APPENDIX F: Manually Adding Temperature and Fecal Coliform

APPENDIX F: Manually Adding Temperature and Fecal Coliform

The modules and corresponding tables described in the following section were added when Temperature and Fecal Coliform where selected to be modeled using the "Pollutant Selection Tool" in WinHSPF. This appendix steps through adding these constituents to your calibrated hydrology model manually. Additionally, this Appendix steps through the required inputs within these modules and tables. If you opened the *bacteria.uci* file and followed the steps within this exercise, the end result would be the same as *bact_2.uci.*

1.   If WinHSPF isn't already open, from the **Start** menu under **Programs**, select **BASINS** and then **WinHSPF**.

2.   From the **File** menu, select **Open**.

3.   Navigate to *c:\basins\modelout\bacteria* and select "*bacteria.uci."* Click OPEN.

4.   Click the "Edit Control Cards" button, .

5.   Click DESCRIPTIONS.

6.   Make sure the "Pervious Land" tab is active. Click the boxes beside ATEMP, PSTEMP, PWTGAS and PQUAL.

        Note: We will turn off all modules associated with sediment in the following steps
                because we are not modeling fecal coliform as a sediment associated
                constituent in this exercise.

7.   Check the box beside SEDMNT to unselect the module. SEDMNT was automatically turned on when you selected PQUAL. Your screen should look like the following:

ATEMP - Module that estimates the surface air temperature over the land segment by correcting for elevation differences between the gage and the land segments.

PSTEMP - Module that simulates soil temperatures for the surface, upper, and lower/groundwater layers of a land segment for use in module section PWTGAS and the agri-chemical sections.

PWTGAS – PWTGAS estimates water temperature and concentrations of dissolved oxygen and carbon dioxide in surface, interflow, and groundwater outflows from a land segment.

PQUAL - Module that simulates water quality constituents or pollutants in the outflows from a pervious land segment using simple relationships with water and/or sediment yield. Any constituent can be simulated by this module section. However, more detailed methods of simulating sediment, heat, dissolved oxygen, dissolved carbon dioxide, nitrogen, phosphorus, soluble tracers, and pesticide removal from a pervious land segment are available, in other module sections.

8.   Click the "Impervious Land" tab. Check the boxes beside ATEMP, IQUAL, and IWTGAS.

9.   Check the box beside SOLIDS to unselect the module. SOLIDS was automatically turned on when you selected IQUAL. Your screen should look like the following:

ATEMP - Module that estimates the surface air temperature over the land segment by correcting for elevation differences between the gage and the land segments.

> *IWTGAS – IWTGAS estimates the water temperature and concentrations of dissolved oxygen and carbon dioxide in the outflow from the impervious land segment.*
> *IQUAL - The IQUAL module section simulates water quality constituents or pollutants in the outflows from an impervious land segment using simple relationships with water yield and/or solids. Any constituent can be simulated by this module section. Note that more detailed methods of simulating solids, heat, dissolved oxygen, and dissolved carbon dioxide removal from the impervious land segment are available in other sections of IMPLND.*

10.   Click the "Reaches/Reservoirs" tab.

11.   Check the boxes beside ADCALC, HTRCH, and GQUAL.

12.   Check the box beside SEDTRN to turn "off" this module. SEDTRN was turned on automatically when you selected GQUAL. Your screen should look like the following:
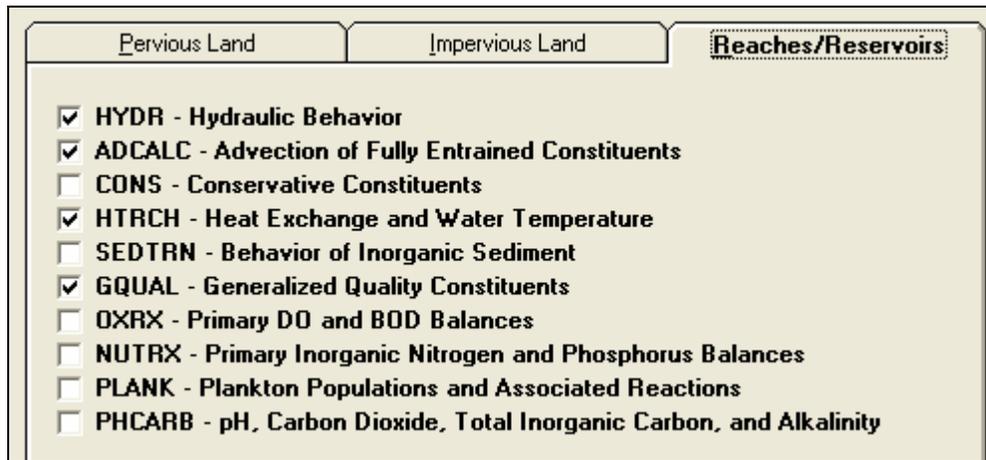
> *ADCALC - Module that calculates values for the variables necessary to simulate longitudinal advection of dissolved or entrained constituents. These variables are dependent upon the volume and outflow values calculated in the hydraulics section (HYDR).*
>
> *HTRCH – Module that simulates the processes that determines the water temperature in a reach or mixed reservoir.*
> *GQUAL – Module that allows the model user to simulate the behavior of a generalized constituent. The constituent which is modeled may be present in the RCHRES only in a dissolved state, or it may also be sediment-associated.*

13.   Click OK.

14.   Click OK three times to add the tables for PERLND, IMPLND, and RCHRES.

15.   Click the "Input Data Editor" button, .

PERVIOUS LAND

ATEMP

1.   **Double click** PERLND → ATEMP → ATEMP-DAT. Click OK if asked whether to
       add the table. Read the parameter explanations below:

   *ELDAT - The difference in elevation between the temperature gage and the previous land segment; it
             is used to estimate the temperature over the pervious land segment by application of a lapse
             rate. It is positive if the pervious land segment is higher than the gage, and negative if the
             land segment is lower than the gage.*
   AIRTMP – The initial (i.e., at the starting time of the RUN) air temperature over the land segment.

