LAKE KEMP REALLOCATION AND YIELD DETERMINATION WITH RIVERWARE'S MRM

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RIVERWARE…..

…a modeling environment for reservoir system planning, operations and analysis…

Center for Advanced Decision Support for Water and Environmental Systems, University of Colorado, Boulder

CADSWES HOMEPAGE…..

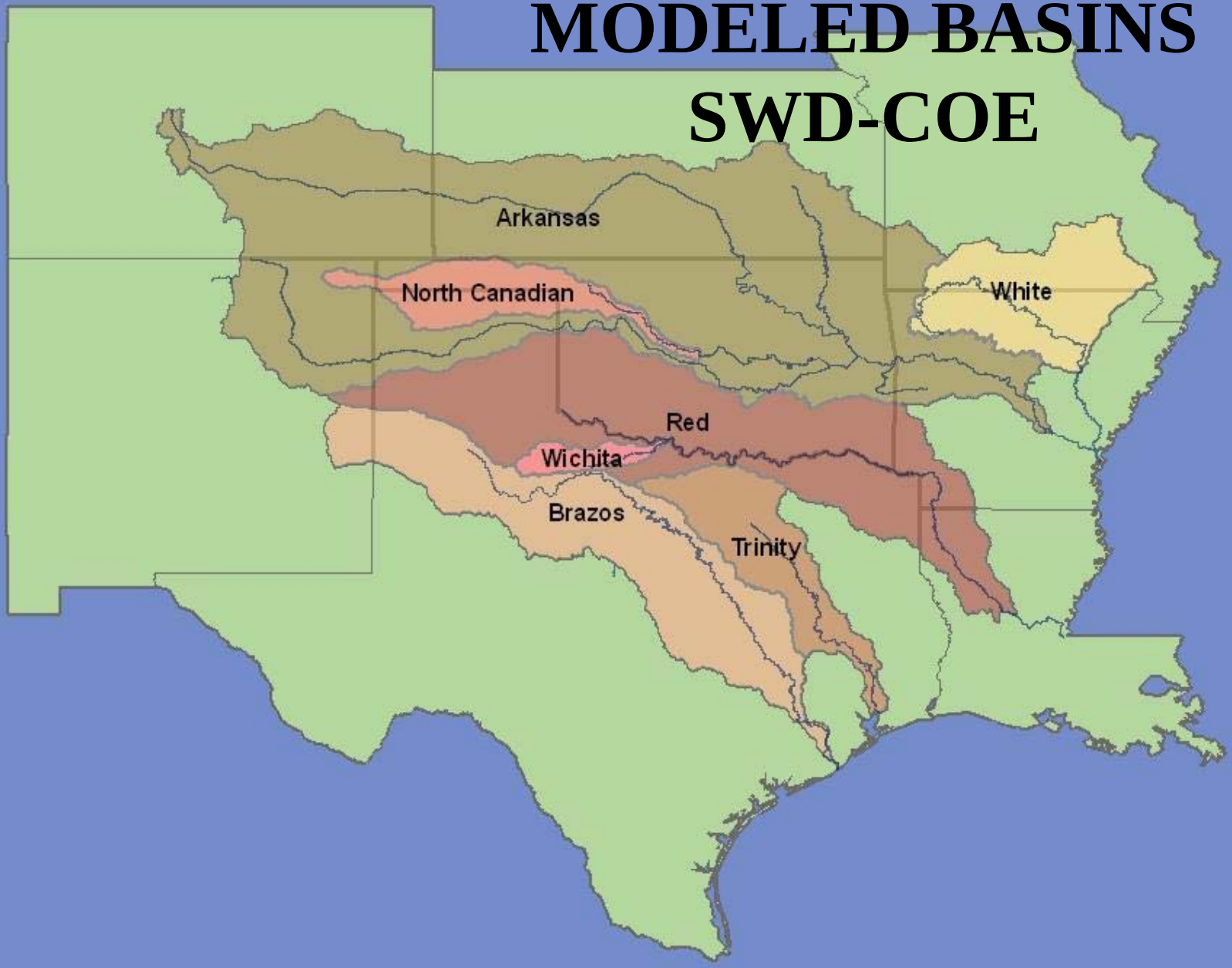
…mission is to research, design, prototype and develop integrated decision support systems to help solve real-world water resources and environmental problems.

Primary research partners:
BoR, TVA, and CoE

LAKE KEMP…..
REALLOCATION STUDY ONGOING

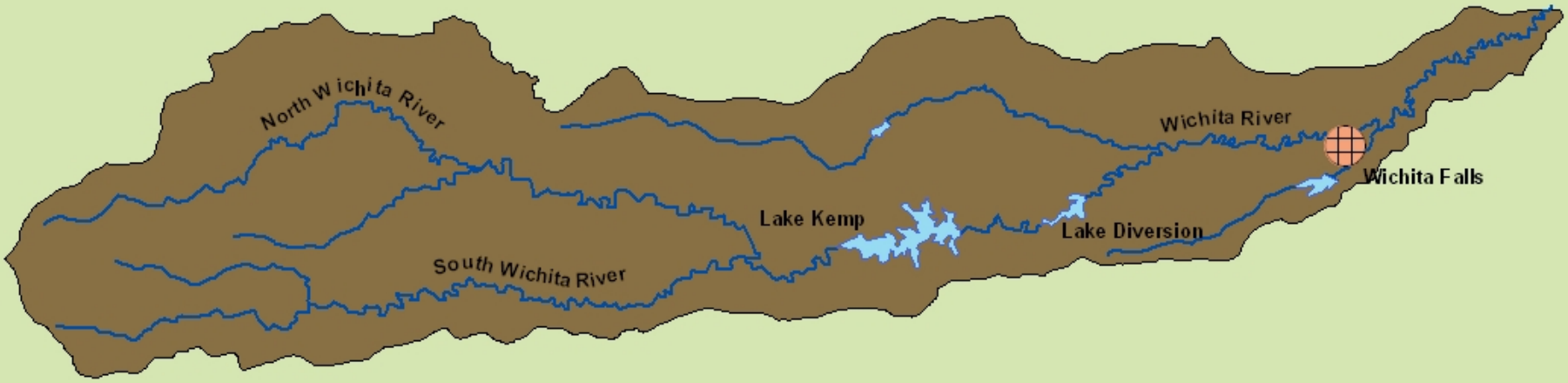
TODAY'S DISCUSSION:
CONCENTRATE ON PROCESS ,
NOT RESULT No's

