APPROVED
OCT 06 2021
BOARD OF RECREATION
AND PARK COMMISSIONERS

BOARD REPORT NO. 21-163

DATE October 06, 2021 C.D. 4

BOARD OF RECREATION AND PARK COMMISSIONERS

SUBJECT: GRIFFITH PARK – APPROVAL OF PROPOSED EARTHQUAKE EARLY WARNING RADIO RELAY STATION; CATEGORICAL EXEMPTION FROM THE PROVISIONS OF THE CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA) PURSUANT TO ARTICLE III, SECTION 1, CLASS 3(4) [INSTALLATION OF NEW EQUIPMENT REQUIRED FOR SAFETY, HEALTH AND THE PUBLIC CONVENIENCE INVOLVING NEGLIGIBLE OR NO EXPANSION OF USE] OF CITY CEQA GUIDELINES AND TO ARTICLE 19, SECTION 15303 OF CALIFORNIA CEQA GUIDELINES

AP Diaz	________	M. Rudnick	________
H. Fujita	________	for *C. Santo Domingo	DF
J. Kim	________	N. Williams	________

M. Shull
General Manager

Approved X Disapproved ________ Withdrawn ________

RECOMMENDATIONS

1. Approve the United States Geological Survey's (USGS) proposed Earthquake Early Warning Radio Relay Station (Station), as described in the USGS Site Plan of Development (Attachment 1) and in the Summary of this Report;

2. Authorize Department of Recreation and Parks (RAP) Staff to issue a Right of Entry Permit to USGS and its contractors to install the Station;

3. Direct RAP Staff to work on a long-term license to USGS to maintain the Station and return to the Board of Recreation and Park Commissioners (Board) for approval of the license;

4. Determine that the proposed Station, consisting of the installation of the Station, is categorically exempt from the provisions of the California Environmental Quality Act (CEQA) pursuant to Article III, Section 1, Class 3(4) [Installation of new equipment required for safety, health and the public convenience involving negligible or no expansion of use] of City CEQA Guidelines and Article 19, Section 15303 of California CEQA Guidelines and direct staff to file a Notice of Exemption (NOE) with the Los Angeles County Clerk;

5. Authorize RAP's Chief Accounting Employee to prepare a check to the Los Angeles County Clerk in the amount of $75.00 for the purpose of filing a NOE; and

6. Authorize RAP Staff to make technical corrections to carry out the intent of this Report.

SUMMARY

USGS Earthquake Science Center (ESC) operates a network of earthquake early warning (EEW) sites. The purpose of this network is to enhance public safety by monitoring the earthquake hazards in Southern California using the fastest, most reliable technology. The Southern California Seismic Network (SCSN) is a partnership between the USGS, the State of California, the California Institute of Technology, and the University of California, Berkeley, and is one of seven regional networks that make up the Advanced National Seismic System.

USGS approached RAP with a proposal to install an Earthquake Early Warning Radio Relay Station (Station) at Griffith Park, located at 4730 North Crystal Springs Drive, Los Angeles, CA 90027 (Attachment 2), near the Griffith Park Observatory Trails Peak (Attachment 3). USGS determined that this location would provide the clearest line of communication, allowing the relay of critical ground movement information to be transmitted to USGS' central data acquisition center in Pasadena, with minimal obstructions that would delay the transmission of time sensitive data for analysis. USGS is proposing to install the components of the Station, at a location with an unused monopole structure. USGS will repurpose the monopole structure and install the components of the Station within the existing approximately 7' long by 6' wide infrastructure footprint, reusing the existing monopole structure, concrete pad, fence poles, and the fencing that was added according to RAP requirements (Attachment 4).

The Station would allow direct radio communication between other stations in the Los Angeles Basin to the central data acquisition center in Pasadena, which would relieve the need to use commercial cellular service during strong shaking and possible network outages.

The Station would contribute to ShakeAlert (Attachment 5), an earthquake early warning system under development in California and eventually the entire west coast. This system could protect against the loss of life and property in a large earthquake. The Station would contribute to better and faster recording of earthquakes in the Los Angeles region. ShakeAlert would ultimately be able to distribute alerts through all available distribution channels, including FEMA's Wireless Emergency Alert system and Integrated Public Alert and Warning System, smartphone apps, social media providers, and other electronic alert technologies as they develop. With further development, it can be used to trigger automated actions, like slowing trains and protecting power infrastructure. It could also initiate human responses, like taking cover, stopping surgery, preparing emergency responses, etc.

The proposed Station would be composed of two components, as described in the USGS Site Plan of Development (Attachment 1). Component 1 will house a solar array, backup power, satellite timing receiver/antenna, and radios for real-time data transfer. The components will be housed within 64” high by 36” long by 24” wide SolarCraft Cabinet that will be installed onto the existing concrete pad. Component 2 will be the existing monopole structure, which will be outfitted with radio antennas and solar panel. The two components will comprise a single radio relay system. The design of the Station would enable components to be swapped or introduced without disturbing the surrounding area. The Station will utilize the footprint of the existing infrastructure, an approximately 7’ long by 6’ wide area and will be enclosed within a fence. The Station will be solar powered and will not generate noise, will not impede public access to surrounding areas, will be low profile, and will be encapsulated to prevent animal damage. USGS will be responsible for the costs and maintenance related to the Station.

RAP Staff will issue a Right of Entry Permit to USGS and its contractors for the installation of the Station, while a long-term license is worked out for USGS to maintain the Station. RAP Staff will return to the Board for approval of the license to USGS.

RAP Staff is in support of the proposed location for the Station, as the components of the Station would be installed within an existing infrastructure footprint, would repurpose an unused monopole structure, would minimally alter the existing landscape, and would not affect the use of the trail. USGS presented the proposed Station to the Griffith Park Advisory Board (GPAB) on May 27, 2021. GPAB is in support of USGS’ proposal (Attachment 6).

