Calibration with A,B, &C Springs using P100827A

Allan Wylie IDWR

Calibration with A,B, &C Springs using P100827A

- MKMOD4.exe
  - Using On-Farm algorithm
- P100827A
  - Assumes that the On-Farm algorithm would be used
  - Place holder for non-irrigated recharge
- No steady state targets
- Aquifer head
  - 1985-2002
    - Same
- Snake reach gain and loss targets
  - Updated through 2008 to match recharge data
  - 1985-2008
- Spring discharge
  - Updated through 2008 to match recharge data
  - 1985-2008

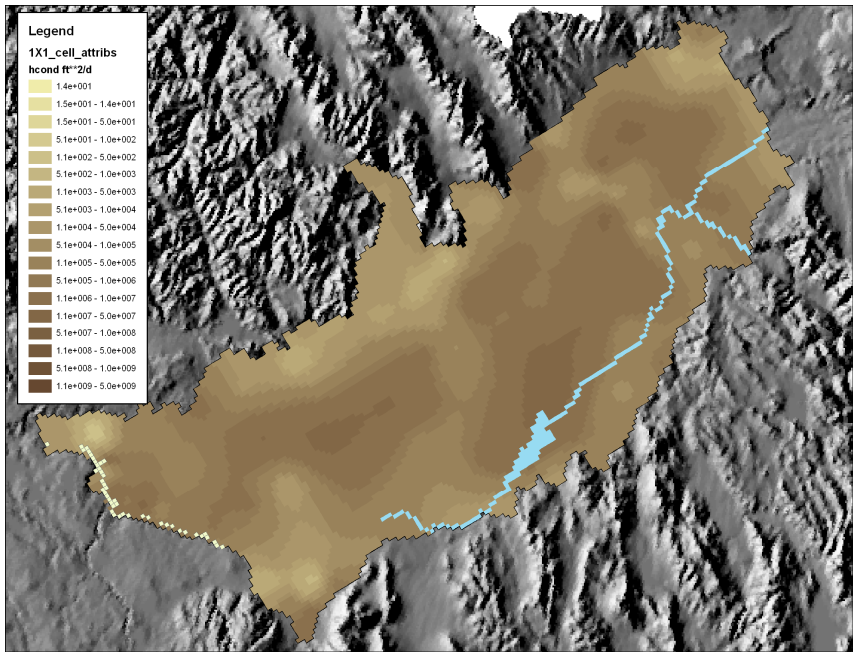
Calibration with A,B, &C Springs using P100827A

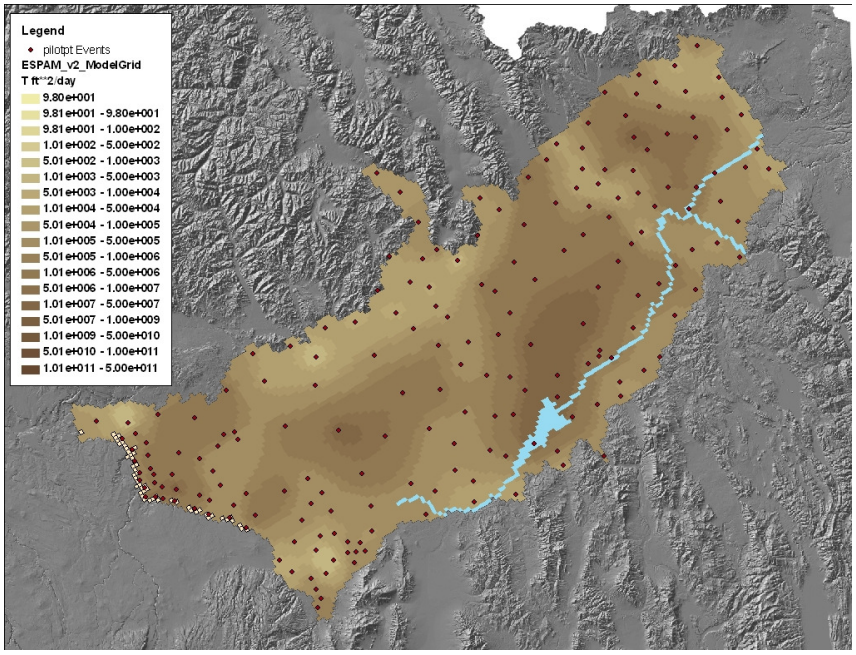
- Adjustable Parameters
  - Transmissivity
    - Pilot Points
      - 1e-10 – 1e+10
  - Specific Yield
    - Pilot Points
      - 0.001 – 0.30
  - Riverbed Conductance
    - By reach
      - 1.0 – 1e+10
  - Drain Conductance
    - By drain
      - Up to 3 drain cells per model cell
      - 1e-10 - 3e+8
  - Canal seepage
    - Uniform by entity
      - 1.05 – 0.95
  - Non-irrigated recharge
    - Thin Thick and Lava
    - 2.0 – 1.0e-6
  - ET
    - Surface Water Entity
      - Sprinkler and Gravity
      - +/-5%
    - Groundwater Entity
      - Sprinkler and Gravity
      - +/-5%
  - Perched River Seepage
    - River reach
    - +/-20%
  - Tributary Underflow
    - Tributary Basin
    - 2 – 0.5

Calibration with A,B, &C Springs using P100827A

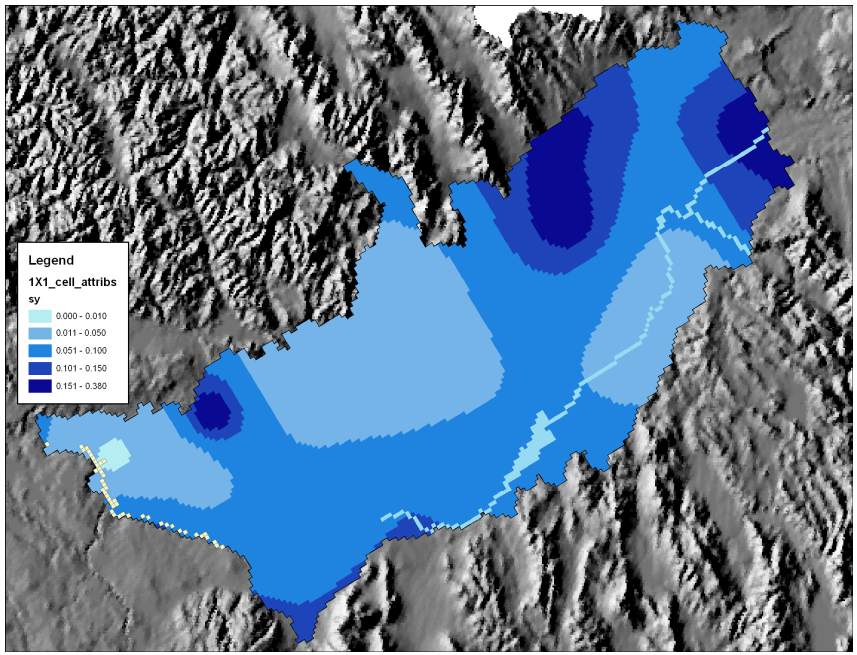
- Adjustable Parameters (cont)
  - On Farm Parameters
    - Conveyance loss
      - Canals +- 5%
      - Fixed for SWCo
    - Maximum achievable efficiency for sprinklers
      - 0.90 – 0.75
    - Maximum achievable efficiency for gravity irrigation
      - 0.90 – 0.75
    - DPin
      - Deep percolation fraction for inefficient portion
      - 0.98 – 0.6
      - Entities with no returns DPin fixed at 1.0
    - Dpex
      - Deep percolation fraction for excess water
      - 0.98 – 0.6
      - Entities with no returns DPex fixed at 1.0

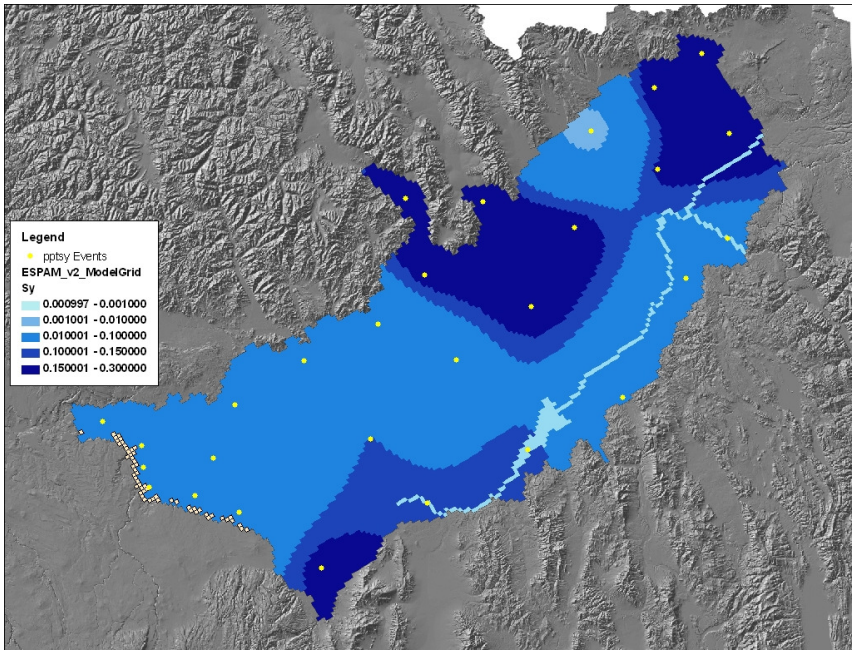
V 1.1


Legend
1X1_cell_attribs
hcond ft**2/d
1.4e+001
1.5e+001 - 1.4e+001
1.5e+001 - 5.0e+001
5.1e+001 - 1.0e+002
1.1e+002 - 5.0e+002
5.1e+002 - 1.0e+003
1.1e+003 - 5.0e+003
5.1e+003 - 1.0e+004
1.1e+004 - 5.0e+004
5.1e+004 - 1.0e+005
1.1e+005 - 5.0e+005
5.1e+005 - 1.0e+006
1.1e+006 - 1.0e+007
1.1e+007 - 5.0e+007
5.1e+007 - 1.0e+008
1.1e+008 - 5.0e+008
5.1e+008 - 1.0e+009
1.1e+009 - 5.0e+009

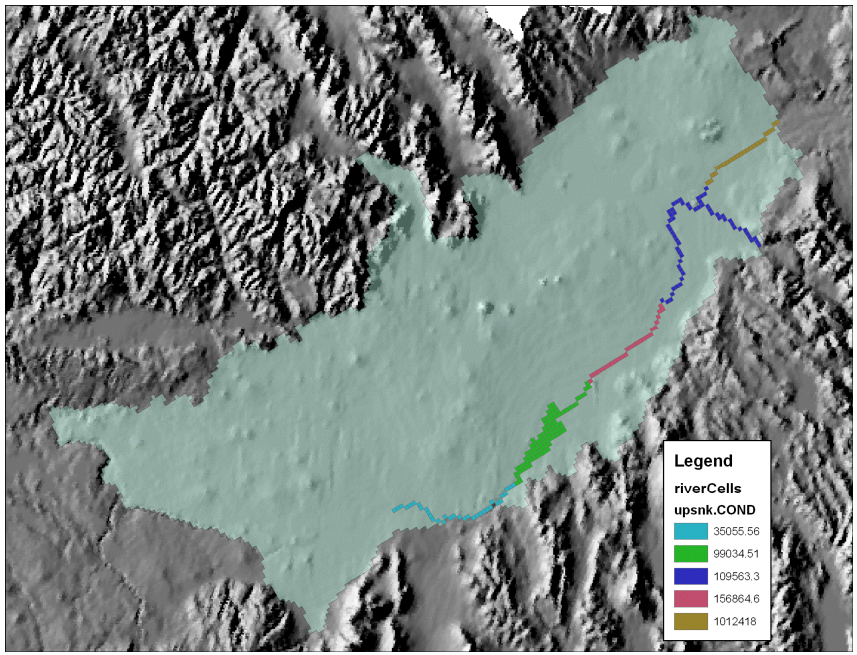

Legend
pilotpt Events
ESPAM_v2_ModelGrid
T ft**2/day
9.80e+001
9.81e+001 - 9.80e+001
9.81e+001 - 1.00e+002
1.01e+002 - 5.00e+002
5.01e+002 - 1.00e+003
1.01e+003 - 5.00e+003
5.01e+003 - 1.00e+004
1.01e+004 - 5.00e+004
5.01e+004 - 1.00e+005
1.01e+005 - 5.00e+005
5.01e+005 - 1.00e+006
1.01e+006 - 5.00e+006
5.01e+006 - 1.00e+007
1.01e+007 - 5.00e+007
5.01e+007 - 1.00e+009
1.01e+009 - 5.00e+010
5.01e+010 - 1.00e+011
1.01e+011 - 5.00e+011

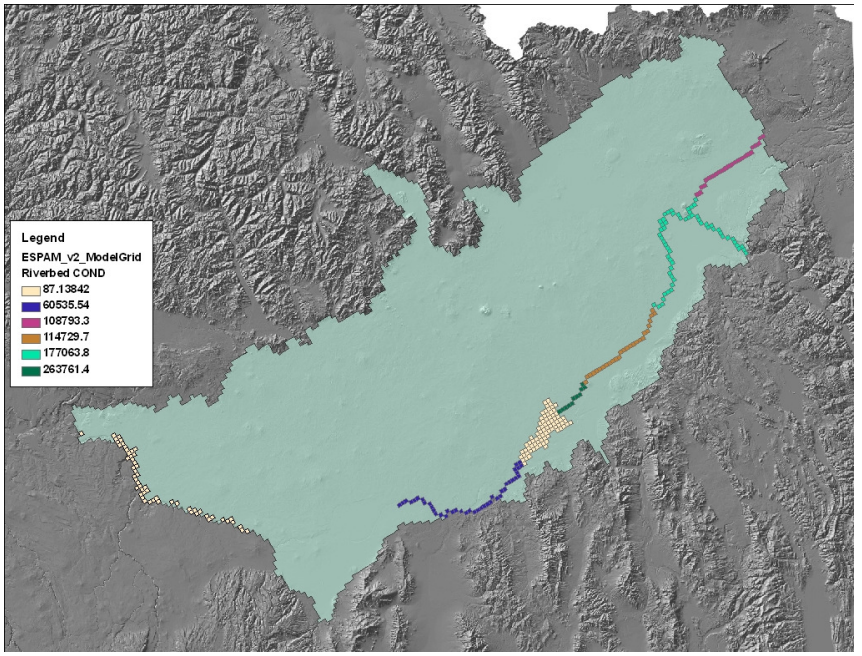
V 1.1


Legend
1X1_cell_attribs
sy
0.000 - 0.010
0.011 - 0.050
0.051 - 0.100
0.101 - 0.150
0.151 - 0.380

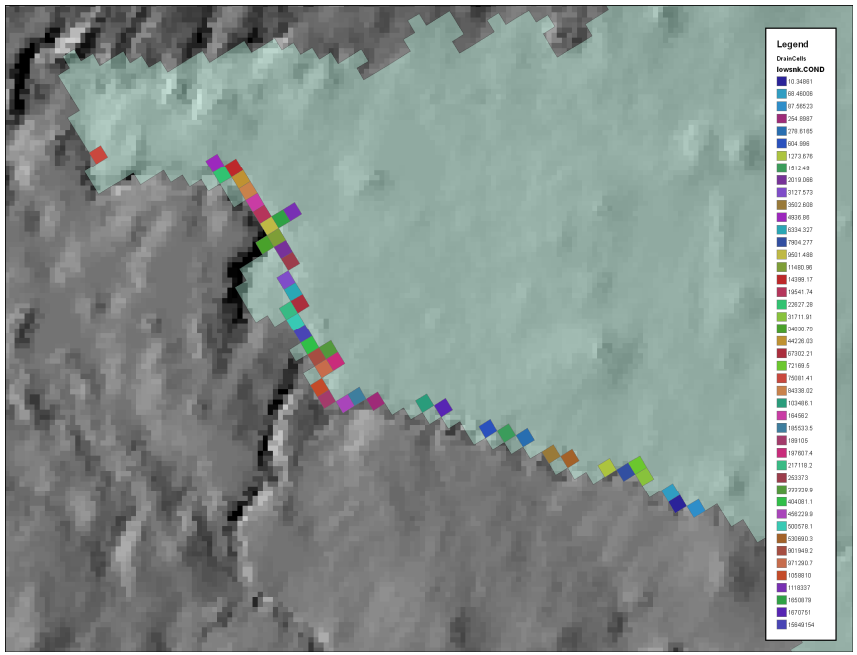

Legend
pptsy Events
ESPAM_v2_ModelGrid
Sy
0.000997 - 0.001000
0.001001 - 0.010000
0.010001 - 0.100000
0.100001 - 0.150000
0.150001 - 0.300000

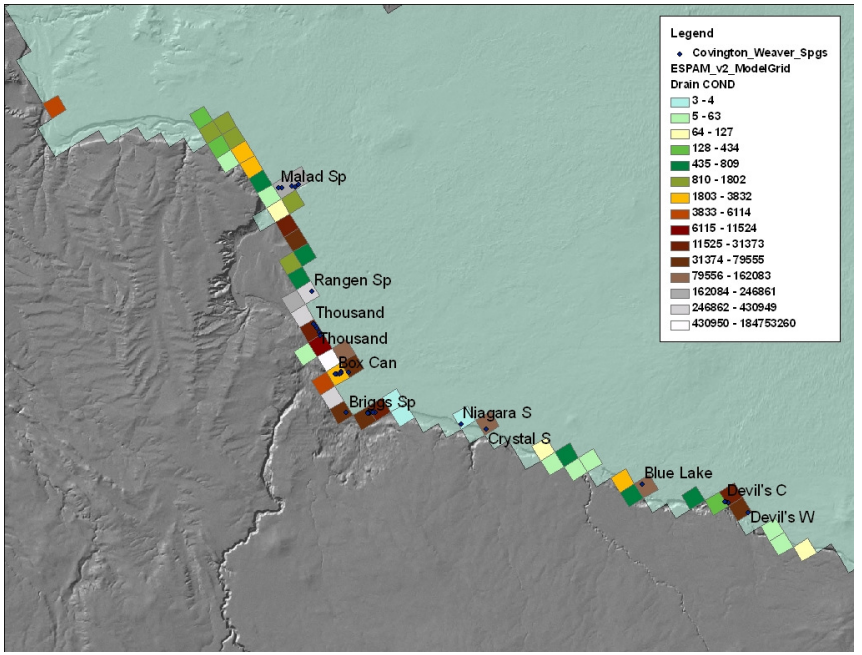
V 1.1


Legend
riverCells
upsnk.COND
35055.56
99034.51
109563.3
156864.6
1012418

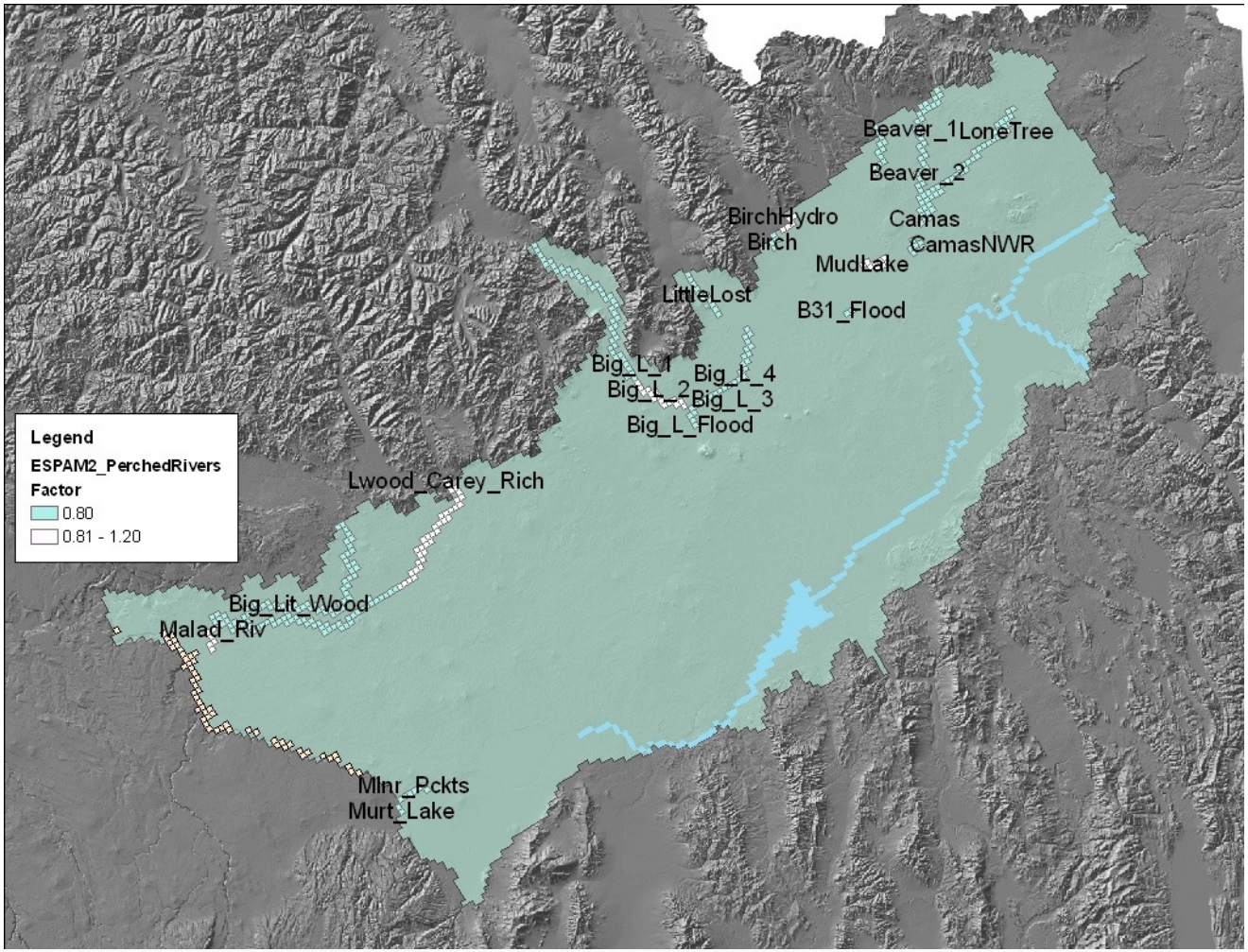

Legend
ESPAM_v2_ModelGrid
Riverbed COND
87.13842
60535.54
108793.3
114729.7
177063.8
263761.4

V 1.1

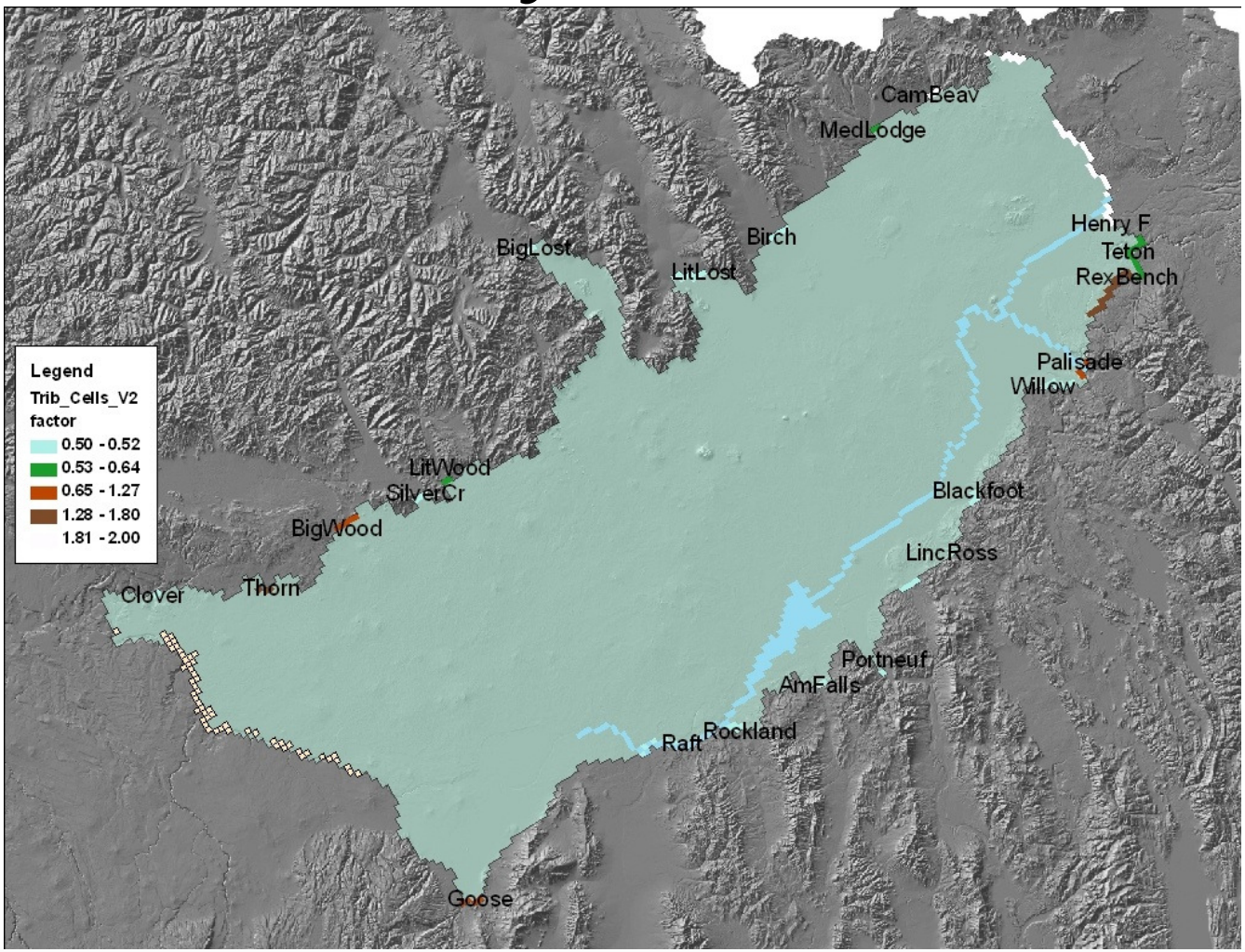

Legend
DrainCells
lowsnk.COND


Legend
Covington_Weaver_Spgs
ESPAM_v2_ModelGrid
Drain COND
3 - 4
5 - 63
64 - 127
128 - 434
435 - 809
810 - 1802
1803 - 3832
3833 - 6114
6115 - 11524
11525 - 31373
31374 - 79555
79556 - 162083
162084 - 246861
246862 - 430949
430950 - 184753260
Malad Sp
Rangen Sp
Thousand
Thousand
Box Can
Briggs Sp
Niagara S
Crystal S
Blue Lake
Devil's C
Devil's W

