

Clean Water Fund Memorandum (2017-001)**Storm Resiliency of Municipal Wastewater Infrastructure****I. PURPOSE**

To provide municipalities with requirements to prepare existing and proposed wastewater infrastructure to be resilient and better withstand the effects from severe weather events and expected climate change impacts including, but not limited to, increases in the frequency and severity of precipitation events, flooding, storm surge, wave action and sea level rise concerns.

II. GOVERNING AUTHORITIES

- A. In 1998, Section 7 of Public Act 08-98 “An Act Concerning Global Warming Solutions” required the Governor’s Steering Committee on Climate Change to establish an Adaptation Subcommittee to evaluate projected impacts of climate change on Connecticut agriculture, infrastructure, natural resources and public health, and develop mitigative and adaptive strategies to address those impacts. The 2011 Connecticut Climate Preparedness Plan created on the heels of this Public Act made a series of recommendations related to wastewater infrastructure including:

“Consider climate change as a part of DEEP facility planning checklist for public/community wastewater treatment plants financed through the Clean Water Fund” and “Consider climate change effects and adaptation in life cycle and asset planning for treatment plant reconstruction and operations and maintenance”

- B. CGS Section 22a-92 establishes goals and policies under the Connecticut Coastal Management Act. In 2012, Public Act 12-101 added CGS Section 22a-92(5), which indicates that projects subject to the Connecticut Coastal Management Act shall:

“...consider in the planning process the potential impact of a rise in sea level, coastal flooding and erosion patterns on coastal development so as to minimize damage to and destruction of life and property and minimize the necessity of public expenditure and shoreline armoring to protect future new development from such hazards”.

- C. In 2013, Public Act 13-15 added Section 22a-478 (a) (8) to the Connecticut General Statutes (CGS), so that Clean Water Fund (CWF) projects must consider:

“the necessity and feasibility of implementing measures designed to mitigate the impact of a rise in sea level over the projected life span of such project.”

- D. Public Act 13-179 redefined “Rise in sea level” in CGS Section 22a-93 as:

“the arithmetic mean of the most recent equivalent per decade rise in the surface level of the tidal and coastal waters of the state, as documented in National Oceanic and Atmospheric Administration online or printed publications for said agency's Bridgeport and New London tide gauges.”

- E. Chapter 476a of the CGS (Section 25-68) defines Connecticut Flood Management Act (FMA) requirements in the State.

CGS Section 25-68d requires all state-funded projects to secure a certification or exemption if the projects is located within or affects floodplains or natural or man-made storm drainage facilities.

- F. Sections 25-68h-1 through 25-68h-3 of the Regulations of the Connecticut State Agencies (RCSA) are the Connecticut floodplain management regulations. Section 25-68h-2(b) establishes restrictions which pertain to all new and substantially improved structures within the floodplain.

- G. CGS Section 8-23 establishes a requirement for municipalities to amend or adopt a plan of conservation and development at least once every ten years. CGS Section 8-23(d)(11) indicates that the plan of conservation and development shall consider sea level rise.

III. FLOOD PROTECTION CRITERIA AND REQUIREMENTS

For all state-funded wastewater projects, the design criteria must adhere with the minimum flood protection levels included in the FMA requirements pursuant to CGS Section 25-68. The DEEP has also determined that state-funded wastewater projects must also adhere to the minimum flood protection levels in *TR-16 Guides for the Design of Wastewater Treatment Works* (TR-16), as may be amended. If there are any discrepancies between the applicable design standards regarding minimum levels of protection, the more conservative level shall prevail.

Notwithstanding any of the requirements listed herein, new or rehabilitated wastewater infrastructure must be able to provide for uninterrupted operation and be protected from physical damage during a 100-year storm.

To meet these requirements, the DEEP strongly encourages municipalities to avoid the placement of new wastewater infrastructure within the 100-year floodplain, if possible. Should this avoidance be technically and/or economically unfeasible, all critical wastewater equipment and structures must be flood protected to the 100-year storm plus 3 feet, at a minimum. In addition, the DEEP may determine that certain critical activities may require flood protection to the 500-year (0.2%) flood elevation, as it is required with

the storage of hazardous materials. All non-critical wastewater plants, facilities and pump stations must be flood protected to the 100-year storm plus 2 feet, at a minimum.

A resiliency evaluation must be conducted during planning and/or early stages of design to determine for each existing or new structure and treatment system component whether it is considered critical per the FMA requirements pursuant to CGS Section 25-68b; and/or TR-16. The DEEP reserves the right to make a final determination on the criticality (i.e., critical versus non-critical status) of structures and equipment and the minimum levels of protection to be incorporated on a case-by-case basis.

Planning and/or design scopes of work previously approved without the resiliency evaluation will require amending to include this evaluation.

IV. GUIDANCE

Municipalities performing facility planning and/or design of upgrades to existing or planned wastewater infrastructure must evaluate and recommend, as applicable, all necessary measures to prepare critical infrastructure or equipment to better withstand the effects from severe weather events and climate change impacts, using best available actionable science and design criteria.

Greater vulnerability and complexity of wastewater infrastructure may require a more comprehensive resiliency evaluation. Facilities located in or near the coastal zone or in tidal areas must consider projected sea level rise over the life span of wastewater infrastructure or equipment. In addition, where appropriate, other factors such as storm surge, wave run-up, shoreline erosion, etc. should also be considered.

First, the resiliency evaluation should confirm the Base Flood Elevation (BFE), and Top Of Concrete (TOC) elevations associated with existing or proposed infrastructure within the entire footprint of the treatment or conveyance facility to determine what lies in the 100-year floodplain. It is also useful to determine what lies in the 500-year floodplain, such as hazardous materials. The resiliency evaluation should also include hydraulic profiles identifying areas of vulnerability.

