EMERGENCY DRINKING WATER FRAMEWORK

Prepared for:

RDPO
Regional Disaster Preparedness Organization
Unified. Prepared. Resilient.

Regional Water Providers Consortium

Salus Resilience

RH2

The Formation Lab

seft
Consulting Group

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EXECUTIVE SUMMARY

The Provision of the Emergency Drinking Water Framework (Framework) was developed to enhance regional coordination and policymaking and provide guidelines for local planning for the provision of emergency potable water to the public following a disaster. The project is funded by a grant from the Department of Homeland Security's Urban Areas Security Initiative (UASI) program. Over the last decade, water providers in the region have been using UASI funds and local budgets to purchase emergency mobile water treatment and distribution systems. Before additional investments are made, there was recognition that the region needed a better understanding of what the emergency drinking water needs are, what resources are available, and what capability gaps exist, in addition to defining roles and responsibilities.

In 2020, the City of Portland (City)'s Bureau of Emergency Management (PBEM), in coordination with the Regional Disaster Preparedness Organization (RDPO) and the Regional Water Providers Consortium (RWPC), contracted with the Salus Resilience Consulting Team, consisting of Salus Resilience, a division of Haley & Aldrich, Inc.; The Formation Lab; SEFT Consulting Group; and RH2 Engineering to develop the Framework for the five-county Portland-Vancouver Metropolitan Region (Region). The area consists of Clackamas, Columbia, Multnomah, and Washington counties in Oregon, as well as Clark County in Washington. The study coverage area is shown in Section 1.

For this Framework, the consulting team assembled data, conducted a literature survey, and solicited feedback and participation from agencies across the Region, the state, and Federal Emergency Management Agency (FEMA), through interviews, surveys, and workshop participation. The analyses and information gathered were used to develop and recommend a Framework for use in future planning efforts by water providers and emergency response agencies to evaluate emergency water supply capacity and Regional needs; and to determine agency responsibilities to plan for distribution of emergency drinking water to the general public during Regional emergencies, including the expected Cascadia Subduction Zone (CSZ) earthquake; and to provide general guidance on future emergency water distribution discussions and related policy development. Note in the context of this report, emergency response agencies include any agencies (local, state, and/or federal) that are responsible for and provide emergency response and recovery services; these include organizations such as police, fire, and medical assistance.

RDPO and RWPC developed several goals for this Framework:

- To enhance emergency water distribution disaster planning, collaboration, and communication among water providers and emergency response agencies;
- To determine post-disaster emergency water supply needs and gaps throughout the region;
- To identify and recommend roles and responsibilities for distribution of emergency drinking water;
- To serve as a planning resource for water providers to evaluate their systems, incorporate needed improvements into planning, and support emergency response efforts to supply emergency drinking water;

- To provide guidance that assists the Regional network of emergency responders and water providers in their planning for emergency water distribution to underserved or vulnerable populations during and after a disaster;
- To develop strategies to close any gaps between available water resources and demand following a disaster; and
- To develop policies to address Regional emergency management and water distribution priorities.

Recommendations and potential policies addressing Region-wide emergency management and water distribution priorities are included.

This Framework will serve as a guide for water providers and emergency response agencies to prepare and develop their emergency water distribution plans, and to establish general water distribution procedures and processes ahead of emergencies. Future work will be necessary by the RDPO, RWPC, individual water providers, and emergency response agencies to implement this Framework collectively and in their individual jurisdictions. Three main elements are included in this Framework: 1) clarity in roles and responsibilities; 2) an effective regional Framework with room to evolve; and 3) equity considerations. Sections 3 through 5 discuss, in detail, how water providers and emergency response agencies can evaluate how much water is needed for their jurisdiction, how much water may be available, and provides guidance for determining emergency supplies needed and emergency planning efforts.

PROJECT METHODOLOGY

Stakeholder Engagement

The development of the Framework relied heavily on stakeholder input and participation. Stakeholders included federal, state, county, and local emergency response and public health agencies, and representatives from large and small water providers across the five-county Region.

A focused stakeholder engagement plan was developed to ensure the Framework would meet the needs of the Region. The engagement plan included select water provider interviews and a detailed on-line survey. The interviews and surveys are discussed in Section 2. In addition, three water provider and emergency response agency stakeholder workshops were held virtually to obtain feedback that drove the development of the Framework. A fourth workshop was held in September 2022 and solicited feedback on the draft Framework, specifically the recommendations for future work and policy development.

- Workshop 1, June 2021 – Roles and Responsibilities
- Workshop 2, October 2021 – Baseline Water Use, Results of Water Provider Survey, Geographic Assessments, and Preliminary Gap Analysis
- Workshop 3, March 2022 – Tabletop Exercise to test the draft Framework
- Workshop 4, September 2022 – Present regional recommendations based on Tabletop Exercise and Gap Analysis

Identification of Emergency Response Islands

During research for the project, it became clear that transportation failures after a large seismic event would hinder water distribution. Thus, we used publicly available state and local agency data to identify anticipated Regional divisions, described as Emergency Response Islands (Islands), that are expected to exist following a large disaster, such as an earthquake. Figure ES-1 shows the Islands in the study area. Figures 2.1 through 2.5 show islands in each county in more detail. These Islands represent geographic areas and associated water service populations that are expected to be isolated in the aftermath of a CSZ event due to transportation system damage and physical and natural barriers. These Islands will likely need to access drinking water without relying on outside help during the first few weeks after a CSZ event. Our evaluations included considerations of these Islands.

Figure ES-1: Emergency Response Islands

Emergency Scenarios

Representative emergency scenarios were developed to test the Framework. Due to the wide variety of potential hazards, we focused on the potential damage due to these hazards and developed three scenarios based on the type of damage and number of water providers affected.

The emergency scenarios for this Framework include:

- Scenario 1 – Small Event: One to five water providers are affected. The existing water distribution networks are functional, while supply/source or transmission is disrupted.
- Scenario 2 – Subregional Event: Source area and transmission affected; multiple water providers are affected (could be one or more providers affected; key is the difference in how the water system is impacted). Water distribution networks are functional, while supply/source and transmission are disrupted.
- Scenario 3 – Regional Event: Source area, transmission, and distribution networks are affected across the Region; most water providers are expected to be affected.

Under most variations of the Small and Subregional Event scenarios, it is assumed that the majority of the existing water distribution and transmission systems will remain largely intact and will continue to distribute water to most of the Region's service population through the existing pipe networks. These scenarios are categorized as "piped-water" scenarios. The Regional Event is typically considered by the project stakeholders to be a large, widespread catastrophic event, such as a CSZ event. Such a catastrophic event is expected to damage significant portions of the Region's water systems and will likely severely impact the ability of water providers to deliver drinking water through the existing piped distribution system. For purposes of this study, this scenario is considered a "distribution failure" scenario and is categorized as a "non-piped-water" scenario.

A previous study commissioned by the RWPC focused on "piped-water" scenarios. The Regional Water Interconnections Map and Evaluation project (Interconnections Study; Murray, Smith & Associates, 2010) identified water system interconnections among water providers and evaluated the ability to move water within individual, interconnected subregions of the Portland Metropolitan Area. The Interconnections Study demonstrates that the interconnectedness of the Region's water systems can facilitate some degree of water service in a "piped-water" scenario, where the distribution system remains sufficiently intact (e.g., during and after Small and Subregional Event scenarios) and pumping equipment and fuel are available. During the Regional Event, we anticipate that the distribution and interconnection systems will be unavailable. Further, due to widespread damage, mandatory curtailment to subsistence-level demands will be required throughout the whole region. Under subsistence conditions, it is reasonable to assume that the priority for potable emergency drinking water will be used for domestic purposes. Considerations for fire suppression, institutions, and other water uses were not included in this emergency drinking water study.

Survey and Interview Results

There are 72 water providers in the study area, each with their own governing body. Collectively, they serve over 2.3 million people. The 54 providers who met a minimum threshold of at least 150 connections were invited to answer the survey. Interviews were conducted, and 43 survey responses were received and informed the development of this Framework. Interview results are summarized in Section 2. Survey results provided information on levels of emergency preparedness, plans, training and planning status, communications, resilience of water systems, and emergency supplies and response equipment.

Roles and Responsibilities

Based on our gathered information, emergency water distribution is seen as a shared responsibility requiring collaboration and partnership among various levels of government emergency response agencies, water service providers, private sector companies, and non-governmental organizations (NGOs). Emergency response starts at the lowest possible level and is elevated to the next level when the resources and capabilities of the lower level are exceeded. For Small and Subregional Events, the emergencies are generally within the capabilities of the water providers with minimal assistance from emergency response agencies. For the Regional Event, we assume: 1) that the water system will be heavily damaged and water providers will be focused on repairing the water system; 2) that the distribution of emergency water will exceed the capabilities of the water providers; and 3) that the provision of emergency water will rest with the emergency response agencies.

