Brazos BBEST

Hydrographic Separation Analyses
at Two Locations

May 23, 2011

Hydrographic Separation

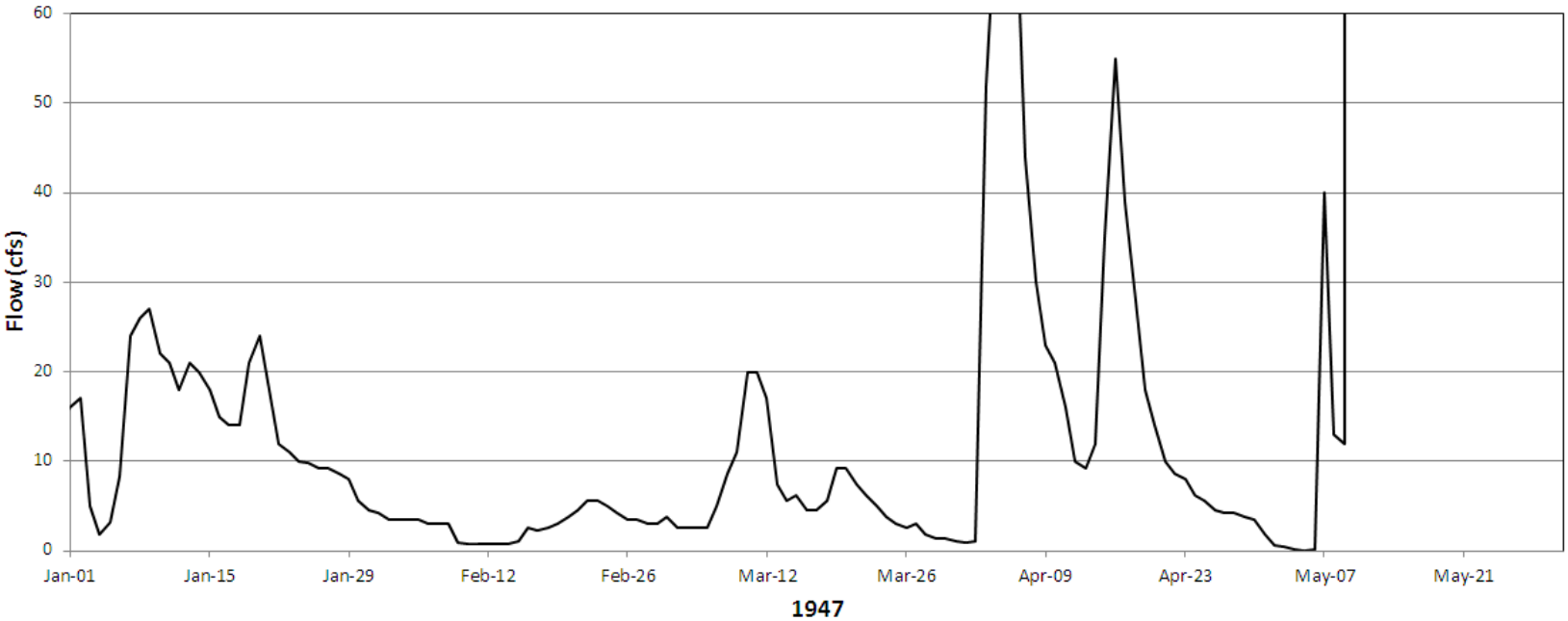
- Assign each and every day of the hydrologic record to one and only one of:
  - Subsistence flow
  - Base flow
  - High flow pulse
  - Overbank event
- Two algorithms available: IHA and MBFIT
  - Both have multiple user-adjustable parameters
- HEFR will then calculate simple statistics on each of these populations of data

Overriding Philosophy

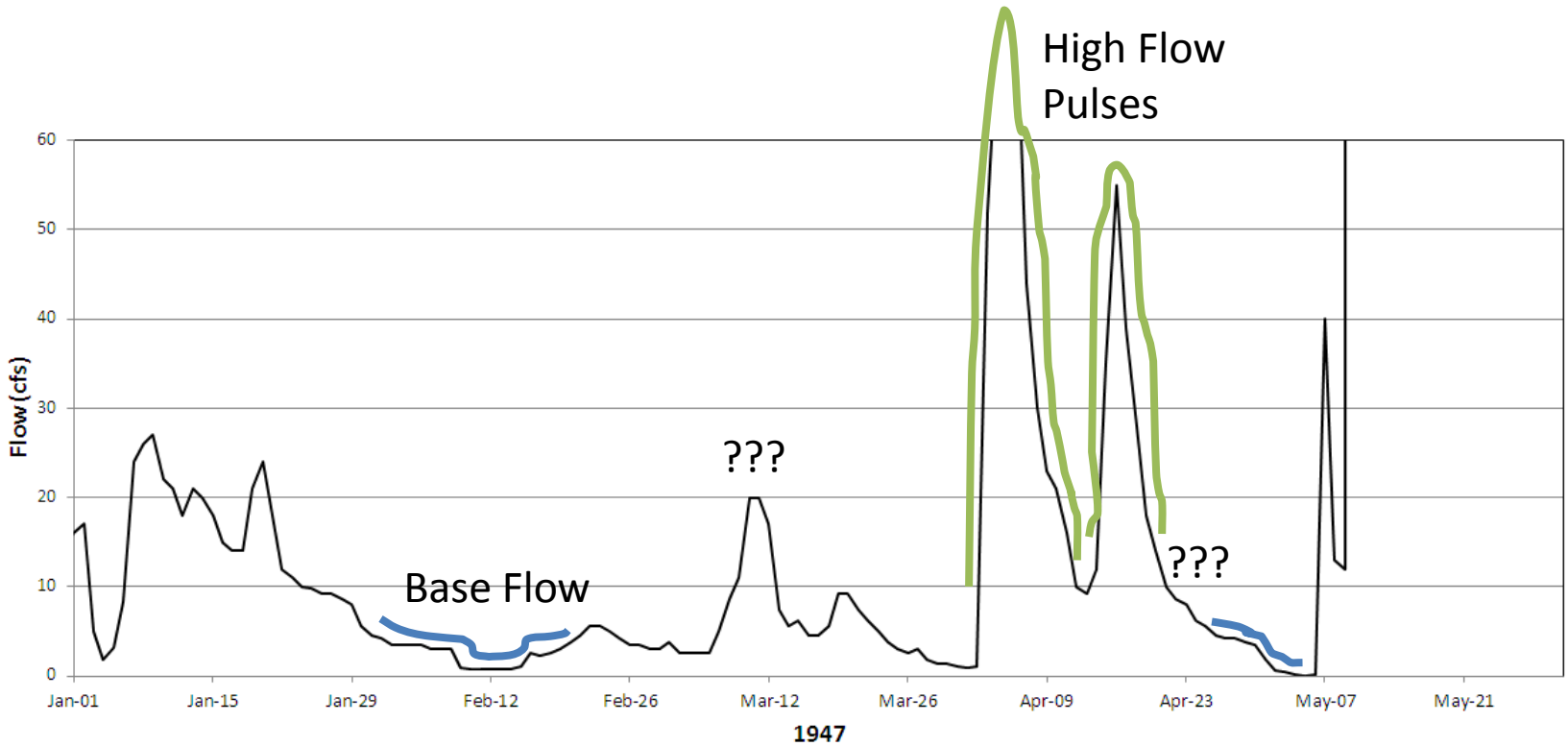
- We are trying to separate the hydrograph into components that primarily provide key ecological functions, not into components based on the source of the water.
- For example:
  - High Flow Pulse = inundates backwater areas for spawning
  - NOT High Flow Pulse = runoff

We perform hydrographic separation using a tuned algorithm, which is inherently an imperfect representation of professional judgment. Do not expect perfection. Luckily, perfection is not required.

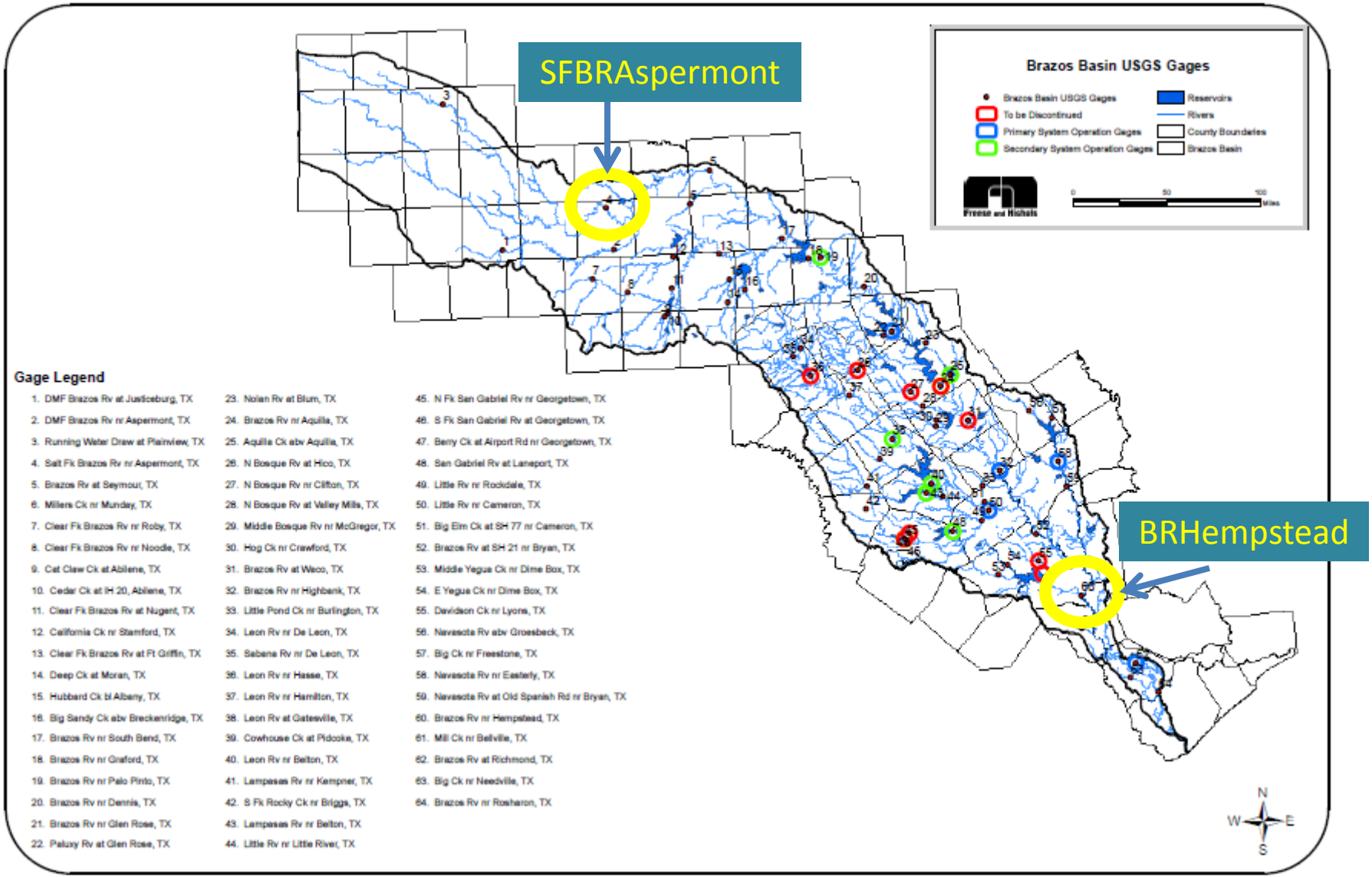
How would you “color” the following?



How would you “color” the following?



Two USGS Gages



Gage Legend

1. DMF Brazos Rv at Justiceburg, TX
2. DMF Brazos Rv nr Aspermont, TX
3. Running Water Draw at Plainview, TX
4. Salt Fk Brazos Rv nr Aspermont, TX
5. Brazos Rv at Seymour, TX
6. Millers Ck nr Munday, TX
7. Clear Fk Brazos Rv nr Roby, TX
8. Clear Fk Brazos Rv nr Noodle, TX
9. Cat Claw Ck at Abilene, TX
10. Cedar Ck at IH 20, Abilene, TX
11. Clear Fk Brazos Rv at Nugent, TX
12. California Ck nr Stamford, TX
13. Clear Fk Brazos Rv at Ft Griffin, TX
14. Deep Ck at Moran, TX
15. Hubbard Ck bl Albany, TX
16. Big Sandy Ck abv Breckenridge, TX
17. Brazos Rv nr South Bend, TX
18. Brazos Rv nr Graford, TX
19. Brazos Rv nr Palo Pinto, TX
20. Brazos Rv nr Dennis, TX
21. Brazos Rv nr Glen Rose, TX
22. Paluxy Rv at Glen Rose, TX
23. Nolan Rv at Blum, TX
24. Brazos Rv nr Aquilla, TX
25. Aquilla Ck abv Aquilla, TX
26. N Bosque Rv at Hico, TX
27. N Bosque Rv nr Clifton, TX
28. N Bosque Rv at Valley Mills, TX
29. Middle Bosque Rv nr McGregor, TX
30. Hog Ck nr Crawford, TX
31. Brazos Rv at Waco, TX
32. Brazos Rv nr Highbank, TX
33. Little Pond Ck nr Burlington, TX
34. Leon Rv nr De Leon, TX
35. Sabana Rv nr De Leon, TX
36. Leon Rv nr Hasse, TX
37. Leon Rv nr Hamilton, TX
38. Leon Rv at Gatesville, TX
39. Cowhouse Ck at Pidcoke, TX
40. Leon Rv nr Belton, TX
41. Lampasas Rv nr Kempner, TX
42. S Fk Rocky Ck nr Briggs, TX
43. Lampasas Rv nr Belton, TX
44. Little Rv nr Little River, TX
45. N Fk San Gabriel Rv nr Georgetown, TX
46. S Fk San Gabriel Rv at Georgetown, TX
47. Berry Ck at Airport Rd nr Georgetown, TX
48. San Gabriel Rv at Laneport, TX
49. Little Rv nr Rockdale, TX
50. Little Rv nr Cameron, TX
51. Big Elm Ck at SH 77 nr Cameron, TX
52. Brazos Rv at SH 21 nr Bryan, TX
53. Middle Yegua Ck nr Dime Box, TX
54. E Yegua Ck nr Dime Box, TX
55. Davidson Ck nr Lyons, TX
56. Navasota Rv abv Groesbeck, TX
57. Big Ck nr Freestone, TX
58. Navasota Rv nr Easterly, TX
59. Navasota Rv at Old Spanish Rd nr Bryan, TX
60. Brazos Rv nr Hempstead, TX
61. Mill Ck nr Bellville, TX
62. Brazos Rv at Richmond, TX
63. Big Ck nr Needville, TX
64. Brazos Rv nr Rosharon, TX

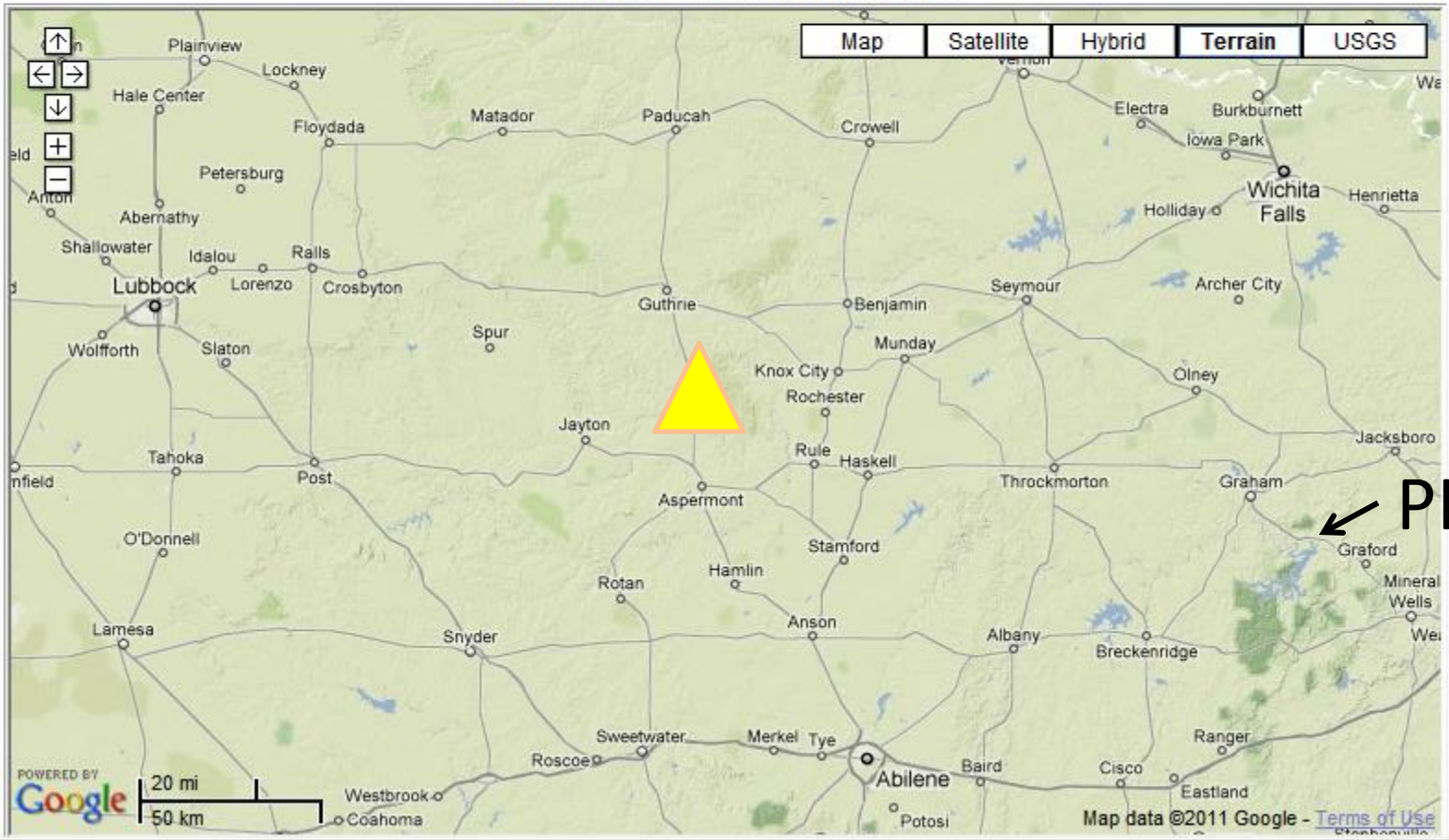
Salt Fork Brazos River near Aspermont

2 IHA Runs
2 MBFIT Runs
1 “Bright Line” Magnitude Run

Salt Fork Brazos River near Aspermont

Stonewall County, Texas
Hydrologic Unit Code 12050007
Latitude 33°20'02", Longitude 100°14'16" NAD27
Drainage area 5,130 square miles
Contributing drainage area 2,496 square miles
Gage datum 1,588.70 feet above NGVD29

Location of the site in Texas.



