

Estimation of Non-Federal Reservoir Evaporation

Basic Input Files:

- 2005_resevoirs_final.shp** (642 NFRs digitized by Dan)
- fed_lakes_05.shp** (Five Federal lakes in the basin, NETEVAP field updated for current year)
- nfr_evap.shp** (A total of 562 NFRs in the NE portion of the basin), which was a copy of the nfr_master_points.shp.
- Repub_AboveHarlan.shp** (Republican River basin above Harlan County Lake)
- union_blw_gage_subs.shp** (Sub-basins boundary file)

Methodology:

For a total of **562** non-federal reservoirs inventoried in the Republican River Basin within Nebraska, each reservoir has attributes of decimal longitude and latitude, storage and surface area at spillway elevation, and the digitized area, and etc.

A shapefile of **5** federal reservoirs with evaporation measurements was created. The nearest one of the federal reservoirs in Republican River basin to those 562 non-federal reservoirs was determined. The net evaporation rate [in inches] of the nearest federal reservoir was assigned to those corresponding non-federal reservoirs.

Evaporation loss [in acre-feet] of each non-federal reservoir was computed as a product of its presumed surface area or digitized area and net evaporation rate of the nearest federal lake. GIS analyses were used to locate each non-federal reservoir to its corresponding RRCA sub-basin.

Finally, the calculated non-federal reservoirs' evaporations were summarized by sub-basin.

Computation Steps:

1. In ArcMap, update the net evaporation rates for 5 federal reservoirs (see **Fed_ResNetEvap05.xls**) by editing **fed_lakes.shp** file. *If necessary*, update **nfr_evap.shp** file if there are new non-federal reservoirs identified for the current year.
2. In ArcCatalog, export following two shapefiles into coverages:
fed_lakes.shp → **fed_lakes_cov**
nfr_evap.shp → **nfr_evap_cov**

Tips: if there are errors in converting a shapefile to coverage, load it into an ArcMap project first, and then re-export it. This would make the shapefile ArcGIS friendly. Still having trouble, use Shapearc command in Arc to convert.

In ArcMap

3. Pre-process digitized non-federal reservoirs by eliminating those with "Note" field as "Dry", "Appear dry", "Mud hole", "Not in Nebraska".

2005_reservoirs_final.shp (642) → 2005_nfr_final.shp (494)

4. In ArcToolbox, select Coverage Tools → Analysis → Proximity → Near

Input Coverage = nfr_evap_cov

Near Coverage = fed_lakes_cov

Output Coverage = NFR_nrLake

Feature Type = POINT

Search Radius = 3000000 ft (Just set large enough to find a nearby lake)

5. Start an ArcMap Project, add following files into it:

nfr_nrlake point <coverage>

fed_lakes.shp

2005_nfr_final.shp

Repub_AboveHarlan.shp

union_blw_gage_subs.shp

6. In ArcMap, right click on **nfr_nrlake** and select Joins and Relates → Join
(Join federal lake's net evaporation rate into the table)

What do you want to join to this layer? Join attributes from a table.

Table to join is **fed_lakes**; the fields based on are FED_LAKES_COV# and FED_LAKES1.

7. Right click on **nfr_nrlake** again and select Joins and Relates → Join
(Join the current year's digitized reservoir surface areas)

What do you want to join to this layer? Join attributes from a table.

Table to join is **2005_nfr_final**; the fields based on are point:Evap_ID and EVAP_ID. Also click on the "Advanced" button and check the "Keep only matching records" option.

8. For whole basin, Export the nfr_nrlake into nfr_WholeBasin.shp (434)

9. In ArcToolbox, select Analysis Tools → Overlay → Identity

Input Feature = nfr_WholeBasin

Identity Feature = union-blw_gage_subs

Output Feature = **NFR_All.shp**

10. For basin above Harlan County Lake, Select only those reservoirs within the basin above Harlan County Lake by Location. Selection → Select By Location. Right click on nfr_nrLake, Selection → Create layer from the selected features. Then export it into **nfr_AbvHarlan.shp (287)**.

11. In ArcToolbox, select Analysis Tools → Overlay → Identity

Input Feature = nfr_AbvHarlan
Identity Feature = union-blw_gage_subs
Output Feature = **NFR_Abv.shp**

12. In ArcMap, add **NFR_All.shp and NFR_Abv.shp into the project.**
Save the ArcMap document (Near_Join2_Identity.mxd)!!!

13. Copy and Rename previous year's NFR_evap.mdb as NFR_evap2005.mdb. Import the *NFR_All.dbf* and *NFR_Abv.dbf* into the database. Copy/rename table NFR_All or NFR_Abv to **NFR_Sub** table.

