

# Hydrological Model of Interim Operations

- Need a hydrologic representation of the Corps' action submitted for formal consultation March 7, 2006.
- FWS will use model output as basis of analysis for determining effects to listed species and their habitat relative to an “environmental baseline”.

# Environmental Baseline

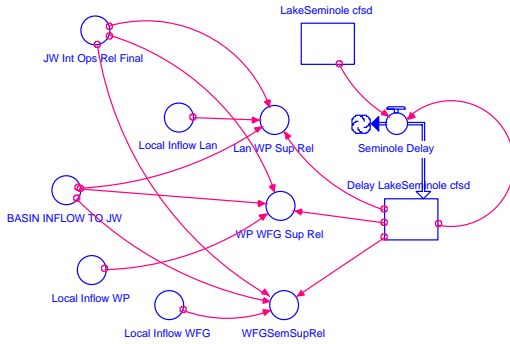
- A “snapshot” of a listed species’ status in the action area.
- Does not include the effects of the action under review.
- Does include the effects of past operation of an ongoing project.
- Historic flow = the hydrologic part of baseline. We will also estimate a “no action” flow regime to isolate the effects of reservoir operations from other effects to the flow regime.

# Modeling Approach

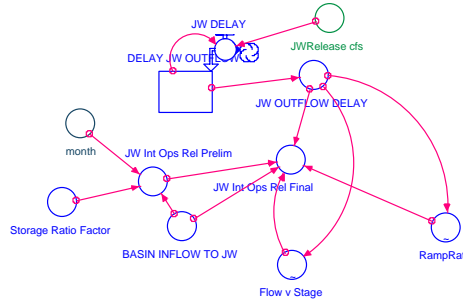
- “Routing” not used.
- Calculate required Woodruff releases daily.
- Prorate support from system reservoirs based on system storage, project local inflow, project local drainage area.
- Include support for Woodruff releases in the mix of other established rules governing releases from each reservoir.

