BIG DRY CREEK
Biological Monitoring Update

December 12, 2019

Aquatics Associates, Inc.
Fort Collins, CO

Biological Monitoring Sites in Big Dry Creek

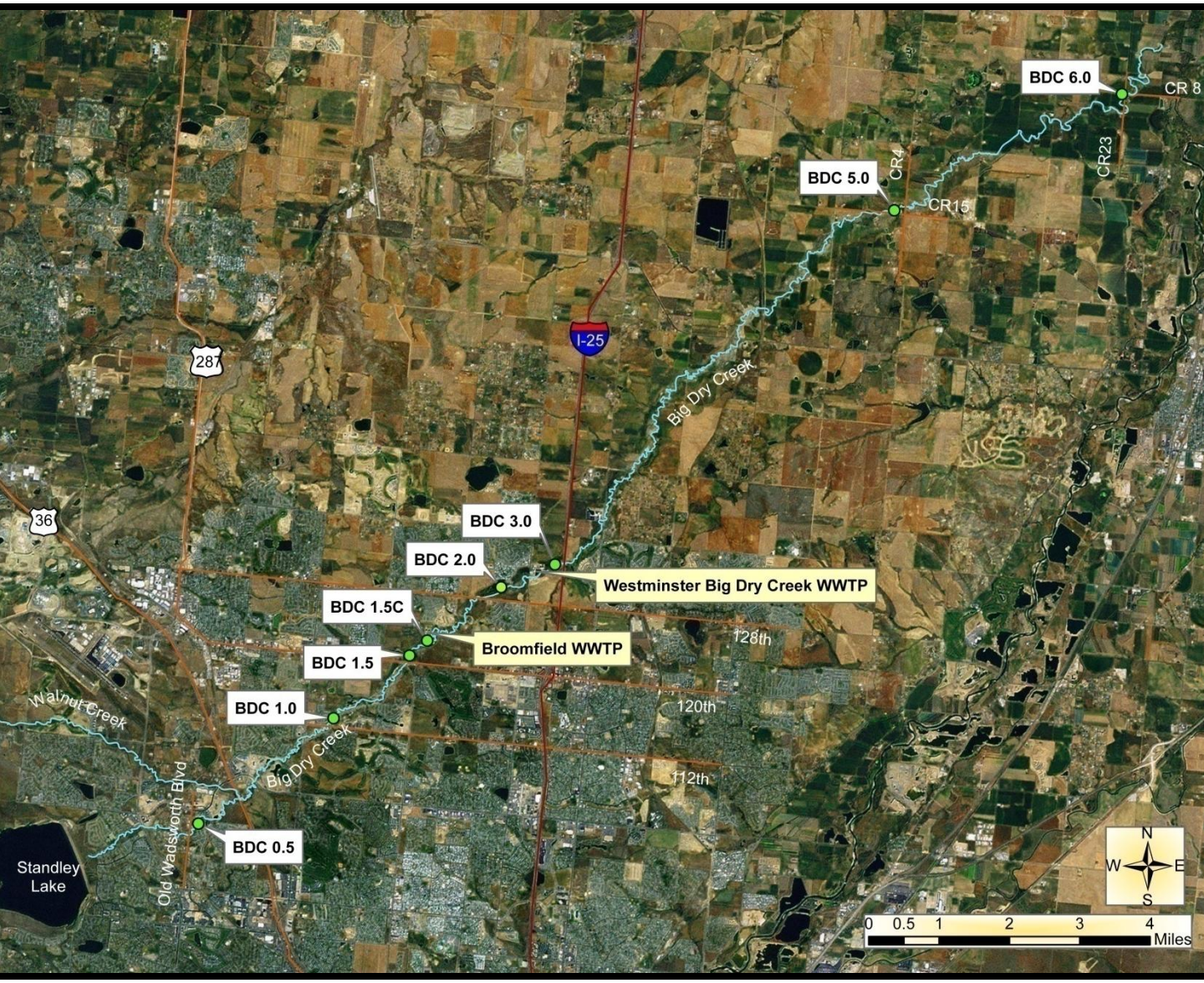


TABLE 1

BIOLOGICAL MONITORING SITES IN BIG DRY CREEK, 1997-2018

Study Site		Distance Between Sites	Cumulative Distance
UPSTREAM FROM WWTPs		*Distance from Standley Lake dam*	
bdc0.5	Church Ranch Open Space, downstream from Old Wadsworth Boulevard	1.5 mi.	1.5 mi.
bdc1.0	Downstream from 112th Avenue	2.8 mi.	4.3 mi.
bdc1.5	Downstream from 120th Avenue 1/	1.5 mi.	5.8 mi.
bdc1.5C	Immediately upstream from Broomfield WWTP 2/	0.4 mi.	6.2 mi.
DOWNSTREAM FROM WWTPs			
bdc2.0	Upstream from 128th Avenue, downstream from Broomfield WWTP	1.5 mi.	7.7 mi.
bdc3.0	At Interstate-25, downstream from Westminster Big Dry Creek WWTP	1.0 mi.	8.7 mi.
bdc5.0	Downstream from Weld County Road 4	8.2 mi.	16.9 mi.
bdc6.0	Near Wattenberg and Weld County Road 23, Upstream from bridge on Weld County Road 8 1/	5.8 mi.	22.7 mi.

1/ Sampling was discontinued at sites bdc1.5 and bdc6.0 in 2008.
2/ Site bdc1.5C was added to program in spring 2000.

BDC Sampling

BDC Fish Sampling

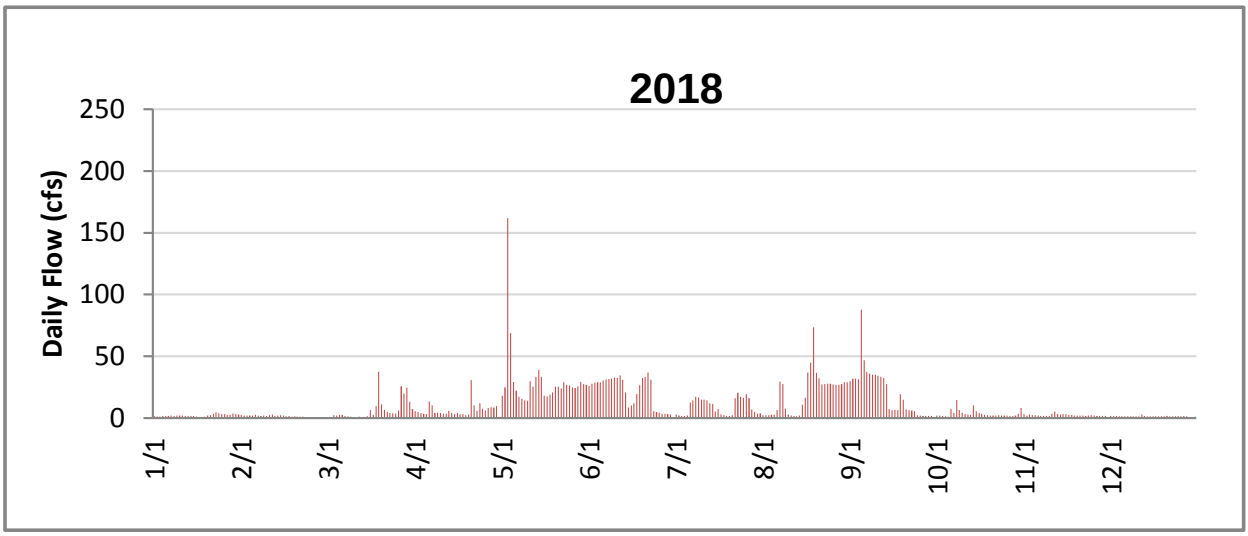
BDC Fish Sampling

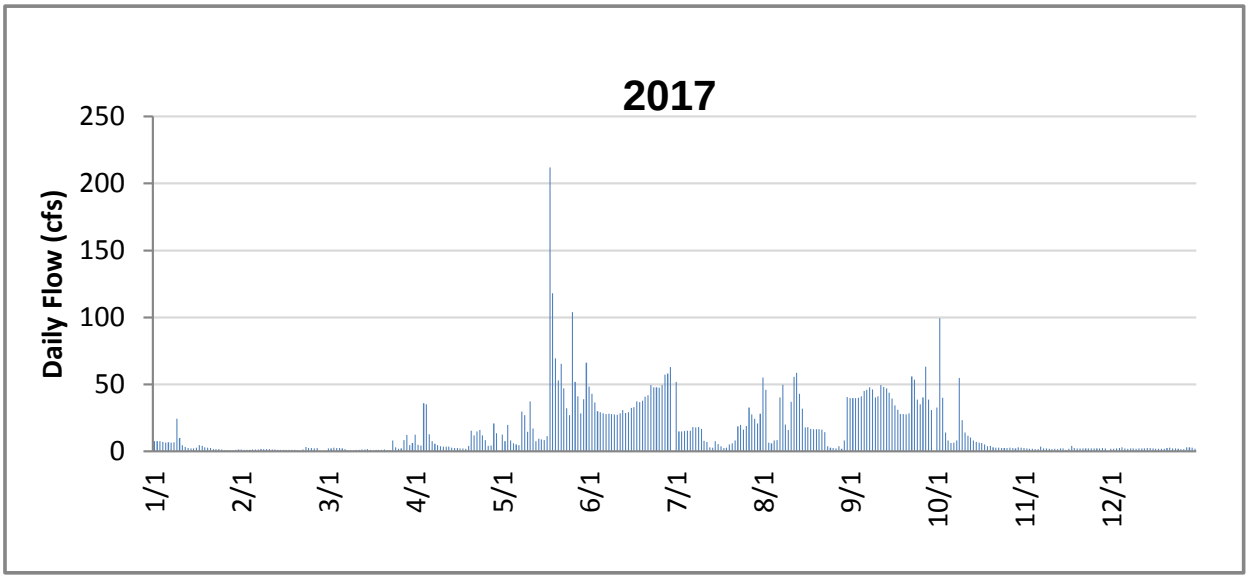
Measuring big common carp at bdc5.0 in Oct 2018

