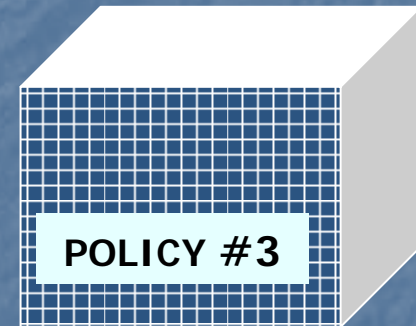
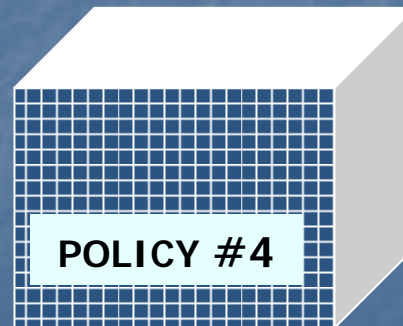
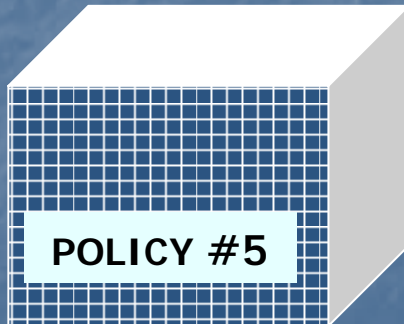
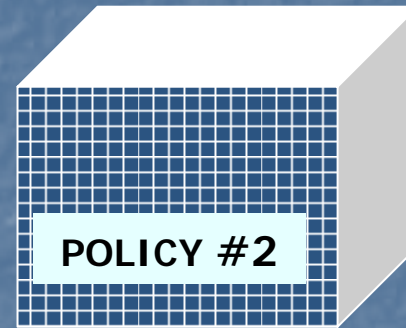
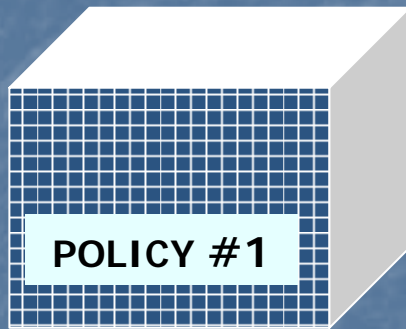


# GPAT

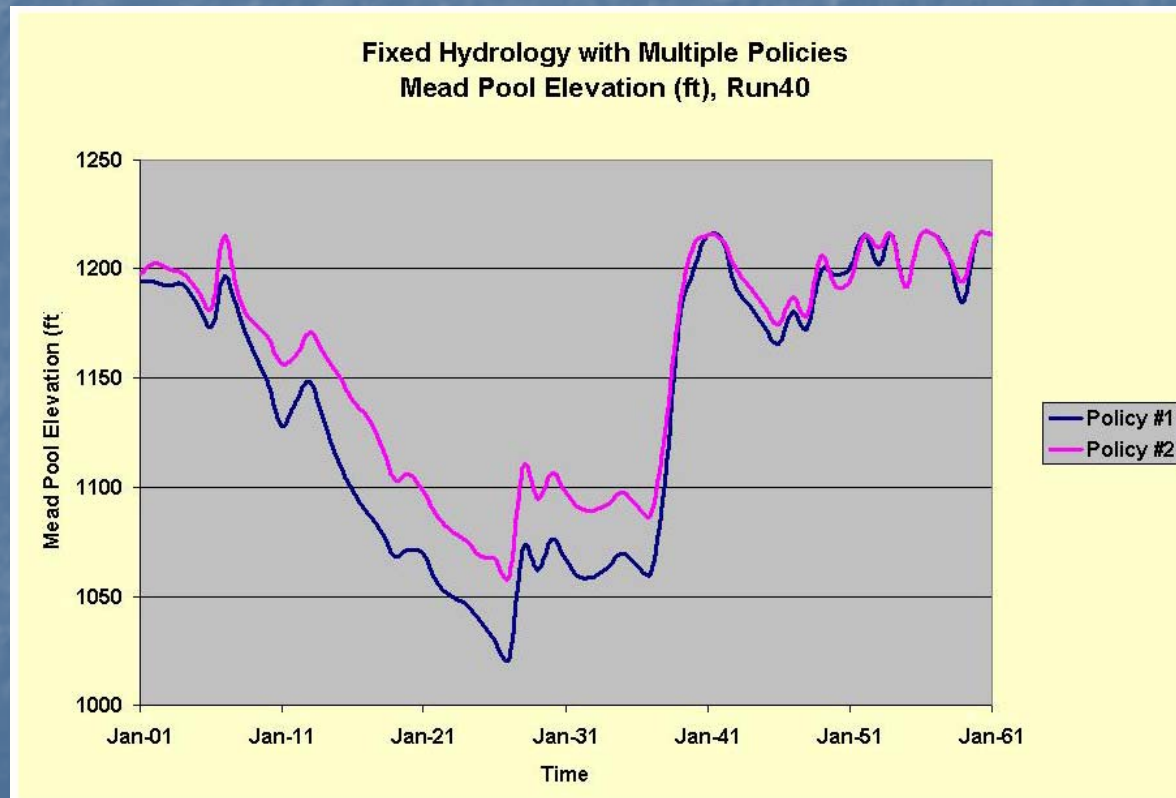
- Graphical Policy Analysis Tool (GPAT)
- Implemented in Visual Basic for Applications (VBA) as an Add-in to Excel
- Analyzes and Compares Excel output from multiple RiverWare runs (policies, hydrologic scenarios, etc.)
- Graphs slots, statistics, percentile, probability distributions and exceedance probabilities
- Allows dynamic data exploration

