



Office of the City Manager

April 18, 2025

To: Honorable Mayor and Members of the City Council
From: Paul Buddenhagen, City Manager
Re: 2024 Tsunami Warning: After Action Report & Community Survey Summary

On December 5, 2024, the Magnitude 7.0 Cape Mendocino earthquake occurred off the coast of Northern California. This triggered the National Tsunami Warning Center (NTWC) to issue a tsunami warning for significant portions of the California coast, including Berkeley.

The City of Berkeley quickly activated the City's Emergency Operations Center (EOC) engaging staff from numerous departments. Incident commanders coordinated evacuation of affected areas and all of the City's alerting tools were activated. The Berkeley Marina and waterfront were evacuated, and evacuation orders were communicated to the public through the City's emergency alerting systems, website, and social media channels by 11:45 am, approximately 30 minutes before the tsunami was expected to hit San Francisco. This was a regional event using standard federal and State protocols, and the City of Berkeley stood out for its proactive evacuation and communication with the public.

As part of the City's efforts to continually improve, staff also undertook a review of the City's response to the tsunami warning. This review included a community survey to capture Berkeley community members' experiences during the tsunami warning event. The survey was shared through multiple platforms and media websites. In total, 1,602 people responded to the survey.

The attached report describes the City of Berkeley's response on December 5, 2024, and outlines the completed and planned changes to further improve the City's response in future incidents.

Part I of this report, Tsunami Background, details Berkeley's tsunami hazard and alerting structures. Understanding this information is helpful to contextualize what happened during the December 5, 2024 tsunami warning.

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Re: 2024 Tsunami Warning: After Action Report & Community Survey Summary

Part II of this report, December 5, 2024 Tsunami Analysis and Next Steps, analyzes the specific response to this tsunami warning. The document provides an overview of key events, as well as key successes in the response. The document also identifies key themes from a community survey, along with actions that the City can take to improve its response to future tsunami events.

Attachments:

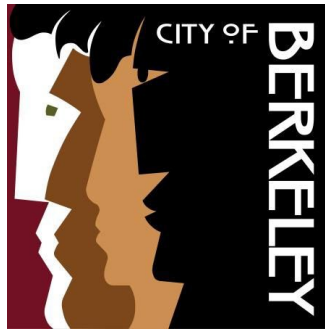
1. 2024 Tsunami Warning: After Action Report & Community Survey Summary

cc:

David White, Deputy City Manager
David Sprague, Fire Chief
Jen Louis, Police Chief
Jenny Wong, City Auditor
Farimah Brown, City Attorney
Mark Numainville, City Clerk
Matthai Chakko, Assistant to the City Manager

2024 Tsunami Warning

After Action Report & Community Survey Summary



February 20, 2025

City of Berkeley Office of Emergency Services

2024 Tsunami Warning AAR & Survey Summary

Introduction

On December 5, 2024, the Magnitude 7.0 Cape Mendocino earthquake occurred off the coast of Northern California. This triggered the National Tsunami Warning Center (NTWC) to issue a tsunami warning for significant portions of the California coast, including Berkeley. After approximately one hour, the tsunami warning was canceled.

A tsunami warning is the most extreme level of alert issued by the NTWC. State research indicates that the inundation zone for a tsunami warning could impact areas along much of the California coast. In Berkeley, the potentially affected areas stretch as far east as Sixth Street.

In response to the December 5 tsunami warning, the City of Berkeley quickly activated the City's Emergency Operations Center (EOC) and staff from numerous departments. Incident commanders coordinated evacuation of affected areas and all of the City's alerting tools were activated. The Berkeley Marina and waterfront were evacuated, and evacuation orders were communicated to the public through the City's emergency alerting systems, website, and social media channels by 11:45 am, approximately 30 minutes before the tsunami was expected to hit San Francisco.

As this was a regional event, the City of Berkeley stood out for its proactive efforts to evacuate and communicate with the public. As part of the City's efforts to continually improve, staff also undertook a review of the City's response to the tsunami warning. This report reviews the City of Berkeley's response on December 5 and outlines the completed and planned changes to further improve the City's response in future incidents.

Part I of this report, *Tsunami Background*, details Berkeley's tsunami hazard and alerting structures. Understanding this information is helpful to contextualize what happened during the December 5, 2024 tsunami warning.

Part II of this report, *December 5, 2025 Tsunami Analysis and Next Steps*, analyzes the specific response to this tsunami warning. First the document overviews key events, as well as key successes in the response. Then the document identifies key themes from a survey of the Berkeley community on members' experiences on December 5, alongside next steps identified by the City to further improve Berkeley's response to future tsunami events.

2024 Tsunami Warning AAR & Survey Summary

Part I: Tsunami Background

Berkeley's Tsunami Hazard

A tsunami occurs in a body of water when a rapid disturbance vertically displaces the water, causing a series of surges. These changes can be caused by an underwater fault rupture (that generates an earthquake) or underwater landslides (typically triggered by earthquakes).

Tsunamis affecting the Bay Area can result from offshore earthquakes within the Bay Area, or from very distant events. While it is most common for tsunamis impacting the Bay Area to be generated by faults in Alaska or across the Pacific Ocean, local tsunamis can be generated from local faults running underwater (such as the [very small \(10 cm\) tsunami that was triggered by the 1906 earthquake](#)). The San Andreas Fault runs along the coast off the Peninsula and the Hayward fault runs partially through San Pablo Bay.

Recent Tsunami Activity in Berkeley

In 2022, an underwater volcano erupted near Tonga in the South Pacific Ocean, resulting in an Advisory-level tsunami for Berkeley. Residents evacuated from boats, docks, and near the shoreline. There were swells and strong currents at the Marina but no reported damage.

The most recent tsunami to cause damage in Berkeley was associated with the March 2011 earthquake off the coast of Japan. As a result of this Advisory-level tsunami, a half-meter-tall surge was observed nearby in Oakland with 4-6 knot current. The tsunami surge entered the Berkeley Marina, causing \$158,000 of damage to docks and boats.