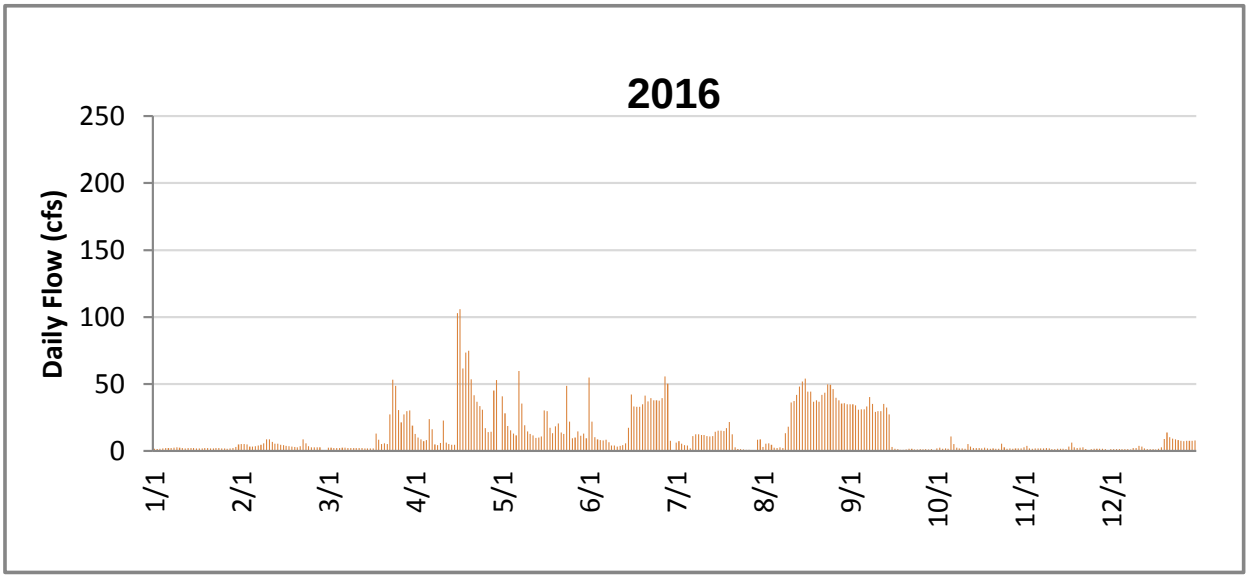
Fish measurements

BDC Important Native Fish Species

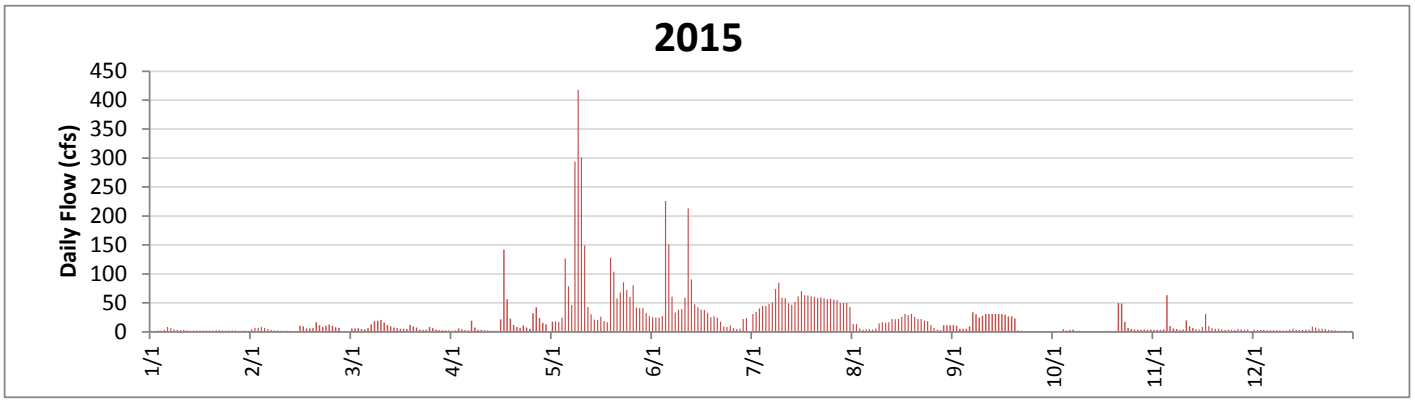
BDC Stream Flow Data

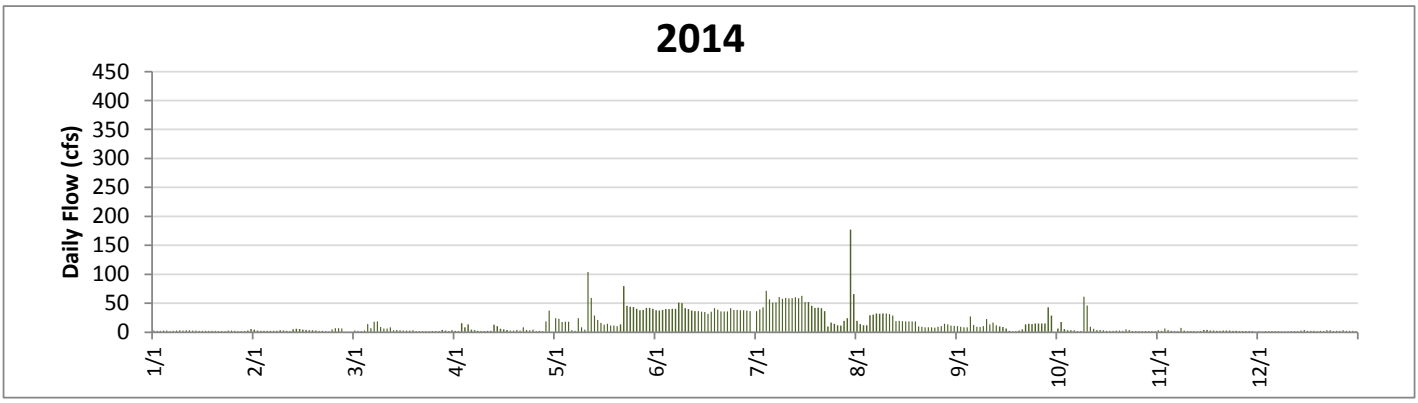


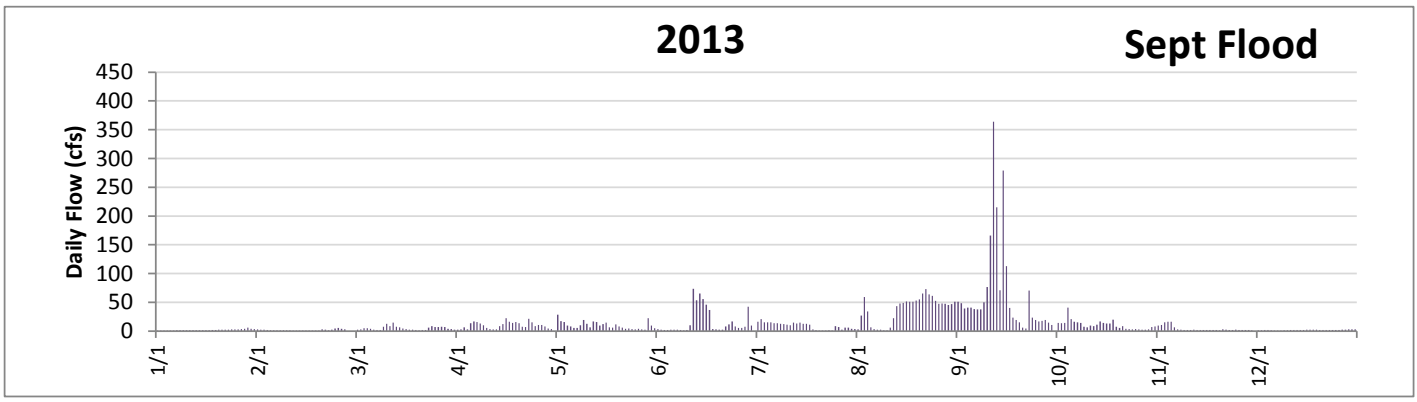


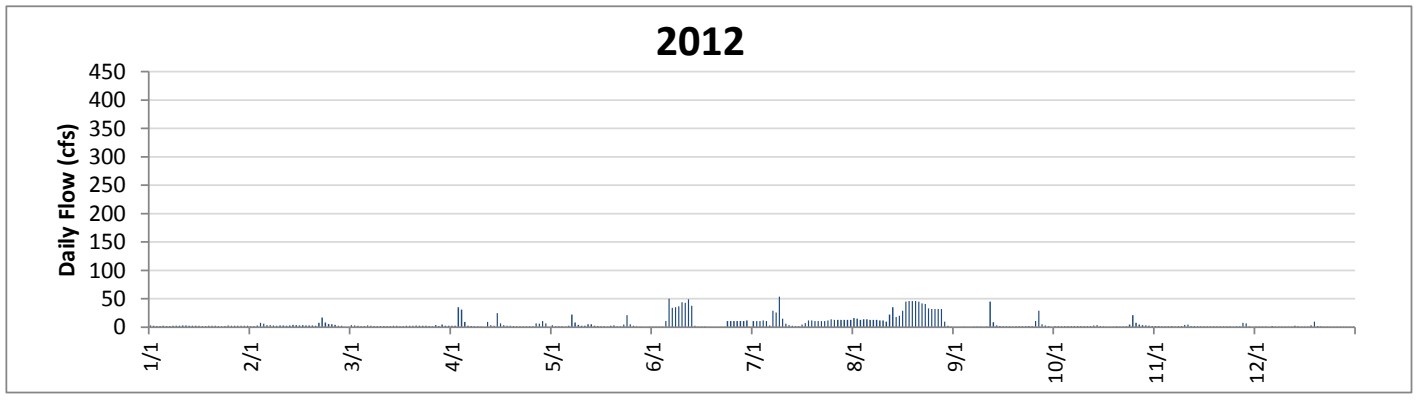


BDC Stream Flow Data









BDC 0.5


Low flow and dense algae and
aquatic weed growth in Oct 2018


Low flow restricting stream
area available for fish in
Oct 2018
Exposed mud

BDC 1.0


Overhanging riparian vegetation
Abundant cobble substrate preferred by longnose dace


Trees along channel no longer present by Oct 2018
Eroded bank
Pool and run habitats providing good fish cover even at low flow conditions

BDC 1.5C


Abundant trees shade
most of the stream reach


Overhanging
vegetation providing
fish cover
Small riffle washed out by Oct 2018.
Only few areas with small cobble substrate.


