National Center for Computational Hydroscience and Engineering (NCCHE)

The University of Mississippi

FEMA

DSS-WISE™ Lite Flood Simulation Report

Sunny day breach

D0558 SPRINGWOOD LAKE DAM

SC00090

June 24, 2019

Contact Information:

DSS-WISE™ Lite modeling questions: admin@dsswiseweb.ncche.olemiss.edu

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1.0 Overview

The Decision Support System for Water Infrastructure Security (DSS-WISE™) is an integrated software package combining 2D numerical flood modeling capabilities with a series of GIS-based decision support tools. It was developed by the National Center for Computational Hydroscience and Engineering (NCCHE) at the University of Mississippi and was initiated by the US Department of Homeland Security (DHS) Science and Technology Directorate through the Southeast Region Research Initiative (SERRI) Program.

A simplified, and fully automated, version of the DSS-WISE™ software suite (DSS-WISE™ Lite Ver 1.0) was developed on behalf of the US Army Corps of Engineers (USACE) Critical Infrastructure Protection and Resilience (CIPR) Program and the DHS Office of Infrastructure Protection. This simplified dam break flood modeling capability was available to interested parties through the Dams Sector Analysis Tool (DSAT) secure web portal until November 2014. An updated version with more features was developed on behalf of Federal Emergency Management (FEMA) and is available at dsswiseweb.ncche.olemiss.edu.

The DSS-WISE™ Lite software suite, running on NCCHE servers, automatically processes input files for dam-break modeling scenarios submitted by an user. DSS-WISE™ Lite further simplifies simulations by making several general overarching assumptions in an effort to streamline data preparation and computations.

The results produced by this simplified dam-break flood simulation tool represent a rough approximation. They are not intended to replace more detailed flood inundation modeling and mapping products or capabilities developed by hydraulic and hydrologic engineers and GIS professionals.

The user is, therefore, warned that professional engineering judgment should be used in the interpolation of the results generated by this simplified and automated dam-break flood analysis.

To learn more about DSS-WISE™ and DSS-WISE™ Lite visit us at:
`https://dsswiseweb.ncche.olemiss.edu`

Disclaimer

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Elevation Datum

All reported elevations use the North American Vertical Datum of 1988 (NAVD 88).

2.0 Modeling Parameters and Conditions

2.1 Project Information

Project Name:	D0558 SPRINGWOOD LAKE DAM
Scenario Name:	Sunny day breach
NIDID:	SC00090
Scenario Description:	Sunny day breach
User e-mail:	chandlbj@dhec.sc.gov

2.2 Simulation Parameters

Simulation distance requested (miles):	5
Simulation cell size requested (m):	6.096
Simulation duration requested (days):	3

2.3 Impounding Structure(s) Characteristics

Number of Structures: 1

Structure Name:	Structure 1
Structure Type:	Embankment
Hydraulic Height (ft):	19.0
Crest Elevation (ft):	225.0
Length (ft):	808.0

2.4 Bridge(s) to be Removed

Number of Bridges: 8

Bridge Name:	Bridge 1
Length(ft):	20.0
Coordinates (Latitude/Longitude):	34.0739727801/-80.9532469511

Bridge Name:	Bridge 2
Length(ft):	20.0
Coordinates (Latitude/Longitude):	34.0737905994/-80.9532630444
Bridge Name:	Bridge 3
Length(ft):	60.0
Coordinates (Latitude/Longitude):	34.0735328797/-80.9532469511
Bridge Name:	Bridge 4
Length(ft):	51.0
Coordinates (Latitude/Longitude):	34.0704512906/-80.9537914395
Bridge Name:	Bridge 5
Length(ft):	32.0
Coordinates (Latitude/Longitude):	34.0670007555/-80.9548535943
Bridge Name:	Bridge 6
Length(ft):	32.0
Coordinates (Latitude/Longitude):	34.0669141015/-80.9547302127
Bridge Name:	Bridge 7
Length(ft):	300.0
Coordinates (Latitude/Longitude):	34.0649165908/-80.9528017044
Bridge Name:	Bridge 8
Length(ft):	32.0
Coordinates (Latitude/Longitude):	34.0603392476/-80.9515571594

2.5 Reservoir Characteristics

Selected Reservoir Point (Latitude/Longitude):	34.0759900722/-80.9520292282
Pool Elevation @ Max Storage (ft):	225.0

Maximum Storage Volume (acre-ft):	364.0
Pool Elevation @ Normal Storage (ft):	220.0
Normal Storage Volume (acre-ft):	182.0

2.6 Failure Conditions

Structure Name:	Structure 1
Structure Type:	Embankment
Failure Mode:	Total Dam Breach
Breach Type:	Embankment
Pool Elevation @ Failure (ft):	225.0
Storage Volume @ Failure (acre ft):	364.0
Breach Location (Latitude/Longitude):	34.0749964397/-80.953199239

3.0 Automated Data Preparation and Job Flow Summary

3.1 Job Flow Summary

1. Prepare Digital Elevation Model (DEM) and Land Use/Land Cover (LULC) tiles for the Area of Interest (AOI) based on requested cellsize and maximum downstream distance.
2. Burn U.S. Army Corps of Engineers (USACE) levee lines into DEM for the AOI.
3. Assign Manning's coefficients based on LULC classifications.
4. Validate user provided simulation input parameters.
5. Remove user identified bridges from the DEM.
6. Estimate reservoir bathymetry.
7. Extend impounding structures if the specified reservoir level cannot be contained.
8. Fill reservoir to specified failure elevation.
9. Prepare boundary condition and all input data for simulation.

3.2 Reservoir Bathymetry and Filling

Bathymetry estimated for the reservoir	
Given Storage Volume at Failure (acre ft):	364.0
Estimated Storage Volume at Failure (acre ft):	364.0
Volume accounted for %:	100.0