2.   Enter the following information in the ATEMP-DAT table:

Land Use	ELDAT	AIRTMP
Forest	7	34
Urban	17	34
Agriculture	14	34
Barren	10	34
Wetland	-67	34

   Note: We used the mean temperature value recorded at the Beltsville weather station
           11:00 – 11:59 pm, December 31, 1995 as the AIRTMP values. The ELDAT
           values were found using the DEM in BASINS (see Appendix B for more
           information).

3.   Click APPLY.

4.   Click OK.

PSTEMP

1.   **Double click** PSTEMP → PSTEMP-PARM1. Click OK if asked whether to add the
       table. Read the parameter explanations below:

   SLTVFG :If this is 1, parameters for estimating surface layer temperature can vary monthly.
   ULTVFG: If this is 1, parameters for estimating upper layer temperature can vary monthly.
   *LGTVFG: If this is 1, parameters for estimating lower layer and active groundwater layer
             temperature calculations can vary monthly.*
   *TSOPFG: Governs the methods used to estimate subsurface soil temperatures. If TSOPFG is 0, they
             are computed using a mean departure from air temperature, together with smoothing
             factors.   If TSOPFG is 1, upper layer soil temperature is estimated by regression on air
             temperature (like surface temperature). The lower layer/groundwater layer temperature is
             supplied directly by the user (a different value may be specified for each month).   If it is 2,
             the same method is used as for a value of 0, except that the upper layer temperature is used*

instead of the air temperature to compute the lower layer/groundwater layer temperature.

2.   Change all the values in the SLTVFG column to "1" (remember that you can enter "1" in the first cell, and then **double click** on the column heading to copy the values to the rest of the cell).

3.   Change all the values in the ULTVFG column to "1."

4.   Change all the values in the LGTVFG column to "1."

          Leave the values in the TSOPFG column as "1." Your screen should look like the following:
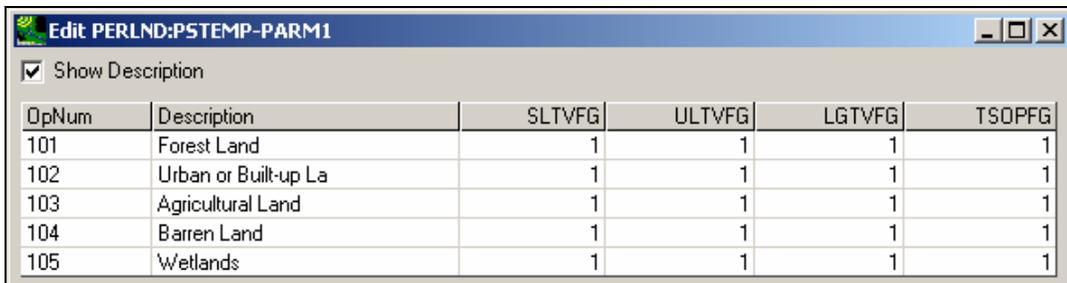
> **Note:** We have now specified that we want surface layer temperatures (SLTVFG), upper layer temperatures (ULTVFG), and lower layer temperatures (LGTVFG) to vary monthly. By setting TSOPFG to 1, we specified that we want to estimate the upper layer temperature by using a regression with air temperature and that we will provide the lower layer temperatures.

5.   Click APPLY.

6.   Click OK.

7.   **Double click** PSTEMP-PARM2. Click OK if asked whether to add the table. Read the parameter explanations below:

> *ASLT: The surface layer temperature when the air temperature is 32 degrees F (0 degrees C). It is the intercept of the surface layer temperature regression equation.*
> *BSLT: The slope of the surface layer temperature regression equation.*
> *ULTP1: The smoothing factor in upper layer temperature calculation, if TSOPFG = 0 or 2. ULTP1 is the intercept in the upper layer soil temperature regression equation (like ASLT and BSLT for the surface layer), if TSOPFG = 1.*
> *ULTP2: The mean difference between upper layer soil temperature and air temperature, if TSOPFG = 0 or 2. ULTP2 is the slope in the upper layer soil temperature regression equation (similar to ASLT and BSLT for the surface layer), if TSOPFG = 1.*
> *LGTP1: The smoothing factor for calculating lower layer/groundwater soil temperature, if TSOPFG = 0 or 2. LGTP1 is the lower layer/groundwater layer soil temperature, if TOSPFG = 1.*
> *LGTP2: The mean departure from air temperature for calculating lower layer/groundwater soil temperature, if TSOPFG = 0 or 2. LGTP2 is not used if TSOPFG is 1.*

8.   Leave the default values in this table since we specified that we will enter monthly tables for these values in PSTEMP-PARM1.

9.   Click APPLY.

10.   Click OK.

> **Note:** At this point you would want to enter the monthly values into the PSTEMP-PARM1 parameters (defined above). These tables include MON-ASLT, MON-BSLT, MON-ULTP1, MON-ULTP2, and MON-LGTP1. The values entered for this study would be as follows:

Edit PERLND:MON-ASLT

☑ Show Description

Description	SLTJAN	SLTFEB	SLTMAR	SLTAPR	SLTMAY	SLTJUN	SLTJUL	SLTAUG	SLTSEP	SLTOCT	SLTNOV	SLTDEC
Forest Land	33.9	33.9	37.5	43	49.6	55.8	59.8	59.8	53.5	44.8	40	35.7
Urban or Built-up La	33.9	33.9	37.5	43	49.6	55.8	59.8	59.8	53.5	44.8	40	35.7
Agricultural Land	33.9	33.9	37.5	43	49.6	55.8	59.8	59.8	53.5	44.8	40	35.7
Barren Land	33.9	33.9	37.5	43	49.6	55.8	59.8	59.8	53.5	44.8	40	35.7
Wetlands	33.9	33.9	37.5	43	49.6	55.8	59.8	59.8	53.5	44.8	40	35.7

Edit PERLND:MON-BSLT

☑ Show Description

OpNum	Description	BSTJAN	BSTFEB	BSTMAR	BSTAPR	BSTMAY	BSTJUN	BSTJUL	BSTAUG	BSTSEP	BSTOCT	BSTNOV	BSTDEC
101	Forest Land	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
102	Urban or Built-up La	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
103	Agricultural Land	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
104	Barren Land	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
105	Wetlands	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

