# Appendix E

## Supporting Information for Ground Water Modeling

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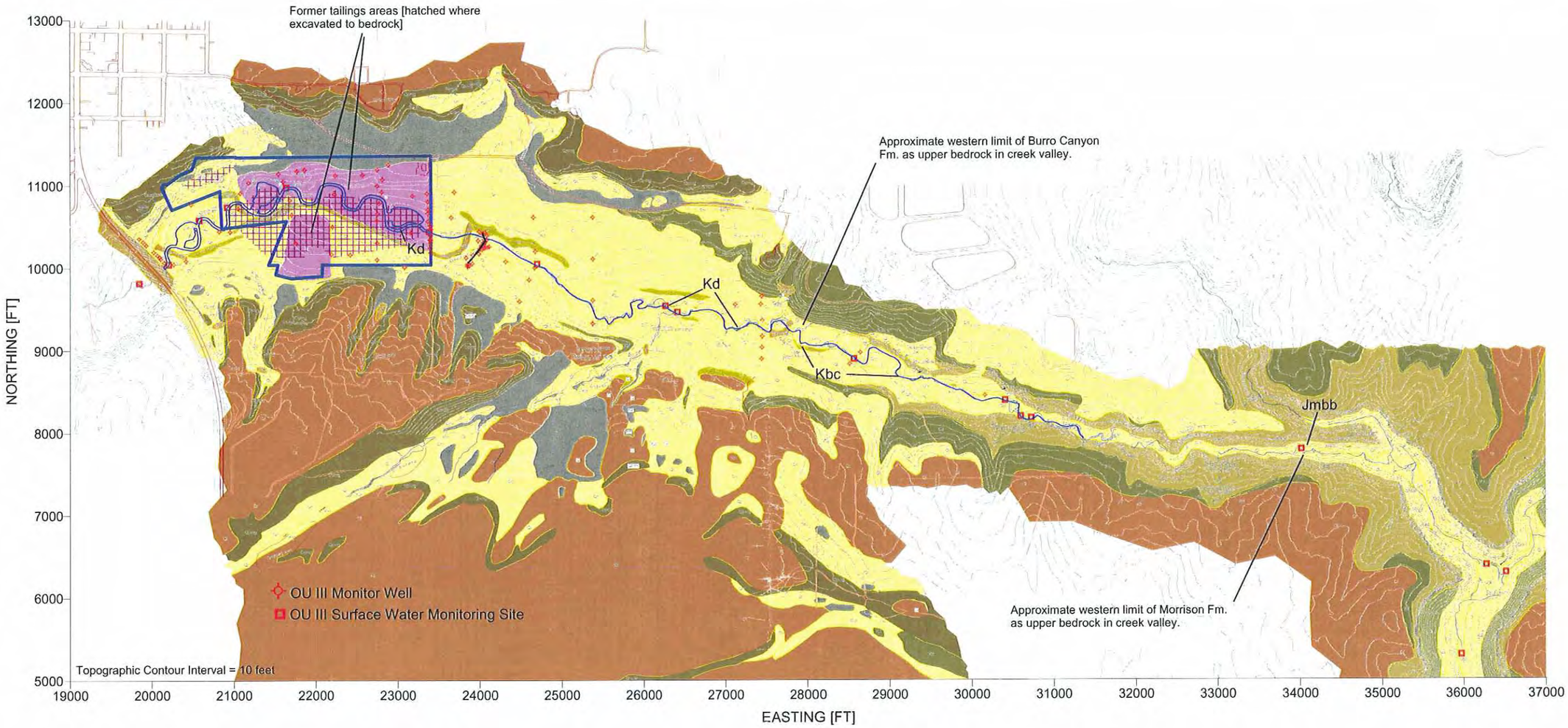


EXPLANATION

| | | |
|---|---|---|
| | T | TAILINGS |
| | Fill | FILL |
| QUATERNARY | Qal | ALLUVIUM along or near present stream course |
| | Qg | GRAVEL along or near present stream course |
| | Qc | COLLUVIUM, slope cover |
| | Ql | LOESS |
| | Qt | TERRACE GRAVEL above level of present streams |
| | Qpmg | PEDIMENT MANTLING GRAVEL/SAND fans mantling upland areas |
| CRETACEOUS | Km | MANCOS SHALE |
| | Kd | DAKOTA SANDSTONE |
| | Kbc | BURRO CANYON FORMATION |
| JURASSIC | Jmbb | BRUSHY BASIN MEMBER OF THE MORRISON FORMATION |

Note:
[1] The geologic map was developed prior to remedial actions at the site. Remedial actions affected the distribution of tailings, areas of fill on and immediately east of the Millsite, and other miscellaneous pre-remediation features of the ground surface on the Millsite.

[2] The creek alignment and ground surface topography represent conditions after site remediation.

End of current text

# Section E2.0

## Stream Flow Measurements

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FLOW GPM

| | Feb-99 | Apr-99 | Aug-99 | Oct-99 | Jan-00 | Apr-00 | Jun-00 | Jul-00 | Aug-00 | Oct-00 | Mar-00 | Mar-00 | Apr-00 | Jul-01 | Oct-01 | Mar-02 | Apr-02 | Aug-02 | Oct-02 | Dec-02 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SW00-01 | flowing | 170 | 160 | 110 | 100 | 197 | 145 | 26 | 7 | 32 | 20 | 25 | 30 | 25 | 0 | 43 | 0 | 0 | 0 | 0 |
| CARB POND IN | 130 | 150 | 130 | 100 | 115 | | | | | | | | | | | | | | | |
| crk abv pond | not constructed | 143 | 135 | 120 | 90 | | | | | | | | | | | | | | | |
| WEST POND IN | ND | 10 | FLOWING | 6 | flowing | flowing | | | | | 12 | | | | | | | | | |
| west pond out | nd | 0 | 0 | 0 | 0 | | | | | | | | | | | | | | | |
| pumping from carb pond | approx 80 gpm | zero | 0 | 0 | na | | | | | | | | | | | | | | | |
| creek abv V pond | | | | | | 170 | 146 | | 2 | | | | | | | | | | | |
| V pond out | | | | | | 120 | 105 | | | | | | | | | | | | | |
| Net trench Capture | 130 | 113 | 105 | 104 | 105 | 93 | 105 | | 76 | | | | | | | | | | | |
| | | | PLUS 6-10gpm WEST POND | | PLUS 6-10gpm WEST POND | PLUS 6-10gpm WEST POND | PLUS 6-10gpm WEST POND | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| sw01-02 wl1 out | | | | | | | | | | | 80 | | | 152 | | | | | 0 | 1 |
| sw01-03 wl2 out | | | | | | | | | | | | 233 | | 199 | | 107 | | | 0 | 30 |
| SW00-02 | | | | | | 335 | 239 | 157 | | 111 | 165 | 272 | 205 | 231 | 71 | 159 | 192 | 30-40 | 7-10 | 13-30 |
| NET MS CAPTURE | | | | | | 138 | 94 | 131 | | 79 | 133 | 247 | 175 | 206 | 71 | 116 | 192 | 30-40 | 7-10 | 30 |
| | | | | | | | | | | | | | | | | | | | | |
| prb culvert | | | | | | | 224 | | | | 205 | 296 | | 17 | | 158 | 105 | trace | | |
| W4 | ND | ND | 265 | | | | | | | | | | | | | | | | | |
| sw01-01 | | | | | | | | | | | | | | 222 | 65 | | 101 | 0 | 0 | flowing |
| SW92-06 | | | 360 | | | 262 | | 108 | | | | | | | | 107 | 38 | 0 | 0 | dry |
| SORENSON | ND | 468 | 300 | | | 322 | | | | 194 | | | | 298 | 159 | 173 | 121 | 24 | 20 | flowing |
| sor/95-01 | | | | | | | | | | | | | | 282 | 121 | | | 32 | | |
| SW92-07 | ND | 350 | | 203 | | | | | | | | | | | | | | | | |
| SW99-04/BFR | ND | 410 | 1250 | 180 | | 428 | | 119 | | 170 | | | | | 166 | 186 | 178 | 59 | 45 | 42 |
| SW92-08 | ND | 454 | | 426 | | 382 | | | | 207 | | | | 222 | 164 | | 189 | 23 | 12 | 56-93 |
| 300 ft abv cabin | | | | | | | | | | | | | | | 128 | | 233 | | 0 | 65 |
| 300ft below cabin | | | | | | | | | | | | | | 241 | 207 | | | | 0 | 65 |
| SW92-09 | ND | 483 | | 378 | | | | | | 166 | | | | | | | | | 0 | |
| SW94-01 | ND | 515 | | 333 | | 951 | | | | 198 | | | | 160 | 199 | | 183 | | 0 | |
| | creek diverted | WWTP DIS TO CRK | RAINY | major bedrk ex on millsite | | gw capture at V pond | north ghb not cap | | | vega dry | | | | vega dry | vega dry | | sw92-06=at Kd | | | |
| | | creek diverted MS TO W4 | NO WWTP AT SITE CITY DUMPING LAGOONS? | | | sw92-06=sw00-03 | | | | | | | | | | | vega dry | | vega dry | |
| | | | | | | sw00-04=bfr | | | | | | | | | | | | | | |
| | | | | | | vega flowing sams as MC | | | | | | | | | | | | | | |
| RI flow data 3/93 to 7/96 | | | | | | | canyon gain = alluvial | | | 70-100 | | | | 80-90 | 100 | 70-80 | 80 | 20-60 | 20-45 | 40-90 |
| Status reports w/stream flow to 2001 | | | | | | discharge plus Burro discharge | | | | | | | | | | | | | | |
| Millsite wells abandoned 10/96 | | | | | | | | | | | | | | | | | | | | |
| Tailings dig start summer 1997 end fall 1999 | | | | | prb to elk approx 20-30 gpm creek loss during wet years | | | | | | | | | | | | | | | |
| summer 97 last of normal creek flow | | | | | | | | | | | | | | | | | | | | |
| JAN 98 LAST UNALTERED MS FLOWS? | | | | | | | | | | | | | | | | | | | | |
| TRENCH CUT MAR 98 | | | | | | | | | | | | | | | | | | | | |
| WWTP START APR 98 | | | | | | | | | | | | | | | | | | | | |
| WWTP STOP MAY 99 | | | | | | | | | | | | | | | | | | | | |
| Trench inflow /millsite water balance msmts start 2/99 end aug 2000 | | | | | | | | | | | | | | | | | | | | |
| Restor start w delhur 8/00 | | | | | | | | | | | | | | | | | | | | |
| Final creek and wetlands june 2001. | | | | | | | | | | | | | | | | | | | | |

End of current text

# Section E3.0

## Estimates of Ground Water Flow

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Monticello OU III ground water flow calculations

(1) Estimate ground water flow in alluvial aquifer at the west boundary of the former Millsite

Darcy's Law calculation
Q=KiA= volumetric flow rate
K=hydraulic conductivity
*i=hydraulic gradient*
A=cross-sectional area of aquifer perpendicular to flow

| K | cm/sec | ft/day | test type | data source |
|---|---|---|---|---|
| K1 | 1.50E-02 | 42.5 | pumping test | MSG OU III RI September 1998 |
| K2 | 5.20E-05 | 0.1 | slug test min | MSG OU III RI September 1998 |
| K3 | 1.70E-03 | 4.8 | slug test mean | MSG OU III RI September 1998 |
| K4 | 1.50E-01 | 425.2 | slug test max | MSG OU III RI September 1998 |

A
aquifer width at west boundary of Millsite = W = 500 ft
saturated thickness at west boundary of Millsite = h = 3 ft
A=W*h= 1500 $ft^2$

i
hydraulic gradient west to east on Millsite = 0.021 ft/ft

| | | |
|---|---|---|
| Oct-01 | west | 6873 gw elev ft |
| Oct-01 | east | 6797.5 gw elev ft |
| west to east distance | | 3600 ft |

| | $ft^3$/day | gal/min | assume |
|---|---|---|---|
| Q1 | 1338 | 7.0 | K1 |
| Q2 | 5 | 0.02 | K2 |
| Q3 | 152 | 0.8 | K3 |
| Q4 | 13376 | 69.7 | K4 |

Monticello OU III ground water flow calculations

(2) Estimate ground water discharge from the Burro Canyon aquifer in the canyon reach of Montezuma Creek

Darcy's Law calculation

Q=KIA= volumetric flow rate

K=vertical hydraulic conductivity

i=vertical hydraulic gradient

A=area of canyon floor underlain by Burro Canyon Fm.

| K | cm/sec | ft/day | |
|---|---|---|---|
| K1 | 1.50E-04 | 0.4 mean | |
| K2 | 7.10E-04 | 2.0 max | |
| K3 | 8.10E-10 | 2.3E-06 min | [anomalous] |

source: MSG OU III RI September 1998, lab permeater tests, n=8

A

total discharge area=area of canyon floor underlain by Burro Canyon Fm.

| | |
|---|---|
| l = | 6000 ft |
| w = | 100 ft |
| l x w = A = | 600000 $ft^2$ |

i

vertical hydraulic gradient between Burro Canyon aquifer and alluvial aquifer at wells 95-01/02 and 95-03/04

| well pair | del h= head difference | del z = vertical distance between midpoints of well screens | | |
|---|---|---|---|---|
| 95-01/02 | 4 ft | 24.5 | i1= | 0.163265 ft/ft |
| 95-03/04 | 0.5 ft | 29.7 | i2= | 0.016835 ft/ft |

| | $ft^3$/day | gal/min | ft^3/sec | assume |
|---|---|---|---|---|
| Q1 | 41652 | 217 | 0.48 | K1, i1 |
| Q2 | 4295 | 22 | 0.05 | K1, i2 |
| Q3 | 197152 | 1027 | 2.28 | K2, i1 |
| Q4 | 20329 | 106 | 0.24 | K2, i2 |
| Q5 | 2.E-01 | 1.E-03 | 3.E-06 | K3, i1 |
| Q6 | 2.E-02 | 1.E-04 | 3.E-07 | K3, i2 |

Summary

If creek flow at the head of the canyon is zero, then the predicted increase by Burro Canyon aquifer at Q1 and Q2 is measureable

If creek flow at the head of the canyon is approximately > 0.5 and < 2 cubic ft per second, then the increase by Burro Canyon discharge is not measurable at Q1 but is measurable at Q2.

