Reservoir Planning Tool for Water Quality and Irrigation Benefits

**Goal:** Minimize irrigation deficit (water that crops need according to some irrigation schedule) and minimize water diverted from drainage system (bypass flow).

**Input interface**

<table>
<thead>
<tr>
<th>Reservoir Planning Tool</th>
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<tbody>
<tr>
<td><strong>Pond Volume (in acre-feet)</strong></td>
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<tr>
<td>Smallest</td>
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<tr>
<td>Largest</td>
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<tr>
<td>Increment</td>
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<tr>
<td>Depth of water in pond on first day of simulation</td>
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**Inputs:**

- PondVolSmallest, PondVolLargest, PondVolIncrement (acre-feet) *For examining a set of pond volumes and comparing outputs*
- PondDepth (feet). *Used to calculate pond area, which is used in seepage and evaporation*
- Initial water depth in pond: Probably Oct 1 with no water in pond (PondWaterVolume(0)=0)

**Time Series files or columns**

- Date
- DrainFlow: Time series of daily drain flow (in depth over area drained – acre-in/day) *(This can be measured data or from DRAINMOD or other model.)*
- Precipitation

**Outputs:**

- PondWaterVolume (acre-feet)
- PondWaterDepth (feet)
- Annual pond inputs and outputs: drain flow and irrigation from inputs, calculate evaporation and seepage.
- BypassFlow, BypassFlowAnnual: Daily and annual drain flow that bypasses pond. (acre-in/day)
- Annual crop yield. *(plus some Intermediate calculations of stress)*
Variables

- **PondVolume** – Remains constant for one run
- **PondArea** – Based on the PondVolume so remains constant. Used in calculating evaporation and seepage.
- **WaterVolDay, WaterVolYear** = the volume of water stored in the pond on one day, year
- **WaterDepthDay, WaterDepthYear** = the depth of water in the pond on one day, year
- **BypassVolDay, BypassVolYear**

Algorithm

**NumberofIncrements** = (PondVolLargest – PondVolSmallest)/PondVolIncrement

For i=1 to NumberofIncrements
- PondVolume = PondVolSmallest + i*PondVolIncrement
- PondArea = PondVol/PondDepth
  
  #Initialize, probably pond is driest on Oct 1
  WaterVolDay(0)=0
  WaterDepthDay(0) = WaterVolDay(0)/PondArea

Read year, month, day #note sure the best way to keep track,

- Calculate IrrigationVolDay *(following rules TBD)*
  
  If IrrigationVolDay > WaterVolDay
    IrrigationDeficit = (IrrigationVolDay – WaterVolDay)/PondArea
    Else IrrigationDeficit = 0 #We keep track of this because one of the objectives is to minimize it.

- Calculate SeepageVolDay based on WaterDepthDay(day-1) *(Method TBD)*


If WaterVolDay > PondVol,
  BypassFlowVolDay= WaterVolDay – PondVol,
  WaterVolDay = PondVol
Else BypassFlow=0

WaterDepthDay = WaterVolDay/PondArea
  
  #Write out daily outputs:
  WaterDepthDay

#Calculate annual values

- InflowVolYear(year) = InflowVolYear(year) + InflowVolDay
- EvaporationVolYear(year) = EvaporationVolYear(year) + EvaporationVolDay
- SeepageVolYear(year) = SeepageVolYear(year) + SeepageVolDay
- IrrigationVolYear(year) = IrrigationVolYear(year) + IrrigationVolDay
- BypassVolYear(year) = BypassVolYear(year) + BypassVolDay
IrrigationDeficitVolYear = IrrigationDeficitVolYear + IrrigationDeficitDay*PondArea #for irrigation deficit, daily is as a depth, yearly is as a volume.

#Write these

Output should be two files

Annual

\[ PondVolume = \text{PondVolume} \]

<table>
<thead>
<tr>
<th>Year</th>
<th>InflowVol Year</th>
<th>PrecipVolYear</th>
<th>EvaporationVolYear</th>
<th>SeepageVolYear</th>
<th>IrrigationVolYear</th>
<th>BypassVolYear</th>
<th>WaterDepth Year</th>
<th>IrrigationDeficitYear</th>
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Graph BypassVolYear, IrrigationDeficitVolYear – something like this. User should be able to get values by hovering over points.

Daily

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Give user option to graph these for a specific year

One graph could include

- Inflow, Precip positive; Evap, Seepage, Irrigation, Bypass as negative.

Another could include

- WaterDepth, Irrigation Deficit on a different graph (Note that Irrigation Deficit is in a depth in the pond, not a depth on the field.)