To understand and properly define the roles and responsibilities of stakeholders at various levels (from local water service providers to the federal government) during an emergency event, a variety of sources of information, including interviews with FEMA, state and local personnel, state and local emergency drinking water planning guides, the Oregon Health Authority rules, and U.S. Environmental Protection Agency UUSEPA) guidance, and local water agencies' after-action reports, have been collected and reviewed. An extended discussion of this information is included in Section 3.

The Framework provides a discussion of current roles and responsibilities and best management practices (Section 3) as well as recommendations for additional responsibilities and practices (Section 7), based on the information collected and obtained during Workshop 1. This information is summarized into Table ES-1, below. Cities and counties are grouped together in the table to minimize duplication. Following their entries are roles and responsibilities unique to the counties.

Table ES-1: Combined Current and Proposed Roles and Responsibilities

Agency	Role in Agency	Current Roles and Responsibilities	Proposed Roles and Responsibilities	Current Best Practices	Proposed Best Practices
Residents and Businesses	NA	NA	NA	• Sign up for the local emergency alert system for notifications.	• Maintain at least two weeks' supply of drinking water after an emergency. One gallon per person per day at a minimum. • Include additional water for pets and livestock. • Prepare clean, refillable containers to obtain water from distribution sites.
Water Providers (including public municipality, Special District, public utility district (PUD), or other)	Emergency Management (includes emergency operations center [EOC], Engineering, and Operations)	<u>Emergency Preparedness</u> • Develop an emergency response plan (ERP); maintain and update regularly. • Develop an emergency drinking water distribution plan (required in Oregon). • Develop rationing and curtailment plans.	• Coordinate with city and county EOCs to distribute emergency drinking water to identified points of distribution (PODs_ and islands. • Work with city/county EOC to develop demobilization plan for emergency water distribution as water infrastructure recovers.	• Obtain contracts or agreements with chemical suppliers for necessary emergency treatment chemicals and associated shipping services. • Obtain contracts or agreements with suppliers for pipes, valves, and materials, services, and deliveries, etc.	• Establish written mutual aid agreements (especially with ones east of the Cascade Mountains and out-of-state). • Provide guidance, technical assistance, and staff to set up the mobile treatment and emergency water distribution at PODs.

Agency	Role in Agency	Current Roles and Responsibilities	Proposed Roles and Responsibilities	Current Best Practices	Proposed Best Practices
Water Providers (Continued)	Emergency Management (Continued)	<u>Emergency Response</u> • Repair water system and restore potable piped water supply. • Activate EOC when necessary. • Prepare information as needed for the local disaster declaration. • Consult Oregon Health Authority (OHA) / Washington Department of Health (DOH) for technical and regulatory advice and issue a health advisory, if necessary. • Notify the public of any water advisories.		• Develop an emergency drinking water distribution plan (suggested in Washington). • Prepare Continuity of Operations Plan (COOP) • Join and participate in Oregon or Washington Water/Wastewater Agency Response Network (ORWARN or WAWARN). • Obtain mutual aid agreements and request assistance. • Obtain shared worker agreements. • Complete resource typing of equipment, staffing, and materials. Promote organization and individual emergency preparedness.	• Contract with fuel vendors for emergency fuel supply. • Establish agreements and/or emergency contracts with vendors for critical supplies, long-lead-time items and unique parts and materials expected to be needed during emergencies to aid in recovery. • Contract with engineers and contractors for technical assistance, emergency repair contracts, post-event damage assessment, or other services needed. • Install two-way interconnections, where feasible, and prepare written agreements with those that share the interconnection for maintenance and emergency assistance. • Procure water-related equipment and materials needed to provide emergency water from

Agency	Role in Agency	Current Roles and Responsibilities	Proposed Roles and Responsibilities	Current Best Practices	Proposed Best Practices
Water Providers (Continued)	Emergency Management (Continued)				tanks, reservoirs, wells, and the backbone pipe POD, as well as at treatment sites and distribution sites.
	Infrastructure Readiness (Engineering, Operations and Field Crews)	• Develop seismic risk assessment and mitigation plan. (Required for most providers in Oregon) • Implement seismic improvement projects needed to comply with American Water Infrastructure Act (AWIA), Oregon Resilience Plan (ORP), and states' resilience requirements and recommendations for water systems.	• No change	• In an emergency impacting delivery of potable water, notify water providers, local government, regulatory agencies, and critical customers. • Develop a seismic risk assessment and mitigation plans (suggested in Washington). • Procure backup power (permanent or portable generators) and adequate fuel storage for emergency power outages.	• Create a map overlaying where resilient water storage is available and where the vulnerable populations are and address any infrastructure gaps. • Collaborate with City/County Emergency Management to develop resilient communications.
	Public Information Officer (PIO) (or Communications Manager)	• Obtain approved language of a water advisory from OHA or WA DHS prior to its release and have translated for the public. • Disseminate information to the	• No change	• Communicate through city-wide alert, the Integrated Public Alert and Warning System (IPAWS), or media. • For small, rural water service providers, obtain assistance from OHA or DOH to	• Establish relationships with local communities, NGOs, school districts, emergency response committees, and media for their assistance in communicating to the public in multiple

Agency	Role in Agency	Current Roles and Responsibilities	Proposed Roles and Responsibilities	Current Best Practices	Proposed Best Practices
Water Providers (Continued)	PIO (continued)	public • Coordinate press conferences and respond to questions.		communicate to the public.	languages and to those with disabilities. • Communicate the emergency response and emergency drinking water plans with stakeholders and the public.
City / County	Emergency Management	<u>Emergency Preparedness</u> • Develop an ERP that includes critical services and infrastructure and regularly refine the plan. • Identify locations with low risk in various emergency scenarios for PODs, including emergency water distribution. <u>Emergency Response</u> • Activate EOC or Emergency Coordination Center (ECC) • Prepare city/county disaster declaration. • Escalate to county/state level emergency management and	• Work with water providers to develop demobilization plan for emergency water distribution as water infrastructure recovers.	• Regularly refine the plan. • Exercise EOC regularly and include water providers. • Collaborate with water providers to identify available locations for emergency water distribution sites. • Coordinate the resources and response among water providers, mutual aid partners, volunteer organizations, and other stakeholders. • Develop a city/county map of vulnerable populations and PODs. • Aggregate resource gaps identified by water providers to estimate resource gaps	• Maintain a list of approved vendors for pre-packaged water supply. • Consider locations of vulnerable populations when identifying PODs, shortening required travel distances in areas with high concentrations of individuals with low mobility (e.g., seniors) or transportation access (e.g., low level of car ownership). • Further study to identify best practices for reaching vulnerable populations with water and other essential services.

Agency	Role in Agency	Current Roles and Responsibilities	Proposed Roles and Responsibilities	Current Best Practices	Proposed Best Practices
City / County (Continued)	Emergency Management (Continued)	request assistance, if necessary. • Identify, arrange, manage, and coordinate distribution of food, water, shelter, and mass care including emergency drinking water to affected populations within city or county jurisdiction. • Lead emergency water distribution, including setup and management. • Notify the public of the anticipated locations of PODs for food, water, shelter, and mass care. • Procure materials and equipment needed for PODs.		and collaborate with water providers and various levels of government to identify potential options to address the gaps. • Include transportation of trucked water between where water is available and the PODs. • Represent member water providers to negotiate with fuel vendors to develop municipal standing offer agreements for liquid fuel.	• Include vulnerable populations in the ERP. • Develop collaborative resilient communications and structure with water providers. • Invest in a centralized data center/platform to show status of outages and repairs. • Develop process for communicating status for all utilities to avoid duplicating efforts.