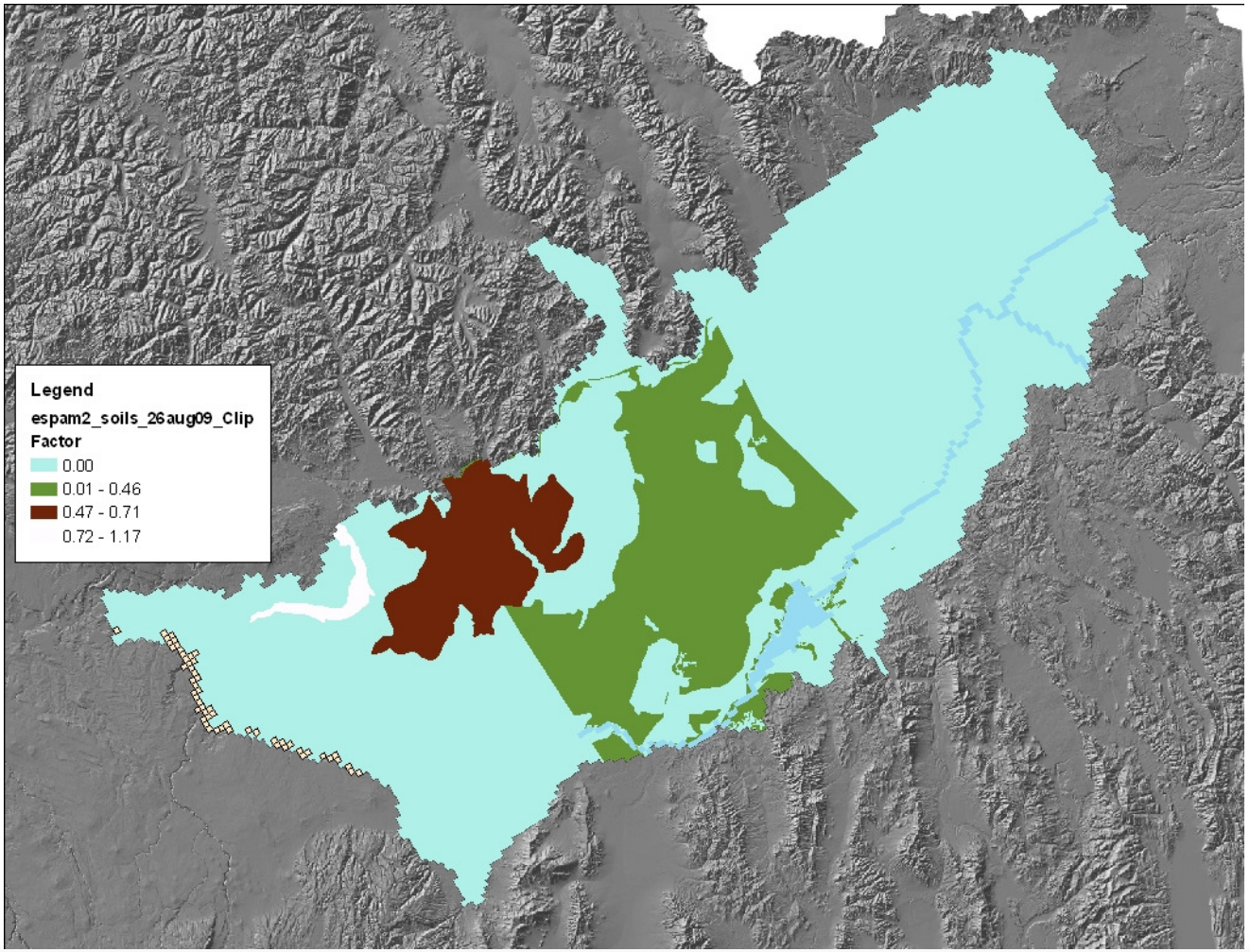
Perched River Seepage



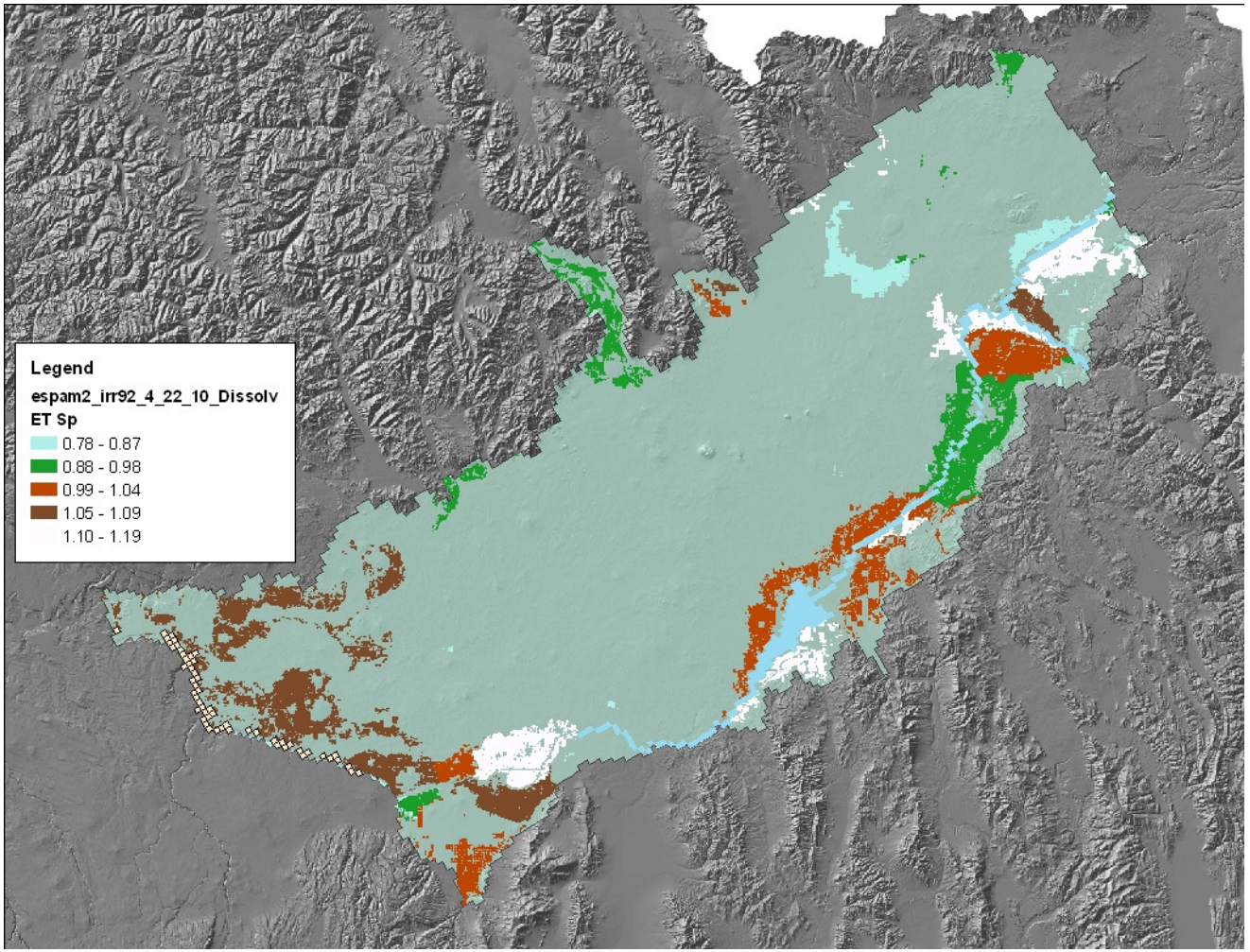
Tributary Underflow



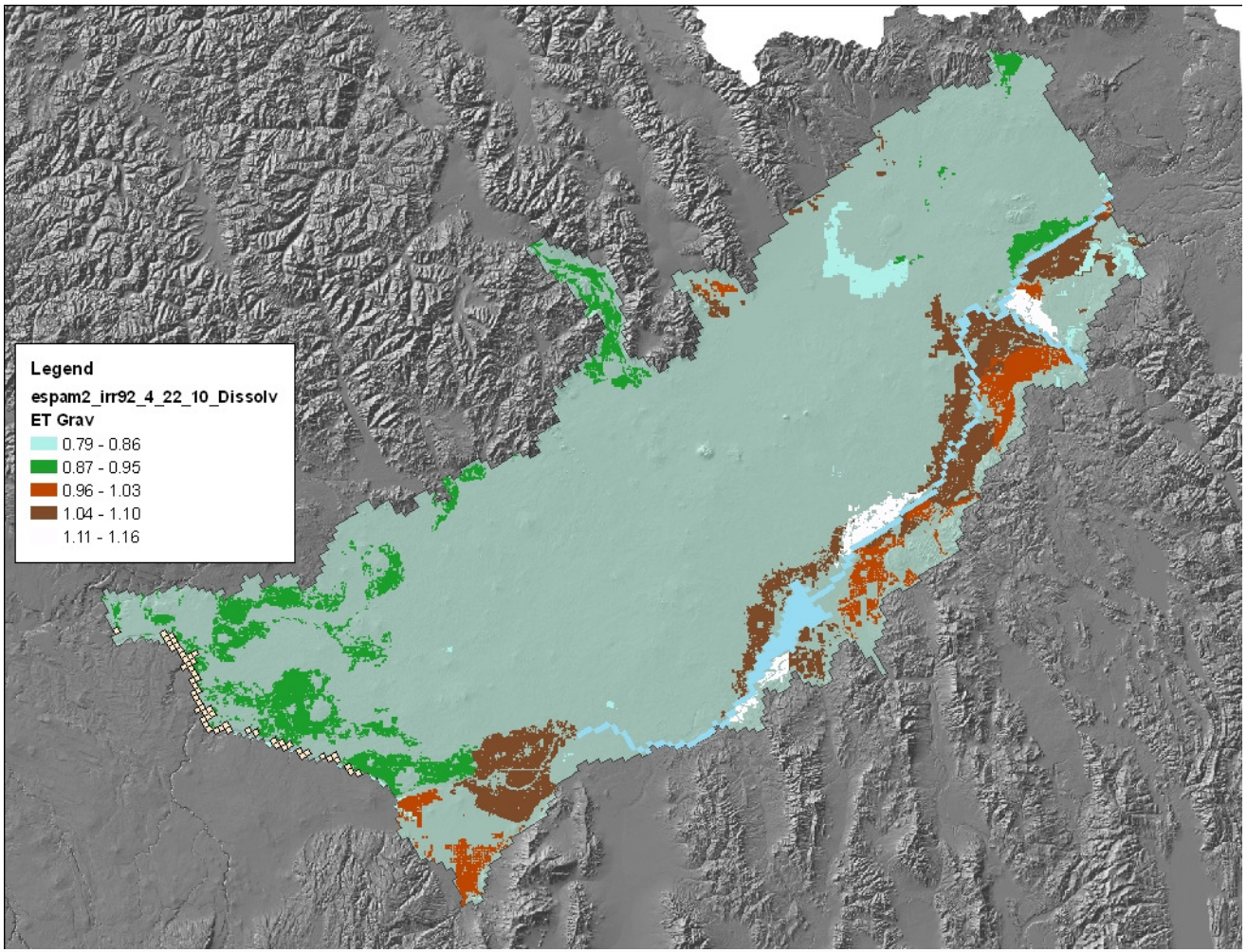
Non-irrigated Recharge



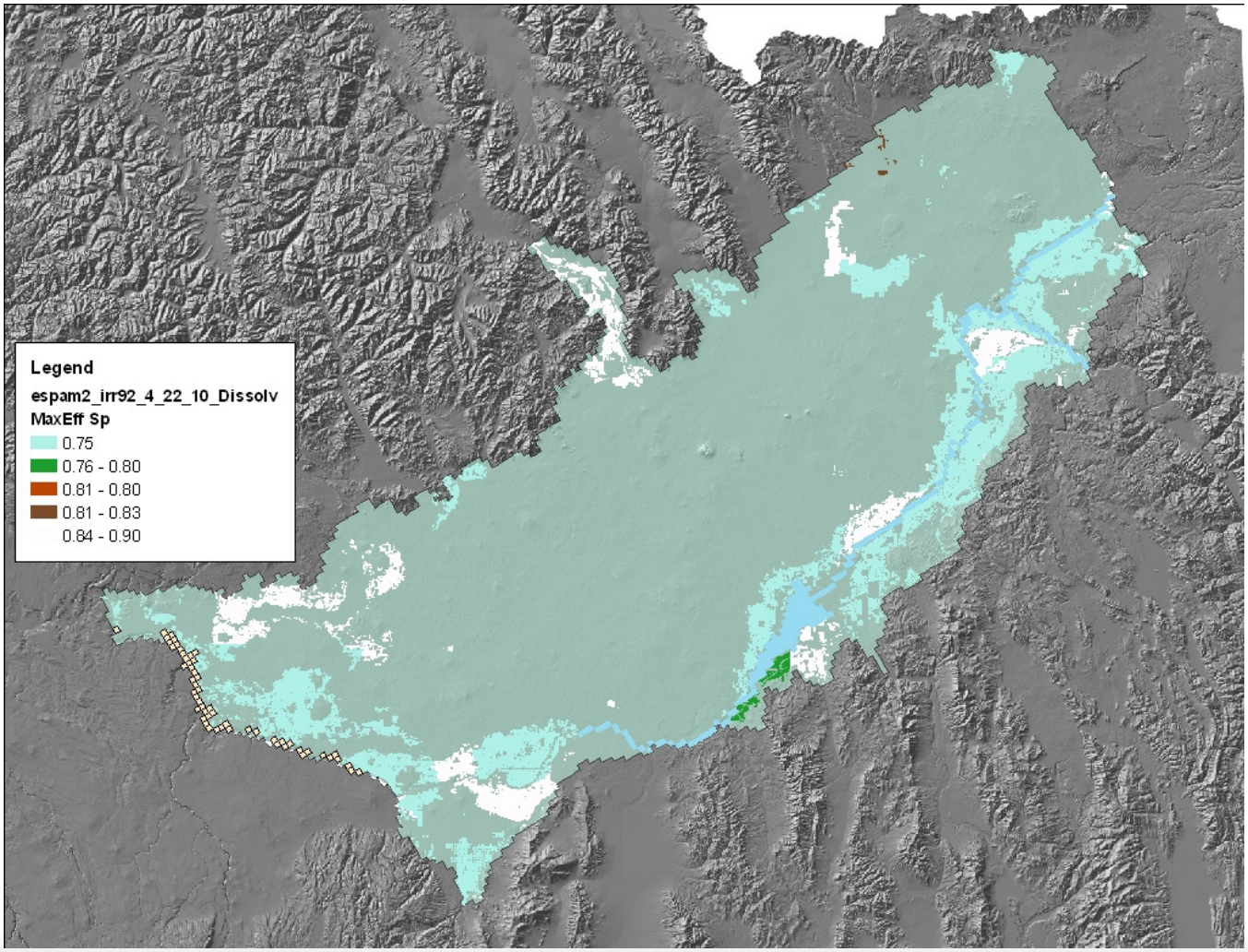
ET Surface Water Sprinkler



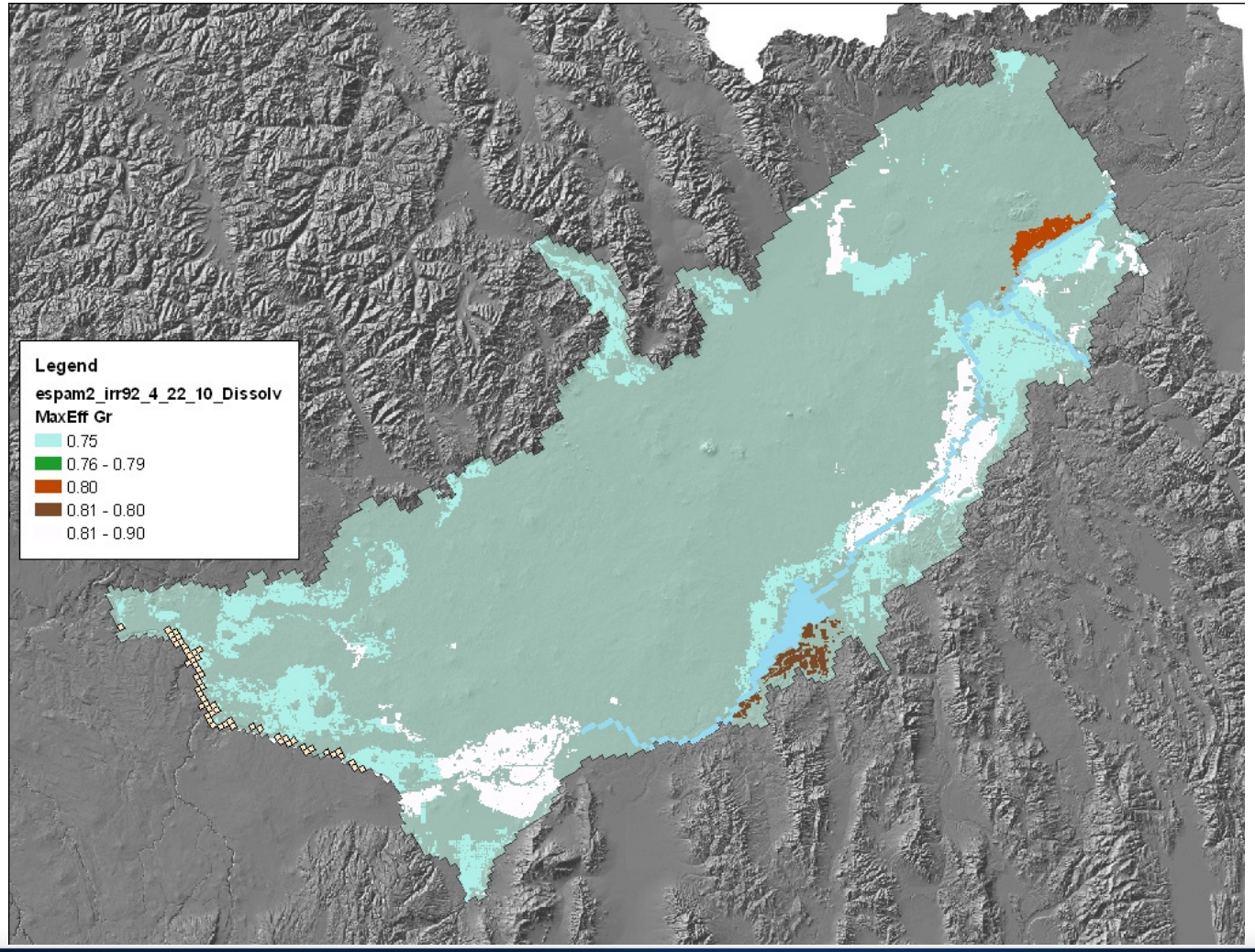
ET Surface Water Gravity



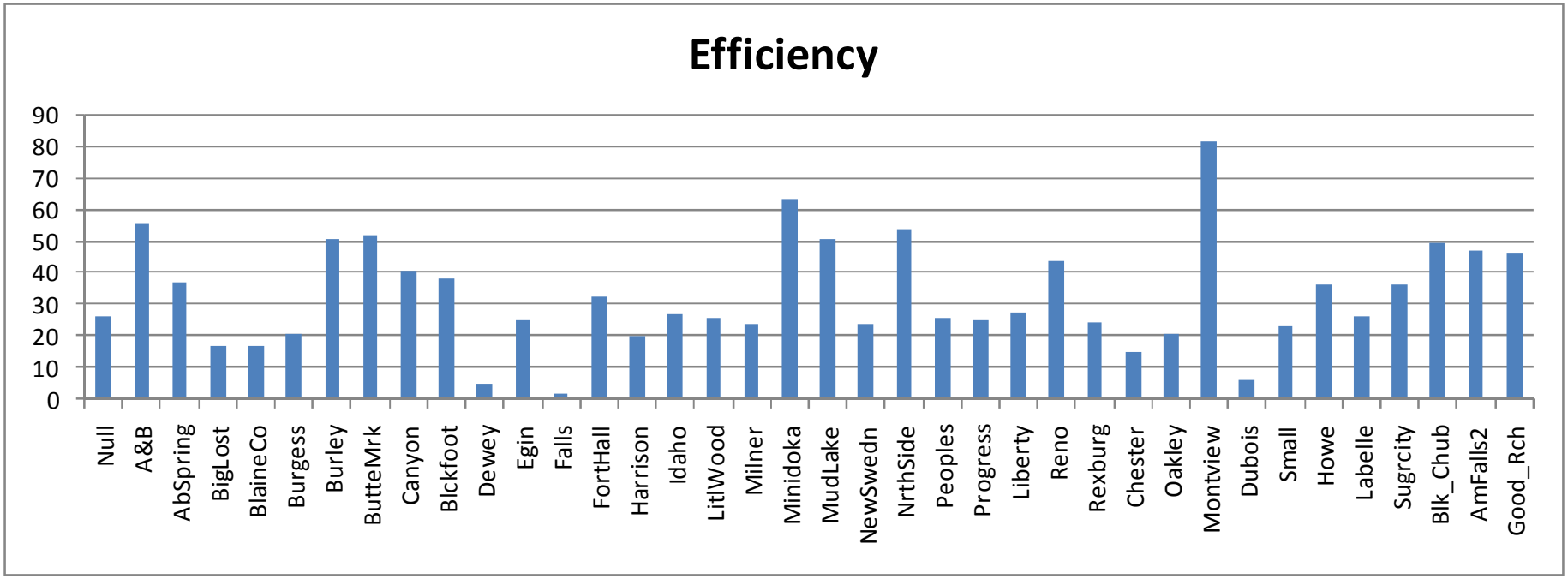
Surface Water Sprinkler Efficiency

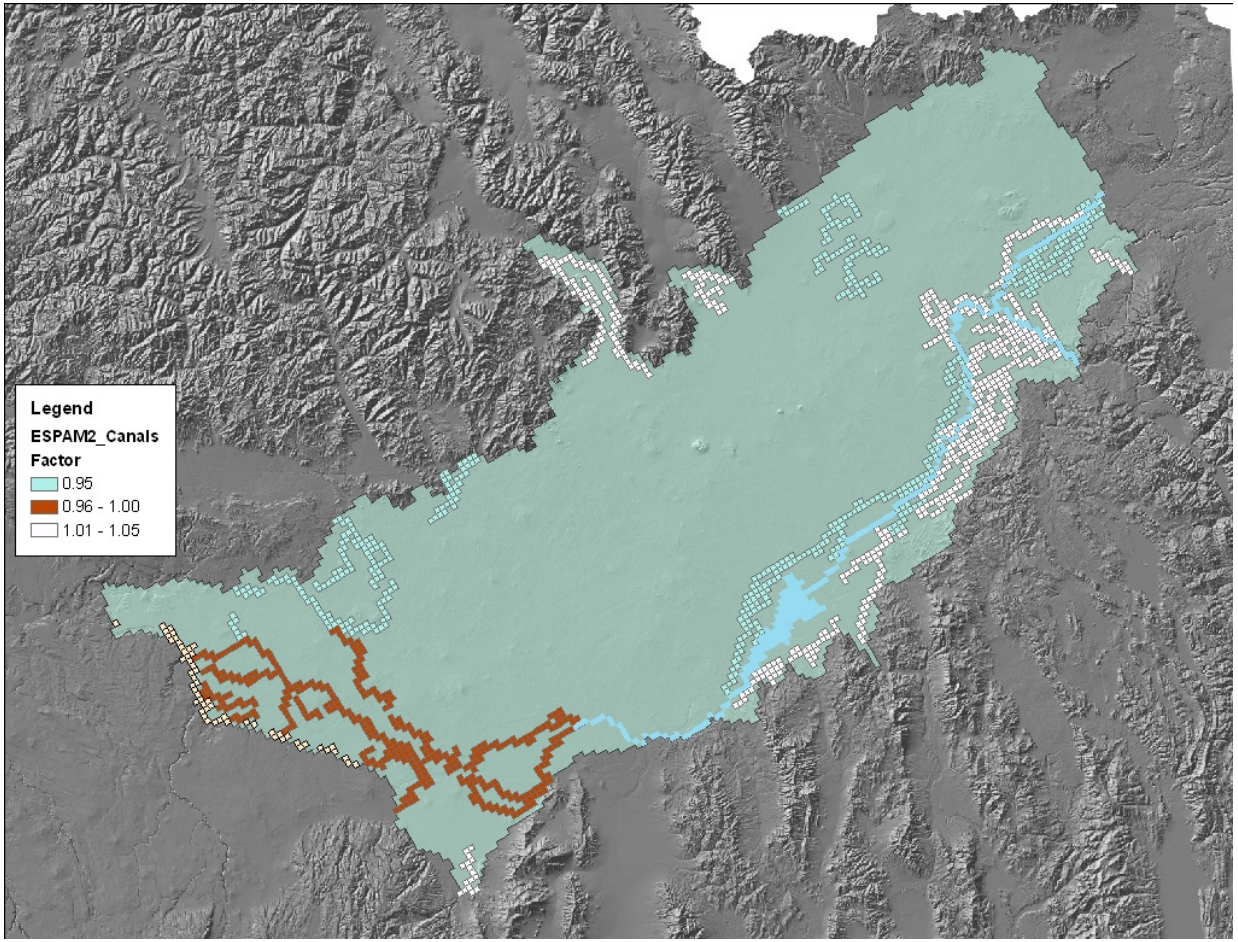


Surface Water Gravity Efficiency

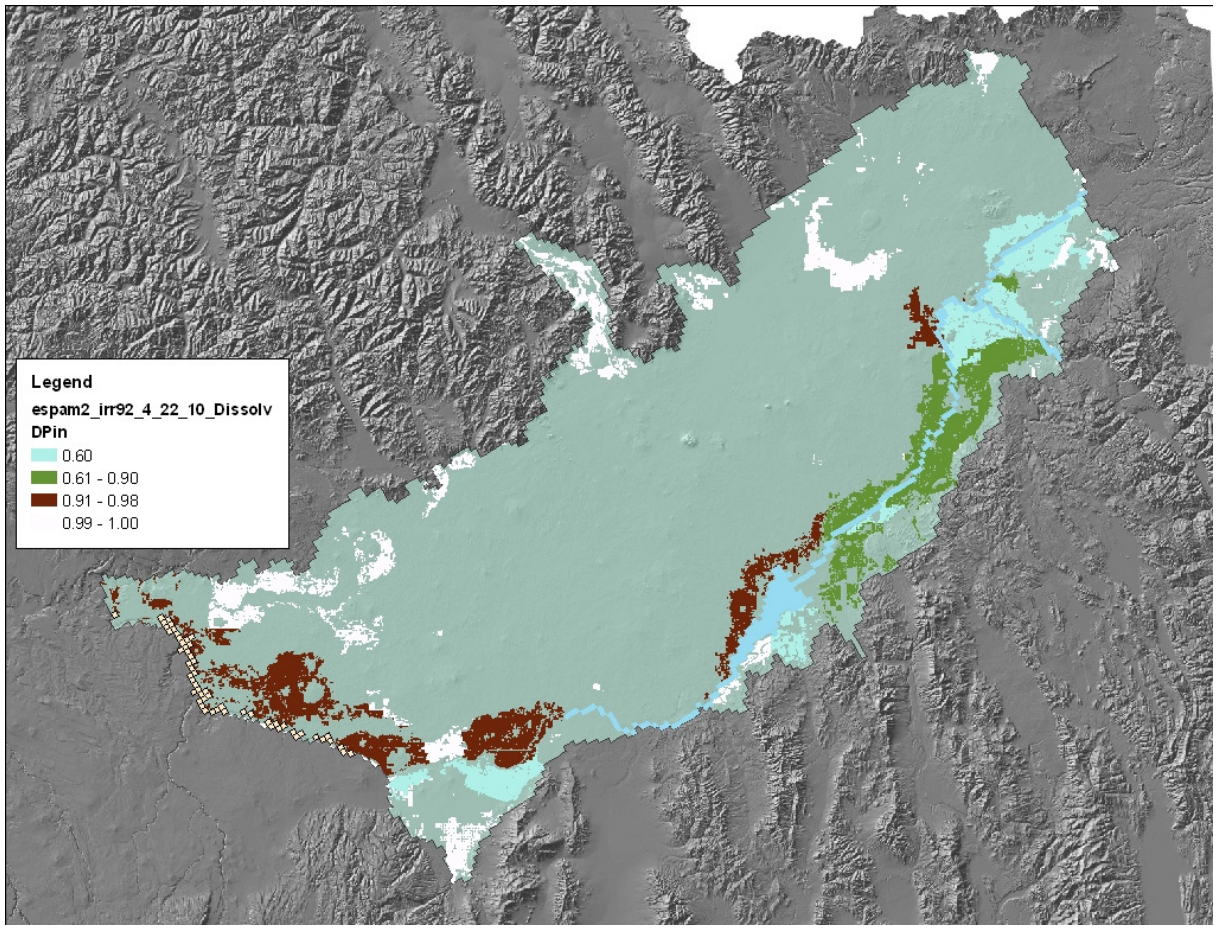


Efficiency = (CIR-deficit)/Applied Water

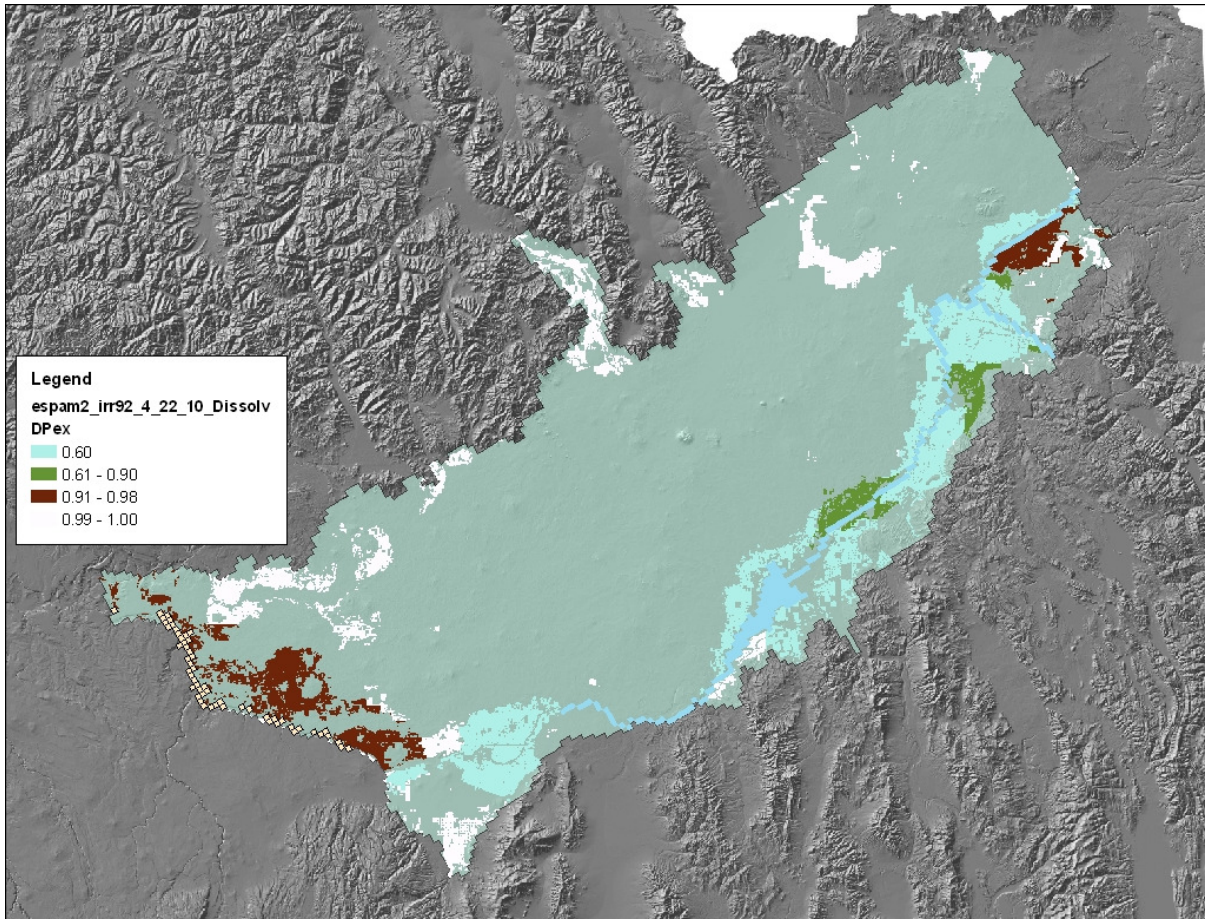




- Canal Seepage
  - CNL fraction * .DIV diversions
  - PEST only allowed to adjust non-coalition entities +/- 5%

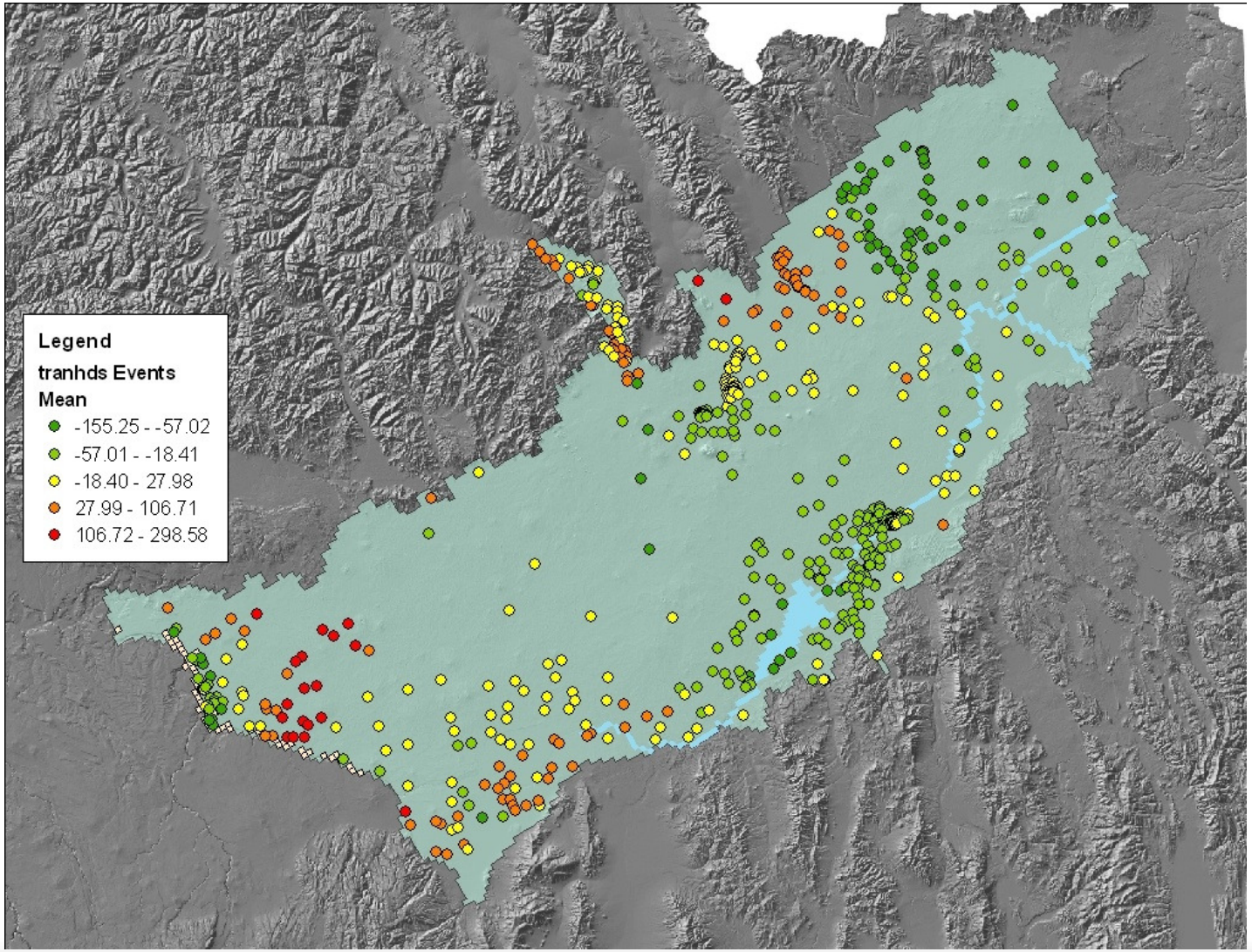


- DPin
  - fraction of the initial irrigation loss (1-eff) that percolates below the root zone
  - Fixed at 1.0 for non-Snake entities and some others
  - PEST allowed to adjust between 0.6-0.98

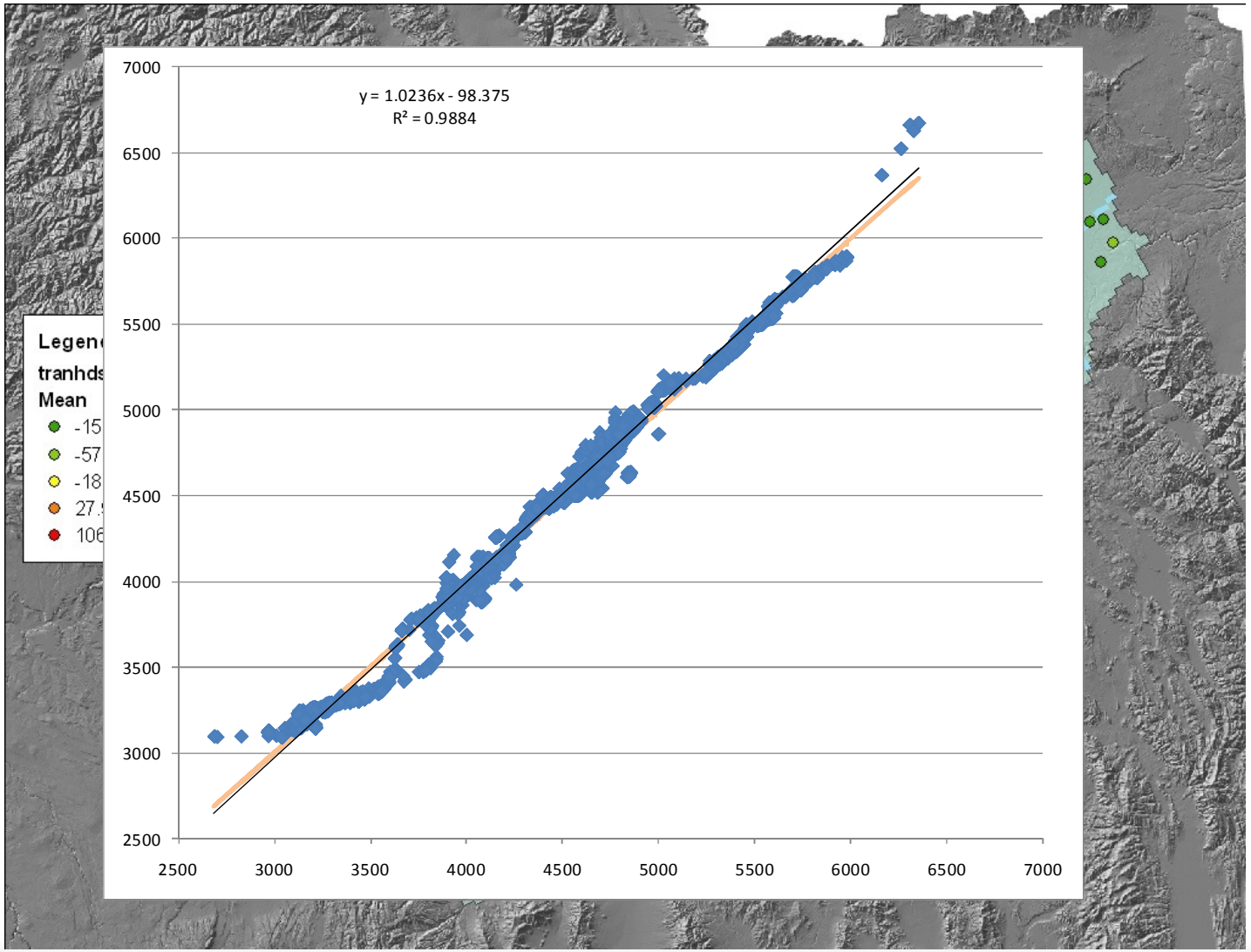


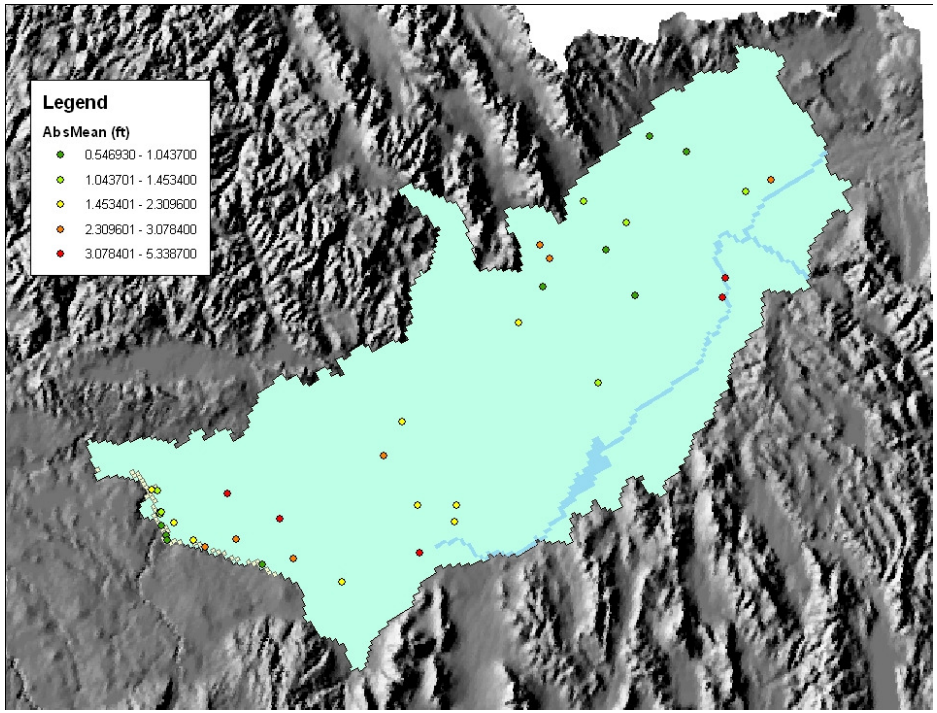
- DPex
  - fraction of delivery exceeding CIR that percolates below the root zone
  - Fixed at 1.0 for non-Snake entities and some others
  - PEST allowed to adjust between 0.6-0.98

Transient Heads

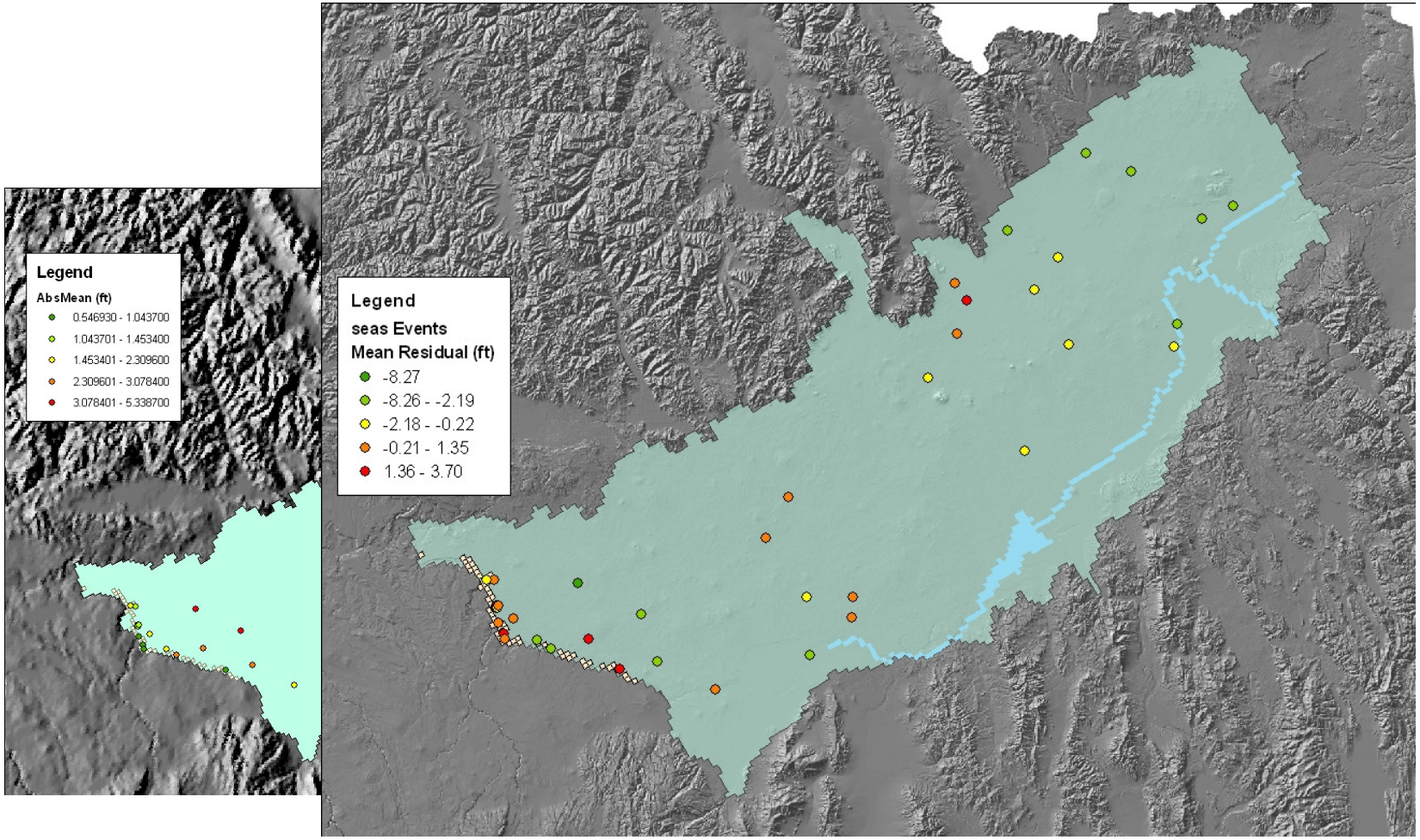


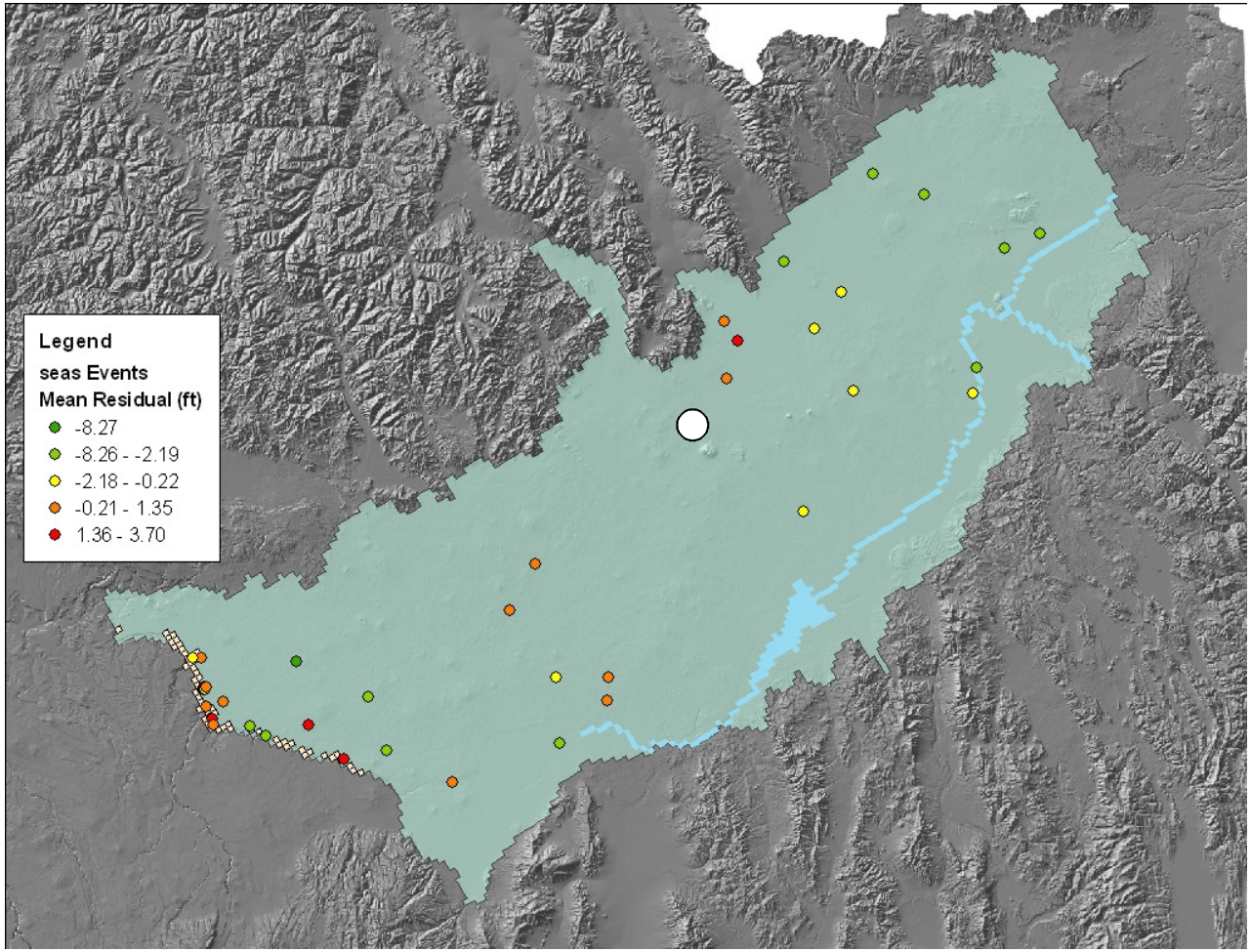
Transient Heads

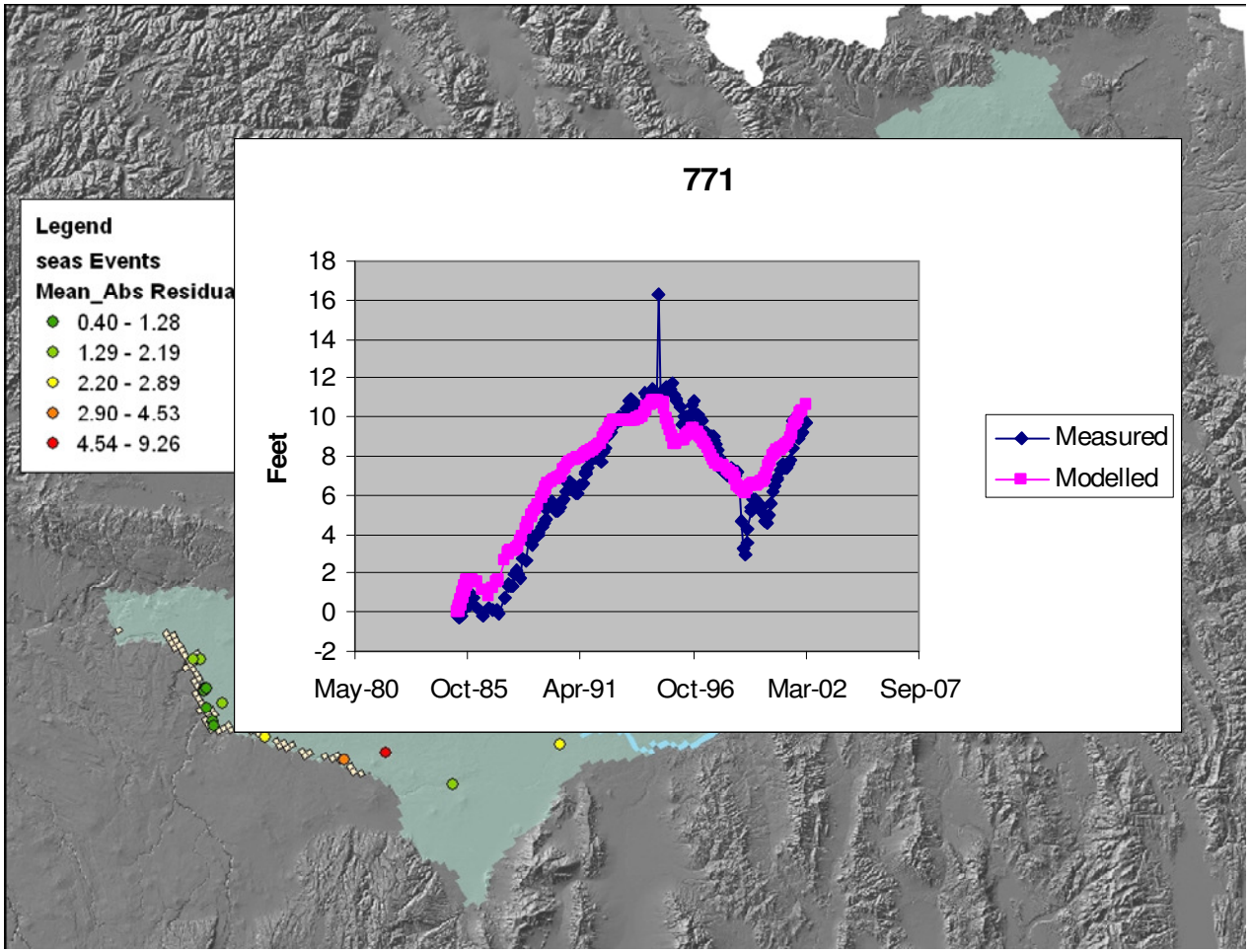


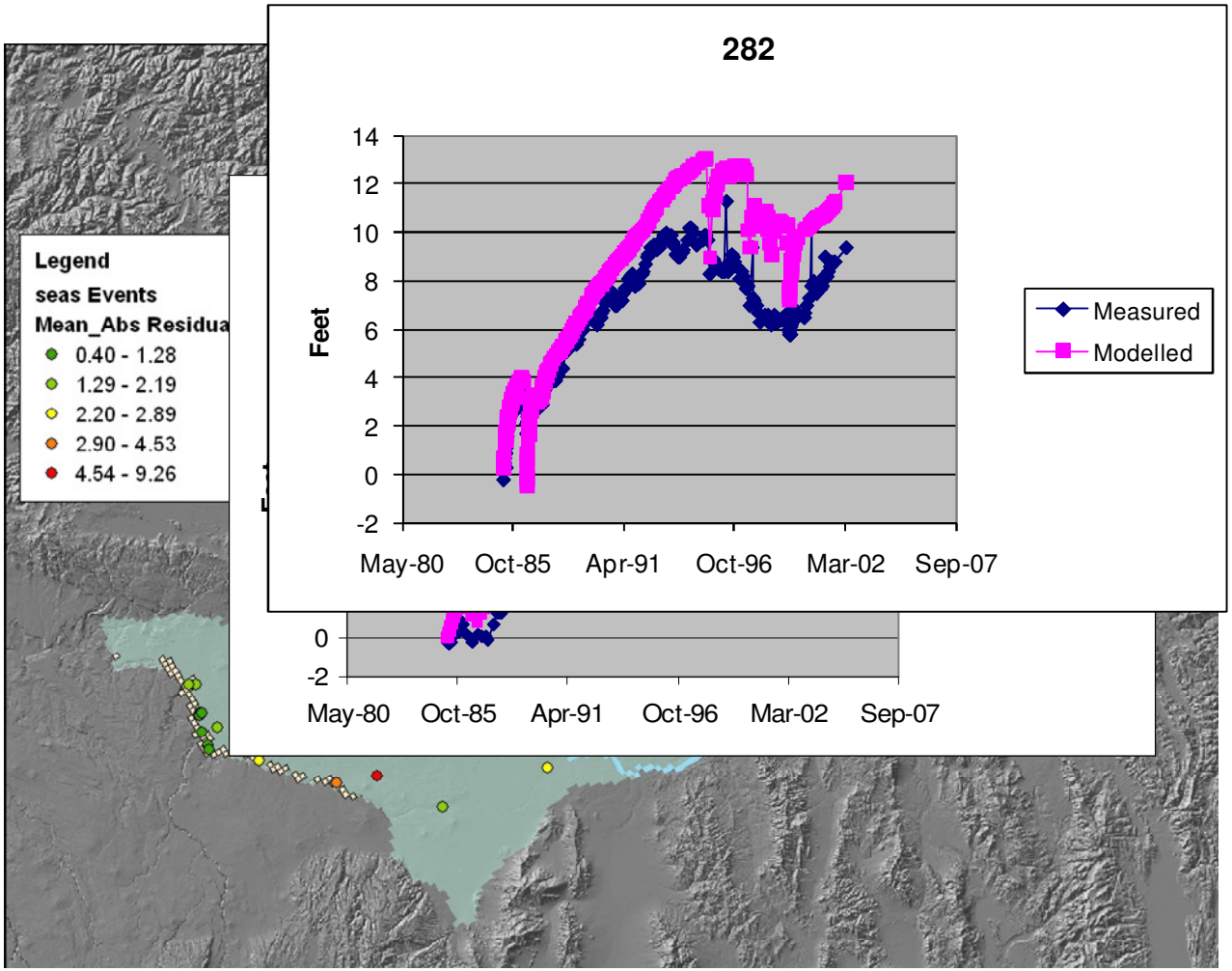


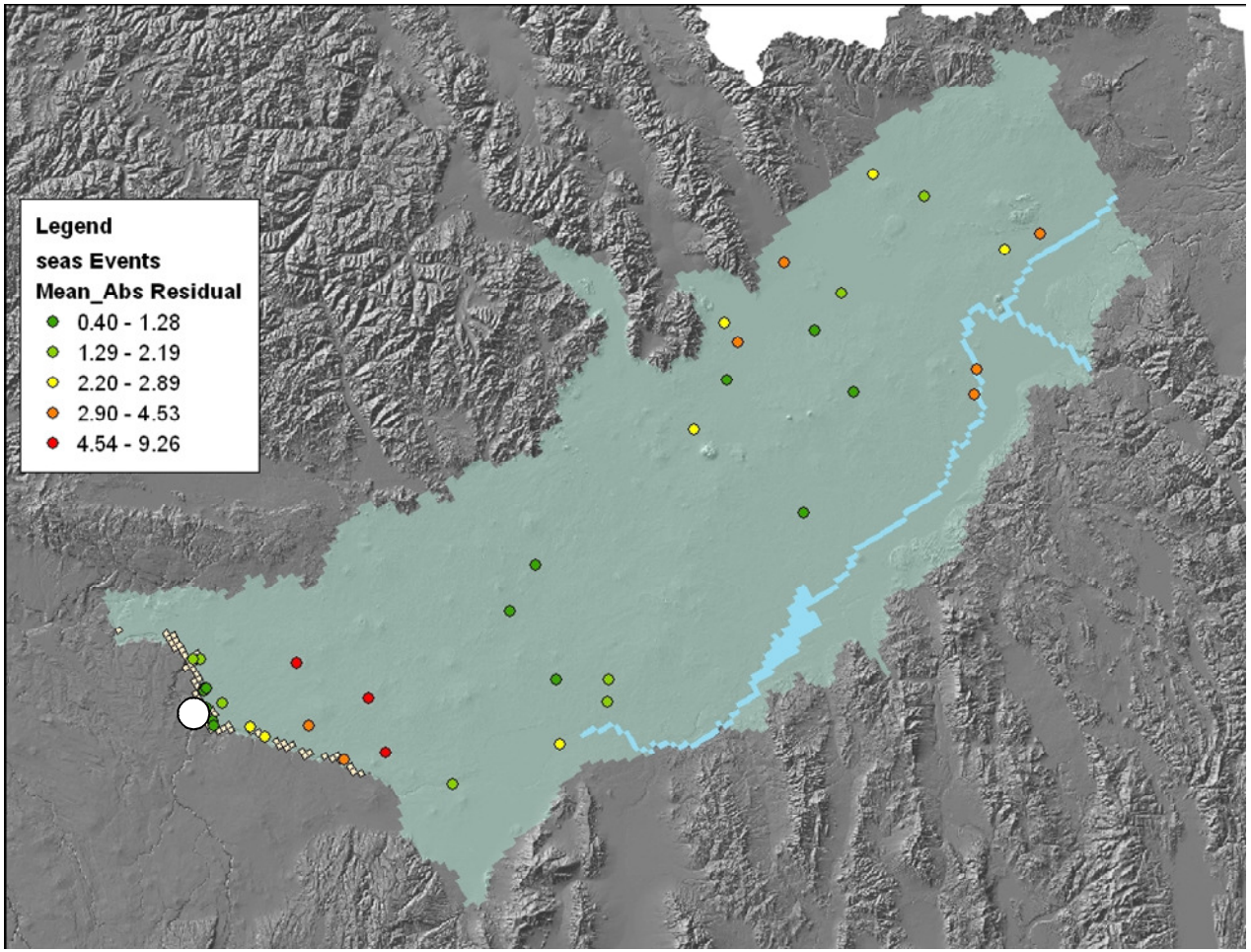
- Hundreds to thousands of observations
  - Lots of data
  - Limited spatial coverage

