Stochastic Empirical Loading and Dilution Model (SELDM) Summary

http://ma.water.usgs.gov/fhwa/

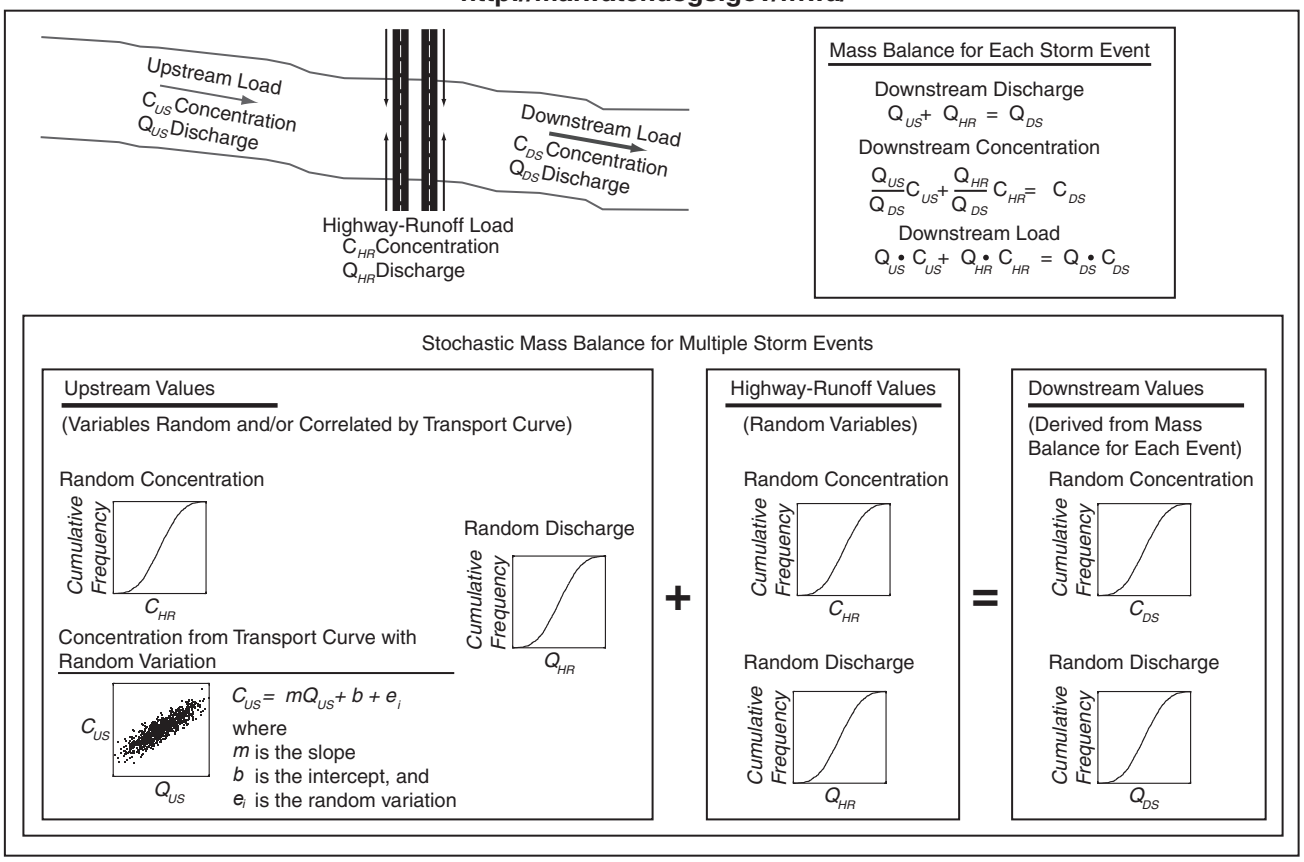

Figure 1. Schematic diagram showing the stochastic mass-balance approach for estimating discharge,concentration, and loads of water-quality constituents upstream of a highway outfall, from the highway,and downstream of a highway-runoff outfall.

Components of Equation: SELDM uses Monte Carlo methods with local or regional statistics to generate a population of concentrations and discharge volumes that can be used to estimate storm loads and annual loads from highway runoff and resultant downstream concentrations and loads. The permutations and combinations of upstream and highway runoff concentrations and loads indicates the potential risk of water-quality exceedances downstream from a highway site by storm event. A lake package can be used to generate a set of annual flows and loads for the highway and the lake basin. The components of this research effort and current status are as follows:

1. **Storm Event Precipitation:** Precipitation for each modeled storm will be generated from synoptic statistics for 15-rain zones based on data from 2,610 NOAA stations with at least 25 years of record during the period 1965-2006. The user may select statistics by rain zone or by proximity to one or more NOAA weather stations.

2. **Upstream Discharge:** Upstream discharge will be generated using prestorm streamflow, precipitation statistics and runoff-coefficient estimates. Prestorm streamflow will be generated using statistics from 2,873 USGS streamflow-gaging stations with at least 20 years of record during the period 1960-2004 Runoff-coefficient statistics are derived from a database with 6,142 storm events from 306 monitoring sites. The user may calculate storm-runoff statistics with information about upstream watershed characteristics and streamflow data by ecoregion or by proximity to one or more nearby gaging stations.

3. **Upstream Water Quality:** More than 1,876,000 paired discharge and water-quality measurements from 24,581 USGS surface-water-quality monitoring stations for 21 constituents commonly studied in highway- and urban-runoff studies were compiled from USGS data. The Kendall-Theil Robust Line software was published to enable water-quality transport-curve development. The user may estimate upstream water-quality by use of water-quality transport curves with a stochastic error component or with random runoff-quality statistics.

4. **Quantity and Quality of Highway Runoff:** The highway-runoff database (HRBD) was developed to serve as a data warehouse for current and future highway-runoff data sets. The HRBD currently includes data for 39,713 event mean concentration (EMC) measurements (including over 100 water-quality constituents) from 2,650 storm events, monitored at 103 highway-runoff monitoring sites in the contermi-nous United States, as documented in 7 selected highway-runoff data sets. The user may estimate the quality and quantity of runoff by use of robust regresstion equations with a stochastic error component or with random runoff-quality statistics.

5. **Modification of highway runoff quality and quantity by BMPs:** The BMP module is designed to model flow reduction, hydrograph extension and concentration modification for each event. The user may specify these BMP treatment factors by use of random population statistics with or without rank correlation to inflow volumes or concentrations.

6. **SELDM Application:** This Monte Carlo model is being implemented as a database application with a graphical-user interface to facilitate generation of input-data sets from regional data by ecoregion based on the latitude and longitude of the site of interest. This approach also facilitates scenario testing and sensitivity analysis.