TsuInfo Alert

prepared on behalf of the
National Tsunami Hazard Mitigation Program
by the Washington Department of Natural Resources

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Contents

TSUNAMI NEWS

Tsunami Event: Sulawesi, May 4, 2000

On May 5, the island of Sulawesi was struck by an earthquake (magnitude 7.4) followed by a tsunami. The tsunami waves hit the Banggai islands, killing at least nine people and destroying hundreds of houses in seven subdistricts in Banggai. The tsunami waves, reportedly measuring up to six meters in height inundated two villages on Peleng Island, Kayuntayo and Uwedikum.

In Luwuk (607 kilometers east of Palu, capital of central Sulawesi), a pier was seriously damaged, tens of houses collapsed, and a market burned down.

Local district administration in Luwuk and on Peleng Island has set up tents to temporarily shelter people who lost their homes and supplied them with rice and medicines. A task force comprised of local government, ministry of social affairs and NGO (world vision) has been formed, and until now has gathered 13.5 tons of rice and 115 boxes of instant noodle that will be targeted to four worst-hit subdistricts, namely Tinangkung, Bulagi, Balantak and Totikum.

(from: report by Christina Neal, Geoscience Advisor, USGS and Office of US Foreign Disaster Assistance, Washington DC 20523)

Indonesian Earthquake, June 4, 2000

The earthquakes that struck Southern Sumatera, Indonesia, June 4, 2000 had magnitudes of 7.9 and 7.6, but did not generate a tsunami. As of June 6, 2000, more than 100 people were known to have died in those events.

NEWS BRIEFS

President Endorses GDIN

On May 2, President Clinton issued an Executive Order directing the executive branch of the U.S. government to support the establishment of a "Global Disaster Information Network (GDIN) to use information technology more effectively to reduce loss of life and property from natural and man-made disaster."

In part, the order states:

"Section 1. Policy. (a) It is the policy of this Administration to use information technology more effectively to coordinate the Federal Government's collection and dissemination of information to appropriate response agencies and State governments to prepare for and respond to natural and man-made disasters..."

The complete executive order is available at http://www.pub.whitehouse.gov/uri-res/12R?urn:pdi://oma.eop.gov.us/2000/4/28/1.text.2

(*from*: Disaster Research #320)

CEMP on the Web

The Washington Emergency Management Division has added the Comprehensive Emergency Management Plan (CEMP) to its home page at http://www.wa.gov/wsem/ The website has many other useful publications dealing with preparedness, response, recovery, and mitigation. For information on the CEMP, call Jeff Parsons, at (253) 512-7056.

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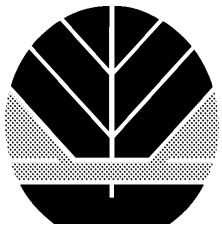

WASHINGTON STATE DEPARTMENT OF
Natural Resources
Jennifer M. Belcher - Commissioner of Public Lands

Recent Legal Developments in Coastal Natural Hazards Policy

by
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(***Note***: Reprinted with permission of the author. The legal research described was current as of the date of original publication but does not reflect significant developments in the US Supreme Court since it was published. Originally published in *Coastal Natural Hazards--Science, Engineering and Public Policy*, edited by J. W. Good and S. S. Ridlington: Oregon Sea Grant, Oregon State University, 1992.)

Introduction

Coastal areas of the United States are affected by a wide range of natural hazards that threaten lives and property. Those hazards include severe storms, floods, erosion, landslides, earthquakes, tsunamis, and subsidence. Over the past decade the problem of coastal hazards has become more pressing. Americans continue to demand more opportunities for coastal recreation, leading to pressure to develop resort areas and single-family homes along the beach. The consequences of this development are increased exposure to storms and the potential for loss of life and property, as was vividly demonstrated in South Carolina when Hurricane Hugo hit two years ago.

Another problem, although less dramatic, is the interference of development with natural shoreline processes. Erosion control structures, such as seawalls and bulkheads, have the ironic effect of accelerating erosion, either in front of the development the structure is designed to protect, or downdrift. In addition, these structures inhibit the ability of the beach to absorb storm energy, thus exposing structures to the full force of wind and waves.

However, decision makers in the private and public sectors should avoid basing policies on preconceptions regarding typical shorelines and their state of development. Establishing setbacks for new development, relocating endangered structures, providing beach nourishment, building protective structures, or doing nothing may each be appropriate under specific local conditions.

State Responses Around the U.S.

Currently, 13 states have some form of setback requirement for coastal development. Many states also have laws to protect dunes, which are the first line of defense from storms (Maine 1987).

Following are some examples of innovative efforts to address coastal hazards (NOAA OCRM 1990).

(1) North Carolina has established setback lines in areas of designated ocean hazard to protect buildings from coastal storms. The setback lines will ensure at least 60 years of protection from coastal erosion for large structures and 30 years of protection for residential structures. Building infrastructures that would serve ocean-hazard areas---such as roads, bridges, water and sewer lines, and erosion-control structures--- is allowed only if the structures will be reasonably safe from coastal hazards and will not promote additional development in the hazardous areas. The state also provides hazard notices to all permit applicants. The notices give the erosion rate in the area, note that bulk-heads and seawalls are not allowed, and warn that the area is hazardous and the property owner is at risk.