If creek flow at the head of the canyon is approximately > 2 cubic ft per second, then the increase by Burro Canyon discharge is not measurable by open channel flow method at Q1 and Q2.

# Section E4.0

## MODFLOW Flow Budget Analysis for OU III Model Subregions

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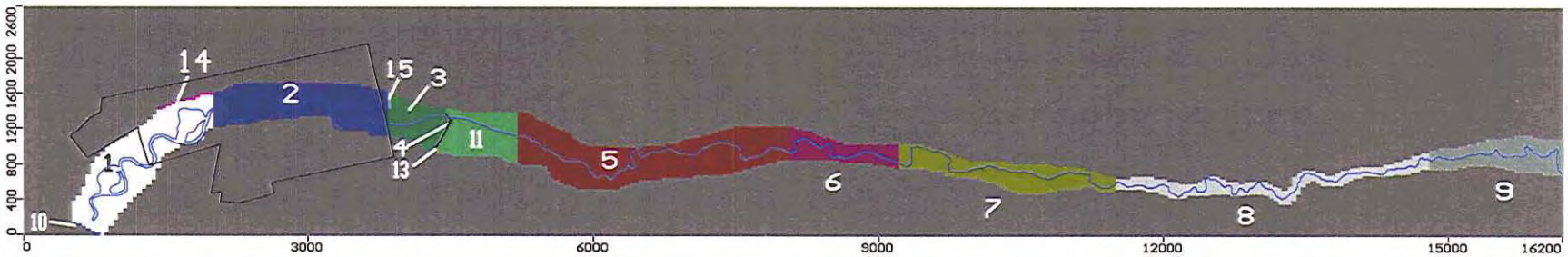


*Water Budget Subregions of OU III Model*

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Water Budget Sub-regions for OU III Flow Model

| Zone | Description |
|---|---|
| 1 | West half of Millsite excluding west underflow boundary (Zone 10, constant head boundary) and north inflow boundary (Zone 14, general head boundary) in Zone 1. |
| 2 | East half of Millsite. |
| 3 | Millsite to PRB excluding Zone 15. |
| 4 | PRB through-flow. |
| 5 | Surface water site SW01-01 to well 92-09. |
| 6 | Well 92-09 to surface water site Sorenson and well 95-03. Canyon reach and Burro Canyon Fm. as upper bedrock starts at about well 92-09. |
| 7 | Well 95-03/Sorenson site to surface water sites SW99-04, SW00-04, and the sediment pond. |
| 8 | Sediment pond to surface water site SW92-08. Upper bedrock changes from Burro Canyon to Morrison Fm. near SW92-08. |
| 9 | SW92-08 to eastern extent of model domain. |
| 10 | Constant head boundary at west end of model domain, controls alluvial aquifer underflow from the west to the Millsite. |
| 11 | PRB to surface water site SW01-01. |
| 12 | undefined |
| 13 | South slurry wall bypass zone. |
| 14 | General head boundary along part of the north edge of the west half of the Millsite. |
| 15 | Underflow at the east end of the Millsite north of Wetland 3. |

```
 ZONBUDEM version 3.0
 ZONEBUDGET version 1.00
 Program to compute a flow budget for subregions of a model using
 cell-by-cell flow data from the USGS Modular Ground-Water Flow Model.

 The cell-by-cell budget file is:
 work.BGT

   1 layers        104 rows        495 columns

 Zone Budget - BATCH

 The zone file is:
 work.ZBI

 Zone Array for layer  1 will be read from the Zone File
 Zone Array for layer  1 will be read using format:  (40I3)
 ----------------------------------------------------------------------
          15 is your highest zone.
1Zone Budget - BATCH
```

```
Flow Budget for Zone  1 at Time Step  1 of Stress Period  1
-------------------------------------------------------------

                    Budget Term     Flow (L**3/T)
                    ----------------------------

          IN:
          ---
                  CONSTANT HEAD =    3561.2
                         DRAINS =   0.00000E+00
                HEAD DEP BOUNDS =    5164.0
                       RECHARGE =    186.72
                  Zone  2 to  1 =   0.00000E+00
                  Zone 10 to  1 =    2643.2
                  Zone 14 to  1 =    6423.9

                       Total IN =    17979.

          OUT:
          ----
                  CONSTANT HEAD =    12417.
                         DRAINS =    2012.4
                HEAD DEP BOUNDS =   0.00000E+00
                       RECHARGE =   0.00000E+00
                  Zone  1 to  2 =    3550.0
                  Zone  1 to 10 =   0.00000E+00
                  Zone  1 to 14 =   0.00000E+00

                      Total OUT =    17979.

                       IN - OUT =   0.66326E-01

            Percent Discrepancy =                0.00
1Zone Budget - BATCH
```

```
Flow Budget for Zone  2 at Time Step  1 of Stress Period  1
-------------------------------------------------------------

                    Budget Term     Flow (L**3/T)
                    ----------------------------

          IN:
          ---
                  CONSTANT HEAD =    1591.2
                         DRAINS =   0.00000E+00
                HEAD DEP BOUNDS =    6135.4
                       RECHARGE =    83.708
                  Zone  1 to  2 =    3550.0
                  Zone  3 to  2 =   0.00000E+00
                  Zone 14 to  2 =    69.478
                  Zone 15 to  2 =   0.00000E+00

                       Total IN =    11430.

          OUT:
          ----
                  CONSTANT HEAD =    2138.4
                         DRAINS =    7274.6
                HEAD DEP BOUNDS =    4.0713
                       RECHARGE =   0.00000E+00
                  Zone  2 to  1 =   0.00000E+00
                  Zone  2 to  3 =    1566.0
                  Zone  2 to 14 =   0.00000E+00
                  Zone  2 to 15 =    442.88

                      Total OUT =    11426.

                       IN - OUT =    3.9487

            Percent Discrepancy =                0.03
1Zone Budget - BATCH
```

```
Flow Budget for Zone  3 at Time Step  1 of Stress Period  1
-----------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                 CONSTANT HEAD =   0.00000E+00
                        DRAINS =   0.00000E+00
               HEAD DEP BOUNDS =   0.00000E+00
                      RECHARGE =    95.731
                 Zone  2 to  3 =    1566.0
                 Zone  4 to  3 =   0.00000E+00
                 Zone 11 to  3 =   0.00000E+00
                 Zone 13 to  3 =   0.00000E+00
                 Zone 15 to  3 =    444.37

                      Total IN =    2106.1

          OUT:
          ----
                 CONSTANT HEAD =   0.00000E+00
                        DRAINS =   0.00000E+00
               HEAD DEP BOUNDS =   0.00000E+00
                      RECHARGE =   0.00000E+00
                 Zone  3 to  2 =   0.00000E+00
                 Zone  3 to  4 =    1202.1
                 Zone  3 to 11 =    293.66
                 Zone  3 to 13 =    611.05
                 Zone  3 to 15 =   0.00000E+00

                     Total OUT =    2106.8

                      IN - OUT =  -0.73001

            Percent Discrepancy =                -0.03
1Zone Budget - BATCH
```

```
Flow Budget for Zone  4 at Time Step  1 of Stress Period  1
-----------------------------------------------------------

                    Budget Term     Flow (L**3/T)
                    ----------------------------

          IN:
          ---
                  CONSTANT HEAD =   0.00000E+00
                         DRAINS =   0.00000E+00
               HEAD DEP BOUNDS =   0.00000E+00
                       RECHARGE =   0.42810
                 Zone  3 to  4 =    1202.1
                 Zone 11 to  4 =   0.00000E+00

                      Total IN =    1202.5

          OUT:
          ----
                  CONSTANT HEAD =   0.00000E+00
                         DRAINS =   0.00000E+00
               HEAD DEP BOUNDS =   0.00000E+00
                       RECHARGE =   0.00000E+00
                 Zone  4 to  3 =   0.00000E+00
                 Zone  4 to 11 =    1199.7

                     Total OUT =    1199.7

                      IN - OUT =    2.7980

            Percent Discrepancy =                0.23
1Zone Budget - BATCH
```

```
Flow Budget for Zone  5 at Time Step  1 of Stress Period  1
-----------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                 CONSTANT HEAD =   0.00000E+00
                        DRAINS =   0.00000E+00
               HEAD DEP BOUNDS =   0.00000E+00
                      RECHARGE =    474.11
                 Zone  6 to  5 =   0.00000E+00
                 Zone 11 to  5 =    2234.6

                      Total IN =    2708.7

          OUT:
          ----
                 CONSTANT HEAD =   0.00000E+00
                        DRAINS =    249.39
               HEAD DEP BOUNDS =   0.00000E+00
                      RECHARGE =   0.00000E+00
                 Zone  5 to  6 =    2461.2
                 Zone  5 to 11 =   0.00000E+00

                     Total OUT =    2710.6

                      IN - OUT =   -1.8924

            Percent Discrepancy =                -0.07
1Zone Budget - BATCH
```

```
Flow Budget for Zone  6 at Time Step  1 of Stress Period  1
-----------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                 CONSTANT HEAD =   0.00000E+00
                        DRAINS =   0.00000E+00
               HEAD DEP BOUNDS =   0.00000E+00
                      RECHARGE =    753.22
                 Zone  5 to  6 =    2461.2
                 Zone  7 to  6 =   0.00000E+00

                      Total IN =    3214.4

          OUT:
          ----
                 CONSTANT HEAD =   0.00000E+00
                        DRAINS =    2187.3
               HEAD DEP BOUNDS =   0.00000E+00
                      RECHARGE =   0.00000E+00
                 Zone  6 to  5 =   0.00000E+00
                 Zone  6 to  7 =    1027.2

                     Total OUT =    3214.6

                      IN - OUT =  -0.16593

            Percent Discrepancy =                -0.01
1Zone Budget - BATCH
```

```
Flow Budget for Zone  7 at Time Step  1 of Stress Period  1
-----------------------------------------------------------

                    Budget Term     Flow (L**3/T)
                    ----------------------------

          IN:
          ---
                  CONSTANT HEAD =   0.00000E+00
                         DRAINS =   0.00000E+00
                HEAD DEP BOUNDS =   0.00000E+00
                       RECHARGE =    2131.8
                  Zone  6 to  7 =    1027.2
                  Zone  8 to  7 =   0.00000E+00

                       Total IN =    3159.1

          OUT:
          ----
                  CONSTANT HEAD =   0.00000E+00
                         DRAINS =    1851.2
                HEAD DEP BOUNDS =   0.00000E+00
                       RECHARGE =   0.00000E+00
                  Zone  7 to  6 =   0.00000E+00
                  Zone  7 to  8 =    1310.4

                      Total OUT =    3161.5

                       IN - OUT =   -2.4580

            Percent Discrepancy =                -0.08
1Zone Budget - BATCH
```

```
Flow Budget for Zone  8 at Time Step  1 of Stress Period  1
-----------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                  CONSTANT HEAD =   0.00000E+00
                         DRAINS =   0.00000E+00
                HEAD DEP BOUNDS =   0.00000E+00
                       RECHARGE =    1878.3
                  Zone  7 to  8 =    1310.4
                  Zone  9 to  8 =   0.00000E+00

                       Total IN =    3188.6

          OUT:
          ----
                  CONSTANT HEAD =   0.00000E+00
                         DRAINS =    2151.2
                HEAD DEP BOUNDS =   0.00000E+00
                       RECHARGE =   0.00000E+00
                  Zone  8 to  7 =   0.00000E+00
                  Zone  8 to  9 =    1043.5

                      Total OUT =    3194.8

                       IN - OUT =   -6.1363

            Percent Discrepancy =                -0.19
1Zone Budget - BATCH
```

```
Flow Budget for Zone  9 at Time Step  1 of Stress Period  1
-----------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                  CONSTANT HEAD =   0.00000E+00
                         DRAINS =   0.00000E+00
                HEAD DEP BOUNDS =   0.00000E+00
                       RECHARGE =    224.93
                  Zone  8 to  9 =    1043.5

                       Total IN =    1268.5

          OUT:
          ----
                  CONSTANT HEAD =   0.00000E+00
                         DRAINS =    1265.5
                HEAD DEP BOUNDS =   0.00000E+00
                       RECHARGE =   0.00000E+00
                  Zone  9 to  8 =   0.00000E+00

                      Total OUT =    1265.5

                       IN - OUT =    2.9241

            Percent Discrepancy =                0.23
1Zone Budget - BATCH
```

```
Flow Budget for Zone 10 at Time Step  1 of Stress Period  1
-----------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                  CONSTANT HEAD =    2643.2
                         DRAINS =   0.00000E+00
                HEAD DEP BOUNDS =   0.00000E+00
                       RECHARGE =   0.00000E+00
                  Zone  1 to 10 =   0.00000E+00

                       Total IN =    2643.2

          OUT:
          ----
                  CONSTANT HEAD =   0.00000E+00
                         DRAINS =   0.00000E+00
                HEAD DEP BOUNDS =   0.00000E+00
                       RECHARGE =   0.00000E+00
                  Zone 10 to  1 =    2643.2

                      Total OUT =    2643.2

                       IN - OUT =   0.00000E+00

            Percent Discrepancy =                0.00
1Zone Budget - BATCH
```

```
Flow Budget for Zone 11 at Time Step  1 of Stress Period  1
-----------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                 CONSTANT HEAD =   0.00000E+00
                        DRAINS =   0.00000E+00
               HEAD DEP BOUNDS =   0.00000E+00
                      RECHARGE =    138.08
                 Zone  3 to 11 =    293.66
                 Zone  4 to 11 =    1199.7
                 Zone  5 to 11 =   0.00000E+00
                 Zone 13 to 11 =    611.67

                      Total IN =    2243.2

          OUT:
          ----
                 CONSTANT HEAD =   0.00000E+00
                        DRAINS =    9.7025
               HEAD DEP BOUNDS =   0.00000E+00
                      RECHARGE =   0.00000E+00
                 Zone 11 to  3 =   0.00000E+00
                 Zone 11 to  4 =   0.00000E+00
                 Zone 11 to  5 =    2234.6
                 Zone 11 to 13 =   0.00000E+00

                     Total OUT =    2244.3

                      IN - OUT =   -1.1296

            Percent Discrepancy =                -0.05
1Zone Budget - BATCH
```

```
Flow Budget for Zone 13 at Time Step  1 of Stress Period  1
------------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                 CONSTANT HEAD =   0.00000E+00
                        DRAINS =   0.00000E+00
               HEAD DEP BOUNDS =   0.00000E+00
                      RECHARGE =   0.32112
                 Zone  3 to 13 =    611.05
                 Zone 11 to 13 =   0.00000E+00

                      Total IN =    611.37

          OUT:
          ----
                 CONSTANT HEAD =   0.00000E+00
                        DRAINS =   0.00000E+00
               HEAD DEP BOUNDS =   0.00000E+00
                      RECHARGE =   0.00000E+00
                 Zone 13 to  3 =   0.00000E+00
                 Zone 13 to 11 =    611.67

                     Total OUT =    611.67

                      IN - OUT =  -0.30484

            Percent Discrepancy =                -0.05
1Zone Budget - BATCH
```

```
Flow Budget for Zone 14 at Time Step  1 of Stress Period  1
------------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                 CONSTANT HEAD =   0.00000E+00
                        DRAINS =   0.00000E+00
               HEAD DEP BOUNDS =    6491.7
                      RECHARGE =   0.85617
                 Zone  1 to 14 =   0.00000E+00
                 Zone  2 to 14 =   0.00000E+00

                      Total IN =    6492.6

          OUT:
          ----
                 CONSTANT HEAD =   0.00000E+00
                        DRAINS =   0.00000E+00
               HEAD DEP BOUNDS =   0.00000E+00
                      RECHARGE =   0.00000E+00
                 Zone 14 to  1 =    6423.9
                 Zone 14 to  2 =    69.478

                     Total OUT =    6493.3

                      IN - OUT =  -0.77968

            Percent Discrepancy =                -0.01
1Zone Budget - BATCH
```

```
Flow Budget for Zone 15 at Time Step  1 of Stress Period  1
------------------------------------------------------------

                 Budget Term     Flow (L**3/T)
                 ----------------------------

        IN:
        ---
                CONSTANT HEAD =   0.00000E+00
                       DRAINS =   0.00000E+00
              HEAD DEP BOUNDS =   0.00000E+00
                     RECHARGE =    1.4983
                Zone  2 to 15 =    442.88
                Zone  3 to 15 =   0.00000E+00

                     Total IN =    444.38

        OUT:
        ----
                CONSTANT HEAD =   0.00000E+00
                       DRAINS =   0.00000E+00
              HEAD DEP BOUNDS =   0.00000E+00
                     RECHARGE =   0.00000E+00
                Zone 15 to  2 =   0.00000E+00
                Zone 15 to  3 =    444.37

                    Total OUT =    444.37

                     IN - OUT =   0.14267E-01

          Percent Discrepancy =                0.00
```