Berkeley's Tsunami Inundation Area

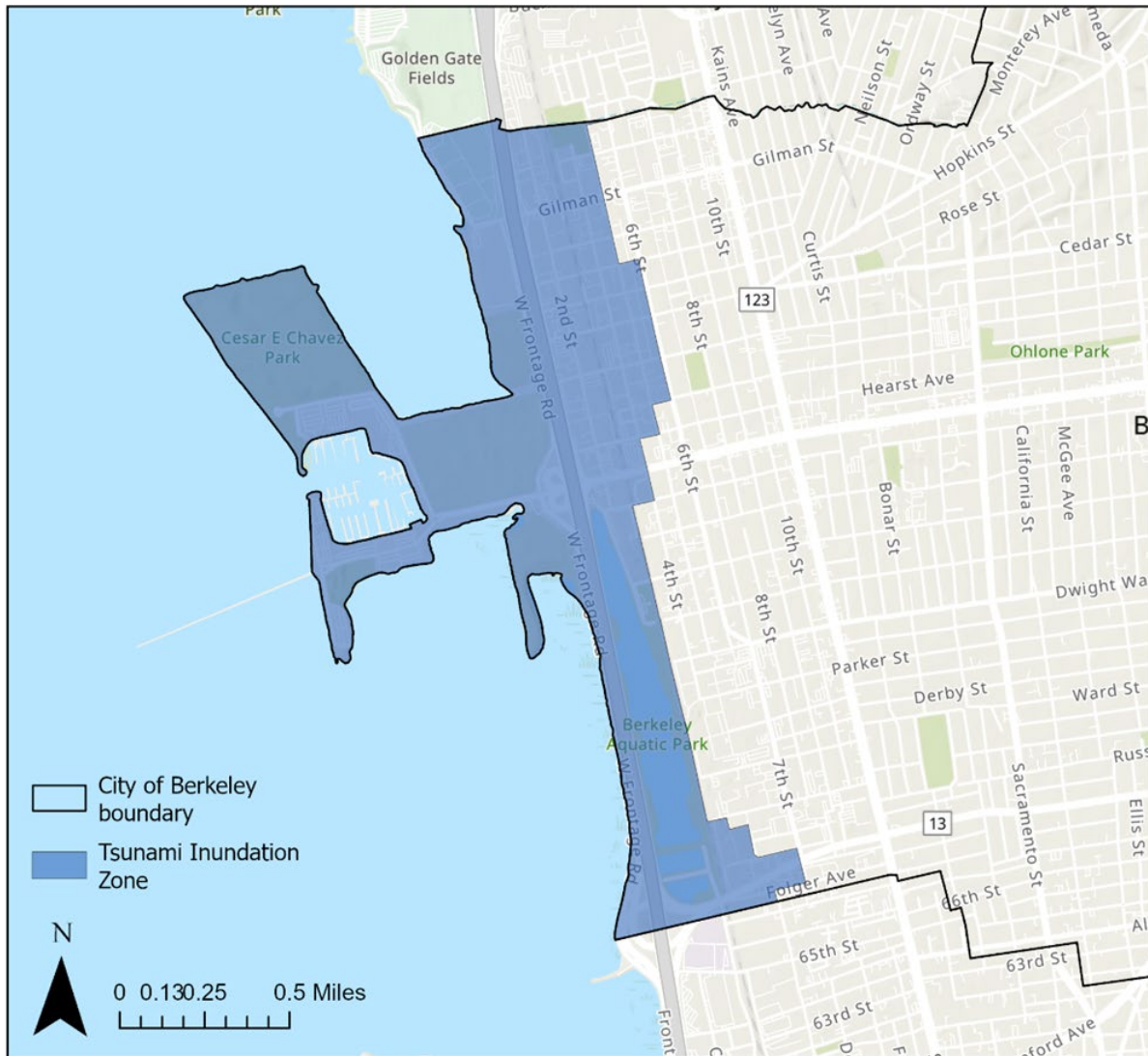
In 2021, the California Geological Survey (CGS) and the California Governor's Office of Emergency Services (Cal OES) updated the existing tsunami inundation maps for Alameda County, shown in Map 1.

The inundation maps highlight areas in Berkeley vulnerable to potential tsunami flooding, with Map 1 shading these areas in blue. The map does not reflect the inundation area from any singular tsunami, but represents what is possible from large, realistic scenarios primarily from the Alaska and Cascadia subduction zones. This map is intended to be used for evacuation planning purposes only.

Given Berkeley's sloping terrain and the Bay's waters at their current levels, tsunami inundation will not extend far inland from the shoreline, but the zone has increased slightly since the last update to reflect new science and local features. According to Map 1 (shaded in blue), the tsunami inundation zone extends along the entire shoreline of the Bay. Starting at the city's northern border, the zone stretches east from the Bay until it meets Fifth Street. At Page Street, the edge of the zone stretches as far east as Sixth Street until Delaware Street. At Hearst Street, the edge of the zone runs east to Fifth Street. At University Avenue, the edge of the zone runs east to Fourth Street. From Addison to Heinz Avenue the eastern edge runs to Third Street or to where Union Pacific Railroad is located. At the far south end of the city after Heinz Avenue, the eastern edge of the zone runs to Fifth Street for one block and to Seventh Street at Potter and Folger Avenue.

2024 Tsunami Warning AAR & Survey Summary

MAP 1. BERKELEY TSUNAMI INUNDATION ZONE



Credits: Tsunami Hazard Area Map, Alameda County; produced by the California Geological Survey and the California Governor's Office of Emergency Services; 2021, mapped at multiple scales.

California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, US Census Bureau, USDA, Esri, NASA, NGA, USGS, FEMA

Additional Tsunami Information

For additional maps and information about Berkeley's tsunami hazard, see:

[Berkeley's Hazards: Tsunami Storymap](#)

2024 Local Hazard Mitigation Plan Update:

- [Tsunami Hazard Video](#)
- [Final Draft Plan](#)

2024 Tsunami Warning AAR & Survey Summary

Tsunami Alerting

Tsunami alerts come from multiple authorities using different alerting systems.

