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September 3, 2010

MEMORANDUM

To: Thad Kuntz, North Platte Natural Resources District

From: Richard R. Luckey, High Plains Hydrology, LLC *Richard R. Luckey*

Copies to: Jesse Bradley, Nebraska Department of Natural Resources

Subject: Streamflow accretion by model cell – shapefile stream_depleteion_100902

This memorandum documents the subject shapefile and associated files contained in the attached DVD.

Background

As part of the process of generating Unit Response Functions (URF) for the Western Water Use Surface-Water model, a series of transects were run perpendicular to the North Platte River using the COHYST utility program CycleWell. CycleWell automatically moves a test well within a block of cells as described in the input file, runs MODFLOW, runs ZoneBudget, and stores the output from ZoneBudget in a specially designed database. Queries within the database performed various operations, including calculating change in streamflow due to the test well and stream accretion at the end of 50 years.

The process of using CycleWell began April 18, 2010. The process was restarted on May 3 when the decision was made to use a single stream zone instead of one zone for the North Platte basin and another zone for the South Platte basin. CycleWell was mostly run at night and on weekends on an idle workstation. Because CycleWell frequently opens and closes various windows, it was difficult to run it while actively using other applications. After initially using these transects to estimate where to place test wells to generate URF's, it became apparent that transects every few miles were insufficient to make the estimates. At that point, it was decided to run CycleWell for every active cell in the model. The process was completed June 27, 2010.

Shapefile

The shapefile is named stream_depleteion_100902. It is a cleaned up version of shapefile Transects_100629 referenced in the URF documentation. Metadata was created for the shapefile. This shapefile depicts 50-year stream accretion calculated using the western Cooperative Hydrology Study (COHYST) model, version dated October 23, 2006. Stream accretion was calculated using a test well simulated as injecting 8000 cubic feet per day continuously for 50 years. Stream accretion is expressed as the ratio of cumulative increased volume of streamflow due to the test well at the end of 50 years to the total volume injected by the test well.

This shapefile was generated to select model nodes to produce URF's for a surface-water model of the North Platte Natural Resources District. This dataset also can be used for preliminary screening of proposed changes in groundwater uses. This dataset will indicated the effects of the

changes in groundwater uses on streamflow as a whole; this dataset will not tell where these effects would occur.

The fields in the shapefile are described in the metadata. Field *strdep* is the ratio of cumulative increased stream accretion at the end of 50 years due to the test well to the volume injected by the test well. As a ratio, this field is between zero and one, except that it is set to -9999 if stream accretion could not be calculated for that cell. This generally happened because the cell went dry during the simulation because of pumping in the cell or in nearby cells. At three cells, the model failed to converge, so stream accretion could not be calculated.

Field *Database* contains the name of the Access database from which monthly data on streamflow changes could be retrieved. Databases are discussed in the next section.

Databases

Four databases had to be used because of Access limits on database size. The databases are ZoneBudget_1_100503, ZoneBudget_1_100518, ZoneBudget_1_100601, and ZoneBudget_1_100618. The last part of the name represents year, month, and day when the database was started. The databases contain information on changes in streamflow for every month for a test well in every cell. However, the databases do not contain queries that can extract this information for a single cell, although one could be easily developed.

The databases contain three tables. Table *Strm|Welldata* is unused.

Table *tblZoneBudget* contains the various components of the water budgets. Fields that start with the letter I indicate an inflow and fields that start with the letter O indicate an outflow. The budget components should generally be obvious from the name. *IStorage* indicates an increase in groundwater storage and *OStorage* indicates a decrease in storage. Both may have values because storage may be increasing in one part of the model and decreasing in another part. *IHeadDepBc* and *OHeadDepBc* indicates the head dependent boundary condition used to simulate Lake McConaughy. Fields *Row* and *Column* indicate the cell in the model in which the test well was placed for that simulation. If both are zero, the simulation is the baseline simulation without the test well. Fields *Period* and *Step* indicate the stress period and time step number in the simulation. Field *Zone* is the ZoneBudget zone number, which is essentially always 1 in these databases.

Table *tblZoneInOut* normally contains the zone-to-zone flow components. This table is pretty meaningless when essentially the entire model area is designated zone 1. One cell in the corner of the model was designated as zone 2 just to make CycleWell operate properly. This table was periodically purged so more data could be stored in the database.