(2) South Carolina's 1988 Beachfront Management Act provides a comprehensive approach for managing the state's beach and dune system. The act requires the South Carolina Coastal Council to determine local erosion rates for all portions of the coast, except areas already protected from development, and to establish development setbacks derived from expected beach erosion over 40 years. To help preserve the beach and ensure that the act's 40-year retreat goal was realized, the act prohibits all new erosion-control structures and requires that such structures damaged more than 50% be removed. The act also requires the disclosure of specific hazardous conditions during property transfers.

In September 1989, Hurricane Hugo provided a severe test of the Beachfront Management Act. Since the hurricane struck, the state has faced political and legal pressures regarding the implications of the act for reconstruction and repair of structures along the state's coast. After intense debate over the future of beach management in South Carolina, the act was amended in June 1990. The most significant changes are (1) strengthened prohibitions against erosion control structures by forbidding the construction of all erosion control devices, not just vertical structures, and (2) authority for the council to issue a special permit when its restriction on development would render a lot unbuildable (owners are required to remove the structure if it becomes situated on the active beach through erosion processes). Enforcement of the act has received strong support from the South Carolina Supreme Court, as I will discuss later.

(3) The Rhode Island Coastal Resources Management Council has mapped critical erosion areas and calculated average annual erosion rates for those areas. The state uses the information to establish building setback lines in areas of intense erosion. Additionally, the council has adopted a poststorm policy which authorizes a moratorium of up to 30 days on reconstruction of structures in specific zones at least 50% destroyed by storm, flood, wave, and wind damage. During the moratorium, the state may consider purchasing damaged properties or pursue other mitigation responses.

(4) In July 1989 the Michigan State Legislature amended the state's Sand Dunes Protection and Management Act

to grant the state Department of Natural Resources authority to regulate activities within newly defined "Critical Dune Areas." Key provisions of the act include the designation of 70,000 acres of Critical dune areas, the establishment of a model zoning plan for the protection of sand dunes, and an option for local governments to administer the act. The amendments prohibit certain uses in Critical dune areas unless the administering authority grants a variance.

(5) Using the results of a recent study, the Massachusetts Coastal Zone Management Program has developed policies that require a review of projects proposed in the 100-year floodplain to determine the effects of relative sea level rise as well as the project's potential to exacerbate those effects.

(6) In California the San Francisco Bay Conservation and Development Commission has taken a leadership role in planning for the effects of possible future rises in sea level. In 1989 the commission developed new policies to require that new shoreline development take sea level rise into consideration. These policies generally require that any new project requiring fill should be above the highest estimated tide level for the design life of the development. The commission also has been working with Bay Area local governments to assist them in addressing future sea level rise.

(7) The Delaware Coastal Management Program has prepared a report which assesses management alternatives to address shoreline erosion along Delaware's Atlantic coast over the next decade. The report concluded that a policy of retreat from the coast was the only viable long-term option, but also proposed a short-term action plan, since implemented, to renourish beaches where economically justified.

(8) In June 1989 the Hawaii Coastal Zone Management Program completed the "Hawaii Shoreline Erosion Management Study," which provided a comprehensive review of erosion management in Hawaii. This was a critical step toward developing consistent regulations governing the use of structural and nonstructural measures to control erosion. The study recommended that the Hawaii coastal program take the lead in working with county governments to develop local long-term plans for managing erosion in erosion-prone areas.

(9) In the Australian states of Victoria and Tasmania, local governments have factored into their coastal development decisions the possibility of sea level rise. Up and down Australia's extensive coastlines, structural responses to coastal erosion are being reduced in favor of renourishment of heavily used beaches, combined with dune restoration and protection programs. Officials are stringently reviewing coastal sand-mining practices and policies. The Australian federal and Queensland state governments plan to jointly nominate Fraser Island, the world's largest sand island, to the World Heritage conservation list in order to preserve it for future generations.

Federal Responses in the U.S.

In Washington, D.C., Congress continues to wrestle with the legal and policy aspects of coastal hazards management. For example, the proposed National Flood Insurance, Mitigation, and Erosion Management Act of 1991 would phase out federal flood insurance coverage for existing development and prohibit such insurance for new development in designated erosion-prone coastal areas.

Under the Coastal Barrier Improvement Act of 1990, the United States Fish and Wildlife Service is required to map all areas along the Pacific coast, except Alaska, that might qualify for addition to the federal Coastal Barrier Resources System established on the Atlantic and Gulf coasts under legislation enacted in 1982. That legislation prohibits any form of federal assistance, including federal flood insurance in coastal areas designated as part of the coastal barrier system. Under the 1990 amendments, the Interior Department will recommend to Congress those Pacific coast areas that state governors deem are appropriate for inclusion in the federal coastal barrier system. Eldon Hout and Paul Klarin of the Oregon Department of Land Conservation and Development (DLCD) are working closely with the Fish and Wildlife Service in an attempt to avoid the many mapping errors that occurred in the Interior Department's earlier effort to map Oregon coastal barriers.