Tsunami Alerting Levels

The National Tsunami Warning Center (NTWC) monitors potential tsunami activity. NTWC issues tsunami messages to notify emergency officials and the public about the potential for a tsunami following a possible tsunami-generating event.

To provide messages as early as possible, the NTWC uses preset criteria to determine when and where to issue tsunami messages and at what alert level. NTWC’s initial alerting criteria are based on preliminary earthquake information and are issued before a tsunami is detected to allow as much time as possible for an emergency response.

In the chart below, warning center alerting levels are associated with their potential impacts in Berkeley and the protective actions for the community.

CHART 1. TSUNAMI ALERT LEVELS, IMPACTS, AND ACTIONS

National Tsunami Warning Center Alert Name	Community Actions	Potential Hazards	Area of Impact in Berkeley
WARNING	Get to high ground or inland IMMEDIATELY Follow tsunami evacuation signage	DANGER! TSUNAMI IMMINENT! Flooding/powerful currents Wave heights > 3ft. or unknown	Depends on tsunami height. Any area shown in the Berkeley Inundation Zone Map (Map 1) could be impacted.
ADVISORY	Stay out of the water and away from the shore	STRONG CURRENTS AND DANGEROUS WAVES In or very near coastal water Wave heights of 1-3 ft.	People in the water (Marina, Harbor) and along the Bay shoreline.
WATCH	Be prepared to take action Stay tuned to local radio/TV/NOAA “alert” weather radios	TSUNAMI IS POSSIBLE Alert level may change once more information is known	Unknown
INFORMATION STATEMENT	No action needed	NO TSUNAMI IMPACT EXPECTED Alert level may change once more information is known	None

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Official Alerting Tools and Technologies

Once the NTWC issues an alert, officials at different levels of government use many different systems and technologies to communicate information and protective actions to the public. The key agencies that alert the Berkeley community with key tsunami information are the NTWC, the County of Alameda, and the City of Berkeley itself. The systems each organization uses to share information are described below.

National Tsunami Warning Center (NTWC)

The NTWC uses **Tsunami.gov** to post its tsunami messages. Messages posted by the NTWC are also pushed through other popular information sources like Google.

For a warning-level tsunami, the National Tsunami Warning Center will push a **Wireless Emergency Alert** to the forecast zones that could be affected by tsunami inundation. Wireless Emergency Alerts are short emergency text messages officials send to smartphones based on those phones' real-time location. The forecast zones that NTWC uses to distribute these Wireless Emergency Alerts are much larger than tsunami inundation areas. This means that when the NTWC uses this technology during a tsunami warning, they alert many people who do not need to take protective action.

County of Alameda and City of Berkeley

AC Alert is used by Alameda County and cities within the County, including Berkeley. Through this system officials can send messages to:

- **Land-line phones and VoIP Phones:** AC Alert can send voice calls to land-line and VOIP phones, or TTY/TDD messages to those devices, in Alameda County.
- **Subscriber cell phones and emails:** Community members can opt in and provide their mobile phone number and email address to receive voice calls, text messages, and emails on these devices. When they subscribe they can indicate "addresses of interest." This means that if an emergency is affecting a specific area, their devices can be sent alerts for that area.
- **Wireless Emergency Alerts:** Through the AC Alert system, the County and the City can send Wireless Emergency Alerts, which target phones based on their real-time location. This technology does not require signup.

Genasys Protect is a tool used by Alameda County and cities within the County, including Berkeley. Through this tool officials post to:

- **Genasys Protect App:** This app sends real-time alerts about evacuations in Berkeley.
- **Berkeley Emergency Map:** This real-time map visualizes evacuation orders and warnings. Users can search for an address to immediately identify the recommended protective action for the address.

City of Berkeley

Berkeley's **Outdoor Warning System** is a network of sirens with voice capability that City officials can activate to alert people outdoors of an emergency.

The Berkeley Police Department uses **Nixle** to send out public safety alerts. Community members can set up an account to personalize messages they receive.

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Social Media Accounts: City Manager’s Office Communications staff amplify the primary emergency communications channel – AC Alert – through the City website, **BerkeleyCA.gov**, as well as the text-based social media platform **Bluesky**: @berkeleyca.gov

UC Berkeley

WarnME is UC Berkeley’s alert and warning service for UC Berkeley students, staff, and faculty.

Community members can sign to receive WarnME alerts by registering at the [Non-UC-Berkeley Affiliate Public Portal](#).

Part II: December 5, 2025 Tsunami Analysis and Next Steps

Event Timeline

Below are key actions and occurrences from the December 5, 2024 Tsunami Warning.

Time	Action
10:44 am	Event 7.0 Earthquake occurs off the coast of Northern California
10:49 am	Event response – Federal government National Tsunami Warning Center (NTWC) issues Tsunami Warning
10:51 am	Public Alerting (from federal government) NTWC sends Tsunami Warning Wireless Emergency Alert, includes Berkeley flats and hills areas
10:52 am	Event response - City City of Berkeley activates Emergency Operations Center (EOC)
11:00 am	Event response - City Berkeley staff mobilizes to evacuate all Berkeley Waterfront residents, visitors and workers
11:11 am	Internal Alerting (from federal government) Emergency managers receive National Weather Service iNWS Alert via Text and email: Tsunami Warning for Coastal North Bay to Davenport including inside San Francisco Bay (predicted impacts for Alameda County in Oakland, Fremont, Hayward, and City of Berkeley)
11:14 am	Public Alerting (from City) City of Berkeley updates Berkeley Emergency Map (Genasys Protect): Berkeley Zones West of San Pablo shifted into Evacuation Order status (BER-E023, BER-E034, BER-E035, BER-E047, BER-E048, BER-E049, BER-E050)
11:16 am	Public Alerting (from City) City of Berkeley sends Tsunami Warning – Evacuation email via GovDelivery to Berkeley Marina Slip Holders (boaters and liveboards)
11:20 am	Public Alerting (from City) City of Berkeley sends AC Alert Evacuate Message targeted alert to Tsunami Max Phase Area (Map 1 above). Sent to all land lines/VoIP phones; opt-in subscribers via mobile phone/email/text.
11:24 am	Internal Alerting (from federal government)