DVD

This memorandum is accompanied by a DVD, which contains the shapefile, the databases, and various other files required by CycleWell. A list of files on the DVD follows.

```
Volume in drive C is HP
Volume Serial Number is 6268-AEAC
```

```
Directory of C:\Data\Nebraska_WMU\Stream_depletion_100902
```

09/02/2010	05:29 PM	<DIR>	.
09/02/2010	05:29 PM	<DIR>	..
09/01/2010	04:49 PM		168 CycleWell1ZB.ini
11/16/2009	10:16 AM		73,728 CycleWell1ZB24.exe
08/06/2007	12:00 PM		92 CycleWell_100130.asp
08/06/2007	12:00 PM		917,889 CycleWell_100130.ba6
08/06/2007	12:00 PM		925,110 CycleWell_100130.dis

08/06/2007	12:01 PM	1,490,597	CycleWell_100130.evt
08/06/2007	12:01 PM	6,775	CycleWell_100130.ghb
09/01/2010	04:49 PM	14,379	CycleWell_100130.glo
08/06/2007	12:00 PM	796,961	CycleWell_100130.lpf
05/03/2010	04:32 PM	655	CycleWell_100130.mfn
08/06/2007	12:00 PM	110	CycleWell_100130.mfr
01/30/2010	05:14 PM	749	CycleWell_100130.mfs
08/25/2008	01:30 PM	31,816	CycleWell_100130.oc
09/01/2010	04:49 PM	365,972	CycleWell_100130.out
08/06/2007	12:01 PM	78,440,958	CycleWell_100130.rch
08/06/2007	12:01 PM	31,583	CycleWell_100130.riv
05/03/2010	04:34 PM	26	CycleWell_100130.sip
08/06/2007	12:01 PM	133,985	CycleWell_100130.str
09/01/2010	04:49 PM	647	CycleWell_100130.wel
09/01/2010	04:49 PM	252,575	CycleWell_100130.zbo
09/01/2010	04:49 PM	8,740,352	CycleWell_1_100503.xls
02/10/2010	10:30 AM	567,232	CycleWell_supp_01.exe
02/19/2010	09:19 PM	121,522,800	CycleWell_supp_error.txt
05/03/2010	04:42 PM	60	CycleWell_supp_input.txt
09/01/2010	04:49 PM	1,728	CycleWell_supp_temp.txt
02/10/2010	10:35 AM	72,000	error_CycleWell.txt
02/10/2010	01:18 PM	352	extract.bat
09/02/2010	05:33 PM	3,308	files.txt
09/01/2010	04:49 PM	123	go
11/02/2004	02:35 PM	1,830,912	mf2k.exe
09/03/2010	11:05 AM	83,456	Stream_accretion_cover.doc
09/02/2010	11:56 AM	18,411,521	stream_depletion_100902.dbf
06/29/2010	08:29 AM	534	stream_depletion_100902.prj
09/02/2010	11:51 AM	474,716	stream_depletion_100902.sbn
09/02/2010	11:51 AM	49,076	stream_depletion_100902.sbx
09/02/2010	11:56 AM	1,260,520	stream_depletion_100902.shp
09/02/2010	01:12 PM	14,153	stream_depletion_100902.shp.xml
09/02/2010	11:56 AM	360,220	stream_depletion_100902.shx
09/02/2010	01:12 PM	8,754	stream_depletion_100902.txt
01/30/2010	11:18 AM	3,100	time_100130.dat
03/22/2010	02:01 PM	842,365	WMU_baseline_100322.ba6
08/08/2007	10:03 AM	355,773	WMU_layer.dat
06/21/2010	03:46 PM	512,000	zonbud_cum.exe
05/03/2010	04:50 PM	326	ZoneBud.bat
09/01/2010	04:49 PM	1,106,862,080	ZoneBudget_1_100503.mdb
09/01/2010	04:34 PM	1,106,477,056	ZoneBudget_1_100518.mdb
06/29/2010	08:14 AM	1,105,362,944	ZoneBudget_1_100601.mdb
09/02/2010	05:27 PM	1,108,361,216	ZoneBudget_1_100618.mdb
05/03/2010	04:56 PM	119,081	Zones_1_100503.txt

49 File(s) 4,665,779,225 bytes
2 Dir(s) 1,036,637,499,392 bytes free

stream_depletion_100902

Shapefile

Description	Spatial	Attributes
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Keywords

Theme: COHYST, western model

Place: Nebraska, Arthur County, Banner County, Box Butte County, Cheyenne County, Deuel County, Garden County, Grant County, Keith County, Kimball County, Morrill County, Scotts Bluff County, Sheridan County, Sioux County

Description

Abstract

This dataset depicts 50-year stream accretion calculated using the western Cooperative Hydrology Study (COHYST) model, version dated October 23, 2006. Stream accretion was calculated using a test well simulated as injecting 8000 cubic feet per day continuously for 50 years. Stream accretion is expressed as the ratio of increased volume of streamflow due to the test well at the end of 50 years to the total volume injected.

Purpose

This dataset was generated to select model nodes to produce Unit Response Functions (URF) for a surface-water model of the North Platte Natural Resources District. The URF's were produced using the existing western COHYST model.

