

APPENDIX D

Numerical Simulation with SMS Model.

SMS Overview

SMS (Surfacewater Modeling System) is a two-dimensional finite element hydrodynamic computer model developed by the WES (Waterway Experimental Station) of the U.S. Army Engineer Research and Development Center. SMS models the water surface elevation, flow velocity, contaminant transport and dispersion, sediment transport and deposition, subcritical-supercritical flow, and long shore waves for complex 2D horizontal flow problems.

Simulation Procedure

At first, the finite element network of the watershed area is needed for simulation. The FASTTABS module in SMS meshed the finite element network for this channel model based on the design map from AMAFCA. A total of 562 elements and 1211 nodes were composed for this network as seen in Figure D1. Manning's roughness coefficient of 0.01 was used for the concrete lined channel surface and 0.04 for the riprap energy dissipation in this model. The turbulence flow coefficient used was 806.4. There are two module options, RMA-2 and FESWMS, for the two dimensional hydrodynamic computations in SMS. The FESWMS module simulation yields better results in the case of channel structures such as a bridge or a weir, thus was used for this simulation.

Simulation Scenarios

Three channel models, "as-design", "modified model", and "full-scale model" were simulated for this project. Each model has a different finite element mesh, boundary conditions, and initial conditions as seen in Table D1. The boundary conditions and the initial conditions are the most important input data for finite element modeling. The flow rate was applied for the upstream boundary condition, and the water surface elevation was applied for the downstream boundary condition and the initial condition. Figures D2, D3, and D4 show the scenarios' simulation results. The arrow indicates the velocity vector, and the filled contour indicates the water surface elevation.

Table D1. SMS Simulation Scenarios

	Element	Node	Boundary Conditions (cfs, ft)		Initial Condition
	No.	No.	Upstream	Downstream	(feet)
As- Design	554	1199	0.65 / 0.67	8.6	8.6
Modified Model	562	1211	0.65 / 0.67	8.6	8.6
Full-Scale Model	603	1296	663 / 682	93.1	93.1