Summary Information

- Period of Record
  - Jan 1, 1924 to Aug 31, 1925
  - Jul 1, 1949 to present
- Contributing Drainage Area: 2,496 sq mi.
- No(?) Major Upstream Impoundments
- TCEQ Pub Critical Low Flow: 0.1 cfs
- NWS Flood Categories:
  - Action Stage: 10 ft ≈ 20,000 cfs

    No text
  - Flood: 12 ft ≈ 31,000 cfs

    "Minor lowland flooding occurs and the river." [stet]
  - Moderate Flood: 24 ft

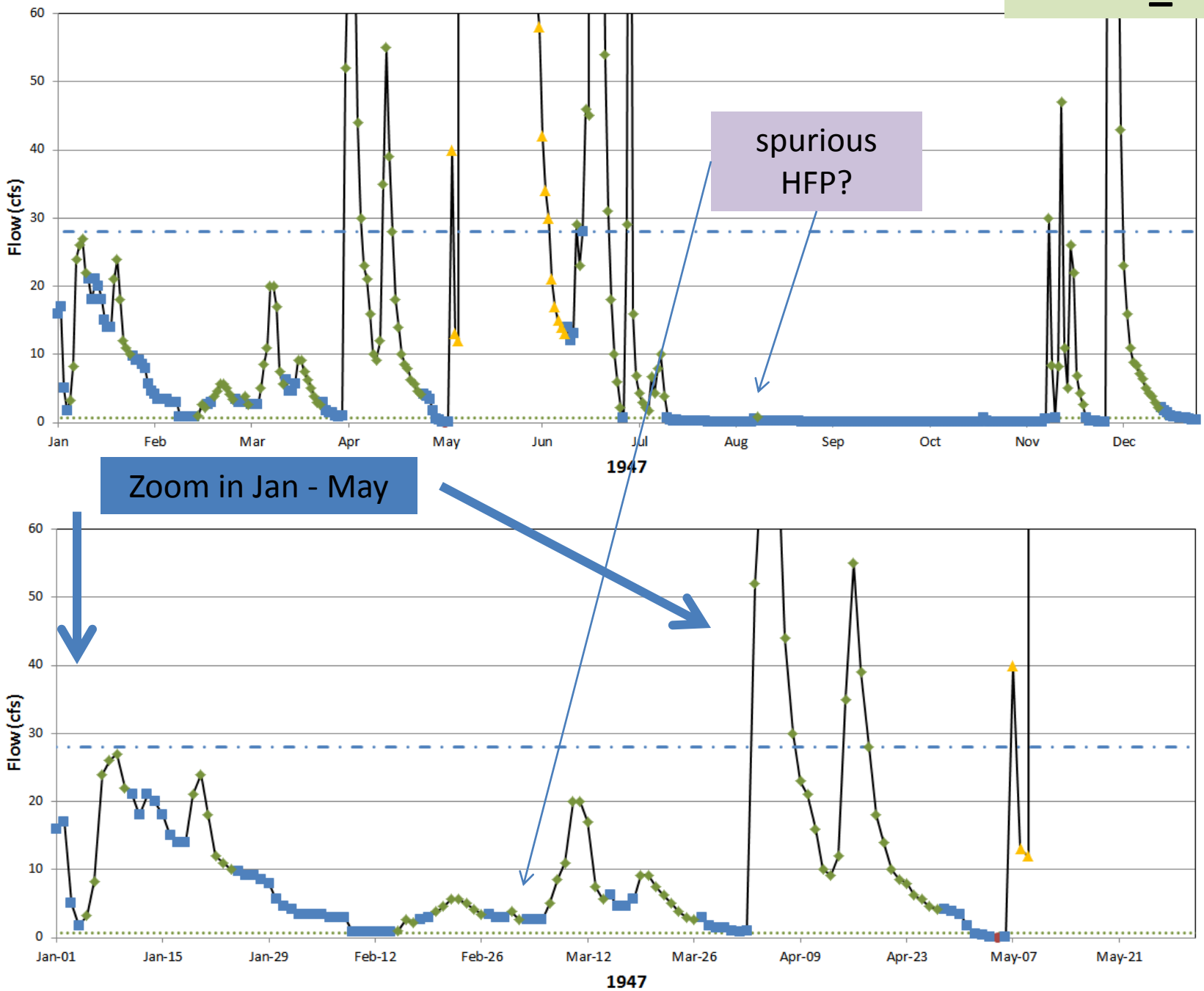
    "The water is 9 ft above record stage. U.S. Highway 83 floods and FM-1385 Northeast of Aspermont may also flood."
  - Major Flood: 25 ft
  - Could use BRA help on this

IHA Run 1

- Upper High Flow Pulse Threshold: 75th %ile (28 cfs)
- Lower High Flow Pulse Threshold: 25th %ile (0.7 cfs)
- Rise Rate: 0.25
- Overbank Threshold (2yr event – placeholder)

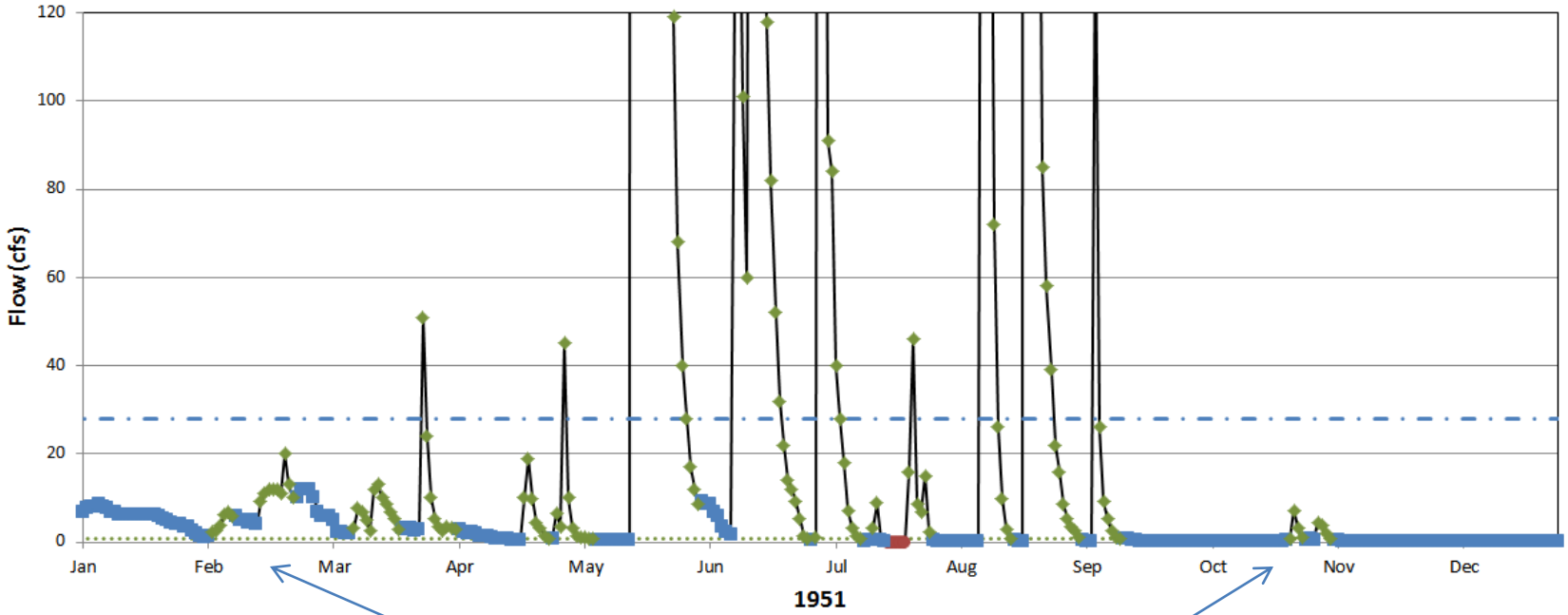
- In the following slides:
  - Yellow = Overbank Event
    - Full event, not just "overbank flows"
  - Green = High Flow Pulse
    - Full event, not just high flow portion
  - Blue = Base Flow
  - Red = Subsistence Flow

SFBRA_IHA1


spurious HFP?
Zoom in Jan - May
Flow (cfs)
60
50
40
30
20
10
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
1947
Jan-01
Jan-15
Jan-29
Feb-12
Feb-26
Mar-12
Mar-26
Apr-09
Apr-23
May-07
May-21
1947

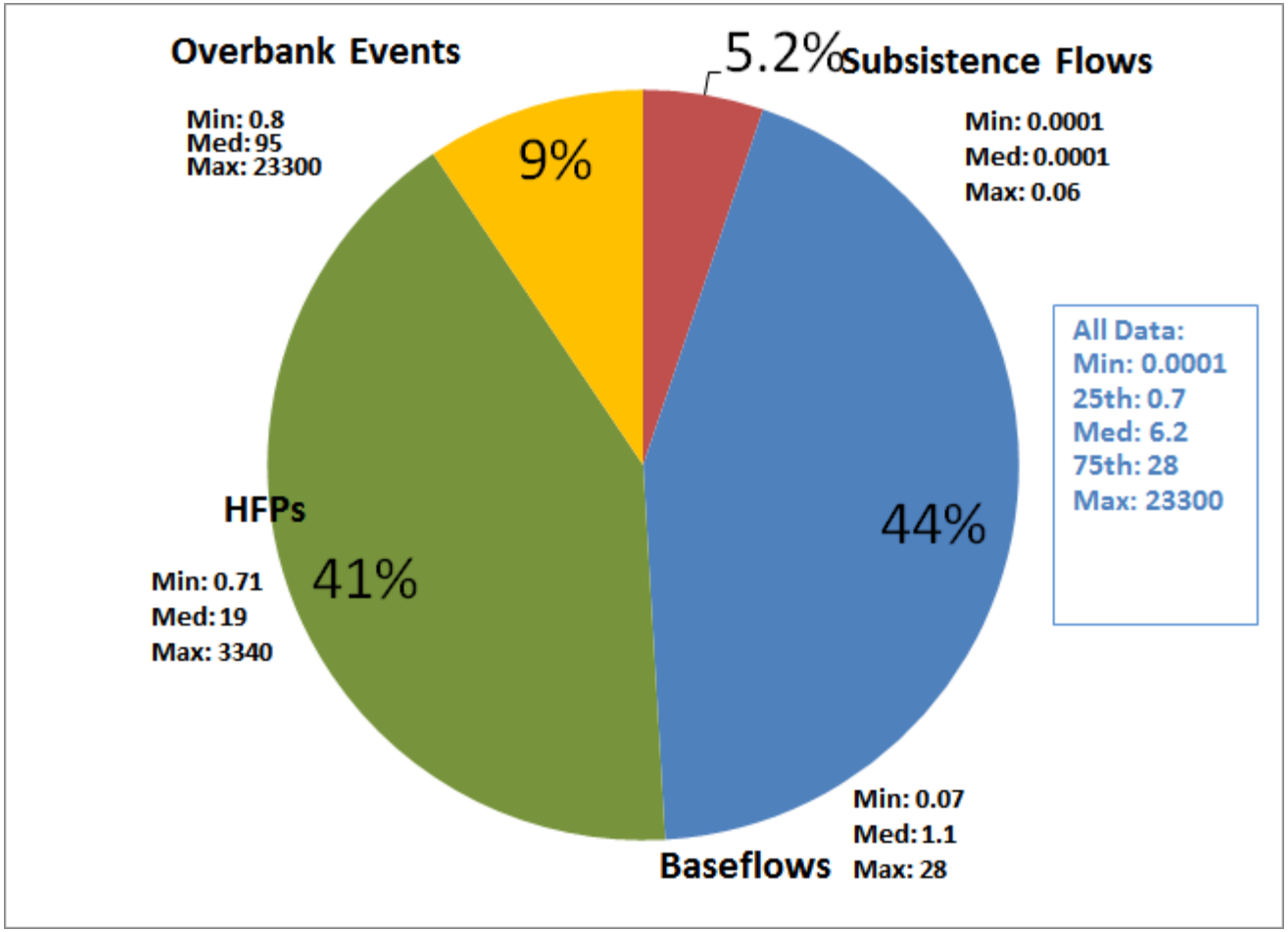
SFBRA_IHA1

A good year with few dubious classifications



Very Small HFPs

SFBRA_IHA1


Overbank Events
Min: 0.8
Med: 95
Max: 23300
9%
5.2%
Subsistence Flows
Min: 0.0001
Med: 0.0001
Max: 0.06
All Data:
Min: 0.0001
25th: 0.7
Med: 6.2
75th: 28
Max: 23300
HFPs
Min: 0.71
Med: 19
Max: 3340
41%
44%
Min: 0.07
Med: 1.1
Max: 28
Baseflows

SFBRA_IHA1

Overbank Flows	Qp: 9,340 cfs with Average Frequency 1 per 5 years Regressed Volume is 26,926 to 76,087 (45,263) Regressed Duration is 8 to 26 (14)											
High Flow Pulses	Qp: 6,040 cfs with Average Frequency 1 per 2 years Regressed Volume is 17,466 to 49,342 (29,356) Regressed Duration is 7 to 24 (13)											
	Qp: 3,610 cfs with Average Frequency 1 per year Regressed Volume is 10,477 to 29,589 (17,607) Regressed Duration is 6 to 22 (12)											
	Qp: 59 cfs with Average Frequency 1 per season Regressed Volume is 255 to 756 (439) Regressed Duration is 5 to 14 (8)			Qp: 1,720 cfs with Average Frequency 1 per season Regressed Volume is 5,061 to 12,088 (7,822) Regressed Duration is 5 to 16 (9)			Qp: 925 cfs with Average Frequency 1 per season Regressed Volume is 2,792 to 6,472 (4,250) Regressed Duration is 5 to 16 (9)			Qp: 162 cfs with Average Frequency 1 per season Regressed Volume is 578 to 1,628 (970) Regressed Duration is 5 to 16 (9)		
	Qp: 24 cfs with Average Frequency 2 per season Regressed Volume is 98 to 291 (169) Regressed Duration is 4 to 11 (6)			Qp: 624 cfs with Average Frequency 2 per season Regressed Volume is 1,838 to 4,387 (2,840) Regressed Duration is 4 to 14 (8)			Qp: 361 cfs with Average Frequency 2 per season Regressed Volume is 1,031 to 2,389 (1,570) Regressed Duration is 4 to 13 (7)			Qp: 44 cfs with Average Frequency 2 per season Regressed Volume is 157 to 442 (263) Regressed Duration is 4 to 12 (7)		
Base Flows (cfs)	8(41.8%)			3.5(64.7%)			0.5(62.8%)			8.5(45.7%)		
	4.6(61.0%)			0.64(81.2%)			0.21(71.6%)			1.7(67.5%)		
	1.1(81.6%)			0.25(89.5%)			0.1(86.2%)			0.3(85.2%)		
Subsistence Flows (cfs)	0(100.0%)			0(100.0%)			0.01(95.6%)			0(100.0%)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Winter			Spring			Summer			Fall		

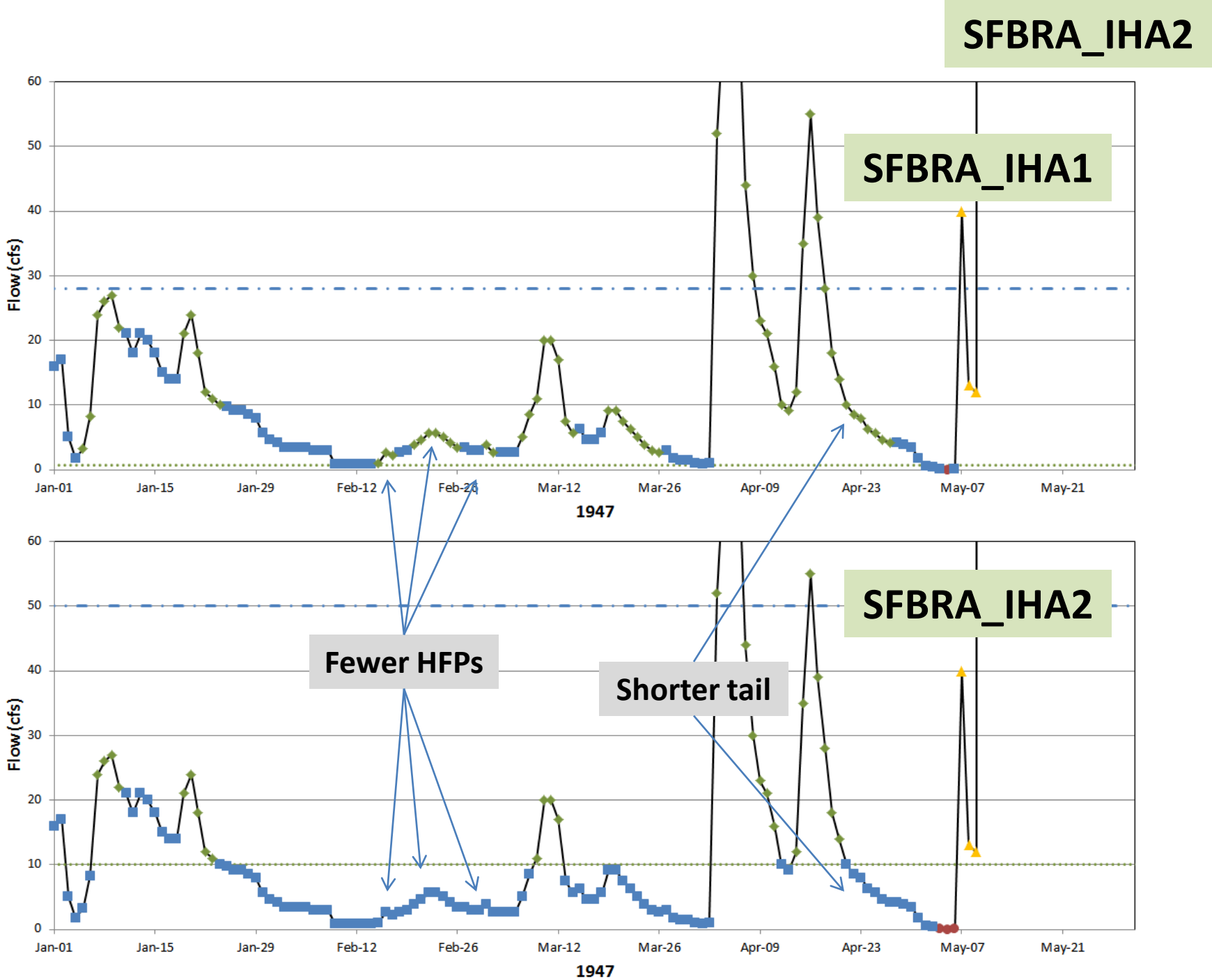
Flow Levels	High (75th %ile)
	Medium (50th %ile)
	Low (25th %ile)
	Subsistence

Notes:
1. Period of Record used : 1/1/1940 to 12/31/2010.