3.3 Data Sources

1. Digital Elevation Model

   Source: USGS 2013 National Elevation Dataset

   Resolution: 1/3, 1, or 2 arc second based on availability

   Vertical Datum: NAVD88

   Horizontal Datum: NAD83

2. National Land Use/Land Cover Data

   Source: USGS 2011 National Land Cover Database

   Resolution: 30 m

3. National Levee Database

   Source: USACE

3.4 Digital Elevation Model

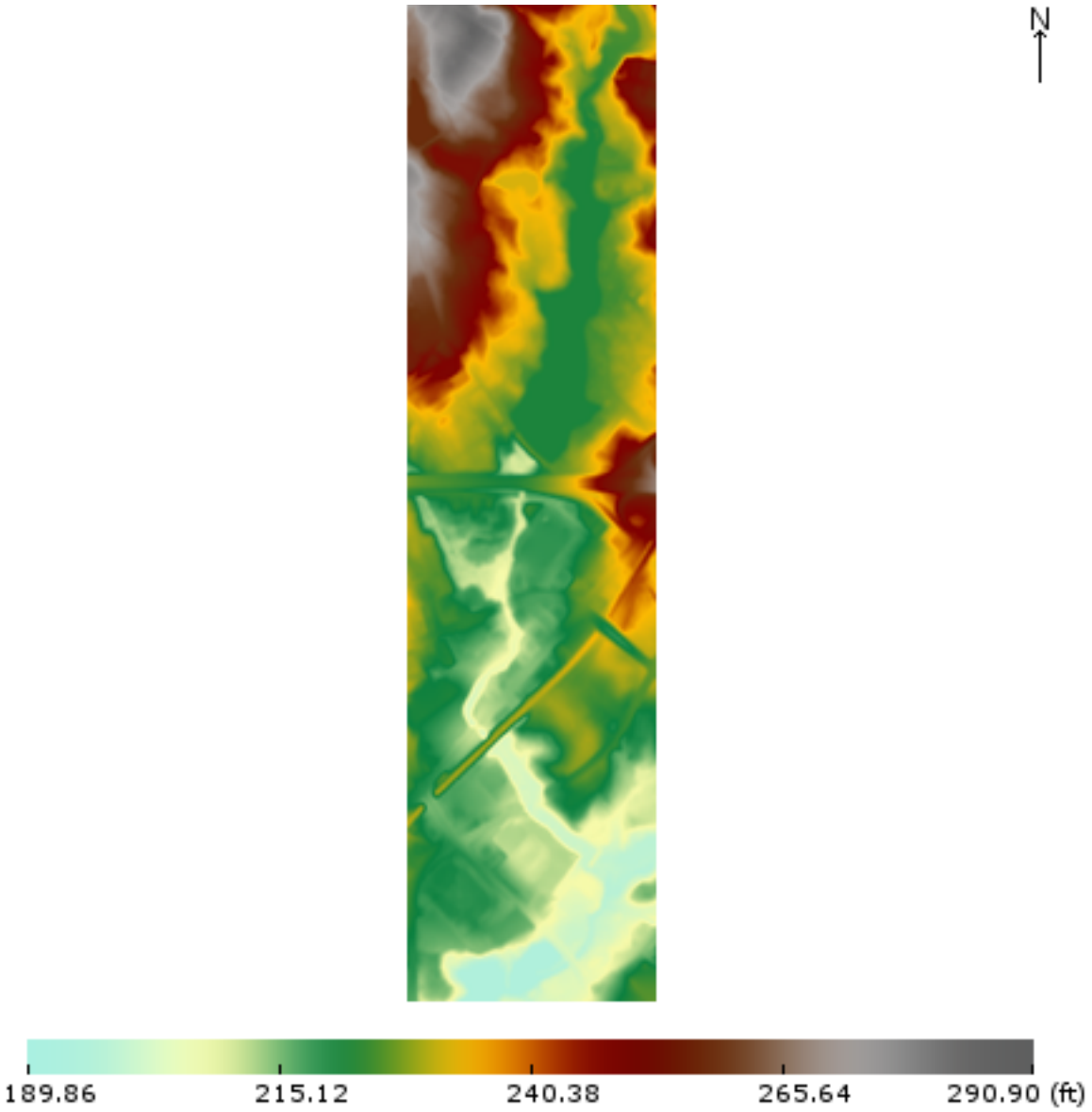

Figure 1. Map of Digital Elevation Model with Levees for AOI.

3.5 Reservoir Boundary and Breaching Structure

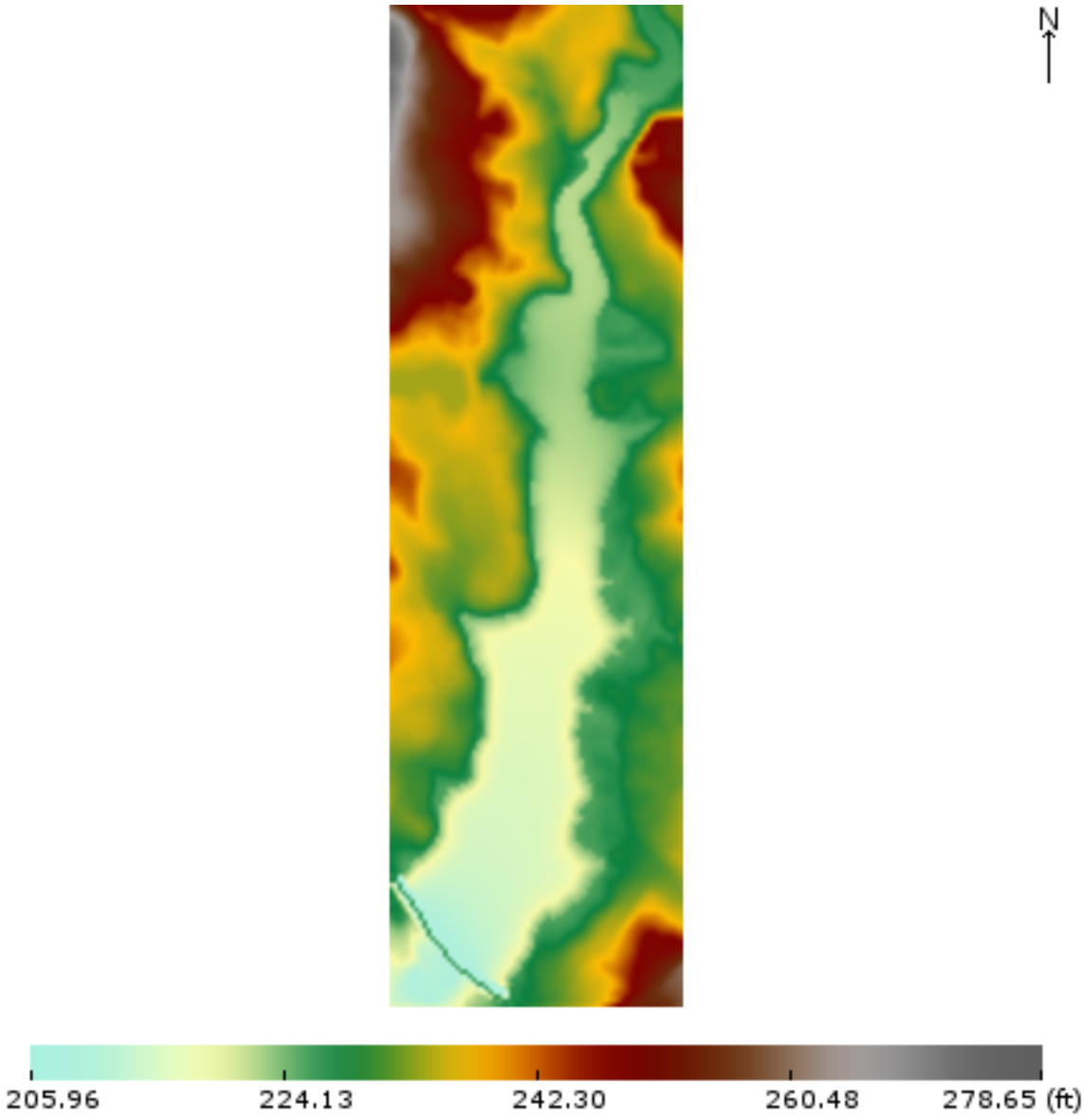

Figure 2. Map of Reservoir Boundary and Breached Structure.