# Interim Operations Sector

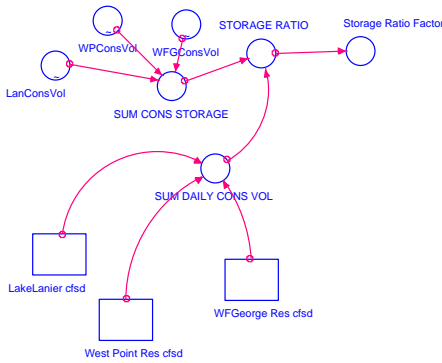
## Upstream Reservoir Support



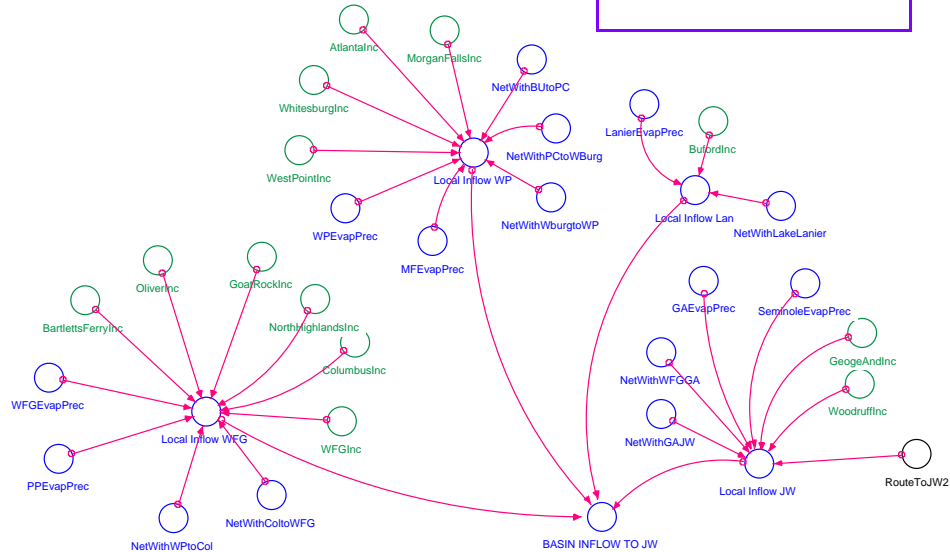
## Woodruff Releases



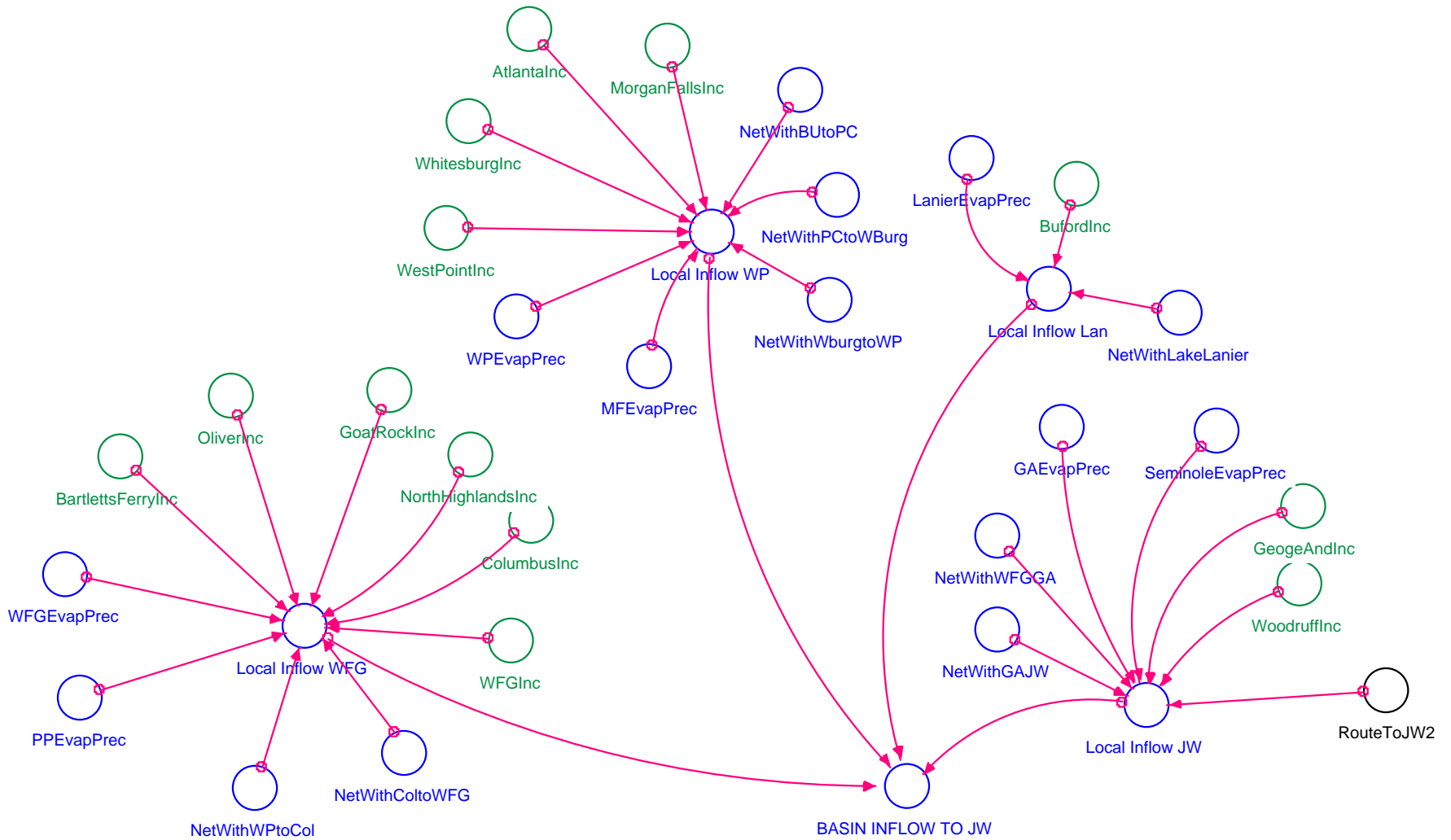
## Upstream Storage Status



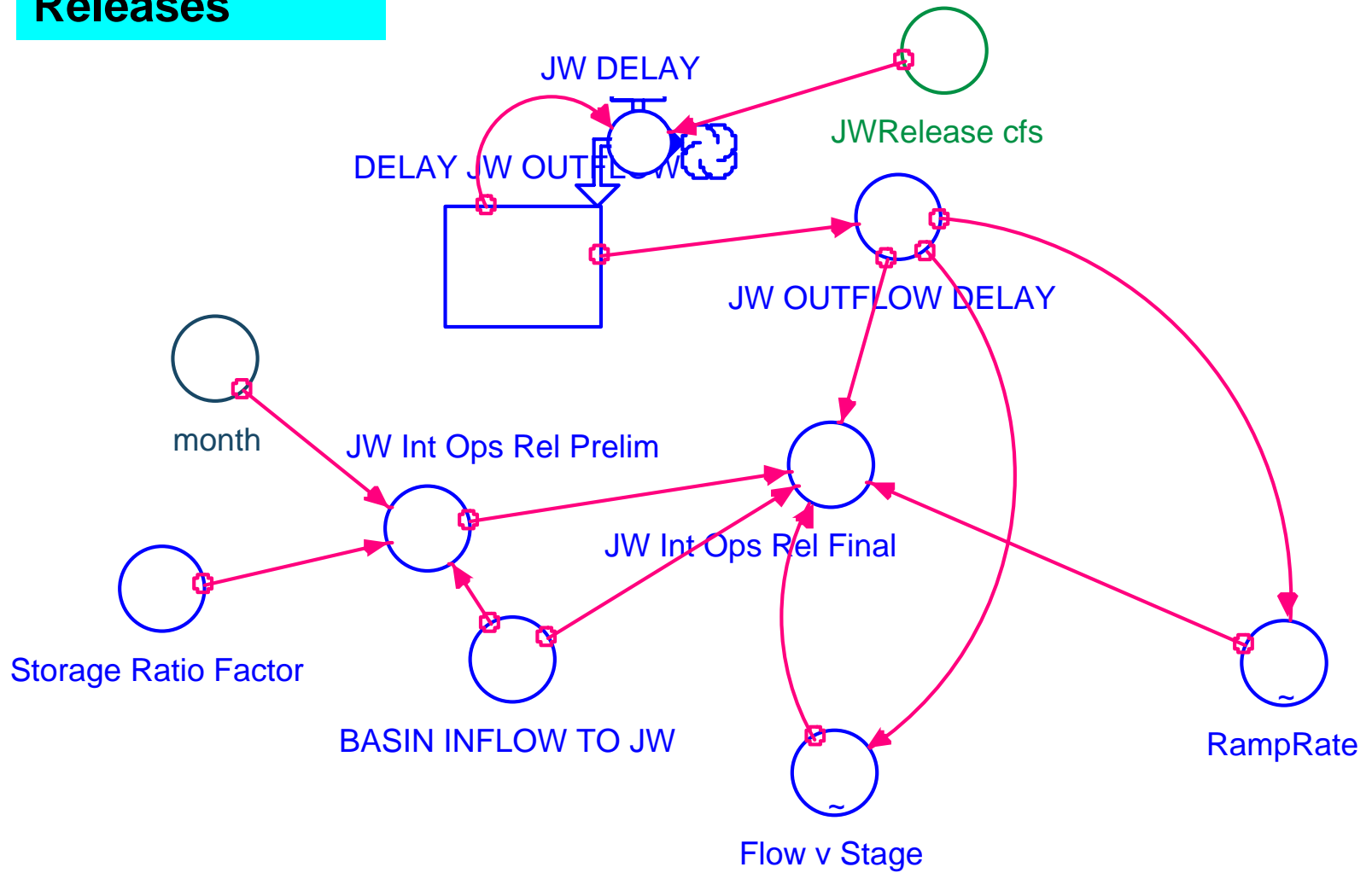
## Basin Inflow

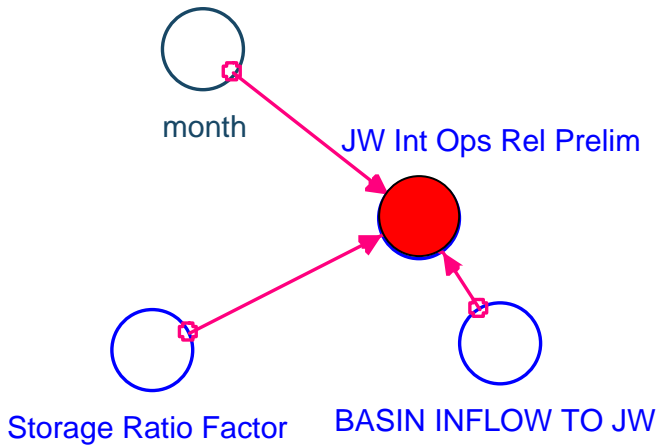


# Basin Inflow



# Woodruff Releases





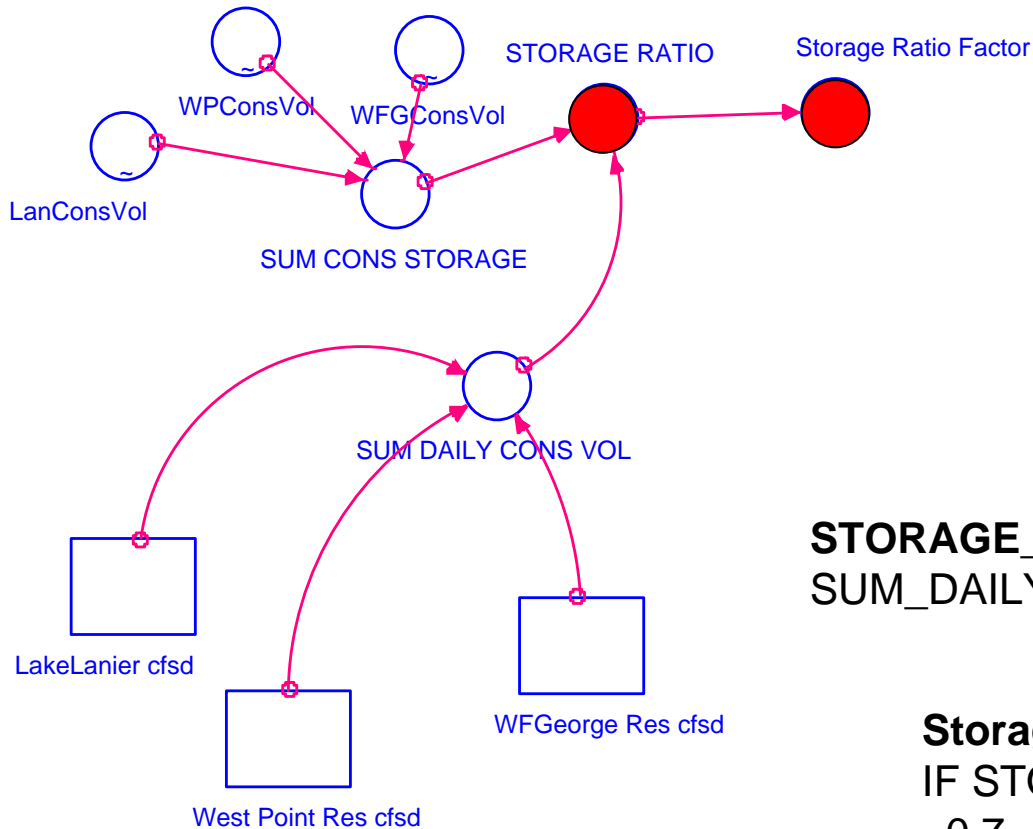
Woodruff Releases  
(before ramping rates applied)

