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File Name State Programs (*from index*)

Sub File Name ASR (*from index*)

Sub-Sub File Name Wichita

Year (calendar) 2003

End Year

Privileged Yes - Circle if true

Comments/Keywords

Memo - ASR permit & accounting

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Memorandum

Burns & McDonnell
SINCE 1898

Date: May 14, 2003

To: Jim Bagley
Tom Huntzinger
David Warren
Jerry Blain
Dave Stous

From: Jeff Klein

Re: WICHITA
ASR Phase 1
ASR Permit and Accounting System
B&McD Project No. 29886

1. A meeting was conducted in Topeka at KDWR's office on May 12, 2003 at 10:00 a.m. to discuss permits and the accounting system for the ASR project. The following people were in attendance:

Jerry Blain	–	City of Wichita
Jim Bagley	–	KDWR
Tom Huntzinger	–	KDWR
Will Gilliland	–	KDWR
Mark Jennings	–	KDWR
Dave Stous	–	Burns & McDonnell
Jeff Klein	–	Burns & McDonnell

2. Opening Comments:

- Hope to layout a path and schedule for issuing permit.
- City is not anticipating the current GMD2 Board will support the Project. This puts KDWR on the spot to judge the Project on science.
- Interest groups in the area do not want the aquifer raised to pre-development conditions – mostly as a concern for lagoon construction.
- Trust and perceptions are big issues with the locals. This is one reason the City prefers the use of actual field measurements. It is simpler than a computer model and may be easier for people to accept.

- Trust and perceptions are big issues with the locals. This is one reason the City prefers the use of actual field measurements. It is simpler than a computer model and may be easier for people to accept.

3. Groundwater Model:

- The groundwater model projections (suggested by Jim Bagley at the last meeting) were reviewed. The projections were for the time period of 1993 through 2002, the last complete year of data. The projections included the following runs:

    1. Wichita and agricultural pumping at reported values (actual conditions).

    2. Wichita pumping their full water right and agricultural use at reported values.

    3. Reported pumping plus the addition of Phase 1 ASR at an average recharge of 6 MGD.

- Actual annual values of river flow, reported annual pumping and recorded annual precipitation was used in the model for these runs.

- Results of the model simulations are presented as changes in the storage volume from January 1993 through January 2002 and shown in a graph with annual changes. The results are as follows:

    1. Increase water volume in the aquifer – about 65,000 acre-feet.

    2. Decrease water volume in the aquifer – about –85,000 acre-feet.

    3. Increase water volume in the aquifer – about 105,000 acre-feet.

- Also shown in the graph are the results of two USGS storage depletions studies and results of the volume calculation made using actual January 2003 index well measurements and effective specific yield calculations.

- If the ASR Phase 1 Project was in –place since 1993, the City would have recharged an average of 6 MGD from 1993 through 2001 (about 60,000 acre-feet in 9 years).

- Points of discussion concerning the groundwater model include:

    1. The overall model has improved calibration over the original USGS model by Nathan Meyers because of increased amounts of data are now available and have

been included in the model. However, the Index Cell Effective Yield data has not been included at this time. The model has some isolated areas, generally in the northeast part of the well field, that do not match well with actual measurements. Nathan also had problems in these areas.

2. The cause may be more complex geology and the low-head dam on the Little Arkansas River that is located at Halstead. At the demonstration diversion well site, the low-head dam causes about 2 feet of backwater.

3. The current groundwater model shows the Project works and how the water moves (big picture) but the calibration can be improved at specific locations.

4. The model works well collectively with index well water level data. However, error bands can vary 30 percent +/- at specific sites. Model can be improved over time, as the calibration is refined to additional test boring and water level data.

- Calculations of aquifer storage based on the effective yield in each index cell were also discussed.

  1. The methodology of deriving the effective yield was discussed. The amount of coarse and fine grain material between the 1940 and 1993 water levels is determined at each Index Well location from the drill logs. Coarse-grained material is assumed to have an effective specific yield of 0.25. Fine-grained material is assumed to have an effective yield of 0.05. The total effective yield is the average of the coarse and fine grain thickness times the individual effective yields. The index cells effective yield range from 0.05 to 0.25 and average about 0.152.