TREES AND SHADE

No additional trees or shade canopy will be added.

ENVIRONMENTAL IMPACT

The proposed Station consists of installation of new equipment required for safety, health and the public convenience involving negligible or no expansion of use. As such, RAP staff recommends that the Board determines that it is categorically exempt from the provisions of the California Environmental Quality Act (CEQA) pursuant to Article III, Section 1, Class 3(4) of City CEQA Guidelines as well as to Article 19, Section 15303 of California CEQA Guidelines. RAP Staff will file an NOE with the Los Angeles County Clerk upon the Board’s approval.

FISCAL IMPACT

The approval of this Report will not impact RAP’s General Fund, as USGS will be responsible for all costs associated with the Station.

STRATEGIC PLAN INITIATIVES AND GOALS

Approval of this Report advances RAP’s Strategic Plan by supporting:

Goal No. 1: Provide Safe and Accessible Parks
Outcome No. 2: All parks are safe and welcoming

Result: USGS' Station will be an integral part of a network of earthquake early warning communications system that will contribute to the safety of the community.

This report was prepared by Ian Kim, Management Analyst, Planning, Maintenance and Construction Branch.

LIST OF ATTACHMENTS

1) Attachment 1 – USGS Site Plan of Development
2) Attachment 2 – Griffith Park Map
3) Attachment 3 – Aerial Map – Proposed Location of Station
4) Attachment 4 – Photograph of Existing Infrastructure
5) Attachment 5 – ShakeAlert Information
6) Attachment 6 – GPAB Letter of Support

USGS EARTHQUAKE MONITORING
SITE PLAN OF DEVELOPMENT FOR MT. HOLLYWOOD

Griffith Park
Los Angeles Ca. 90027
34°07'44.3"N 118°18'04.2"W
34.128984, -118.301157

1. Purpose and Need of the Facilities

Structure Description

The U.S. Geological Survey (USGS) will build an Earthquake Early Warning Radio Relay Station consisting of two components.

> **Component 1** 64” tall SolarCraft Cabinet will house the solar array, backup power, satellite timing receiver/antenna and radios for real-time data transfer.
>
> **Component 2** Existing Monopole Structure

These two components comprise a single radio relay system.

The design of this station enables components to be swapped or introduced without further disturbing the surrounding area.

Purpose of site

- This relay station will allow direct radio communication between Earthquake Early Warning stations in the Los Angeles Basin to central data acquisition center in Pasadena. This will relieve the need to use commercial cellular service during strong shaking and possible network outages.
- This station will contribute to ShakeAlert, an earthquake early warning system under development in California and eventually the entire west coast. This network could protect against the loss of life and property in a large earthquake.
- Better and faster recording of earthquakes in the region.
- Records of ground motion close to a slipping fault. Such records are rare and would be of immense scientific and engineering value.

Size of site

Station will utilize an approximately 7’x6’ plot within the allotted permit. These are the approximate dimensions of the existing fence. Everything will be inside the existing fence, which will be replaced. We will utilize the existing fence poles to minimize disturbance and re-fence with the parks preferred style of fencing.

Component 1: 64” H x 36” L x 24” W

Component 2: 30’ H x 1’ D

Will structure(s) be housed within an existing site?

No.

Will this site be constructed to allow for future expansion and permit subleasing of the facility?

No. The station is specifically designed to house seismic and communication instruments. Newer instruments must fit the structure.

Can it accommodate government agencies as sub lessee?

No.

Is this ancillary to an existing right-of-way?

No. This will not be considered a Right of Way by the LA Department of City Parks. It is simply an agreement to grant access to the site for construction and occasional maintenance. However, an existing seismic station exists at Griffith Observatory telemetering data via cellular system.

Can a list alternative routes or locations be considered?

Other locations will be considered in the current area if required by Griffith Park.

