

West Bull Creek Watershed

Summary Sheet

Catchment	Total area	6.9 sq. miles				
	Area in recharge	2.7 sq. miles				
	Creek length	5 miles				
Demographics	Receiving water	Bull Creek				
	2000 population	2,446				
	2030 projected population	10,987				
Land Use	30 year projected % increase	349 %				
	Impervious cover (2003 estimate)	6.4 %				
	Impervious cover (2013 estimate)	10.2 %				
Overall EII Scores	2001	2004	2007	2010	2012	2014
	81	78	75	75	76	74

Featured Watershed
 Phase I Watersheds
 Other Phase II Watersheds

Flow Regime* for Sample Sites on West Bull 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	Apr	May	Jul	Sep	Jan	Apr	May	Jun	Jul	Sep
148	Bell Mt	B	B	B	B	B	B	B	B	B	B	B	n	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	n
343	us Bull	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	n	B	B	B	B	B	B	n
1107	Jester Blvd	B	B	B	B	B	B	B	B	B	B	B	B																						
1030	COW @ Standing Rock	B	B	B	B	B	B	B	B	B	B	B	B																						

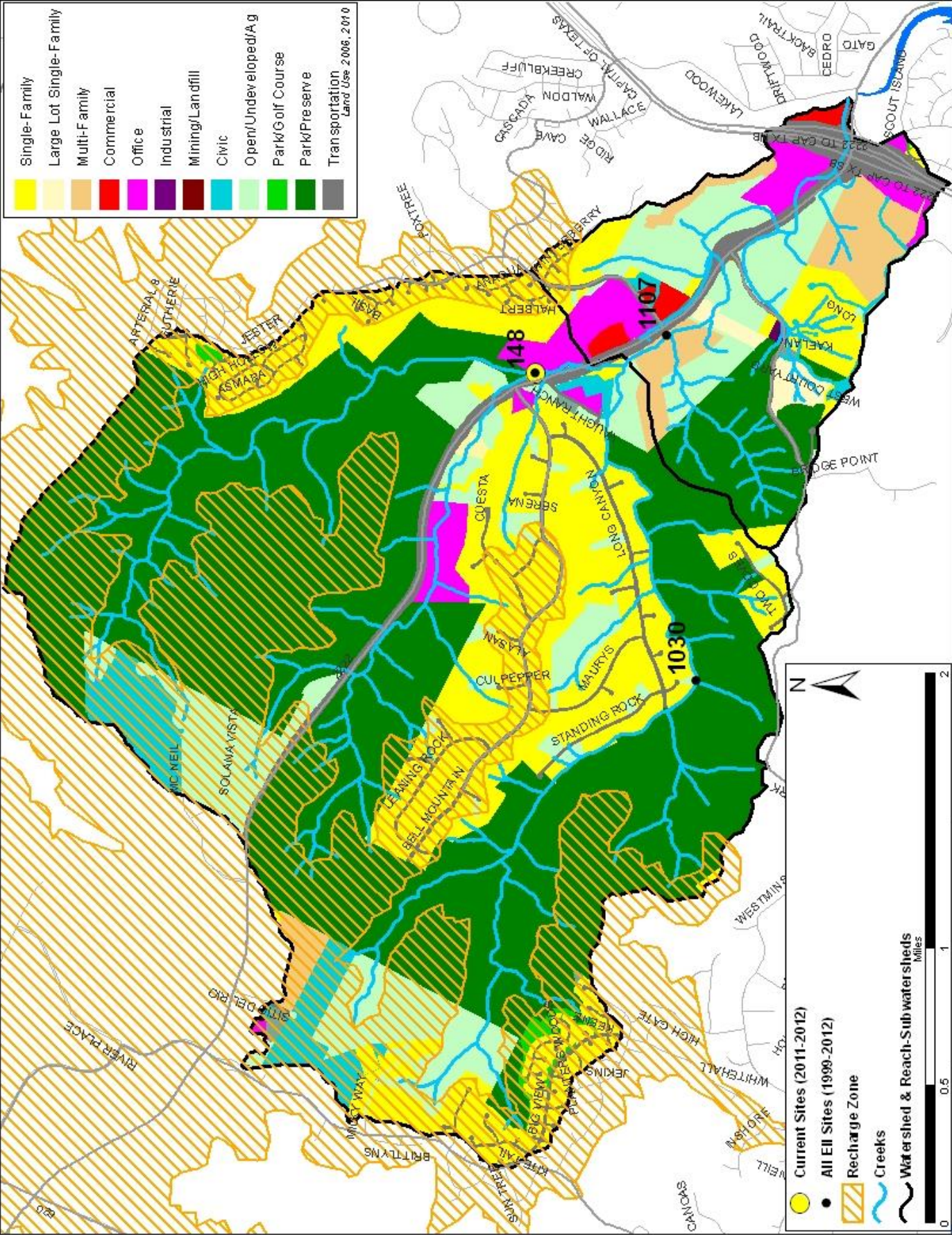
* B = baseflow n = no flow S = storm flow blue = Samples were taken light blue = Samples were not taken blank = not visited

Index scores* for West Bull 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
WBL1	1030	Cow Fork Bull Creek @ Standing Rock Trail	1998	69	85	79	93	76	88	84	92	82
WBL1	343	West Bull Creek Upstream of Bull Creek (EK)	1998	72	85	65	86	76	92	98	86	79
WBL1	1107	West Bull Creek @ Jester Blvd	1998	74	85	88	82	84	83	75	91	83
WBL2	148	West Bull Creek @ Bell Mt. Road (ED)	1998	74	85	83	83	66	71	58	84	77
WBL1	1030	Cow Fork Bull Creek @ Standing Rock Trail	2001	66	91	88	80	47	76	60	92	73
WBL1	343	West Bull Creek Upstream of Bull Creek (EK)	2001	69	91	89	87	85	89	90	87	81
WBL1	1107	West Bull Creek @ Jester Blvd	2001	68	91	95	88	84	91	90	92	82
WBL2	148	West Bull Creek @ Bell Mt. Road (ED)	2001	64	91	93	90	66	58	54	62	73
WBL1	1030	Cow Fork Bull Creek @ Standing Rock Trail	2004	65	84	52	88	86	87	80	93	77
WBL1	343	West Bull Creek Upstream of Bull Creek (EK)	2004	75	84	47	83	89	95	90	99	79
WBL1	1107	West Bull Creek @ Jester Blvd	2004	68	84	65	89	88	93	86	100	81
WBL2	148	West Bull Creek @ Bell Mt. Road (ED)	2004	68	84	59	80	72	84	81	87	75
WBL1	343	West Bull Creek Upstream of Bull Creek (EK)	2007	65	73	44	88	71	99	98	100	73
WBL2	148	West Bull Creek @ Bell Mt. Road (ED)	2007	77	73	76	96	78	62	54	70	77
WBL1	343	West Bull Creek Upstream of Bull Creek (EK)	2010	67	80	35	91	67	98	99	97	73
WBL2	148	West Bull Creek @ Bell Mt. Road (ED)	2010	70	80	60	92	79	75	74	76	76
WBL1	343	West Bull Creek Upstream of Bull Creek (EK)	2012	50	86	42	91	85	88	99	77	74
WBL2	148	West Bull Creek @ Bell Mt. Road (ED)	2012	71	86	81	86	85	59	61	57	78
WBL1	343	West Bull Creek Upstream of Bull Creek (EK)	2014	60	79	38	73	77	95	96	94	70
WBL2	148	West Bull Creek @ Bell Mt. Road (ED)	2014	70	79	57	83	76	99	100	98	77