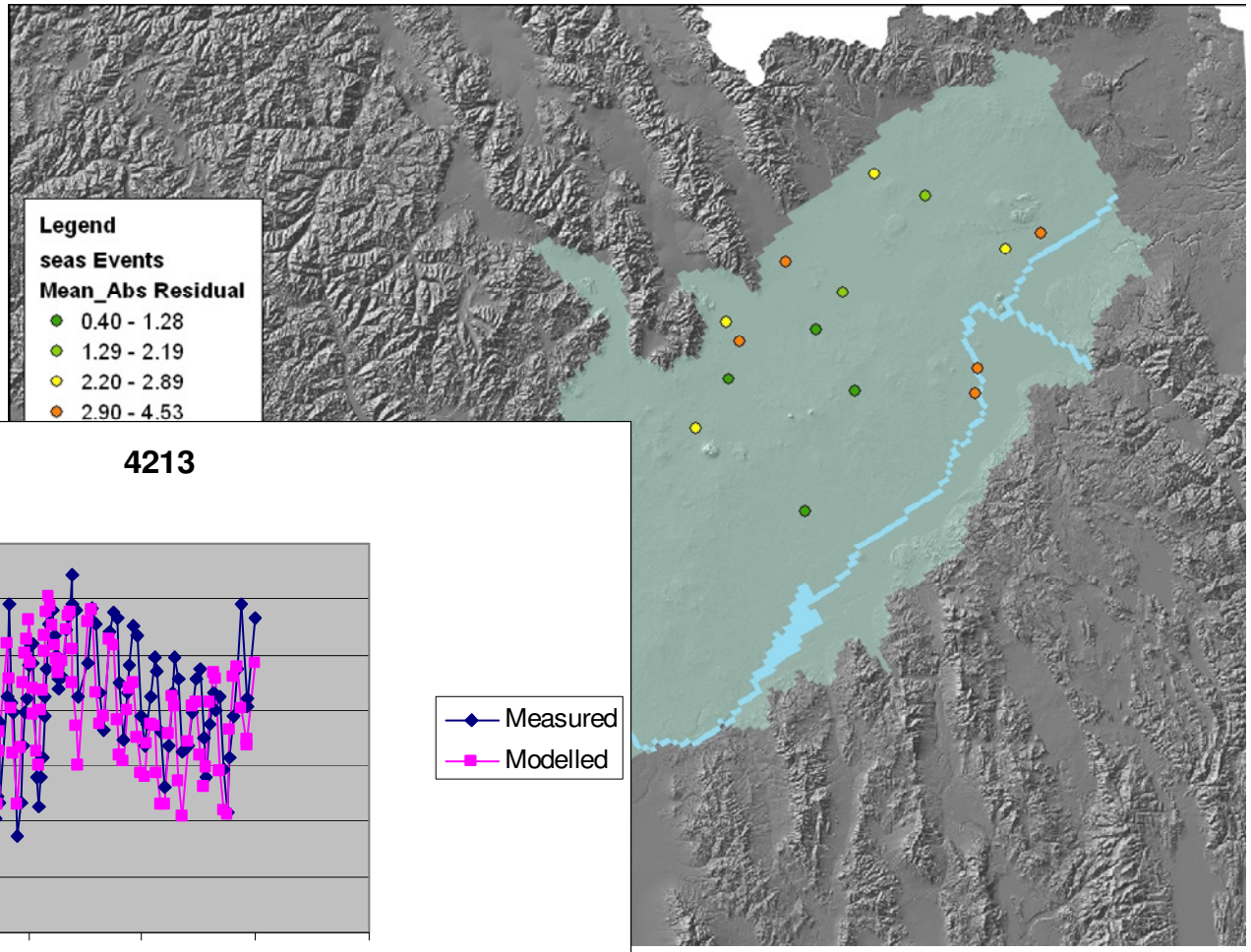

Legend
AbsMean (ft)
0.546930 - 1.043700
1.043701 - 1.453400
1.453401 - 2.309600
2.309601 - 3.078400
3.078401 - 5.338700
Legend
seas Events
Mean Residual (ft)
-8.27
-8.26 - -2.19
-2.18 - -0.22
-0.21 - 1.35
1.36 - 3.70

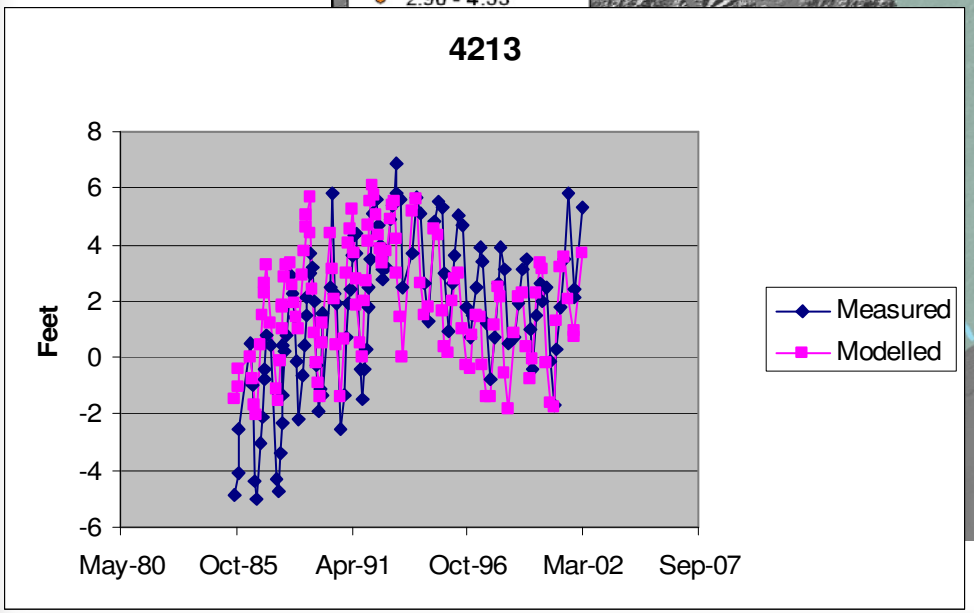

Legend
seas Events
Mean Residual (ft)
-8.27
-8.26 - -2.19
-2.18 - -0.22
-0.21 - 1.35
1.36 - 3.70

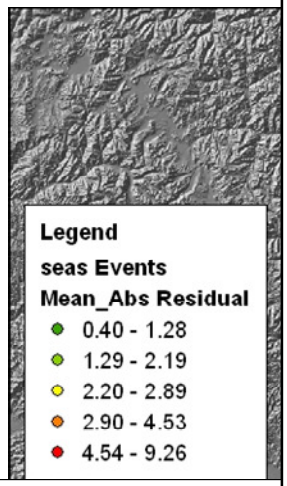

Legend
seas Events
Mean_Abs Residua
0.40 - 1.28
1.29 - 2.19
2.20 - 2.89
2.90 - 4.53
4.54 - 9.26
771
Feet
18
16
14
12
10
8
6
4
2
0
-2
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07
Measured
Modelled

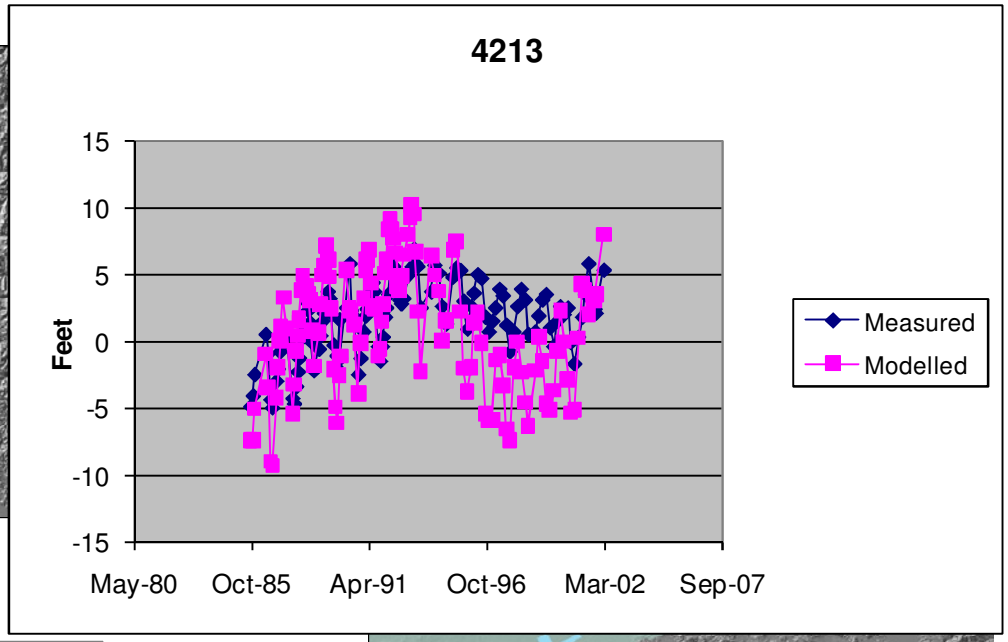

Legend
seas Events
Mean_Abs Residua
0.40 - 1.28
1.29 - 2.19
2.20 - 2.89
2.90 - 4.53
4.54 - 9.26
282
Feet
14
12
10
8
6
4
2
0
-2
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07
Measured
Modelled

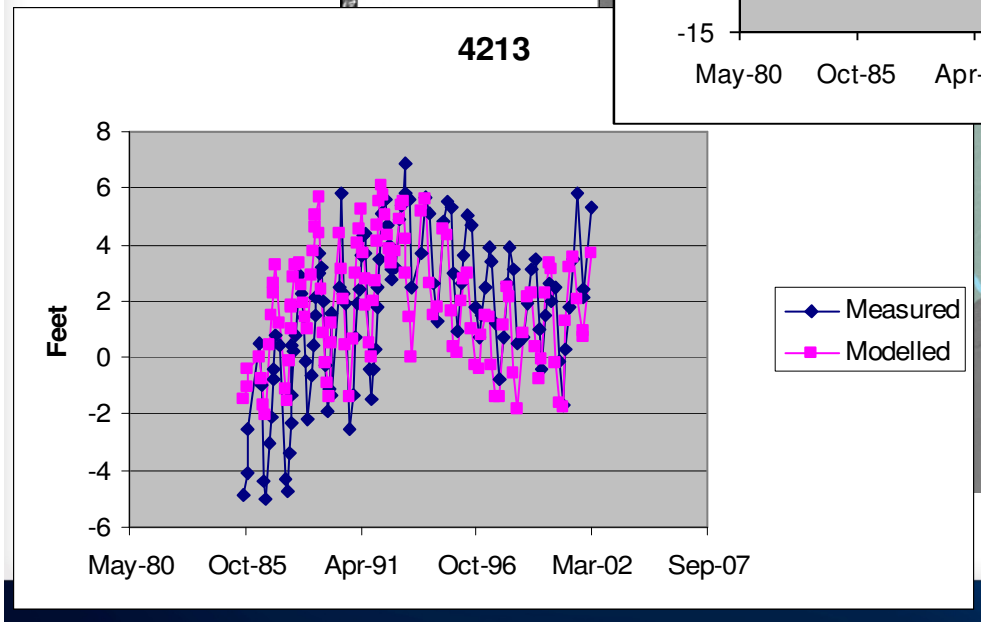

Legend
seas Events
Mean_Abs Residual
0.40 - 1.28
1.29 - 2.19
2.20 - 2.89
2.90 - 4.53
4.54 - 9.26

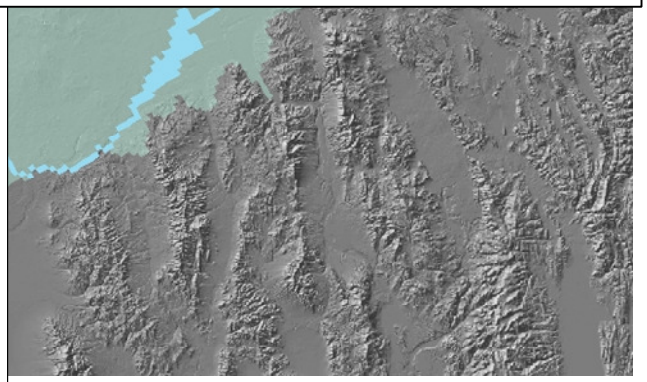

Legend
seas Events
Mean_Abs Residual
0.40 - 1.28
1.29 - 2.19
2.20 - 2.89
2.90 - 4.53

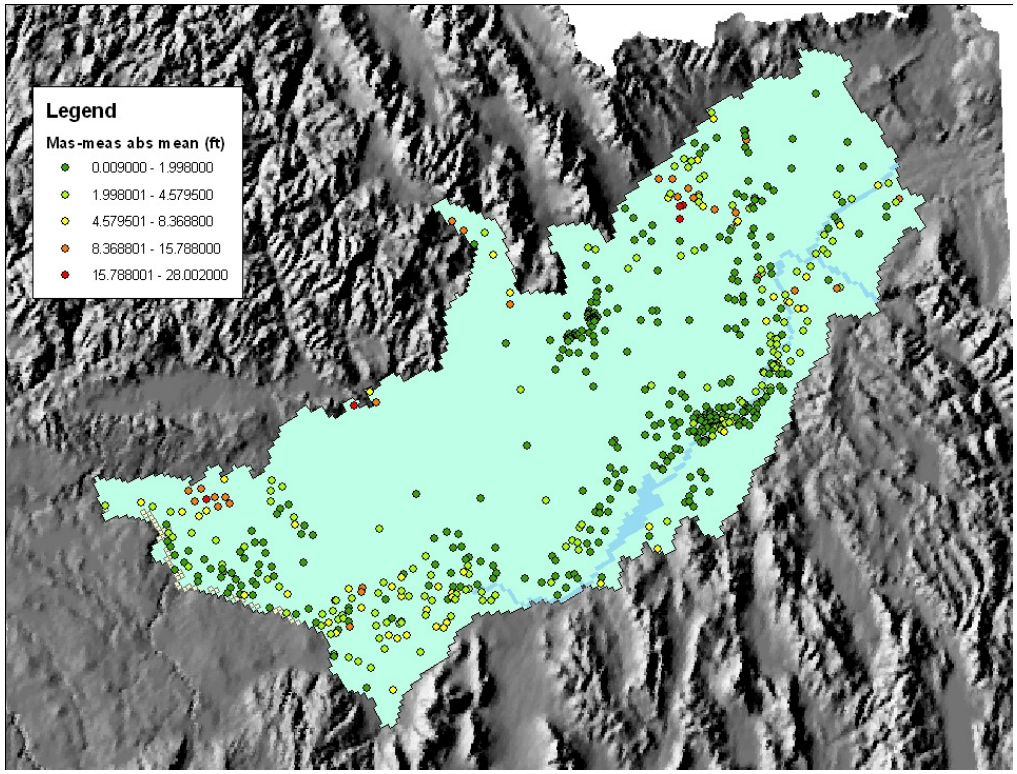

4213
Feet
8
6
4
2
0
-2
-4
-6
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07
Measured
Modelled


Legend
seas Events
Mean_Abs Residual
0.40 - 1.28
1.29 - 2.19
2.20 - 2.89
2.90 - 4.53
4.54 - 9.26

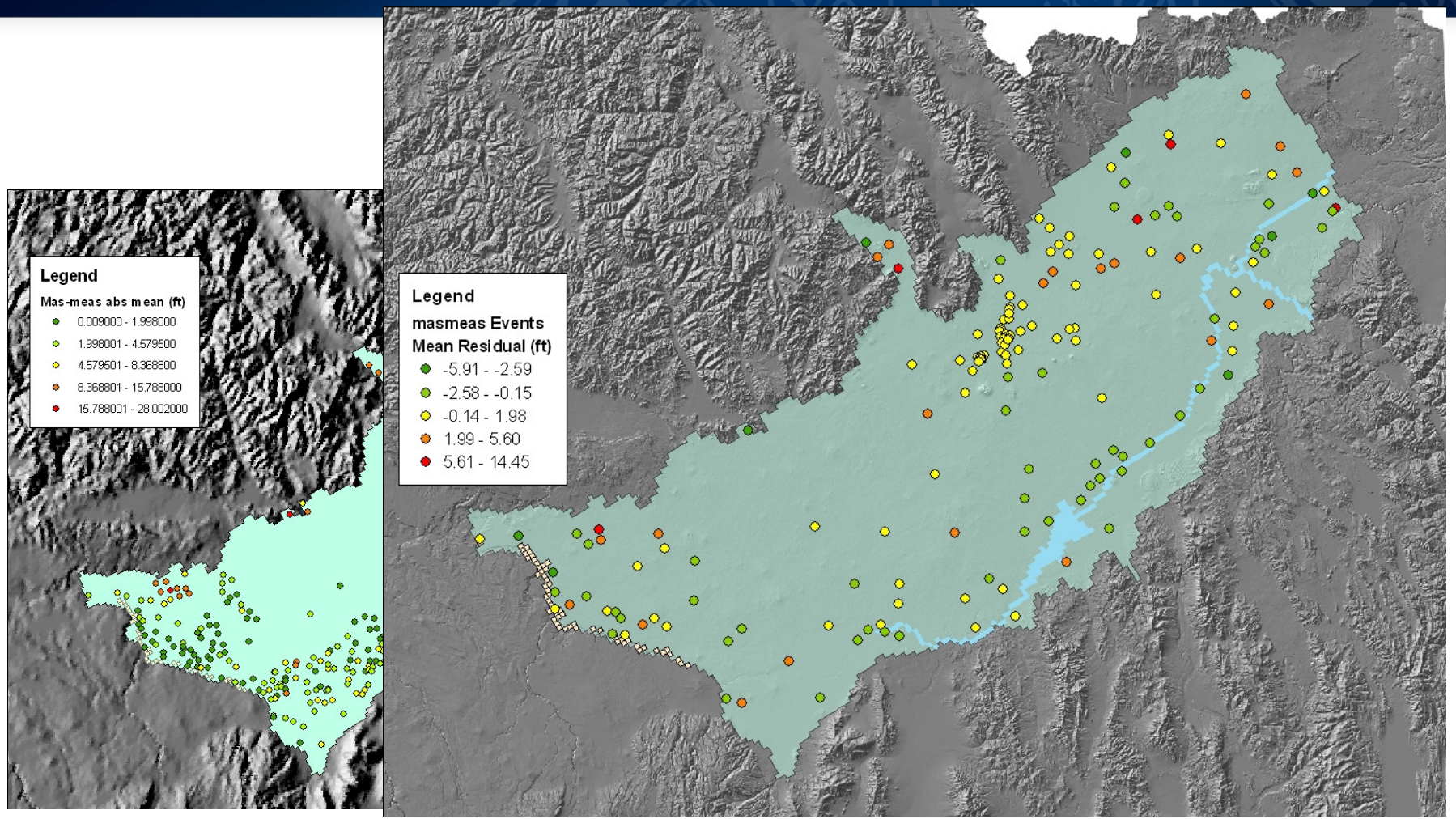

4213
Feet
15
10
5
0
-5
-10
-15
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07
Measured
Modelled

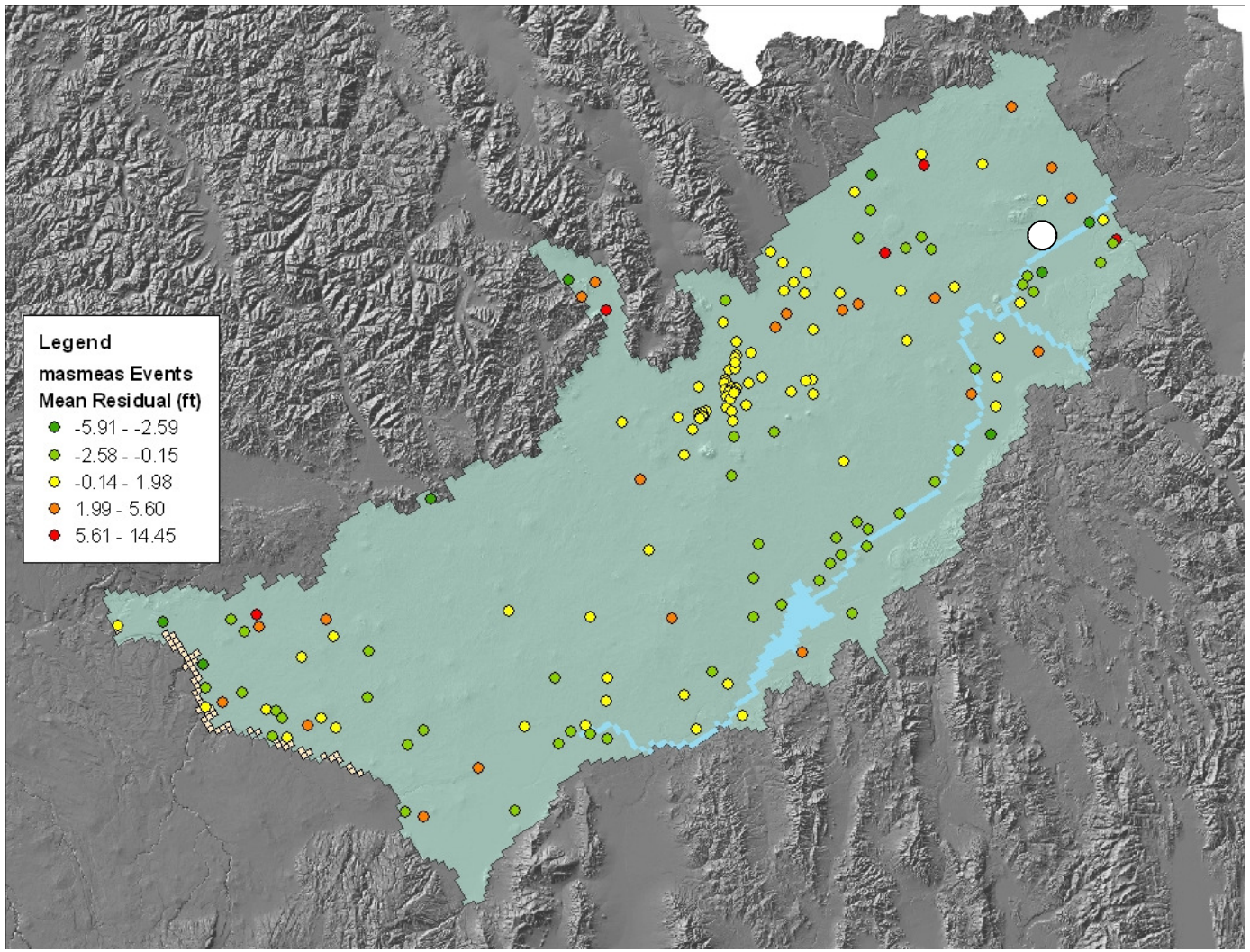

4213
Feet
8
6
4
2
0
-2
-4
-6
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07
Measured
Modelled

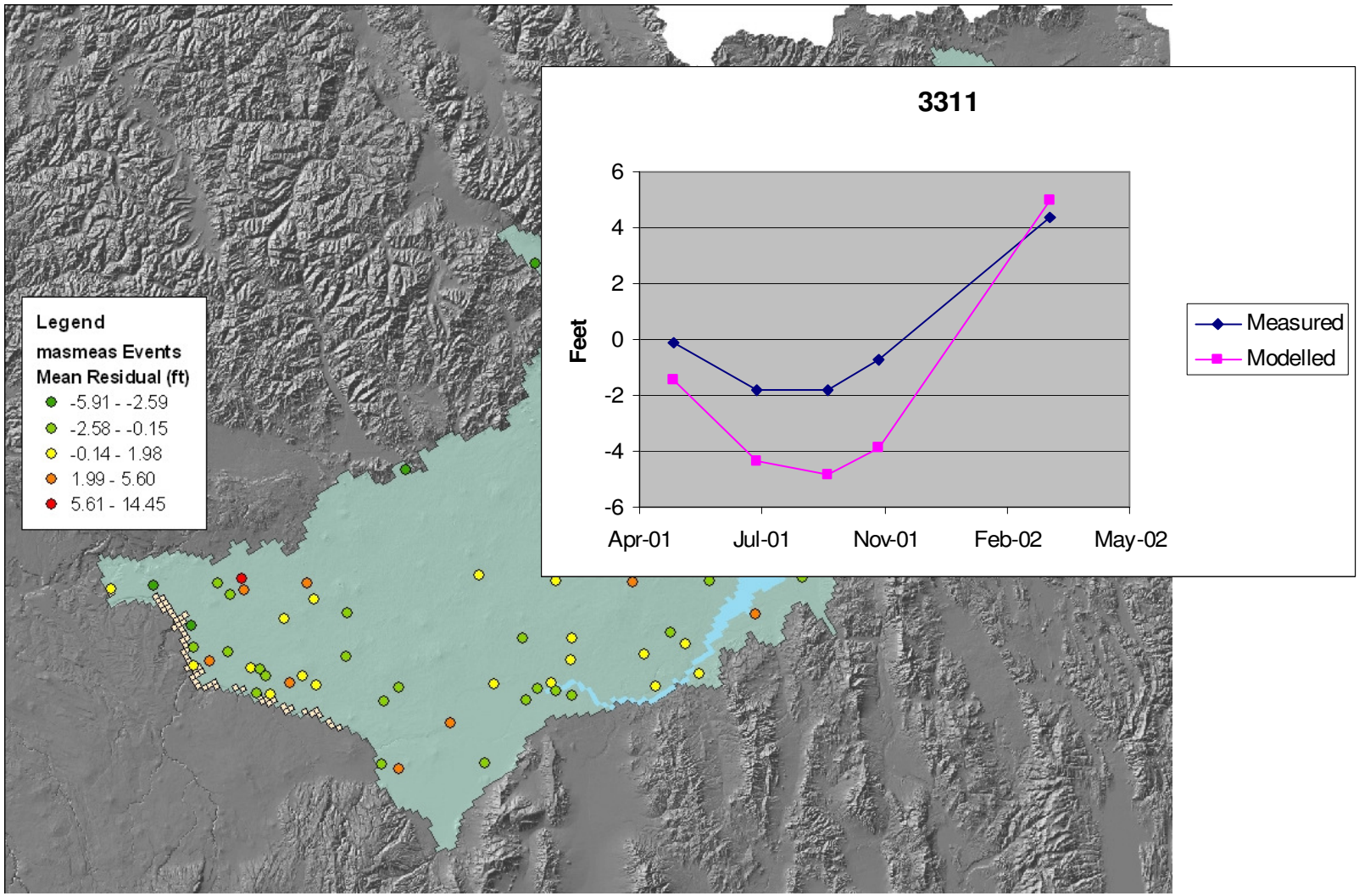


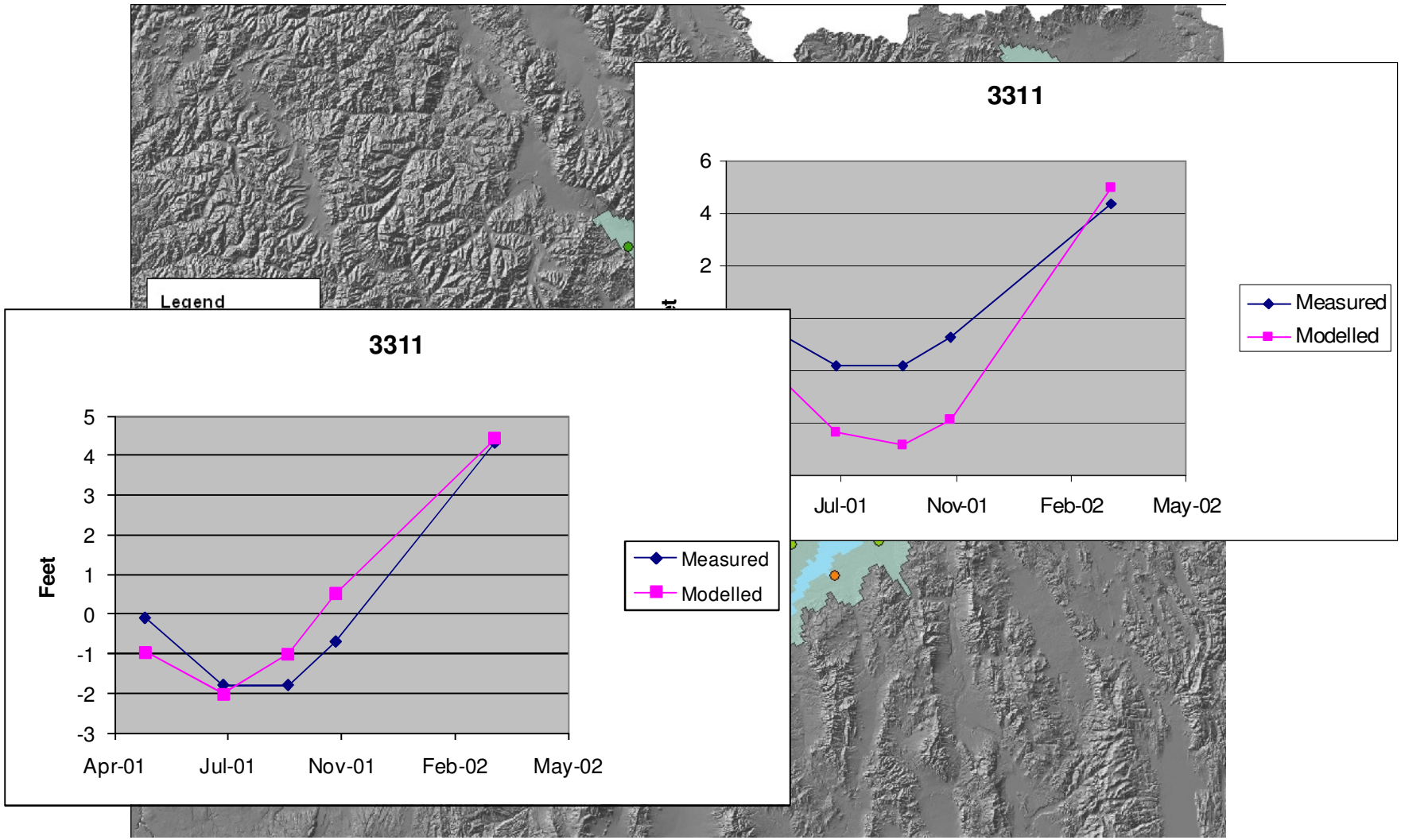


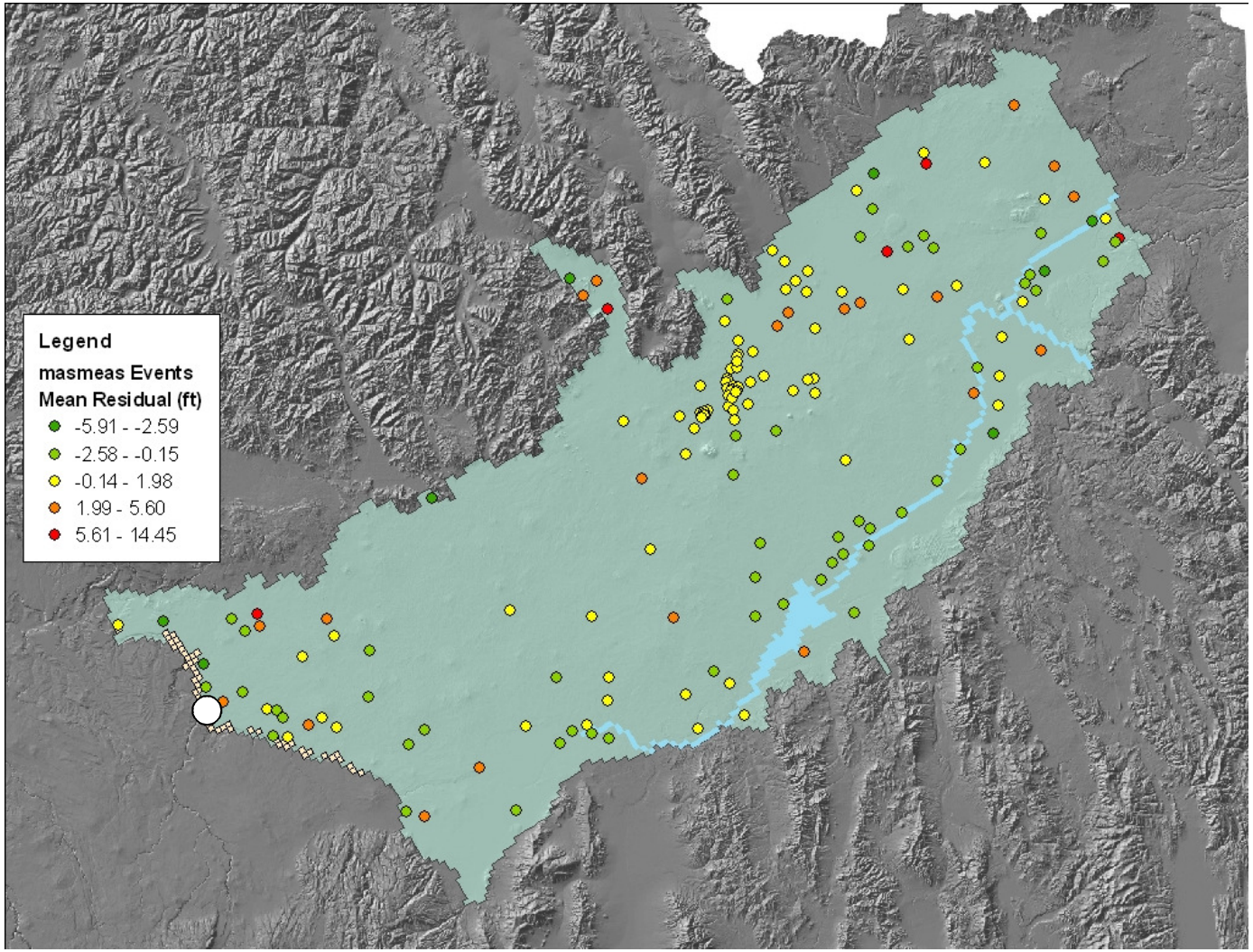
- Observations collected on behalf of this modeling effort
  - 3/1/2001 –5/8/2002

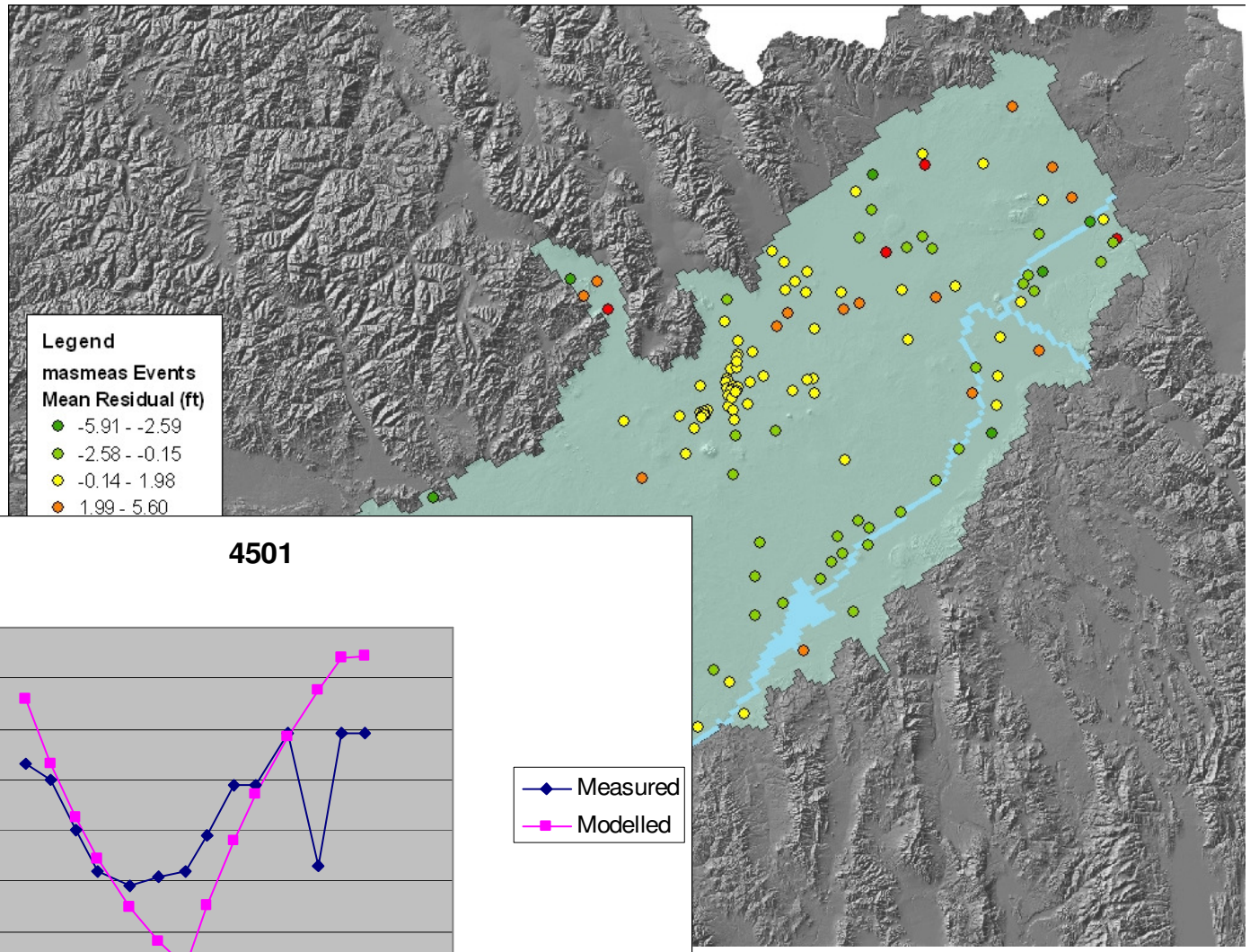

Legend
Mas-meas abs mean (ft)
0.009000 - 1.998000
1.998001 - 4.579500
4.579501 - 8.368800
8.368801 - 15.788000
15.788001 - 28.002000
Legend
masmeas Events
Mean Residual (ft)
-5.91 - -2.59
-2.58 - -0.15
-0.14 - 1.98
1.99 - 5.60
5.61 - 14.45

