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Guideline for Development of Effective Water Sharing Agreements

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ENVIRONMENTAL & WATER RESOURCES INSTITUTE

American Society of Civil Engineers

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In 2006, the Board of Direction approved the revision to the ASCE Rules for Standards Committees to govern the writing and maintenance of standards developed by the Society. All such standards are developed by a consensus standards process managed by the Society's Codes and Standards Committee (CSC). The consensus process includes balloting by a balanced standards committee made up of Society members and nonmembers, balloting by the membership of the Society as a whole, and balloting by the public. All standards are updated or reaffirmed by the same process at intervals not exceeding five years.

The following standards have been issued:

ANSI/ASCE 1-82 N-725 Guideline for Design and Analysis of Nuclear Safety Related Earth Structures

ASCE/EWRI 2-06 Measurement of Oxygen Transfer in Clean Water

ANSI/ASCE 3-91 Standard for the Structural Design of Composite Slabs and ANSI/ASCE 9-91 Standard Practice for the Construction and Inspection of Composite Slabs

ASCE 4-98 Seismic Analysis of Safety-Related Nuclear Structures

Building Code Requirements for Masonry Structures (ACI 530-02/ASCE 5-02/TMS 402-02) and Specifications for Masonry Structures (ACI 530.1-02/ASCE 6-02/TMS 602-02)

ASCE/SEI 7-10 Minimum Design Loads for Buildings and Other Structures

SEI/ASCE 8-02 Standard Specification for the Design of Cold-Formed Stainless Steel Structural Members

ANSI/ASCE 9-91 listed with ASCE 3-91

ASCE 10-97 Design of Latticed Steel Transmission Structures

SEI/ASCE 11-99 Guideline for Structural Condition Assessment of Existing Buildings

ASCE/EWRI 12-05 Guideline for the Design of Urban Subsurface Drainage

ASCE/EWRI 13-05 Standard Guidelines for Installation of Urban Subsurface Drainage

ASCE/EWRI 14-05 Standard Guidelines for Operation and Maintenance of Urban Subsurface Drainage

ASCE 15-98 Standard Practice for Direct Design of Buried Precast Concrete Pipe Using Standard Installations (SIDD)

ASCE 16-95 Standard for Load Resistance Factor Design (LRFD) of Engineered Wood Construction

ASCE 17-96 Air-Supported Structures

ASCE 18-96 Standard Guidelines for In-Process Oxygen Transfer Testing

ASCE 19-10 Structural Applications of Steel Cables for Buildings

ASCE 20-96 Standard Guidelines for the Design and Installation of Pile Foundations

ANSI/ASCE/T&DI 21-05 Automated People Mover Standards—Part 1

ANSI/ASCE/T&DI 21.2-08 Automated People Mover Standards—Part 2

ANSI/ASCE/T&DI 21.3-08 Automated People Mover Standards—Part 3

ANSI/ASCE/T&DI 21.4-08 Automated People Mover Standards—Part 4

SEI/ASCE 23-97 Specification for Structural Steel Beams with Web Openings

ASCE/SEI 24-05 Flood Resistant Design and Construction

ASCE/SEI 25-06 Earthquake-Actuated Automatic Gas Shutoff Devices

ASCE 26-97 Standard Practice for Design of Buried Precast Concrete Box Sections

ASCE 27-00 Standard Practice for Direct Design of Precast Concrete Pipe for Jacking in Trenchless Construction

ASCE 28-00 Standard Practice for Direct Design of Precast Concrete Box Sections for Jacking in Trenchless Construction

ASCE/SEI/SFPE 29-05 Standard Calculation Methods for Structural Fire Protection

SEI/ASCE 30-00 Guideline for Condition Assessment of the Building Envelope

SEI/ASCE 31-03 Seismic Evaluation of Existing Buildings

SEI/ASCE 32-01 Design and Construction of Frost-Protected Shallow Foundations

EWRI/ASCE 33-09 Comprehensive Transboundary International Water Quality Management Agreement

EWRI/ASCE 34-01 Standard Guidelines for Artificial Recharge of Ground Water

EWRI/ASCE 35-01 Guidelines for Quality Assurance of Installed Fine-Pore Aeration Equipment

CI/ASCE 36-01 Standard Construction Guidelines for Microtunneling

SEI/ASCE 37-02 Design Loads on Structures during Construction

CI/ASCE 38-02 Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data

EWRI/ASCE 39-03 Standard Practice for the Design and Operation of Hail Suppression Projects