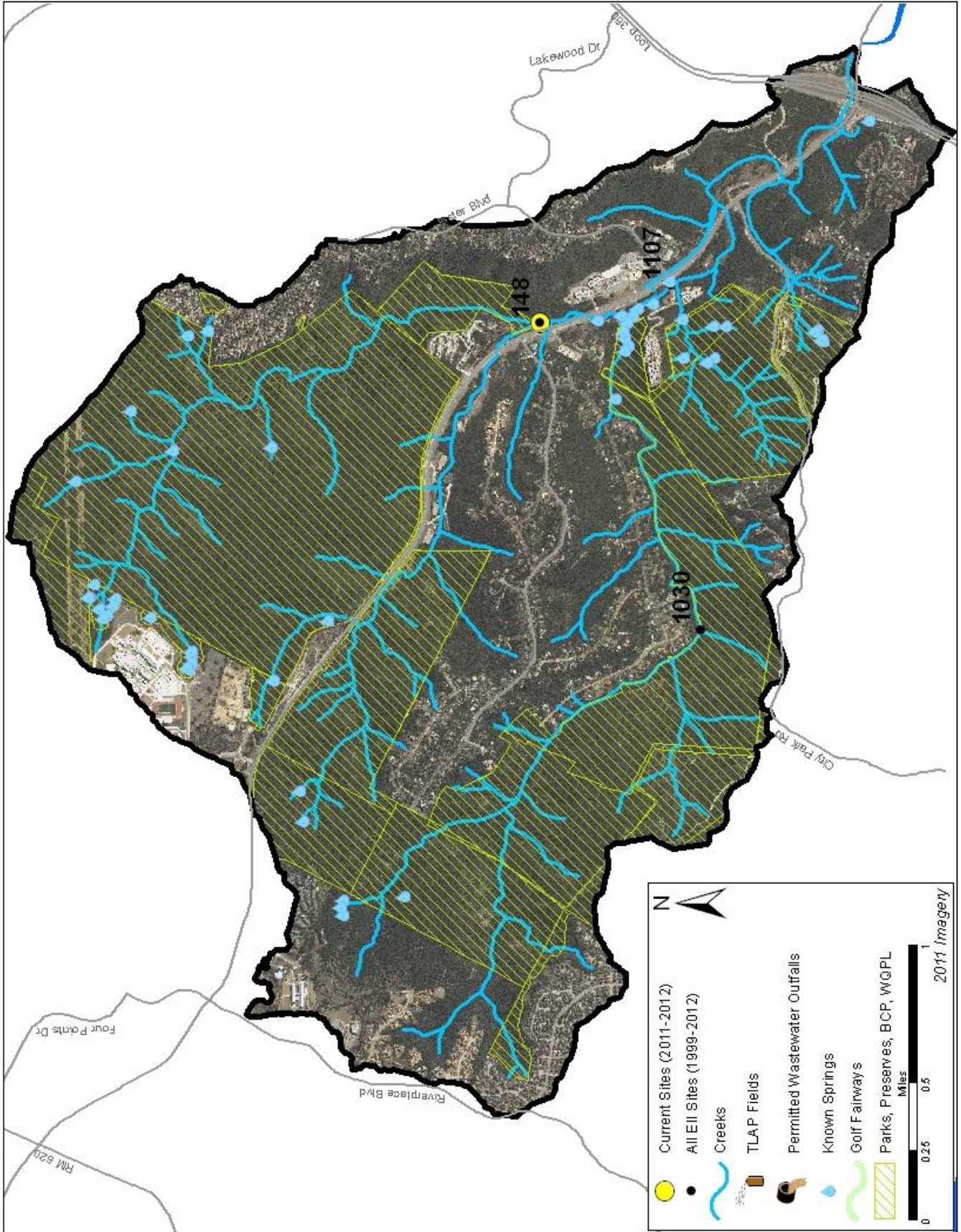
* blank cells indicate parameter was not collected, blank row indicate site was dropped **sediment samples only collected at the downstream site
 100-87.5 Excellent 87.5-75 V. Good 75-62.5 Good 62.5-50 Fair 50-37.5 Marginal 37.5-25 Poor 25-12.5 Bad 12.5-0 V. Bad

West Bull Creek Watershed
Land Use Map



West Bull Creek Watershed

Aerial Map



West Bull 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	E.coli Value	E.coli flag
West Bull us Bull Creek	343	WBL1	01/15/2014	9.4		703		8.09		11.7		53.8	
West Bull us Bull Creek	343	WBL1	04/17/2014	15.5		719		7.74		5.4		980.4	
West Bull us Bull Creek	343	WBL1	05/09/2014	21.8		774		7.57		1.8			
West Bull us Bull Creek	343	WBL1	07/02/2014	25.9		748		7.67		4.6		387.3	
Site 343 Mean				18.2		736		7.77		5.9		473.8	
West Bull @ Bell Mt. Rd	148	WBL2	01/15/2014	8.6		591		8.09		11.3		26.9	
West Bull @ Bell Mt. Rd	148	WBL2	04/17/2014	15.2		535		7.76		8.3		135.4	
West Bull @ Bell Mt. Rd	148	WBL2	06/11/2014	23.9		559		8.19		8.6			
West Bull @ Bell Mt. Rd	148	WBL2	07/02/2014	24.8		555		7.51		4.2		240.0	
Site 148 Mean				18.1		560		7.89		8.1		134.1	
Watershed Mean				18.1		648		7.83		7.0		304.0	

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
E.coli. (col/100ml)	435	1	4840	1127	

West Bull 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		
West Bull us Bull Creek	343	WBL1	01/15/2014	<J	0.008		0.46	<J	0.004	<J	1.04	0.3	R
West Bull us Bull Creek	343	WBL1	04/17/2014		0.063		0.06	<J	0.004	<J	1.03	0.1	R
West Bull us Bull Creek	343	WBL1	05/09/2014										
West Bull us Bull Creek	343	WBL1	07/02/2014	<J	0.008		0.09	<J	0.004		8.10	0.7	
Site 343 Mean					0.026		0.20		0.004		3.39	0.4	
West Bull @ Bell Mt. Rd	148	WBL2	01/15/2014	<J	0.008		0.26	<J	0.004	<J	1.04	0.2	R
West Bull @ Bell Mt. Rd	148	WBL2	04/17/2014		0.022	<J	0.01	<J	0.004		19.30	0.6	R
West Bull @ Bell Mt. Rd	148	WBL2	06/11/2014										
West Bull @ Bell Mt. Rd	148	WBL2	07/02/2014	<J	0.008		0.11	<J	0.004		3.95	0.1	
Site 148 Mean					0.013		0.13		0.004		8.10	0.3	
Watershed Mean					0.020		0.16		0.004		5.74	0.3	