Agency	Role in Agency	Current Roles and Responsibilities	Proposed Roles and Responsibilities	Current Best Practices	Proposed Best Practices
City / County (Continued)	PIO	• Disseminate information to the public. • Coordinate press conferences and respond to questions	• No change	• Use city- or county-wide alert, IPAWS, or media.	• No change
	Department of Public Works (Division or Department of Transportation, [DOT])	• Remove debris from city-or county-maintained roads to facilitate recovery of critical services. • Repair damaged roads and bridges for emergency access.	• No change	• Include facilitating recovery of water services and other critical infrastructure.	• No change
	Law Enforcement	• Protect essential city/county and other agency facilities within jurisdiction.	• No change	• Protect water supplies, equipment, and staff repairing the water system, and maintain security at emergency water distribution sites.	• No change

Agency	Role in Agency	Current Roles and Responsibilities	Proposed Roles and Responsibilities	Current Best Practices	Proposed Best Practices
County-specific (not listed above)	Emergency Management	• Facilitate coordination between the state and the city (if water service provider is a municipal department). • Collaborate with non-municipal water providers to identify distribution locations. • Request emergency declaration from Governor.	• No change	• Prioritize drinking water agencies for emergency fuel allotment/distribution including those in municipalities.	• No change
Oregon/ Washington State	State Governors	• Declare a State of Emergency	• No change	NA	NA
	State Emergency Manager, or Incident Commander	• Lead and coordinate state emergency response. • Responsible for coordinating all Emergency Support Functions (ESFs) with federal, state, and local agencies.	• No change	• Assist partners in providing a coordinated response. • Identify state staging areas for commodity PODs.	• Revisit ESFs to ensure appropriate state agencies are leading emergency water distribution and recovery.

Agency	Role in Agency	Current Roles and Responsibilities	Proposed Roles and Responsibilities	Current Best Practices	Proposed Best Practices
Oregon / Washington State (Continued)	Oregon Department of Human Services (DHS)/ Washington Department of Social and Health Services (DSHS)	• Responsible for ESF #6 Mass Care, #8 Health and Medical, and ESF #11 Food and Water. • Collaborate with local emergency management agencies to identify and provide resources for mass care, food, water, and ice needs. • Coordinate with supporting state agencies to obtain requested resources. • Collaborate with supporting state agencies to coordinate transportation of food and water resources.	• No change	• Establish procedures to ensure water is safe for consumption.	• No change
	OHA or DOH:	• Support agency for ESF #6 and ESF #11. • Provide regulatory oversight of water systems repair and operations. • Provide consultation and approval of issuing drinking water health advisories.	• No change	• Provide technical assistance to water providers.	• Provide guidance on treatment of emergency water supplies.

Agency	Role in Agency	Current Roles and Responsibilities	Proposed Roles and Responsibilities	Current Best Practices	Proposed Best Practices
Oregon / Washington State (Continued)	Oregon DOT (ODOT)	• ODOT – Lead agency for ESF #3 Public Works. • Remove debris from state highways and bridges and repair as needed to facilitate access and recovery.	• No change	• Focus on engineering, transportation, and infrastructure needs. • Include access and recovery to critical infrastructure and emergency services.	• No change
	National Guard	• Assist in emergency water distribution.	• No change	• Provide and staff water treatment units such as water purification systems that provide emergency water distribution, when requested.	• No change
Federal	FEMA	• Obtain bottled water and deliver water to state distribution sites. • Participate in a multi-agency coordination. • Coordinate federal resources. • Provide technical assistance.	• No change	• Mobilize federal response within 3 to 5 days (or as soon as practicable) after the event. • Include equipment, supplies, and materials for water treatment and/or distribution, when requested.	• No change
	U.S. Army Corps of Engineers (USACE)	• Assist in emergency water distribution. • Deliver water to distribution sites. • Provide technical assistance.	• No change	• If requested, set up emergency water treatment and distribution sites.	• No change

Agency	Role in Agency	Current Roles and Responsibilities	Proposed Roles and Responsibilities	Current Best Practices	Proposed Best Practices
RWPC	NA	NA	NA	• Promote emergency preparedness to the public. • Apply for grants to fund planning tools and equipment for emergency water treatment and distribution. • Provide guidance on the use of the Region's emergency water treatment and distribution equipment. • Update and maintain a regional study on water system interconnections. • Promote mutual aid agreements. • Maintain and update water providers' emergency contact list. • Maintain inventory of emergency water treatment and distribution resources owned by local water providers.	• No change

Agency	Role in Agency	Current Roles and Responsibilities	Proposed Roles and Responsibilities	Current Best Practices	Proposed Best Practices
ORWARN/ WAWARN	Water and wastewater mutual aid	NA	NA	• Maintain written mutual aid agreements among members. • Facilitate mutual aid assistance among members. • In Oregon, promote shared worker agreement	• Continue to promote shared worker agreement (OR)
Power Utilities (Portland General Electric [PGE], Pacific Power and Light (PP&L), Columbia River PUD, Clark Public Utilities, etc.)	NA	NA	NA	NA	• Prioritize requests from water providers for restoration of power. • Collaborate with water providers to prioritize pre- disaster mitigation so that power services can be restored quickly for water facilities.
Communication Providers	NA	NA	NA	NA	• Prioritize restoration of communications for water providers. • Collaborate with water providers to prioritize pre- disaster mitigation so that communication

Agency	Role in Agency	Current Roles and Responsibilities	Proposed Roles and Responsibilities	Current Best Practices	Proposed Best Practices
Communication Providers (Continued)					services can be restored quickly for water facilities.
Private Consultants and Contractors	NA	NA	NA	NA	• Provide technical assistance and post-event damage assessment. • Assist in preparing emergency contracts, plans and specification for repairs. • Assist in repairing the damages to water systems, as requested.
CERT/NET and other volunteers	NA	NA	NA	• Assist emergency responders	• Participate in the development of an emergency drinking water plan. • Assist emergency responders, including water providers, as requested.
*NA = Not applicable; **Blue Font** = Proposed Change; Blank Boxes or Regular Font = No Change*					

Base Emergency Water Need

For the purposes of this analysis, Base Emergency Water Need is defined as the minimum quantity of potable water needed to serve the domestic water needs of a population during a Regional Event scenario when potable water must be conserved and rationing of water at subsistence levels may be required. As discussed later in this section, the duration for which subsistence-level water provision will be required will vary depending on the type and magnitude of the event, and when assistance from organizations outside the Region may be able to respond at a level sufficient to restore normal water service. The following definitions are used in this Framework:

- **Base Daily Water Rate** – Volume of water required to support an individual's basic water needs at a subsistence level for one (1) day. Reported in units of gallons per capita per day (GPCD).
- **Base Water Duration** – Period of time during which a water provider is operating under emergency conditions and emergency water distribution is required. Reported in units of days.
- **Base Daily Water Demand** – Volume of water required to meet the base water needs of all populations within a defined area for one (1) day (for this project, we used service populations within Islands). Reported in units of millions of gallons per day (MGD).
- **Base Emergency Water Need** – Volume of water needed to serve all population within an Island at the base water rate and duration specified. Reported in units of gallons (gal) or million gallons (MG).

The calculation to determine the base water need for a water district or Island is shown in Figure ES-2. An example of how the Base Emergency Water Need is calculated is included in Section 4. For the purposes of this exercise, a duration of 45 days was assumed for Scenario 3 – Regional Planning Event.

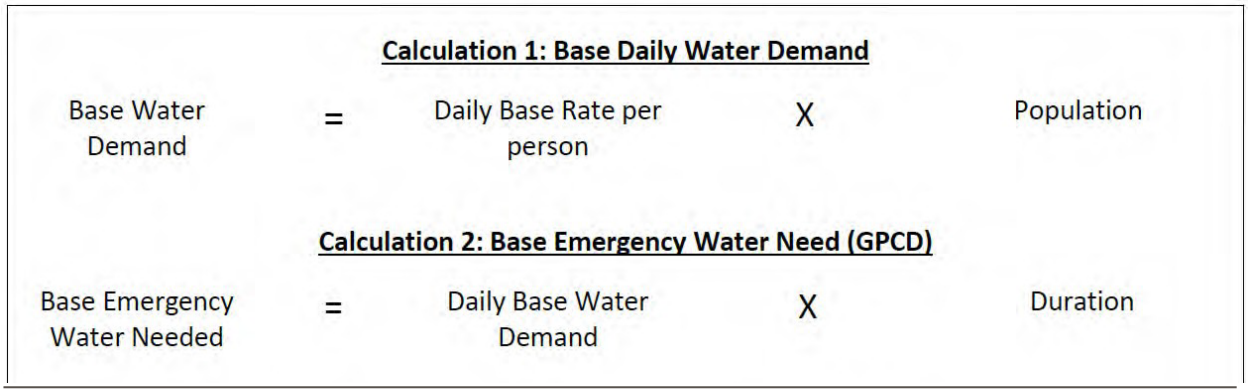
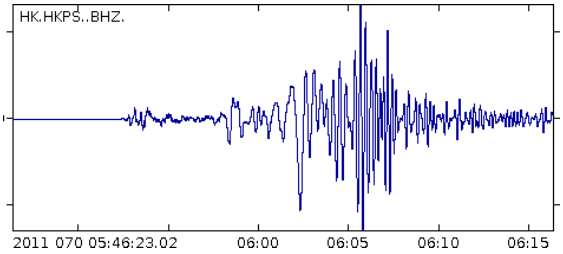


Figure ES-2: **Base Emergency Water Need Calculations**

Emergency Water Resources

A summary of the basic information gathered from the survey and resources available to water providers within the RDPO to support provision of emergency water during an emergency is included below and detailed in Section 5. Below is a quick summary of key questions and answers the overall region may need to access immediately after a Regional Event (Figure ES-3).