# Section E5.0

## Burro Canyon Aquifer Ground Water Model

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## Burro Canyon Aquifer Ground Water Model

*Introduction*

Recent drought has increased reliance on ground water from the Burro Canyon aquifer for secondary use in Monticello. Pumping rates for 2002 totaled about 270 gpm from nine municipal wells located within or near city limits. Continued pumping will lower the potentiometric surface of the Burro Canyon aquifer. At present, the potentiometric surface of the Burro Canyon aquifer is approximately 0.5 and 4 ft above the water table of the alluvial aquifer at monitor wells 95–01 and 95–03, respectively, located in the canyon reach of Montezuma Creek. If drawdown greater than those amounts extends into the canyon reach, ground water discharge from the Burro Canyon aquifer in that region may decrease, thereby possibly reducing dilution of the uranium plume and allowing its further migration into the canyon.

This Appendix describes a numerical ground water flow model that was developed using MODFLOW to estimate transient drawdown in the Burro Canyon aquifer resulting from ground water extraction at the Monticello well field. The model is independent of the OU III alluvial aquifer ground water model, and does not address leakage between the alluvial aquifer, Montezuma Creek, and the Burro Canyon aquifer. There is insufficient data to calibrate the Burro Canyon aquifer model.

*Domain and Boundaries of Burro Canyon Aquifer Ground Water Model*

The domain for the Burro Canyon aquifer model measures 78,000 ft east to west and 35,000 ft north to south (Figure A3–5.1). Grid row and column width is 350 ft (grid not shown). The Burro Canyon Fm. is assumed to comprise a single layer that is homogeneous, isotropic, and 100 ft thick. The relative elevations of the top and bottom of the model layer are 100 ft and 0 ft, respectively. The north and south sides of the model are no-flow. A specified head boundary across the west edge of the model (in red at left margin of Figure A3–5.1) is applied to represent recharge to the Burro Canyon aquifer in the Abajo Mountains. The elevation of this boundary is constant at 100 ft.

Discharge from the Burro Canyon aquifer occurs where the formation is fully incised by the north-south canyons of Montezuma Creek and Vega Creek, about 3 miles east of the Millsite. This discharge zone is represented as a specified head boundary (in red near the right margin of Figure A3–5.1), with the head elevation set 5 ft above the bottom of the model layer. Pumping from the municipal wells is represented by a specified head boundary that encompasses the general area of the well field (square region in red near the center of the right half of Figure A3–5.1). The pumping level is assumed to be 25 ft above the model bottom. A single observation point, used to display model output of hydraulic head vs. time, is placed in the model midway between the locations of alluvial aquifer monitor wells 95–02 and 95–04 (checkered green and white symbol labeled "OBS" in Figure A3–5.1). These wells are completed in the Burro Canyon aquifer discharge zone within the upper one-half of the canyon reach of Montezuma Creek, and are the easternmost two red symbols in Figure A3–5.1. Alluvial aquifer monitor wells 95–01 and 95–03, respectively, are paired with these bedrock wells. For geographic reference, Figure 3–5.1 includes all other OU III monitor wells (red symbols), the outline of the former Millsite (fuchsia), Montezuma Creek (blue) within the OU III study area, and local roads (gray). Length units in this and all subsequent figures are feet.

*Hydraulic Properties Assigned to Burro Canyon Aquifer Ground Water Model*

Hydraulic conductivity of the Burro Canyon aquifer is specified to be $7.5 \times 10^{-4}$ cm/sec. This is an average value determined from aquifer pumping tests reported in DOE 1998b. The storage coefficient applied to the model, also from DOE 1998b, is 0.015. This value was determined at monitor well locations where the Burro Canyon aquifer is unconfined. The porosity of the Burro Canyon Fm. is assumed to be 30 percent in the model.

*Simulation of Transient Drawdown in the Burro Canyon Aquifer*

The model was first run to compute hydraulic heads under the assumption of steady state flow without the effects of pumping from the city wells. The predicted steady state potentiometric surface is shown in map and cross-section view in Figures A3–5.1 and A3–5.2, respectively. At observation point OBS, the predicted saturated thickness of the Burro Canyon aquifer at is 40 ft. This is consistent with the estimated thickness of the Burro Canyon aquifer (30 to 40 ft) at those wells, where core sampling indicated a minimum thickness of 20 ft thick.

The predicted steady state hydraulic heads without pumping were then specified as the initial heads for the subsequent simulation of transient flow in response to pumping from the municipal wells. Twelve stress periods were applied to the transient simulation. In the first two stress periods (0 to 0.5 day and 0.5 to 1 day), the specified head of the municipal well field was set at the predicted non-pumping steady state level (60 ft). This represented a very short period of no pumping. In the remaining stress periods (day 2 to 50 yr), the specified head of the well field boundary was set at 25 ft to simulate well pumping. This is the assumed pumping level and corresponds to 35 ft of drawdown in those wells.

*Results of Transient Flow Model*

Figures A3–5.3 through A3–5.8 illustrate the predicted drawdowns in feet, relative to the initial head distribution as shown in Figure A3–5.1, for times of 5, 10, 20, 30, 40, and 50 yr of simulated pumping. Figure A3–5.9 illustrates the predicted drawdown at observation point OBS through the 50 yr transient simulation. The model predicts that 2 ft of drawdown in the Burro Canyon aquifer at the observation point between wells 95–02 and 95–04 will occur within 12 to 15 years of steady pumping. An additional 2 ft of drawdown will result after 10 more years of pumping.

Rates of ground water extraction, predicted as the outflows from the specified head boundary of the municipal well field, decreased from the initial rate of 360 gpm to about 50 gpm at 10 yr, and 35 gpm at 40 yr, as ground water in storage is depleted. Predicted rates of extraction and release from storage are shown in Figure A3–5.10. MODFLOW mass balance and water budget information follow the figures in this Appendix. Units of flow for the water budget terms ($L^3/T$) are cubic feet per day. Flow budget output is included for each stress period. The end of stress periods 1 through 12 are respectively 0.5 day, 1 day, 1 yr, 2 yr, 5 yr, 10 through 50 yr in decade increments, 75 yr and 100 yr. Figure A3–5.11 provides a key for the zones identified in the water budget output file.

In this model, ground water flow in the Burro Canyon aquifer under non-pumping conditions is 26 gpm, with the inflow originating from the specified head boundary on the west side of the model. This rate did not change significantly during the 50 years of simulation and therefore the

boundary condition did not bias predicted drawdown. Similarly, there was no bias introduced by the eastern specified head boundary, i.e, no inflow occurred from this boundary. Assumptions in the model that minimized the estimated drawdown include (1) the specified head representing the pumping level in the production wells was about 20 ft above the maximum available drawdown, and (2) a relatively high value for the storage coefficient (0.015) was used in the model. Actual drawdown may be less than predicted if declining recovery rates lead to discontinuous pumping.

