NUTRIENT AND WATER QUALITY OVERLAY ON HYDROLOGY-BASED INSTREAM FLOW RECOMMENDATIONS

DRAFT JUNE 5, 2009

PAUL JENSEN

BASIC POINTS

- Flow and Water Quality Parameters are often related
- Environmental Flow recommendations based only on a hydrologic record need to incorporate a check or overlay on water quality
- A methodology for the overlay is presented

STEPS

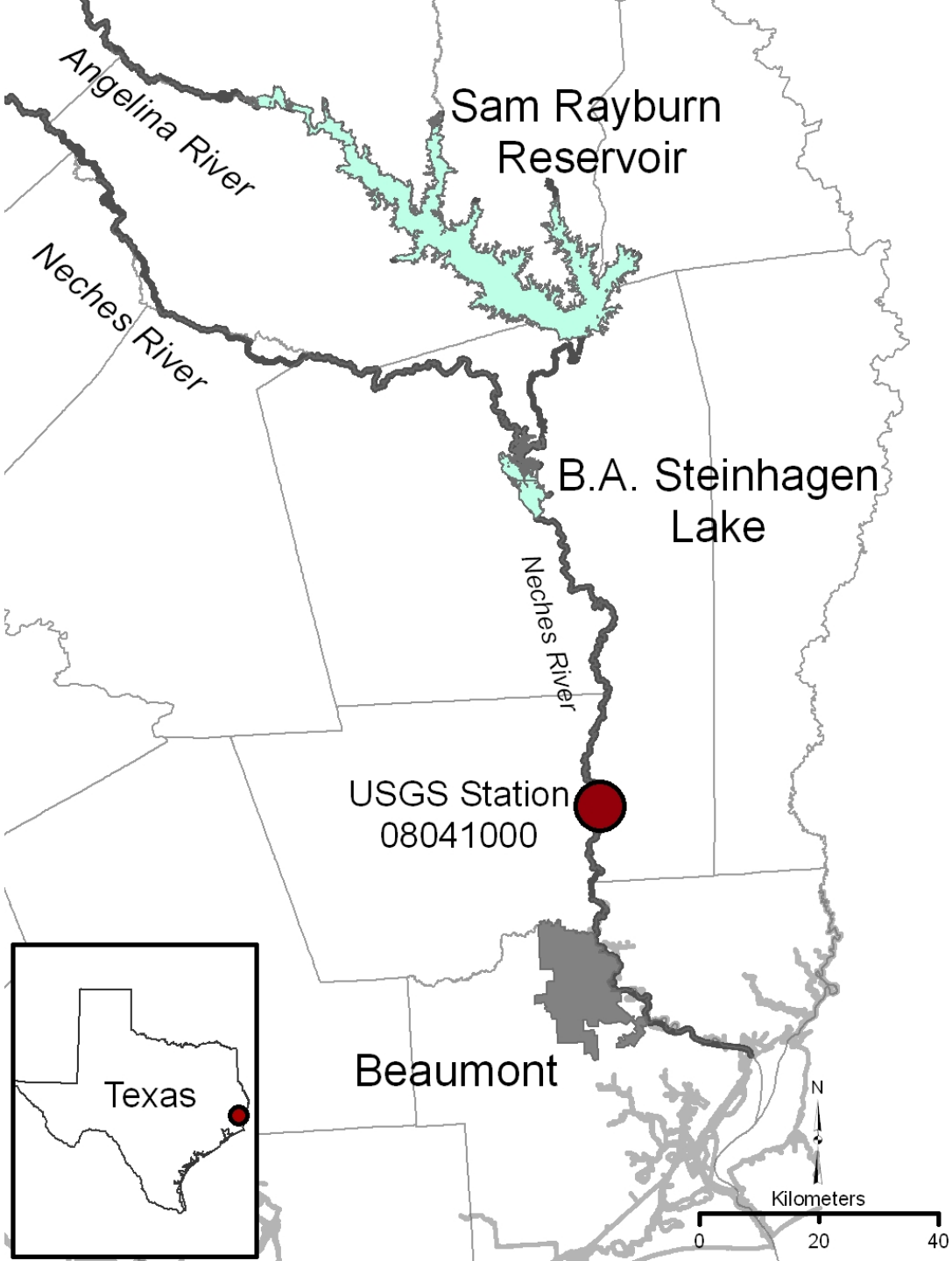
- Check current water quality conditions
  - 303(d) listing?
  - Adverse trend in 305(b) assessment?
- Nature of HEFR recommendation
  - No Change--A flow regime based on and intended to maintain an existing natural condition
  - Change—A flow regime that is different from what exists today