Waveform of the 2011 Great Tohoku Earthquake, Japan

- How much storage/source water is available?
- What supplies do we have?
- What emergency supplies do we need?
- Where do we need the supplies?
- How do we get water from here to there?

Figure ES-3: **What Happens When the Big One Hits**
(Seismograph Source: Incorporated Research Institutions for Seismology)

Based on the survey results, stakeholders indicated we can assume there may be as much as 380 MG (Table ES-2) of water in seismically-resilient storage throughout the Region. However, of the 380 MG, only about 80 MG (approximately 21 percent) is from resilient storage that also include seismic valves or an alternate approach to isolate and retain the storage. Further, wells and other sources may be available after a large event. Based on this and our calculations on the water needed in the Region, the Region may have an estimated 17- to 83-day supply of water available in reliable storage to meet its Base Emergency Water Need.

This water will require transportation to emergency response agencies' PODs so it can be distributed to the public. There are several ways water might be able to be moved, including through pipes that are either not damaged or have been repaired; through temporary overland pipes; through temporary or permanent connections at tanks, reservoirs, and backbone piping at specified PODs; trucked within Islands or from other Islands, water providers, or localities; water hauled in from out of the Region; and bottled water.

Table ES-2 also summarizes the Base Emergency Water Need, resilient water storage available, and the gap between the Base Emergency Water Need and the resilient storage with seismic valves.

Section 5 provides guidance for exercises to determine the emergency water needs within jurisdictions. Figures ES-4a and ES-4b (below) summarizes these key steps.

Table ES-2: Base Emergency Water Need and Seismically-Resilient Water Storage Available (assuming 45 days and 2 GPCD)

Emergency Response Island	Population (M)	Volume of Seismically-Resilient Storage		Base Emergency Water Need (MG)	Gap between Base Emergency Water Need and available storage with seismic valves (MG)
		Total (MG)	With seismic valves (MG)		
CLACK1	0.070	9.3	5.3	6.3	-1.0
CLACK11	0.010	NA	NA	0.9	-0.9
CLACK2	0.102	12.5	11.0	9.2	1.8
CLACK3	0.058	10.0	3.0	5.2	-2.2
CLACK5	0.050	15.8	1.3	4.5	-3.2
CLACK7	0.002	NA	NA	0.1	-0.1
CLACK9	0.004	0.3	NA	0.4	-0.4
Clackamas County	**0.296**	**47.8**	**20.5**	**26.6**	**-6.0**
CLARK1	0.415	33	2	37.4	-35.4
CLARK3	0.021	NA	NA	1.9	-1.9
Clark County	**0.436**	**33**	**2**	**39.3**	**-37.3**
COLUM2	0.002	1.0	1.0	0.2	0.8
COLUM4	0.017	0.5	NA	1.5	-1.5
COLUM5	0.008	2.0	NA	0.7	-0.7
Columbia County	**0.027**	**3.5**	**1.0**	**2.4**	**-1.7**
MULT1	0.115	14.2	4.4	10.4	-6.0
MULT2	0.740	132.4	31.4	66.6	-35.2
MULT3	0.003	1.0	NA	0.3	-0.3
Multnomah County[1]	**0.858**	**147.6**	**35.8**	**77.3**	**-41.4**
WASH1	0.002	1.2	NA	0.2	-0.2
WASH3	0.591	98.1	20.5	53.2	-32.7
WASH4	0.069	11.2	0.0	6.2	-6.2
WASH6	0.024	40	NA	2.2	-2.2
WASH7	0.005	0.0	0.0	0.4	-0.4
Washington County	**0.691**	**150.5**	**20.5**	**62.2**	**-41.7**
Total rounded	**2.31**	**382**	**80**	**208**	**-128**

Notes:

1. *Portland Water Bureau (PWB) has implemented a backbone reservoirs isolation plan using two cells that can operate independently instead of seismic isolation valves. The Bureau's related mid-range estimate for water retained through isolation is included in the seismic valve column.*
2. *Negative number in red denotes shortage*
3. *NA = Information not available*