Building on the federal model, Maine's coastal program has developed a state Coastal Barriers Resource System. State expenditures for development activities within the Maine coastal barrier system are prohibited. Depending on the outcome of the federal process regarding Oregon coastal barriers, Oregon might want to establish a state coastal barrier system like Maine's.

Section 309 of the federal Coastal Zone Management Act Amendments of 1990 established a new federal grant program to encourage coastal states like Oregon to improve their federally approved coastal zone management programs in several areas, including the management of coastal natural hazards. The clear thrust of section 309 is toward further "preventing or significantly reducing threats to life and destruction of property by eliminating development and redevelopment in high-hazard areas...and anticipating and managing the affects of potential sea level rise." As Oregon's coastal zone management agency, DLCD could seek 309 funds for what I believe would be a very timely review of the legal and policy framework for coastal natural hazards management in Oregon. Those components include goals 7, 17, and 18 of the statewide land-use planning program; the Removal-Fill law (ORS 196.800-.999), administered by the Parks and Recreation Division of the Department of Transportation.

As my summary of recent state and federal legislative developments indicates, Oregon would not be alone in taking a hard look at its coastal hazards laws and policies during the 1990s.

Judicial Support for State and Local Hazards Management

Certainly many of the state coastal hazard programs I have just described have resulted in increased restrictions on coastal development. The validity of some of those restrictions has been challenged in the state and federal courts. In preparing this paper I have done an extensive survey of relevant state and federal court decisions and can report to you that almost uniformly the courts have supported the enforcement of development restrictions based on credible scientific evidence of a hazard to life or property (Mack1983; Town 1991). In the extreme situation where property is rendered undevelopable by serious hazards, they have supported the enforcement of such restrictions without requiring compensation to the affected landowner.

Indicative of this trend of strong judicial support is a series of decisions rendered by the South Carolina Supreme Court (Beard 1991; Lucas 1991) upholding the restrictions of South Carolina's Beachfront Management Act on reconstruction of properties damaged by Hurricane Hugo (Beatley 1990). The South Carolina Supreme Court is probably as supportive of private property rights as any state court in the nation. Yet the court has upheld stringent enforcement of the South Carolina act's restrictions on reconstruction in hazardous locations without compensation to the affected landowners, finding that the well-documented public harms that flow from development in hazardous locations justify such regulation (Carter 1984). A federal court of appeals just below the U.S. Supreme Court also has upheld the validity of the South Carolina act (Esposito 1991).

These decisions regarding the South Carolina act join recent court decisions regarding similar legislation in Florida and elsewhere which also have found that regulations strictly controlling development in hazardous coastal areas may be enforced without compensation (Arrington 1989; McNulty 1989; Rolleston 1980; Town 1981).

The lesson to be derived from these opinions seems to be that where the legislature makes specific findings regarding the risks posed by coastal natural hazards and sets forth policies to reduce or avoid those risks, the courts generally will support enforcement of those policies (Comment 1991; Hwang 1991; Kusler 1989; Pendergrast 1984; Pfundstein and Charles 1991).

The trend in the coastal hazards decisions just described is further supported by a recent California decision regarding inland flood hazards (First English 1989). That decision upheld a Los Angeles County moratorium on redevelopment in a flood-prone creek pending study of the safety issues involved against a challenge that property affected by the moratorium was being unconstitutionally taken without compensation. This case had been sent back to the California court by the U. S. Supreme Court after it rendered its famous decision in the *First English Evangelical* case, which ruled that if local governments did regulate private property unconstitutionally, they could not merely repeal the offending regulation but also must pay compensation for any damages suffered by the regulated property owner due to the regulation.

That basic principle continues to apply to coastal hazard regulations as well. However, the resulting California court decision and the coastal hazards decisions seem to stand for a very important point: that when a coastal hazards regulation is based on credible scientific evidence, the courts are very unlikely to hold that the regulating governmental entity has regulated property unconstitutionally. Regulations based on inadequate evidence or on poorly documented evidence of course remain vulnerable to judicial invalidation (Annicelli 1983; Saint Joe Paper 1988).

At this time it seems appropriate to assess the current state of knowledge regarding natural hazards on the Oregon coast and the risks they pose to life and property, both public and private. Flowing from that assessment could be an evaluation of the adequacy of current Oregon regulatory and planning processes to reduce or avoid those risks.

Relevant Oregon court decisions seem to fall in line with the general trend I have previously outlined. The Oregon courts have supported protection of public access to the state's sandy beaches through stringent state regulation of construction on private property seaward of the coastal vegetation line (State Highway Commission 1971). A recent request to build a seawall on the beach at Cannon Beach was rejected by state and local agencies; the rejections were then upheld at the trial court level. These actions fall in line with the general pattern in Oregon courts. Any appellate court decisions resulting from that particular matter would obviously be an important indicator of future directions in the Oregon courts with respect to the control of shoreline construction for reasons of natural hazards as well as public access.