2. Radio Relay System Location

Legal description of the facility

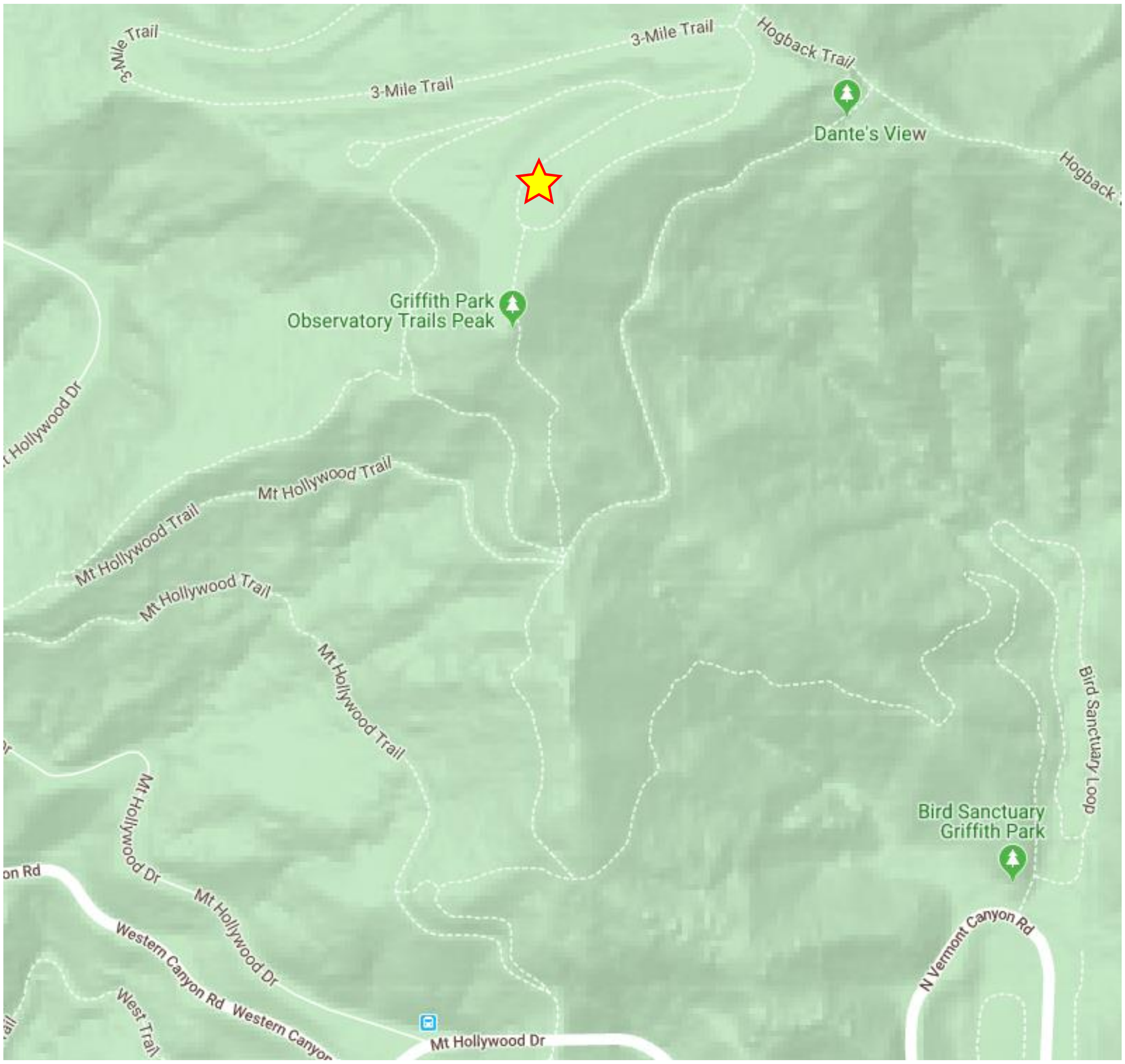
Radio relay station for earthquake monitoring. The proposed site will occupy no more than the existing ~7’x6’ fence line site near Griffith Park Observatory Trails Peak as shown on the map. Everything will be held within the existing fence and on the existing monopole structure. Site is approximately 90 meters North of the City of LA Engineering Monument by the Mt Hollywood/Tom LaBonge Panorama Overlook. See pictures of monument and overlook below.

View of overlook, monument located by rock

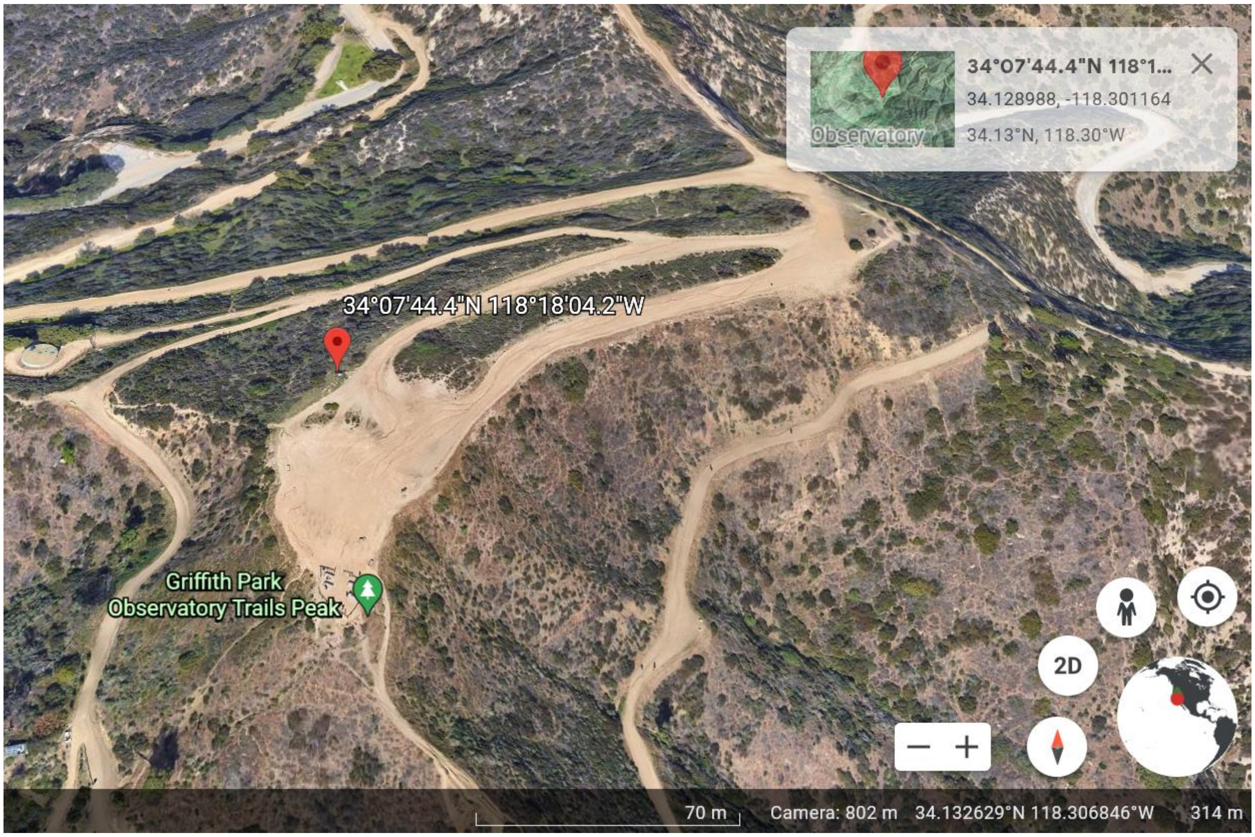
View of site from Monument/Overlook

Maps

Site of Proposed Location



Map with Star Showing Proposed Site



Google Earth Satellite View with Red Pin Showing Site Location

Component 1: SolarCraft Cabinet

SolarCraft Cabinet stock photo, actual cabinet is taller.

