

STREADO User's Guide

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This User's Guide is to be used in conjunction with the STREADO manual. While the manual gives a detailed discussion of the code and its equations, this guide is written to discuss the practicalities of operating the code.

Just to remind you what the code does, STREADO calculates the steady-state dissolved oxygen deficit profile of a stream, based on CBOD, NBOD, SOD, and DO sources and sinks along the stream (I assume you already know what these acronyms are - if you don't you shouldn't be running this code). STREADO allows the stream to be broken down into reaches, where it is assumed that various stream coefficients are constant throughout the reach (e.g., depth, velocity, and DO source/sink rates). Point sources can also be specified at the beginning of each reach, such as heavy industry or sewage treatment plant outfalls. Thus, reaches allow you to break down a stream into defined segments, with each segment delimited by a change in a stream's characteristics. With STREADO you can use up to 11 reaches to define your stream (i.e., use the first reach as the initial conditions for your stream and remaining the 10 reaches to define your stream).

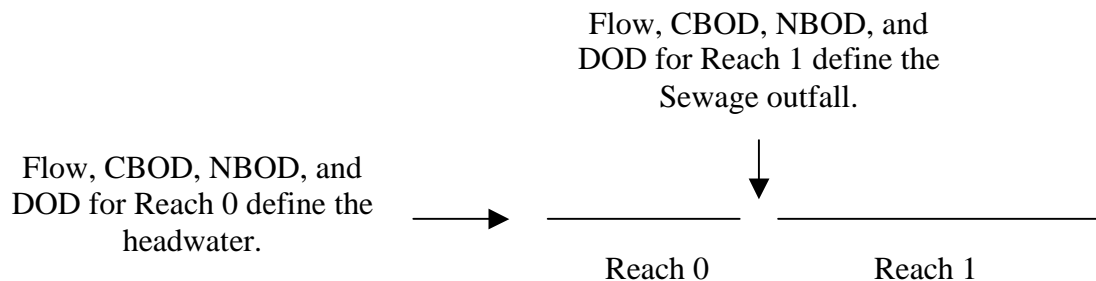
"Ok, ok, now how do I use this code?"

1. **STREADO executable**: STREADO is compiled to run under MS Windows 95/98. It should also work under Windows NT. Just double-clicking on its icon under Explorer and/or File Manager. Note that the input file should be in the same directory as the executable or the code will not run.
2. **Input/output files**: STREADO prompts you for the names of the input and output files. The input file should reside in the same directory as STREADO, and the input and output filenames should be in the DOS 8.3 format, e.g., "filename.txt". If you are going to use Microsoft Excel for analyzing the output, I recommend that you give the output filename the extension ".csv". This is because the output file is formatted as comma-delimited text, and the ".csv" extension is the default extension which Excel recognizes as a comma delimited (it should show up with an Excel icon under Explorer or File Manager in Windows). Then all you have to do is double-click on the output file, and it will automatically open up under Excel.
3. **Input file format**: An example input file has been provided along with this User's Guide. I recommend that you copy this file and edit it as required for your specific streams. As seen in the example input file, it is organized as follows: (1) a one-line title, (2) a constants data set, and (3) a data set for each reach.

The input file is formatted such that there is one input variable per line, and they must be in the order as shown in the example input file (the input variables and their units

are defined in the example input file, and additional detail on the variables is provided in the manual). If you skip a variable in the input file, the code will stop and spit-out an error message. Two other requirements are (1) an asterisk '*' must be the first character in the line preceding each input block (i.e., the constants block and the data for each reach), and (2) each reach must be numbered sequentially, starting with zero. If you don't follow these simple rules, the code will yell at you. One other thing – make sure that the input file is in text format. Don't edit it and save it as a Microsoft Word document. Best thing is to edit the input file using Microsoft Notepad (it comes with the Windows operating system).

4. **Data on inflows for each reach:** The data set for each reach has two types of information associated with it. The first is data associated with an inflow specified at the beginning of the reach, and the second is data associated with the properties of the reach itself. The data that defines the inflow is the flow rate, the initial DO deficit, the initial CBOD, and the initial NBOD. All other variables are associated with the reach itself. Note that for Reach 0 (i.e., the headwater of your stream region of interest), the inflow data will be the initial conditions for your stream. As an example, consider a stream with a sewage treatment plant outfall:



For this scenario, STREADO automatically takes the flow, CBOD, NBOD, and DOD data at the end of Reach 0 and mixes it with the sewage outfall data to provide the initial conditions for Reach 1. (Note that STREADO is a one-dimensional code, and thus assumes that the inflow completely mixes with the stream at the discharge point).

5. **Reach-specific data:** As stated under item 5 above, the second grouping of data is associated with the properties of the reach itself. This data includes the reach dimensions length, depth, velocity (width is the free variable); the various source/sink coefficients K_a , K_d , K_r , K_n , P_a , R , and S_b (see the input file or manual for a description); data required to calculate the source/sink coefficients including area averaged SOD rate, light extinction coefficient, and the average daily solar radiation; and the number of elements to grid the reach over (nsteps - a bigger number gives a finer numerical resolution and requires more computer memory).

Note that you can either enter any of the DO source/sink coefficients directly, or let STREADO calculate them using empirical relations (see the manual for a discussion of the equations used by STREADO). To let STREADO calculate a source/sink

coefficient, set that variable to a negative number in the input file. Note that if you want STREADO to calculate Pa, R, or Sb, then auxiliary data is required; if you enter any of these coefficients directly, then the associated auxiliary data is not used (i.e., value in the input file does not matter). This auxiliary data is given in the following table.

Data required by STREADO to calculate the specified coefficients

Coefficient	Auxiliary Data
Pa	P, Is, f, aop, Gmax, Ke, Ia
R	aop, P
Sb	Areal_Sb

The other coefficients (Ka, Kd, Kr, Kn) are calculated using flow, depth, and velocity data. Note that if you want STREADO to calculate any of the source/sink coefficients, then the stream temperature is required so that STREADO can make temperature corrections. If you specify any of the source/sink coefficients, then it is assumed that they are the correct values for the stream and no temperature correction is made.

Finally, there have been two additions to the code that are not documented in the manual. The first is the input variable DO_in, which allows you to add DO directly at the beginning of each reach (e.g., you can add aerators at the beginning of the reach that add a given amount of oxygen). The units for DO_in are in kg/hr. Note that if you add more DO than there is deficit, the DO deficit is set to zero. This is because you cannot aerate beyond the solubility limit of oxygen.

The second is the input variable DO_solubility, which is the solubility of oxygen for your stream temperature, in mg/L. The dissolved oxygen equations all use the dissolved oxygen deficit, rather than the dissolved oxygen concentration. The code has been modified to output the actual dissolved oxygen concentration, which is the difference between the solubility of oxygen and the dissolved oxygen deficit, rather than the dissolved oxygen deficit.

6. **Output file format:** An example output file has been provided along with this User's Guide. The output file is formatted as comma-delimited text, with the columns representing different pieces of data (Reach number, distance, CBOD, NBOD, and Dissolved Oxygen). This output file is easily imported into spreadsheet programs for plotting. Also, as I stated earlier, if you use the extension .csv for your output file, such as "output.csv", then Microsoft Excel automatically recognizes the file as a comma-delimited file and will open it right up into a spreadsheet.