Edit PERLND:MON-ULTP1

☑ Show Description

OpNum	Description	UT1JAN	UT1FEB	UT1MAR	UT1APR	UT1MAY	UT1JUN	UT1JUL	UT1AUG	UT1SEP	UT1OCT	UT1NOV	UT1DEC
101	Forest Land	34.6	34.6	40.7	50.7	62.4	74	81.2	81.2	69.7	53.2	45.2	37.7
102	Urban or Built-up La	34.6	34.6	40.7	50.7	62.4	74	81.2	81.2	69.7	53.2	45.2	37.7
103	Agricultural Land	34.6	34.6	40.7	50.7	62.4	74	81.2	81.2	69.7	53.2	45.2	37.7
104	Barren Land	34.6	34.6	40.7	50.7	62.4	74	81.2	81.2	69.7	53.2	45.2	37.7
105	Wetlands	34.6	34.6	40.7	50.7	62.4	74	81.2	81.2	69.7	53.2	45.2	37.7

Edit PERLND:MON-ULTP2

☑ Show Description

OpNum	Description	UT2JAN	UT2FEB	UT2MAR	UT2APR	UT2MAY	UT2JUN	UT2JUL	UT2AUG	UT2SEP	UT2OCT	UT2NOV	UT2DEC
101	Forest Land	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
102	Urban or Built-up La	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
103	Agricultural Land	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
104	Barren Land	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
105	Wetlands	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Edit PERLND:MON-LGTP1

☑ Show Description

OpNum	Description	LT1JAN	LT1FEB	LT1MAR	LT1APR	LT1MAY	LT1JUN	LT1JUL	LT1AUG	LT1SEP	LT1OCT	LT1NOV	LT1DEC
101	Forest Land	50	50	55	60	60	65	65	65	60	55	55	50
102	Urban or Built-up La	50	50	55	60	60	65	65	65	60	55	55	50
103	Agricultural Land	50	50	55	60	60	65	65	65	60	55	55	50
104	Barren Land	50	50	55	60	60	65	65	65	60	55	55	50
105	Wetlands	50	50	55	60	60	65	65	65	60	55	55	50

11.   **Double click** PSTEMP-TEMPS. Click OK if asked whether to add the table. Read the following parameter explanations:

        AIRTC: The initial air temperature.
        SLTMP: The initial surface layer soil temperature.
        ULTMP: The initial upper layer soil temperature.
        LGTMP: The initial lower layer/groundwater layer soil temperature.

12.   Enter the following values into the table:
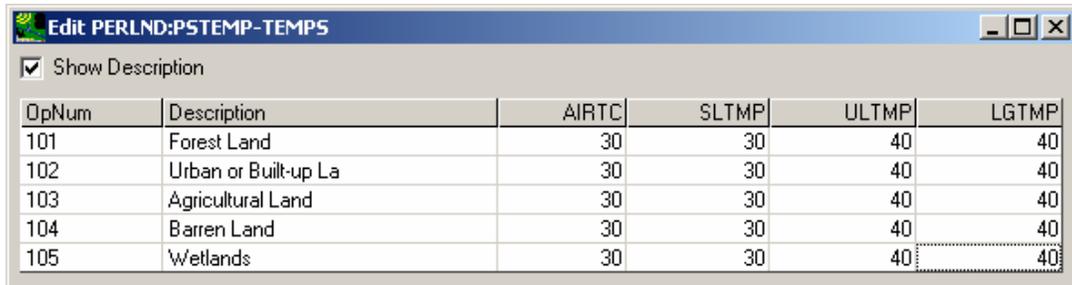
    Note: These inputs were determined by estimating the required values at the beginning time of the simulation.

13.   Click APPLY.

14.   Click OK.

PWTGAS

1.   Click on the "Input Data Editor" button [icon].

2.   **Double click** PERLND.

3.   **Double click** PWTGAS. This will expand the tables that are accessible in this module.

4.   **Double click** PWT-PARM1. Click OK if asked whether to add the table. Read the following definitions:

        IDVFG: If IDVFG is 1, interflow DO concentration may vary monthly.
        ICVFG: If ICVFG is 1, interflow CO2 concentration may vary monthly.
        GDVFG: If GDVFG is 1, groundwater DO concentration may vary monthly.
        GCVFG: If GCVFG is 1, groundwater CO2 concentration may vary monthly.

    Note: The PWT-PARM1 table contains flags for section PWTGAS. These flags indicate whether a parameter is allowed to vary my month. If a flag is set to 1, the user is expected to provide the corresponding table of monthly values.

5.   Click OK. For simplification, we will not be providing monthly values for these the interflow nor groundwater parameters.

6.   **Double click** PWT-PARM2. If asked whether you want to add the table, click OK.

            Note: The PWT-PARM2 table contains the second group of PWTGAS parameters to estimate water temperature concentrations of dissolved gases.

            ELEV: The elevation of the PLS above sea level (used to adjust saturation concentrations of dissolved gasses in surface outflow).
            IDOXP: The concentration of dissolved oxygen in interflow outflow.
            ICO2P: The concentration of dissolved CO2 in interflow outflow.
            ADOXP: The concentration of dissolved oxygen in active groundwater outflow.
            ACO2P: The concentration of dissolved CO2 in active groundwater outflow.

7.   Navigate to PERLND → PWAT-GAS → PWT-PARM2. Click on the column heading "OpNum" to show the data in order of increasing landuse number.

8.   In the ELEV column, enter 120 into the first cell and then **double click** on the column heading.

9.   In the IDOXP column, enter 8.8 into the first cell and then **double click** on the column heading.

10.   In the ADOXP column, enter 8.8 into the first cell and then **double click** on the column heading.

            Note: These inputs have to be estimated given the conditions in the area being modeled.

11.   Click APPLY.

12.   Click OK.

            Note: We will not need to add the LAT-FACTOR table or any of the PWAT-GAS monthly tables because we did not choose to vary anything monthly in the PWT-PARM1 table.