Accommodating Public and Private Interests in Coastal Hazards Management

As I have said, the courts generally support enforcement of coastal hazards regulations without compensation to affected landowners. However, that does not mean that some form of compensation may not be provided even though it is not constitutionally required. Throughout the nation and in Oregon we need to give more thought to schemes that recognize the sometimes dramatic impacts of nature on coastal property owners and that attempt to accommodate affected private interests wherever possible. Techniques for achieving such accommodation include (1) acquiring outright fee simple or less than fee simple interests such as conservation easements in affected coastal properties, (2) reducing property tax values and rates, and (3) awarding density bonuses and transferrable development rights to affected property owners.

I understand that in coastal Oregon some local governments have provided for density bonuses to be awarded to

developers who avoid hazardous areas. Their experiences need to be documented. Ideally such accommodations should be worked out at the local level.

In that connection, I recently heard a consultant's presentation on the development of a local wetlands conservation plan for Rockaway Beach. The process was moving forward with extensive local participation. The consultant acknowledged that there clearly would be some winners and losers locally in the designation of wetlands on privately owned property and in the community decision making about their future. Wetlands conservation has reached the highest political levels in this nation, and local wetland owners are faced with a great deal of uncertainty and a period of rapid change in federal and state laws, policies, and court decisions. However, what impressed me was that it appeared there would at least be some local winners in the Rockaway Beach process. Without such a local effort, wetland owners in Rockaway Beach might only be losers in trying to deal with the rapidly changing complexities of federal and state wetland law and policy.

Implications for Oregon Coastal Hazards Management

We know a lot more about coastal processes and coastal engineering and their effects and limitations than we did when Oregon put in place its current scheme for coastal natural hazards management. The time may be right to review that scheme and, where appropriate, revise it through legislative action, administrative rule making, comprehensive plan revisions, and related processes. Furthermore, some federal dollars may be available to assist in that effort.

Following are some questions that need to be reexamined:

(1) Are structural protection devices always bad for the adjacent beach and neighboring properties, or is that an over generalization?

(2) Should alteration of dunes for view preservation and similar purposes continue to be authorized by goal 18?

(3) Are the true and total costs, both direct and indirect, of coastal development and coastal protection works currently being fairly allocated?

Oregon's current approaches to coastal hazards need revision regardless of whether the Oregon coast will or will not be significantly affected by any sea level rise caused by global warming. And if at some point in the future, officials and scientists reach the consensus that accelerated sea level rise poses risks to Oregon, the state's revised coastal hazards program will certainly be the starting point for designing and implementing adaptive responses (Corfield 1987; Rychlak 1990; Titus 1991, 1990).

In conclusion, and in a more philosophical vain, I believe three emerging international principles governing resources development (morally but not legally binding at this point) are relevant to revisions in Oregon hazards law and policy:

(1) the "polluter pays" principle---the notion that any development allowed in hazardous coastal areas should pay its full costs;

(2) the precautionary principle---the notion that in the absence of good information about a coastal development's safety and impacts on adjacent beaches and neighboring properties, we don't move forward with it until we have better information; and

(3) the principle favoring sustainable development of resources over unsustainable development--building in hazardous coastal locations generally is not a sustainable use of those resources.

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The Chilling Effects of Takings on Coastal Planning and Permitting

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The coast is not merely the place where the ocean meets the land and crashes upon the shore. The coast is also where private property rights clash with public property rights and where development interests often conflict with resource protection as well as protection of public and private interests from coastal hazards. In planning and permitting along the coast, public agencies must consider not only what is best for coastal resources but also the potential fiscal effect of their decisions. Given limited public coffers and the value of coastal property, threats of liability for inverse condemnation through a regulatory taking can have a chilling effect on coastal planning and permitting. A series of United States Supreme Court decisions commencing in 1987 changed and clarified the law on regulatory takings to the benefit of private property rights. Public agencies can now be held liable for temporary takings damages where property owners were temporarily denied the right to legitimate uses of property. Public agencies are required to establish that conditions imposed upon approvals of development are in furtherance of legitimate state purposes and have a sufficient nexus between the condition and the impacts. There must also be a rough proportionality between the impacts of the development and the condition imposed. Conditions imposed on development must thus be closely tailored to the impacts of the project rather than simply in furtherance of resource protection. Government can deny all use of property where the use would constitute a nuisance or where the use is not allowed under a state's property laws. However, whether a particular use would constitute a nuisance or is disallowed under state property laws is not always clear. Development in areas of high hazard may be dangerous but may not necessarily rise to the level of a nuisance. Alternatively, such development may not become a nuisance until long after it has been permitted and built. This paper will generally explore the impact of takings jurisprudence on coastal planning and permitting, with a focus on California since the author is most familiar with California coastal laws. Other papers in this session will focus on specific examples both at the state and local government levels and on the types of hazards that may be encountered by decision-makers along the coast.