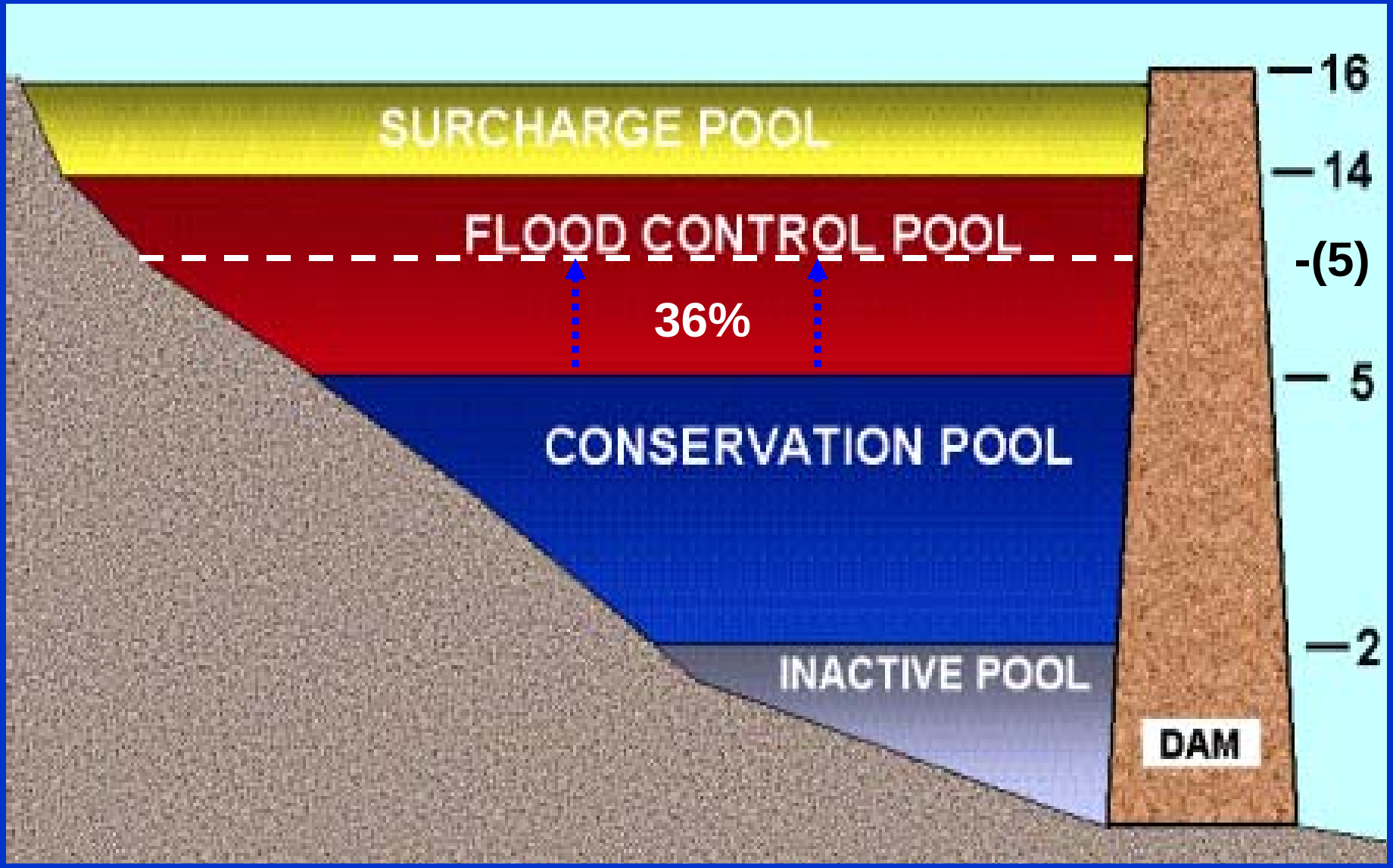
MODELED BASINS SWD-COE



Wichita River Basin: approx 3,480 sq mi

Lake Kemp: approx 2,090 sq mi

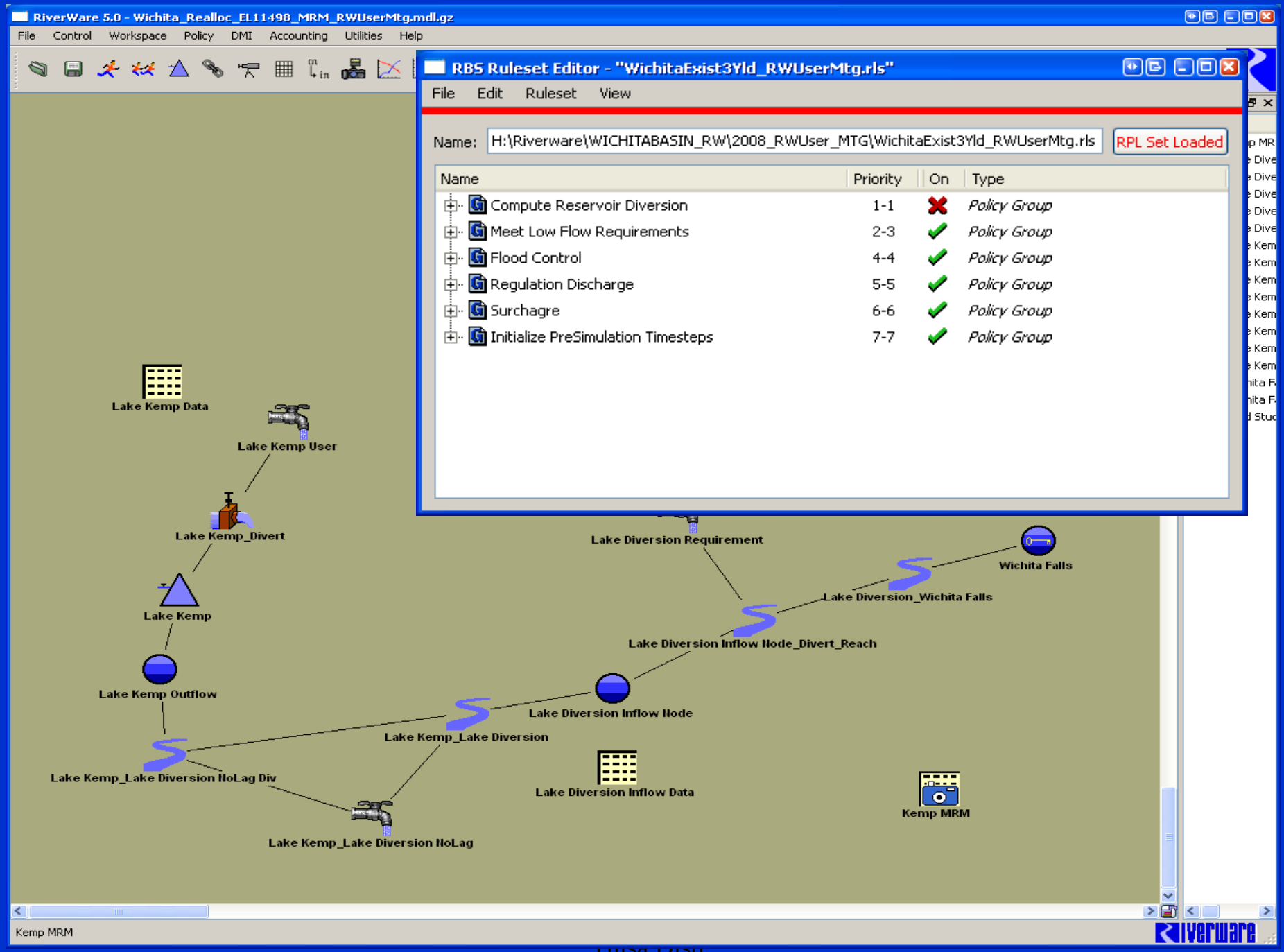




USACE storage divisions and balance levels

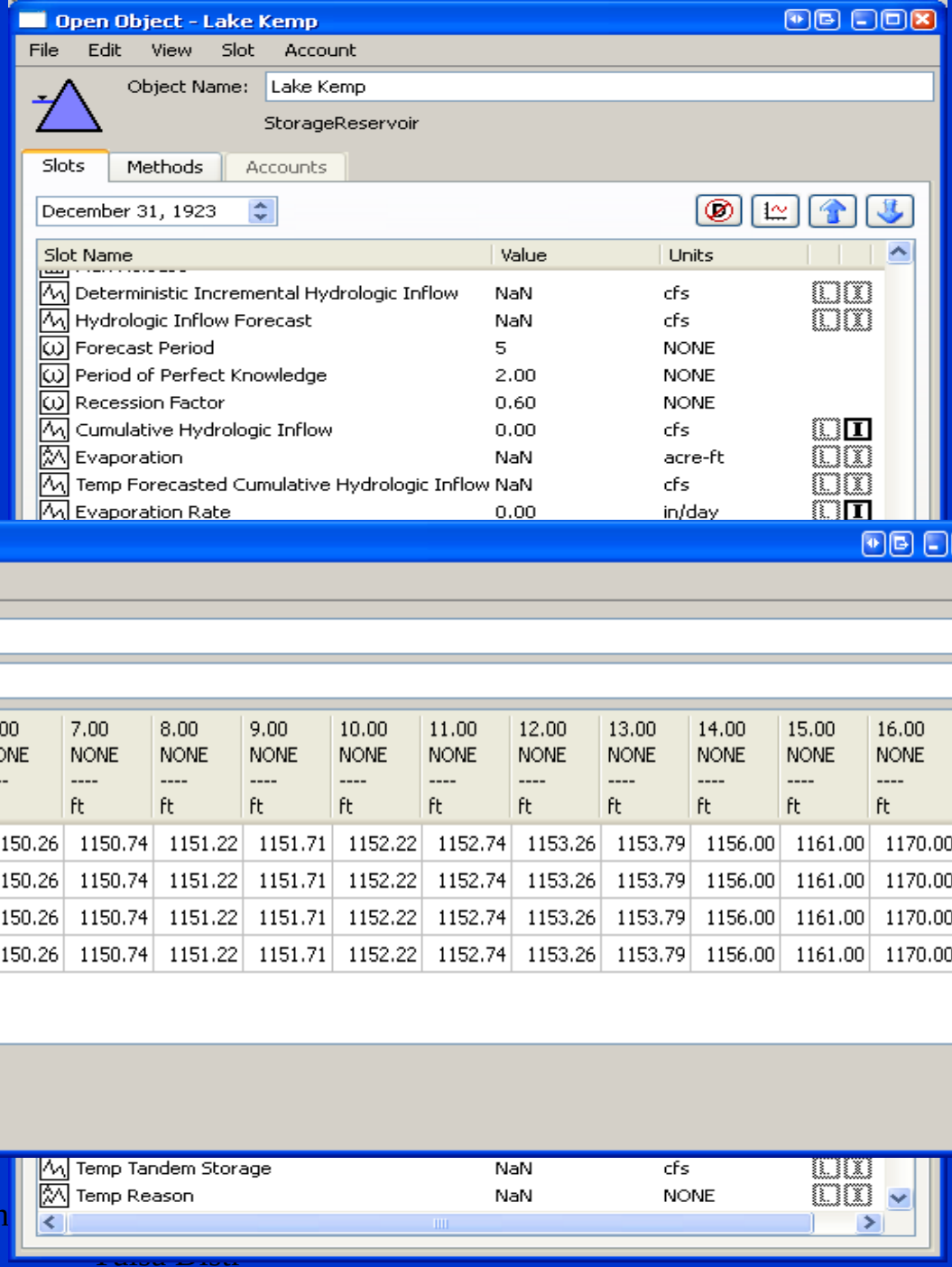
RIVERWARE APPROACH:

- SWD CoE Flood Control Balancing Method
- Rules Based
- 79-Year Period of Record Daily Simulation
- Multi-Run-Mgr for Yield
- Base Condition & Alternative Runs
- Statistics: Evaluation & Mitigation


RiverWare 5.0 - Wichita_Realloc_EL11498_MRM_RWUserMtg.mdl.gz
File Control Workspace Policy DMI Accounting Utilities Help
RBS Ruleset Editor - "WichitaExist3Yld_RWUserMtg.rls"
File Edit Ruleset View
Name: H:\Riverware\WICHITABASIN_RW\2008_RWUser_MTG\WichitaExist3Yld_RWUserMtg.rls
RPL Set Loaded
Name Priority On Type
Compute Reservoir Diversion 1-1 Policy Group
Meet Low Flow Requirements 2-3 Policy Group
Flood Control 4-4 Policy Group
Regulation Discharge 5-5 Policy Group
Surchagre 6-6 Policy Group
Initialize PreSimulation Timesteps 7-7 Policy Group
Lake Kemp Data
Lake Kemp User
Lake Kemp_Divert
Lake Kemp
Lake Kemp Outflow
Lake Kemp_Lake Diversion NoLag Div
Lake Kemp_Lake Diversion NoLag
Lake Kemp_Lake Diversion
Lake Diversion Inflow Node
Lake Diversion Inflow Data
Lake Diversion Requirement
Lake Diversion Inflow Node_Divert_Reach
Lake Diversion_Wichita Falls
Wichita Falls
Kemp MRM
Kemp MRM

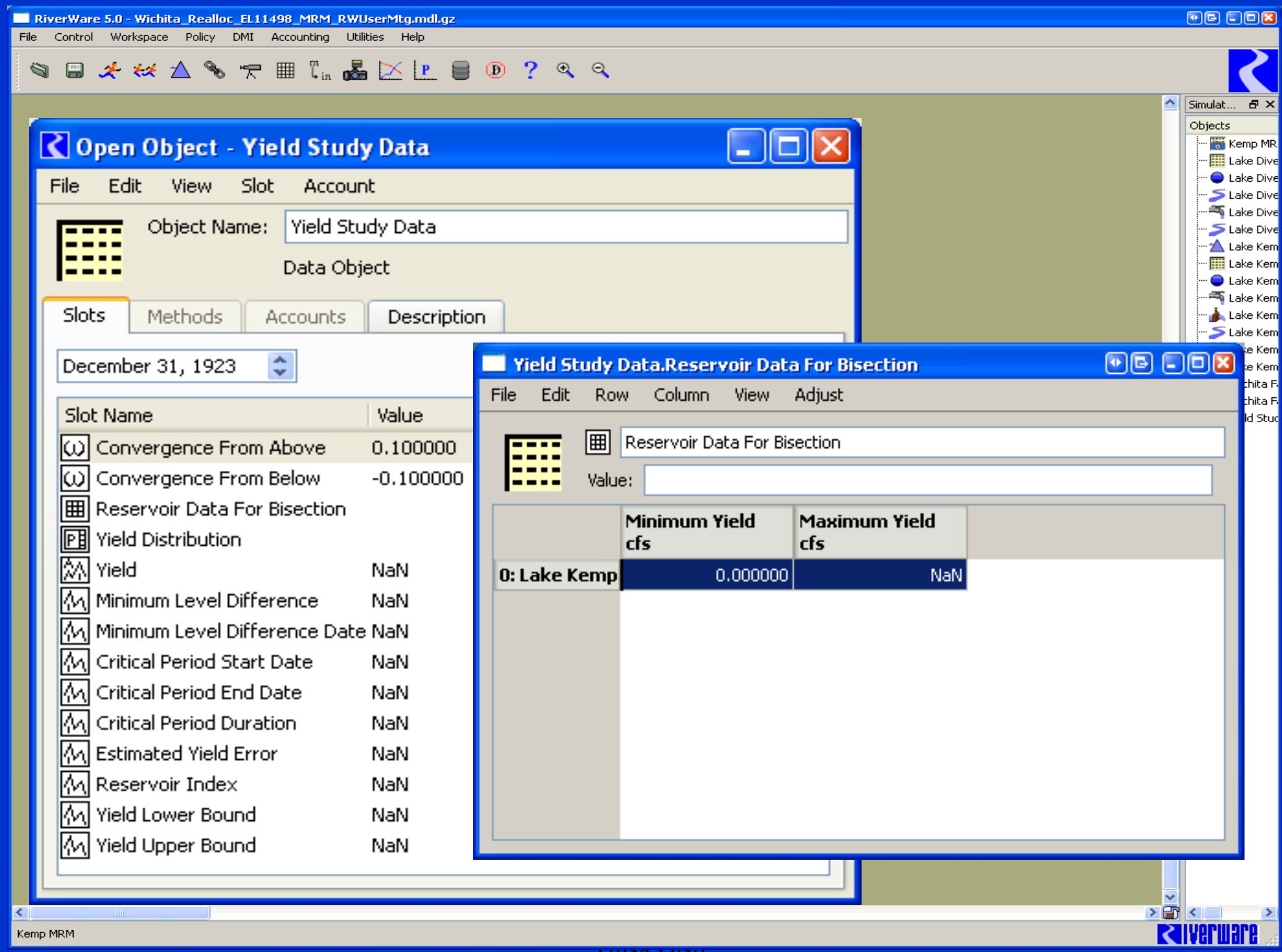
Tulsa Dist

CoE SWD Flood Control Method:



“Critical Dependable Yield”

Dependable Yield that Results in the Depletion of the Conservation Storage During Period of Record Drought


