# P8 Model Parameter Selection

Because no inflow water quantity or quality data was collected for this UAA, Program for Predicting Polluting Particle Passage through Pits, Puddles, and Ponds (P8) modeling parameters could not be calibrated to any great extent. However, from the data that were collected for the Holiday-Wing-Rose UAA, model calibration afforded the opportunity to select P8 parameters that resulted in a good fit between modeled and observed data. The parameters selected for the Holiday-Wing-Rose P8 model are discussed in the following paragraphs. P8 parameters not discussed in the following paragraphs were left at the default setting. P8 version 2.4 was used for the modeling.

**Time Step, Snowmelt, & Runoff Parameters (Case-Edit-Other)**

- Time Steps Per Hour (Integer)— 8. Selection was based upon the number of time steps required to reduce continuity errors greater than two percent. A single continuity error greater than 2 percent does occur in the model, but does not significantly impact model results. The error occurs at a device intended to model a StormCeptor.

- Minimum Inter-Event Time (Hours)— 10. The selection of this parameter was based upon an evaluation of storm hydrographs to determine which storms should be combined and which storms should be separated to accurately depict runoff from the lake's watershed. It should be noted that the average minimum inter-event time for the Minneapolis area is 6. In a more typical climatic year a value of 6 would be used.

- Snowmelt Factors—Melt Coef (Inches/Day-Deg-F)—0.06. This coefficient is within the lower end of the recommended range and was selected to minimize the disparity between observed and predicted snowmelt (i.e., the coefficient lessens the number of inches of snow melted per day and increases the number of snowmelt runoff days).

- Snowmelt Factors— Scale Factor for Max Abstraction—1. This factor controls the quantity of snowmelt runoff (i.e., controls losses due to infiltration). Selection was based upon the factor that resulted in the closest fit between modeled and observed runoff volumes.

- Growing Season AMC—II = 1.4 and AMC—III = 2.1. These factors were set at the default values based on the ability of the model to produce reasonable runoff values. The model did not demonstrate high sensitivity to these parameters. Curve numbers selected by the model are based upon antecedent moisture conditions.

**Particle Scale Factor (Case-Edit-Components)**

- Scale Fac.—TP—1.0. The particle scale factor determines the total phosphorus load generated by the particles predicted by the model in watershed runoff. The factor for total phosphorus was selected as 1.0.

**Particle File Selection (Case—Read—Particles)**

- NURP50.PAR. The NURP 50 particle file was found to most accurately predict phosphorus loading to Lake Holiday, Wing Lake, and Lake Rose.

**Precipitation File Selection (Case—Edit—First—Prec. Data File)**

- HpEp9293.pcp – This precipitation file was used to model wet conditions. It includes hourly precipitation data obtained from the NMCWD rain gage in Eden Prairie and from the National Weather Service (NWA) site at the Minneapolis-St. Paul International Airport. NMCWD data was used predominantly for periods from April through October, while NWA data was used for the remaining periods.

- HE9899_M.pcp – This precipitation file was used to model average conditions. It includes hourly precipitation data obtained from the NMCWD rain gages in Eden Prairie and Hopkins and from the National Weather Service (NWA) site at the Minneapolis-St. Paul International Airport. NMCWD data from the Eden Prairie gage was used for April 1998 through October 1998. Precipitation from the Hopkins Gage for April 1999 through October 1999, and NWA data for the remainder of the period. MSP data was also used for specific storms in early April 1998 and mid to late April 1999.

- HpEp0708.pcp – This precipitation file was used to model dry conditions. Data for dry climatic conditions includes precipitation from the Hopkins gage for April 2007 through September 2007 and April 2008 through August 2008. Precipitation data for October 2007 is based on the Hopkins gage. All remaining precipitation data for 2007 and 2008 is derived from the MSP gage.

**Air Temperature File Selection (Case—Edit—First—Air Temp. File)**

- MSP4908.tmp. The MSP4908.tmp file was used for all simulations. The temperature file was comprised of temperature data from the Minneapolis–St. Paul International Airport during the period from 1949 through 2008.

**Devices Parameter Selection (Case—Edit—Devices—Data—Select Device)**

- Detention Pond— Permanent Pool— Area and Volume— The surface area and dead storage volume of each detention pond was determined and entered here.

- Detention Pond— Flood Pool— Area and Volume— The surface area and storage volume under flood conditions (i.e., the storage volume between the normal level and flood elevation) was determined and entered here.

- Detention Pond— Infiltration Rate (in/hr)— Only infiltration from landlocked (i.e., no piped outlet) was included in the model. This was done to provide a better water balance model. An infiltration rates of 0.008 in/hr was used, based on soil type.

