
PLOAD version 3.0

An ArcView GIS Tool to Calculate Nonpoint Sources of Pollution in Watershed and Stormwater Projects

User's Manual

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Table of Contents

Topic	Page
GIS Pollutant Loading Application – Users Manual	1
1. Pollutant Loading Application Overview	1
2. Input Data.....	2
2.1 GIS Data.....	2
2.2 Tabular Data	2
3. Pollutant Loading Calculation Equations.....	4
3.1 Export Coefficient Method	4
3.2 Simple Method	4
3.3 BMP Computations	5
4. User Input Parameters.....	6
5. Output Product Options	6
6. PLOAD Input Data	6
7. Setup and Executing PLOAD.....	9
7.1 Starting PLOAD	9
7.2 Running PLOAD via New Session.....	10
7.3 Running PLOAD via Open Session.....	19
7.4 Viewing Output	20
7.5 Creating Layouts and Data Post Processing	20
 Appendices	
Glossary of Terms	24
Graphic and Tabular Product Examples	25
Description of PLOAD Scripts	32
Event Mean Concentrations (EMCs) and Export Coefficients	37

GIS Pollutant Loading Application— Users Manual

1. Pollutant Loading Application Overview

PLOAD is a simplified, GIS-based model to calculate pollutant loads for watersheds¹. PLOAD estimates nonpoint sources (NPS) of pollution on an annual average basis, for any user-specified pollutant. The user may calculate the NPS loads using either the export coefficient or the EPA's Simple Method approach². Optionally, best management practices (BMPs), which serve to reduce NPS loads, and point source loads, may also be included in computing total watershed loads. Finally, there are several product alternatives that may be specified to show the NPS pollution results as maps and tabular lists, and to compare multiple sessions.

The PLOAD application requires pre-processed GIS and tabular input data as listed below:

- GIS land use data
- GIS watershed data
- GIS BMP site and area data (optional)
- Pollutant loading rate data tables
- Impervious terrain factor data tables
- Pollutant reduction BMP data tables (optional)
- Point source facility locations and loads (optional).

PLOAD was designed to be generic so that it can be applied as a screening tool in a wide range of applications including NPDES stormwater permitting, watershed management, or reservoir protection projects. The application's organization and structure facilitates modification and customization. It was designed to be an analytical tool for end users. PLOAD uses the menu-driven ArcView desktop GIS. Custom scripts were written with ArcView's Avenue scripting language.

Various sections of this document describe the PLOAD input data, pollutant load calculations, end products, installation instructions, and general-use guidelines. Refer to Appendix I – Glossary of Terms for clarification of technical terminology. Appendix II provides some example graphical and tabular output generated by PLOAD. Appendix III provides the steps in incorporating PLOAD in BASINS, a list of PLOAD script names, and

¹ The distinction between watershed and subwatershed scales should not matter for the calculation. The words watershed, subwatershed, basin and subbasin are used interchangeably in the rest of this Users Manual. Operationally the only difference will be whether the user grabs a watershed coverage or the subwatershed coverage for a given run of the model. The user is cautioned that the Simple Method model is applicable only to watersheds smaller than 1 square mile.

² "The Simple Method is an empirical approach developed for estimating pollutant export from urban development sites in the Washington DC, area (*Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs*, Schueler, July 1987). Its application is limited to small drainage areas of less than one square mile." (*Compendium of Tools for Watershed Assessment and TMDL Development*, EPA, May 1997). The Simple Method has been endorsed by EPA as a viable screening tool for NPDES stormwater projects (e.g. *Guidance Manual for the Preparation of Part 2 of the NPDES Permit Application for Discharge from Municipal Separate Storm Sewer Systems*, EPA, 1992).

brief description of the scripts. Appendix IV includes two tables providing Event Mean Concentrations (EMCs) and Export Coefficients for different parts of United States. These values were obtained from literature.

The areal export coefficient model is a similarly empirical approach that provides total loads based on factors containing mass pollutant per unit area, per year. This option is provided for agricultural and undeveloped land uses or larger watersheds for which the Simple Method may not apply.

2. Input Data

A variety of GIS and tabular source data is accessed by the PLOAD model. This section describes the required and optional input data components. Note that the GIS data must be developed as either ESRI Arc/Info coverages or ArcView shapefiles, while the tabular data may be prepared as Microsoft Excel, comma delimited text, dBASE, or INFO files.

2.1 GIS Data

Watershed boundary and land-use GIS data coverages are required for PLOAD. The watersheds define the areas for which the pollutant loads are calculated. The watershed coverage must have a code field containing unique identifiers for each watershed. The land use file is essential for calculating the pollutant loads. The land use coverage must also have a code field identifying the land use types, but these types need not be unique. Prior to calculating the pollutant loads, PLOAD will spatially overlay the watershed and land use coverages in order to determine the areas of the various land use types for each watershed. The land use coverage should encompass the entire watershed coverage.

Digital watershed and land use data are available from local government agencies in most moderate- to high-density urban areas. The Arc/Info software can translate most popular digital formats, such as Microstation, AutoCad, and USGS, as Arc/Info coverage. If digital data does not exist, watershed boundaries may be derived using standard GIS or BASINS tools and the United States Geological Survey (USGS) Digital Elevation Model (DEM) data files. If necessary, land use may be mapped and digitized.

BMPs serve to reduce pollutant loads using natural processes (settling, filtration, and biological uptake) for the BMP area of influence. PLOAD will account for the influence of either site or areal BMPs. Site BMPs represented as point GIS files must contain attribute codes describing the BMP type and area of influence. Areal BMPs must be delineated as polygon files coded for BMP type only. The polygon boundaries define the area of influence. BMP input is optional because they may not exist for the area of evaluation or be desired for analysis.

Usually, BMPs must be identified and mapped by water resource specialists, then converted as GIS files by GIS analysts for most evaluation areas. Digital files or hardcopy maps are seldom available for most study areas.

2.2 Tabular Data

Pollutant loading rate, impervious factor, and BMP efficiency information (if BMPs are modeled) must be compiled in tabular files for use in the PLOAD application. The three files

of tabular input data can be provided in one of four formats: a Microsoft Excel spreadsheet, comma-delimited text, dBASE, or INFO database tables. Note that no spaces are allowed in sheet names in Microsoft Excel or file names.

The pollutant loading tables consist of the event mean concentration (EMC) and the export coefficient. The EMC and export coefficient tables contain pollutant rates for urban and rural land use types, respectively. The user may use PLOAD to estimate pollutant loads for any pollutant if EMCs or export coefficients are available. Pollutants commonly evaluated include:

TSS	Nitrogen	Lead
TDS	Nitrate plus Nitrite	Zinc
BODS	TKN	
COD	Ammonia	
Phosphorus	Fecal Coliform	

The impervious factor table identifies the percentage of imperviousness for each land use type. The BMP table identifies the percentage of efficiency for reducing pollutant loads for each BMP type. Multiple versions of each type of table may be generated to simulate alternative conditions. A description of each lookup table is provided below.

2.2.1 Export Coefficient Table

The export coefficient table lists loading rates for each pollutant type by land use type. The first record (row) of the table must identify the field names starting with land use type followed by the pollutants under evaluation. The table may contain any number of land use and pollutant types. The land use type names must be the same in the table as they are in the GIS land use file. There should be loading rates for each land use and pollutant type in the evaluation area, otherwise the load for the area will be zero. The rates in the export coefficient table are measured in pounds per acre and are typically used to calculate the pollutant loads for rural land use types.

The export coefficient table is developed by water resource engineers generally based on values available from the literature or they can be developed based on analysis of watershed stormwater monitoring data.

2.2.2 Event Mean Concentration Table

The event mean concentration (EMC) table is identical to the export coefficient table, except that the EMC values are measured in milligrams per liter and typically used to calculate the pollutant loads for urban land use types.

The EMC table is developed by water resource engineers. based on values available from the literature or can be developed based on analysis of watershed storm water-monitoring data.

2.2.3 Impervious Factor Table

The impervious factor table identifies the percentage of imperviousness for each land use type. It is used to calculate the EMC runoff coefficient. The first record (row) of the table identifies the field names comprised of the land use type and percent age of impervious

field names. The table may contain any number of land use types, but there should be impervious percentages for each land use type in the evaluation area. If there is no impervious factor in the table for a particular land use type, then the EMC runoff coefficient will default to .05 for areas with that land use. The names describing the land use types must be the same in the table as they are in the GIS land use file.

The impervious factor table is developed by water resource engineers and GIS analysts, by analyzing the impervious surfaces of different land uses on aerial photographs, or by use of literature values.

2.2.4 BMP Efficiency Table

The BMP table contains percentage removal efficiency multipliers for each BMP type that are used to calculate pollutant load reductions. The first record (row) of the table identifies the field names starting with BMP type followed by the pollutants under evaluation. The table may contain any number of BMP types. The pollutant types without percentage efficiency multipliers will not reduce the pollutant load for the BMP type.

The BMP table is developed by water resource engineers by use of literature values, or by analyzing local monitoring data comparing pollutant loads entering and leaving BMPs.

3. Pollutant Loading Calculation Equations

Annual pollutant loads may be calculated for each watershed using either the pollutant export coefficient or simple methods. Optionally, the pollutant loads derived from these methods may be refined based on the remedial effects of BMPs. Descriptions of the equations used to calculate the pollutant loads follows:

3.1 Export Coefficient Method

If the export coefficient method is designated for calculating pollutant loads in PLOAD, then the loads are calculated for each specified pollutant type by watershed using the following equation:

$$L_P = \sum_U(L_{PU} * A_U)$$

Where: L_P = Pollutant load, lbs;

L_{PU} = Pollutant loading rate for land use type u, lbs/acre/year; and

A_U = Area of land use type u, acres

The loading rates are derived from the export coefficient tables, while the land use areas are interpreted from the land use and watershed GIS data.

3.2 Simple Method

If the Simple Method is designated for calculating pollutant loads in PLOAD, then two equations are required to calculate the loads for each specified pollutant type. First, the runoff coefficient for each land use type must be derived with the equation:

$$R_{VU} = 0.05 + (0.009 * I_U)$$

Where: R_{VU} = Runoff Coefficient for land use type u , inches_{run}/inches_{rain}
 I_U = Percent Imperviousness

Percent impervious is extracted from the impervious terrain factor table.

The pollutant loads are then calculated with the following equation:

$$L_P = \sum_U (P * P_j * R_{VU} * C_U * A_U * 2.72 / 12)$$

Where: L_P = Pollutant load, lbs
 P = Precipitation, inches/year
 P_j = Ratio of storms producing runoff (default = 0.9)
 R_{VU} = Runoff Coefficient for land use type u , inches_{run}/inches_{rain}
 C_U = Event Mean Concentration for land use type u , milligrams/liter
 A_U = Area of land use type u , acres (In BASINS areas calculated from GIS data are in square meters. PLOAD converts areas from square meters to acres prior to using the information in the above equation)

The precipitation and storm ratio values are entered by the PLOAD user interactively. The loading rates are derived from the EMC tables, while the land use areas are interpreted from the land use and watershed GIS data.

3.3 BMP Computations

BMPs serve to reduce pollutant loads and PLOAD has an option to calculate loads based on the remedial effects of the various BMP types. This section describes the equations used to calculate pollutant loads influenced by BMPs. BMP types may be represented as either area or site features, but the approach for both is similar. After the raw pollutant loads are calculated using the export coefficient or simple methods, three equations are used to recalculate the pollutant loads.

First, the percent of the watershed area serviced by BMPs are determined using the following equation:

$$\%AS_{BMP} = AS_{BMP} / A_B$$

Where: $\%AS_{BMP}$ = Percent area serviced by the BMP, decimal percent
 AS_{BMP} = Area serviced by the BMP, acres
 A_B = Area of watershed, acres

The BMP and watershed areas are derived from the BMP and watershed GIS data.

Next, the pollutant loads remaining after removal by each BMP are calculated:

$$L_{BMP} = (L_P * \%AS_{BMP}) * [1 - \%EFF_{BMP}/100]$$

Where: L_{BMP} = BMP load, lbs
 L_P = Raw watershed load, lbs
 $\%EFF$ = Percent load reduction of BMP, percentage

The raw watershed pollutant loads are derived from the results of the export coefficient or simple methods, while the percent load reduction comes from the BMP efficiency tables.