This component will house the electronics. Actual cabinet will be 64” H x 36” L x 24” W

Component 1: SolarCraft Cabinet with electronics

Example of similar cabinet, completed with electronics. Houses batteries, radios, charger, timing device, power controller. Everything will be grounded to a grounding rod.

Component 2: Existing Monopole Structure

Proposed Site Showing Monopole and Fencing (after maintenance work)

Radio antennas and solar panel will be attached to pole

Drawings of typical tower installation, shelters, and guy wire configuration

We will use the existing tower, pictured above.

Engineering design drawings and/or standards for roads, drainage, and power lines

No new roads, drainage or power lines are required. Existing roads and foot trails will be used.

3. Facility Design Factors

What design factors were considered? Wind loads, type and color of structures, wiring standards, suitability of soils and geology for placement of the facility.

- Design can withstand 100+MPH winds.
- Stainless and powder coated steel used to mitigate corrosive nature of native soils.
- Concrete will be used to isolate steel and other components from surrounding soils.
- All other components PVC or concrete.
- 12V DC solar array: All DC wiring protected by aluminum flex conduit or buried in SCH40 grey PVC to prevent shorting or animal damage.

Technical data information

Infrastructure Materials list:

- Steel Battery/ radio enclosure anchored to existing concrete slab.
- Aluminum flex conduit protects all exposed cabling from exposure.
- 15' SCH-40 grey 1½" conduit buried to 18" (standard depth).
- 8' ground rod and cable, driven into soil.
- 30' Monopole Structure (existing)
- 64" tall (H) SolarCraft Cabinet. Approx. 3 feet x 2 feet (LxW)

Component Materials List:

- Six 12V 100AH AGM batteries
- 30A solar regulator 12VDC.
- Four 130W solar panels, site sun exposure dependent.
- Six 900MHz or cell modem antenna. 12"L
- Six 900 MHz unlicensed spread spectrum radio.
- RG58.
- Stainless steel hose clamps for coax.

Temporary use areas that are needed

USGS and its licensed contractor may need a temporary staging area during construction near location.

List of required associated rights-of-way, including access roads, power lines

None

Length, width, and acreage of construction site

Site is entirely within the existing fence-line, which is approximately 7’x6’ (42 square feet).

Description of potential conflicts with other communication modes (i.e., mixing high power continuous with low power intermittent operations, obstructions between microwave towers, etc.)

None

Location of temporary equipment storage areas

None needed.

4. Government Agencies Involved

Federal Communication Commission

No licensed radio traffic used.

State and local agencies

Los Angeles Department of City Parks, Griffith Park.

5. Construction of the Facilities

Will the site be fenced after construction?

Yes, USGS has already replaced the fencing to meet the specifications provided by the Parks.

Brief description of construction

SolarCraft Cabinet will be installed on existing pad and bolted down. Cabinet will be outfitted with electronic equipment. Radio antennas and solar panel will be hung on the monopole structure using a bucket lift.

Description of the work force (number of people and vehicles)

3-4 USGS employees – 3-4 trucks/SUVs and one bucket lift attached to truck.

Description of clearing and grading

The proposed location will occupy a previously disturbed area. No clearing or grading will be necessary.

Safety requirements

All contractor personnel will be prepared to wear hardhats and reflective vests during construction if needed.

Industrial wastes and toxic substances

No toxic or industrial wastes will be generated during construction.

6. Resource Values and Environmental Concerns

Address at level commensurate with anticipated impacts

Location with regard to designated corridors:

- All activities will be limited to permitted areas and access roads.
- Impacts would be minimal as the scope of work would be completed in a period of days.

What are anticipated conflicts with resources or public health and safety?

Air, noise, geologic hazards, mineral and energy resources, paleontological resources, soils, water, vegetation, wildlife, threatened and endangered species, cultural resources, visual resources, projects, recreation activities, wilderness, etc.:

- Stations are solar powered, do not generate noise, will not impede public access to surrounding areas, are low profile, and are encapsulated to prevent animal damage.
- No large profile vegetation damaged.
- The USGS can accommodate threatened species by scheduling maintenance and installation around their birthing, mating or migration activities.
- No water table interaction or soil erosion is anticipated by USGS activities.
- Cultural resources may be involved, the SCSN can move the requested location after consulting with Park cultural departments.

7. Stabilization and Rehabilitation

a. Soil replacement and stabilization

N/A

b. Disposal of vegetation removed during construction (i.e., trees, shrubs, etc.)

N/A

c. Seeding specifications

N/A

d. Fertilizer

N/A

e. Limiting access to right-of-way

N/A

8. Operation and Maintenance

a. Will all-weather roads be required?

No

b. Will operational access to the site require a helicopter?

No

c. Safety procedures

All USGS personnel will follow "flight follow-up" guidelines put forth by USGS management

d. Industrial wastes and toxic substances

No industrial or toxic wastes are generated by this project.

e. Inspection and maintenance schedules

Each individual station will require at least one scheduled preventative maintenance visit per year.

Repairs as needed.

f. Work schedules

All work will be accomplished during normal business hours between 06:00A – 05:00P.

In the event of a major earthquake 24/7 access will be needed.

g. Fire control

All USGS vehicles are required to carry a minimum of two fire extinguishers, a shovel and vehicles are equipped with exhaust spark arrestors.

h. Short-term ROE to install equipment (cabinet, solar panel, radio antennas)

i. Long term access

USGS foresees this project as being a long term one. We can apply for a permit or access agreement for up to 30 years.

j. Signs

Signs will be posted with all pertinent information such as permit number, contact phone number and station description.

k. Inspections

Each individual station will require at least one scheduled visit per year.

l. Contingency planning

Dictated by site.

