



South Carolina Electric & Gas Saluda Project

Reservoir Modeling



Model Objectives

- What are the objectives of the modeling work?
 - Reservoir Model
 - Watershed Model
 - Water Quality Model
 - Generation Model
 - System Model
 - Other



Model Objectives

- Hydrologic Model
- Hydraulic Model
- Economic Model
- Water Quality Model

- Combination of all?



Model Objectives

- Suggested objectives from 12/6 Operations Group Meeting
 - Lake levels
 - LSR or Minimum Flows
 - Inflows
 - Generation
 - Storage
 - Graphic Ability
 - Interactive Front End



Mission Statement

“...establish a baseline of current hydrologic, hydraulic and operational conditions, and aid in analyzing and understanding the potential upstream and downstream effects of potential changes to project operation....”



System Modeling

- Potential new model options
 - HEC-5
 - OASIS
 - CHEOPS
 - *MIKE Basins*
 - *WMS*
 - Decision Support Programs

HEC-5



- Designed to simulate a sequential operation of a reservoir channel system
- Public domain software
- Major focus of model
 - Reservoir operations
 - Flood Control
 - Optimization of Water Supply and Hydropower operations
 - Flood Damage and reservoir economics



OASIS

- Routes water through a **water resource system**
- Extremely flexible
- Purchased Software
- Can account for both human and physical constraints on the reservoir system.
- Allows for assessment of management options, supply options, alterations due to biologic requirements or other sociologic driven demands.



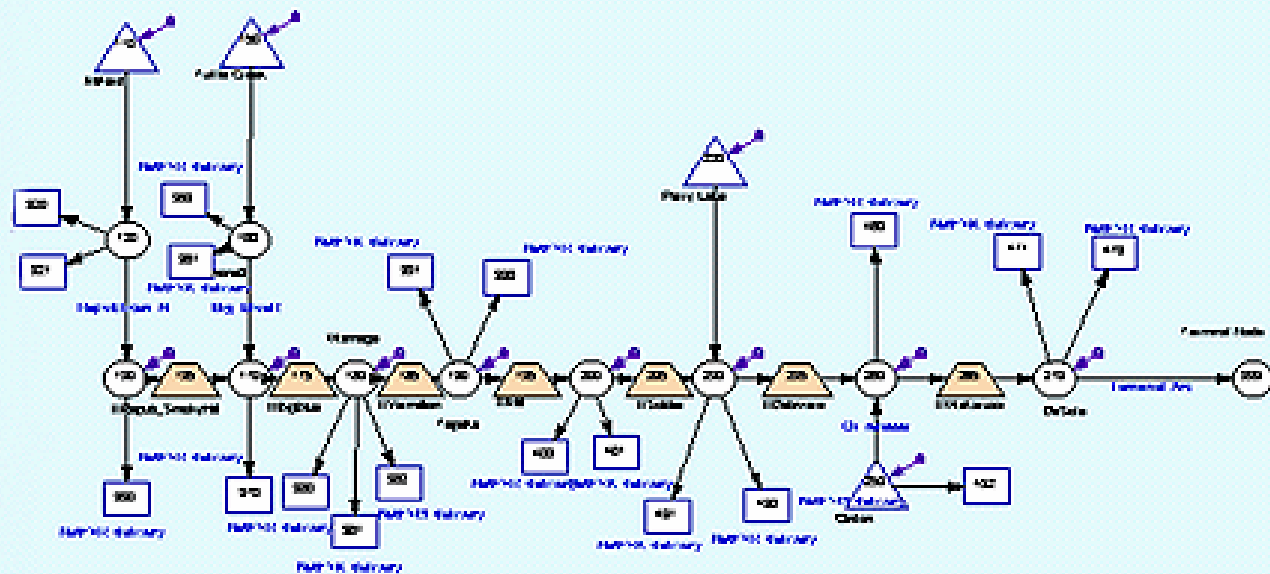
OASIS

- Operates using Constraints and Goals for all decisions
- Ability to interface with a wide variety of other models.
- Can run several models simultaneously within the OASIS shell.
- Graphical Interfaces