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Time	Action
	Emergency managers receive National Weather Service iNWS Alert via Text and email: Tsunami Warning remains in effect. Message provided estimated tsunami landfall times.
11:24 am	<p>Public Alerting (from City) City of Berkeley activates Outdoor Warning System (OWS) sirens targeting the evacuation area with evacuation message. Siren locations:</p> <ul style="list-style-type: none"> • Marina Harbor Watchtower • City of Berkeley Animal Shelter • Berkeley Unified School District Transportation • Fire Station 1
11:25 am	<p>Public Alerting (from City) City of Berkeley sends Evacuation Order message using Nixle</p>
11:27 am	<p>Public Alerting (from City) City of Berkeley posts community message to City website (Berkeleyca.gov/community-recreation/news)</p>
11:30 am	<p>Public Alerting (from City) City of Berkeley posts “Evacuate Now” message to social media accounts (Bluesky and X)</p>
11:31 am	<p>Internal Alerting (from State government) Emergency Managers receive email from State of California Office of Emergency Services: Advised NTWC tsunami warning for the Northern California coastline, spanning from 10 miles northwest of Santa Cruz to the Oregon border. The warning was issued based solely on the magnitude of the earthquake, with no confirmed reports of tsunami waves at this time. Indicated an 11:45am NTWC conference call scheduled for further information.</p>
11:32 am	<p>Public Alerting (from City) City of Berkeley activates Outdoor Warning System (OWS) sirens targeting the evacuation area with evacuation message for the 2nd time</p>
11:38 am	<p>Public Alerting (from UC Berkeley) UC Berkeley sends WarnMe email to UC Berkeley staff, students, and university affiliates, and WarnMe subscribers with tsunami evacuation zones</p>
11:38 am	<p>Event response - City City begins recall efforts to upstaff two squads and the Fire Department Above Ground Water Supply (AWGS)</p>
11:42 am	<p>Public Alerting (from City) City of Berkeley posts updates to “Evacuate Now” messages on social media accounts (Bluesky and X) to link to Community Message posted on City website</p>

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Time	Action
11:45 am	Event response - City All known people are evacuated from the Marina, Tom Bates Field, in RVs along Frontage Road, and McLaughlin Eastshore State Park
11:47 am	Public Alerting (from City) City of Berkeley activates Outdoor Warning System (OWS) sirens targeting the evacuation area sounded evacuation message for the 3 rd time
11:50 am	Event Response – County/State Statewide Coordination Call with California Office of Emergency Services (Alameda County representing City of Berkeley; cities are not invited to this call)
11:54 am	Internal Alerting (from federal government) National Weather Service sends iNWS Alert via text and email canceling the Tsunami Warning
11:56 am	Public Alerting (from City) City of Berkeley activates Outdoor Warning System (OWS) sirens targeting the evacuation area sounded evacuation message for the 4th time
11:58 am	Internal Alerting (from State government) Emergency Managers receive email from State of California Office of Emergency Services: Advised that per NTWC conference call, tsunami warning is canceled
12:02 pm	Public Alerting (from City) City of Berkeley updates Bluesky and X accounts to indicate tsunami warning canceled
12:04 pm	Public Alerting (from City) City of Berkeley updates Berkeley Emergency Map (Genasys Protect) to cancel Tsunami Warning/evacuation orders for recipients within Tsunami Inundation Zone (Map 1 above): Berkeley Zones West of San Pablo shifted into Evacuation Orders Lifted status (BER-E023, BER-E034, BER-E035, BER-E047, BER-E048, BER-E049, BER-E050)
12:04 pm	Public Alerting (from City) City of Berkeley sends Cancellation message using Nixle
12:06 pm	Public Alerting (from City) City of Berkeley sends AC Alert All-Clear Message targeted alert to Tsunami Max Phase Area (Map 1 above). Sent to all land lines/VoIP phones; opt-in subscribers via mobile phone/email/text
12:12 pm	Public Alerting (from County) Alameda County issues cancellation notifications using AC Alert. Sent using WEA, Emergency Alert System, NOAA Weather Radio, text, email, phone call

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Time	Action
12:16 pm	<p>Public Alerting (from City) City of Berkeley updates Bluesky and X tsunami warning cancelation posts to include link to Genasys Protect map</p> <p>City of Berkeley sends Evacuation Order cancelation email via GovDelivery to Berkeley Marina Slip Holders (boaters and liveboards)</p>
12:16 pm	<p>Public Alerting (from UC Berkeley) UC Berkeley sends WarnMe email to UC Berkeley staff, students, and university affiliates, and WarnMe subscribers with “All clear” message</p>
12:17 pm	<p>Public Alerting (from City) City of Berkeley updates community message on City website to reflect tsunami warning cancelation</p>
12:24 pm	<p>Public Alerting (from City) City of Berkeley updates Berkeley Emergency Map (Genasys Protect) to reset areas within Tsunami Inundation Zone (Map 1 above) into Normal status: Berkeley Zones West of San Pablo shifted into Evacuation Orders Lifted status (BER-E023, BER-E034, BER-E035, BER-E047, BER-E048, BER-E049, BER-E050)</p>
12:30 pm	<p>Public Alerting (from County) Alameda County issues Cancelation via AC Alert, sent via text and email to all opt-in subscribers</p>
12:39 pm	<p>Public Alerting (from City) City of Berkeley updates Bluesky and X tsunami warning cancelation posts to include link to updated Community message on City website</p>

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Response Strengths

The City's response to the tsunami warning was swift, decisive, and grounded in the State's best practice guidance.