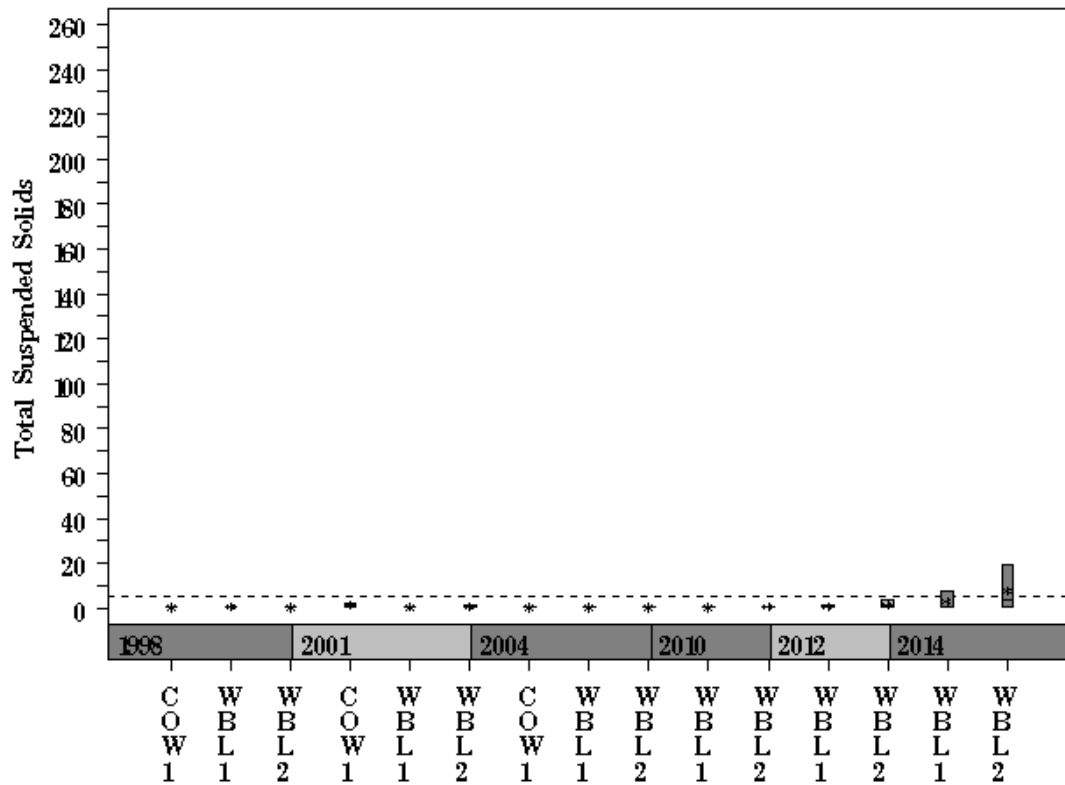
Orange highlighting indicates that the value exceeds one standard deviation from the mean of all E.I.I. sites combined.

