Contents

Exhibits

Preface

Homeland security can no longer be taken for granted. Vulnerabilities that previously were not even considered must now be identified and addressed. Therefore, design and operational practices and procedures for wastewater facilities must be updated. Traditionally, wastewater systems were designed to meet the requirements of emergency events such as floods, tornadoes, and fires. With the new millennium, it has become apparent that malevolent acts are unpredictable and can affect any type of facility with possibly greater impacts than would be expected for most natural events.

Updates to wastewater system practices over the past several decades have not incorporated the significant security measures that must now be considered. As such, the American Society of Civil Engineers (ASCE), the American Water Works Association (AWWA), and the Water Environment Federation (WEF) agreed to work together to develop materials to assist in the improvement of water infrastructure security. The project was funded by the U.S. Environmental Protection Agency (EPA) under cooperative agreement X-83128301-0. Although the information in this document has been funded wholly or in part by the USEPA, it may not necessarily reflect the views of the Agency and no official endorsement should be inferred.

The three organizations (ASCE, AWWA, and WEF) divided the project into the areas of water supply, treatment, and distribution systems (led by AWWA); wastewater and stormwater collection, treatment, and disposal systems (WEF), and methodology and characteristics pertinent to designing contaminant detection and monitoring systems (ASCE).

This document was prepared by CH2M HILL Inc. under the guidance of a Project Steering Committee of WEF members with varied perspectives and experience with wastewater/stormwater facility security issues. Drafts of the document underwent thorough technical review by the Project Steering Committee, and members of the Water Infrastructure Security Enhancements (WISE) Standards Committee, members of various related WEF technical committees as well as other stakeholders who volunteered to provide input. The comments offered by the reviewers served as a "real-world" check to ensure that the ideas and suggestions presented would likely be applicable for various sizes and configurations of utilities.

The purpose of this document is to provide a centralized starting point for utilities as they integrate modern security practices into the operation, construction, or retrofit of their wastewater systems. The guidance focuses on these four common principles:

- Maintaining decision-making about security at the local utility level
- Developing a balanced approach to security by applying design, management, and operations strategies
- Developing cost-effective solutions
- Successfully introducing security into the culture of wastewater utilities

To enhance the value of this document, an annotated bibliography has been included in lieu of a "References Cited" section. The bibliography contains not only a list of the materials and web sites used in the preparation of this document, but also numerous other resources that may assist wastewater utility managers as they design, operate, and manage their facilities.

With the same concept in mind, information has been included in this guidance that may seem to be very basic or redundant. The purpose of this format is to ensure that all users of this guidance have the same level of understanding on which the more advanced and complex concepts are built.

Where appropriate, a range of implementation options, from basic to advanced, are presented. Each utility should apply its own decision-making process as it determines which of the options most closely meets its unique needs and situations.

Acknowledgements

Completion of a document such as this requires significant effort and expertise, not only from those who construct the text, but also those who, often at their own expense, review the document and provide invaluable guidance. It is with appreciation that the following individuals are acknowledged for their key contributions to this document.

Project Steering Committee Members	
Jeanette Brown, Stamford WPCA	Madeline F. Goddard, City of Phoenix, AZ
William Boyle, UW-Madison	Robert L. Griffin, Shield Engineering, Inc.
Findlay Edwards, University of Arkansas	Bart G. Jones, Strand Associates, Inc.
Homer C. Emery, San Antonio Water System	Carl M. Koch, Greeley & Hansen

CH2M HILL Primary Authors	
William E. Desing	Jacqueline T. Kepke
Forrest M. Gist	Michael J. Matichich
Kristine K. Hargreaves	Kenneth A. Thompson
Rex T. Hesner	Laurens van der Tak
Alan B. Ispass	Linda P. Warren