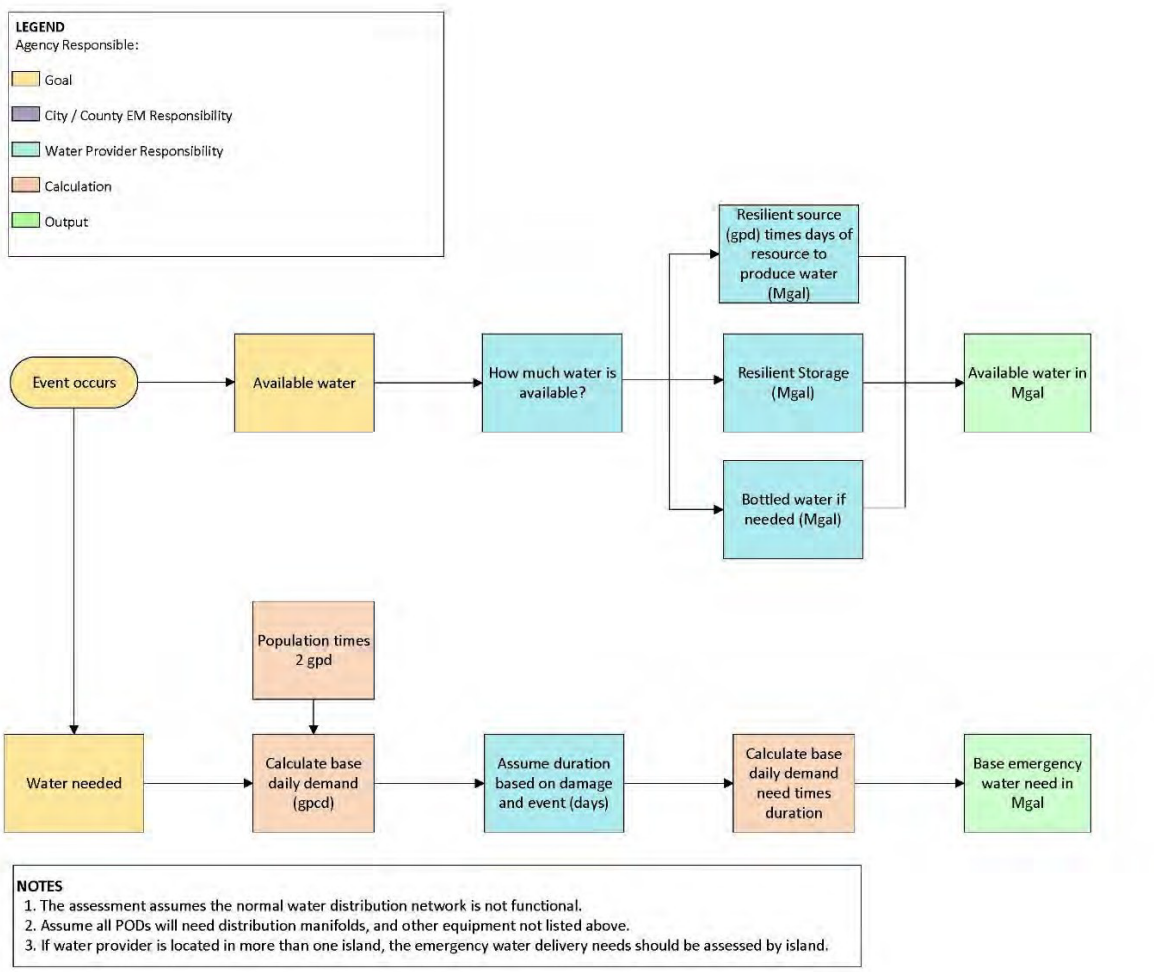


Figure ES-4a: Emergency Water Needs Assessment Summary – Part 1

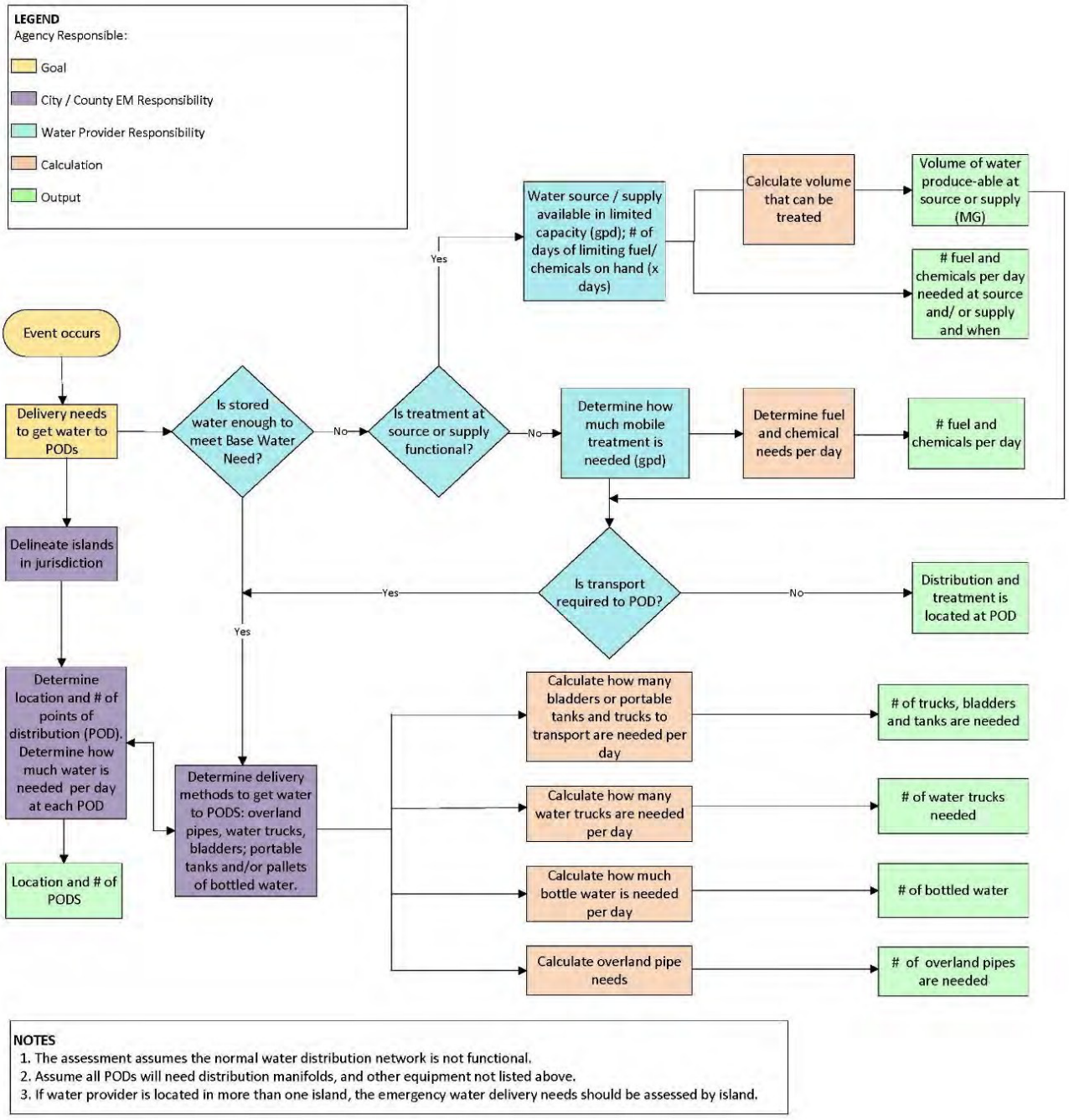


Figure ES-4b: **Emergency Water Needs Assessment Summary – Part 2**

The Regional distribution of seismically-resilient water sources is shown in Figure ES-5.

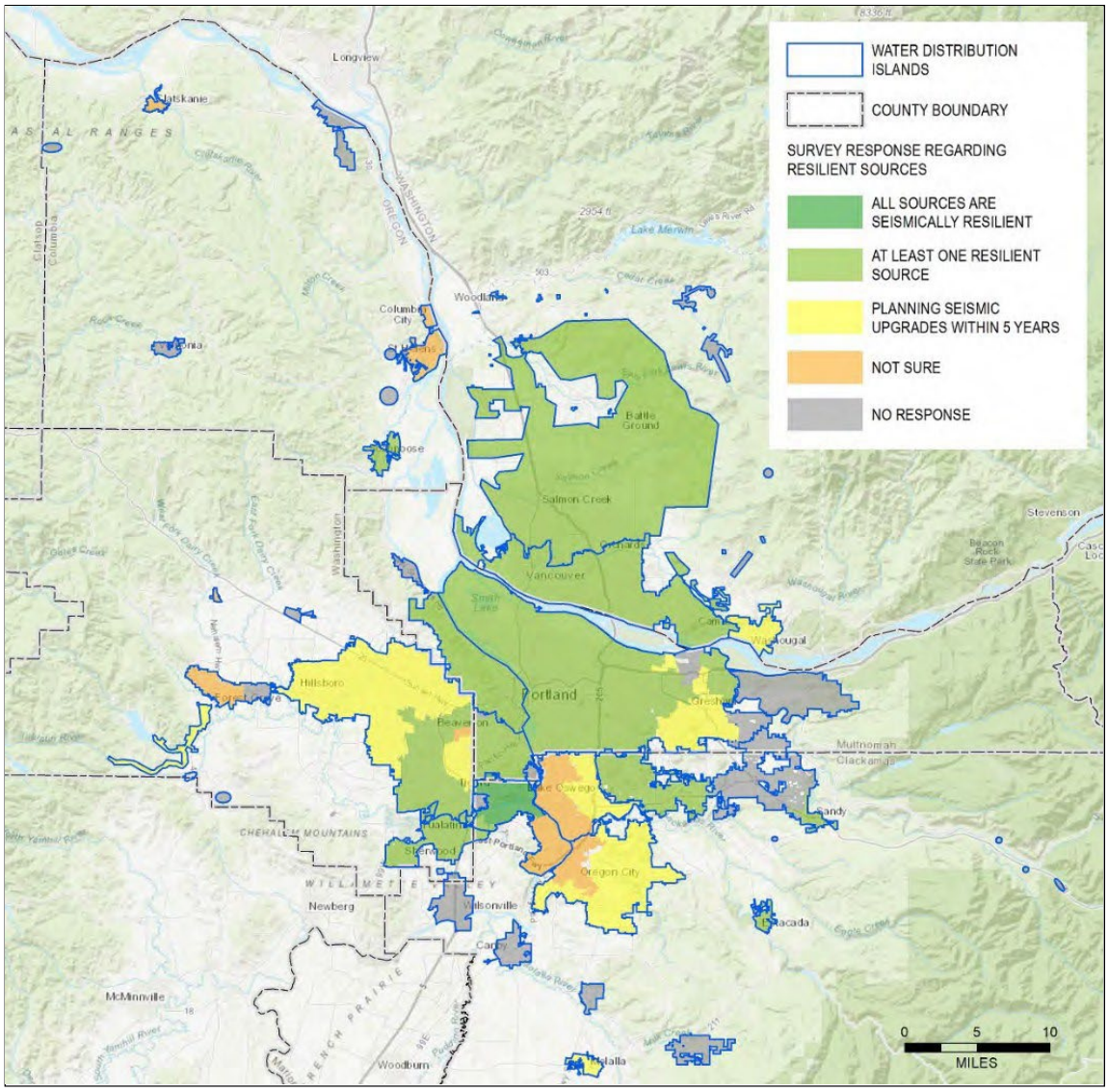


Figure ES-5: Regional Distribution of Resilient Sources by Emergency Response Island

Gap Analysis

Gaps in regional emergency drinking water distribution and planning are based on data self-reported by water providers, best practices, plans from other agencies, and technical expertise of the project team. Details are included in Section 6.

Recommendations

Successful implementation of the emergency water provision and distribution plans following a large disaster with broad and severe impacts (Regional Scenario 3) will require effective partnering and preparation at the federal, state, county, and local levels. Emergency response agencies bearing the primary responsibility of distributing emergency water tend to use standardized approaches that primarily include commercially-bottled water, and they may not have considered water providers or local water resources within their emergency response approaches or how to get emergency water during the interim period before outside aid arrives.

Water providers have made considerable progress in investing in resilient water supply and storage, as well as in other infrastructure improvements over the past couple of decades. This readiness on the water providers' behalf opens opportunities for emergency management agencies to expand their approaches to incorporate water providers and local water resources in their planning. However, a lack of consensus on or clear definition for roles and responsibilities of water providers has led few water providers or emergency response agencies to invest in the planning or supplies required to leverage that resilient infrastructure for the provision of emergency water. Our understanding of these current roles and responsibilities, as well as our recommendations for future changes, are included above in Table ES-1. In addition, Figure ES-6 (appended at the end of the report) is a flowchart of the proposed roles and responsibilities process, including recommendations such as using volunteers to deliver water to vulnerable customers or customers that cannot make it to the distribution site on their own; and increasing multi-language communications to the public.

