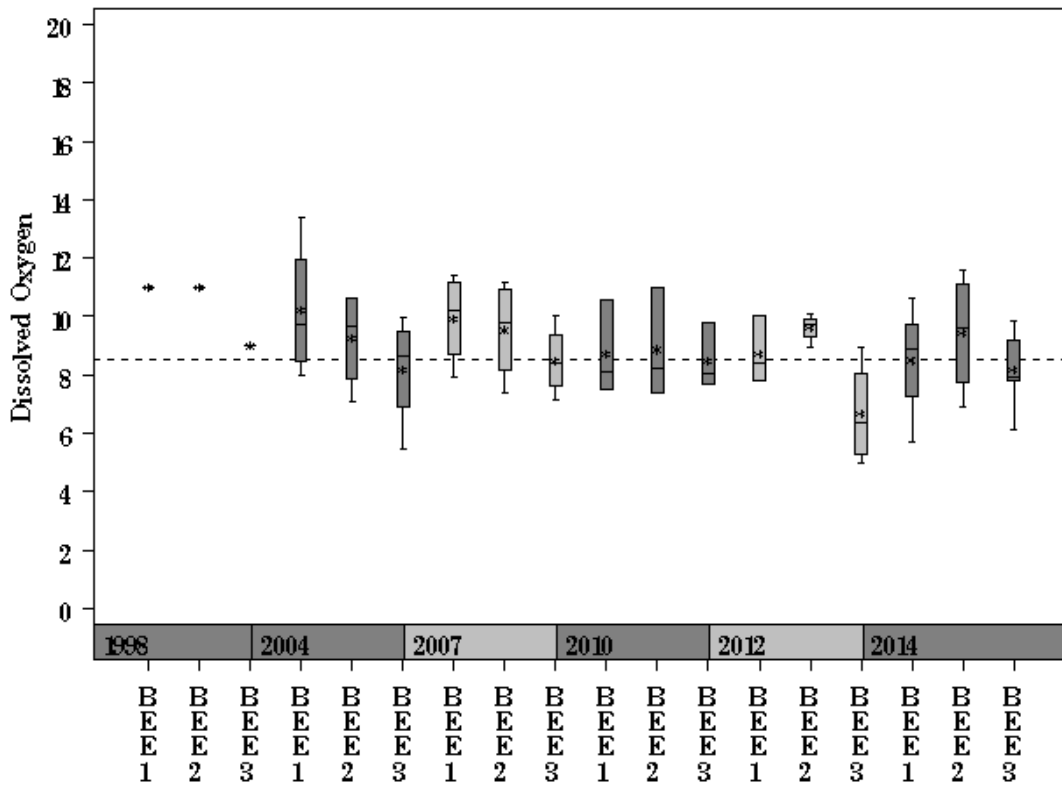
# Bee Creek Watershed

Data Summary Graphs – Orthophosphate and Dissolved Oxygen (Downstream to Upstream by Year)