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

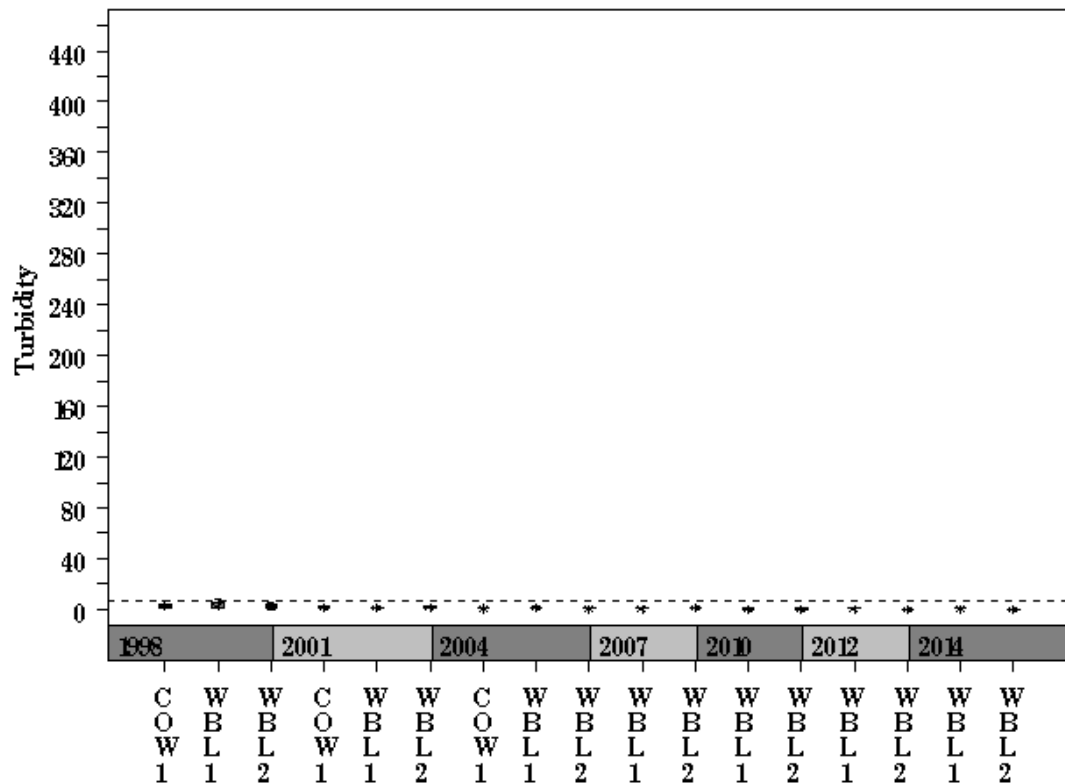
West Bull Creek Watershed

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

Parameter= TOTAL SUSPENDED SOLIDS Unit= mg/L Watershed= West Bull



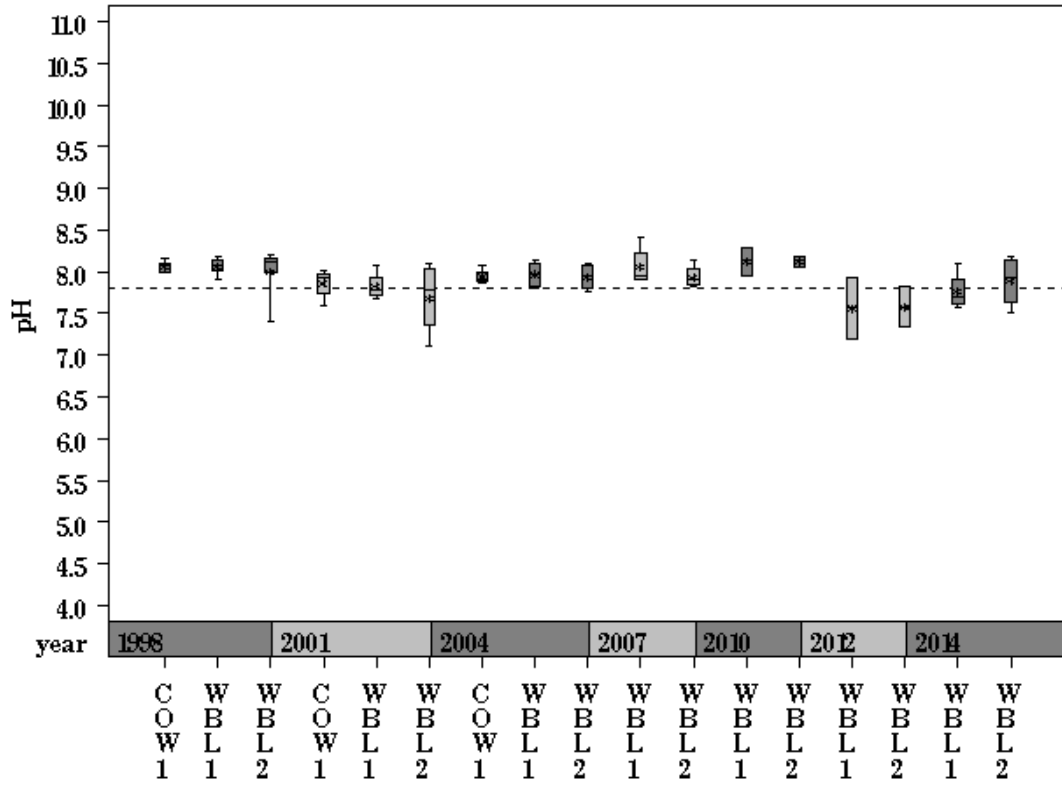
Parameter= TURBIDITY Unit= NTU Watershed= West Bull



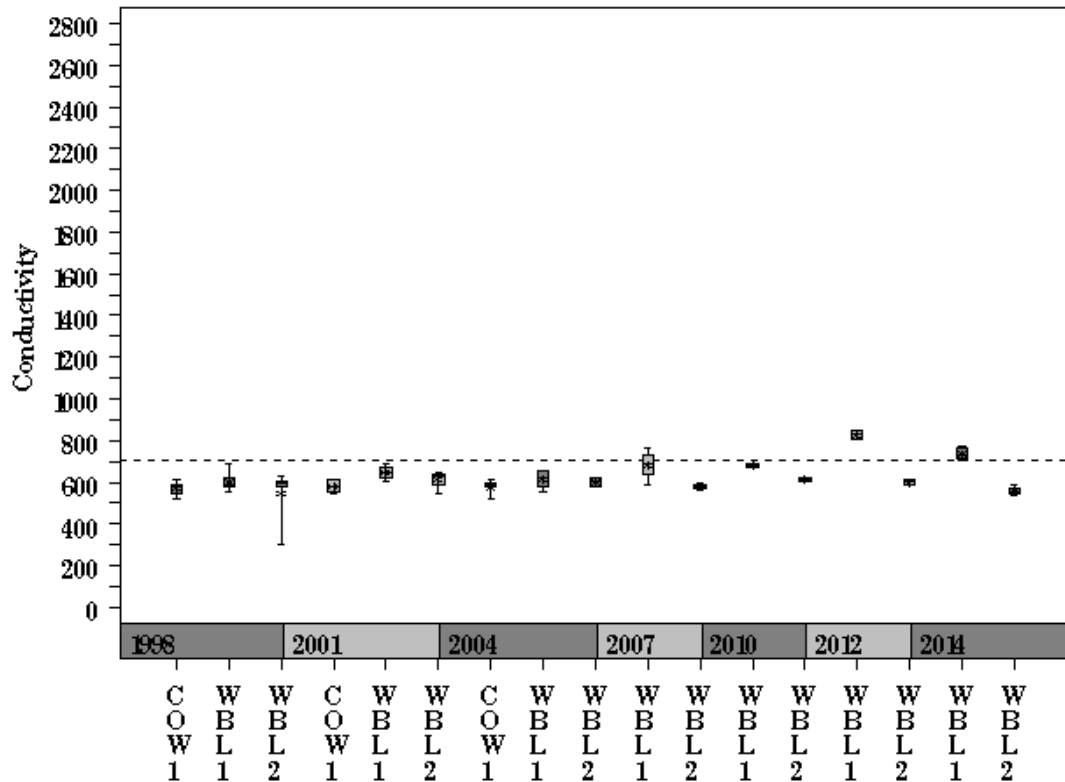
West Bull Creek Watershed

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

Parameter= PH Unit= Standard units Watershed= West Bull



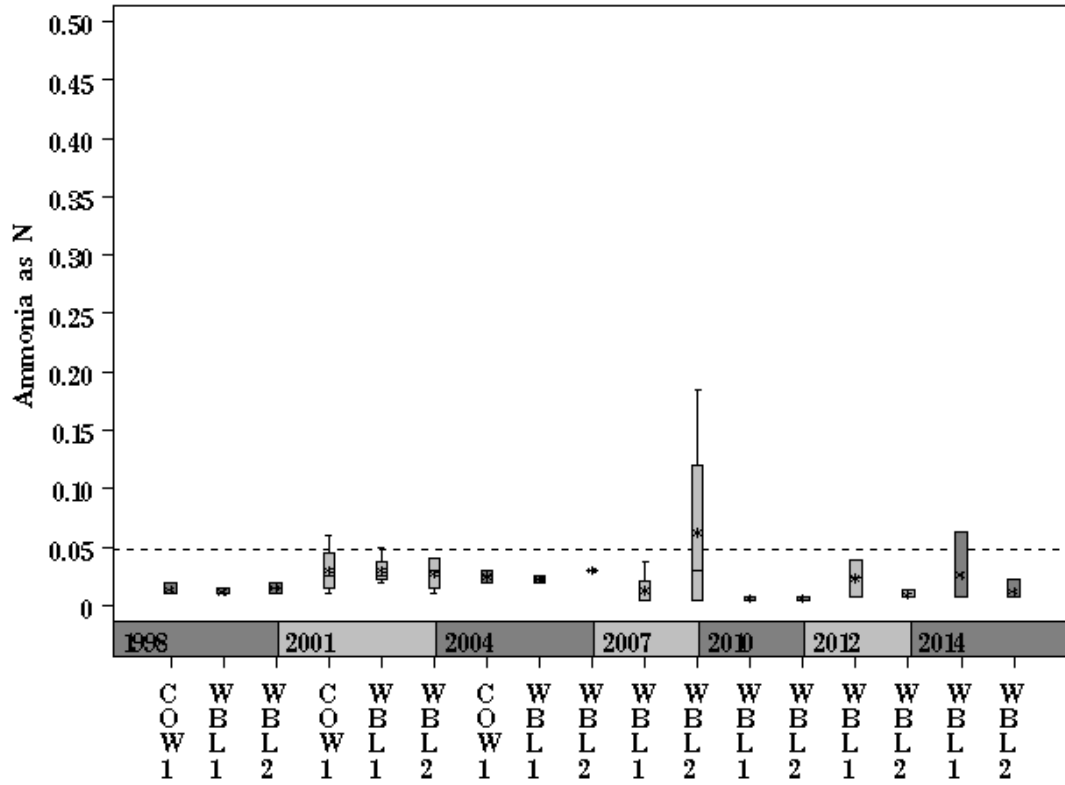
Parameter= CONDUCTIVITY Unit= uS/cm Watershed= West Bull