RiverWare 5.0 - Wichita_Realloc_EL11498_MRM_RWUserMtg.mdl.gz
File Control Workspace Policy DMI Accounting Utilities Help
Open Object - Yield Study Data
File Edit View Slot Account
Object Name: Yield Study Data
Data Object
Slots Methods Accounts Description
December 31, 1923
Slot Name Value
Convergence From Above 0.100000
Convergence From Below -0.100000
Reservoir Data For Bisection
Yield Distribution
Yield NaN
Minimum Level Difference NaN
Minimum Level Difference Date NaN
Critical Period Start Date NaN
Critical Period End Date NaN
Critical Period Duration NaN
Estimated Yield Error NaN
Reservoir Index NaN
Yield Lower Bound NaN
Yield Upper Bound NaN
Yield Study Data.Reservoir Data For Bisection
File Edit Row Column View Adjust
Reservoir Data For Bisection
Value:
Minimum Yield cfs
Maximum Yield cfs
0: Lake Kemp 0.000000 NaN
Simulat...
Objects
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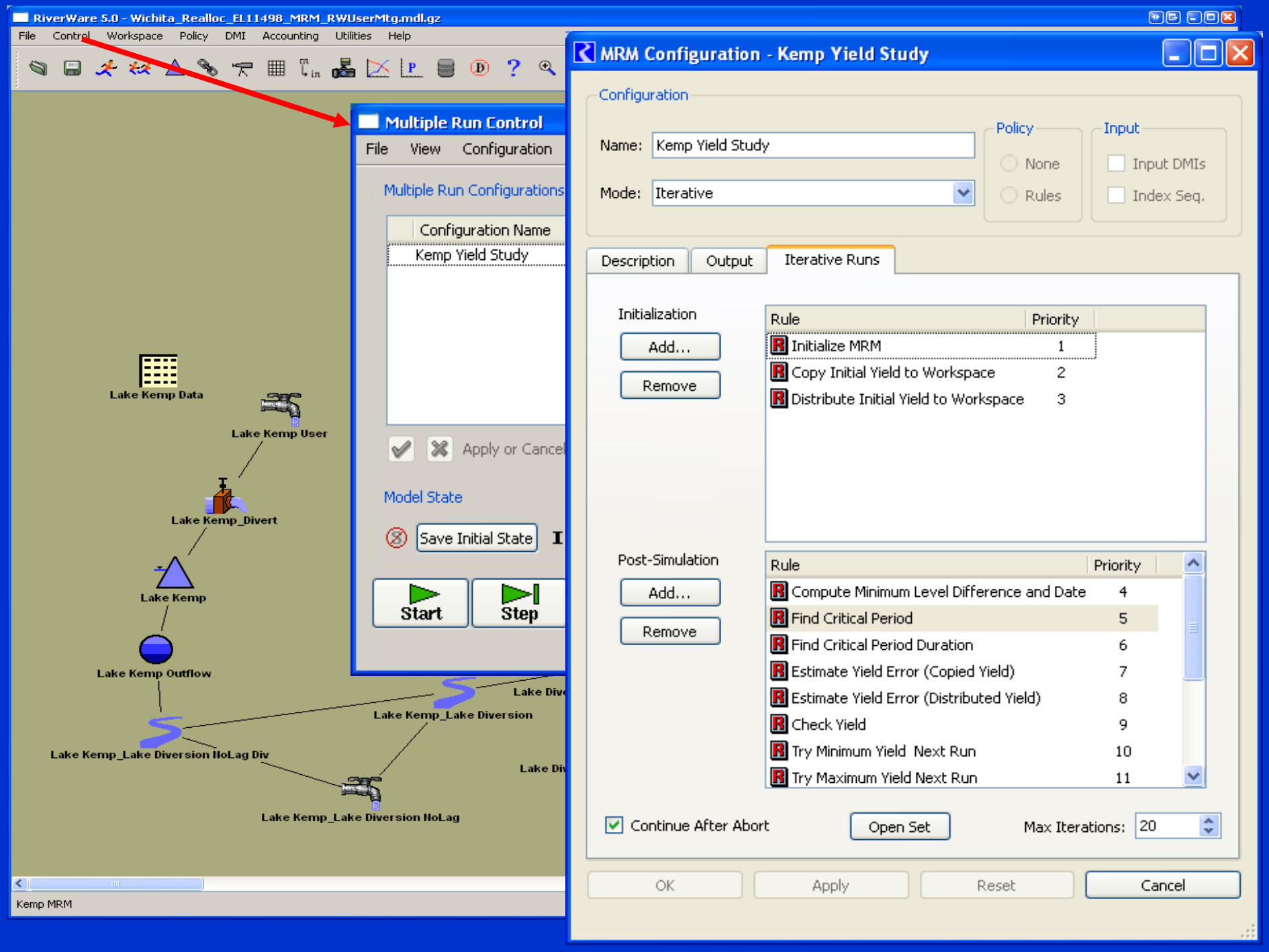
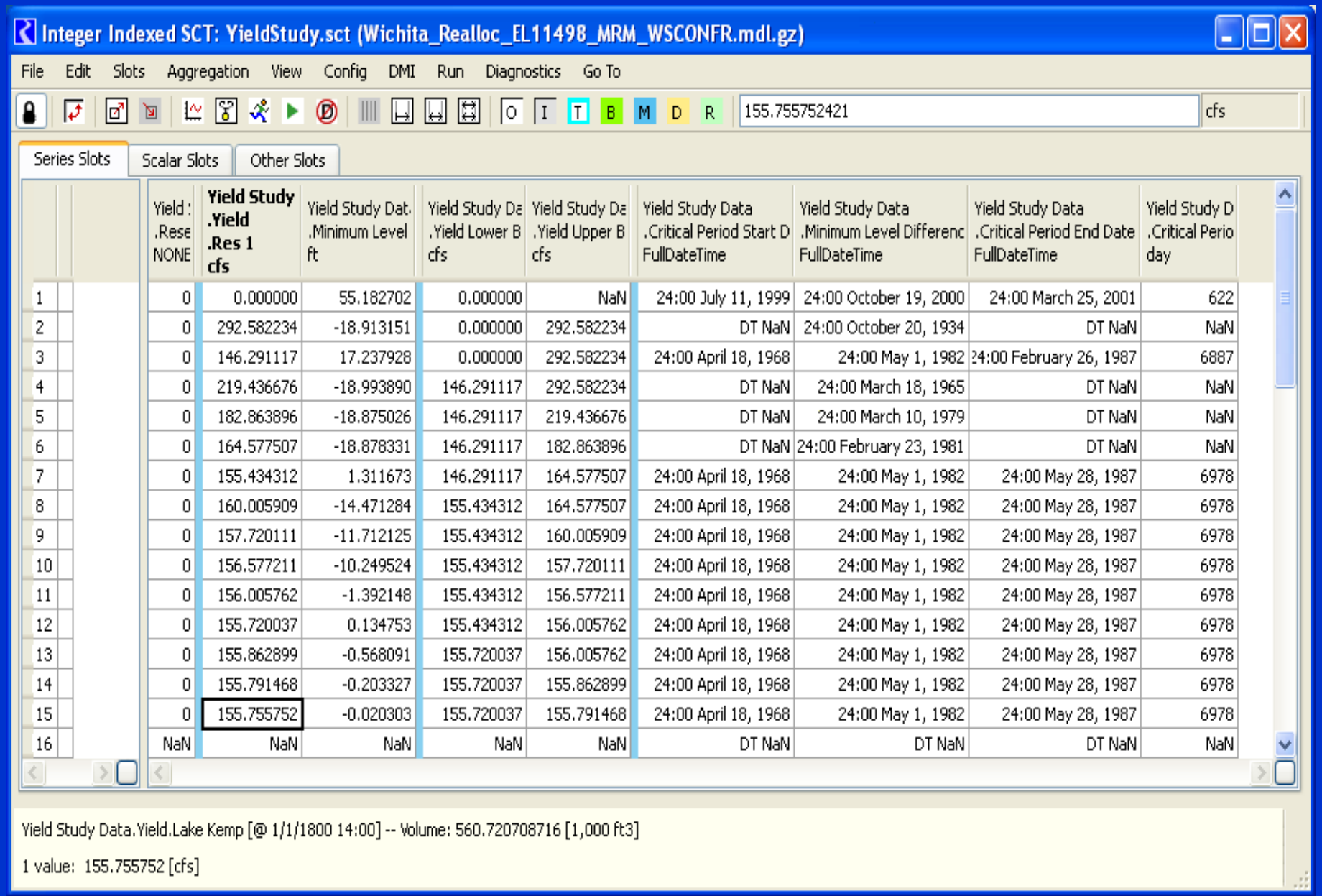
Lake Dive
Lake Kem
Kemp MRM
RiverWare

Tulsa Dist


RiverWare 5.0 - Wichita_Realloc_EL11498_MRM_RWUserMtg.mdl.gz
File Control Workspace Policy DMI Accounting Utilities Help
Multiple Run Control
File View Configuration
Multiple Run Configurations
Configuration Name
Kemp Yield Study
Apply or Cancel
Model State
Save Initial State
Start
Step
Lake Kemp Data
Lake Kemp User
Lake Kemp_Divert
Lake Kemp
Lake Kemp Outflow
Lake Kemp_Lake Diversion
Lake Kemp_Lake Diversion NoLag Div
Lake Kemp_Lake Diversion NoLag
Kemp MRM
MRM Configuration - Kemp Yield Study
Configuration
Name: Kemp Yield Study
Mode: Iterative
Policy
None
Rules
Input
Input DMIs
Index Seq.
Description
Output
Iterative Runs
Initialization
Add...
Remove
Rule
Priority
Initialize MRM 1
Copy Initial Yield to Workspace 2
Distribute Initial Yield to Workspace 3
Post-Simulation
Add...
Remove
Rule
Priority
Compute Minimum Level Difference and Date 4
Find Critical Period 5
Find Critical Period Duration 6
Estimate Yield Error (Copied Yield) 7
Estimate Yield Error (Distributed Yield) 8
Check Yield 9
Try Minimum Yield Next Run 10
Try Maximum Yield Next Run 11
Continue After Abort
Open Set
Max Iterations: 20
OK
Apply
Reset
Cancel

SCT: Yield Iteration Results



Integer Indexed SCT: YieldStudy.sct (Wichita_Realloc_EL11498_MRM_WSCONFR.mdl.gz)

