RIVERWARE APPLICATIONS: USACE - TULSA DISTRICT

John Daylor PE, CFM

2012 RiverWare User Meeting

US Army Corps of Engineers
BUILDING STRONG®

Flood Control & Hydropower

Navigation


M&I Diversion

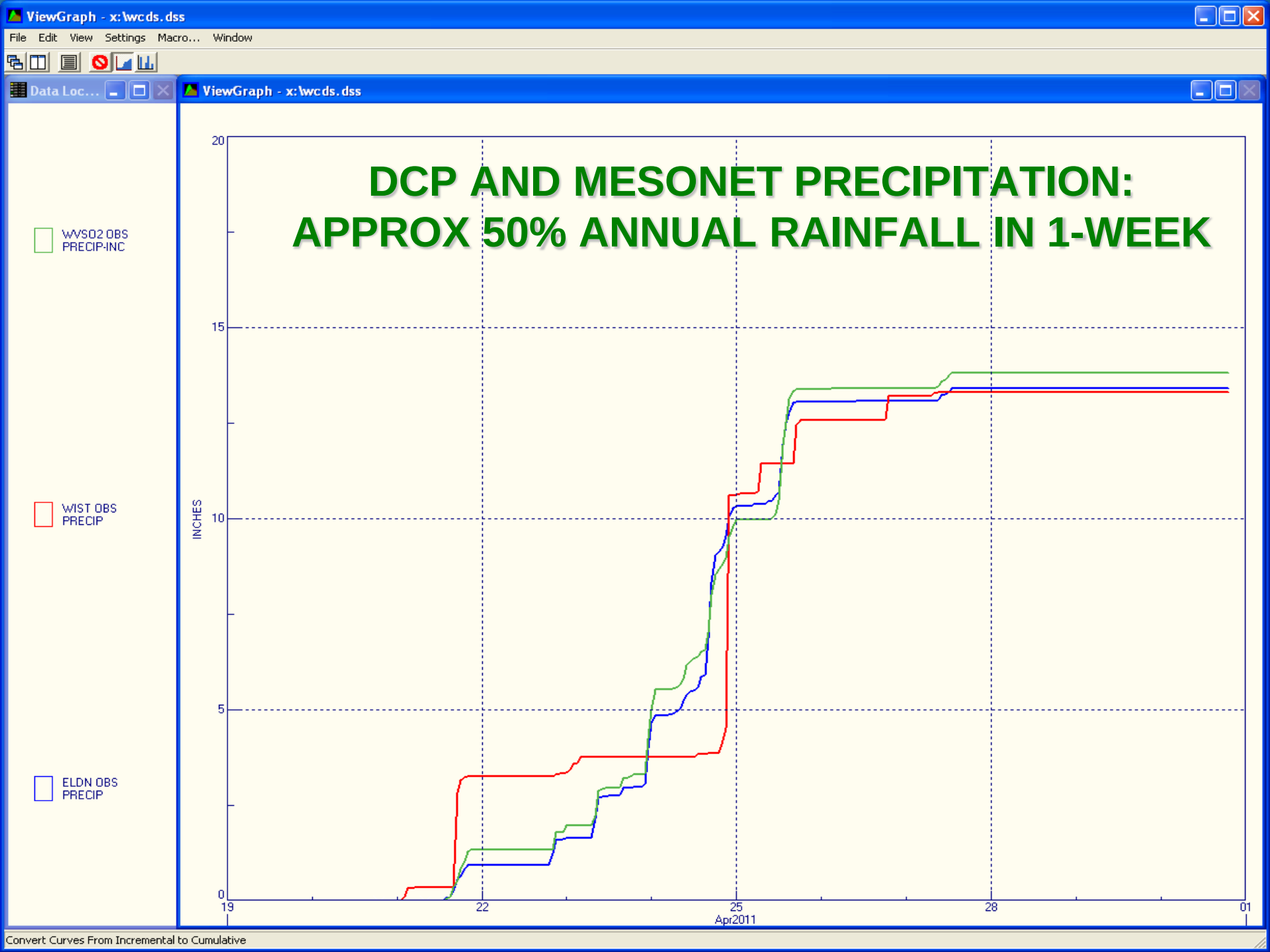
Recreation


PICNICKING ONLY
CAMPING ONLY
BOAT RAMP
SWIMMING AREA
REST ROOMS

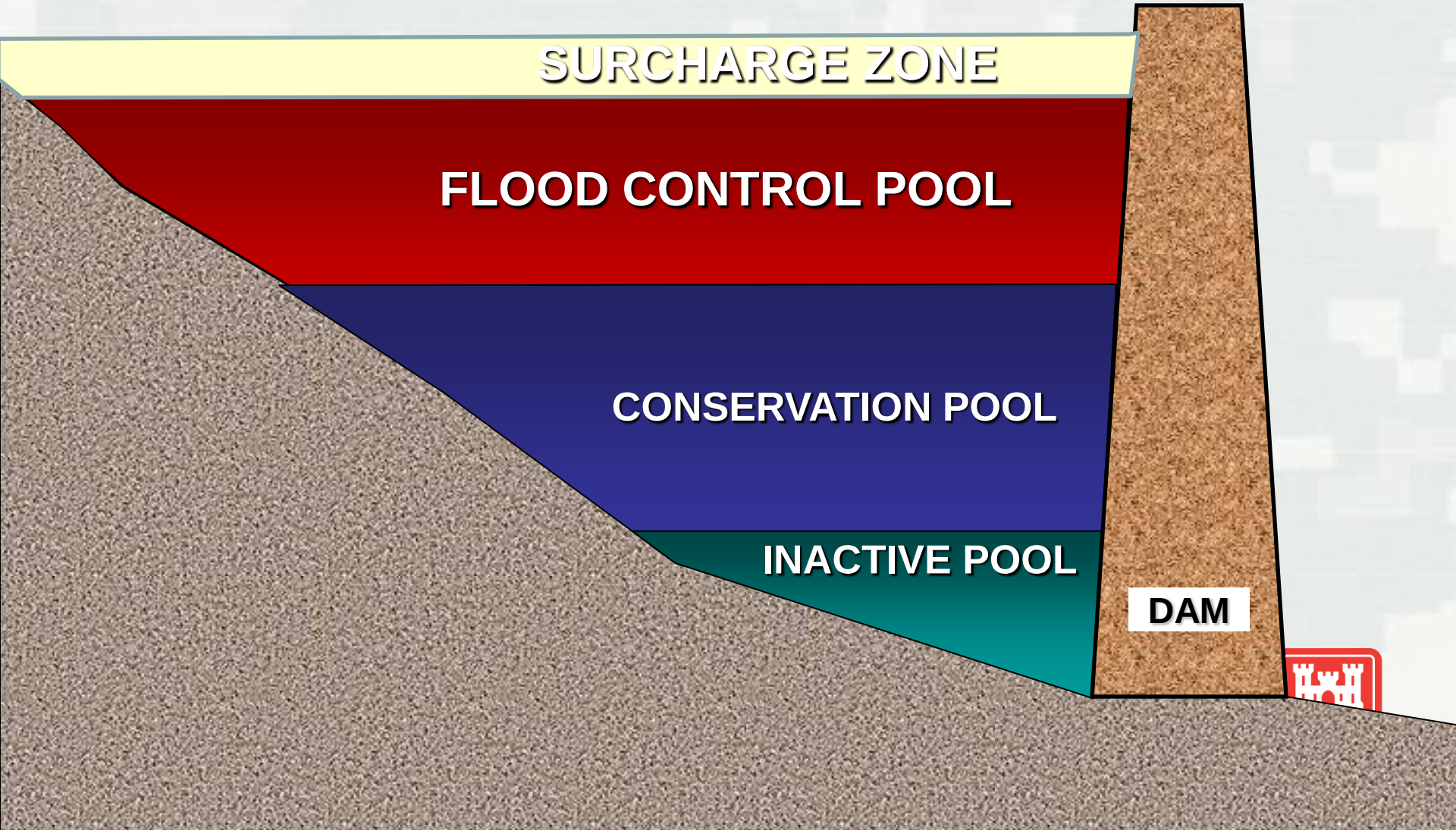

Fish and Wildlife
Interior Least Terns

Competing Purposes & Interests

Authorized Purposes vs Political Interests


ViewGraph - x:\wcds.dss
File Edit View Settings Macro... Window
Data Loc...
ViewGraph - x:\wcds.dss
DCP AND MESONET PRECIPITATION:
APPROX 50% ANNUAL RAINFALL IN 1-WEEK
WVSO2 OBS PRECIP-INC
WIST OBS PRECIP
ELDN OBS PRECIP
INCHES
20
15
10
5
0
19
22
25
28
01
Apr2011
Convert Curves From Incremental to Cumulative

Typical Storage Zones



STUDY APPROACH WITH RIVERWARE:

- Period of Record Rules Simulation: Daily Time Step
- CoE – SWD Flood Control Methods
- Base Condition Run: "Replicates Existing Reservoir & System Regulation Criteria"
- Alternative Run
- Post Processing for Evaluation

CoE-SWD FLOOD CONTROL METHODS:

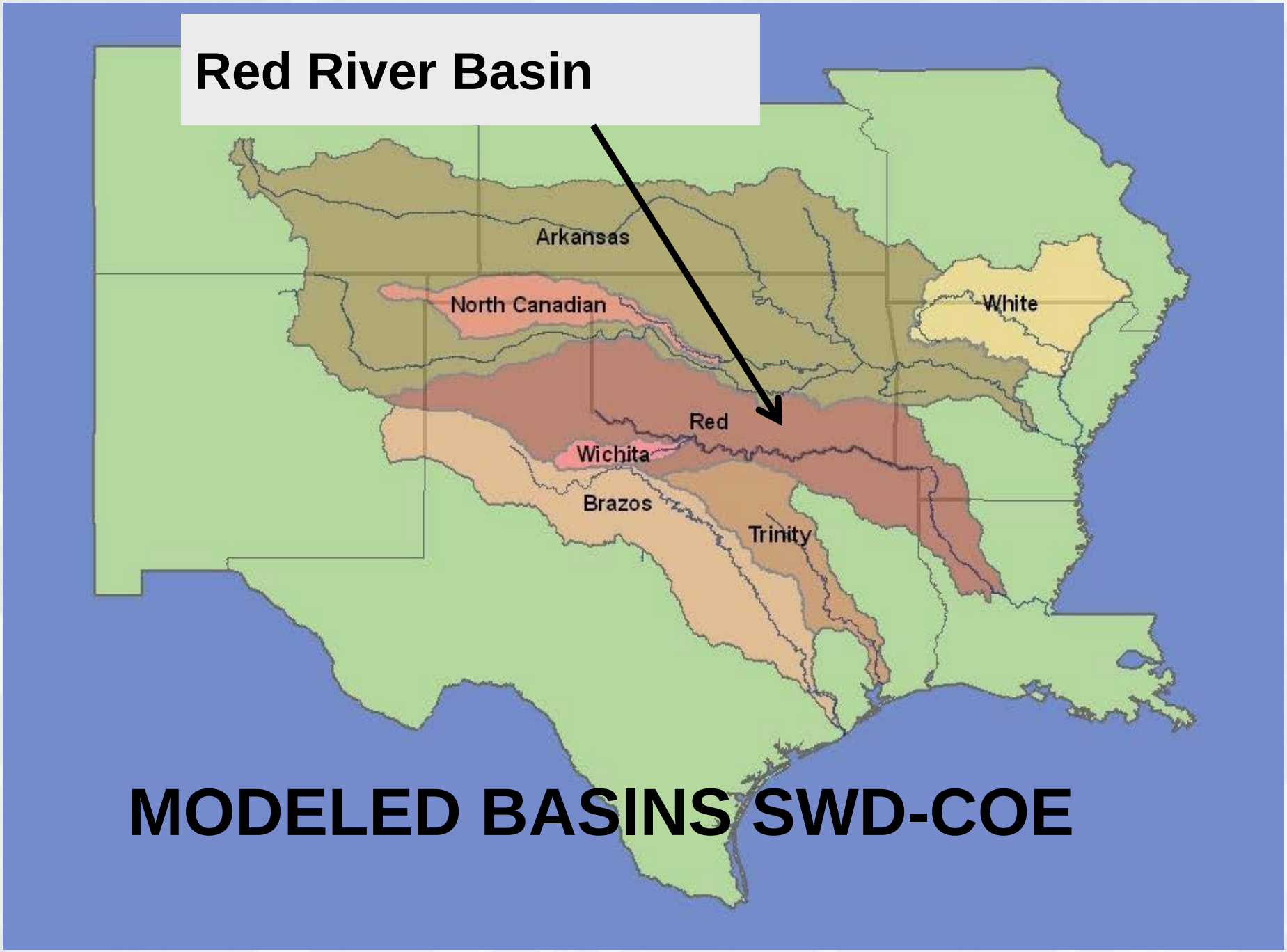
Balance Level vs % Storage

Period of Record Rules Simulation:

- Local Flow From Historic Hydrology
- Surcharge Routine
- Downstream Control Point Determination
- Reservoir Release Determination

CONSERVATION POOL OPERATIONS:

- Low Flow
- Reservoir Diversions
- Hydropower


Red River Basin
Arkansas
North Canadian
White
Red
Wichita
Brazos
Trinity
MODELED BASINS SWD-COE

RiverWare 6.1.1 - REDCOE_610P_BaseModel_Pine_438.mdl.gz

File Control Workspace Policy DMI Accounting Utilities Help

Simulation View

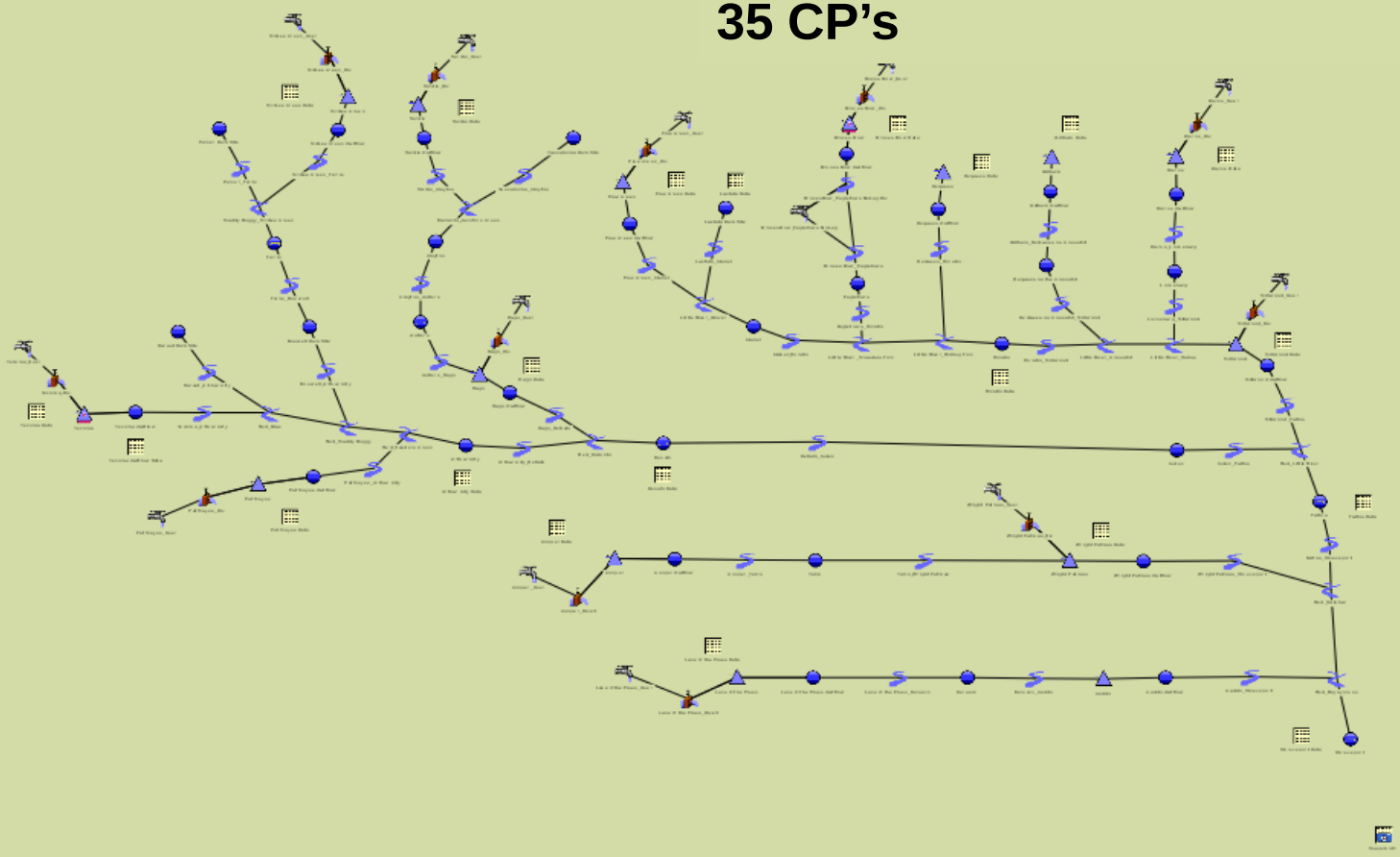
Red River System:

Jan 1937 – Dec 2007

15 Reservoirs

2 Hydropower

35 CP's



Simulation Object List

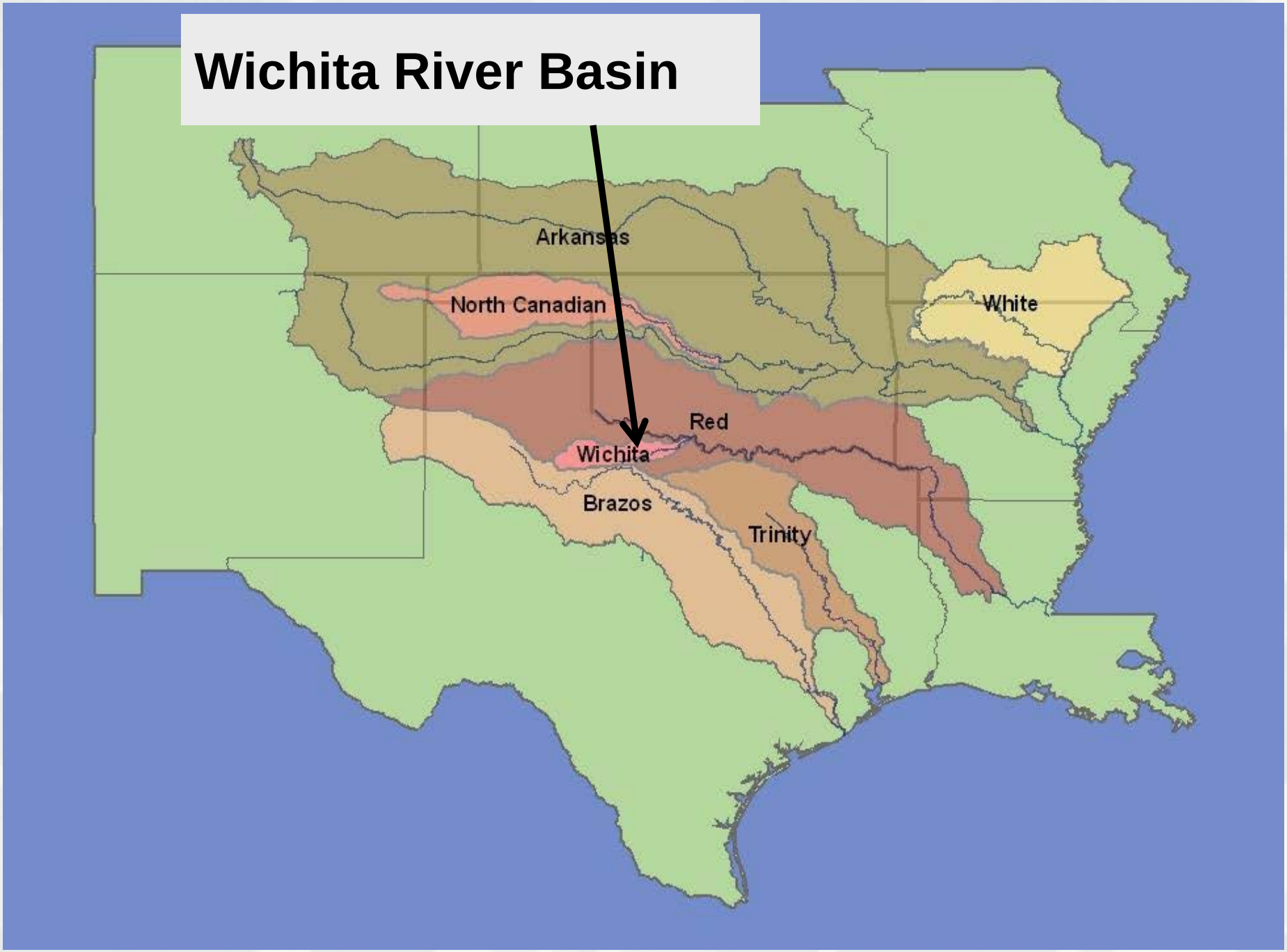
Sort by Name

Objects

- Antlers
- Antlers_Hugo
- Arthur City
- Arthur City Data
- Arthur City_DeKalb
- Boken Bow_User
- Boswell Dam Site
- Boswell_Arthur City
- Broken Bow
- Broken Bow Data
- Broken Bow Outflow
- Broken Bow_Div
- Broken Bow_Eagletown
- BrokenBow_Eagletown M
- BrokenBow_Eagletown M
- Caddo
- Caddo Outflow
- Caddo_Shreveport
- Clayton
- Clayton_Antlers
- Cooper
- Cooper Data
- Cooper Outflow
- Cooper_Divert
- Cooper_Talco
- Cooper_User
- Dekalb
- Dekalb Data
- DeKalb_Index
- Dequeen
- Dequeen Data
- DeQueen on Cossatot_M
- Dequeen on the Cossato
- Dequeen Outflow
- DeQueen_Horatio
- Dierks
- Dierks Data
- Dierks Outflow
- Dierks_Div
- Dierks_Locksburg

RBS Opt riverware

Wichita River Basin



RiverWare 6.1.1 - WichitaExist3bYld.mdl.gz

File Control Workspace Policy DMI Accounting Utilities Help

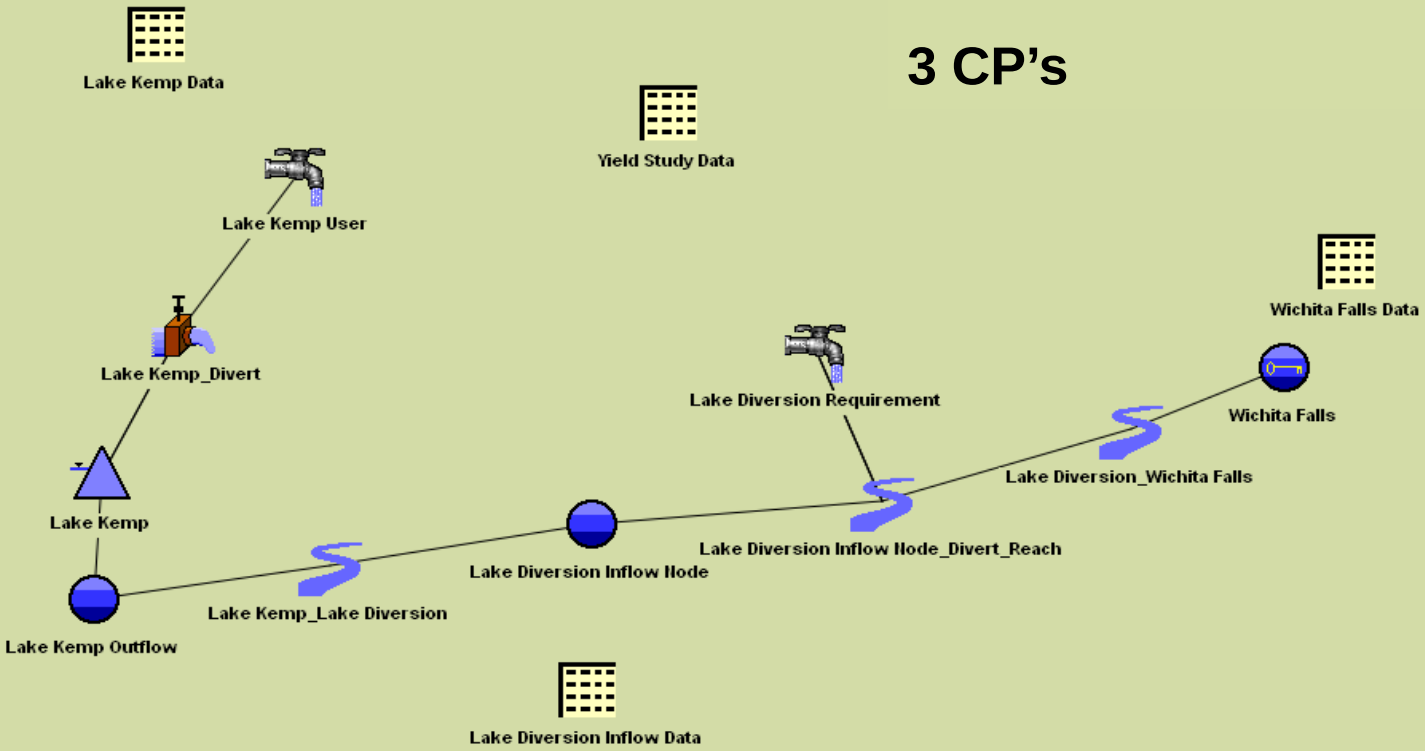
Simulation View

Wichita River System:

Jan 1924 – Dec 2002

1 Reservoir

3 CP's



Simulation Object List

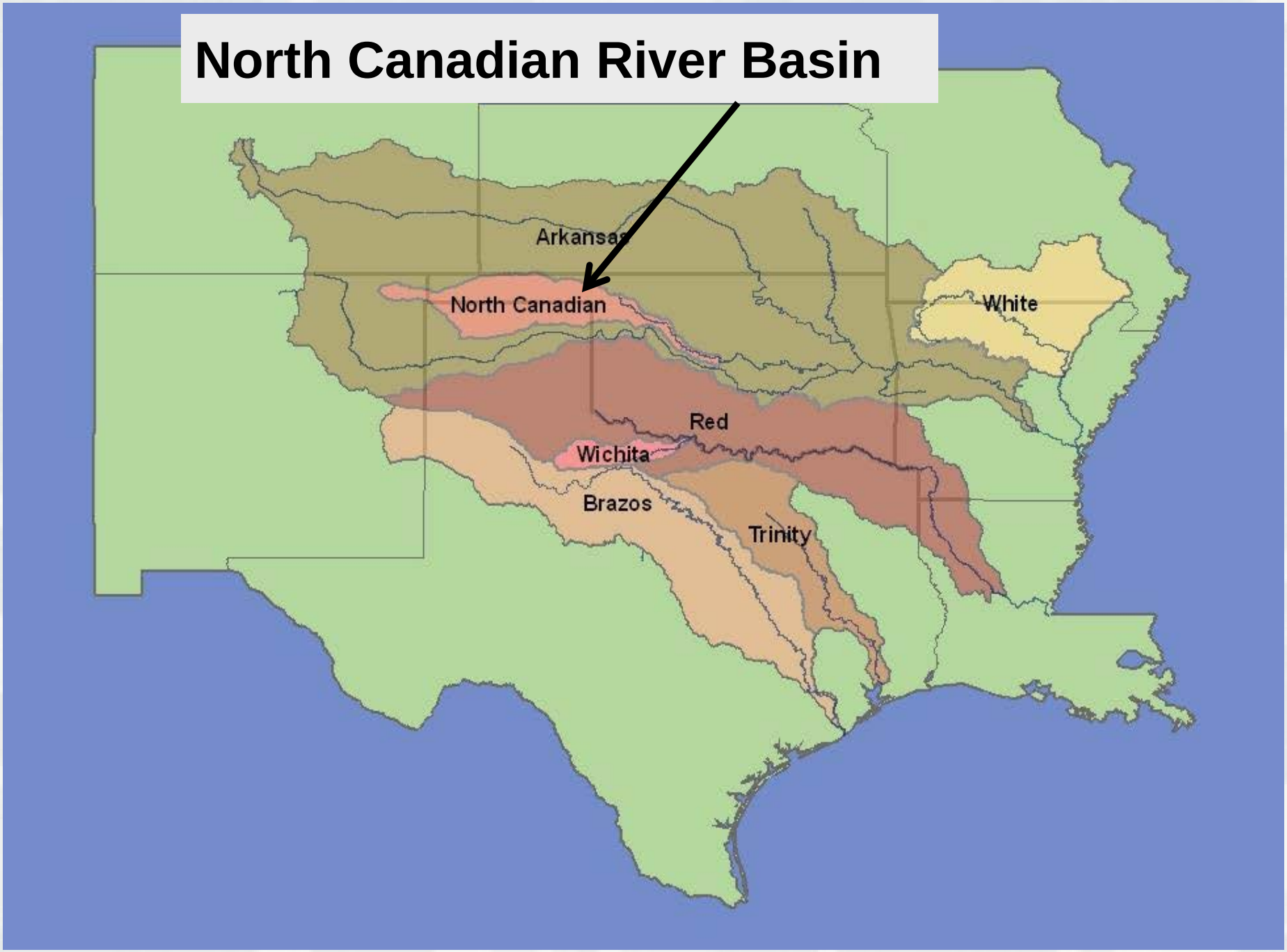
Sort by Name

Objects

- Lake Diversion Inflow Data
- Lake Diversion Inflow Node
- Lake Diversion Inflow Node_
- Lake Diversion Requirement
- Lake Diversion_Wichita Falls
- Lake Kemp
- Lake Kemp Data
- Lake Kemp Outflow
- Lake Kemp User
- Lake Kemp_Divert
- Lake Kemp_Lake Diversion
- Wichita Falls
- Wichita Falls Data
- Yield Study Data

RBS Opt riverware

North Canadian River Basin



RiverWare 6.1.1 - North Canadian.mdl.gz

File Control Workspace Policy DMI Accounting Utilities Help

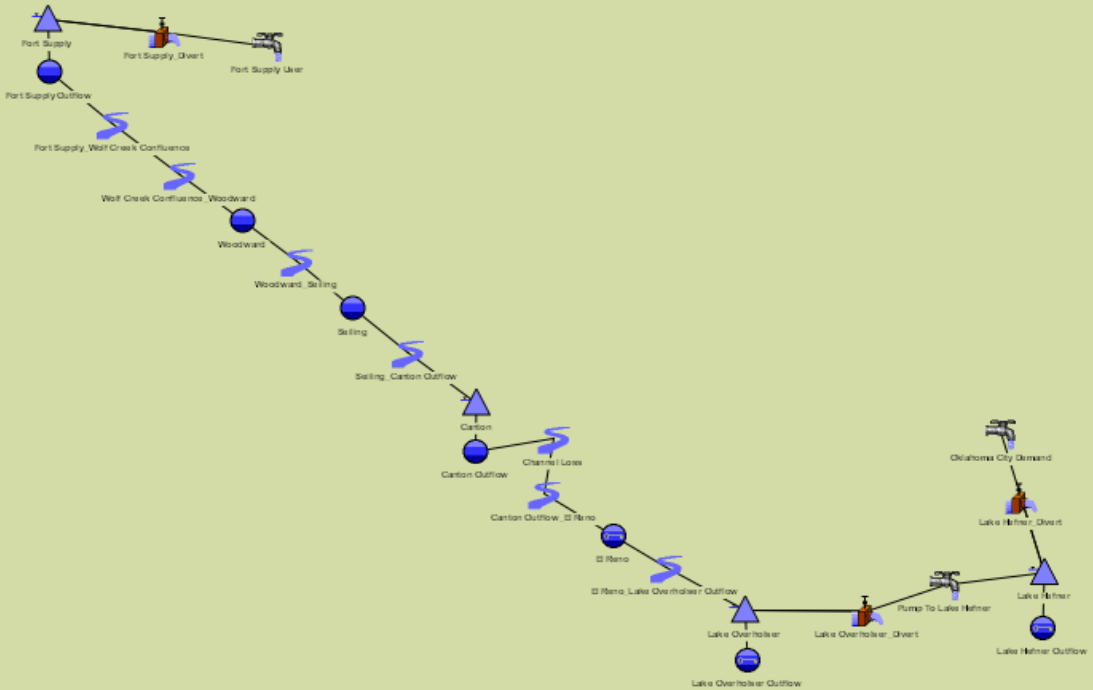
Simulation View

North Canadian River System:

Jan 1940 – Dec 1995

4 Reservoirs

7 CP's



Simulation Object List

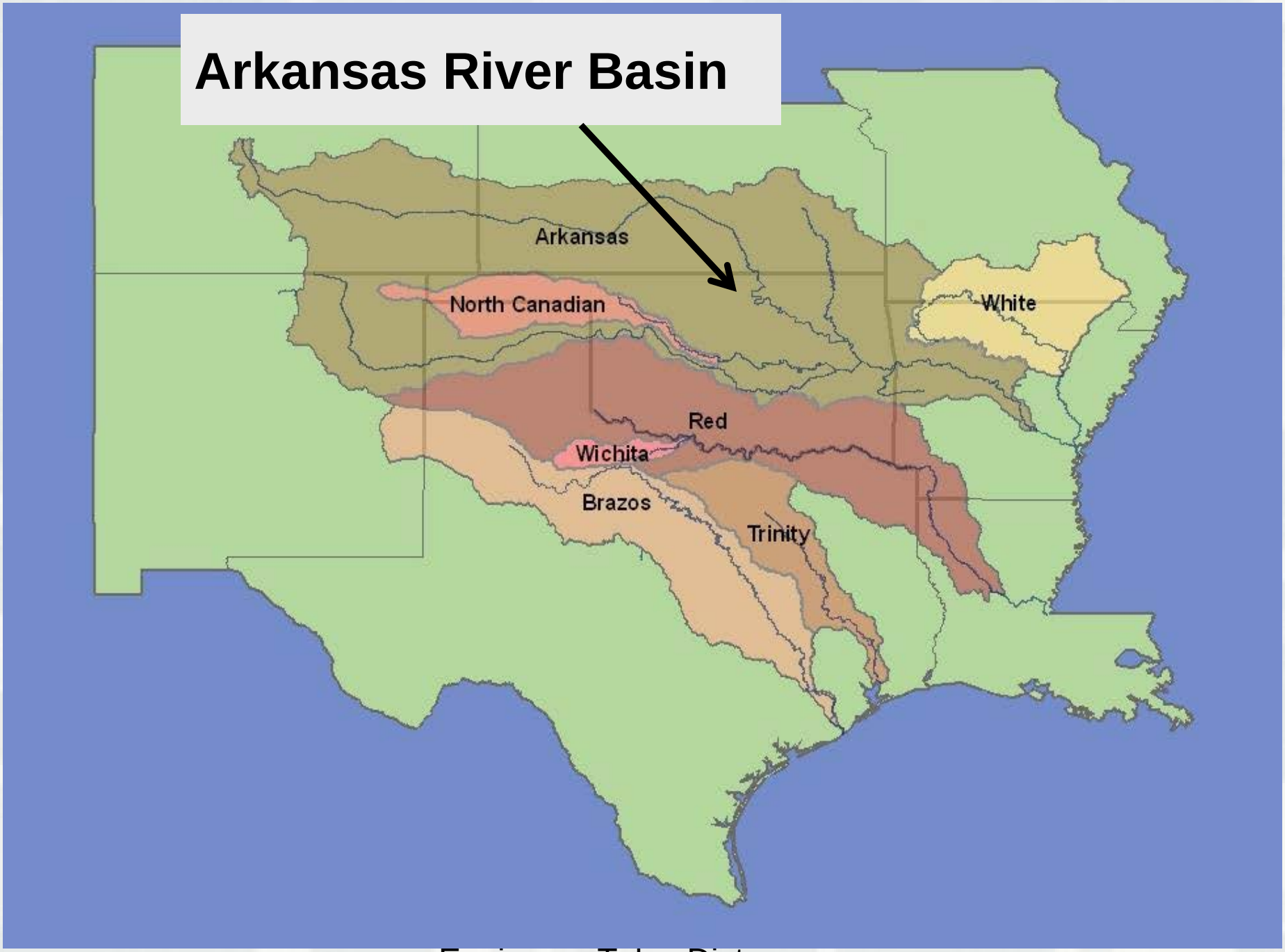
Sort by Name

Objects

- Canton
- Canton Outflow
- Canton Outflow_El Reno
- Channel Loss
- El Reno
- El Reno_Lake Overholser O
- Fort Supply
- Fort Supply Outflow
- Fort Supply User
- Fort Supply_Divert
- Fort Supply_Wolf Creek Co
- Lake Hefner
- Lake Hefner Outflow
- Lake Hefner_Divert
- Lake Overholser
- Lake Overholser Outflow
- Lake Overholser_Divert
- Oklahoma City Demand
- Pump To Lake Hefner
- Seiling
- Seiling_Canton Outflow
- Wolf Creek Confluence_Wo
- Woodward
- Woodward_Seiling