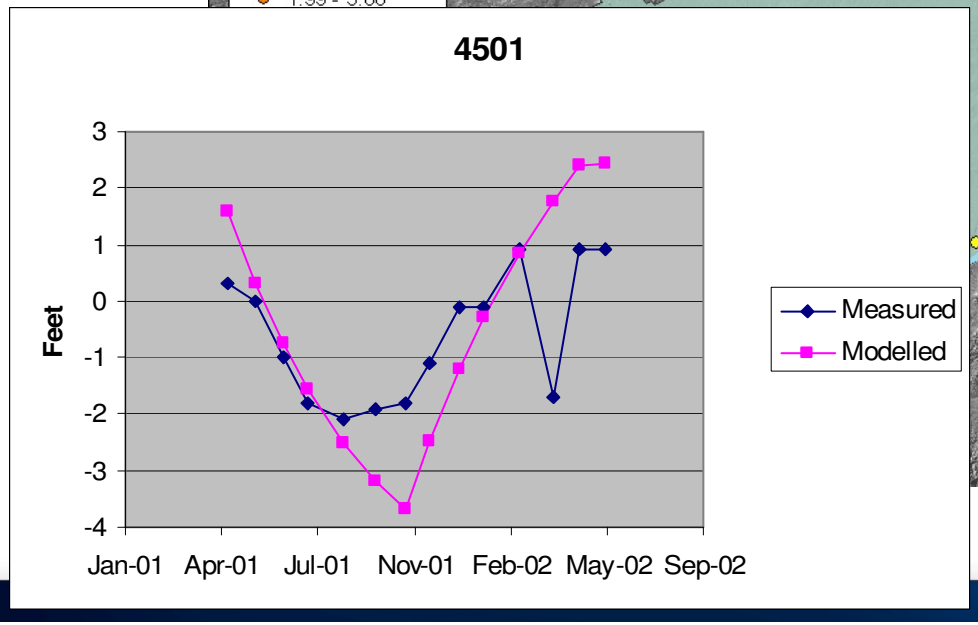

Legend
masmeas Events
Mean Residual (ft)
-5.91 - -2.59
-2.58 - -0.15
-0.14 - 1.98
1.99 - 5.60
5.61 - 14.45

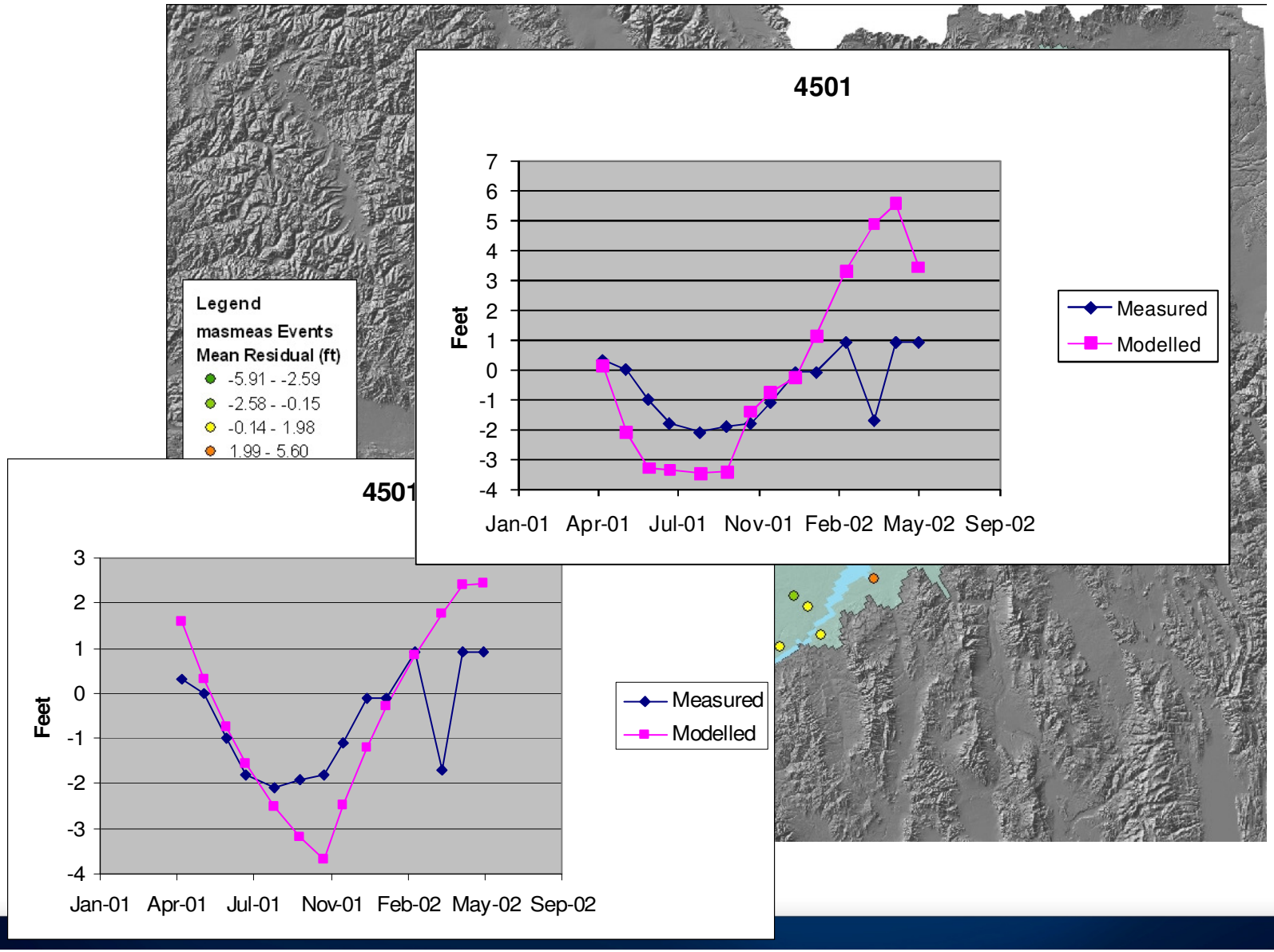

Legend
masmeas Events
Mean Residual (ft)
-5.91 - -2.59
-2.58 - -0.15
-0.14 - 1.98
1.99 - 5.60
5.61 - 14.45
3311
Feet
6
4
2
0
-2
-4
-6
Apr-01
Jul-01
Nov-01
Feb-02
May-02
Measured
Modelled

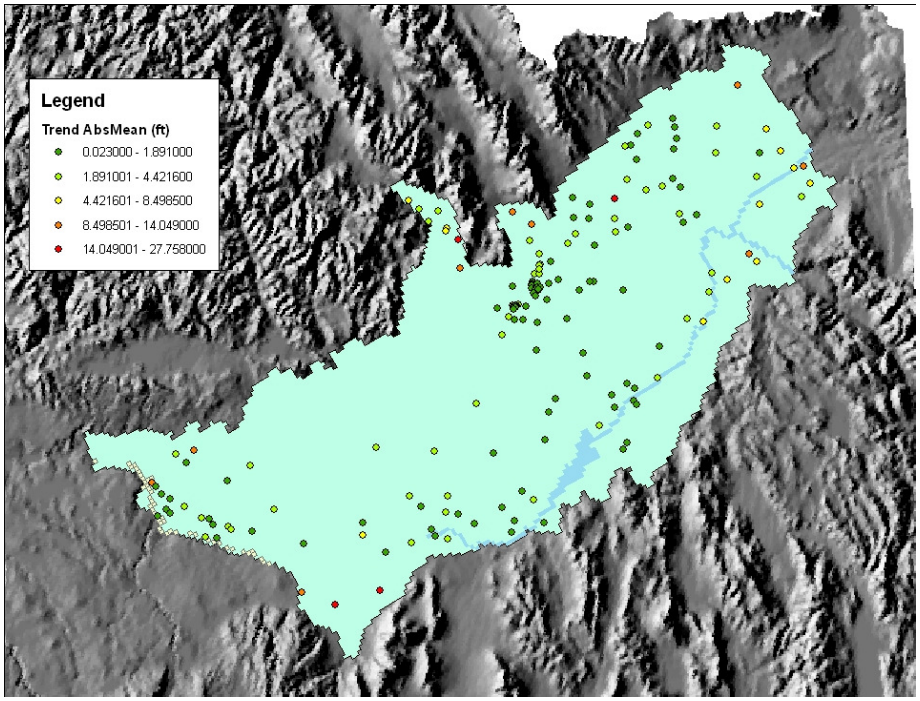

Legend
3311
6
4
2
Measured
Modelled
Jul-01
Nov-01
Feb-02
May-02
3311
Feet
5
4
3
2
1
0
-1
-2
-3
Measured
Modelled
Apr-01
Jul-01
Nov-01
Feb-02
May-02


Legend
masmeas Events
Mean Residual (ft)
-5.91 - -2.59
-2.58 - -0.15
-0.14 - 1.98
1.99 - 5.60
5.61 - 14.45

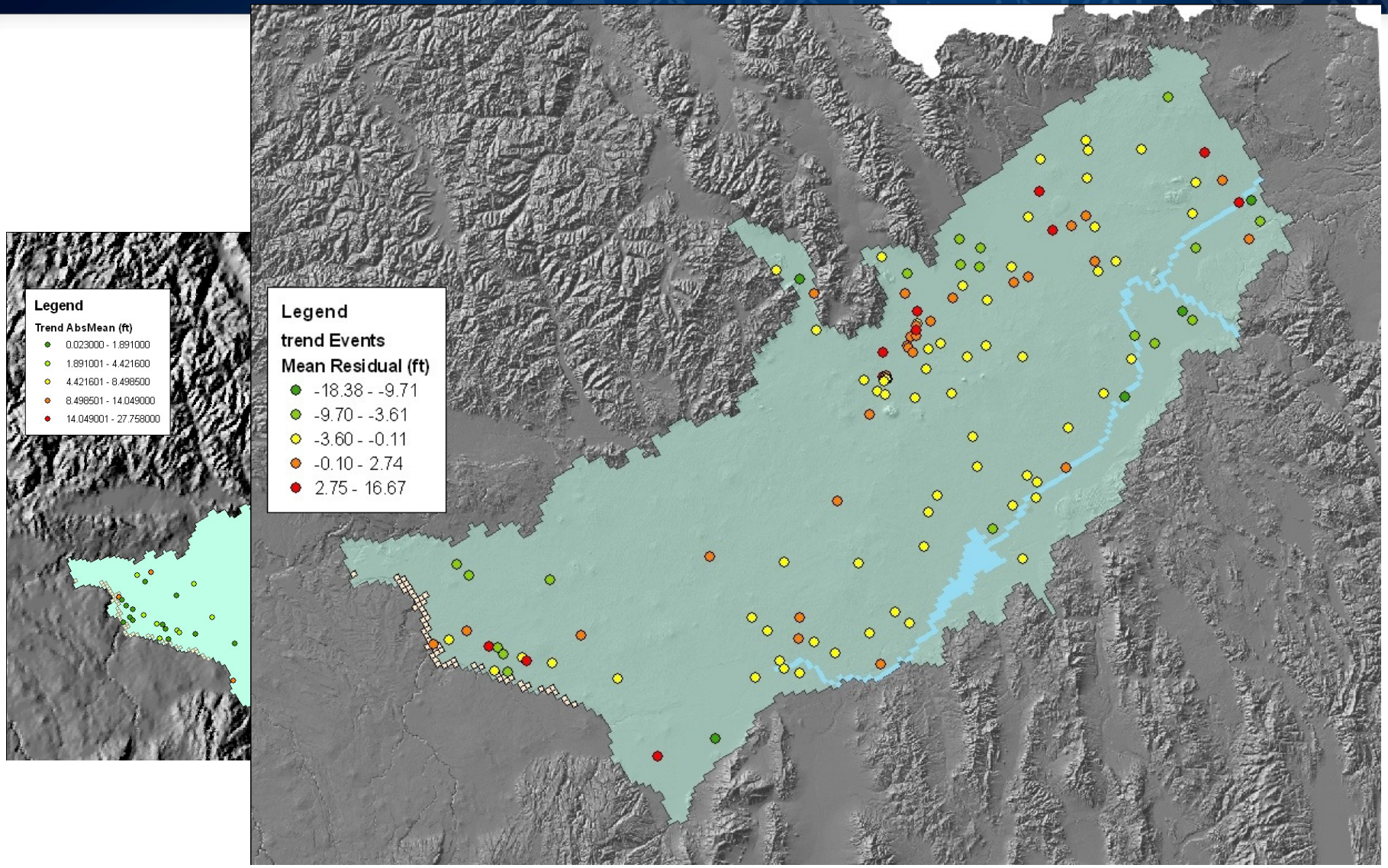

Legend
masmeas Events
Mean Residual (ft)
-5.91 - -2.59
-2.58 - -0.15
-0.14 - 1.98
1.99 - 5.60

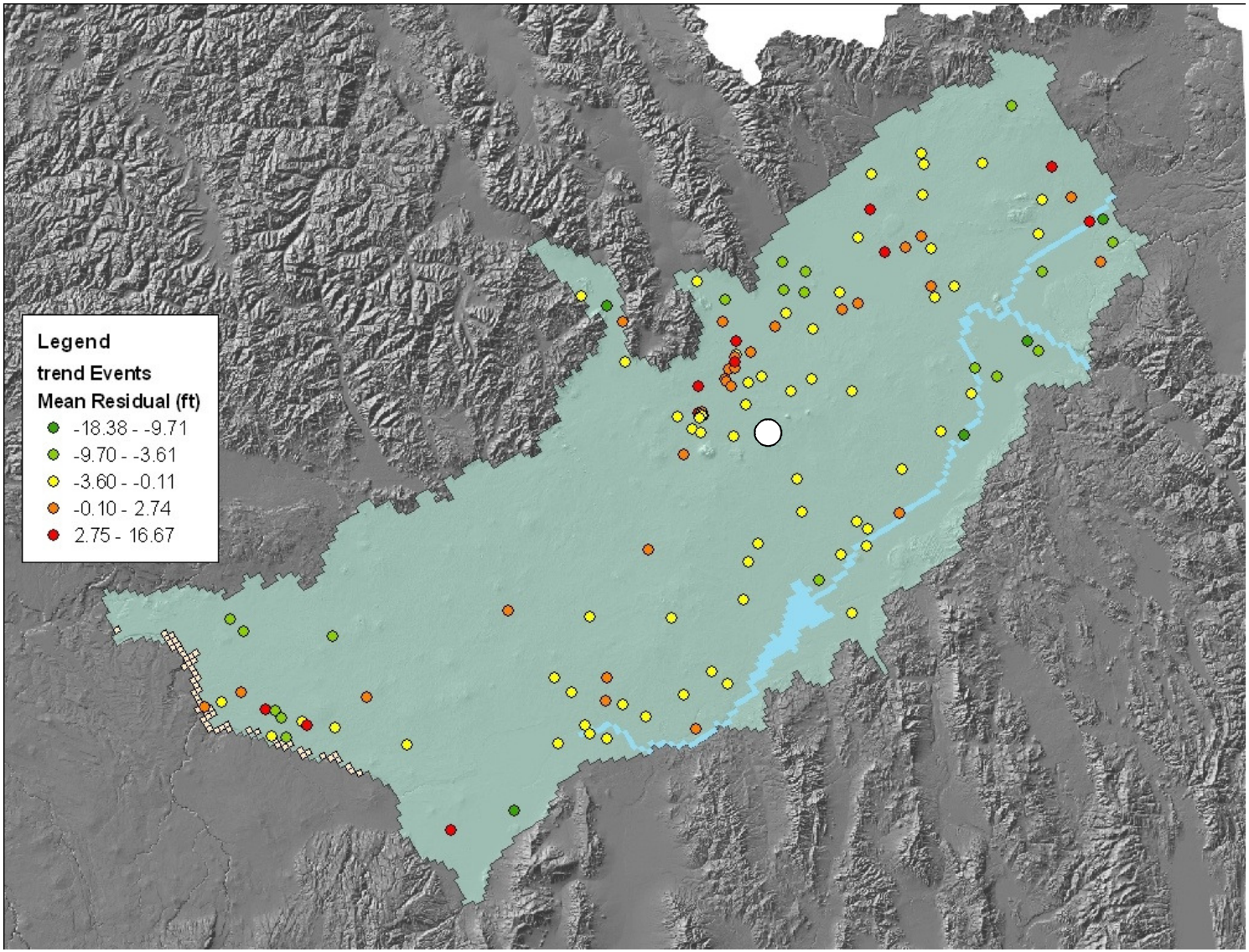

4501
Feet
3
2
1
0
-1
-2
-3
-4
Jan-01
Apr-01
Jul-01
Nov-01
Feb-02
May-02
Sep-02
Measured
Modelled

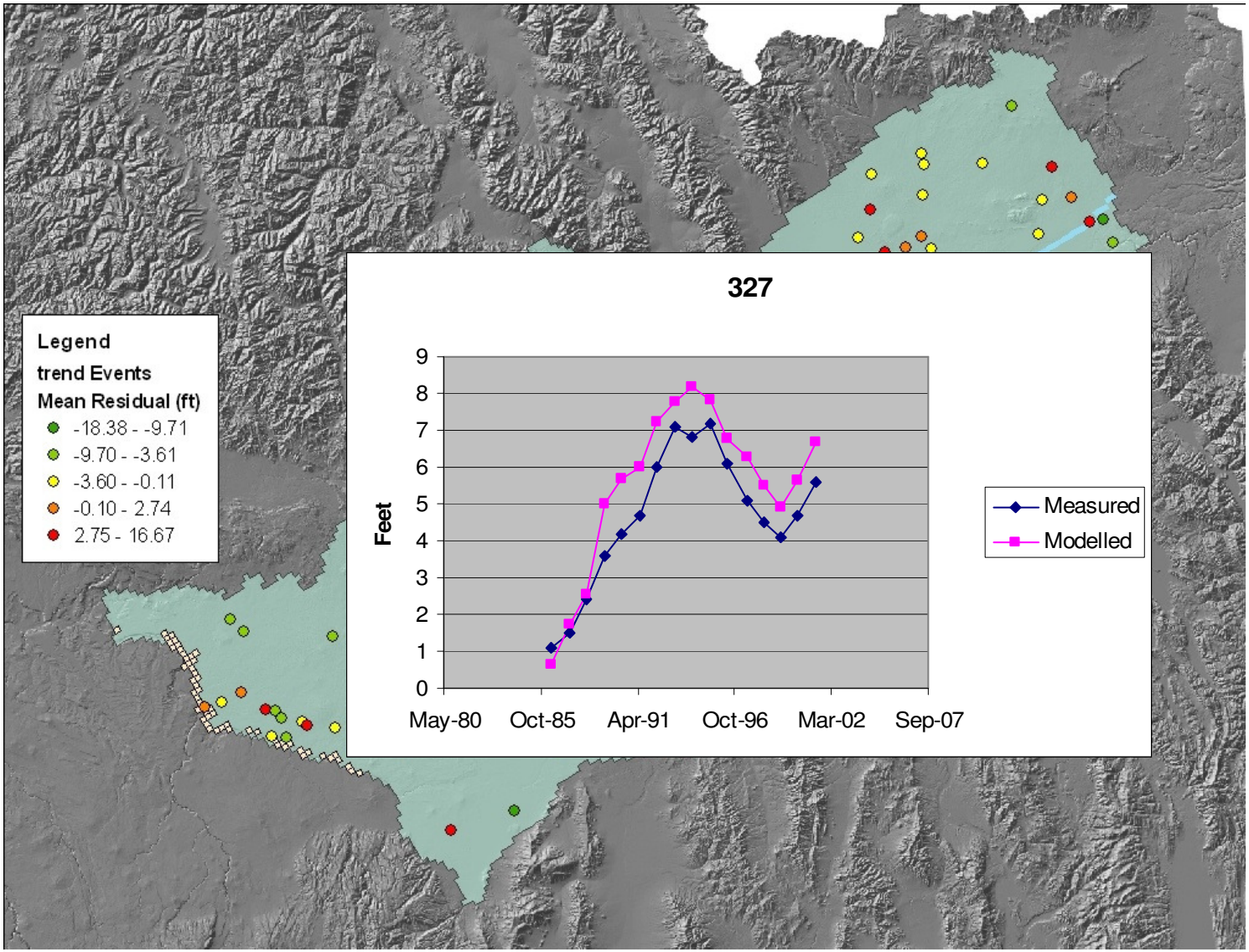

Legend
masmeas Events
Mean Residual (ft)
-5.91 - -2.59
-2.58 - -0.15
-0.14 - 1.98
1.99 - 5.60
4501
Feet
7
6
5
4
3
2
1
0
-1
-2
-3
-4
Jan-01
Apr-01
Jul-01
Nov-01
Feb-02
May-02
Sep-02
Measured
Modelled
4501
Feet
3
2
1
0
-1
-2
-3
-4
Jan-01
Apr-01
Jul-01
Nov-01
Feb-02
May-02
Sep-02
Measured
Modelled

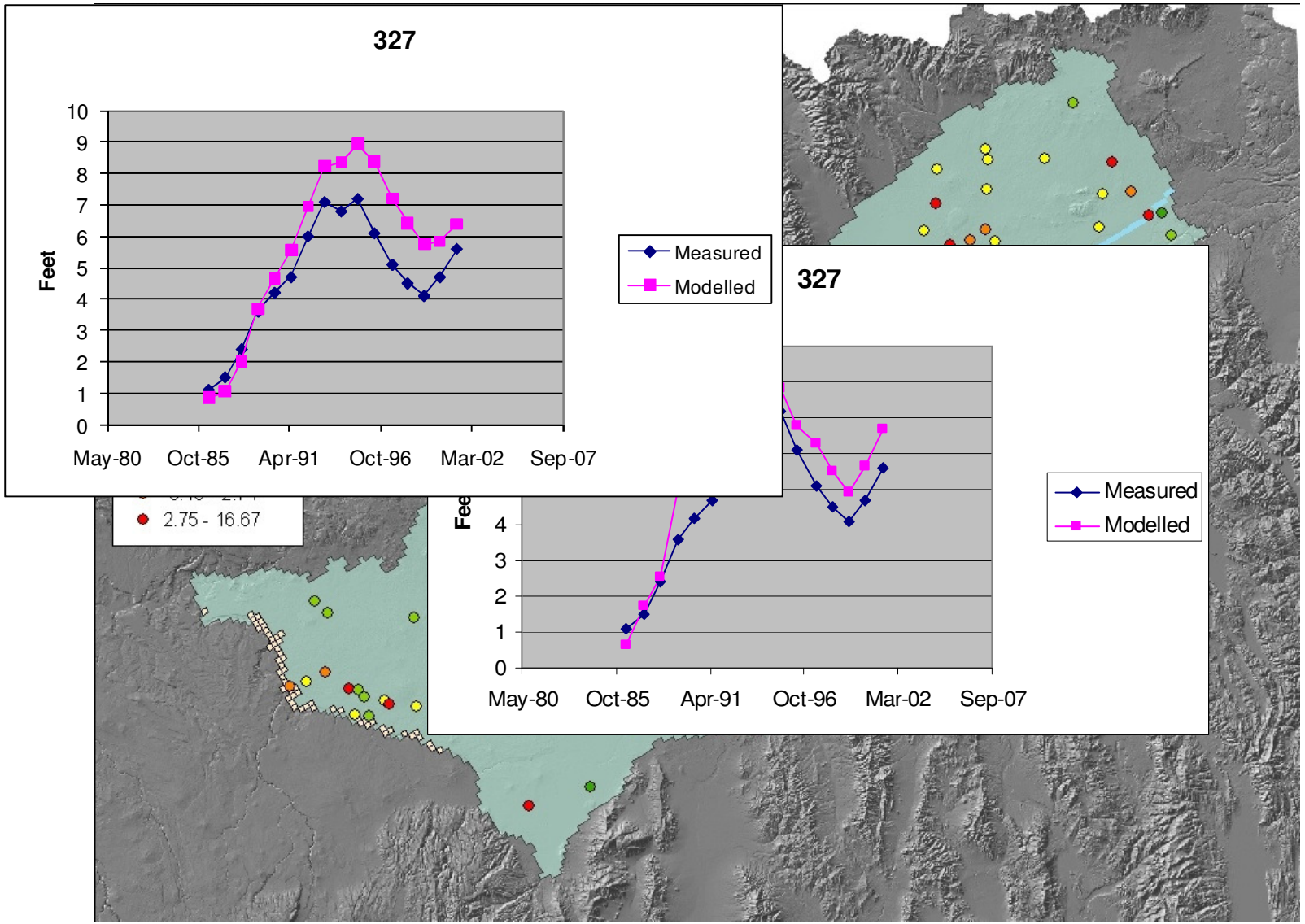


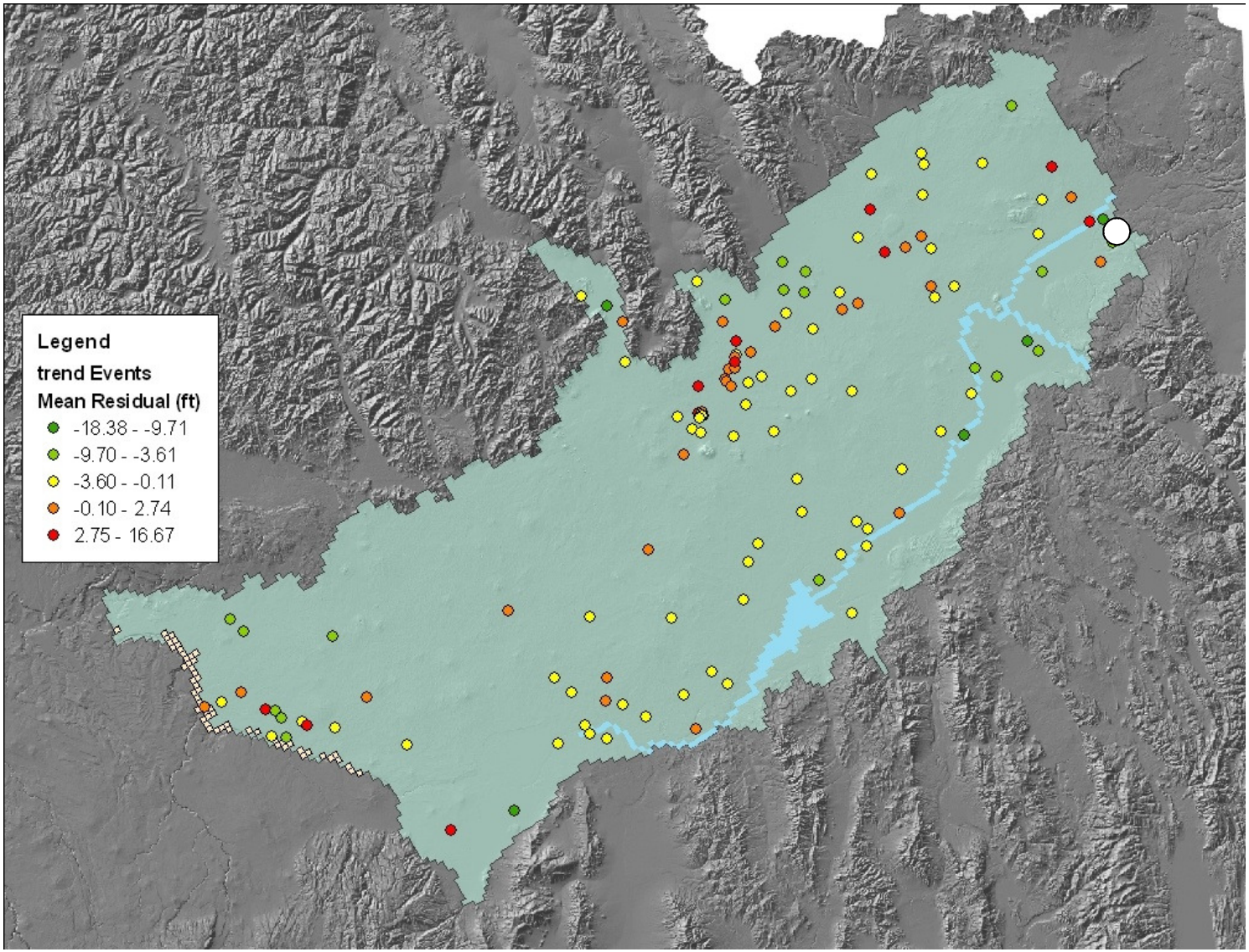
- Annual observations in wells

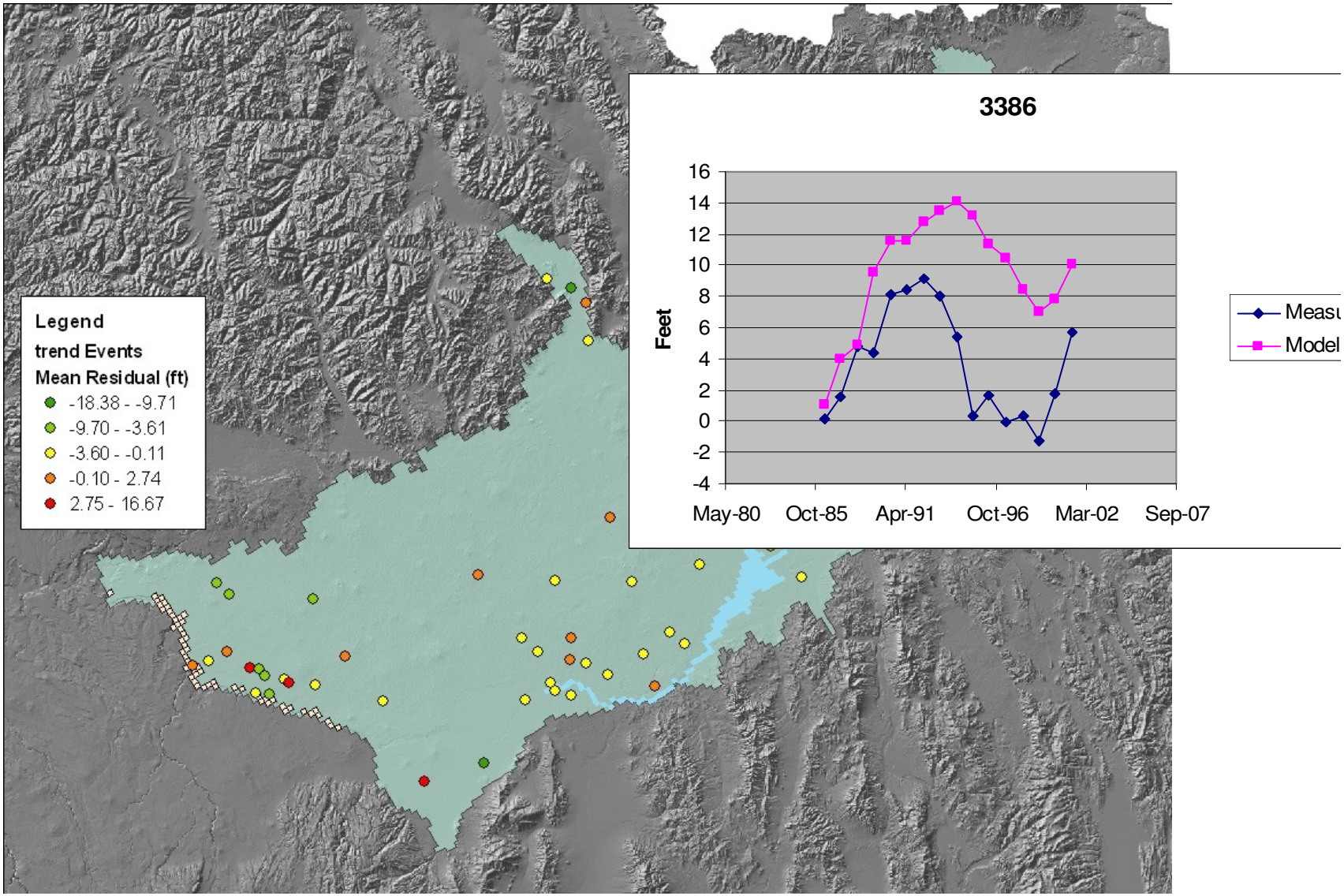

Legend
Trend AbsMean (ft)
0.023000 - 1.891000
1.891001 - 4.421600
4.421601 - 8.498500
8.498501 - 14.049000
14.049001 - 27.758000
Legend
trend Events
Mean Residual (ft)
-18.38 - -9.71
-9.70 - -3.61
-3.60 - -0.11
-0.10 - 2.74
2.75 - 16.67

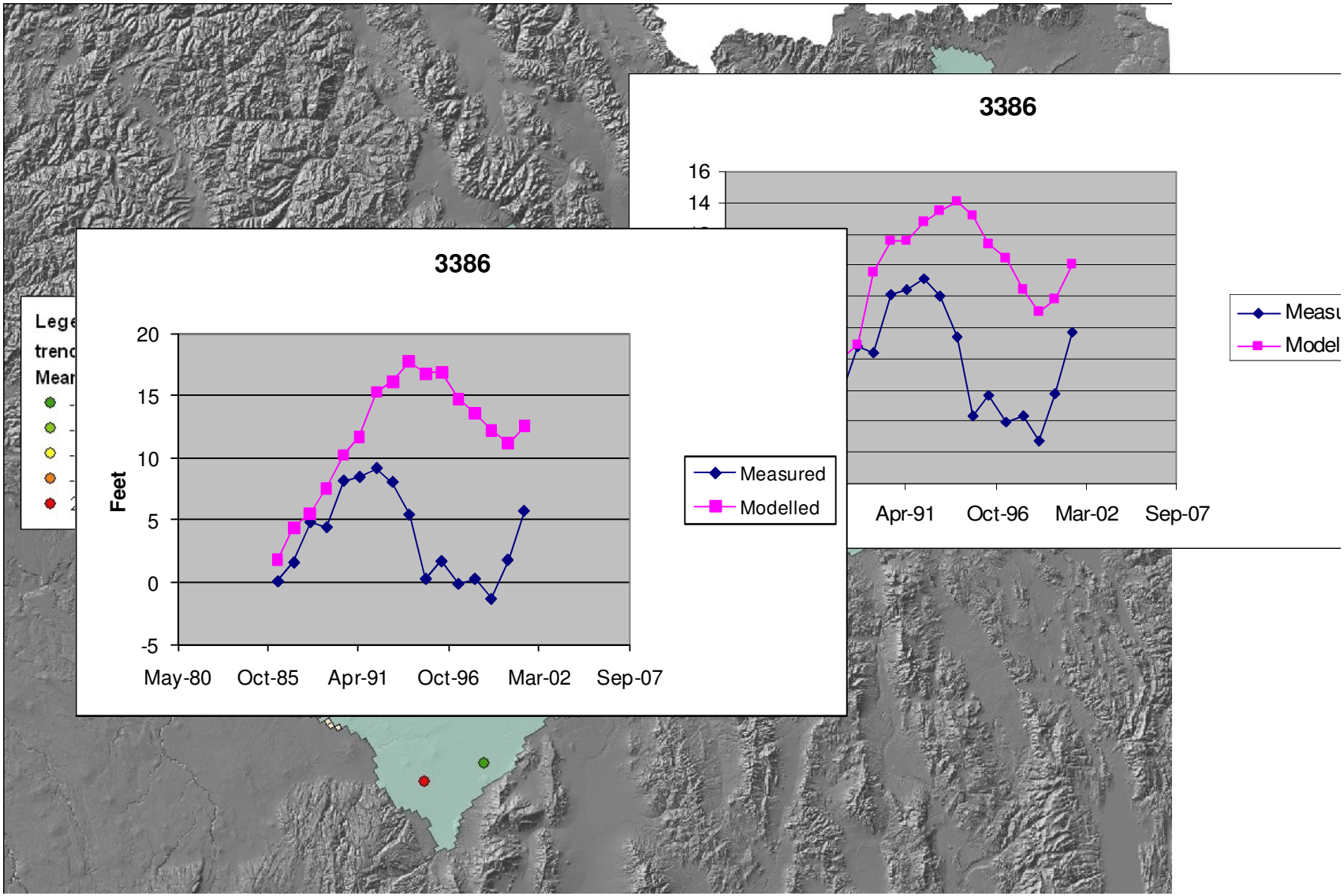

Legend
trend Events
Mean Residual (ft)
-18.38 - -9.71
-9.70 - -3.61
-3.60 - -0.11
-0.10 - 2.74
2.75 - 16.67

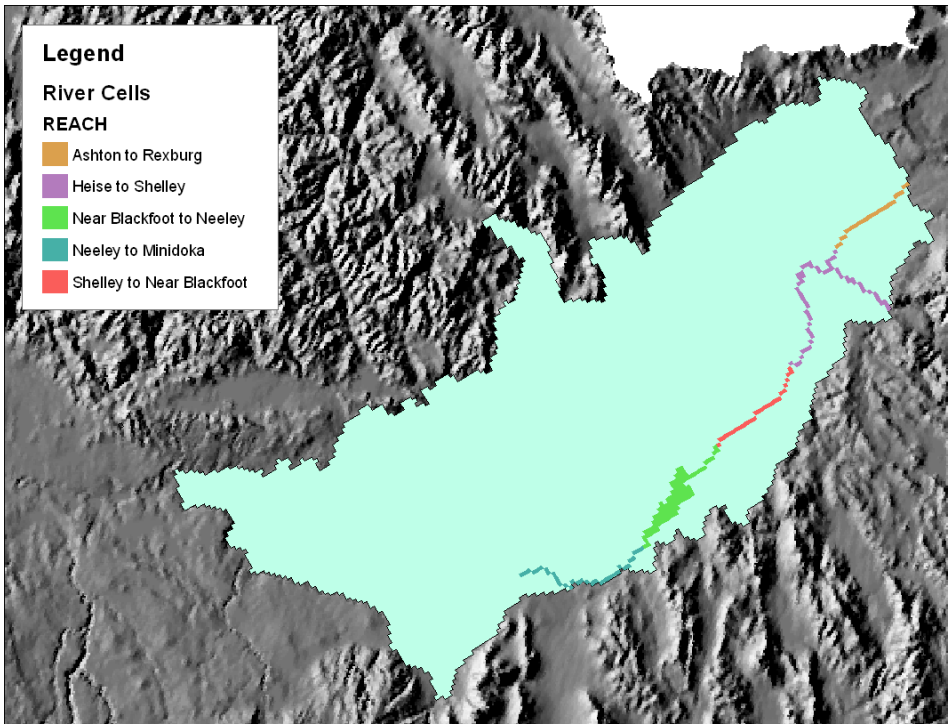

Legend
trend Events
Mean Residual (ft)
-18.38 - -9.71
-9.70 - -3.61
-3.60 - -0.11
-0.10 - 2.74
2.75 - 16.67
327
Feet
9
8
7
6
5
4
3
2
1
0
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07
Measured
Modelled


327
Feet
10
9
8
7
6
5
4
3
2
1
0
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07
Measured
Modelled
2.75 - 16.67
327
Feet
4
3
2
1
0
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07
Measured
Modelled

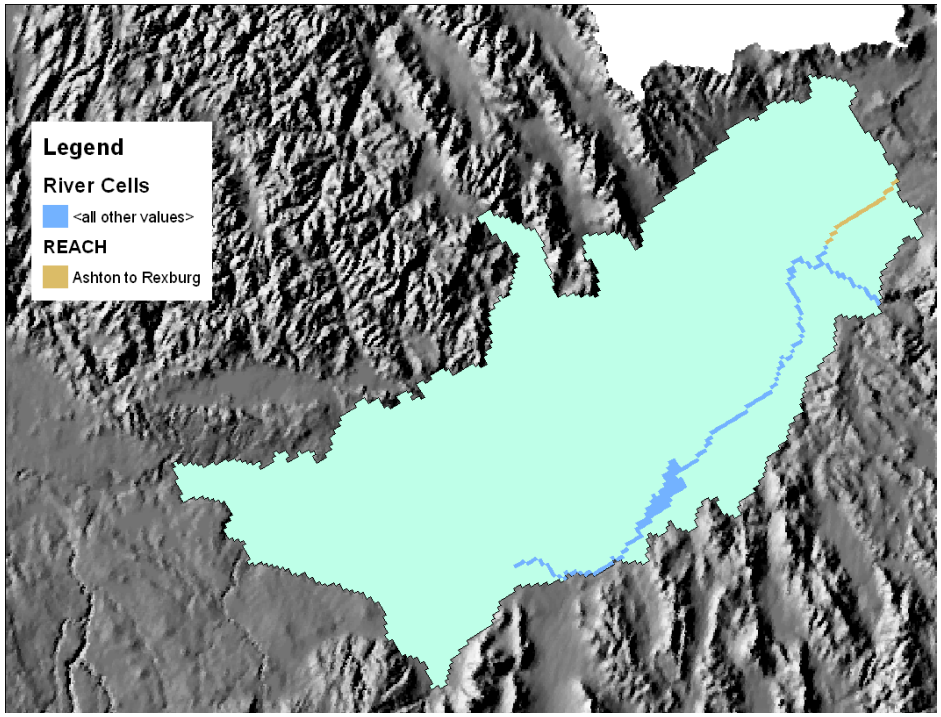

Legend
trend Events
Mean Residual (ft)
-18.38 - -9.71
-9.70 - -3.61
-3.60 - -0.11
-0.10 - 2.74
2.75 - 16.67