File Edit Slots Aggregation View Config DMI Run Diagnostics Go To

155.755752421 cfs

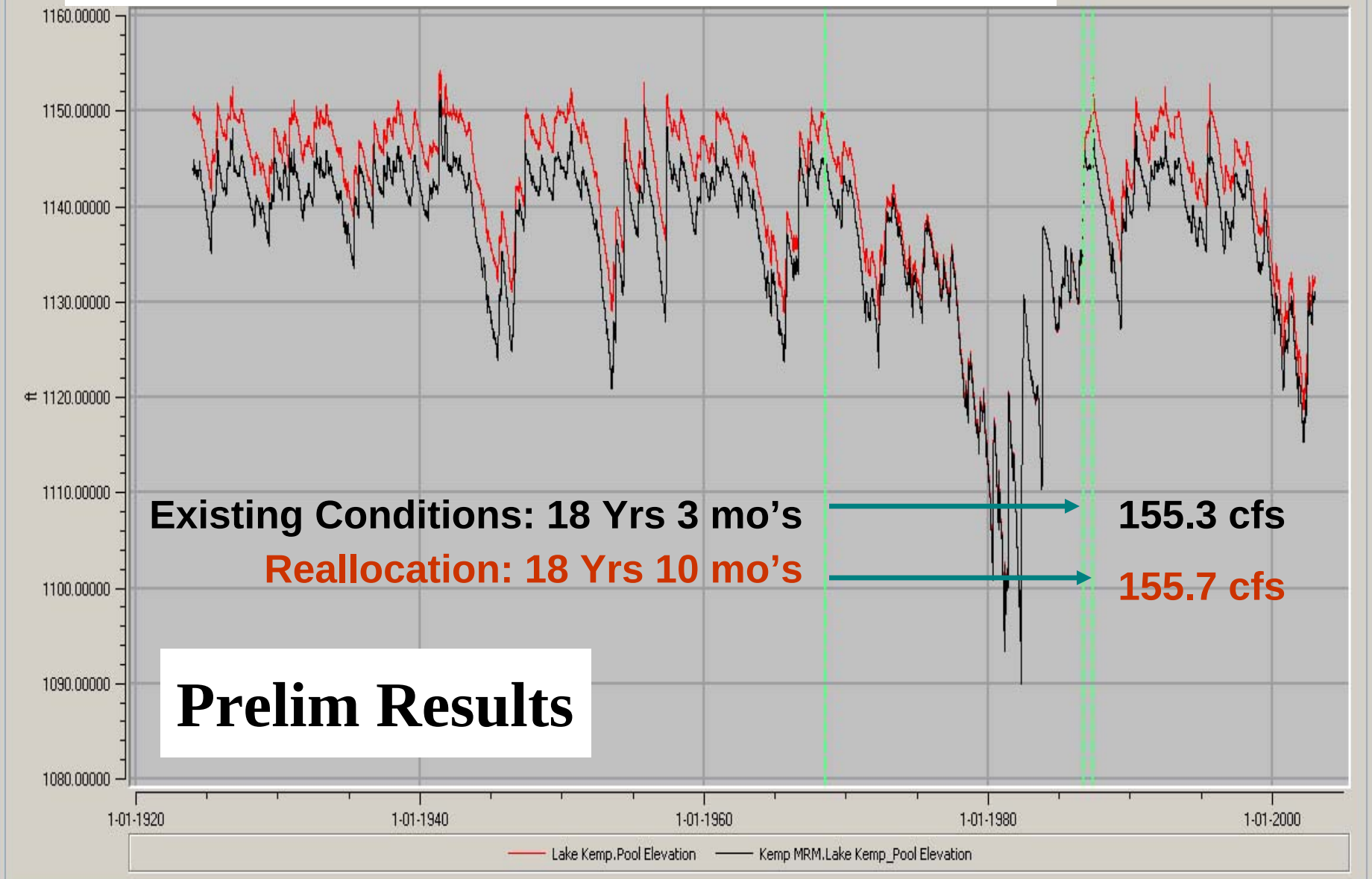
Series Slots | Scalar Slots | Other Slots

	Yield : .Rese NONE	**Yield Study .Yield .Res 1 cfs**	Yield Study Dat. .Minimum Level ft	Yield Study Da .Yield Lower B cfs	Yield Study Da .Yield Upper B cfs	Yield Study Data .Critical Period Start D FullDateTime	Yield Study Data .Minimum Level Differenc FullDateTime	Yield Study Data .Critical Period End Date FullDateTime	Yield Study D .Critical Perio day
1	0	0.000000	55.182702	0.000000	NaN	24:00 July 11, 1999	24:00 October 19, 2000	24:00 March 25, 2001	622
2	0	292.582234	-18.913151	0.000000	292.582234	DT NaN	24:00 October 20, 1934	DT NaN	NaN
3	0	146.291117	17.237928	0.000000	292.582234	24:00 April 18, 1968	24:00 May 1, 1982	24:00 February 26, 1987	6887
4	0	219.436676	-18.993890	146.291117	292.582234	DT NaN	24:00 March 18, 1965	DT NaN	NaN
5	0	182.863896	-18.875026	146.291117	219.436676	DT NaN	24:00 March 10, 1979	DT NaN	NaN
6	0	164.577507	-18.878331	146.291117	182.863896	DT NaN	24:00 February 23, 1981	DT NaN	NaN
7	0	155.434312	1.311673	146.291117	164.577507	24:00 April 18, 1968	24:00 May 1, 1982	24:00 May 28, 1987	6978
8	0	160.005909	-14.471284	155.434312	164.577507	24:00 April 18, 1968	24:00 May 1, 1982	24:00 May 28, 1987	6978
9	0	157.720111	-11.712125	155.434312	160.005909	24:00 April 18, 1968	24:00 May 1, 1982	24:00 May 28, 1987	6978
10	0	156.577211	-10.249524	155.434312	157.720111	24:00 April 18, 1968	24:00 May 1, 1982	24:00 May 28, 1987	6978
11	0	156.005762	-1.392148	155.434312	156.577211	24:00 April 18, 1968	24:00 May 1, 1982	24:00 May 28, 1987	6978
12	0	155.720037	0.134753	155.434312	156.005762	24:00 April 18, 1968	24:00 May 1, 1982	24:00 May 28, 1987	6978
13	0	155.862899	-0.568091	155.720037	156.005762	24:00 April 18, 1968	24:00 May 1, 1982	24:00 May 28, 1987	6978
14	0	155.791468	-0.203327	155.720037	155.862899	24:00 April 18, 1968	24:00 May 1, 1982	24:00 May 28, 1987	6978
15	0	155.755752	-0.020303	155.720037	155.791468	24:00 April 18, 1968	24:00 May 1, 1982	24:00 May 28, 1987	6978
16	NaN	NaN	NaN	NaN	NaN	DT NaN	DT NaN	DT NaN	NaN

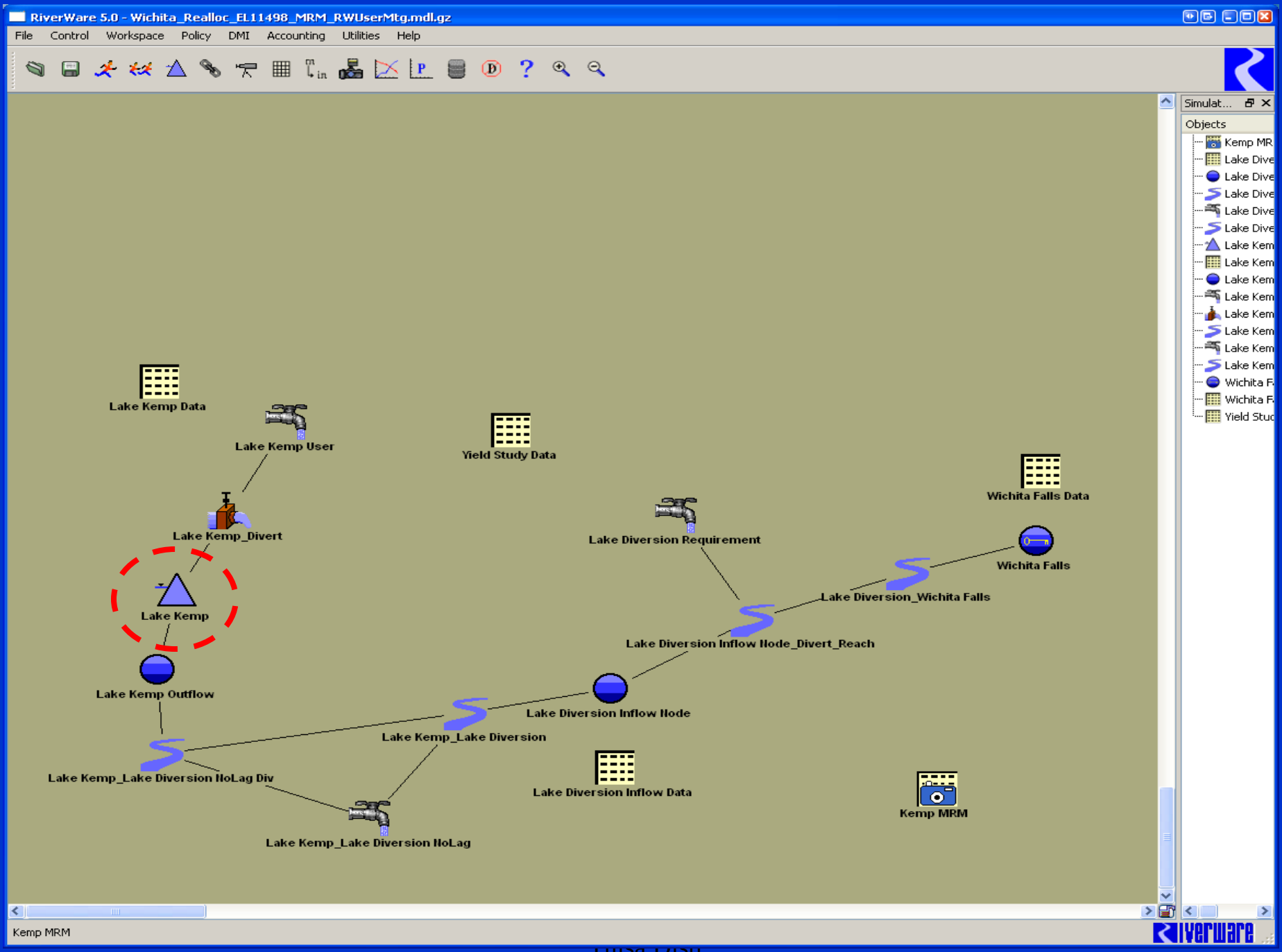
Yield Study Data.Yield.Lake Kemp [@ 1/1/1800 14:00] -- Volume: 560.720708716 [1,000 ft3]