### JW Int Ops Rel Prelim =

```

IF BASIN_INFLOW_TO_JW >= 37400 THEN
  37400
ELSE
  IF (month >= 3) AND (month <= 5) THEN
    IF BASIN_INFLOW_TO_JW >= 20400 THEN
      MAX (20400, BASIN_INFLOW_TO_JW * Storage_Ratio_Factor)
    ELSE
      MAX (5000, BASIN_INFLOW_TO_JW)
  ELSE
    IF BASIN_INFLOW_TO_JW >= 8000 THEN
      MAX (8000, BASIN_INFLOW_TO_JW * Storage_Ratio_Factor)
    ELSE
      MAX (5000, BASIN_INFLOW_TO_JW)
  
```

Composite Reservoir Storage for use in computing percentage of basin inflow released

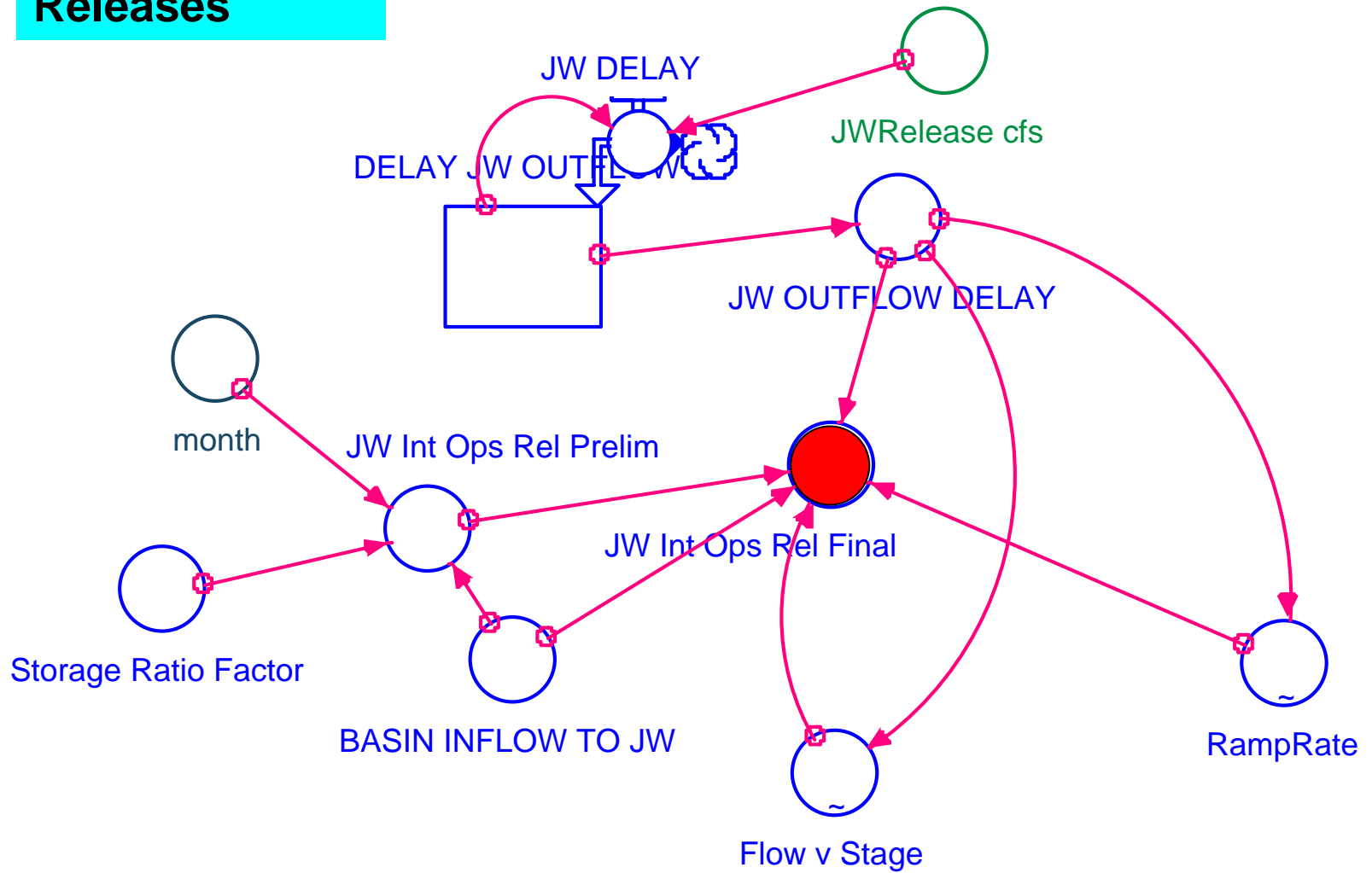


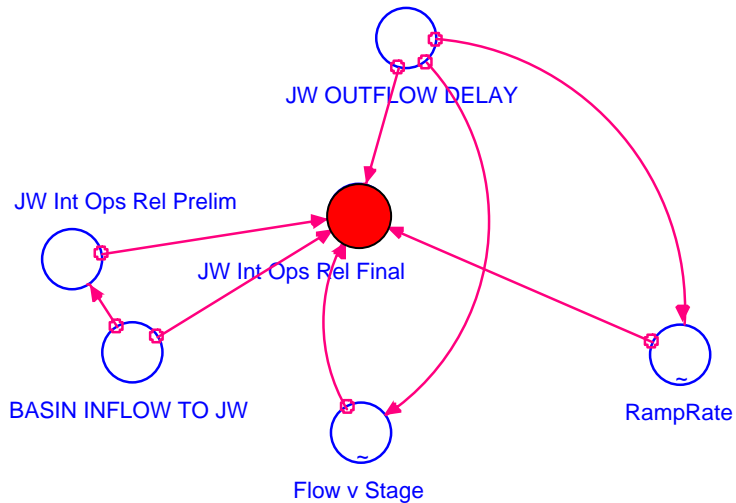
$$\text{STORAGE\_RATIO} = \frac{\text{SUM\_DAILY\_CONS\_VOL}}{\text{SUM\_CONS\_STORAGE}}$$

$$\text{Storage\_Ratio\_Factor} = \begin{cases} 0.7 & \text{IF STORAGE\_RATIO} < 0.7 \text{ THEN} \\ \text{ELSE MIN}(1, \text{STORAGE\_RATIO}) \end{cases}$$



# Woodruff Releases





Woodruff Releases  
(after ramping rates applied)

**JW Int Ops Rel Final =**

IF BASIN\_INFLOW\_TO\_JW > 37400 THEN

    JW\_Int\_Ops\_Rel\_Prelim

ELSE

    IF JW\_OUTFLOW\_DELAY < JW\_Int\_Ops\_Rel\_Prelim THEN

        JW\_Int\_Ops\_Rel\_Prelim

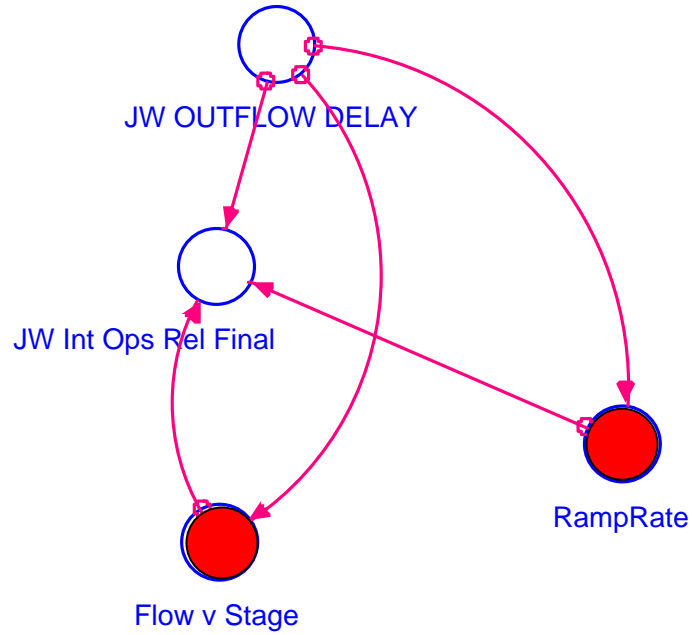
    ELSE

        IF JW\_OUTFLOW\_DELAY - JW\_Int\_Ops\_Rel\_Prelim > Flow\_v\_Stage \* RampRate THEN