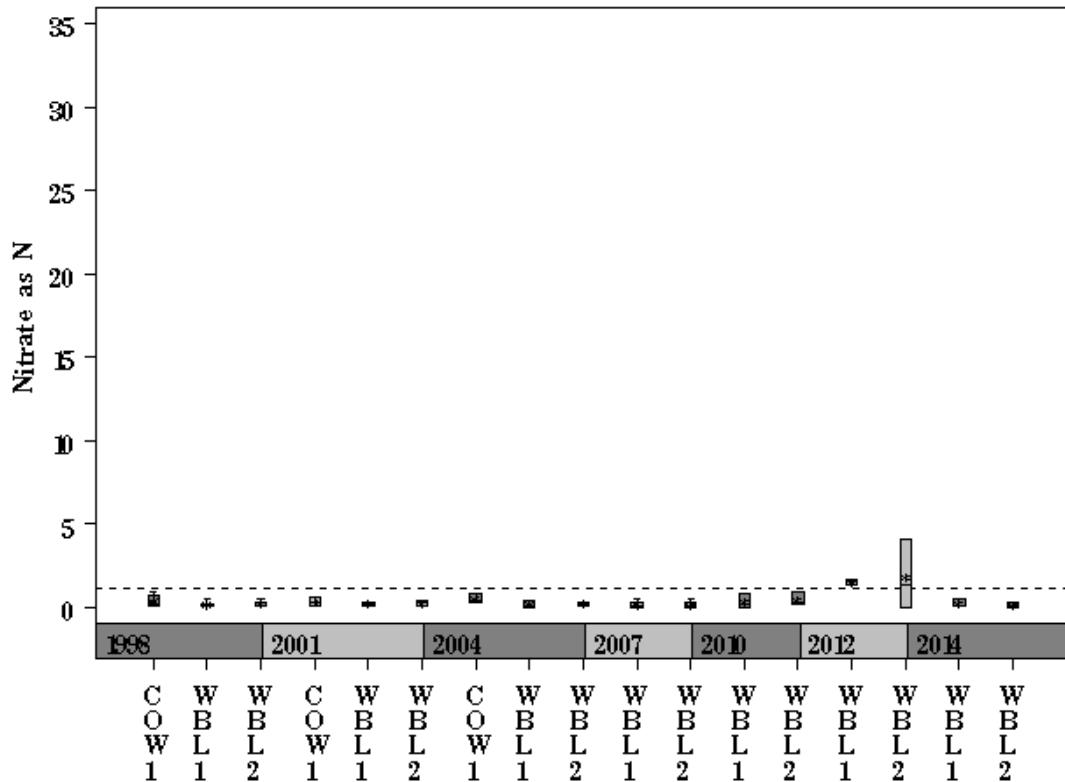
West Bull Creek Watershed

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

Parameter= AMMONIA AS N Unit= mg/L Watershed= West Bull



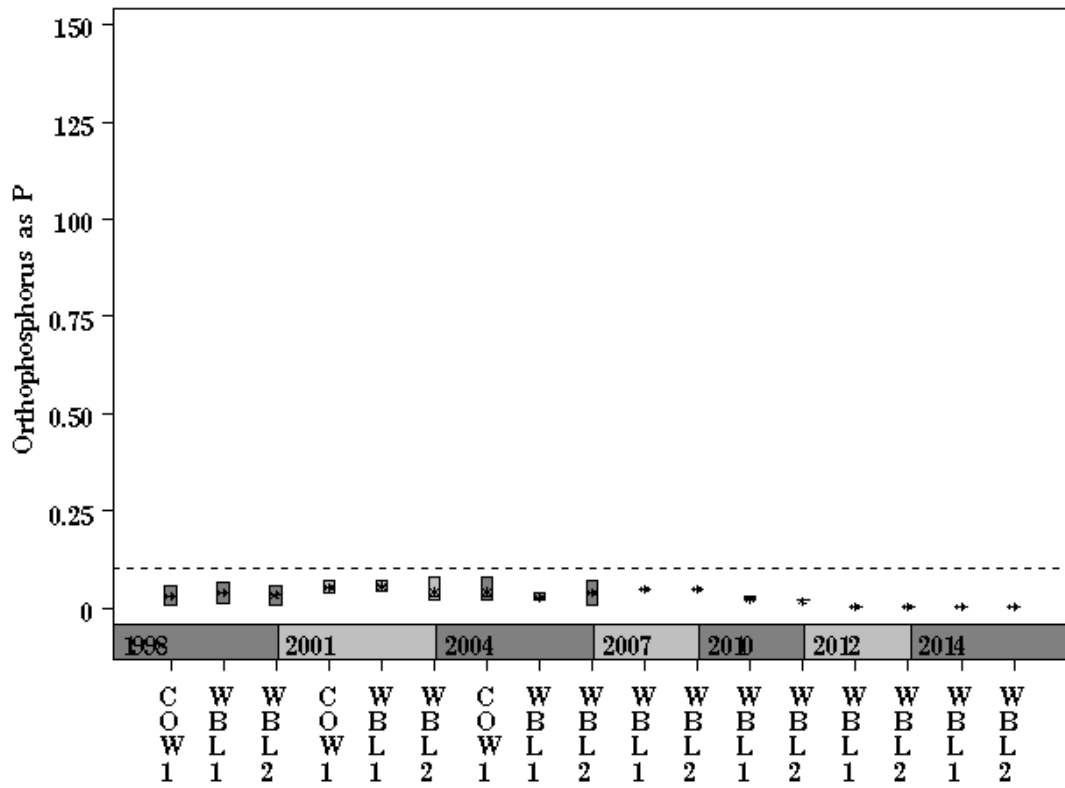
Parameter= NITRATE AS N Unit= mg/L Watershed= West Bull



