Nebraska
Department of Natural Resources

NEBRASKA'S WATER MANAGEMENT RESOURCE

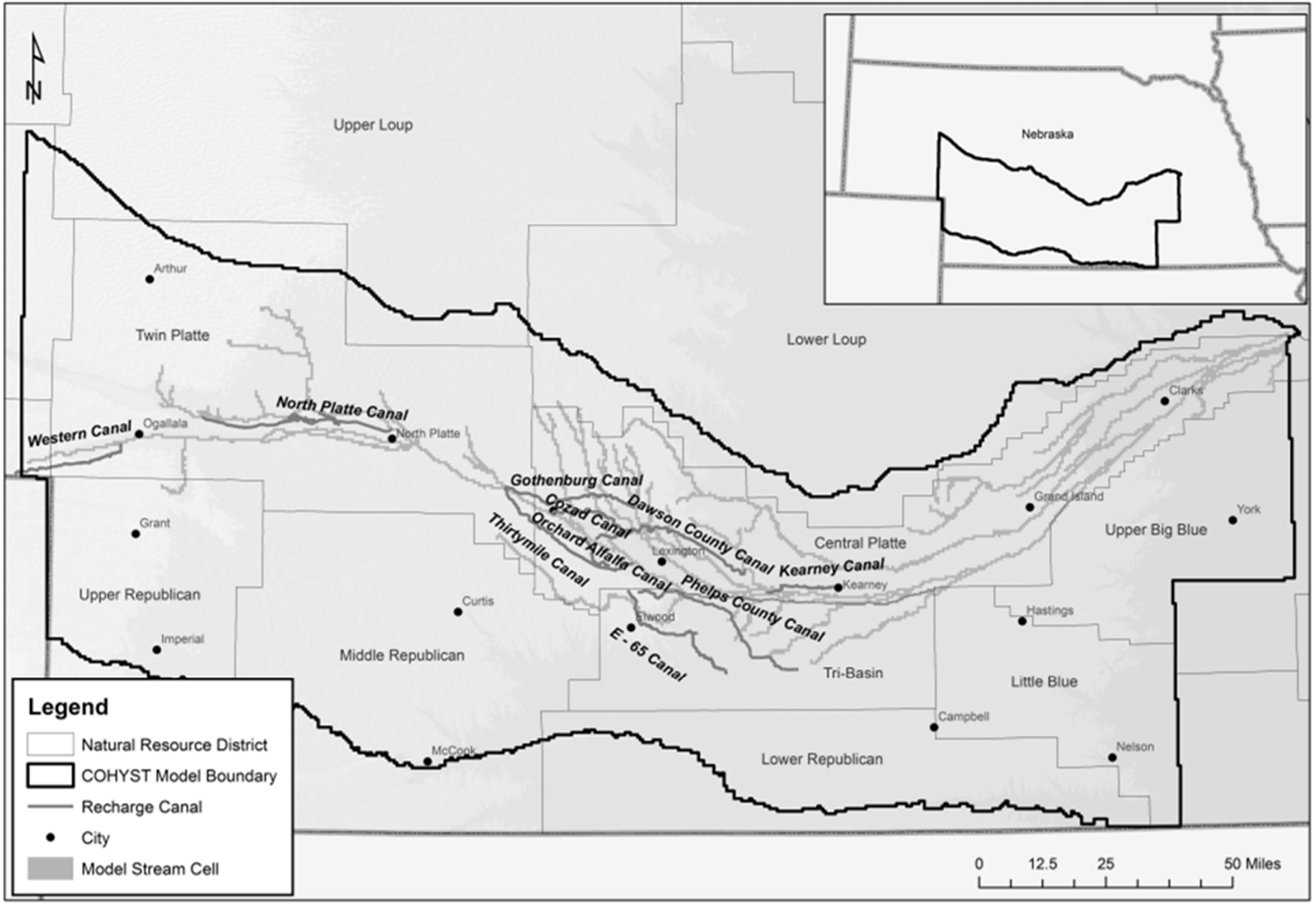
Providing the sound science and support for managing
Nebraska's most precious resource.