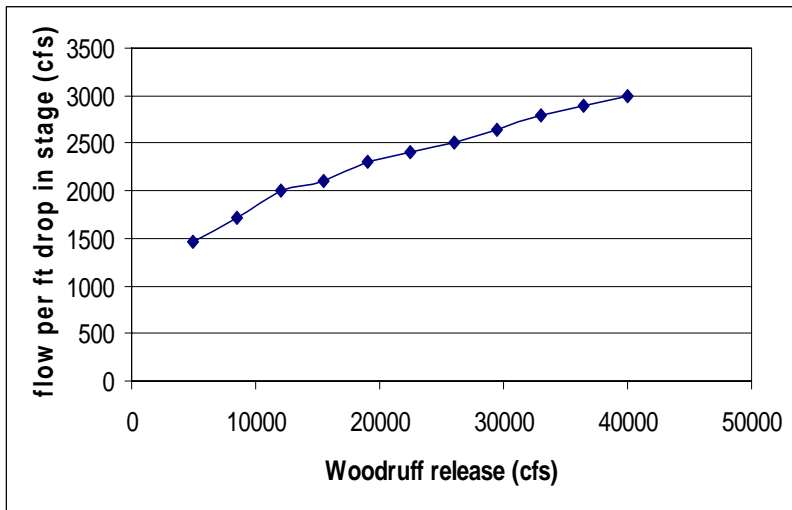
            JW\_OUTFLOW\_DELAY - (Flow\_v\_Stage \* RampRate)

        ELSE

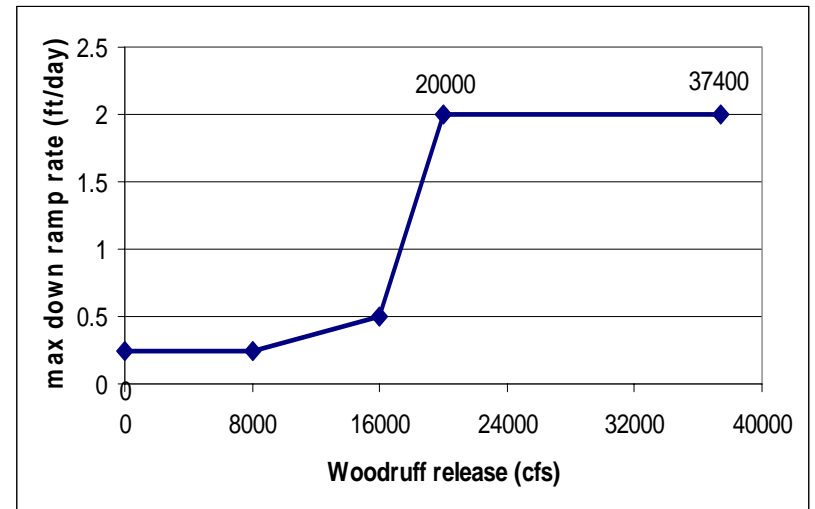
            JW\_Int\_Ops\_Rel\_Prelim



Flow v Stage

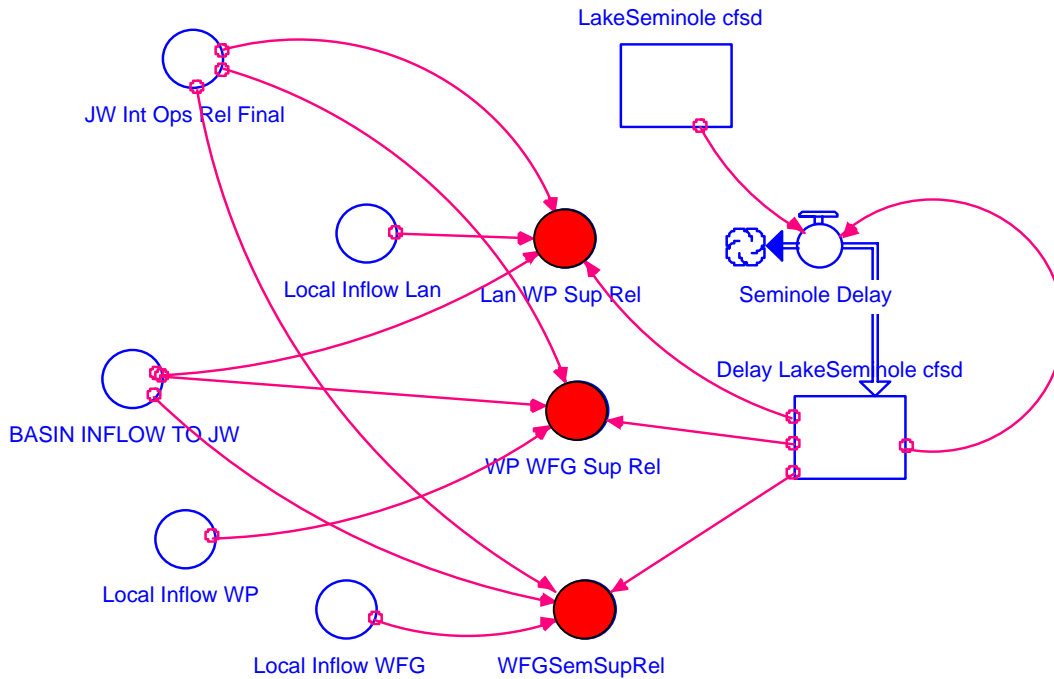


RampRate



Chattahoochee Reservoir Releases to Support Releases from Woodruff

## Upstream Reservoir Support



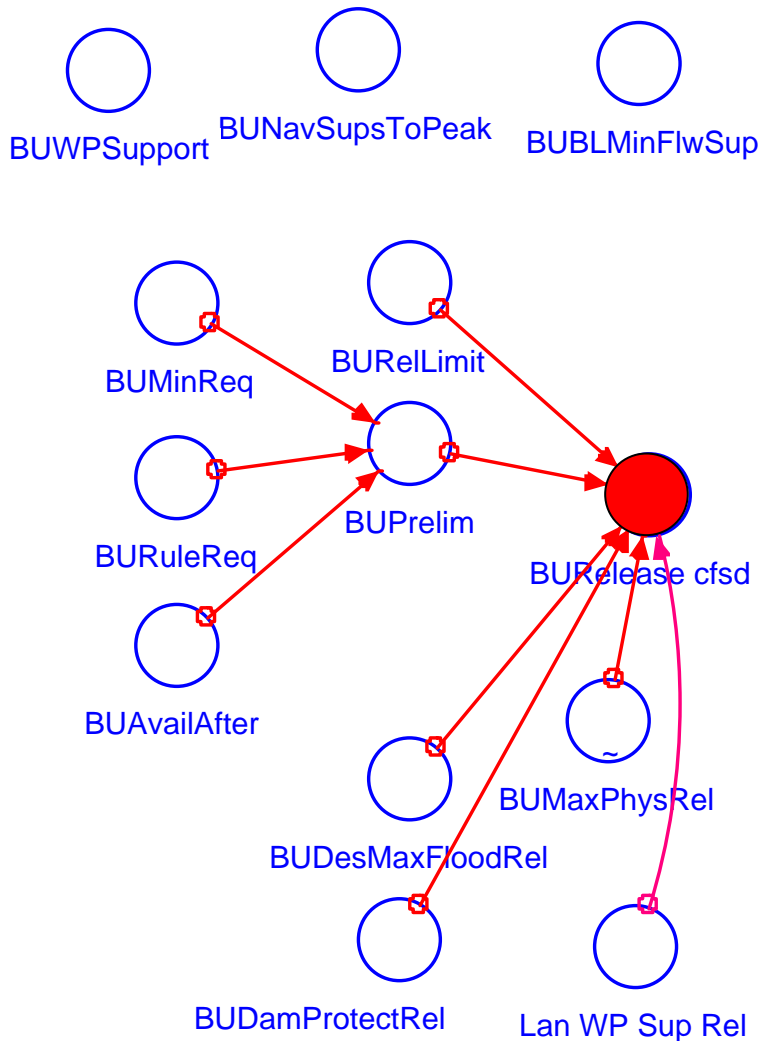
$$\text{Lan WP Sup Rel} = \text{MAX} ($$