Emergency Operations Center Coordination

The City activated its Emergency Operations Center (EOC) within 5 minutes of receiving the federally issued tsunami warning, enabling key officials to quickly coordinate policy-level instructions, City departments and partner agencies, and field-level responders. Agencies represented in the EOC included the Fire Department, Police Department, Department of Parks, Recreation and Waterfront, Department of Public Works, and City Manager's Office. Further, the EOC coordinated with external agencies including the California Highway Patrol, AC Transit, Berkeley Unified School District, American Red Cross, City of Albany, UC Berkeley, the Lawrence Berkeley National Lab, and the Alameda County Sheriff's Office.

Swift evacuation

Field responders from the Waterfront Division of Berkeley's Parks, Recreation and Waterfront Department, Berkeley Police, and Berkeley Fire evacuated the Berkeley waterfront and Marina in 45 minutes. They coordinated with the California Highway Patrol to shut down freeway off-ramps, addressing traffic backups moving eastward into Berkeley. Responders and Marina residents leveraged their experience from the 2023 Tonga Tsunami, an Advisory-Level tsunami during which evacuation orders were issued for boats, docks, and the shoreline.

Supportive Plans

The City's tsunami public alerting protocols were developed based on best practice guidance from the State of California. These documents were quickly operationalized on December 5, enabling key stakeholders to quickly coordinate and mobilize public safety efforts for those in the inundation zone.

Partner Coordination with AC Transit

EOC responders coordinated support from AC Transit to bring buses to the 4th Street and Marina areas to facilitate evacuation. The tsunami warning was canceled before these resources were used.

Mass Care coordination

EOC responders coordinated with the PRW Recreation Division to activate James Kenney Community Center as an evacuee reception site in under one hour. The tsunami warning was canceled before these resources were used.

Emergency Alerting Systems

Officials activated a suite of emergency alerting systems to share evacuation orders. The tsunami warning was the first emergency activation of the newly-installed Outdoor Warning System. Officials activated four siren installations, targeting alerts to people outdoors within the tsunami inundation zone.

Public Communications

The City's Communications staff posted a message to the home page of BerkeleyCA.gov, created a sitewide banner appearing on all pages, and posted guidance to Bluesky and X. In observing other cities throughout the region – all of whom were subject to the same guidance – staff is not aware of any local

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jurisdiction that posted guidance across so many platforms or so thoroughly across the jurisdiction's website. Metrics also showed high engagement:

- BerkeleyCA.gov: 27,256 page views (about 20,000 more than a typical day)
- Bluesky: 14 posts
- X: 14 posts, 293,240 impressions

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Community Survey Results and the City's Next Steps

On December 5, 2024, the day of the tsunami warning, the City of Berkeley's Office of Emergency Services created a community survey to capture Berkeley community members' experiences during the tsunami warning event.

The survey was shared through multiple platforms and media websites. Responses were collected until December 9. In total, 1,602 people responded to the survey.

Survey results are represented below using key themes from survey respondents in three areas:

1. Community Tsunami Education
2. Public Alert and Warning
3. Traffic and Transportation Support

In response to these themes, City staff have identified key actions to further improve the City's response in future tsunami warnings. These actions are identified below in association with the community response theme. They are also summarized at the end of this section.

2024 Tsunami Warning AAR & Survey Summary

1. Community Tsunami Education

Survey responses elevated two themes around tsunami education. The first was a general uncertainty about Berkeley's tsunami hazard, and the second was a lack of understanding about the area of Berkeley that could be subject to tsunami inundation. These themes are explored further below.

General uncertainty about Berkeley's tsunami risk

Many survey respondents did not understand or know about Berkeley's tsunami risk and where a tsunami could impact, causing many people to evacuate from areas that are outside the tsunami inundation zone.

"I would have liked more of an explanation of what to expect from a tsunami. People in my building weren't sure if being on the 2nd floor and above was ok, what to expect, and if we could get back to our apartments after." - Survey Respondent

Analysis: According to the [City of Berkeley Local Hazard Mitigation Plans](#) from 2014, 2019, and 2024 (Draft), tsunami is one of Berkeley's natural hazards of concern. However, the likelihood and anticipated impact of a tsunami event makes it a lower priority for community outreach than an earthquake or wildfire.

For this reason, the City's community education about the tsunami hazard has primarily targeted residents of the Berkeley Marina, who must evacuate for an Advisory or Warning level tsunami. This outreach included online videos and resources as well as a March 2024 community tsunami outreach workshop. But because a warning-level tsunami could extend as far east as 7th Street, many affected community members did not have enough information about the science of tsunamis in Berkeley to understand how alerts applied to them and evacuate if directed.

Confusion about Berkeley's tsunami inundation zone

Survey respondents sought clarification on the areas of Berkeley considered inside Berkeley's tsunami inundation zone, the relevant risks, and actions to take. There were survey respondents who evacuated from areas outside of the inundation zone due to not knowing where the exact inundation zone is. Other survey respondents saw alerting maps from the National Tsunami Warning Center showing the tsunami alert area based on forecast zones (see *Official Alerting Tools and Technologies* above) which left them skeptical about the warning.

"Many people questioned how a tsunami could enter the Bay and stated it must only be people on the coast who need to evacuate. Most people were unconcerned and their intention was to do nothing. There was a lot of confusion, and honestly I felt like the odd man out for taking it seriously and wanting to evacuate. Thankfully, our office chose to tell people they needed to evacuate (though I could easily see that as having gone the other way). Eventually we did, but it took a lot of time. My kids' schools and daycares did not evacuate when they should have. There was just tons of confusion all around, lots of complacency and not taking it seriously. I learned how uneducated many of us are about tsunami threats."

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- Evacuation Zone Respondent

"Be more specific what zone to evacuate. I didn't know what zone so I left"

- Survey Respondent

"Store employees at 4th Street shops need to know what to do when a tsunami warning is issued. I don't live in the area but was shopping. Sur La Table closed but Stained Glass Garden and other stores stayed open. It wasn't until I looked at a map of the evacuation zone that I realized the parking lot would be flooded and decided to leave. East-West streets from 4th st. were very congested so early notification to evacuate is essential."