Parameter= ORTHOPHOSPHORUS AS P Unit= mg/L Watershed= Bee

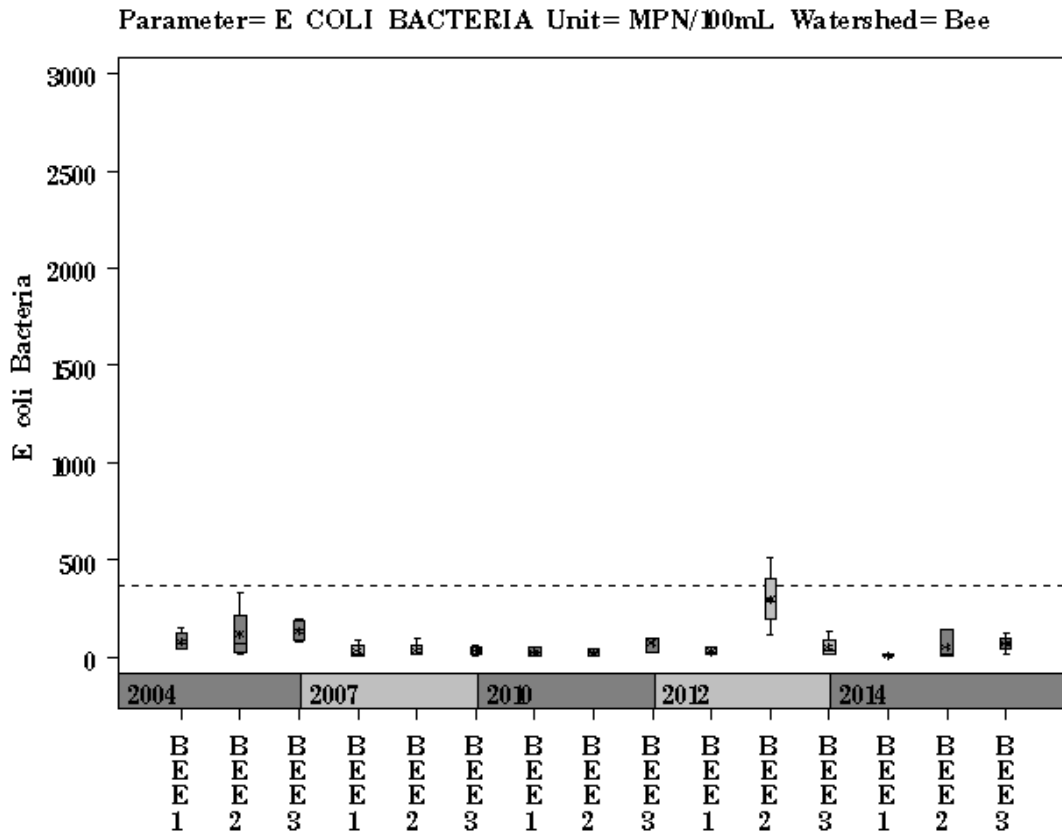


Parameter= DISSOLVED OXYGEN Unit= mg/L Watershed= Bee



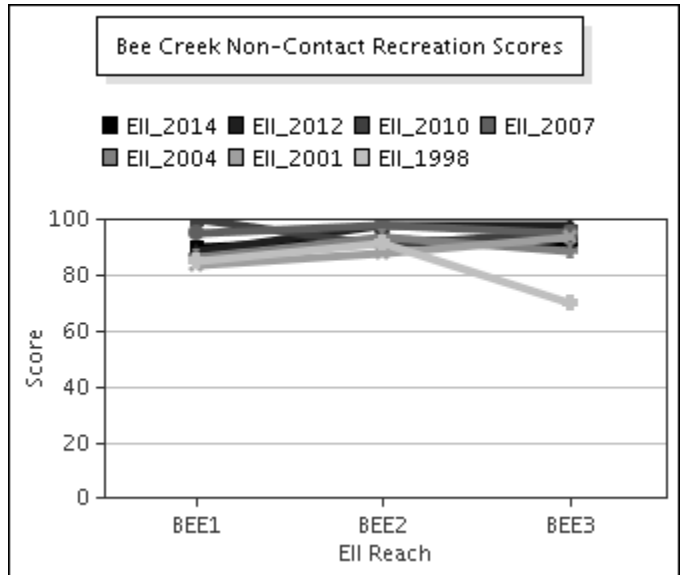