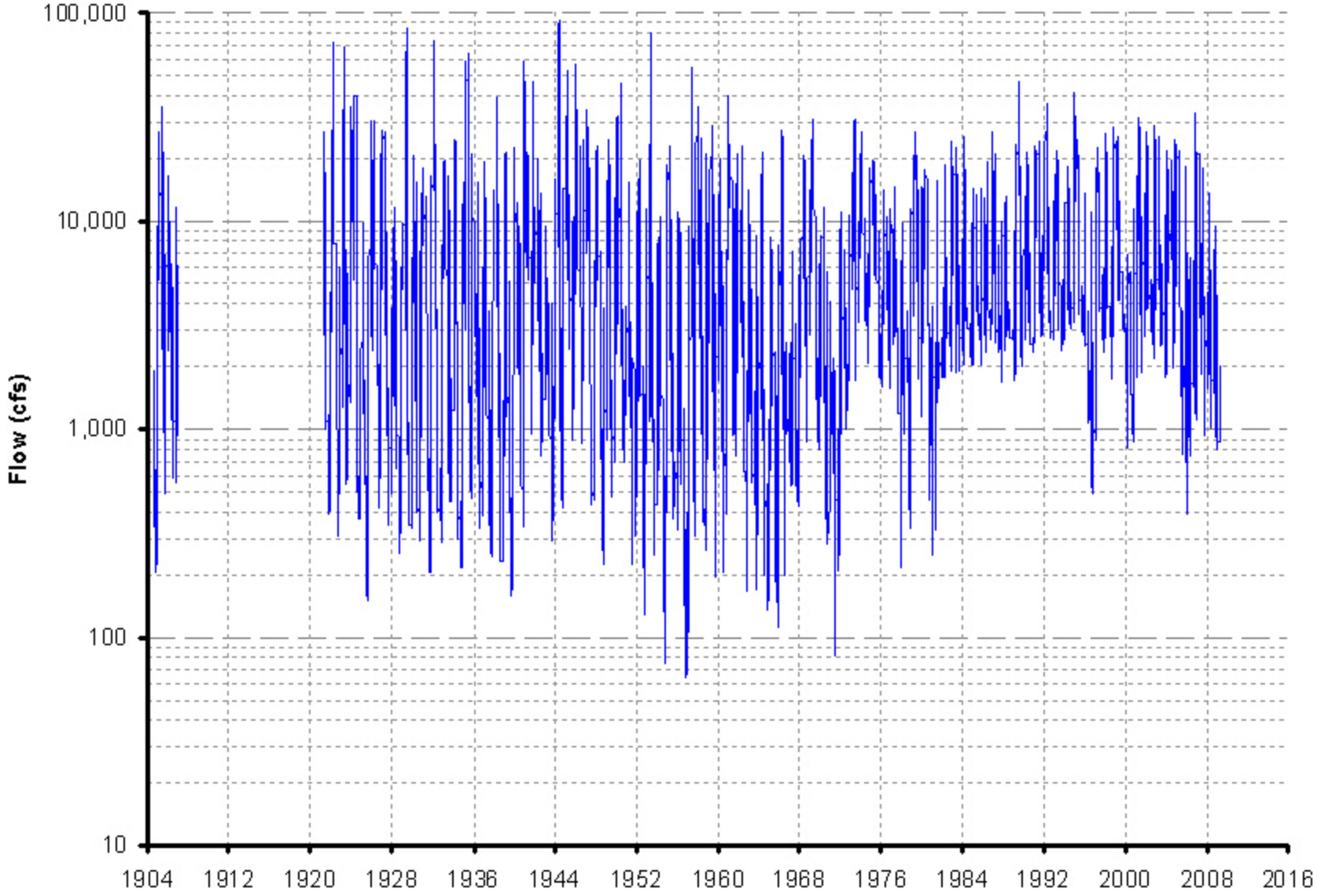
IF WQ ISSUE EXISTS OR FLOW CHANGE RECOMMENDED

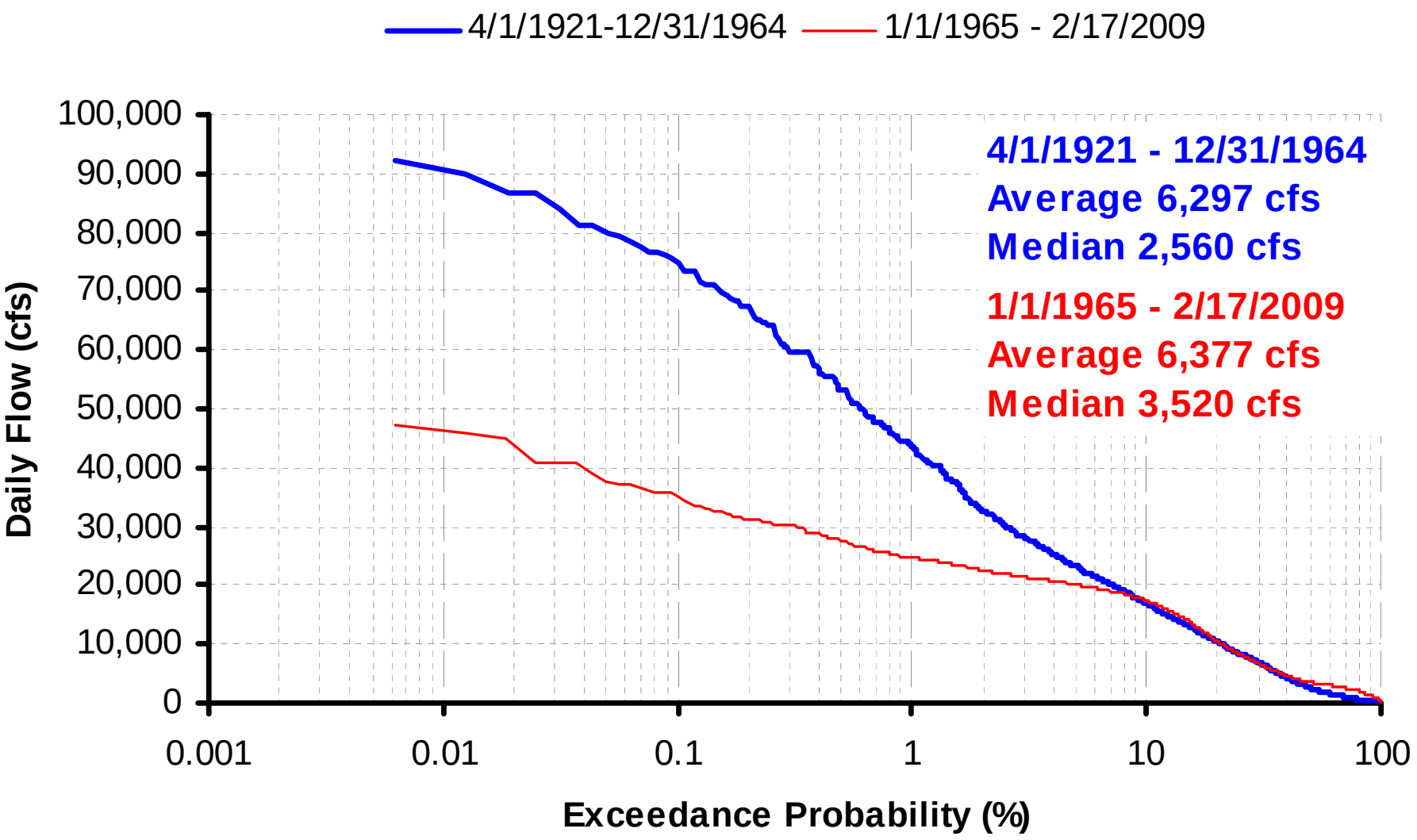
- Develop relations between flow and water quality parameters
- Analyze the effects of the issue or the recommended changes
- Prepare alternatives to modify or improve the situation