Overhanging
grasses
Reach more channelized by Oct 2018.
Deep run habitat with sand/silty uniform
bottom common.

BDC 2.0

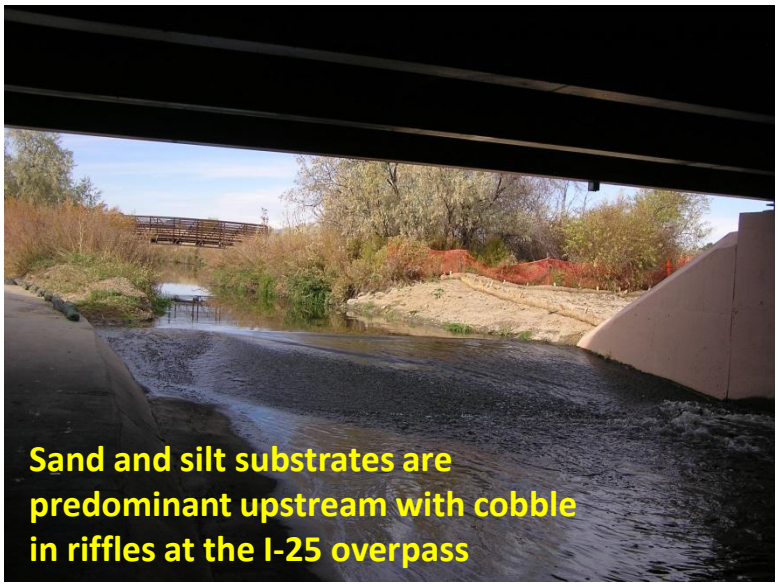

Sand and silt substrates
are predominant with
small areas of gravel

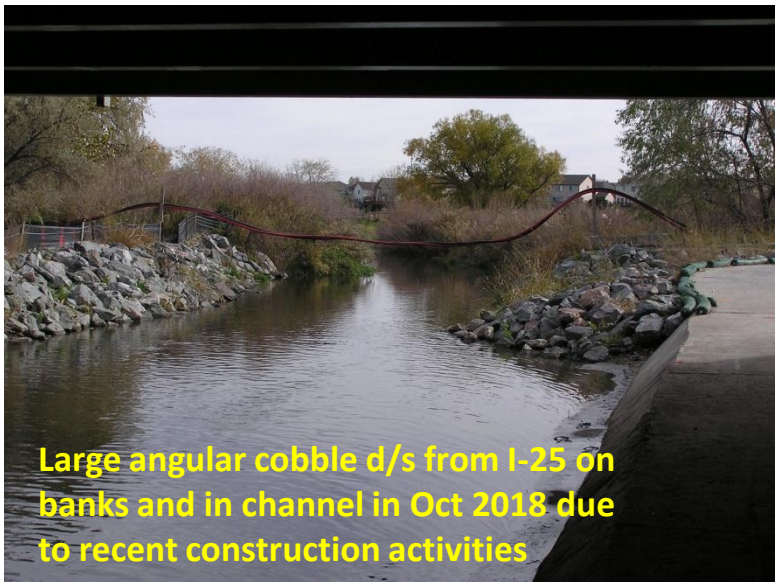

Large woody debris
providing good
instream cover for fish


Banks covered by
grasses and riparian
vegetation
Some eroded and
collapsed stream banks

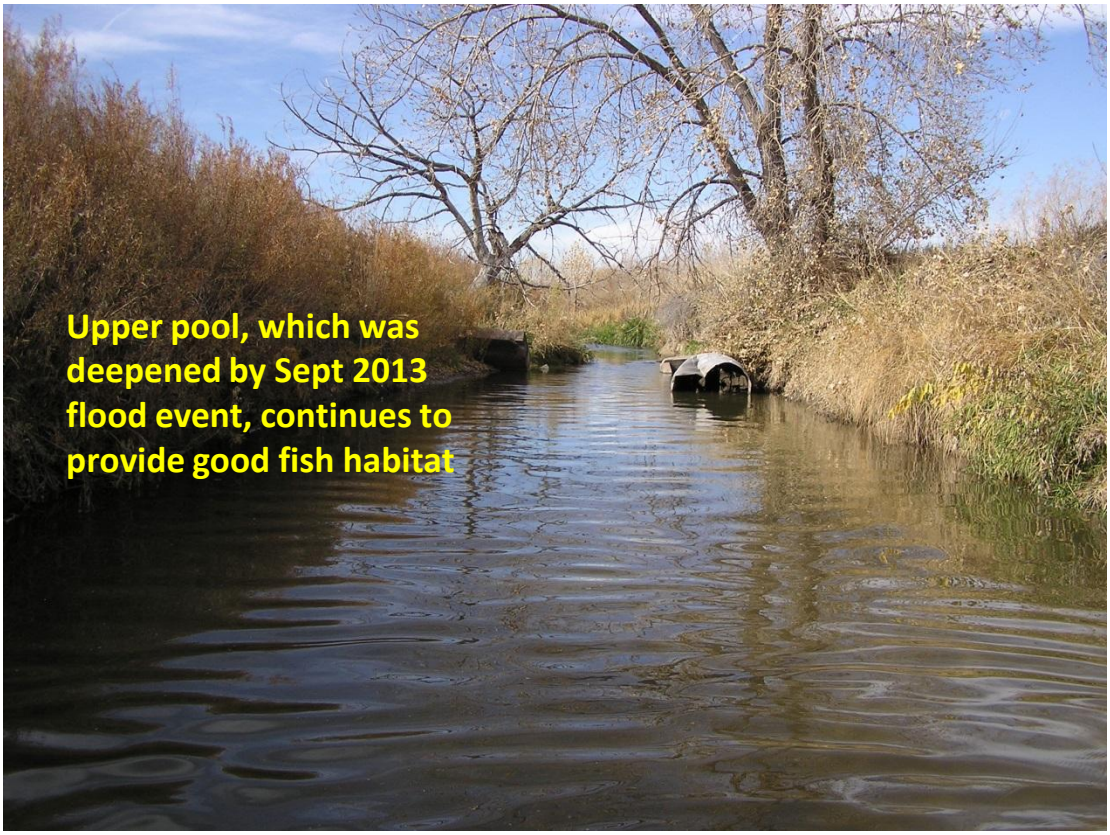
BDC 3.0


Overhanging grasses provide good cover for fish
Deep channelized reach upstream from I-25


Sand and silt substrates are predominant upstream with cobble in riffles at the I-25 overpass


Large angular cobble d/s from I-25 on banks and in channel in Oct 2018 due to recent construction activities

BDC 5.0


Upper pool, which was deepened by Sept 2013 flood event, continues to provide good fish habitat


Banks well-vegetated with overhanging grasses in Oct 2018
Good flow conditions for fish and macroinvertebrate sampling in the stream reach in Oct 2018

Append B-1
FISH POPULATION DATA SUMMARY FALL 2018

RELATIVE ABUNDANCE

	0.5	1.0	1.5C	2.0	3.0	5.0
Longnose Dace	**11.4**	**27.9**	1.6	1.3	**67.2**	1.0
Creek Chub	**54.4**	**38.4**	**23.9**	**20.0**	1.1	**15.5**
Fathead Minnow	**19.7**	4.4	**17.9**	**40.0**	**9.6**	**15.2**
Sand Shiner	-	**7.3**	0.3	-	5.3	**45.4**
White Sucker	**11.4**	**17.8**	**30.8**	**34.4**	**8.8**	**13.6**
Longnose Sucker	3.1	-	-	0.1	-	-
Johnny Darter	0.04	**4.1**	**18.9**	1.2	-	0.1
Green Sunfish	-	-	6.6	3.0	6.5	0.2
Black Bullhead	-	-	-	-	-	1.0
Brook Stickleback	-	-	-	-	-	0.2
Mosquitofish	-	-	-	-	0.1	1.2
Largemouth Bass	-	-	-	-	-	2.4
Common Carp	-	-	-	0.1	0.4	**3.5**
Black Crappie	-	-	-	-	0.2	-
Bluegill	-	-	-	-	0.8	0.9

NUMBER COLLECTED

	0.5	1.0	1.5C	2.0	3.0	5.0
Longnose Dace	**258**	**425**	5	21	**629**	12
Creek Chub	**1229**	**586**	**76**	**323**	10	**191**
Fathead Minnow	**444**	67	**57**	**646**	**90**	**188**
Sand Shiner	-	**112**	1	-	50	**561**
White Sucker	**258**	**272**	**98**	**556**	**82**	**168**
Longnose Sucker	70	-	-	1	-	-
Johnny Darter	**1**	**63**	**60**	**19**	-	**1**
Green Sunfish	-	-	21	48	61	2
Black Bullhead	-	-	-	-	-	12
Brook Stickleback	-	-	-	-	-	2
Mosquitofish	-	-	-	-	1	15
Largemouth Bass	-	-	-	-	-	29
Common Carp	-	-	-	1	4	**43**
Black Crappie	-	-	-	-	2	-
Bluegill	-	-	-	-	7	11

Total Collected	2260	1525	318	1615	936	1235	all sites
Total Species Collected	6	6	7	8	10	13	15
Native Species	6	6	7	7	6	9	10

Append B-2
BDC FISH SUMMARY DATA 1999-2018
Comparison of Fish Numbers

	Numbers of Fish Collected					
Years	0.5	1.0	1.5C	2.0	3.0	5.0
1999	1892	144	ns	967	940	1464
2000	1212	360	1149	230	990	1125
2001	780	351	496	222	152	794
2002	854	883	172	**59**	**88**	2612
2003	856	831	196	**9**	**68**	1762
2004	226	531	72	**38**	**67**	674
2006	841	2171	398	336	762	2660
2008	999	1012	206	66	255	611
2010	688	374	176	129	416	3833
2012	470	797	403	**1394**	**1118**	2849
2014	1474	541	289	**629**	**691**	419
2016	648	754	319	**716**	225	1772
2018	**2260** max	**1525**	318 min	**1615**	**936**	**1235**

ns indicates not sampled.