  2. Most index cells represent an average for a 4 square mile area. Storage volume is calculated using an Excel spreadsheet based on interpolated January 1993 water levels in the index wells and measured actual water levels time the cell's effective specific yield.

  3. A value of about 80,000 acre-foot increase from January 1993 to January 2003 was calculated using the index well effective specific capacity. This is different than the values that the USGS has published in 2001, which are 83,400 acre-feet for the well field and 129,000 acre-feet for the study area based on data from January 1993 to January 2000. USGS depletion studies used a specific yield of 0.2. Also, the USGS areas evaluated are different than the total index well cell area. The USGS "well field" area is 55 square miles and their "study area" is 165 square miles. The index well area is about 150 square miles.

- The color graphs of the modeling results, sample index cell specific yield evaluation, index well summary, and a table comparing results of measured index well water levels to groundwater model results were distributed.

4. Issues discussed:

- Accounting methodology.

  - Can be based on volume or elevation (or a combination).

  - Water level data alone is not adequate. A water budget or balance needs to be included.

  - The area's water rights are over-allocated and aquifer levels would have continued to decline if the City had not altered their water supply priorities.

  - There was concern about a statement in the draft cover letter indicating that the City should be entitled to any water above the 1993 level. A passive recharge credit on a one-time basis is feasible, continued passive credit cannot be allowed.

  - The impact of the continued Equus Beds Well Field pumpage on water levels is shown in the modeling. Review of the graphs shows how levels will continue to decline due to a lack of infiltration and over-pumpage of the area by users.

  - Metered water recharged can accumulate recharge credits regardless. The regulations do not preclude use of accumulated recharge credits that when withdrawn would lower water levels below a base water level.

  - There are water quality and quantity issues associated with filling the aquifer to pre-development levels. These include separation distances for KDHE lagoon lining requirements

  - Migration of water across cell boundaries can best be tracked with the model.

  - Discussed what portion of increased flow into the Little Arkansas River is passive recharge water, diversion recharge water, natural recharge, and inflow from the Arkansas River and Burrton oil field brine.

  - Discussed how much of the water above the 1993 level the City is entitled to recover. Additionally, once the area reaches a certain level, recharge is stopped

- Accounting system will dictate if City uses water rights or recharge credits first. For a volumetric based system, water rights will be used first.

- The City is not against a volumetric or combination approach. Certain items need to be considered including but not limited to the following:

  - Need credit for volume used or filled above the January 1993 level.

  - Use obtained water level values to calibrate the model.

  - Passive recharge credits for the City.

  - The 1993 water level minimum level will not apply to water rights or recharge credits.

  - Consider drought impacts as they apply to the timeline to fill the area. What happens if we fall into a serious drought while the ASR facilities are being built?

- KDWR will be at the June 10th GMD2 meeting to discuss the process for the ASR project – applications required, set accounting methodology, public hearing, comment period, and chief engineer decision.

- Why is it necessary to have deep diversion wells versus shallow wells?

  - This is a concern to some citizens.

  - Deep diversion wells are more efficient from hydrogeological and cost aspects. Deep wells improve the water quality through bank filtration, especially the triazine herbicides and are better for the local environment. Water level recovery occurs after the wells are deactivated. Each diversion well will be tested to prove water level recovery per GMD2 based on the extensive tests conducted on the Demonstration Project Test Well near Halstead. Assuming the wells do not impair other uses, no negative scientific or regulatory flaws have been presented.

  - Shallow wells have no advantages and could push the project to treating 100 percent surface water. Shallow wells would have small yields requiring a larger number of wells. Recent advancements in technology show these revised costs to be similar to the diversion wells on a capital, operational and present worth basis. One of the highest operating costs for the surface water is PAC addition for treatment of the agricultural runoff, primarily herbicides. Elimination of herbicide runoff would result in substantial cost savings to the ASR surface water treatment plant budget for chemicals.

5. Permits:

   - City has permits nearly ready to submit. The accounting system needs to be set first so the cover letter can be finalized.

6. Schedule:

   - No schedule for completion has been set. KDWR will consider the accounting approaches and call the City.

7. Action Items:

   - KDWR to review the accounting approaches considering the City's concerns.