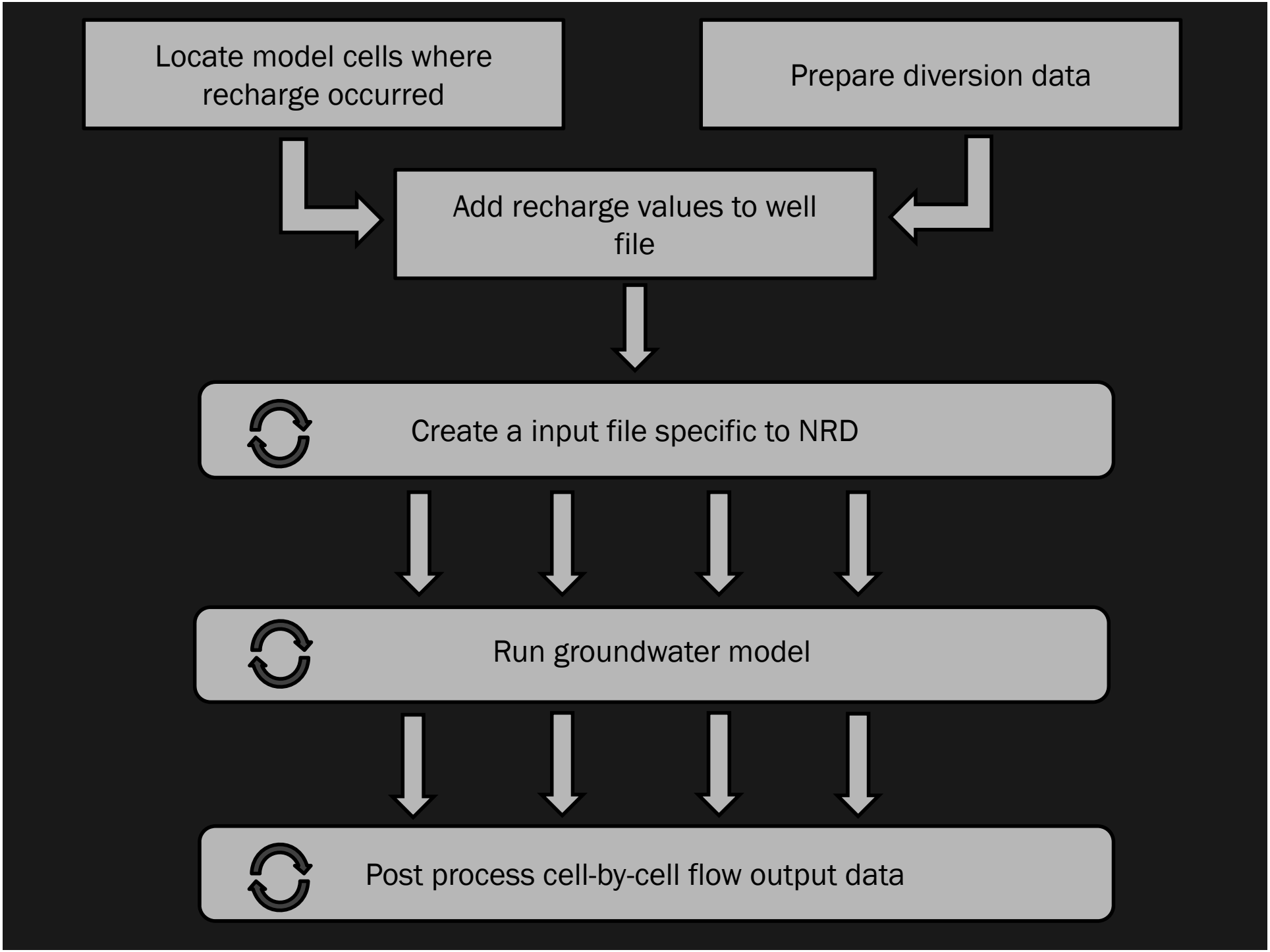
Modeling High Flow Diversions

Colby Osborn

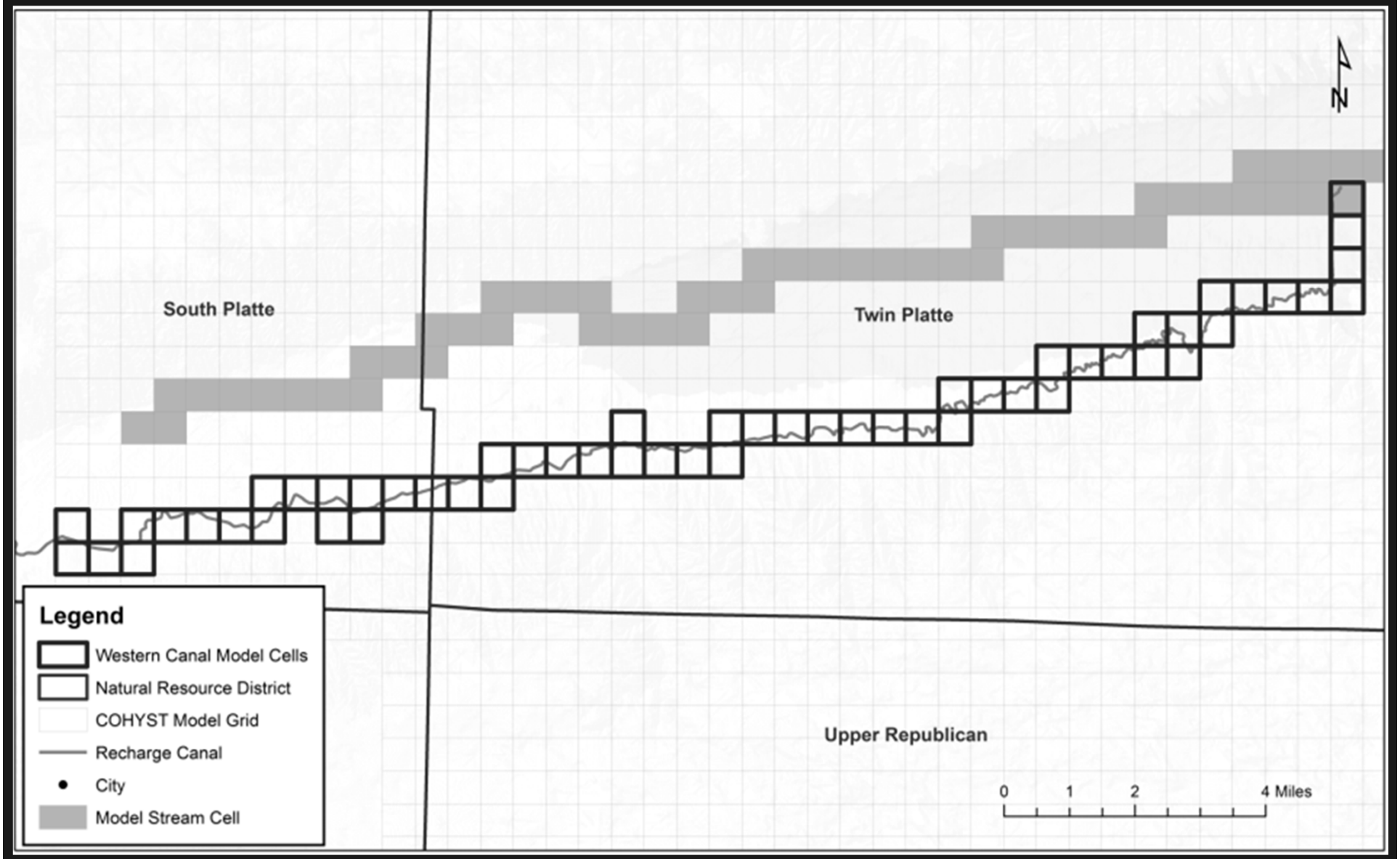
Objective

Determine the quantity and timing which the recharged water returns to the Platte River, and which natural resource district (NRD) is responsible.


N
Upper Loup
Nebraska
Arthur
Twin Platte
Lower Loup
North Platte Canal
Western Canal
Ogallala
North Platte
Clarks
Gothenburg Canal
Cozad Canal
Dawson County Canal
Kearney Canal
Grand Island
York
Grant
Thirtymile Canal
Orchard Alfalfa Canal
Phelps County Canal
Central Platte
Upper Big Blue
Lexington
Kearney
Upper Republican
Curtis
Elwood
Hastings
Imperial
E - 65 Canal
Middle Republican
Tri-Basin
Little Blue
Campbell
McCook
Lower Republican
Nelson
Legend
Natural Resource District
COHYST Model Boundary
Recharge Canal
City
Model Stream Cell
0
12.5
25
50 Miles


Locate model cells where recharge occurred
Prepare diversion data
Add recharge values to well file
Create a input file specific to NRD
Run groundwater model
Post process cell-by-cell flow output data