$$0,$$

$$(\text{Local\_Inflow\_Lan} / \text{BASIN\_INFLOW\_TO\_JW}) * \text{JW\_Int\_Ops\_Rel\_Final},$$

$$0.139 * (185190 - \text{Delay\_LakeSeminole\_cfsd}))$$

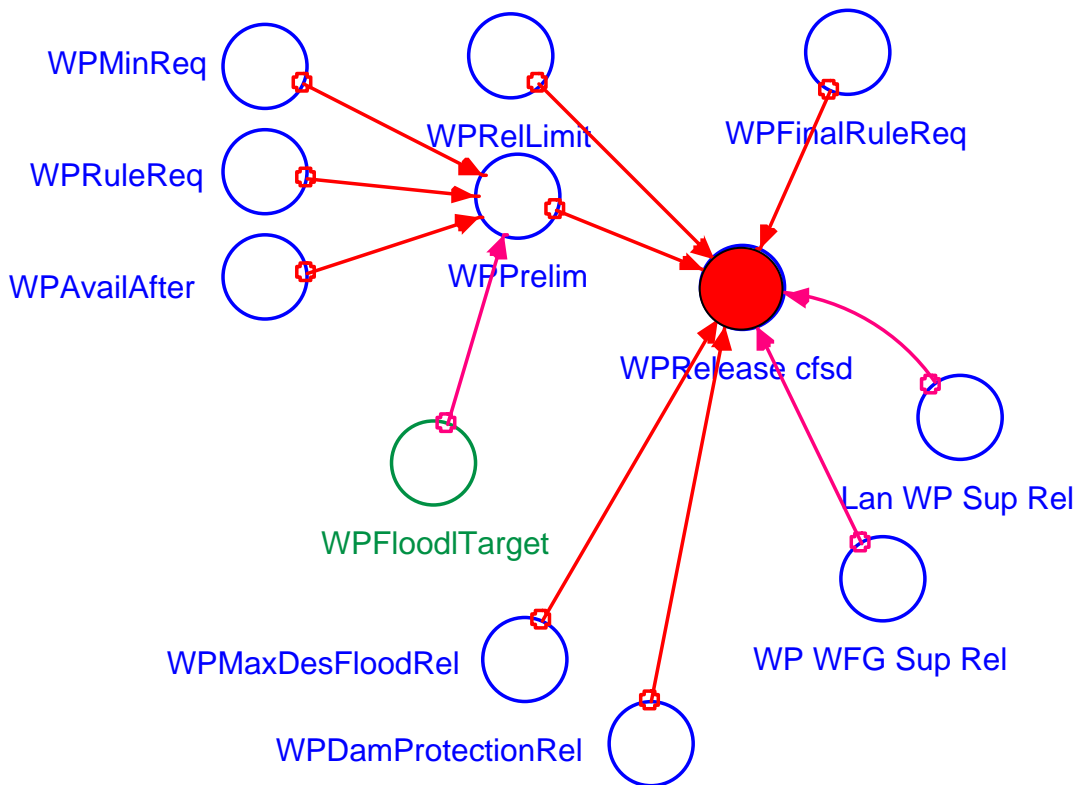
# Buford Final Release Calculations



$$\text{MIN}(\text{BUMaxPhysRel}, \text{MAX}(\text{BUDamProtectRel}, \text{MIN}(\text{BURelLimit}, \text{MAX}(\text{BUPrelim}, \text{Lan\_WP\_Sup\_Rel}), \text{BUDesMaxFloodRel}))))$$

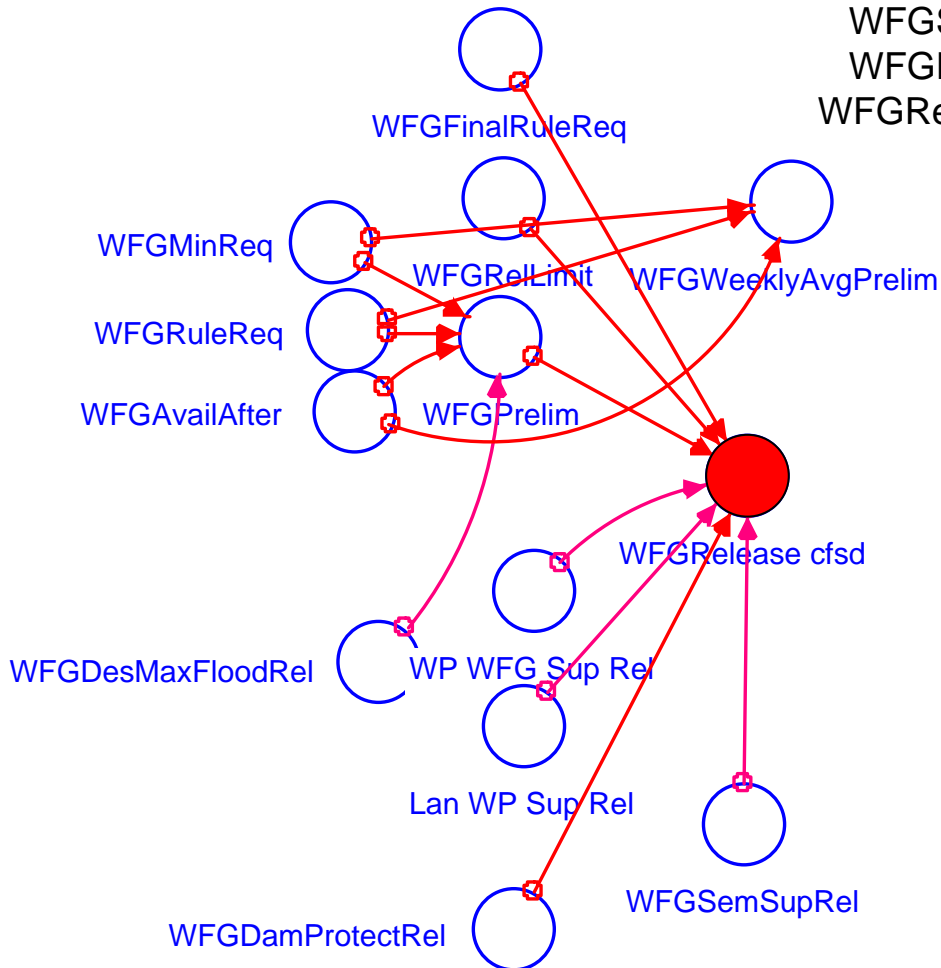
# West Point Final Release Calculations

MAX(  
  WPDamProtectionRel,  
  MIN(  
    MAX(WPPrelim, WP\_WFG\_Sup\_Rel + Lan\_WP\_Sup\_Rel, WPFinalRuleReq),  
    WPRelLimit,  
    WPMMaxDesFloodRel))