This dataset also can be used for preliminary screening of proposed changes in groundwater uses. This dataset will indicated the effects of the changes in groundwater uses on streamflow as a whole; this dataset will not tell where these effects would occur.

Status of the data

Complete

Data update frequency: None planned

Time period for which the data is relevant

Date and time: September 2, 2010

Description:
publication date

Publication Information

Who created the data: Richard R. Luckey

Date and time: September 2, 2010

Data storage and access information

File name: stream_depletion_100902

Type of data: vector digital data

Location of the data:

- \\HP_PAVILION\Data\Nebraska_WMU\GIS\strm_riv_cells.shp

Data processing environment: Microsoft Windows Vista Version 6.1 (Build 7600) ;

ESRI ArcCatalog 9.3.1.3500

Accessing the data

Size of the data: 1.202 MB

Data transfer size: 0.206 MB

Constraints on accessing and using the data

Access constraints: This dataset is in the public domain and may be freely accessed.

Use constraints:

This dataset is in the public domain and may be freely used. When used, acknowledgement of Nebraska Department of Natural Resources, North Platte Natural Resources District, South Platte Natural Resources District, and High Plains Hydrology, LLC is appreciated.

Details about this document

Contents last updated: 20100902 at time 13115100

Who completed this document

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Standards used to create this document

Standard name: FGDC Content Standards for Digital Geospatial Metadata

Standard version: FGDC-STD-001-1998

Time convention used in this document: local time

Metadata profiles defining additional information

- ESRI Metadata Profile: <http://www.esri.com/metadata/esriprof80.html>
- ESRI Metadata Profile: <http://www.esri.com/metadata/esriprof80.html>
- ESRI Metadata Profile: <http://www.esri.com/metadata/esriprof80.html>



stream_depletion_100902

Shapefile

Description	Spatial	Attributes
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Horizontal coordinate system*Projected coordinate system name:*

NAD_1983_StatePlane_Nebraska_FIPS_2600_Feet

Geographic coordinate system name: GCS_North_American_1983**Details****Bounding coordinates****Horizontal****In decimal degrees***West:* -104.245833*East:* -101.666604*North:* 42.578407*South:* 40.870626**In projected or local coordinates***Left:* 496320.000000*Right:* 1180080.000000*Top:* 1004520.000000*Bottom:* 405240.000000**Lineage****FGDC lineage****Process step 1***Process description:* Metadata imported.*Source used:* C:\Temp\xmlA3F4.tmp*Process date:* 20100902 at time 12002900**Spatial data description****Vector data information****ESRI description****stream_depletion_100902***ESRI feature type:* Simple*Geometry type:* Point*Topology:* FALSE*Feature count:* 45015*Spatial Index:* FALSE*Linear referencing:* FALSE

SDTS description

Feature class: SDTS feature type, feature count

- stream_depletion_100902: Entity point, 45015

stream_depletion_100902

Shapefile

Description	Spatial	Attributes
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Details for stream_depletion_100902

Type of object: Feature Class

Number of records: 45015

Attributes

FID

Alias: FID

Data type: OID

Width: 4

Precision: 0

Scale: 0

Definition:

Internal feature number.

Definition Source:

ESRI

Shape

Alias: Shape

Data type: Geometry

Width: 0

Precision: 0

Scale: 0

Definition:

Feature geometry.

Definition Source:

ESRI

ROW

Alias: ROW

Data type: Number

Width: 8

Definition:

Row in model grid

COLUMN

Alias: COLUMN

Data type: Number

Width: 8

Definition:

Column in model grid

temp_01

Alias: TEMP_01
Data type: Double
Width: 16
Precision: 15
Scale: 8
Definition:
Temporary field used for calculations

X_COORD

Alias: X_COORD
Data type: Number
Width: 18
Number of decimals: 5
Definition:
X coordinate of model node

Y_COORD

Alias: Y_COORD
Data type: Number
Width: 18
Number of decimals: 5
Definition:
Y coordinate of model node

RowCol

Alias: RowCol
Data type: Number
Width: 10
Definition:
Concatenation of ROW and COLUMN

sumsd

Alias: sumsd
Data type: Float
Width: 19
Number of decimals: 11
Definition:
Volume of stream accretion to drains, general head boundaries, rivers, and streams due to test well at end of 50 years

difwell

Alias: difwell
Data type: Float
Width: 19
Number of decimals: 11
Definition:
Volume injected by the test well at end of 50 years

sumriv

Alias: sumriv
Data type: Float
Width: 19
Number of decimals: 11
Definition:
sumsd times -1

strdep

Alias: strdep
Data type: Float
Width: 19
Number of decimals: 11
Definition:
Ratio of increased stream accretion at end of 50 years due to test well to volume injected by the test well

Database

Alias: Database
Data type: String
Width: 254
Definition:
Name of Access database from which monthly response curve can be produced