9. Termination and Restoration

a. Removal of structures

As needed

b. Obliteration of roads, building sites, antenna sites

As needed

c. Stabilization and re-vegetation of disturbed areas

No undisturbed lands will be occupied.

Purpose/ Scope of Work (e.g. digging – hauling – planting – etc.):

No digging is anticipated as we are utilizing existing infrastructure. We will use the monopole structure as our tower, and use the existing concrete pad to secure the cabinet that houses electronics.

Term – (starting & finishing dates and time of operation):

Construction will take place between

Start: August 15, 2021- August 15, 2022

Construction can usually be completed in a few days, and the project can begin in a matter of weeks from being approved. We are flexible on the start/end dates for construction.

Long term access:

If possible, the USGS would like to work on being permitted to be allowed occasional access for maintenance of site for up to 30 years. Maintenance is infrequent, and the site may be visited once a year or less. If at any time the existence of the site and maintenance is considered a nuisance or unwanted, the USGS does not argue and dismantles and removes the site.

Insurance: The Federal Government is "self-insured," and cannot carry liability insurance. We are held responsible for any liabilities under the Federal Tort Claims Act. We can, however, require our contractor to provide a certificate of insurance to cover their activities during the project. Further explanation of Provisions will be sent along with this document.

Other Information: (e.g. # of people in the job site, # of vehicles & vehicle type, other machinery:

One USGS employee – 3-4 US fleet vehicles. One bucket lift will be towed by a pickup truck.

Contingency planning

i. Permit holder contacts:

Marcos Alvarez, SCSN Acting Manager, Supervisory Geophysicist
US Geological Survey
(626) 768-1009
malvarez@usgs.gov

Brian McDowell, Physical Science Technician
US Geological Survey
(626) 658-1608
bmcdowell@usgs.gov