ASCE/EWRI 40-03 Regulated Riparian Model Water Code

ASCE/SEI 41-06 Seismic Rehabilitation of Existing Buildings

ASCE/EWRI 42-04 Standard Practice for the Design and Operation of Precipitation Enhancement Projects

ASCE/SEI 43-05 Seismic Design Criteria for Structures, Systems, and Components in Nuclear Facilities

ASCE/EWRI 44-05 Standard Practice for the Design and Operation of Supercooled Fog Dispersal Projects

ASCE/EWRI 45-05 Standard Guidelines for the Design of Urban Stormwater Systems

ASCE/EWRI 46-05 Standard Guidelines for the Installation of Urban Stormwater Systems

ASCE/EWRI 47-05 Standard Guidelines for the Operation and Maintenance of Urban Stormwater Systems

ASCE/SEI 48-11 Design of Steel Transmission Pole Structures

ASCE/SEI 49-07 Wind Tunnel Testing for Buildings and Other Structures

ASCE/EWRI 50-08 Standard Guideline for Fitting Saturated Hydraulic Conductivity Using Probability Density Functions

ASCE/EWRI 51-08 Standard Guideline for Calculating the Effective Saturated Hydraulic Conductivity

ASCE/SEI 52-10 Design of Fiberglass-Reinforced Plastic (FRP) Stacks

ASCE/G-I 53-10 Compaction Grouting Consensus Guide

ASCE/EWRI 54-10 Standard Guideline for Geostatistical Estimation and Block-Averaging of Homogeneous and Isotropic Saturated Hydraulic Conductivity

ASCE/SEI 55-10 Tensile Membrane Structures
ANSI/ASCE/EWRI 56-10 Guidelines for the Physical Security of Water Utilities
ANSI/ASCE/EWRI 57-10 Guidelines for the Physical Security of Wastewater/Stormwater Utilities
ASCE/T&DI/ICPI 58-10 Structural Design of Interlocking Concrete Pavement for Municipal Streets and Roadways
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ASCE/EWRI 60-12 Guidelines for Development of Effective Water Sharing Agreements

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FOREWORD

The Board of Direction approved revisions to the ASCE Rules for Standards Committees to govern the writing and maintenance of standards developed by ASCE. All such standards are developed by a consensus standards process managed by the ASCE Codes and Standards Committee (CSC). The consensus process includes balloting by a balanced standards committee, and reviewing during a public comment period. All standards are updated or reaffirmed by the same process at intervals between five and ten years. Requests for formal interpretations shall be processed in accordance with Section 7 of ASCE Rules for Standards Committees, which are available at www.asce.org. Errata, addenda, supplements, and interpretations, if any, for this standard can also be found at www.asce.org.

The form of this Standard Guideline reflects the goals of the Water Regulatory Standards Committee (WRSC) of the Environmental and Water Resources Institute (EWRI) of ASCE. The provisions of this document are written in permissive language and, as such, offer to the user a series of options or instructions but do not prescribe a specific course of action. Significant judgment is left to the user of this document.

Three model water sharing agreements are included in this Standard Guideline in Appendixes A, B, and C. Although the general format the appendixes follows *The Chicago Manual of Style*, imbedded within these model agreements is the format commonly used today in the drafting of proposed uniform state laws. This format, developed under the auspices of the National Conference of Commissioners of Uniform Laws, has been accepted as the format for the ASCE Model Water Codes documents (ASCE 2004a; Dellapenna 2007a). The format of the sections and subsections of each model agreement consists of statutory language in boldface that a legislature could enact with or without change. This statutory language is followed by a commentary section that describes the purpose and scope of the statutory provisions. Cross-references to other provisions in the specific agreement follow. The section or subsection is closed by a paragraph listing other interstate and international water sharing agreements that contain similar provisions.

Each section of each agreement is optional. Authorities may, however, enact the bulk of the agreement yet delete or change any particular section. Nonetheless, the WRSC made an effort to create a complete, comprehensive, and well-integrated contract between the parties capable of effectively managing shared water. The WRSC has concluded that almost every section of each agreement is necessary to achieve that goal. Some sections apply, however, only to water sharing compacts within the United States, others only to an international agreement. Others are specifically denominated optional in any jurisdiction, which indicates that the drafters consider that these sections might not be necessary or appropriate to the needs of the specific situation. A coherent and workable agreement would still result were all of the optional sections omitted. This Standard Guideline refers to current ASCE Policy Statements and to certain common references. ASCE Policy Statements normally are updated every three years and should be consulted for changes that may have occurred (www.asce.org/pressroom/news/policy.cfm).