Finally, the total pollutant loads accounting for BMPs are computed by watershed. Each watershed load is a cumulative total of areas which are and are not influenced by BMPs.

$$L = (\sum_{\text{BMP}} (L_{\text{BMP}})) + L_P * (A_B - (\sum_{\text{AS}} (AS_{\text{BMP}})))$$

4. User Input Parameters

Many input parameter options have been built into the PLOAD tool that the user must specify. Several of the more important ones are listed as follows:

- Specify watershed and land-use GIS data files.
- Select single, multiple, or all watersheds from watershed file for evaluation.
- Specify either the export coefficients or the simple method for calculating pollutant loads.
- If the simple method is specified, then enter annual precipitation and ratio of storms producing runoff value to override defaults.
- Evaluate pollutant loads with or without BMPs.
- When BMPs are evaluated, identify whether they are derived from point or polygon GIS data.
- Save file of input data sources and parameter settings that may be used to rerun PLOAD at a later date, with or without input modifications.
- Select output products.

5. Output Product Options

After the pollutant loads have been determined, PLOAD may be used to generate a variety of graphic plots. Listed below are the product options. See Appendix II—Graphic and Tabular Product Examples.

- Total Pollutant Loads by Watershed – Map and Table
- Pollutant Loads Per Acre by Watershed – Map and Table
- Event Mean Concentration (EMC) by Watershed – Map and Table

6. PLOAD Input Data

PLOAD data can be separated into two general categories, tabular and GIS, which are described below. Tabular data for all file types (.XLS, .TXT, etc.) requires a format that consists of headers in the first row. The common identifying field (land use, BMP type, or point source identification) should proceed the other required data from the table (pollutant

event mean concentrations (EMCs), land use impervious data, BMP removal efficiencies, point source annual pollutant discharges, pollutant export coefficients). Extra columns, such as land-use code descriptions, can be included in the table. Data specific requirements are described below. None of the files or sheets (in Excel) containing the tabular data are allowed to have spaces in their names.

GIS Data

GIS data must be in either ArcInfo or ArcView format. All GIS data must be consistently projected. The distance unit for GIS data must be meters.

EMC Data

Event Mean Concentration (EMC) data for nonbacterial pollutants needs to have units mg/l in order to be properly utilized in calculations. Bacteria needs to have units counts/100 ml.

TABLE 6.1
An Example EMC Data Table

LUCODE	LEVEL2	BOD	COD	TSS	TDS	FC
11	RESIDENTIAL	7	43	39	73	8700
12	COMMERCIAL AND SERVICES	6	46	26	48	1400
13	INDUSTRIAL	6	46	26	48	1400
14	TRANS, COMM, UTIL	10	94	104	30	1400
15	INDUST & COMMERC CMLXS	6	46	26	48	1400
16	MXD URBAN OR BUILT-UP	6	46	26	48	8700
17	OTHER URBAN OR BUILT-UP	6	46	26	48	1400
21	CROPLAND AND PASTURE	8	103	132	192	15000
22	ORCH,GROV,VNYRD,NURS,ORN	8	103	132	192	500

Impervious Factor Data

Impervious factor data is the percent impervious associated with each land use. The data can be obtained from literature sources, such as the NRCS (formerly SCS) TR-55 user's manual, or may be derived based on local data (planimetrics, orthophotos, etc). The data can be in the format of percentage of impervious (0 to 100). If this is the case, then PLOAD will automatically divide each value by 100 prior to processing. The data can also be in the format of impervious fraction (0.00 to 100).

TABLE 6.2
An Example Impervious Data Table

LUCODE	LEVEL2	Imperv
11	RESIDENTIAL	25
12	COMMERCIAL AND SERVICES	85
13	INDUSTRIAL	70
14	TRANS, COMM, UTIL	65
15	INDUST & COMMERC CMLXS	75
16	MXD URBAN OR BUILT-UP	60

17	OTHER URBAN OR BUILT-UP	15
21	CROPLAND AND PASTURE	2
22	ORCH,GROV,VNYRD,NURS,ORN	2

Export Coefficient Data

Export coefficient data for nonbacterial pollutants need to have units lb/ac-yr in order to be properly utilized in calculations. Bacteria need to have units counts/ac-yr.

TABLE 6.3
An Example Export Coefficient Data Table

LUCODE	LEVEL2	BOD
11	RESIDENTIAL	42.10
12	COMMERCIAL AND SERVICES	53.90
13	INDUSTRIAL	46.80
14	TRANS, COMM, UTIL	87.40
15	INDUST & COMMERC CMLXS	46.80
16	MXD URBAN OR BUILT-UP	46.80
17	OTHER URBAN OR BUILT-UP	46.80
21	CROPLAND AND PASTURE	16.03
22	ORCH,GROV,VNYRD,NURS,ORN	16.03

BMP Data

BMP pollutant removal efficiencies are required for each pollutant for each type of BMP present in the study area. Additional BMPs may be present in the table. PLOAD will ignore those values not identified by the BMP coverage. The data can be in the format of percentage removal (0 to 100). If this is the case, then PLOAD will automatically divide each value by 100 prior to processing. The data can also be in the format of removal fraction (0.00 to 1.00).

TABLE 6.4
An Example BMP Data (Pollutant Removal Efficiency) Table

BMPtype	BMP	BOD	COD	TSS	TDS	NOX
WP	wet pond	30	30	90	30	0
DP	dry pond	20	20	60	0	0
RB	riparian buffer	15	15	20	15	15

Point Source Data

PLOAD requires the point source data to have the units lb/yr for each pollutant with the exception of bacteria. Bacteria have the units counts/yr.

TABLE 6.5
An Example Point Source Data Table

ID	BOD	COD	TSS	TDS	NOX
1	15196	30000	2553328	1000000	340000

7. Setup and Executing PLOAD

This section describes how to install and run the PLOAD application. It assumes that the user has already setup a BASINS project file (APR) and has started BASINS. There are three primary steps required to use the PLOAD application. First, the data inputs and evaluation parameters must be specified. This involves identifying the watershed and land-use data inputs, defining the pollution loading evaluation method, and, if desired, specifying the BMP and point source inputs. After the inputs and parameters are entered, the pollutant loads are calculated. Finally, the output products are specified and produced.

The PLOAD application general use guidelines are described below. These guidelines may be referenced by new and intermittent users to navigate through the application.

Note: The GIS data is referred to as coverages, the standard Arc/Info data structure. For the purposes of this users guide, coverages may also refer to ArcView shapefiles. Simply put, either coverages or shapefiles may be accessed by PLOAD.

7.1 Starting PLOAD

1. Select the *BASINS Extensions* from the *File* menu. Select *Models* from the *Select an Extension Category* pull down menu and click on the *PLOAD* box. Click *OK* to proceed. Select *PLOAD* from the *Models* menu.
2. Once *PLOAD* is selected from the *Models* menu, the *Session Manager* will be displayed. The *Session Manager* allows the user to initiate a new session, open an existing session, view output from a previously run session and delete a session. As can be seen in Figure 7-1, the *Session Manager* offers 6 options to the user. They are described below:

New Session – Adds a new session to the project file. Used for the first PLOAD scenario of a project file as well as the addition of subsequent scenarios. Can be used to open a session that was previously saved but not run.

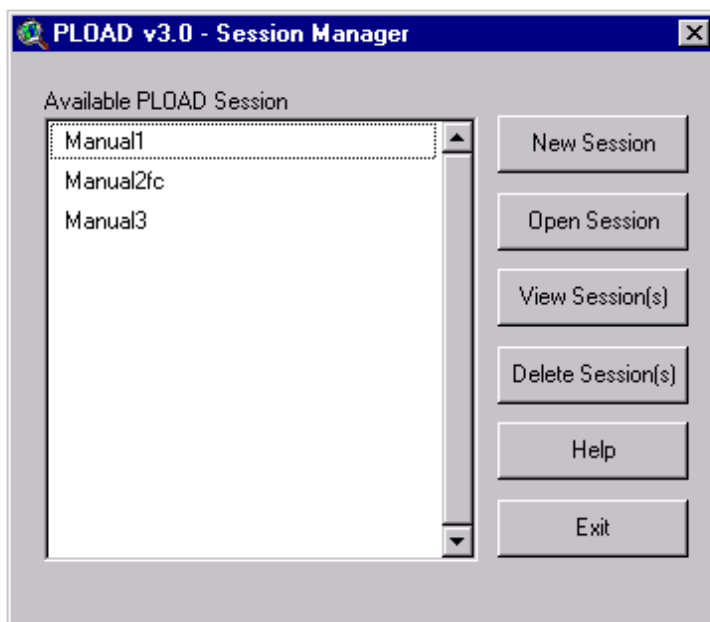
Open Session – Opens a previously run and saved session/scenario. This includes sessions that have been saved but not run. *Open Session* can be used also for the creation of a new session based on a previous session.

View Session(s) – Opens up to three previously run sessions for the purpose of comparing the results of each session.

Delete Session(s) – Deletes previously saved sessions.

Help – View an online version of the PLOAD User's Manual

Exit – Exits PLOAD and returns to BASINS.



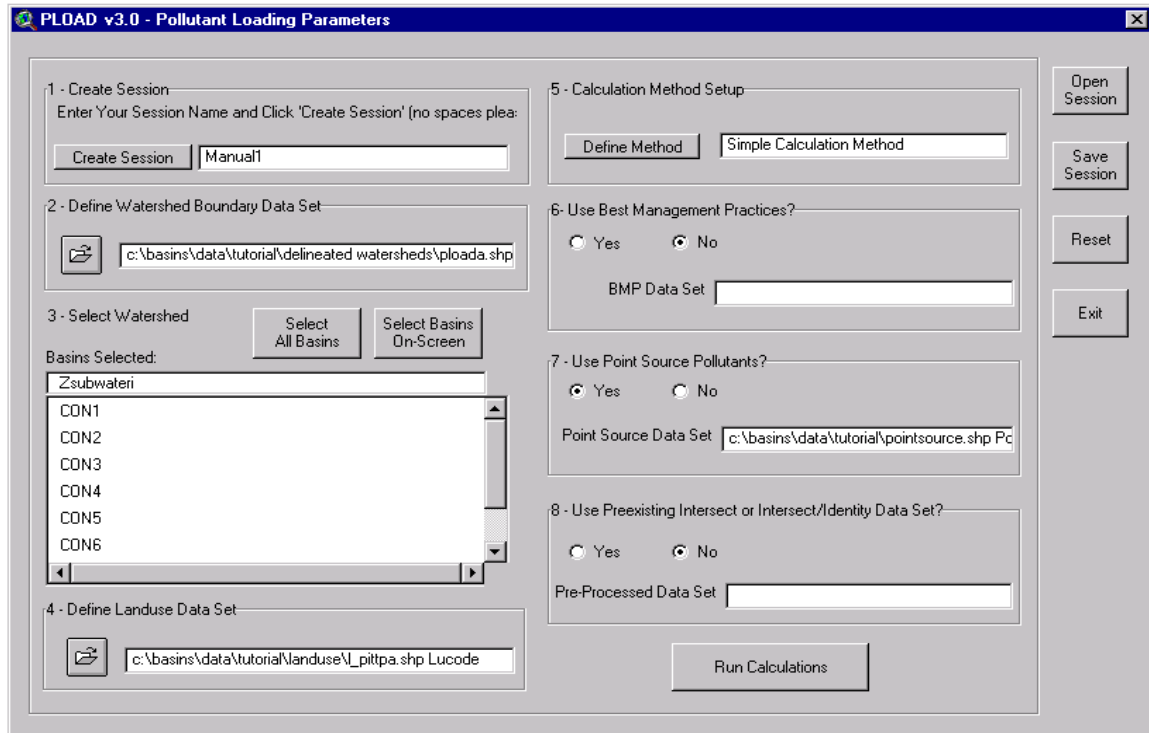
7.2 Running PLOAD via New Session

Selecting New Session closes the *Session Manager* window and opens a window titled Pollutant Loading Parameters. This is the main menu for the data setup of a session. It consists of eight steps that are carried out in sequence, prior to running the calculations.

