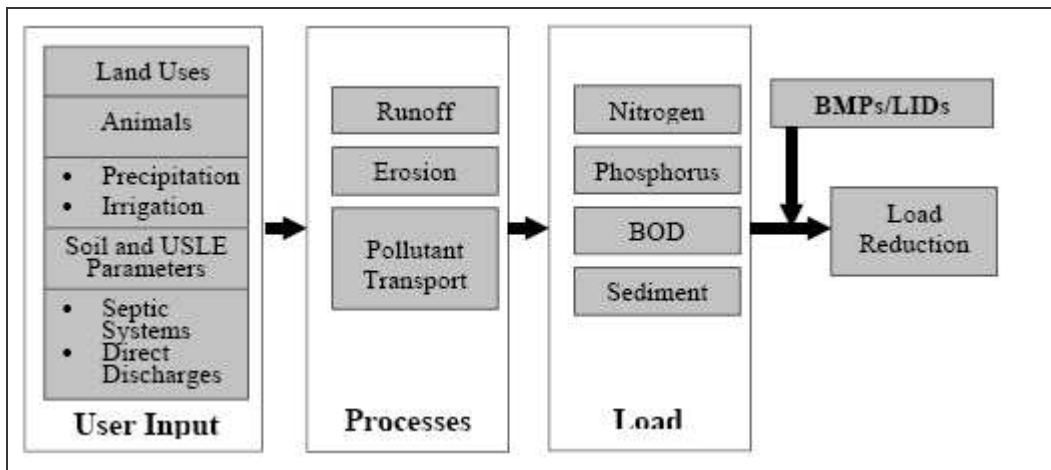


The STEPL program provides a user-friendly Visual Basic (VB) interface to create a customized spreadsheet-based model in Microsoft (MS) Excel. It employs simple algorithms to calculate nutrient and sediment loads from different land uses and the load reductions that would result from the implementation of various best management practices (BMPs), including Low Impact Development practices (LIDs) for urban areas. It computes surface runoff; nutrient loads, including nitrogen, phosphorus, and 5-day biological oxygen demand (BOD5); and sediment delivery based on various land uses and management practices. The land uses considered are urban land, cropland, pastureland, feedlot, forest, and a user-defined type. The pollutant sources include major nonpoint sources such as cropland, pastureland, farm animals, feedlots, urban runoff, and failing septic systems. The types of animals considered in the calculation are beef cattle, dairy cattle, swine, horses, sheep, chickens, turkeys, and ducks. For each watershed, the annual nutrient loading is calculated based on the runoff volume and the pollutant concentrations in the runoff water as influenced by factors such as the land use distribution and management practices. The annual sediment load (from sheet and rill erosion only) is calculated based on the Universal Soil Loss Equation (USLE) and the sediment delivery ratio. The sediment and pollutant load reductions that result from the implementation of BMPs are computed using the known BMP efficiencies.

Figure 2 shows the overall spreadsheet structure of STEPL. It is composed of worksheets for input and output interaction with the user as well as hidden worksheets to handle intermediate calculations. The input data include state name, county name, weather station, land use areas, agricultural animal numbers, manure application months, population using septic tanks, septic tank failure rate, direct wastewater discharges, irrigation amount/frequency, and BMPs for simulated watersheds. When local data are available, users may choose to modify the default values for USLE parameters, soil hydrologic group, nutrient concentrations in soil and runoff, runoff curve numbers, and detailed urban land use distribution. Pollutant loads and load reductions are automatically calculated for total nitrogen, total phosphorus, BOD5, and sediment.



Using pollutant loading models has pros and cons. Measured data are preferable to simulated data, especially when characterizing the magnitude of a pollution problem, because accurate concentration values are important. Models cannot substitute for good field-sampling programs, but they can be used to extrapolate and to augment field-sampling results.

To ensure quality results from a modeling effort, sensitivity analyses should be performed when uncertainty exists regarding data quality or model assumptions. Also, models should be calibrated and validated if possible using measured values (field monitoring). This process is labor-intensive and can add to the expense of the modeling effort, but it is worthwhile to ensure accuracy when making management decisions.

Table 1.8: Typical pollutant concentrations found in urban storm water (adapted from MDE, 1999, and Terrene Institute, 1994).

Typical Pollutants Found in Storm Water Runoff	Units	Residential ^a	Mixed ^a	Commercial ^a	General Urban ^b
Total suspended solids	mg/L	101	67	69	80 ^c
Total phosphorus	mg/L	383	263	201	0.30 ^c
Total nitrogen	mg/L	–	–	–	2.0 ^c
Total Kjeldahl nitrogen	mg/L	1.9	1.3	1.2	–
Nitrate + Nitrite	µg/L	736	558	572	–
Total organic carbon	mg/L	–	–	–	12.7 ^c
Biological oxygen demand	mg/L	10	7.8	9.3	–
Chemical oxygen demand	mg/L	73	65	57	–
Fecal coliform bacteria	MPN/100 mL	–	–	–	3,600 ^c
<i>E. coli</i> bacteria	MPN/100 mL	–	–	–	1,450 ^c
Petroleum hydrocarbons	mg/L	–	–	–	3.5 ^c
Oil and grease	mg/L	–	–	–	2 to 10 ^d
Cadmium	µg/L	–	–	–	2 ^c
Copper	µg/L	33	27	29	10 ^c
Lead	µg/L	144	114	104	18 ^c
Zinc	µg/L	135	154	226	140 ^c
Chlorides (winter only)	mg/L	–	–	–	230 ^c
Insecticides	µg/L	–	–	–	0.1 to 2.0 ^c
Herbicides	µg/L	–	–	–	1 to 5.0 ^c

^a Source: USEPA, 1983.

^b These concentrations represent mean or median storm concentrations measured at typical sites and may be greater during individual storms. Also note that mean or median runoff concentrations from storm water “hotspots” are 2 to 10 times higher than those shown here. Units: mg/L = milligrams/liter, µg/L = micrograms/l, MPN = most probable number.

^c Source: MDE, 1999.

^d Source: Terrene Institute, 1994.