Locate Model Cells Which to Assign Recharge



Preparing Diversion Data for the Model

Convert to cubic feet per day

	A	B	C
1	Date	Diversion (cfs)	Diversion (cfd)
2	1-Apr-11	579	50,000,000
3	2-Apr-11	810	70,000,000
4	3-Apr-11	579	50,000,000
5	4-Apr-11	810	70,000,000
6	5-Apr-11	579	50,000,000
7	6-Apr-11	810	70,000,000
8	7-Apr-11	579	50,000,000
9	8-Apr-11	810	70,000,000
10	9-Apr-11	579	50,000,000
11	10-Apr-11	810	70,000,000
12	11-Apr-11	579	50,000,000
13	12-Apr-11	810	70,000,000

Calculate the monthly average, daily rate

	A	B
1	Date	Average Diversion Rate (CFD)
2	1-Apr-11	60,000,000
3	1-May-11	70,000,000
4	1-Jun-11	0
5	1-Jul-11	0
6	1-Aug-11	0
7	1-Sep-11	0

Adjust the diverted rate by the canal loss

	A	B	C	D
1	Date	Average Diversion Rate (CFD)	Canal loss (%)	Average Recharge Rate (CFD)
2	1-Apr-11	60,000,000	40	24,000,000
3	1-May-11	70,000,000	40	28,000,000
4	1-Jun-11	0	40	0
5	1-Jul-11	0	40	0
6	1-Aug-11	0	40	0
7	1-Sep-11	0	40	0

Divide the monthly average, daily rate amongst the model cells

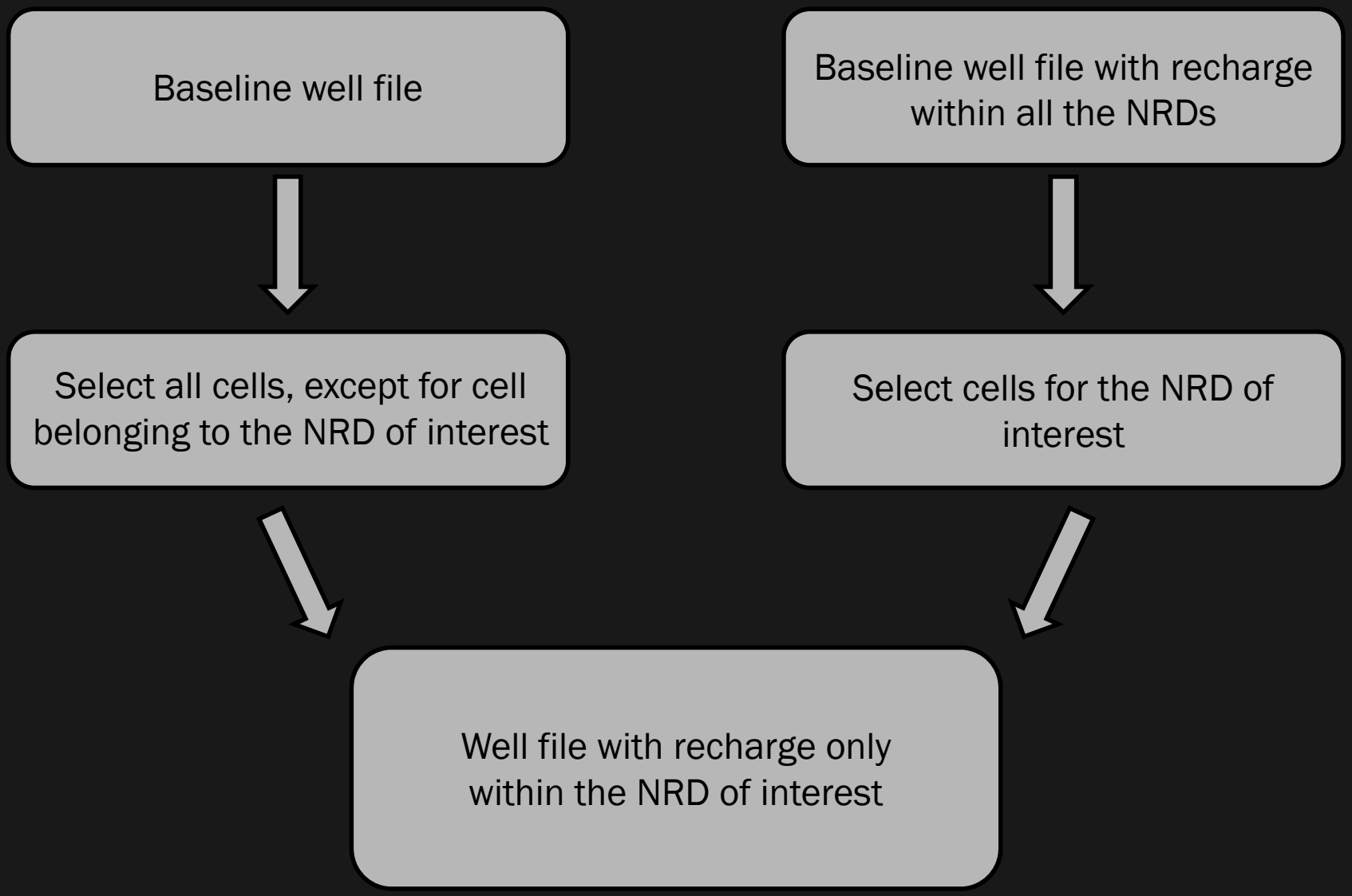
	A	B	C	D
1	Date	Average Recharge Rate (CFD)	# of Model Cells for Canal	Recharge Rate Per Cell (CFD)
2	1-Apr-11	20,000,000	100	200,000
3	1-May-11	24,000,000	100	240,000
4	1-Jun-11	0	100	0
5	1-Jul-11	0	100	0
6	1-Aug-11	0	100	0
7	1-Sep-11	0	100	0