The ground water model for the OU III alluvial aquifer and site characterization data, presented in the main body of this document, identify two processes responsible for preventing migration of the uranium ground water plume beyond its present extent. These are (1) significant discharge of alluvial aquifer ground water to Montezuma Creek in its reach directly upstream of the Burro Canyon aquifer discharge zone, and (2) dilution by ground water discharge from the Burro Canyon aquifer to the alluvial aquifer in the canyon reach, and ultimate discharge to the creek. Eastward advancement of the uranium plume is not the necessary result of eliminating the Burro Canyon discharge zone.

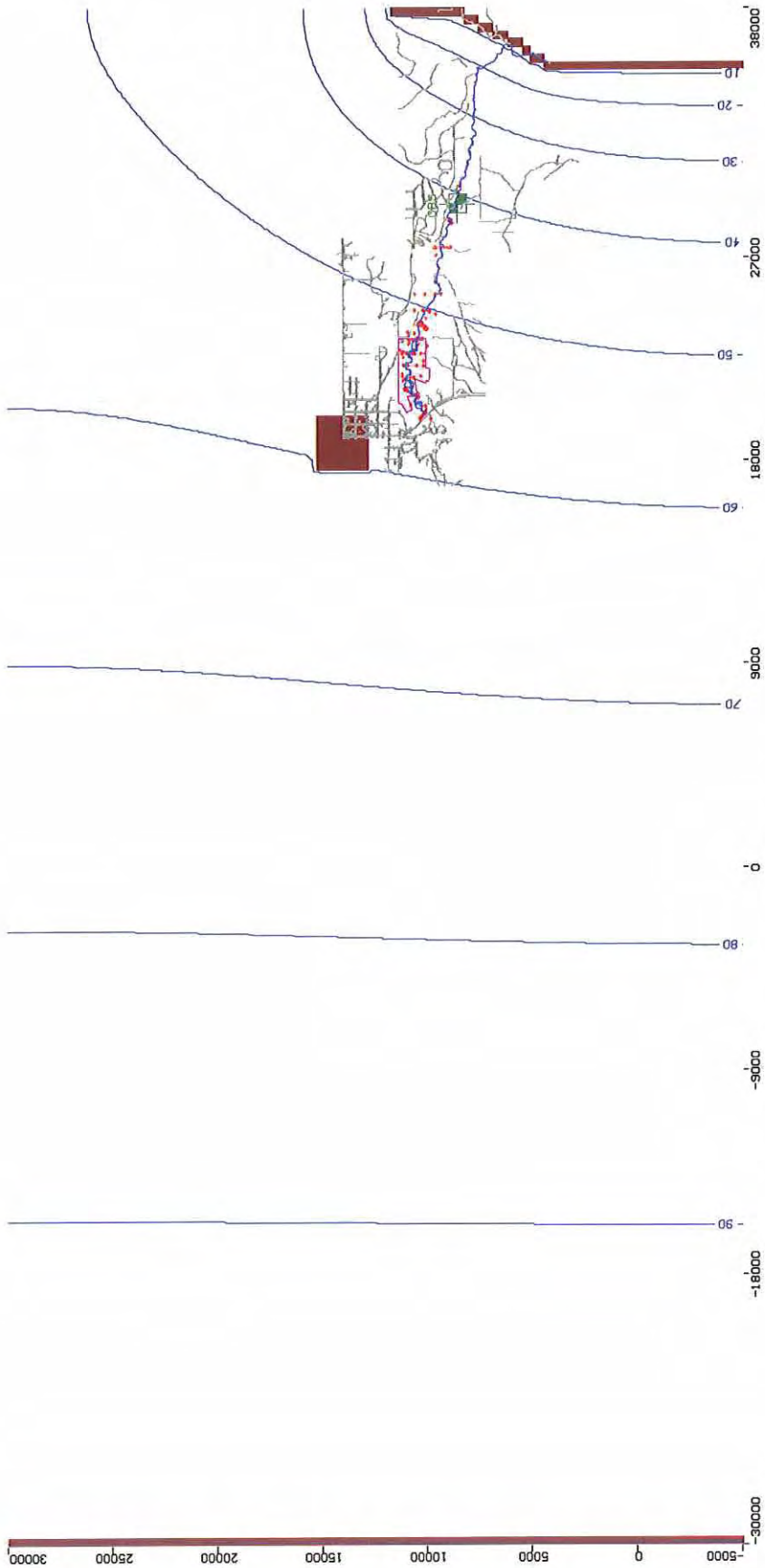


*Figure A3–5.1. Model domain, boundaries and initial steady state hydraulic heads*