Prior to the mid-1980's, great deference was given to public agency decisions regarding development along the coast. In 1987 the United States Supreme Court decided two regulatory takings cases which caused the pendulum to swing the other direction and directed courts to give less deference to governmental decisions. These cases have had distinct impacts on governmental decision-makers. In First English Evangelical Lutheran Church of Glendale v. County of Los Angeles (1987) 482 U.S. 304 [107 S.Ct. 2378, 96 L.E.2d 250] the Court held that government may be liable for damages for a temporary taking of private property. In Nollan v. California Coastal Commission (1987) 483 U.S. 825 [107 S.Ct. 3141, 97 L.Ed.2d 677] the Court held that a condition imposed on a permit for development requiring dedication of land to public use must be in furtherance of a legitimate state interest and there must be a nexus between the impacts of the development and the required dedication. Absent such a nexus, the condition requiring a dedication of land results in a regulatory taking of private property. In the Nollan case, the Coastal Commission had required a dedication of public access as a condition of approval of demolition and reconstruction of an existing residence. While the reconstructed residence would block visual access, it would not block physical access thus the requisite nexus between the impact of the residence and the condition was lacking. The impact of the Nollan decision coupled with the risk of damages for a temporary taking as announced in First

English has been to eliminate public access conditions on redevelopment projects unless a direct impact on public access can be demonstrated. Given the amount of existing development and the tendency for beach cottages to be redeveloped into larger manses in California, the impact of these decisions has been to greatly reduce the opportunity to require public access dedications in many areas of the coast.

The Court decided two more cases which had similar impacts on governmental decision-makers. In Lucas v. South Carolina Coastal Council (1992) 505 U.S. 1003 [112 S.Ct. 2886, 120 L.Ed.2d 798] the Court held that denial of all economically viable use of property constitutes a taking unless background rules of state property law would not allow the use or the use proposed would constitute a nuisance. Thus, in order to be able to deny all use of property, government must show that the property owner either lacks the property right to use the property as proposed or the proposed use would constitute a nuisance. Finally, in Dolan v. City of Tigard (1994) 512 U.S. 374 [114 S.Ct. 2309, 129 L.Ed.2d 304] the Court held that in addition to establishing a nexus between a condition imposed on development and the impacts of the development, government must show that the condition is roughly proportional to the impacts of the development. Essentially, the condition must be reasonably related to the impacts of the development. Government can no longer simply point to the need to protect coastal resources from development; instead, government must have an evidentiary basis for conditioning or denying a project that will satisfy judicial review. In California, the standard is the so-called substantial evidence test which requires that a decision be supported by substantial evidence in light of the whole record and that the findings of the agency adequately explain how it traveled the analytic route between the development reviewed and the decision made, whether that decision is approval, approval with conditions or denial. (Cal. Code Civ. Proc. ' 1094.5.)

In California, coastal permitting and planning are governed by the California Coastal Act of 1976 (Pub. Resources Code, ' 30000 et seq.). The Coastal Act is the legislative continuation of the Coastal Initiative, Proposition 20, enacted by the People of California in 1972 with the goal of preserving, protecting and enhancing precious coastal resources through a combination of planning and permitting processes. The Coastal Act created the California Coastal Commission as a statewide agency charged with implementation of the Coastal Act, both from a planning and permitting perspective. (Pub. Resources Code, " 30300, 30330.) One of the key focuses of both Proposition 20 and the Coastal Act is the preservation and maximization of public access to and along the coast. (Pub. Resources Code, " 30001, 30001.5) Another key goal is the protection, preservation and enhancement of wetlands and other environmentally sensitive habitat areas. (Ibid.) The Coastal Act contains specific policies which govern planning and permitting along the coast. These policies include maximization of public access, prioritization of uses of ocean front lands, protection of wetlands against unauthorized fill and dredging, protection of environmentally sensitive habitats, and the minimization of adverse impacts of new development including minimizing the risk to life and property in areas of high geologic, flood and fire hazard. (Pub. Resources Code, " 30200-30212, 30221, 30222, 30230-30233, 30240, 30253.) Unfortunately, many coastal lands are held in private ownership and the Coastal Act goals and policies often conflict with the desires of private property owners to use their lands. The Coastal Act also contains a specific prohibition on using the power to grant or deny a permit in a way that will take or damage private property for public use without providing just compensation. (Pub. Resources Code, ' 30010.) Thus, while the Coastal Commission and local governments implementing the Coastal Act are charged with implementing its goals and policies, they are also specifically prohibited from doing so in manner which takes private property.