Section 7 outlines the recommendations provided, including proposed tasks or actions that can be implemented to narrow or close identified gaps. Included are both operational and emergency management recommendations as well as policy recommendations developed to help emergency managers and water providers better prepare to distribute emergency water after a disaster, including to vulnerable populations. Recommendations are offered in the spirit of helping the agencies in the Region be more prepared and resilient regardless of the size and severity of the disaster.

Figure ES-6
Emergency Drinking Water Framework
Proposed Flowchart Roles and Responsibilities

Disaster Occurs

WP:
Is drinking water available?

Yes

WP:
Proceed with provision.

No

WP:
Assess internal resources, equipment, and staff to handle.

WP:
Can it be handled internally?

Yes

No

No

WP:
Is County/City EOC aid needed?

WP:
Is WARN aid needed?

WP:
Follow WARN mutual request process.

WARN Members:
Aid found, negotiated
Gathered, sent to WP.

WP:
Elevate to County/City EOC

County/City EOC:
- Declare disaster;
- Assess resource needs;
- Assess status; and
- Coordinate response.

County/City EOC:
Assess and establish POD resources
- Where it is needed;
- How much;
- what equipment;
- In what form – bottled, tankers, trucks; and
- Staff resources needed.

WP:
Send <u>available</u> resources to help County/City EOC as requested.
Including:
- **Develop emergency water plan in coordination with County/City EOC;**
- **Set up PODs at tanks, reservoirs and backbone pipe locations where feasible;**
- **Assess specific POD needs with County/City EOC;**
- **Procure water-related equipment materials for emergency water treatment and distribution sites <u>as agreed to locations and quantities</u>; and**
- **Provide technical assistance and training in locating sites, setup and operating water equipment.**

Do County/City EOC have ability, resources to provide emergency drinking water?

Yes

No

County/City EOC:
Set up PODs; staff, operate and manage emergency drinking water distribution sites **including:**

- **Coordinate with Water Providers;**
- **Procure tankers, trucks, blivits to transport water from available tanks, reservoirs and pipe POD to emergency water distribution sites;**
- **Procure materials, equipment and supplies needed at the distribution sites needed to manage, staff and operate sites that are not obtained by water provider.**

County/City EOC:
Request aid from State EOC.

County/City EOC: Request and obtain assistance through mutual aid agreements or EMAC.
Coordinate with Water Providers to identify mutual aid needs to assist at distribution sites.

County/City EOC:
Receive resources from mutual aid and/or other states.

State EOC:
Is FEMA or EMAC assistance needed?

No

Yes

State EOC:
Send resources to County/City EOC **including temp treatment and distribution facilities.**

Other states send requested resources to State EOC.

State EOC:
Request aid through EMAC and/or from FEMA **including temporary treatment and distribution facilities.**

FEMA tasks USACE to assist state emergency water provisions.

USACE sends pallets of water to state EOC.

USACE sends resources to set up temporary treatment and distribution sites if requested.

LEGEND
Agency Responsible:

- Water Provider
- County/City Emergency Management
- State Emergency Management
- FEMA / USACE

ACRONYMS
Bold denotes proposed change.
EMAC = Emergency Management Assistance Compact
EOC = Emergency Operations Center
FEMA = Federal Emergency Management Agency
POD = Point of Distribution
USACE = United States Army Corps of Engineers
WARN = Wastewater Agency Response Network
WP = Water Provider

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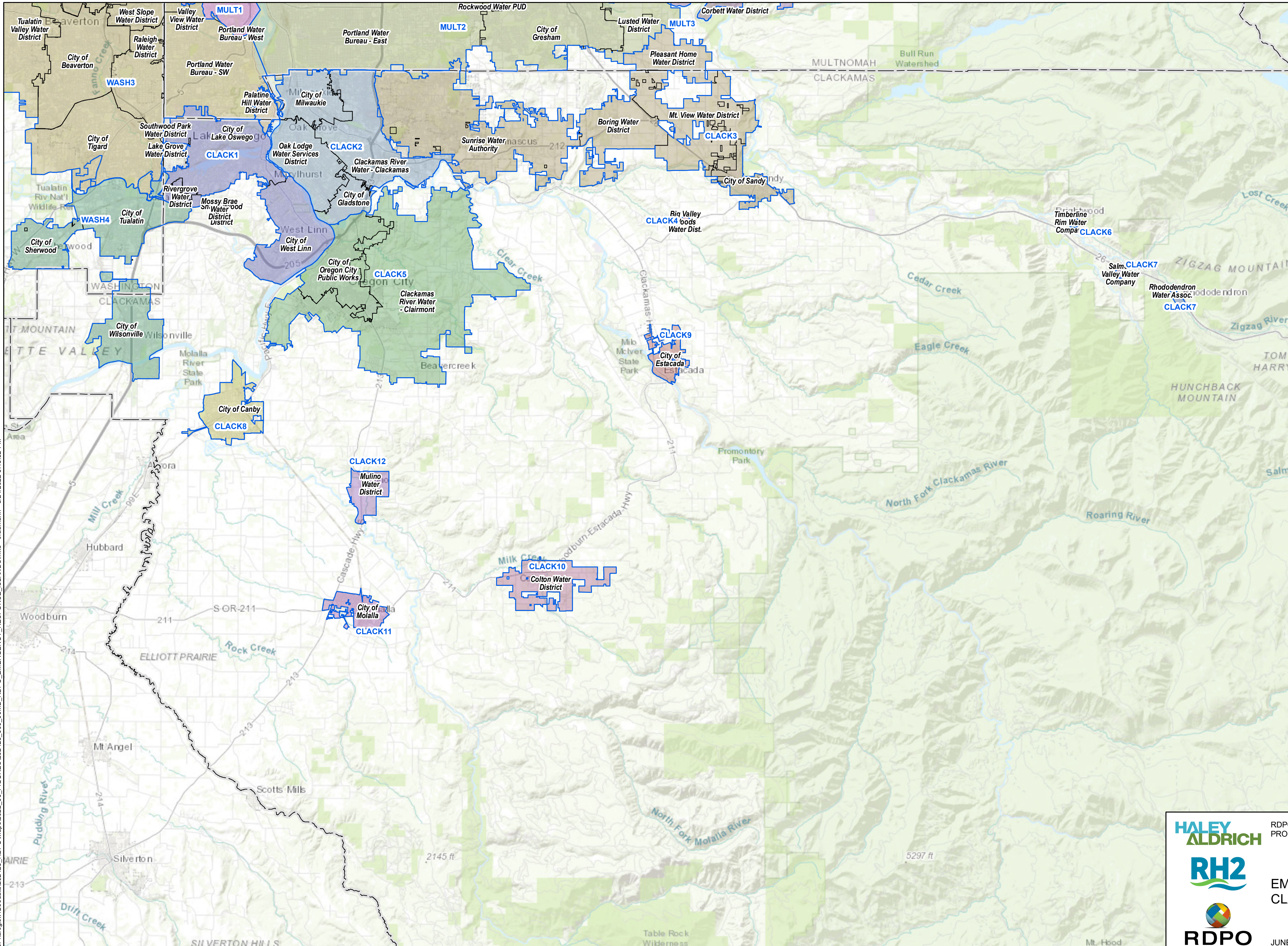


LEGEND

WATER DISTRIBUTION ISLANDS (VARIOUS COLORS)

WATER DISTRICT SERVICE AREA

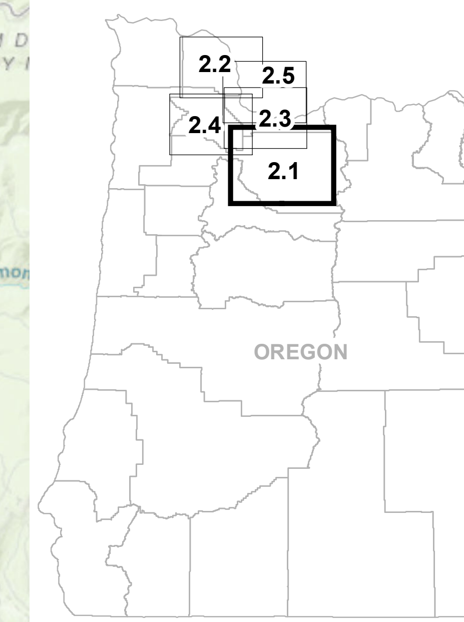
COUNTY BOUNDARY

ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

THIS MAP IS A GRAPHIC PRESENTATION DERIVED FROM THE OREGON METRO AND CLARK COUNTY GEOGRAPHIC INFORMATION SYSTEMS (GIS, AND IS DESIGNED AND INTENDED FOR RDPO STAFF USE ONLY.