*Figure A3–5.2 Cross-section view of initial steady state heads*

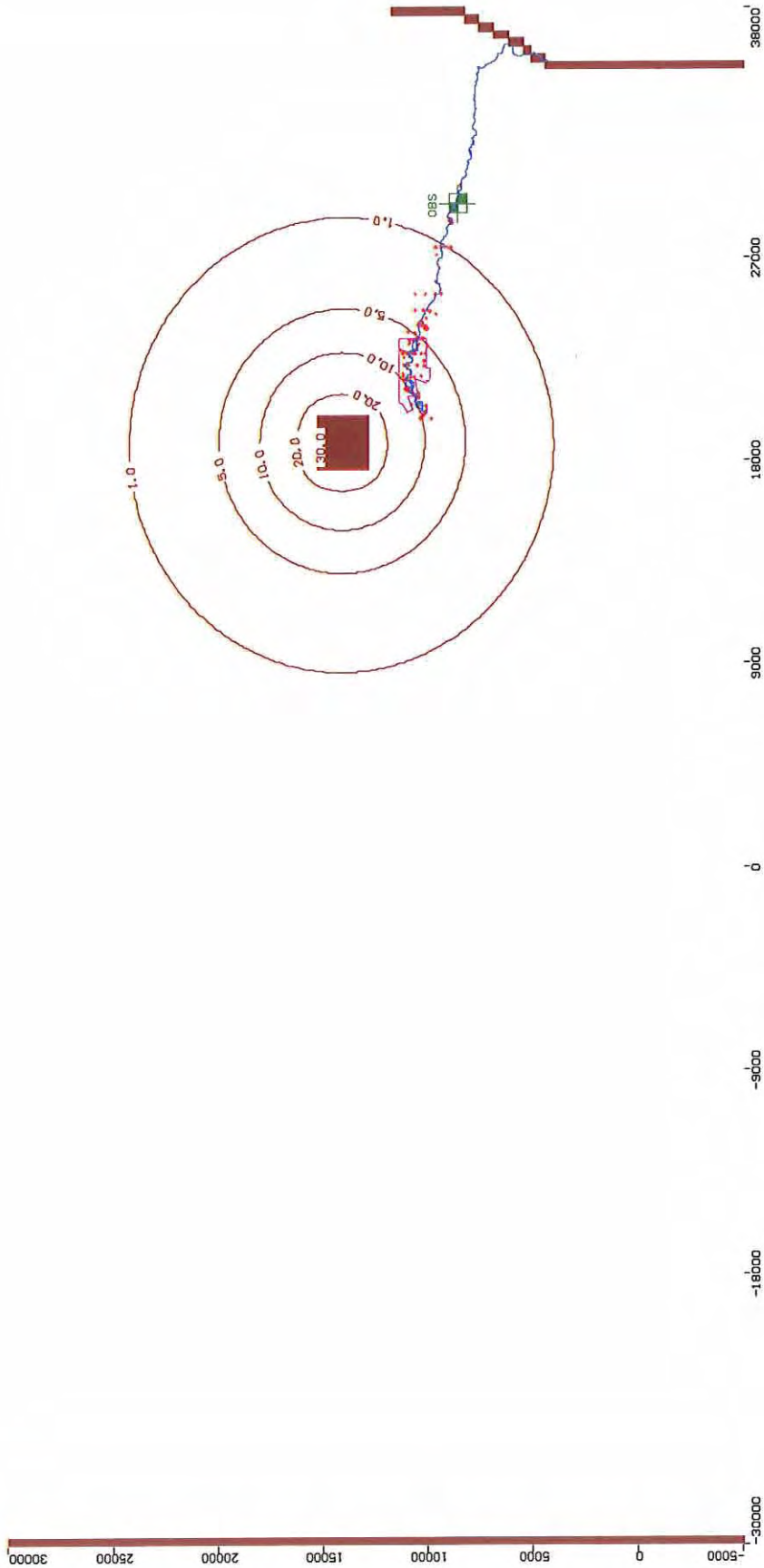


*Figure A3–5.3 Predicted heads after 5 years of pumping*

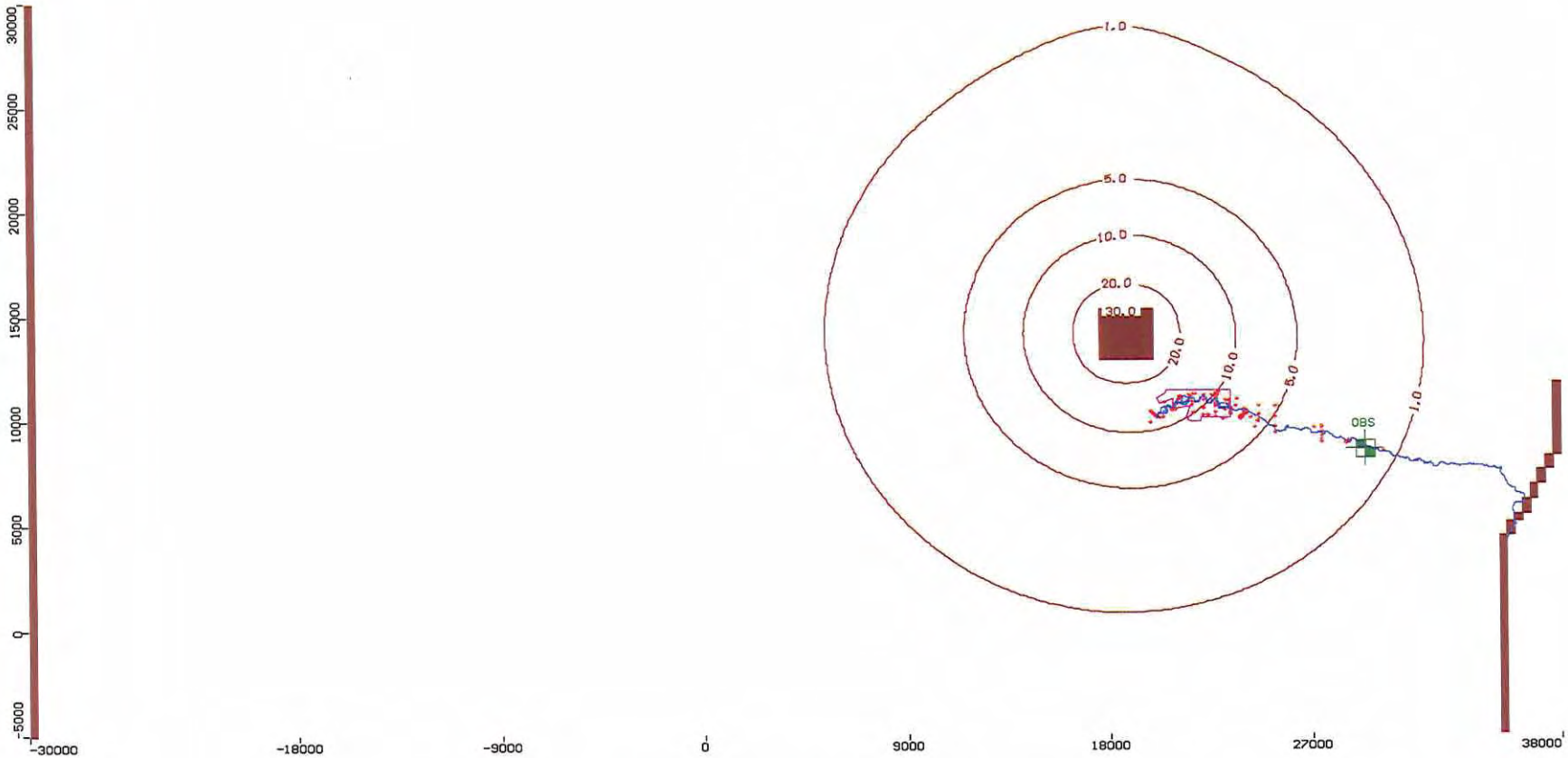


*Figure A3–5.4 Predicted heads after 10 years of pumping*

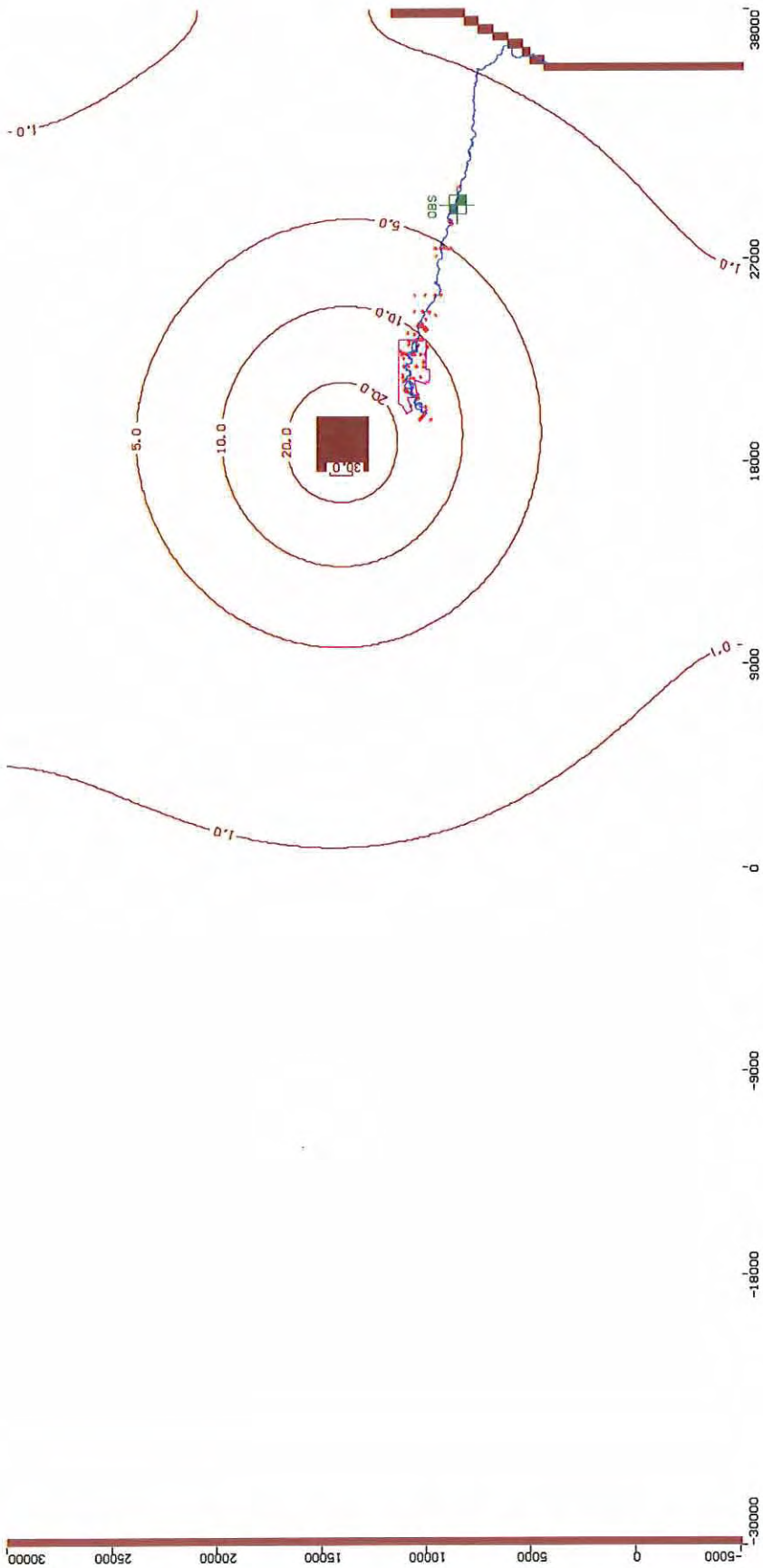


*Figure A3–5.5 Predicted heads after 20 years of pumping*

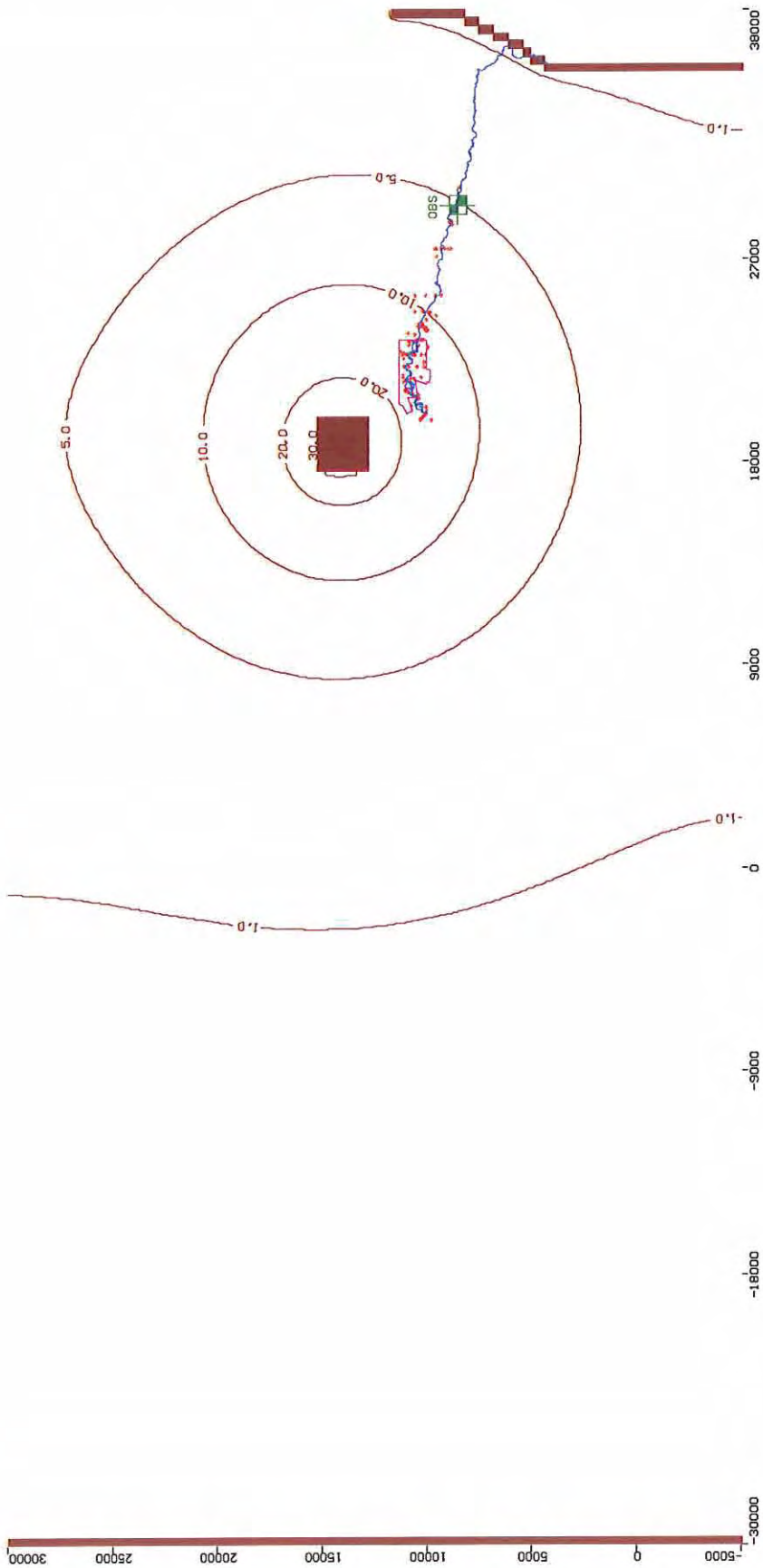


*Figure A3–5.6 Predicted heads after 30 years of pumping*