FIGURE 4

COMPARISONS OF NUMBERS OF FISH AND SPECIES COLLECTED AT BIG DRY CREEK SITES, 2008-2018

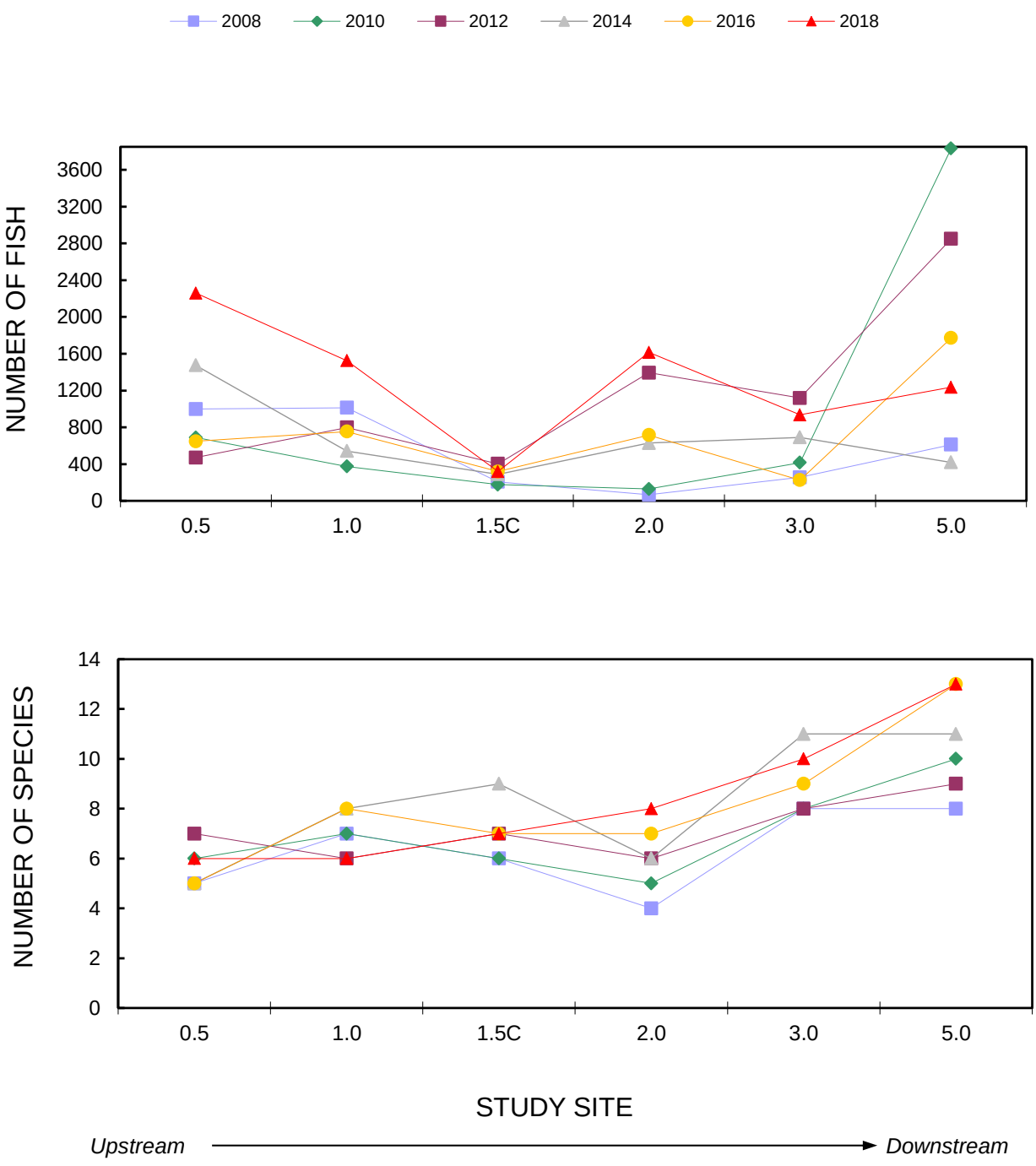
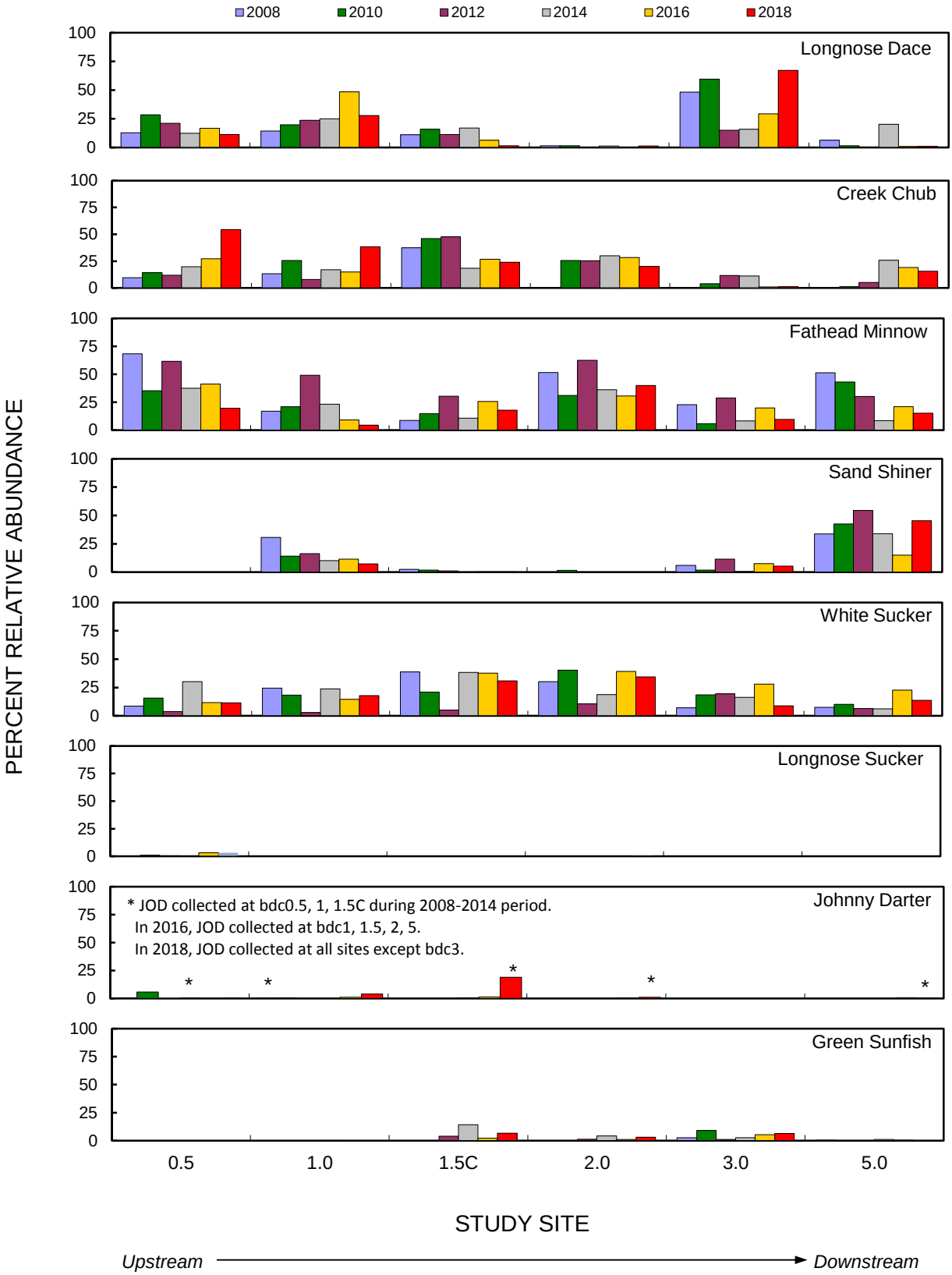


FIGURE 3

PERCENT RELATIVE ABUNDANCE OF NUMERICALLY DOMINANT AND IMPORTANT NATIVE FISH SPECIES COLLECTED AT BIG DRY CREEK SITES, FALL 2008-2018