RBS Opt riverware

Arkansas River Basin



RiverWare 6.1.1 - ARK_Base_06Jan2012_611.mdl.gz

File Control Workspace Policy DMI Accounting Utilities Help

Simulation View

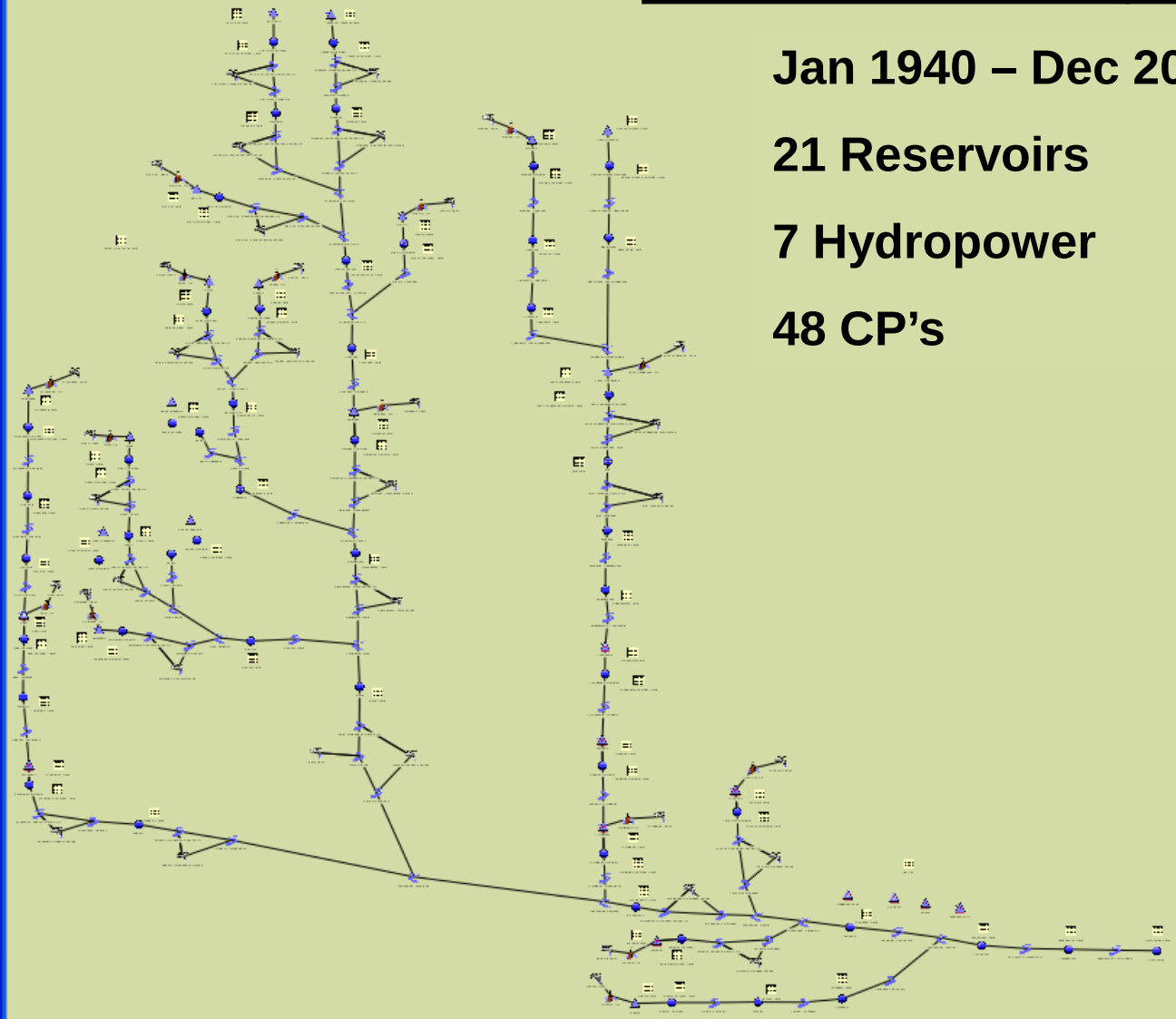
Arkansas River System

Jan 1940 – Dec 2008

21 Reservoirs

7 Hydropower

48 CP's



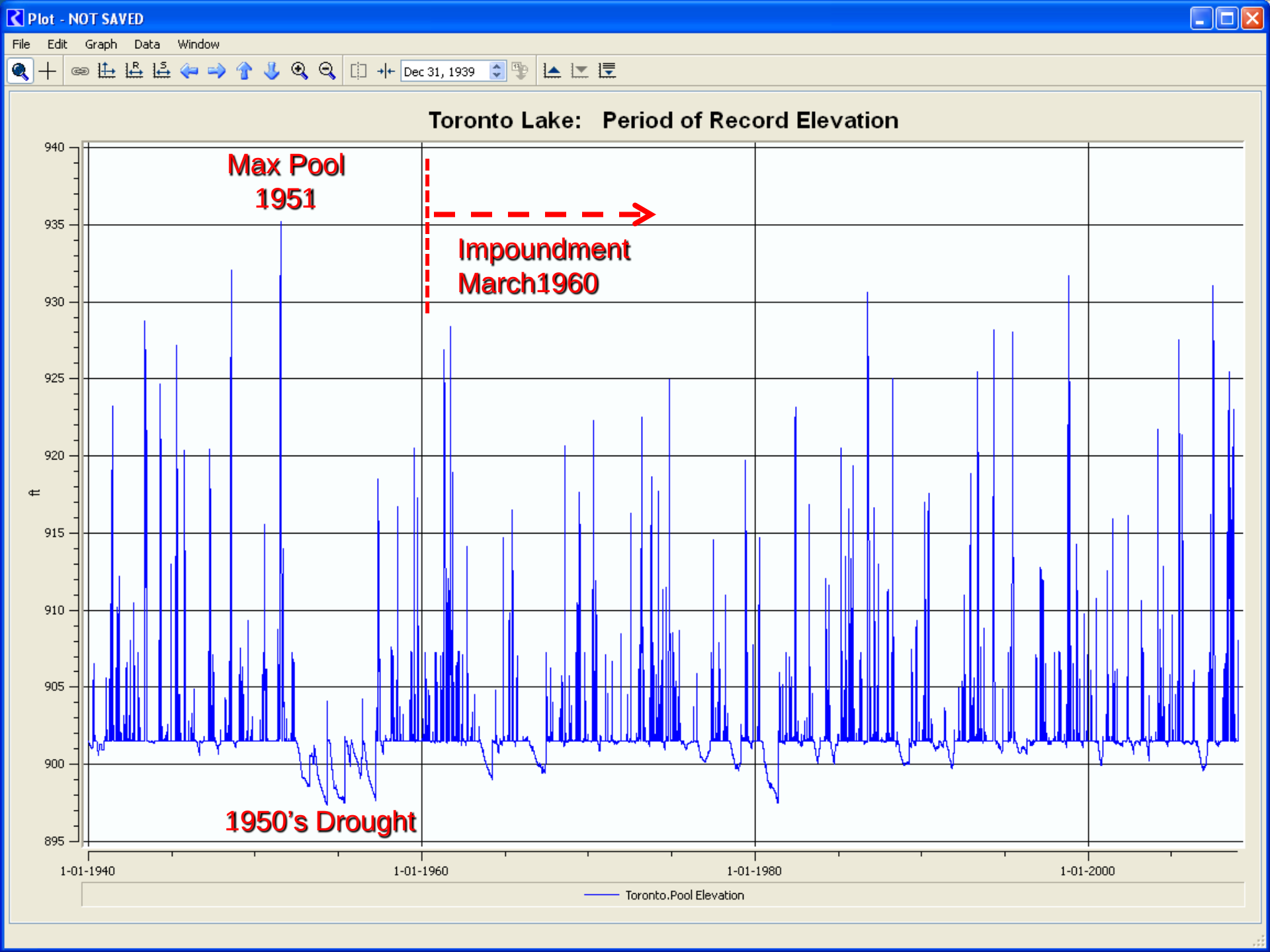
Simulation Object List

Sort by Name

Objects

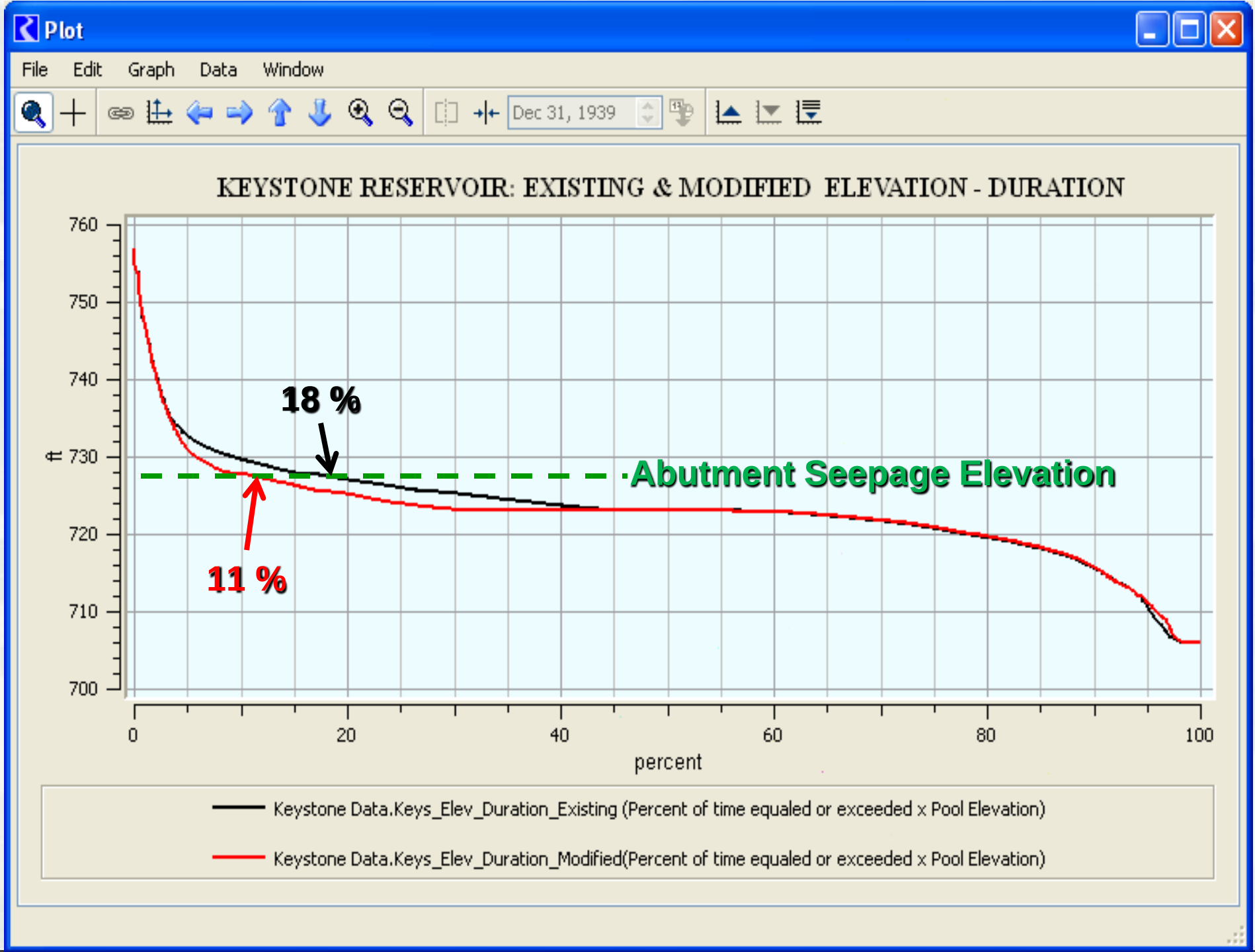
- Poteau_Data
- Poteau_Panama
- Ralston
- Ralston_Data
- Ralston_Keystone
- Ramona
- Ramona_Claremore
- Ramona_Data
- RS Kerr
- Sallisaw
- Sallisaw_Data
- Sallisaw_Van Buren
- Sand
- Sand Damsite
- Sand Outflow
- Sand Outflow_Data
- Sand_Ramona
- Skiatook
- Skiatook Data
- Skiatook Outflow
- Skiatook Outflow_Data
- Skiatook_Div
- Skiatook_Sperry
- Skiatook_Sperry NoLag
- Skiatook_Sperry NoLag I
- Skiatook_User
- Sperry
- Sperry_Data
- Sperry_Inola
- Tenkiller
- Tenkiller Data
- Tenkiller Outflow_Data
- Tenkiller_Div
- Tenkiller_Outflow
- Tenkiller_Sallisaw
- Tenkiller_Sallisaw NoLag
- Tenkiller_Sallisaw NoLag
- Tenkiller_User
- Toronto
- Toronto Data

RBS Opt riverware


Plot - NOT SAVED
File Edit Graph Data Window
Dec 31, 1939
Toronto Lake: Period of Record Elevation
Max Pool
1951
Impoundment
March1960
1950's Drought
940
935
930
925
920
915
910
905
900
895
ft
1-01-1940
1-01-1960
1-01-1980
1-01-2000
Toronto.Pool Elevation

RECENT & ONGOING STUDIES WITH RIVERWARE:

- Dam Safety Analysis
- Reservoir Control Manual Updates
- Capacity Resurveys
- Firm Yield with MRM
- Low Flow & Seasonal Pool