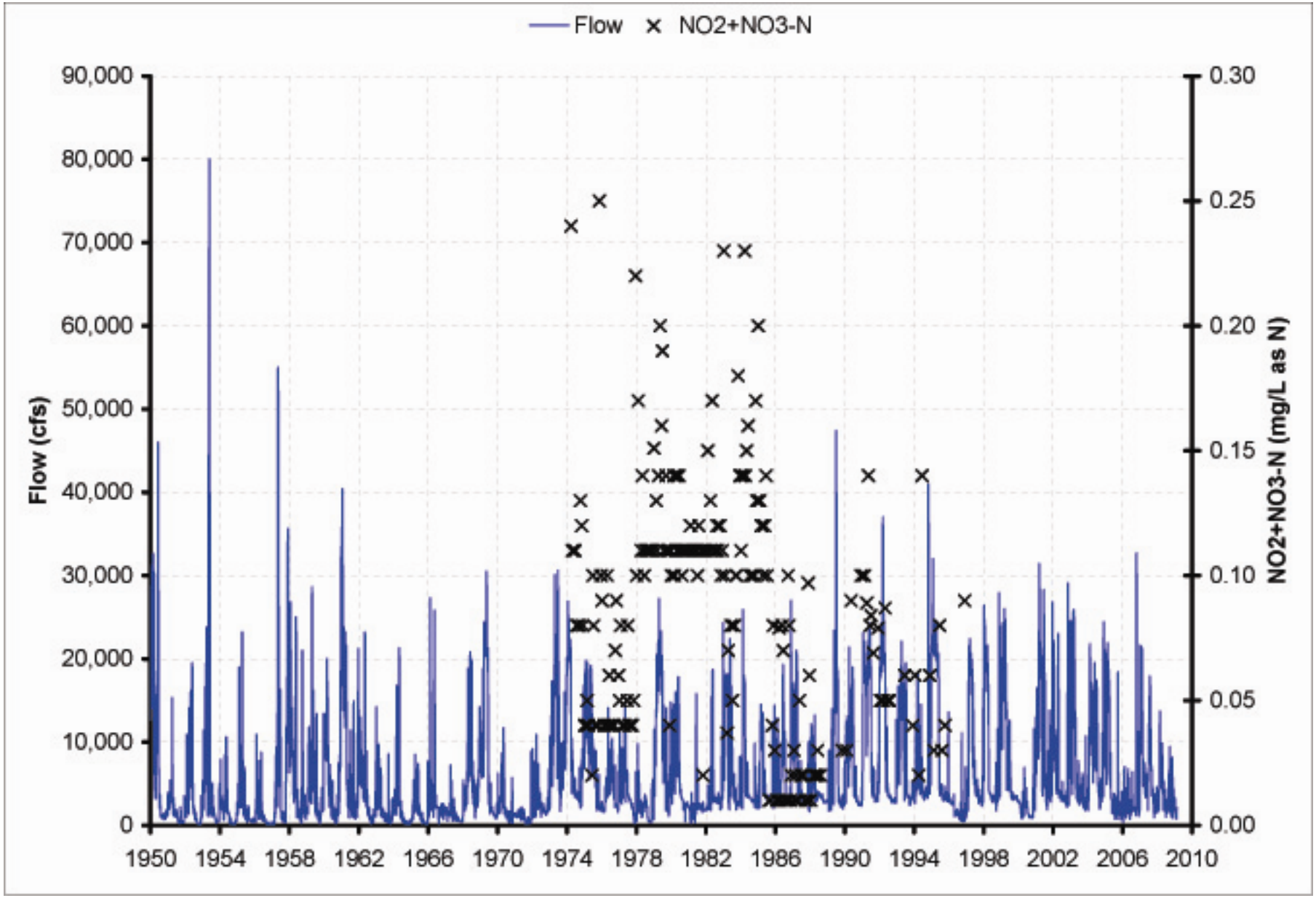
EXAMPLE

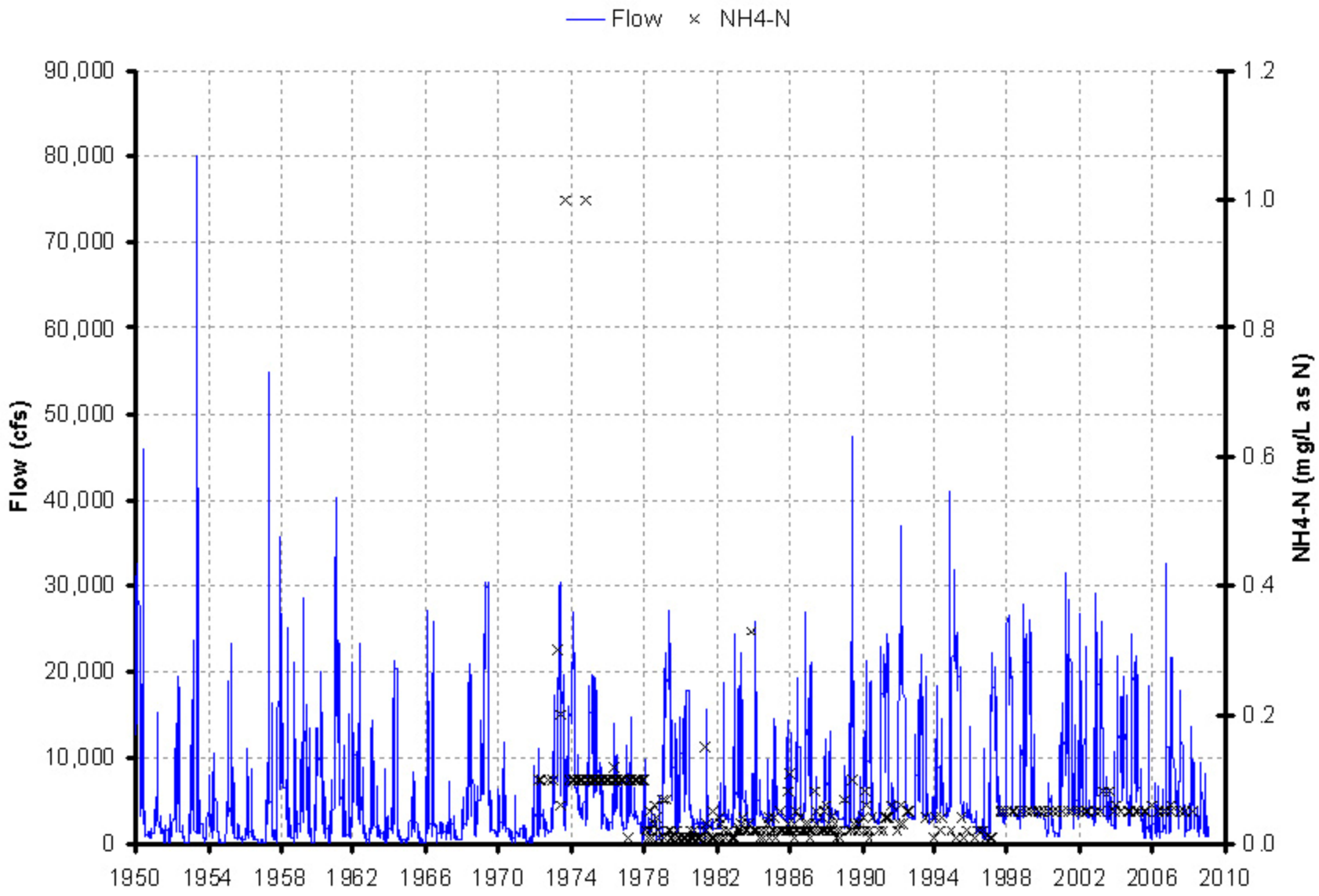
- USGS Gage 08041000, Neches River at Evadale
- Example used in HEFR document
- Long Record—1922-present
- Substantial Changes
  - 1922-1964 Substantially natural
  - 1965-present Significant hydrologic modification