3.6 Reservoir Initial Depth Profile

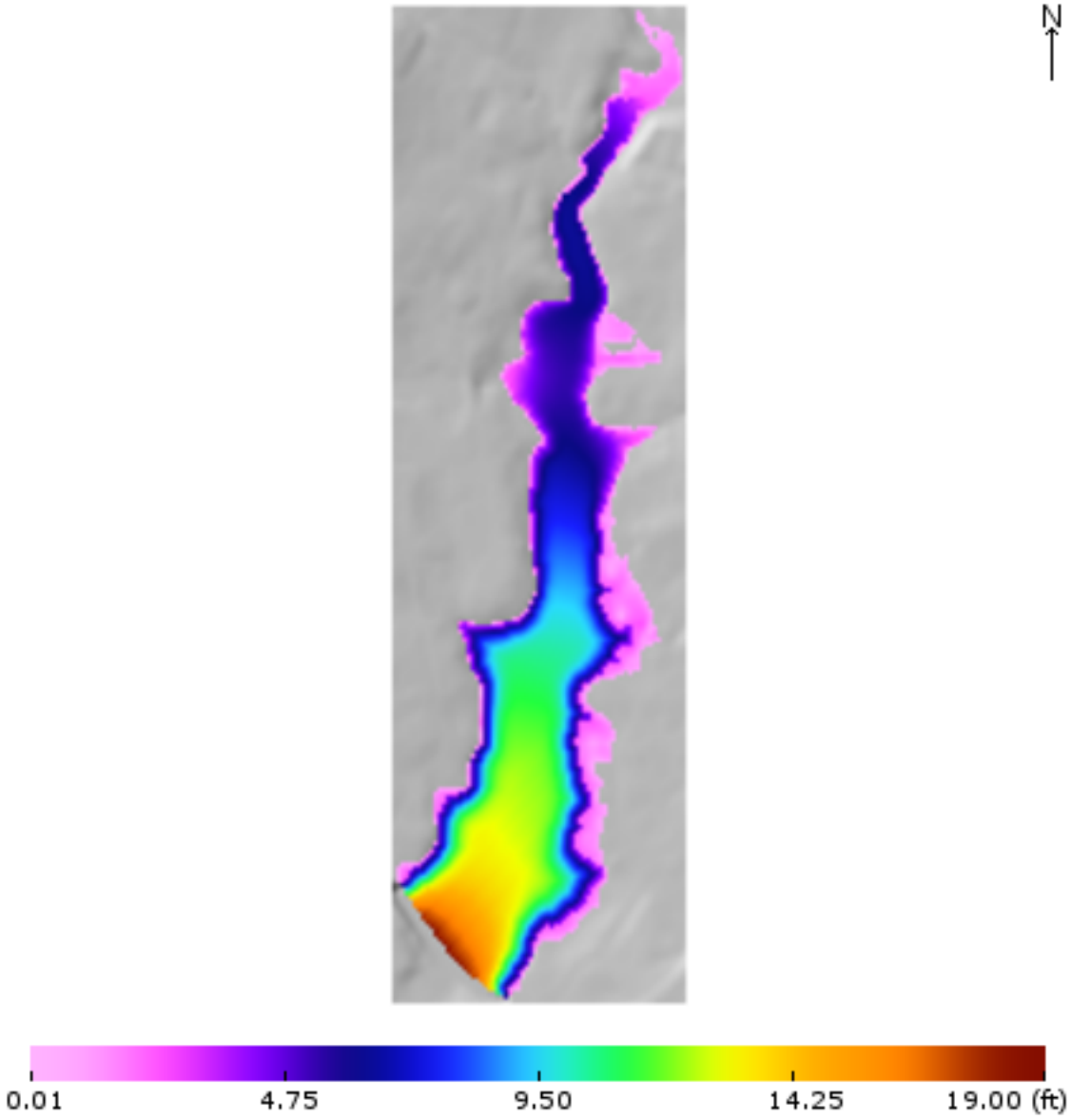

Figure 3. Map of Initial Depths in Reservoir at Failure Conditions.

3.7 Land Use/Land Cover

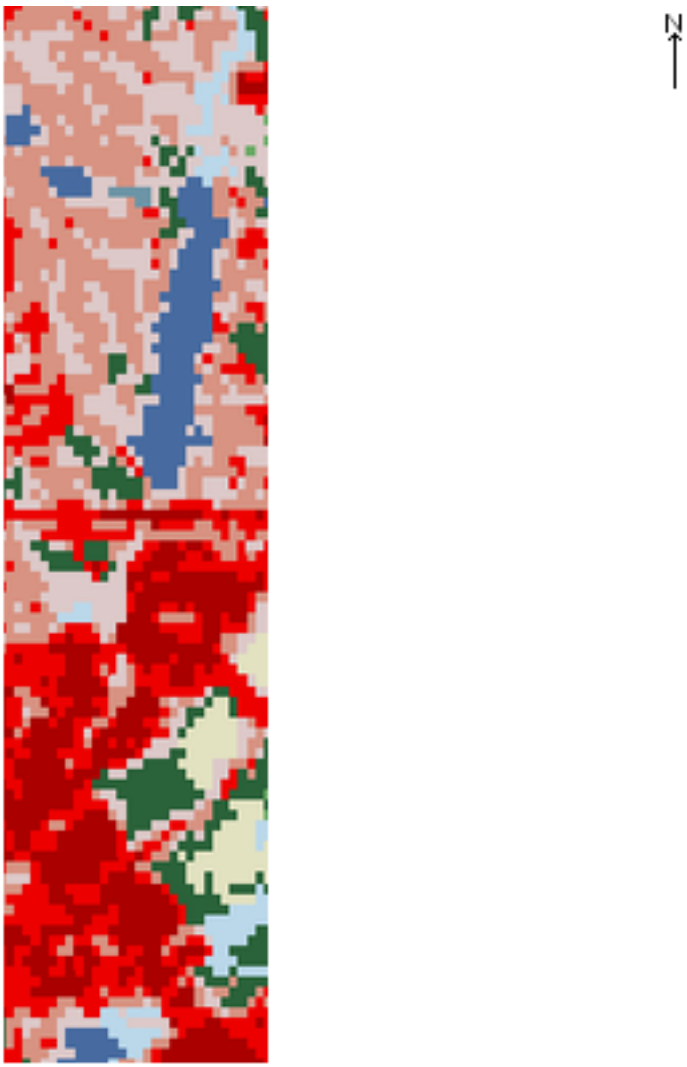

Image Dimensions: N-S: 1.947 miles E-W: 0.489 miles

Figure 4. Map of Land Use for AOI.

4.0 Simulation Results

4.1 Simulation Summary

Simulation Request Received:	09:23 AM CDT (06/24/2019)
Simulation Start Time:	09:24 AM CDT (06/24/2019)
Simulation End Time:	09:26 AM CDT (06/24/2019)
DEM resolution used for simulation (meters):	6.096
DEM resolution requested (m):	6.096
Final distance reached downstream (miles):	0.6
Maximum downstream distance requested (miles):	5
Elapsed simulation time after breach initiation (hrs):	6.1
Remaining reservoir volume at termination (%):	48.068
Termination condition:	Water stopped spreading.