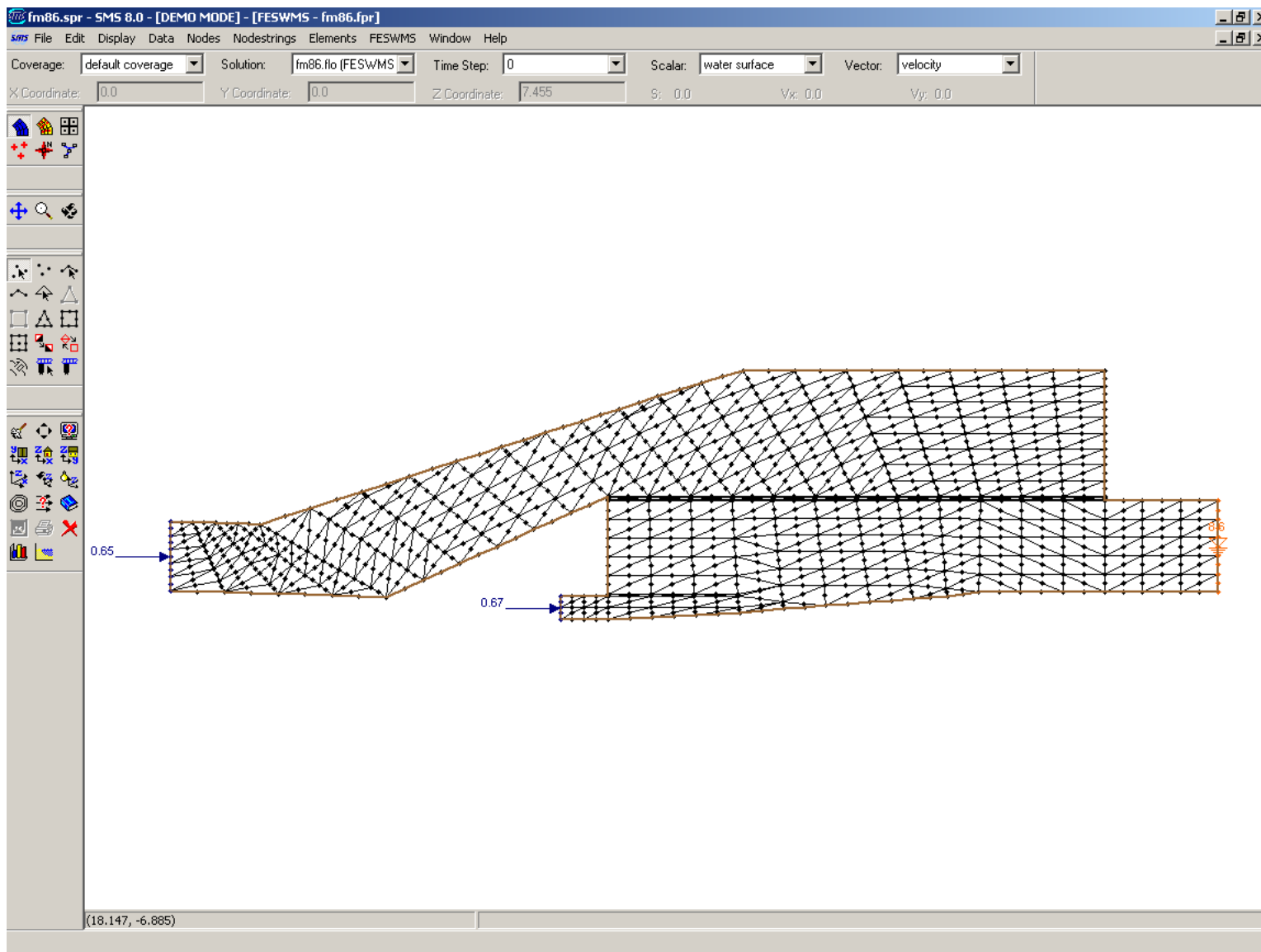


Figure D1. Finite Element Network for Modified Channel Model.