- Respondent within Evacuation Zone

Analysis: Additional outreach is necessary to educate Berkeley residents and visitors about the area that could be subject to tsunami inundation, and appropriate steps for critical facilities to take in response to various tsunami alert levels.

Critical Facilities Seeking Tsunami Evacuation Plans

Some respondents at critical facilities requested guidance on how to evacuate large groups of people from the tsunami zone.

"As a school we are in a situation where we do not have the transportation to evacuate 90+ children by vehicle. If a city official could help us develop a reasonable plan that would be helpful. We have an earthquake, fire and air pollution evacuation plan in place but have not faced tsunami and don't feel educated about timing, location and transportation guidelines, especially since we are in the tsunami zone"

- Survey Respondent

Analysis: Additional outreach is necessary to ensure that critical facilities in Berkeley have information necessary about the tsunami hazard, alerting levels/areas of impact, and potential timeframes for response, so that they can make an evacuation plan for their facilities. The City plans to reach out directly to critical facilities in the tsunami inundation zone to offer this guidance.

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Community Tsunami Education: Key City Actions

Below are the City’s key steps to improve tsunami education, along with estimated months during which each action will be complete.

Key Action	Due Date
Publish and share Berkeley’s Hazards website, which includes map of tsunami inundation area: https://arcg.is/maaa91	Complete
Explore and develop a recommendation re: City participation in the Tsunami Ready Program with the California Office of Emergency Services, which requires certain activities to educate the public and provides tsunami evacuation signage and kiosks in the tsunami zone.	March 2025
Create a tsunami-focused hazard page on the City of Berkeley website that includes a map of the inundation zone and preparedness steps.	May 2025
Offer tsunami-focused educational sessions for the public.	May 2025
Work with PRW-Waterfront team to finalize calendar of 2025 outreach events to continue tsunami risk education for Marina residents, businesses, and waterfront visitors.	April 2025
Integrate tsunami information into disaster preparedness training offered by the City, including Community Emergency Response Team (CERT) Training Unit 1: Disaster Preparedness.	March 2025
Initiate targeted tsunami outreach to critical facilities, including schools, in the inundation area and offer recommendations and training opportunities.	May 2025

2. Public Alert and Warning

Survey respondents reported that messaging from varied official sources was inconsistent, disconnected, and that event-specific instructions could be hard to find.

National Tsunami Warning Center (NTWC) alerting issues

Survey respondents who were not signed up for the City of Berkeley’s alerting systems expressed that the alerts they received lacked critical information on evacuation zone locations, directives, and directions for where to go.

“I was not signed up for any city of Berkeley notifications and only received the wireless emergency alert. That was true for most of our office, so there was not enough information. We had no information at all about who should evacuate and who should not, access to a map, how much time we had (when the tsunami was expected), etc. My workplace was in the recommended evacuation zone (which I didn't learn until after the fact), and there was general confusion and inaction when the wireless alert went out.”

- Evacuation Zone Respondent

“It would be make sense if the standard initial alert template would include either a description or link to the location of the Tsunami Evacuation Zone. I am sure that not

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everyone knows where the Zone is in Berkeley, or whether they are in it, and this isn't something that changes for different events.”

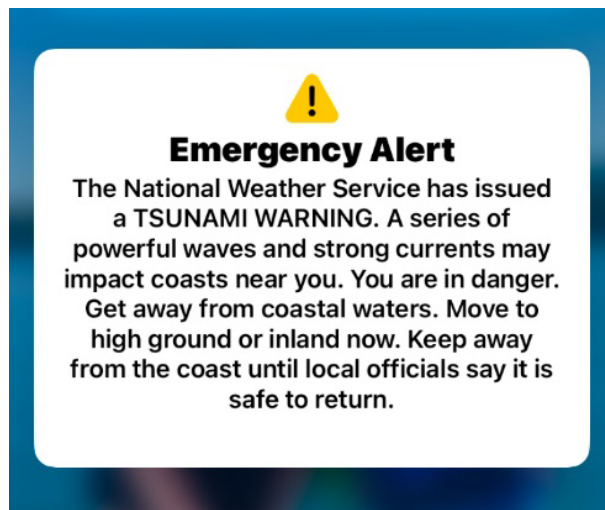
- Survey Respondent

“...There was no link to anyplace to get more specific information about whether I was in an actual evacuation zone. Nor was there any specific information about WHEN the event might occur, although that information was absolutely available. So all I got was an incredibly alarming, panic-inducing message that was completely useless in the end. I had to do my own research to get the information I needed.”

- Evacuation Zone Respondent

Analysis: There are three primary issues with the NTWC’s alerting approach:

1. As discussed in *Official Alerting Tools and Technologies* above, for a Warning-level tsunami, the NTWC National Tsunami Warning Center sends a Wireless Emergency Alert to all affected forecast zones. In Berkeley, the activated forecast zones are considerably larger than the tsunami inundation area, covering nearly all of the city.
2. Additionally, the NTWC’s template language is very vague, indicating that all recipients are in danger, but lacking sufficient detail for a recipient to determine if they are indeed in the tsunami inundation zone. Below is the text from the NTWC WEA sent on December 5:



3. The NTWC opts to send the tsunami warning alert as soon as possible, without advance notice to public safety officials. This means that local public safety officials must send follow-up messages to clarify instructions for their local communities. Until this can be done, community members are put on alert without sufficient information to take appropriate protective action.

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Berkeley alerting systems: effective for target audiences, gaps for those not connected
Respondents who were in Berkeley's evacuation zone generally had the information needed to act because they received targeted alerts from Berkeley's alerting systems (AC Alert, Berkeley Emergency Map, Outdoor Warning System sirens).