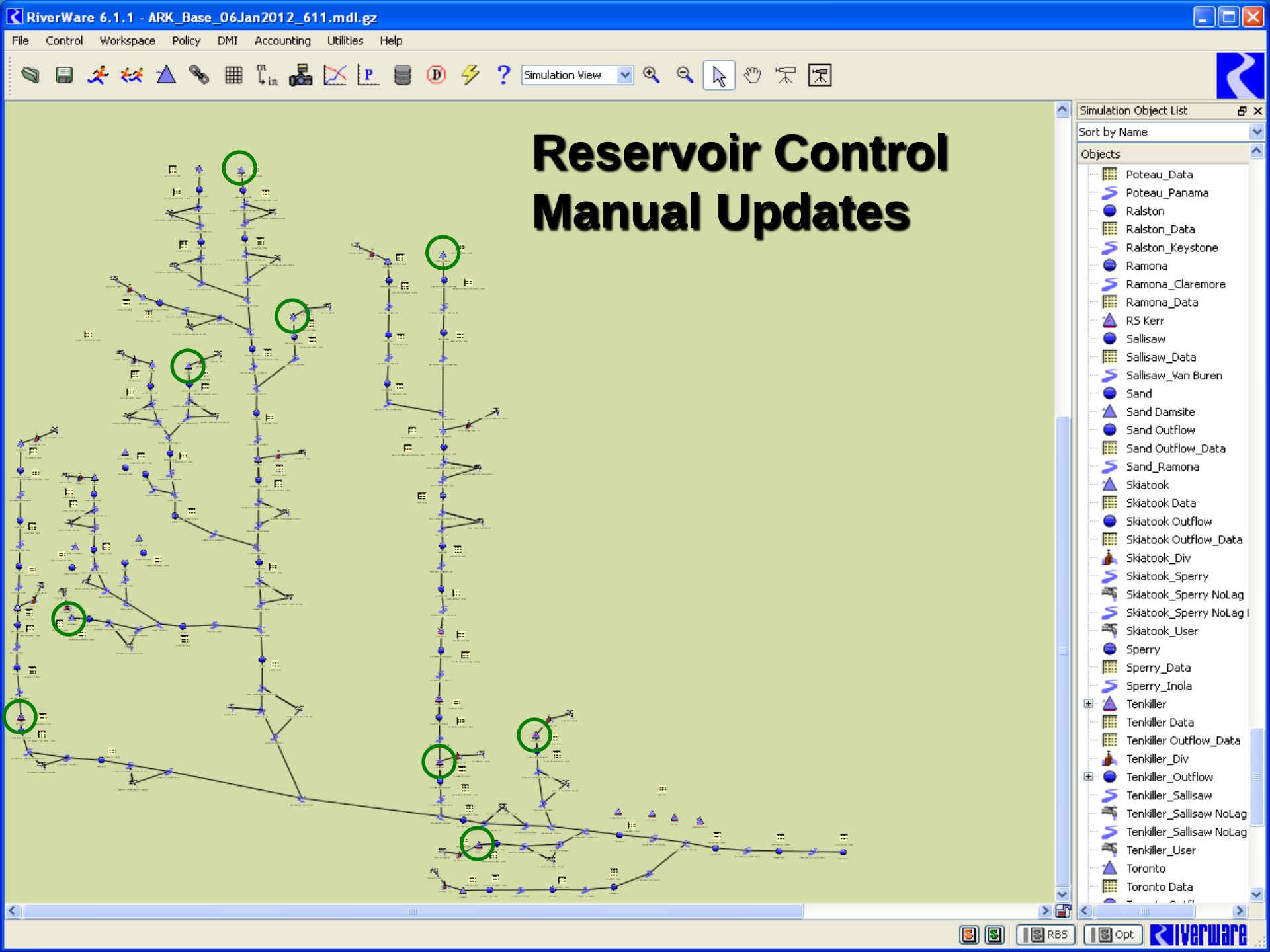

Plot
File
Edit
Graph
Data
Window
Dec 31, 1939
KEYSTONE RESERVOIR: EXISTING & MODIFIED ELEVATION - DURATION
760
750
740
730
720
710
700
ft
18 %
11 %
Abutment Seepage Elevation
0
20
40
60
80
100
percent
Keystone Data.Keys_Elev_Duration_Existing (Percent of time equaled or exceeded x Pool Elevation)
Keystone Data.Keys_Elev_Duration_Modified(Percent of time equaled or exceeded x Pool Elevation)

TORONTO LAKE
VERDIGRIS RIVER, KANSAS
WATER CONTROL MANUAL

APPENDIX C – PART I
TO
WATER CONTROL MASTER MANUAL
ARKANSAS RIVER BASIN

PREVIOUS EDITION – FEBRUARY 1990
REVISED EDITION – JANUARY 2012

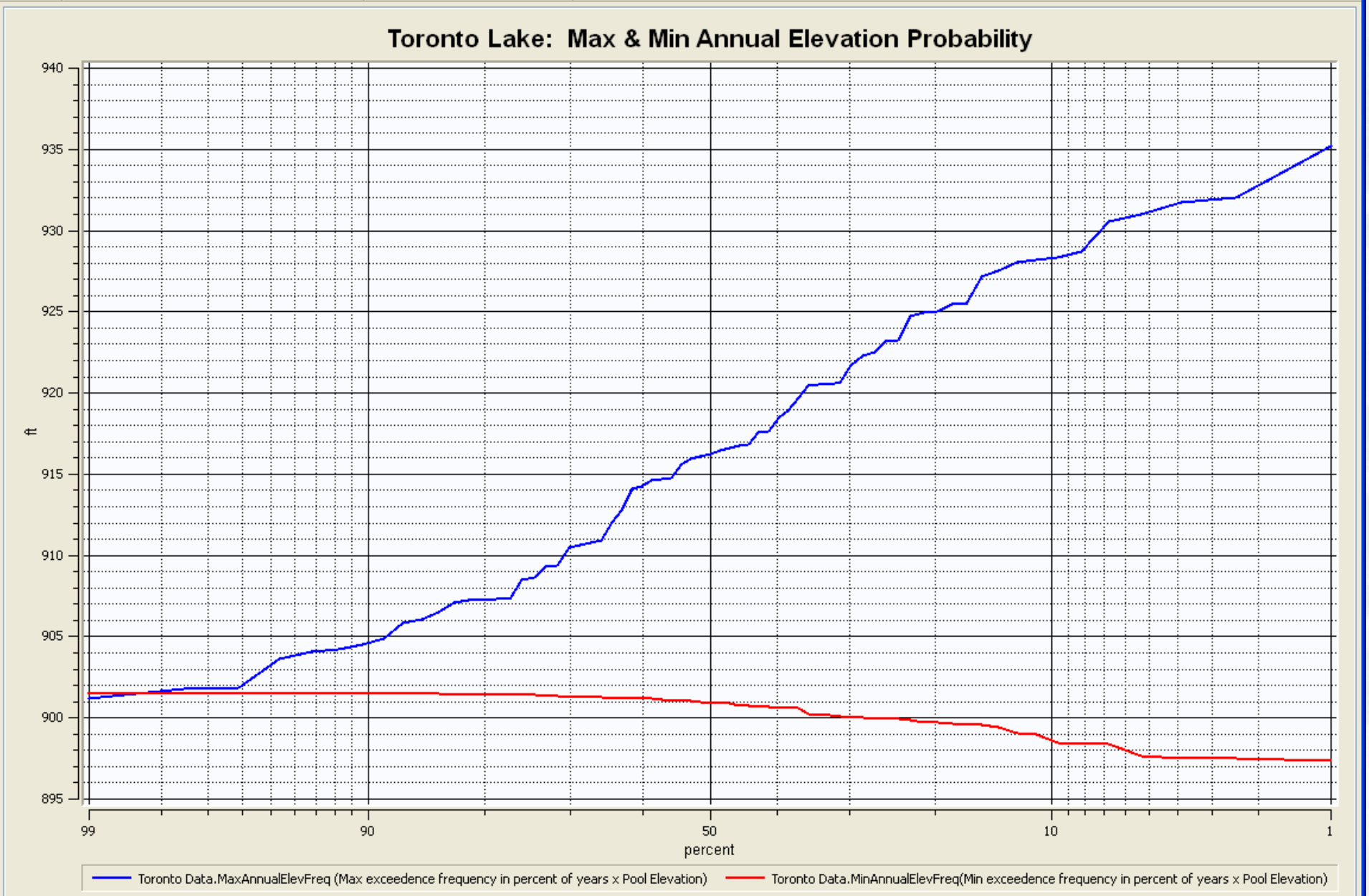
DEPARTMENT OF THE ARMY
TULSA DISTRICT, CORPS OF ENGINEERS
OKLAHOMA

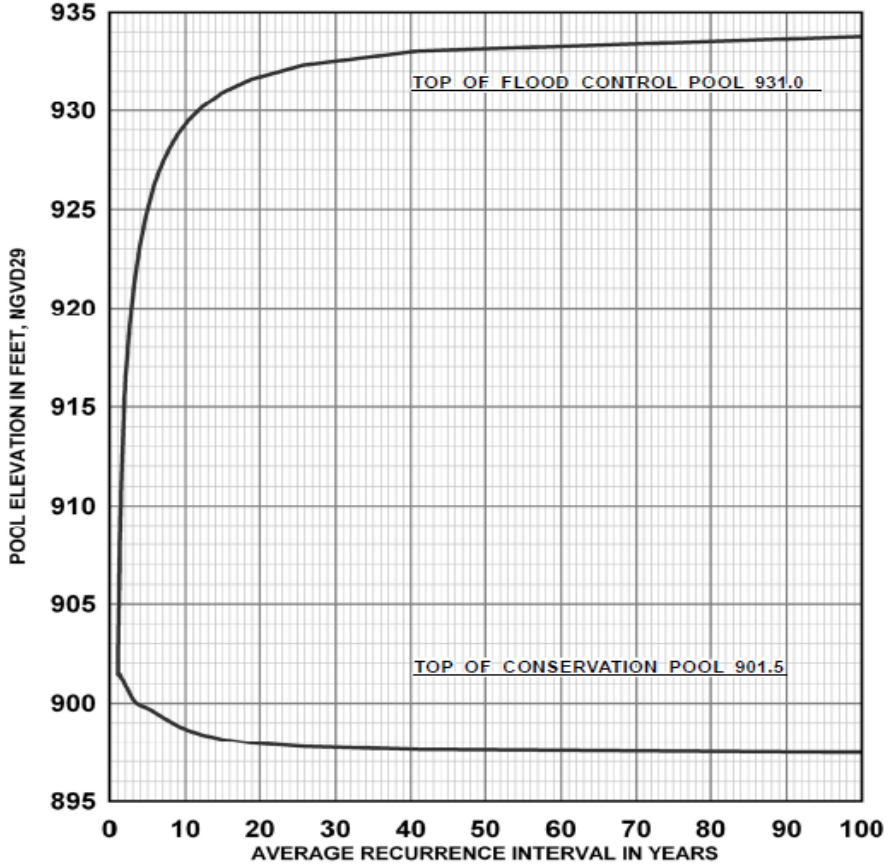

RiverWare 6.1.1 - ARK_Base_06Jan2012_611.mdl.gz
File
Control
Workspace
Policy
DMI
Accounting
Utilities
Help
Simulation View
Reservoir Control
Manual Updates
Simulation Object List
Sort by Name
Objects
Poteau_Data
Poteau_Panama
Ralston
Ralston_Data
Ralston_Keystone
Ramona
Ramona_Claremore
Ramona_Data
RS Kerr
Sallisaw
Sallisaw_Data
Sallisaw_Van Buren
Sand
Sand Damsite
Sand Outflow
Sand Outflow_Data
Sand_Ramona
Skiatook
Skiatook Data
Skiatook Outflow
Skiatook Outflow_Data
Skiatook_Div
Skiatook_Sperry
Skiatook_Sperry NoLag
Skiatook_Sperry NoLag I
Skiatook_User
Sperry
Sperry_Data
Sperry_Inola
Tenkiller
Tenkiller Data
Tenkiller Outflow_Data
Tenkiller_Div
Tenkiller_Outflow
Tenkiller_Sallisaw
Tenkiller_Sallisaw NoLag
Tenkiller_Sallisaw NoLag
Tenkiller_User
Toronto
Toronto Data
RBS
Opt
RiverWare