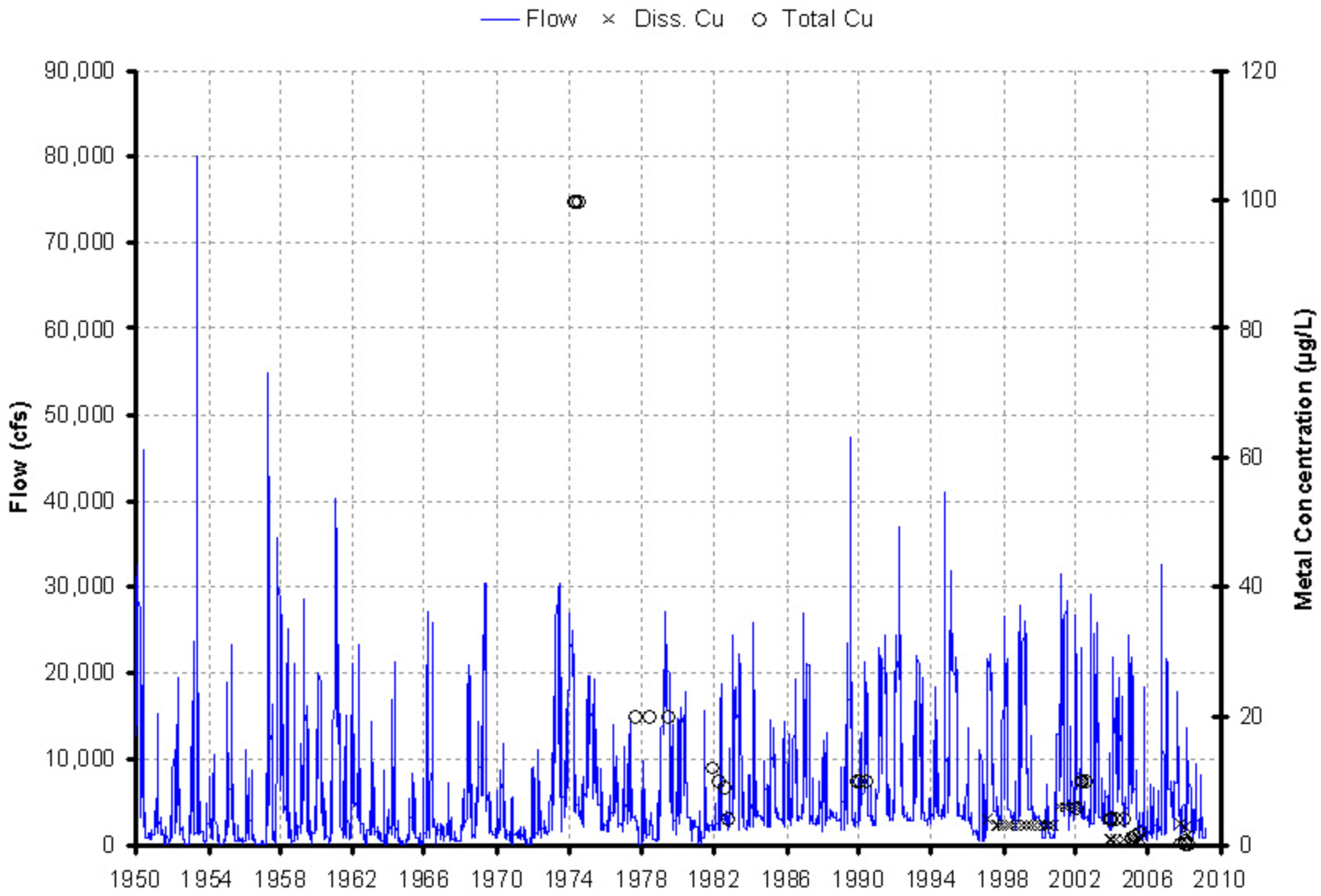

Angelina River
Sam Rayburn
Reservoir
Neches River
B.A. Steinhagen
Lake
Neches River
USGS Station
08041000
Beaumont
Texas
N
Kilometers
0
20
40

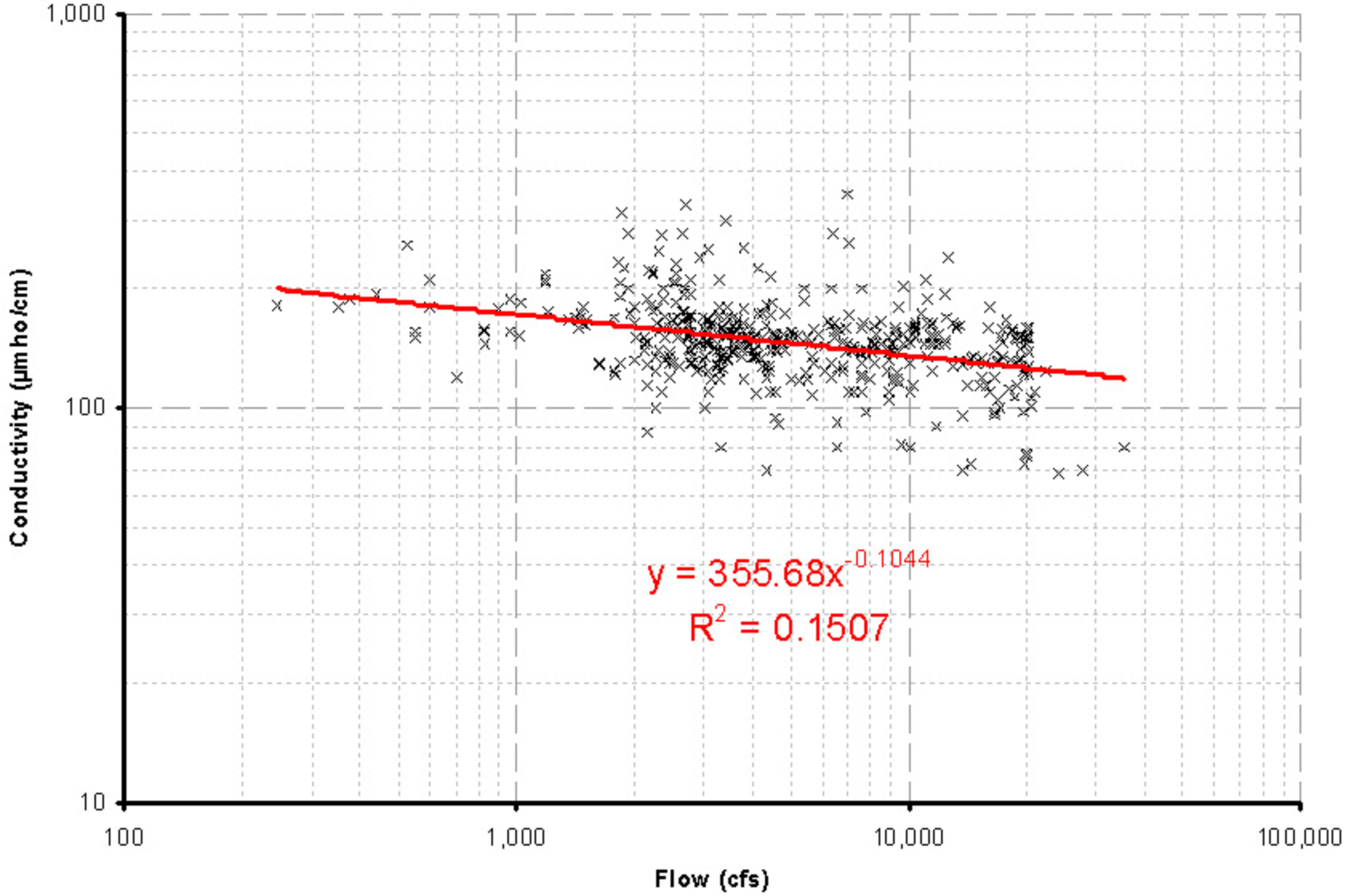

100,000
10,000
1,000
100
10
Flow (cfs)
1904
1912
1920
1928
1936
1944
1952
1960
1968
1976
1984
1992
2000
2008
2016