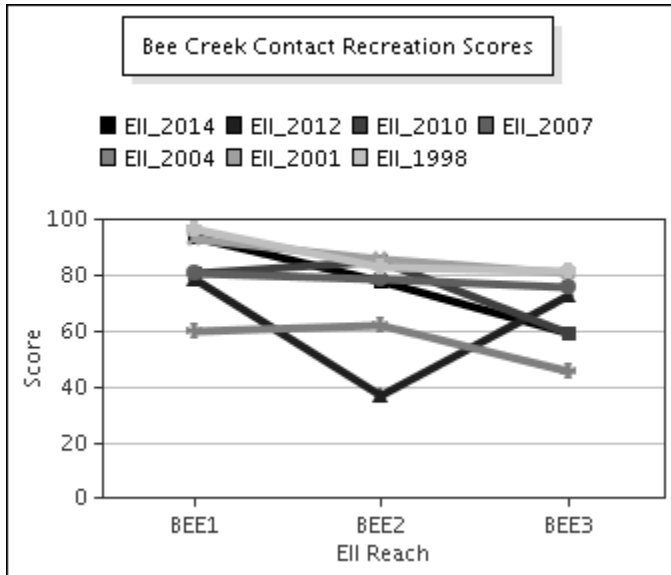
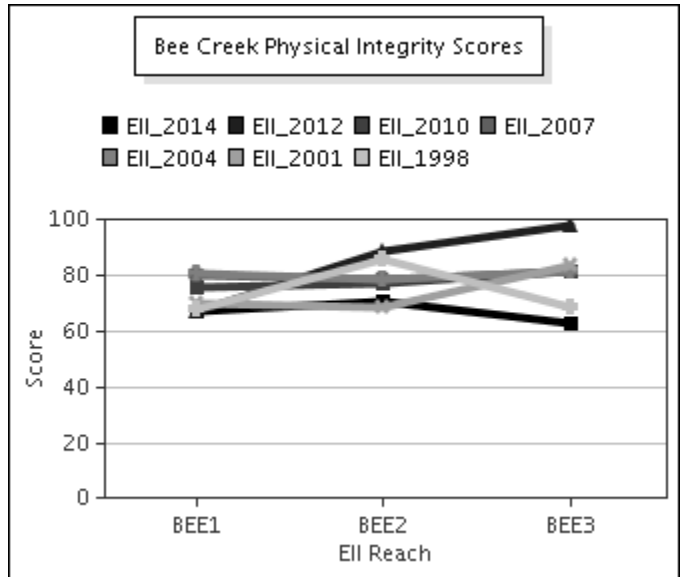
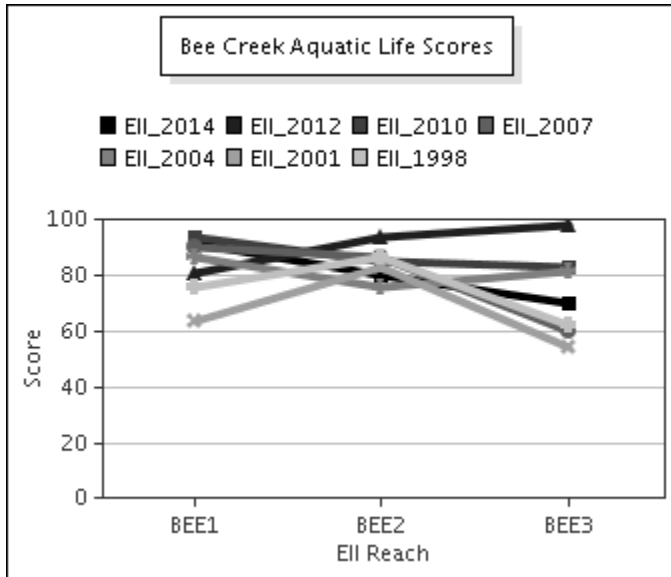
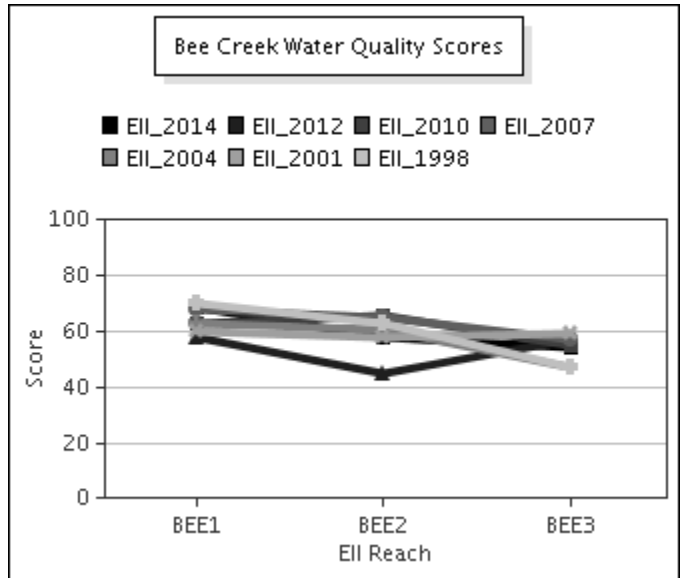
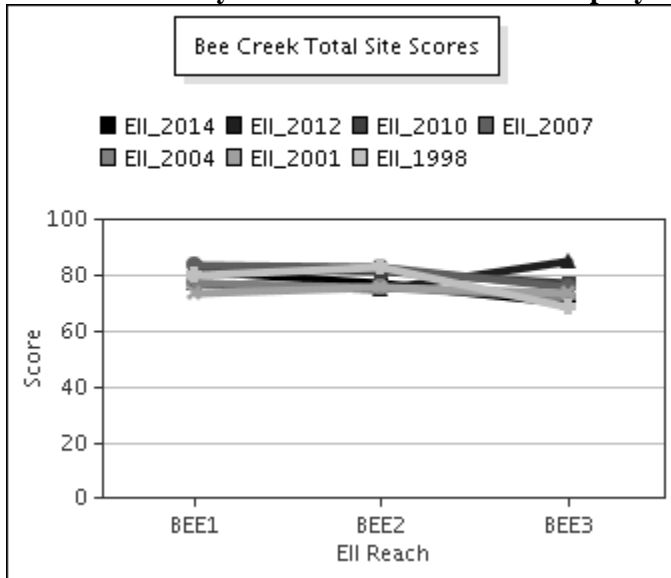
# Bee Creek Watershed