Technical Reviewers	
Zafar Bhatti, Ontario Ministry of the Environment, Toronto, Canada	Paul A. Bizier, Chastain-Skillman, Inc.
Haydn Blaize, Fulton County Public Works, GA	Charles B. Bott, Virginia Military Institute
Terry Bradham, Earth Tech, Inc.	Chris Browning, Fulton County Public Works, GA
Derek J. Burton, Woodard & Curran	William L. Cairns, Trojan Technologies, Inc.
Leonard Carson, Metropolitan Water Reclamation District	Leonard W. Casson, University of Pittsburgh
Paul H. Causey, Marin County, CA	Jerry Cevetello, Manasquan River Regional Sewerage Authority, NJ
Chein-Chi Chang, District of Columbia Water & Sewer Authority	James H. Clifton, Simsbury, CT WPC
James J. Courchaine, Brown and Caldwell	Stephen J. Craig, City of Redding, CA
Bob Decker, Pima Co. Wastewater Management Dept.	David A. Flowers, Natural Water Solutions, LLC
Wes Frye, Metro Water Services Nashville, TN	Fred R. Gaines, Applied Water Management Division
Daniel Graber, HDR, Inc.	Alan Hais, U.S. Environmental Protection Agency
Carl R. Hendrickson, Veolia Water North America	Douglas G. Honegger, D.G. Honegger Consulting
Srinivas Jalla, Parsons	Elizabeth James, Georgia Department of Natural Resources
Bart G. Jones, Strand Associates, Inc.	Patrick T. Karney, CH2M Hill
Conrad G. Keyes, Jr., American Society of Civil Engineers	Joseph S. Kowalczyk, CDM

Stephen R. Krai, LA County Sanitation District

Thomas P. Krueger, City of Tulsa WPC

Karl E. Landis, Buchart-Horn, Inc.

Glinda Loving, Milwaukee Metropolitan Sewerage District

Debbie Magin, Guadalupe Blanco River Authority

George Martin, Greenwood Metro District, SC

Bill Maxwell, City of Fort Wayne City Utilities

Shellie Chard McClary, Oklahoma Department of Environmental Quality

William McKeon, Philadelphia Water Department

John L. Murphy, City of Bangor, ME

Roger Myers, City of San Diego MWWD

Vincent L. Nazareth, R.V. Anderson Associates Limited

Daniel D. O'Brien, DHPW U&FD United States Military Academy - West Point

Rudolf Ohlemutz, Vallejo Sanitation and Flood Control District

John P. O'Neil, Unified Wastewater District

Jim Peters, Brown and Caldwell

Luke Richmond, Beckley Sanitary Board

Dan Ryan, Veolia Water North America

Cordell Samuels, Region of Durham

Harold E. Schmidt Jr., Hartman & Associates, Inc.

Robert J. Scott, Westin Engineering, Inc.

Marie Shadden, Department of Watershed Management, City of Atlanta, GA

Michael Shatynski, LA County Sanitation District

Irwin Silverstein, NHSRC

Stephen L. Simpson, Black & Veatch Corporation

Marsha Slaughter, City of Oklahoma City

Chris M. Sorensen, City of Great Falls

Monica Sowders, Knoxville Utilities Board

Peter L. Stump, Jordan, Jones & Goulding, Inc. – Norcross office, GA

Robert A. Villee, Plainfield Area Regional Sewerage Authority, NJ

Thor A. Young, Stearns & Wheler

Jody Zabolio, City of Fort Worth, TX

Executive Summary

Preparing for extreme events has been a standard practice of wastewater and stormwater designers, managers, and operators for many decades. Major rain events, blizzards, and earthquakes have been considerations in the design of infrastructure and in the planning for emergency preparedness and disaster response. The focus had always been on natural events, some of which could be predicted hours, if not days, before they occurred. The events of September 11, 2001 changed this focus. Now, wastewater and stormwater facilities, along with other public infrastructure and essential service providers, are clearly potential targets for malevolent acts of destruction and disruption from domestic and international terrorists. This new focus of concern has also enlightened wastewater and stormwater industry leaders to recognize and address the potential consequences of other vulnerabilities such as sabotage, vandalism, and theft.

Wastewater and stormwater infrastructure, while possible targets of purposeful attack, also serves as a conduit for access to other targets. Large-diameter gravity sanitary, storm, or combined sewers are often easily accessible via manholes, inlets, and overflow structures, and they can provide a means of undetected passage under the streets of a municipality to attack both "soft" and "hardened" targets. Large and small pipelines can also be made into weapons via the introduction of a highly flammable substance such as gasoline through a manhole or inlet, or even through a building drain or cleanout.

Purposeful contamination of wastewater or stormwater, as well as damage to or destruction of treatment or conveyance systems, can lead to widespread and long-term environmental damage, and severe public health impacts. The remote location and frequently unattended operation of many wastewater pump stations and stormwater facilities increase their vulnerability. Additionally, a cyber attack on Supervisory Control and Data Acquisition (SCADA) system communications can cause sewer overflows and flooding, possibly damaging property and environmentally sensitive lands, contaminating ground and surface waters, and threatening public health.