1. **Create Session** – Name a session by typing in the desired name and clicking the *Create Session* button.

Note: Do not use any spaces in the name of the session. This is a limitation of ArcView/Avenue not handling spaces in file names, folder names, or worksheet names properly.

2. **Define Watershed Boundary Data** – Set Define Watershed Boundary Data Set by first clicking on the *Open File* button. The user is then given a choice for selecting their data set either from BASINS view or from disk. The choice is made by highlighting either one and clicking *OK*. If *Select Data Set From BASINS View* is selected, then the watershed boundary theme must be included in the BASINS view. However, it does not need to be active. The next window shows all of the themes from the BASINS view. Select the appropriate one and click *OK*.



It is not necessary for the watershed boundary data set to be a theme within the BASINS view. Indeed, user-generated boundaries will not be included in the default BASINS view. If this is the case, or a different watershed data set is desired, highlight *Select Data Set From Disk* and click *OK*. Find the desired file in the appropriate subdirectory (any mapped drive), select by highlighting, and click *OK*.

Note: PLOAD does not have multiple data set/file capability when assessing watersheds. All watersheds to be assessed within any given session have to be included in one file (e.g. ArcView shapefile).

After the watershed data set has been selected, via either method, choose the attribute that contains a unique identifier for the watersheds. This will be used for future labeling of output tables and layouts. The attribute table generated from the data set is displayed in the background to assist in identifying the unique identifier. Highlight the identifier and click on *OK*. This will return the user to the *Pollutant Loading Parameters* window.

2. **Select Watershed(s)** – Upon returning to the *Pollutant Loading Parameters* window, the user will notice that step 3 is now available. There are two options for selecting the watersheds triggered by buttons on the *Pollutant Loading Parameters* menu. The *Select All Basins* button will specify all subwatersheds in the watershed coverage. The *Select Basins on Screen* button will draw all the subwatersheds of the study area and prompt the user to select those for evaluation. The subwatersheds may be selected individually (use the shift key to specify multiple watersheds) or by defining an area containing the subwatersheds of interest. The selected subwatersheds will be highlighted in yellow. After the desired subwatersheds are selected, click the *Done* button. The *Pollutant Loading Parameters* menu will reappear and the selected subwatershed identifiers will be listed in the Basins Selected window.

3. **Define Land use Data Set** – Defining the land-use data set is similar to defining the watershed boundary data set. The user clicks on the *Open File* button. The user is then given a choice for selecting their data set either from BASINS view or from disk. The choice is made by highlighting either one and clicking *OK*. If *From BASINS View* is selected, then the land use theme must be included in the BASINS view. However, it does not need to be active. The next window shows all of the themes from the BASINS view. Select the appropriate one and click *OK*.

It is not necessary for the land use data set to be a theme within the BASINS view. Indeed, user generated land use files will not be included in the default BASINS view. If this is the case, or a different land use data set is desired, select *From Disk* option. Find the desired file in the appropriate folder in any mapped drive, select by highlighting, and click *OK*.

Note: PLOAD does not have multiple data set/file capability when assessing land use. All land use within the study area to be assessed for any given session must be included in a single file. BASINS land use data broken into tiles or rectangular areas. If the study area extends over multiple land use tiles, combine the tiles using standard ArcView's *Geoprocessing Wizard* under the *View* menu. In the *Geoprocessing* dialog box choose the *Merge theme together* option, click the *Next* button and follow the instruction. This operation needs to be done prior to initiating the PLOAD model.

After the land use data set has been selected, via either method, choose the attribute that contains the land-use field. The attribute table generated from the data set is displayed in the background to assist in identifying the unique identifier. Highlight the identifier and click on *OK*. This will return the user to the *Pollutant Loading Parameters* window.

4. **Specify Calculation Method** – Specify the pollutant loading calculation method by clicking the *Define Method* button. This will activate the *Calculation Method and Parameters Definition* window. Click either the *Simple* or *Export Coefficient* method radio button, depending on the calculation method desired. A radio button is a control on the Windows dialog boxes that the user can select to specify an option.

Radio Button

Calculation Method and Parameters Definition

Choose a Calculation Method

"Simple" Calculation Method

Precipitation Parameters

Annual Precipitation in Inches(P)


Ratio of Storms Producing Runoff(Pi)

Bacteria Option for "Simple" Method

Yes, Specify a Pollutant as Bacteria

No, Do Not Specify a Pollutant as Bacteria


Load EMC Table

 EMC Table

Landuse Field

Pollutant Field

Load Impervious Table


 Impervious Table

Landuse Field

Impervious Rating Field

"Export Coefficient" Calculation Method

Load Export Coefficient Table

 Export Coefficient Table

Landuse Field

Pollutant Field

Done Reset

Simple Method. If the simple method is selected, enter an annual precipitation value in the appropriate box and verify that the default value for ratio of storms producing runoff is correct. If bacteria is one of the pollutants to be evaluated, click on the *Yes* radio button. If not, click on the *No* radio button.

Tip – Seasonally derived values of precipitation may be accessed to evaluate seasonal loads.

Note: PLOAD assumes that all pollutant EMCs are in mg/L. Since bacteria are usually assessed in counts/100 mL, the bacteria field needs to be assessed separately from the other pollutants.

Next, click the *Load EMC Table* button. PLOAD then requests the location of Excel.exe.

If the simple method data is in a non-Excel format (.txt/.csv/.dbf/INFO files) then click on *Cancel*, a warning will appear, click on *No* and proceed. Otherwise, locate *Excel.exe* (the default location on many computers is C:\Program Files\Microsoft Office\Office).

Identify the file type of the EMC tabular data from the *Data Type* popup window. Options include Excel spreadsheet, dBASE file, text file, comma delimited text file, and INFO database. After the file type is identified, navigate to the file and select it.

Tip - Different versions of the EMC file may be accessed to evaluate different sessions.

The file contents will then be displayed from which the land use and pollutant type data for importing to model must be selected (highlighted). Once selection is complete, bring PLOAD back to the foreground (see Tip) and click on the *Continue* button. Then identify the land use field from the *Land use Field Selection* popup menu and the pollutant types from the *Pollutant Field Selection* popup menu. If the *Yes* button for bacteria was selected, the bacteria field will be requested first, then the remainder of the pollutants.

	A	B	C	D	E	F	G
1	LUCODE	LEVEL2	BOD	TSS	TDS	TP	
2	11	RESIDENTIAL	7	39	73	0.28	
3	12	COMMERCIAL AND SERVICES	6	26	48	0.10	
4	13	INDUSTRIAL	6	26	48	0.10	
5	14	TRANS, COMM, UTIL	10	104	30	0.33	
6	15	INDUST & COMMERC CMLX	6	26	48	0.10	
7	16	MXD URBAN OR BUILT-UP	6	26	48	0.10	
8	17	OTHER URBAN OR BUILT-UP	6	26	48	0.10	
9	21	CROPLAND AND PASTURE	8	132	192	1.00	
10	24	OTHER AGRICULTURAL LAND	8	132	192	1.00	
11	32	SHRUB & BRUSH RANGELAND	8	78	30	0.14	
12	41	DECIDUOUS FOREST LAND	8	78	30	0.14	
13	42	EVERGREEN FOREST LAND	8	78	30	0.14	
14	43	MIXED FOREST LAND	8	78	30	0.14	
15	51	STREAMS AND CANALS	3	26	0	0.03	
16	61	FORESTED WETLAND	8	78	30	0.14	
17	62	NONFORESTED WETLAND	8	78	30	0.14	
18	76	TRANSITIONAL AREAS	8	78	30	0.14	
19							
20							
21							

Warning – Do not use spaces in the filename or the Microsoft Excel spreadsheet names.

Warning – Land use codes in the EMC tabular data must match the land use codes in the land use data set. Land use codes in the land use data set not included in the EMC tabular data will be treated as zeros, lowering corresponding results.

Tip – Increase speed and efficiency by highlighting all fields when importing data and then selecting only those desired. The highlighting process requires a continuous string of data.

Tip – Press the ALT and the TAB buttons simultaneously to toggle between open applications (e.g. Excel and ArcView).

After the fields are entered, the *Tabular Data Definition* menu will again be displayed. It will show the pathname of the EMC table and the land use and pollutant data field names. Next click the *Load Impervious Table* button and use procedures like those described for the simple method to identify the impervious file and codes.

Click *Done* to return to the *Pollutant Loading Parameters* menu. Note that the *Reset* button may be used to purge existing entries and respecify the simple or export coefficient files and codes.

Tip –If using excel spreadsheets to import the data, one can efficiently combine all of the required data files on separate tabs within the same file.

Export Coefficient Method. If the export coefficient method is desired, click on the *Load Export Coefficient Table* box and use the same procedures described above for the simple method to identify the file and codes. The export coefficient method does not require precipitation data or impervious data, but only export coefficients for each pollutant by land use type.

5. **Use Best Management Practices** – If best management practices (BMPs) are used to reduce the pollutant loads click the *Yes* radio button in the *Use Best Management Practices* area of the *Pollutant Loading Parameter* window, otherwise click *No*. If *Yes* is clicked, then *Define Best Management Practices Parameters* menu will display. This dialogue menu is used to specify the BMP coverage and table.

Click the *Load BMP Data Set* button to display the *BMP Data Set Definition* popup menu. The *BMP Data Set Definition* menu can be used to navigate to the BMP coverage and select it. Coverage selection is similar to the watershed data set or the land use data set selection. The user has the additional option of selecting BMP coverage as sites (points) or BMP coverage as drainage areas (polygons).

If a BMP point coverage is selected, the user will then be asked to designate the area served, units of the area served, and BMP type fields in the succeeding popup menus. If the BMP is an area (polygon) coverage, the user will only be asked to identify the BMP type field. The area serviced defaults to the extent of each polygon area. After the coverage is entered, the *BMP Data Set Definition* menu will again be displayed.

To identify the BMP efficiency table, click the *Load BMP Lookup Table* button and identify the file type from the *Data Type* popup menu. Once again, options include Excel spreadsheet, dBASE file, comma delimited text file, and INFO database. After the file type is identified use the *Add BMP_LUT Table* popup menu to navigate to the file and select it. The file contents will then be displayed. Next, select the BMP type field from the *BMP-Type Field Selection* popup menu. If bacteria has not been selected as a pollutant, PLOAD will automatically associate BMP removal efficiencies with the pollutants previously selected by matching field names (BOD, NH₃, etc) between the two files. If bacteria are among the pollutants, the user will be asked to designate the bacteria field and then all others will be automatically assigned as previously described.

Define Best Management Practices Parameters

Load Best Management Practices (BMP) Data Set and Look Up Table

Load BMP Data Set

BMP Data Set: c:\basins\data\bmppoint.shp Point

Area Serviced Field: Acres

BMP Type Field: Bmptype

Load BMP Lookup Table

BMP Lookup Table: c:\basins\data\tutorial\tutoriallut_working.xls

BMP Type Field: BMP

Pollutant Field: BOD

Buttons: Done, Reset

Caution: The title of the popup menu references the pollutant selected for evaluation from either the EMC or export coefficient tables. Make sure that the pollutant type abbreviations from the BMP table correspond to those in the EMC table.

Note: If you are using BASINS point source data, the Discharge Monitoring Report (DMR) data need to be processed prior to using the information in PLOAD. Follow the steps listed below to process DMR data before initiating the PLOAD model.

1. Link the DMR data tables to the Permit Compliance System (PCS) coverage using the NPDES number field.
2. Select PCS facilities located in the watersheds. This will automatically select all DMR data that belong to the selected facilities.
3. Select Export option from the File menu to export highlighted data to dBase format.
4. Open the dBase file in Excel to calculate annual loads from monthly loads or concentrations reported in DMR. Use this spreadsheet to specify point source pollutant loads in PLOAD.

After the fields are designated, the *BMP Data Set Definition* menu will again be displayed.

Click the *Done* button to return to the *Pollutant Loading Parameters* menu. Click the *Reset* button to clear all existing BMP entries.

Note: Clicking *Done* on a *Best Management Practices Parameters* dialog with no entries automatically resets the *Use Best Management Practices* option to *No*.