RIVER BASIN STRATEGIES FOR PUBLIC WATER SUPPLIES IN KANSAS

KICK OFF MEETING
9:00 AM - May 13, 2003

AGENDA

INTRODUCTION OF THE TEAM MEMBERS............Kerry Wedel, KWO

PROJECT OVERVIEW..Kerry Wedel, KWO

- Purpose
- Interagency Work Group
- Corps of Engineers Assistance
- Contractor - Burns & McDonnell
- Schedule

CORPS OF ENGINEERS ROLE..................................Ron Jansen, Kansas City District

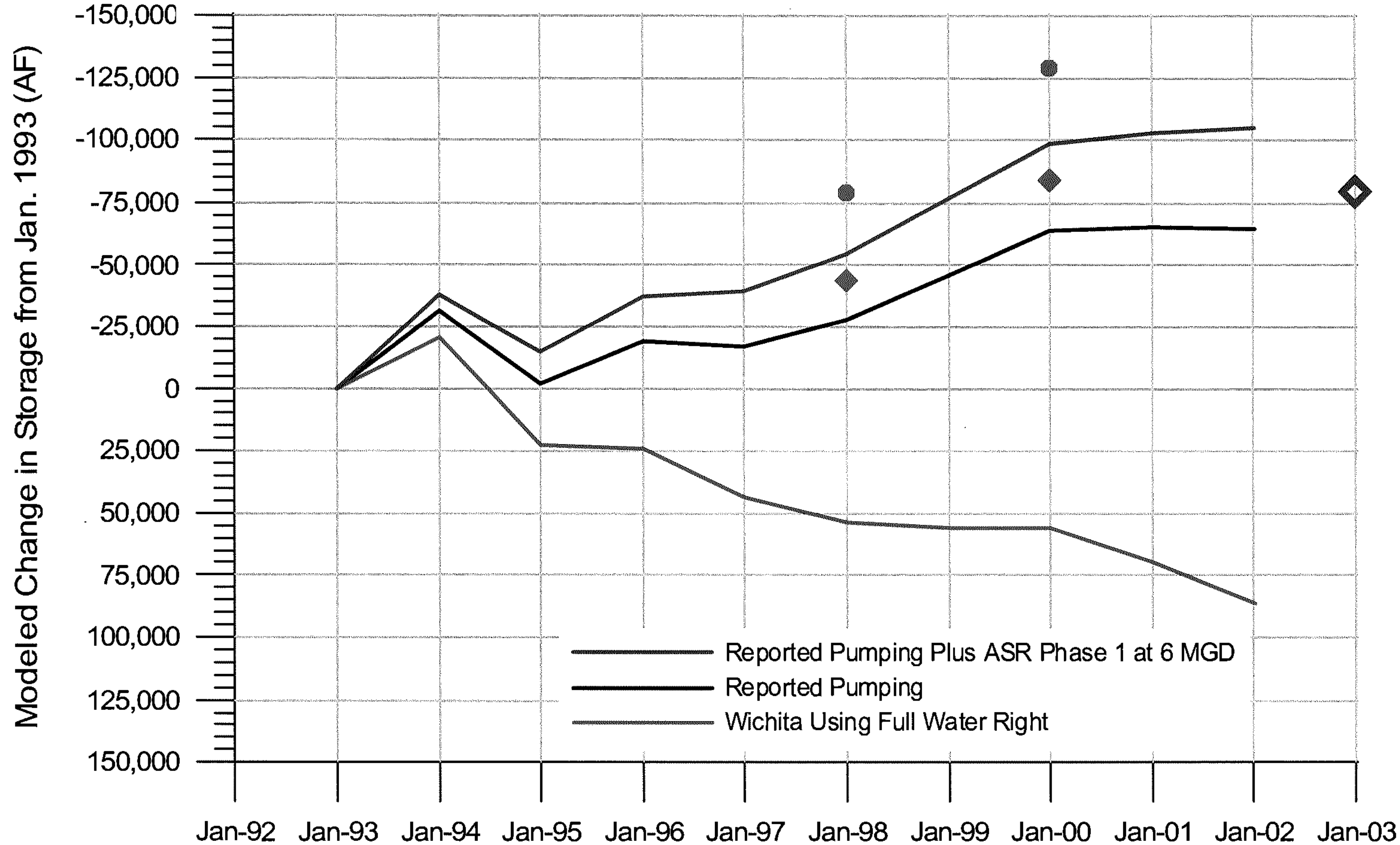
TECHNICAL ISSUES..Jeff Klein, Burns & McDonnell