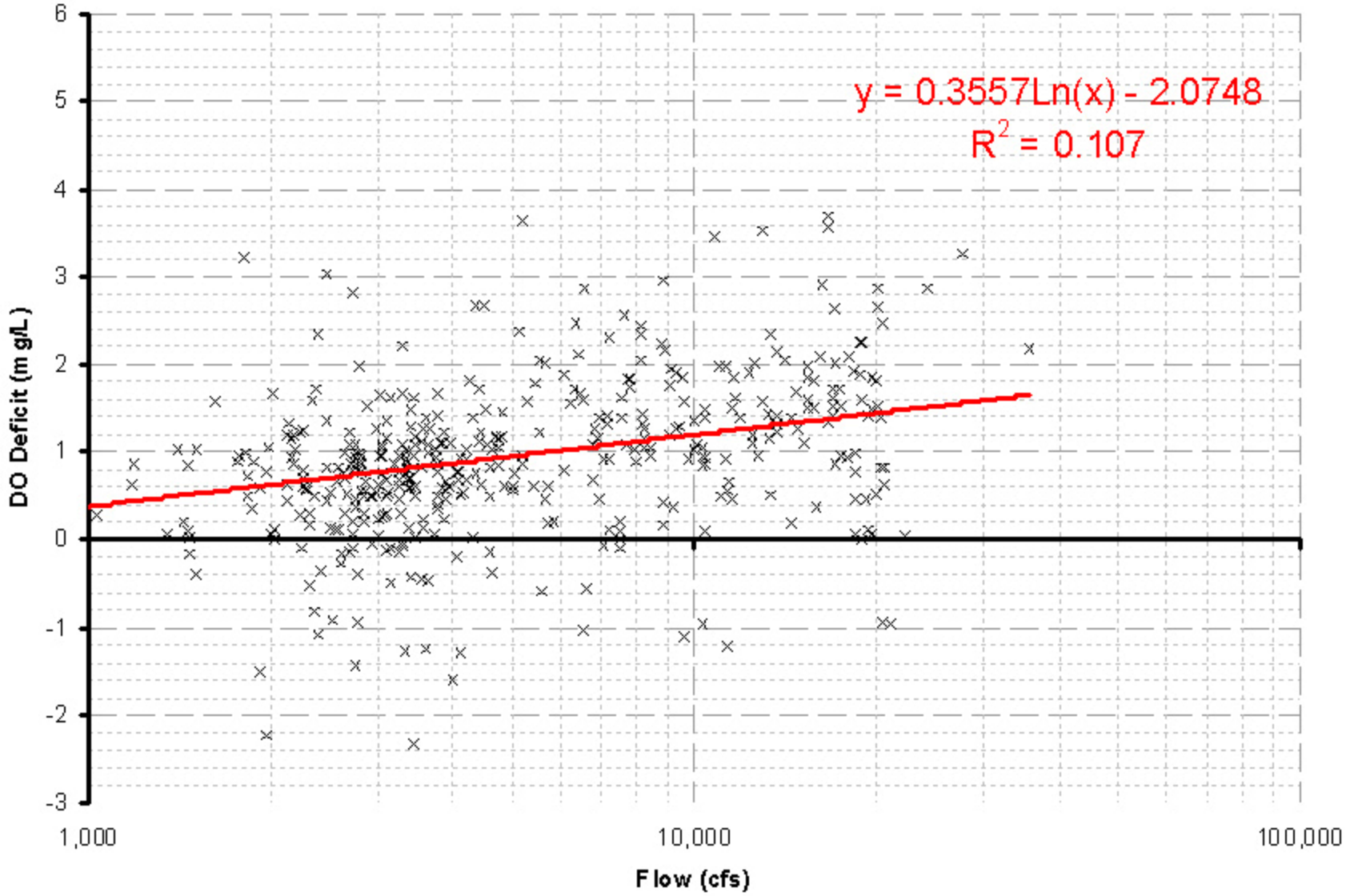

4/1/1921-12/31/1964
1/1/1965 - 2/17/2009
4/1/1921 - 12/31/1964
Average 6,297 cfs
Median 2,560 cfs
1/1/1965 - 2/17/2009
Average 6,377 cfs
Median 3,520 cfs
Daily Flow (cfs)
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
0.001
0.01
0.1
1
10
100
Exceedance Probability (%)