# How to Compare Policies???



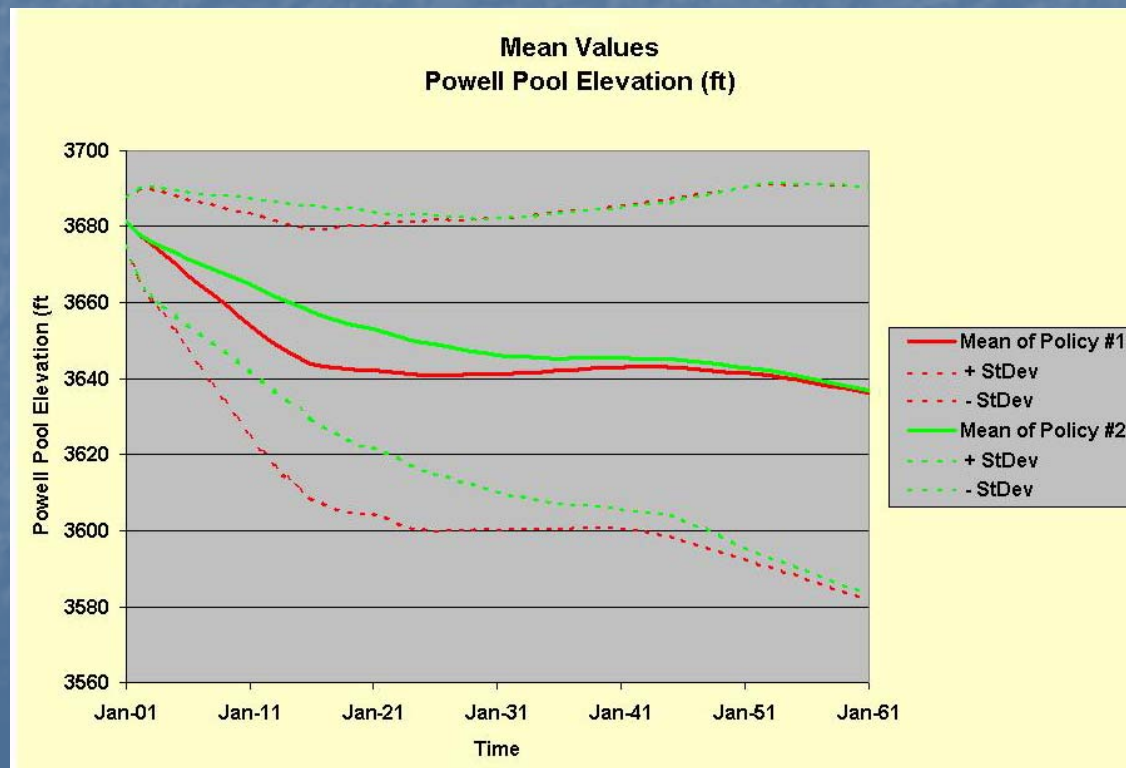
# One run, Alt. policies

- I want to compare individual slot values over time for a common hydrology



# Statistic(runs), Alt. policies

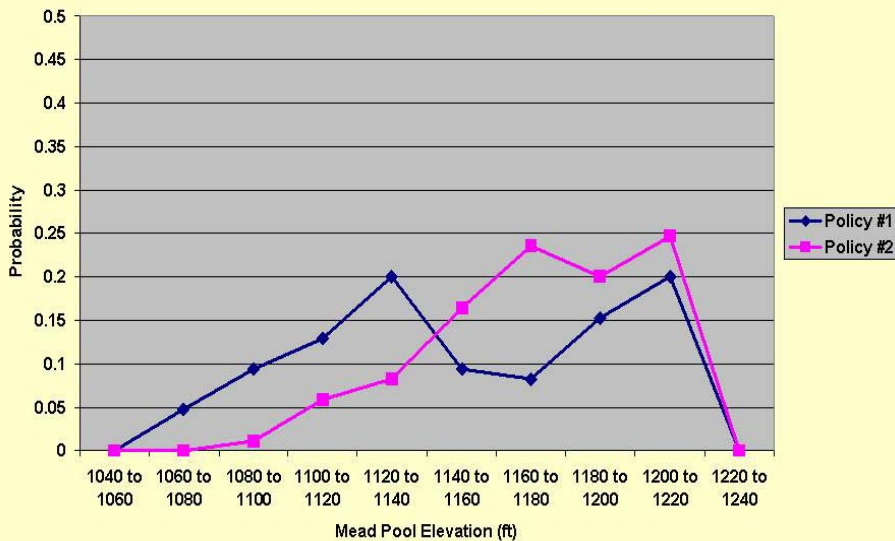