14. Use *qry1ForMeaningfulFields* to query out those meaningful data fields in NFR_sub table. (*Becareful in selecting the right fields!!!*)

15. Use *qry2DetermineArea* to assign presumed surface area for each non-federal reservoir.

If a reservoir's normal storage is greater than 200 AF, use its surface acre at normal level;

For a reservoir with a storage capacity less than 200 AF, ~~the presumptive average annual surface area equals to 25% of its surface area at the principal spillway elevation. If the area at principal spillway is not available, the digitized acre is used.~~

** Use and digitizing manually*

16. Use *qry3CalculateEvap* to calculate each reservoir's evaporation as a product of the determined reservoir area and the net evaporation rate at the nearest federal reservoir.

17. Finally, use *qry4NFR_evap_bysubbasin* to summarize total non-federal reservoir evaporation for each sub-basin. Export the query results into an Excel file.

All files are located in C:\RRCA2006\NFR4 directory on PC29007.

29007

Estimates of Non-federal Reservoirs Net Evaporation in 2005

(Republican River Basin Above Harlan Co. Lake in Nebraska)

[acre-feet]

Sub Basin Name	Net Evaporation
Beaver Creek	50.66
Buffalo Creek	20.98
Driftwood Creek	1.75
Frenchman Creek	134.76
Mainstem Rep Riv & N F abv Guide Rock	976.68
Medicine Creek above Gage	292.27
Medicine Creek below Gage	7.15
Prairie Dog Creek	21.20
Red Willow Creek	181.89
Rock Creek	81.59
Sappa Creek above Gage	42.80
Sappa Creek below Gage	5.20
Total	1816.91

Estimates of Non-federal Reservoirs Net Evaporation in 2005

(Whole Republican River Basin in Nebraska)

[acre-feet]

Sub Basin Name	Net Evaporation
Beaver Creek	50.66
Buffalo Creek	20.98
Driftwood Creek	1.75
Frenchman Creek	134.76
Lower Republican River	24.52
Mainstem Rep Riv & N E-abv Guide Rock	1890.93
Mainstem Republican River blw Guide Rock	136.86
Medicine Creek above Gage	292.27
Medicine Creek below Gage	7.15
Prairie Dog Creek	21.20
Red Willow Creek	181.89
Rock Creek	81.59
Sappa Creek above Gage	42.80
Sappa Creek below Gage	5.20
Total	2892.55

Lower Republican River
 Mainstem Rep. R. blw Guide Rock
 Combined

**Instructions
For
Net Evaporation Computations of Non-federal Reservoirs**

1. Update **Fed_ResNetEvap07.xls** to calculate the current year net evaporation rate [inches] for five federal reservoirs in Republican River Basin within Nebraska.
2. In **NFR_NetEvapEstimation.mdb**, update table **FedLake**'s NETEVAP column to reflect the current year values.
3. Import the digitized NFR shapefile's dbf file into **NFR_NetEvapEstimation.mdb**.
4. Update/run queries: **qryNFR_NetEvap_AboveHarlanCoLake** and **qryNFR_NetEvap_All**
5. Update/run queries: **qryNetEvap_BySubbasin_AboveHarlanCoLake** and **qryNetEvap_BySubbasin_All**
6. Export two queries in Step 5 into Excel files, and format them.

Estimated Non-federal Reservoir Net Evaporation - 2007 (All Non-federal Reservoirs)

Sub_Basin Name	Net Evaporation [acre-fee]
Beaver Creek	59.25
Buffalo Creek	18.39
Driftwood Creek	5.26
Frenchman Creek	151.62
Lower Republican River*	13.44
Mainstem Rep Riv & N F abv Guide Rock	1524.45
Mainstem Republican River blw Guide Rock*	149.80
Medicine Creek above Gage	250.99
Medicine Creek below Gage	5.56
Prairie Dog Creek	43.70
Red Willow Creek	75.39
Rock Creek	54.97
Sappa Creek above Gage	32.38
Sappa Creek below Gage	2.63
Total	2153.31

** Lower Republican River needs to be comined into Mainstem Republican River blw Guide Rock for accounting purpose.*

Estimated Non-federal Reservoir Net Evaporation - 2007 (Above Harlan County Lake)

Sub_Basin Name	Net Evaporation [acre-fee]
Beaver Creek	59.25
Buffalo Creek	18.39
Driftwood Creek	5.26
Frenchman Creek	151.62
Mainstem Rep Riv & N F abv Guide Rock	838.99
Medicine Creek above Gage	250.99
Medicine Creek below Gage	5.56
Prairie Dog Creek	43.70
Red Willow Creek	75.39
Rock Creek	54.97
Sappa Creek above Gage	32.38
Sappa Creek below Gage	2.63
Total	1539.12