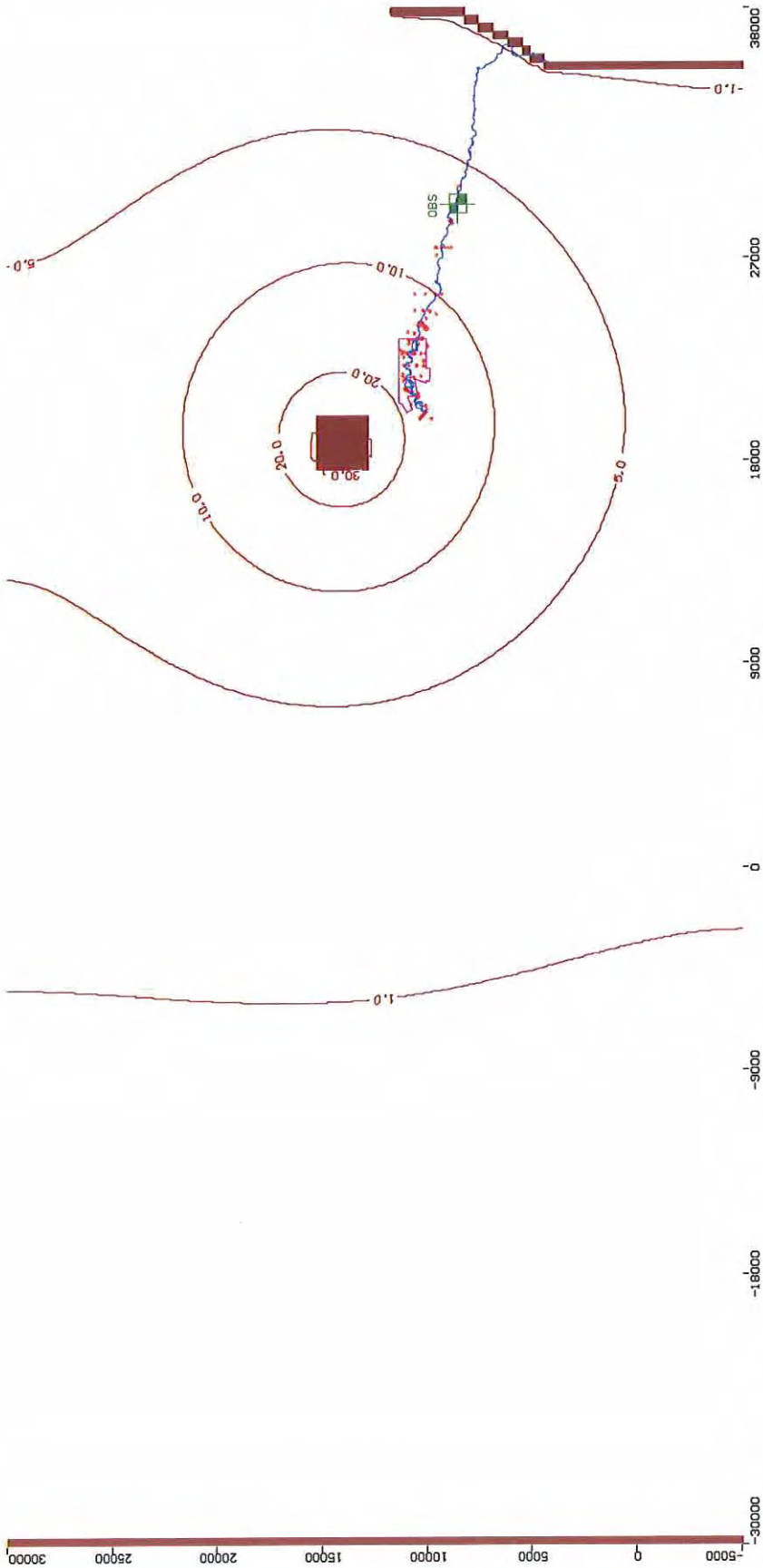


*Figure A3–5.7 Predicted heads after 40 years of pumping*

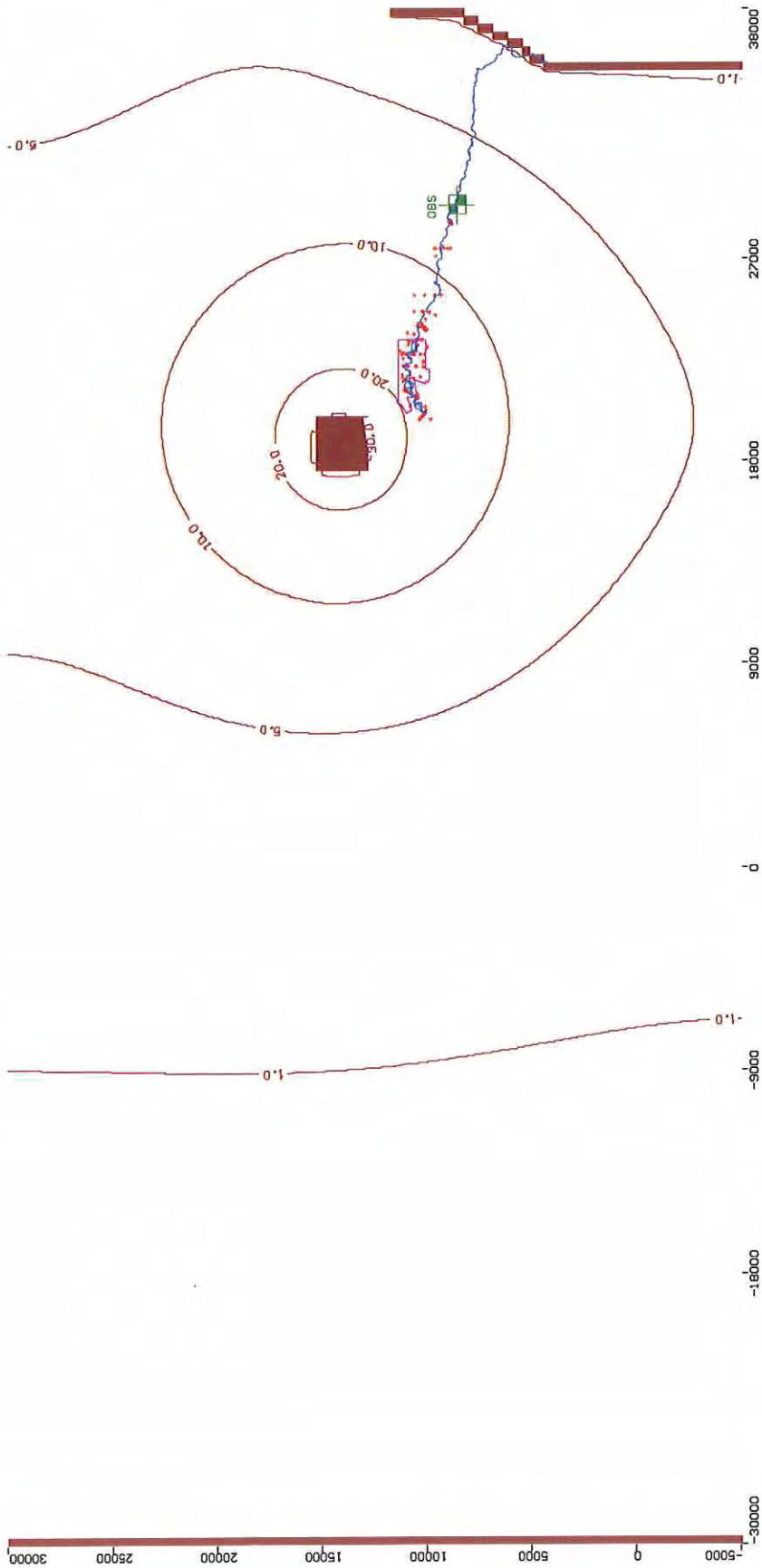


*Figure A3–5.8 Predicted heads after 50 years of pumping*

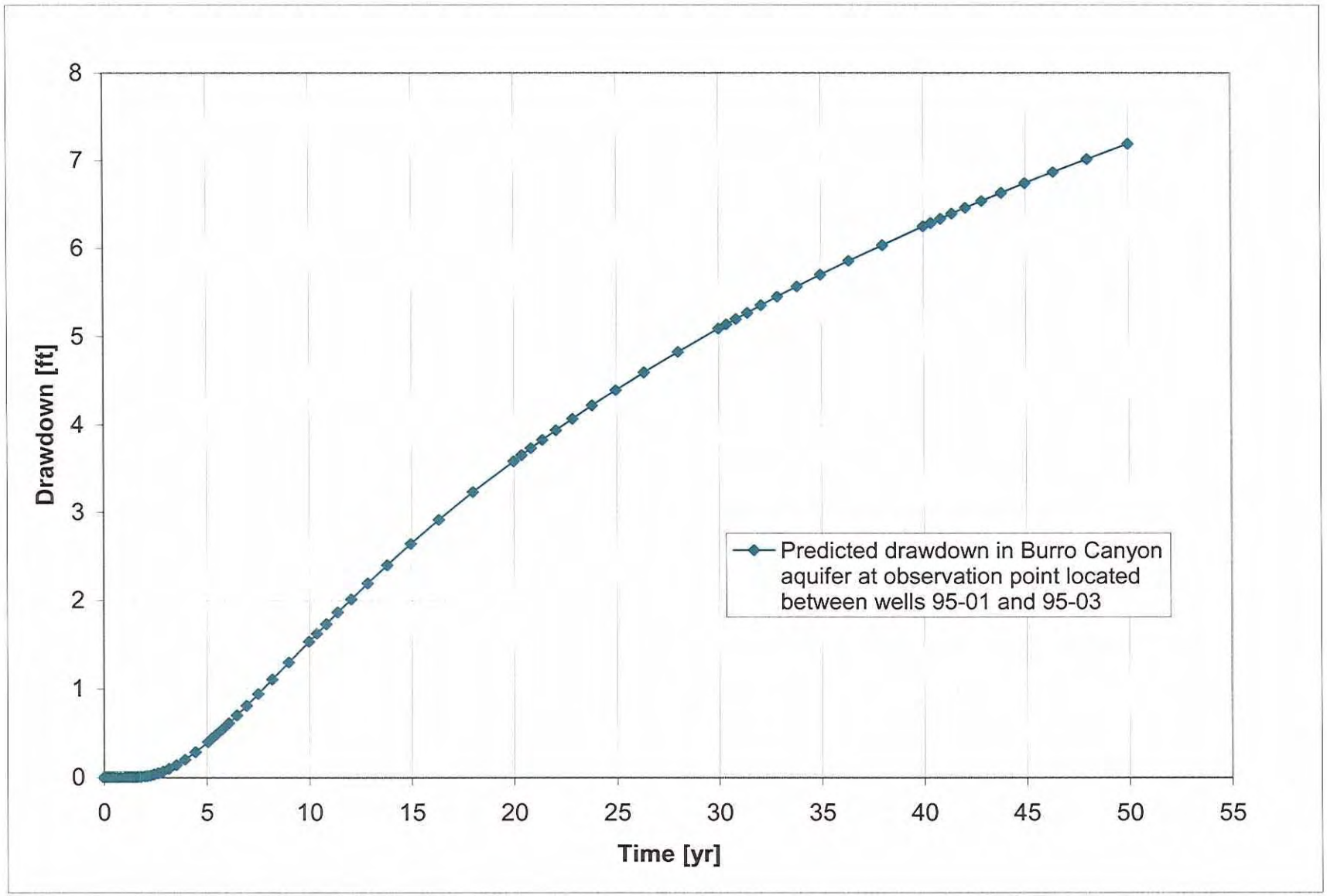


*Figure A3–5.9 Predicted heads vs. time at observation well*

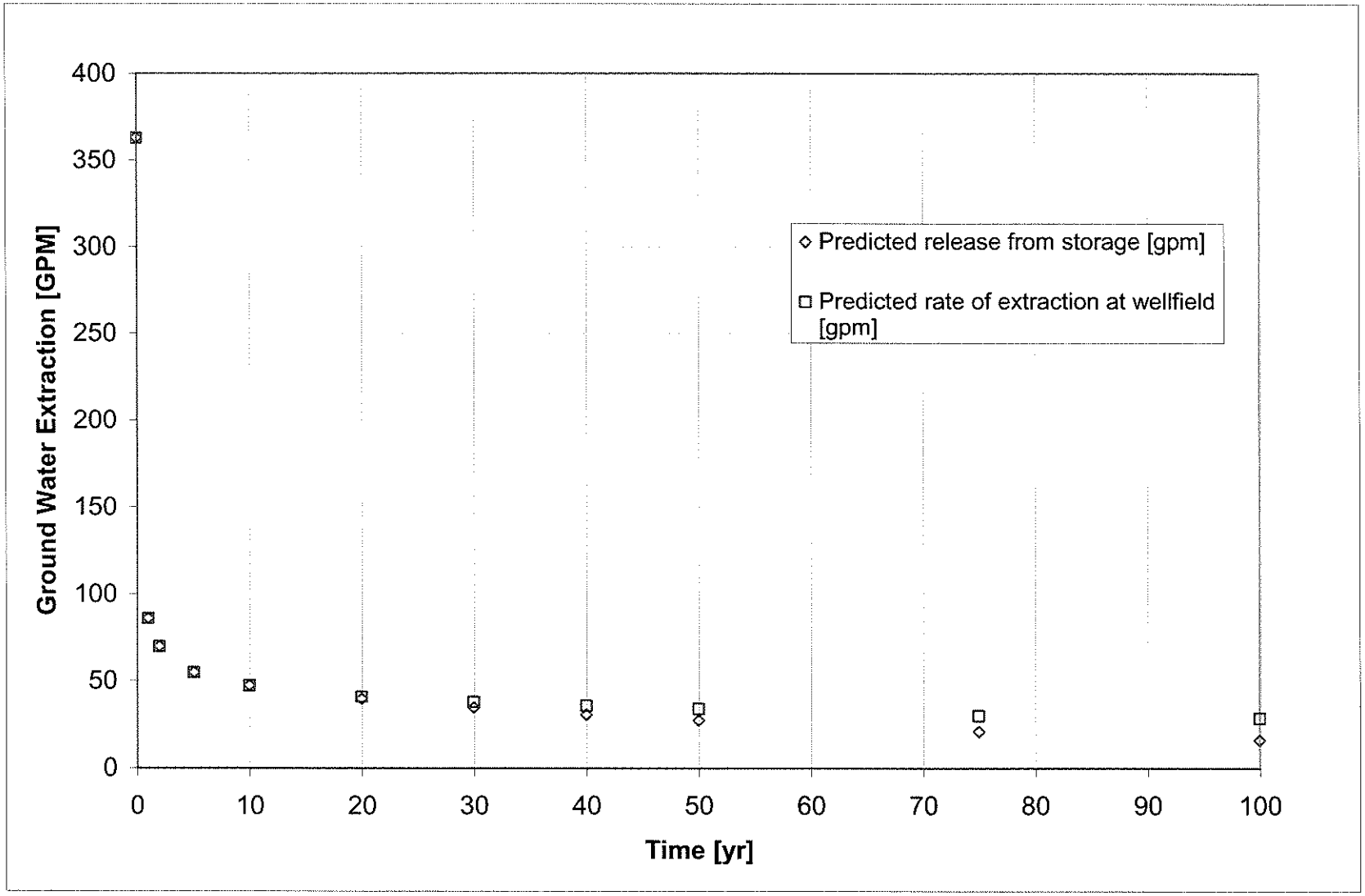


*Figure A3–5.10 Predicted rates of ground water extraction and release from storage*