- I want to compare the statistics of all hydrologic scenarios over time
  - Mean, Minimum, Maximum, Standard Deviation



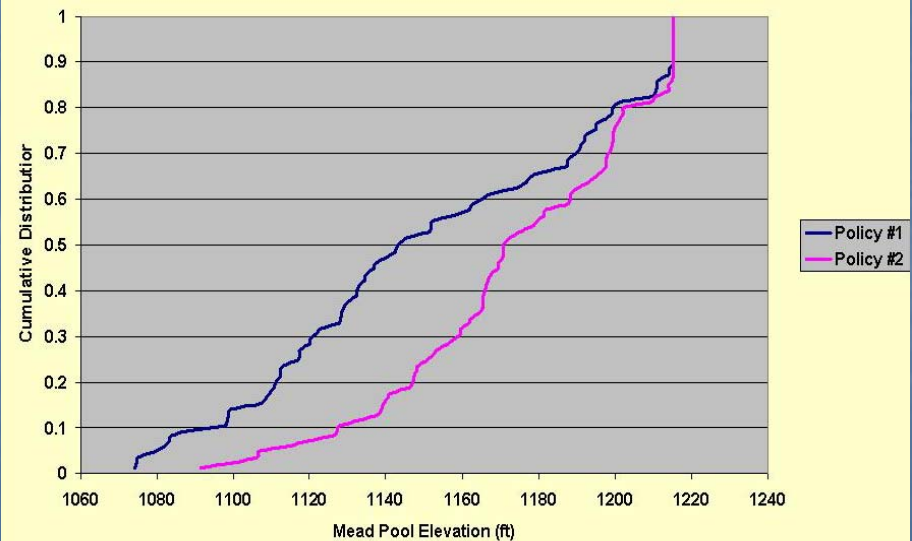
# Distribution(runs), Alt. policies

- How do the probabilistic distributions of slot values compare at one point in time? PDF (Histogram) , CDF