Legend
trend Events
Mean Residual (ft)
-18.38 - -9.71
-9.70 - -3.61
-3.60 - -0.11
-0.10 - 2.74
2.75 - 16.67
3386
Feet
16
14
12
10
8
6
4
2
0
-2
-4
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07
Measu
Model

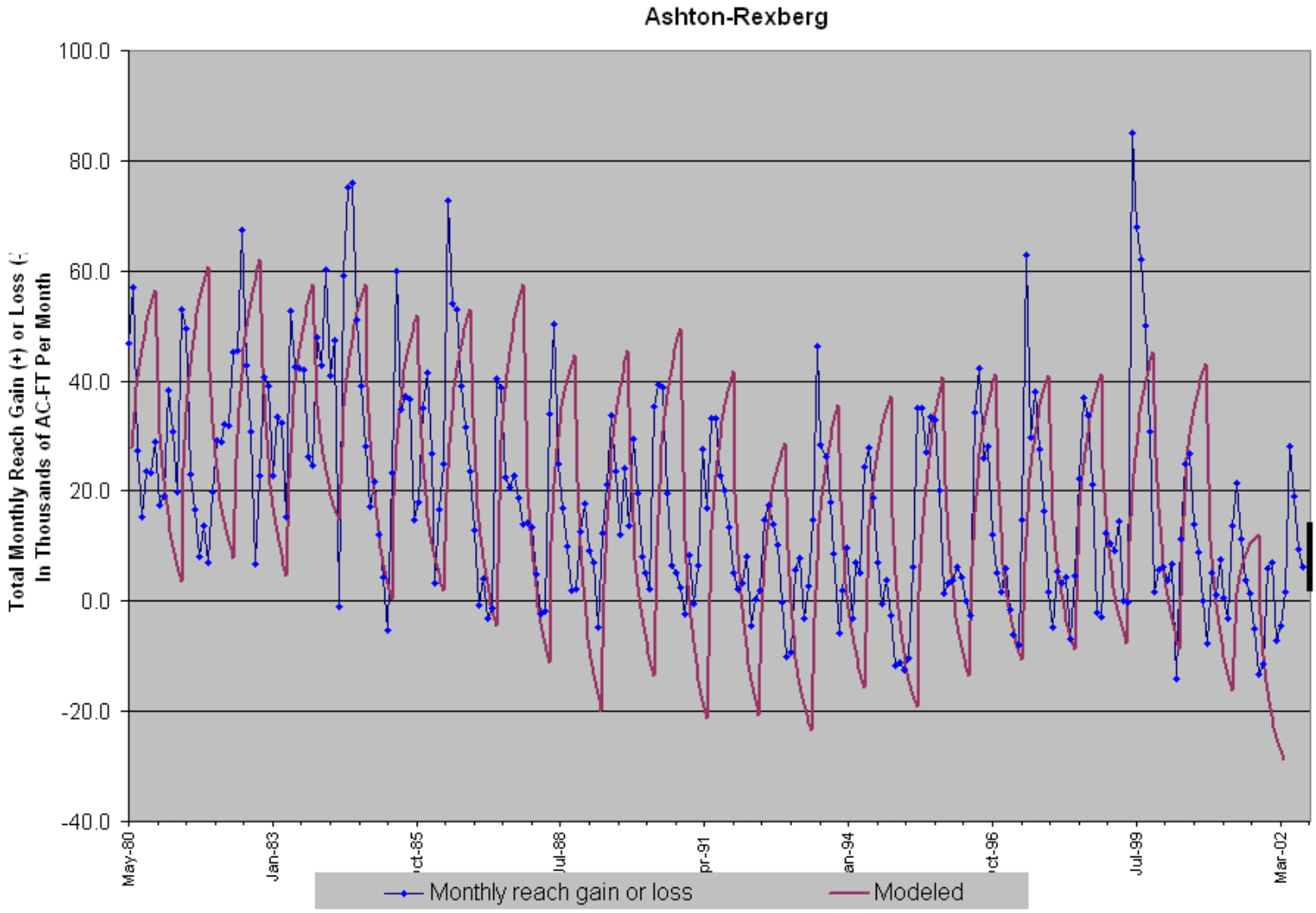

3386
16
14
Apr-91
Oct-96
Mar-02
Sep-07
Measu
Model
3386
Feet
20
15
10
5
0
-5
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07
Measured
Modelled

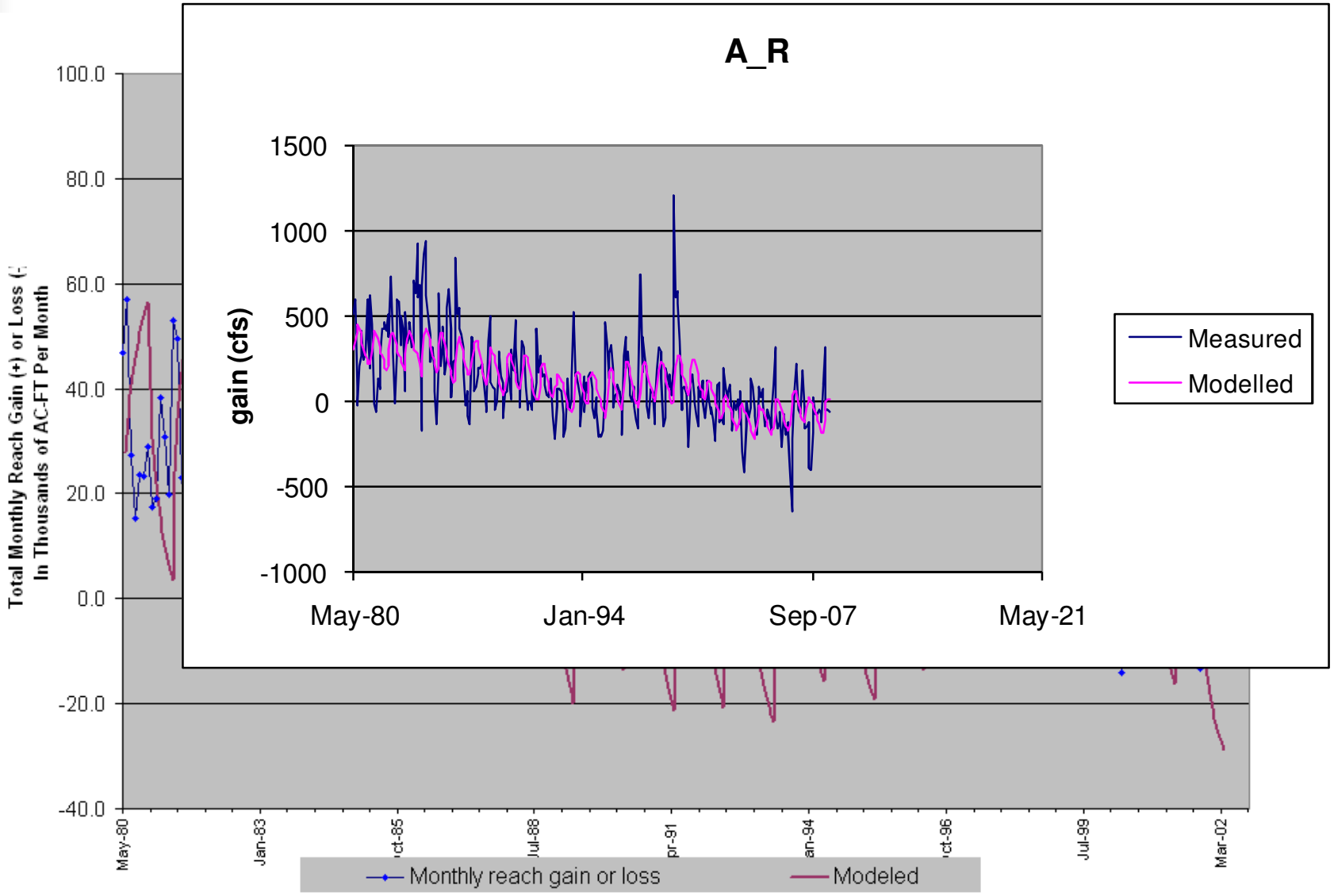


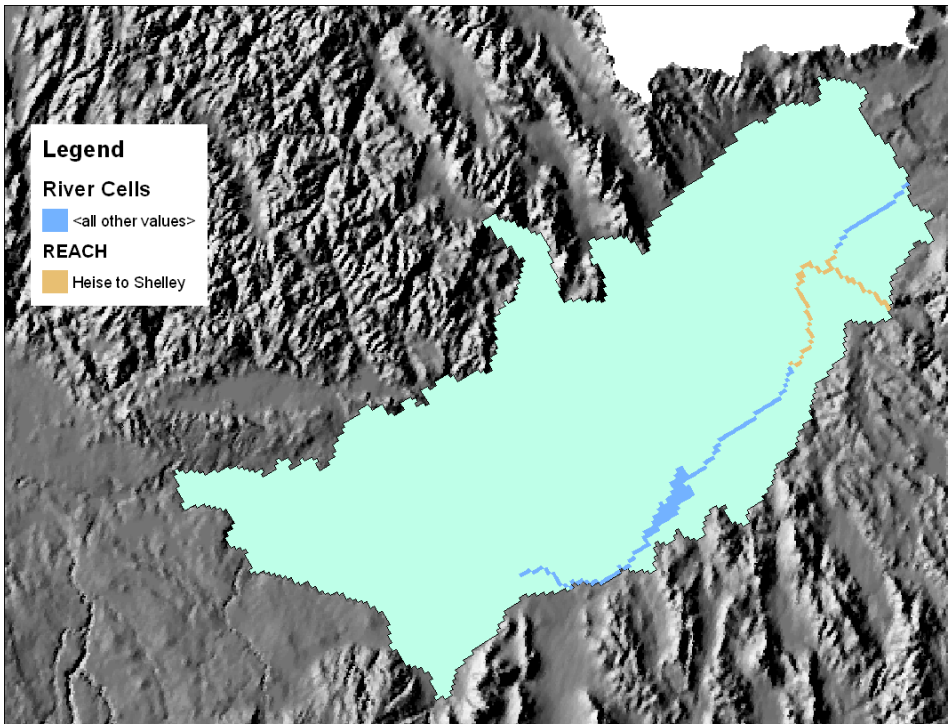
- Snake River reaches



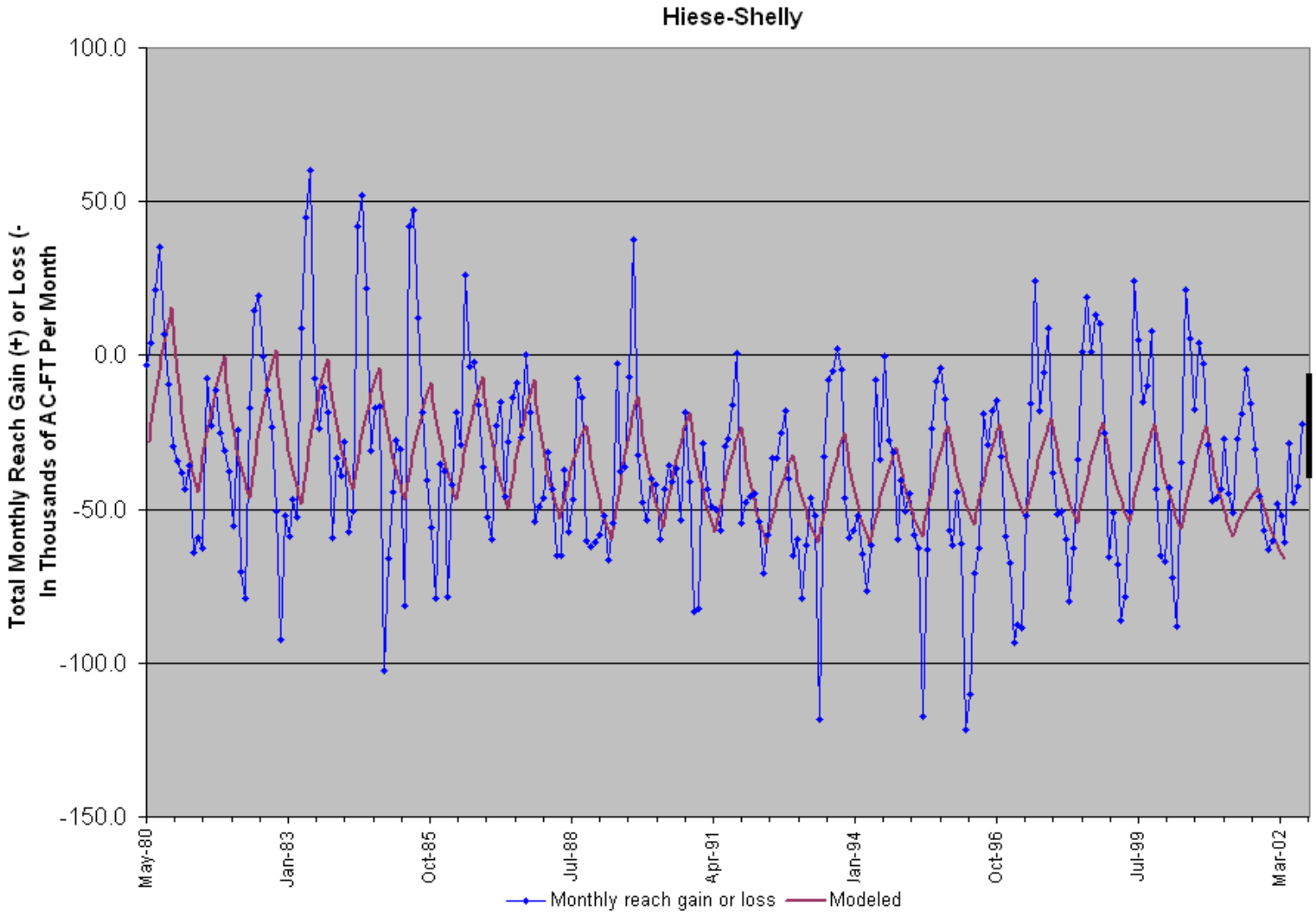
- Ashton to Rexburg

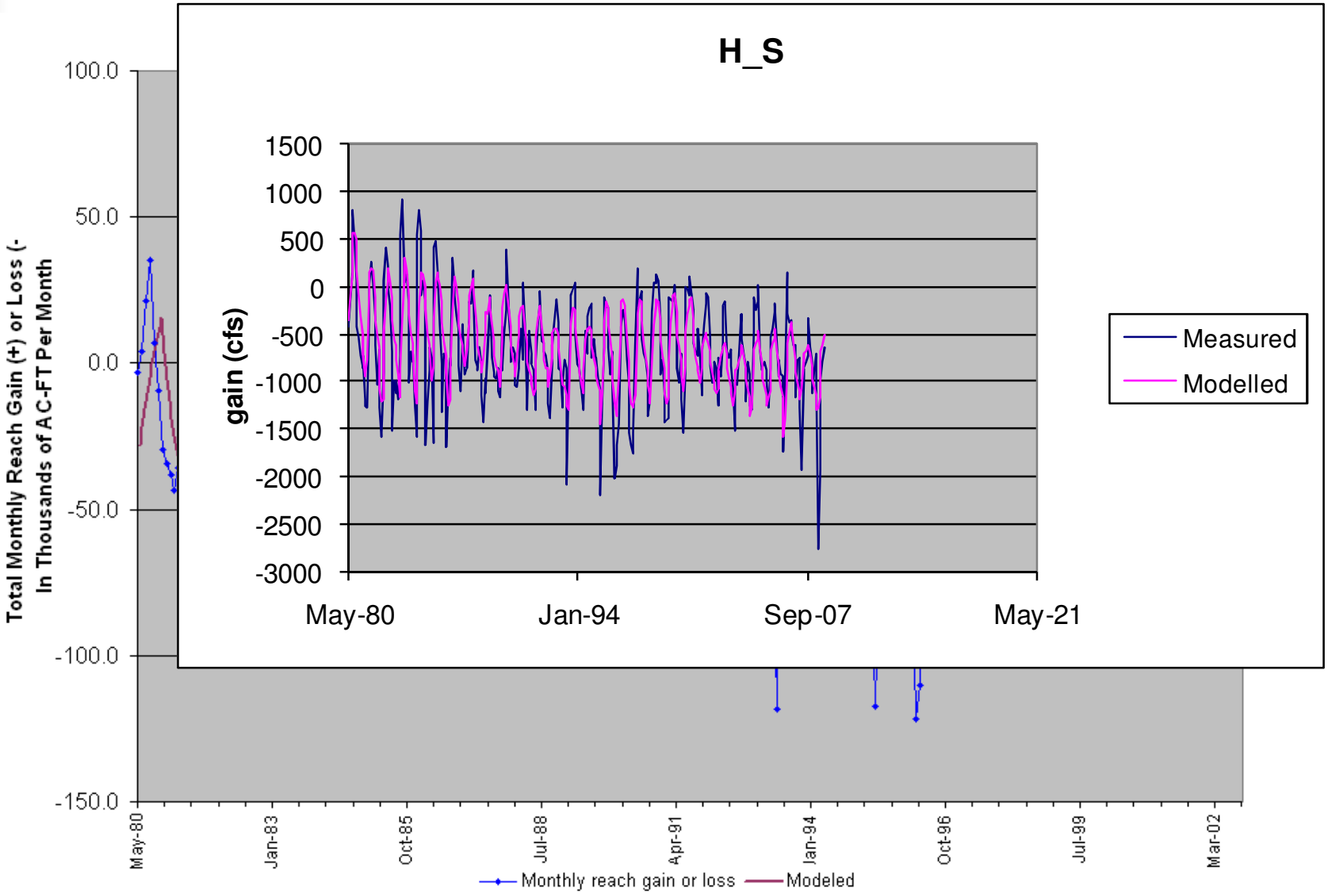

Ashton-Rexberg
Total Monthly Reach Gain (+) or Loss (-)
In Thousands of AC-FT Per Month
100.0
80.0
60.0
40.0
20.0
0.0
-20.0
-40.0
May-80
Jan-83
Jul-88
Jul-99
Mar-02
Monthly reach gain or loss
Modeled

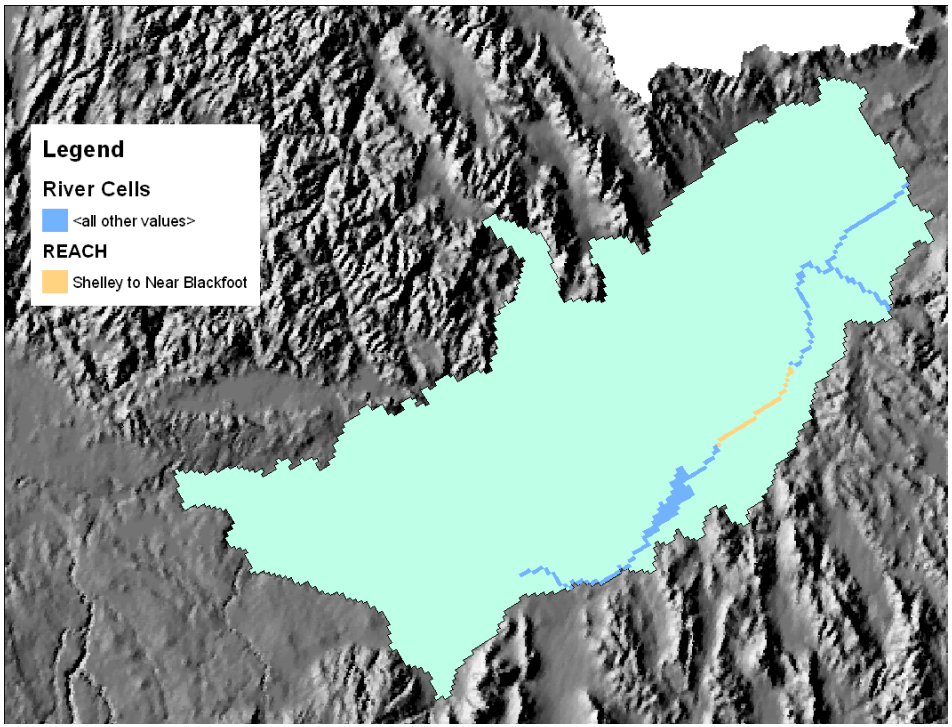

A_R
gain (cfs)
1500
1000
500
0
-500
-1000
May-80
Jan-94
Sep-07
May-21
Measured
Modelled
Total Monthly Reach Gain (+) or Loss (-)
In Thousands of AC-FT Per Month
100.0
80.0
60.0
40.0
20.0
0.0
-20.0
-40.0
May-80
Jan-83
Jul-88
Jul-99
Mar-02
Monthly reach gain or loss
Modeled



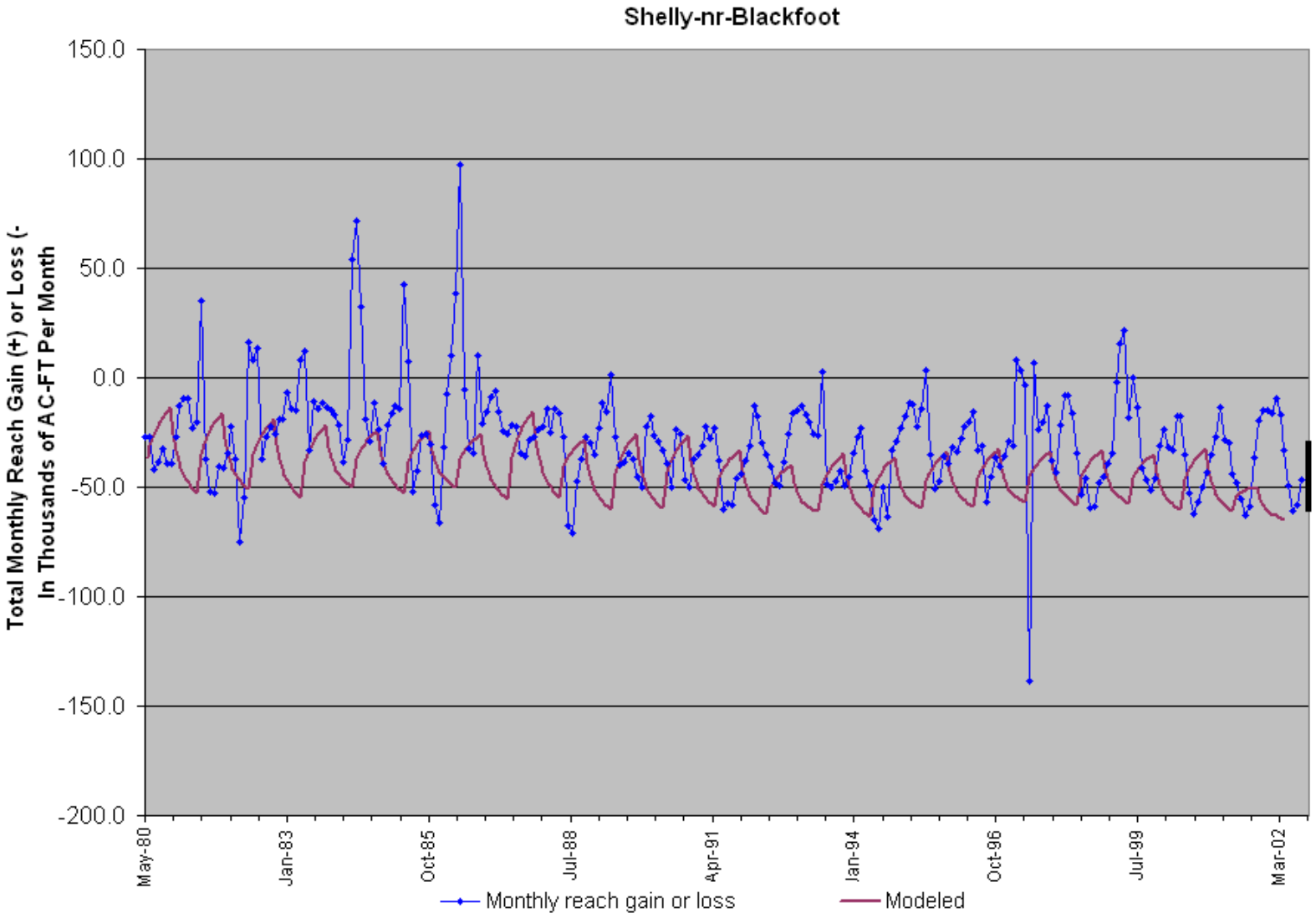
- Heise to Shelly

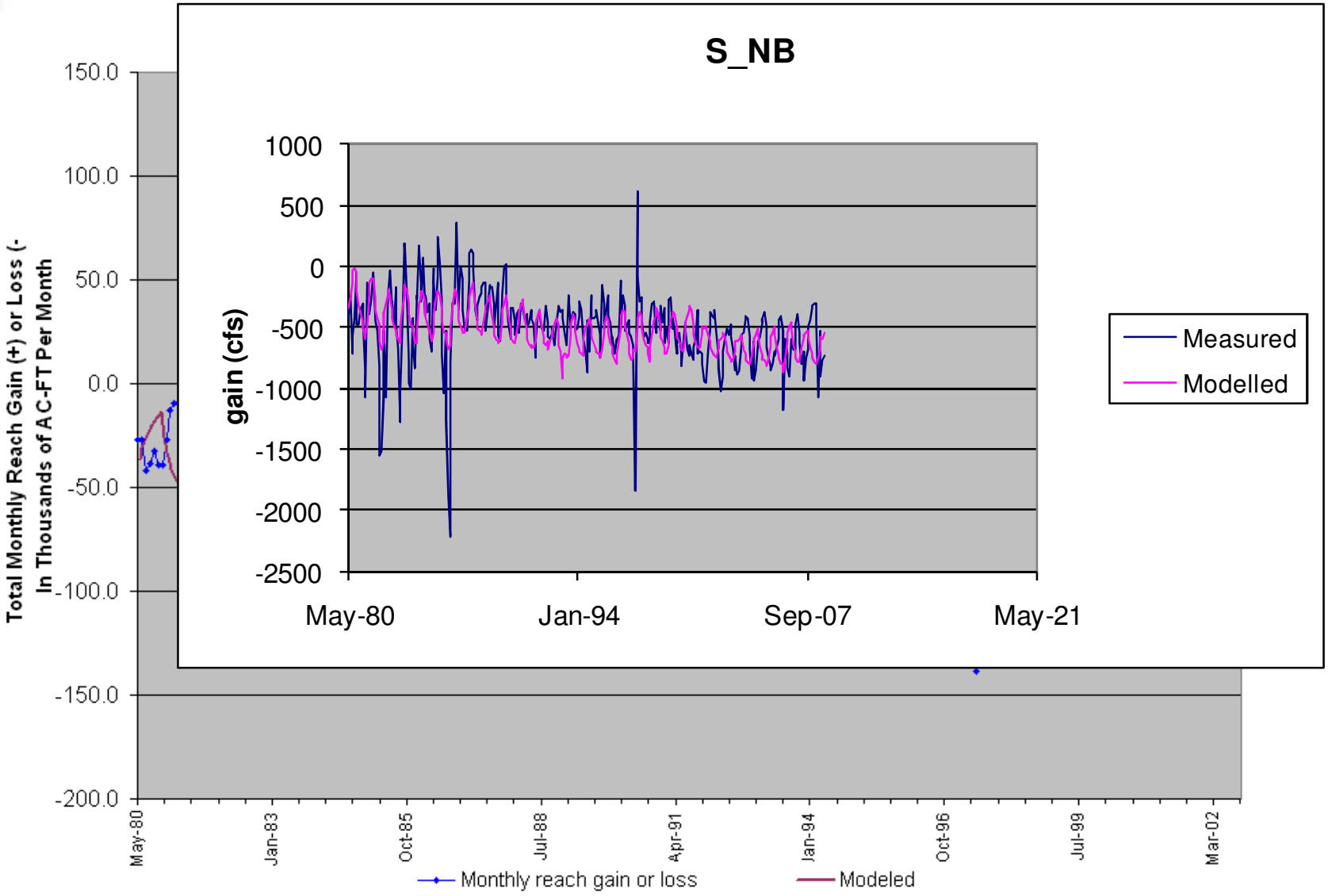

Hiese-Shelly
Total Monthly Reach Gain (+) or Loss (-
In Thousands of AC-FT Per Month
100.0
50.0
0.0
-50.0
-100.0
-150.0
May-80
Jan-83
Oct-85
Jul-88
Apr-91
Jan-94
Oct-96
Jul-99
Mar-02
Monthly reach gain or loss
Modeled

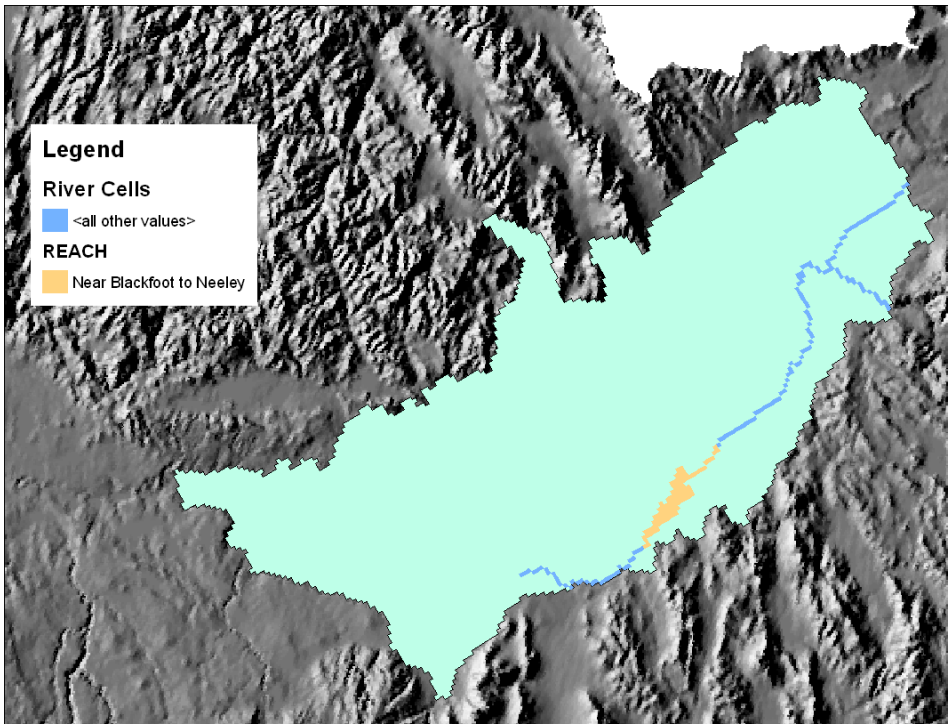

H_S
gain (cfs)
1500
1000
500
0
-500
-1000
-1500
-2000
-2500
-3000
May-80
Jan-94
Sep-07
May-21
Measured
Modelled
Total Monthly Reach Gain (+) or Loss (-
In Thousands of AC-FT Per Month
100.0
50.0
0.0
-50.0
-100.0
-150.0
May-80
Jan-83
Oct-85
Jul-88
Apr-91
Jan-94
Oct-96
Jul-99
Mar-02
Monthly reach gain or loss
Modeled



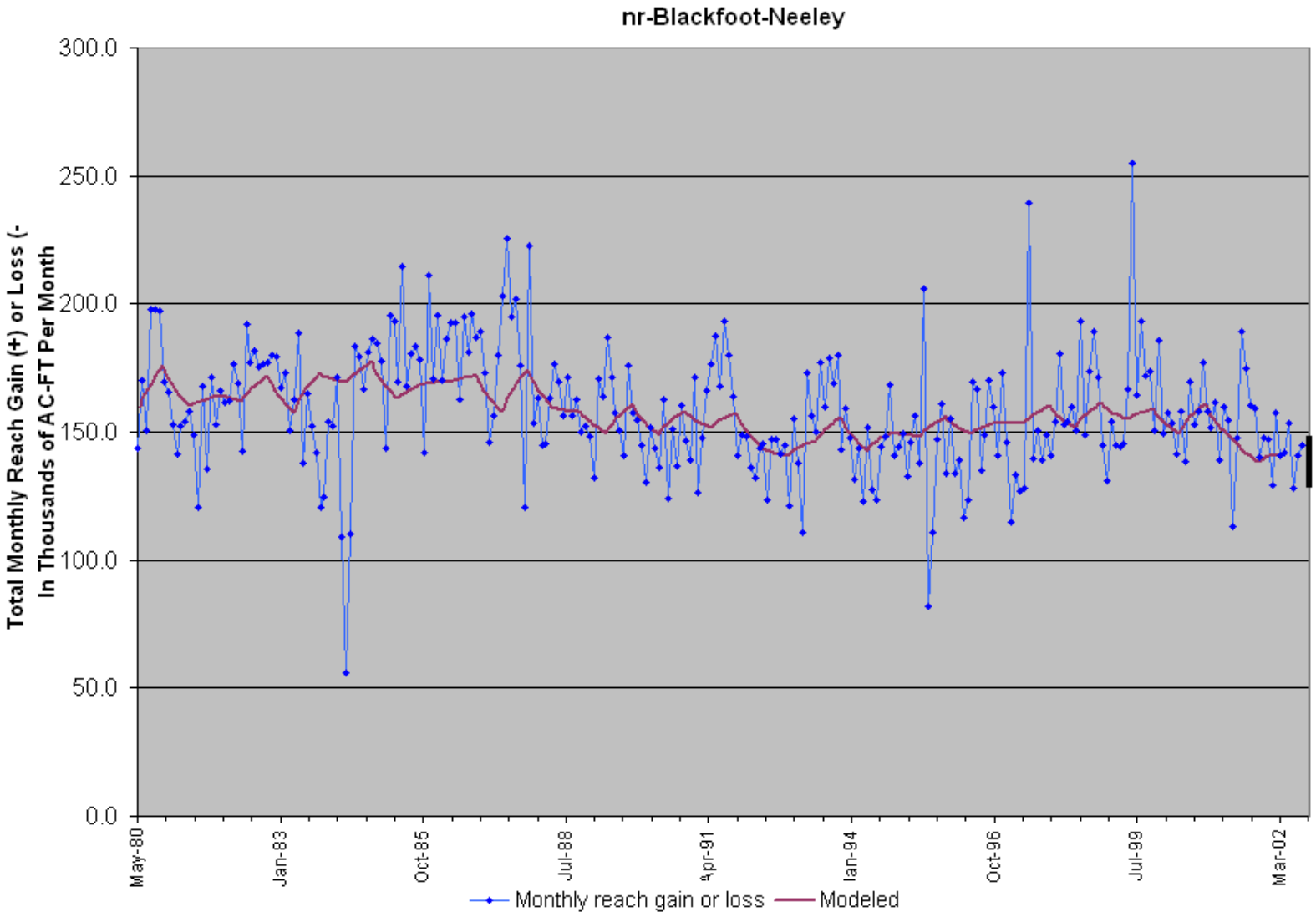
- Shelly - Blackfoot

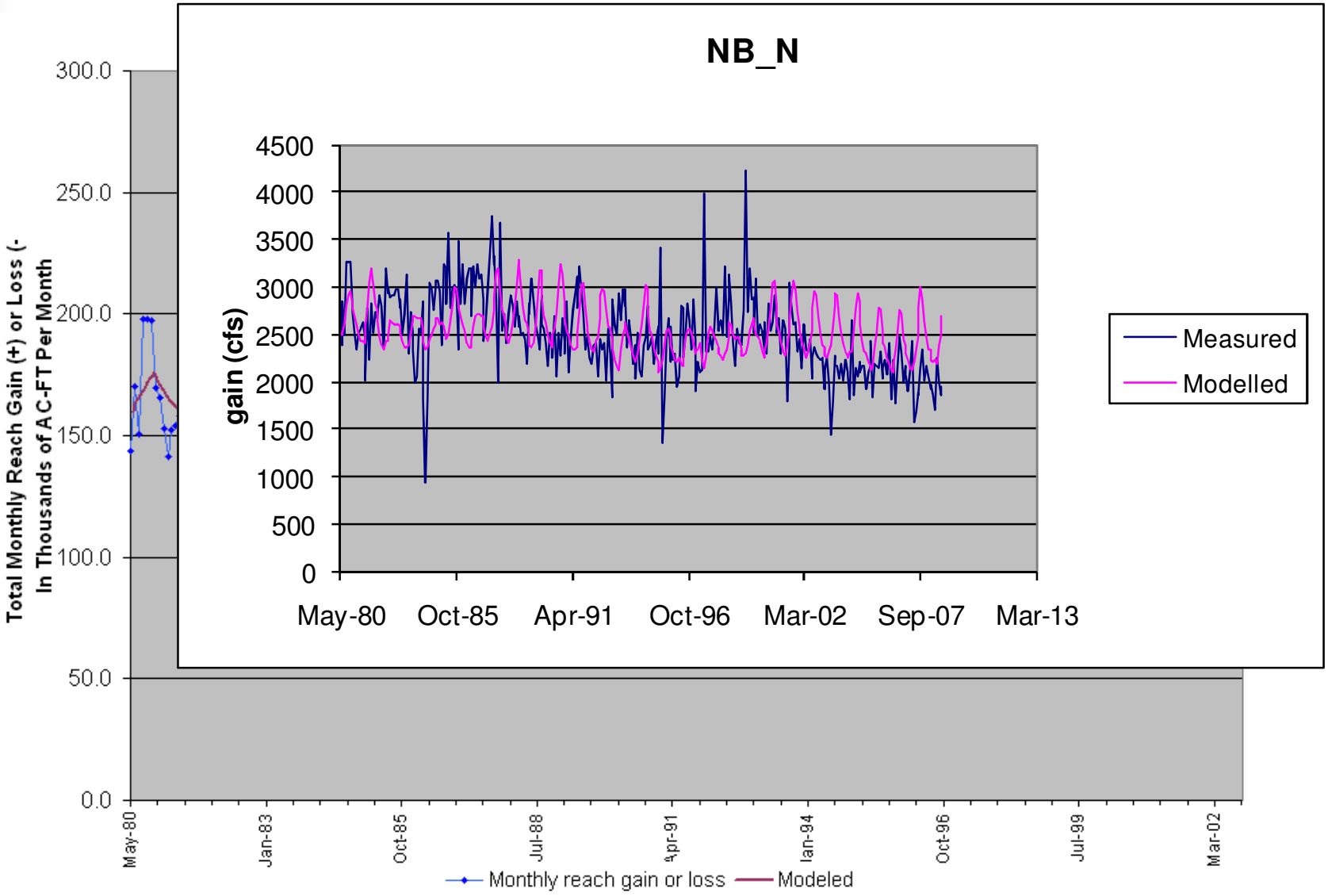

Shelly-nr-Blackfoot
Total Monthly Reach Gain (+) or Loss (-
In Thousands of AC-FT Per Month
150.0
100.0
50.0
0.0
-50.0
-100.0
-150.0
-200.0
May-80
Jan-83
Oct-85
Jul-88
Apr-91
Jan-94
Oct-96
Jul-99
Mar-02
Monthly reach gain or loss
Modeled

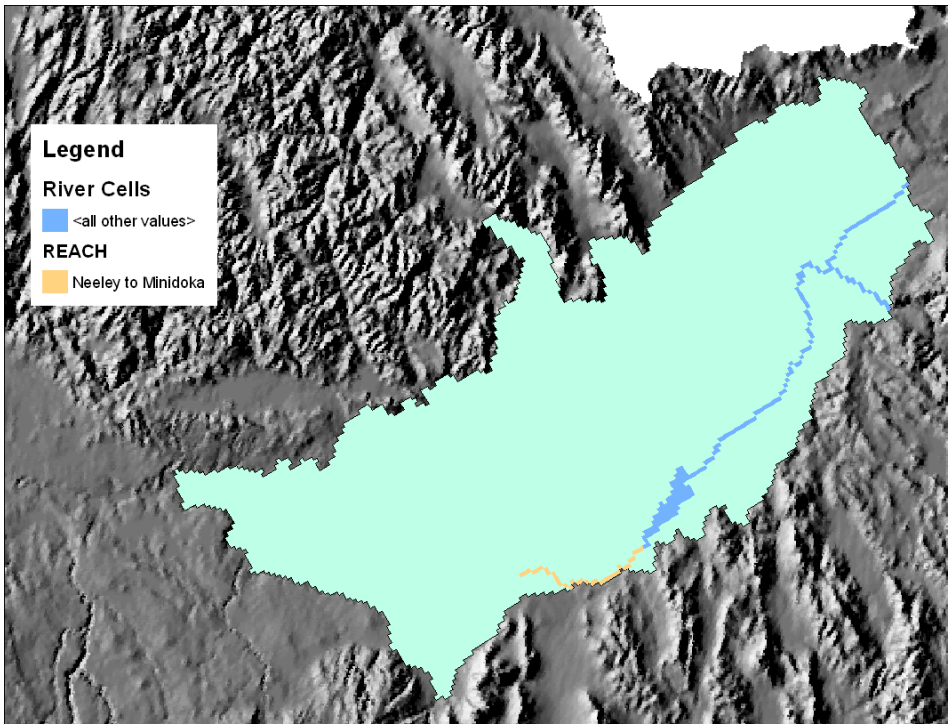

S_NB
gain (cfs)
1000
500
0
-500
-1000
-1500
-2000
-2500
May-80
Jan-94
Sep-07
May-21
Measured
Modelled
Total Monthly Reach Gain (+) or Loss (-
In Thousands of AC-FT Per Month
150.0
100.0
50.0
0.0
-50.0
-100.0
-150.0
-200.0
May-80
Jan-83
Oct-85
Jul-88
Apr-91
Jan-94
Oct-96
Jul-99
Mar-02
Monthly reach gain or loss
Modeled