Griffith Park
4730 Crystal Springs Drive
Los Angeles, CA 90027

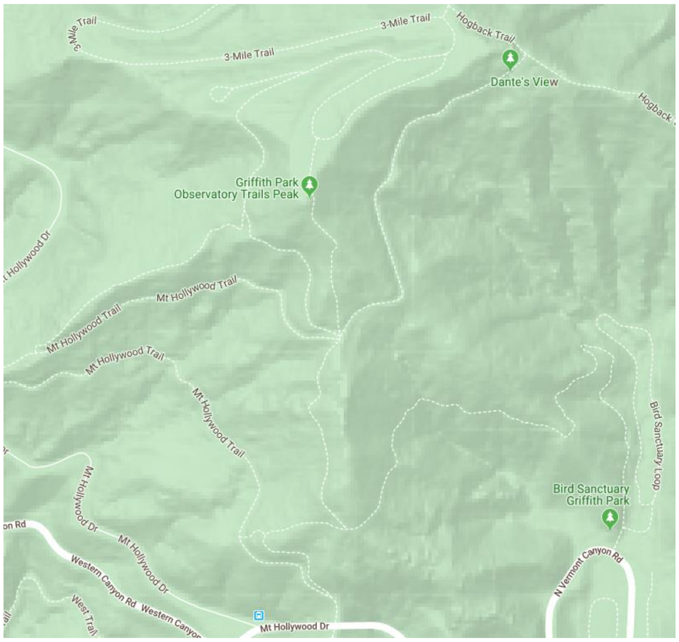
Attachment 3

Griffith Park

Observatory Trails Peak

Aerial Map -
Proposed Location for Earthquake Early Warning Radio Relay Station

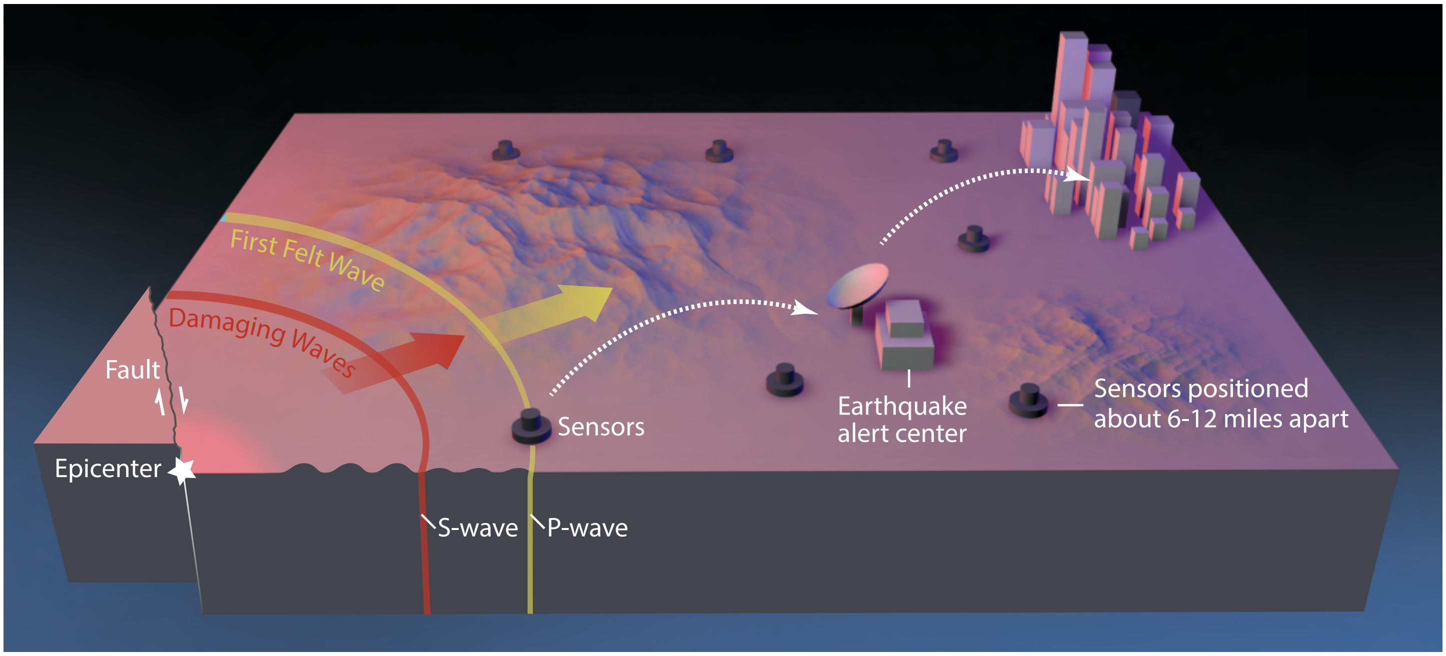
Attachment 3



Photograph of Existing Infrastructure

USGS
science for a changing world

ShakeAlert—An Earthquake Early Warning System for the United States West Coast



Earthquake early warning systems like ShakeAlert work because the warning message can be transmitted almost instantaneously, whereas the shaking waves from the earthquake travel through the shallow layers of the Earth at speeds of one to a few kilometers per second (0.5 to 3 miles per second). This diagram shows how such a system would operate. When an earthquake occurs, both compressional (P) waves and transverse (S) waves radiate outward from the epicenter. The P wave, which travels fastest, trips sensors placed in the landscape, causing alert signals to be sent ahead, giving people and automated electronic systems some time (seconds to minutes) to take precautionary actions before damage can begin with the arrival of the slower but stronger S waves and later-arriving surface waves. Computers and mobile phones receiving the alert message calculate the expected arrival time and intensity of shaking at your location. USGS image created by Erin Burkett (USGS) and Jeff Goertzen (Orange County Register).

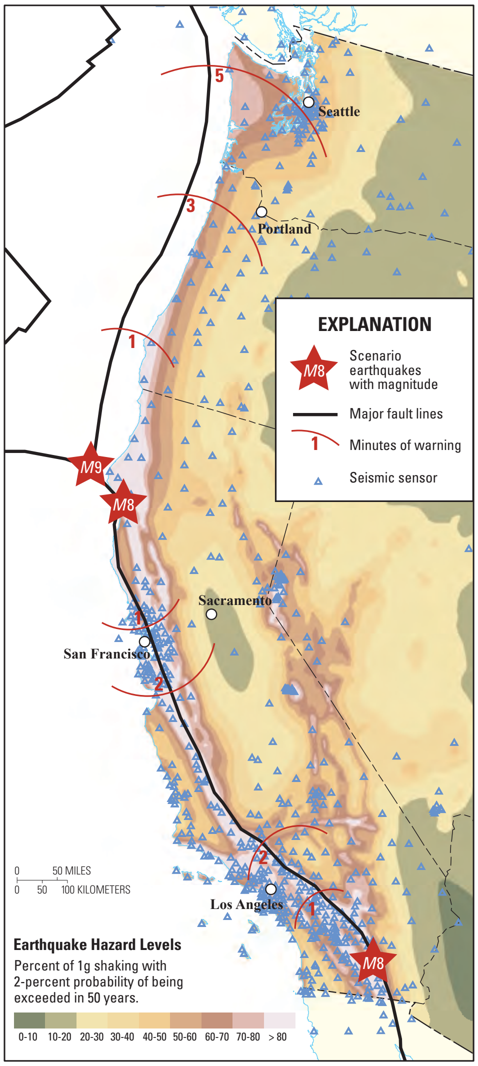
Earthquake early warning systems use earthquake science and the technology of monitoring systems to alert devices and people when shaking waves generated by an earthquake are expected to arrive at their location. The seconds to minutes of advance warning can allow people and systems to take actions to protect life and property from destructive shaking. The United States Geological Survey (USGS) in collaboration with several partners has been working to develop an early warning system for the United States. ShakeAlert, a demonstration system currently under development, is designed to cover the West Coast States of California, Oregon, and Washington.

Earthquakes pose a serious risk to our Nation. According to the Federal Emergency Management Agency (FEMA), 77 percent of that risk, or an average annual loss of $4.1 billion, is concentrated on the West Coast in California, Oregon, and Washington (Federal Emergency Management Agency, 2008). Growing urbanization and increasing reliance on complex infrastructure for power, water, telecommunication, and transportation magnify that risk. An earthquake early warning system that can rapidly detect earthquakes and send alerts could prompt actions to protect life and property before strong shaking arrives. Development of such a system is a critical step toward offsetting physical risks, improving public understanding of earthquake hazards, and reducing fear of the unknown and unpredictable nature of earthquakes.

How Do Earthquakes and Early Warning Systems Work?

An earthquake occurs when a fault in the Earth's crust breaks suddenly and the two sides move relative to one another. The rupture begins at one point on the fault and rapidly extends along some distance of the fault, like a lengthening crack in a car windshield. As the rupture travels along the fault, the sudden movement of the two sides of the fault generates seismic (shaking) waves that radiate outward through the Earth—much like ripples from a stone dropped in water. It is these waves that cause the ground shaking you can feel and the damage and destruction during earthquakes.