Plot - NOT SAVED

File Edit Graph Data Window

Dec 31, 1939





NOTE: PERIOD OF RECORD
JAN 1940 THRU DEC 2008
USED "STATISTICAL
METHODS IN HYDROLOGY"
BY LEO BEARD FOR
PLOTTING POSITION

ARKANSAS RIVER WATERSHED VERDIGRIS RIVER, KANSAS

TORONTO LAKE

POOL ELEVATION PROBABILITY CURVE

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 8 - 11

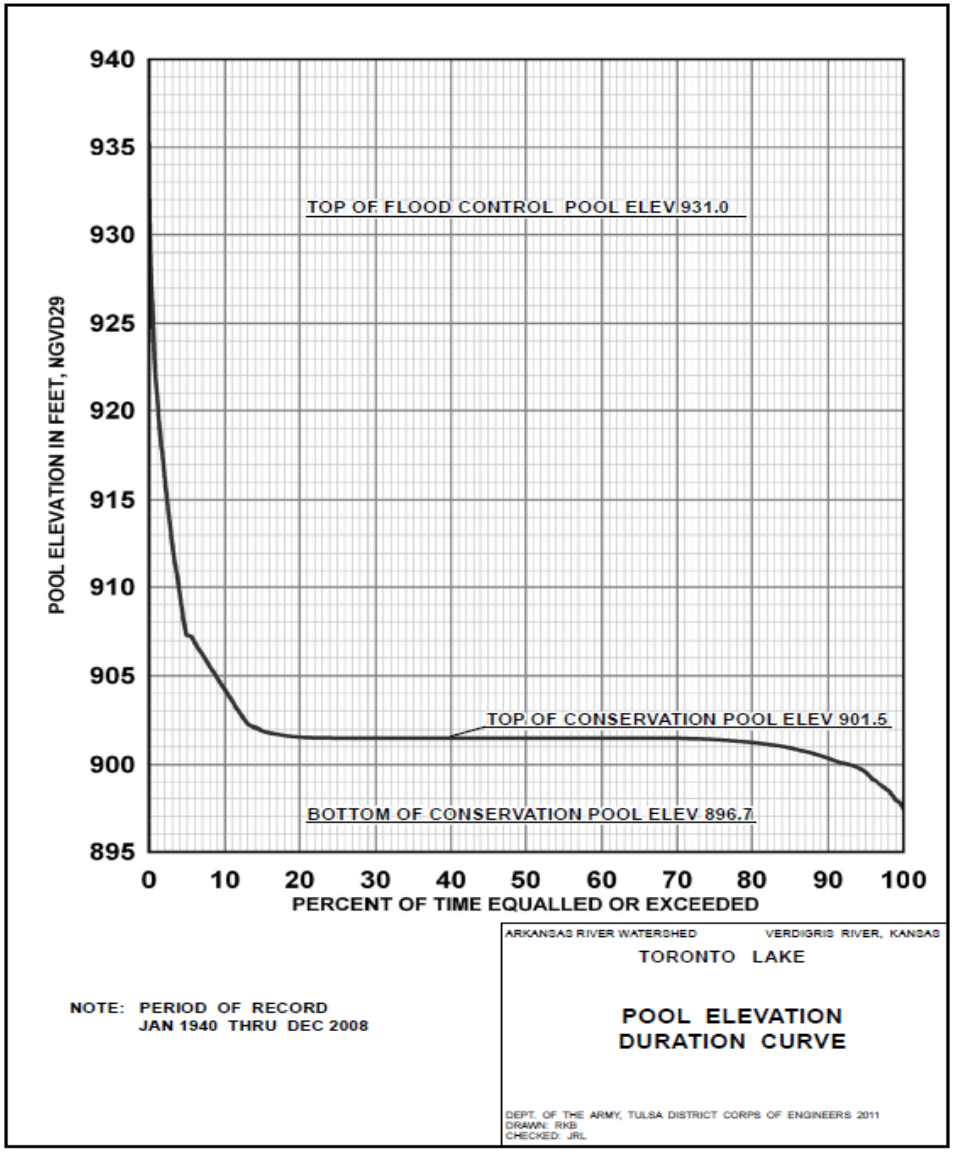
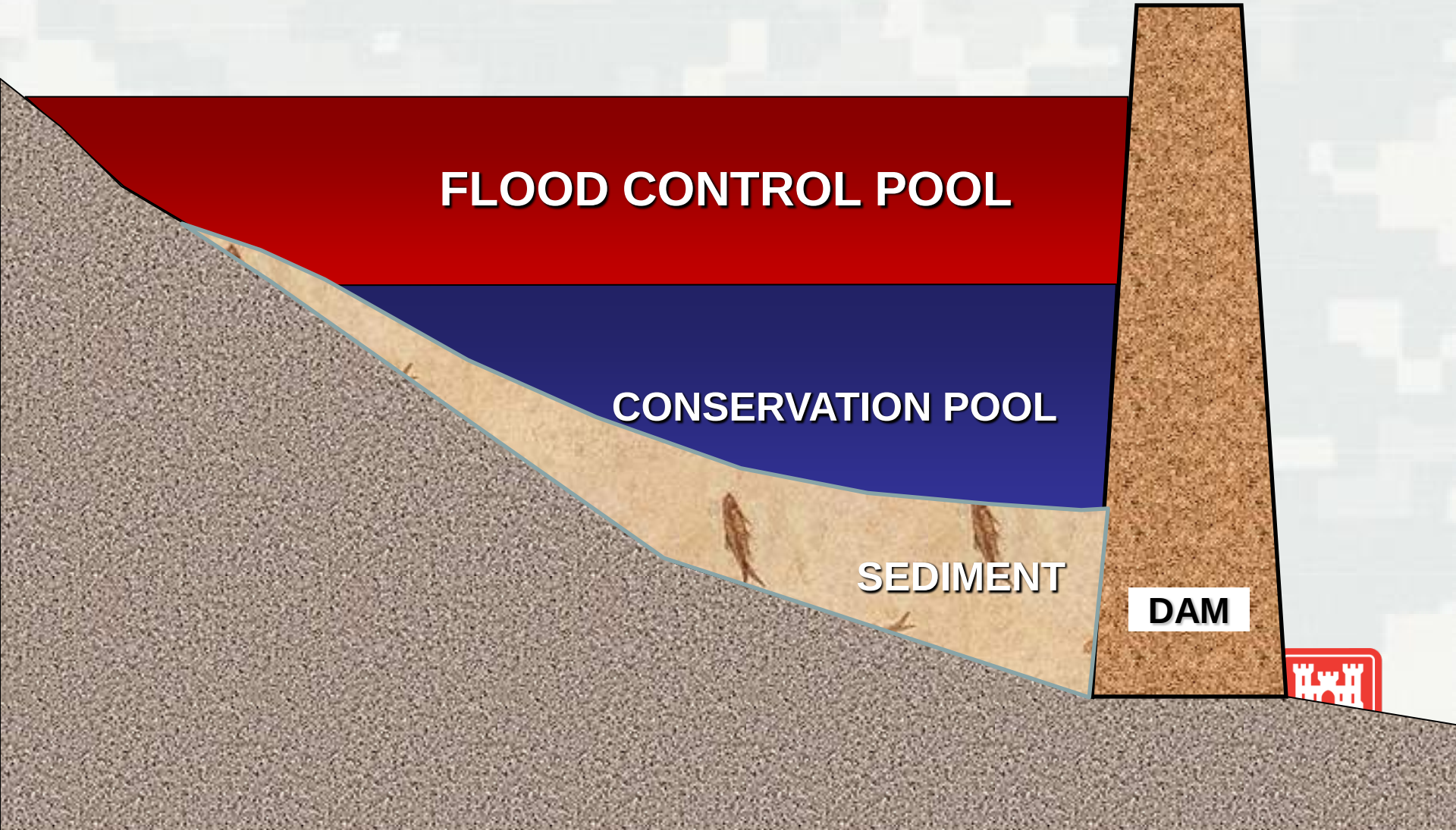
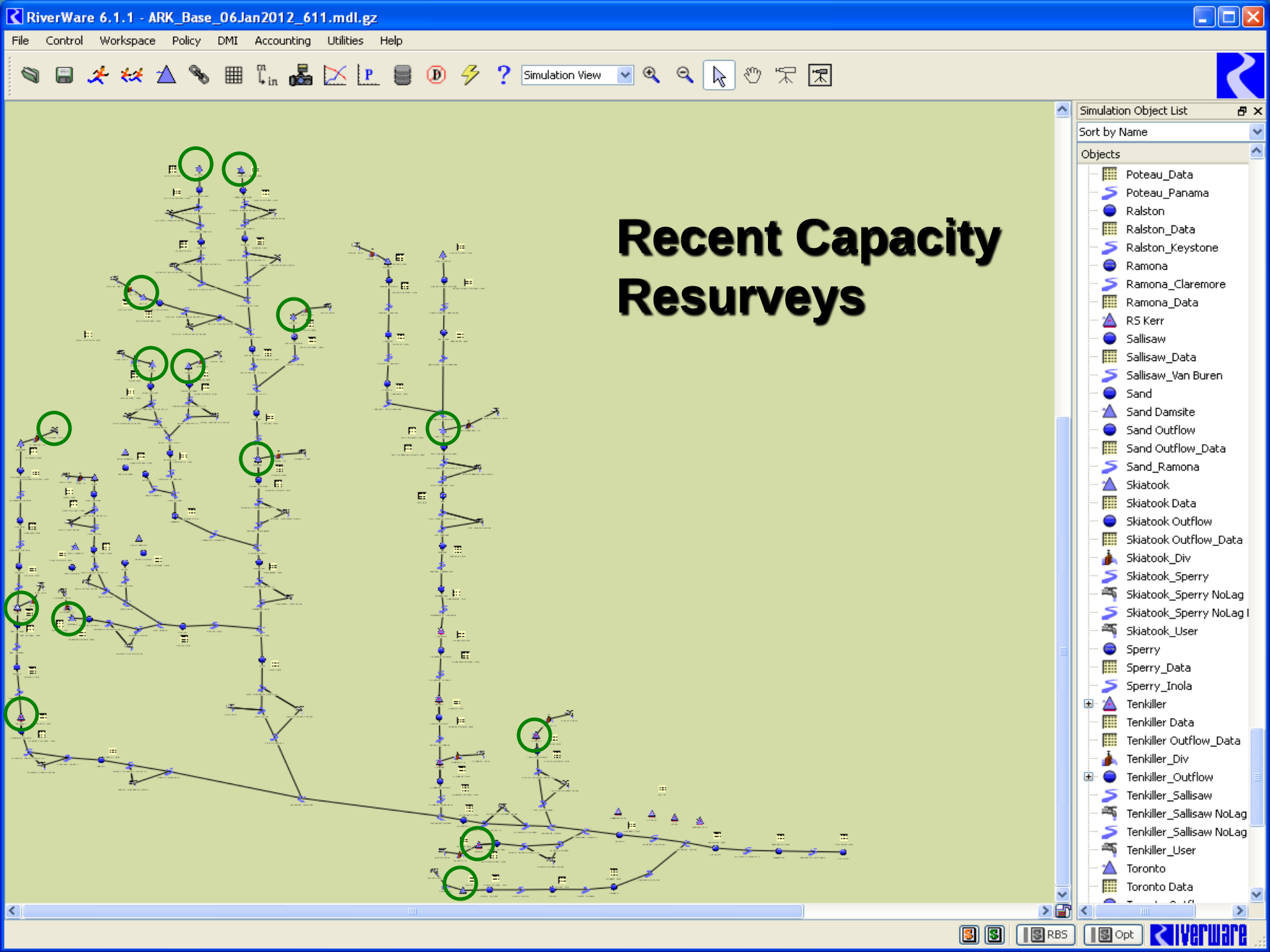