SFBRA_IHA1

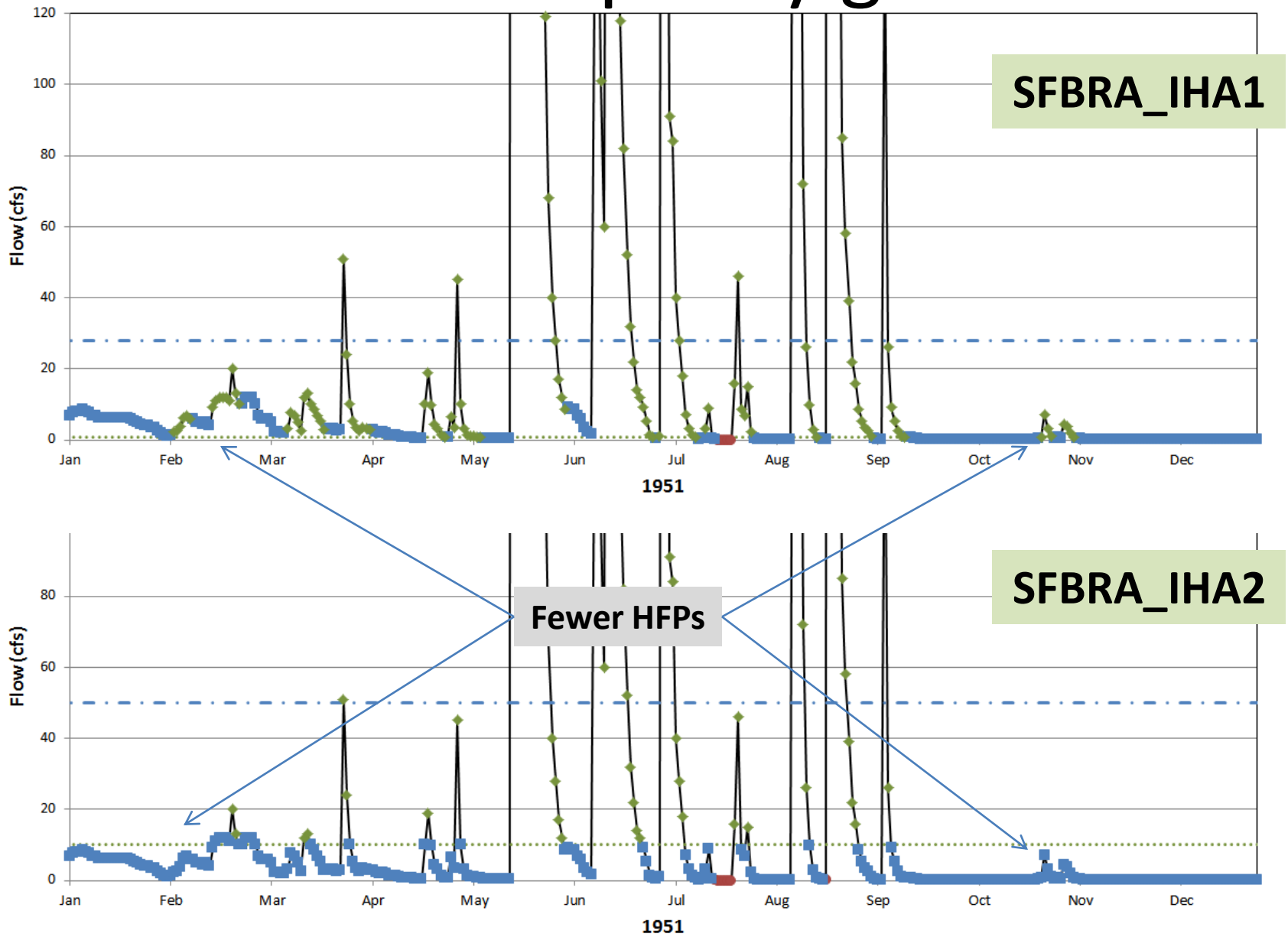
IHA Run 2

- Upper High Flow Pulse Threshold: 50 cfs
- Lower High Flow Pulse Threshold: 10 cfs
- Rise Rate: 0.25
- Overbank Threshold (2yr event – placeholder)

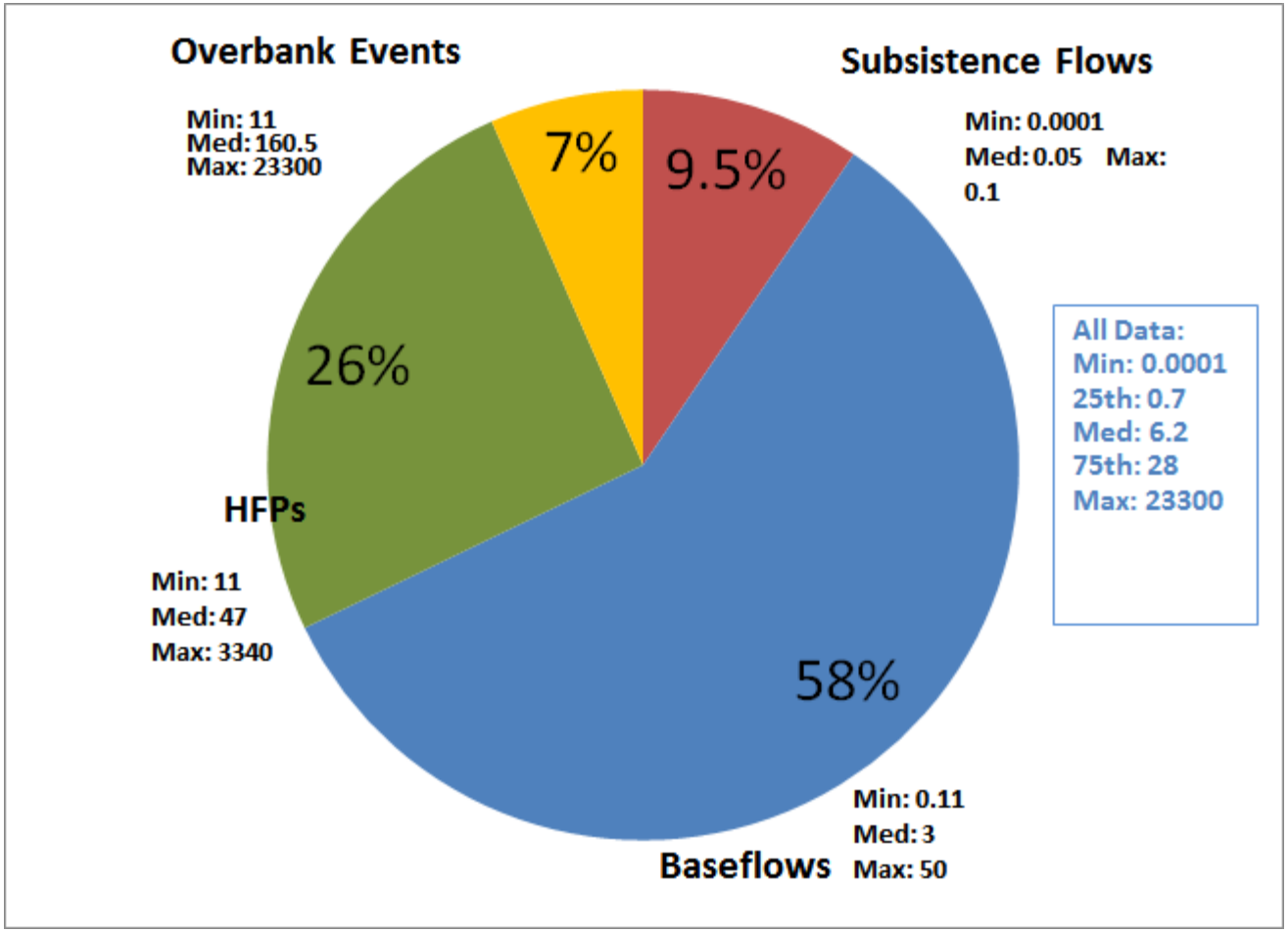

SFBRA_IHA2
SFBRA_IHA1
SFBRA_IHA2
Fewer HFPs
Shorter tail
Flow (cfs)
60
50
40
30
20
10
0
Jan-01
Jan-15
Jan-29
Feb-12
Feb-26
Mar-12
Mar-26
Apr-09
Apr-23
May-07
May-21
1947

SFBRA_IHA2

1951 still pretty good



SFBRA_IHA2


Overbank Events
Min: 11
Med: 160.5
Max: 23300
7%
9.5%
Subsistence Flows
Min: 0.0001
Med: 0.05 Max: 0.1
26%
All Data:
Min: 0.0001
25th: 0.7
Med: 6.2
75th: 28
Max: 23300
HFPs
Min: 11
Med: 47
Max: 3340
58%
Min: 0.11
Med: 3
Max: 50
Baseflows

SFBRA_IHA2

Overbank Flows	Qp: 9,340 cfs with Average Frequency 1 per 5 years Regressed Volume is 27,240 to 77,079 (45,822) Regressed Duration is 7 to 26 (14)											
High Flow Pulses	Qp: 6,040 cfs with Average Frequency 1 per 2 years Regressed Volume is 17,463 to 49,392 (29,369) Regressed Duration is 6 to 23 (12)											
	Qp: 3,610 cfs with Average Frequency 1 per year Regressed Volume is 10,330 to 29,205 (17,369) Regressed Duration is 6 to 20 (11)											
	Qp: 60 cfs with Average Frequency 1 per season Regressed Volume is 202 to 662 (366) Regressed Duration is 3 to 9 (5)			Qp: 1,720 cfs with Average Frequency 1 per season Regressed Volume is 5,073 to 12,367 (7,921) Regressed Duration is 4 to 14 (8)			Qp: 920 cfs with Average Frequency 1 per season Regressed Volume is 2,653 to 6,360 (4,108) Regressed Duration is 4 to 12 (7)			Qp: 162 cfs with Average Frequency 1 per season Regressed Volume is 498 to 1,477 (858) Regressed Duration is 3 to 11 (6)		
	Qp: 25 cfs with Average Frequency 2 per season Regressed Volume is 81 to 266 (147) Regressed Duration is 2 to 7 (4)			Qp: 624 cfs with Average Frequency 2 per season Regressed Volume is 1,751 to 4,265 (2,733) Regressed Duration is 3 to 11 (6)			Qp: 361 cfs with Average Frequency 2 per season Regressed Volume is 964 to 2,309 (1,492) Regressed Duration is 3 to 9 (5)			Qp: 46 cfs with Average Frequency 2 per season Regressed Volume is 137 to 406 (236) Regressed Duration is 2 to 7 (4)		
Base Flows (cfs)	8.5(40.2%)			5.8(57.5%)			4.4(46.4%)			9.6(43.3%)		
	5(59.2%)			2.3(70.5%)			0.9(57.6%)			3.3(59.9%)		
	2(77.4%)			0.55(82.3%)			0.3(69.3%)			0.63(76.1%)		
Subsistence Flows (cfs)	0(100.0%)			0.06(97.6%)			0.05(90.2%)			0.07(96.4%)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Winter			Spring			Summer			Fall		

Flow Levels	High (75th %ile)
	Medium (50th %ile)
	Low (25th %ile)
	Subsistence

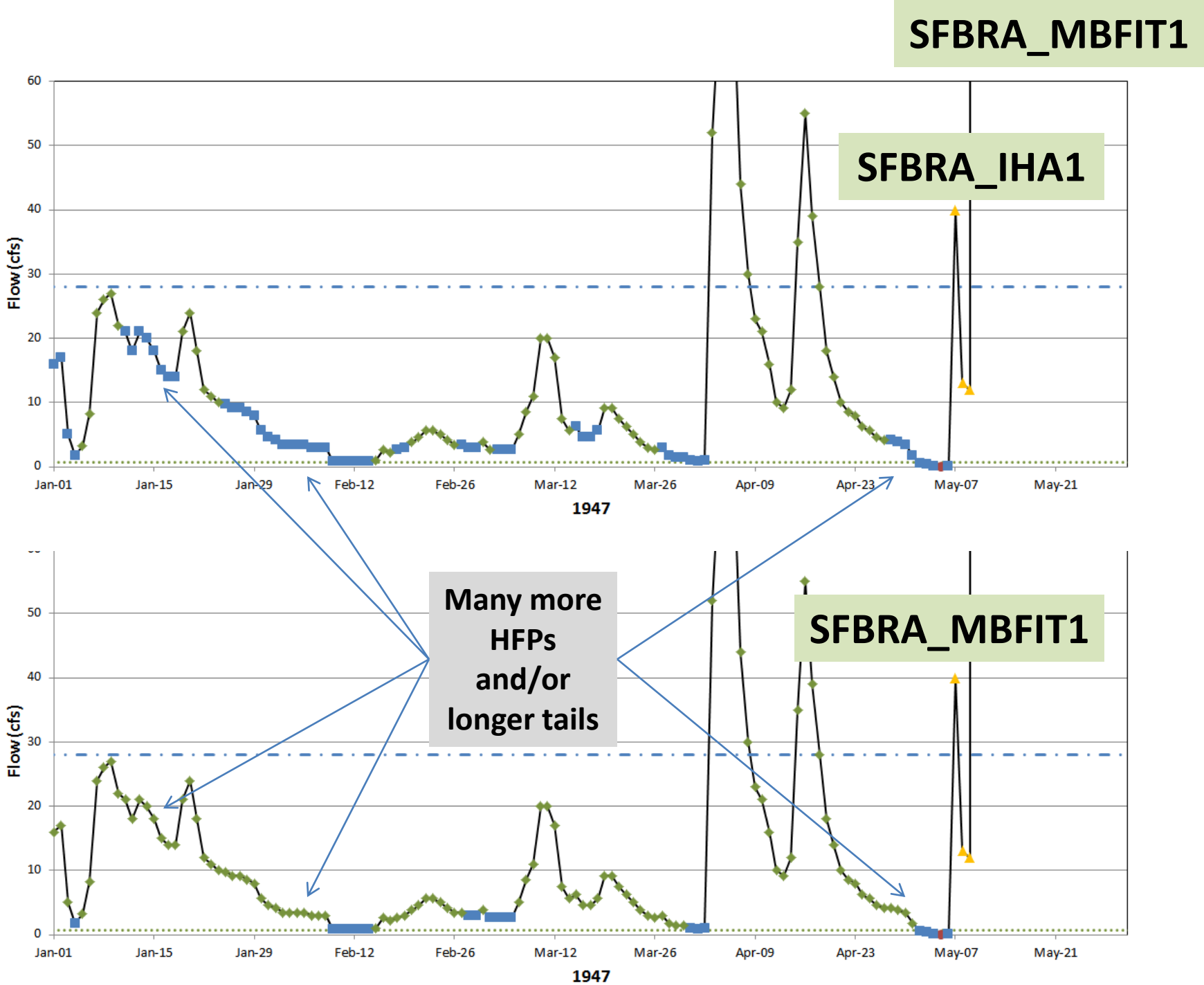
Notes:

1. Period of Record used : 1/1/1940 to 12/31/2010.

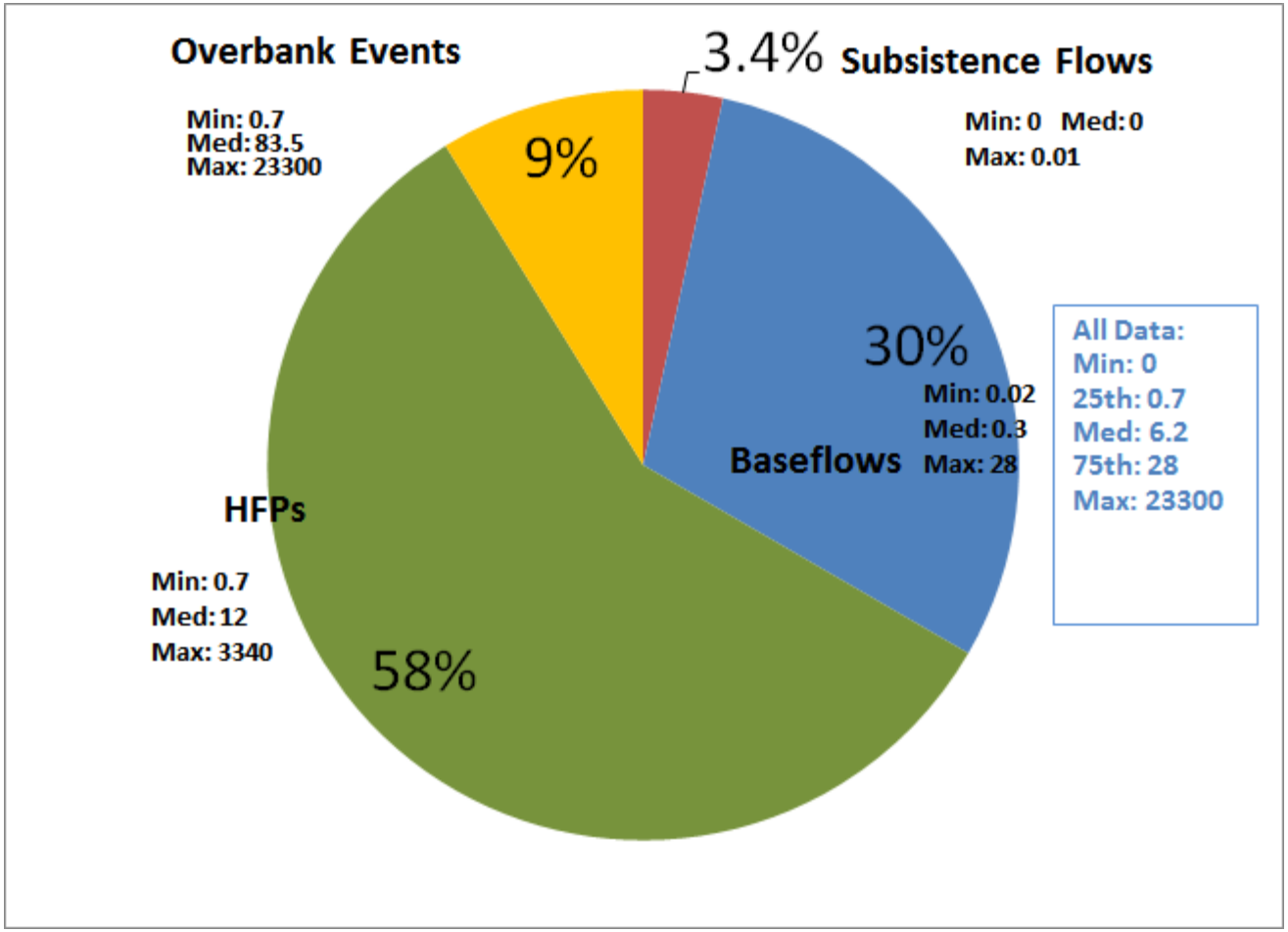
SFBRA_IHA2

MBFIT Run 1

- Upper High Flow Pulse Threshold: 75th %ile
- Lower High Flow Pulse Threshold: 25th %ile
- N = 7
- Overbank Threshold (2yr event – placeholder)