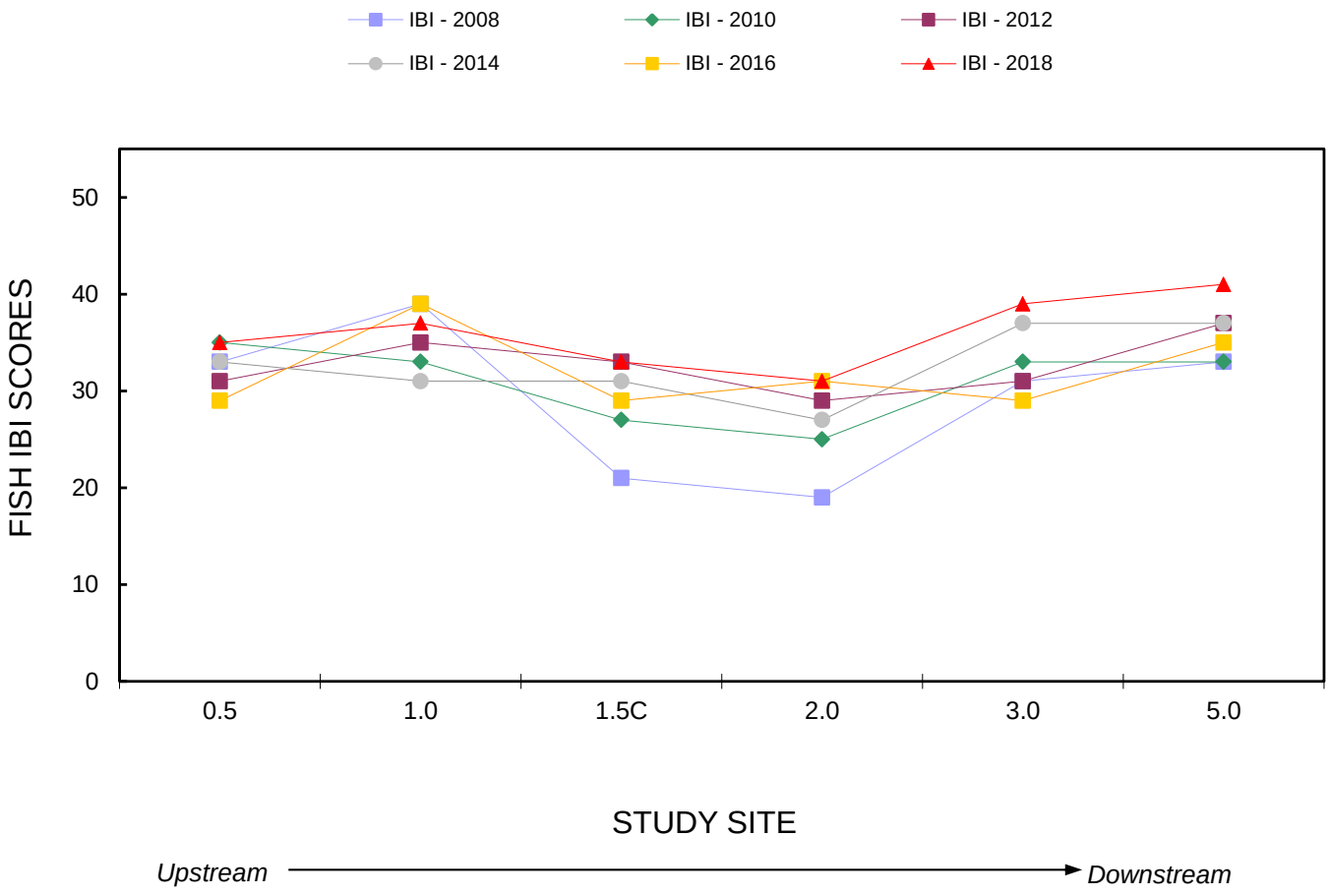
Append B-3
JOHNNY DARTER COLLECTIONS 1997-2018

	Numbers Collected							
Dates Sampled *	0.5	1.0	1.5	1.5C	2.0	3.0	5.0	6.0
1997 spring	**10**	**5**	0	ns	**2**	0	0	0
1997 fall	**28**	**13**	0	ns	0	0	0	0
1998	**20**	**6**	0	ns	**4**	0	0	0
1999	**27**	0	**1**	ns	0	0	0	0
2000	**11**	**2**	0	0	**2**	0	0	0
2001	**15**	0	0	0	**1**	0	0	0
2002	0	**1**	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0
2008	**5**	**1**	ns	0	0	0	0	ns
2010	**40**	**2**	ns	0	0	0	0	ns
2012	**3**	**1**	ns	0	0	0	0	ns
2014	**2**	0	ns	**1**	0	0	0	ns
2016	0	**9**	ns	**4**	**1**	0	**11**	ns
2018	**1**	**63**	ns	**60**	**19**	0	**1**	ns
No. of Years Collected 1997-2018	10	9	1	3	6	nc	2	nc
Total Individuals (when collected)	1-40	1-63	1	1-60	1-19	nc	1-11	nc

* Fish sampling includes only Fall collections for 1998-2018 period.
ns = not sampled
nc = not collected

FIGURE 5

COMPARISONS OF FISH INDEX OF BIOTIC INTEGRITY (IBI) SCORES
FOR BIG DRY CREEK, 2008-2018



Append B-4

FISH IBI SCORES

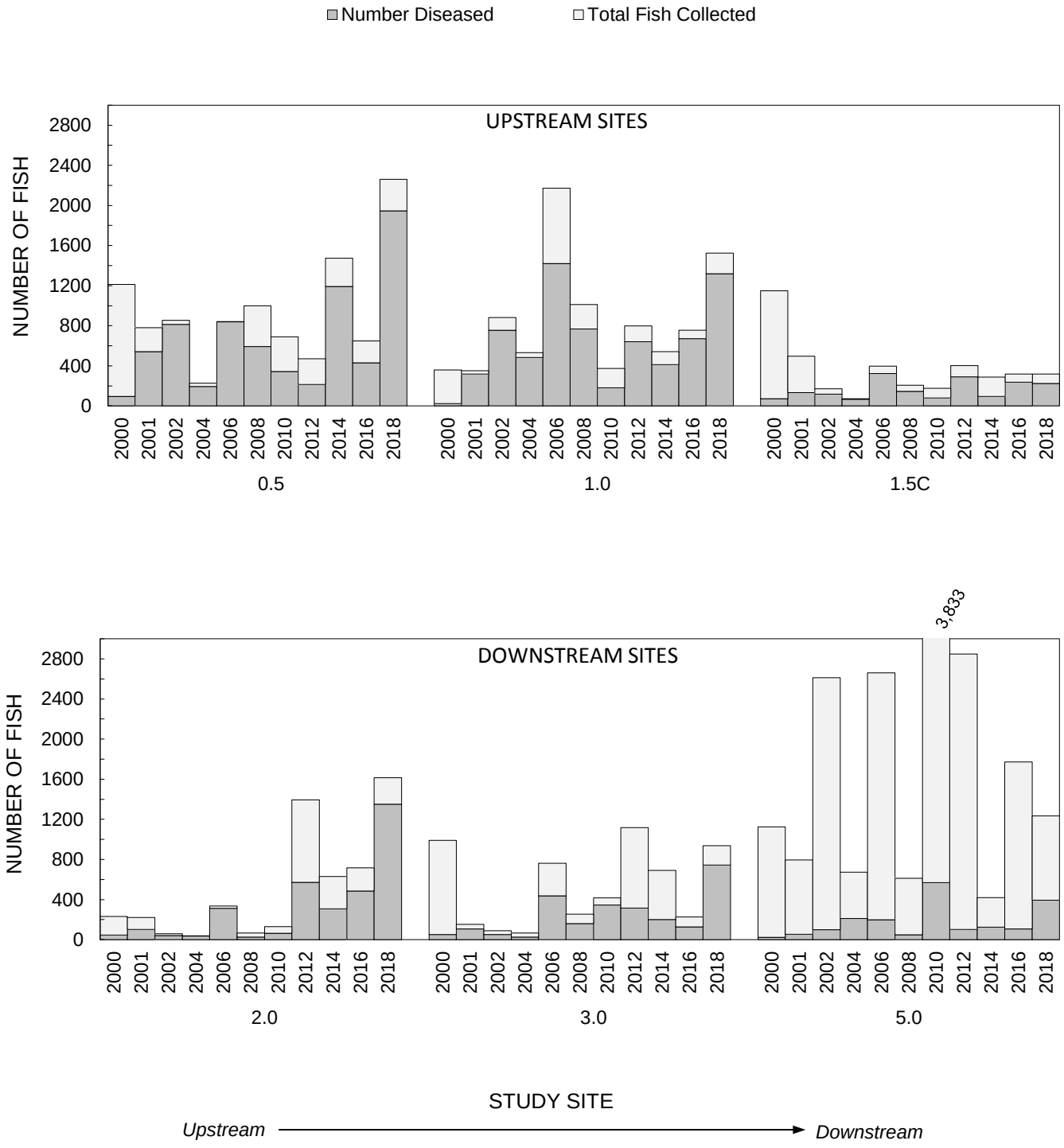
BIG DRY CREEK 2008-2018

IBI Score	0.5	1.0	1.5C	2.0	3.0	5.0
2008	33	39	21	19	31	33
2010	35	33	27	25	33	33
2012	31	35	33	29	31	37
2014	33	31	31	27	37	37
2016	29	39	29	31	29	35
2018	35	37	33	**31**	39	**41**
				min		max
6-yr Mean IBI 2008-2018	32.7	35.7	29.0	**27.0**	33.3	**36.0**
mean up/down	32.4 upstream sites			32.1 downstream sites		

Condition Category	Score Range
Excellent	53 - 55
Good	44 - 52
Fair	37 - 43
Poor	29 - 36
Very Poor	11 - 28

FIGURE 6

FISH DISEASE OCCURRENCE AT
BIG DRY CREEK SITES, 2000-2018



BLACK SPOT DISEASE

TABLE 5

COMPARISONS OF PERCENT DISEASE BY SITE AND UPSTREAM VS. DOWNSTREAM AT SITES IN BIG DRY CREEK, 2000-2018

	Big Dry Creek					
	upstream sites			downstream sites		
	bdc0.5	bdc1.0	bdc1.5C	bdc2.0	bdc3.0	bdc5.0
Percent Disease by site						
2000	**7.8**	**6.4**	**6.2**	**19.6**	**5.3**	**2.1**
2001	69.4	90.3	26.8	46.4	70.4	6.8
2002	95.2	85.6	68.0	71.2	56.8	3.8
2003	66.6	75.6	94.4	66.7	50.0	5.2
2004	85.8	91.0	91.7	92.1	38.8	31.5
2006	99.8	65.4	81.5	92.9	57.4	7.5
2008	59.2	75.7	70.9	39.4	63.0	8.0
2010	50.0	48.6	44.7	48.8	83.0	14.8
2012	45.5	80.3	71.9	41.0	28.1	3.6
2014	80.9	76.0	32.9	49.0	29.2	29.9
2016	66.4	89.0	74.2	67.6	57.1	6.0
2018	**86.1**	**86.4**	**70.8**	**83.6**	**79.6**	**31.8**
11-yr Mean 2001-2018	**73.2**	**78.5**	**66.2**	**63.5**	**55.8**	**13.5**

Annual Mean Percent Disease

	all sites	upstream sites	downstream sites	
2000	7.0	5.6	8.4	
2001	52.2	66.4	38.0	
2002	56.4	76.6	36.2	
2003	59.0	78.3	39.8	
2004	66.9	88.2	45.7	
2006	63.3	81.8	44.7	
2008	52.7	68.6	36.8	
2010	48.3	47.8	48.9	
2012	45.1	65.9	24.2	
2014	49.7	63.3	36.0	
2016	60.1	76.5	43.6	
2018	**73.1**	**81.1**	**65.0**	
11-yr Mean 2001-2018	**58.4**	**72.6**	**44.3**	
			59.6	**when bdc2 and bdc3 only**

* ns indicates not sampled.