This standard has been prepared in accordance with recognized engineering principles and should not be used without the user's competent knowledge for a given application. The publication of this standard by ASCE is not intended to warrant that the information contained herein is suitable for any general or specific use, and ASCE takes no position respecting the validity of patent rights. The user is advised that the determination of patent rights or risk of infringement is entirely his or her own responsibility.

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PREFACE

The Model Water Code Project of the American Society of Civil Engineers (ASCE) was initiated in 1990 under the leadership of Ray Jay Davis of the Brigham Young University School of Law. The purpose of the project was to develop model statutory provisions intended for adoption by state governments for allocating water rights among competing interests and for resolving quantitative conflicts over water (Dellapenna 1997b).

After Davis retired from Brigham Young University in 1995, the project continued under the leadership of Joseph W. Dellapenna of the Villanova University School of Law. In 1997, ASCE published *The Regulated Riparian Model Water Code* (Dellapenna 1997b). In 2001, the code was accepted as EWRI/ASCE Standard 40-03.

Early in the project formulation and development process, the ASCE Water Laws Committee recognized that effective water allocation and management required planning and regulation by water basins. Because most basins are shared by two or more political entities and their independent legal jurisdictions (e.g., states or nations), the committee recognized the need for a companion agreement or compact to manage the waters flowing across or along the boundary between separate legal jurisdictions.

When two or more independent governments share a common water resource, the timing and magnitude of the respective individual uses can be continual sources of conflict. Water scarcity is evident throughout much of the western United States, and the use of shared water resources is often a major source of legal and political conflict. The interstate and international conflicts over the allocation of the waters of the Colorado River began early in the twentieth century and have still not been totally resolved. However, the problem is not limited to the western states. Even when water is relatively plentiful, the increasing demand for water from shared resources is growing as the population expands, dramatically increasing the needs for public water supply. This problem has been graphically shown by the recent dispute among Florida, Alabama, and Georgia over allocation of the waters of the Apalachicola–Chattahoochee–Flint River Basin. The problem is pervasive, since few river basins in the continental United States are contained within a single state's boundaries (Dellapenna 2002b; Draper 2002a, 2006).

The problem is magnified in the international arena. There are more than 250 major rivers shared between and among two or more nations. These international river basins cover almost one half of the total land surface of the globe. More than 50 rivers are shared by three or more nations, and the Danube is shared by 13 riparian countries. International river basins sustain more than 40% of the world's population. Almost 25% of the world's population lives in the Earth's semiarid and arid zones, where scarcity of water is often acute. Therefore, the potential for conflict is enormous (Draper 2002a, 2006; *The Transboundary Freshwater Dispute Database* 2012).

Among others, protracted conflict over shared waters exists among Turkey, Iraq, and Syria in the Tigris–Euphrates basin; between Jordan and Israel regarding the opposite bank sharing of the Jordan River; and among nations in the Nile River Basin. The Ganges River is a source of dispute between India and Bangladesh. Armed conflict has occurred between Ecuador and Peru over the Cenepa River. The breakup of the Soviet Union has caused conflict between former members, especially in the arid regions east of the Caspian Sea. Seven active transboundary water disputes currently exist in Africa; six in Europe and Asia; and at least five in the Americas (Dellapenna 2001a; Draper 2002a, 2006).

The need for effective cooperation among riparian countries has greatly expanded because of the growing demand for water in various international basins and the increasingly harmful effects of activities in upstream countries. Although some form of interstate compact covers most of the shared river basins in the United States, many were drafted in the first half of the twentieth century. These agreements were often one-dimensional and limited in scope, oriented to specific problems rather than holistic management of the basin's water. It can be argued that many of these interstate water compacts are inadequate to resolution of the more complex water sharing issues that will develop in the twenty-first century (Draper 2002a, 2006).

Water resource experts now recognize that the shared use of water resources is most effective when management is on the river basin level and when management of the shared resource is comprehensive and multidimensional. Internationally, the problems are more acute. More than a third of the 200 international river basins are not covered by any international agreement, and only some 30 have truly cooperative institutional arrangements. Therefore, a significant need exists for guidance and procedures that can facilitate the development of agreements that can provide a basis for effective and efficient water sharing between autonomous political entities (Draper 2002a, 2006; *The Transboundary Freshwater Dispute Database* 2012).

The creation of this Standard Guideline proceeded in two stages. First, three model water sharing agreements were published (Draper 2002a). The model agreements were then followed by a second report that provided a narrative description of suggested guidelines to be used in choosing the model agreement that might best serve as the basis of the specific water sharing agreement to be created by the parties (Draper 2006).