Although no one can predict earthquakes, the technology exists to provide some warning to surrounding communities once a quake begins. This is done



Map of the United States West Coast showing the amount of advance warning time that might be available from a system like ShakeAlert for several plausible future earthquake scenarios. Those scenarios include magnitude 8 (*M*8) quakes on the San Andreas Fault with epicenters in northern and southern California and an *M*9 quake on the Cascadia Subduction Zone with an epicenter offshore of northernmost California. Major population centers could have as much as several minutes warning before shaking waves from those quakes struck them. The map also shows the regional variation in the level of earthquake hazard in terms of the intensity of shaking (as a percentage of g, the acceleration of gravity) having at least a 2-percent probability of being exceeded in a 50-year period (from 2014 USGS hazard map). The network of seismic (earthquake) sensors is more concentrated near major faults and population centers. Illustration modified from Allen (2013).

How Warning Can Increase Safety and Prevent Damage

Even a few seconds of warning can enable actions that protect people and property. In the time between receipt of an alert and arrival of damaging shaking, the following actions can be taken:

Human Responses

- Public: Citizens, including schoolchildren, drop, cover, and hold on; turn off stoves, safely stop vehicles.
- Businesses: Personnel move to safe locations.
- Medical services: Surgeons, dentists, and others stop delicate procedures.
- Emergency responders: Open firehouse doors, personnel prepare and prioritize response decisions.

Automated responses

- Businesses: Open elevator doors, shut down production lines, secure chemicals, place sensitive equipment in a safe mode.
- Transportation: Automatically slow or stop trains to prevent derailment.
- Power infrastructure: Protect power stations and grid facilities from strong shaking.

by an earthquake early warning system, which rapidly detects seismic waves as an earthquake happens, calculates the maximum expected shaking, and sends alerts to electronic systems and devices before damaging waves arrive. Early warning is possible because information can be sent through communication systems virtually instantaneously, whereas seismic waves travel through the shallow Earth at speeds ranging from one to a few kilometers per second (0.5–3 miles/sec). This means that the shaking can take some seconds or even minutes to travel from where the earthquake occurred to where you are.

Thus it is possible for automated systems or even your personal electronic devices, such as smartphones, to receive an alert before destructive shaking arrives. A coalition of the United States Geological Survey (USGS) and university partners has been developing and testing ShakeAlert, an early warning system for earthquakes along the West Coast of the United States.

How Does ShakeAlert Work?

ShakeAlert is a demonstration early warning system that began sending alerts to test users in California in January 2012 (see www.shakealert.org). The system detects earthquakes using the California Integrated Seismic Network (CISN), an existing network of about 400 high-quality ground motion sensors. CISN is a partnership between the U.S. Geological Survey (USGS), State of California, California Institute of Technology, and University of California, Berkeley, and is one of seven regional networks that make up the Advanced National Seismic System. ShakeAlert extends CISN's current research and post-earthquake response products and takes advantage of our Nation's existing infrastructure for earthquake monitoring. When fully operational, ShakeAlert will be able to distribute alerts through all available distribution channels, including FEMA's Wireless Emergency Alert system and Integrated Public Alert and Warning System, smartphone apps, social media providers, and other electronic alert technologies as they develop.

Test users of ShakeAlert receive alerts through the demonstration user interface, a computer application with both audible and visual alert features. After ShakeAlert detects an earthquake, a map pops up on the user's screen to show the location of the earthquake epicenter (the point on the surface directly above the quake's starting point) and of waves moving toward the user; also shown is the time remaining until waves will reach the user's location and cause the indicated intensity of shaking. An alert sound alternates with a voice that counts down to the arrival time of seismic waves and announces the expected intensity.

How Much Warning is Possible?

An early warning system like ShakeAlert can provide seconds to minutes of warning before strong shaking arrives. The amount of warning time depends on the speed of the warning system and your distance from the epicenter. A good system requires a dense network of sensors to ensure that there are enough of them near all possible earthquake sources. Such a dense network can reduce the area near the epicenter for which reliable warning is not possible because the earthquake source is too close for an alert to outpace the seismic waves. The farther a location is from the epicenter, the greater the possible amount of warning time. To maximize warning time, the system must minimize delays in data processing, communication, and delivery of alerts.

Major Components of an Early Warning System

The ability to send adequate warning before shaking arrives depends on:

- A network of sensors that are densely spaced and close to faults
- Quick and robust telecommunication from sensors
- Computer algorithms to quickly estimate an earthquake's location, magnitude, and fault rupture length, and to map resulting intensity
- Quick and reliable mass notifications
- End users educated in how to use the alerts

Future Developments

Although few notable earthquakes have occurred since ShakeAlert began testing, the system has successfully provided warnings to test users during such earthquakes as the *M*5.1 La Habra earthquake on March 28, 2014, and the *M*6.0 South Napa earthquake on August 24th, 2014. Test users in Berkeley, California, received alerts 5 seconds before shaking arrived from the South Napa earthquake, and users in Pasadena, California, received about 6 seconds of warning for the La Habra earthquake.

The ShakeAlert system is still in the demonstration phase. USGS has published an implementation plan spelling out the steps needed to complete the system and begin issuing public alerts (Given and others, 2014). Before it can be released to the public and be set up to trigger automated actions, it requires additional development and further testing to make it sufficiently reliable (see sidebar "How Warning Can Increase Safety and Prevent Damage"), as well as end-user education on how to understand and use alerts.

The successful completion of the system will require the coordinated efforts of government agencies at all

Why ShakeAlert Emphasizes Intensity, not Magnitude

The shaking you feel is described by earthquake intensity rather than magnitude. High intensities are what cause damage in earthquakes.