6. **Use Point Source Pollutants** – PLOAD also can incorporate point sources into the watershed loading calculations. If point sources (PS) are to be incorporated into the calculations, click the *Yes* radio button in the *Use Point Source Pollutants* area of the *Pollutant Loading Parameter* window, otherwise click *No*. If *Yes* is clicked, then *Define Point Source Pollutant Parameters* menu will display. This dialogue menu is used to specify the PS coverage and table.

Click the *Load Point Source Pollutant Data Set* button. This will display the *Point Source Data Set Definition* popup menu used to navigate to the point source coverage and select it. Coverage selection is similar to the watershed data set or the land use data set selection. Once the coverage has been selected, the user designates the Point ID field (e.g., NPDES number) via popup window and PLOAD returns to the *Point Source Pollutant Parameters* window.

To identify the *Point Source Pollutant Load* table, click the *Load Point Source Pollutant Lookup Table* button and identify the file type from the *Data Type* popup menu. Once again, options include Excel spreadsheet, dBASE file, comma delimited text file, and INFO database. After the file type is identified, use the *Add Pnt_LUT Table* pop-up menu to navigate to the file and select it. The file contents will then be displayed. Next, select the PS identifier field from the popup menu.

If bacteria has not been selected as a pollutant, PLOAD will automatically associate BMP removal efficiencies with the pollutants previously selected by matching field names (BOD, NH₃, etc) between the two files. If bacteria are among the pollutants, the user will be asked to designate the bacteria field and then all others will be automatically assigned as previously described.

Note: Point source values are in lb/yr for each pollutant other than bacteria and in counts/yr for bacteria.

After the fields are designated, the *Point Source Pollutant Parameters* menu will again be displayed. Click the *Done* button to return to the *Pollutant Loading Parameters* menu. Click the *Reset* button to clear all existing BMP entries.

7. **Use Preexisting Intersect or Intersect/Identify Data Set** – In order to calculate the pollutant loads the watershed watershed and land use coverage must first be spatially overlaid. There are two options in PLOAD for specifying the overlay. Clicking the *Yes* radio button will allow the user to designate a Preexisting Intersect coverage. A preexisting intersect is useful for large overall areas with many small watersheds or with many small land use polygons.

Note: If the land use coverage is large, greater than 500 polygon areas, and Arc/Info software is readily available, it is recommended that the overlay be done with Arc/Info prior to launching PLOAD.

This preprocessing saves time if the user desires to make multiple runs in a short amount of time. If a preexisting overlay coverage is specified, then the *Select Intersect Coverage* popup menu will display. Use the menu to navigate to the overlay file and select it.

Warning: The preexisting intersect coverage must contain the same land use codes and watershed identifiers as the original coverages.

Clicking the *No* radio button results in ArcView conducting the intersect prior to the calculation.

1. **Execute Model Run** – After the overlay option has been selected, click *Run Calculation* to execute the ArcView intersect or access the existing overlay coverage and calculate the pollutant loads. Prior to execution, PLOAD will automatically save the session.
2. **Use Other Functions** – Other functions of the Pollutant Loading Parameters Window include the following buttons:
 - Open Session Allows the user to open any session created within the project file;
 - Save Session Allows the user to save the current session at any point;
 - Reset Clears all input data; and
 - Exit Allows the user to exit PLOAD. Session is automatically saved when exiting. However, the user needs to save the APR file prior to exiting BASINS in order to save changes after running calculations, viewing and altering output, etc.

7.3 Running PLOAD via Open Session

The user has the option of opening a previously saved session. This is initiated by clicking on the *Open Session* button in the *Session Manager*. The appropriate session is then selected from the Load Saved Session popup window. The user has the option of recalling a saved session from any directory, however, the resulting session will be saved to the default subdirectory\BASINS\modelout\ploadout.

Note: Each session is saved as a PLOAD parameters file (.ODB) using the session name as the file name.

Once the file has been selected, the user is given the option of renaming a session. Generally, when returning to a session, the user will probably desire not to rename. However, during scenario generation, it may be advantageous to rename a previously run session in order to not start with a blank slate. Click *Yes* to rename, otherwise click *No*.

Warning: Running a session a second time under the same name will overwrite the data generated by the first run. The user should rename the session if there is any desire to retain the previously run output.

If the user clicks *No*, an informational window appears followed by the *Open Session* window. This provides the user a second chance not to retain the same session name and potentially overwrite previously generated output. If the user desires to continue with the current session name, then highlight the overwrite option and click *OK*. Otherwise, highlight the rename option and click *OK*. The user may click on *Cancel* to return to the *Session Manager*. If the overwrite option is chosen, the user confirms the overwrite via a popup window and the session is opened in the *Pollutant Loading Parameters* window. If the session is renamed at any time, the *Pollutant Loading Parameters* window is opened with the

new session name, while retaining any parameter information generated by the original session.

7.4 Viewing Output

Up to three sessions can be viewed concurrently using the *View Sessions* option in the *Session Manager*. This enables the onscreen comparison of different scenarios. Multiple sessions are selected by using the shift key while clicking on each session. After clicking on the *View Sessions* button, the user is presented with nonspecific view of each session and its output table. The views and tables are tiled across the screen with each view above its table.

Figure 7.4.1 include a screen capture of the PLOAD view showing the results of two model runs. The user is free to edit the views, in order to display point sources and BMPS as well as any pollutant output (annual load, annual loading rate, EMC). Each view must be edited separately in order to display the same information. While viewing the session(s), the user has the option of bringing the *Session Manager* to the foreground, creating layouts, and closing all PLOAD documents. These options are accomplished by way of making appropriate selection from the *PLOAD* menu. Any changes to various output views can be saved by saving the ArcView project (.APR) file from the *BASINS* view.

7.5 Creating Layouts and Data Post Processing

PLOAD allows the viewer to create layouts for any session's output. The layouts generated by PLOAD should be considered a starting point, and thus, are relatively simple displays of the output. The user should feel free to modify any of the layouts, to fit their own needs.

Layout creation can be accomplished either immediately after a session run, or while viewing session(s). In either case, activate the PLOAD pull down menu from the command line, and click on *Create Layouts*. This activates the *Layout Options* window.

Note: When creating layouts from *View Sessions*, only the active session view will generate layouts. The user must activate each view in turn, in order to create layouts for each session.

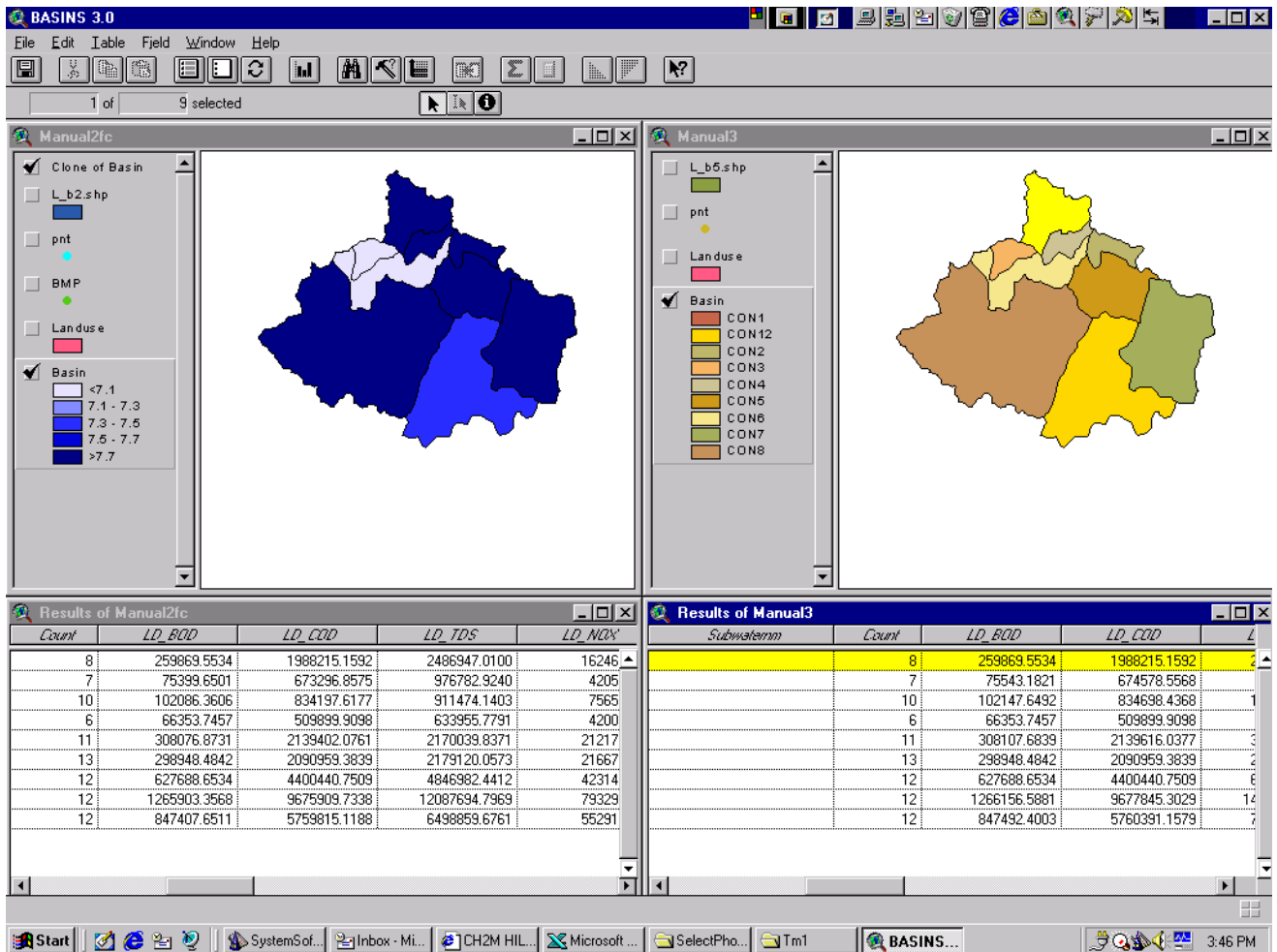
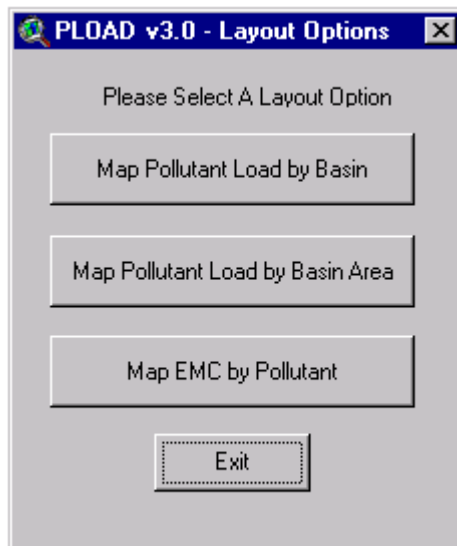


FIGURE 7.4.1
PLOAD Views Showing the Results of Two Modeling Sessions

The user may create three different types of layouts. If the simple method was used as the method of calculation, the user can create all three layouts:

- Pollutant Load by Watershed (lb/year);
- Pollutant Load by Watershed Area (lb/ac-year); and
- EMC by Pollutant (mg/L).

If bacteria were calculated, the units will be counts/year, counts/ac-year, and counts/100 ml respectively. If the export coefficient method was used, EMC by Pollutant will not be available.



No matter which output is displayed, the procedure is the same. PLOAD takes the user through a series of windows, and generates layouts according to user responses. The windows include:

- Watershed (watershed labels) (*Yes or No*);
- Map size (8x11, 11x17, 17x22, or 34x44); and
- Legend type for each pollutant modeled (Unique value black and white, unique value color, color ramp equal interval; and color ramp natural break algorithm).

PLOAD then generates the maps (Figure 7.1) which can be saved as part of the APR file save from BASINS view. The following is an example of a PLOAD generated layout. It is EMC by Watershed for TDS. The legend type is unique value in black and white. Other examples are included in Appendix II.

The user may access model output in a tabular form by selecting the session and clicking the *View Sessions* button in the *Session Manager* screen. PLOAD will open a map of the watershed and a corresponding attribute table containing watershed information as well as model output. One or more of the following fields can be found in the attribute table depending on the number of modeled pollutants and the calculation method selected.