13.   **Double click** PWT-GASES and click OK when asked if you want to add the table. Read the following definitions.

            Note: The PWT-GASES table contains the initial DO and CO2 concentration values for section PWTGAS.

            SODOX: The initial DO concentration in surface outflow.
            SOCO2: The initial CO2 concentration in surface outflow.
            IODOX: The initial DO concentration in interflow outflow.

IOCO: *The initial CO2 concentration in interflow outflow.*
AODOX: *The initial DO concentration in active groundwater outflow.*
AOCO2: *The initial CO2 concentration in active groundwater outflow.*

14.   Click in the first cell in the SODOX column and enter 8.8, then double click on the
        SODOX column heading.

15.   Click in the first cell in the IODOX column and enter 8.8, then double click on the
        IODOX column heading.

16.   Click in the first cell in the AODOX column and enter 8.8, then double click on the
        AODOX column heading. We will leave the values in the SOCO2, IOCO2 and
        AOCO2 columns as "0" because we are not modeling pH.

        Note: These inputs were determined by estimating the required values at the
               beginning time of the simulation.

17.   Click APPLY.

18.   Click OK.

PQUAL

1.   Double click PQUAL → NQUALS. Click OK if asked whether to add the table.
        Notice that the value for NQUAL is "1" for each pervious land segment. This
        specifies that we will model one quality constituent, fecal coliform.
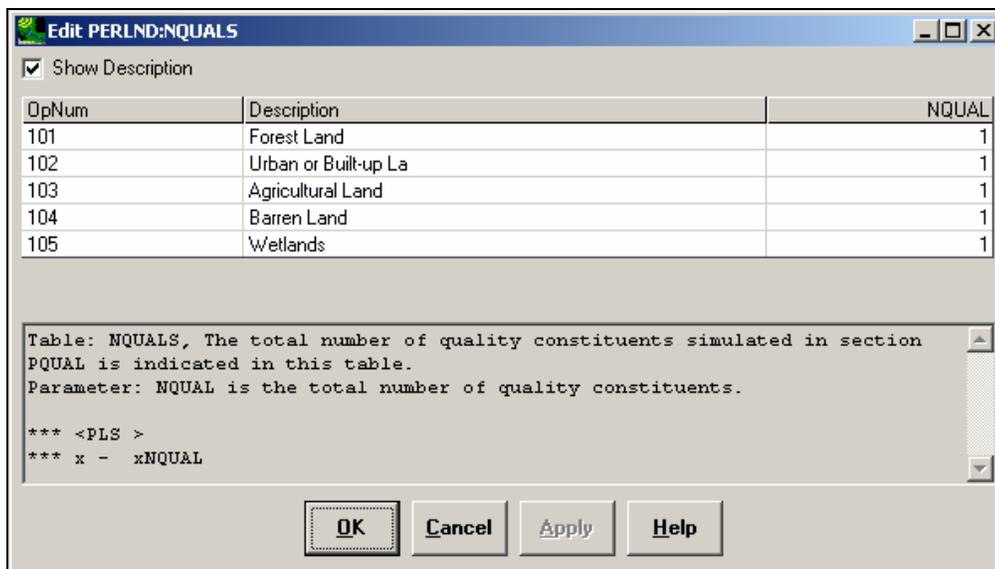
2.   We will not make any changes in this screen. Click OK or Cancel.

3.   **Double click** QUAL-PROPS. Click OK if asked whether to add the table. Read the following parameter explanations:

> *QUALID: A string of up to 10 characters that identifies the quality constituent.*
> *QTYID: A string of up to 4 characters that identifies the units associated with this constituent (e.g., kg, (for coliforms)). These are the units referred to as "qty" subsequent tables (eg. Table-type QUAL-INPUT).*
> *QSDFG: If 1, this constituent is a QUALSD (sediment associated).*
> *VPFWFG: If 1, the washoff potency factor may vary monthly. If VPWFG is 2, the daily factors are not interpolated between monthly values.*
> *VPFSFG: If 1, the scour potency factor may vary monthly.*
> *QSOFG: If 1 or 2, this constituent is a QUALOF (directly associated with overland flow). If 1, then accumulation and removal are performed daily, and the removal rate is dependent only on the accumulation and storage limit parameters (ACQ and SQOLIM). If 2, accumulation and removal are performed every interval, and the removal rate also takes into account atmospheric deposition plus lateral inflows.*
> *VQOFG: If 1 then the rate of accumulation and the limiting storage of QUALOF may vary monthly.*
> *QIFWFG: If 1 this constituent is a QUALIF (interflow associated).*
> *VIQCFG: If 1 or greater, then the concentration of this constituent in interflow outflow may vary monthly. If 2 or 4, no interpolation is used. If 3 or 4, units are mg/L. This requires QTYID to be LB (English or KG (Metric).*
> *QAGWFG: If 1, this constituent is a QUALGW (groundwater associated).*
> *VAQCFG: If 1, the concentration of this constituent in groundwater outflow may vary monthly. If VAQCFG is 2 or 4, the daily values are obtained directly from the monthly values; no interpolation between monthly values is performed. If VAQCFG is 3 or 4, the units of the input concentrations are mg/l; note: this option requires that the "qty" units be pounds (English system) or kilograms (Metric system).*

4.   In the first cell under the QUALID column, type "F. Coli." **Double click** the column heading QUALID to copy the values to the rest of the cells in the column.

5.   In the first cell under the QTYID column, type "#ORG." **Double click** the column heading QTYID to copy the values to the rest of the cells in the column.

6.   Enter the following numbers in the remaining columns:

QUALID	QTYID	QSDFG	VPFWFG	VPFSFG	QSOFG	VQOFG	QIFWFG	VIQCFG	QAGWFG	VAQCFG
F. Coli.	#ORG	0	0	0	1	1	1	0	1	0
F. Coli.	#ORG	0	0	0	1	1	1	0	1	0
F. Coli.	#ORG	0	0	0	1	1	1	0	1	0
F. Coli.	#ORG	0	0	0	1	1	1	0	1	0
F. Coli.	#ORG	0	0	0	1	1	1	0	1	0

> **Note:** We have now specified that Fecal Coliform is associated with surface flow (QSOFG), interflow (QIFWFG), and groundwater (QAGWFG). We have also specified that the surface accumulation and storage limitations can vary monthly by setting VQOFG to 1. For simplification, we will not be providing monthly values for these the interflow nor groundwater parameters (VIQCFG and VAQCFG will remain 0).