SFBRA_MBFIT1
SFBRA_IHA1
Flow (cfs)
60
50
40
30
20
10
0
Jan-01
Jan-15
Jan-29
Feb-12
Feb-26
Mar-12
Mar-26
Apr-09
Apr-23
May-07
May-21
1947
Many more HFPs and/or longer tails
SFBRA_MBFIT1
Flow (cfs)
50
40
30
20
10
0
Jan-01
Jan-15
Jan-29
Feb-12
Feb-26
Mar-12
Mar-26
Apr-09
Apr-23
May-07
May-21
1947

SFBRA_MBFIT1



SFBRA_MBFIT1

Overbank Flows	Qp: 9,340 cfs with Average Frequency 1 per 5 years Regressed Volume is 22,413 to 85,519 (43,781) Regressed Duration is 7 to 33 (15)											
High Flow Pulses	Qp: 6,040 cfs with Average Frequency 1 per 2 years Regressed Volume is 14,713 to 56,121 (28,735) Regressed Duration is 6 to 31 (14)											
	Qp: 3,610 cfs with Average Frequency 1 per year Regressed Volume is 8,950 to 34,129 (17,477) Regressed Duration is 6 to 28 (13)											
	Qp: 59 cfs with Average Frequency 1 per season Regressed Volume is 255 to 1,189 (551) Regressed Duration is 5 to 26 (12)			Qp: 1,720 cfs with Average Frequency 1 per season Regressed Volume is 4,858 to 12,734 (7,866) Regressed Duration is 5 to 18 (9)			Qp: 920 cfs with Average Frequency 1 per season Regressed Volume is 2,729 to 6,723 (4,283) Regressed Duration is 5 to 18 (9)			Qp: 162 cfs with Average Frequency 1 per season Regressed Volume is 527 to 2,228 (1,083) Regressed Duration is 5 to 25 (11)		
	Qp: 23 cfs with Average Frequency 2 per season Regressed Volume is 96 to 445 (206) Regressed Duration is 4 to 20 (9)			Qp: 624 cfs with Average Frequency 2 per season Regressed Volume is 1,783 to 4,669 (2,885) Regressed Duration is 4 to 16 (8)			Qp: 361 cfs with Average Frequency 2 per season Regressed Volume is 1,015 to 2,500 (1,593) Regressed Duration is 4 to 14 (7)			Qp: 44 cfs with Average Frequency 2 per season Regressed Volume is 146 to 618 (301) Regressed Duration is 4 to 18 (8)		
Base Flows (cfs)	5.9(53.1%)			0.6(81.8%)			0.31(66.8%)			3.3(59.9%)		
	2.2(76.4%)			0.32(87.2%)			0.2(76.4%)			0.4(81.6%)		
	0.3(90.9%)			0.2(92.9%)			0.1(86.2%)			0.2(89.6%)		
Subsistence Flows (cfs)	0(100.0%)			0(100.0%)			0(100.0%)			0(100.0%)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Winter			Spring			Summer			Fall		

Flow Levels	High (75th %ile)
	Medium (50th %ile)
	Low (25th %ile)
	Subsistence

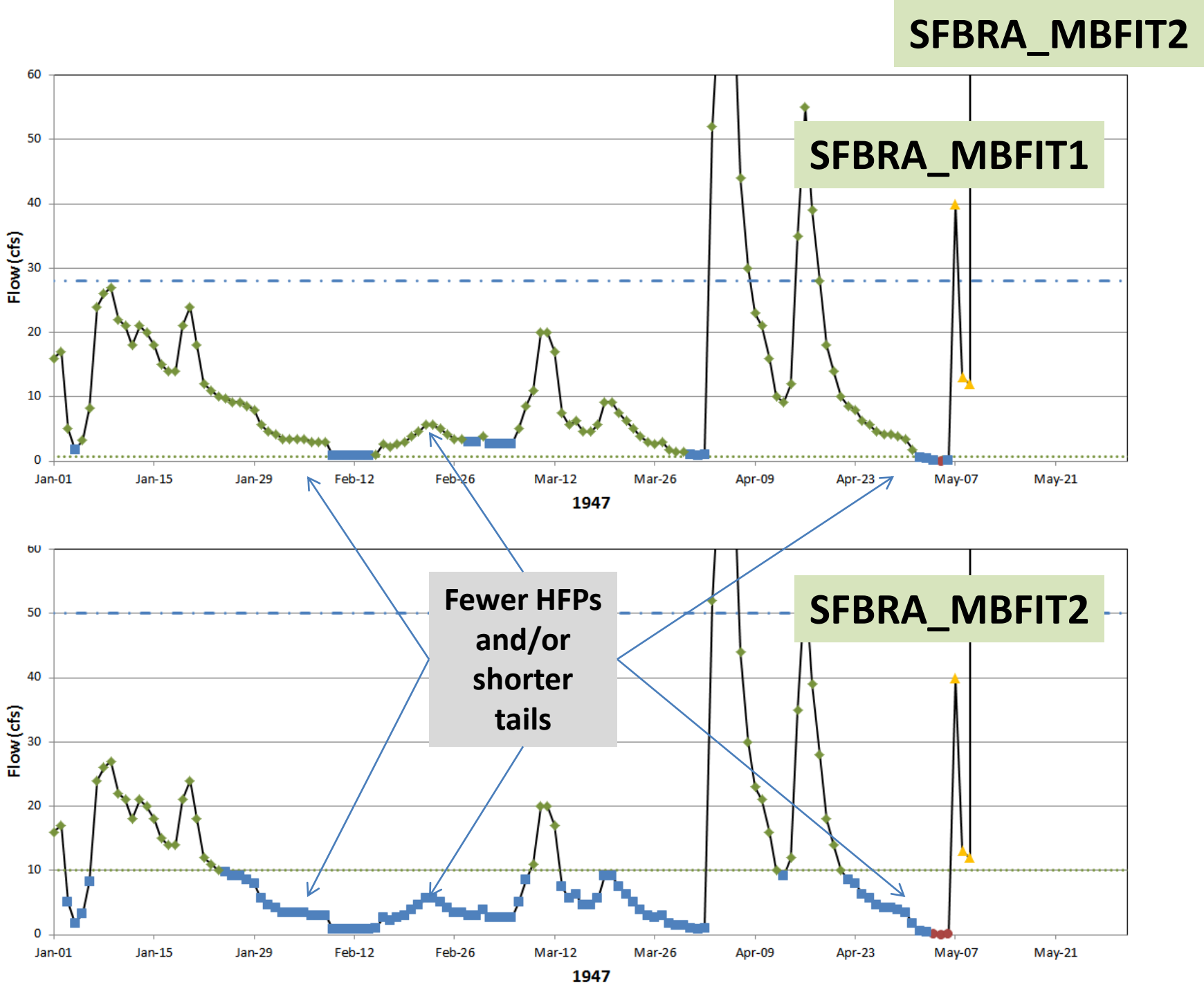
Notes:

1. Period of Record used : 1/1/1940 to 12/31/2010.

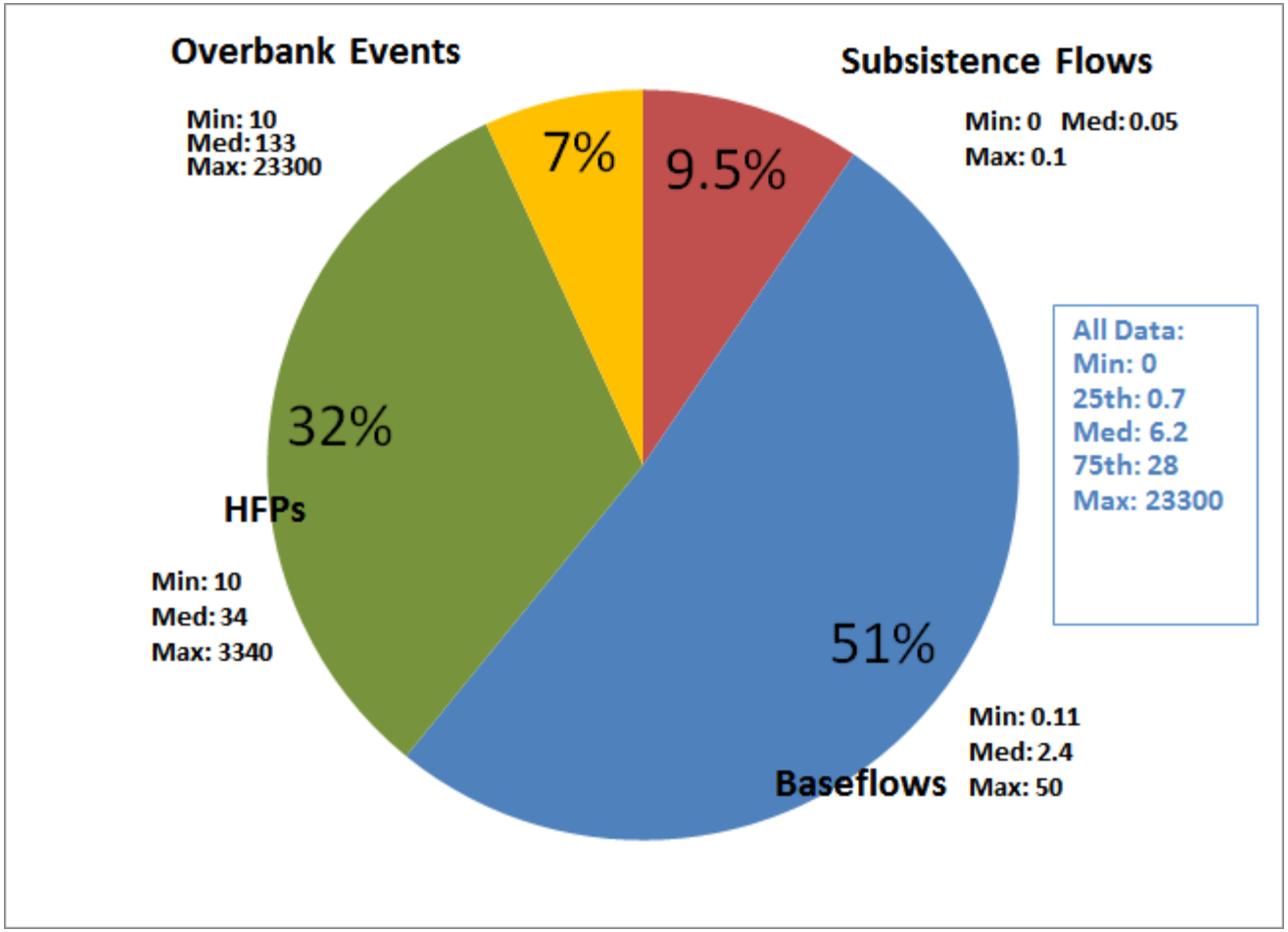
SFBRA_MBFIT1

MBFIT Run 2

- Upper High Flow Pulse Threshold: 50 cfs
- Lower High Flow Pulse Threshold: 10 cfs
- N = 7
- Overbank Threshold (2yr event – placeholder)


SFBRA_MBFIT2
SFBRA_MBFIT1
SFBRA_MBFIT2
Fewer HFPs and/or shorter tails
Flow (cfs)
60
50
40
30
20
10
0
Jan-01
Jan-15
Jan-29
Feb-12
Feb-26
Mar-12
Mar-26
Apr-09
Apr-23
May-07
May-21
1947

SFBRA_MBFIT2



SFBRA_MBFIT2

Overbank Flows	Qp: 9,340 cfs with Average Frequency 1 per 5 years Regressed Volume is 23,980 to 83,061 (44,630) Regressed Duration is 7 to 31 (14)											
High Flow Pulses	Qp: 6,040 cfs with Average Frequency 1 per 2 years Regressed Volume is 15,519 to 53,727 (28,875) Regressed Duration is 6 to 28 (13)											
	Qp: 3,610 cfs with Average Frequency 1 per year Regressed Volume is 9,283 to 32,121 (17,268) Regressed Duration is 5 to 24 (11)											
	Qp: 60 cfs with Average Frequency 1 per season Regressed Volume is 201 to 907 (427) Regressed Duration is 3 to 14 (6)			Qp: 1,720 cfs with Average Frequency 1 per season Regressed Volume is 4,982 to 12,785 (7,981) Regressed Duration is 4 to 16 (8)			Qp: 920 cfs with Average Frequency 1 per season Regressed Volume is 2,626 to 6,619 (4,169) Regressed Duration is 4 to 14 (7)			Qp: 162 cfs with Average Frequency 1 per season Regressed Volume is 465 to 1,949 (952) Regressed Duration is 3 to 16 (7)		
	Qp: 24 cfs with Average Frequency 2 per season Regressed Volume is 75 to 339 (160) Regressed Duration is 2 to 10 (4)			Qp: 624 cfs with Average Frequency 2 per season Regressed Volume is 1,728 to 4,432 (2,768) Regressed Duration is 3 to 12 (6)			Qp: 361 cfs with Average Frequency 2 per season Regressed Volume is 958 to 2,413 (1,520) Regressed Duration is 3 to 10 (5)			Qp: 44 cfs with Average Frequency 2 per season Regressed Volume is 127 to 531 (259) Regressed Duration is 2 to 11 (5)		
Base Flows (cfs)	6.6(48.1%)			4.6(60.7%)			3(48.6%)			5.9(51.5%)		
	4.1(63.5%)			2(72.3%)			0.75(59.0%)			2.2(65.2%)		
	1.6(79.4%)			0.5(83.7%)			0.29(69.4%)			0.5(78.9%)		
Subsistence Flows (cfs)	0(100.0%)			0.06(97.6%)			0.05(90.2%)			0.07(96.4%)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Winter			Spring			Summer			Fall		

Flow Levels	
	High (75th %ile)
	Medium (50th %ile)
	Low (25th %ile)
	Subsistence

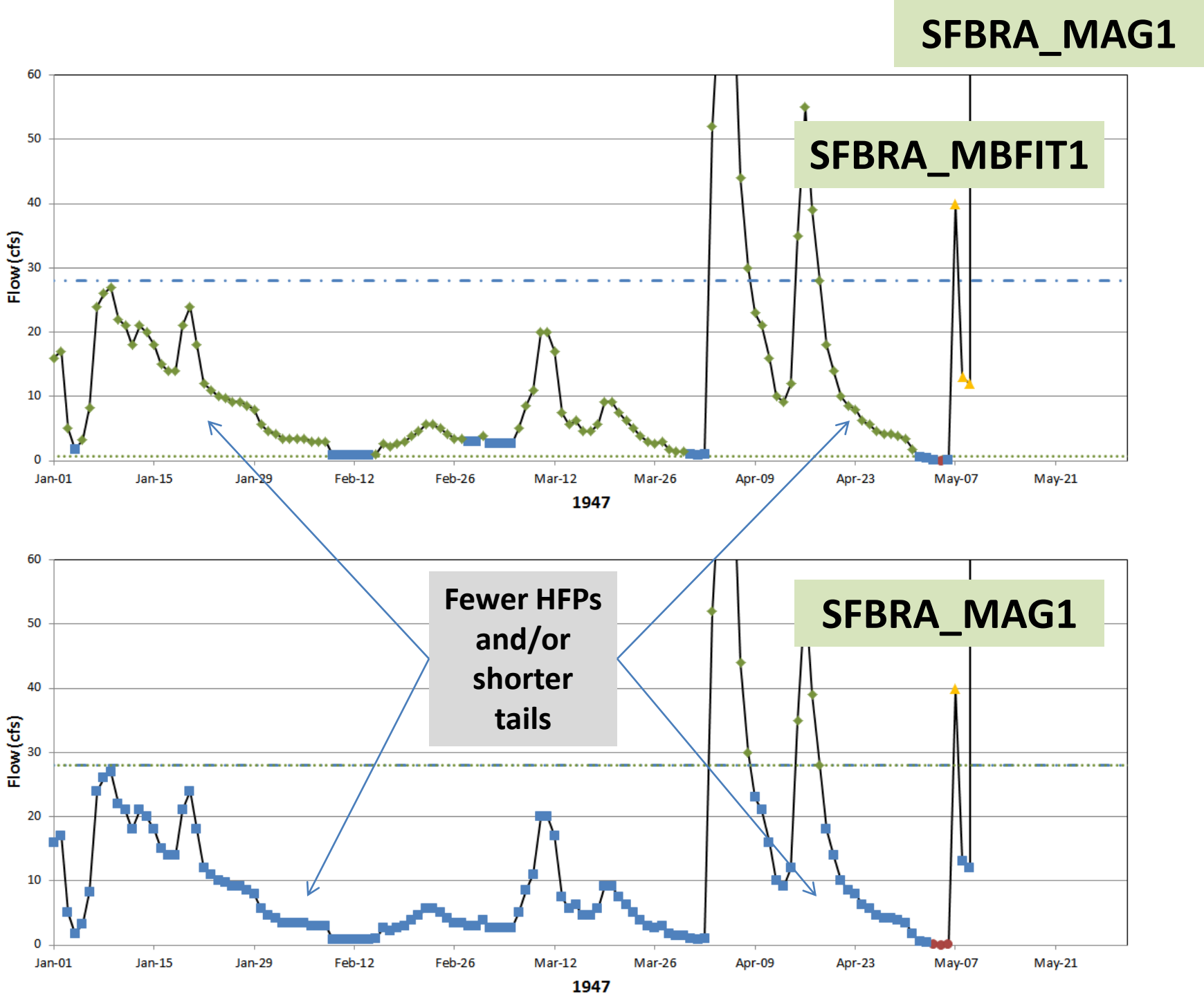
Notes:

1. Period of Record used : 1/1/1940 to 12/31/2010.

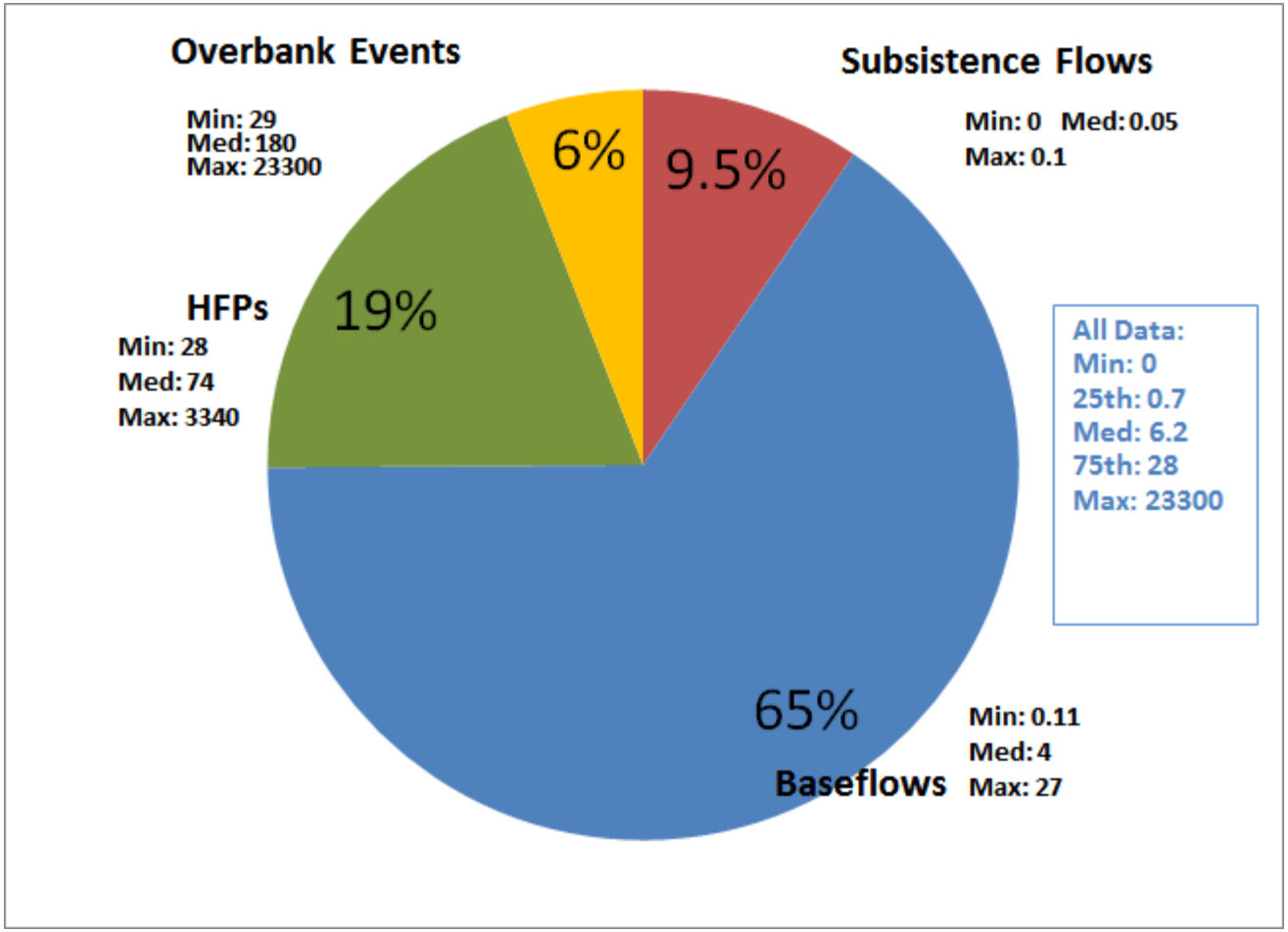
SFBRA_MBFIT2

“Bright Line” Magnitude Run 1

- All flows ≥ 75th %ile (28 cfs) are high flow pulses or overbank events
- All flows < 75th %ile are base flows or subsistence flows
- Subsistence flows = bottom 10% of population of “<75th %ile”


SFBRA_MAG1
SFBRA_MBFIT1
Flow (cfs)
60
50
40
30
20
10
0
Jan-01
Jan-15
Jan-29
Feb-12
Feb-26
Mar-12
Mar-26
Apr-09
Apr-23
May-07
May-21
1947
Fewer HFPs and/or shorter tails
SFBRA_MAG1
Flow (cfs)
60
50
40
30
20
10
0
Jan-01
Jan-15
Jan-29
Feb-12
Feb-26
Mar-12
Mar-26
Apr-09
Apr-23
May-07
May-21
1947

SFBRA_MAG1


Overbank Events
Min: 29
Med: 180
Max: 23300
Subsistence Flows
Min: 0 Med: 0.05
Max: 0.1
6%
9.5%
HFPs
19%
Min: 28
Med: 74
Max: 3340
All Data:
Min: 0
25th: 0.7
Med: 6.2
75th: 28
Max: 23300
65%
Min: 0.11
Med: 4
Max: 27
Baseflows

SFBRA_MAG1

Overbank Flows	Qp: 9,340 cfs with Average Frequency 1 per 5 years Regressed Volume is 28,794 to 86,433 (49,888) Regressed Duration is 7 to 30 (15)											
High Flow Pulses	Qp: 6,040 cfs with Average Frequency 1 per 2 years Regressed Volume is 18,058 to 54,172 (31,277) Regressed Duration is 6 to 25 (13)											
	Qp: 3,610 cfs with Average Frequency 1 per year Regressed Volume is 10,408 to 31,205 (18,022) Regressed Duration is 5 to 21 (10)											
	Qp: 59 cfs with Average Frequency 1 per season Regressed Volume is 127 to 616 (280) Regressed Duration is 1 to 8 (3)			Qp: 1,720 cfs with Average Frequency 1 per season Regressed Volume is 4,900 to 12,107 (7,702) Regressed Duration is 4 to 13 (7)			Qp: 920 cfs with Average Frequency 1 per season Regressed Volume is 2,557 to 6,253 (3,998) Regressed Duration is 3 to 10 (6)			Qp: 162 cfs with Average Frequency 1 per season Regressed Volume is 396 to 1,409 (747) Regressed Duration is 2 to 9 (4)		
				Qp: 624 cfs with Average Frequency 2 per season Regressed Volume is 1,652 to 4,077 (2,595) Regressed Duration is 3 to 9 (5)			Qp: 361 cfs with Average Frequency 2 per season Regressed Volume is 900 to 2,200 (1,407) Regressed Duration is 2 to 7 (4)			Qp: 44 cfs with Average Frequency 2 per season Regressed Volume is 96 to 344 (182) Regressed Duration is 1 to 5 (2)		
Base Flows (cfs)	10(35.1%)			9.8(50.6%)			8.4(40.6%)			11(41.2%)		
	5.6(54.9%)			3.3(65.3%)			1.6(53.9%)			4(57.8%)		
	2.4(75.1%)			0.78(80.2%)			0.32(66.7%)			0.7(75.4%)		
Subsistence Flows (cfs)	0(100.0%)			0.06(97.6%)			0.05(90.2%)			0.07(96.4%)		
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
	Winter			**Spring**			**Summer**			**Fall**		

Flow Levels	**High (75th %ile)**
	Medium (50th %ile)
	Low (25th %ile)
	Subsistence

Notes:

1. Period of Record used : 1/1/1940 to 12/31/2010.

SFBRA_MAG1

Brazos River near Hempstead

2 IHA Runs
1 MBFIT Run
1 “Bright Line Magnitude” Run

Brazos River near Hempstead

Washington County, Texas
Hydrologic Unit Code 12070101
Latitude 30°07'44", Longitude 96°11'15" NAD27
Drainage area 43,880 square miles
Contributing drainage area 34,314 square miles
Gage datum 107.90 feet above NGVD29

Location of the site in Texas.

Lake Somerville

Summary Information

- Period of Record
  - Oct 1, 1938 to present
- Contributing Drainage Area: 34,314 sq mi.
- Major Upstream Impoundments
  - Far upstream, PK, Granbury, Whitney, tributary reservoirs
- TCEQ Pub Critical Low Flow (7Q2): 841 cfs
- NWS Flood Categories:
  - Action Stage: 25 ft ≈ 20,000 cfs

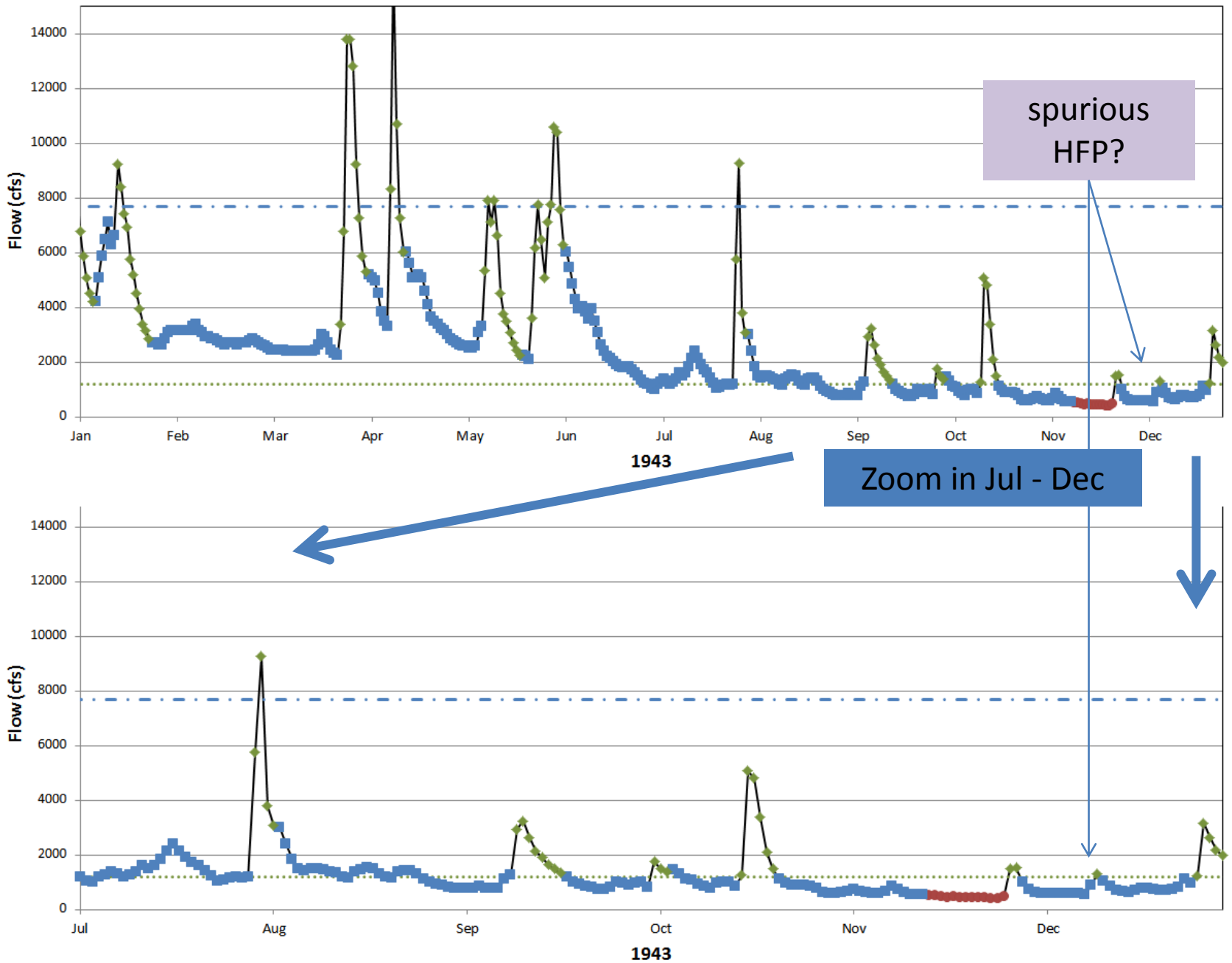
    No text
  - Flood: 50 ft ≈ 100,00 cfs

    "Minor lowland flooding begins."
  - Moderate Flood: 53 ft
  - Major Flood: 55 ft
  - Could use BRA help on this

IHA Run 1

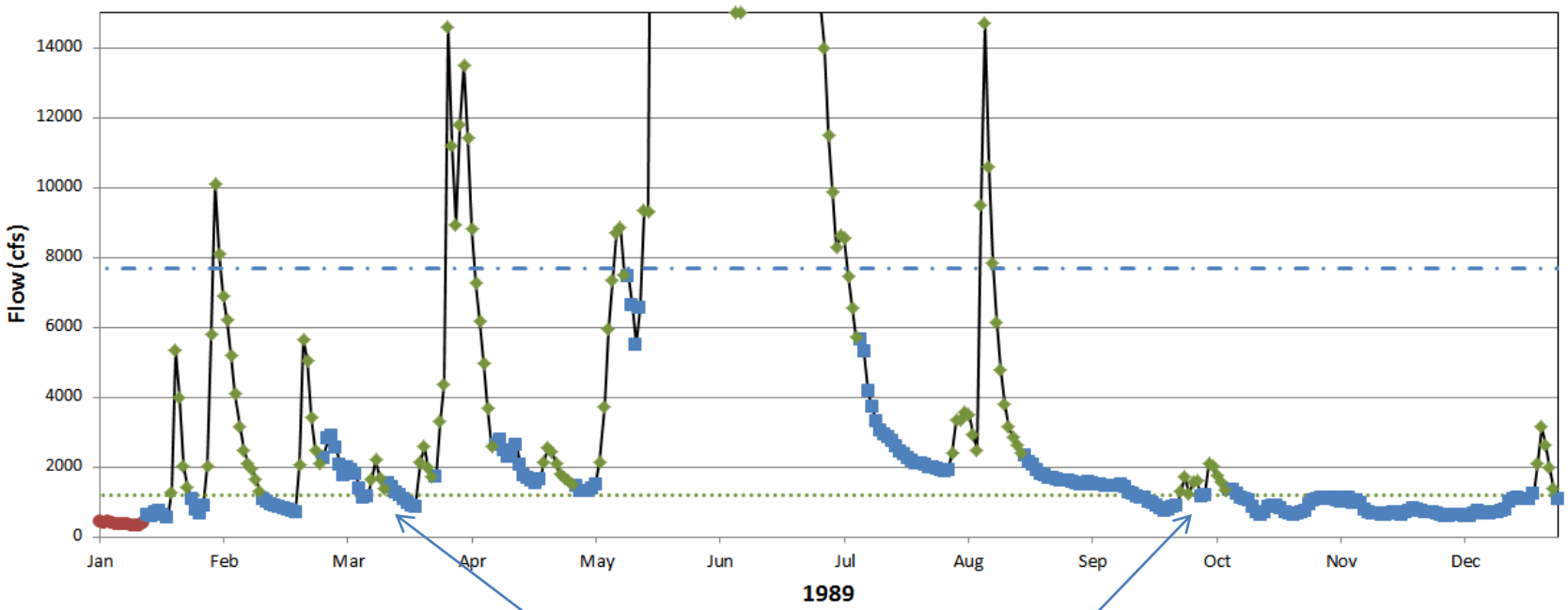
- Upper High Flow Pulse Threshold: 75th %ile (7680 cfs)
- Lower High Flow Pulse Threshold: 25th %ile (1200 cfs)
- Rise Rate: 0.25
- Overbank Threshold (2yr event – placeholder)

BRHS_IHA1


spurious HFP?
Zoom in Jul - Dec
Flow (cfs)
14000
12000
10000
8000
6000
4000
2000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
1943
Flow (cfs)
14000
12000
10000
8000
6000
4000
2000
0
Jul
Aug
Sep
Oct
Nov
Dec
1943