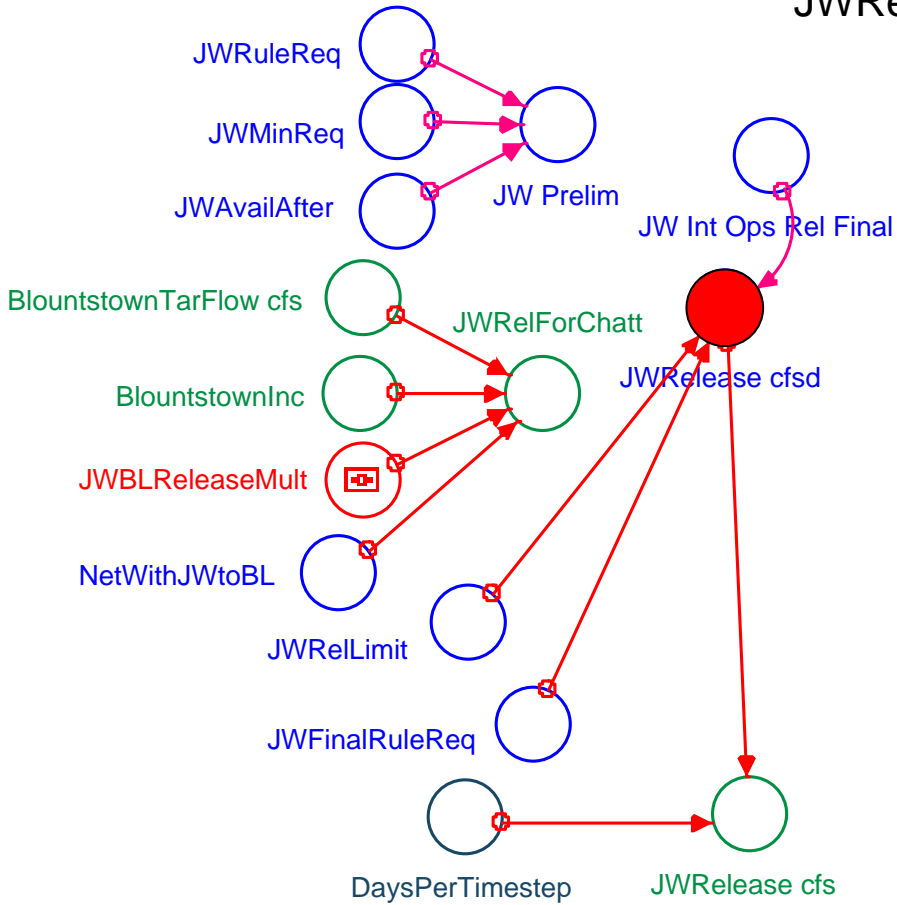
# WF George Final Release Calculations

$$\text{MAX}(\text{WFGDamProtectRel}, \text{MIN}(\text{MAX}(\text{WFGPrelim}, \text{WFGSemSupRel} + \text{WP\_WFG\_Sup\_Rel} + \text{Lan\_WP\_Sup\_Rel}, \text{WFGFinalRuleReq}), \text{WFGRelLimit}))$$



# Woodruff Final Release Calculations

$$\text{MIN}(\text{MAX}(\text{JWFinalRuleReq}, \text{JW\_Int\_Ops\_Rel\_Final}), \text{JWRelLimit})$$