Adding Recharge Values to Input File

2011_2012_2013.WEL

```
          1        275        441 -23701.42
          1        275        442 -34740.96
          1        275        443 -39259.43
          1        275        444 -15367.90
          1        275        445 -11838.03
          1        275        446  -1349.84
          1        275        448 -19956.09
          1        275        449 -18099.26
          1        275        450 -36268.24
          1        275        451   -297.85
          1        275        452 -21109.47
          1        275        455 -23650.72
          1        275        457 -26711.62
45297     0                                                    Stress Period:0765
1         112        118        41628.34
1         113        118        41628.34
1         113        119        41628.34
1         113        120        41628.34
1         114        120        41628.34
1         114        121        41628.34
1         114        122        41628.34
1         114        123        41628.34
1         114        124        41628.34
1         115        124        41628.34
1         116        124        41628.34
1         117        124        41628.34
1         117        125        41628.34
1         117        126        41628.34
1         114        106        68826.46
1         114        107        68826.46
1         114        108        68826.46
1         114        109        68826.46
1         114        110        68826.46
1         115        110        68826.46
1         115        111        68826.46
```

Creating a Well File Specific to the NRD



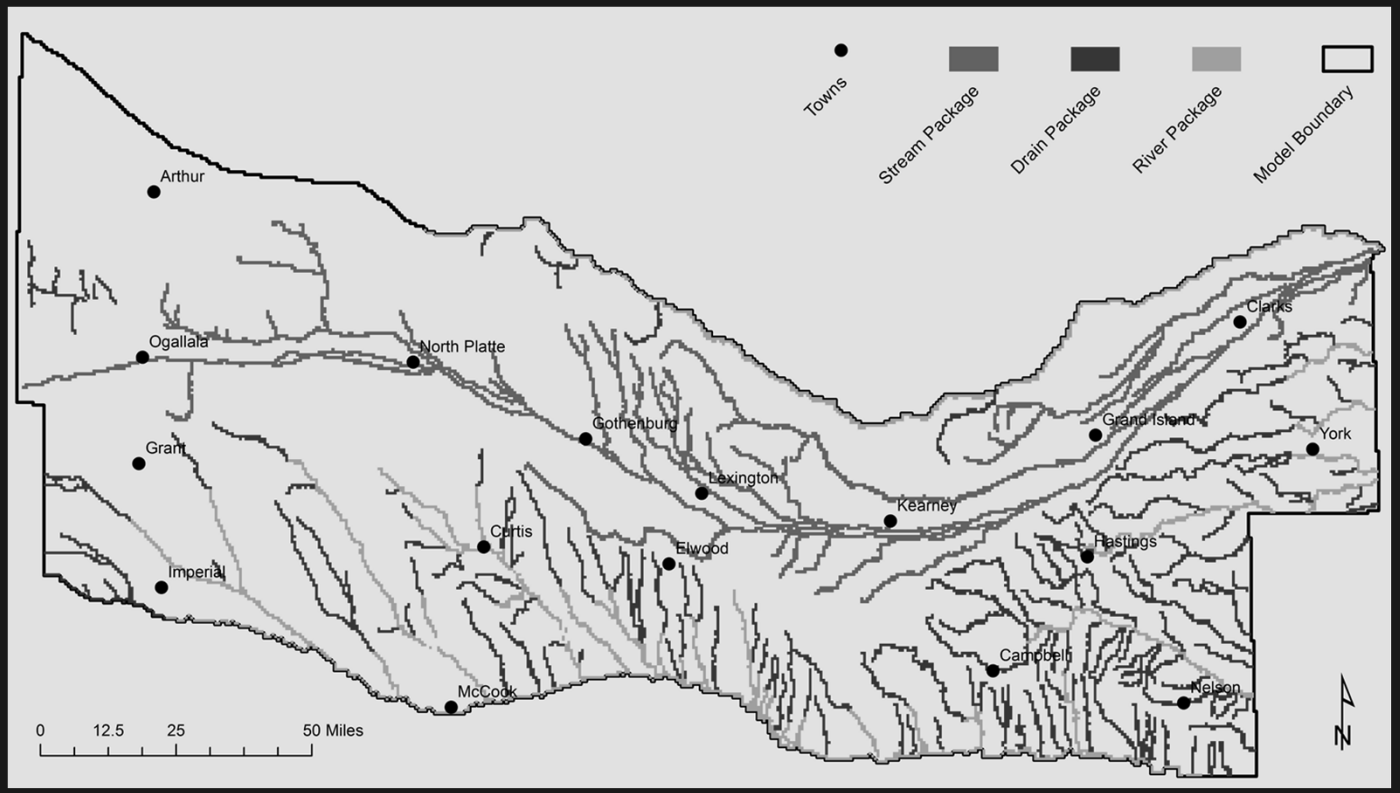
Run groundwater model

mf2005

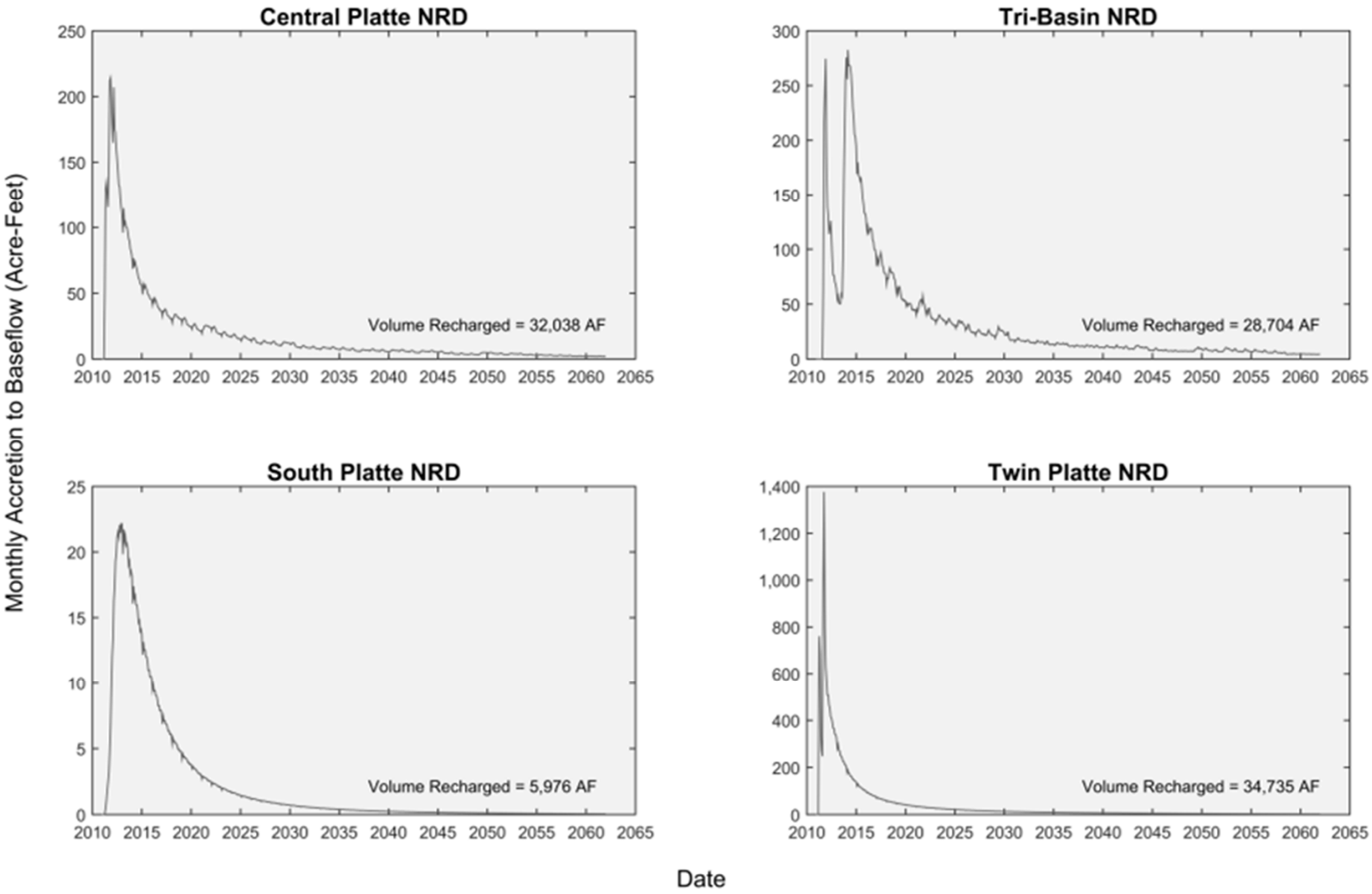
```
Z:\Users\Colby\Models\COHYST2001_24b_13_25>mf2005

                                  MODFLOW-2005
    U.S. GEOLOGICAL SURVEY MODULAR FINITE-DIFFERENCE GROUND-WATER FLOW MODEL
                             Version 1.11.00 8/8/2013

  Enter the name of the NAME FILE:
COHYST2010_24b_13_25
 Using NAME file: COHYST2010_24b_13_25.nam
 Run start date and time (yyyy/mm/dd hh:mm:ss): 2015/09/10 14:32:52

 Solving:  Stress period:     1    Time step:     1    Ground-Water Flow Eqn.
 Solving:  Stress period:     1    Time step:     2    Ground-Water Flow Eqn.