Intensity

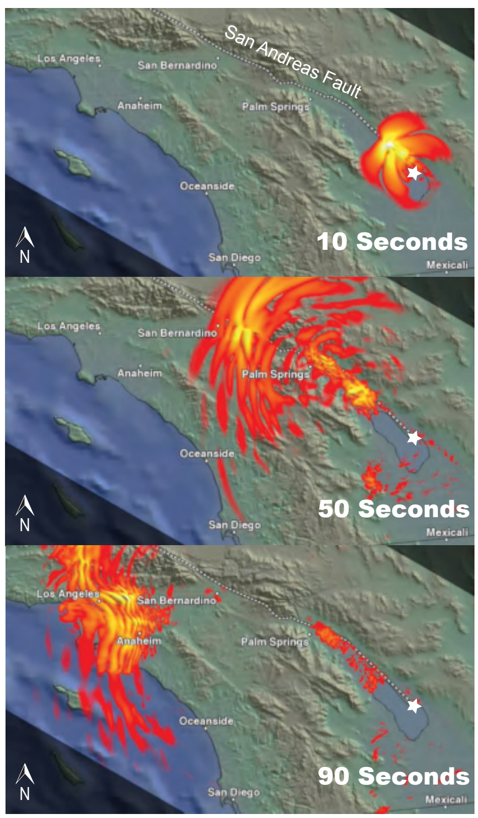
- represents the level of shaking caused by earthquake waves at a particular location
- depends on magnitude + distance + local geology
- varies from place to place in a single earthquake

Magnitude

- is one number representing the amount of energy released in an earthquake
- depends on the size (surface area) of fault rupture

ShakeMaps (Wald and others, 2003) rapidly show the distribution of intensity after an earthquake (**http://earthquake.usgs.gov/earthquakes/shakemap/**).

You can also report the ground shaking you experienced to help create intensity maps through Did You Feel It (**http://earthquake.usgs.gov/earthquakes/dyfi/**).



Diagrammatic maps showing northwestward spreading of ground shaking (red and yellow) generated by the *M*7.8 ShakeOut scenario earthquake centered in the Imperial Valley of southern California. The times shown are times after the start of the earthquake rupture at the epicenter (white star). This scenario was part of a comprehensive earthquake exercise conducted in the State of California in 2008 (Perry and others, 2008).

Will the West Coast have an Early Warning System Before or After the Next Big Quake?

Most countries with early warning systems built them after a devastating earthquake.

Japan invested $600 million in such a system after the 1995 Kobe earthquake killed 6,400 people. Today, Japan's system allows every citizen to receive advance alert of earthquake ground shaking from the Japan Meteorological Agency. Thanks to this system, no trains derailed in the 2011 magnitude 9.0 Tohoku earthquake, and according to a poll in Japan, 90 percent of the citizens think the system is worth the investment (Fujinawa and Noda, 2013).

Other countries that built systems after devastating earthquakes include:

- China (after the 2008 Wenchuan Earthquake killed 87,587 people)
- Taiwan (after the 1999 Chi Chi Earthquake killed 2,415)
- Turkey (after the 1999 Izmit Earthquake killed 17,127)
- Mexico (after the 1985 Mexico City Earthquake killed 10,153)

levels, private companies, and the public. California recently committed to developing earthquake early warning statewide, and companies are beginning to develop products to use and distribute the alerts.

The ongoing work of USGS scientists, together with partner organizations, on earthquake early warning systems is only part of the National Earthquake Hazard Reduction Program's efforts to safeguard lives and property from the future quakes that are certain to strike along the West Coast and other areas of the United States.

References

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On your screen: ShakeAlert

1. Real-time tracking of seismic waves from quake's epicenter.
2. Real-time tracking of the fault rupture (updates intensity).
3. Your current location tracked by GPS.
4. Seconds remaining before seismic waves reach you.
5. Expected intensity of quake at your current location.
6. Estimated magnitude of quake.
7. Intensity scale.

A user of ShakeAlert receives a message like this on the screen of his computer. The message alerts the user to how many seconds before the shaking waves arrive at their location and the expected intensity of shaking at that site. The shaking intensity follows the Modified Mercalli scale; an intensity of VI, as shown here, would mean the shaking is felt by everyone, people find it difficult to stand, and structures may suffer some damage. The warning message also displays a map with the location of the epicenter, the magnitude of the quake, and the current position of the P and S waves. In this example, the alert is for the ShakeOut scenario earthquake (Perry and others, 2008).

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California Institute of Technology
California Office of Emergency Services
The Moore Foundation
Southern California Earthquake Center
Swiss Federal Institute of Technology, Zürich
University of California, Berkeley
University of Washington

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Griffith Park Advisory Board
Community Stewards of LA's Largest Park & Great Urban Wilderness
Department of Recreation and Parks, City of Los Angeles
www.laparks.org/griffithpark/advisory

June 29, 2021

LA Board of Recreation and Parks Commissioners

Dear Commissioners:

Every Angeleno knows the drill: Drop, Cover, and Hold On. But earthquake science has advanced to the point where residents can sometimes receive an alert before the shaking starts. The ShakeAlert Early Warning System depends on thousands of sensors throughout Southern California – and now has the opportunity for an upgrade with the addition of a relay station atop Mt. Hollywood in Griffith Park.

The Griffith Park Advisory Board is writing in support of this proposal by the US Geological Survey. Notably, the USGS team is working directly with RAP staff to ensure that the relay station will be as unobtrusive as possible. They plan to make use of existing infrastructure and to keep a light footprint.

In the event of a major earthquake, the benefits of the relay station – which will transmit real-time data from multiple locations via a direct radio signal to Caltech in Pasadena – could be beyond measure. During such an emergency, seconds truly do count, as ShakeAlert can help Angelenos take cover & minimize damage. Given our region's frequent seismic activity, GPAB is fully in support of this project.

Sincerely,

Jason Greenwald

Chair, Griffith Park Advisory Board

cc: RAP: Mike Shull, AP Diaz, Matthew Rudnick, Stefanie Smith, Elena Maggioni

CD4: Sarah Tanberg, Helene Rotolo

USGS: Marcos Alvarez, Brian McDowell