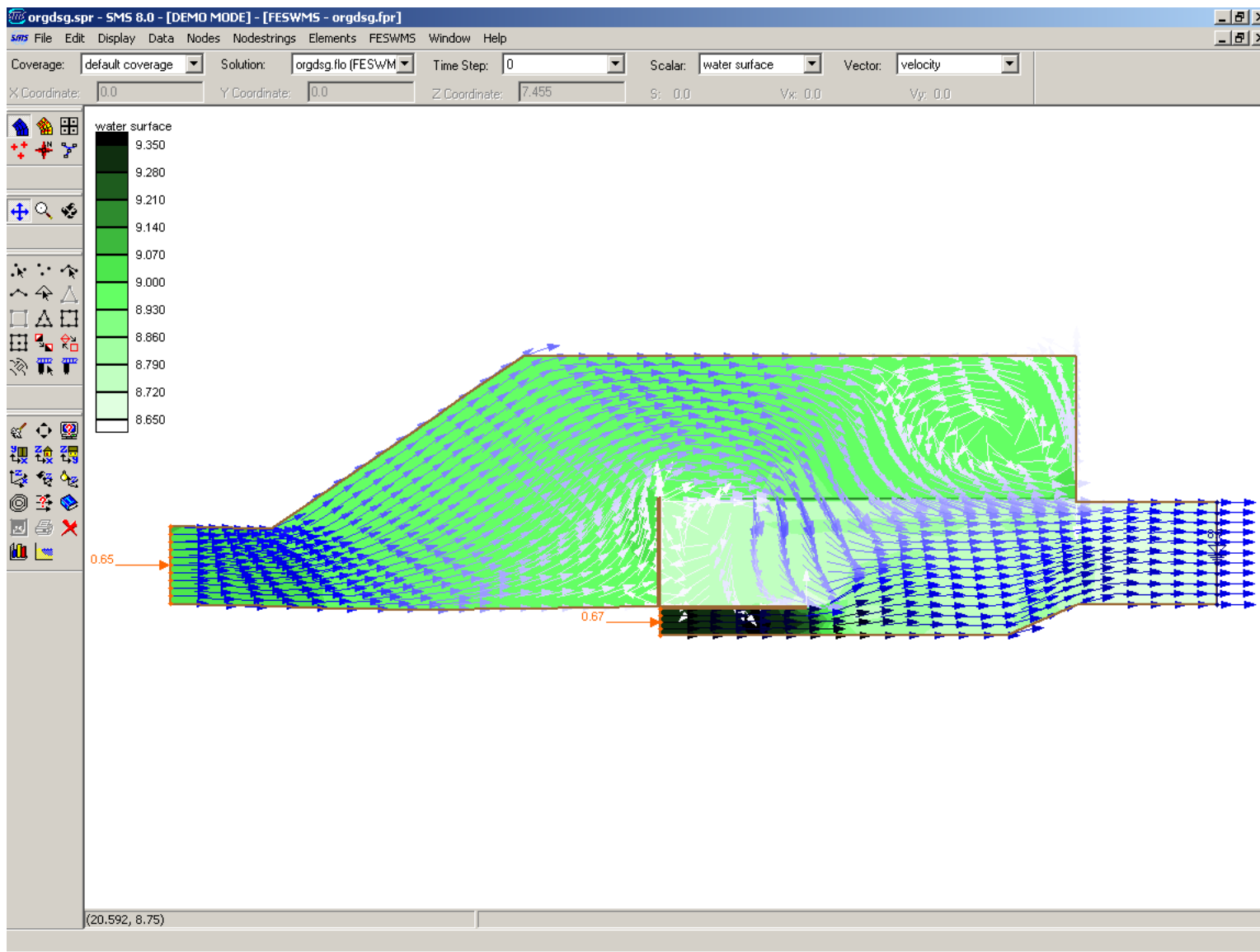


Figure D2. "As-Design" Channel Model Numerical Simulation.

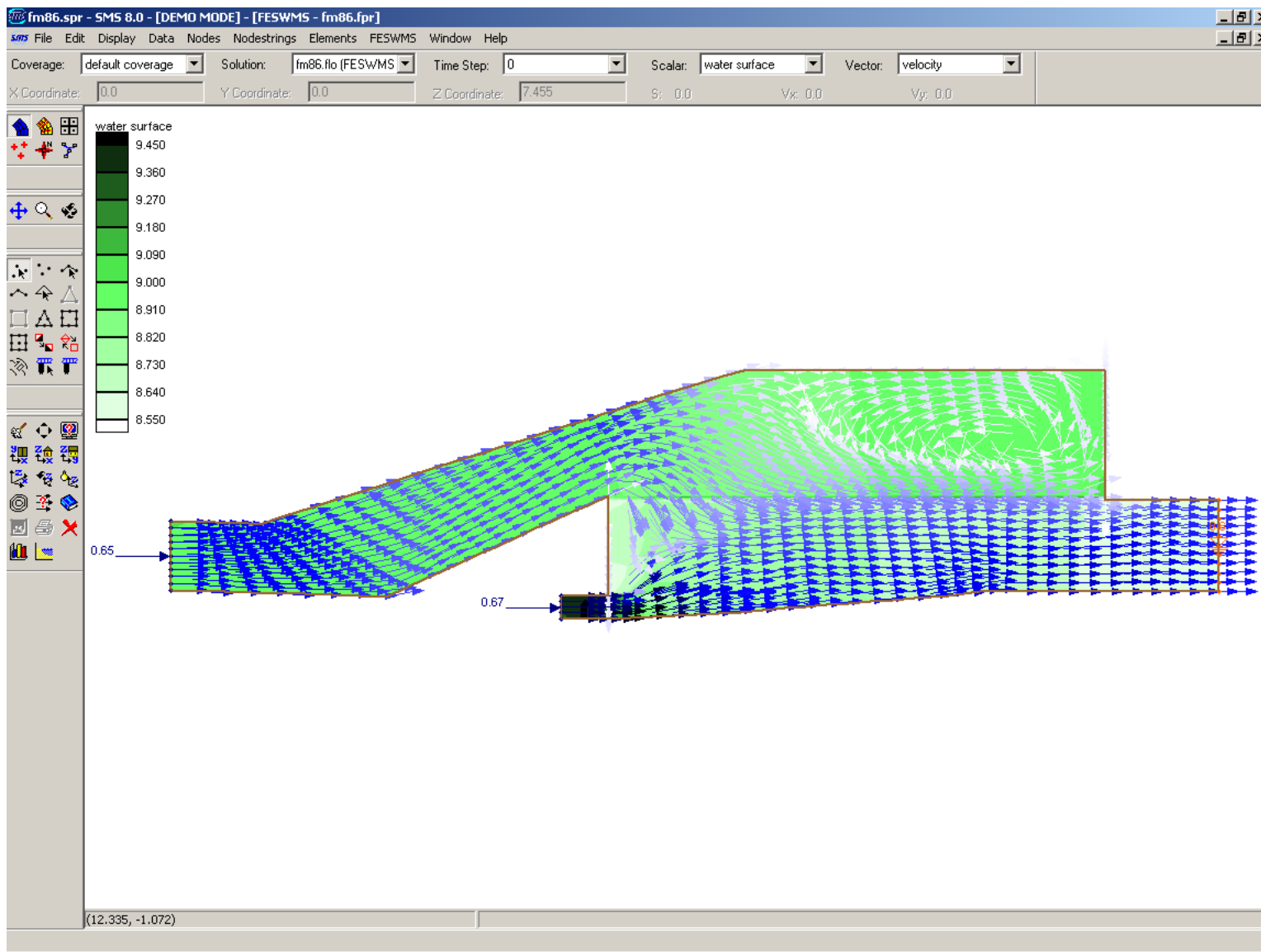


Figure D3. "Modified Model" Channel Numerical Simulation.