 Solving:  Stress period:     2    Time step:     1    Ground-Water Flow Eqn.
 Solving:  Stress period:     2    Time step:     2    Ground-Water Flow Eqn.
 Solving:  Stress period:     3    Time step:     1    Ground-Water Flow Eqn.
 Solving:  Stress period:     3    Time step:     2    Ground-Water Flow Eqn.
 Solving:  Stress period:     4    Time step:     1    Ground-Water Flow Eqn.
 Solving:  Stress period:     4    Time step:     2    Ground-Water Flow Eqn.
 Solving:  Stress period:     5    Time step:     1    Ground-Water Flow Eqn.
 Solving:  Stress period:     5    Time step:     2    Ground-Water Flow Eqn.
 Solving:  Stress period:     6    Time step:     1    Ground-Water Flow Eqn.
 Solving:  Stress period:     6    Time step:     2    Ground-Water Flow Eqn.
 Solving:  Stress period:     7    Time step:     1    Ground-Water Flow Eqn.
 Solving:  Stress period:     7    Time step:     2    Ground-Water Flow Eqn.
 Solving:  Stress period:     8    Time step:     1    Ground-Water Flow Eqn.
 Solving:  Stress period:     8    Time step:     2    Ground-Water Flow Eqn.
 Solving:  Stress period:     9    Time step:     1    Ground-Water Flow Eqn.
```