7.   Click APPLY.

8. Click OK.

9. **Double click** QUAL-INPUT. Click OK if asked whether to add the table. Read the following parameter explanations:

    SQO: The initial storage of QUALOF on the surface of the PLS.
    POTFW: The washoff potency factor for a QUALSD. A potency factor is the ratio of constituent yield
    *   to sediment (washoff or scour) outflow.*
    POTFS: The scour potency factor for a QUALSD. A potency factor is the ratio of constituent yield to
    *   sediment (washoff or scour) outflow.*
    ACQO: The rate of accumulation of QUALOF if QSOFG is positive. If QSOFG is negative, then
    *   ACQOP is the concentration of QUALOF in the surface outflow in mg/l.*
    SQOLIM: The maximum storage of QUALOF if QSOFG is positive.
    WSQOP: The rate of surface runoff that will remove 90 percent of stored QUALOF per hour.
    IOQC: The concentration of the constituent in interflow outflow (meaningful only if this is a QUALIF).
    AOQC: The concentration of the constituent in active groundwater outflow (meaningful only if this is a
    *   QUALGW).*

10. Change all values in the initial storage of fecal coliform (SQO) column to "1,500,000."

    Note: This parameter depends on the conditions and practices within the watershed being modeled.

11. Change all the values in the WSQOP column to "1."

    Note: This parameter will need to be estimated and then calibrated.

12. Change all the values in the IOQC column to "100,000."

13. Change all the values in the AOQC column to "50."

    Note: The values for interflow concentrations (IOQC) and groundwater concentrations (AOQC) can be determined given the conditions in the watershed being modeled.

    Note: We will not need to enter values for ACQO or SQOLIM because of the flag that we turned on in QUAL-PROPS specifying that we would provide monthly values.

14. Click APPLY.

15. Click OK.

16. **Double click** MON-ACCUM.

Note: This is one of the tables where we will enter the values for bacteria loadings generated with the *Bacterial Indicator Tool* (see Exercise 9). The other is the MON-SQOLIM table. Remember that the *Bacterial Indicator Tool* provided us with monthly values for ACQO and SQOLIM for each subwatershed for both Cropland and Pastureland. Average yearly values were produced for Forest and Built-Up land by the *Bacterial Indicator Tool*. This tool gives these values for these landuse categories within each subwatershed. The West Branch Patuxent model currently has not been segmented, meaning that separate parameter inputs are not allowed for individual subwatersheds (as will be discussed in the segmentation lecture and exercise). We are therefore required to use an average monthly or annual ACQO and SQOLIM value across subwatersheds for each landuse category.

17.   Enter the monthly values for each landuse from the *Bacterial Indicator Tool.* Your screen should look like the following:

OpNum	Description	QUAJAN	QUAFEB	QUAMAR	QUAAPR	QUAMAY	QUAJUN	QUAJUL	QUAAUG	QUASEP	QUAOCT	QUANOV	QUADEC
101	Forest Land	4700000	4700000	4700000	4700000	4700000	4700000	4700000	4700000	4700000	4700000	4700000	4700000
102	Urban or Built-up La	8600000	8600000	8600000	8600000	8600000	8600000	8600000	8600000	8600000	8600000	8600000	8600000
103	Agricultural Land	4.1E+08	4.5E+08	1E+09	8.7E+08	1.1E+09	4.2E+08	4.1E+08	4.1E+08	4.2E+08	3.2E+09	3.3E+09	4.1E+08
104	Barren Land	1200000	1200000	1200000	1200000	1200000	1200000	1200000	1200000	1200000	1200000	1200000	1200000
105	Wetlands	3.7E+08	4.1E+08	9.1E+08	7.9E+08	1E+09	3.8E+08	3.7E+08	3.7E+08	3.8E+08	2.9E+09	3E+09	3.7E+08

Note: You can copy and paste the values from a spreadsheet table by reformatting the Bacterial Indicator Tool output into a format exactly like the MON-ACCUM table, copying (Ctrl-C) the values from Excel to the clipboard, highlighting all the rows and columns to the left of the Description field, and then pasting (Ctrl-V) the values new values. After the values are pasted, you MUST click in a cell and re-enter the value. The APPLY button will then become active.

18.   Click OK.

19.   **Double click** MON-SQOLIM.

20.   Enter the monthly SQOLIM values for each landuse from the *Bacterial Indicator Tool.* Your screen should look like the following:

OpNum	Description	SQOJAN	SQOFEB	SQOMAR	SQOAPR	SQOMAY	SQOJUN	SQOJUL	SQOAUG	SQOSEP	SQOOCT	SQONOV	SQODEC
101	Forest Land	8500000	8500000	8500000	8500000	8500000	8500000	8500000	8500000	8500000	8500000	8500000	8500000
102	Urban or Built-up La	1.6E+07	1.6E+07	1.6E+07	1.6E+07	1.6E+07	1.6E+07	1.6E+07	1.6E+07	1.6E+07	1.6E+07	1.6E+07	1.6E+07
103	Agricultural Land	7.3E+08	8.1E+08	1.8E+09	1.3E+09	1.7E+09	6.3E+08	6.1E+08	6.1E+08	6.3E+08	5.8E+09	6E+09	7.3E+08
104	Barren Land	2100000	2100000	2100000	2100000	2100000	2100000	2100000	2100000	2100000	2100000	2100000	2100000
105	Wetlands	6.6E+08	7.3E+08	1.6E+09	1.2E+09	1.6E+09	5.7E+08	5.5E+08	5.5E+08	5.7E+08	5.2E+09	5.4E+09	6.6E+08

21.   Click OK.

IMPERVIOUS LAND

ATEMP

1.   Click the "Input Data Manager" button, [icon].

2.   **Double click** IMPLND → ATEMP → ATEMP-DAT. Change the values to the following:
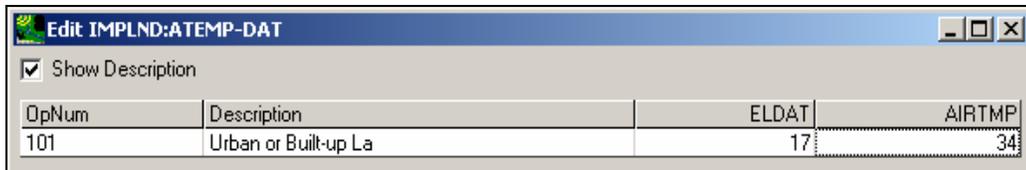
3.   Click APPLY.