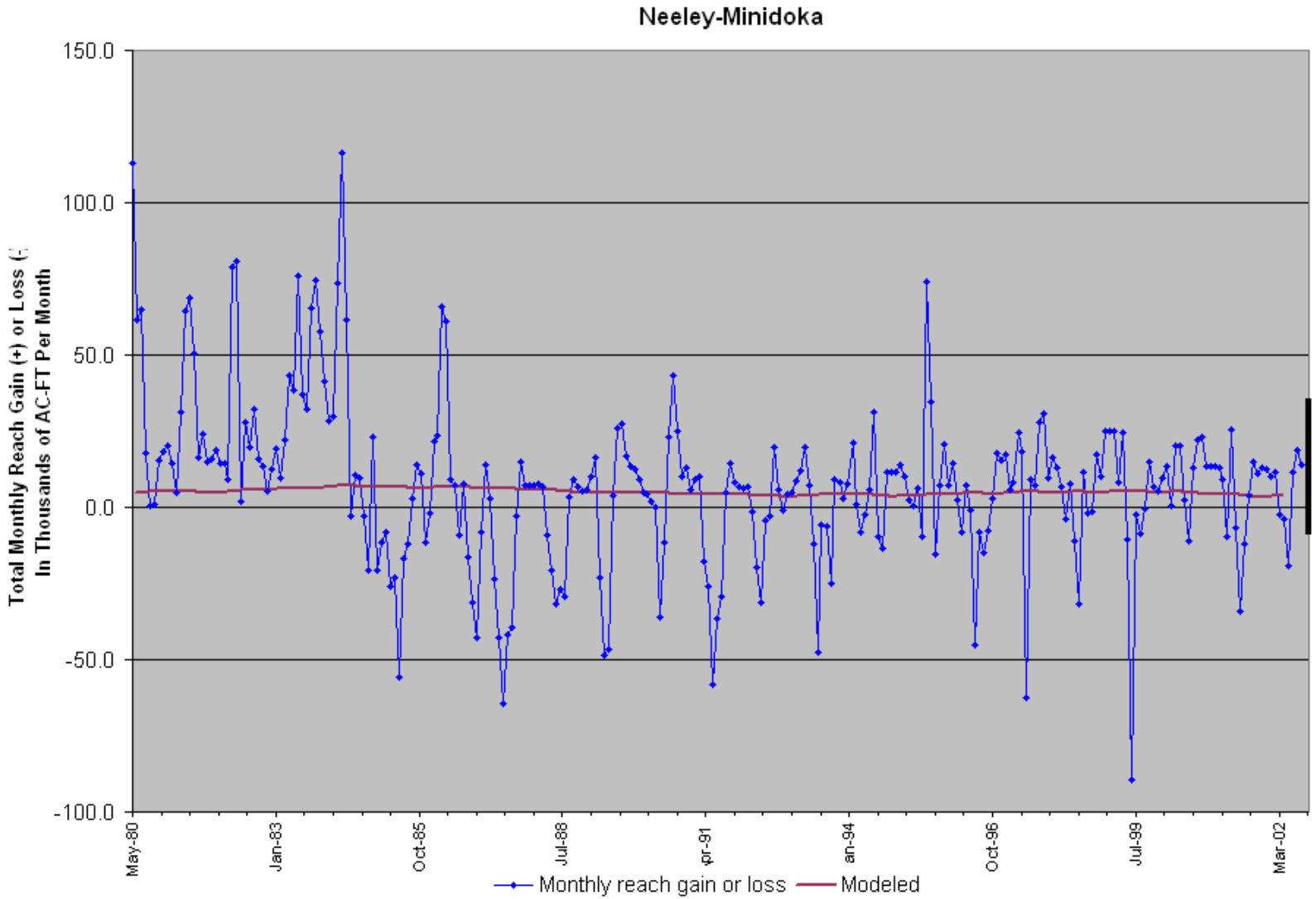
- Blackfoot – Neeley

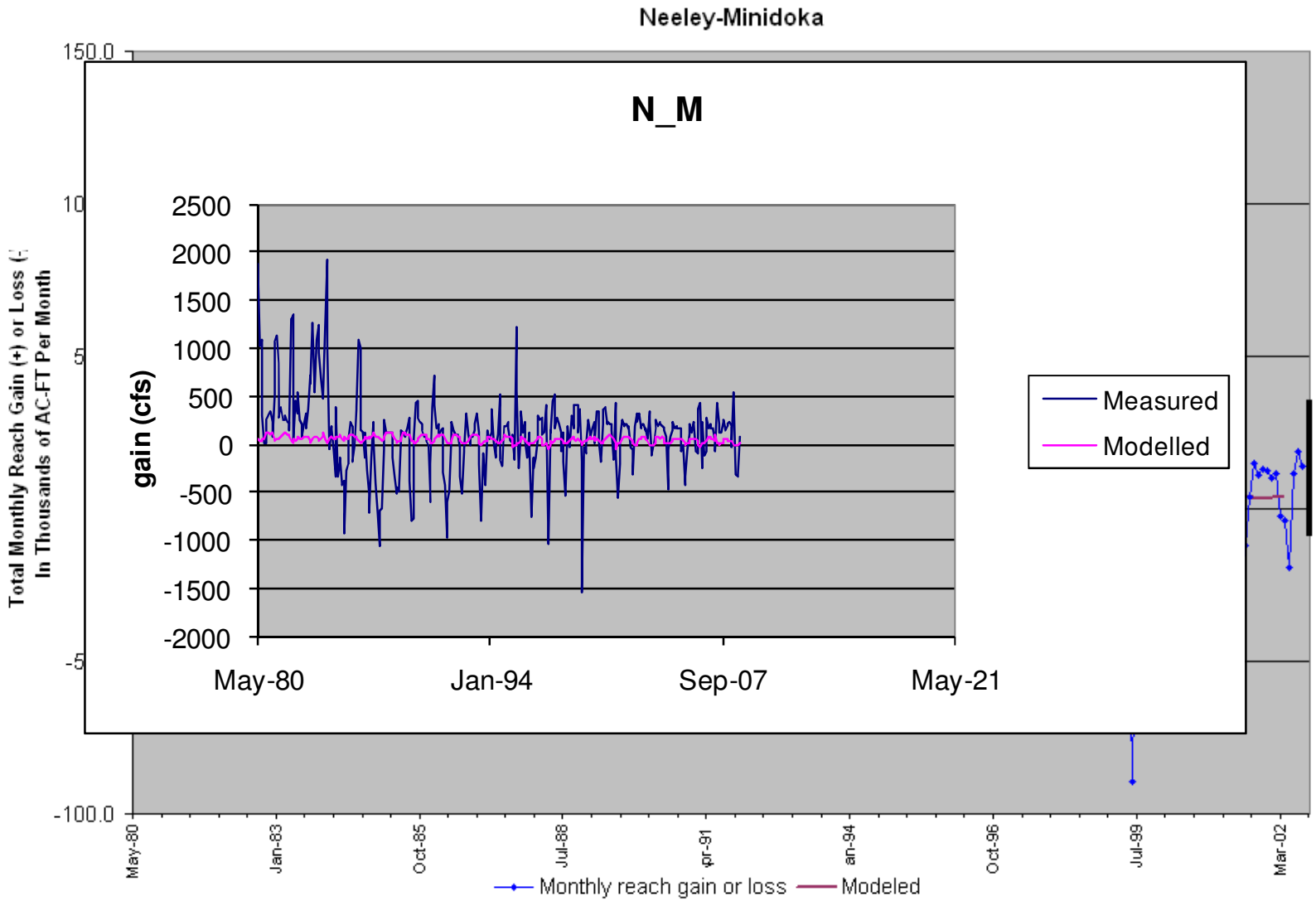

nr-Blackfoot-Neeley
Total Monthly Reach Gain (+) or Loss (-
In Thousands of AC-FT Per Month
300.0
250.0
200.0
150.0
100.0
50.0
0.0
May-80
Jan-83
Oct-85
Jul-88
Apr-91
Jan-94
Oct-96
Jul-99
Mar-02
Monthly reach gain or loss
Modeled

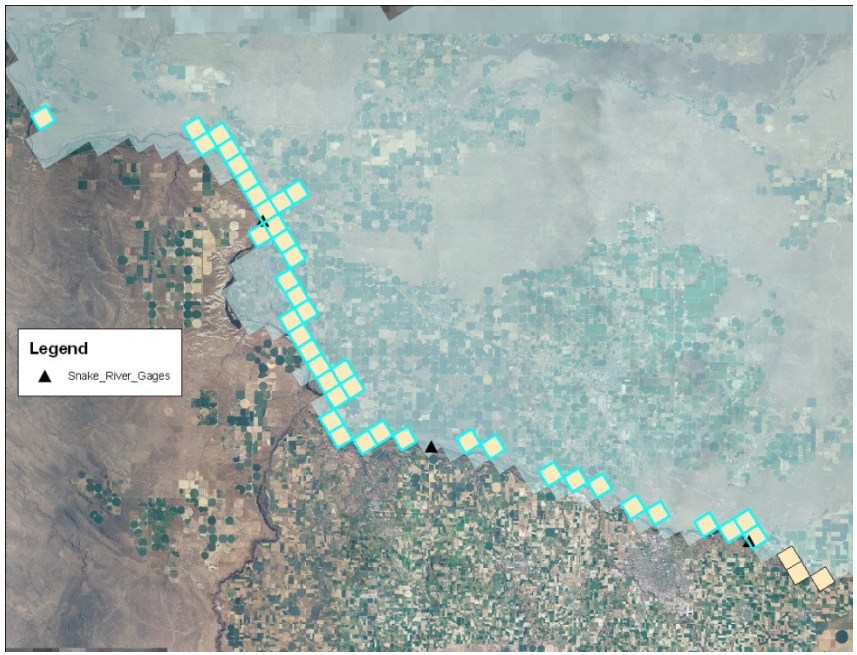

NB_N
gain (cfs)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07
Mar-13
Measured
Modelled
Total Monthly Reach Gain (+) or Loss (-
In Thousands of AC-FT Per Month
300.0
250.0
200.0
150.0
100.0
50.0
0.0
May-80
Jan-83
Oct-85
Jul-88
Apr-91
Jan-94
Oct-96
Jul-99
Mar-02
Monthly reach gain or loss
Modeled



- Neeley – Minidoka

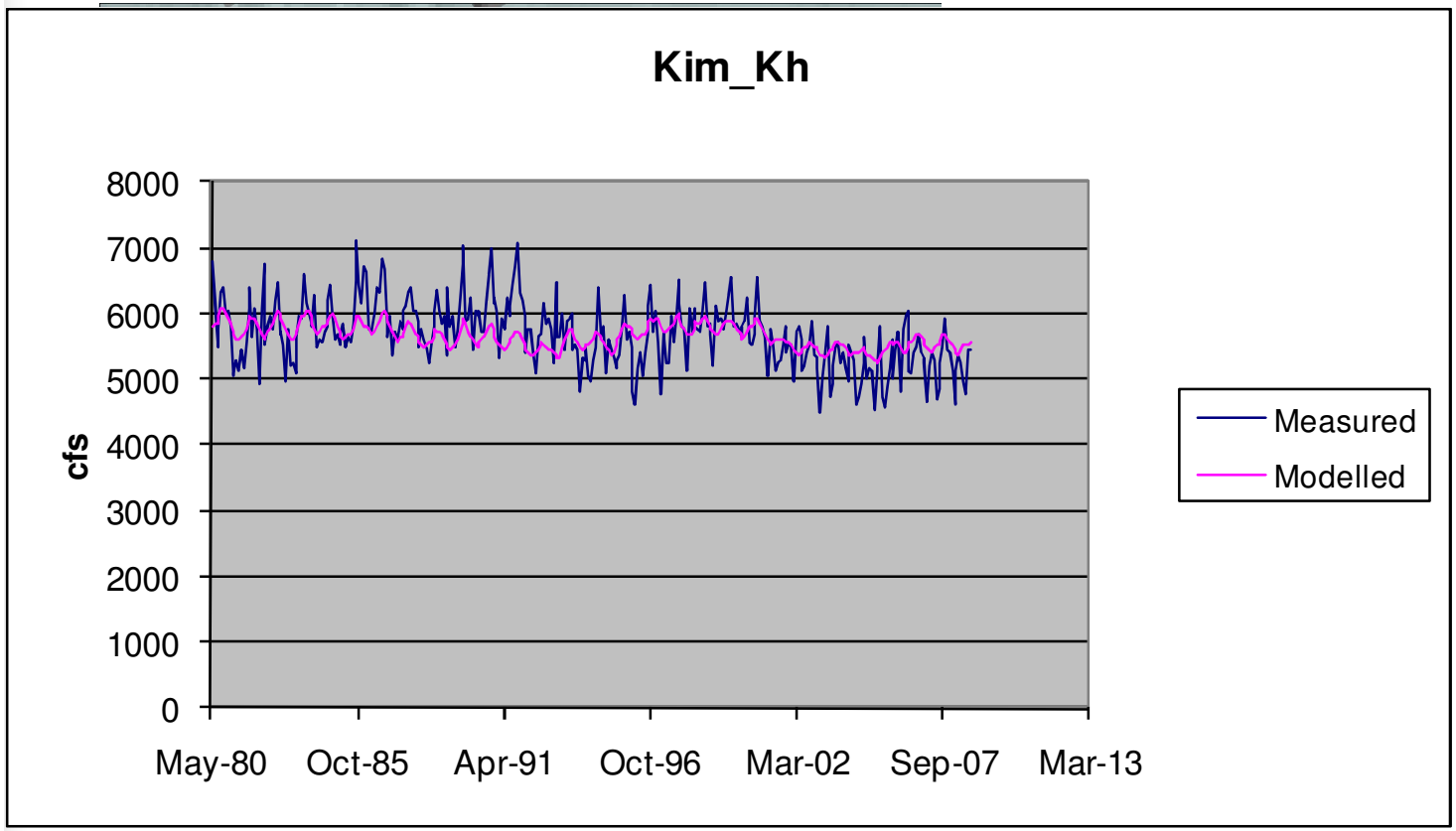

Neeley-Minidoka
150.0
100.0
50.0
0.0
-50.0
-100.0
Total Monthly Reach Gain (+) or Loss (-)
In Thousands of AC-FT Per Month
May-80
Jan-83
Oct-85
Jul-88
Apr-91
Jan-94
Oct-96
Jul-99
Mar-02
Monthly reach gain or loss
Modeled

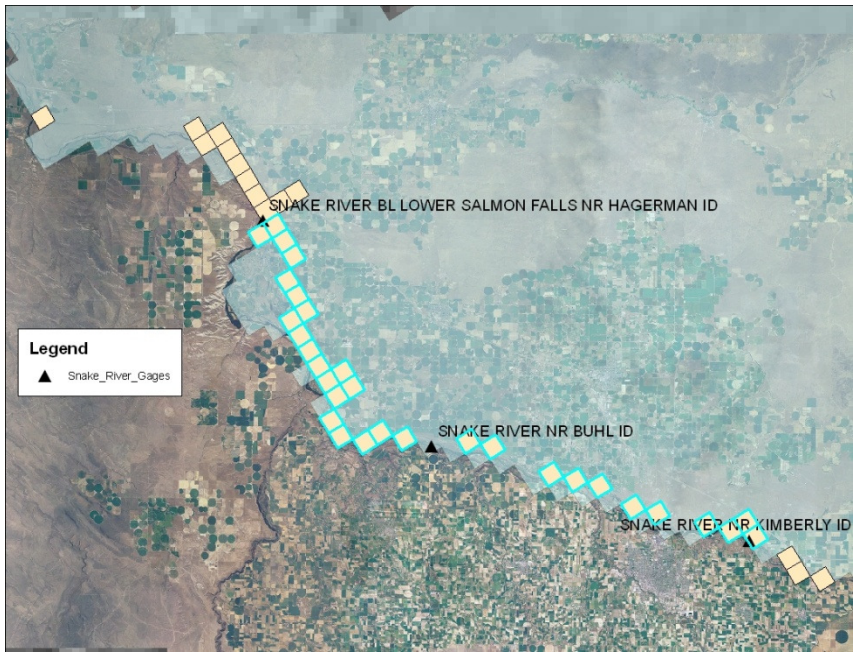

Neeley-Minidoka
150.0
100.0
-100.0
Total Monthly Reach Gain (+) or Loss (-)
In Thousands of AC-FT Per Month
May-80
Jan-83
Oct-85
Jul-88
Jan-94
Oct-96
Jul-99
Mar-02
Monthly reach gain or loss
Modeled
N_M
gain (cfs)
2500
2000
1500
1000
500
0
-500
-1000
-1500
-2000
May-80
Jan-94
Sep-07
May-21
Measured
Modelled



- Kimberly-King Hill

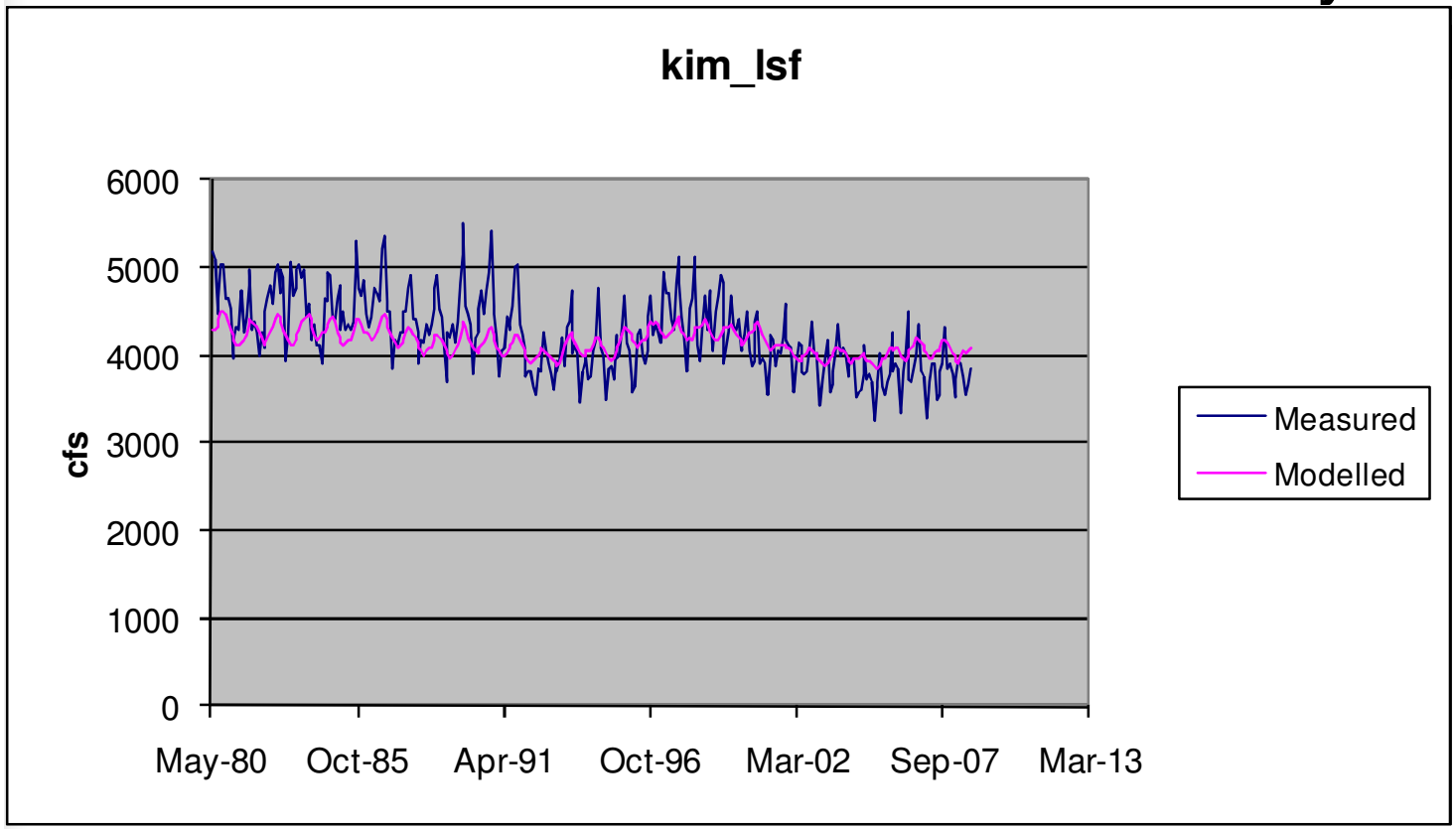
- Kimberly-King Hill

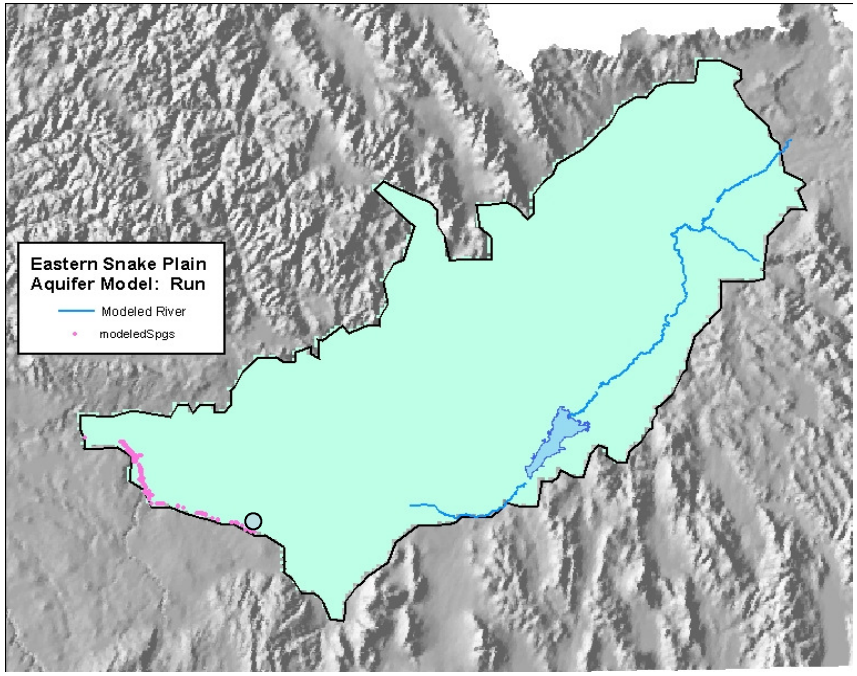




- Kimberly-Lower Salmon Falls

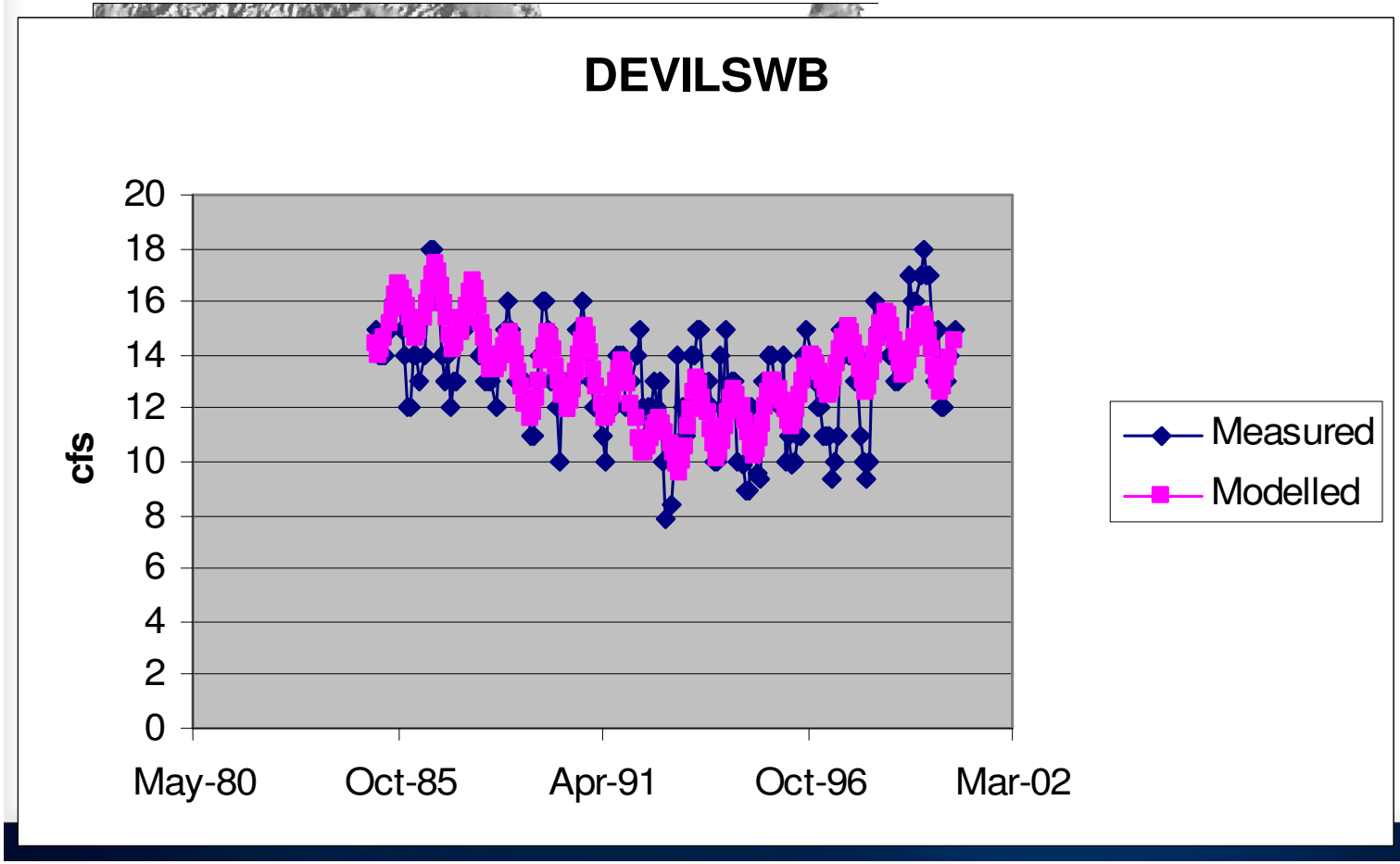
- Kimberly-Lower S

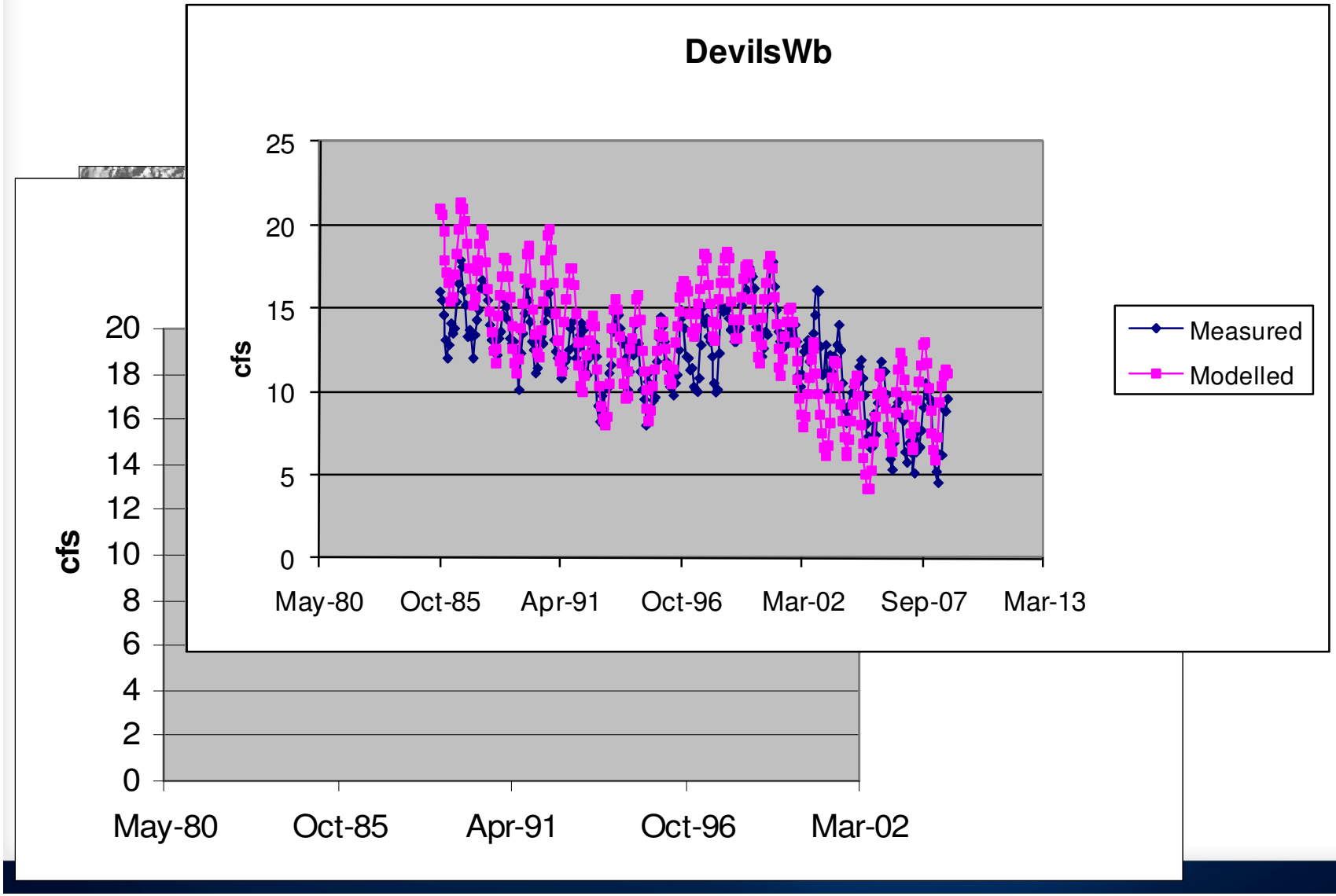


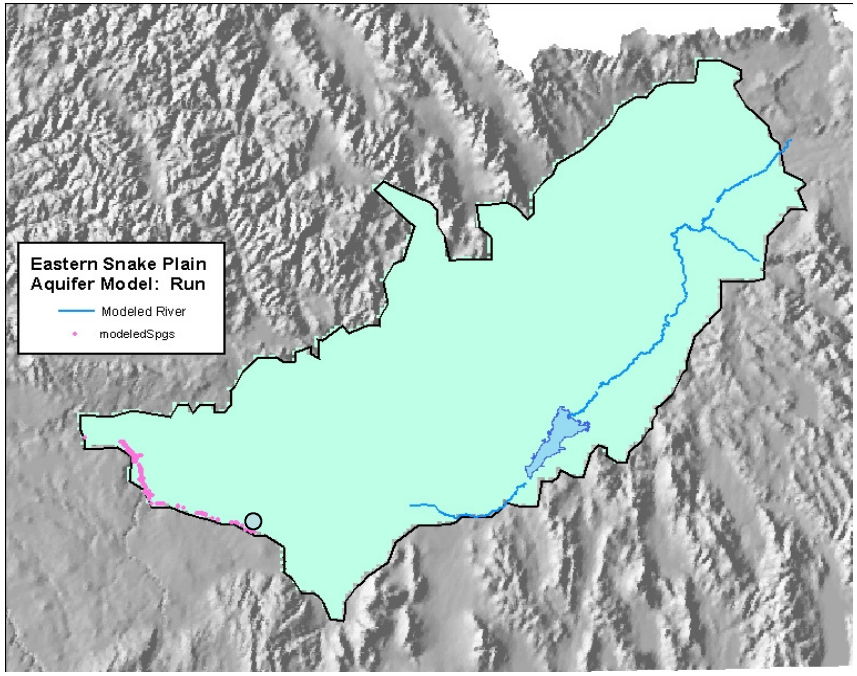


- Devils Washbowl

- Devils Washbowl

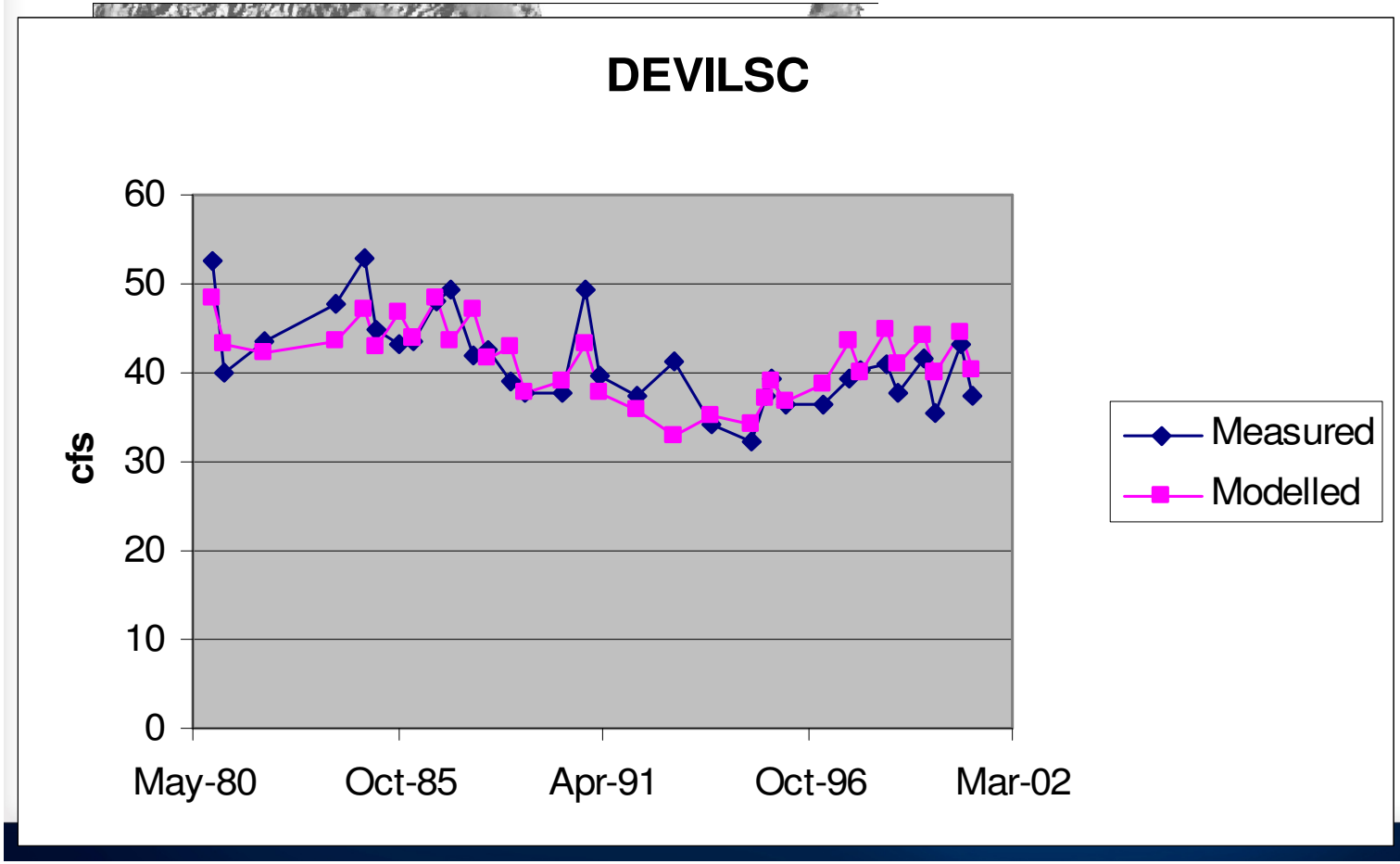


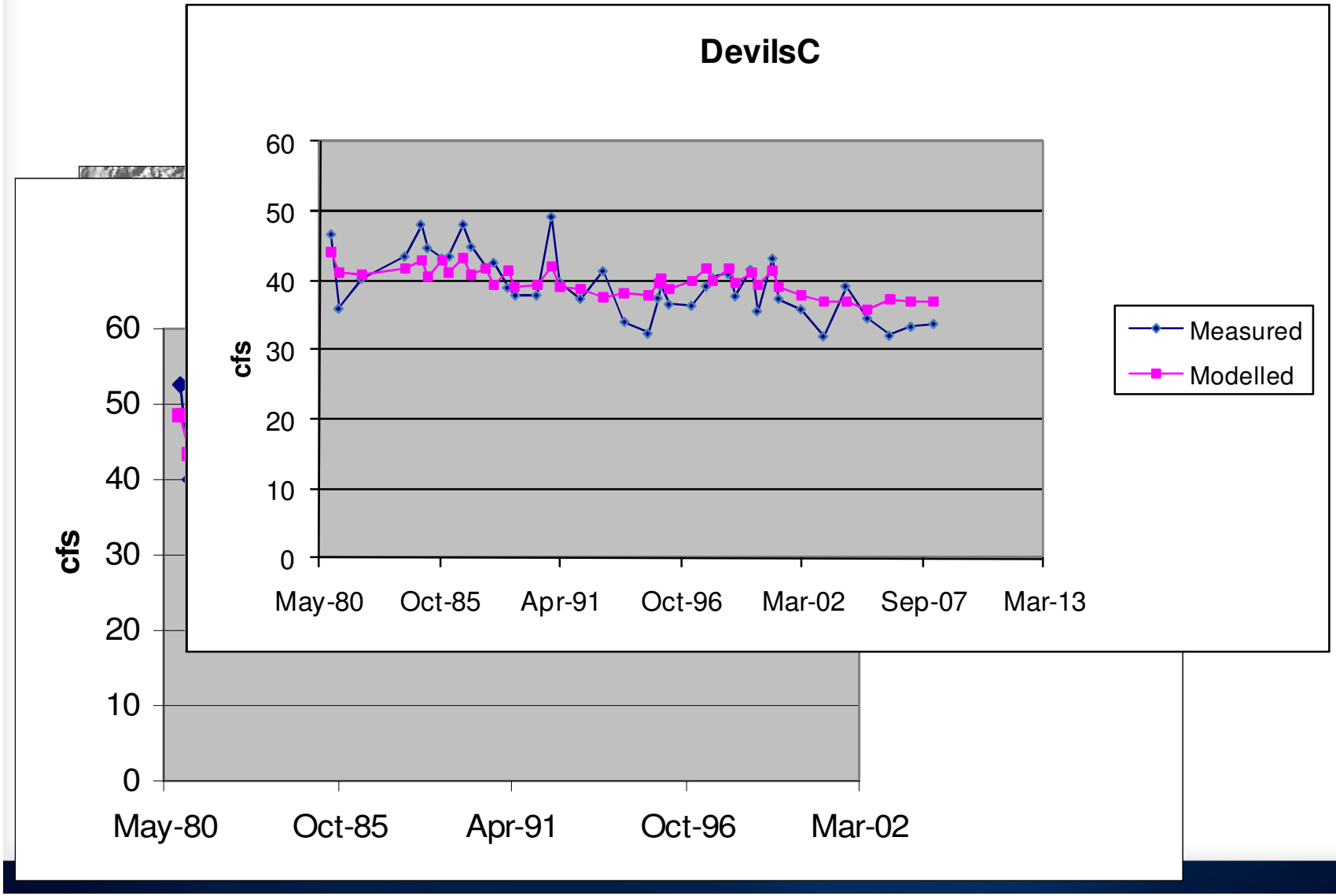

DevilsWb
cfs
25
20
15
10
5
0
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07
Mar-13
Measured
Modelled
cfs
20
18
16
14
12
10
8
6
4
2
0
May-80
Oct-85
Apr-91
Oct-96
Mar-02