BASE MAP SOURCE: ESRI

FIGURE INDEX MAP



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SCALE IN FEET

HALEY ALDRICH

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RDPO - REGIONAL DISASTER PREPAREDNESS ORGANIZATION
PROVISION OF EMERGENCY DRINKING WATER FRAMEWORK

EMERGENCY RESPONSE ISLANDS
CLACKAMAS COUNTY

JUNE 2022

FIGURE 2.1

GIS:\\arcgisw\Geodata\202425_RDPO\Maps\2022_06_FIGURES\202425_000_00MB_RDPO_EMERGENCY_RESPONSE_ISLANDS.mxd - craumann - 6/24/2022 3:15:52 PM

COLUM2
City of Clatskanie
City of Rainier
Fishhawk Lake Reserve
COLUM1
COLUM3
COLUM6
City of Vernonia
McNulty Water PUD
COLUM4
COLUM4
City of Saint Helens
COLUM4
Warren Water Association
COLUM5
City of Scappoose
Ridgefield
City of Battle Ground

LEGEND

- WATER DISTRIBUTION ISLANDS (VARIOUS COLORS)
- WATER DISTRICT SERVICE AREA
- COUNTY BOUNDARY

ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

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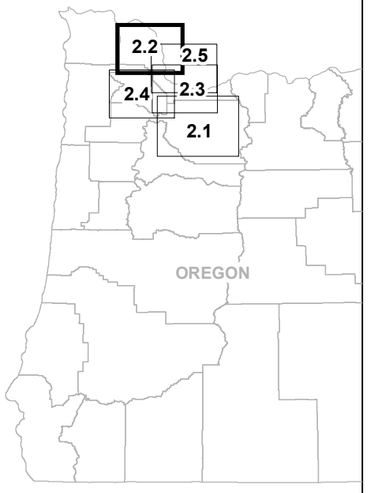

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SCALE IN FEET

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PROVISION OF EMERGENCY DRINKING WATER FRAMEWORK

EMERGENCY RESPONSE ISLANDS COLUMBIA COUNTY

JUNE 2022

FIGURE 2.2

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COLUM5
City of Scappoose
CLARK1
Clark Public Utilities
City of Battle Ground
Larch Corrections Center
CLARK2
CLARK1
Burlington Water District
City of Vancouver
City of Camas
City of Washougal
CLARK3
MULT1
Portland Water Bureau - East
MULT2
City of Fairview
City of Wood Village
City of Troutdale
Rockwood Water PUD
Corbett Water District
MULT3
City of Hillsboro
Tualatin Valley Water District
Portland Water Bureau - West
Valley View Water District
West Slope Water District
Raleigh Water District
WASH3
City of Beaverton
Portland Water Bureau - SW
City of Gresham
Lusted Water District
Pleasant Home Water District
City of Milwaukie
Palatine Hill Water District
Southwood Park Water District
City of Tigard
Lake Grove Water District
CLACK1
City of Lake Oswego
Clackamas River Water - Clackamas
Sunrise Water Authority
Boring Water District
CLACK3
Oak Lodge Water Services District
CLACK2
Mt. View Water District
City of Sandy
Rivergrove Water District
Mossy Brae Water District
Shadowood Water District
City of Tualatin
WASH4
City of Gladstone
City of West Linn
City of Oregon City Public Works
CLACK5
Clackamas River Water - Clairmont
Big Valley Woods Water Dist.
CLACK4
City of Sherwood

LEGEND

- WATER DISTRIBUTION ISLANDS (VARIOUS COLORS)
- WATER DISTRICT SERVICE AREA
- COUNTY BOUNDARY

ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

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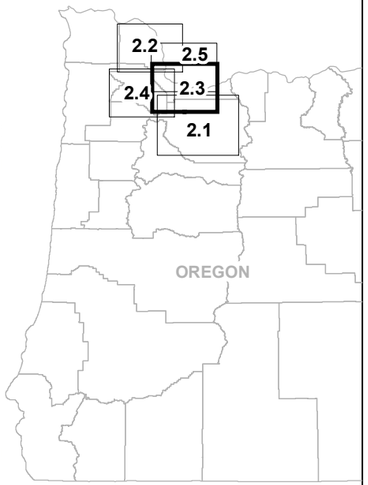

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PROVISION OF EMERGENCY DRINKING WATER FRAMEWORK

EMERGENCY RESPONSE ISLANDS MULTNOMAH COUNTY

JUNE 2022

FIGURE 2.3

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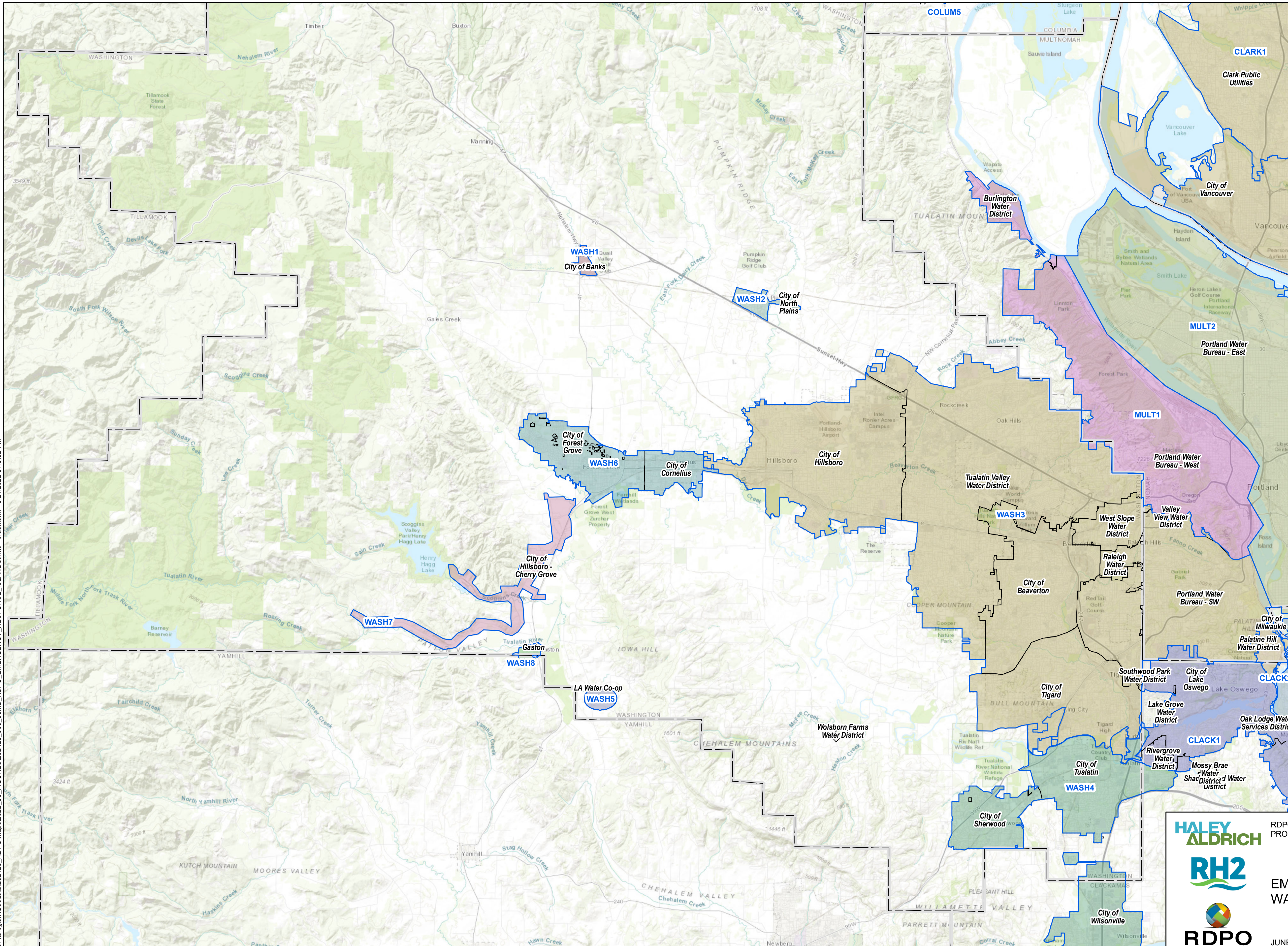
COLUM5
CLARK1
Clark Public Utilities
City of Vancouver
Vancouver
Burlington Water District
WASH1
City of Banks
WASH2
City of North Plains
MULT2
Portland Water Bureau - East
MULT1
Portland Water Bureau - West
City of Forest Grove
WASH6
City of Cornelius
City of Hillsboro
Hillsboro
Tualatin Valley Water District
WASH3
West Slope Water District
Valley View Water District
Raleigh Water District
City of Beaverton
Portland Water Bureau - SW
Portland
City of Milwaukie
Palatine Hill Water District
City of Hillsboro - Cherry Grove
WASH7
Gaston
WASH8
LA Water Co-op
WASH5
Southwood Park Water District
City of Lake Oswego
CLACK2
City of Tigard
Lake Grove Water District
Oak Lodge Water Services District
CLACK1
Rivergrove Water District
Mossy Brae Water District
Shadow Wood Water District
City of Tualatin
WASH4
City of Sherwood
City of Wilsonville
Wolsborn Farms Water District
Tillamook State Forest
Henry Hagg Lake
WASHINGTON
TILLAMOOK
YAMHILL
COLUMBIA
MULTNOMAH
CLACKAMAS
CHEHALEM MOUNTAINS
PARRETT MOUNTAIN
WILLAMETTE VALLEY
CHEHALEM VALLEY
Newberg
Yamhill

