Appendix B

P8 Model Parameter Selection

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Because no inflow water quantity or quality data was collected for this UAA, P8 modeling parameters could not be calibrated to any great extent. However, from the data that were collected for the Southeast, Southwest, and Northwest Anderson Lake 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 Southeast, Southwest, and Northwest Anderson Lake 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)— 1. Selection was based upon the number of time steps required to eliminate continuity errors greater than two percent.

- Minimum Inter-Event Time (Hours)— 10. During 2000-2001 frequent storms were noted during the summer. 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)—.03. The P8 model predicts snowmelt runoff beginning and ending earlier than observed snowmelt. The lowest coefficient of the recommended range was selected to minimize the disparity between observed and predicted snowmelt (i.e., the coefficient minimizes the number of inches of snow melted per day and maximizes 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 = .05 and AMC—III = 2.1. Selection of this factor was based upon the observation that the model accurately predicted runoff water volumes from monitored watersheds when the Antecedent Moisture Condition II was selected (i.e., 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 to allow in-lake modeling to better predict phosphorus concentrations.

Particle File Selection (Case—Read—Particles)

- NURP50.PAR. The NURP 50 particle file was found to most accurately predict phosphorus loading to Southeast, Southwest, and Northwest Anderson Lake.

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

- MS4902EP.PCP. The precipitation file MS4902EP.PCP is comprised of hourly precipitation measured at the Eden Prairie Precipitation Gage (i.e., located near T.H. 212 and I-494) during October 1, 1997 through September 30, 2002. For time periods when the Eden Prairie gage was not recording, data from the Hopkins gage were used. Precipitation data from the Minneapolis–St. Paul International Airport were used for the period between 1949 and September 1997.

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

- MSP4902.tmp. The temperature file was comprised of temperature data from the Minneapolis–St. Paul International Airport during the period from 1949 through 2002.

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. Infiltration rates of 0.005 in/hr for ponds partially located on marsh soils, 0.015 in/hr (dead storage pool) and 0.02 in/hr (flood storage pool) for ponds located on loam soils, and 0.05 for ponds located on sandy loam soils.

- 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— 0.3 for ponds less than two feet deep and 1.0 for all ponds three feet deep or greater. For ponds with normal water depths between two and three feet, a particle removal factor of 0.6 was selected. The particle removal factor for watershed devised determines the particle removal by device. The factors were selected based on similar work in the *Round Lake Use Attainability Analysis*, Barr Engineering, March 1999.

- 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 determined and entered here. Time of concentration was determined in accordance with *TR-55 Urban Hydrology for Small Watershed* for watersheds without ponding areas. A "dummy" pipe/manhole was installed in the network to represent Southeast, Southwest, and Northwest Anderson Lake. This forced the model to total all loads (i.e., water, nutrients, etc.)

entering the 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 NW-AL-1 (watershed No. 1) flows into device 1 (labeled NW-AL-1).

- 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 (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). A pervious curve number of 61 was selected for all subwatersheds. The pervious curve number was then weighted with indirect (i.e., disconnected) impervious areas in each subwatershed as follows:

$$WCN = \frac{[(Indirect\ Impervious\ Area] * (98)] + [(Pervious\ Area) * (Pervious\ Curve\ Number)]}{Total\ Area}$$

The assumptions for direct, indirect, and total impervious were based upon measurements from the Southeast, Southwest, and Northwest Anderson Lake 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. The direct and total impervious fractions were modified slightly based on 2000 Metropolitan Council Aerial Photos of the Southeast, Southwest, and Northwest Anderson Lake watershed.

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
Developed Parks	0.03	0.05	0.08
Golf Course	0.05	0.03	0.08
Agricultural	0.00	0.03	0.03
Very Low Density Residential (< 1 unit/ac)	0.15	0.05	0.20
Low Density Residential (1-4 units/ac)	0.25	0.05	0.30
Medium Density Residential (4-8 units/ac)	0.30	0.10	0.40
High Density Residential (>8 units/ac)	0.48	0.17	0.65
Institutional	0.35	0.05	0.40
Institutional- High Impervious	0.40	0.25	0.65
Airport	0.10	0.20	0.30
Highway	0.40	0.10	0.50
Commercial	0.80	0.05	0.85
Industrial/Office	0.70	0.05	0.75
Open Water	1.00**	0.00	1.00
Wetland	0.00	*	*

* Modeled percent impervious will vary according to wetland type and modeling strategy, was typically modeled as 5% total and indirect impervious.

** Using 100% impervious may skew model results. Therefore open water was 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. The previous table indicates 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— 0.02

- Impervious Runoff Coefficient— 1.0

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

- Passes Through Storm File—5. 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. To determine the number of passes to select, the model was run with three passes, five passes, and ten passes. A comparison of phosphorus predictions for all devices was evaluated to determine whether changes occurred between the three scenarios. If there is no difference between three and five passes, three passes are sufficient to achieve model stability. If differences are noted between three and five passes and no differences are noted between five and ten passes, then five passes are sufficient to achieve model stability. Several differences were noted between three and five passes and no differences were noted between five and ten passes. Therefore, it was determined that five passes through the storm file resulted in model stability for the Southeast, Southwest, and Northwest Anderson Lake project.