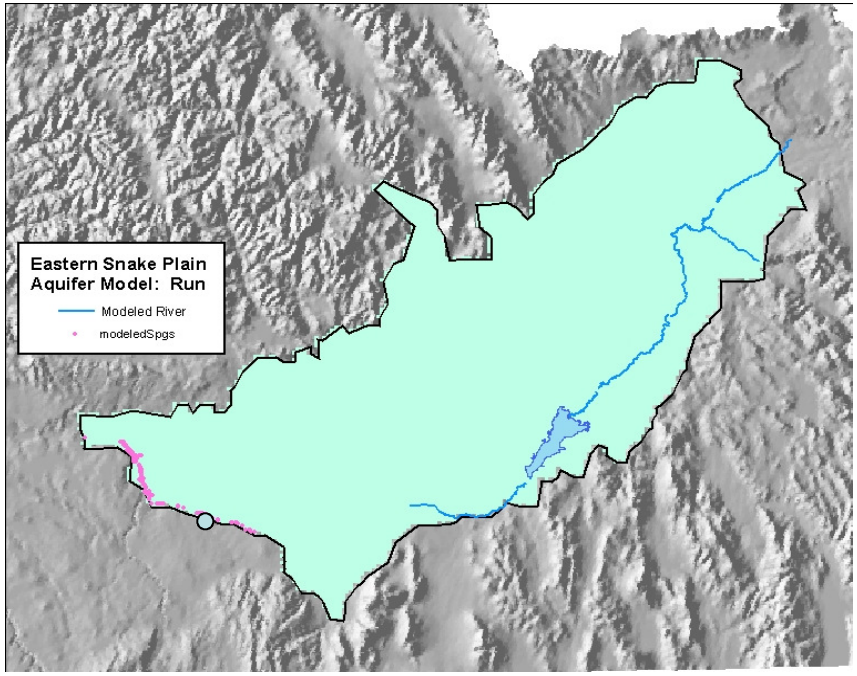


- Devils Corral

- Devils Corral

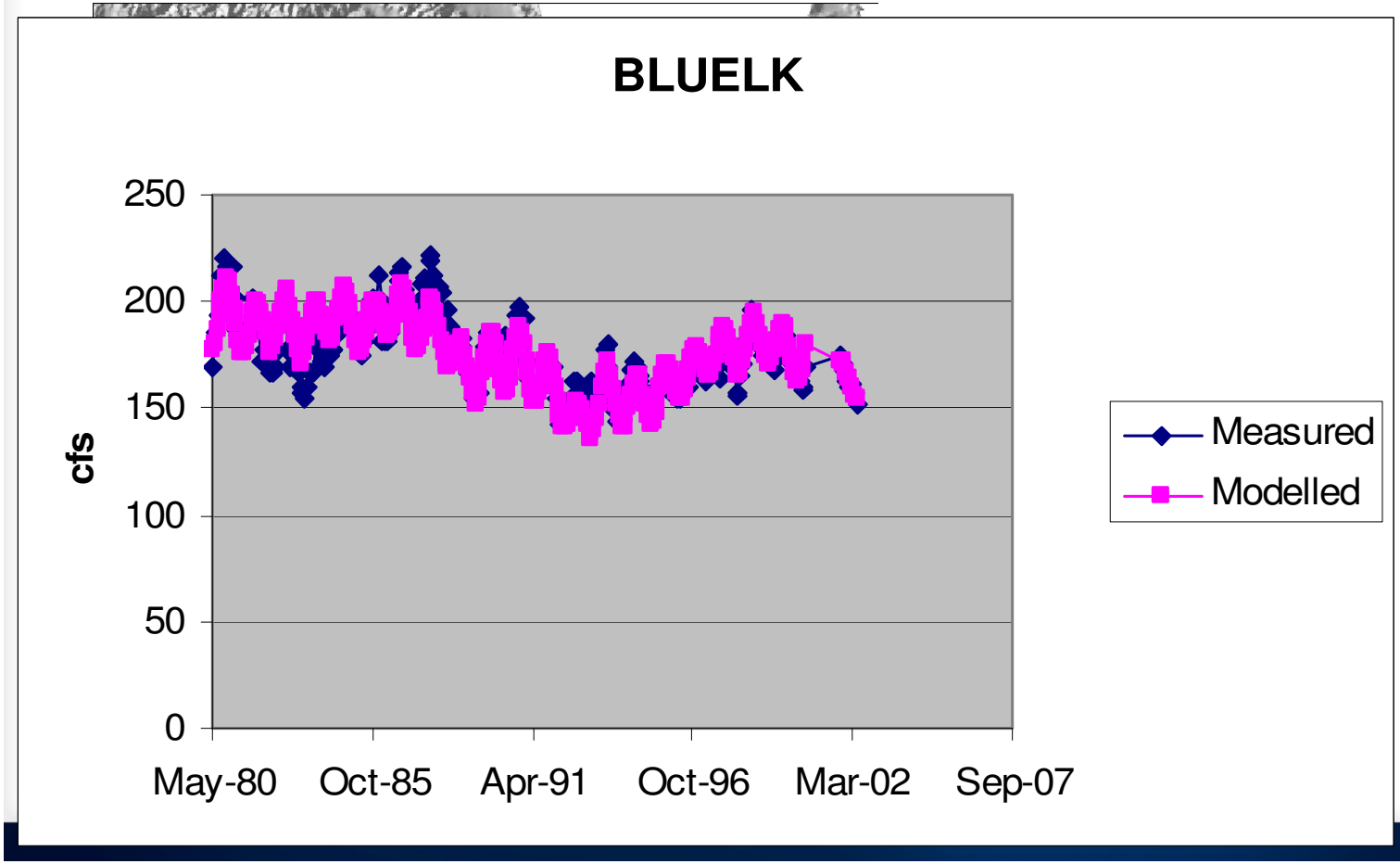


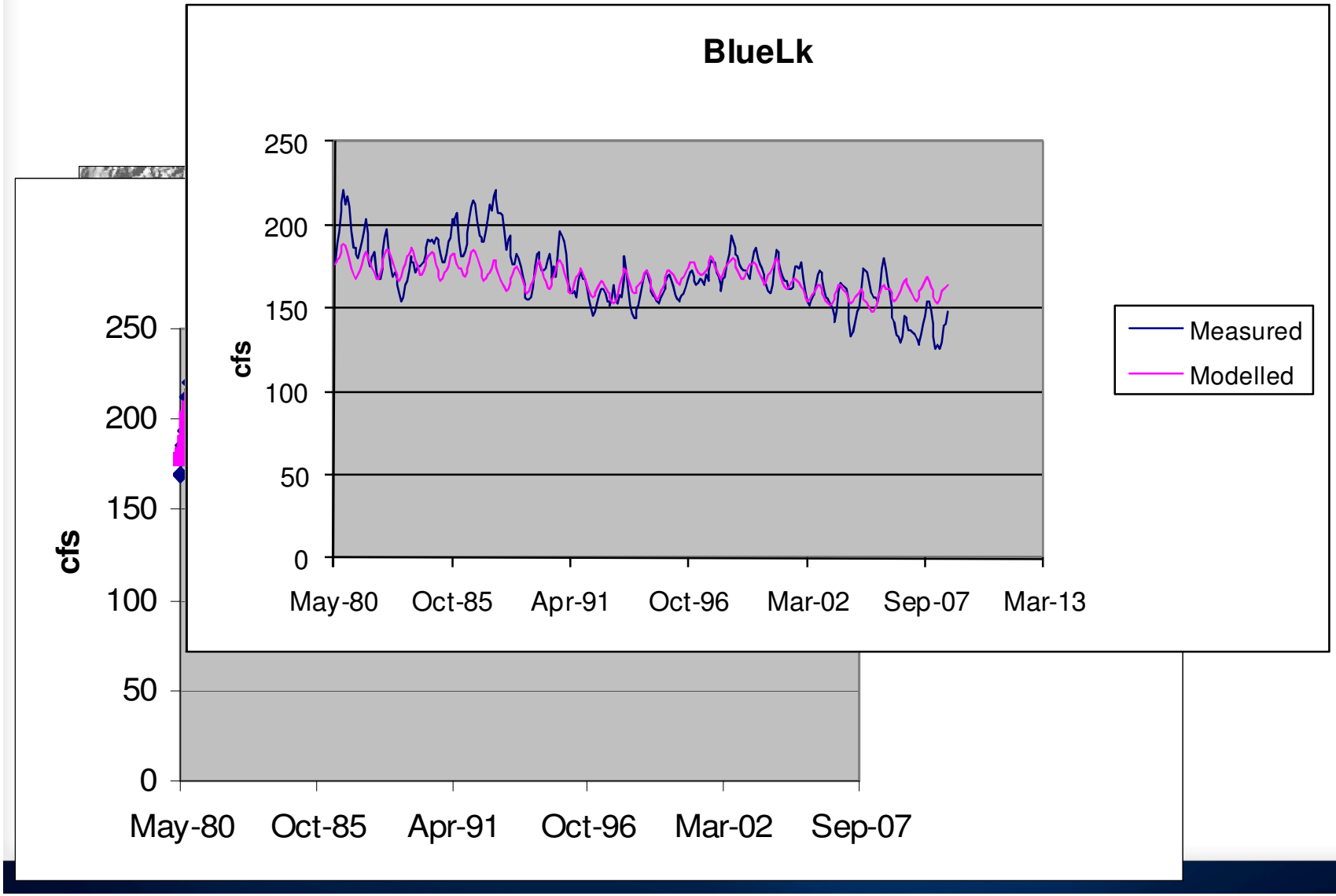

DevilsC
cfs
60
50
40
30
20
10
0
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07
Mar-13
Measured
Modelled
cfs
60
50
40
30
20
10
0
May-80
Oct-85
Apr-91
Oct-96
Mar-02

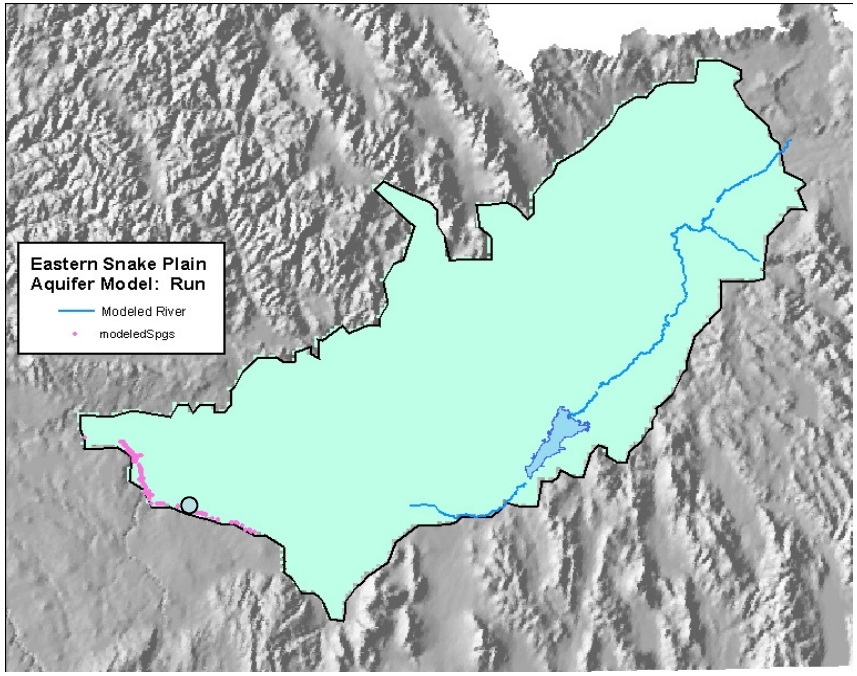

Eastern Snake Plain
Aquifer Model: Run
Modeled River
modeledSpgs

- Blue Lakes

- Blue Lakes

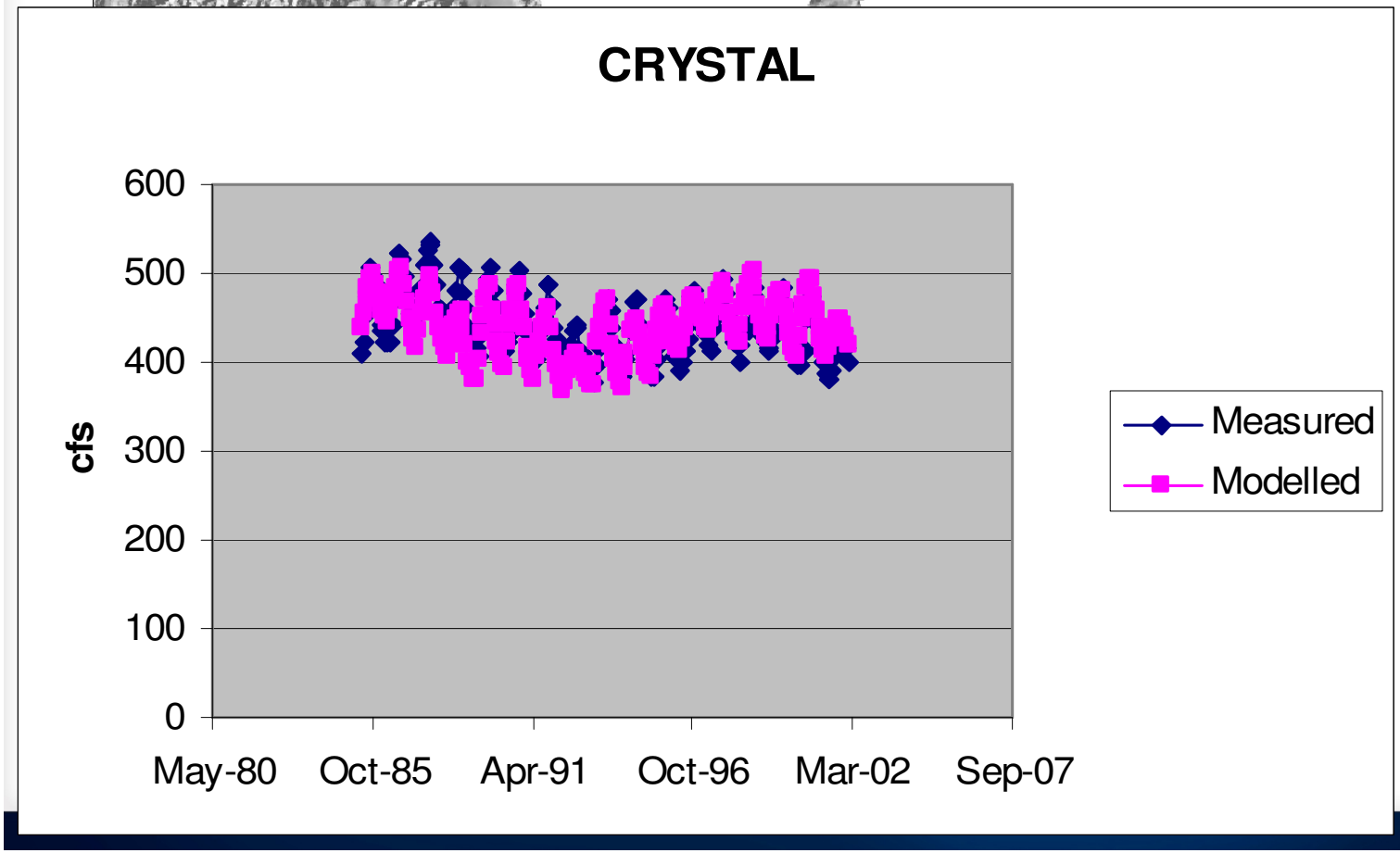

BLUELK
250
200
150
100
50
0
cfs
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07
Measured
Modelled

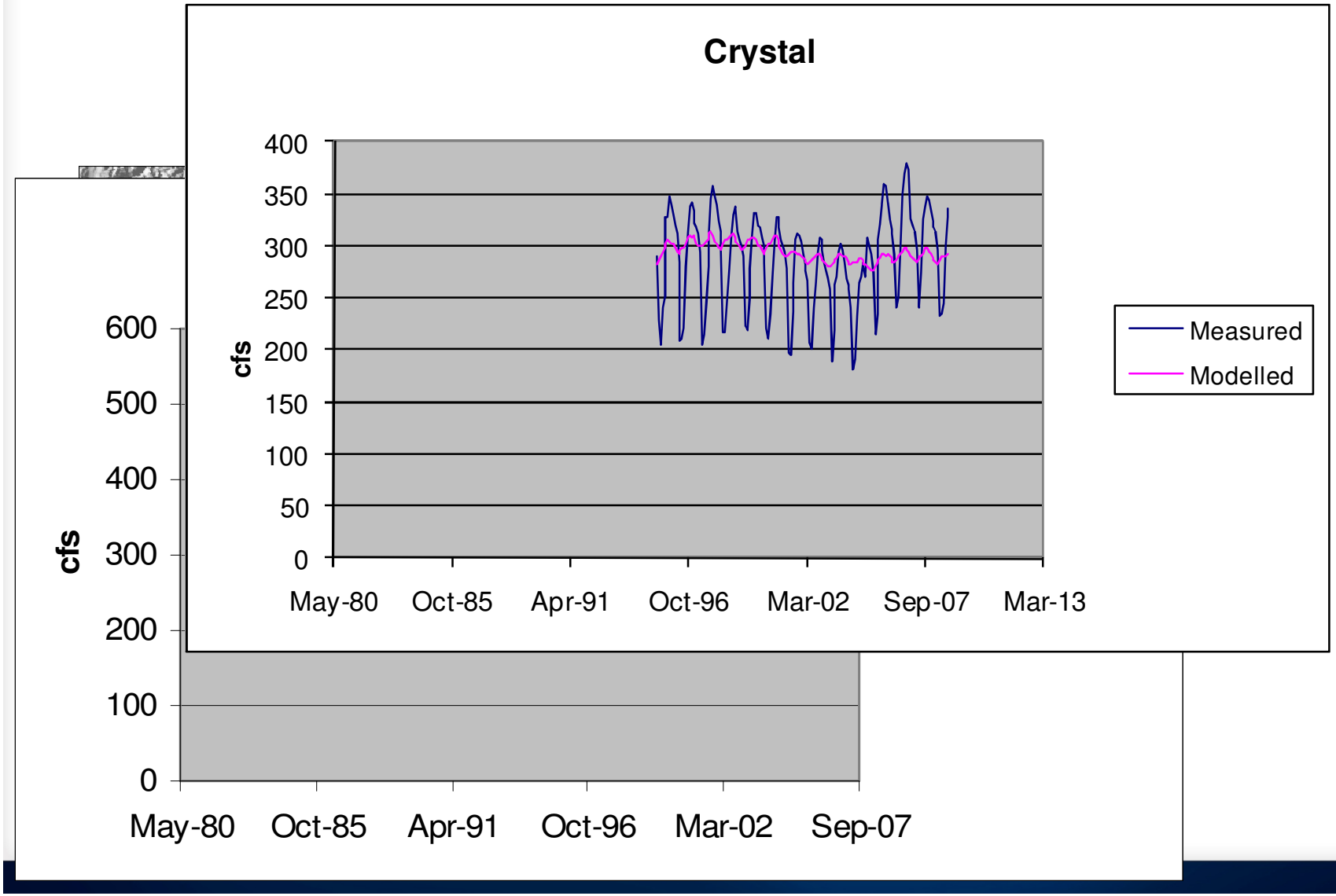

BlueLk
250
200
150
100
50
0
cfs
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07
Mar-13
Measured
Modelled

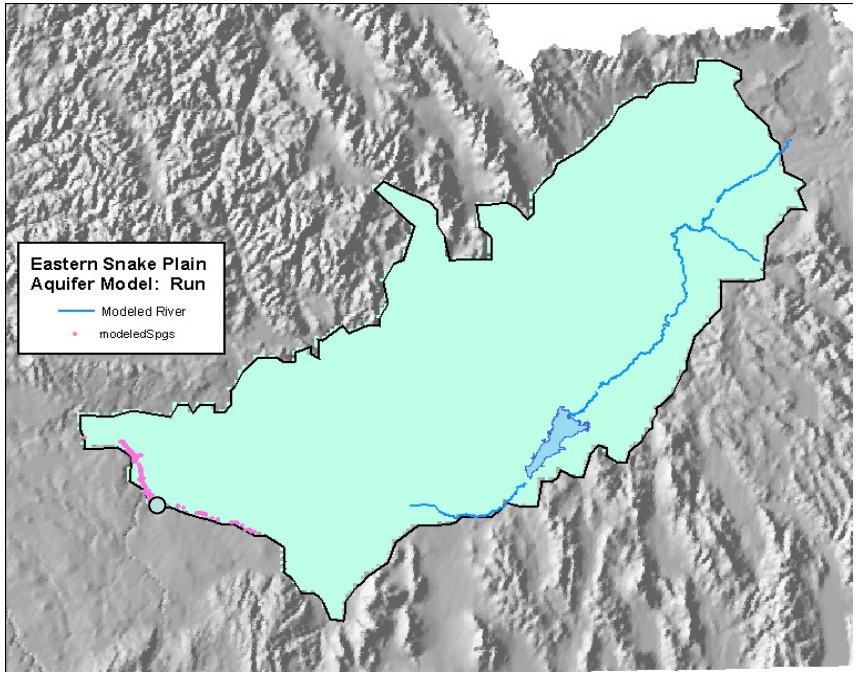


- Crystal Springs

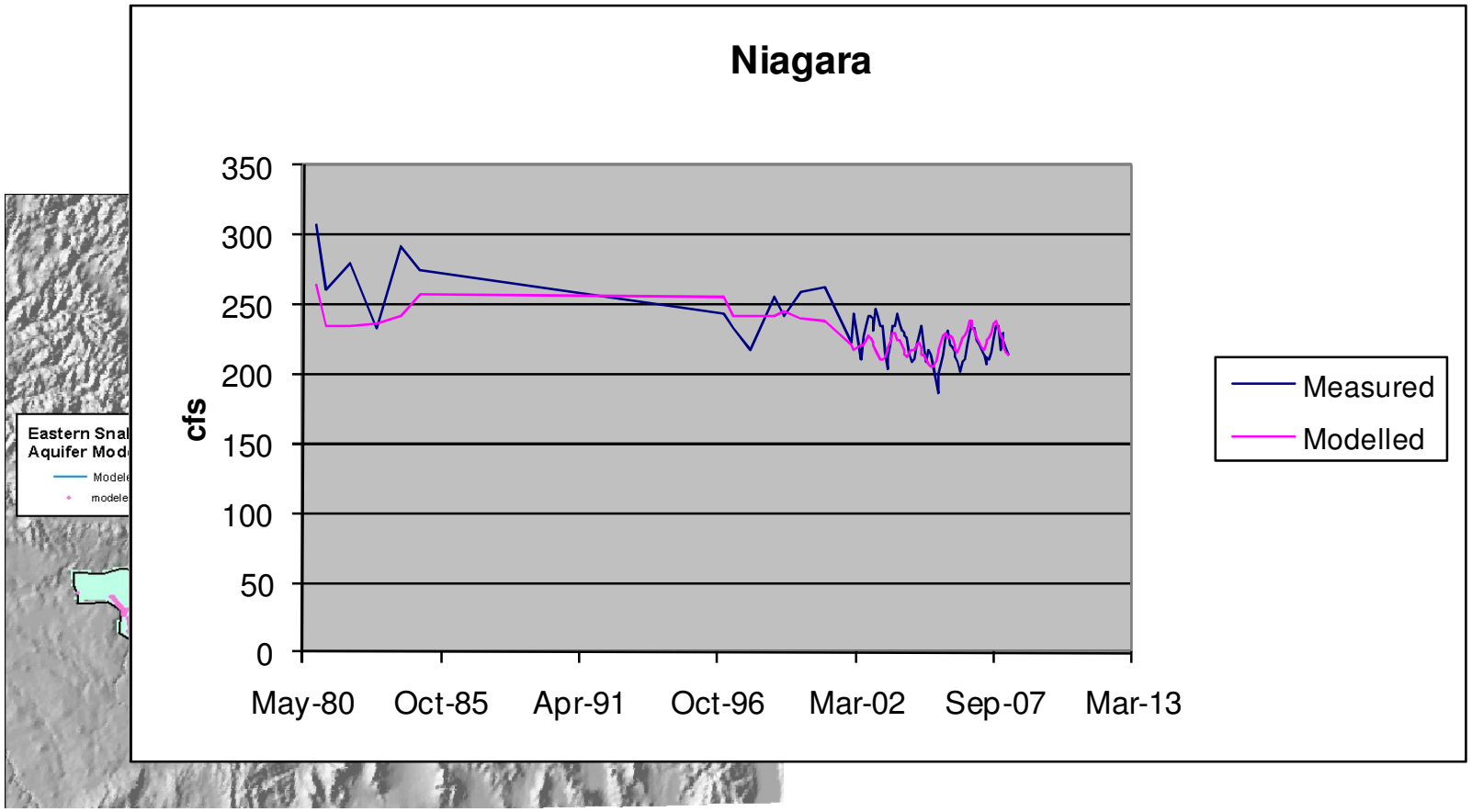
- Crystal Springs

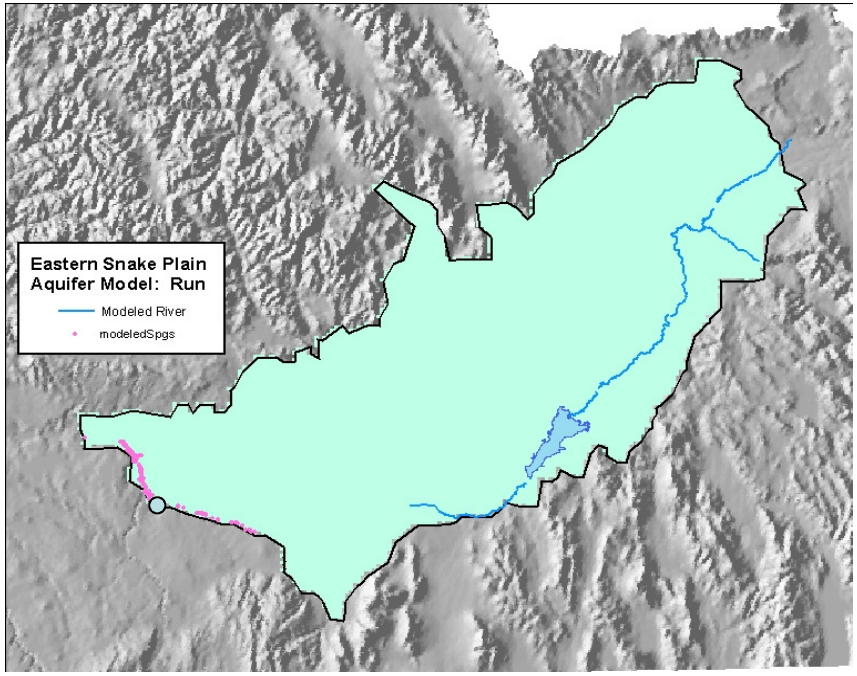



Crystal
400
350
300
250
200
150
100
50
0
cfs
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07
Mar-13
Measured
Modelled
600
500
400
300
200
100
0
cfs
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07


Eastern Snake Plain
Aquifer Model: Run
Modeled River
modeledSpgs

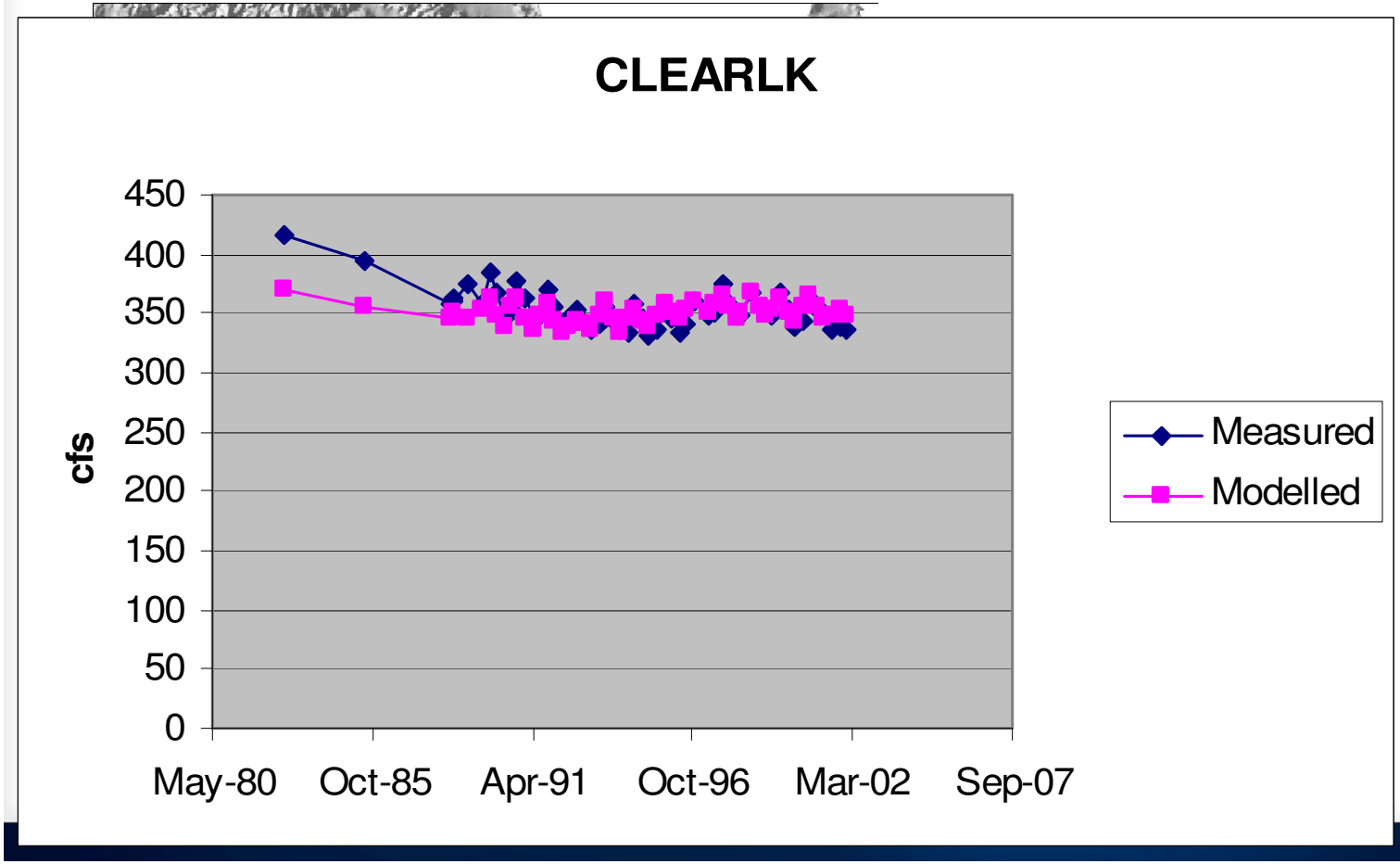
- Niagara

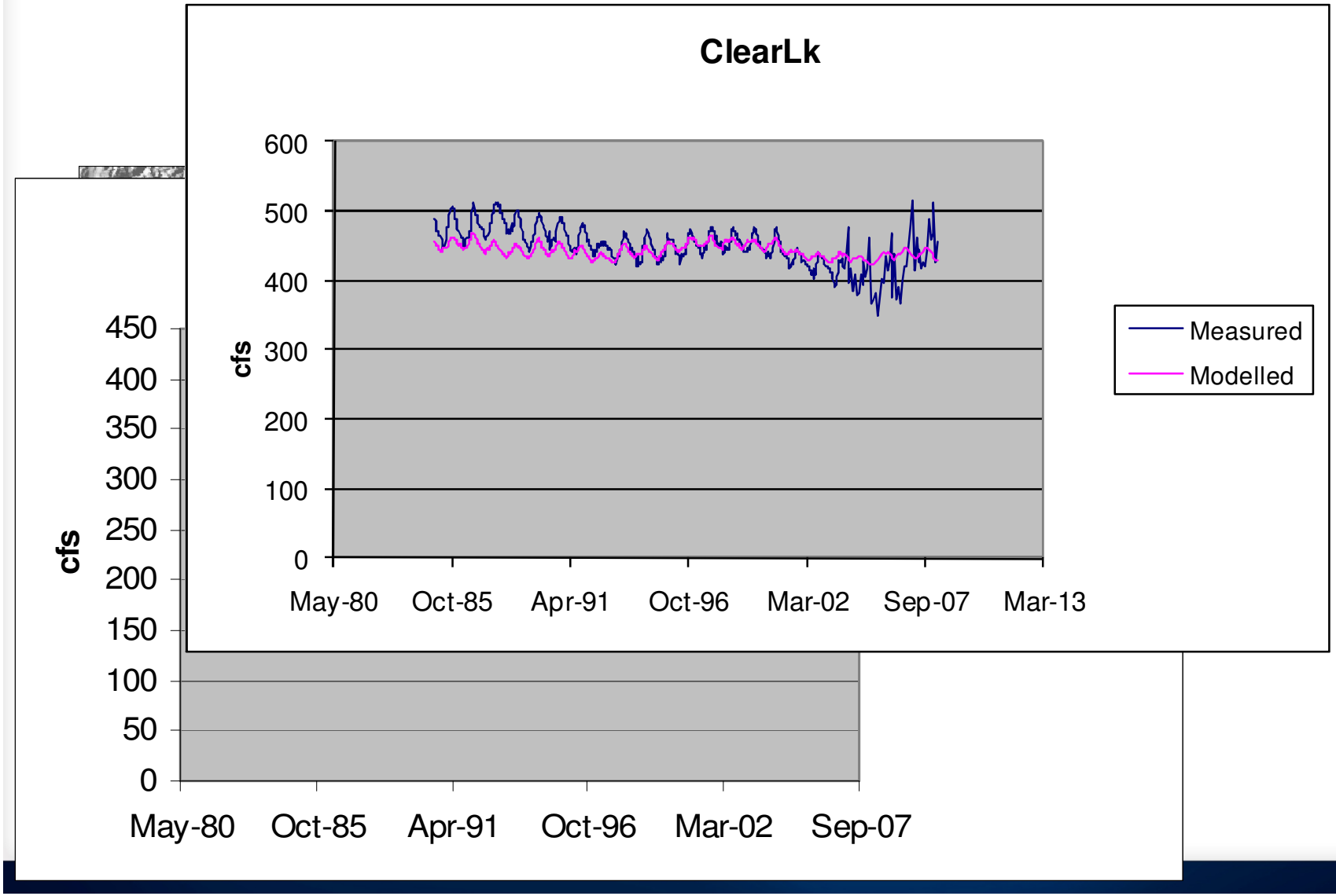

Niagara
350
300
250
200
150
100
50
0
cfs
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07
Mar-13
Measured
Modelled

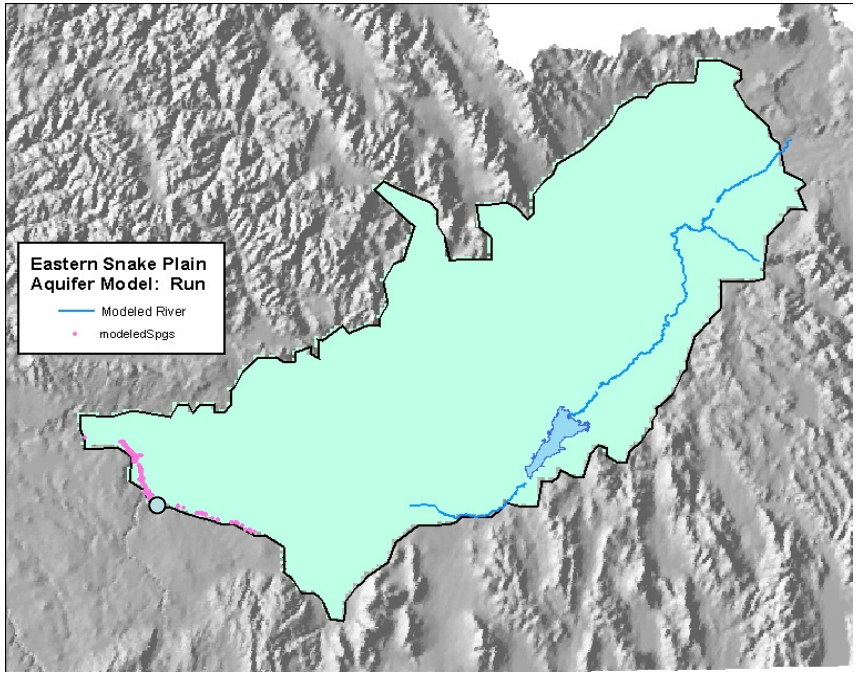

Eastern Snake Plain
Aquifer Model: Run
Modeled River
modeledSpgs

- Clear Lakes

- Clear Lakes

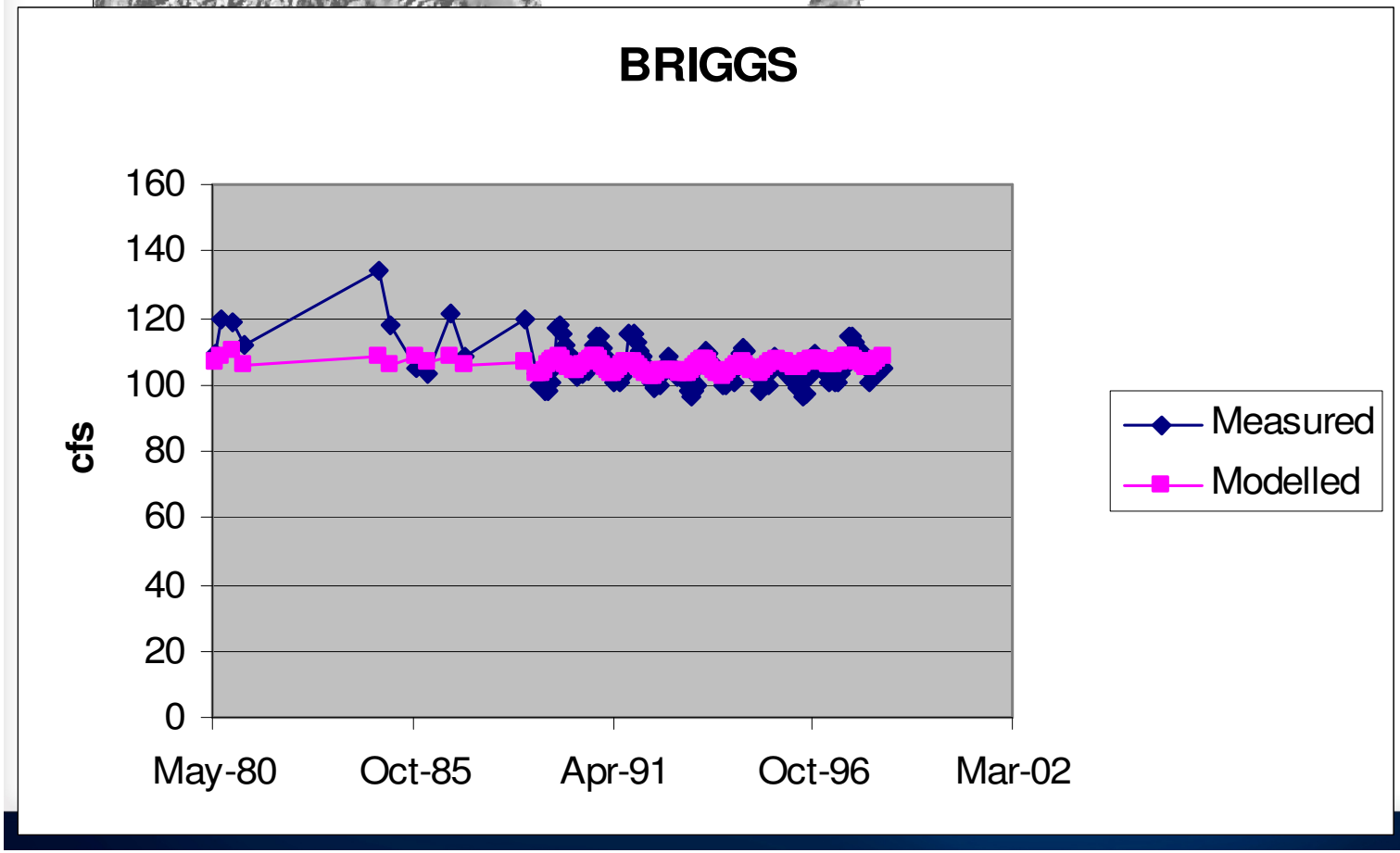

CLEARLK
cfs
450
400
350
300
250
200
150
100
50
0
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07
Measured
Modelled

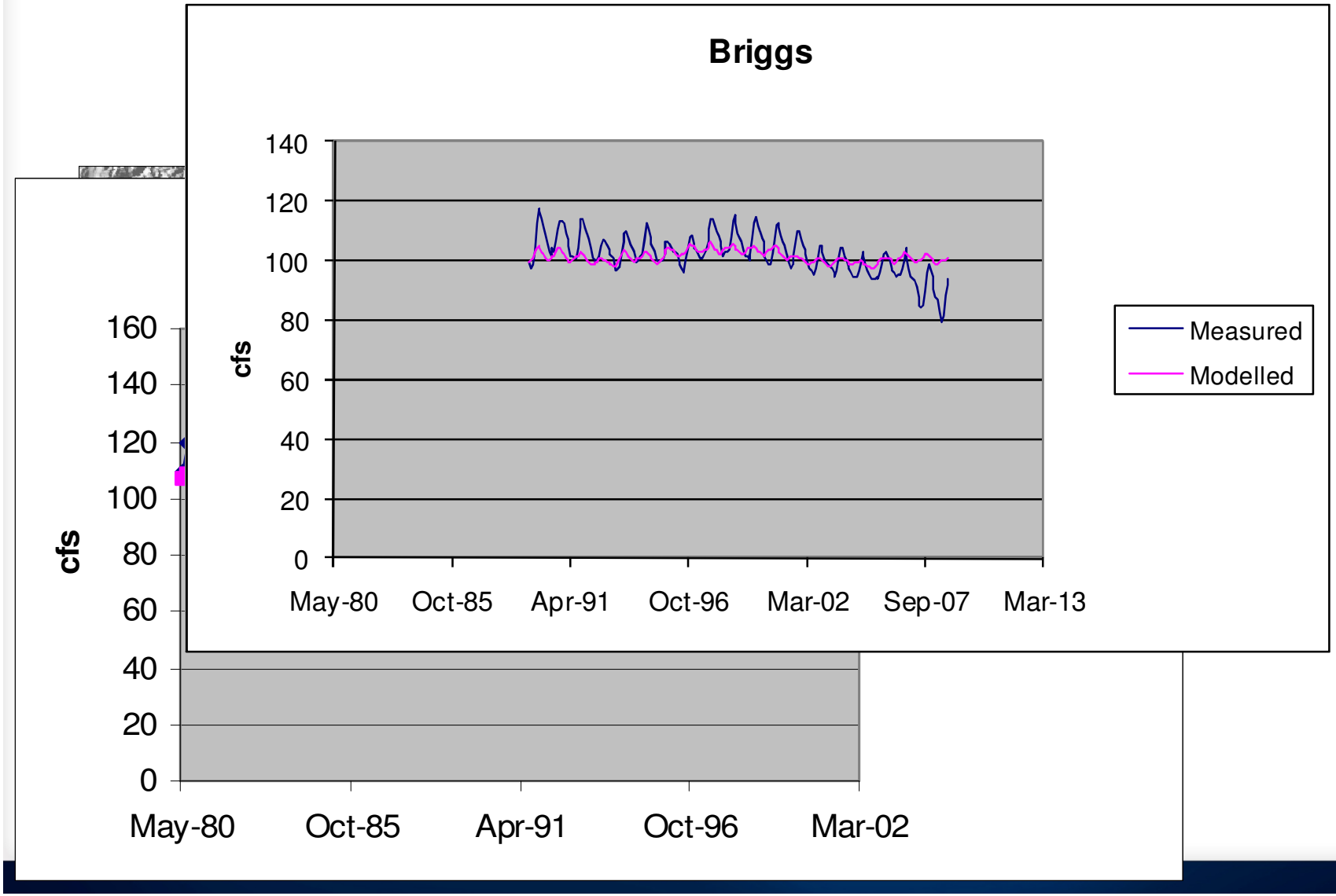

ClearLk
600
500
400
300
200
100
0
cfs
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07
Mar-13
Measured
Modelled
450
400
350
300
250
200
150
100
50
0
cfs
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07