1 value: 155.755752 [cfs]

Lake Kemp POR Critical Drought



Prelim Results


RiverWare 5.0 - Wichita_Realloc_EL11498_MRM_RWUserMtg.mdl.gz
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Lake Kemp Outflow
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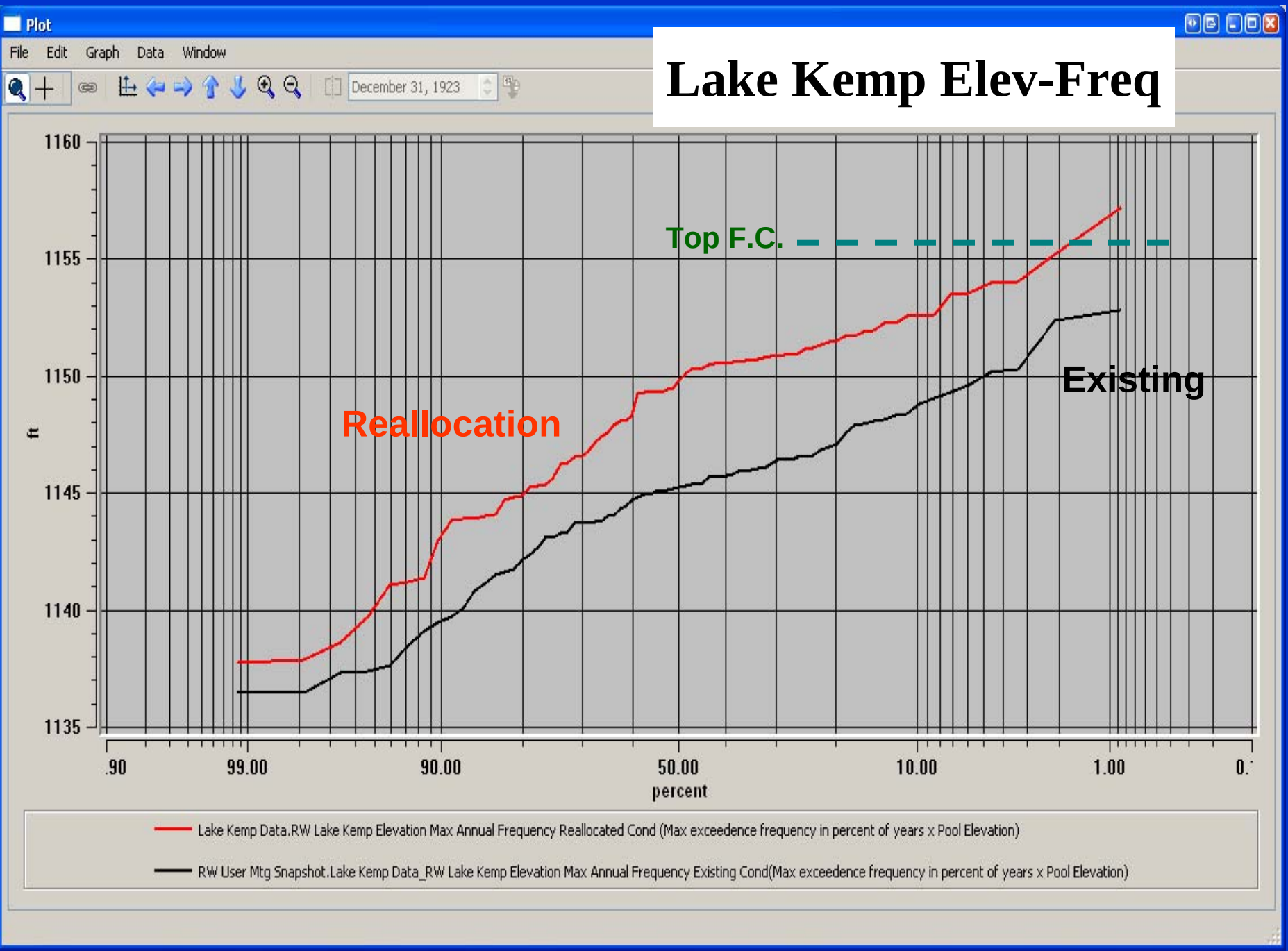
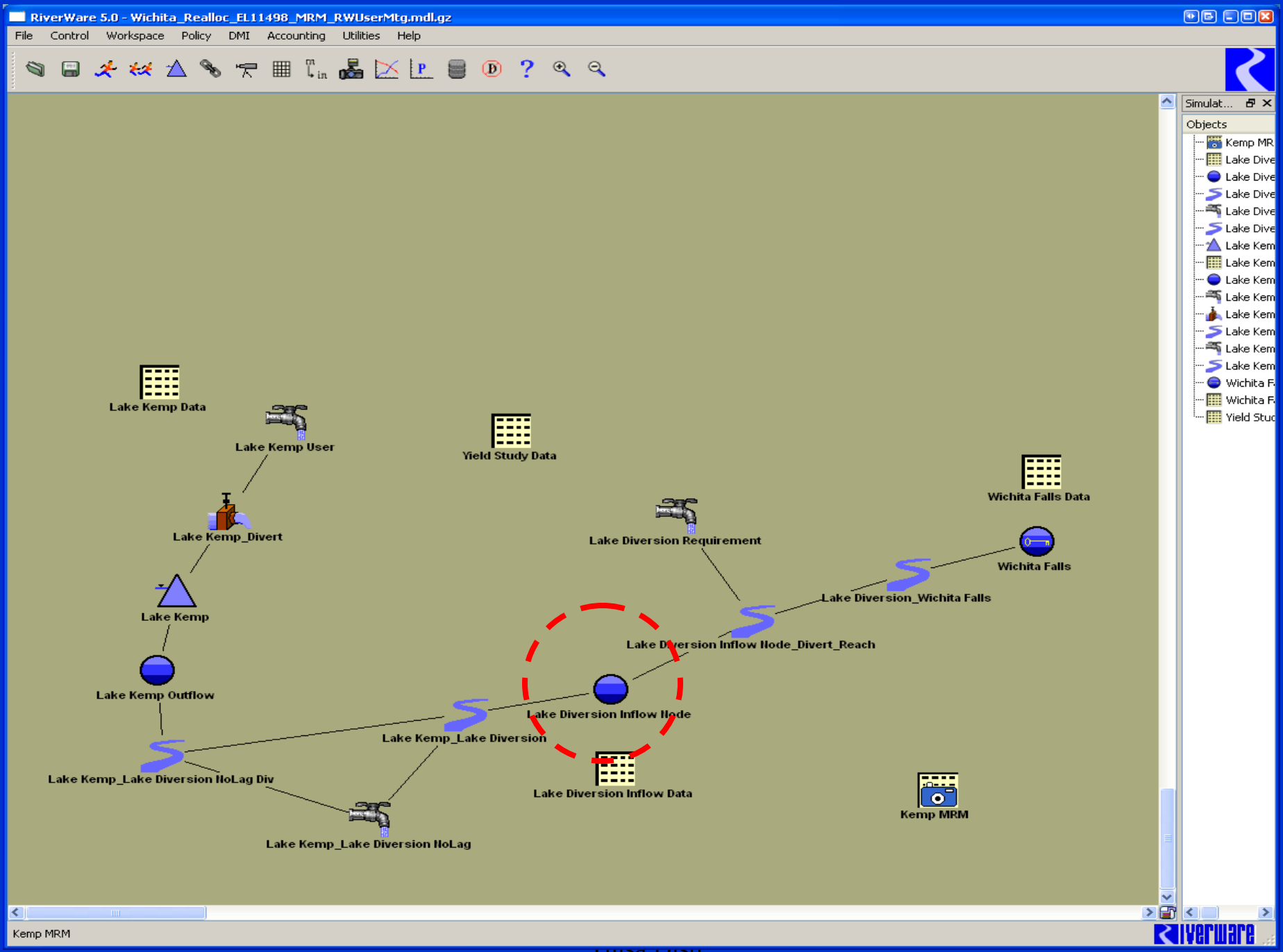
Lake Kemp_Lake Diversion NoLag
Kemp MRM
RIVERWARE

Lake Kemp Elev-Freq




RiverWare 5.0 - Wichita_Realloc_EL11498_MRM_RWUserMtg.mdl.gz
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Kemp MRM
RIVERWARE