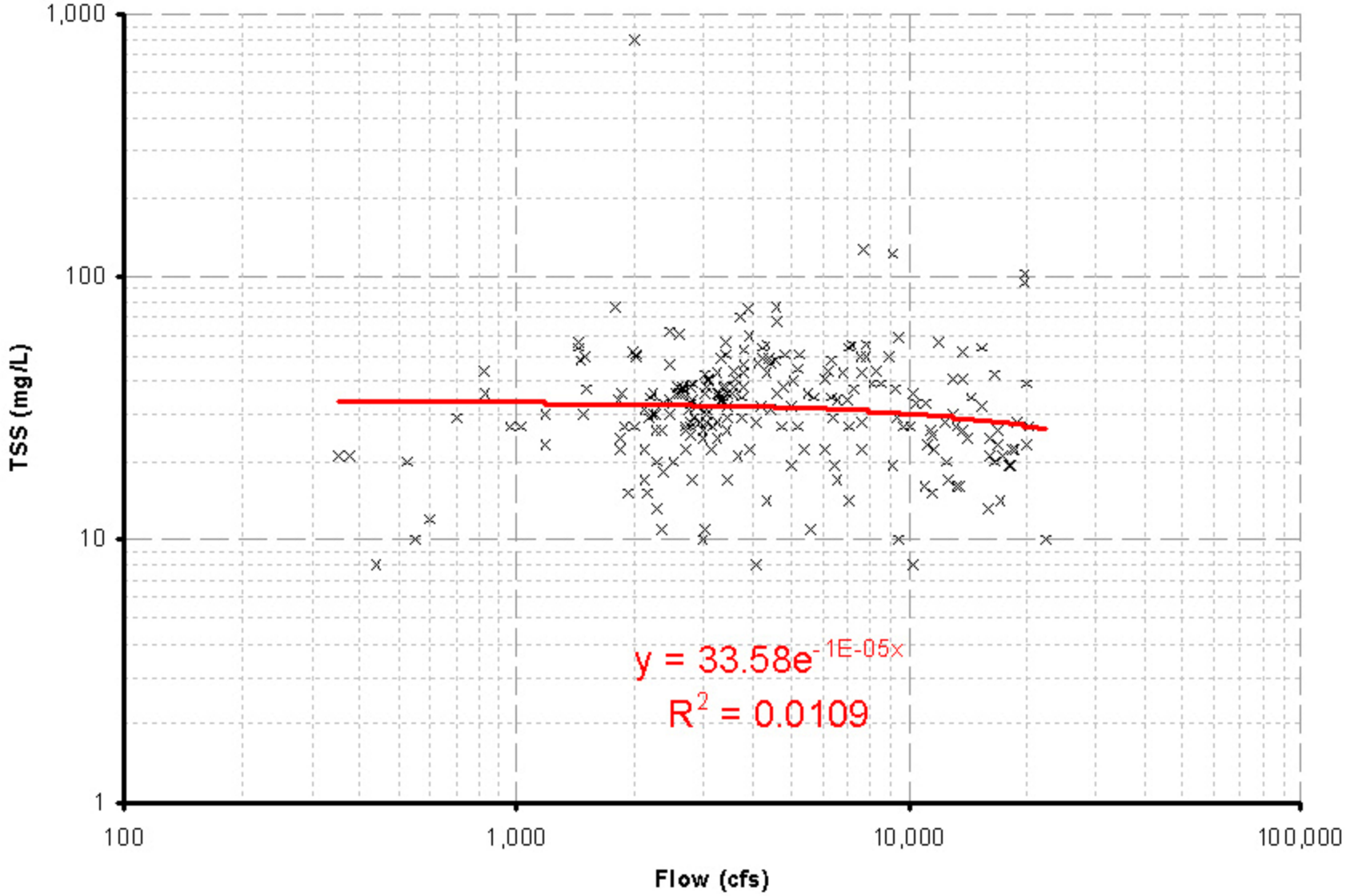

Flow
NO2+NO3-N
Flow (cfs)
NO2+NO3-N (mg/L as N)
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1950
1954
1958
1962
1966
1970
1974
1978
1982
1986
1990
1994
1998
2002
2006
2010


Flow
NH4-N
Flow (cfs)
NH4-N (mg/L as N)
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1950
1954
1958
1962
1966
1970
1974
1978
1982
1986
1990
1994
1998