Development of River Basin Strategies for Public Water Supplies in Kansas
U.S Army Corps of Engineers and Kansas Water Office

May 13, 2003
Technical Agenda Items

1. Organization
2. Basin Selection
3. Boundaries
    a. Watershed
    b. Regional
    c. PWS Service Areas
4. Web Site
    a. Development
    b. Maintenance
    c. Questionnaire
        1) Service Area
        2) Demand (total and for primary customer classes)
        3) Customers
        4) Supply
        5) Water Rights
        6) Water Use
        7) SDWA Compliance
5. Demand Projections
    a. KWO
    b. PWS
    c. Comparison
    d. Consensus
6. Existing Water Supply Sources
    a. Rivers
    b. Federal Reservoirs
    c. State Lakes
    d. Small Municipal Lakes
    e. Groundwater
7. Net Need
8. Available Water Supply Sources
    a. Rivers
    b. Federal Reservoirs
    c. State Lakes
    d. Groundwater
9. Other Issues
    a. MDS
    b. Streamflow Gages
10. Conceptual Allocation of Available Supply
11. Regional Treatment Needs
12. Recommendations for New Data Requirements
13. Work Group Meetings
14. Stakeholder Meeting
15. Report
16. Available GIS/IT Data
17. GIS/IT Coordination
18. Project Management/Coordination