Overall, the protection of wastewater and stormwater systems, and their staffs, poses many unique issues and thought-provoking challenges. Industry leaders are meeting these challenges directly through the Water Environment Federation, the American Society of Civil Engineers, the American Water Works Association, and others, assisted and funded by the U.S. Environmental Protection Agency. This Security Guidance is intended to serve as the "go-to" reference for designers, operators, and managers of wastewater and stormwater infrastructure intent on meeting these challenges.

The primary purpose of this document is to provide considerations for the design of wastewater and stormwater systems that can help to reduce the risks posed by malevolent threats. However, along with design considerations, there are many management and operational practices that can reduce the risks from malevolent threats as well. Because many of these management and operational practices can provide a considerable reduction in risk and can be implemented without major capital investment, they are presented first, prior to the section on design.

It is important to understand that this document is intended to be used by wastewater and stormwater professionals who have completed a vulnerability assessment and are looking for ways to improve the security of their system through utility management, facility operations, and infrastructure design.

This guidance is organized into the following sections:

Introduction. This section presents an overview of wastewater security, including a description of the potential natural and man-made threats to wastewater systems. It describes methodologies for conducting a vulnerability assessment—a step that should be undertaken before using this document—and discusses drivers for security improvements and strategies for balancing security risks with costs and other utility priorities.

Managing for Reduced Risk. Many simple shifts in utility management and culture can result in great improvements to wastewater security. This section outlines management techniques related to working with the utility's governing body; human resources strategies including considerations related to the organizational culture; elements of an effective training program; financial considerations for funding security improvements; tips on records management; policies and procedures; procurement; and communication practices and interagency communication—before, during, and after an event.

Operational Considerations for Reducing Risk. Along with changes in the way the utility is managed, operational changes often provide some of the more cost-effective ways for utilities to enhance the physical security of their systems. This section provides suggestions for operational strategies that wastewater utilities may adopt to cost-effectively improve the security of their infrastructure support facilities. It evaluates the applicability of different operational approaches to security for a variety of threats and provides suggestions for operating treatment facilities, laboratories, support facilities, remote pumping facilities, and collection system infrastructure.

Design Considerations for Reducing Risk. The objective of this section is to provide guidance that enables wastewater utility decision-makers and designers to develop secure sites and facilities that protect people, information, property, and assets. This section provides general design recommendations and physical protection system design concepts, as well as specific design considerations for different types of wastewater treatment and collection facilities.

Cyber Security. As more wastewater utilities automate their processes and rely on the digital transfer of information, the utilities are increasingly vulnerable to a cyber attack that could compromise not only data, but infrastructure as well. This section describes potential cyber attacks and presents management, operational, and design solutions to improve cyber security.

Electric and Electronic Security Devices. The operational and design sections of this document identify applications for which utilities may want to install electric and electronic security devices. This section provides an overview of issues and situations that should be considered when determining the type of electric/electronic security system to install. Included are descriptions of security devices, including intrusion detection systems, access control and card readers, biometric readers, and closed-circuit surveillance camera systems. Lighting and wiring are also discussed.

Emergency Response. No utility can protect against all threats, thus a utility must be prepared to respond and recover in the event that existing security systems do not prevent a harmful occurrence. This section presents information for wastewater utilities to consider when planning for and responding to incidents in order to minimize disruption of service, protect employees and the public, and mitigate adverse environmental impact. The issues discussed provide the basis for development of a wastewater Emergency Response Plan for both human-caused and natural hazard emergencies.

Other Information Sources. Many additional resources are available to assist wastewater utilities looking to delve further into improving security at their facilities. This section presents information on agencies and associations that have an interest in utility security, as well as their related documents and web sites.

Water Environment Federation

Founded in 1928, the Water Environment Federation (WEF) is a not-for-profit technical and educational organization with members from varied disciplines who work toward the WEF vision of preservation and enhancement of the global water environment. The WEF network includes water quality professionals from 76 Member Associations in 30 countries.

