



Standard Guide for Defining Boundary Conditions in Ground-Water Flow Modeling¹

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1. Scope

1.1 This guide covers the specification of appropriate boundary conditions that are an essential part of conceptualizing and modeling ground-water systems. This guide describes techniques that can be used in defining boundary conditions and their appropriate application for modeling saturated ground-water flow model simulations.

1.2 This guide is one of a series of standards on ground-water flow model applications. Defining boundary conditions is a step in the design and construction of a model that is treated generally in Guide D 5447.

1.3 *This standard does not purport to address all of the safety concerns, 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.*

1.4 *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:

D 653 Terminology Relating to Soil, Rock, and Contained Fluids²

D 5447 Guide for Application of a Ground-Water Flow Model to a Site-Specific Problem³

3. Terminology

3.1 Definitions:

3.1.1 *aquifer, confined*—an aquifer bounded above and below by confining beds and in which the static head is above the top of the aquifer.

3.1.2 *boundary*—geometrical configuration of the surface enclosing the model domain.

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

3.1.4 *conceptual model*—a simplified representation of the hydrogeologic setting and the response of the flow system to stress.

3.1.5 *flux*—the volume of fluid crossing a unit cross-sectional surface area per unit time.

3.1.6 *ground-water flow model*—an application of a mathematical model to the solution of a ground-water flow problem.

3.1.7 *hydraulic conductivity*—(*field aquifer tests*), the volume of water at the existing kinematic viscosity that will move in a unit time under unit hydraulic gradient through a unit area measured at right angles to the direction of flow.

3.1.8 *hydrologic condition*—a set of ground-water inflows or outflows, boundary conditions, and hydraulic properties that cause potentiometric heads to adopt a distinct pattern.

3.1.9 *simulation*—one complete execution of the computer program, including input and output.

3.1.10 *transmissivity*—the volume of water at the existing kinematic viscosity that will move in a unit time under a unit hydraulic gradient through a unit width of the aquifer.

3.1.11 *unconfined aquifer*—an aquifer that has a water table.

3.1.12 For definitions of other terms used in this test method, see Terminology D 653.

4. Significance and Use

4.1 Accurate definition of boundary conditions is an essential part of conceptualizing and modeling ground-water flow systems. This guide describes the properties of the most common boundary conditions encountered in ground-water systems and discusses major aspects of their definition and application in ground-water models. It also discusses the significance and specification of boundary conditions for some

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 Ground Water and Vadose Zone Investigations.

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² *Annual Book of ASTM Standards*, Vol 04.08.

³ *Annual Book of ASTM Standards*, Vol 04.09.