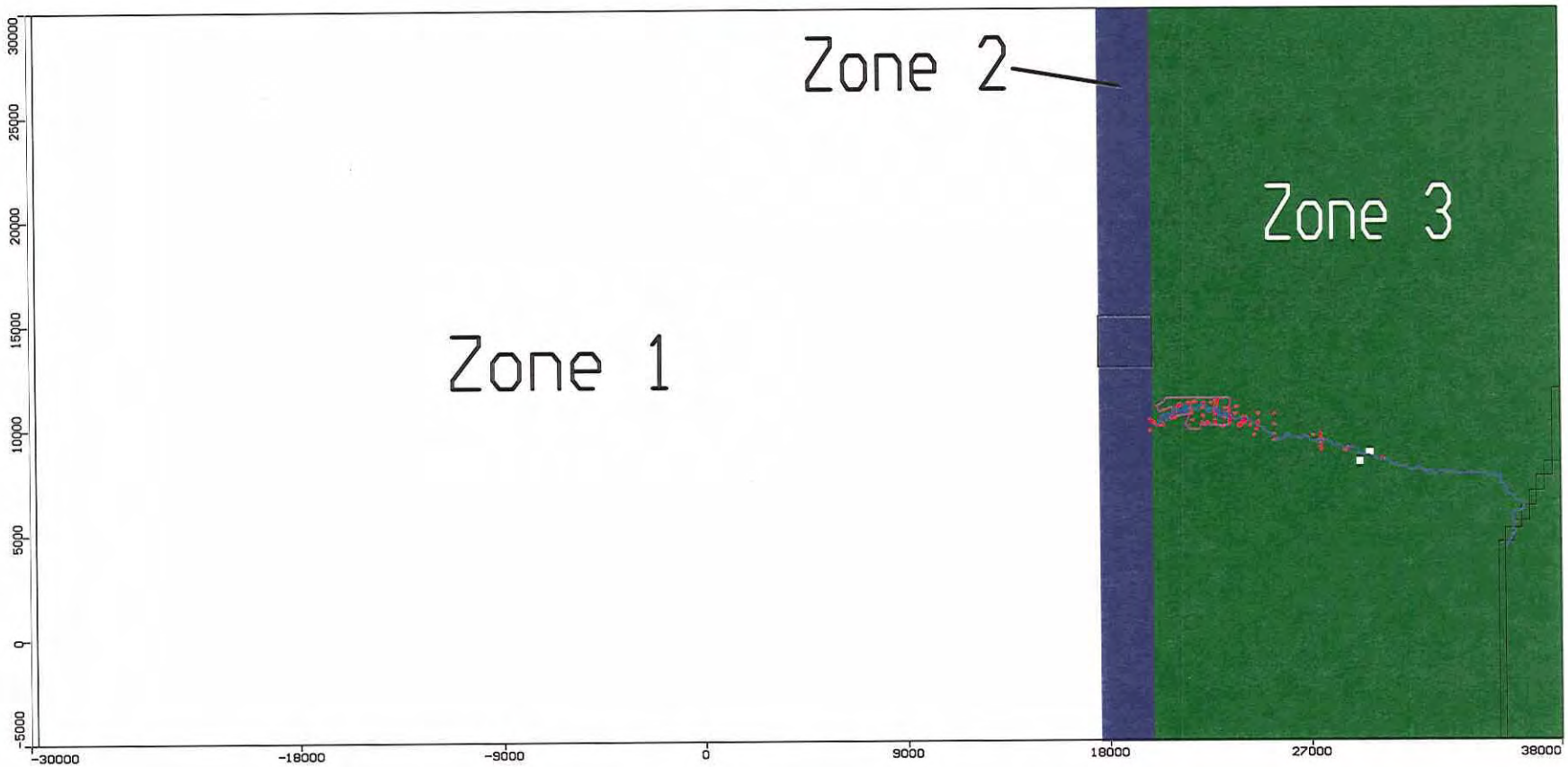


*Figure A3-5.11 MODFLOW water budget zone map*

```
 ZONBUDEM version 3.0
 ZONEBUDGET version 1.00
 Program to compute a flow budget for subregions of a model using
 cell-by-cell flow data from the USGS Modular Ground-Water Flow Model.

 The cell-by-cell budget file is:
 KBC_nss.BGT

   1 layers        100 rows        200 columns

 Zone Budget - BATCH

 The zone file is:
 KBC_nss.ZBI

 Zone Array for layer  1 will be read from the Zone File
 Zone Array for layer  1 will be read using format:  (40I3)
 ----------------------------------------------------------------------
           3 is your highest zone.
1Zone Budget - BATCH


     Flow Budget for Zone  1 at Time Step 10 of Stress Period  1
     ------------------------------------------------------------

                       Budget Term     Flow (L**3/T)
                       ----------------------------

             IN:
             ---
                            STORAGE =    4510.8
                     CONSTANT HEAD =    5014.4
                     Zone  2 to  1 =   0.00000E+00

                         Total IN =    9525.2

             OUT:
             ----
                            STORAGE =    77.147
                     CONSTANT HEAD =   0.00000E+00
                     Zone  1 to  2 =    9443.4

                        Total OUT =    9520.5

                          IN - OUT =    4.6968

               Percent Discrepancy =                0.05
1Zone Budget - BATCH
```

```
Flow Budget for Zone  2 at Time Step 10 of Stress Period  1
------------------------------------------------------------

                    Budget Term     Flow (L**3/T)
                    ----------------------------

          IN:
          ---
                         STORAGE =    6369.1
                   CONSTANT HEAD =   0.00000E+00
                   Zone  1 to  2 =    9443.4
                   Zone  3 to  2 =    2070.7

                       Total IN =    17883.

          OUT:
          ----
                         STORAGE =    6.9884
                   CONSTANT HEAD =    13222.
                   Zone  2 to  1 =   0.00000E+00
                   Zone  2 to  3 =    4654.8

                      Total OUT =    17884.

                       IN - OUT =  -0.85922

            Percent Discrepancy =                0.00
1Zone Budget - BATCH


Flow Budget for Zone  3 at Time Step 10 of Stress Period  1
------------------------------------------------------------

                    Budget Term     Flow (L**3/T)
                    ----------------------------

          IN:
          ---
                         STORAGE =    2452.2
                   CONSTANT HEAD =   0.00000E+00
                   Zone  2 to  3 =    4654.8

                       Total IN =    7107.1

          OUT:
          ----
                         STORAGE =    17.163
                   CONSTANT HEAD =    5020.7
                   Zone  3 to  2 =    2070.7

                      Total OUT =    7108.6

                       IN - OUT =   -1.4952

            Percent Discrepancy =               -0.02
1Zone Budget - BATCH
```

```
Flow Budget for Zone  1 at Time Step 10 of Stress Period  2
------------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                       STORAGE =    18666.
                 CONSTANT HEAD =    5014.4
                 Zone  2 to  1 =   0.00000E+00

                    Total IN =     23681.

          OUT:
          ----
                       STORAGE =    31.037
                 CONSTANT HEAD =   0.00000E+00
                 Zone  1 to  2 =    23653.

                   Total OUT =     23684.

                    IN - OUT =    -2.9453

            Percent Discrepancy =              -0.01
1Zone Budget - BATCH


Flow Budget for Zone  2 at Time Step 10 of Stress Period  2
------------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                       STORAGE =    33531.
                 CONSTANT HEAD =   0.00000E+00
                 Zone  1 to  2 =    23653.
                 Zone  3 to  2 =    17021.

                    Total IN =     74205.

          OUT:
          ----
                       STORAGE =    5.9607
                 CONSTANT HEAD =    69623.
                 Zone  2 to  1 =   0.00000E+00
                 Zone  2 to  3 =    4576.6

                   Total OUT =     74205.

                    IN - OUT =   -0.92328

            Percent Discrepancy =               0.00
1Zone Budget - BATCH
```

```
Flow Budget for Zone  3 at Time Step 10 of Stress Period  2
------------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

        IN:
        ---
                       STORAGE =    17473.
                 CONSTANT HEAD =   0.00000E+00
                 Zone  2 to  3 =    4576.6

                    Total IN =     22050.

        OUT:
        ----
                       STORAGE =    9.2837
                 CONSTANT HEAD =    5020.7
                 Zone  3 to  2 =    17021.

                   Total OUT =      22051.

                    IN - OUT =     -1.2144

          Percent Discrepancy =                -0.01
1Zone Budget - BATCH


Flow Budget for Zone  1 at Time Step 10 of Stress Period  3
------------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

        IN:
        ---
                       STORAGE =    6568.1
                 CONSTANT HEAD =    5014.4
                 Zone  2 to  1 =   0.00000E+00

                    Total IN =     11582.

        OUT:
        ----
                       STORAGE =   0.00000E+00
                 CONSTANT HEAD =   0.00000E+00
                 Zone  1 to  2 =    11582.

                   Total OUT =      11582.

                    IN - OUT =    0.52609E-01

          Percent Discrepancy =                 0.00
1Zone Budget - BATCH
```

```
Flow Budget for Zone  2 at Time Step 10 of Stress Period  3
------------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                       STORAGE =    3577.0
                 CONSTANT HEAD =   0.00000E+00
                 Zone  1 to  2 =    11582.
                 Zone  3 to  2 =    5109.5

                     Total IN =    20269.

          OUT:
          ----
                       STORAGE =   0.00000E+00
                 CONSTANT HEAD =    16528.
                 Zone  2 to  1 =   0.00000E+00
                 Zone  2 to  3 =    3742.3

                    Total OUT =    20270.

                     IN - OUT =   -1.5524

            Percent Discrepancy =              -0.01
1Zone Budget - BATCH


Flow Budget for Zone  3 at Time Step 10 of Stress Period  3
------------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                       STORAGE =    6387.9
                 CONSTANT HEAD =   0.00000E+00
                 Zone  2 to  3 =    3742.3

                     Total IN =    10130.

          OUT:
          ----
                       STORAGE =   0.00000E+00
                 CONSTANT HEAD =    5020.7
                 Zone  3 to  2 =    5109.5

                    Total OUT =    10130.

                     IN - OUT =   0.64865E-02

            Percent Discrepancy =               0.00
1Zone Budget - BATCH
```

```
     Flow Budget for Zone  1 at Time Step 10 of Stress Period  4
     ------------------------------------------------------------

                       Budget Term     Flow (L**3/T)
                       ----------------------------

             IN:
             ---
                            STORAGE =    5612.9
                     CONSTANT HEAD =    5014.4
                     Zone  2 to  1 =   0.00000E+00

                          Total IN =    10627.

             OUT:
             ----
                            STORAGE =   0.00000E+00
                     CONSTANT HEAD =   0.00000E+00
                     Zone  1 to  2 =    10628.

                         Total OUT =    10628.

                          IN - OUT =  -0.40643

               Percent Discrepancy =                0.00
1Zone Budget - BATCH


     Flow Budget for Zone  2 at Time Step 10 of Stress Period  4
     ------------------------------------------------------------

                       Budget Term     Flow (L**3/T)
                       ----------------------------

             IN:
             ---
                            STORAGE =    2233.2
                     CONSTANT HEAD =   0.00000E+00
                     Zone  1 to  2 =    10628.
                     Zone  3 to  2 =    4117.7

                          Total IN =    16979.

             OUT:
             ----
                            STORAGE =   0.00000E+00
                     CONSTANT HEAD =    13404.
                     Zone  2 to  1 =   0.00000E+00
                     Zone  2 to  3 =    3573.1

                         Total OUT =    16977.

                          IN - OUT =    1.8483

               Percent Discrepancy =                0.01
1Zone Budget - BATCH
```

```
Flow Budget for Zone  3 at Time Step 10 of Stress Period  4
------------------------------------------------------------

                    Budget Term     Flow (L**3/T)
                    ----------------------------

          IN:
          ---
                         STORAGE =    5565.4
                   CONSTANT HEAD =   0.00000E+00
                   Zone  2 to  3 =    3573.1

                       Total IN =    9138.5

          OUT:
          ----
                         STORAGE =   0.00000E+00
                   CONSTANT HEAD =    5020.7
                   Zone  3 to  2 =    4117.7

                      Total OUT =    9138.3

                       IN - OUT =   0.15076

            Percent Discrepancy =                0.00
1Zone Budget - BATCH


Flow Budget for Zone  1 at Time Step 10 of Stress Period  5
------------------------------------------------------------

                    Budget Term     Flow (L**3/T)
                    ----------------------------

          IN:
          ---
                         STORAGE =    4639.4
                   CONSTANT HEAD =    5014.4
                   Zone  2 to  1 =   0.00000E+00

                       Total IN =    9653.8

          OUT:
          ----
                         STORAGE =   0.00000E+00
                   CONSTANT HEAD =   0.00000E+00
                   Zone  1 to  2 =    9653.9

                      Total OUT =    9653.9

                       IN - OUT =  -0.50787E-01

            Percent Discrepancy =                0.00
1Zone Budget - BATCH
```

```
     Flow Budget for Zone  2 at Time Step 10 of Stress Period  5
     ------------------------------------------------------------

                       Budget Term     Flow (L**3/T)
                       ----------------------------

             IN:
             ---
                            STORAGE =    1231.7
                     CONSTANT HEAD =   0.00000E+00
                     Zone  1 to  2 =    9653.9
                     Zone  3 to  2 =    3122.3

                          Total IN =    14008.

             OUT:
             ----
                            STORAGE =   0.00000E+00
                     CONSTANT HEAD =    10610.
                     Zone  2 to  1 =   0.00000E+00
                     Zone  2 to  3 =    3399.1

                         Total OUT =    14009.

                          IN - OUT =  -0.88766

               Percent Discrepancy =                -0.01
1Zone Budget - BATCH


     Flow Budget for Zone  3 at Time Step 10 of Stress Period  5
     ------------------------------------------------------------

                       Budget Term     Flow (L**3/T)
                       ----------------------------

             IN:
             ---
                            STORAGE =    4741.7
                     CONSTANT HEAD =   0.00000E+00
                     Zone  2 to  3 =    3399.1

                          Total IN =    8140.8

             OUT:
             ----
                            STORAGE =   0.00000E+00
                     CONSTANT HEAD =    5018.6
                     Zone  3 to  2 =    3122.3

                         Total OUT =    8140.9

                          IN - OUT =  -0.30180E-01

               Percent Discrepancy =                 0.00
1Zone Budget - BATCH
```

```
Flow Budget for Zone  1 at Time Step 10 of Stress Period  6
------------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                       STORAGE =    4060.5
                 CONSTANT HEAD =    5014.6
                 Zone  2 to  1 =   0.00000E+00

                     Total IN =    9075.1

          OUT:
          ----
                       STORAGE =   0.00000E+00
                 CONSTANT HEAD =   0.00000E+00
                 Zone  1 to  2 =    9075.1

                    Total OUT =    9075.1

                     IN - OUT =  -0.85115E-01

            Percent Discrepancy =                0.00
1Zone Budget - BATCH


Flow Budget for Zone  2 at Time Step 10 of Stress Period  6
------------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                       STORAGE =    797.14
                 CONSTANT HEAD =   0.00000E+00
                 Zone  1 to  2 =    9075.1
                 Zone  3 to  2 =    2561.7

                     Total IN =    12434.

          OUT:
          ----
                       STORAGE =   0.00000E+00
                 CONSTANT HEAD =    9123.5
                 Zone  2 to  1 =   0.00000E+00
                 Zone  2 to  3 =    3310.0

                    Total OUT =    12434.

                     IN - OUT =   0.42688

            Percent Discrepancy =                0.00
1Zone Budget - BATCH
```

```
     Flow Budget for Zone  3 at Time Step 10 of Stress Period  6
     ------------------------------------------------------------

                       Budget Term     Flow (L**3/T)