4.2 Land Use and Manning's Roughness Coefficient for Inundated Area

Land Use Description	% of Inundated Area	n-Value($m^{-1/3}s$)	Code	Color
Developed, High Intensity	27.63	0.0404	24	
Developed, Medium Intensity	26.36	0.0678	23	
Developed, Open Space	21.40	0.0404	21	
Developed, Low Intensity	13.37	0.0678	22	
Evergreen Forest *	8.81	0.1000	42	
Woody Wetlands	2.38	0.1500	90	
Open Water	0.01	0.0330	11	
unclassified	0.00	0.0350	0	
Perennial Snow/Ice	0.00	0.0100	12	
Barren Land	0.00	0.0113	31	
Deciduous Forest *	0.00	0.1000	41	
Mixed Forest *	0.00	0.1200	43	
Dwarf Scrub *	0.00	0.0350	51	
Shrub/Scrub	0.00	0.0400	52	
Grassland/Herbaceuous	0.00	0.0400	71	
Sedge/Herbaceous *	0.00	0.0350	72	
Lichens *	0.00	0.0350	73	
Moss *	0.00	0.0350	74	
Hay/Pasture	0.00	0.0350	81	
Cultivated Crops	0.00	0.0700	82	
Emergent Herbaceuous Wetlands	0.00	0.1825	95	

Note: * indicates a n-value estimated by NCCHE. Other values are taken from literature.

4.3 Maximum Flood Depth

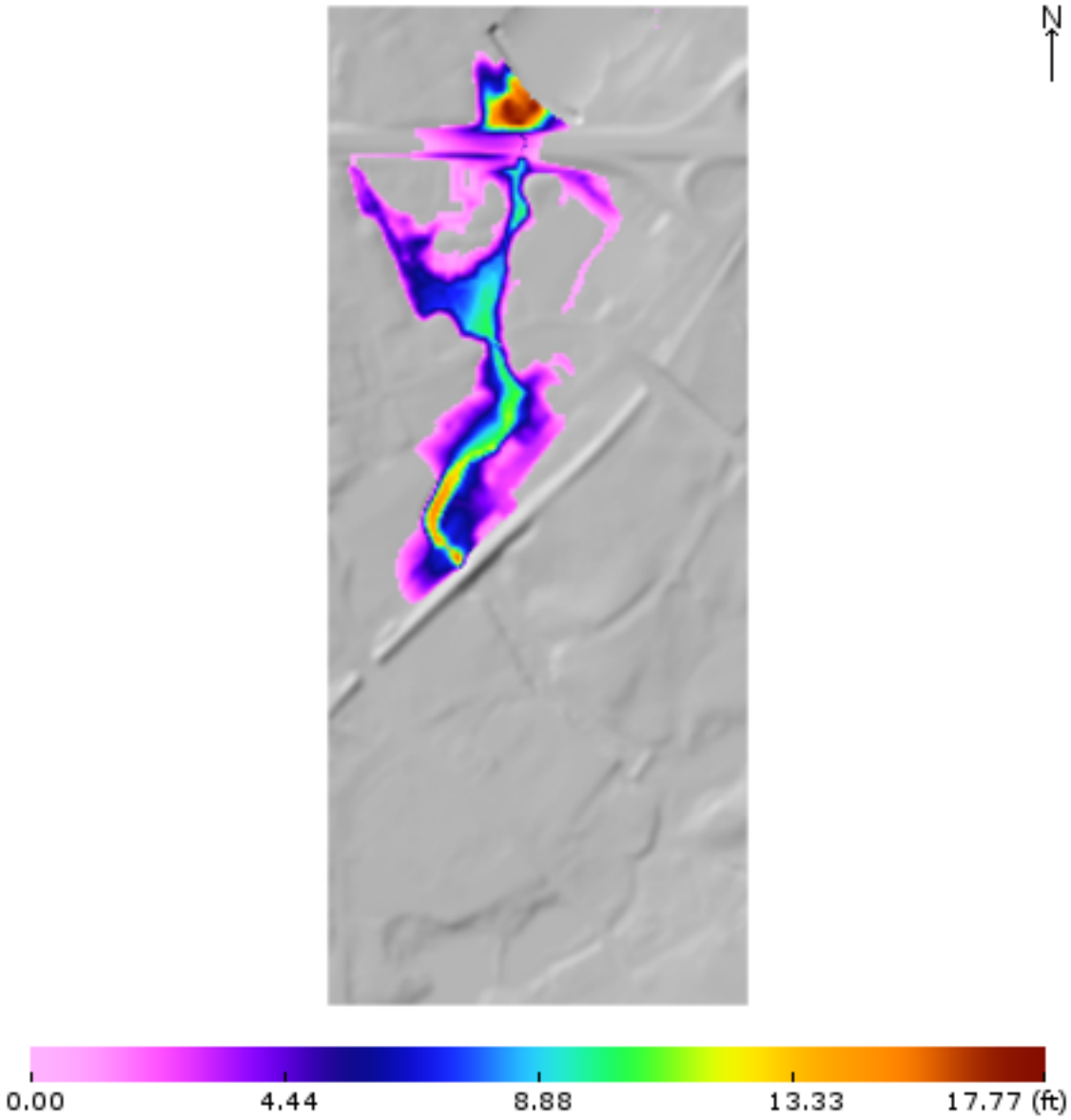

Figure 5. Maximum Flood Depth Map.

4.4 Flood Arrival Time

Flood arrival time is measured from the beginning of the simulation.