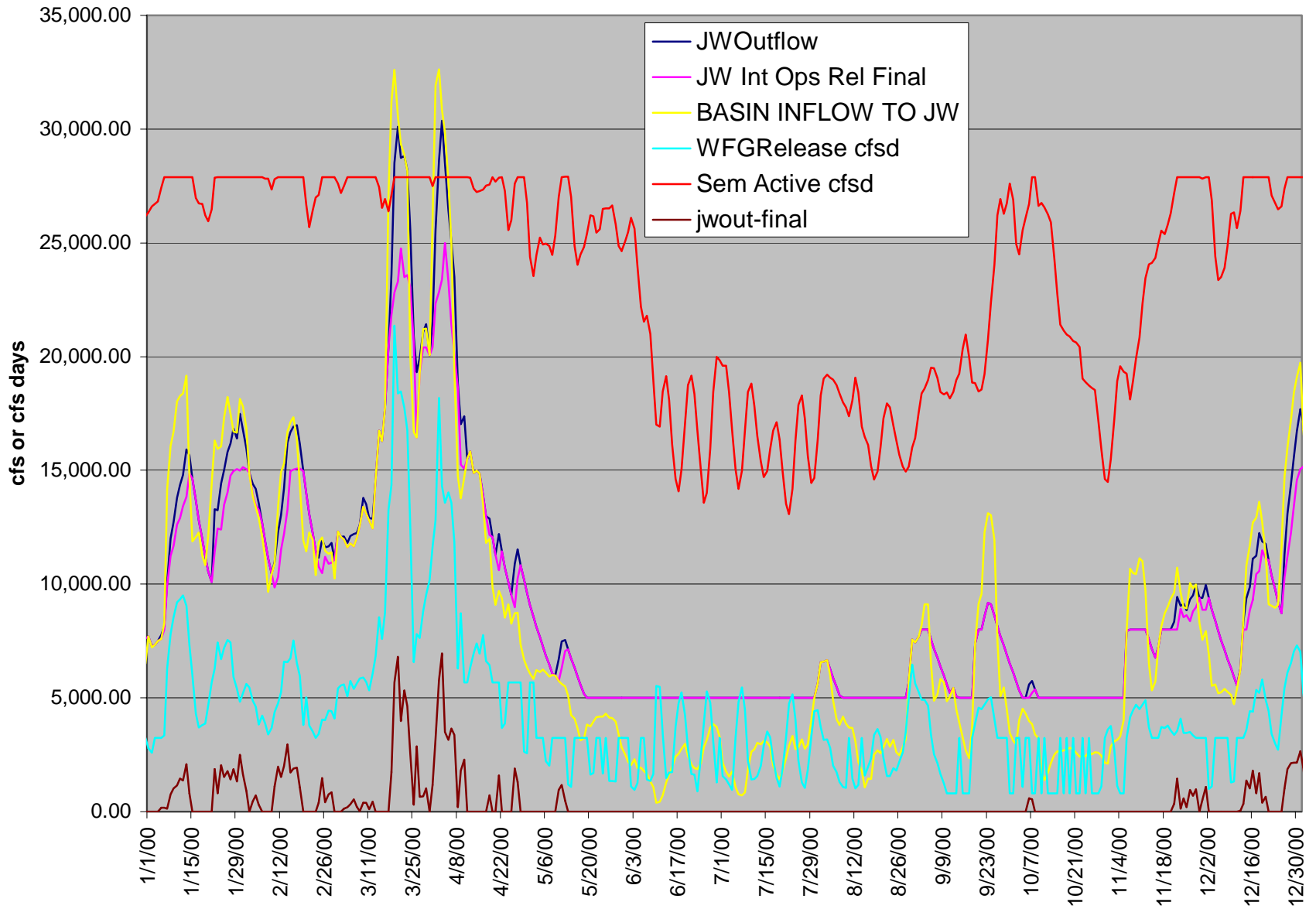




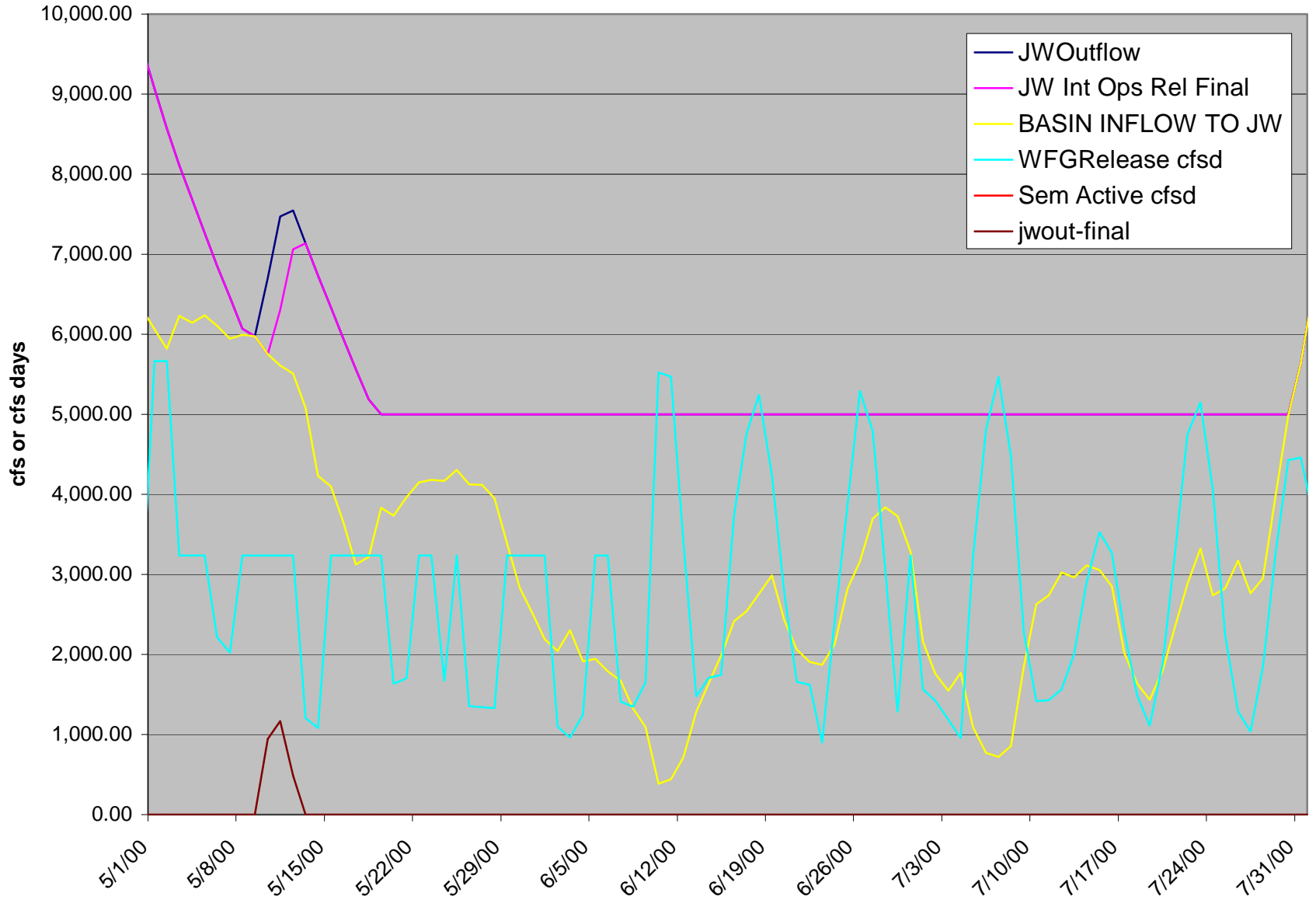
# Summary of Woodruff Release Results

- Woodruff Release  $\geq$  Interim Minimum Flow 23,011 days (100%) 1939-2001.
- Woodruff Release = Interim Min. 6610 days (29%).
- Woodruff Release – Interim Min.  $<$  500 cfs 9232 days (40%).
- WFG Release  $>$  Support release for Interim Min. 16199 days (70%).