Zoom 60 %



Kansas River Basin Simulation Model



NODES

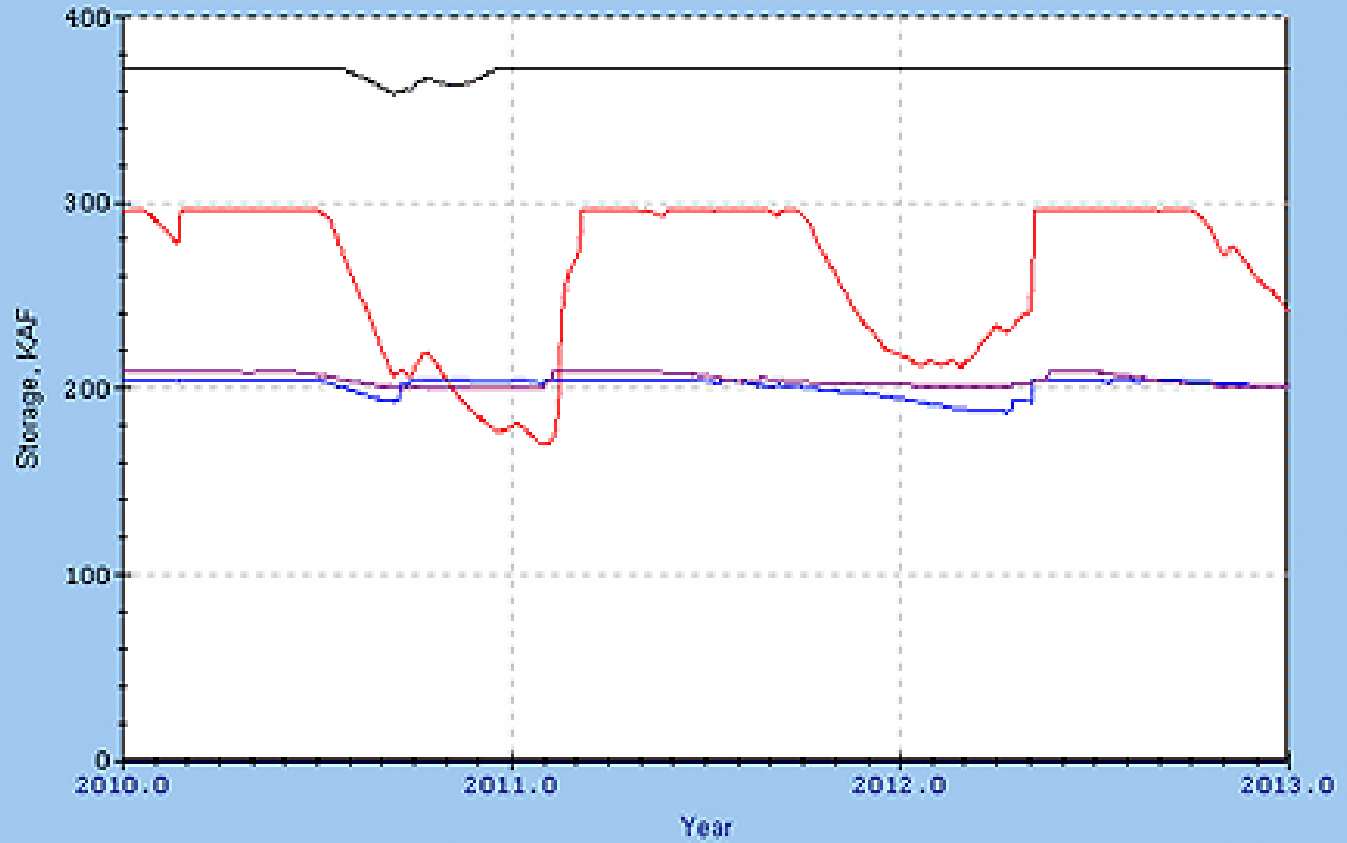
ARCS



Select items for editing

 Output CURRENT

System Storage



— Total Milford Storage

— Total Perry Storage

— Total Tuttle Creek Storage

— Total Clinton Storage

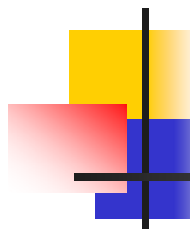
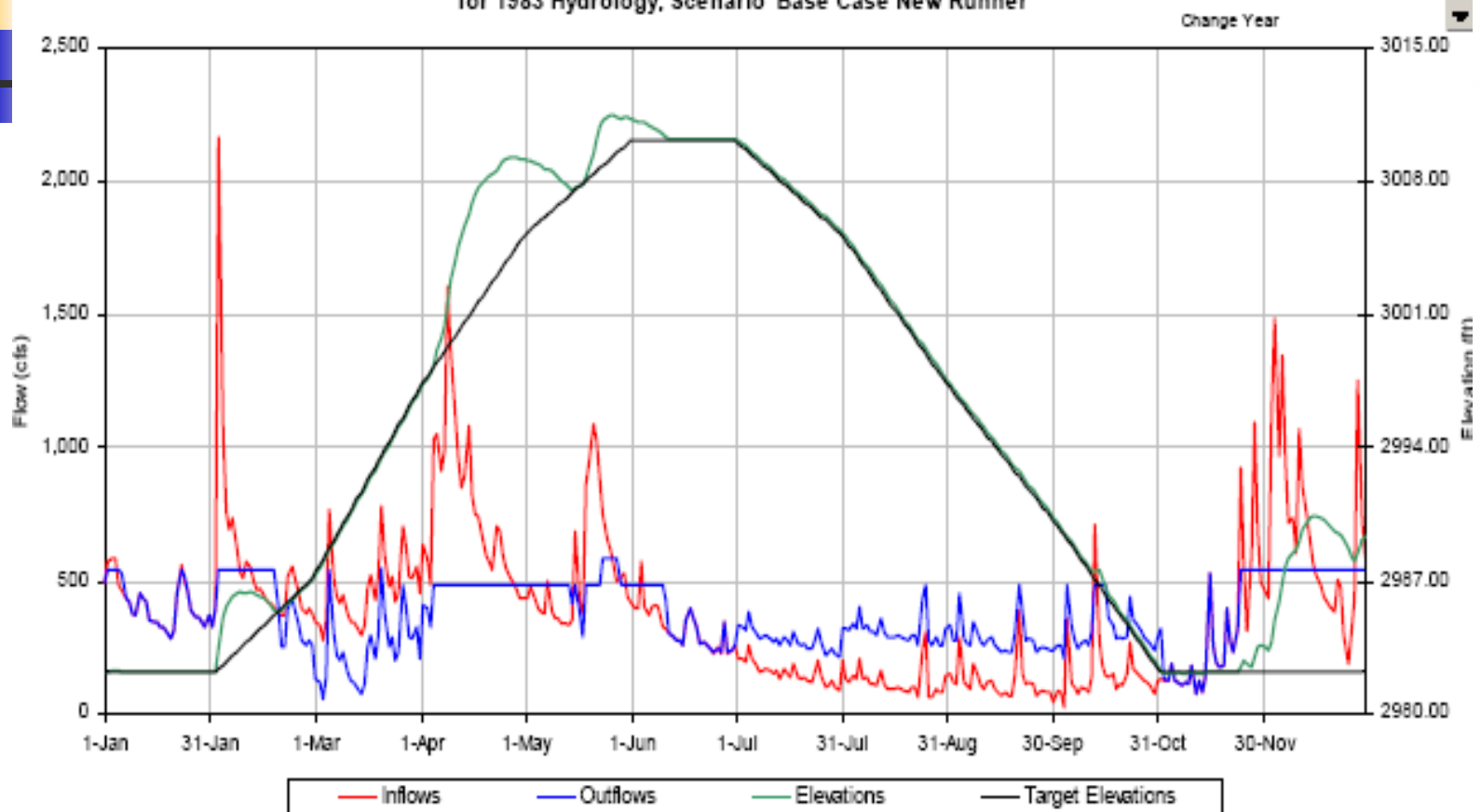


CHEOPS

- Operations and Planning Program
- Models reservoir systems
- Private domain software
- Focuses on hydroelectric optimization
- Has Graphical and Tabular Outputs
- Potential for Long Run Time

Base Case New Runner (Normal 1983)

Nantahala Reservoir Operational Details
for 1983 Hydrology, Scenario 'Base Case New Runner'





Existing Models

- SCE&G Flow Forecast Model
 - Currently used to model what-if scenarios for project operations.
 - Model is calibrated to system, updated as required
 - Run daily – incorporates NWS and USGS data.
 - Encompasses entire Saluda Basin
 - Rainfall/Runoff Relationship
 - Reservoir levels
 - Inflows/Outflows
 - Minimum flows
 - Meets almost all criteria noted in minutes from 12/6 group meeting



Existing Models

- RMS 4 – Downstream water quality (DO and Temp) and simulated fish growth
- W2 model
 - Assessed water quality parameters of reservoir.
 - Phosphorous
 - DO
 - Thermal Stratification



Conclusion

- Most of the noted objectives are met with existing models
- Any additional model objectives need to be identified
- Can existing models be modified to meet all required objectives?



Data Sources

- SCE&G Operations Data
 - Generation
 - Lake Level
 - Tailwater
 - Downstream flows
- NWS – Precipitation data
- USGS – Flow Data
 - Flow Model Hydrology output



Data Sources

- Other Resources?



Output Requirements

- Water Levels
- Generation Impacts
- Downstream levels
- Economics



Model Methodology

- Use typical year
- Hold inflows constant to assess impact on changes in operation on lake levels