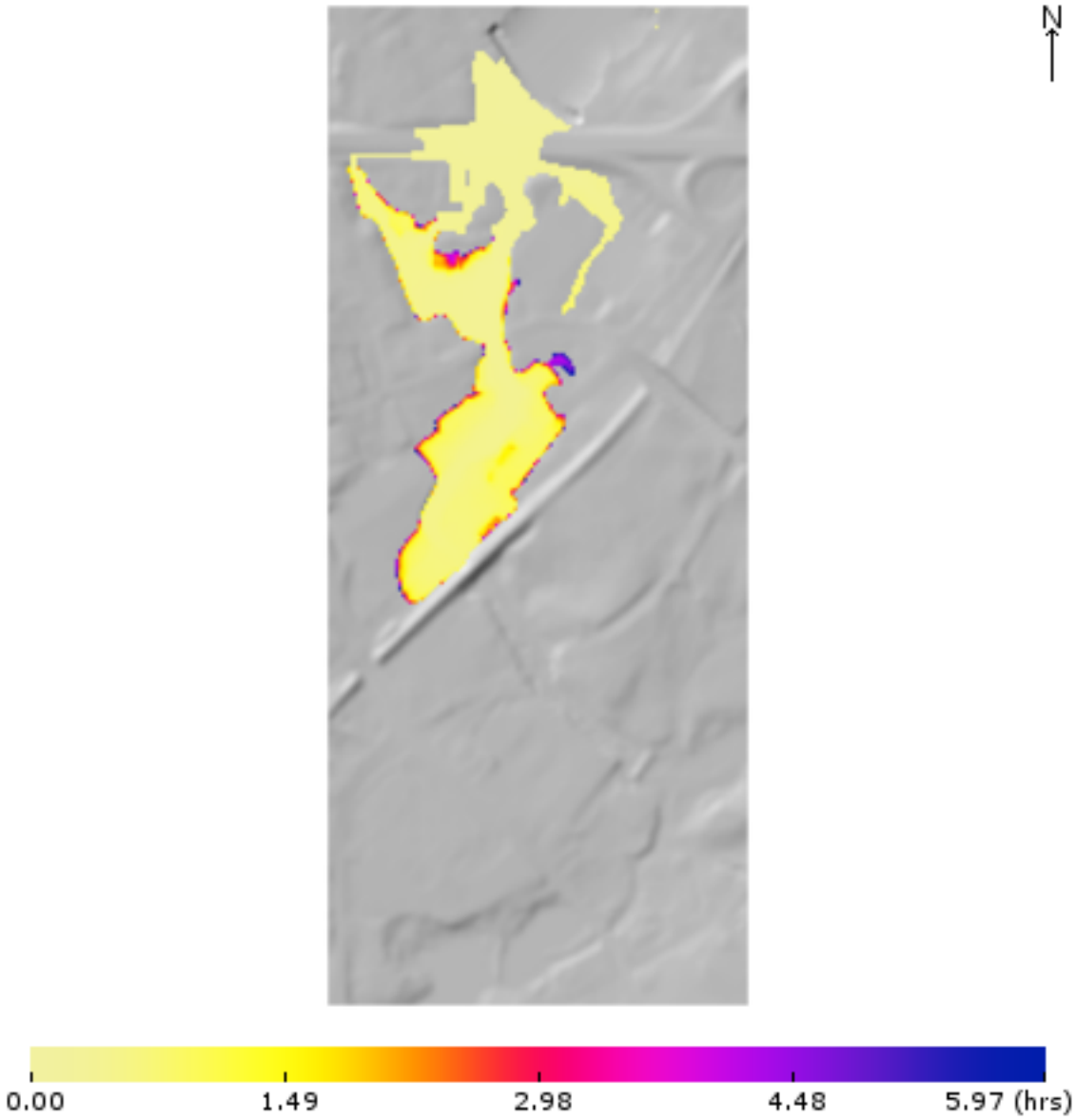

Figure 6. Flood Arrival Time Map.

4.5 Computed Breach Hydrograph through the Breaching Structure

The positive discharges (Q^+) are measured in the positive direction with respect to each observation line.

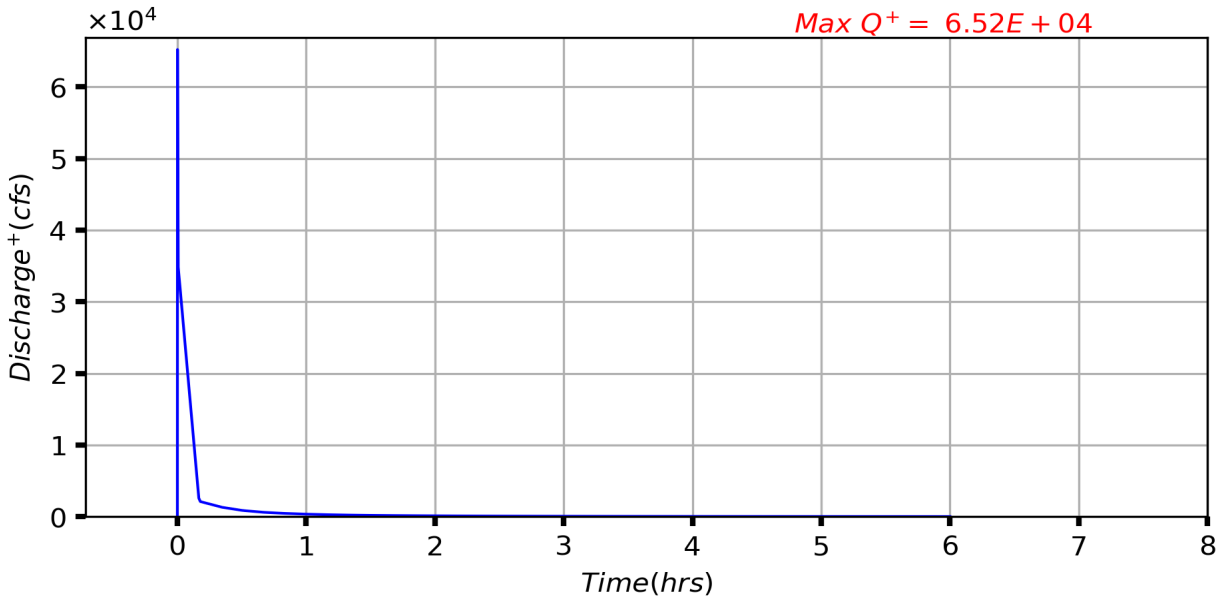

Figure 7. Breach Discharge Measured at: Structure 1.

4.6 Observation Line Hydrograph(s)

The positive discharges (Q^+) are measured in the positive direction with respect to each observation line.

OLine 1

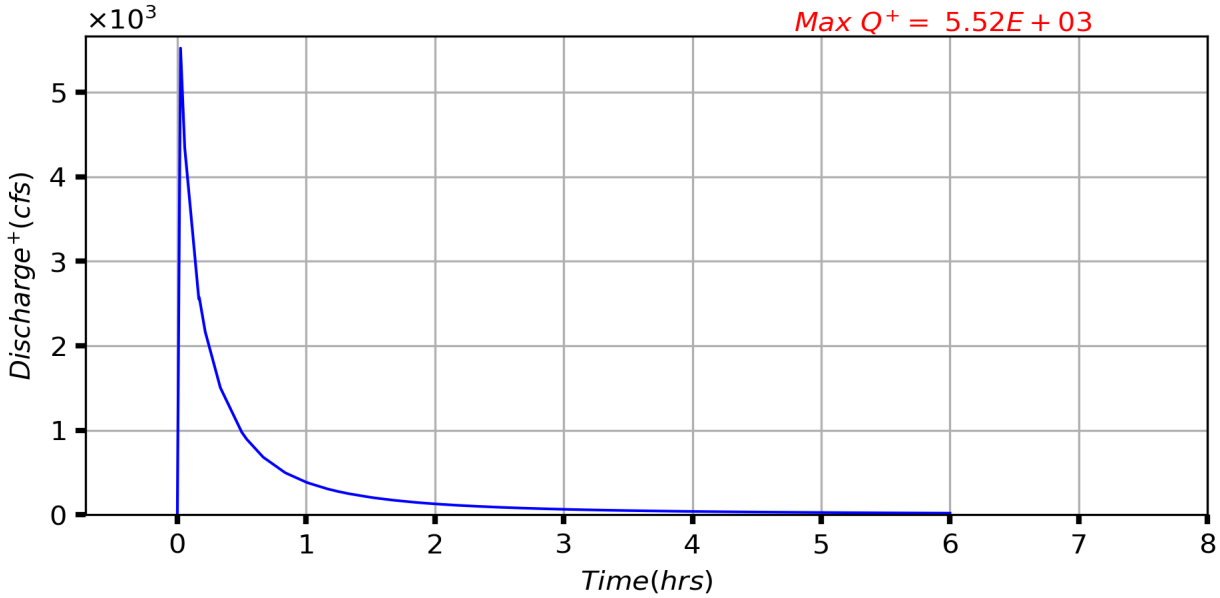

Figure 8. Discharge Measured at: OLine 1.

Image Dimensions: N-S: 0.024 miles E-W: 0.506 miles

Figure 9. Observation Line: OLine 1.