- LD_Pollutant is the annual (or any other time period selected by the user) load in pounds. The word "Pollutant" is replaced by the pollutant name. For example, LD_BOD is the field name for BOD load.

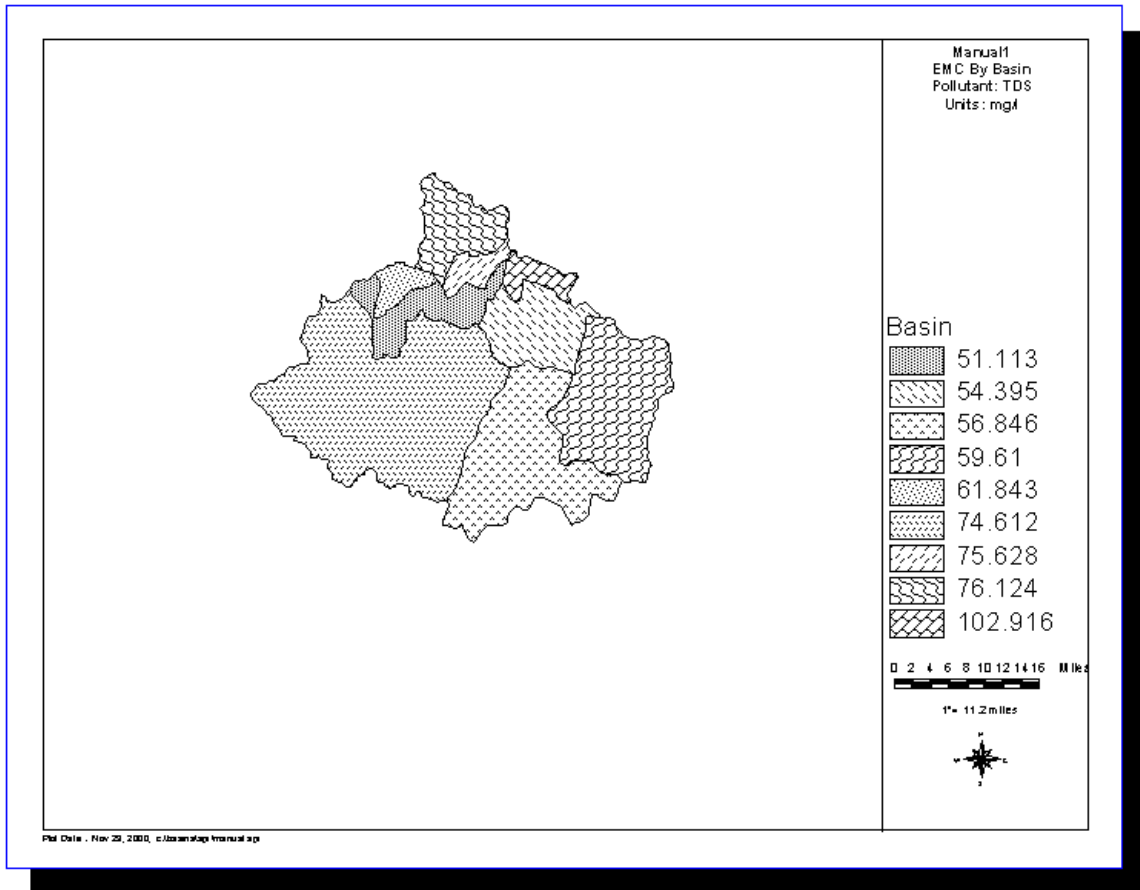


FIGURE 7.1
An Example Map (Layout) Generated by PLOAD

- AR_Pollutant is the annual (or any other time period selected by the user) load per unit area (pounds per acre), and
- EMC_Pollutant is the average event mean concentration by watershed for the specific pollutant in milligrams per liter.

Glossary of Terms

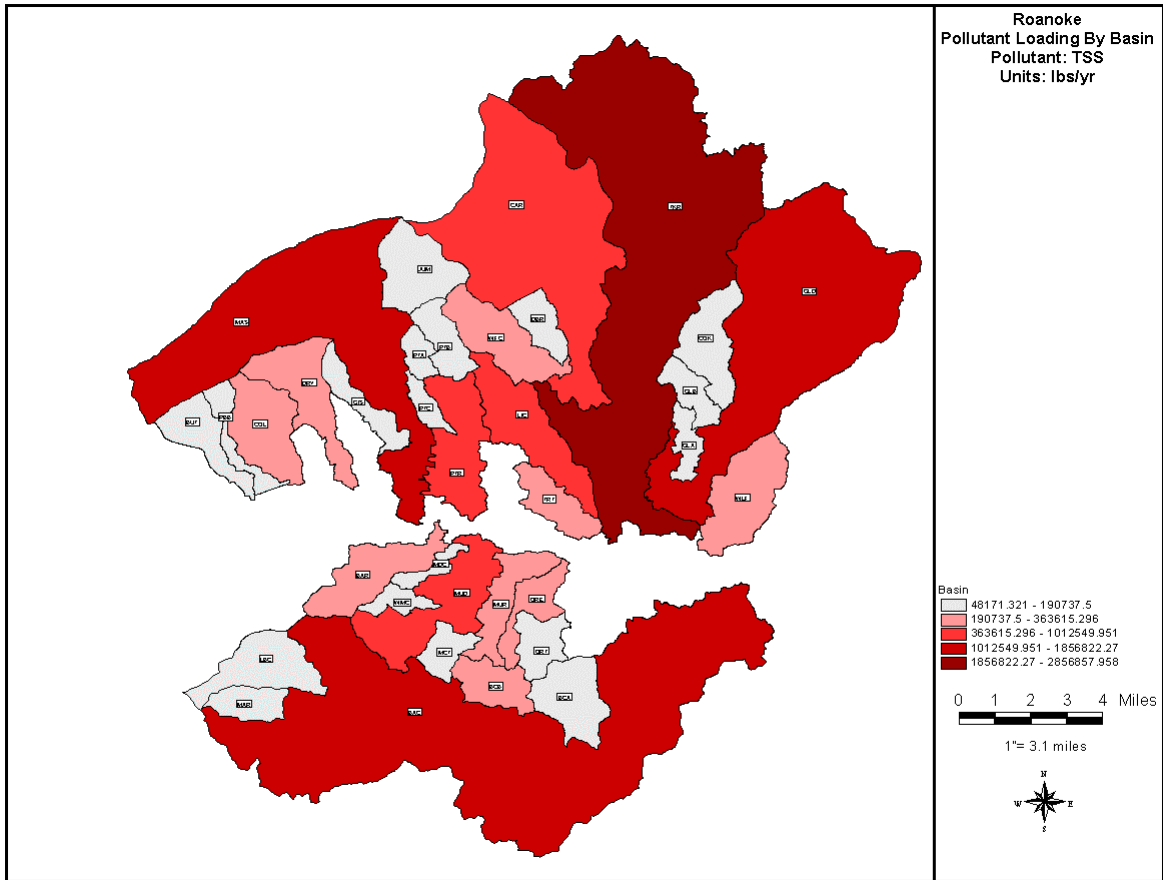
Arc/Info	Professional GIS software developed by ESRI. Command line driven software package with a macro (AML) programming language.
ArcView	Desktop GIS software developed by ESRI. Menu driven software package with a macro (Avenue) programming language.
Attribute Codes	Descriptive characteristics of the geographic map features.
Basemap Data	Includes administrative, parcel, and planimetric data layers
CADD Files	Computer aided design and drafting files, including Microstation design (dgn) and AutoCad drawing (dwg) files, are usually used for display purposes only.
Coverage	The basic unit of data storage in the Arc/Info GIS. It is comprised of thematic layers stored as features related to descriptive attributes stored in the INFO database management system.
Data Conversion	The process of transforming mapped features, codes and text as digital computer data.
Data Translation	To change the structure of digital data from one format to another (e.g. AutoCad dwg files to Arc/Info coverages).
Dialogue Design	An ArcView Avenue GUI that may be customized for focused needs
Digital Data	Pre-processed digital data
Features	Geographic map features represented as polygon areas, lines and points.
GUI	A graphical method of controlling how a user interacts with a computer to perform various tasks. The user performs desired tasks by using a mouse to choose from 'a dashboard' of options presented on the display screen. These are in the form of pictorial buttons (icons) and lists.
Projection	A mathematical model that transforms the locations of features on the earth's surface to locations on a two-dimensional surface. Some projections preserve the shape of mapped features, while others preserve the accuracy of area, distance, or direction.
Shapefile	The basic unit of data storage in the ArcView GIS. It is comprised of features related to descriptive attributes in dBASE files.
Tables	A set of data elements that has a horizontal dimension (rows) and a vertical dimension (columns) in a relational database system. A table has a specified number of columns but can have any number of rows.
Topology	The spatial relationships between connecting and adjacent geographic features.

APPENDIX II

Graphic and Tabular Product Examples

The following examples are simplified versions of the PLOAD products.

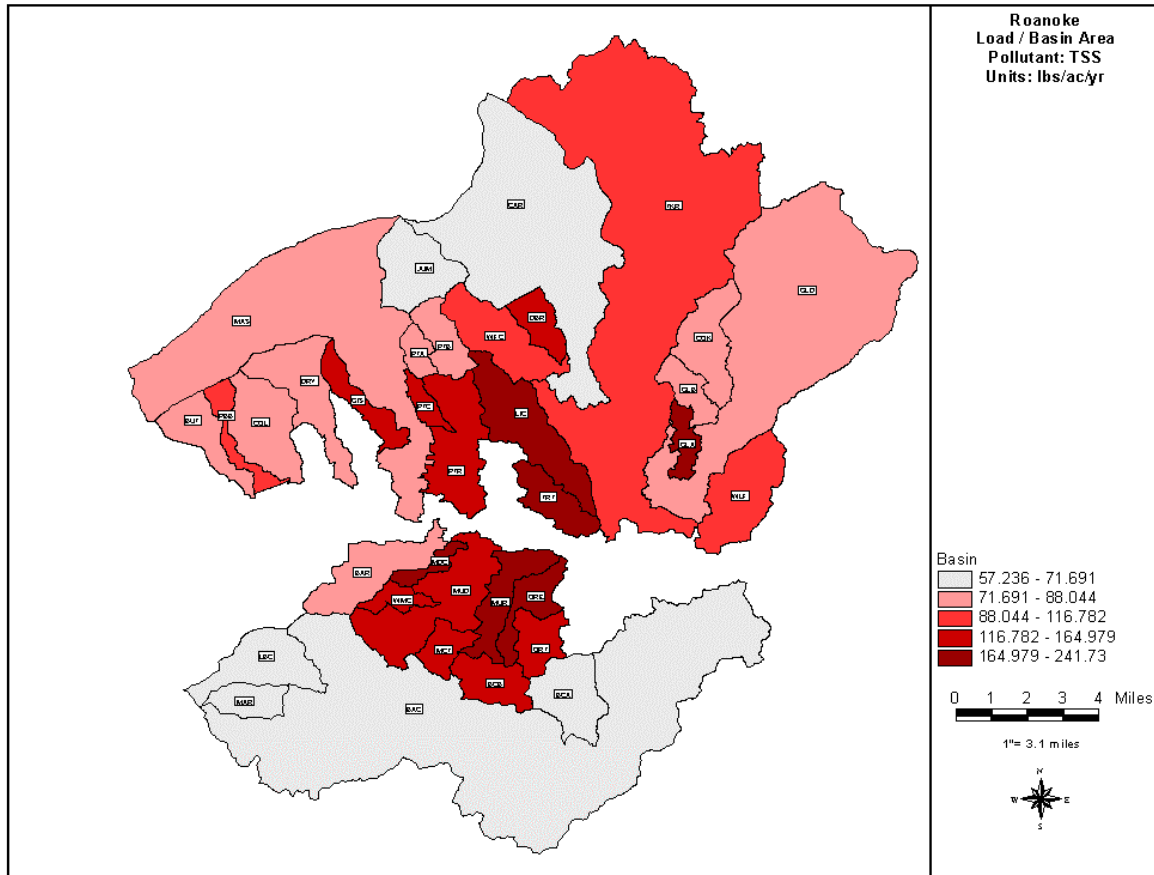
TOTAL POLLUTANT LOADS BY WATERSHED - MAP