Histogram  
Mead Pool Elevation (ft), 12/15

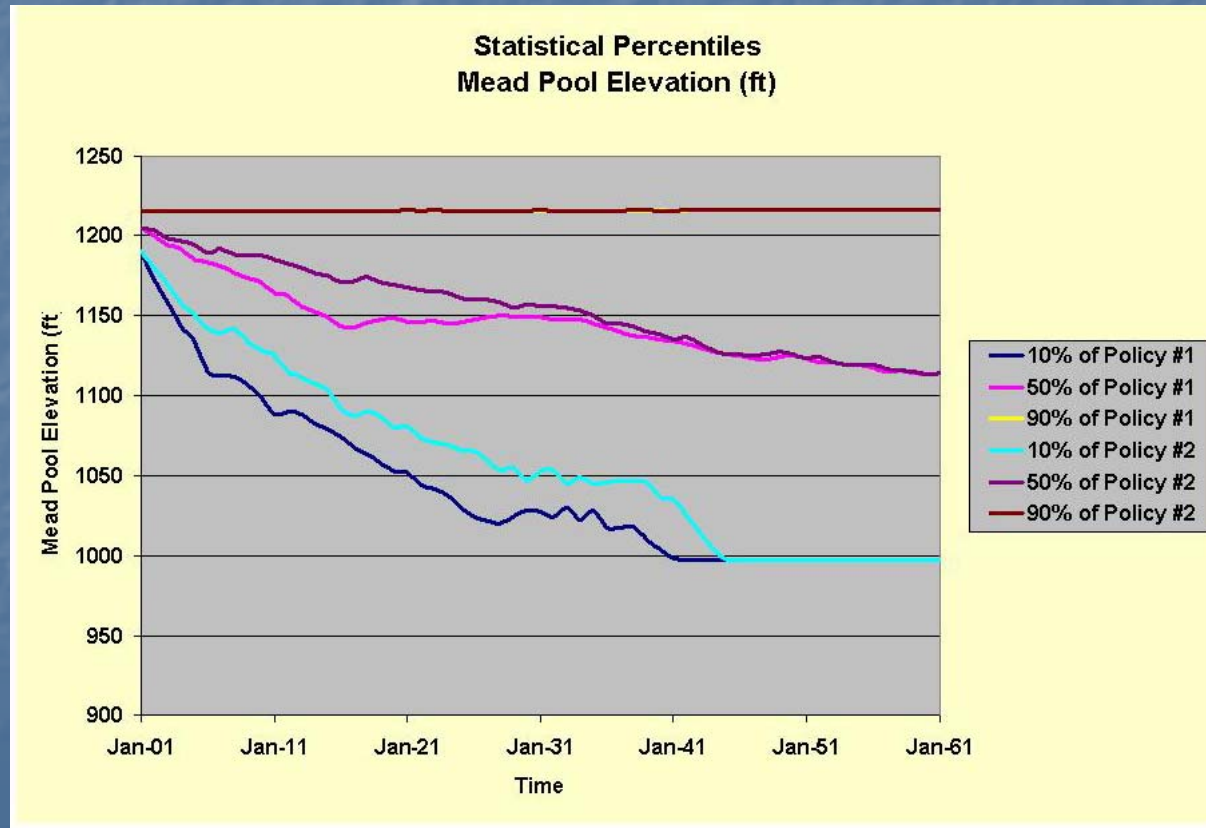


Cumulative Density Function  
Mead Pool Elevation (ft), 12/15



# Percentiles(runs), Alt. policies

- What will the slot values be over time that correspond to a particular percentile of occurrence?



# Exceedance Probability

- What is the probability of a slot variable exceeding or not exceeding a certain value through time?
- What is the probability of a slot variable falling within a specified range through time?
- What is the probability of a binary occurrence?
  - Flood release, shortage, surplus, equalization flags

# Recent GPAT Development

- GUI reorganized into tabbed interface
- Flexible specification of samples across columns, worksheets, and workbooks
- Time range specification
- Graph format options for vertical gridlines and data markers
- Choice of six methods for calculating percentiles



Tabbed Interface

**Graphical Policy Analysis Tool**

DATA SETUP | GRAPH SETUP | UTILITIES

Source Data Selection

**Workbooks**

Open Workbooks

Close Selected Workbooks

Select Workbooks To Include In Analysis

- LITE.xls
- Alt1a elev.xls

Menu Example Book: LITE.xls

**Worksheets**

Use All Worksheets

Select Worksheets

- Slot0: PowellMonthly Storage
- Slot1: PowellOutflow
- Slot2: MeadMonthly Storage
- Slot3: MeadOutflow

**Columns**

Use All Columns

Select Columns

- Run0
- Run1
- Run2
- Run3

**Rows**

Full Timestep Range

Limit Timestep Range

Start Time: 12/04

End Time: 12/63

Filter By Months

**Sample Definition**

**Data Dimensions**

Sample Options	Workbooks	Worksheets	Columns
Separate Samples	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Single Sample	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