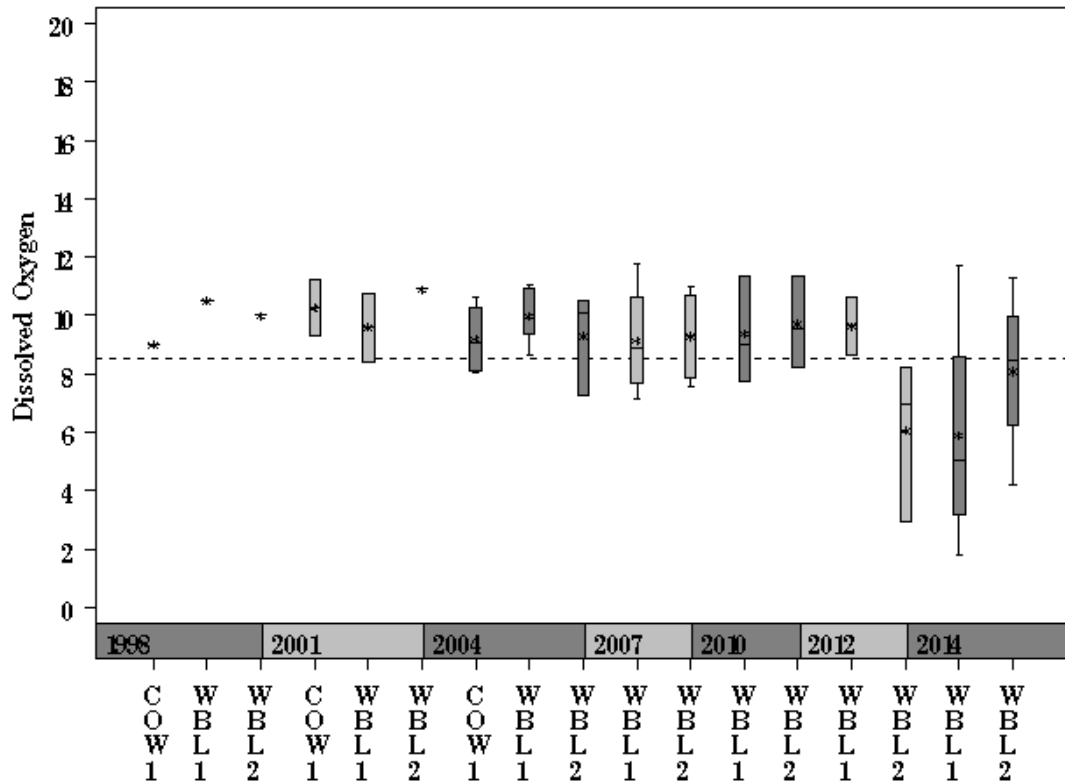
West Bull Creek Watershed

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

Parameter= ORTHOPHOSPHORUS AS P Unit= mg/L Watershed= West Bull



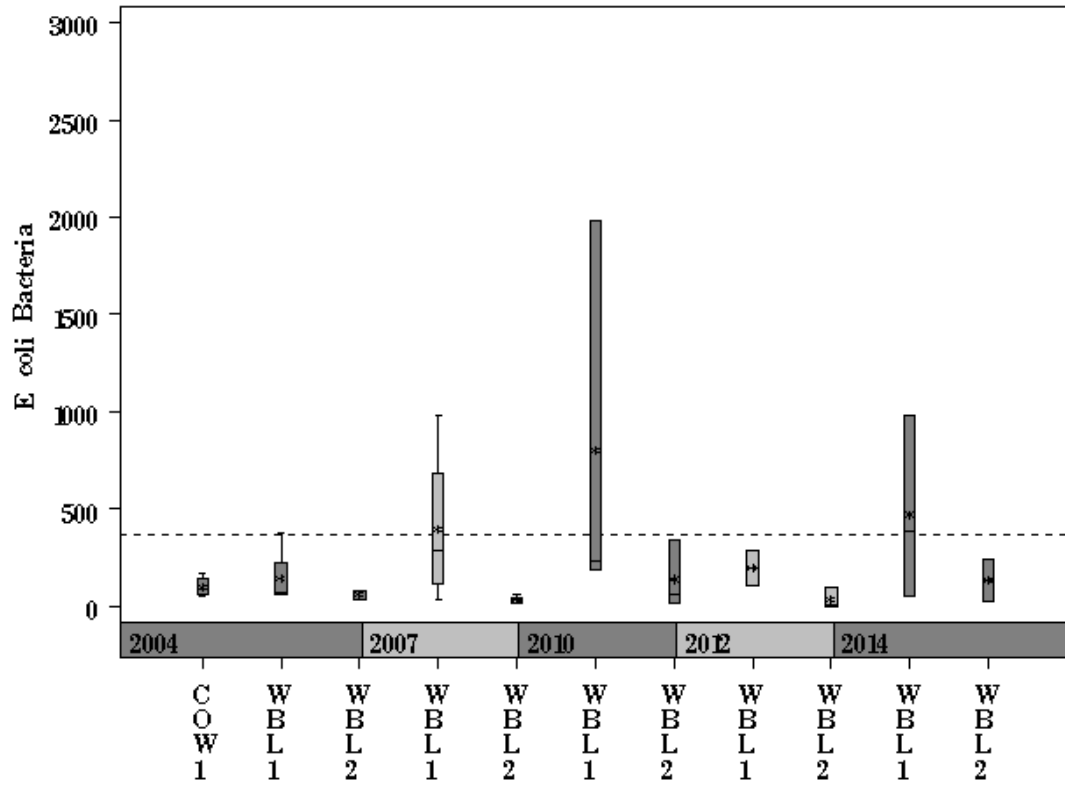
Parameter= DISSOLVED OXYGEN Unit= mg/L Watershed= West Bull