4.   Click OK.

IWTGAS

1.   **Double click** IMPLND.

2.   **Double click** IWTGAS. This will expand the tables that are accessible in this module.

3.   **Double click** IWT-PARM1. Click OK if asked whether to add the table. Read the following definitions:

> *WTFVFG: A value of 1 means to vary the water temperature regression parameters (AWTF and BWTF) monthly; 0 means use annual values.*
> *CSNOFG: A value of 1 means the effects of snow accumulation and melt are being considered; if it is zero, they are not. If section IWATER is active the value of CSNOFG supplied here is ignored because it was first supplied in the input for that section.*

4.   Leave the both values as 0.

>   **Note:** We do not want to vary the monthly water regression parameters (WTFVFG) monthly for the impervious land segment and we are not modeling snow in this watershed.

5. **Double click** IWT-PARM2. Click OK if asked whether to add the table. Read the following definitions:

    ELEV: *The elevation of the ILS above sea level (used to adjust saturation concentrations of dissolved gasses in surface outflow).*
    AWTF: *The surface water temperature, when the air temperature is 32 degrees F (0 degrees C). It is the intercept of the surface water temperature regression equation.*
    BWTF: *The slope of the surface water temperature regression equation.*

6. Change all the values in the ELEV column to "120."

7. Change all the values in the BWTF column to "34."

8. Change all the values in the AWTF column to "0.3."

    Note: The ELEV input would be estimated using the DEM. The slope (BWTF) and intercept (AWTF) of the temperature regression equation would be estimated and then calibrated.

9. Click APPLY.

10. Click OK

    Note: We will not need to enter any other parameters into IWTGAS because we did not specify that we wanted to enter monthly values.

IQUAL

1. Double click IQUAL → NQUALS. The following screen will appear: Notice that the value in the "NQUAL" column is "1." This specifies that we will model one quality constituent.

2. We will not make any changes to this table. Click CANCEL.

3. **Double click** QUAL-PROPS. Click OK if asked whether to add the table. Enter the following values into the table for QUALID, QTYID, and QSOFG:

> **Note:** By setting QSOFG to 1, we specified that fecal coliform is associated with surface flow in impervious land segments.

4.   Click APPLY.

5.   Click OK.

6.   **Double click** QUAL-INPUT. Click OK if asked whether to add the table. Read the following explanations:

> *SQO is the initial storage of QUALOF on the surface of the impervious land segment.*
> *POTFW is the wash off potency factor for a QUALSD. A potency factor is the ratio of constituent yield to sediment outflow.*
> *ACQOP is the rate of accumulation of QUALOF if QSOFG is positive. If QSOFG is negative, then ACQOP is the concentration of QUALOF in the surface outflow in mg/l.*
> *SQOLIM is the maximum storage of QUALOF if QSOFG is positive.*
> *WSQOP is the rate of surface runoff that will remove 90 percent of stored QUALOF per hour.*

7.   Make the following changes to the table:

> **Note:** SQO depends on the conditions and practices within the watershed being modeled. ACQOP and SQOLIM are taken from the *Bacterial Indicator Tool*. WSQOP will need to be estimated and then calibrated.

8.   Click APPLY.

9.   Click OK.

REACHES AND RESERVOIRS

HTRCH

1.   **Double click** RCHRES → HTRCH →HT-BED-FLAGS.

2.   Change all the values in the BEDFLG column to "0." We will not be simulating bed

conductance.

3. **Double click** RCHRES → HTRCH → HEAT-PARM. Read the following explanations:

    ELEV: The mean RCHRES elevation.
    ELDAT: The difference in elevation between the RCHRES and the air temperature gage (positive if RCHRES is higher than the gage).
    CFSAEX: The correction factor for solar radiation (it includes fraction of RCHRES surface exposed to radiation).
    KATRAD: The long-wave radiation coefficient.
    KCOND: The conduction-convection heat transport coefficient.
    KEVAP: The evaporation coefficient.

4. Enter the following values:

OpNum	ELEV	ELDAT	CFSAEX	KATRAD	KCOND	KEVAP
1	123	2	0.95	9.5	6.12	2.24
2	174	53	0.95	9.5	6.12	2.24
3	51	-71	0.95	9.5	6.12	2.24
4	49	-72	0.95	9.5	6.12	2.24
5	49	-72	0.95	9.5	6.12	2.24
6	99	-22	0.95	9.5	6.12	2.24

    Note: The ELEV and ELDAT values can be found using the DEM in BASINS. The CFSAEX input is dependent on the amount solar radiation actually reaching the waterbody you are modeling (this can account for shading present, etc.) and should be estimated and then calibrated.

5. Click APPLY.

6. Click OK.

7. **Double click** RCHRES → HTRCH → HEAT-INIT. Click OK if asked whether to add the table. Read the following explanations:

    TW: The initial water temperature in the RCHRES.
    AIRTMP: The initial air temperature at the RCHRES

8. Change all the values in the TW column to "40."

9. Change all the values in the AIRTMP column to "34."

    Note: The value entered for AIRTMP in the RCHRES portion is the same as that entered for AIRTMP in the ATEMP-DAT table. The AIRTEMP input was again determined by estimating the air temperature value at the beginning time of the simulation.

10.   Click APPLY.

11.   Click OK.

GQUAL

1.   **Double click** RCHRES → GQUAL→ GENDATA.