                       ----------------------------

             IN:
             ---
                            STORAGE =    4223.8
                     CONSTANT HEAD =   0.40285E-04
                     Zone  2 to  3 =    3310.0

                          Total IN =    7533.8

             OUT:
             ----
                            STORAGE =   0.00000E+00
                     CONSTANT HEAD =    4972.1
                     Zone  3 to  2 =    2561.7

                         Total OUT =    7533.7

                          IN - OUT =   0.40975E-01

               Percent Discrepancy =                0.00
1Zone Budget - BATCH


     Flow Budget for Zone  1 at Time Step 10 of Stress Period  7
     ------------------------------------------------------------

                       Budget Term     Flow (L**3/T)
                       ----------------------------

             IN:
             ---
                            STORAGE =    3549.5
                     CONSTANT HEAD =    5019.0
                     Zone  2 to  1 =   0.00000E+00

                          Total IN =    8568.5

             OUT:
             ----
                            STORAGE =   0.00000E+00
                     CONSTANT HEAD =   0.00000E+00
                     Zone  1 to  2 =    8567.9

                         Total OUT =    8567.9

                          IN - OUT =   0.57074

               Percent Discrepancy =                0.01
1Zone Budget - BATCH
```

```
Flow Budget for Zone  2 at Time Step 10 of Stress Period  7
------------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                       STORAGE =    510.90
                 CONSTANT HEAD =   0.00000E+00
                 Zone  1 to  2 =    8567.9
                 Zone  3 to  2 =    2106.7

                     Total IN =    11185.

          OUT:
          ----
                       STORAGE =   0.00000E+00
                 CONSTANT HEAD =    7936.3
                 Zone  2 to  1 =   0.00000E+00
                 Zone  2 to  3 =    3246.1

                    Total OUT =    11182.

                     IN - OUT =    3.0504

            Percent Discrepancy =                0.03
1Zone Budget - BATCH

Flow Budget for Zone  3 at Time Step 10 of Stress Period  7
------------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                       STORAGE =    3561.1
                 CONSTANT HEAD =   0.00000E+00
                 Zone  2 to  3 =    3246.1

                     Total IN =    6807.2

          OUT:
          ----
                       STORAGE =   0.00000E+00
                 CONSTANT HEAD =    4699.8
                 Zone  3 to  2 =    2106.7

                    Total OUT =    6806.4

                     IN - OUT =   0.79419

            Percent Discrepancy =                0.01
1Zone Budget - BATCH
```

```
Flow Budget for Zone  1 at Time Step 10 of Stress Period  8
------------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                       STORAGE =    3238.6
                 CONSTANT HEAD =    5043.2
                 Zone  2 to  1 =   0.00000E+00

                     Total IN =    8281.8

          OUT:
          ----
                       STORAGE =   0.00000E+00
                 CONSTANT HEAD =   0.00000E+00
                 Zone  1 to  2 =    8281.3

                    Total OUT =    8281.3

                     IN - OUT =   0.51735

            Percent Discrepancy =                0.01
1Zone Budget - BATCH


Flow Budget for Zone  2 at Time Step 10 of Stress Period  8
------------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                       STORAGE =    385.49
                 CONSTANT HEAD =   0.00000E+00
                 Zone  1 to  2 =    8281.3
                 Zone  3 to  2 =    1872.5

                     Total IN =    10539.

          OUT:
          ----
                       STORAGE =   0.00000E+00
                 CONSTANT HEAD =    7313.8
                 Zone  2 to  1 =   0.00000E+00
                 Zone  2 to  3 =    3223.5

                    Total OUT =    10537.

                     IN - OUT =    1.9543

            Percent Discrepancy =                0.02
1Zone Budget - BATCH
```

```
Flow Budget for Zone  3 at Time Step 10 of Stress Period  8
-----------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                       STORAGE =    3035.9
                 CONSTANT HEAD =   0.00000E+00
                 Zone  2 to  3 =    3223.5

                     Total IN =    6259.4

          OUT:
          ----
                       STORAGE =   0.00000E+00
                 CONSTANT HEAD =    4386.3
                 Zone  3 to  2 =    1872.5

                    Total OUT =    6258.8

                     IN - OUT =   0.62571

            Percent Discrepancy =                0.01
1Zone Budget - BATCH


Flow Budget for Zone  1 at Time Step 10 of Stress Period  9
-----------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                       STORAGE =    2979.2
                 CONSTANT HEAD =    5094.9
                 Zone  2 to  1 =   0.00000E+00

                     Total IN =    8074.0

          OUT:
          ----
                       STORAGE =   0.00000E+00
                 CONSTANT HEAD =   0.00000E+00
                 Zone  1 to  2 =    8073.6

                    Total OUT =    8073.6

                     IN - OUT =   0.41066

            Percent Discrepancy =                0.01
1Zone Budget - BATCH
```

```
     Flow Budget for Zone  2 at Time Step 10 of Stress Period  9
     ------------------------------------------------------------

                       Budget Term     Flow (L**3/T)
                       ----------------------------

             IN:
             ---
                            STORAGE =    310.67
                     CONSTANT HEAD =   0.00000E+00
                     Zone  1 to  2 =    8073.6
                     Zone  3 to  2 =    1710.8

                          Total IN =    10095.

             OUT:
             ----
                            STORAGE =   0.00000E+00
                     CONSTANT HEAD =    6880.9
                     Zone  2 to  1 =   0.00000E+00
                     Zone  2 to  3 =    3212.7

                         Total OUT =    10094.

                          IN - OUT =    1.4711

               Percent Discrepancy =                0.01
1Zone Budget - BATCH


     Flow Budget for Zone  3 at Time Step 10 of Stress Period  9
     ------------------------------------------------------------

                       Budget Term     Flow (L**3/T)
                       ----------------------------

             IN:
             ---
                            STORAGE =    2609.3
                     CONSTANT HEAD =   0.00000E+00
                     Zone  2 to  3 =    3212.7

                          Total IN =    5822.1

             OUT:
             ----
                            STORAGE =   0.00000E+00
                     CONSTANT HEAD =    4110.8
                     Zone  3 to  2 =    1710.8

                         Total OUT =    5821.6

                          IN - OUT =   0.48785

               Percent Discrepancy =                0.01
1Zone Budget - BATCH
```

```
Flow Budget for Zone  1 at Time Step 10 of Stress Period 10
-----------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                       STORAGE =    2738.3
                 CONSTANT HEAD =    5168.4
                 Zone  2 to  1 =   0.00000E+00

                     Total IN =    7906.7

          OUT:
          ----
                       STORAGE =   0.00000E+00
                 CONSTANT HEAD =   0.00000E+00
                 Zone  1 to  2 =    7906.7

                    Total OUT =    7906.7

                     IN - OUT =  -0.19507E-02

            Percent Discrepancy =                0.00
1Zone Budget - BATCH


Flow Budget for Zone  2 at Time Step 10 of Stress Period 10
-----------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                       STORAGE =    259.23
                 CONSTANT HEAD =   0.00000E+00
                 Zone  1 to  2 =    7906.7
                 Zone  3 to  2 =    1585.7

                     Total IN =    9751.7

          OUT:
          ----
                       STORAGE =   0.00000E+00
                 CONSTANT HEAD =    6543.6
                 Zone  2 to  1 =   0.00000E+00
                 Zone  2 to  3 =    3207.0

                    Total OUT =    9750.5

                     IN - OUT =    1.1570

            Percent Discrepancy =                0.01
1Zone Budget - BATCH
```

```
     Flow Budget for Zone  3 at Time Step 10 of Stress Period 10
     -----------------------------------------------------------

                       Budget Term     Flow (L**3/T)
                       ----------------------------

             IN:
             ---
                            STORAGE =    2259.2
                     CONSTANT HEAD =   0.00000E+00
                     Zone  2 to  3 =    3207.0

                          Total IN =    5466.2

             OUT:
             ----
                            STORAGE =   0.00000E+00
                     CONSTANT HEAD =    3880.3
                     Zone  3 to  2 =    1585.7

                         Total OUT =    5466.0

                           IN - OUT =   0.14766

               Percent Discrepancy =                0.00
1Zone Budget - BATCH


     Flow Budget for Zone  1 at Time Step 10 of Stress Period 11
     -----------------------------------------------------------

                       Budget Term     Flow (L**3/T)
                       ----------------------------

             IN:
             ---
                            STORAGE =    2199.2
                     CONSTANT HEAD =    5391.9
                     Zone  2 to  1 =   0.00000E+00

                          Total IN =    7591.2

             OUT:
             ----
                            STORAGE =   0.00000E+00
                     CONSTANT HEAD =   0.00000E+00
                     Zone  1 to  2 =    7588.8

                         Total OUT =    7588.8

                           IN - OUT =    2.4062

               Percent Discrepancy =                0.03
1Zone Budget - BATCH
```

```
Flow Budget for Zone  2 at Time Step 10 of Stress Period 11
-----------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                       STORAGE =    180.30
                 CONSTANT HEAD =   0.00000E+00
                 Zone  1 to  2 =    7588.8
                 Zone  3 to  2 =    1366.5

                     Total IN =    9135.6

          OUT:
          ----
                       STORAGE =   0.00000E+00
                 CONSTANT HEAD =    5931.1
                 Zone  2 to  1 =   0.00000E+00
                 Zone  2 to  3 =    3197.0

                    Total OUT =    9128.0

                     IN - OUT =    7.5554

            Percent Discrepancy =                0.08
1Zone Budget - BATCH


Flow Budget for Zone  3 at Time Step 10 of Stress Period 11
-----------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                       STORAGE =    1625.9
                 CONSTANT HEAD =   0.00000E+00
                 Zone  2 to  3 =    3197.0

                     Total IN =    4822.8

          OUT:
          ----
                       STORAGE =   0.00000E+00
                 CONSTANT HEAD =    3455.9
                 Zone  3 to  2 =    1366.5

                    Total OUT =    4822.4

                     IN - OUT =   0.44421

            Percent Discrepancy =                0.01
1Zone Budget - BATCH
```

```
Flow Budget for Zone  1 at Time Step 10 of Stress Period 12
-----------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                       STORAGE =    1742.1
                CONSTANT HEAD =    5607.1
                Zone  2 to  1 =   0.00000E+00

                     Total IN =    7349.2

          OUT:
          ----
                       STORAGE =   0.00000E+00
                CONSTANT HEAD =   0.00000E+00
                Zone  1 to  2 =    7347.6

                    Total OUT =    7347.6

                     IN - OUT =    1.5681

            Percent Discrepancy =                0.02
1Zone Budget - BATCH


Flow Budget for Zone  2 at Time Step 10 of Stress Period 12
-----------------------------------------------------------

                  Budget Term     Flow (L**3/T)
                  ----------------------------

          IN:
          ---
                       STORAGE =    131.89
                CONSTANT HEAD =   0.00000E+00
                Zone  1 to  2 =    7347.6
                Zone  3 to  2 =    1216.9

                     Total IN =    8696.4

          OUT:
          ----
                       STORAGE =   0.00000E+00
                CONSTANT HEAD =    5506.6
                Zone  2 to  1 =   0.00000E+00
                Zone  2 to  3 =    3184.4

                    Total OUT =    8691.1

                     IN - OUT =    5.3013

            Percent Discrepancy =                0.06
1Zone Budget - BATCH
```

```
Flow Budget for Zone  3 at Time Step 10 of Stress Period 12
-----------------------------------------------------------

                 Budget Term     Flow (L**3/T)
                 ----------------------------

        IN:
        ---
                      STORAGE =    1201.2
                CONSTANT HEAD =   0.00000E+00
                Zone  2 to  3 =    3184.4

                     Total IN =    4385.7

        OUT:
        ----
                      STORAGE =   0.00000E+00
                CONSTANT HEAD =    3168.6
                Zone  3 to  2 =    1216.9

                    Total OUT =    4385.5

                     IN - OUT =   0.20866

          Percent Discrepancy =                0.00
```

End of current text