Data Summary Graphs – *E.coli* (Downstream to Upstream by Year)



# Bee Creek Watershed

## Score Summary – Reach scores for each sample year



# Bee Creek Watershed

## Benthic Macroinvertebrates – Taxa List, Pollution Tolerance Index & Functional Feeding Group for 2014 Sample Sites (Downstream to Upstream)

Benthic Macroinvertebrate ID	PTI	FFG	Bee @ Lake Austin (Site 319)	Bee @ Road Runner Rd (Site 322)	Bee @ Loop 360 (Site 1104)
<i>Chimarra</i> sp.	2	FC	18	3	1
<i>Polycentropus</i> sp. / <i>Cernotina</i> sp.	3	P,FC	1		
<i>Fallicon quilleri</i>	4	SC,CG	60	63	1
Ostracoda	4	FC,CG		1	1
<i>Simulium</i> sp.	4	FC	5		1
<i>Agabus</i> sp.	5	P	1		1
Gerridae	5	P	1		5
<i>Liodessus obscurellus</i>	5	P	1		
<i>Argia</i> sp.	6	P	10	7	12
<i>Cheumatopsyche</i> sp.	6	FC	13	10	5
Chironomidae	6	P,FC	2	3	13
Hydracarina	6			2	2
<i>Microvelia</i> sp.	6	P	5	6	1
<i>Rhagovelia</i> sp.	6	P	1	6	
<i>Stenonema femoratum</i>	6	SC,CG		1	
Tanypodinae	6	P	1	4	5
<i>Bezzia</i> sp. / <i>Palpomyia</i> sp.	7	P,CG	1		
<i>Stenelmis</i> sp.	7	SC,CG	3		
<i>Caloparyphus</i> sp. / <i>Euparyphus</i> sp.	8	SC,CG	2		1
<i>Cymbiodyta</i> sp.	8	P	1		
Oligochaeta	8	CG		1	
<i>Physella</i> sp.	9	SC	39		
<i>Dugesia</i> sp.		P,CG	1	32	16

# Bee Creek Watershed

## Benthic Macroinvertebrates – Metric Summary for 2014 Sample Sites (Downstream to Upstream)

Scoring Metric	Bee @ Lake Austin (Site 319)	Bee @ Road Runner Rd (Site 322)	Bee @ Loop 360 (Site 1104)
Number of Taxa *	18	12	13
Hilsenhoff Biotic Index *	5.5	4.7	5.7
Number of Ephemeroptera Taxa *	1	2	1
Percent of Total as Chironomidae *	2	5	28
Number of EPT Taxa *	4	4	3
Percent of Total as EPT *	55	55	11
Percent of Total as Predator *	16	42	82
Number of Intolerant Taxa *	4	3	4
Percent Dominance (Top 3 Taxa) *	70	76	63
EPT / EPT + Chironomidae	1	1	0
Number of Diptera Taxa	4	1	3
Number of Non-Insect Taxa	2	4	3
Number of Organisms	166	139	65
Percent Dominance (Top 1 Taxa)	36	45	25
Percent of Total as Collector / Gatherer	40	71	29
Percent of Total as Dominant Guild (FFG)	63	71	82
Percent of Total as Elmidae	2	0	0
Percent of Total as Filterers	24	15	40
Percent of Total as Grazers (PI & SC)	63	46	3
Percent of Total as Tolerant Organisms	23	0	0
Percent of Trichoptera as Hydropsychidae	41	77	83
Ratio of Intolerant : Tolerant Organisms	1.11	1.67	0.25
TCEQ Qualitative Aquatic Life Use Score	28	20	18
TCEQ Quantitative Aquatic Life Use Score	27	29	21

\* **EII scoring parameter: Nine metric parameters are used in the calculation of the EII Benthic Subindex score. Other metrics are shown to supplement evaluation.**