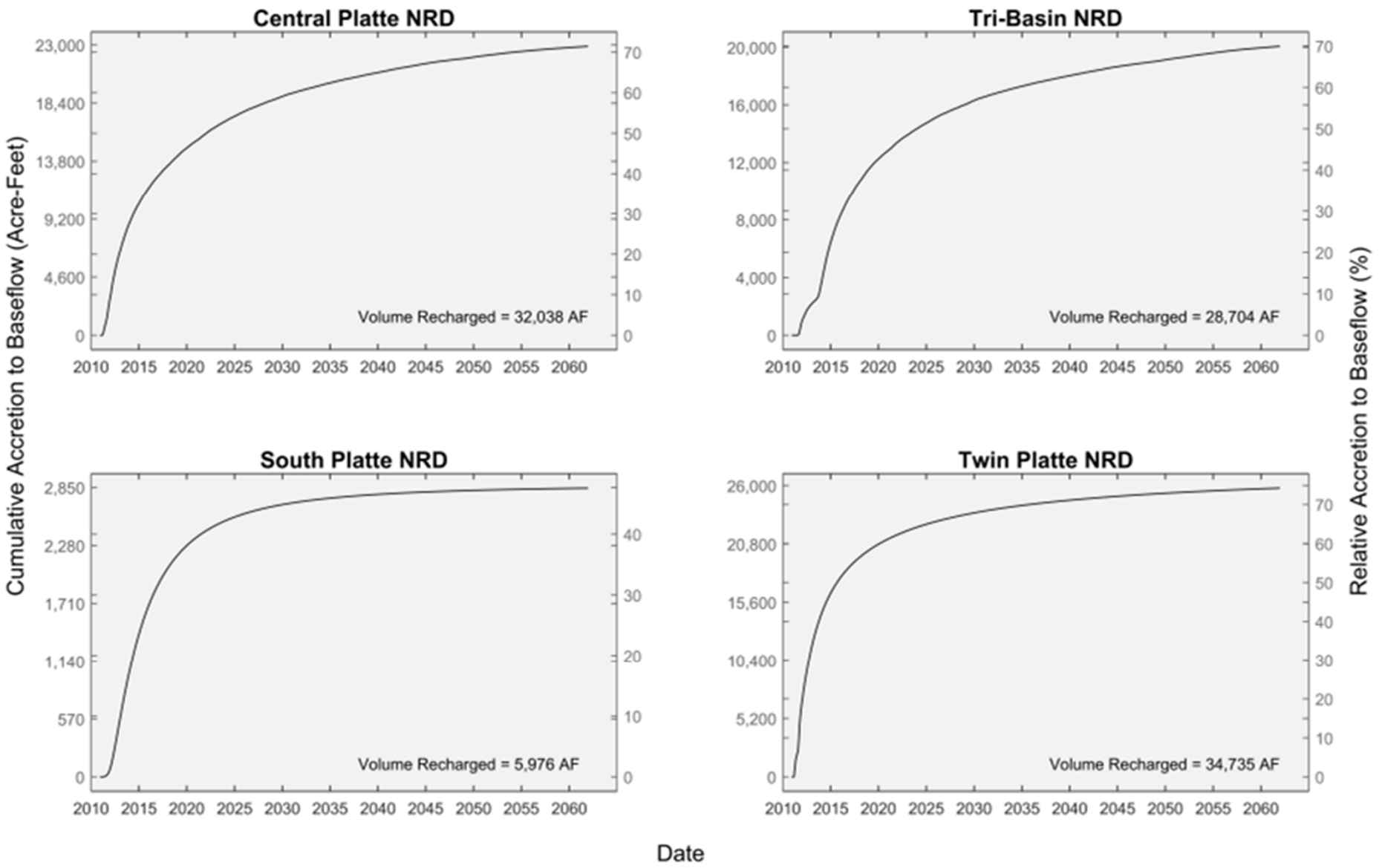
Post Process Cell-by-Cell Flow Data

Platte River and it's tributaries = All stream cells



Accretion to Baseflow = Baseline Baseflow - Stress Baseflow


Central Platte NRD
Volume Recharged = 32,038 AF
Tri-Basin NRD
Volume Recharged = 28,704 AF
South Platte NRD
Volume Recharged = 5,976 AF
Twin Platte NRD
Volume Recharged = 34,735 AF
Monthly Accretion to Baseflow (Acre-Feet)
Date


Central Platte NRD
Volume Recharged = 32,038 AF
Tri-Basin NRD
Volume Recharged = 28,704 AF
South Platte NRD
Volume Recharged = 5,976 AF
Twin Platte NRD
Volume Recharged = 34,735 AF
Cumulative Accretion to Baseflow (Acre-Feet)
Relative Accretion to Baseflow (%)
Date
2010 2015 2020 2025 2030 2035 2040 2045 2050 2055 2060

Summary

- Understand when the recharged water may return to the Platte River
- Understand how much of the recharged water will return to the Platte River
- Enabling managers to have a better idea of how the NRDs efforts have applied towards achieving their management goals.

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Providing the sound science and support for managing
Nebraska's most precious resource.

Thank You

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