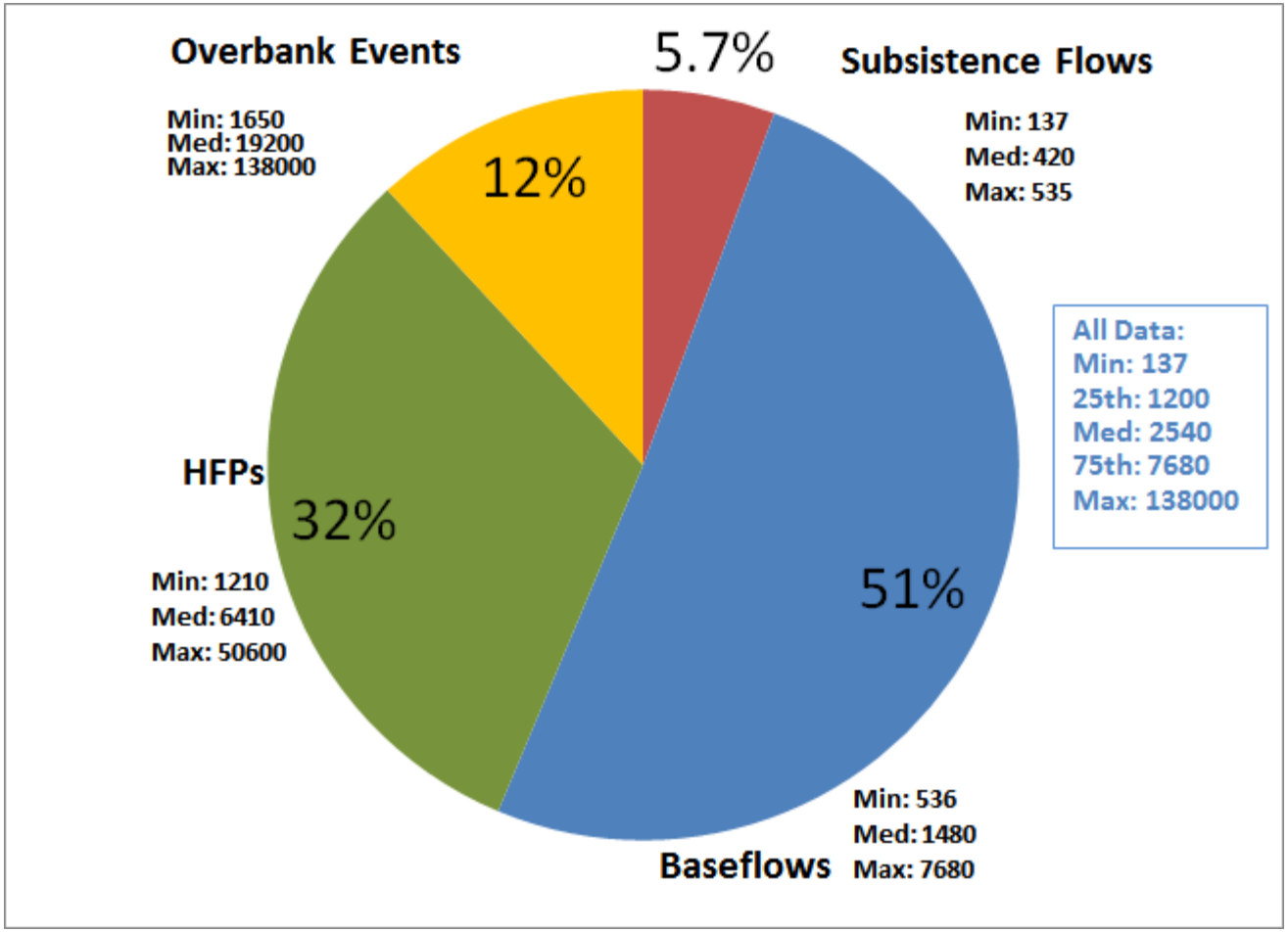
BRHS_IHA1

A good year with few dubious classifications



Very Small HFPs

BRHS_IHA1


Overbank Events
Min: 1650
Med: 19200
Max: 138000
12%
5.7%
Subsistence Flows
Min: 137
Med: 420
Max: 535
All Data:
Min: 137
25th: 1200
Med: 2540
75th: 7680
Max: 138000
HFPs
32%
Min: 1210
Med: 6410
Max: 50600
51%
Min: 536
Med: 1480
Max: 7680
Baseflows

BRHS_IHA1

Overbank Flows	Qp: 80,300 cfs with Average Frequency 1 per 5 years Regressed Volume is 1,163,433 to 2,845,588 (1,819,520) Regressed Duration is 17 to 46 (28)											
High Flow Pulses	Qp: 63,900 cfs with Average Frequency 1 per 2 years Regressed Volume is 851,446 to 2,081,857 (1,331,386) Regressed Duration is 15 to 40 (24)											
	Qp: 50,000 cfs with Average Frequency 1 per year Regressed Volume is 608,930 to 1,488,433 (952,025) Regressed Duration is 13 to 35 (21)											
	Qp: 21,000 cfs with Average Frequency 1 per season Regressed Volume is 199,088 to 492,456 (313,117)			Qp: 28,100 cfs with Average Frequency 1 per season Regressed Volume is 278,917 to 681,813 (436,084)			Qp: 6,210 cfs with Average Frequency 1 per season Regressed Volume is 34,696 to 86,543 (54,797) Regressed Duration is 4 to 11 (7)			Qp: 14,900 cfs with Average Frequency 1 per season Regressed Volume is 111,740 to 260,312 (170,550)		
	Qp: 8,480 cfs with Average Frequency 2 per season Regressed Volume is 57,071 to 141,033 (89,715) Regressed Duration is 5 to 13 (8)			Qp: 10,600 cfs with Average Frequency 2 per season Regressed Volume is 72,572 to 177,216 (113,406) Regressed Duration is 5 to			Qp: 2,610 cfs with Average Frequency 2 per season Regressed Volume is 11,273 to 28,125 (17,806) Regressed Duration is 3 to 7 (4)			Qp: 6,240 cfs with Average Frequency 2 per season Regressed Volume is 33,489 to 77,971 (51,100) Regressed Duration is 4 to 10 (6)		
Base Flows (cfs)	3150(52.6%)			3573(59.7%)			2043(39.1%)			2320(43.9%)		
	1700(69.2%)			1980(75.1%)			1340(62.2%)			1300(62.5%)		
	1010(82.7%)			1180(88.7%)			990(79.6%)			862(75.9%)		
Subsistence Flows (cfs)	435(97.0%)			449(99.3%)			440(98.2%)			398(94.4%)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Winter			Spring			Summer			Fall		

Flow Levels	High (75th %ile)
	Medium (50th %ile)
	Low (25th %ile)
	Subsistence

Notes:

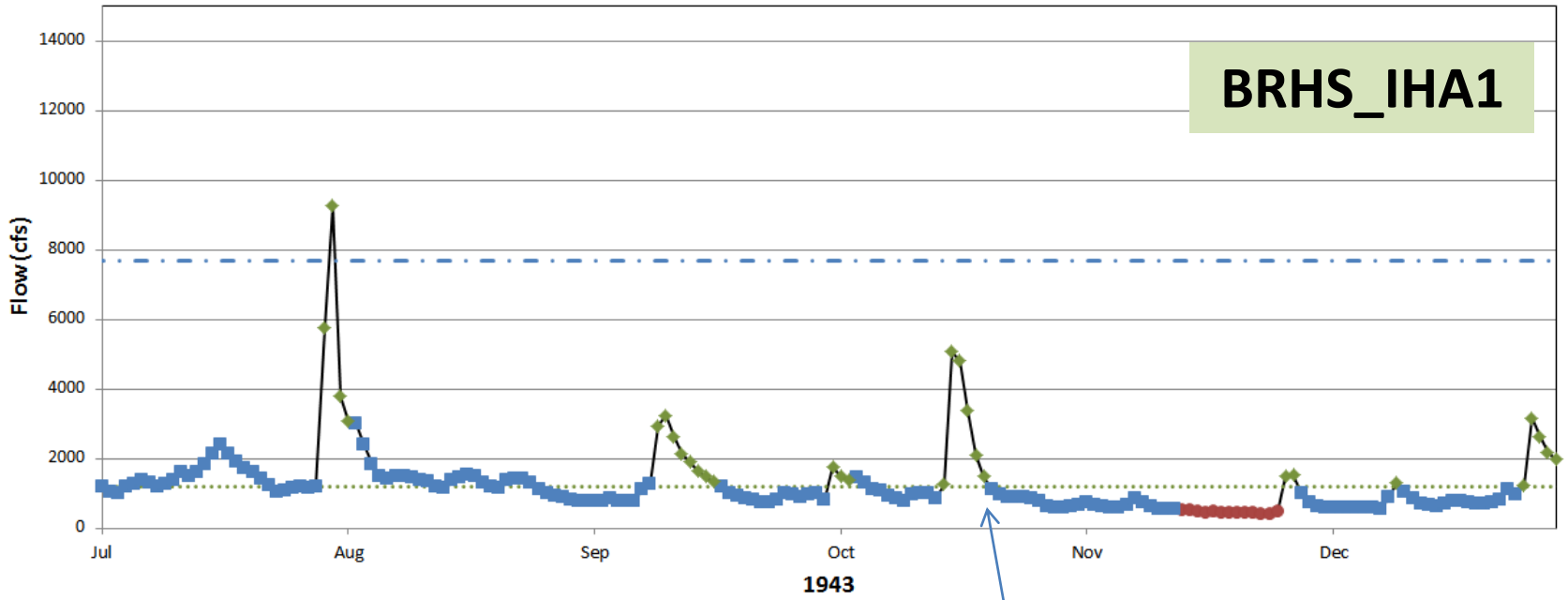
1. Period of Record used : 1/1/1939 to 40543.

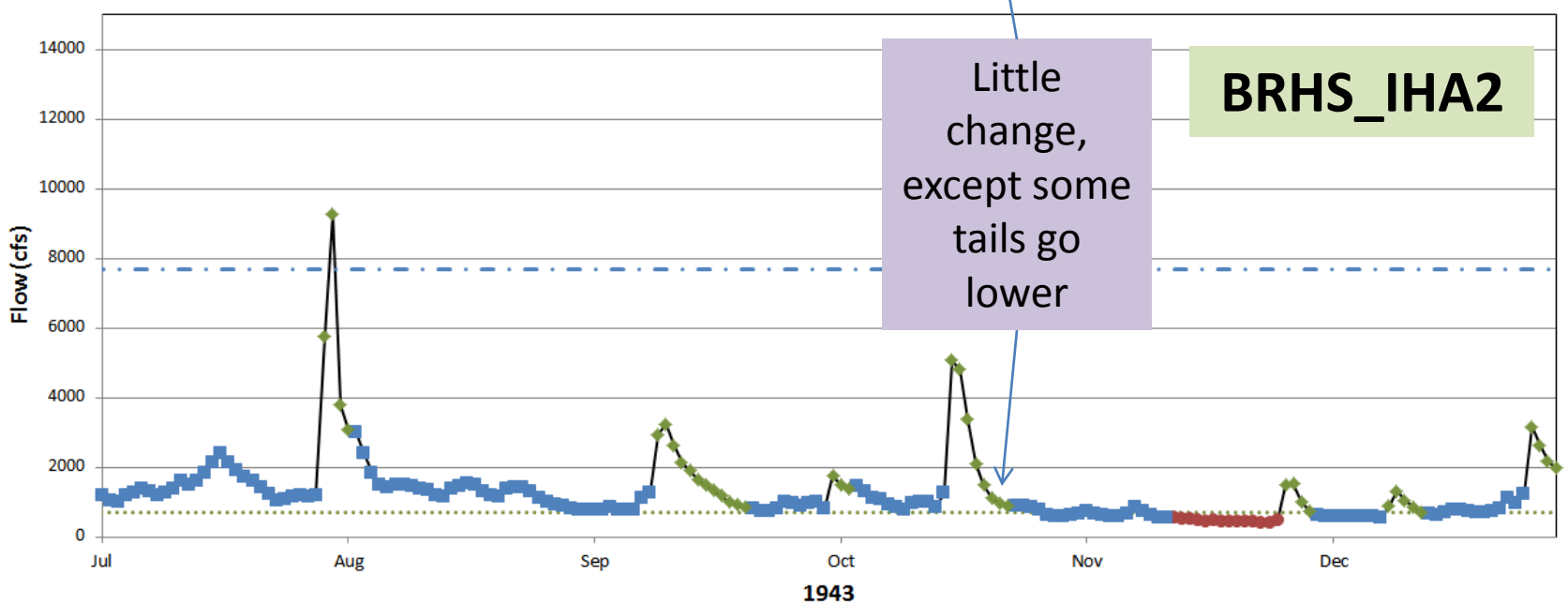
BRHS_IHA1

IHA Run 2

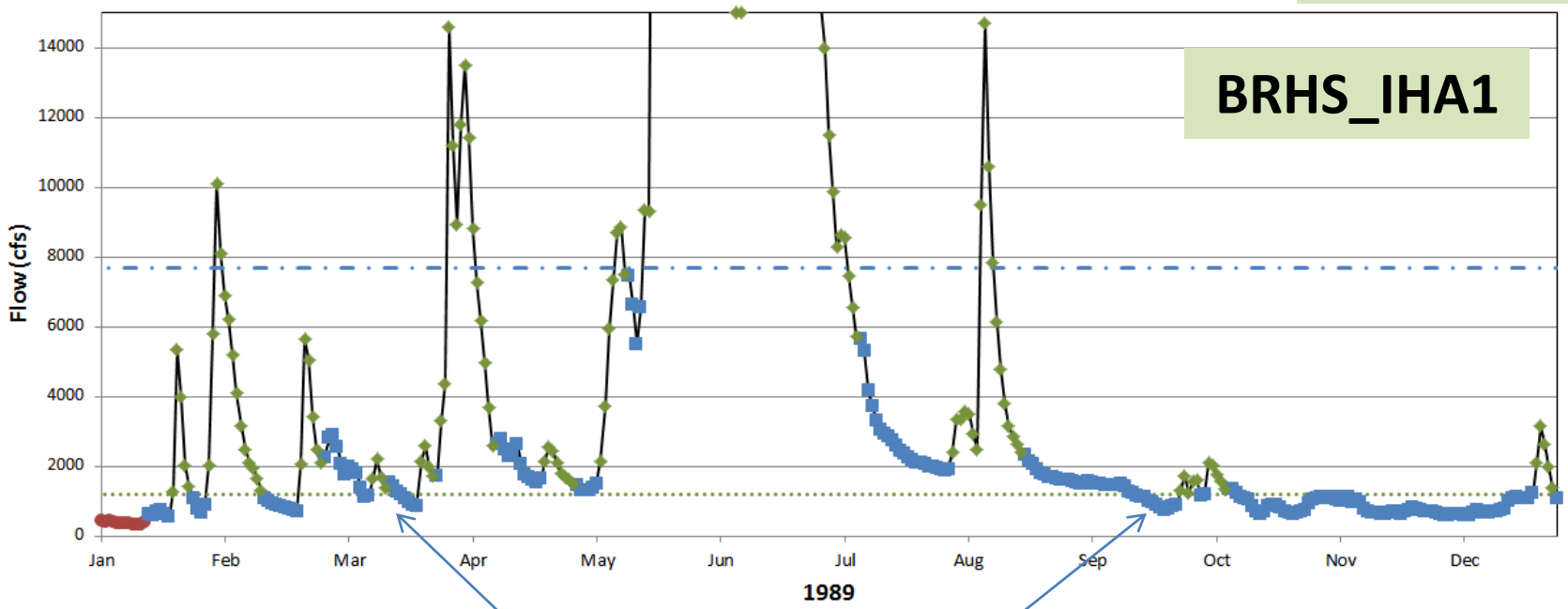
- SysOps parameter set
  - Upper High Flow Pulse Threshold: 75th %ile (7680 cfs)
  - Lower High Flow Pulse Threshold: 10th %ile (695 cfs)
  - Rise Rate: 0.50
  - Overbank Threshold: 1.5yr event

BRHS_IHA2

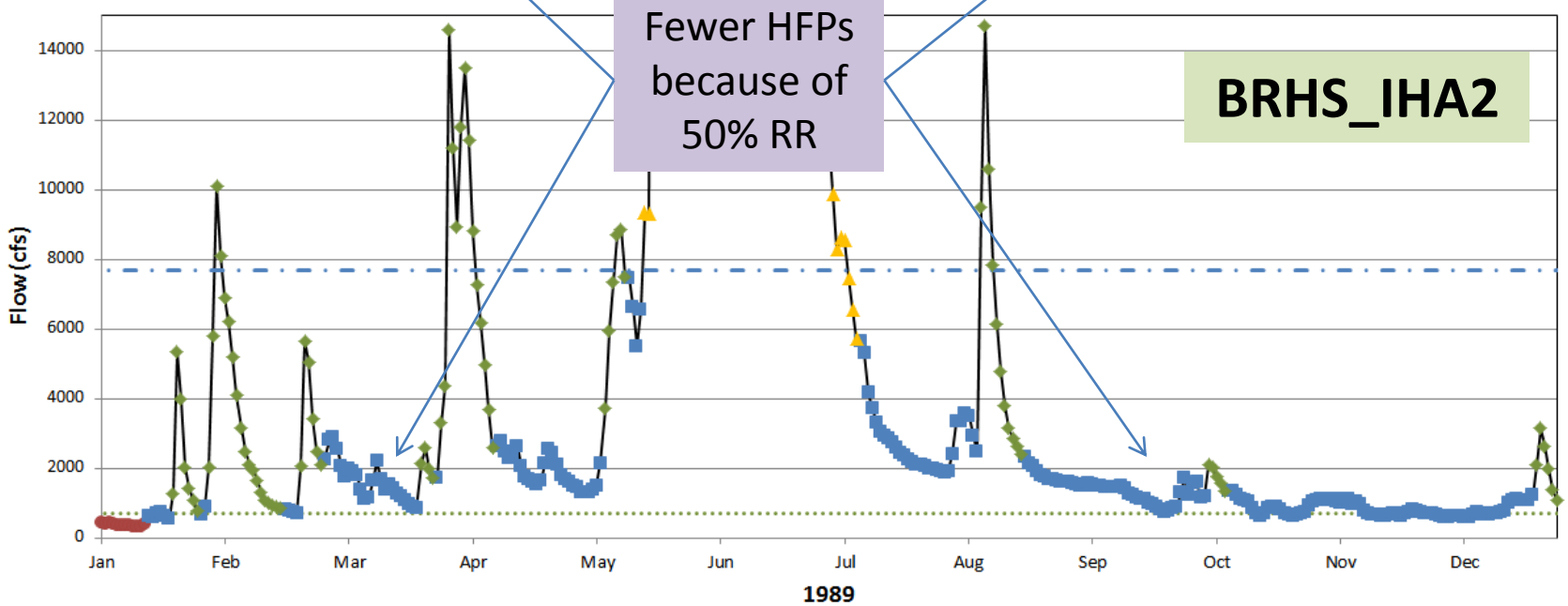

BRHS_IHA1
Flow (cfs)
14000
12000
10000
8000
6000
4000
2000
0
Jul
Aug
Sep
Oct
Nov
Dec
1943


BRHS_IHA2
Little change, except some tails go lower
Flow (cfs)
14000
12000
10000
8000
6000
4000
2000
0
Jul
Aug
Sep
Oct
Nov
Dec
1943