Although water scarcity and the increasing competition for water suggest that comprehensive management of a shared river basin is appropriate, a significant challenge to overcome is the prevailing tendency for governments at all levels to resist outside control over and interference with their internal affairs and those decisions that affect economic growth or quality of life. Each government or legally competent authority subject to the agreement, whether it is a nation-state, a state within a federal system, or a tribal entity within a national federal system, normally wants to maintain authority over the people, places, assets, and natural resources within its political boundaries. Local control is the operative word.

Strong incentives are required for a government to relinquish control of resources within its jurisdiction. Early in the process, the committee recognized that the degree to which the parties were willing to relinquish such control over water resources in or adjacent to their jurisdiction depended on the hydrologic, geographic, and political situation involved in the shared water dispute. In some situations, the parties might be willing to relinquish considerable autonomy in the search for efficient water management. In other situations, the parties may insist on maintaining control of the waters within their boundaries and may be content to coordinate water management activities in some manner (Draper 2002a). Therefore, the committee chose to

develop three distinct model transboundary agreements to serve as a framework for individual agreements, each of which is based on how much control the parties might be willing to cede.

In 2002, model water sharing agreements were published as *Model Water Sharing Agreements for the 21st Century* (Draper 2002b). This publication provided three separate model agreements that may be used to provide a framework around which an agreement could be formed. It was recognized, however, that the model agreements alone would not provide sufficient guidelines to the drafters of a water sharing agreement. Because an effective agreement to share water involves a complex amalgamation of data and information, a narrative discussion was required that detailed for the drafters of a real-world water sharing agreement the research and procedures leading to the decision to use one of the model agreements as a basis for their specific agreement.

In 2006, a narrative analysis of the development of model agreements was published as the EWRI/ASCE *Sharing Water in Times of Scarcity* (Draper 2006). This publication provided guidelines to enable integration of the multiple aspects of the water resource through an analysis that synthesizes the disciplines of science, engineering, technology, economics, and law. The document sought to ensure that all pertinent factors are considered in the development of an agreement so that the agreement accommodates the physical realities of the shared resource along with the different political systems, cultures, and/or water use customs of the particular water basin.

This Standard Guideline has merged and refined these two Shared Use of Transboundary Water Resources publications (Draper 2002a, 2006). The scope of this Standard Guideline includes application for international agreements, interstate compacts, and state–tribal agreements for regulating water resources along or across political boundaries. This Standard Guideline is used to apply to any sharing of waters between independent political governments. This Standard Guideline considers a variety of issues that influence the development of interstate and/or international water sharing agreements. This publication provides guidance to enable integration of the multiple aspects of the water resource through an analysis that synthesizes the disciplines of science, engineering, technology, economics, and law. The document seeks to ensure that all pertinent factors are considered in the development of an agreement so that the agreement accommodates the physical realities of the shared resource along with the different political systems, cultures, and/or water use customs of the particular water basin.

This Standard Guideline forms a bridge between the theory and the practice of effective shared water management. It provides a process that all states and/or nations can use when creating or modifying a transboundary water sharing agreement. This process includes an assessment of the various factors influenced by the shared water use, to include correlating the geographic and political issues surrounding utilization of the water resource, inventorying the sources and uses of the water resource, analyzing the ecological impact of the transboundary use, and examining its effect on economic growth and quality of life of the various constituents. This Standard Guideline presents the various alternatives available for allocation of water among the parties, with special emphasis on extreme events (e.g., droughts or floods). The alternatives include allocation methods for surface water, underground water, and atmospheric waters. Finally, different choices for the administrative apparatus that is to supervise implementation are provided.

ACKNOWLEDGMENTS

The American Society of Civil Engineers acknowledges the work of the Water Regulatory Standards Committee (WRSC) of the Standards Development Council (SDC) of the Environmental and Water Resources Institute (EWRI). The WRSC consists of individuals from many backgrounds, including consulting engineering, law, research, the construction industry, education, government, design, and private practice. Work on this Standard Guideline material began in 1995 with the formation of the Shared Use of Transboundary Water Resources (SUTWR) Task Committee and incorporates information developed by the EWRI Laws & Institutions Committees of the American Society of Civil Engineers. Two SUTWR committee reports provide the foundation for this Standard Guideline: *Model Water Sharing Agreements for the 21st Century* (Draper 2002b) and *Sharing Water in Times of Scarcity* (Draper 2006). This Standard Guideline was prepared through the consensus standards process by balloting in compliance with rules as administered by the Codes and Standard Committee of the American Society of Civil Engineers. Those individuals who served on the Water Regulatory Standards Committee were