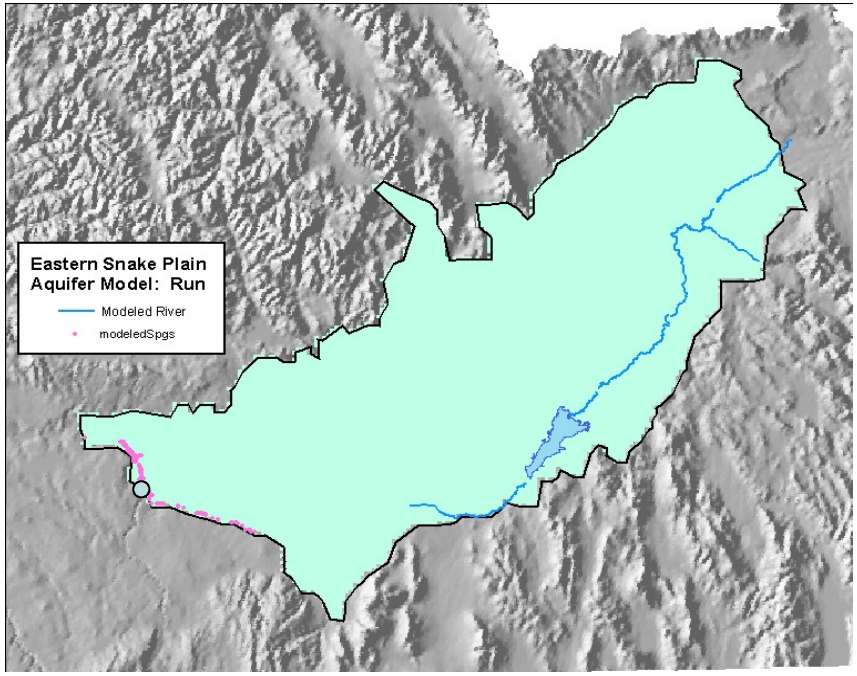


- Briggs Spring

- Briggs Spring

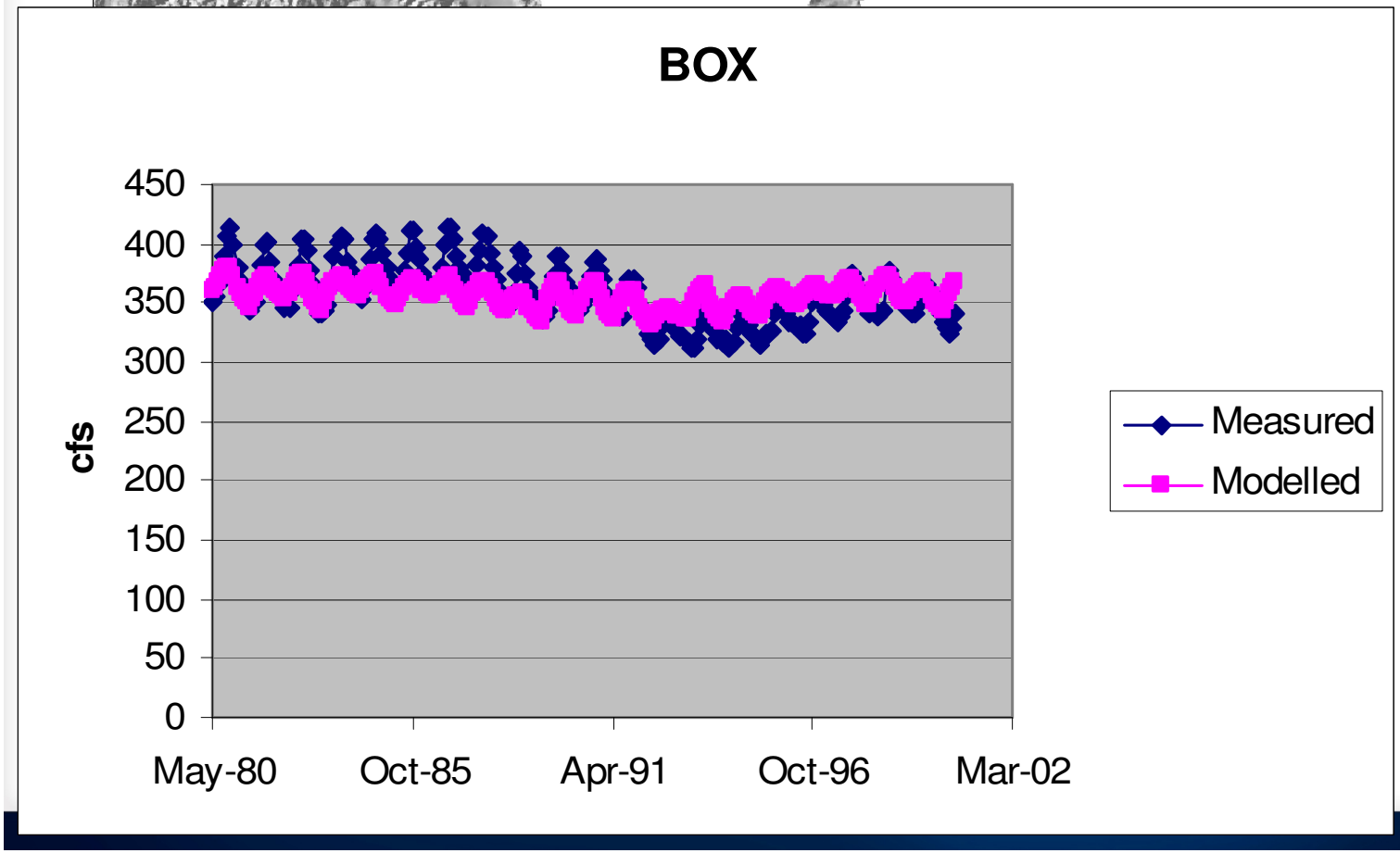


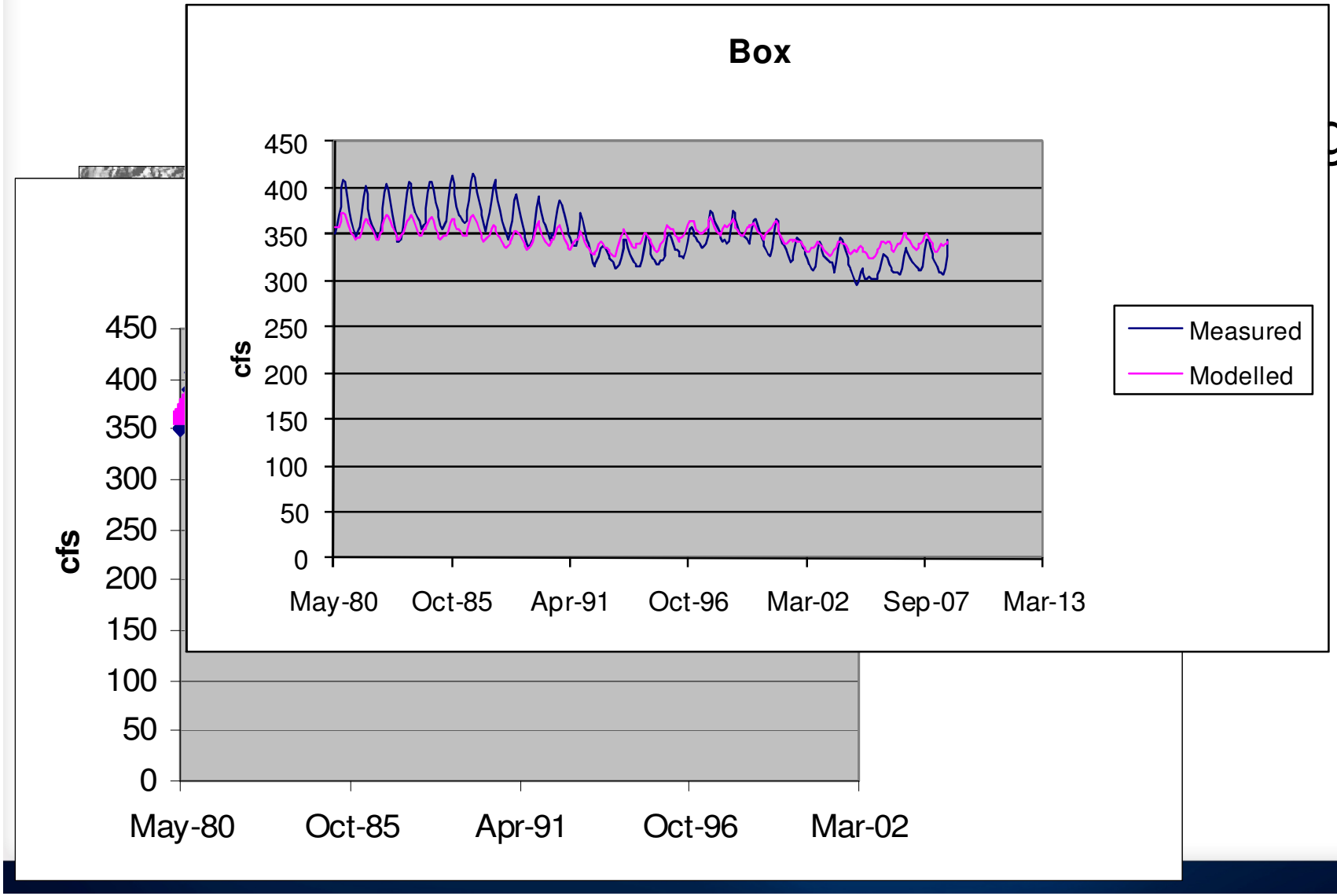

Briggs
cfs
140
120
100
80
60
40
20
0
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07
Mar-13
Measured
Modelled
cfs
160
140
120
100
80
60
40
20
0
May-80
Oct-85
Apr-91
Oct-96
Mar-02

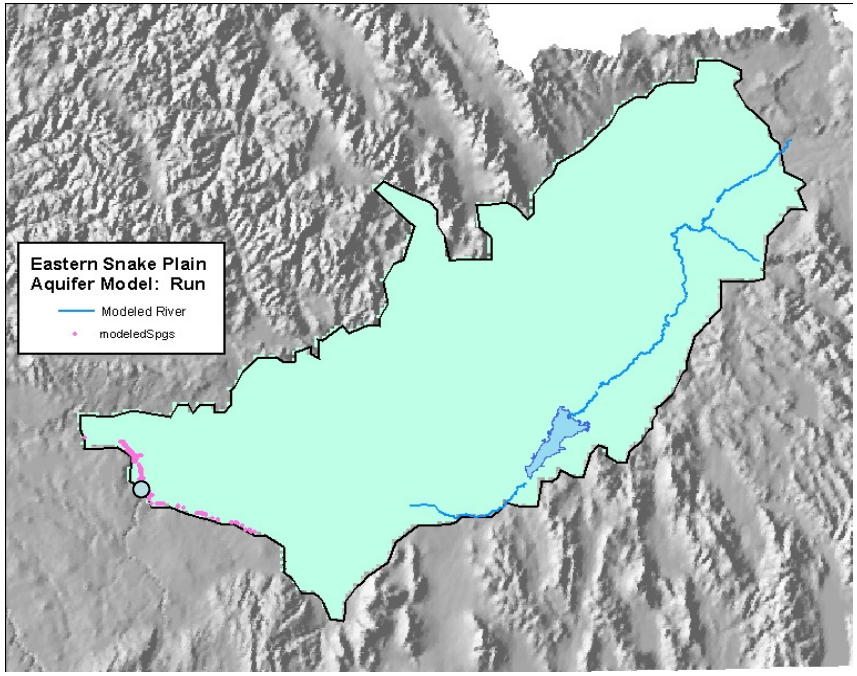


- Box Canyon Spring

- Box Canyon Spring

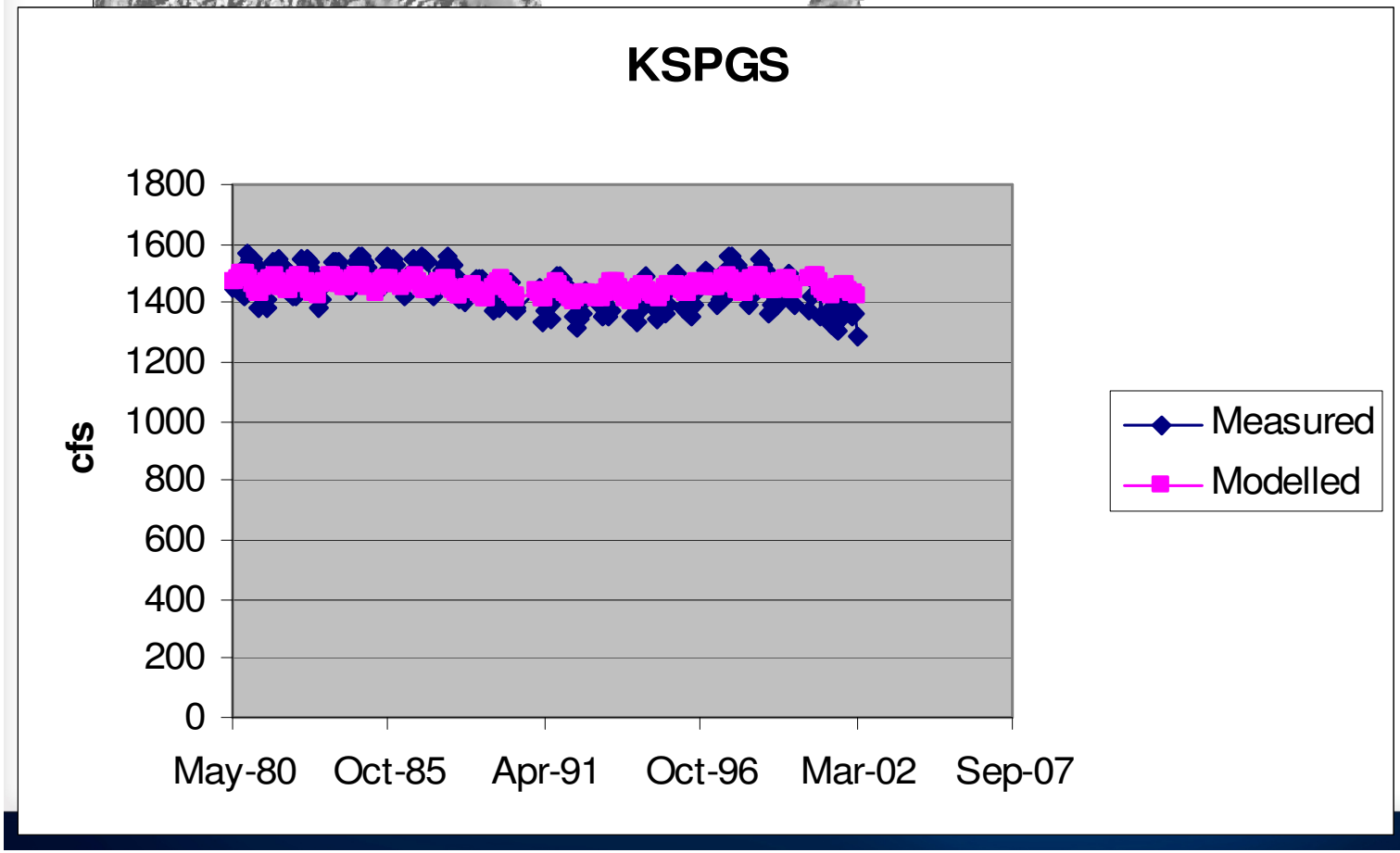


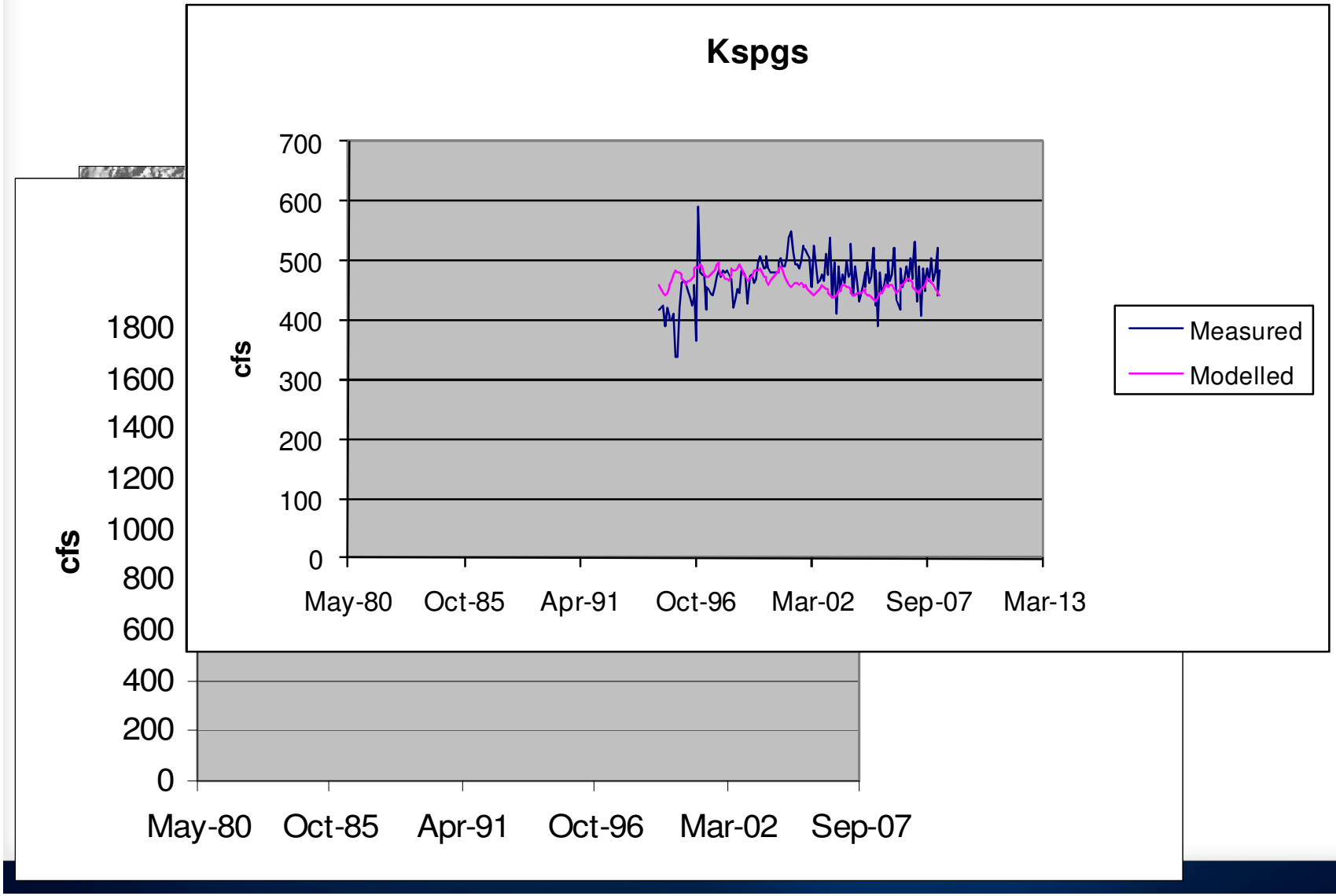

Box
cfs
450
400
350
300
250
200
150
100
50
0
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07
Mar-13
Measured
Modelled
cfs
450
400
350
300
250
200
150
100
50
0
May-80
Oct-85
Apr-91
Oct-96
Mar-02

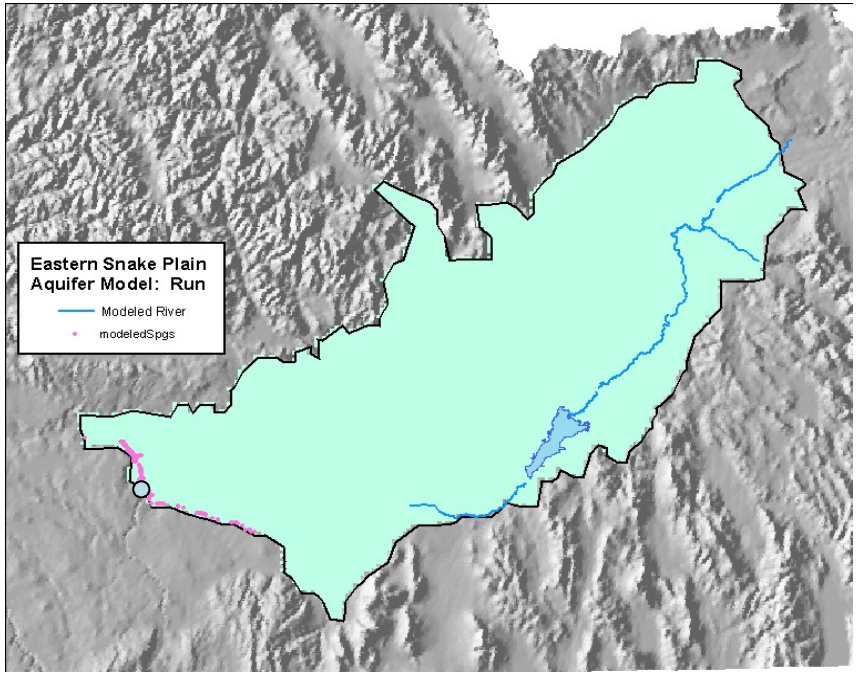


- Thousand Springs

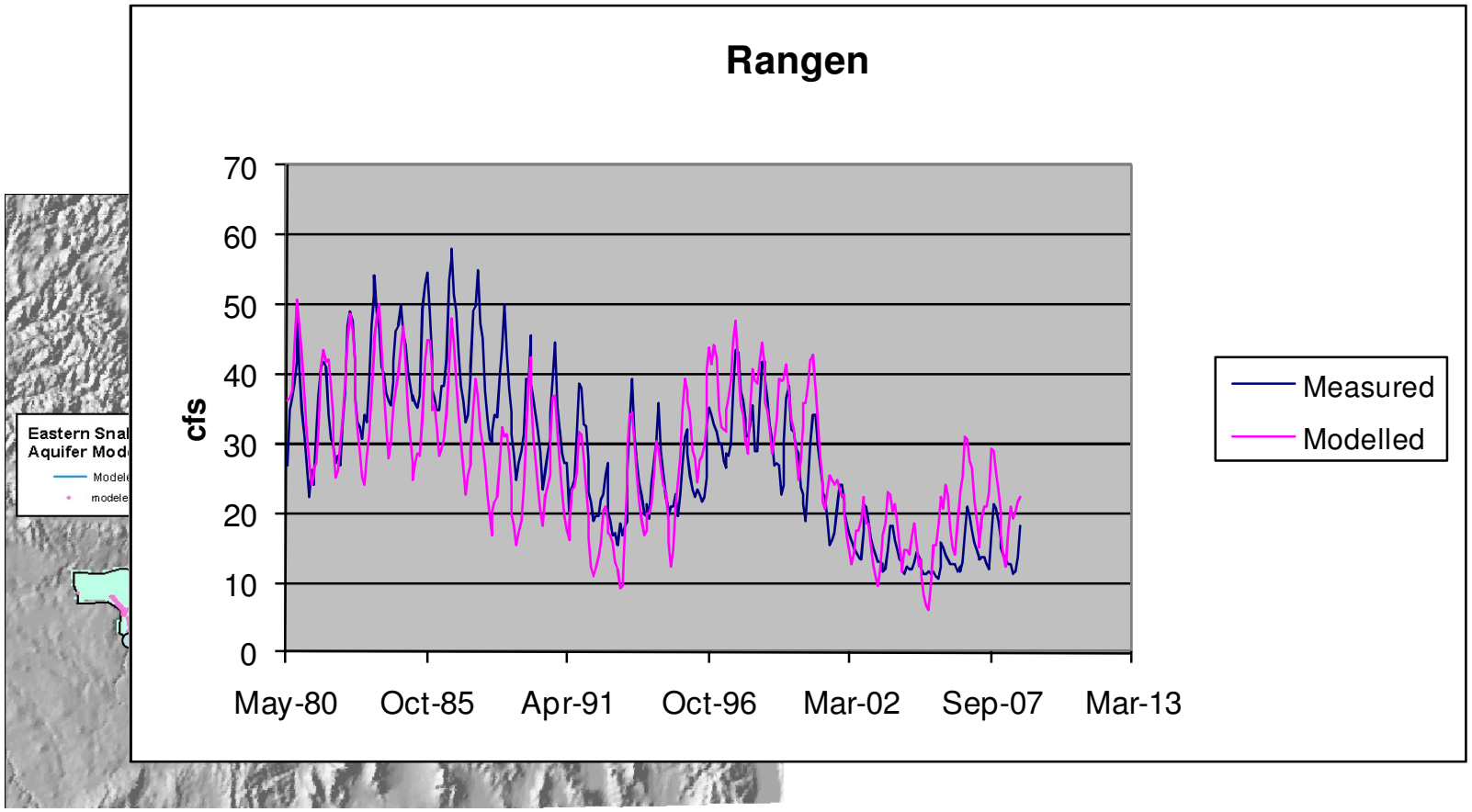
- Thousand Springs

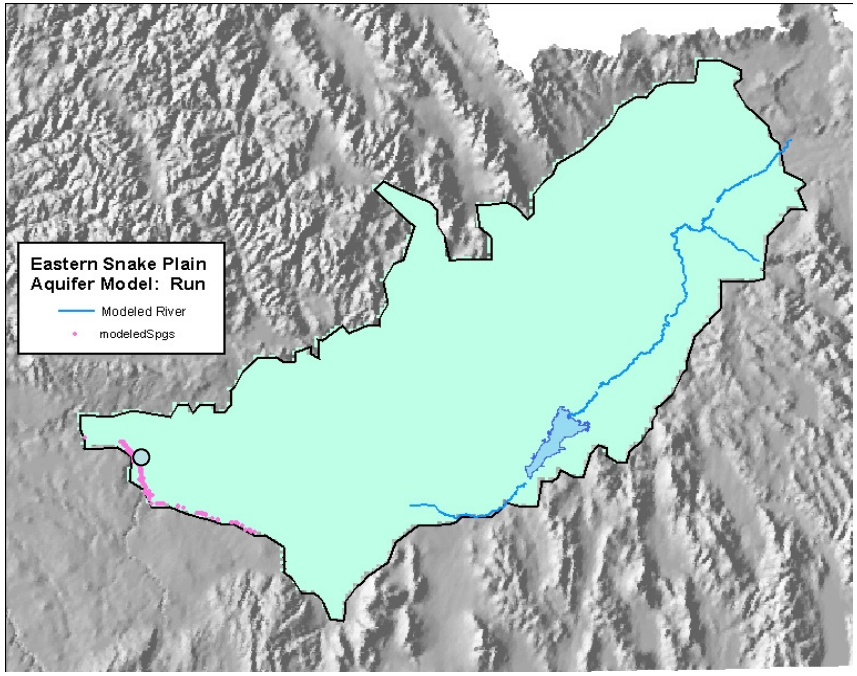



Kspgs
cfs
700
600
500
400
300
200
100
0
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07
Mar-13
Measured
Modelled
cfs
1800
1600
1400
1200
1000
800
600
400
200
0
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07



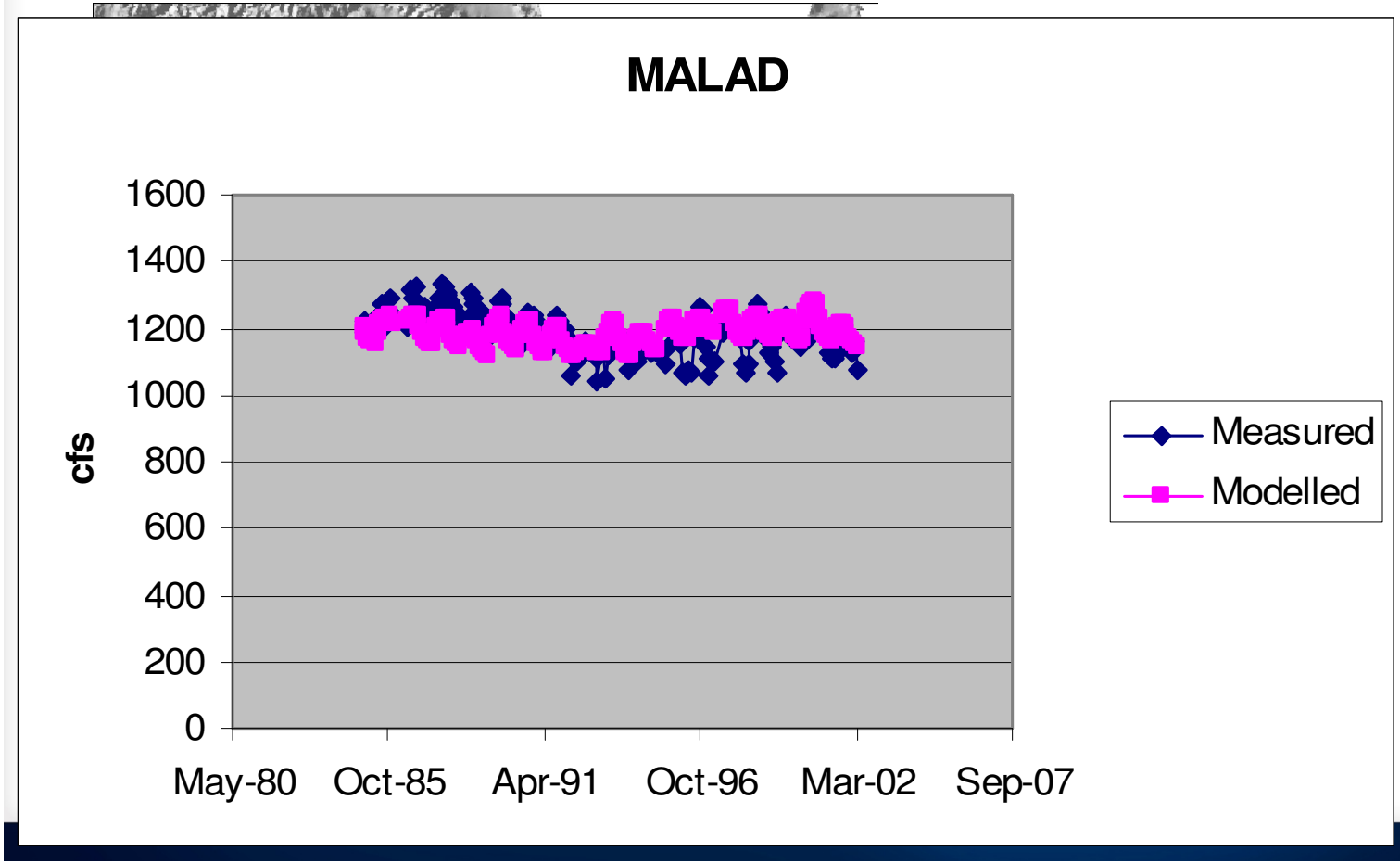
- Rangen Spring

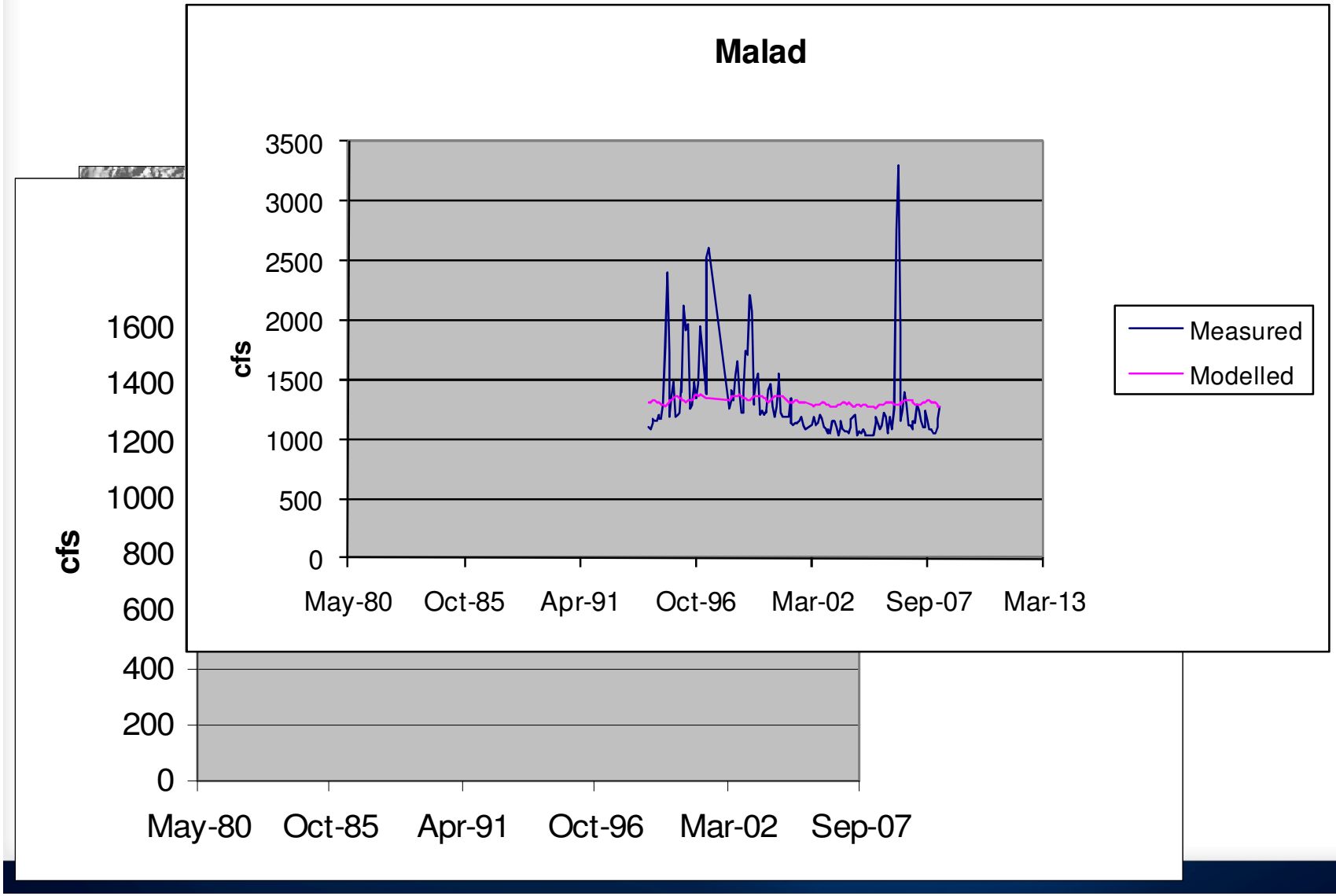

Rangen
cfs
70
60
50
40
30
20
10
0
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07
Mar-13
Measured
Modelled

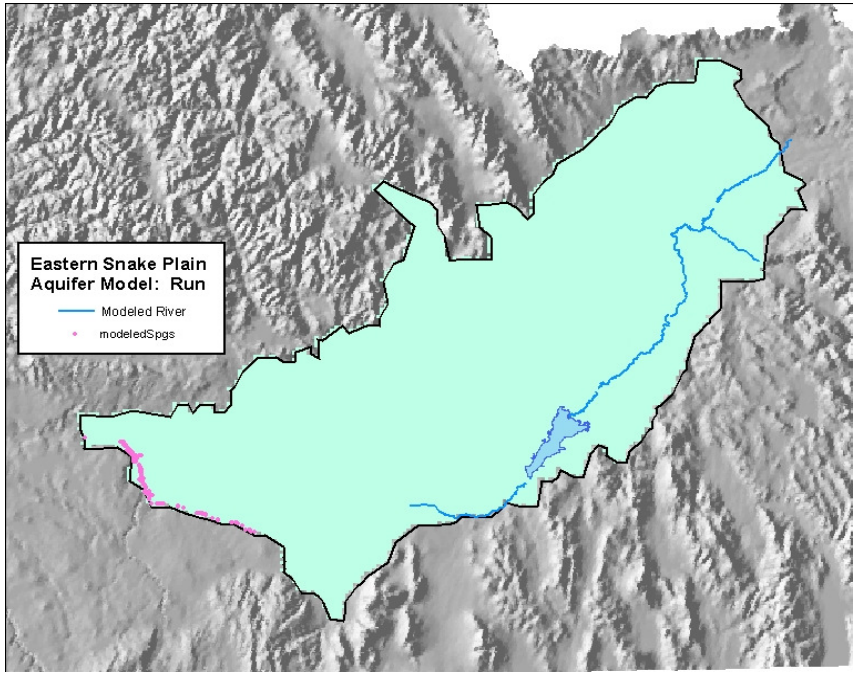

Eastern Snake Plain
Aquifer Model: Run
Modeled River
modeledSpgs

- Malad

- Malad

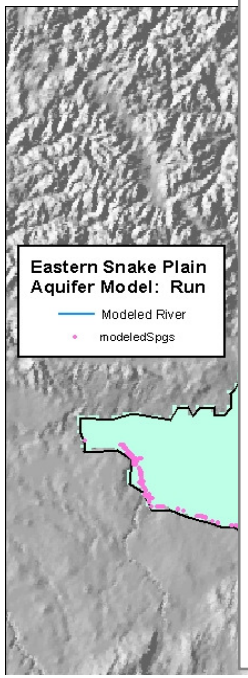

MALAD
cfs
1600
1400
1200
1000
800
600
400
200
0
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07
Measured
Modelled

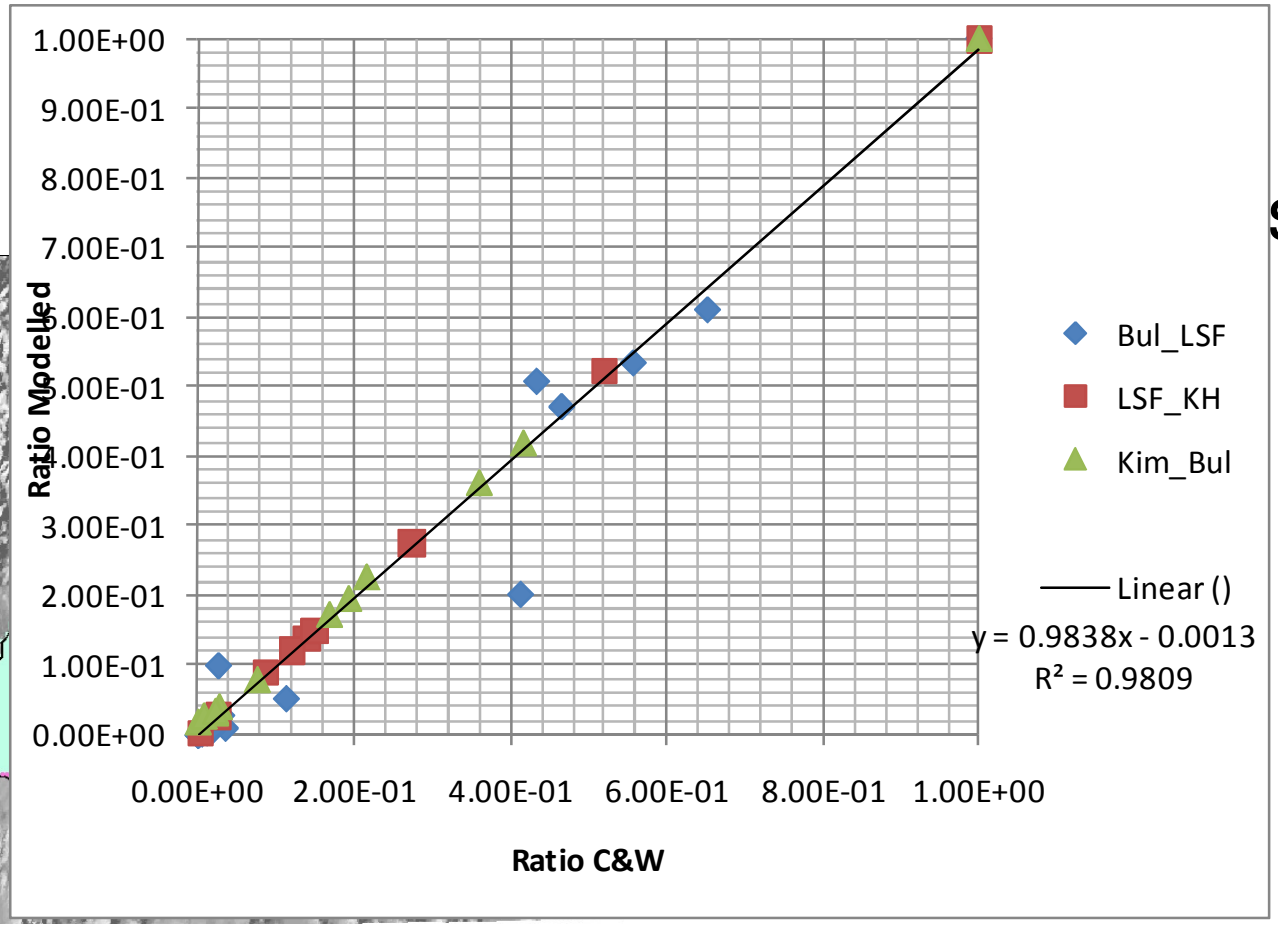

Malad
3500
3000
2500
2000
1500
1000
500
0
cfs
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07
Mar-13
Measured
Modelled
1600
1400
1200
1000
800
600
400
200
0
cfs
May-80
Oct-85
Apr-91
Oct-96
Mar-02
Sep-07



- Group C Springs

S


Eastern Snake Plain
Aquifer Model: Run
Modeled River
modeledSpgs


1.00E+00
9.00E-01
8.00E-01
7.00E-01
6.00E-01
5.00E-01
4.00E-01
3.00E-01
2.00E-01
1.00E-01
0.00E+00
Ratio Modelled
0.00E+00
2.00E-01
4.00E-01
6.00E-01
8.00E-01
1.00E+00
Ratio C&W
Bul_LSF
LSF_KH
Kim_Bul
Linear ()
y = 0.9838x - 0.0013
R² = 0.9809

END