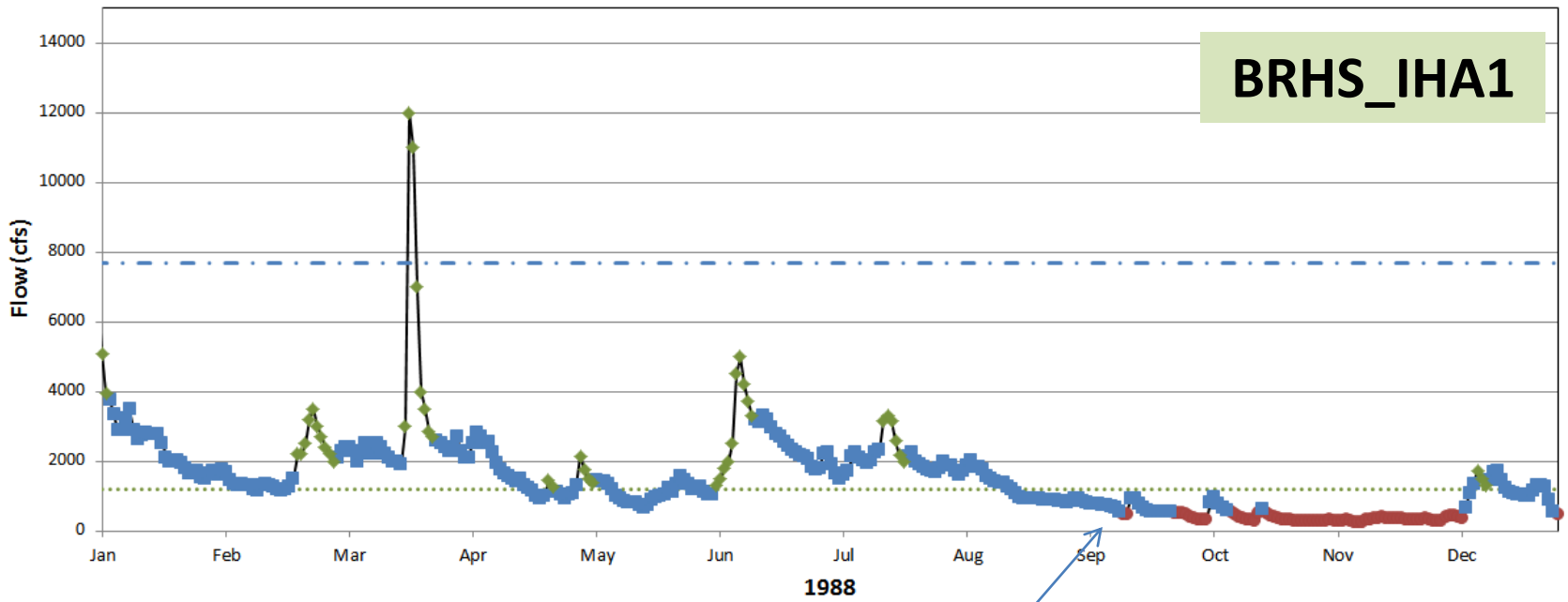
BRHS_IHA2



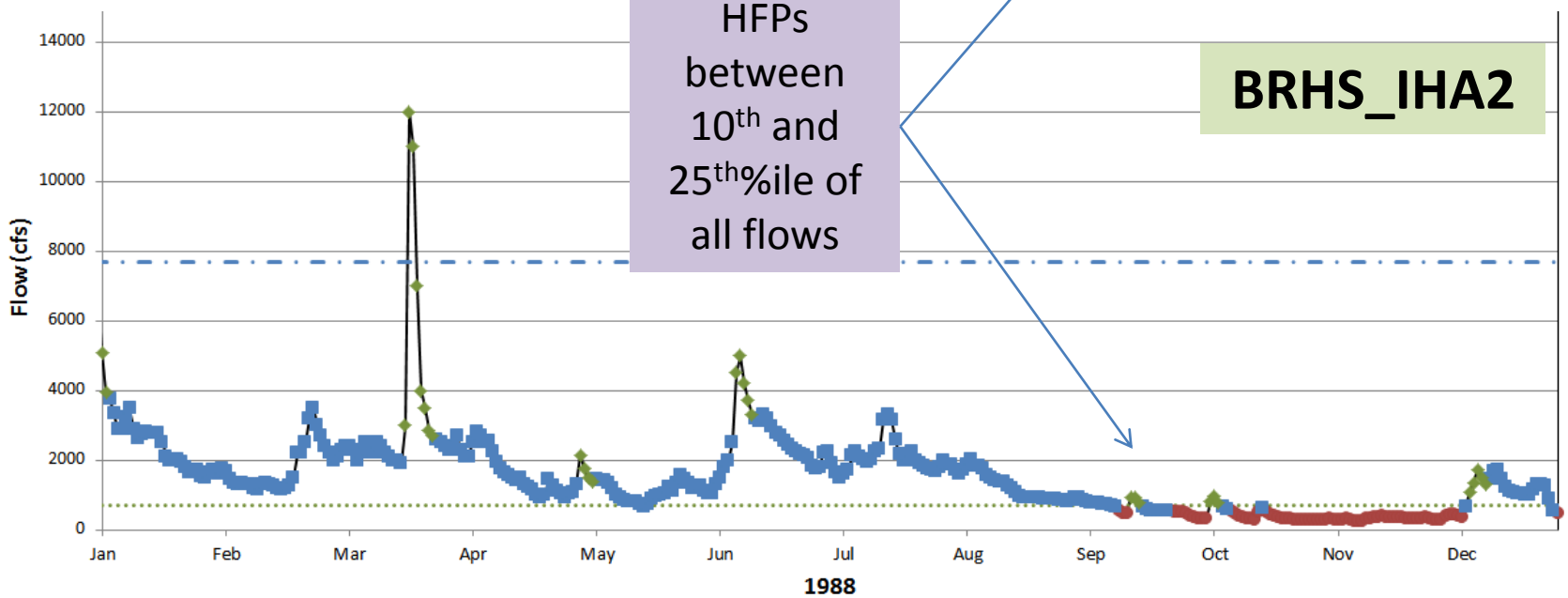
Fewer HFPs because of 50% RR



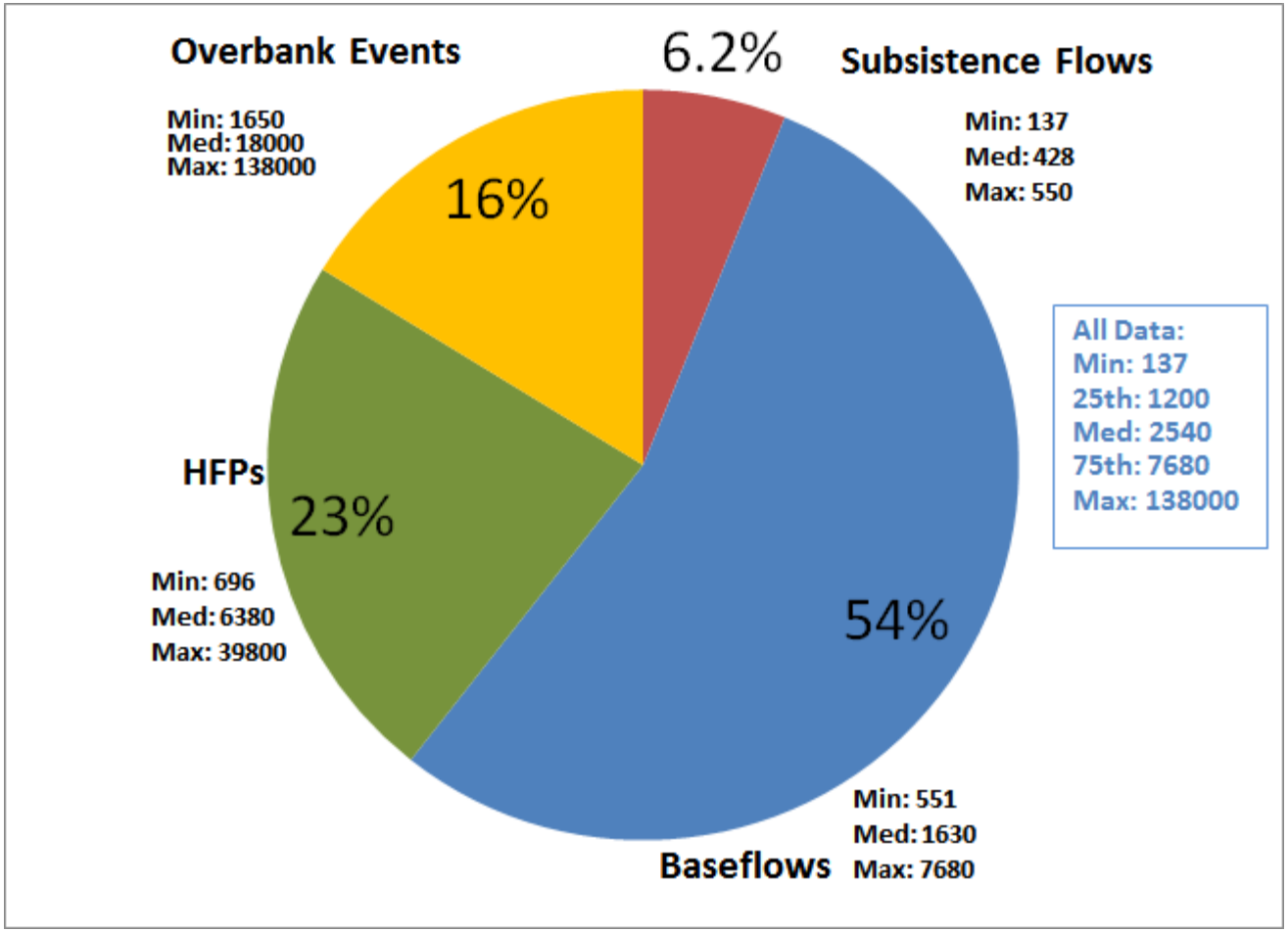
BRHS_IHA2



HFPs between 10th and 25th%ile of all flows



BRHS_IHA2


Overbank Events
Min: 1650
Med: 18000
Max: 138000
16%
6.2%
Subsistence Flows
Min: 137
Med: 428
Max: 550
All Data:
Min: 137
25th: 1200
Med: 2540
75th: 7680
Max: 138000
HFPs
23%
Min: 696
Med: 6380
Max: 39800
54%
Min: 551
Med: 1630
Max: 7680
Baseflows

BRHS_IHA2

Overbank Flows	Qp: 80,300 cfs with Average Frequency 1 per 5 years Regressed Volume is 1,051,688 to 2,598,425 (1,653,098) Regressed Duration is 14 to 40 (24)											
High Flow Pulses	Qp: 63,900 cfs with Average Frequency 1 per 2 years Regressed Volume is 777,844 to 1,921,169 (1,222,444) Regressed Duration is 13 to 36 (21)											
	Qp: 50,000 cfs with Average Frequency 1 per year Regressed Volume is 562,638 to 1,389,183 (884,085) Regressed Duration is 11 to 32 (19)											
	Qp: 21,000 cfs with Average Frequency 1 per season Regressed Volume is 196,918 to 491,350 (311,055)			Qp: 28,100 cfs with Average Frequency 1 per season Regressed Volume is 269,771 to 668,426 (424,644)			Qp: 5,650 cfs with Average Frequency 1 per season Regressed Volume is 30,057 to 79,603 (48,915) Regressed Duration is 4 to 11 (7)			Qp: 14,900 cfs with Average Frequency 1 per season Regressed Volume is 111,181 to 246,903 (165,683)		
	Qp: 8,480 cfs with Average Frequency 2 per season Regressed Volume is 59,163 to 147,525 (93,424) Regressed Duration is 5 to 14 (8)			Qp: 10,600 cfs with Average Frequency 2 per season Regressed Volume is 70,508 to 174,573 (110,945) Regressed Duration is 5 to			Qp: 952 cfs with Average Frequency 2 per season Regressed Volume is 3,498 to 9,345 (5,717) Regressed Duration is 2 to 6 (3)			Qp: 6,210 cfs with Average Frequency 2 per season Regressed Volume is 35,253 to 78,256 (52,524) Regressed Duration is 4 to 10 (6)		
Base Flows (cfs)	3360(51.2%)			3700(58.7%)			2180(36.7%)			2530(41.6%)		
	1910(65.9%)			2120(73.2%)			1475(56.4%)			1450(58.5%)		
	1135(79.9%)			1310(86.2%)			1060(76.2%)			925(73.7%)		
Subsistence Flows (cfs)	446(96.7%)			455(99.2%)			454(97.8%)			400(94.1%)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Winter			Spring			Summer			Fall		

Flow Levels	
	High (75th %ile)
	Medium (50th %ile)
	Low (25th %ile)
	Subsistence

Notes:

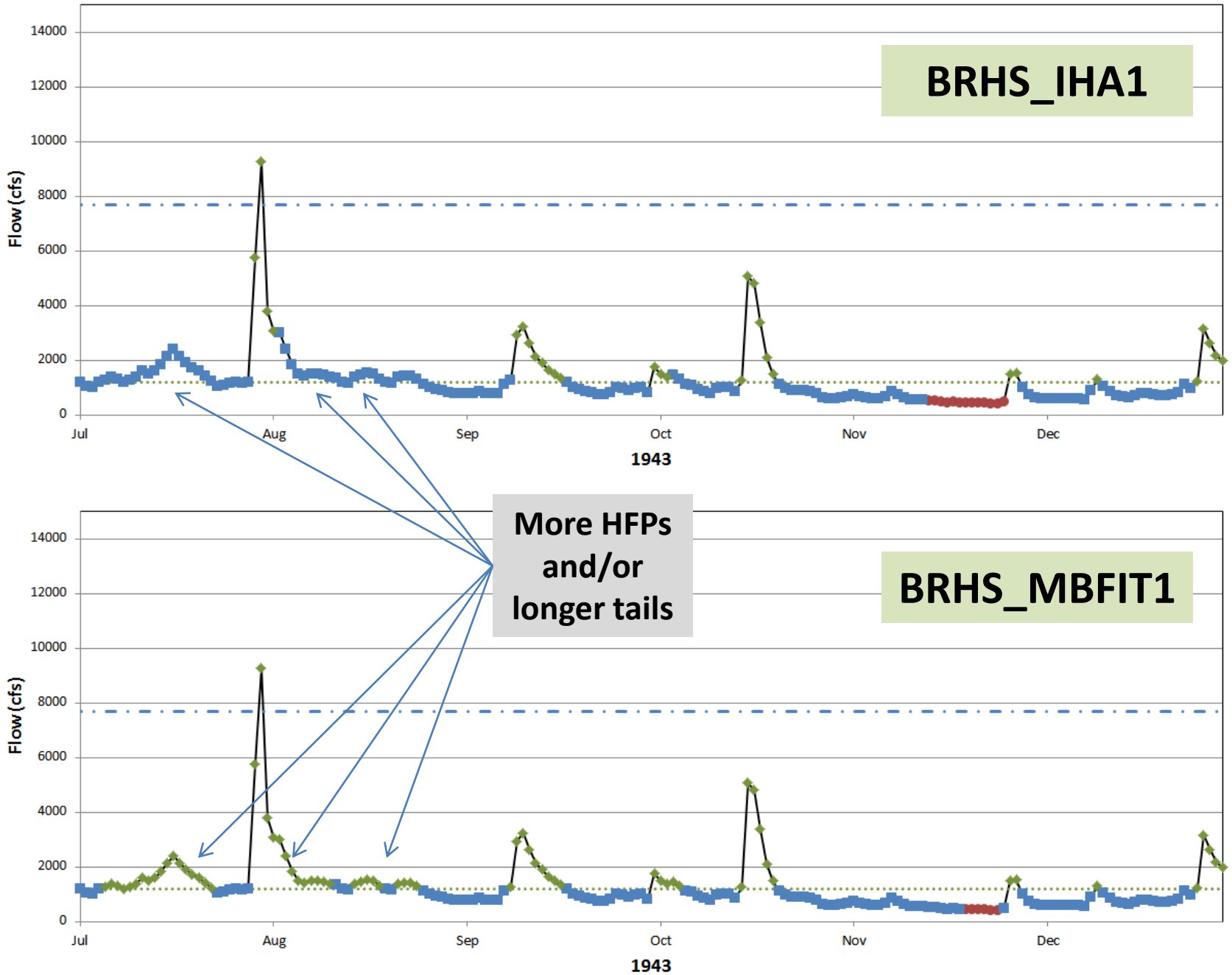
1. Period of Record used : 1/1/1939 to 40543.