PLATE 8 - 10

Volume Lost to Sediment




RiverWare 6.1.1 - ARK_Base_06Jan2012_611.mdl.gz
File
Control
Workspace
Policy
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Help
Simulation View
Recent Capacity Resurveys
Simulation Object List
Sort by Name
Objects
Poteau_Data
Poteau_Panama
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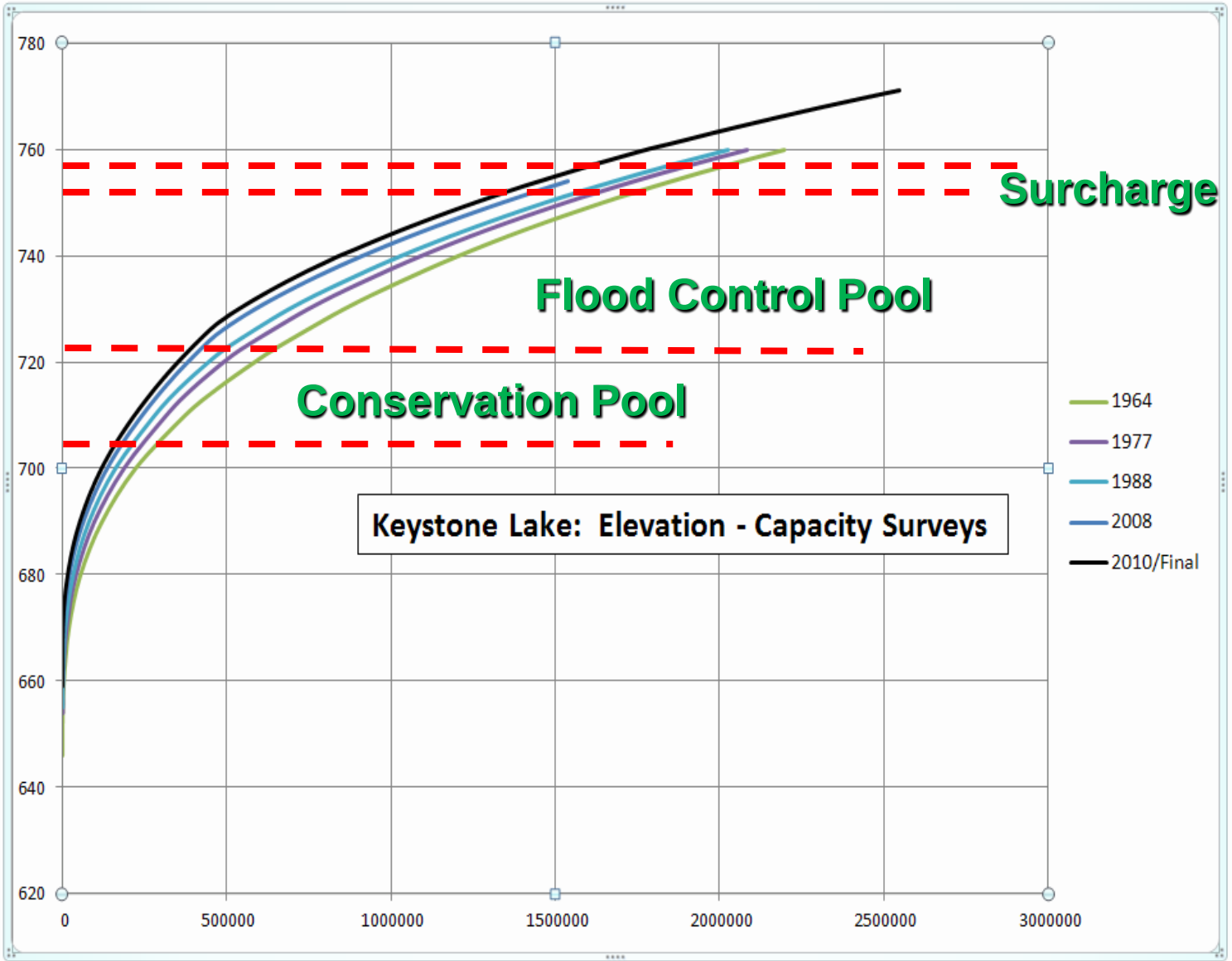
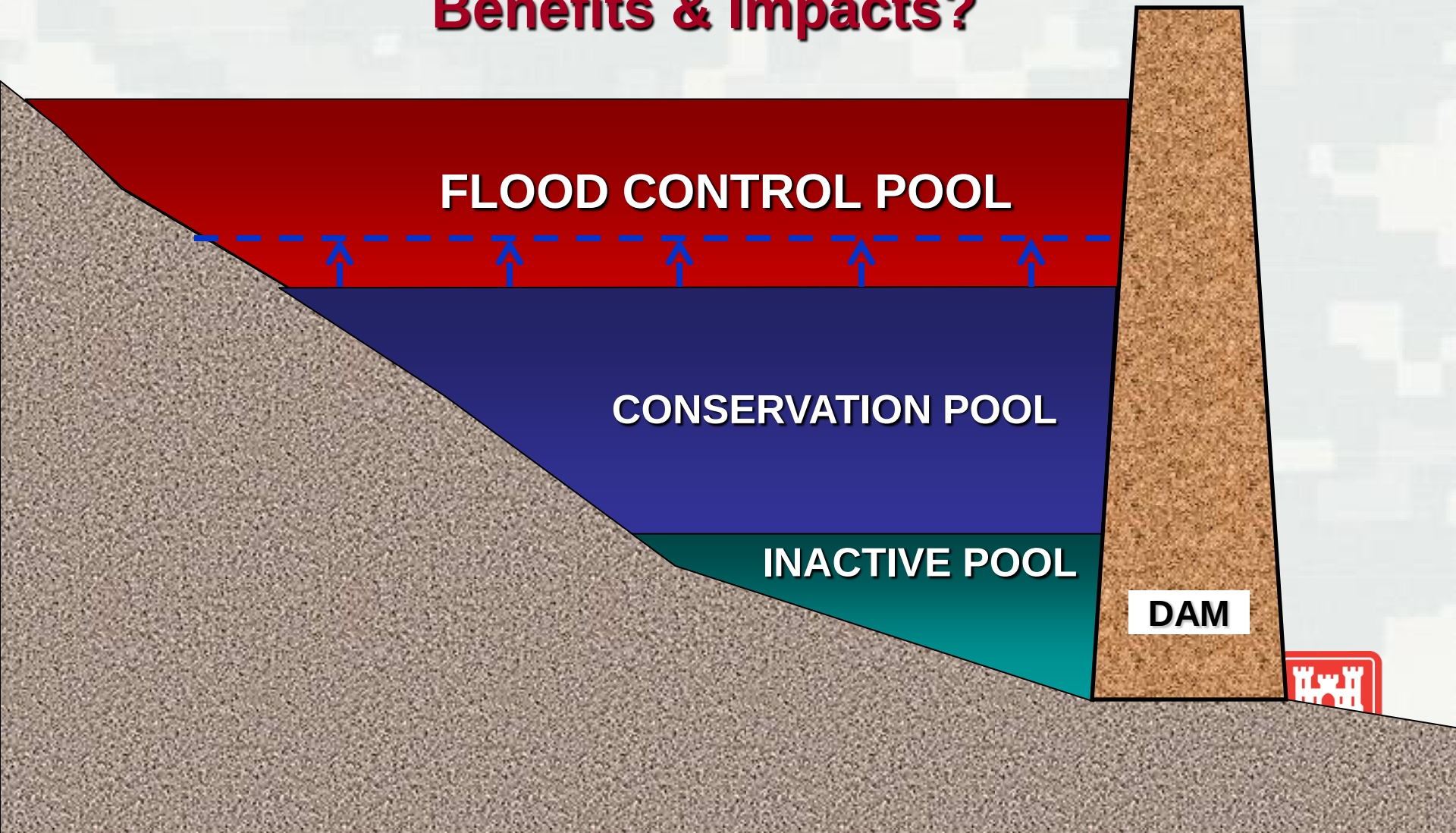
Ralston_Data
Ralston_Keystone
Ramona
Ramona_Claremore
Ramona_Data
RS Kerr
Sallisaw
Sallisaw_Data
Sallisaw_Van Buren
Sand
Sand Damsite
Sand Outflow
Sand Outflow_Data
Sand_Ramona
Skiatook
Skiatook Data
Skiatook Outflow
Skiatook Outflow_Data
Skiatook_Div
Skiatook_Sperry
Skiatook_Sperry NoLag
Skiatook_Sperry NoLag I
Skiatook_User
Sperry
Sperry_Data
Sperry_Inola
Tenkiller
Tenkiller Data
Tenkiller Outflow_Data
Tenkiller_Div
Tenkiller_Outflow
Tenkiller_Sallisaw
Tenkiller_Sallisaw NoLag
Tenkiller_Sallisaw NoLag
Tenkiller_User
Toronto
Toronto Data
RBS
Opt
riverware


780
760
740
720
700
680
660
640
620
0
500000
1000000
1500000
2000000
2500000
3000000
Surcharge
Flood Control Pool
Conservation Pool
Keystone Lake: Elevation - Capacity Surveys
1964
1977
1988
2008
2010/Final

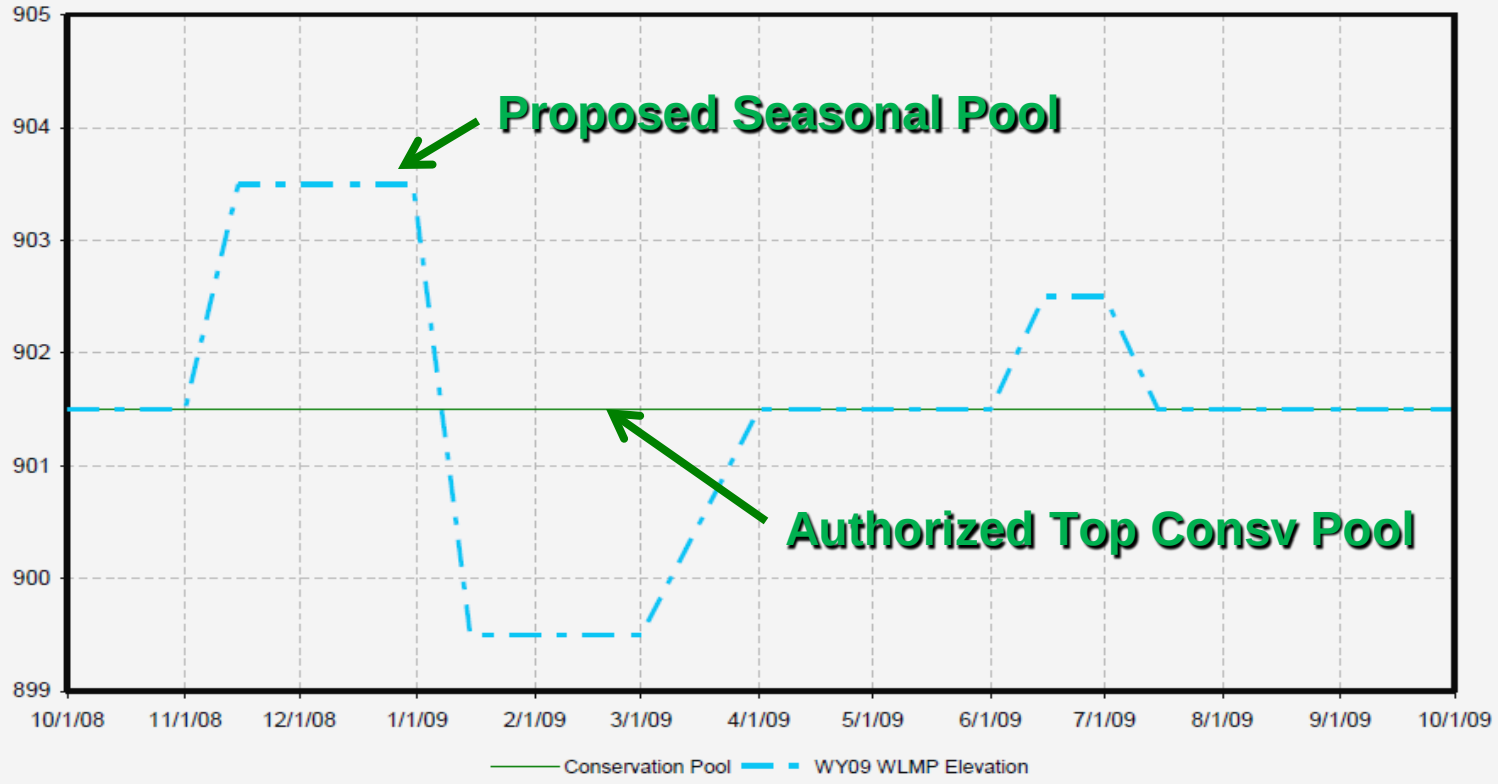
Reallocate Portion of Flood Control Storage to Additional Conservation Storage….

Benefits & Impacts?