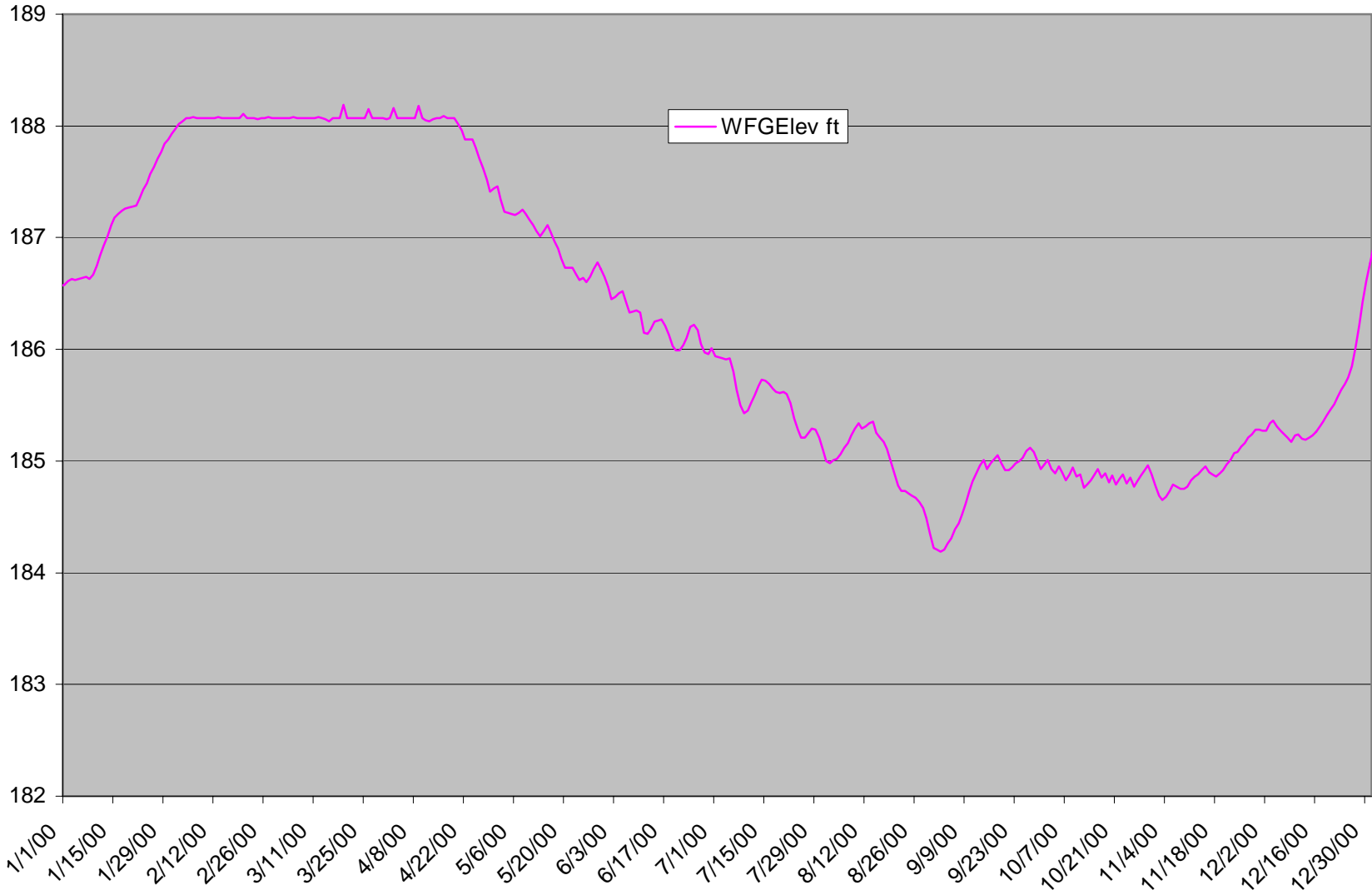
# Year 2000 – Selected Model Output



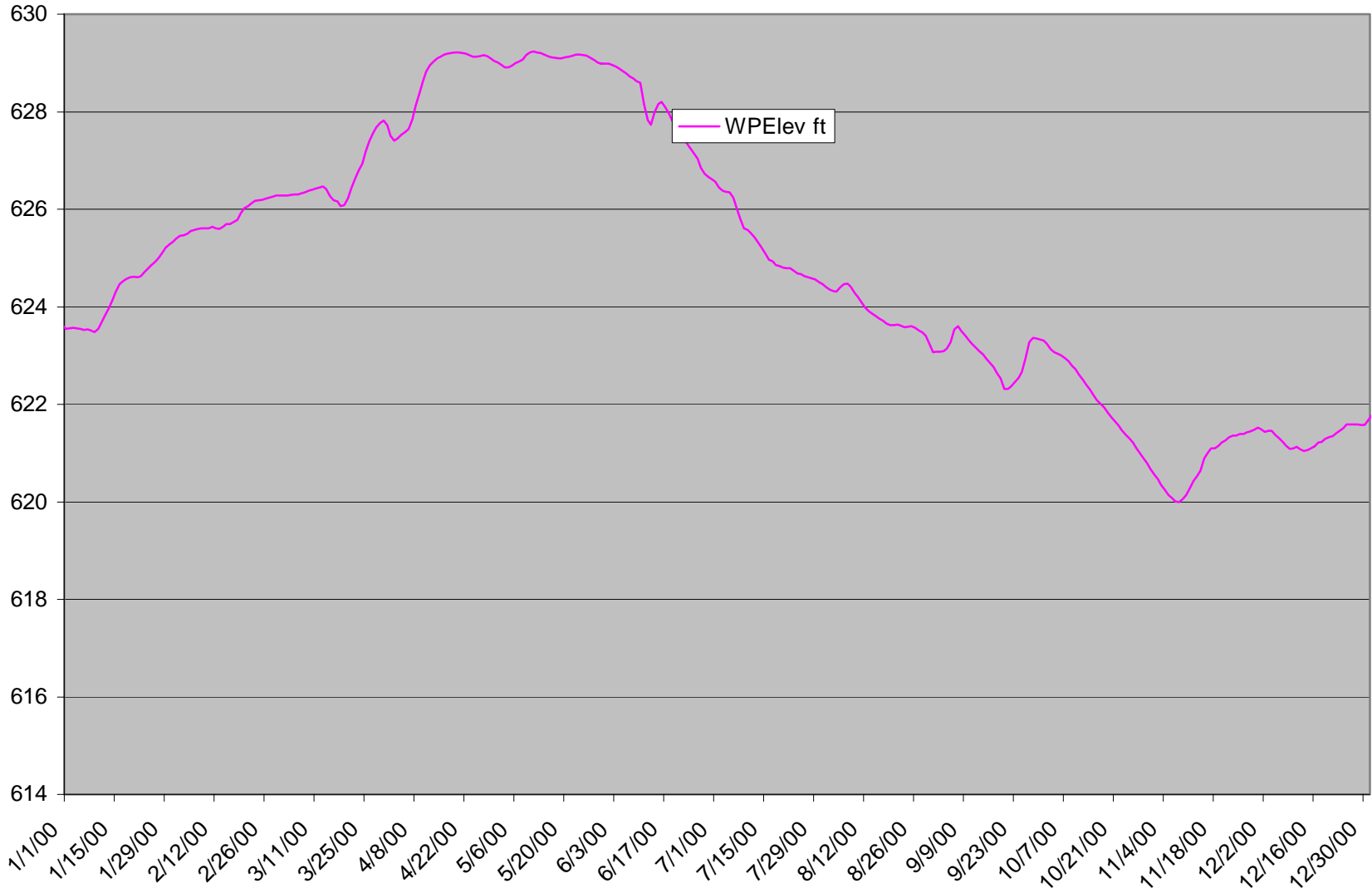
# May-July 2000 – Selected Model Output



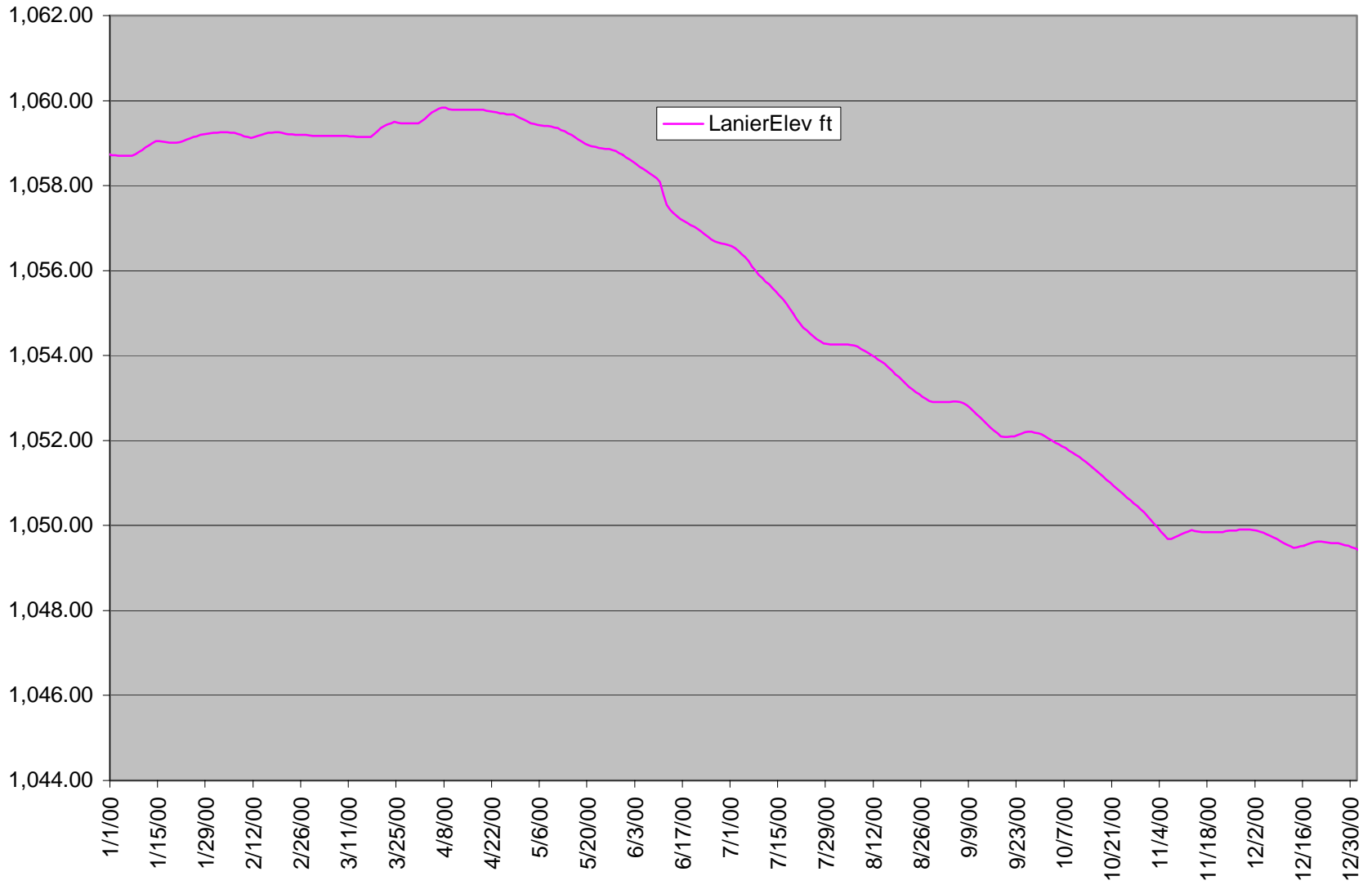
# WFG Elev ft



WPElev ft



LanierElev ft



# Further Work Needed:

- As necessary and feasible, enhance model to more closely approximate actual operations.
- Use results to evaluate potential effects on sturgeon, mussels, and their habitat.