2002
2006
2010


Flow
Diss. Cu
Total Cu
Flow (cfs)
Metal Concentration (µg/L)
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
120
100
80
60
40
20
0
1950
1954
1958
1962
1966
1970
1974
1978
1982
1986
1990
1994
1998
2002
2006
2010

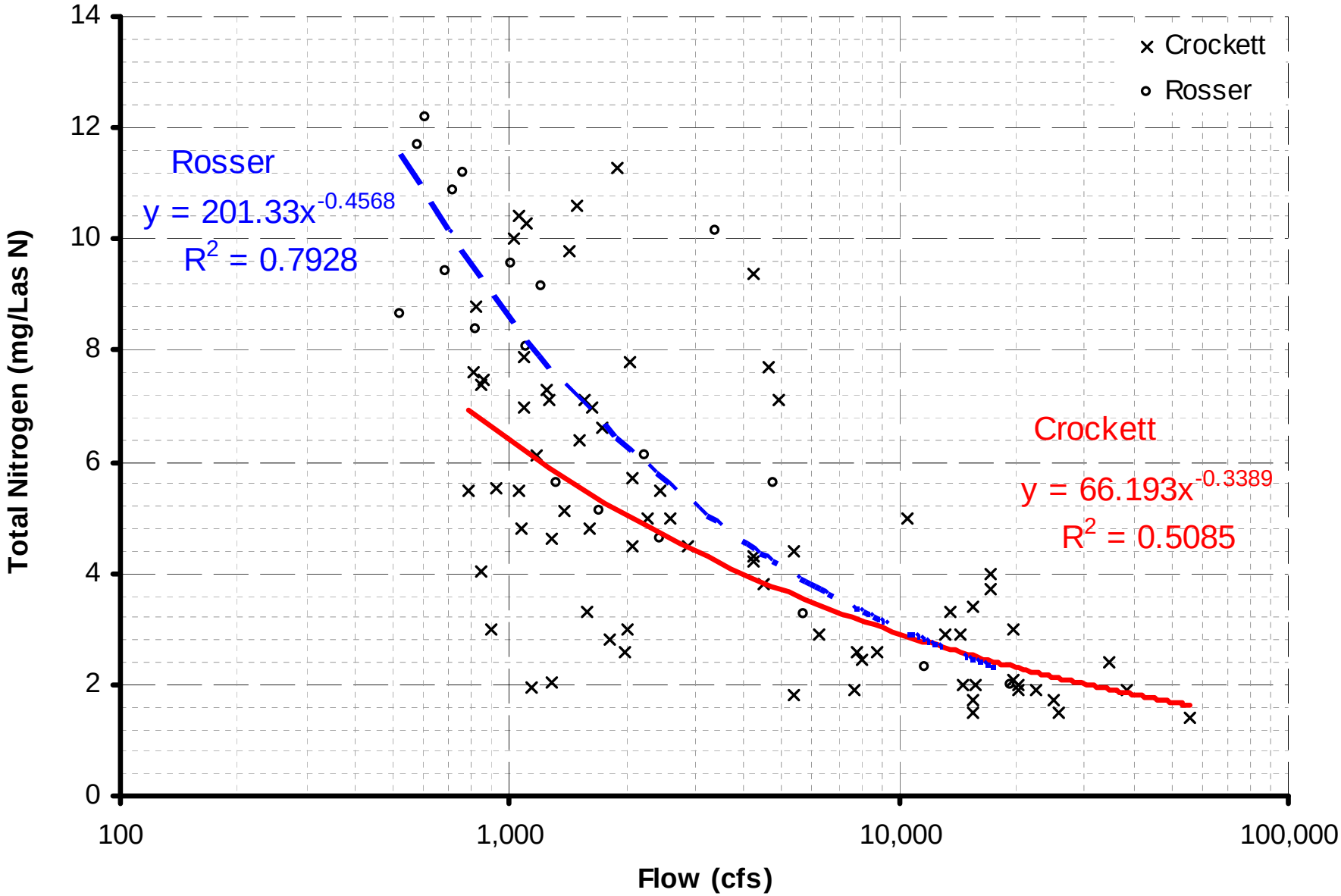

1,000
100
10
Conductivity (µmho/cm)
100
1,000
10,000
100,000
Flow (cfs)
y = 355.68x^-0.1044
R^2 = 0.1507