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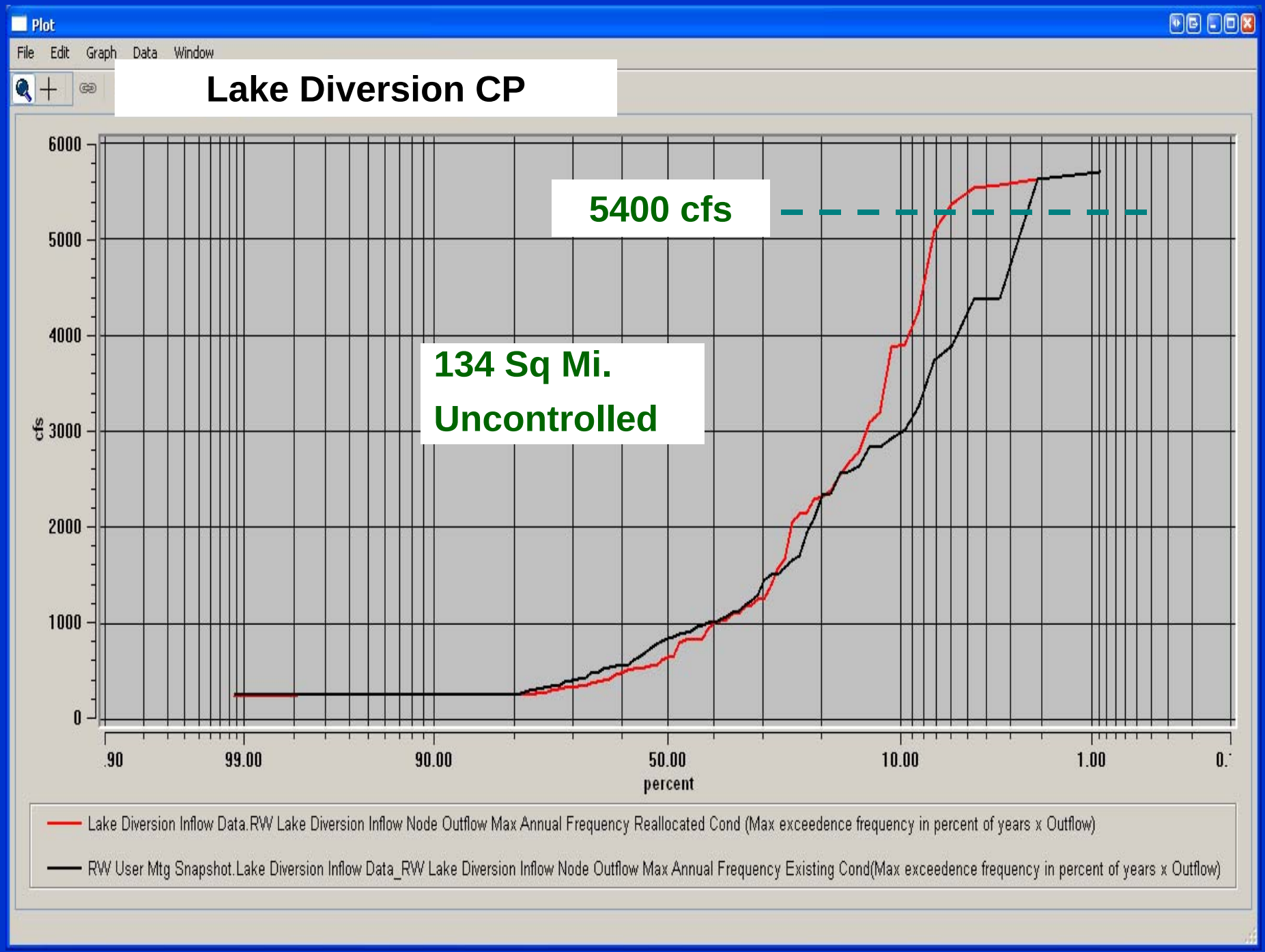
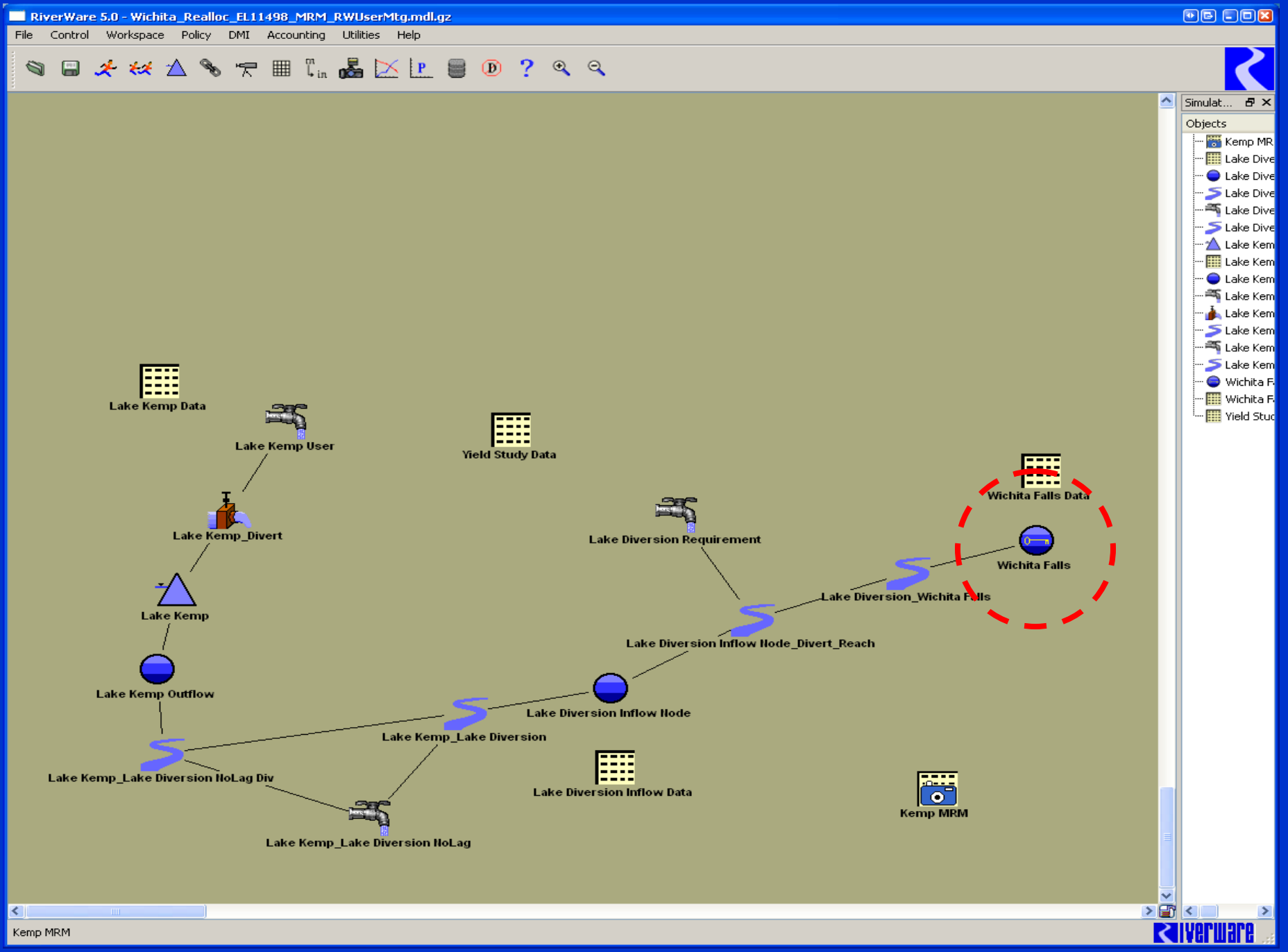

Plot
File Edit Graph Data Window
Lake Diversion CP
5400 cfs
134 Sq Mi.
Uncontrolled
6000
5000
4000
3000
2000
1000
0
cfs
.90
99.00
90.00
50.00
10.00
1.00
percent
Lake Diversion Inflow Data.RW Lake Diversion Inflow Node Outflow Max Annual Frequency Reallocated Cond (Max exceedence frequency in percent of years x Outflow)
RW User Mtg Snapshot.Lake Diversion Inflow Data_RW Lake Diversion Inflow Node Outflow Max Annual Frequency Existing Cond(Max exceedence frequency in percent of years x Outflow)