However, the NTWC WEA was sent to people throughout and beyond Berkeley. In response to the NTWC's overly-general WEA with significant overreach, the public sought out information on their own but could not find a singular website with consolidated and current information. People who did not directly receive alerts from Berkeley's emergency alerting systems found it difficult or impossible to find event-specific information.

"The city and county warning systems performed very well, for which I thank them."

- Survey Respondent within Evacuation Zone

"I know it turned out to be a false alarm, but these are hard to predict, and I was happy to see the warning system work as well as it did."

- Survey Respondent

"Received no notice about evacuation zone. No state, county or city website was working to allow access to tsunami evacuation maps for Berkeley or the County. Found random presentation on YouTube with map and then turned to Twitter/X as it was only resource with info on evacuation zone in Berkeley. As it turned out, not in zone so stayed put."

- Survey Respondent

Analysis:

While the NTWC WEA was broadly distributed across Berkeley, the Berkeley's emergency alerting system messages were targeted to people in the evacuation zone. This meant that many people who were alerted to potential danger by the NTWC did not receive follow-up message from the City of Berkeley's emergency alerting systems. Additionally, people who were not connected to emergency alerting systems had trouble accessing information contained in alert and warning messages. Two broad approaches will address these issues:

- 1) Expand reach of emergency alerts:
 - a. Continue to encourage community signups for AC Alert and the Genasys Protect App through direct community outreach as well as community messages and social media platforms. Continue to educate community members about the use of the Berkeley Emergency Map.
 - b. In recognition of the NTWC's approach to alert nearly all of Berkeley during a tsunami warning, City will restructure its tsunami warning alerts to send to all Berkeley

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- subscribers, rather than to be targeted only on people who must evacuate. Integrate language to encourage people outside the evacuation zone to stay off the roads.
- c. At the direction of Alameda County, the City of Berkeley did not activate WEA technology to distribute Berkeley-specific messages. This was due to concern about overlapping alerting areas among cities “canceling out” neighboring cities’ messages. The City will work with Alameda County and partner cities to explore options for coordinated use of Wireless Emergency Alert technology for Warning-level tsunamis.
- 2) Improve ad-hoc access to emergency alerts: The City’s Communications team will explore options to increase efficiency, speed and effectiveness of emergency messaging on the City’s non-emergency communication platforms, such as BerkeleyCA.gov.

Inconsistent Tsunami Zone Information Across Alert Platforms

Respondents noted inconsistencies in the tsunami alerting areas across different platforms and senders, making it difficult for community members to confirm information quickly and take protective action:

- As discussed above, the initial NTWC WEA message was sent broadly to forecast zones, which included almost all of Berkeley. Numerous respondents reported leaving in response to the NTWC WEA’s general recommendation to move to higher ground, learning later that this was not necessary for their particular location.
- Berkeley’s emergency alerts described the evacuation area in detail when possible, but short form messages had to describe the inundation area as west of 7th Street, which included some areas not in the evacuation zone.
- The Berkeley Emergency Map activated zones containing tsunami inundation areas, with specific descriptions in the “Reason” box, but also highlighted areas that were not under evacuation order.

“...Berkeley's emergency map said everyone above San Pablo was outside the evacuation zone; tsunami.gov said no one below the hills was outside it; ...; the state page had a 503 error. And most local news sources took ages after the ac alert before passing any information. How are we supposed to know what's going on?”

- Evacuation Zone Respondent

Analysis: In all cases, the inconsistencies noted were due to a lack of precision in associated alerting systems, rather than any disagreement on the inundation area for a tsunami warning. The City will address these inconsistencies using three approaches:

- 1) Advocating for improvements to NTWC alerting systems to prevent overreach, as described above.
- 2) Updating the AC Alert template to refer to Berkeley-specific information sources rather than Tsunami.gov, which will display the overly-broad NTWC alerting zones
- 3) Updating the Berkeley Emergency Map to enable evacuation zones to be split for tsunami alerting, ensuring that the zone map will be consistent with the text and PDF map of the evacuation area.

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Outdoor Warning System Effective but too short

The City activated four siren installations in its Outdoor Warning System with evacuation alerts. The sirens were heard by people outdoors in the target area. Acoustic messages are short to facilitate audience comprehension, with alerts lasting approximately two minutes. However, this led to a need to for the EOC to continually re-activate alerts. Additionally, when community members heard the siren complete a cycle, some mistakenly believed that the evacuation order was canceled.

Analysis: Once an alert is activated on speakers, it cannot be paused or stopped mid-stream. This means that selecting the length of an alert is a balance: The alert must be long enough that it doesn't need to be consistently replayed, and short enough that if the situation changes and evacuation orders or affected areas change, the wrong information isn't still playing to the public from the speakers. The City will double the length of the evacuation alerts on the Outdoor Warning system to at least five minutes.

Public Alert and Warning: Key City Actions

Below are the City's key steps to improve tsunami public alert and warning, along with estimated months during which each action will be complete.

Key Action	Due Date
Advocate for improvements to National Tsunami Warning Center alerting procedures to prevent overreach, improve message clarity, and facilitate local guidance.	Ongoing
Continue to encourage community signup for AC Alert and Genasys Protect App	Ongoing
AC Alert (Everbridge): Update alerting templates for Tsunami Warning <ul style="list-style-type: none"> To send Citywide instead of targeted to evacuating areas, and To direct people to Berkeley sources instead of Tsunami.gov, and To include instructions to stay off the roads to facilitate evacuation for people outside the evacuation area 	Complete
With Alameda County and partner cities, explore options for coordinated use of Wireless Emergency Alert technology for Warning-level tsunamis.	May 2025
Improve ad-hoc access to emergency alerts: City Manager's Office Communications team will explore options to increase efficiency, speed and effectiveness of emergency messaging on the City's non-emergency communication platforms, such as BerkeleyCA.gov.	Ongoing
Berkeley Emergency Map (Genasys Protect): Split zones to better target areas of impact (removing areas from San Pablo to inundation zone boundary)	Complete
Outdoor Warning System: Extend siren evacuation alerts to loop for at least 5 minutes	March 2025

3. Traffic Management and Mass Transportation Support

Evacuation Traffic (within and outside of the tsunami inundation zone)

Emergency responders, survey respondents and other community media postings indicated significant traffic jams as people moved east in Berkeley.