TOTAL POLLUTANT LOADS BY WATERSHED – TABLE

	A	B	C
1	Roanoke BasinSum.dbf Load in lbs/yr		
2	Prefix	Sum_LD_TSS	
3	BAC	1856822	
4	BAR	234113.6	
5	BCA	146804.4	
6	BCB	209992.1	
7	BUT	126394.5	
8	CAR	1012550	
9	COK	190737.5	
10	COL	242280.8	
11	DBR	181785.1	
12	DRY	238398.3	
13	GIS	180063.2	
14	GLA	148160.3	
15	GLB	85883.13	
16	GLD	1378907	
17	JUM	146673.7	
18	LBC	165851.3	
19	LIC	607949.2	
20	MAR	71099.79	
21	MAS	1149572	
22	MCT	153443.3	
23	MDC	95738.6	
24	MUD	565384.5	
25	MUR	317374.8	
26	ORE	282709.5	
27	ORT	177357.6	
28	PBB	114546.1	
29	PTA	48171.32	
30	PTB	96251.94	
31	PTC	72920.52	
32	PTR	517608.6	
33	TKR	2856858	
34	TRT	363615.3	
35	WFC	270942.1	
36	WLF	323213.1	
37	WMC	84200.55	
38			

POLLUTANT LOADS PER ACRE BY WATERSHED - MAP

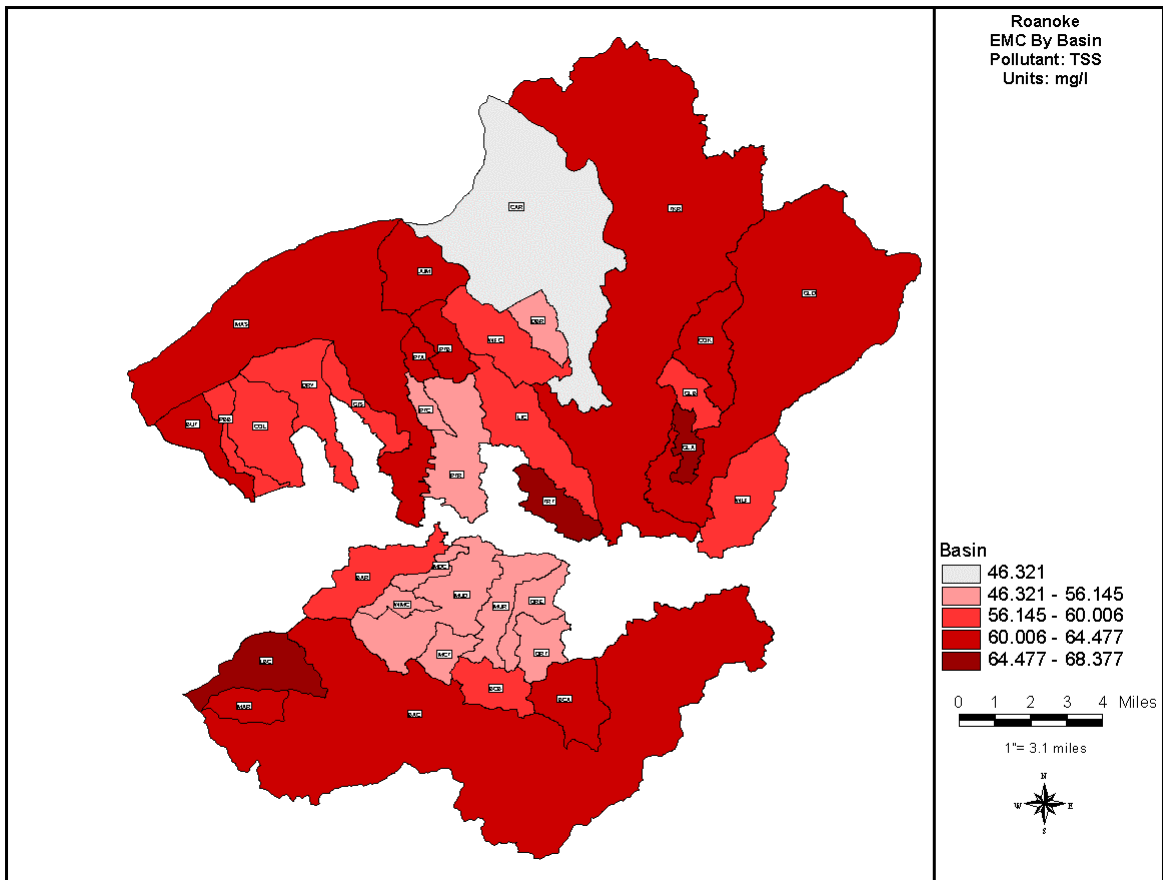


Plot Date : Apr 19, 1999; I:\demo\rod_root\load_data\roanoke\proj1.apr

POLLUTANT LOADS PER ACRE BY WATERSHED - TABLE

	1	2
1	Roanoke BasinSum.dbf Load in lbs/ac/yr	
2	Prefix	AR_TSS
3	BAC	61.5665
4	BAR	88.04377
5	BCA	65.0181
6	BCB	137.1742
7	BUT	73.39718
8	CAR	71.69148
9	COK	83.92911
10	COL	87.25787
11	DBR	164.9792
12	DRY	83.83004
13	GIS	140.1726
14	GLA	182.2197
15	GLB	82.87651
16	GLD	81.15629
17	JUM	57.23581
18	LBC	65.62727
19	LIC	175.8736
20	MAR	64.06887
21	MAS	76.13612
22	MCT	164.2653
23	MDC	183.5481
24	MUD	140.54
25	MUR	173.2102
26	ORE	211.6285
27	ORT	139.9605
28	PBB	116.782
29	PTA	75.38095
30	PTB	73.57498
31	PTC	127.1961
32	PTR	159.1954
33	TKR	104.3104
34	TRT	241.7298
35	WFC	99.96037
36	WLF	102.703
37	WMC	131.1034

EVENT MEAN CONCENTRATION BY WATERSHED - MAP



EVENT MEAN CONCENTRATION BY WATERSHED – TABLE

	A	B
1	Roanoke BasinSum.dbf Aggregate EMC by Basin in mg/l	
2	Prefix	EMC_TSS
3	BAC	64.3596
4	BAR	57.5399
5	BCA	60.6763
6	BCB	58.9448
7	BUT	60.9686
8	CAR	46.3213
9	COK	60.688
10	COL	59.4883
11	DBR	55.4828
12	DRY	60.0055
13	GIS	58.1014
14	GLA	67.998
15	GLB	59.1016
16	GLD	63.6762
17	JUM	64.4771
18	LBC	66.9321
19	LIC	58.653
20	MAR	63.5748
21	MAS	61.9063
22	MCT	54.4733
23	MDC	55.0438
24	MUD	55.0281
25	MUR	55.4201
26	ORE	55.4193
27	ORT	55.8591
28	PBB	57.5285
29	PTA	62.478
30	PTB	61.7573
31	PTC	56.1445
32	PTR	55.2543
33	TKR	62.66
34	TRT	68.3767
35	WFC	58.5554
36	WLF	58.1321
37	WMC	54.2337
38		

POLLUTANT LOADS BY BMP, LAND USE AND WATERSHED - TABLE

	1	2	3	4	5
1	Roanoke AreaSum.dbf Load in lbs/yr				
2	Merge	Prefix	Land	Acres	LD_TSS
3	BAC AC no	BAC	AC	2732.759	189519.2
4	BAC AP no	BAC	AP	553.5726	35991.32
5	BAR OS no	BAR	OS	193.2443	11726.45
6	BAR OW no	BAR	OW	11.7574	0
7	BAR PP no	BAR	PP	21.3951	8067.278
8	BAR R1 no	BAR	R1	21.6817	2015.318
9	BAR R12 BASIN	BAR	R12	1.362	61.3881
10	BAR R12 no	BAR	R12	473.8863	53397.58
11	BAR R13 no	BAR	R13	86.0562	11394.71
12	BAR R14 no	BAR	R14	189.1171	31011.06
13	BAR R18 no	BAR	R18	18.6515	5045.605
14	BAR R2 no	BAR	R2	15.0539	924.0412
15	BAR WF BASIN	BAR	WF	10.0423	226.3437
16	BAR WF no	BAR	WF	1427.735	80449.39
17	BCA AC no	BCA	AC	141.9152	9841.941
18	MAS AC no	MAS	AC	563.3961	39072
19	MAS AP no	MAS	AP	76.5106	4974.446
20	MAS BR DRY POND	MAS	BR	0.0225	0.5461
21	MAS BR no	MAS	BR	26.5379	1610.373
22	MAS CD DRY POND	MAS	CD	2.5089	380.9389
23	MAS CD no	MAS	CD	470.054	178426.7
24	MAS ID no	MAS	ID	60.7858	27666.18
25	MAS OS DRY POND	MAS	OS	9.8503	239.0944
26	MAS OS no	MAS	OS	468.2329	28413.31
27	MAS PP DRY POND	MAS	PP	2.0393	307.577
28	MAS PP no	MAS	PP	105.4346	39755.38
29	MAS R1 no	MAS	R1	335.8436	31216.72
30	MAS R12 no	MAS	R12	105.9188	11934.95
31	MAS R13 no	MAS	R13	14.6245	1936.432
32	MAS R14 DRY POND	MAS	R14	0.2368	15.532

Description of PLOAD Scripts

This section describes the steps involved integrating PLOAD into BASINS and lists PLOAD Avenue scripts. PLOAD scripts which are not part of a PLOAD dialog are grouped under 'Menus' or 'Extension.' A brief description follows the name of each Avenue script.

Steps to Integrate PLOAD into BASINS

- BASINS software has a fixed directory structure with the BASINS folder being located at the root level. Some new folders for PLOAD were (e.g. PLOAD folder under MODELS) added in a manner consistent with BASINS directory structure. The PLOAD ArcView extension (i.e. the avx file) was copied to the \basins\etc\extensions folder.
- Use of global variables was minimized and generic names were avoided for global variables. Use of generic names increases risk of interfering with other BASINS extensions using a global variable by the same name. PLOAD uses function calls explicitly stating global variable names and avoids global function calls (e.g. ClearGlobals). This global function call would affect global variables used by other BASINS extensions and may cause the program to crash.
- PLOAD was originally designed to work with user supplied datasets. Therefore, filenames and field names were never hardcoded in the scripts. PLOAD scripts were slightly modified to allow users to select GIS data from the BASINS View Table of Contents (i.e. list of themes) in addition to data stored in the hard disk.
- PLOAD scripts originally assumed that the distance unit of the GIS data would be in 'feet.' The distance unit of GIS data in BASINS is 'meters.' Therefore, PLOAD scripts were modified to make appropriate unit conversions prior to using the variables (distance and area variables) in formulas.
- For BASINS Extension Manager to incorporate PLOAD correctly, the 'Make' script to build the PLOAD extension was modified to recognize the custom 'Models' menu in the View document GUI.

