Tulsa District: Sedimentation Projections Contractors

Tulsa District Reservoirs:

- We have almost 50 reservoirs within our district boundaries.
- Most of these reservoirs were constructed between the 1940's through the 1980's, with typical design lives of 50 to 100 yrs.
 Many of our projects are approaching their design life.

Tulsa District Reservoirs:

- Local public and private sectors have seen these lakes as a source of municipal and industrial water supply for the state's population.
- These reservoirs are being used for recreational purposes, and supplemental stream flow water for water quality, aquatic life, and related activities

Tulsa District's FORCTEOS:

 Paul Bisdorf from the Tulsa District researched various methods of determining the reduction in storage capacity due to sedimentation, and wrote an algorithm to accomplish the best method.

This program is called forcteos.

FORCTEOS:

- FORCTEOS (the software) requires the following information to predict future sedimentation:
 - Original Capacity at top of flood control pool
 - Resurveyed capacity at the top of flood control pool
 - Original capacity at top of conservation pool
 - Resurveyed capacity at top of conservation pool
 - Original capacity at the top of inactive pool
 - Resurveyed capacity at the top of inactive pool
 - Year of reservoir closure
 - Period in years from closure to date of resurvey
 - Total number of years for forecast periods.
 - Percentage of soil type from collected sediment samples
 - Average Annual Inflows from Closure to Resurvey

FORCTEOS Input File:

The input data is put in an excel spreadsheet: Microsoft Excel-Kemp Forecast Input Data - 2005.xts Elle Edit View Inset Format Iools Data Approvelt Window Live Meeting Help Adobe PDF

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Computations

Tons of sediment deposited
Trap Efficiency
Detention Time
Flow Through Time
Volume of Sediment in a 100 yr period
Total Volume Deposited

Tons of Sediment deposited

Determines Sediment Yield

- The software computes a total sediment deposit of each type of soil of the material found in the sediment samples.
- Age of the deposit in years
- Based on one of the three (3) types of projects the software uses predefined dry density weights to compute the total yield based on the percentage of the separate soils.

Determines Total Tons of Sediment.

 Once the total sediment yield is calculated the software determines the tons of sediment deposited since the last survey.

Trap Efficiency

 The next step requires determining the ratio of sediment inflow to sediment outflow and refining this ratio.

$$T_{e} = (Q_{si} - Q_{so}) / Q_{si} \, {}^{\text{HEC's}}_{\text{Eqn (5)}}$$

HD Vol 12

-01)

 T_e = trap efficiency expressed as a decimal Q_{si} = inflowing sediment load Q_{so} = outflowing sediment load.

Detention-time

 Refinement of the trap efficiency is determined by converting the trap efficiency ratio into the log of the trap efficiency ratio.

Flow through time

The flow through time, or detention time in years, is the ratio of the capacity of the reservoir in ac-ft over the average annual water yield in volume/year.

$$T_d = S / Y_w$$

HEC's IHD Vol 12 Eqn (5-02)

 T_d = Flow through time in years S = Capacity of reservoir in ac-ft Y_w = average annual water yield in volume/yr.

Volume of sediment in 100-year period

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 The software then converts the sediment inflow from tons/year to ac. ft. in 100 year period.

$$V_{d} = Q_{si} * \frac{1}{PercentSed} \frac{ft^{3}}{lb} * 200lb / ton * \frac{1ac.ft.}{43560 ft^{3}} * 100 years$$

HEC's IHD Vol 12 Eqn (5-03)

Final step

 Total Volume Deposit is the result of the trap efficiency multiplied by the total volume of sediment delivered during a 100 year period.

$$V_t = T_e * V_d$$

HEC's IHD Vol 12 Eqn (5-05)

V_t = Total Volume Deposited
 T_e = Trap Efficiency
 V_d = Total Volume Deposited in 100 yr period

Tulsa District Reservoirs:

Forcteos program is run to obtain the following output:



WordPad Document

Create the EAC curves

So essentially the program output gives you 3 points on an elevation capacity curve:
 Capacity at top of conservation pool top of flood pool top of inactive pool

 Using an excel spreadsheet, I take these three points and work backwards to create a complete 1 ft EAC table.

Questions??

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