- Detention Pond— Orifice Diameter and Weir Length— The orifice diameter or weir length was determined from field surveys or development plans of the area for each detention pond and entered here.

- Detention Pond or Generalized Device— Particle Removal Scale Factor— Particle Removal Scale Factor—1.0 for all ponds.

- Detention Pond or Generalized Device— Outflow Device Nos.— The number of the downstream device receiving water from the detention pond outflow was entered.

- Generalized Device— Infiltration Outflow Rates (cfs)— Although the infiltration rates listed under the detention pond category are the same, the outflow rates at each pond depth were calculated in cfs and entered.

- Pipe/Manhole— Time of Concentration— The time of concentration for each pipe/manhole device was set at 1 hour for each piped outlet. A "dummy" pipe/manhole was installed in the network to represent Lake Holiday, Wing Lake, and Lake Rose. This forced the model to total all loads (i.e., water, nutrients, etc.) entering each lake. Failure to enter the "dummy" pipe requires the modeler to manually tabulate the loads entering the lake.

**Watersheds Parameter Selection (Case—Edit—Watersheds—Data—Select Watershed)**

- Outflow Device Number— The Device Number of the device receiving runoff from the watersheds was selected to match the watershed number. For example, subwatershed 700 flows into device 27 (labeled p700).

- Pervious Curve Number— A weighted SCS Curve number was used, as outlined in the following procedure. The Hennepin County Soils Survey was consulted to determine the soil types within each subwatershed and a pervious curve number was selected for each subwatershed based upon soil types, land use, and hydrologic conditions using a P8 pre-processor GIS routine (e.g., if watershed soils are type B and pervious areas are comprised of grassed areas with >75% cover, then a Curve Number of 61 would be selected). The pervious curve number was then weighted with indirect (i.e., disconnected) impervious areas in each subwatershed as follows:

$$WCN = \frac{[(Impervious\ Area) * 98 + (Pervious\ Area) * (Pervious\ CN)]}{[Impervious\ Area + Pervious\ Area]}$$

  The assumptions for direct, indirect, and total impervious were based upon measurements from the Lake Cornelia watershed and areas with similar land use.

  The following assumptions shown in Table B-1, for direct impervious and total impervious, were used to determine the weighted curve numbers.

**Table B-1 Direct, Indirect and Total Impervious Fractions Based on Land Use**

| Land Use | Direct Impervious | Indirect Impervious | Total Impervious |
|---|---|---|---|
| Natural/Park/Open | 0.00 | 0.02 | 0.02 |
| High Density Residential (>8 units/ac) | 0.40 | 0.30 | 0.70 |
| Institutional- High Impervious | 0.50 | 0.20 | 0.70 |
| Highway | 0.50 | 0.00 | 0.50 |
| Commercial | 0.80 | 0.10 | 0.90 |
| Industrial/Office | 0.80 | 0.10 | 0.90 |
| Open Water | 1.00* | 0.00 | 1.00 |
| Wetland | 1.00* | 0.00 | 0.00 |
| Developed Park | 0.00 | 0.02 | 0.02 |

* Using 100% impervious may skew model results. Therefore open water and wetland areas were not accounted for while determining the pervious curve number.

- Swept/Not Swept— An "Unswept" assumption was made for the entire impervious watershed area. A Sweeping Frequency of 0 was selected. Selected parameters were placed in the "Unswept" column since a sweeping frequency of 0 was selected.

- Impervious Fraction— The direct or connected impervious fraction for each subwatershed was determined and entered here. The direct or connected impervious fraction includes driveways and parking areas that are directly connected to the storm sewer system. Table B-1 was used to determine the direct impervious fractions for each land use type. Then, the average direct impervious fraction was determined by weighting the acres of each land use with the direct impervious fraction to obtain a weighted average.

- Depression Storage— 0.03

- Impervious Runoff Coefficient— 0.94

**Passes Through the Storm File (Case—Edit—First—Passes Through Storm File)**

- Passes Through Storm File—6. The number of passes through the storm file was determined after the model had been set up and a preliminary run completed. The selection of the number of passes through the storm file was based upon the number required to achieve model stability. Multiple passes through the storm file were required because the model assumes that dead storage waters contain no phosphorus. Consequently, the first pass through the storm file results in lower phosphorus loading than occurs with subsequent passes. Stability occurs when subsequent passes do not result in a change in phosphorus concentration in the pond waters. Six passes through the storm file were selected for the Holiday-Wing-Rose model.