2.   **Double click** GQUAL. The following screen will appear. Notice that the values in the "NQUAL" column are all "1." This means that we will model one quality constituent.

NGQUAL: The number of generalized constituents (quals) being simulated.
TEMPFG: Indicates the source of water temperature data; 1 means a time series (either input or computed), 2 means an annual value, and 3 means 12 monthly values.
PHFLAG: Indicates the source of pH data; 1 means a time series (either input or computed), 2 means an annual value, and 3 means 12 monthly values. Input only if any QALFG(1)=1.
ROXFG: Indicates the source of free radical oxygen data; 1 means a time series (either input or computed), 2 means an annual value, and 3 means 12 monthly values. Input only if any QALFG(2)=1.
CLDFG: Indicates the source of cloud cover data; 1 means a time series (either input or computed), 2 means an annual value, and 3 means 12 monthly values. Input only if any QALFG(3)=1.
SDFG: Indicates the source of total sediment concentration data; 1 means a time series (either input or computed), 2 means an annual value, and 3 means 12 monthly values. Input only if any QALFG(3)=1.
PHYTFG: Indicates the source of phytoplankton data; 1 means a time series (either input or computed), 2 means an annual value, and 3 means 12 monthly values. Input only if any QALFG(3)=1.
LAT: The latitude of the RCHRES. Input only if any QALFG(3)=1. Positive for northern hemisphere.

      Note: Only NGQUAL and TEMPFG values are applicable to our simulation.

3.   **Double click** GQ-QUALDATA. Click OK if asked whether to add the table. Read the following explanations:

DQAL: The initial concentration of the quality constituent.
CONCID: Specifies the concentration units (implied that it is "per liter"), eg. "mg"(/l).
CONV: The factor to convert from Qty/volume to concentration units: Conc= CONV* Qty/volume   (in English system, volume is in ft³) (in Metric system, volume is in m³).

4.   Change all the values in the GQUID column to "F.Coli."

5.   Change the values in the DQUAL column to "50."

        Note: This input was determined by estimating the required values at the beginning
                  time of the simulation.

6.   Change the values in the CONCID column to "#ORG."

7.   Change the values in the CONV column to "0.03532."

8.   Change the values in the QTYID column to "#ORG."

OpNum	Description	GQID	DQAL	CONCID	CONV	QTYID
3	South Collington Bra	F. Coli	50	#ORG	0.03532	#ORG
4	South Reach, Western	F. Coli	50	#ORG	0.03532	#ORG
6	North Collington Bra	F. Coli	50	#ORG	0.03532	#ORG

Edit RCHRES:GQ-QALDATA — Show Description — Occurrence 1

9.   Click APPLY.

10.   Click OK.

11.   **Double click** GQ-GENDECAY. Click OK if asked whether to add the table. Read
        the following explanations:

        FSTDEC: The first order decay rate for the quality consituent.
        THFST: The temperature correction coefficient for first order decay.

12.   Change all the values in the FSTDEC column to "1."

        Note: This input was determined by estimating then calibrating.

13.   Change all the values in the THFST column to "1.1."

14.   Click APPLY.

15.   Click OK.

MASS -LINK

In addition to adding the modules and the associated tables and parameters, the user is also
required to add information in the MASS LINK block (or table) that specifies the linkage
from the pervious and impervious land segments to the reaches. If you were to have used the

"Pollutant Selection" tool, the following mass links would have automatically been added to your *.uci* file if they did not already exist.

```
PERLND      PQUAL  POQUAL 1                    RCHRES        INFLOW IDQAL   1
IMPLND      IQUAL  SOQUAL 1                    RCHRES        INFLOW IDQAL   1

PERLND      PWTGAS POHT                        RCHRES        INFLOW IHEAT   1
IMPLND      IWTGAS SOHT                        RCHRES        INFLOW IHEAT   1
```

These lines in the input file mean that the output from the first pervious (POQUAL) and impervious quality constituent (SOQUAL) becomes the input to the first RCHRES quality constituent (IDQAL), and that the heat energy from the land surface (POHT and SOHT) becomes heat input to each reach (IHEAT).

To add these mass links manually, you will need to go through the following steps. Note that you might not have to add these Mass-Links, as the default Mass-Link configuration for a UCI developed within WinHSPF includes these records, and they should only be included once in a Mass-Link.

1.   Double click MASS LINK. Your screen should look like the following:
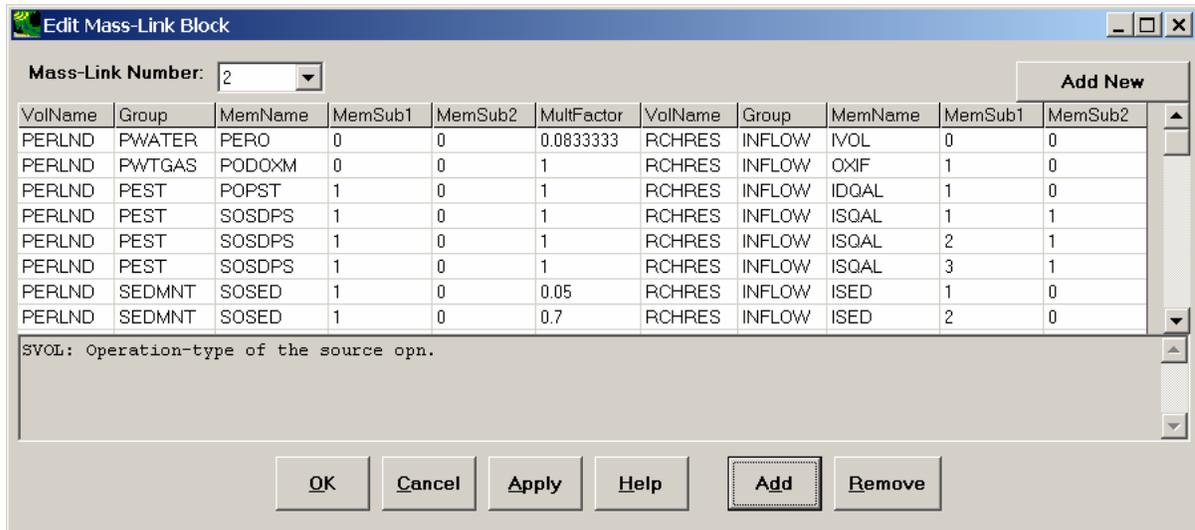
> **Note**: Notice the "Mass Link Number" drop down box in the left hand corner. This shows the number of the various MASS LINK blocks available. Each MASS LINK block has the mass links for interrelated times series. For example, all mass links for hydrology for pervious land segments are in Mass-Link Number 90 while those for hydrology for impervious land segments are in Mass-Link Number 91. Similarly, mass links for water quality for pervious land segments are in Mass-Link 2 and those for impervious land segments are in Mass-Link 1.