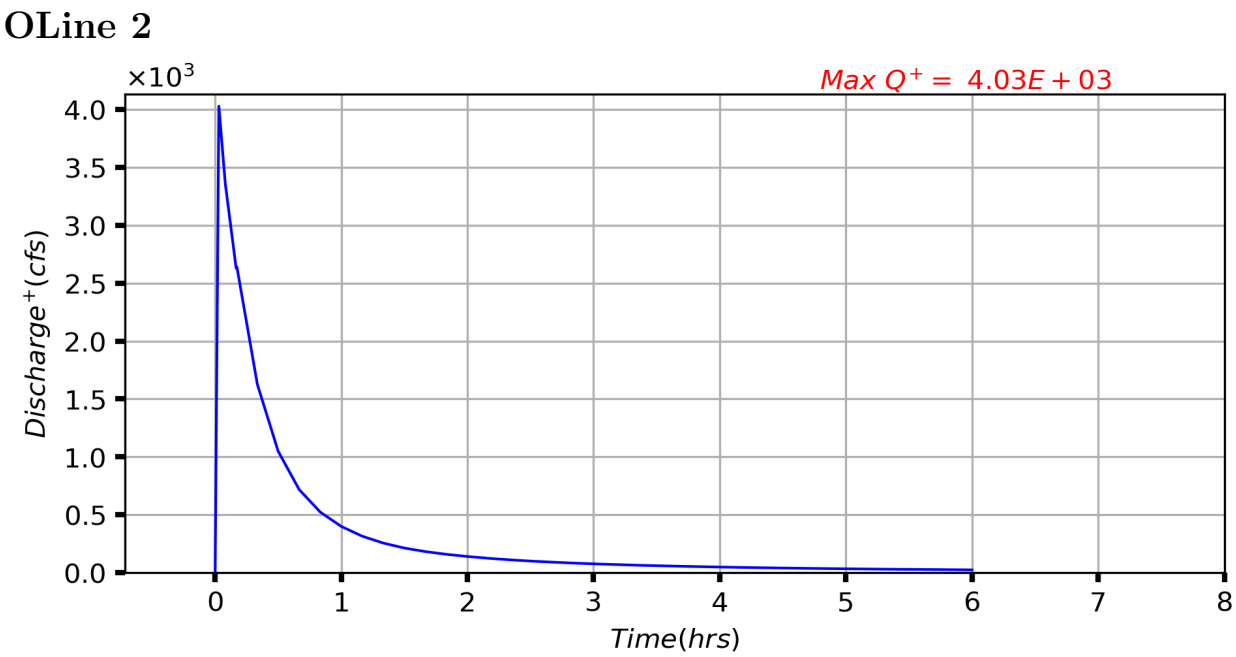

Figure 10. Discharge Measured at: OLine 2.

Image Dimensions: N-S: 0.102 miles E-W: 0.366 miles

Figure 11. Observation Line: OLine 2.

OLine 3

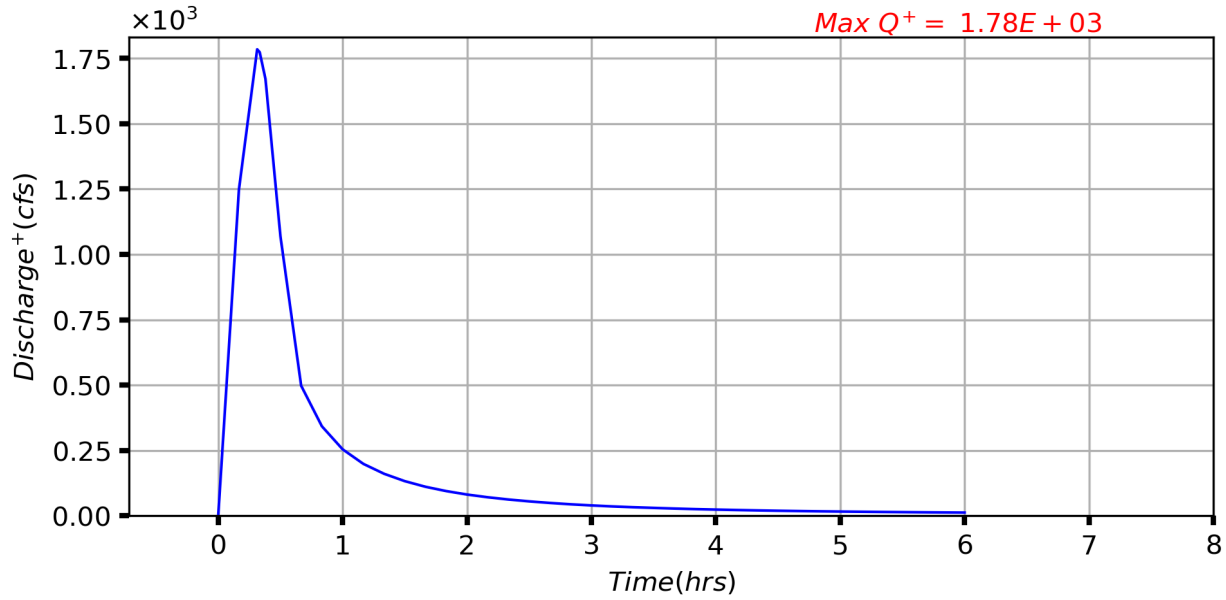

Figure 12. Discharge Measured at: OLine 3.

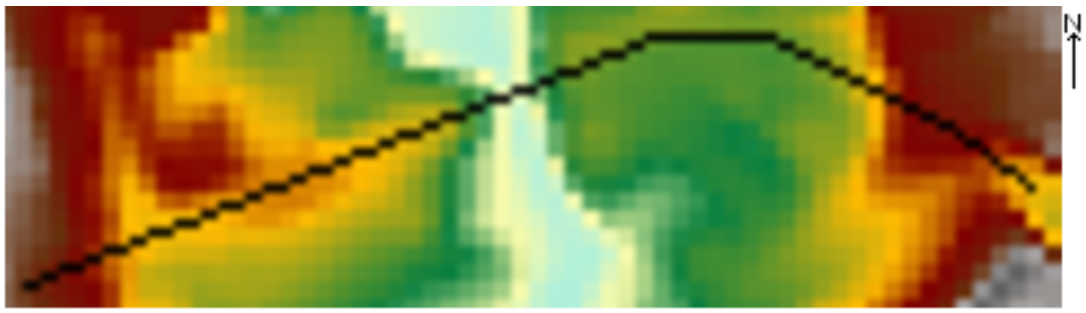

Image Dimensions: N-S: 0.105 miles E-W: 0.369 miles

Figure 13. Observation Line: OLine 3.