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"...Offer details about who should evacuate. I live on 9th Street, so very near the affected area. But the tie up getting of the freeway was frightening. Could not move. If the wave had actually struck all of us stuck on the off ramps would have died."

- Respondent within Evacuation Zone

Analysis: Significant traffic backups were noted both inside and outside of the evacuation zone. The City will address these issues as follows:

- Backups outside evacuation zone: Improvements to community education and alerting will reduce the number of people needlessly evacuating. Alerting language updates will also remind people outside the evacuation zone of the importance to stay off the roads.
- Backups exiting the evacuation zone: The most significant backups reported in the evacuation cleared up once offramps from I-80 into Berkeley were shut down. This background traffic entering into Berkeley affected the ability of evacuees, especially those on the western side of I-80, to reach safety. The City will update tsunami evacuation procedures to request shutdown of I-80 offramps into Berkeley at the onset of a tsunami warning event.

Mass Transportation Support

During the evacuation, the City EOC coordinated with AC Transit to request buses to facilitate egress from the 4th Street and Marina areas. The tsunami warning was canceled before these resources were used.

Analysis: The City of Berkeley does not control mass transportation resources and must rely on external partnerships to facilitate evacuations. The City plans to continually improve those relationships and clarify procedures to request support for tsunami evacuations in particular. The primary partners in these conversations will be AC Transit and the Berkeley Unified School District.

Traffic Management and Transportation Support: Key City Actions

Below are the City's key steps to improve tsunami traffic and transportation support, along with estimated months during which each action will be complete.

Key Action	Due Date
Update protocols to immediately request shutdown of I-80 offramps into the City of Berkeley during a tsunami evacuation.	March 2025
Continue planning with transportation partners (AC Transit, Berkeley Unified School District) to further clarify protocols for tsunami evacuation support.	Ongoing

Summary of Key City Actions

Key Action	Due Date
Publish and share Berkeley's Hazards website, which includes map of tsunami inundation area: https://arcg.is/maaa91	Complete
Explore and develop a recommendation re: City participation in the Tsunami Ready Program with the California Office of Emergency Services, which requires certain activities to educate the public and provides tsunami evacuation signage and kiosks in the tsunami zone.	March 2025
Create a tsunami-focused hazard page on the City of Berkeley website that includes a map of the inundation zone and preparedness steps.	May 2025
Offer tsunami-focused educational sessions for the public.	May 2025
Work with PRW-Waterfront team to finalize calendar of 2025 outreach events to continue tsunami risk education for Marina residents, businesses, and waterfront visitors.	April 2025
Integrate tsunami information into disaster preparedness training offered by the City, including Community Emergency Response Team (CERT) Training Unit 1: Disaster Preparedness.	March 2025
Initiate targeted tsunami outreach to critical facilities, including schools, in the inundation area and offer recommendations and training opportunities.	May 2025
Advocate for improvements to National Tsunami Warning Center alerting procedures to prevent overreach, improve message clarity, and facilitate local guidance.	Ongoing
Continue to encourage community signup for AC Alert and Genasys Protect App	Ongoing
AC Alert (Everbridge): Update alerting templates for Tsunami Warning <ul style="list-style-type: none"> To send Citywide instead of targeted to evacuating areas, and To direct people to Berkeley sources instead of Tsunami.gov, and To include instructions to stay off the roads to facilitate evacuation for people outside the evacuation area 	Complete
Explore a Countywide plan for using Wireless Emergency Alert technology for Warning-level tsunamis, in coordination with the Alameda County Sheriff's Office and partner cities.	April 2025
Improve ad-hoc access to emergency alerts: City Manager's Office Communications team will explore options to increase efficiency, speed and effectiveness of emergency messaging on the City's non-emergency communication platforms, such as BerkeleyCA.gov.	Ongoing
Berkeley Emergency Map (Genasys Protect): Split zones to better target areas of impact (removing areas from San Pablo to inundation zone boundary)	Complete
Outdoor Warning System: Extend siren evacuation alerts to loop for at least 5 minutes	March 2025
Update protocols to immediately request shutdown of I-80 offramps into the City of Berkeley during a tsunami evacuation.	March 2025
Continue planning with transportation partners (AC Transit, Berkeley Unified School District) to further clarify protocols for tsunami evacuation support.	Ongoing

Key Community Actions

Below are the next steps that the City encourages Berkeley community members to take to increase their readiness for our next tsunami.

- Determine if your home or any locations that you care about are in the Tsunami Zone using the map on the [City of Berkeley's Hazards site](#).
- If you live or work in the tsunami zone, make a tsunami evacuation plan. Think of where you will go, how you will get there, what you will pack, and who in your network can offer your help. In the event of a tsunami, you only need to evacuate east of the tsunami zone. Depending on your location, you may be able to move quickly out of the zone by walking, biking, or scooting.
- If you are part of Berkeley's maritime community:
 - Make sure you're connected to Berkeley's Harbormaster.
 - Make a plan for your boat. Generally, it is safer to keep your boat docked during a tsunami because most tsunamis are relatively small. On the rare occasion when a larger tsunami is expected (Warning level), you may consider taking your boat offshore. Berkeley's Harbormaster will provide the best advice.
- Sign up for [AC Alert](#) to receive tsunami evacuation updates issued by Berkeley's public safety officials.
- Download the [Genasys Protect App](#), which can alert you if zones you care about have evacuation orders or warnings.
- Explore and learn how to use the [Berkeley Emergency Map](#) before an emergency occurs, to be prepared to look up evacuation information in an emergency.
- Stay connected with the Office of Emergency Services by signing up for the [Berkeley Ready newsletter](#). Community education opportunities are promoted through this email newsletter.