For information on membership, publications, and conferences, contact:

Water Environment Federation
601 Wythe Street
Alexandria, VA 22314-1994 USA
(703) 684-2400
http://www.wef.org

IMPORTANT NOTICE

The material presented in this publication has been prepared in accordance with generally recognized engineering principles and practices and is for general information only. However, the material only should be used based on site-specific evaluation and vulnerability assessments and after securing competent advice with respect to its suitability for your application. It is your responsibility to ensure that the information you use is accurate and appropriate to your use. WEF makes no representation of warranty of any kind, whether expressed or implied, concerning the accuracy, product, or process discussed in this publication and assumes no liability for consequences resulting from the use of the information included here. Anyone using this information assumes all liability arising from such use.

The contents of this publication are not intended to be a standard of WEF and are not intended for use as a reference in purchase specifications, contracts, regulations, statutes, or any other legal document.

No reference made in this publication to any specific method, product, process or service constitutes or implies an endorsement, recommendation, or warranty thereof by WEF.

Acronyms and Abbreviations

ACC	American Chemistry Council
ACL	access control list
AMSA	Association of Metropolitan Sewerage Agencies
AMWA	Association of Metropolitan Water Agencies
ASCE	American Society of Civil Engineers
ASIWPCA	Association of State and Interstate Water Pollution Control Administrators
AWRA	American Water Resources Association
AWWA	American Water Works Association
AwwaRF	American Water Works Association Research Foundation
CBR	chemical, biological, or radiological
CCTV	closed-circuit television
CDC	Centers for Disease Control and Prevention
CHIPS	Citizens Helping in Police Service
CIAO	Critical Infrastructure Assurance Office
CIP	capital improvement plan, critical infrastructure protection
CPR	cardio-pulmonary resuscitation
CPTED	Crime Prevention Through Environmental Design
CSO	combined sewer overflow
CWSRF	Clean Water State Revolving Fund
DBT	design basis threat
DHS	Department of Homeland Security
DoD	Department of Defense
DoS	Department of State
EOC	emergency operations center
EPA	U.S. Environmental Protection Agency
ERP	emergency response plan
EWRI	Environmental and Water Resources Institute
FBI	Federal Bureau of Investigation
FEMA	Federal Emergency Management Agency

FOIA	Freedom of Information Act
GC/MS	gas chromatograph/mass spectrometer
GETS	General Emergency Telecommunications Service
GPS	global positioning system
GSA	General Services Administration
HAZWOPER	Hazardous Waste Operations and Emergency Response
HMI	human-machine interface
HSPD	Homeland Security Presidential Directive
HVAC	heating, ventilation, and air conditioning
ICS	Incident Command System
IDS	intrusion detection system
IED	improvised explosive device
IID	improvised incendiary device
IP	Internet protocol
ISAC	Information Sharing and Analysis Center
IT	Information Technology
IWA	International Water Association
LEPC	Local Emergency Planning Committee
MHz	Megahertz
NELAP	National Environmental Laboratory Accreditation Program
NETCSC	National Environmental Training Center for Small Communities
NIMS	National Incident Management System
NIOSH	National Institute of Occupational Safety and Health
NPDES	National Pollutant Discharge Elimination System
NRWA	National Rural Water Association
NSFC	National Small Flows Clearinghouse
O&M	operation and maintenance
ODP	Office of Domestic Preparedness
ORP	oxidation-reduction potential
OSHA	Occupational Health and Safety Administration
PCII	Protection of Critical Infrastructure Information

PCIS	Partnership for Critical Infrastructure Security
PDD	Presidential Decision Directive
PIN	personal identification number
PIO	Public Information Officer
PIR	passive infrared
PLC	programmable logic controller
POTW	publicly owned treatment works
PSM	process safety management plan
PTZ	pan, tilt, and zoom
RAM-W™	Risk Assessment Methodology for Water
RFID	radio frequency identification
RMP	risk management plan
RPG	rocket-propelled grenade
RTU	remote terminal unit
SARA	Superfund Amendments and Reauthorization Act
SBCCOM	United States Army Soldier and Biological Chemical Command
SCADA	Supervisory Control and Data Acquisition
SEMS	Security Emergency Management System
TISP	The Infrastructure Security Partnership
UPS	uninterruptible power supply
USFA	U.S. Fire Administration
UV	ultraviolet
VA	vulnerability assessment
VPN	virtual private network
VSAT™	Vulnerability Self-assessment Tool
WEF	Water Environment Federation
WERF	Water Environment Research Foundation
WISE SC	Water Infrastructure Security Enhancements Standards Committee
WVU	West Virginia University