5-12-2003



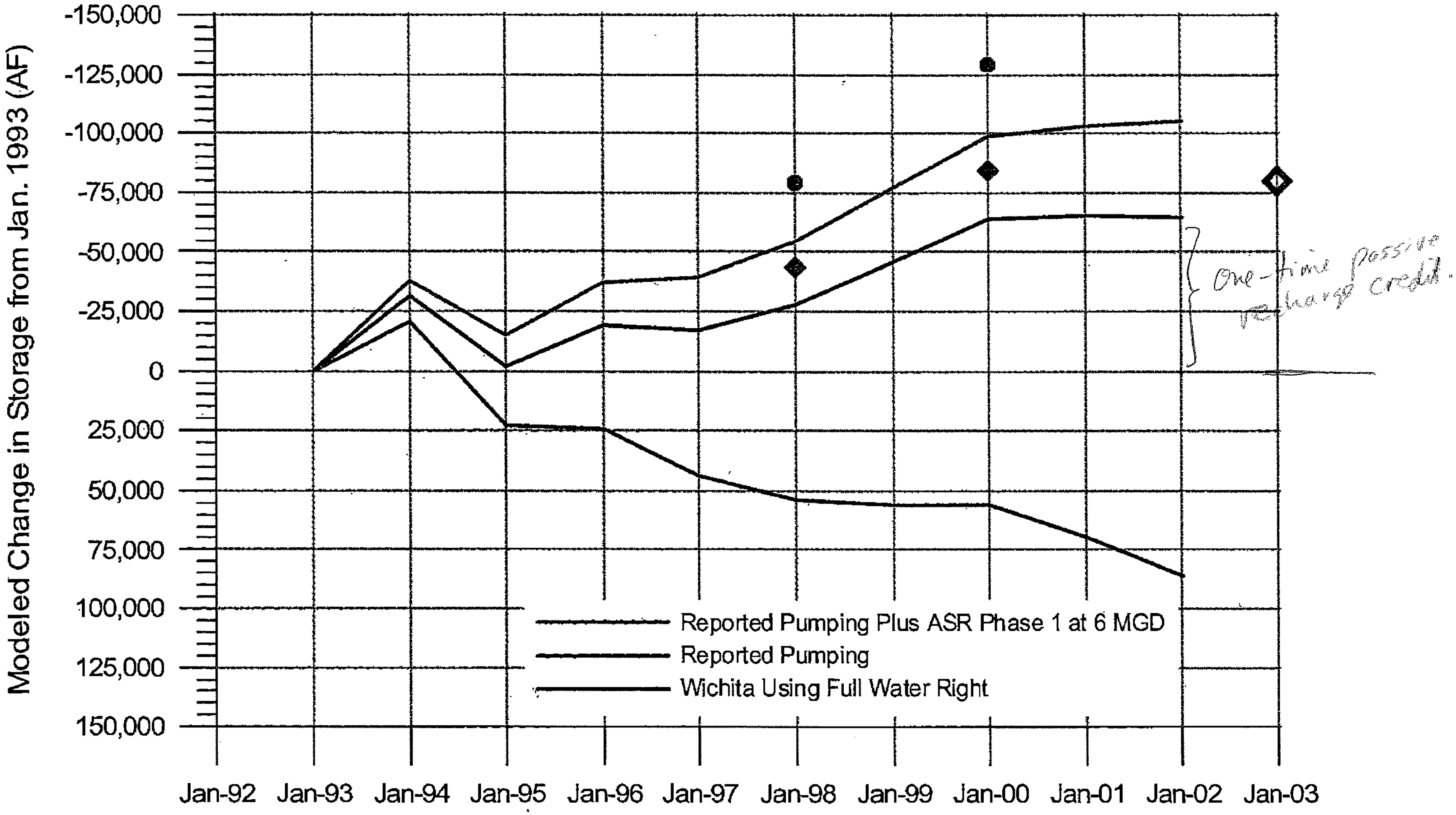
WATER BUDGET

Modeled Area = 140.8 mi2 (Specific Yield = 0.15)

USGS (Specific Yield = 0.20)
- ◆ Study Area = 165 mi2
- ● Well Field Area = 55 mi2

Index Well Measurements (Average Specific Yield = 0.153)