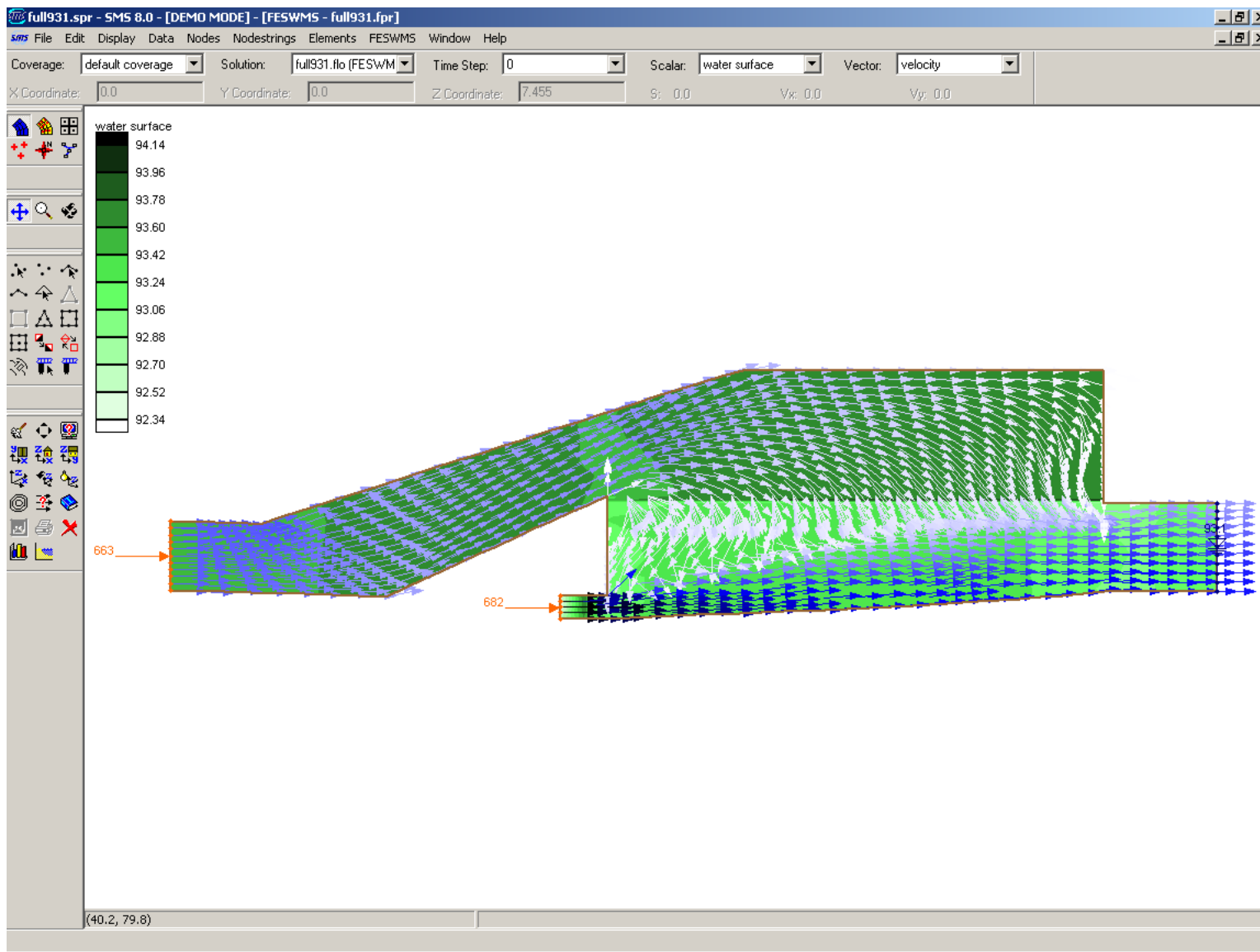


Figure D4. "Full Scale Model" Channel Numerical Simulation.