2.   Make sure you have selected "2" in the "Mass-Link Number" drop down box.

3.   Click ADD twice. Two blank lines should appear at the bottom on the MASS LINK table. Enter the following information:

VolName	Group	MemName	MemSub1	MemSub2	MultFactor
PERLND	PQUAL	POQUAL	1	0	1
PERLND	PWTGAS	POHT	0	0	1

VolName	Group	MemName	MemSub1	MemSub2
RCHRES	INFLOW	IDQAL	1	0
RCHRES	INFLOW	IHEAT	1	0

Your screen should look like the following:
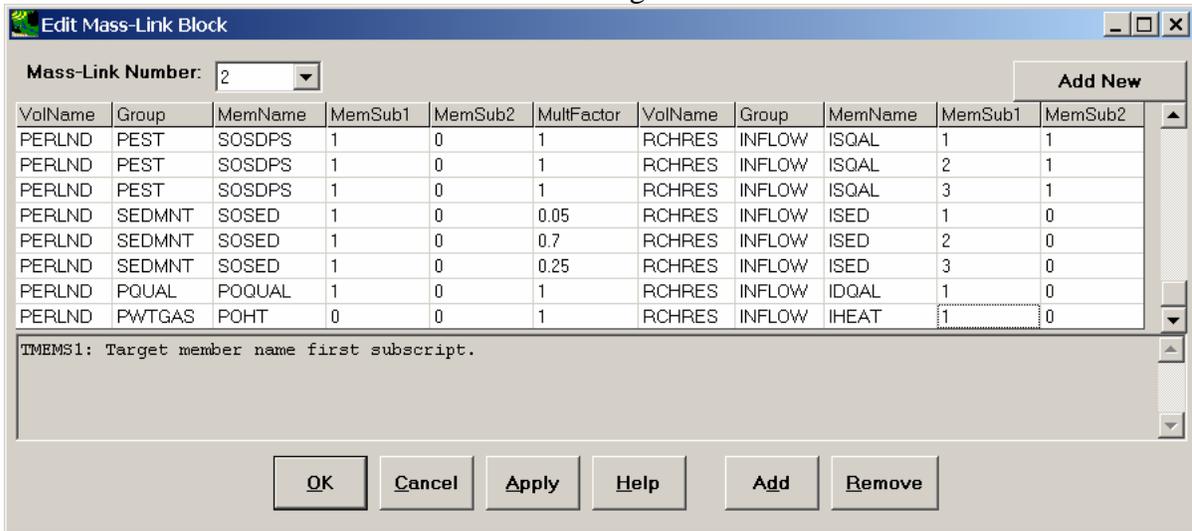
4.   Make sure you have selected "1" in the "Mass-Link Number" drop down box.

5.   Click ADD twice. Two blank lines should appear at the bottom on the MASS LINK table. Enter the following information:

VolName	Group	MemName	MemSub1	MemSub2	MultFactor
IMPLND	IQUAL	SOQUAL	1	0	1
IMPLND	IWTGAS	SOHT	0	0	1

VolName	Group	MemName	MemSub1	MemSub2
RCHRES	INFLOW	IDQAL	1	0
RCHRES	INFLOW	IHEAT	1	0

Your screen should look like the following:
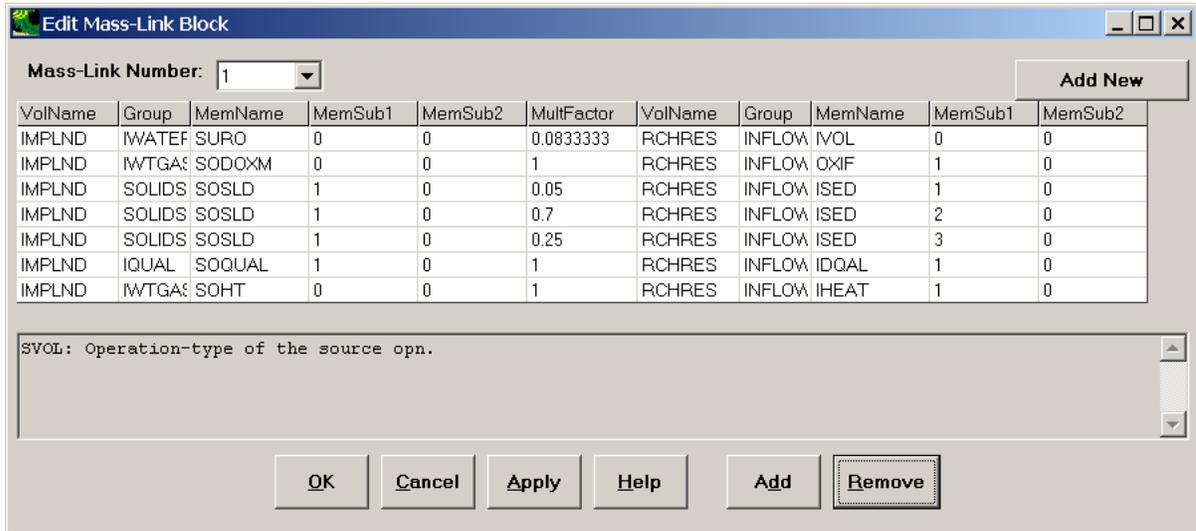
6.   Click APPLY.

7.   Click OK.

8.   Click Close.

You have now recreated *Bact_2.uci*.