y = 0.3557Ln(x) - 2.0748
R2 = 0.107
DO Deficit (mg/L)
6
5
4
3
2
1
0
-1
-2
-3
1,000
10,000
100,000
Flow (cfs)

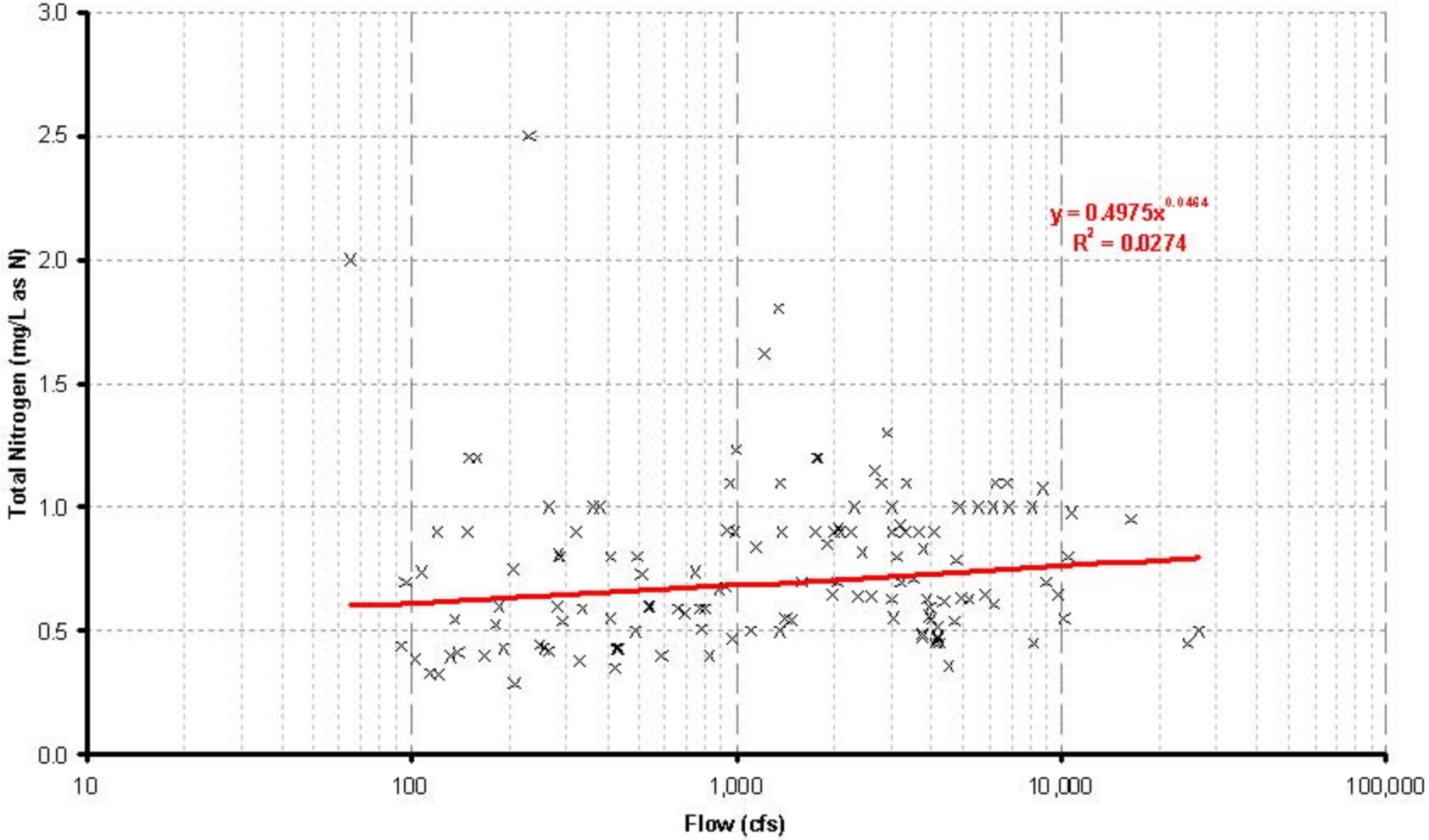

1,000
100
10
1
TSS (mg/L)
100
1,000
10,000
100,000
Flow (cfs)
y = 33.58e^-1E-05x
R^2 = 0.0109

SOME OBSERVATIONS

- WQ data are relatively recent additions
- The ability to measure parameters continues to evolve
- Reservoirs are very effective means to remove many water quality parameters
- Concentrations of most parameters coming from reservoirs tends to be quite low
- Other streams may be different


Crockett
Rosser
Rosser
y = 201.33x^-0.4568
R^2 = 0.7928
Crockett
y = 66.193x^-0.3389
R^2 = 0.5085
Total Nitrogen (mg/Las N)
Flow (cfs)
0
2
4
6
8
10
12
14
100
1,000
10,000
100,000

Station 10585 (USGS 08033500)



RECAP

- Confirm need to assess WQ effects
- Develop understanding of relations between flow and key WQ parameters
- Assess likely effects of HEFR recommendations
- Develop corrective actions or mitigation measures