Additionally, the Coastal Act provides that where existing structures are threatened by erosion, shoreline protective devices must be approved where they are designed to eliminate or mitigate the adverse impacts on local shoreline sand supply even though such devices alter natural shoreline processes. (Pub. Resources Code, ' 30235.) Such devices include revetments, breakwaters, groins, seawalls, and cliff retaining walls. Hence, existing structures threatened by erosion can be protected by shoreline protective devices which cause even more harm to shoreline processes and may exacerbate the erosive effects of the ocean. Upcoast and downcoast property owners may be harmed by construction of such devices. Yet it is an open question whether the impacts on surrounding properties would create a sufficient nuisance to support a denial under Lucas. This kind of perplexing situation may confound decision-makers faced with applications for seawalls necessary to protect existing homes yet which pose significant adverse impacts on neighboring properties. Where, however, the private property owner desires to use public property in order to construct seawalls and the like in order to protect private structures, those desires may be denied. Public property may not be used to construct private protective devices, particularly where such devices could feasibly be located on the adjacent private property. Where private development has encroached on public land in order to protect adjacent private structures, government may compel the encroachments to be removed if accomplished in a way that allows for due process such as through a nuisance abatement proceeding. (Scott v. City of Del Mar (1997) 58 Cal. App.4th 1296 [68 Cal.Rptr.2d 317]; Barrie v. California Coastal Commission (1987) 196 Cal.App.3d 8 [241 Cal.Rptr. 477].)

A different problem is confronted by a decision-making body when a property owner presents evidence that a site is safe or nonhazardous and project-opponents present contrary evidence. If the evidence is in the form of competing

expert opinions or well-documented personal observations, the credibility of the witnesses is key and under most circumstances the courts will defer to the agency's decision. Nevertheless the decision is a tough one since the desires and property rights of the property owner directly conflict with the desires and rights of the opponents. On the one hand, if the project is denied, the agency may be sued for a taking under Lucas and the question will be whether the project might have created or would be a nuisance. On the other hand, if the project is approved with conditions to address its potential impacts, the agency may be sued by the opposition for approving something inconsistent with applicable goals and policies. Either way, the agency will need to have a sufficient evidentiary basis for the decision it made.

One additional aspect of takings jurisprudence bears mention. In order to have a taking of private property, the agency's decision must impermissibly interfere with reasonable, investment backed expectations. (Penn Central Transportation Co. v. New York City (1978) 438 U.S. 104 [98 S.Ct. 2646, 57 L.Ed.2d 631].) In a risky and hazardous location, the reasonableness of the investment and the reasonableness of the expectations of use of the site may be called into question. If, because of its physical constraints, an area is so hazardous that there could be no reasonable expectation that development would be allowed, denial of the use of that site may not amount to a taking. The Supreme Court has not yet addressed this particular aspect of takings jurisprudence but it appears the Court would be willing to allow a denial of all use under such circumstances. Given the risks to the property owner and the surrounding areas of allowing development in areas of high hazard, it can only be hoped that the Court would consider denial of all use to be appropriate.

Planning and permitting development along the coast is not a simple or easy proposition. Given the constantly changing coastal environment, the various natural processes at work and the increased value placed on the coast by private property owners and the public alike, decision-makers have a difficult task before them. This task is further complicated by the chilling effect of takings law with its attendant fiscal impacts.

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Editor's note: Just change the word "landslide" to "tsunami" as you read this, and you'll find that this is just as true for tsunami hazard maps as for landslide maps.

The Dilemma of Transforming Landslide Hazard Maps into Effective Policy and Regulation

by
Jerome V. DeGraff
USDA Forest Service
1600 Tollhouse Road
Clovis, CA 93611

As geoscientists, we often perceive the production of a map or model to adequately define landslide hazard for an area as the answer or end point for reducing risk to people and property. In reality, the risk to people and property remains pretty much the same as it did before the map existed. Real landslide risk reduction takes place when the activities and populations at risk are changed so the consequences of a landslide event results in lower losses. Commonly, this takes place by translating the information embodied in the landslide hazard map into some change in policy and regulation applying to the affected area. This is where the dilemma arises. Scientific information generally has qualifications, gradations, and conditions associated with it. Regulations are necessarily written in language that tries to avoid any need for interpretation. For example, the line delineating two zones of differing levels of hazard clearly represents a somewhat arbitrary set of points. However, regulations translating this into actions acceptable on one side of the line but not the other will need to define that line in terms of a specific set of points. Producing a landslide hazard map is really the starting point rather than the endpoint in risk reduction. It is the start of an educational process requiring a change in how the affected society behaves. Unless geoscientists are willing to participate in that process, real risk reduction is unlikely to occur.

(reprinted from Geological Society of America Abstracts with Programs, v. 32, no. 6, p. A9-A10, April 2000)

INFREQUENTLY ASKED QUESTIONS

COMPILED BY
LEE WALKLING

Where can you find a concrete tsunami story? And, when was the term "tsunami" first used in the English language?

The gist of the most famous tsunami story in Japan is inscribed in seven concrete blocks on the lawn in front of Jefferson Park fire station, Beacon Hill, south Seattle, Washington.

The story is based on events during an 1854 tsunami in Hirokawa, 43 miles south of Kobe. This tsunami, which followed a Japanese earthquake of magnitude 8.5, left 30 dead in Hirokawa. But many lives were reportedly saved in that village when Hamaguchi Goryou, a 34-year-old village headman, lured villagers to safety by burning rice straw on high ground.