The BFE may be determined using the appropriate Federal Emergency Management Agency (FEMA) Flood Insurance Study and accompanying Flood Insurance Rate Map (FIRM). More recent FEMA flood mapping products, including Advisory Base Flood Elevation Maps, working maps, preliminary updated Flood Insurance Rate maps or FEMA non-regulatory RiskMAPs may be available in some locations. Check with the National Flood Insurance Program state coordinator at the DEEP; or the FEMA flood map service center at msc.fema.gov for the status of FEMA flood mapping products in your project area.

If more recent FEMA maps have higher BFEs, those elevations should be considered. If the FIRM depicts the project area within a floodplain that is suspected to be overly

conservative, a revised floodplain must be supported with extensive field data, subject to DEEP approval. Such data should include a bathymetric study of the waterbody(ies) associated with the mapped floodplain, and a detailed topographic survey of the area prone to flooding. It is not sufficient for the municipality to say that its staff has never seen the project area flood, and therefore the project area does not require flood protection.

The resiliency evaluation should account for the hydrostatic and dynamic forces exerted by flood waters. The resiliency evaluation should also consider several worst-case scenarios that may occur during severe weather, which will be unique to each facility and each municipality.

The resiliency evaluation may select the appropriate level of protection using one or more of the following approaches:

- Freeboard Value Approach (FVA): Freeboard (100-year base flood elevation + X, where X is 3 feet for critical actions and 2 feet for other actions);
- Climate-Informed Science Approach (CISA): Utilizing the best-available, actionable hydrologic and hydraulic data and methods that integrate current and future changes in flooding based on climate science;
- 0.2 percent annual chance Flood Approach: 0.2 percent annual chance flood (also known as the 500-year flood); or
- The elevation and flood hazard area that result from using any other method identified in an update to the Federal Flood Risk Management Standard (FFRMS).

Existing facilities planned for upgrade shall be improved to the maximum extent possible to meet the flood protection criteria described above. However, floodproofing measures may be allowed where elevation of equipment or structures may not be feasible, including but not limited to:

- The use of stop logs at entrances;
- Raising motor drives and pumps;
- Lab cabinets with positive latching systems to prevent lab chemicals from mingling with floodwaters;
- Storage at the highest practical elevation;
- The use of water tight enclosures;
- The use of equipment capable of withstanding flooding and;
- The use of quick-connect and/or disconnect mechanisms to enable equipment relocation and facilitate post-storm recovery tasks.

DEEP will verify adherence to the above-discussed requirements through the review of facilities planning reports, plans and specifications documents, and flood management certification process. Failure to comply with these requirements may render all or portions of a project ineligible for CWF funding assistance.

V. ADDITIONAL RESOURCES FOR MUNICIPALITIES

The Connecticut Institute for Resilience and Climate Adaptation (CIRCA) at UCONN helps communities identify critical infrastructure that is at risk, measures the vulnerability, and identifies ways to reduce that vulnerability. CIRCA's mission is to help Connecticut's towns and cities be more resilient to the impacts of climate change and extreme weather. In order to do so, CIRCA researchers are making climate change predictions for Connecticut.

Importantly, a recent CIRCA report developed a predicted static sea level rise of 0.5 meters by 2050 along the Connecticut coastline. This static sea level rise prediction does not take into account tidal cycle, wave action or any other factors that may exacerbate storm surge. Information relating to calculating current and future flood risk from precipitation changes under climate change, modeling sea level rise and storm surge inundation, and others can be found on CIRCA web site at <http://circa.uconn.edu/>.

VI. DEFINITIONS

Base Flood Elevation (BFE) is the topographic elevation having a one percent chance of being equaled or exceeded by flood waters in any given year. This is the regulatory standard also referred to as the "100-year flood" elevation.

CISA: Climate-Informed Science Approach

CIRCA: Connecticut Institute for Resilience and Climate Adaptation at UCONN

CGS: Connecticut General Statutes

Critical Activity: Any activity deemed to be vital to the core operation of wastewater facilities or that will prevent a facility to return to full function as safely and quickly as possible after a flood event. Per CGS Section 25-68b, this means any activity, including, but not limited to, the treatment, storage and disposal of hazardous waste and the siting of hospitals, housing for the elderly, schools or residences, in the 0.2 per cent floodplain in which the commissioner determines that a slight chance of flooding is too great.

Critical Equipment: According to TR-16, critical equipment includes conveyance and treatment system components identified for protection including, but not limited to, all electrical, mechanical, and control systems associated with pump stations and treatment facilities that are responsible for conveyance of wastewater to and through the treatment facility to maintain primary treatment and disinfection during the flood event. Other equipment that, if damaged by flood conditions, will prevent the facility from returning to pre-event operation after cessation of flood conditions is also critical equipment.

CWF: Connecticut Clean Water Fund

DEEP: Connecticut Department of Energy and Environmental Protection

EPA: Environmental Protection Agency

FEMA: Federal Emergency Management Agency

FFMRS: Federal Flood Management Risk Standard

FIRM: Flood Insurance Rate Map

Floodplain: That area located within the real or theoretical limits of the base flood or base flood for a critical activity.

FMA: Connecticut Flood Management Act

FVA: Freeboard Value Approach

PFA: Percent Annual Chance Flood Approach

RCSA: Regulations of the Connecticut State Agencies

TOC: Top of concrete elevation is defined as the lowest elevation that would provide infrastructure with structural protection from severe weather impacts such as from anticipated flood conditions.

TR-16: Technical Report #16, as may be amended, entitled *Guides for the Design of Wastewater Treatment Works*, prepared by the New England Interstate Water Pollution Control Commission.

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