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CHAPTER 1
THE FOUNDATION FOR EFFECTIVE WATER SHARING

Economic growth and prosperity and improved quality of life require adequate supplies of high-quality water on a regular and sustained basis. This requirement means that the utilization of shared waters must be carefully and systematically coordinated among or between the parties sharing the waters. In 2007, 268 transboundary river basins were identified worldwide. These basins cover almost two-thirds of the global landmass. Forty percent (40%) of the world's population depends on these shared river basins for the water they need (International Network of Basin Organizations 2002; Sea River 2002; Draper 2007b). Of the 71 rivers in the continental United States (excluding Alaska and Hawaii) that are more than 565 km (350 mi) long, only six are not shared by one or more states and/or countries. Of more than 90,000 river km (55,800 river mi), less than 7% are not shared (Pearson Education 2002; Draper 2002b, 2007b). More than 90% of the population in the continental United States depends on waters shared with other states (Draper 2002b, 2007b).

1.1 PURPOSE AND SCOPE OF THE STANDARD GUIDELINE

An effective agreement can facilitate adequate planning, conservation, utilization, development, management, and control of water resources on a water basin basis, in a manner that is reasonable and equitable under the circumstances and that causes no significant harm to most other parties. A key challenge for the parties is to make more efficient and productive use of water and to reshape the water policies of the individual parties to better respond to periods of water shortages (Postel 1996; Draper 2002b, 2007b).

This document provides guidance to be used in the formulation of water sharing agreements between and among governments so that they may meet the challenge of devising an effective and equitable water sharing agreement. The Standard Guideline seek*s* to limit potential conflict while providing an appropriate balance among efficient use of the water resource for existing economic purposes, preserving the common water resource for future needs, and promoting the protection of the environment. The procedures focus on the process of creating or modifying a transboundary water sharing agreement to ensure that the parties include all pertinent factors in their negotiations.

Although this Standard Guideline has been developed predominately using the U.S. experience with transboundary water sharing, a number of international agreements were analyzed to gain an appreciation for other experiences. Consequently, this Standard Guideline has broad application for use in international agreements, interstate compacts, or state–tribal agreements for regulatory purposes along or across intergovernmental boundaries. The Standard Guideline can apply to any sharing of waters between autonomous political entities. As presented, this Standard Guideline can be applied to a variety of circumstances involving shared water. Only those sections appropriate to the particular situation and conditions need be applied (Draper 2006). The need for careful analysis of the situation and conditions that influence those sections that may apply is especially relevant when an international agreement is being developed because the hydropolitical conditions may be greatly aggravated by significant sociocultural issues. This complication may be further aggravated by the lack of an appropriate legal forum and institutions necessary to adequately ensure compliance.

The following ASCE/EWRI Standards are incorporated in this Standard Guideline and provide additional guidance when and where required:

- ASCE/EWRI Standard 33-09, *Comprehensive Transboundary Water Quality Management Agreement* (2009c);
- ASCE/EWRI Standard 34-01, *Standard Guidelines for Artificial Recharge of Ground Water* (2001);
- ASCE/EWRI Standard 42-04, *Standard Practice for the Design and Operation of Precipitation Enhancement Projects* (2004b); and
- ASCE/EWRI Standard 40-03, *Regulated Riparian Model Water Code* (2004a).

1.2 DISTINCTIVE CHARACTERISTICS OF WATER

In setting the framework for sharing water resources, it is appropriate to briefly discuss several special characteristics of the natural resource water. Water is central to the survival of life itself, and without it plant and animal life would be impossible. Water is a central component of the Earth's systems, providing important controls on the world's weather and climate. Water is also central to our economic well-being because it supports rainfed and irrigated agriculture, forestry, navigation, waste processing, and hydroelectricity (Vörösmarty 2002). Recreation and tourism are other primary uses supported by water, especially in developed countries.

Water, unlike oil or gold, is a shared, mobile, and public resource that is used and reused for different purposes as it moves through the hydrologic cycle. Before its capture by withdrawal or diversion, a claim of exclusive ownership is difficult to sustain. Water is different from other natural resources because different users use the same water repeatedly as the water travels downstream, as in the case of surface water, or downgradient, as in the case of underground water aquifers. A case in point is Atlanta, Georgia, which withdraws most of its reliable water supply from the Chattahoochee River, consumes a portion of the water, and returns the rest of the water to the river for use by downstream users such as Lagrange or Columbus, Georgia, and even cities in Alabama and Florida (Draper 2002a, 2004, 2007b). This use and reuse is the essence of riparian law, the fundamental law theory upon which shared water use historically has been based (Draper 2006, 2007b).

It is often said that water is renewable, but the term can be misleading. Surface water and some underground water moving