- ◇ Storage increase from Jan-1993 (interpolated) and Jan-2003 (measured) = 79,900 AF

storageplot.grf 4/22/03



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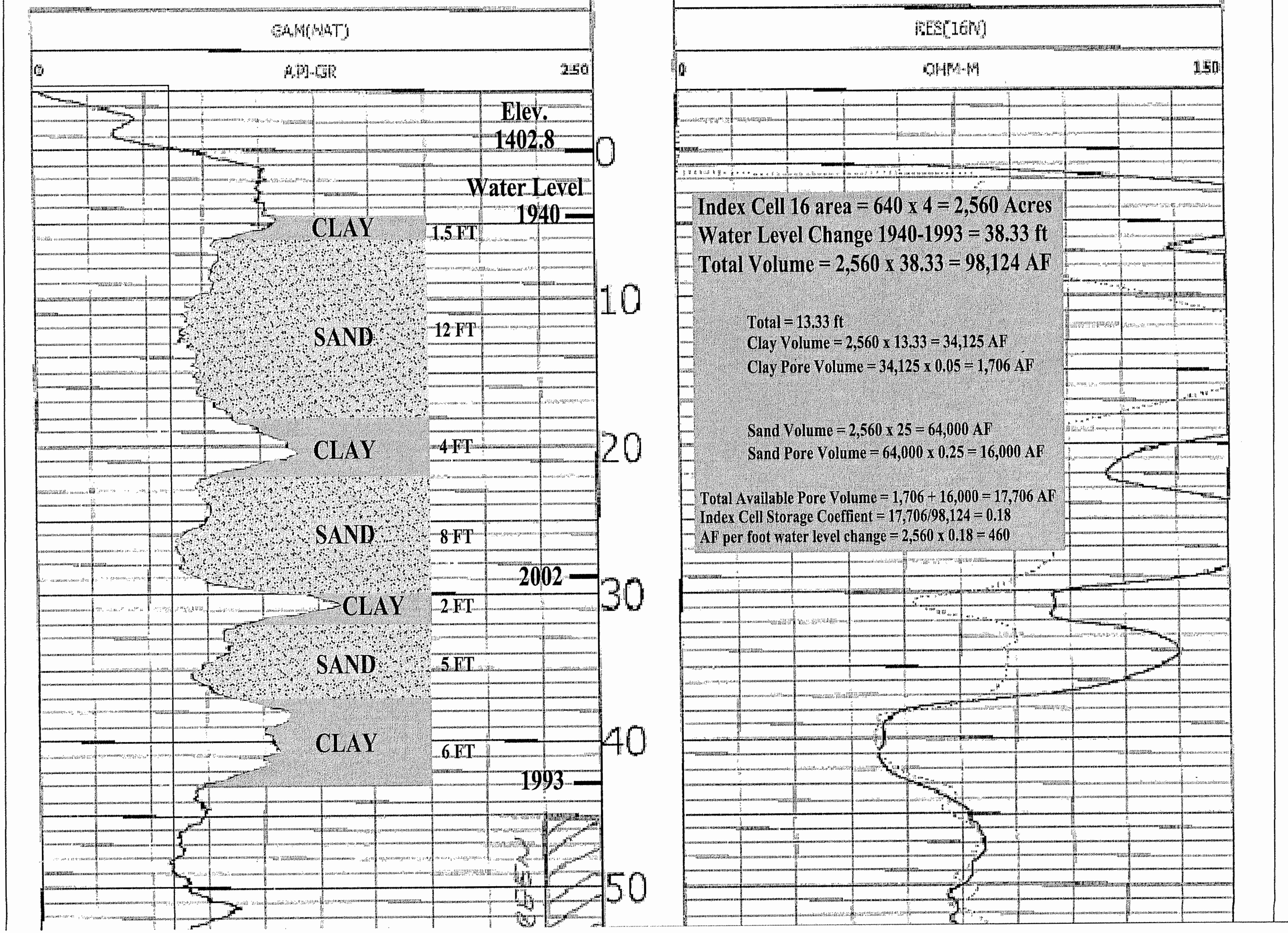
storageplot.grf 4/22/03