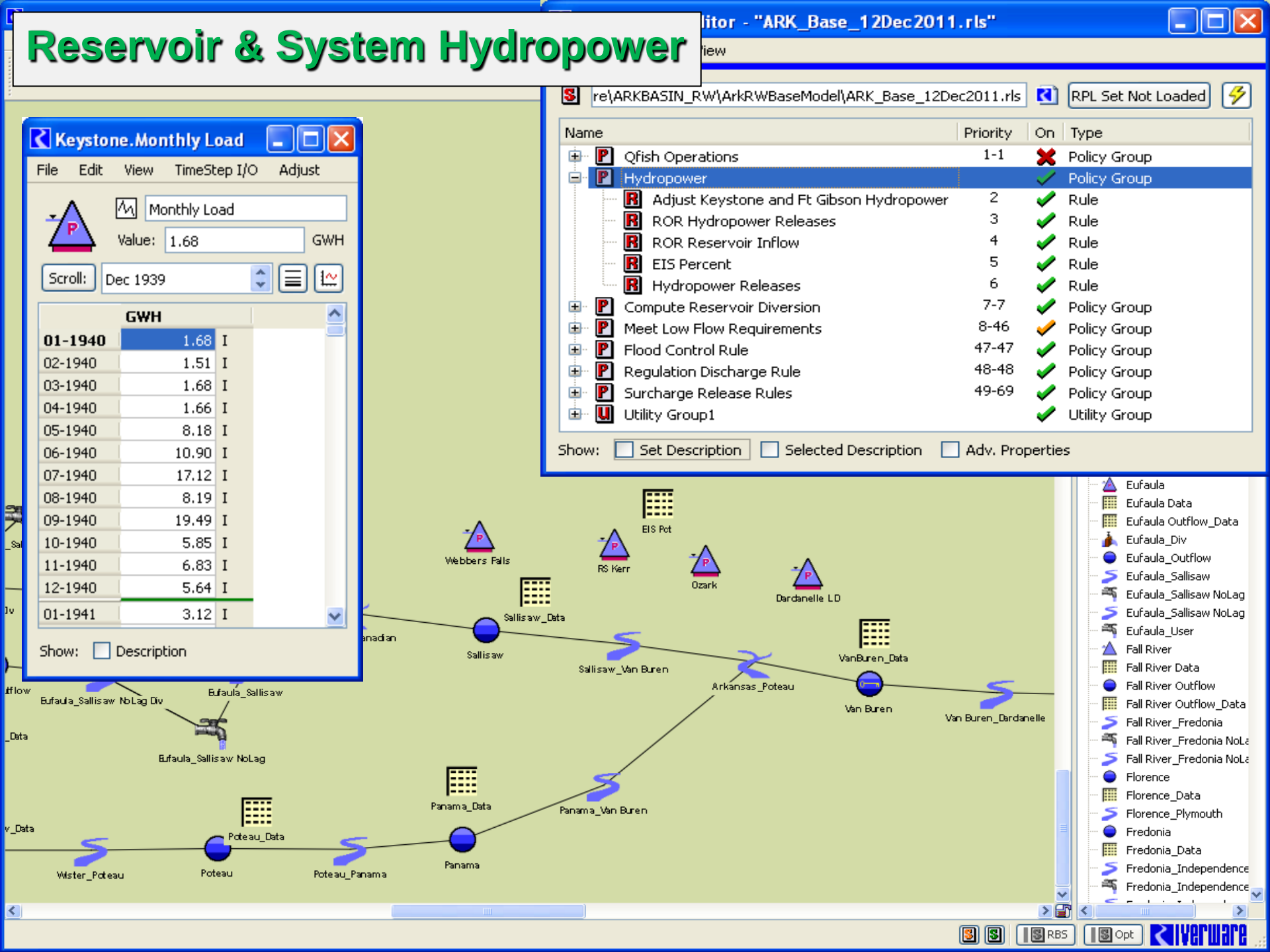


Toronto Reservoir

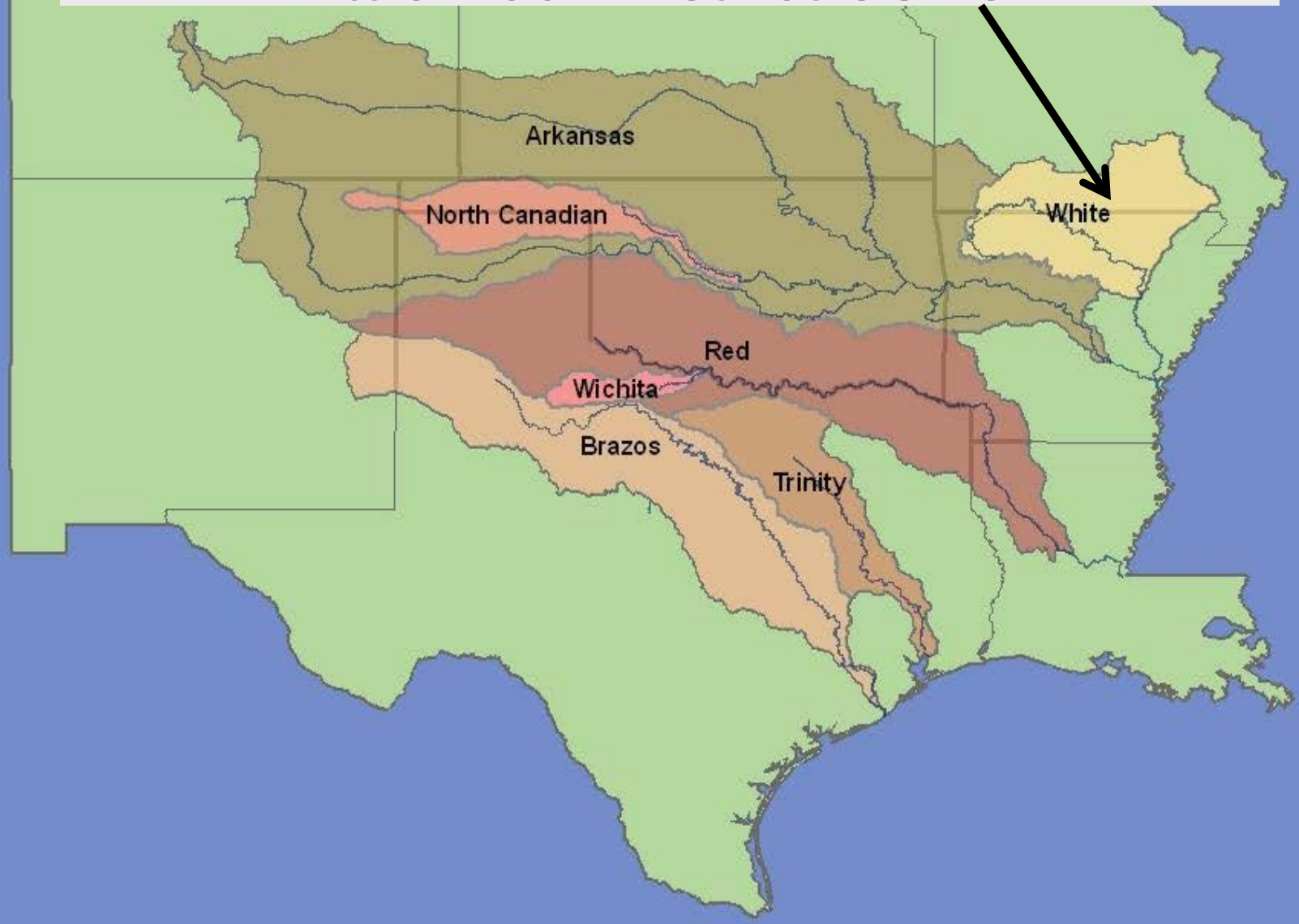
Conservation Pool = 901.5 Flood Pool = 931.0 5% into FP = 904.5



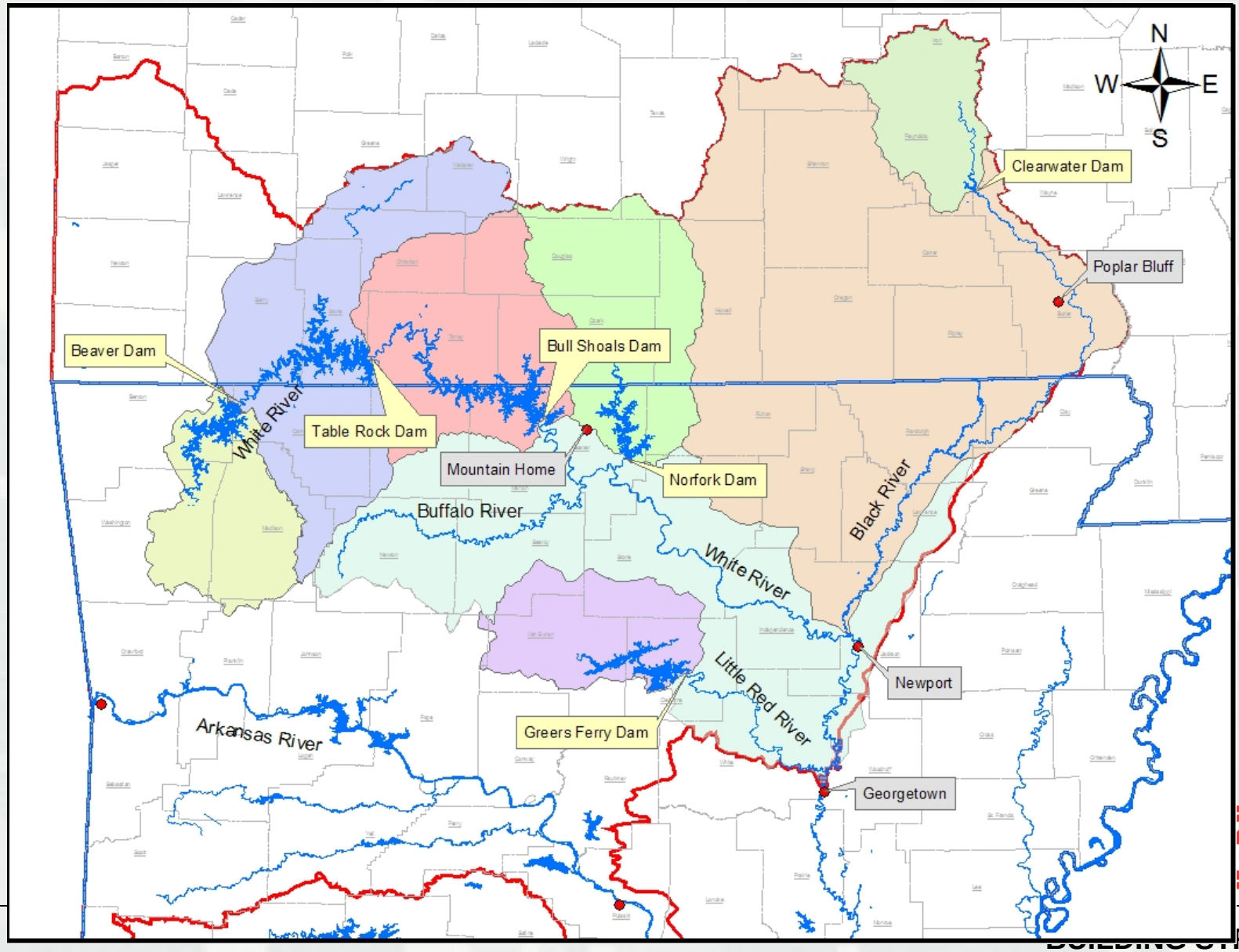
Reservoir & System Hydropower

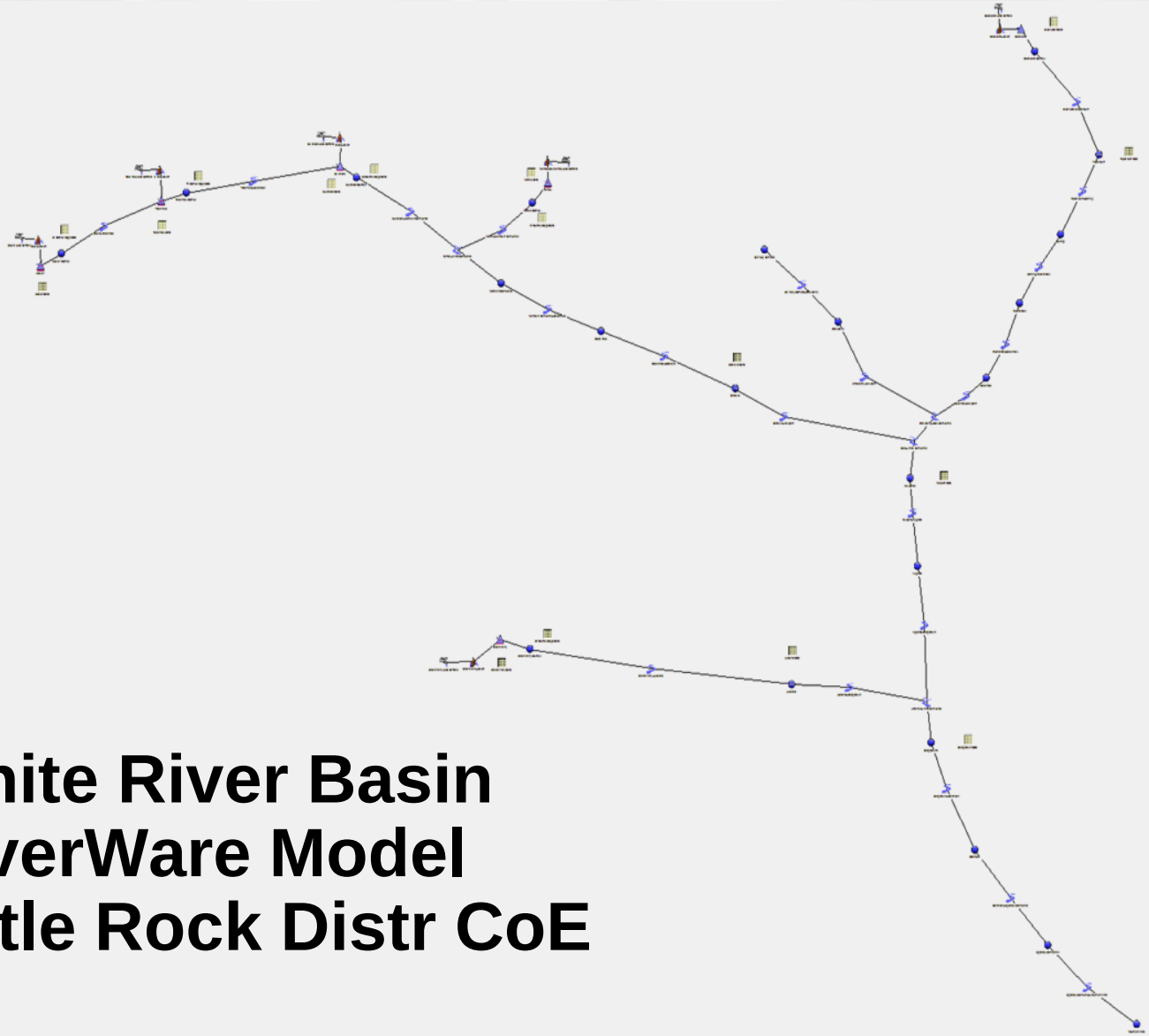


White River Basin RiverWare Modeling
Little Rock District USACE



White River Basin





White River Basin
RiverWare Model
Little Rock Distr CoE

Need for RiverWare Program:

- Reservoir & System Analyses
- Existing Regulation Criteria
- Proposed Alternative Scenarios
- Stakeholder Interests


THANK YOU!
05/11/2011 09:35