TABLE 6

MEAN DISEASE RATINGS AND PERCENT OF HEAVY INFECTED FISH COLLECTED AT BIG DRY CREEK SITES, FALL 2008-2018

	upstream sites				downstream sites			
Year Sampled	bdc0.5	bdc1.0	bdc1.5	bdc1.5C	bdc2.0	bdc3.0	bdc5.0	bdc6.0
Fall 2008								
Mean Disease Rating	0.8	1.1	ns	0.8	0.4	0.6	0.1	ns
upstream sites	0.9							
downstream sites	0.4							
Percent Heavy	**1.2**	**2.8**	ns	2.4	0.0	0.0	0.0	ns
upstream sites	**2.1**							
downstream sites	0.0							
Fall 2010								
Mean Disease Rating	0.5	0.5	ns	0.5	0.5	0.6	0.1	ns
upstream sites	0.5							
downstream sites	0.4							
Percent Heavy	**0.0**	**0.0**	ns	0.6	0.0	0.0	0.0	ns
upstream sites	**0.2**							
downstream sites	0.0							
Fall 2012								
Mean Disease Rating	0.5	1.1	ns	0.7	0.6	0.3	0.1	ns
upstream sites	0.8							
downstream sites	0.3							
Percent Heavy	**0.4**	**9.3**	ns	0.7	0.4	0.0	0.0	ns
upstream sites	**3.5**							
downstream sites	0.1							
Fall 2014								
Mean Disease Rating	0.8	0.8	ns	0.3	0.4	0.4	0.3	ns
upstream sites	0.6							
downstream sites	0.4							
Percent Heavy	**1.2**	**2.1**	ns	0.0	0.0	0.0	0.0	ns
upstream sites	**1.1**							
downstream sites	0.0							
Fall 2016								
Mean Disease Rating	0.7	1.0	ns	0.7	0.6	0.6	<0.1	ns
upstream sites	0.8							
downstream sites	0.4							
Percent Heavy	**0.5**	**1.8**	ns	0.0	0.0	0.0	0.0	ns
upstream sites	**0.8**							
downstream sites	0.0							
Fall 2018								
Mean Disease Rating	0.8	1.1	ns	0.8	0.4	0.6	0.10	ns
upstream sites	0.9							
downstream sites	0.4							
Percent Heavy	**1.2**	**2.8**	ns	**2.4**	0.0	0.0	0.0	ns
upstream sites	**2.1**							
downstream sites	0.0							

Append B-5
BDC Snail Population 1999-2018

		Numbers Collected					
year	season	0.5	1.0	1.5C	2.0	3.0	5.0
1999	spring	**2**	0	na	0	0	0
2000	spring	**36**	0	0	0	0	0
	fall	**73**	0	0	0	0	0
2001	spring	**254**	0	0	0	**73**	0
	fall	**98**	**73**	0	0	**254**	**36**
2002	spring	**83**	**28**	**28**	0	0	0
	fall	**4774**	**388**	**413**	**167**	**358**	**248**
2003	spring	**559**	0	0	0	0	0
	fall	**551**	**413**	**55**	0	**110**	**55**
2004	spring	**78**	**78**	**39**	0	0	0
	fall	**496**	**55**	**110**	0	**96**	0
2006	spring	0	**138**	**28**	0	**28**	0
	fall	**78**	**248**	**83**	0	**55**	**18**
2008	fall	0	0	0	0	**2**	0
2010	fall	**83**	**469**	**165**	0	**55**	**717**
2012	fall	**165**	**276**	0	0	**28**	**28**
2014	fall	**386**	**33**	0	**110**	**55**	0
2016	fall	**331**	0	**1323**	**55**	0	0
2018	fall	**0**	**1544**	**303**	**165**	**224**	0
2018 vs. 2016 changes							
snails		**down**	**up**	**down**	**up**	**up**	**down**
disease		**up**	**down**	**down**	**up**	**up**	**up**
		20%	**3%**	**3%**	**16%**	**23%**	**26%**

FIGURE 7

PERCENT RELATIVE ABUNDANCE OF MACROINVERTEBRATE TAXONOMIC GROUPS COLLECTED IN KICK SAMPLES FROM BIG DRY CREEK, FALL 2012- 2018

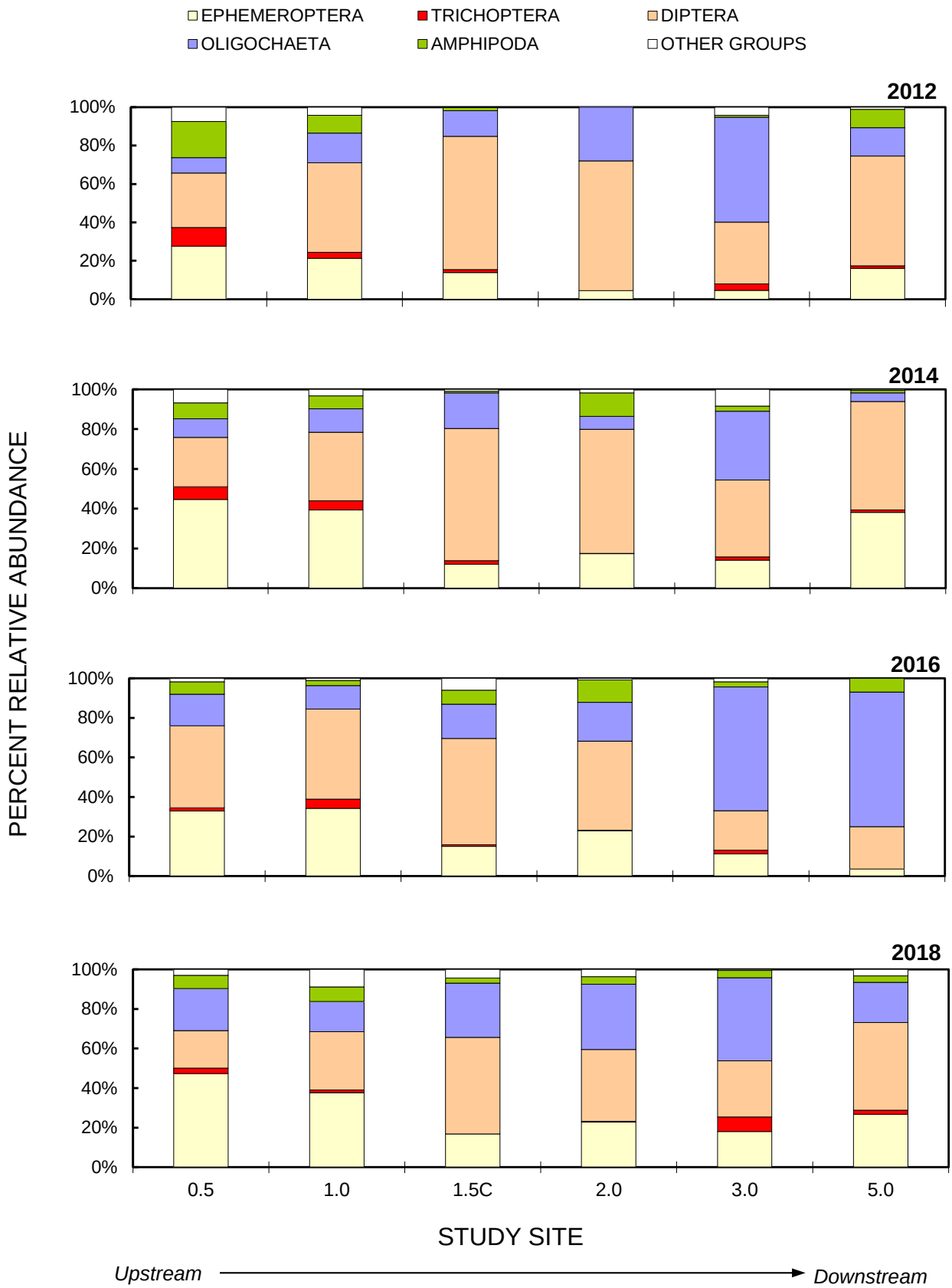


Figure 7 data

BDC Macroinvertebrate percent abundance for FALL 2012-2018

2012

	0.5	1.0	1.5C	2.0	3.0	5.0
EPHEMEROPTERA	**27.7**	**21.3**	13.9	4.5	4.6	16.1
TRICHOPTERA	9.6	3.1	1.5	0.0	3.4	1.4
DIPTERA	28.4	46.6	**69.4**	**67.6**	32.1	57.2
OLIGOCHAETA	8.0	15.5	13.4	27.9	**54.6**	14.7
AMPHIPODA	18.9	9.3	1.7	0.0	1.0	9.5
OTHER GROUPS	7.4	4.2	0.2	0.0	4.2	1.2
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

2014

	0.5	1.0	1.5C	2.0	3.0	5.0
EPHEMEROPTERA	**44.7**	**39.4**	12.1	**17.3**	**14.2**	**38.1**
TRICHOPTERA	6.3	4.6	1.7	0.2	1.6	1.2
DIPTERA	24.8	34.5	**66.5**	**62.4**	38.7	54.6
OLIGOCHAETA	9.4	11.8	17.9	6.5	**34.5**	4.4
AMPHIPODA	8.0	6.6	0.9	11.8	2.6	1.2
OTHER GROUPS	6.8	3.2	0.9	1.7	8.4	0.5
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

2016

	0.5	1.0	1.5C	2.0	3.0	5.0
EPHEMEROPTERA	**32.9**	**34.2**	15.0	**22.9**	**11.2**	**3.6**
TRICHOPTERA	1.7	4.7	0.8	0.3	2.0	0.0
DIPTERA	**41.4**	**45.6**	**53.8**	**45.0**	19.8	21.5
OLIGOCHAETA	16.0	11.8	17.4	19.7	**62.6**	**68.0**
AMPHIPODA	6.4	2.7	7.1	11.3	2.6	6.9
OTHER GROUPS	1.7	1.0	5.9	0.8	1.7	0.0
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

