This is a README file orienting you to the different files of the network-based, nitrate and organic carbon code developed by Jon Czuba (Virginia Tech; as of January 16, 2018).

This code is capable of reproducing the results (with some work of commenting/uncommenting code by the end user) described in the following publication:

Czuba, J.A., A.T. Hansen, E. Foufoula-Georgiou, and J. Finlay (2018), Contextualizing wetlands within a river network to build understanding and inform management of nitrate removal in watersheds, Water Resources Research.

The code is currently setup to run a high flow condition for the Le Sueur Basin. The code will read in auxiliary data files and display a plot of nitrate concentration. This code is written in Matlab and takes advantage of the Statistics Toolbox (necessary) and the Mapping Toolbox (convenient but not critical). If you do not have the Mapping Toolbox, you will receive an error, will need to uncomment this related code, and will not be able to have a spatial map of nitrate concentration plot at the end of the model run. Instead, this data can simply be exported and joined to the shapefile in ArcGIS for display. All data necessary to reproduce the results in the above paper are provided with the code and allow you to see how the model functions. When applying the model to another system, you will have to generate the input data and adapt some of the code for your study basin. This code is intended to be used by researchers with an understanding of rivers and biogeochemistry or equivalent and be experienced in the use of Matlab.

DISCLAIMER: The code provided here is offered as-is, with no guarantees or technical support. It is meant to provide an entry for the interested user to begin to produce results described in the above publications. You will need to generate your own input data and adapt some of the code for your study basin at your own risk. Jon Czuba, Virginia Tech, and any coauthors and their affiliations of the above publication are not responsible for the misuse or misinterpretation of the results generated by this code.

The files include:

***CODE:***

**WetRivNet\_Preprocessing.m**

This file provides a collection of snippets of codes (best run using cell mode) that help take a network shapefile with attributes into Matlab variables. The most important piece is to use this code to obtain a network with the following Matlab variables: LinkNum, GridID, ToNode, Length, Area, Slope, usarea. Other important network variables are created such as Connect, which is one of a number of variables that can be created for mapping out the connectivity structure of the network.

**Network\_N\_C\_direct\_calc2.m**

This is the main self-contained nitrate network model code. If you execute this file it runs for a high flow condition for the Le Sueur Basin and generates a spatial map of nitrate concentration at the end. There is a lot of commented out code which if properly uncommented can be used to probe the model in various ways as discussed in the above paper.

***DATA:***

**CALidx2.mat**

This data file contains an index for whether a particular biogeochemical field measurement was incorporated into the calibration or validation dataset.

**LS\_attributes3.mat**

This data file contains attributes of links of the Le Sueur network and its connectivity structure. This includes channel attributes and lake/wetland attributes. Many of these attributes were developed in ArcGIS from the shapefiles and some of the preprocessing code in WetRivNet\_Preprocessing.m.

**LS\_fainC.mat**

This data file contains that is the fraction of the directly contributing area classified as vegetated without row crops and excluding barren and developed lands that drains to link *i* without being intercepted by isolated wetlands.

**LS\_fainN.mat**

This data file contains that is the fraction of the directly contributing area classified as row-crop agriculture that drains to link *i* without being intercepted by isolated wetlands.

**LS\_Q\_site\_data.mat**

This data file contains measured flow, depth, width, and velocity data for the Le Sueur Basin used in model validation.

**LS\_QBrating.mat**

This data file contains parameters of the curve fit to determine channel width from discharge at the downstream Le Sueur USGS gage.

**LS\_site\_data\_v2.mat**

This data file contains measured nitrate and DOC data for the Le Sueur Basin used in model calibration and validation.

***GIS SHAPEFILES:***

**LS\_boundary1\_utm.shp**

Le Sueur Basin boundary polygon shapefile.

**LS\_channels2\_utm.shp**

Channel network of the Le Sueur Basin derived from the NHDPlusV2 dataset.

**LS\_wetlands2.shp**

Wetlands and lakes on the network in the Le Sueur Basin derived from the National Wetlands Inventory update for Minnesota, which was based on 2011 spring aerial imagery.