1. # of Taxa: Higher diversity (number of taxa) correlates with greater biological integrity. The average number of taxa per site for 2013/2014 samples was 15; the lowest value was 5 and the highest value was 30.
2. Hilsenhoff Biotic Index (HBI): HBI values range from 0 to 10. Low HBI values reflect a higher abundance of taxa that are sensitive to organic (nutrient) pollution, thus a lower level of this type of pollution. The average HBI per site for 2013/2014 samples was 5.4; the lowest value was 3.7 and the highest value was 8.1.
3. # of Ephemeroptera taxa: A higher number of Ephemeroptera (mayfly) taxa correlates with greater biological integrity. The average number of taxa per site for 2013/2014 samples was 2; the lowest value was 0 and the highest value was 7.
4. % of total as Chironomidae: The percentage of the sample represented by the Dipteran family Chironomidae will increase with a decrease in biological integrity. The average percent Chironomidae per site for 2013/2014 samples was 16%; the lowest value was 0% and the highest value was 77%.
5. # of EPT Taxa: A higher number of Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly) taxa correlates with greater biological integrity. The average number of EPT taxa per site for 2013/2014 samples was 4; the lowest value was 0 and the highest value was 12.
6. % of total as EPT: The percentage of the sample represented by the insect orders Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly) will decrease with a decrease in biological integrity. The average percent EPT taxa per site for 2013/2014 samples was 46%; the lowest value was 0% and the highest value was 89%.
7. % of total as Predator: The percentage of the sample represented by predators is variable with regard to biological integrity. The average percent predator per site for 2013/2014 samples was 31%; the lowest value was 3% and the highest value was 82%.
8. # of Intolerant Taxa: A higher number of pollution intolerant taxa correlates with greater biological integrity. The average number of intolerant taxa per site for 2013/2014 samples was 5; the lowest value was 0 and the highest value was 15.
9. % Dominance (top 3 taxa): The percentage of the sample represented by the three most abundant taxa will increase with a decrease in biological integrity. The average percent of sample dominated by the top three taxa per site for 2013/2014 samples was 72%; the lowest value was 39% and the highest value was 96%.

# Bee Creek Watershed

## Diatoms – Taxa List & Pollution Tolerance Index for 2014 Sample Sites (Downstream to Upstream)

Diatom Species Name	PTI	Bee @ Lake Austin (Site 319)	Bee @ Road Runner Rd (Site 322)	Bee @ Loop 360 (Site 1104)
<i>Brachysira neoexilis (serians)</i>	4	11		
<i>Diploneis oblongella</i>	4	8	2	218
<i>Eucoconeis flexella</i>	4	4		
<i>Eunotia arcus</i>	4	2	6	3
<i>Pinnularia interrupta</i>	4	2		
<i>Achnantheidium affine</i>	3	4	18	
<i>Achnantheidium alteragracillimum</i>	3	60	2	19
<i>Achnantheidium minutissimum</i>	3	43	13	156
<i>Achnantheidium pyrenaicum</i>	3	16	4	
<i>Brachysira vitrea</i>	3	14		3
<i>Cocconeis pediculus</i>	3		4	
<i>Cymbella laevis</i>	3	6	14	4
<i>Denticula kuetzingii</i>	3	72	133	
<i>Encyonema evergladianum</i>	3	14		2
<i>Encyonema silesiacum</i>	3	3	2	7
<i>Encyonopsis microcephala</i>	3	2		
<i>Eunotia bilunaris</i>	3		2	4
<i>Fragilaria capucina</i>	3	6		
<i>Gomphonema affine</i>	3	2	2	2
<i>Gomphonema intricatum var. vibrio</i>	3	10	8	
<i>Navicula radiosa</i>	3			4
<i>Tryblionella angustata</i>	3	1		
<i>Anomoeoneis sphaerophora</i>	2	4		
<i>Gomphonema angustatum</i>	2		2	
<i>Mastogloia elliptica</i>	2		1	
<i>Navicula veneta</i>	2			2
<i>Nitzschia amphibia</i>	2	25	48	6
<i>Nitzschia frustulum</i>	2			9
<i>Gomphonema parvulum</i>	1	2		2
<i>Navicymbula pusilla</i>	1	1		
<i>Cocconeis placentula var. euglypta</i>		2	1	
<i>Cymbella cistula</i>			23	
<i>Cymbella neoleptoceros</i>			6	
<i>Delicata delicatula</i>		162	189	
<i>Encyonema semilanceolatum</i>		2	2	47
<i>Gomphonema mclaughlinii</i>		1		2
<i>Sellaphora stroemii</i>		4		
<i>Ulnaria acus</i>			2	
<i>Ulnaria ulna</i>		17	16	10