2018

	0.5	1.0	1.5C	2.0	3.0	5.0
EPHEMEROPTERA	**47.4**	**37.6**	16.8	**22.9**	**18.0**	**26.8**
TRICHOPTERA	2.6	1.5	0.0	0.4	7.4	1.9
DIPTERA	19.0	**29.4**	**48.9**	**36.3**	**28.4**	**44.4**
OLIGOCHAETA	**21.3**	15.3	**27.4**	**33.0**	**42.0**	20.3
AMPHIPODA	6.7	7.4	2.6	3.7	3.7	3.3
OTHER GROUPS	3.0	8.8	4.4	3.7	0.5	3.3
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

TABLE 7

MEAN PERCENT RELATIVE ABUNDANCE FOR PREDOMINANT AND IMPORTANT MACROINVERTEBRATE SPECIES COLLECTED AT BIG DRY CREEK SITES UPSTREAM AND DOWSTREAM FROM WWTPs, FALL 2018 VS. 2012-2016 1/

	2012		2014		2016		2018	
Taxa	Up	Down	Up	Down	Up	Down	Up	Down
TURBELLARIA (flatworms)								
Dugesia sp.	0.4	0.1	1.3	1.2	0.1	0.5	0.6	0.5
OLIGOCHAETA (aquatic worms)								
Nais spp.	1.9	**14.1**	1.0	3.7	**5.0**	**31.5**	2.3	**15.8**
Tubificidae	**10.1**	**16.8**	**11.6**	**10.5**	**9.5**	**18.2**	**17.7**	**14.0**
AMPHIPODS (scuds)								
Crangonyx sp.	6.2	1.2	1.7	1.2	4.2	4.4	2.8	2.0
Hyalella azteca	3.8	2.3	3.5	4.0	1.2	2.6	2.7	1.6
EPHEMEROPTERA (mayflies)								
Acentrella insignificans	0.2	0.7	nc 2/	5.8	nc	0.2	1.1	4.3
Baetis tricaudatus	1.1	0.0	**15.5**	4.3	**7.0**	0.6	0.8	0.1
Fallceon quilleri	**10.0**	4.4	4.2	**7.8**	**7.8**	3.4	**8.7**	3.5
Tricorythodes explicatus	**8.1**	2.8	**11.9**	4.6	**12.2**	**7.5**	**22.8**	**13.7**
TRICHOPTERA (caddisflies)								
Cheumatopsyche sp.	3.2	0.5	3.6	0.8	1.4	0.4	1.3	1.9
Hydropsyche sp.	0.2	0.1	0.1	nc	0.6	0.2	0.1	1.1
Hydroptila sp.	1.2	1.0	0.5	0.3	0.4	0.3	nc	0.3
DIPTERA								
Chironomidae (midges)								
Chironomus sp.	0.2	1.0	0.6	0.3	2.2	3.0	1.2	0.8
Cladotanytarsus sp.	0.1	0.6	0.5	1.9	0.2	1.3	nc	1.1
Cricotopus sp.	**4.0**	**10.2**	**6.3**	**15.9**	**12.2**	**11.9**	2.5	**17.0**
Cryptochironomus sp.	2.2	1.3	1.4	0.5	2.9	0.5	1.4	0.6
Eukiefferiella sp.	0.5	0.0	0.1	0.2	0.1	0.2	0.4	0.4
Hydrobaenus sp.	5.6	1.4	4.5	2.1	0.6	0.1	4.4	0.5
Micropsectra sp.	0.7	4.7	0.1	3.1	1.6	3.1	2.6	3.4
Parakiefferiella sp.	0.2	0.6	1.8	1.4	1.2	0.4	0.2	0.2
Paratanytarsus sp.	1.3	0.0	0.8	nc	2.1	0.1	0.2	nc
Polypedilum sp.	0.3	0.4	1.5	0.5	1.1	0.3	1.1	0.3
Rheotanytarsus sp.	0.4	nc	0.3	nc	7.5	0.1	1.3	nc
Saetheria tylus	0.1	nc	0.3	2.9	1.0	0.2	0.1	0.3
Stictochironomus sp.	**26.1**	**17.4**	**17.2**	3.9	**10.0**	2.0	**13.1**	**5.1**
Thienemanniella sp.	1.5	6.7	0.9	0.6	nc	0.5	0.6	0.5
Thienemannimyia group	1.5	0.8	0.8	0.3	1.0	0.2	0.4	0.1
Simuliidae (black flies)								
Simulium vittatum complex	0.6	3.6	2.7	**16.8**	1.1	3.4	1.4	3.9
GASTROPODA (snails)								
Ferrissia sp.	0.5	0.1	0.4	0.2	1.6	0.1	1.6	0.1
Physidae	0.1	0.0	0.4	0.1	0.1	nc	0.1	nc

FIGURE 8

MACROINVERTEBRATE DENSITY AND TOTAL NUMBER OF TAXA COLLECTED IN KICK SAMPLES FROM BIG DRY CREEK, FALL 2012- 2018

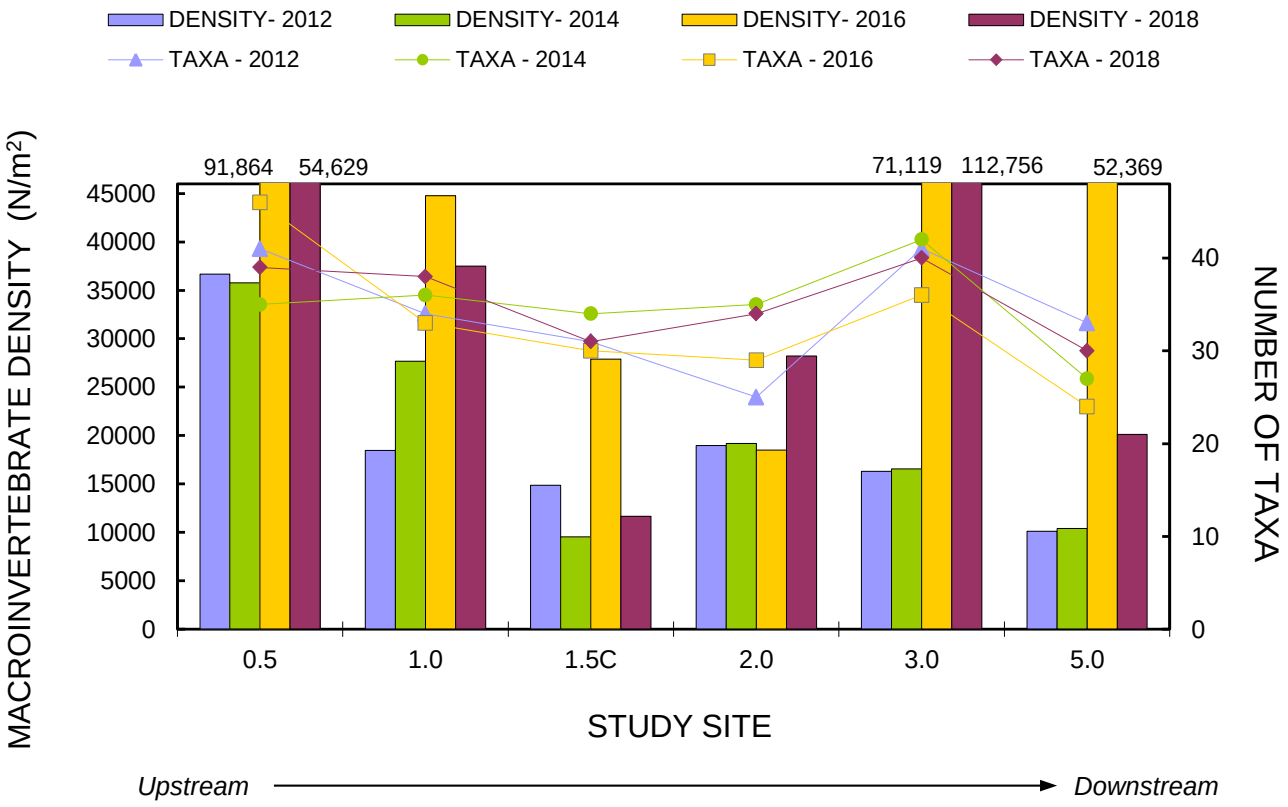
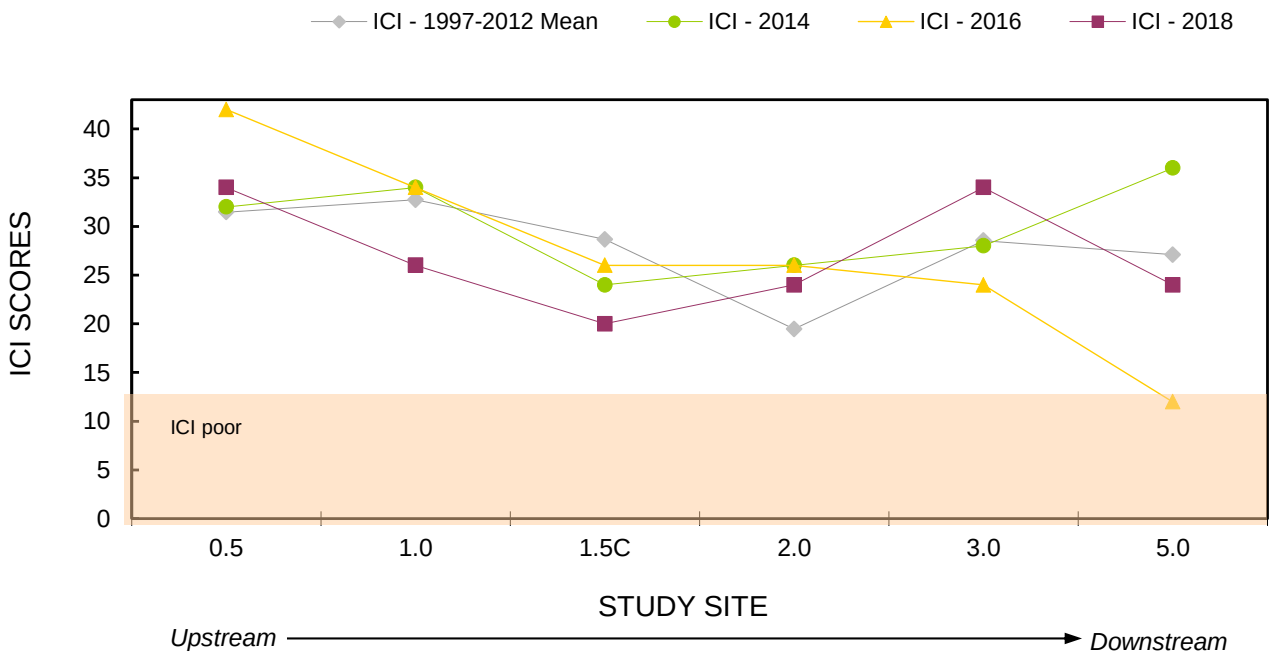