5-12-2003

Geophysical Log for Index Well 16C



5-12-2003

Water Level Elevations for Index Wells

A shallow -
C deep -

NAME	NORTHING (FT)	EASTING (FT)	TOP ELEVATION (FT)	1/1940** WATER LEVEL ELEVATION (FT MSL)	1/1993** WATER LEVEL ELEVATION (FT MSL)	INDEX CELL AVAILABLE (ACRE FT)	INDEX CELL STORAGE COEFFICIENT	ACRE FEET PER FOOT OF WATER LEVEL	1/2003 WATER LEVEL (FT)	1/2003 WATER LEVEL ELEVATION (FT MSL)	WATER LEVEL DIFFERENCE 1993-2003 (FT)	1993 TO 2003 STORAGE INCREASE (ACRE FT)
IW01A	1825319.16	1557832.54	1476.31	1424.15	1413.48	1,365	0.05	128	3.63	1472.68		
IW01AQC	1825319.07	1557832.55										
IW01C	1825313.97	1557833.56	1475.69						57.94	1417.75	-4.27	546
IW01CQC	1825314.08	1557833.69										
IW02A	1820124.47	1568428.90	1451.15	1416.8	1408.97	1,002	0.05	128	9.19	1441.96		
IW02AQC	1820124.47	1568428.91										
IW02C	1820124.35	1568424.56	1451.37						38.16	1413.21	-4.24	542
IW02CQC	1820124.30	1568424.58										
IW03A	1820215.74	1579072.30	1408.67	1400	1396.62	433	0.05	128	11.85	1396.82		
IW03AQC	1820215.70	1579072.26										
IW03C	1820216.16	1579067.27	1409.15						12.61	1396.54	0.08	-10
IW03CQC	1820216.05	1579067.32										
IW04A	1808005.44	1557998.54	1443.49	1431.35	1423.30	5,152	0.25	640	13.24	1430.25		
IW04C	1808011.90	1557999.27	1444.15						22.75	1421.40	1.90	-1,214
IW05A	1809553.16	1565880.16	1443.96	1425.41	1407.27	2,355	0.05	128	28.12	1415.84		
IW05C	1809552.96	1565887.41	1443.87						28.13	1415.74	-8.47	1,085
IW06A	1809525.90	1577827.91	1433.90	1412.13	1387.04	5,760	0.09	228	31.8	1402.10		
IW06AQC	1809525.78	1577827.94										
IW06C	1809525.10	1577820.91	1433.93						32.74	1401.19	-14.15	3,227
IW06CQC	1809525.01	1577820.84										
IW07A	1804376.08	1585311.23	1428.19	1395.64	1363.97	6,110	0.11	187	46.06	1382.13		
IW07C	1804375.72	1585317.90	1428.00						46.98	1381.02	-17.05	3,189
IW08A	1800581.12	1558155.07	1441.25	1430.97	1421.58	2,425	0.10	256	15.05	1426.20		
IW08AQC	1800581.58	1558155.16										
IW08C	1800581.29	1558150.75	1441.32						15.93	1425.39	-3.81	976
IW08CQC	1800580.99	1558150.62										
IW09A	1798779.92	1568640.33	1433.26	1421.45	1402.49	10,598	0.22	563	18.25	1415.01		
IW09C	1798787.16	1568640.24	1433.22						27.57	1405.65	-3.16	1,776
IW10A	1799024.72	1577966.62	1433.47	1412.43	1385.00	12,947	0.18	460	36.98	1396.49		
IW10C	1799024.35	1577961.82	1433.35						38.13	1395.22	-10.22	4,700
IW11A	1796444.46	1589844.65	1417.42	1390	1365.00	3,200	0.05	128	37.85	1379.57		
IW11C	1796444.15	1589854.91	1417.87						37.76	1380.11	-15.11	1,934
IW12A	1799164.25	1600485.05	1388.79	1370	1369.56	217	0.25	494	19.93	1368.86		
IW12C	1799163.91	1600478.68	1389.00						20.31	1368.69	0.87	-429
IW13A	1788309.23	1558182.13	1438.07	1430	1422.04	2,534	0.12	307	12.75	1425.32		
IW13C	1788303.37	1558181.46	1438.39						13.09	1425.30	-3.26	1,002
IW14A	1785704.39	1568741.41	1424.43	1417.5	1396.35	13,760	0.25	640	15.99	1408.44		
IW14C	1785709.75	1568741.48	1424.54						19.01	1405.53	-9.18	5,873
IW15A	1788405.37	1579223.86	1421.50	1408.33	1366.74	18,425	0.17	435	31.47	1390.03		
IW15C	1788412.89	1579223.75	1420.95						31.75	1389.20	-22.46	9,769
IW16A	1788459.35	1587245.25	1405.03	1398.33	1360.00	17,706	0.18	460	24.09	1380.94		
IW16C	1788459.26	1587251.84	1404.67						24.53	1380.14	-20.14	9,265
IW17A	1788598.71	1600532.19	1388.24	1375.81	1365.00	1,383	0.05	128	19.33	1368.91		
IW17C	1788599.40	1600525.02	1388.17						19.89	1368.28	-3.28	419
IW18A	1778914.36	1558202.09	1433.70	1425.68	1420.45	2,717	0.20	512	9.51	1424.19		
IW18C	1778920.48	1558200.31	1433.74						9.53	1424.21	-3.76	1,926
IW19A	1775194.34	1568893.55	1420.82	1414.21	1401.85	1,582	0.05	128	12.67	1408.15		
IW19C	1775187.05	1568893.74	1421.01						12.91	1408.10	-6.25	800
IW20A	1777889.43	1579297.89	1417.86	1404.48	1380.00	11,325	0.18	460	26.11	1391.75		
IW20C	1777889.90	1579291.82	1417.32						27.88	1389.44	-9.44	4,340
IW21A	1777937.47	1588330.35	1408.30	1392.94	1367.02	9,973	0.15	384	29.24	1379.06		
IW21C	1777937.37	1588324.57	1408.46						29.19	1379.27	-12.25	4,704
IW22A	1778028.21	1602651.25	1387.31	1374.75	1355.00	12,256	0.24	614	22.01	1365.30		
IW22C	1778028.08	1602645.47	1387.51						22.39	1365.12	-10.12	6,214
IW23A	1778152.76	1611263.98	1381.33	1361.67	1358.78	339	0.05	117	21.96	1359.37		
IW23C	1778152.80	1611269.89	1381.23						21.94	1359.29	-0.51	60
IW24A	1767079.64	1556973.34	1429.79	1421.94	1418.52	2,188	0.25	640	8.23	1421.56		
IW24C	1767079.87	1556980.82	1429.78						8.14	1421.64	-3.12	2,000
IW25A	1767165.72	1567509.53	1420.77	1412.72	1407.04	2,263	0.20	512	11.23	1409.54		
IW25C	1767168.22	1567503.30	1420.51						10.97	1409.54	-2.50	1,280
IW26A	1769351.76	1579525.41	1410.20	1401.19	1390.00	4,504	0.16	410	14.12	1396.08		
IW26C	1769359.33	1579526.43	1410.28						25.2	1385.08	4.92	-2,019
IW27A	1766263.58	1590121.24	1398.84	1389.57	1371.19	10,288	0.22	563	18.62	1380.22		
IW27C	1766268.98	1590122.21	1398.85						22	1376.85	-5.66	3,185
IW28A	1764816.39	1600706.13	1389.58	1376.69	1351.17	12,736	0.19	486	24.93	1364.65		
IW28C	1764823.52	1600706.20	1390.01						29.86	1360.15	-8.98	4,363