PLOAD Scripts

1. PLOAD Extension - General Scripts

zz.ploadsortguis	Places PLOAD document under View document in the ProjectWindow
------------------	--

2. View Document Menu - 'Models' Menu Item

zz.menustart	Opens PLOAD Session Manager dialog
--------------	------------------------------------

3. PLOAD Document Menu – ‘PLOAD’ Menu Items

zz.menustart	Opens PLOAD Session Manager dialog
zz.plviewmenulayout	Opens PLOAD Layout Options dialog
zz.closealldocs	Closes all open PLOAD documents

4. DoneWin Dialog

zz.lbtviewdone	Closes the view window after user is done selecting watersheds
----------------	--

5. ExcelDlog Dialog

zz.importexcel2	Opens Excel and asks for user to select range of cells
zz.setexcelpath	Sets path to Excel executable if not previously defined

6. Pload_Start Dialog (Session Manger)

zz.startup	Calls script that opens main PLOAD dialog
zz.ploaddlogrun	Opens main PLOAD dialog (Pollutant Loading Parameters)
zz.oddb_getodb_new_name	Allows user to open saved session
zz.oddb_dialogparamrestore	Restores saved dialog and session parameters
zz.ploadstartdelete	Allows user to delete a session within a project
zz.ploadstartview	Allows user to view PLOAD views and tables
zz.ploadstarthelp	Allows user to access PLOAD Help
zz.ploadstartexit	Exits user from Session Manager

7. PLOAD Dialog (Pollutant Loading Parameters)

General

zz.oddb_getodb_newname	Called by ‘Open Session’ button. Allows user to open a saved session
zz.oddb_makeodb_no_output	Called by ‘Save Session’ button. Allows user save a session
zz.oddb_dialogdict	Writes contents of PLOAD dictionary to odb
zz.ploadreset	Resets PLOAD dialog
zz.ploadexit	Exits PLOAD dialog
zz.oddb_makeodb_no_output2	Script save s PLOAD session when user closes PLOAD dialog
zz.ploaddlogopen	Standard open script for PLOAD dialog
zz.ploaddlogopennull	Special open script for PLOAD dialog
zz.lbtruncalc	Called by ‘Run Calculations’ button. Performs calculations
zz.identity	Performs Identity on Watershed and Land use data
zz.intersect	Performs intersect on BMP’s and Identity theme
zz.lbtruncalc_intersectthmdefinition	Called by zz.lbtruncalc
zz.lbtruncalc_pointbmp	Called by zz.lbtruncalc
zz.lbtruncalc_pointpollutant	Called by zz.lbtruncalc
zz.jointoareasum	Called by zz.lbtruncalc
zz.ploadsummarize	Called by zz.lbtruncalc

zz.ploadexporttable	Called by zz.lbtruncalc. Generic script used to create new tables
zz.basinthemeexport	Called by zz.lbtruncalc, creates session specific shape file

Section 1 – Create Session

zz.lbtcreatesessionclick	Allows user to name a new session
--------------------------	-----------------------------------

Section 2 – Watershed Definition

zz.coverdefinition_basin	Allows user to select watershed dataset
zz.tablequery_basin	Allows user to select watershed unique identifier (or name) field

Section 3 – Watershed Selection

zz.lbtselectbasin	Allows user to interactively select watersheds on screen
zz.lbtallbasin	Allows user to select all watersheds in data set

Section 4 – Land use Definition

zz.coverdefinition_land use	Allows user to select land use data set
zz.tablequery_land use	Allows user to select land use code field

Section 5 – Calculation Method Definition

zz.definecalcmethod	Opens Calculation Method dialog
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Section 6 – Best Management Practices

zz.ploadbmpradno	Sets bmp option to no
zz.ploadbmpradyes	Opens BMP Definition dialog

Section 7 – Point Source Definition

zz.ploadpointradno	Sets point source option to no
zz.ploadpointradyes	Opens Point Source Definition dialog

Section 8 – Pre-existing Intersect/Intersect-Identity Data

zz.ploadpreprocradno	Sets pre-existing data option to no
zz.ploadpreprocradyes	Opens Predefined Geographic Data dialog

8. CalcMethod Dialog (Calculation Method Definition)

General

zz.calcmethoddlogopen	Open script for CalcMethod dialog
zz.calcmdlogopennull	Special Open script for CalcMethod dialog
zz.calcmldbtdone	Tells PLOAD user is done with CalcMethod dialog
zz.calcmldbreset	Rests CalcMethod dialog
zz.importexcel	Opens Excel and allows user to select a range of cells

Simple Method

zz.calcmradsimple	Sets calculation method parameter to Simple
zz.calcmradfecal	Sets Bacteria parameter to either yes or no
zz.calcmsimple_emc	Allows user to select EMC table
zz.tablequery_emc	Allows user to define EMC fields
zz.calcmsimple_imp	Allows user to select Impervious Ratings table
zz.tablequery_impervious	Allows user to define Impervious Ratings fields

Export Method

zz.calcmradexport	Sets calculation method to export coefficient
zz.calcmexport_cf	Allows user to select Export Coefficient table
zz.tablequery_export	Allows user to define Export Coefficient table fields

9. LoadBMP Dialog (BMP Definition)

General Scripts

zz.loadbmplbtdone	Tells PLOAD that user is done with LoadBMP dialog
zz.loadbmplbtreset	Resets LoadBMP dialog
zz.loadbmpdlogclose	Close script for LoadBMP dialog
zz.loadbmpdlogopen	Standard open script for LoadBMP dialog
zz.loadbmpopencurrent	Special open script for LoadBMP dialog

Data Set Definition Section

zz.coverdefinition_bmp	Allows user to select BMP data set
zz.tablequery_bmpcover	Allows user to define area serviced and BMP type fields

Look Up Table Definition Section

zz.loadbmp_lut	Allows user to select BMP LUT
zz.tablequery_bmplut	Allows user to define BMP type field

10. LoadPNT Dialog (Point Source Pollutants)

General Scripts

zz.loadpointlbttdone	Tells PLOAD that user is done with LoadPNT dialog
zz.loadpointlbtreset	Resets LoadPNT dialog
zz.loadpointdlogclose	Close script for LoadPNT dialog
zz.loadpointdlogopen	Standard open script for LoadPNT dialog
zz.loadpointopencurrent	Special open script for LoadPNT dialog

Data Set Definition Section

zz.coverdefinition_point	Allows user to select PNT data set
zz.tablequery_pntcover	Allows user to define PNT unique id (name) field

Lookup Table Definition Section

zz.loadpoint_lut	Allows user to select PNT LUT
zz.tablequery_pntlut	Allows user to define pollutant field(s)

11. Pload_GD Dialog (Pre-existing identity/intersect-identity data)

zz.pload_gdlbtdone	Tells PLOAD that user is done with Pload_GD dialog
zz.importintersect	Allows user to import pre-existing Watershed/Land use data set
zz.importintersect_identity	Allows user to import pre-existing Watershed/LU/BMP data set
zz.pload_gddlogclose	Close script for Pload_GD dialog
zz.pload_gddlogopen	Open script for Pload_GD dialog

12. Pload_Out Dialog (Output/Layout options)

zz.mapbasin	Allows user to map pollutant load by watershed
zz.mapemc	Allows user to map EMC by pollutant
zz.mapload_area	Allows user to map pollutant load by area
zz.mapexit	Exits from Pload_Out dialog
zz.pload_outopencurrent	Open script for Pload_Out dialog
zz.radout_labeler	Allows user to label watershed in layouts
zz.layout	Creates layouts based on user input

Event Mean Concentrations (EMCs) and Export Coefficients

This section includes a EMC values (Table IV.1) and Export Coefficients for different part of the country.

TABLE IV.1
Some EMC Values as Reported in Literature

Land Use	BOD (mg/L)	COD (mg/L)	TSS (mg/L)	Total Dissolved Solids (mg/L)	Total Nitrogen (mg/L)	Nitrate and Nitrite (mg/L)	Nitrate Nitrogen (mg/L)	TKN (mg/L)	Ammonia Nitrogen (mg/L)	Org. Nitrogen (mg/L)	Total Phosphorus (mg/L)	Diss. Phosphorus (mg/L)	Zinc (mg/L)	Copper (mg/L)	Lead (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Nickel (mg/L)	Fecal Coliform - Geometric Means (counts/100ml)	Comment	Reference		
National (NURP)																							
Residential	10	73	101			0.736		1.9			0.383	0.143	0.135	0.033	0.144								U.S. EPA, 1983
Mixed	7.8	65	67			0.558		1.288			0.262	0.056	0.154	0.027	0.114								U.S. EPA, 1983
Commercial	9.3	57	69			0.572		1.179			0.201	0.08	0.226	0.029	0.104								U.S. EPA, 1983
Open/Nonurban	----	40	70			0.543		0.965			0.121	0.026	0.195	----	0.03								U.S. EPA, 1983
Mid-Atlantic																							
Suburban	5.1	35.6					0.48	1.51	0.26		0.26		0.037	----	0.018								Schueler 1987
Urban	----	163.0					8.90	7.20	1.10		1.08		0.397	0.105	0.389								Schueler 1987
Commercial	36.0	----					0.84	1.49	----		----		0.250	----	0.370								Schueler 1987
Forest	----	>40					0.17	0.61	0.07		0.15		----	----	----								Schueler 1987
Highway	----	124.0					----	2.72	----		----		0.380	----	0.550								Schueler 1987
Texas - Coastal																							
Residential	25.5	49.5	41			0.23		1.50			0.57	0.48	0.080	0.015	0.009								Raird, et al, 1996
Commercial	23	116	55.5			0.26		1.10			0.32	0.11	0.180	0.015	0.013								Raird, et al, 1996
Industrial	14	45.5	60.5			0.30		0.99			0.28	0.22	0.245	0.015	0.015								Raird, et al, 1996

TABLE W.1
Some EMC Values as Reported in Literature

Land Use	BOD (mg/L)	COD (mg/L)	TSS (mg/L)	Total Dissolved Solids (mg/L)	Total Nitrogen (mg/L)	Nitrate and Nitrite Nitrogen (mg/L)	Nitrate Nitrogen (mg/L)	TKN (mg/L)	Ammonia Nitrogen (mg/L)	Org. Nitrogen (mg/L)	Total Phosphorus (mg/L)	Diss. Phosphorus (mg/L)	Zinc (mg/L)	Copper (mg/L)	Lead (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Nickel (mg/L)	Fecal Coliform - Geometric Means (counts/100ml)	Comment	Reference	
Transportation	6.4	59	73.5	194		0.56		1.50			0.22	0.10	0.060	0.011	0.011							Raird, et al, 1996
Cropland	4	----	107	1225		1.60		1.70			1.30	----	0.016	0.002	0.002							Raird, et al, 1996
Rangeland	0.5	----	1	245		0.40		0.20			<0.01	----	0.006	<10	0.005							Raird, et al, 1996
Undev/Open	----	40	70	----		0.54		0.96			0.12	0.05	----	----	0.002							Raird, et al, 1996
West Watershed, Atlanta, GA																						
Forest/Open Space	5.0		70						0.2		0.1		0.04	0.00	0.00	0.000				500 Based on a non-statistical review and best professional judgment	CH2M HILL, W.L. Jorden, and CDM.	
Residential-Low	15		180						0.2		0.4		0.10	0.03	0.03	0.005				8,700 Based on a non-statistical review and best professional judgment	CH2M HILL, W.L. Jorden, and CDM.	
Residential-Medium	15		180						0.2		0.4		0.10	0.03	0.03	0.005				8,700 Based on a non-statistical review and best professional judgment	CH2M HILL, W.L. Jorden, and CDM.	
Residential-High	15		180						0.2		0.4		0.10	0.03	0.03	0.005				8,700 Based on a non-statistical review and best professional judgment	CH2M HILL, W.L. Jorden, and CDM.	
Multifamily Residential	15		180						0.2		0.4		0.10	0.03	0.03	0.005				8,700 Based on a non-statistical review and best professional judgment	CH2M HILL, W.L. Jorden, and CDM.	

TABLE IV.1
Some EMC Values as Reported in Literature

Land Use	BOD (mg/L)	COD (mg/L)	TSS (mg/L)	Total Dissolved Solids (mg/L)	Total Nitrogen (mg/L)	Nitrate and Nitrite Nitrogen (mg/L)	Nitrate Nitrogen (mg/L)	TKN (mg/L)	Ammonia Nitrogen (mg/L)	Org. Nitrogen (mg/L)	Total Phosphorus (mg/L)	Diss. Phosphorus (mg/L)	Zinc (mg/L)	Copper (mg/L)	Lead (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Nickel (mg/L)	Fecal Coliform - Geometric Means (counts/100ml)	Comment	Reference
Institutional	10		140						0.5		0.3		0.14	0.01	0.02	0.005				1,400 Based on a non-statistical review and best professional judgment	CH2M HILL, W.L. Jorden, and CDW.
Commercial	10		130						0.5		0.3		0.12	0.01	0.02	0.005				1,400 Based on a non-statistical review and best professional judgment	CH2M HILL, W.L. Jorden, and CDW.
Industrial	14		88						0.4		0.3		0.16	0.02	0.02	0.006				2,300 Based on normal means of ARSWCS monitoring data (1992-1996) for industrial land use	CDM, 1996
Water/Wetland	5.0		70						0.2		0.1		0.20	0.00	0.00	0.000				500 Based on a non-statistical review and best professional judgment	CH2M HILL, W.L. Jorden, and CDW.
Highway	14		140						0.5		0.3		0.14	0.01	0.02	0.005				1,400 Based on a non-statistical review and best professional judgment	CH2M HILL, W.L. Jorden, and CDW.
Construction Area	13		1000						0.2		0.2		0.40	0.05	0.02	0.008				1,000 Based on a non-statistical review and best professional judgment	CH2M HILL, W.L. Jorden, and CDW.