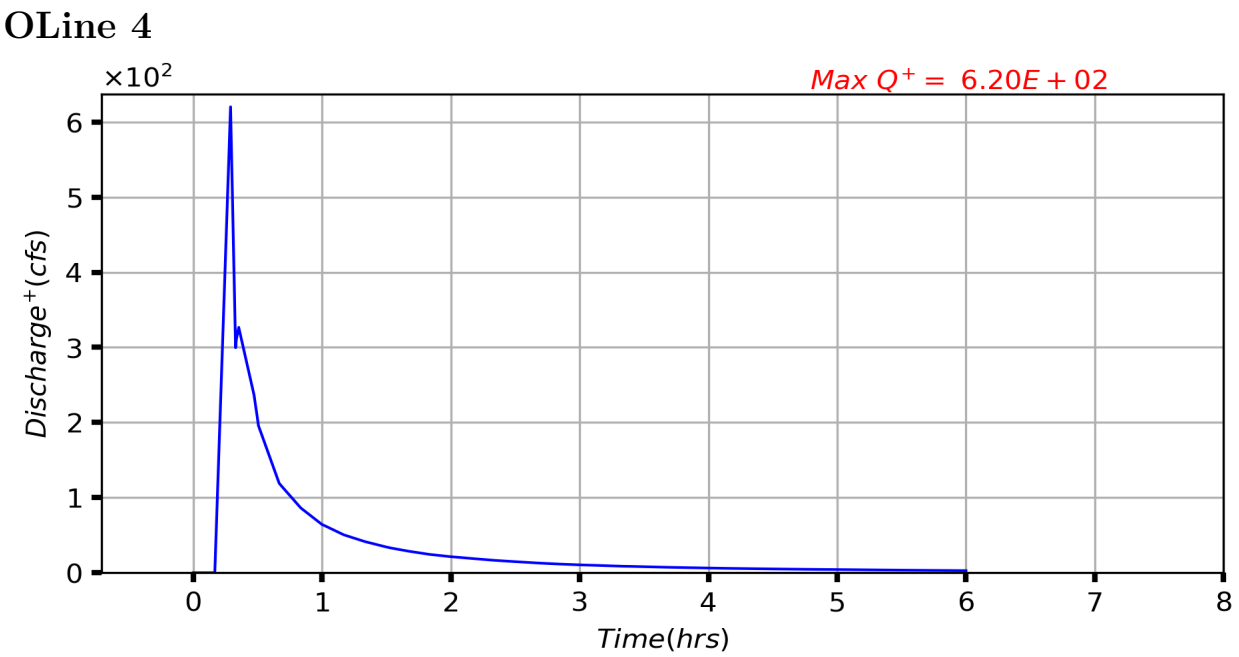

Figure 14. Discharge Measured at: OLine 4.

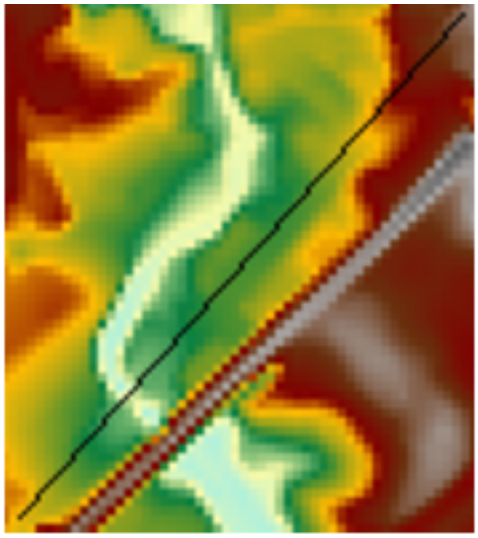

Image Dimensions: N-S: 0.369 miles E-W: 0.329 miles

Figure 15. Observation Line: OLine 4.

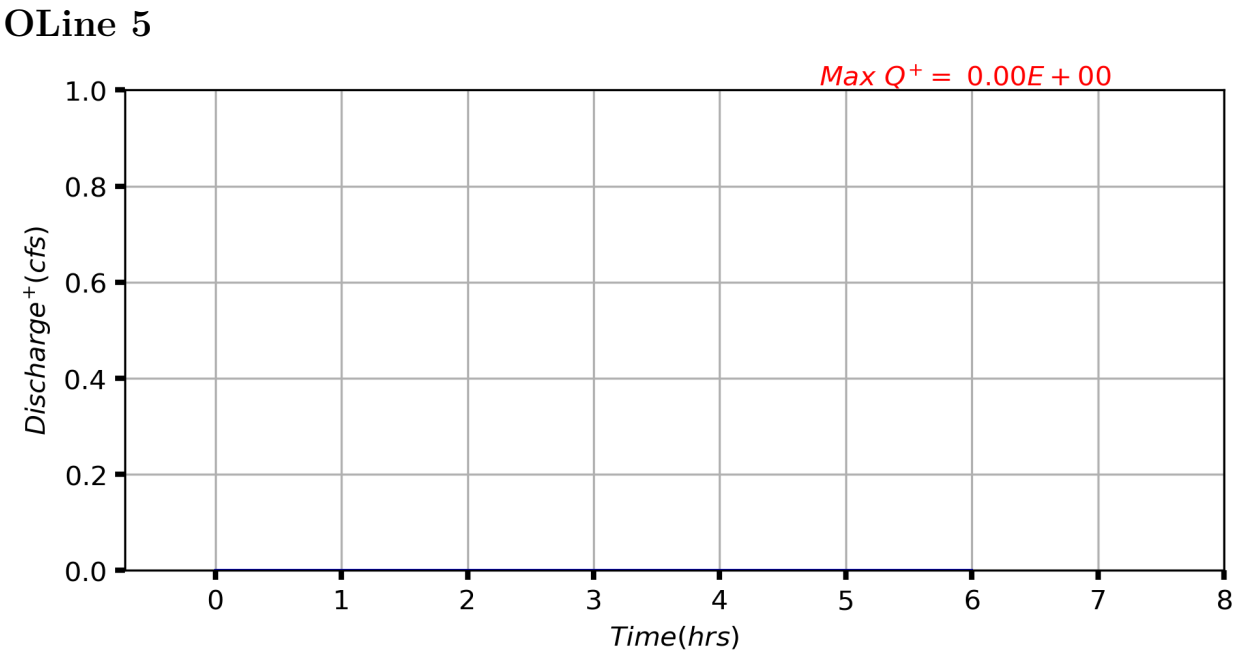

Figure 16. Discharge Measured at: OLine 5.

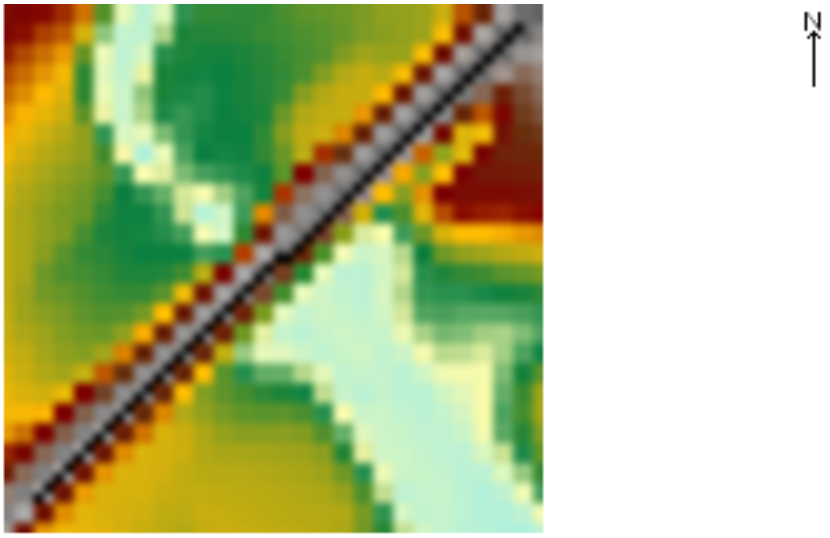

Image Dimensions: N-S: 0.164 miles E-W: 0.167 miles

Figure 17. Observation Line: OLine 5.