BRHS_IHA2

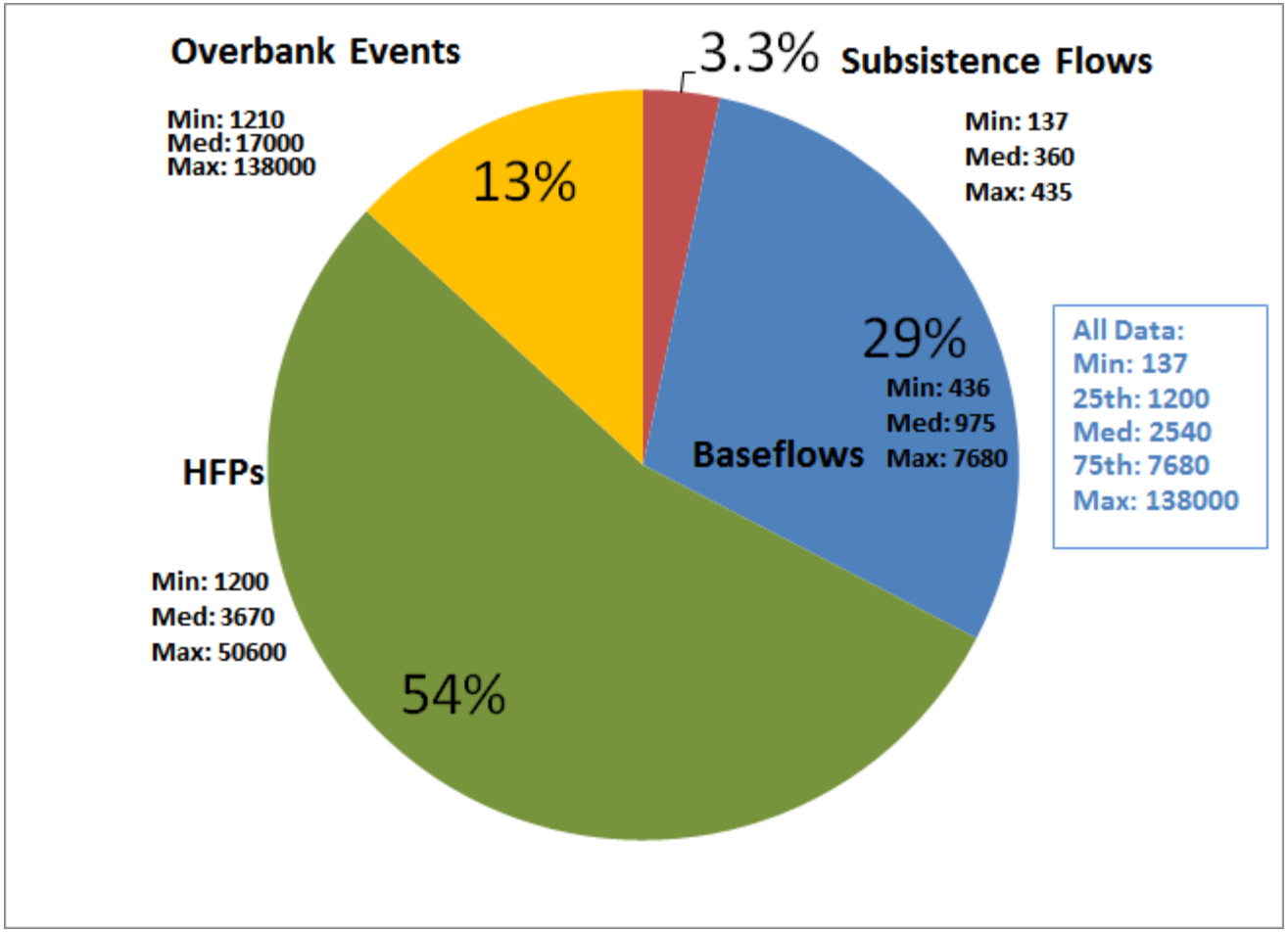
MBFIT Run 1

- Upper High Flow Pulse Threshold: 75th %ile (7680 cfs)
- Lower High Flow Pulse Threshold: 25th %ile (1200 cfs)
- Rise Rate: 0.25
- Overbank Threshold (2yr event – placeholder)

BRHS_MBFIT1


BRHS_IHA1
Flow (cfs)
14000
12000
10000
8000
6000
4000
2000
0
Jul
Aug
Sep
Oct
Nov
Dec
1943
More HFPs and/or longer tails
BRHS_MBFIT1
Flow (cfs)
14000
12000
10000
8000
6000
4000
2000
0
Jul
Aug
Sep
Oct
Nov
Dec
1943

BRHS_MBFIT1


Overbank Events
Min: 1210
Med: 17000
Max: 138000
13%
3.3%
Subsistence Flows
Min: 137
Med: 360
Max: 435
29%
Min: 436
Med: 975
Max: 7680
Baseflows
HFPs
Min: 1200
Med: 3670
Max: 50600
54%
All Data:
Min: 137
25th: 1200
Med: 2540
75th: 7680
Max: 138000

BRHS_MBFIT1

Overbank Flows	Qp: 80,300 cfs with Average Frequency 1 per 5 years Regressed Volume is 1,180,620 to 4,467,050 (2,296,495) Regressed Duration is 21 to 93 (44)											
High Flow Pulses	Qp: 63,900 cfs with Average Frequency 1 per 2 years Regressed Volume is 862,405 to 3,261,754 (1,677,186) Regressed Duration is 18 to 80 (38)											
	Qp: 50,000 cfs with Average Frequency 1 per year Regressed Volume is 615,524 to 2,327,124 (1,196,830) Regressed Duration is 15 to 69 (32)											
	Qp: 21,000 cfs with Average Frequency 1 per season Regressed Volume is 199,304 to 719,872 (378,779)			Qp: 28,100 cfs with Average Frequency 1 per season Regressed Volume is 276,637 to 970,623 (518,180)			Qp: 5,650 cfs with Average Frequency 1 per season Regressed Volume is 32,539 to 142,110 (68,001) Regressed Duration is 5 to 23 (10)			Qp: 14,900 cfs with Average Frequency 1 per season Regressed Volume is 110,051 to 389,448 (207,024)		
	Qp: 8,360 cfs with Average Frequency 2 per season Regressed Volume is 56,540 to 203,898 (107,371) Regressed Duration is 5 to 22 (10)			Qp: 10,600 cfs with Average Frequency 2 per season Regressed Volume is 73,151 to 256,258 (136,914) Regressed Duration is 6 to			Qp: 2,470 cfs with Average Frequency 2 per season Regressed Volume is 9,977 to 43,536 (20,841) Regressed Duration is 3 to 12 (5)			Qp: 5,800 cfs with Average Frequency 2 per season Regressed Volume is 29,354 to 103,741 (55,184) Regressed Duration is 4 to 15 (7)		
Base Flows (cfs)	1730(68.5%)			1930(75.6%)			1150(72.0%)			1160(66.3%)		
	995(83.0%)			1100(90.0%)			968(80.5%)			890(74.8%)		
	687(90.0%)			852(94.7%)			762(89.4%)			650(83.7%)		
Subsistence Flows (cfs)	361(98.5%)			406(99.7%)			375(99.1%)			348(96.3%)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Winter			Spring			Summer			Fall		

Flow Levels	
	High (75th %ile)
	Medium (50th %ile)
	Low (25th %ile)
	Subsistence

Notes:

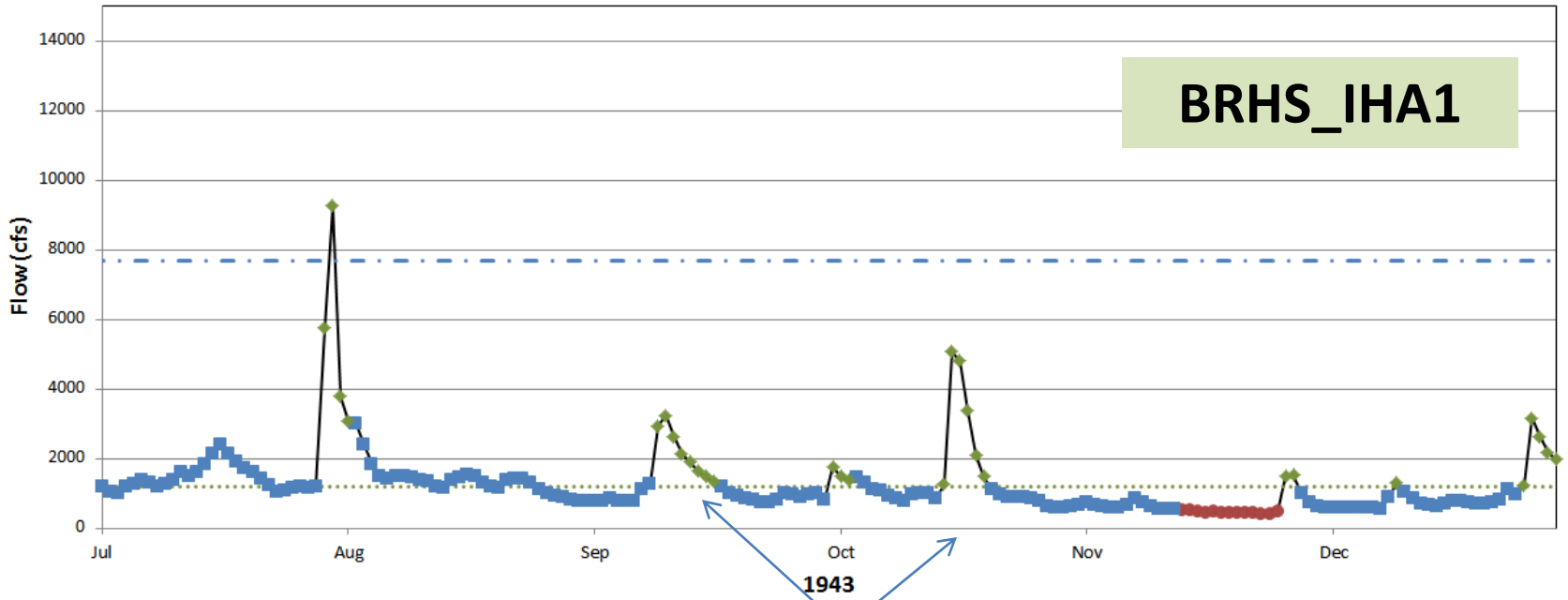
1. Period of Record used : 1/1/1939 to 40543.

BRHS_MBFIT1

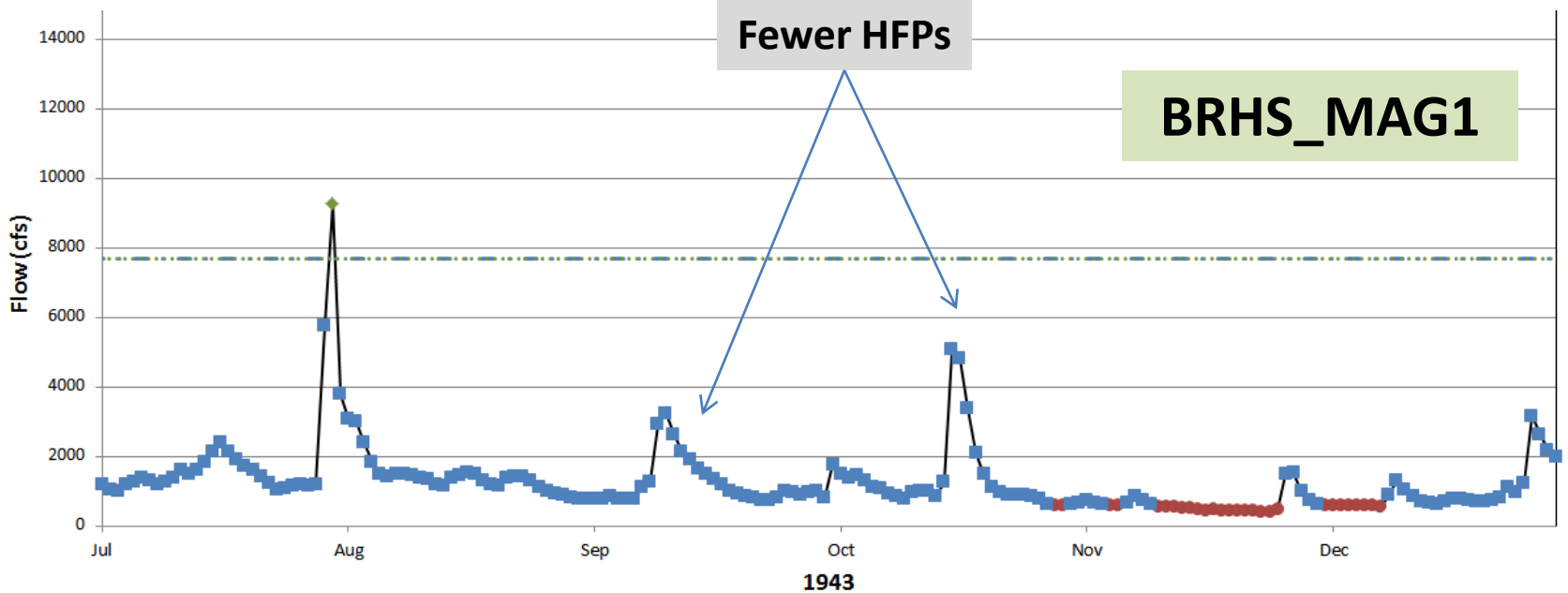
Bright Line Magnitude Run 1

- All flows ≥ 75th %ile (7680 cfs) are high flow pulses or overbank events
- All flows < 75th %ile are base flows or subsistence flows
- Subsistence flows = bottom 10% of population of "<75th %ile"

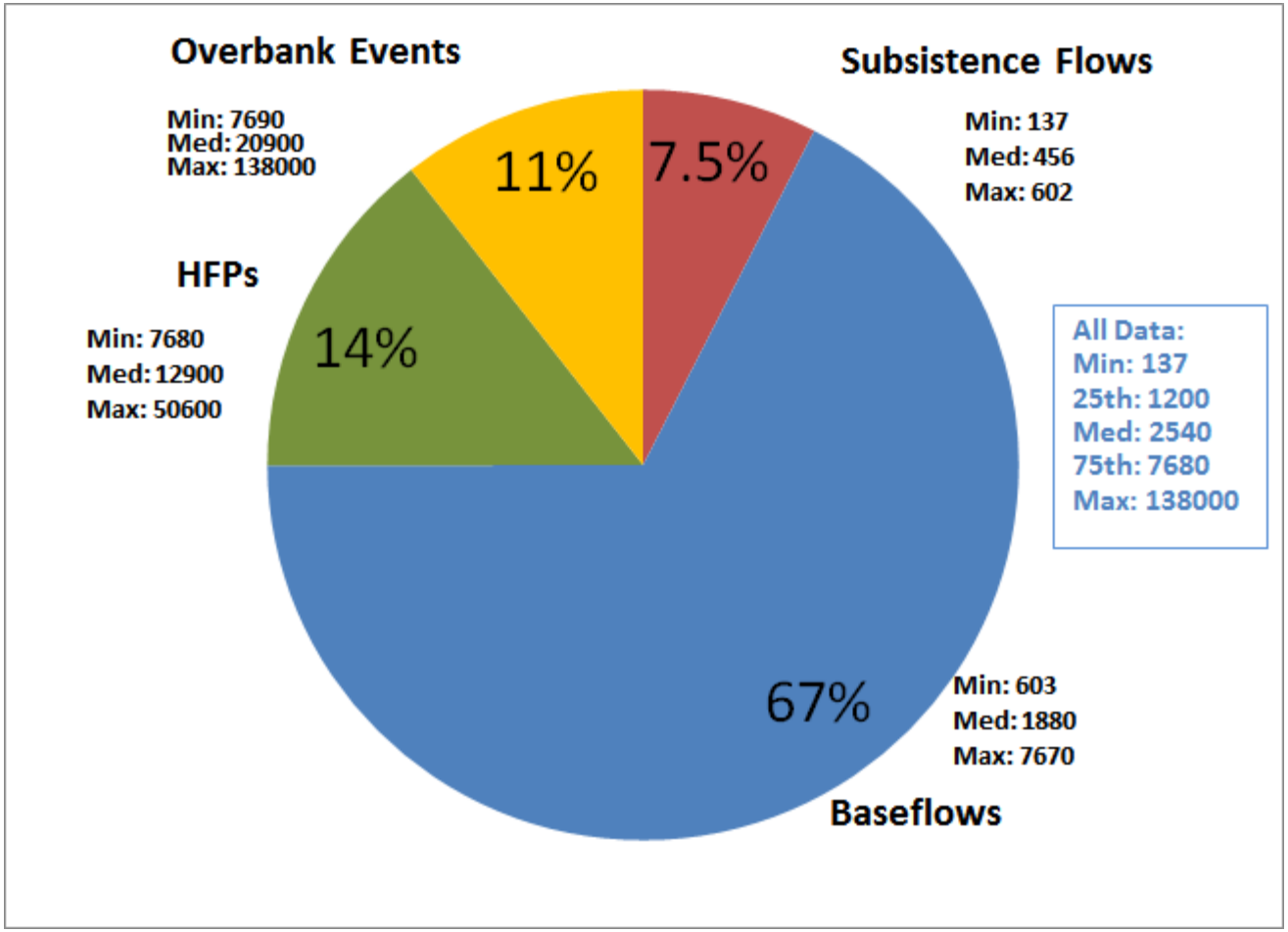
BRHS_MAG1



Fewer HFPs



BRHS_MAG1


Overbank Events
Min: 7690
Med: 20900
Max: 138000
11%
7.5%
Subsistence Flows
Min: 137
Med: 456
Max: 602
HFPs
Min: 7680
Med: 12900
Max: 50600
14%
All Data:
Min: 137
25th: 1200
Med: 2540
75th: 7680
Max: 138000
67%
Min: 603
Med: 1880
Max: 7670
Baseflows

BRHS_MAG1

Overbank Flows	Qp: 80,300 cfs with Average Frequency 1 per 5 years Regressed Volume is 1,432,062 to 4,551,473 (2,553,036) Regressed Duration is 22 to 74 (40)			
High Flow Pulses	Qp: 63,900 cfs with Average Frequency 1 per 2 years Regressed Volume is 933,490 to 2,963,267 (1,663,184) Regressed Duration is 16 to 56 (30)			
	Qp: 50,000 cfs with Average Frequency 1 per year Regressed Volume is 589,522 to 1,869,384 (1,049,782) Regressed Duration is 12 to 41 (22)			
	Qp: 21,000 cfs with Average Frequency 1 per season Regressed Volume is 138,628 to 424,662 (242,632)	Qp: 28,100 cfs with Average Frequency 1 per season Regressed Volume is 194,652 to 618,755 (347,048)		Qp: 14,900 cfs with Average Frequency 1 per season Regressed Volume is 59,297 to 178,856 (102,983) Regressed Duration is 2 to
	Qp: 8,920 cfs with Average Frequency 2 per season Regressed Volume is 29,234 to 90,005 (51,295) Regressed Duration is 2 to 6 (3)	Qp: 11,200 cfs with Average Frequency 2 per season Regressed Volume is 34,189 to 108,937 (61,028) Regressed Duration is 2 to		
Base Flows (cfs)	4040(47.0%)	4440(53.8%)	2580(31.9%)	3370(35.3%)
	2210(62.1%)	2550(68.5%)	1560(53.0%)	1770(52.1%)
	1260(77.2%)	1460(83.4%)	1110(73.5%)	1080(68.9%)
Subsistence Flows (cfs)	468(96.0%)	490(99.0%)	492(97.2%)	425(92.9%)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Winter			Spring			Summer			Fall		

Flow Levels	
	High (75th %ile)
	Medium (50th %ile)
	Low (25th %ile)
	Subsistence

Notes:

1. Period of Record used : 1/1/1939 to 12/31/2010.

BRHS_MAG1

Issues

- What hydrographic separations look good/bad
- What characteristics look good/bad
- Need feedback on appropriate lower thresholds for high flow pulses
- How can biological information guide hydrographic separation
- What additional information does the BBEST need
- ??