GIS:\\arcgisw\Geodata\202425_RDPO\Maps\2022_06_FIGURES\202425_000_00MB_RDPO_EMERGENCY_RESPONSE_ISLANDS.mxd - craumann - 6/24/2022 3:15:52 PM

LEGEND

- WATER DISTRIBUTION ISLANDS (VARIOUS COLORS)
- WATER DISTRICT SERVICE AREA
- COUNTY BOUNDARY

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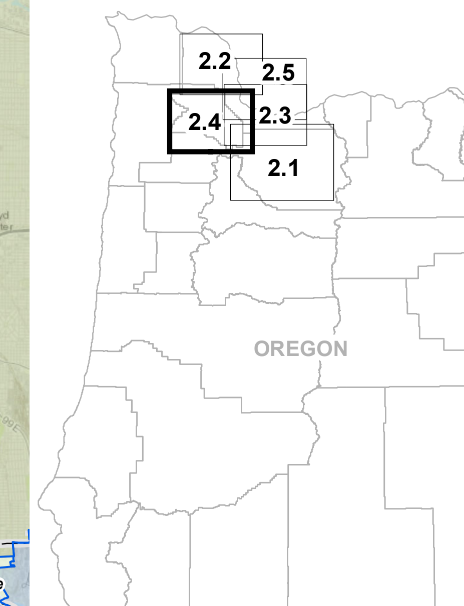

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PROVISION OF EMERGENCY DRINKING WATER FRAMEWORK

EMERGENCY RESPONSE ISLANDS
WASHINGTON COUNTY

JUNE 2022

FIGURE 2.4

LEGEND

- WATER DISTRIBUTION ISLANDS (VARIOUS COLORS)
- WATER DISTRICT SERVICE AREA
- COUNTY BOUNDARY

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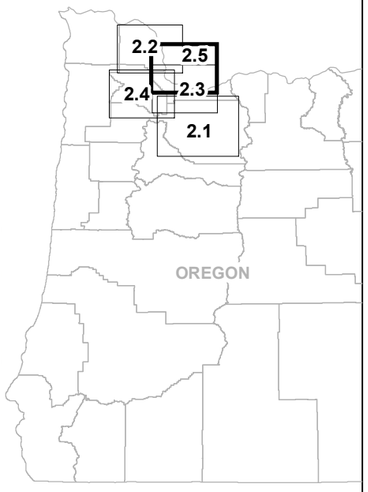

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PROVISION OF EMERGENCY DRINKING WATER FRAMEWORK

EMERGENCY RESPONSE ISLANDS CLARK COUNTY

JUNE 2022

FIGURE 2.5

Figure 3.5
Emergency Drinking Water Framework:
Roles and Responsibilities Flowchart – Current Process

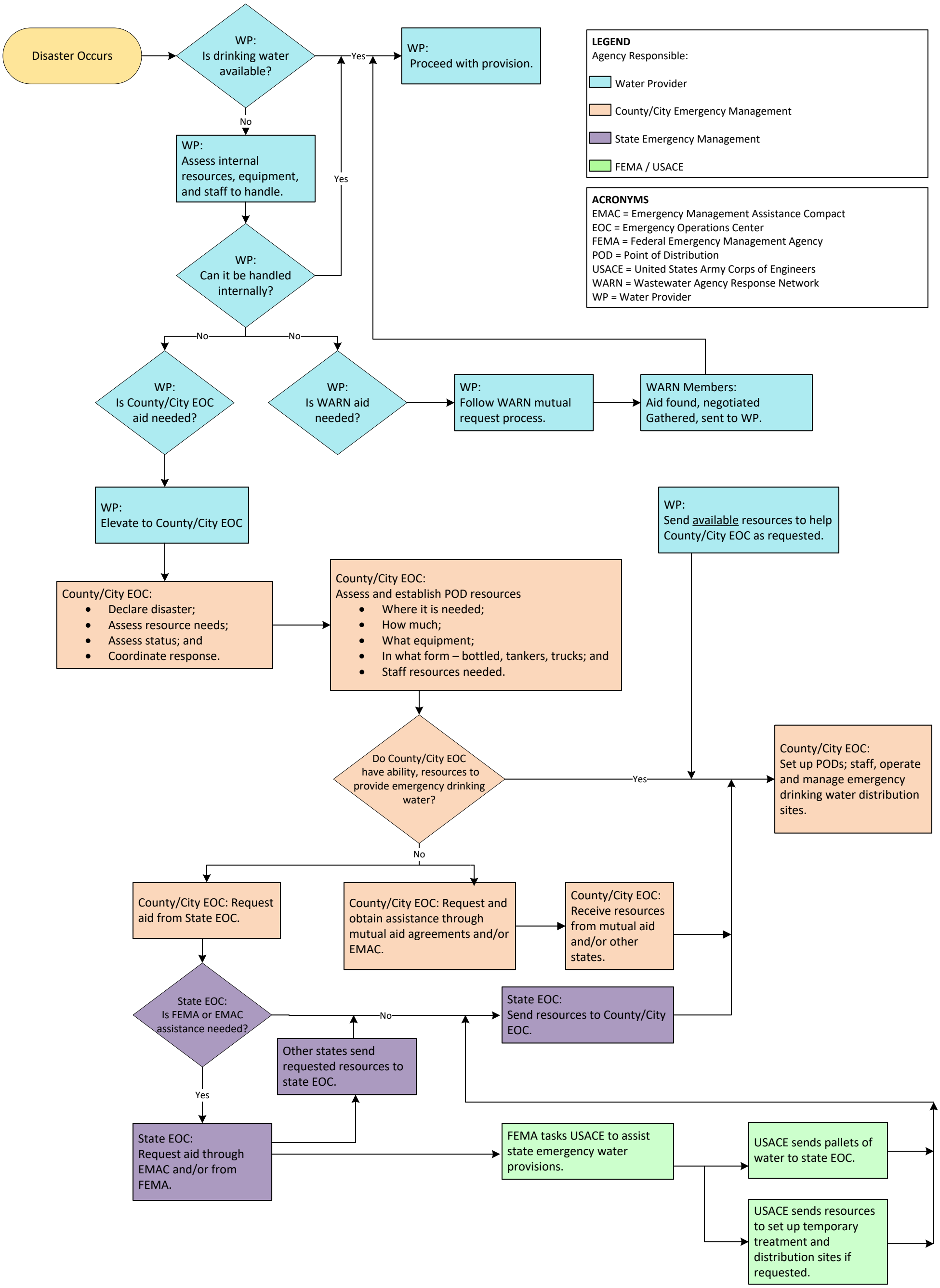

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Figure 7.1
Emergency Drinking Water Framework:
Roles and Responsibilities Flowchart – Proposed Process

Disaster Occurs

WP:
Is drinking water available?

Yes

WP:
Proceed with provision.

No

WP:
Assess internal resources, equipment, and staff to handle.

WP:
Can it be handled internally?

Yes

No

No

WP:
Is County/City EOC aid needed?

WP:
Is WARN aid needed?

WP:
Follow WARN mutual request process.

WARN Members:
Aid found, negotiated
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- Declare disaster;
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Do County/City EOC have ability, resources to provide emergency drinking water?

Yes

No

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