A romanticized account of this event, written in 1897 by Lafcadio Hearn, contains the first English-language use of "tsunami", according to the Oxford English Dictionary. A simplified version of Hearn's story became part of a national Japanese fifth-grade reader in 1938. Use of the story for tsunami education continues today through children's videotapes.

(*from*: Yamaguch, David; Atwater, Brian, 2000, Tsunami stones on Beacon Hill: How a rice-straw ruse saved a village in Japan and brought "tsunami" into the English language. *In* U.S. Geological Survey, University of Washington Geophysics Program, Cascadia quakes--A tricentennial exposition: University of Washington Geophysics Program, p. 6.)

Note: The animated children's video of this story, *The Wave* (9 min.), can be borrowed from *TsuInfo*. See the reservation form in this issue.

Do all U.S. communities have building codes?

"Building codes are also effective for reducing disaster losses....Some states have codes that are set at the state level but enforced at the local level, whereas other states let local governments set and enforce their own standards; however, more than half of the 30,000 communities in the United States have not adopted a building code at all."
from: Science, v. 284, p. 1945 (1999)

Are jet-setters on the French Riviera safe from tsunamis?

No. "On 16 October 1979, at about 14:00 local time, a tsunami struck the French Riviera without warning. The sea retreated more than 300 meters, then returned rapidly in 2 waves that had crests up to 10 meters high. From Menton SW to Antibe, about 60 km of coastline were hit by the tsunami. Six people were killed and 3 missing. Numerous buildings near the coast were damaged; many automobiles were destroyed and boats pulled loose from their moorings and swept out to sea. It is reported that no seismic events were recorded that could have triggered the tsunami. It is believed that the cause of the tsunami is submarine landsliding of sediments at the mouth of the Var River (between Antibes and Nice)...Tsunamis in this area of the Mediterranean Sea are not uncommon. The historical records show that tsunamis in the area occurred on 27 July 1564, on 16 February 1752, on 24-25 February 1818, on 29 February 1854, and on 23 February 1887."

(*from*: Tsunami Newsletter, v. XIII, no. 1, January 1980, p. 10-11.)

New Web Resources
from *Disaster Research,* #319 and #320)

http://www.doi.gov/nathaz/index.html

The U.S. Department of the Interior has devoted one portion of its Web site entirely to natural hazards, with sections on wildfires, volcanoes, earthquakes, floods, landslides, wildlife diseases, geomagnetism, storms and tsunamis, and other hazards. For each topic, the site offers selected links--primarily to USGS Web pages--as well as a link to a "Fact Sheet" on the given subject.

http://www.state-of-coast.noaa.gov

In 1996, Vice President Al Gore challenged federal agencies to develop a "report card" on the state of the nation's environment. In response, the National Oceanic and Atmospheric Administration (NOAA) has created the "State of the Coast Report" provided at this Web site. The foundation of the report is a series of essays on important coastal issues; two of these essays are entitled "Population at Risk from Natural Hazards," and "Reducing the Impacts of Coastal Hazards." These thorough articles include overviews of the problem on a national scale, regional analyses, specific case studies, interviews with experts, suggested readings and references, and glossaries.

http://www.nerc-bas.ac.uk/tsunami-risks/

The Tsunami Risks Project, based in the U.K., was launched to introduce the British insurance industry to tsunamis and the risks they pose and to quantify tsunami hazards by developing frequency-magnitude distributions and evaluations of direct and indirect insurance risks. The project is examining subjects ranging from how tsunamis are generated and how they propagate across the oceans; to the mechanisms by which they cause damage when they make landfall; to the means by which disaster planning can reduce the economic losses that result; to the sources of postdisaster information and mapping that can be consulted to validate tsunami-related insurance claims. The project's Web site provides details about this initiative, as well as an interactive map with accompanying articles about historic tsunami disasters of the world; a "Risk Atlas"; another interactive map showing tsunami risk around the world; a case study of the 1964 Alaska earthquake and tsunami; an extensive report by A.G. Dawson entitled, "Tsunami Risk in the North Atlantic Region"; a bibliography; and an index of related Web sites.

http://coe-dmha.org

The Center of Excellence in Disaster Management and Humanitarian Assistance in Hawaii has completely revamped its Web site (including moving to a new address). The new site lists the many training and education opportunities supported by the center, incorporates an on-line version of the Center's magazine "The Liaison," and provides much other information about disaster management and humanitarian aid world wide.

http://www.adpc.ait.ac.th/infores/newsletter/2000/1.html

The January-March 2000 issue of "Asian Disaster Man-agement News" (always a good source of hazards informa-tion, both generally and concerning the Southeast Asia/ Pacific Rim region) focuses on postdisaster reconstruction issues. It presents a theme article on common issues that emerge in design and management of reconstruction pro-grams, features brief case studies from Asia, and provides pointers to information resources on the subject available both on the World Wide Web and in print.