Figure 8 data
BDC Macroinvertebrate Density and Taxa FALL 2012-2018

		STUDY SITE						Annual
		0.5	1.0	1.5C	2.0	3.0	5.0	Mean
DENSITY	**(N/m^2)**							
2012		**36,658**	**18,467**	14,862	**18,963**	**16,291**	10,126	19,228
2014		**35,765**	**27,673**	9,537	**19,190**	**16,574**	10,401	19,857
2016		**91,864**	**44,762**	**27,893**	**18,511**	**71,119**	**52,369**	51,086
2018		**54,629**	**37,492**	11,674	**28,224**	**112,756**	**20,121**	44,149
	4-yr Mean	54,729	32,098	15,991	21,222	54,185	23,254	33,580
		highest		lowest				
TAXA								
2012		**41**	34	31	25	**41**	33	34
2014		**35**	**36**	34	**35**	**42**	27	35
2016		**46**	33	30	29	**36**	24	33
2018		**39**	**38**	31	34	**40**	30	35
	4-yr Mean	40	35	32	31	40	29	34
		highest				highest	lowest	

FIGURE 9

COMPARISON OF INVERTEBRATE COMMUNITY INDEX (ICI) SCORES
FOR BIG DRY CREEK SITES IN FALL,
1997-2012 MEAN VS. 2014, 2016 AND 2018



Append C-2

ANNUAL ICI RESULTS, 2000-2018

	STUDY SITE					
	0.5	1.0	1.5C	2.0	3.0	5.0
2000	38	36	30	30	36	14
2001	30	38	38	14	32	32
2002	24	22	28	16	22	28
2003	24	36	34	14	22	22
2004	36	20	28	20	30	36
2006	28	22	28	10	30	28
2008	22	34	16	20	22	32
2010	36	42	30	20	28	24
2012	38	32	26	16	32	26
2014	32	34	24	26	28	36
2016	42	34	26	26	24	12
2018	**34** max	26	**20** min	24	**34** max	24
12-yr mean ICI 2000-2018	**32.0**	31.3	27.3	**19.7**	28.3	26.2
4-yr mean ICI 2012-2018	**36.5** max	31.5	24	**23** min	29.5	24.5

Poor

Good

TABLE 8

SUMMARY OF KEY COMMUNITY PARAMETERS AND INDICES
BIG DRY CREEK SITES, FALL 2018 VS. 2012-2016

Site	Total Taxa	EPT Taxa	Metric: Species Diversity	Metric: ICI	Metric: HBI	Metric: % Chironomidae
2012						
Upstream Sites						
bdc0.5	41	5	4.18	38	6.04	23.2
bdc1.0	34	8	3.82	32	6.52	37.9
bdc1.5C	31	7	2.99	26	6.84	63.2
Mean	**35**	**7**	**3.66**	**32.0**	**6.47**	**41.4**
Downstream Sites						
bdc2.0	25	5	2.84	16	7.16	48.3
bdc3.0	41	8	3.54	32	8.22	27.6
bdc5.0	33	5	3.76	26	6.60	31.0
Mean	**33**	**6**	**3.38**	**24.7**	**7.33**	**35.6**
2014						
Upstream Sites						
bdc0.5	35	5	3.58	32	5.75	21.9
bdc1.0	36	6	3.69	34	6.20	31.1
bdc1.5C	34	6	3.83	24	6.90	63.3
Mean	**35**	**6**	**3.70**	**30.0**	**6.28**	**38.8**
Downstream Sites						
bdc2.0	35	6	3.75	26	6.47	34.7
bdc3.0	42	7	4.11	28	7.25	38.2
bdc5.0	27	8	3.30	36	5.73	31.8
Mean	**35**	**7**	**3.72**	**30.0**	**6.48**	**34.9**
2016						
Upstream Sites						
bdc0.5	46	6	3.76	42	6.21	40.2
bdc1.0	33	7	4.11	34	6.17	43.4
bdc1.5C	30	6	3.71	26	6.75	53.6
Mean	**36**	**6**	**3.86**	**34.0**	**6.38**	**45.7**
Downstream Sites						
bdc2.0	29	6	3.62	26	6.74	37.5
bdc3.0	36	6	3.13	24	8.10	17.2
bdc5.0	24	4	2.27	12	8.47	19.2
Mean	**30**	**5**	**3.01**	**20.7**	**7.77**	**24.6**
2018						
Upstream Sites						
bdc0.5	39	6	3.58	34	6.02	15.1
bdc1.0	38	5	4.10	26	6.21	27.4
bdc1.5C	31	5	3.44	20	7.14	48.6
Mean	**36**	**5**	**3.71**	**26.7**	**6.46**	**30.4**
Downstream Sites						
bdc2.0	34	6	3.74	24	7.07	31.5
bdc3.0	40	8	3.73	34	7.20	26.6
bdc5.0	30	5	3.56	24	6.52	38.6
Mean	**35**	**6**	**3.68**	**27.3**	**6.93**	**32.2**

MMI Scores for Big Dry Creek Sites, 2012, 2014, 2016 and 2018

			MMI Sores				
Site	**Location**	**Biotype**	**2012**	**2014**	**2016**	**2018**	**4-yr mean**
BDC 0.5	d/s from Old Wadsworth Ave., at Church Ranch Open Space	3	**60.2**	50.9	**52.9**	**55.2**	54.8
BDC 1.0	u/s from 112th Ave.	3	47.5	50.0	41.4	**55.9**	48.7
BDC 1.5C	d/s from 120th Ave., immediately u/s Broomfield WWTP	3	**59.5**	**58.3**	43.4	46.3	51.9
BDC 2.0	u/s from 128th Ave., d/s from Broomfield WWTP	3	37.2	**52.4**	46.7	44.8	45.3
BDC 3.0	at I-25, d/s from Westminster WWTP	3	45.5	41.7	42.0	39.3	42.1
BDC 5.0	d/s from Weld County Rd. 4	3	**58.2**	41.1	24.9	43.8	42.0
		Annual Mean	51.4	49.1	41.9	47.6	

MMIs per EDAS v4 and Policy Statement 10-1 (CWQCC 2017).
Bold indicates High Scoring Water (MMI >51 for Biotype 3).
MMI Impairment threshold for Class 2 streams is <29. impaired
All analyses performed by Aquatics Associates, Inc.

Comments for 2018

MMI values for 2018 met use attainment all six sites on Big Dry Creek (MMIs >29 threshold for Class 2 streams).
Sites bdc0.5 and bdc1.0 were High Scoring waters.
Lowest score in 2018 was at site bdc3.0.

USEFULNESS OF DATA SET FOR
BDC SEGMENT 1 WQ REGS

- **Reg 93- 303(d) Monitoring & Evaluation List**

Division removed BDC Seg 1 from 303(d) list early Dec 2019 based on 2018 MMI results.

- **Reg 31**

Temperature standard driven by presence of the Johnny darter in BDC Seg 1.

- **Reg 38- Fish Ingestion Qualifier**

"whether BDC Seg 1 has fish of catchable size and which are normally consumed and where there is evidence that fishing occurs on a recurring basis".

- **Future New Ammonia Criteria**

Basis on presence of Unionid Mussles and Non-Pulmonate Snails (cited as ammonia-sensitive). Our review of BDC macroinvert data set 1997-2018 indicates none ever collected in BDC.

Reg 38 - FISH INGESTION QUALIFIER
BDC NUMBERS OF CATCHABLE FISH 2016 AND 2018

Species	Cutoff for Catchable Size	Site	No. of Catchables 2016	2018
White Sucker	10" (250 mm)	bdc0.5	2	9
		bdc1.0	2	0
		bdc1.5C	1	0
		bdc2.0	39	34
		bdc3.0	5	19
		bdc5.0	3	3
Black Bullhead	8" (200 mm)	bdc3.0	1	0
		bdc5.0	3	6
Common Carp	11" (280 mm)	bdc3.0	17	3
		bdc5.0	52	25
Green Sunfish	6" (150 mm)	bdc5.0	1	0

BDC Reg 38 - Relevant Fish Species Collected

Green Sunfish largest adult (136mm: catchable size >150mm = 6”) and YOY collected at bdc3.0

Common Carp 25 catchable size (>280mm = 11”) at bdc5.0

White Sucker catchable size (>250mm = 10”) at bdc0.5, 2.0, 3.0 ,5.0

RECOMMENDATIONS FOR FUTURE MONITORING

- Keep future monitoring program intact (six sites, fish & bugs fall season only, continue MMI) with monitoring in even years. Next event is Oct 2020.

  These data have been crucial for supporting the Cities various compliance issues with the State's stream classification regulations (i.e., 303(d) M&E listing [MMIs], Reg 38 fish ingestion [fish data], Reg 31 temperature standard [Johnny darter], etc.).

- If MMIs do not meet use attainment, add an additional macroinvertebrate collection in odd years (in between year) at sites not meeting use attainment to have supporting data for WQCD's 303(d) Monitoring & Evaluation De-Listing.

- As always, savings can be realized if Cities provide assistance (2-4 people) for the 3-day fish sampling event.

THANKS TO ALL OF OUR VOLUNTEERS FOR A SUCCESSFUL 2018 SAMPLING SEAS0N!