West Bull Creek Watershed

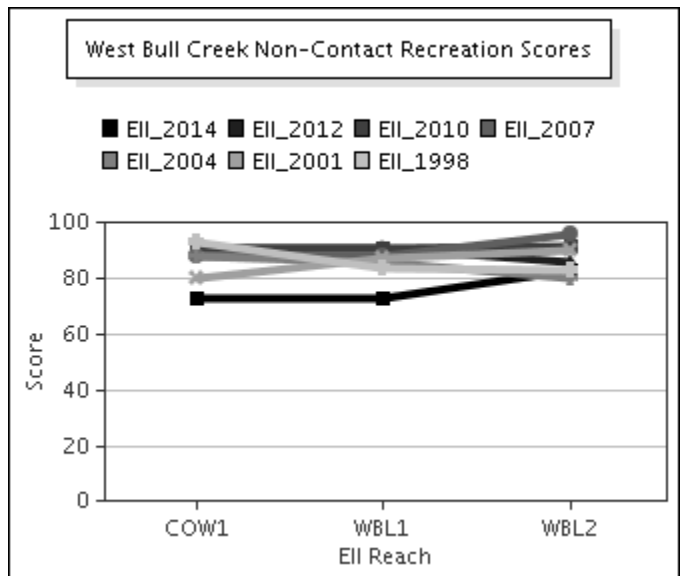
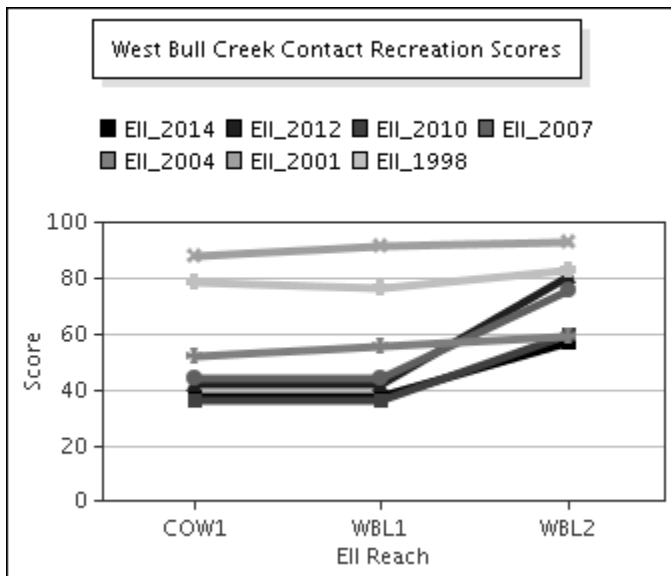
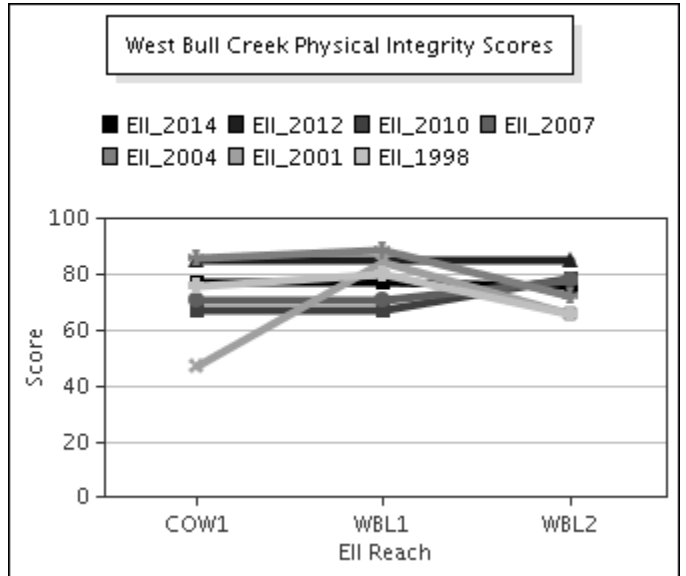
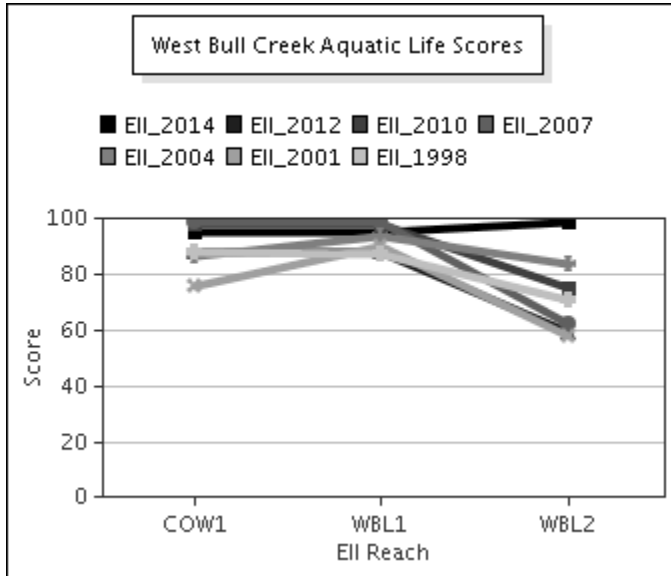
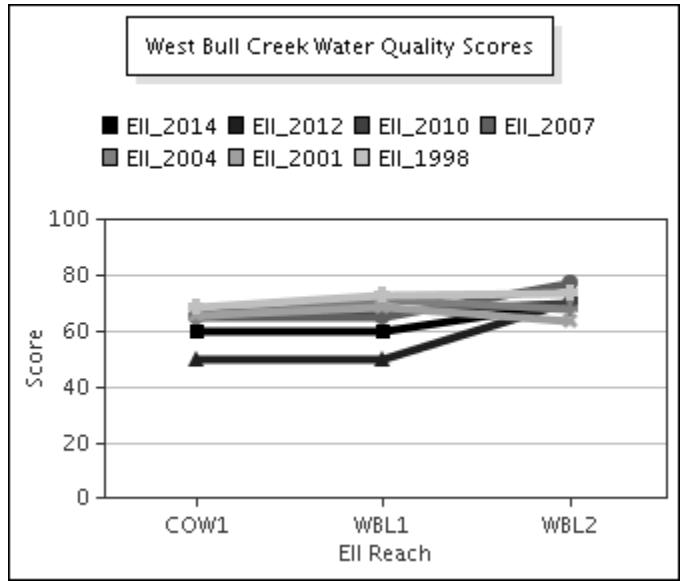
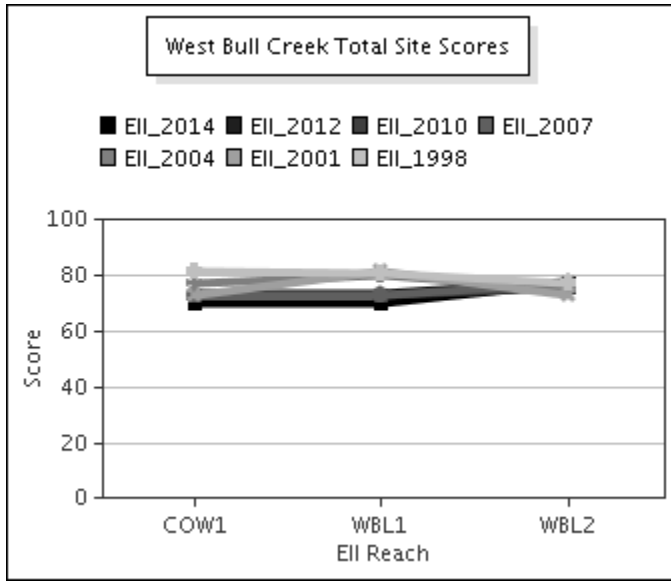
Data Summary Graphs – *E.coli* (Downstream to Upstream by Year)