NAME	NORTHING (FT)	EASTING (FT)	TOP ELEVATION (FT)	1/1940** WATER LEVEL ELEVATION (FT MSL)	1/1993** WATER LEVEL ELEVATION (FT MSL)	INDEX CELL AVAILABLE (ACRE FT)	INDEX CELL STORAGE COEFFICIENT	ACRE FEET PER FOOT OF WATER LEVEL	1/2003 WATER LEVEL (FT)	1/2003 WATER LEVEL ELEVATION (FT MSL)	WATER LEVEL DIFFERENCE 1993-2003 (FT)	1993 TO 2003 STORAGE INCREASE (ACRE FT)
IW29A	1767609.11	1611273.43	1377.18	1365.41	1351.13	2,483	0.07	179	19.05	1358.13		
IW29C	1767602.65	1611275.05	1377.00						19.84	1357.16	-6.03	1,081
IW30A	1756621.66	1580935.74	1405.52	1396.86	1390.00	4,390	0.25	640	13.68	1391.84		
IW30C	1756621.15	1580942.01	1405.60						14	1391.60	-1.60	1,027
IW31A	1756725.37	1590338.24	1392.41	1385	1377.50	3,776	0.20	512	9.44	1382.97		
IW31C	1756718.12	1590338.65	1392.73						23.24	1369.49	8.01	-4,099
IW32A	1755598.78	1600820.69	1384.16	1374	1361.79	5,658	0.18	460	17.17	1366.99		
IW32C	1755593.78	1600821.21	1384.45						17.47	1366.98	-5.19	2,387
IW33A	1759610.19	1611365.93	1378.12	1360	1344.00	3,840	0.25	640	22.56	1355.56		
IW33C	1759615.31	1611365.99	1378.41						22.9	1355.51	-11.51	7,369
IW34A	1757111.49	1620292.72	1365.94	1349.26	1351.00				16.74	1349.20		
IW34C	1757112.28	1620299.15	1366.19						16.72	1349.47	1.53	
IW35A	1746193.40	1593027.37	1383.75	1378.96	1376.77	163	0.05	74	5.16	1378.59		
IW35C	1746196.61	1593033.15	1383.61						8.04	1375.57	1.20	-89
IW36A	1746268.18	1602176.30	1376.74	1370	1365.00	2,016	0.25	403	9.22	1367.52		
IW36C	1746267.24	1602182.59	1376.38						10.56	1365.82	-0.82	329
IW37A	1746420.44	1611521.96	1371.36	1360	1351.00	3,066	0.21	348	14.89	1356.47		
IW37C	1746414.52	1611522.52	1371.51						14.87	1356.64	-5.64	1,962
IW38A	1749102.51	1622024.92	1363.54	1350	1343.00	596	0.05	85	15.59	1347.95		
IW38C	1749108.09	1622025.46	1363.42						15.79	1347.63	-4.63	393
						201,531	**0.152**					**79,865**

NOTES:
1. TOP = Top of PVC well casing
2. WATER LEVEL measured from top of PVC casing September 23-27, 2002
3. Survey performed from September 23-27, 2002 with Global Positioning System equipment (Trimble Total Station Model 5700).
4. Survey data accuracy is +/-1 cm vertically, and < 1 cm horizontally.

** -- Elevations interpolated from USGS contours in WRI 98-4141.

*** -- Deep well water levels were used to calculate 2002 water elevations for each index cell.