# Bee Creek Watershed

## Diatoms – Metric Summary for 2014 Sample Sites (Downstream to Upstream)

Scoring Metric	Bee @ Lake Austin (Site 319)	Bee @ Road Runner Rd (Site 322)	Bee @ Loop 360 (Site 1104)
<i>Cymbella</i> Richness	5	3	3
Number of organisms	500	500	500
Number of taxa	29	23	18
Percent motile taxa	5	10	4
Percent similarity to reference condition	57	37	28
Pollution tolerance index	2.97	2.84	3.45

\* **EII scoring parameter: Four metric parameters are used in the calculation of the EII Diatom Subindex score: *Cymbella* richness, percent motile taxa, percent similarity to reference condition and pollution tolerance index. Number of taxa is non-scoring, but is shown to supplement evaluation. The number of organisms is typically a sample of 500, but occasionally differs due to sample conditions.**

1. *Cymbella* Richness: The Cymbelloid taxa include species in the genus *Cymbella*, in addition to some species belonging to the genera *Cymbellopsis*, *Cymbopleura*, *Encyonema*, *Encyonemopsis*, *Navicymbula* and *Reimeria*. Their presence highlights the presence of sensitive species, especially with regard to impervious cover, and this value increases with an increase in overall water quality. The average number of Cymbelloid taxa per site for 2013/2014 samples was 3; the lowest value was 0 and the highest value was 7.
2. % Motile Taxa: This is a siltation index showing the relative abundance of genera that are able to move towards the surface if covered by silt. A higher percentage is indicative of a degraded condition caused by increased silt pollution. The average percent motile taxa per site for 2013/2014 samples was 16%; the lowest value was 0% and the highest value was 77%.
3. % similarity to reference condition: This percentage compares a site to reference sites that are selected based on having low percent impervious cover. A higher percentage reflects greater biological integrity. The average percent similarity per site for 2013/2014 samples was 31%; the lowest value was 6% and the highest value was 57%.
4. Pollution Tolerance Index (PTI): This is a total value for a sample, which is a function of the abundance of each taxon (usually species) in a sample and the individual PTI's for each of those taxa. Individual PTI's for each taxon range from 1 (most pollution tolerant) to 4 (most pollution sensitive), thus higher total PTI's for a site reflect greater biological integrity. The average PTI per site for 2013/2014 samples was 2.76; the lowest value was 1.70 and the highest value was 3.45.

# Bee Creek Watershed

## Site Photographs



322\_t00-us-05\_21\_2004



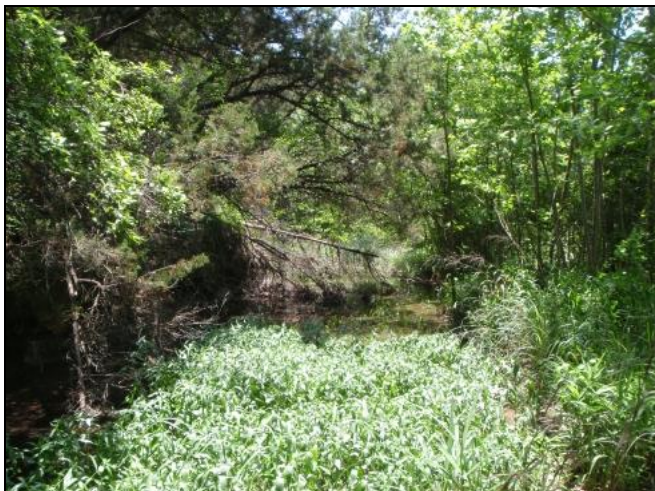
322\_t00-ds-05\_21\_2004



322\_us\_06\_18\_2007



322\_ds\_06\_18\_2007



322\_00-us-05\_17\_2010



322\_00-ds-05\_17\_2010



# Bee Creek Watershed

## Site Photographs



1104\_t00-us-05\_21\_2004



1104\_ur\_06\_19\_2007



319\_t00-ds-05\_21\_2004



319\_ds\_07\_13\_2007



319\_00-us-05\_17\_2010

SR-15-08



319\_00-ds-05\_17\_2010

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