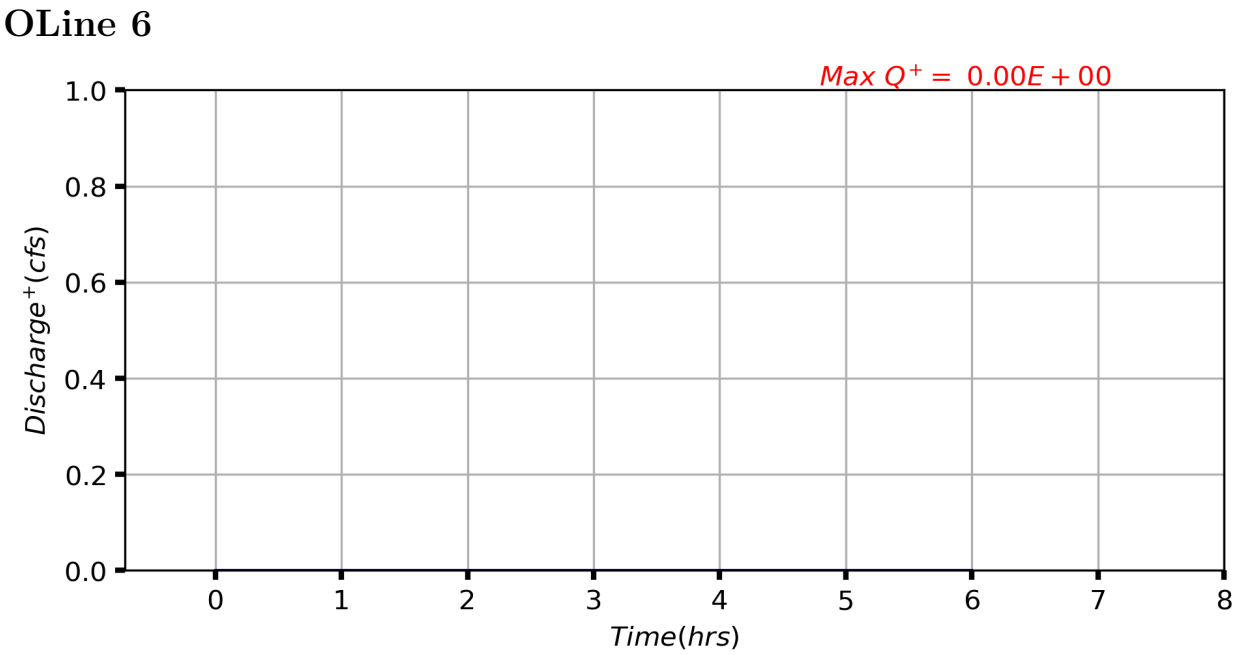

Figure 18. Discharge Measured at: OLine 6.

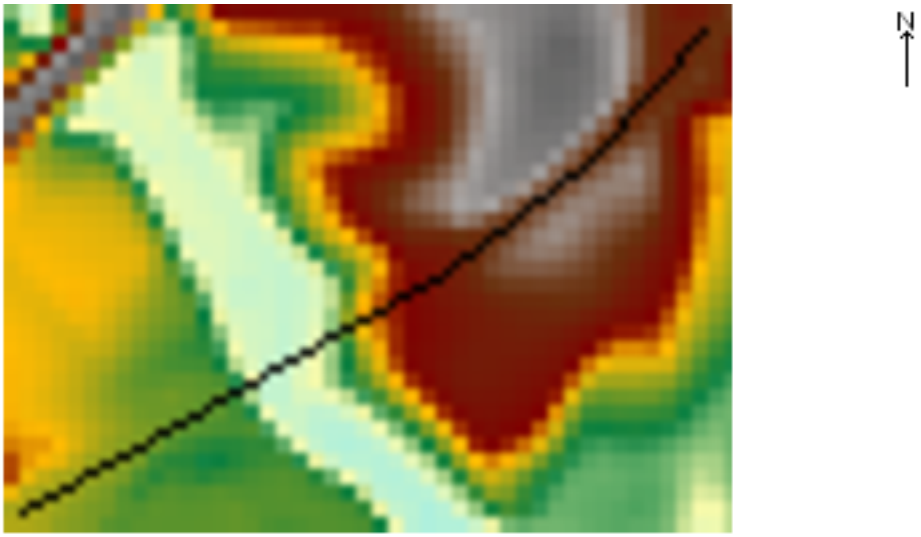

Image Dimensions: N-S: 0.205 miles E-W: 0.282 miles

Figure 19. Observation Line: OLine 6.

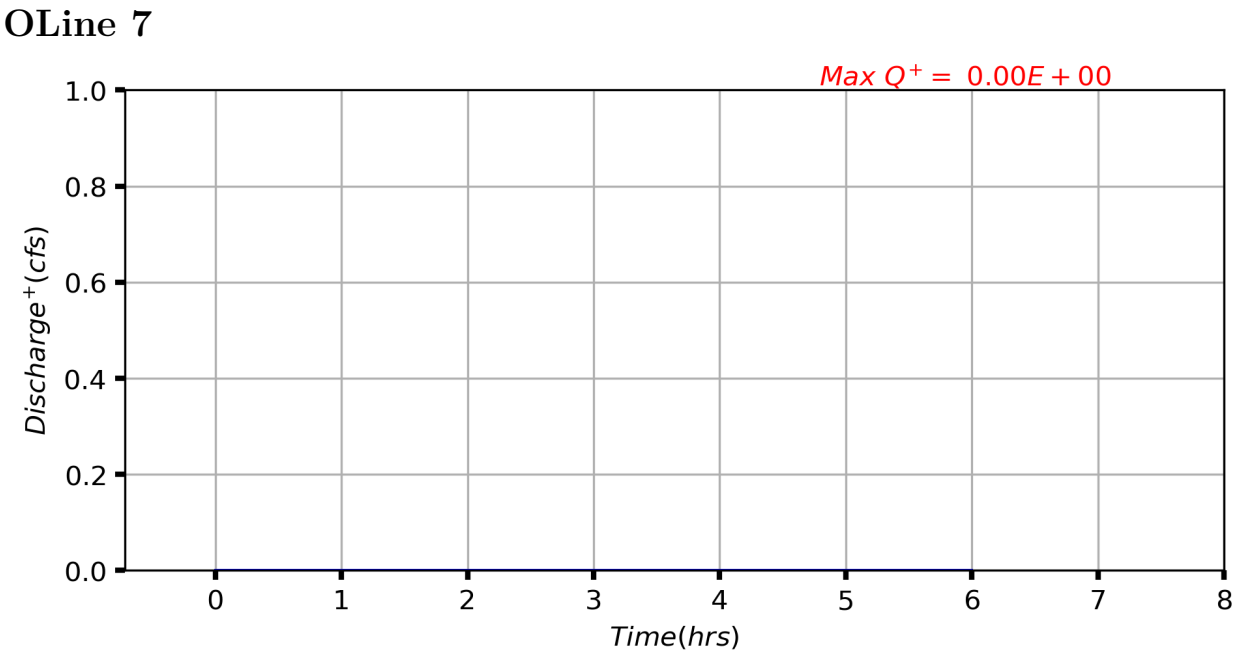

Figure 20. Discharge Measured at: OLine 7.

Image Dimensions: N-S: 0.152 miles E-W: 0.102 miles

Figure 21. Observation Line: OLine 7.

4.7 Downloading Simulation Results

The simulation results can be accessed at the following web address:

`https://dsswiseweb.ncche.olemiss.edu/download`

Job ID: 19219