



Standard Guide for Application of a Groundwater Flow Model to a Site-Specific Problem¹

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1. Scope

1.1 This guide covers the application and subsequent documentation of a groundwater flow model to a particular site or problem. In this context, “groundwater flow model” refers to the application of a mathematical model to the solution of a site-specific groundwater flow problem.

1.2 This guide illustrates the major steps to take in developing a groundwater flow model that reproduces or simulates an aquifer system that has been studied in the field. This guide does not identify particular computer codes, software, or algorithms used in the modeling investigation.

1.3 This guide is specifically written for saturated, isothermal, groundwater flow models. The concepts are applicable to a wide range of models designed to simulate subsurface processes, such as variably saturated flow, flow in fractured media, density-dependent flow, solute transport, and multiphase transport phenomena; however, the details of these other processes are not described in this guide.

1.4 This guide is not intended to be all inclusive. Each groundwater model is unique and may require additional procedures in its development and application. All such additional analyses should be documented, however, in the model report.

1.5 This guide is one of a series of standards on groundwater model applications. Other standards have been prepared on environmental modeling, such as Practice E978.

1.6 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use*

1.7 *This guide offers an organized collection of information or a series of options and does not recommend a specific course of action. This document cannot replace education or*

experience and should be used in conjunction with professional judgment. Not all aspects of this guide may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word “Standard” in the title of this document means only that the document has been approved through the ASTM consensus process.

2. Referenced Documents

2.1 ASTM Standards:²

D653 Terminology Relating to Soil, Rock, and Contained Fluids

E978 Practice for Evaluating Mathematical Models for the Environmental Fate of Chemicals (Withdrawn 2002)³

3. Terminology

3.1 Definitions:

3.1.1 *application verification*—using the set of parameter values and boundary conditions from a calibrated model to approximate acceptably a second set of field data measured under similar hydrologic conditions.

3.1.1.1 *Discussion*—Application verification is to be distinguished from code verification, that refers to software testing, comparison with analytical solutions, and comparison with other similar codes to demonstrate that the code represents its mathematical foundation.

3.1.2 *boundary condition*—a mathematical expression of a state of the physical system that constrains the equations of the mathematical model.

3.1.3 *calibration (model application)*—the process of refining the model representation of the hydrogeologic framework, hydraulic properties, and boundary conditions to achieve a desired degree of correspondence between the model simulation and observations of the groundwater flow system.

¹ This guide is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.21 on Groundwater and Vadose Zone Investigations.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ The last approved version of this historical standard is referenced on www.astm.org.