Watershed Engineering with Nature (EWN)
Design Workshop
With *WMS* and *GSSHA*

September 6-7, 2023

Hybrid In Person/Virtual Training sponsored by the H&H Set and EWN Programs

Web meeting information:
Join by video
URL: **https://usace1.webex.com/meet/WatershedEngineeringWithNature**

WMS Software Download:
https://www.aquaveo.com/downloads
Download Version 11.2
Licenses for WMS will be given to attendees prior to the course.

Course Materials:
WMS tutorials are available here: https://www.aquaveo.com/wms-learning-tutorials
Additional materials will be posted on the GSSHA wiki home page:
https://www.gsshawiki.com
Additional materials may be provided directly to participants at the beginning of the course

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Students will learn the basics of:
- *Gridded Surface Subsurface Hydrologic Analysis* (*GSSHA*) model, developed at the U.S. Army Corps of Engineers, Engineering Research and Development Center and the University of Wyoming
- *Dept. of Defense Watershed Modeling System* (*WMS*), developed by Aquaveo LLC
- Spatial data needed to estimate distributed *GSSHA* model parameters, including data requirements, basics of *GSSHA/WMS* and how to find and use spatial geographic data to develop GSSHA models using the *WMS Hydrologic Model Wizard*.
- How to utilize *GSSHA* and *WMS* to design EWN projects.

The *GSSHA* model with *WMS* support constitutes a complete watershed analysis system that can be used for a variety of hydrologic science and engineering computation and design evaluation, such as flood simulation, hydrologic impacts of land use change, best management practice design, and testing of flood mitigation measures.

Course Layout:
Through a combination of lectures and experiential applications, the course features the spatially distributed modeling components of this system. The course begins with an overview of the capabilities of the *WMS* to ensure maximum benefit from the hands-on portions of the class. Attendees will learn to use *WMS* to set up *GSSHA* models that include

overland flow, infiltration, distributed rainfall, hydraulic structures, and design of EWN projects.

Outcome:
Having completed this course, attendees will gain a working knowledge of the U.S. Army Corps of Engineers (USACE), Engineer Research and Development Center (ERDC) *GSSHA* model that is supported by the Watershed Modeling System (*WMS*) graphical user interface software. Attendees will also understand how, when, and why to apply the tools to specific studies as well as understand input data requirements. This class provides users with enough background to easily deploy a sophisticated hydrological model. This course will specifically focus on the development and use of GSSHA to model hydrology and hydraulics needed for EWN project design.

Who Should Attend?
The course is intended for anyone interested in watershed hydrology as it relates to design of EWN projects. Experience with hydrologic modeling and numerical methods are a plus, but not required. Some college-level background in hydrologic science and/or engineering is required.

Instructors: This short course will be taught by the *GSSHA* developers Drs. Aaron R. Byrd, Charles W. Downer, and Nawa Pradhan USACE-ERDC, Dr. Chris Smemoe from Aquaveo, and *GSSHA* application expert Mr. Stephen J. Turnbull USACE-ERDC.

Requirements: Attendees will provide their own computer. Licenses for the Watershed Modeling System 11.2 software will be provided (see download information in the heading section of this document).

Tutorial Downloads:
Students shall download most of the tutorials from: http://www.aquaveo.com/software/wms-learning-tutorials

PDFs of the presentations can be downloaded from the main page of GSSHA wiki at: http://gsshawiki.com/Gridded_Surface_Subsurface_Hydrologic_Analysis

Fees, access, other: This course is sponsored by the USACE H&H Set and EWN programs and hosted by the University of Oklahoma Norman. The course is offered free of charge to all USACE and DoD personnel. The course may be attended by others with permission of the lead course instructor. Access to the physical course may be restricted. The course will be physically conducted at the National Weather Center at University of Oklahoma, Norman. Travel funds may be available for USACE and DoD personnel.

Attached is information on local hotels in Norman. Attendees will find it easiest to fly into Will Rogers Airport in Oklahoma City and get a rental car to travel to Norman.

PDHs are awarded based on contact hours. There are 16 possible contact hours.

Information: For additional information about the course and to sign up for the course contact Aaron Byrd at aaron.r.byrd2@usace.army.mil.

Schedule: The basic course is two days.

Day 1 – Introduction to *WMS* and *GSSHA* and Building a Basic *GSSHA* Model with the Hydrologic Wizard
Day 2 – EWN project design with *GSSHA* and *WMS*

A detailed itinerary follows.

DETAILED SCHEDULE

All Times CDT (UTC-5)

Day 1 Wednesday, September 6, 2023

**Introduction to GSSHA and Building a Basic GSSHA Model
with the Hydrologic Wizard**

Start	Finish	Duration	Activity	Topic	Presentation #
08:30	08:45	15	Greeting	Introduction of Instructors/Attendees	0
08:45	09:30	45	Lecture	Introduction to Hydrologic Modeling	1
09:30	10:15	45	Lecture	Introduction to *GSSHA*	2
10:15	10:30	15	Break		
10:30	10:45	15	Lecture	*WMS* overview using digital spatial data	4
10:45	11:00	15	Lecture	Images and Projections	5
11:00	12:00	60	Workshop	Complete 2 Tutorials: Introduction to WMS.pdf, Images	
12:00	12:30	30	Demo	Using the *WMS Hydrologic Model Wizard*	
12:30	13:30	60	Lunch		
13:30	13:50	20	Lecture	Watershed delineation using DEMs	7
13:50	14:00	10	Lecture	Basic model setup in *WMS*	9
14:00	14:20	20	Lecture	Overland flow modeling in *GSSHA*	8
14:20	14:50	30	Workshop	GSSHA Initial Overland Flow Model Setup	
14:50	15:15	25	Lecture	Stream routing	12A
15:15	15:30	15	Lecture	Assigning channel properties with *WMS*	12B
15:30	15:40	10	Break		
15:40	16:10	30	Workshop	GSSHA-StreamFlow.pdf	
16:00	16:25	15	Lecture	Developing index maps with spatial data	10
16:25	16:55	30	Lecture	Modeling infiltration	11A
16:55	17:05	10	Lecture	Using *WMS* to develop infiltration inputs	11B

Day 2, Thursday, September 7, 2023
Flood Modeling with GSSHA

Start	Finish	Duration	Activity	Topic
08:30	09:30	60	Workshop	Complete 2 Tutorials: GSSHA-Infiltration.pdf, GSSHA-Roughness.pdf
09:30	09:45	15	Lecture	Hydraulic structures and embankments – Presentation 15
09:45	10:15	30	Lecture	Distributed rainfall – Presentation 14
10:15	10:30	15	Break	
10:30	10:00	30	Lecture	Sediment Transport Modeling
11:00	11:30	60	Workshop	Sediment Transport
11:30	12:00	30	Lecture	Engineering with Nature
12:00	13:00	60	Lunch	
13:00	13:45	45	Lecture	GSSHA as a Watershed EWN Design Tool
13:45	14:00	15	Presentation	EWN Tutorial
14:00	16:30	150	Workshop	GSSHA Land Use Change and EWN
16:30	16:45	15	Discussion	GSSHA Land Use Change and EWN
16:45	17:00	10	Lecture	Additional resources – Presentation 23
17:00	17:00	10	Course wrap up	