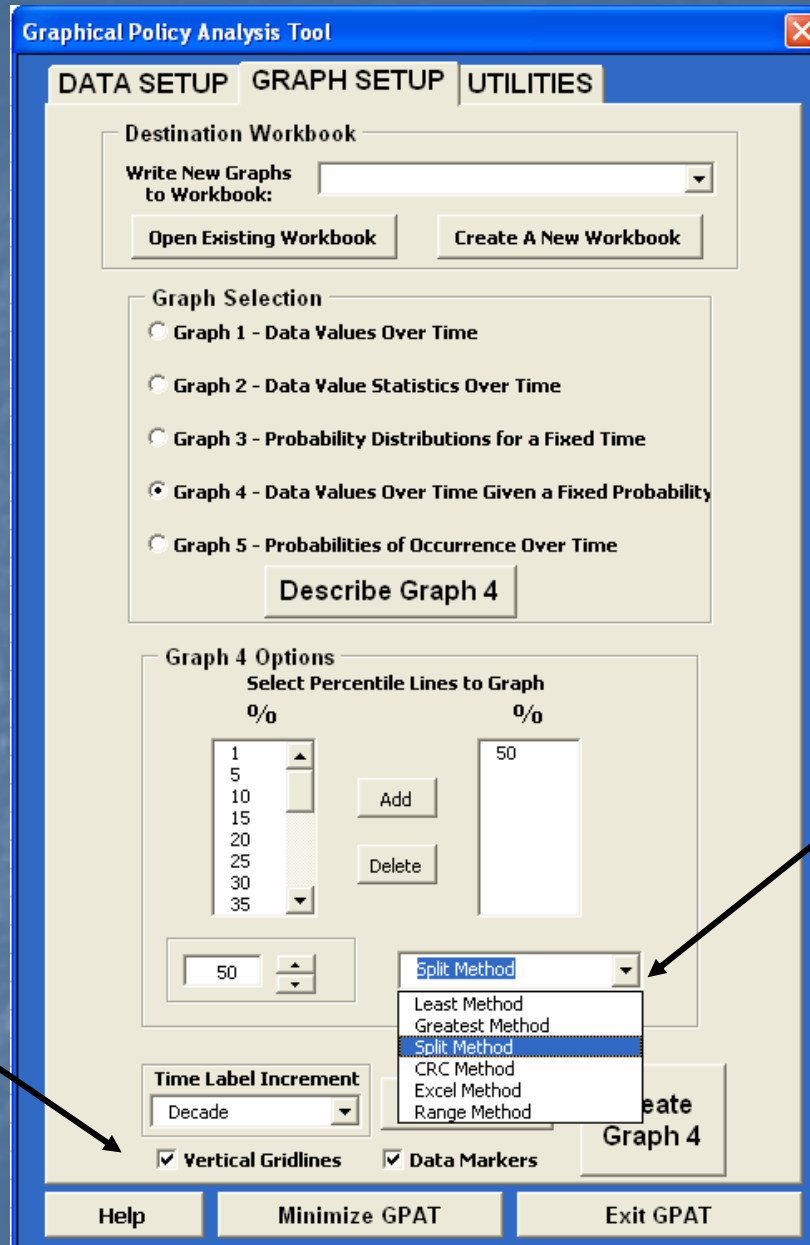
NOTE: Either separate samples or a single sample can be defined across the data in each data dimension. Statistics are calculated and graphed separately for each sample that results from combining the dimension definitions.

Help | Minimize GPAT | Exit GPAT

Customized Selection of Workbooks Worksheets & Columns

Flexible Sample Specification

Time Range Choice



Options for Including Vertical Gridlines & Data Markers

Six Methods for Calculating Percentiles

# Percentile Methods

- Particularly with small sample sizes, the methods can yield very different results
- Suppose we have 4 observations with values of: 1, 2, 3, and 4. The percentiles (p) associated with the values are shown in the following table

Observation	Least	Greatest	Split	CRC	Excel	Range
1	0	25	12.5	20	0	$0 = p = 25$
2	25	50	37.5	40	33.3	$25 < p = 50$
3	50	75	62.5	60	66.7	$50 < p = 75$
4	75	100	87.5	80	100	$75 < p = 100$

# Upcoming GPAT Development\*

- New analysis for probability of event occurrence among time series
  - Find the number of times a shortage is declared in each run
  - Calculate statistics and plot distribution of the numbers of shortages across the runs

\* Funded by Lower Colorado Region of USBR

# Upcoming GPAT Development\*

- Compound event definition
  - Define an event with required conditions across a number of different slots
  - Lake Mead elevation  $< 1075$  and  
Lake Powell elevation  $> 3526$  and  
Lake Powell elevation  $< 3575$

\* Funded by Lower Colorado Region of USBR

# Upcoming GPAT Development\*

- Graph format options for pre-selecting plot area color, line formats, and data marker formats
- Placeholder in results for an initial timestep value so a value can be easily entered and displayed on graphs

\* Funded by Lower Colorado Region of USBR

# Potential Future Development

- Change the user interface from specifying a graph "type" to specifying transformations and analyses
- Expand capabilities for sampling by time, transforming series, and analyzing events
- Non-spreadsheet GPAT to bypass row/column limitations in Excel