RiverWare 5.0 - Wichita_Realloc_EL11498_MRM_RWUserMtg.mdl.gz
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Lake Kemp User
Yield Study Data
Wichita Falls Data
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Lake Diversion Requirement
Wichita Falls
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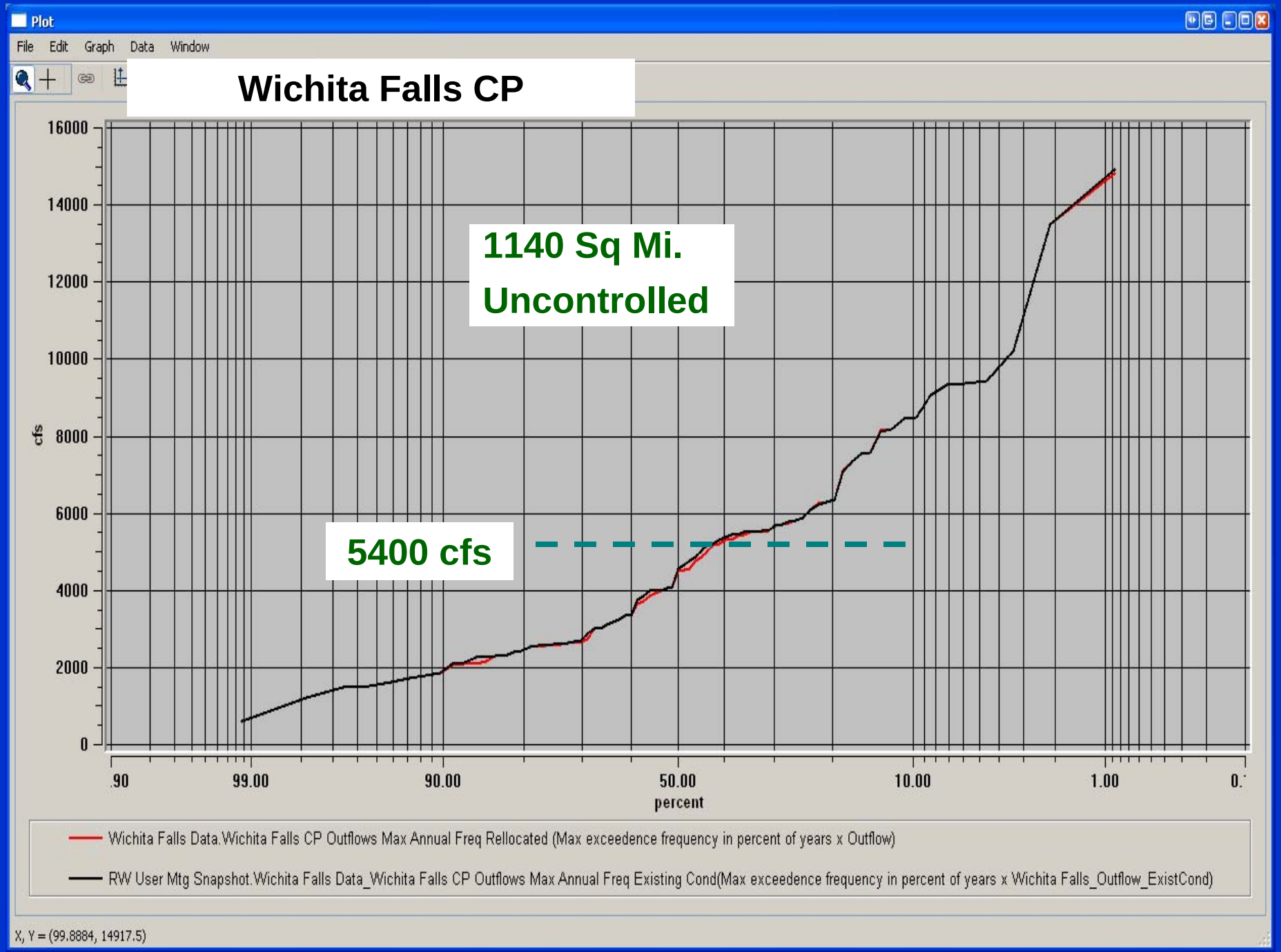
Lake Diversion_Wichita Falls
Lake Diversion Inflow Node_Divert_Reach
Lake Kemp Outflow
Lake Diversion Inflow Node
Lake Kemp_Lake Diversion
Lake Kemp_Lake Diversion NoLag Div
Lake Diversion Inflow Data
Kemp MRM
Lake Kemp_Lake Diversion NoLag
Kemp MRM
RiverWare


Plot
File Edit Graph Data Window
Wichita Falls CP
1140 Sq Mi.
Uncontrolled
5400 cfs
16000
14000
12000
10000
8000
6000
4000
2000
0
cfs
.90
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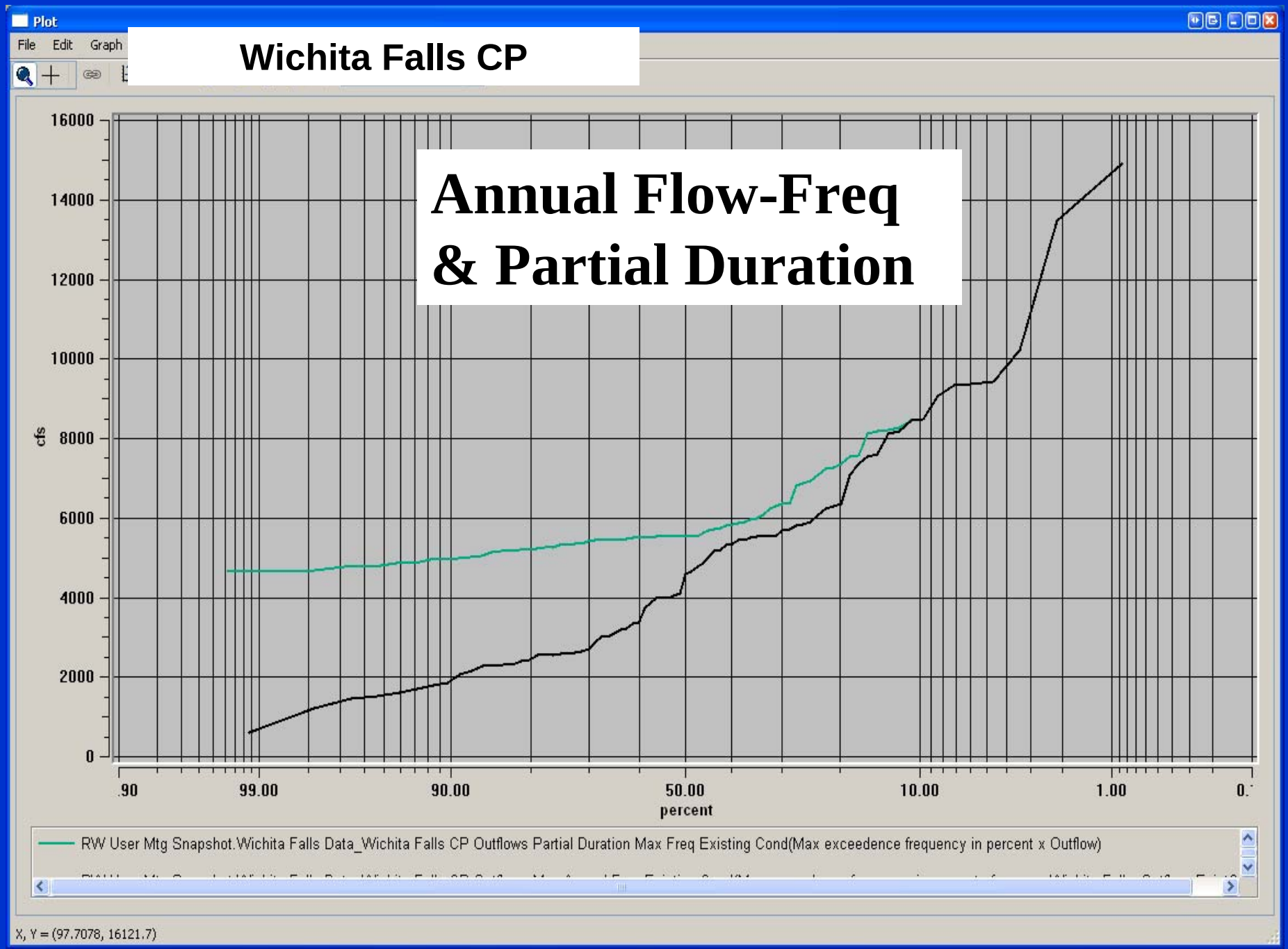
90.00
50.00
10.00
1.00
0.
percent
Wichita Falls Data.Wichita Falls CP Outflows Max Annual Freq Rellocated (Max exceedence frequency in percent of years x Outflow)
RW User Mtg Snapshot.Wichita Falls Data_Wichita Falls CP Outflows Max Annual Freq Existing Cond(Max exceedence frequency in percent of years x Wichita Falls_Outflow_ExistCond)
X, Y = (99.8884, 14917.5)


Plot
File Edit Graph
Wichita Falls CP
Annual Flow-Freq
& Partial Duration
16000
14000
12000
10000
8000
6000
4000
2000
0
cfs
.90
99.00
90.00
50.00
10.00
1.00
percent
RW User Mtg Snapshot.Wichita Falls Data_Wichita Falls CP Outflows Partial Duration Max Freq Existing Cond(Max exceedence frequency in percent x Outflow)
X, Y = (97.7078, 16121.7)

RIVERWARE PROGRAM

2008 MOU: HQ & CADSWES

Free license for COE for 3 Years

HEC INTEGRATING RIVERWARE INTO CWMS, WAT, & RTS

Lake Kemp