Parameter= E COLI BACTERIA Unit= MPN/100mL Watershed= West Bull



West Bull Creek Watershed

Score Summary – Reach scores for each sample year



West Bull Creek Watershed

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

Benthic Macroinvertebrate ID	PTI	FFG	West Bull us Bull Creek (Site 343)	West Bull @ Bell Mt. Rd (Site 148)
<i>Perlesta</i> sp.	0	P	3	
<i>Chimarra</i> sp.	2	FC	4	10
<i>Helicopsyche</i> sp.	2	SC	1	
<i>Hydroptila</i> sp.	2	SC,PI	3	1
<i>Microcylloepus pusillus</i>	2	SC,CG	1	
<i>Gammarus</i> sp.	3	SH,CG	2	
<i>Callibaetis</i> sp.	4	CG	1	1
<i>Camelobaetidius</i> sp.	4	CG	1	6
<i>Fallceon quilleri</i>	4	SC,CG	44	44
Ostracoda	4	FC,CG	24	
<i>Psephenus</i> sp.	4	SC	4	
<i>Simulium</i> sp.	4	FC		2
<i>Ambrysus</i> sp.	5	P	1	
<i>Helochaers</i> sp.	5	CG	1	
<i>Lutrochus</i> sp.	5	CG	1	
<i>Archilestes</i> sp.	6	P		2
<i>Argia</i> sp.	6	P	8	9
<i>Cheumatopsyche</i> sp.	6	FC	24	7
Chironomidae	6	P,FC	23	4
Hydracarina	6		5	2
<i>Microvelia</i> sp.	6	P	8	
<i>Rhagovelia</i> sp.	6	P	3	2
<i>Stenonema femoratum</i>	6	SC,CG	26	1
Tanypodinae	6	P	13	1
<i>Stenelmis</i> sp.	7	SC,CG	11	
<i>Anopheles</i> sp.	8	FC	1	
<i>Caloparyphus</i> sp. / <i>Euparyphus</i> sp.	8	SC,CG	8	9
<i>Hyalella</i> sp.	8	SH,CG	7	
<i>Physella</i> sp.	9	SC	1	5
<i>Dugesia</i> sp.		P,CG	34	

West Bull Creek Watershed

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

Scoring Metric	West Bull us Bull Creek (Site 343)	West Bull @ Bell Mt. Rd (Site 148)
Number of Taxa *	27	15
Hilsenhoff Biotic Index *	5.3	4.9
Number of Ephemeroptera Taxa *	4	4
Percent of Total as Chironomidae *	14	5
Number of EPT Taxa *	9	7
Percent of Total as EPT *	41	66
Percent of Total as Predator *	35	17
Number of Intolerant Taxa *	11	6
Percent Dominance (Top 3 Taxa) *	40	59
EPT / EPT + Chironomidae	1	1
Number of Diptera Taxa	3	3
Number of Non-Insect Taxa	6	2
Number of Organisms	263	106
Percent Dominance (Top 1 Taxa)	17	42
Percent of Total as Collector / Gatherer	61	58
Percent of Total as Dominant Guild (FFG)	61	58
Percent of Total as Elmidae	5	0
Percent of Total as Filterers	34	23
Percent of Total as Grazers (PI & SC)	38	57
Percent of Total as Tolerant Organisms	0	5
Percent of Trichoptera as Hydropsychidae	75	39
Ratio of Intolerant : Tolerant Organisms	0.65	1.52
TCEQ Qualitative Aquatic Life Use Score	30	24
TCEQ Quantitative Aquatic Life Use Score	37	31

* **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%.

West Bull Creek Watershed

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

Diatom Species Name	PTI	West Bull us Bull Creek (Site 343)	West Bull @ Bell Mt. Rd (Site 148)
<i>Brachysira neoexilis (serians)</i>	4	2	30
<i>Cymbella cymbiformis</i>	4		2
<i>Diploneis oblongella</i>	4		3
<i>Eunotia arcus</i>	4	4	6
<i>Platessa hustedtii</i>	4	1	
<i>Rhopalodia parallela</i>	3.2		8
<i>Achnanthydium affine</i>	3	2	
<i>Achnanthydium alteragracillimum</i>	3	22	113
<i>Achnanthydium minutissimum</i>	3	28	81
<i>Achnanthydium pyrenaicum</i>	3	33	12
<i>Brachysira vitrea</i>	3	4	4
<i>Cymbella hustedtii</i>	3		1
<i>Denticula kuetzingii</i>	3	34	16
<i>Diploneis puella</i>	3		2
<i>Encyonema evergladianum</i>	3	33	79
<i>Encyonopsis microcephala</i>	3	8	25
<i>Eunotia bilunaris</i>	3	2	
<i>Fragilaria delicatissima</i>	3	4	
<i>Gomphonema affine</i>	3	2	
<i>Mastogloia smithii</i>	3		8
<i>Navicula cryptotenella</i>	3	4	
<i>Reimeria sinuata</i>	3		2
<i>Fragilaria vaucheriae</i>	2	49	
<i>Gomphonema angustatum</i>	2	10	2
<i>Navicula veneta</i>	2	2	
<i>Gomphonema parvulum</i>	1		1
<i>Sellaphora seminulum</i>	1		2
<i>Cymbella excisa</i>		56	
<i>Cymbella neoleptoceros</i>		4	
<i>Delicata delicatula</i>		150	72
<i>Encyonema semilanceolatum</i>		8	
<i>Fragilaria sepes</i>		8	
<i>Gomphonema lagenula</i>			6
<i>Sellaphora stroemii</i>		14	2
<i>Ulnaria ulna</i>		16	23

West Bull Creek Watershed

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

Scoring Metric	West Bull us Bull Creek (Site 343)	West Bull @ Bell Mt. Rd (Site 148)
<i>Cymbella</i> Richness	4	5
Number of organisms	500	500
Number of taxa	25	23
Percent motile taxa	1	0
Percent similarity to reference condition	48	52
Pollution tolerance index	2.78	3.09

* **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.

West Bull Creek Watershed

Site Photographs



148_t00-us-05_20_2004



148_t00-ds-05_20_2004



148_00-ur-05_26_2010



148_00-ds-05_26_2010



1030_t00-us-05_20_2004



1030_t00-ds-05_20_2004

West Bull Creek Watershed

Site Photographs



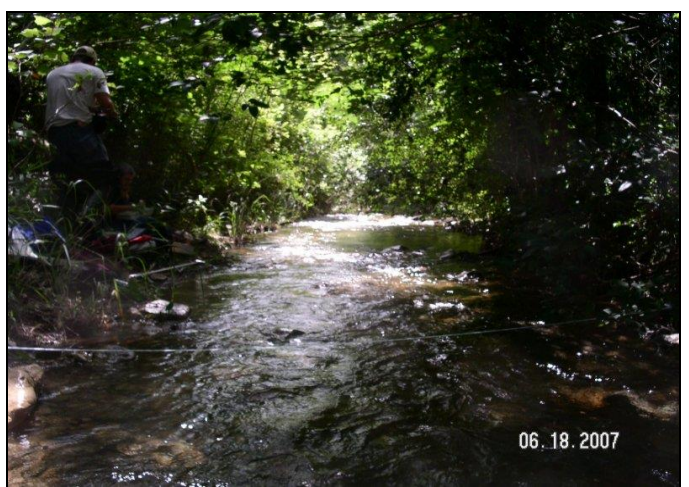
1107_t00-us-05_20_2004



1107_t00-ds-05_20_2004



343_t00-us-05_19_2004



343_ds_06_18_2007



343_00-ur-05_26_2010



343_00-ds-05_26_2010

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