TABLE W.1
Some EMC Values as Reported in Literature

Land Use	BOD (mg/L)	COD (mg/L)	TSS (mg/L)	Total Dissolved Solids (mg/L)	Total Nitrogen (mg/L)	Nitrate and Nitrite Nitrogen (mg/L)	Nitrate Nitrogen (mg/L)	TKN (mg/L)	Ammonia Nitrogen (mg/L)	Org. Nitrogen (mg/L)	Total Phosphorus (mg/L)	Diss. Phosphorus (mg/L)	Zinc (mg/L)	Copper (mg/L)	Lead (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Nickel (mg/L)	Fecal Coliform - Geometric Means (counts/100ml)	Comment	Reference
Florida																					
Commercial	7.86	67	93.83	149.7	1.82				1.75		0.206	----	0.3509	0.2305	0.558	0.00815					
Highway	6.7	111.7	38.5	102.5	2				----		0.281	----	0.1893	0.0359	0.3985	0.007267					
Industrial	17.54	186.8	517.7	173.1	----				----		1.71	----	0.8801	0.03149	0.3966	----					
Open/Recreation	1.45	----	11.1	----	1.25				----		0.05	----	0.006	----	----	----					
Residential	10.55	66.25	47.16	105	2.53				1.67		0.5304	----	0.0582	0.016	0.104	0.00353					
Washington																					
In-pipe Industrial			194								0.633		0.629	0.053							Washington State Department of Ecology, 2000
Transportation			169								0.376		0.236	0.035							Washington State Department of Ecology, 2000
Commercial			92								0.391		0.168	0.032							Washington State Department of Ecology, 2000
Residential			64								0.365		0.108	0.014							Washington State Department of Ecology, 2000
Open			58								0.166		0.025	0.004							Washington State Department of Ecology, 2000
North Carolina Recommended EMCs by Land Use for Mean Values (CH2M HILL, 2000)																					
Forested Wetland	4.1	29.4	19	52	1.1				0.4		0.2	0.1	0.0229	0.0053	0.003	0.0005	0.0028	0.0047			CH2M HILL, 2000
Cropland and Pasture	4.2	29.7	19.2	52	1.1				0.4		0.2	0.1	0.0235	0.0054	0.0031	0.0005	0.0029	0.0047			CH2M HILL, 2000

TABLE IV.1
Some EMC Values as Reported in Literature

Land Use	BOD (mg/L)	COD (mg/L)	TSS (mg/L)	Total Dissolved Solids (mg/L)	Total Nitrogen (mg/L)	Nitrate and Nitrite Nitrogen (mg/L)	Nitrate Nitrogen (mg/L)	TKN (mg/L)	Ammonia Nitrogen (mg/L)	Org. Nitrogen (mg/L)	Total Phosphorus (mg/L)	Diss. Phosphorus (mg/L)	Zinc (mg/L)	Copper (mg/L)	Lead (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Nickel (mg/L)	Fecal Coliform - Geometric Means (counts/100ml)	Comment	Reference
Upland Forest	4.3	30.4	19.7	52	1.1	0.4	0.4	0.1	0.1	0.5	0.2	0.1	0.0248	0.0056	0.0032	0.0005	0.0029	0.0047			CH2M HILL, 2000
Urban Open	4.4	30.7	20	52	1.1	0.4	0.4	0.1	0.1	0.5	0.2	0.1	0.0254	0.0057	0.0032	0.0005	0.0029	0.0047			CH2M HILL, 2000
Unsewered Low Density Res.	4.5	31.3	20.5	52	1.1	0.4	0.4	0.1	0.1	0.5	0.2	0.1	0.0268	0.0059	0.0034	0.0005	0.003	0.0048			CH2M HILL, 2000
Communications and Utilities	4.6	31.7	20.7	52	1.2	0.4	0.4	0.1	0.1	0.5	0.2	0.1	0.0275	0.006	0.0034	0.0005	0.003	0.0048			CH2M HILL, 2000
Low Density Residential	5	33.4	22.1	52	1.2	0.4	0.4	0.1	0.1	0.6	0.2	0.1	0.0312	0.0065	0.0038	0.0005	0.0031	0.0048			CH2M HILL, 2000
Transitional/Construction	6.4	39.2	26.8	52	1.5	0.5	0.5	0.2	0.2	0.7	0.2	0.1	0.0459	0.0083	0.005	0.0005	0.0035	0.005			CH2M HILL, 2000
Medium Density Residential	7.5	43.5	30.5	52	1.7	0.6	0.6	0.2	0.2	0.7	0.2	0.1	0.0594	0.0097	0.0061	0.0006	0.0038	0.005			CH2M HILL, 2000
Unsewered Medium Density Residential	7.5	43.5	30.5	52	1.7	0.6	0.6	0.2	0.2	0.7	0.2	0.1	0.0594	0.0097	0.0061	0.0006	0.0038	0.005			CH2M HILL, 2000
Institutional	11.3	56.7	41.9	52	2.4	0.7	0.7	0.4	0.4	1	0.3	0.2	0.1129	0.0147	0.0099	0.0006	0.0045	0.0053			CH2M HILL, 2000
High Density Residential	13.3	63.1	47.7	52	2.7	0.8	0.8	0.4	0.4	1.1	0.3	0.2	0.1459	0.0173	0.012	0.0007	0.0049	0.0054			CH2M HILL, 2000
Multifamily Density Residential	13.3	63.1	47.7	52	2.7	0.8	0.8	0.4	0.4	1.1	0.3	0.2	0.1459	0.0173	0.012	0.0007	0.0049	0.0054			CH2M HILL, 2000
Commercial and Services	15.7	70.1	54.2	52	3.1	0.9	0.9	0.5	0.5	1.3	0.4	0.2	0.1887	0.0204	0.0145	0.0007	0.0053	0.0055			CH2M HILL, 2000
Highways	17	74	57.8	52	3.3	1	1	0.6	0.6	1.3	0.4	0.2	0.2146	0.0221	0.016	0.0007	0.0055	0.0055			CH2M HILL, 2000
Industrial	17	74	57.8	52	3.3	1	1	0.6	0.6	1.3	0.4	0.2	0.2146	0.0221	0.016	0.0007	0.0055	0.0055			CH2M HILL, 2000

Location	Land Use Category	BOD (lbs/ac/yr)	TSS (lbs/ac/yr)	TN (lbs/ac/yr)	TP (lbs/ac/yr)	Lead (lbs/ac/yr)	Cadmium (lbs/ac/yr)	Chromium (lbs/ac/yr)	Copper (lbs/ac/yr)	Mercury (lbs/ac/yr)	Nickel (lbs/ac/yr)	Zinc (lbs/ac/yr)		
Florida	Low density residential	8.83	28.00	4.43	0.47							Median value	Northeast Florida Water Management District, 1994	
	Multi-family residential	42.10	344.10	7.07	1.97							Median value	Northeast Florida Water Management District, 1994	
	Commercial	53.90	586.50	9.48	2.05							Median value	Northeast Florida Water Management District, 1994	
	Highway	87.40	980.90	6.25	2.50							Median value	Northeast Florida Water Management District, 1994	
	Industrial	46.80	696.00	9.93	4.77							Median value	Northeast Florida Water Management District, 1994	
	Open Lands	3.09	19.40	2.32	0.16							Median value	Northeast Florida Water Management District, 1994	
	Wetlands	13.90	24.30	4.90	0.22							Median value	Northeast Florida Water Management District, 1994	
	Pasture	14.85	591.15	5.60	0.50							Median value	Northeast Florida Water Management District, 1994	
	Agriculture	16.03	1997.03	15.65	0.94							Median value	Northeast Florida Water Management District, 1994	
	Woodland	4.48	57.4	2.78	0.13							Median value	Northeast Florida Water Management District, 1994	
	Wisconsin, Milwaukee	Over 95% Agricultural				0.92							Median value	Panuska and Lillie, 1995
		Over 75% Agricultural				0.66							Median value	Panuska and Lillie, 1995
		Over 50% Agricultural				0.50							Median value	Panuska and Lillie, 1995
Mixed					0.86							Median value	Panuska and Lillie, 1995	
Forest					0.08							Median value	Panuska and Lillie, 1995	
Urban					0.46							Median value	Panuska and Lillie, 1995	

Location	Land Use Category	BOD (lbs/ac/yr)	TSS (lbs/ac/yr)	TN (lbs/ac/yr)	TP (lbs/ac/yr)	Lead (lbs/ac/yr)	Cadmium (lbs/ac/yr)	Chromium (lbs/ac/yr)	Copper (lbs/ac/yr)	Mercury (lbs/ac/yr)	Nickel (lbs/ac/yr)	Zinc (lbs/ac/yr)			
Wisconsin, Milwaukee - Urban Land Use	Freeways		873.61		0.93	4.43						Apr - Nov	Novotny and Olem, 1997		
	Industrial		853.98		1.33	2.41						Apr - Nov	Novotny and Olem, 1997		
	Commercial		853.98		1.33	2.41						Apr - Nov	Novotny and Olem, 1997		
	Parking Lots		404.24		0.70	0.86						Apr - Nov	Novotny and Olem, 1997		
	High density residential		434.58		1.00	0.80						Apr - Nov	Novotny and Olem, 1997		
	Medium density residential		192.75		0.52	0.21						Apr - Nov	Novotny and Olem, 1997		
	Low density residential		9.82		0.04	0.01						Apr - Nov	Novotny and Olem, 1997		
	Parks		2.68		0.03	0.01							Apr - Nov	Novotny and Olem, 1997	
	PLUARG - Storm Sewers Loads	I. Low Pollution	30.34	348.02	8.03	1.43	0.14	0.01	0.02	0.04	0.03	0.03	0.51	Includes low- and medium-density residential land uses (<125 people/ha) and limited-nuisance industrial activities (whole-sale, warehouses).	Novotny and Olem, 1997
		II. Intermediate Pollution Loads	80.31	321.25	9.99	3.03	0.16	0.01	0.02	0.04	0.04	0.03	0.56	Include high-density residential (>125 people/ha) and commercial land use.	Novotny and Olem, 1997
		III: Highest Pollution Loads	30.34	599.66	6.96	1.96	0.24	0.02	0.04	0.07	0.06	0.03	0.87	Includes medium- and high-intensity industrial uses.	Novotny and Olem, 1997
		IV: Lowest Pollution Potential	1.00	9.99	0.20	0.04	0.02	0.00	0.00	0.01	0.01	0.00	0.07	Include parks and playgrounds. In many cases pollution loads from these lands are negligible.	Novotny and Olem, 1997

Location	Land Use Category	BOD (lbs/ac/yr)	TSS (lbs/ac/yr)	TN (lbs/ac/yr)	TP (lbs/ac/yr)	Lead (lbs/ac/yr)	Cadmium (lbs/ac/yr)	Chromium (lbs/ac/yr)	Copper (lbs/ac/yr)	Mercury (lbs/ac/yr)	Nickel (lbs/ac/yr)	Zinc (lbs/ac/yr)	
PLUARG - Combined Sewers	I. Low Pollution Loads	119.58	689.79	28.11	9.10	0.14	0.01	0.02	0.06	0.04	0.03	0.57	Includes low- and medium-density residential land uses (<125 people/ha) and limited-nuisance industrial activities (wholesale, warehouses).
		261.46	599.66	32.57	10.35	0.16	0.02	0.03	0.06	0.04	0.03	0.63	Include high-density residential (>125 people/ha) and commercial land use.
		99.94	660.34	30.79	9.73	0.25	0.02	0.04	0.10	0.07	0.05	0.97	Includes medium- and high-intensity industrial uses.
		1.43	9.99	0.98	0.30	0.02	0.00	0.00	0.01	0.01	0.00	0.08	Include parks and playgrounds. In many cases pollution loads from these lands are negligible.

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