http://members.spree.com/education/helpu
http://members.spree.com/education/helpu/maynews2000.html
http://members.spree.com/education/helpu/hurricanpage5.htm

The HELPU Web site is intended to serve all members of the disabled community, their care-givers, attendants, fire and rescue personnel, and emergency services departments. The site offers numerous pages with tips on emergency/ disaster preparedness for various hazards. ...Interested persons should see http://members.spree.com/education/ helpu/mitigationcalendar.html for a "Mitigation and Preparation Scheduling Calendar."

http://www.terraserver.microsoft.com

Need a map? The Microsoft Corporation has scanned more than 57,000 U.S. Geological Survey topographic maps into digital form and made them available on the Web. Users can search for locations by place name or by zooming in on a world/U.S. map, and maps can be downloaded and printed for free. The data are primarily for the U.S., although a few other selected regions around the world are also displayed.

http://atlas.gc.ca
http://atlas.gc.ca/english/index.html

Need a map of Canada? With hazards? Natural Resources Canada has published a new on-line edition of the Canadian National Atlas of Canada at the URL above. The atlas, available in French and English, includes extensive information about natural hazard occurrence in Canada, including data on earthquakes, floods, hurricanes, tornadoes, tsunamis, volcanic eruptions, landslides, hail storms, and forest fires.

Disaster Costs
http://www.colorado.edu/hazards/sites/cost.html

The Natural Hazards Research and Applications Information Center has received many requests over the years for information about the frequency, severity, social consequences, and monetary costs of natural disasters. Although apparently straightforward, such queries are extremely difficult to answer. They are complicated by such questions as: What constitutes a "disaster"? What constitutes a "cost"? Do we want to look at insured losses or all losses? How can we be sure that loss estimates are accurate for individual disasters and/or that they are comparable across disasters? How can we possibly compare the relatively high property losses in developed countries with the relatively high social costs (such as deaths, injuries, and homelessness) in developing nations? Which indirect costs should be included? And so on...

To respond to these questions, the Hazards Center has recently added a page to its Web site---"Selected Sources of Data on Disasters and Disaster Costs"---at the URL above.

The page does not provide numbers directly, but guides the user to various sources elsewhere on the Internet that offer such information for either the United States or the entire planet. The list focuses on sources of data relating to the human consequences of disasters, not on catalogs of physical events.

(from: Natural Hazards Observer, May 2000, p. 5)

http://omzg.sscc.ru/tsulab/

Current research projects , Tsunami Laboratory, Institute of Computational Mathematics and Mathematical Geophysics (Computing Center), Siberian Division. Russian Academy of Sciences. Head of the Laboratory: Dr. Viacheslav K.Gusiakov. Tel: (3832) 34-20-70 Fax: (3832) 32-42-59 Email: gvk@omzg.sscc.ru

http://tsun.sscc.ru/htdbpac

The *New On-line Pacific Tsunami Catalog, 47B.C.-1998A.D.* has been available at this site since December 1998. The site contains basic tsunami parameters on almost 1490 historical tsunamigenic events that occurred in the Pacific from 47 B.C. to the present and includes nearly 8,000 coastal run-up and tide-gauge observations of wave heights. The site provides users with screen forms for data search by a number of criteria, for their listing, sorting and for intensity-magnitude charts. (reported in http://omzg.sscc.ru/ tsulab/IUGGTCrep99.html)

"Research conducted over the past two decades suggests that if local governments make the right choices in crafting land use planning programs, communities will be less likely to suffer severe losses of lives and property in natural disasters."

from: Burby, R. J.; Deyle, R. E.; and others, 2000, Creating hazard resilient communities through land-use planning: Natural Hazards Review, v. 1, no. 2, p. 99.

VIDEO RESERVATIONS

Place a check mark (3) beside the video(s) you want to reserve; write the date of the program behind the title.
Mail to TsuInfo Alert Video Reservations, Lee Walkling, Division of Geology and Earth Resources Library, PO Box 47007, Olympia, WA 98504-7007; or email lee.walkling@wadnr.gov

___**Adventures of Disaster Dudes** (14 min.)
Preparedness for pre-teens

___**The Alaska Earthquake, 1964** (20 min.)
Includes data on the tsunamis generated by that event

___**Cannon Beach Fire District Community Warning System** (COWS) (21 min.)
Explains why Cannon Beach chose their particular system

___**Disasters are Preventable** (22 min.)
Ways to reduce losses from various kinds of disasters through preparedness and prevention.

___**Killer Wave: Power of the Tsunami** (60 min.)
National Geographic video.

___**Numerical Model Aonae Tsunami - 7-12-93** (animation by Dr. Vasily Titov) and **Tsunami Early Warning** by Glenn Farley, KING 5 News. The Glenn Farley portion cannot be rebroadcast.

___**The Prediction Problem** (58 min.)
Episode 3 of the PBS series "Fire on the Rim." Explores earthquakes and tsunamis around the Pacific Rim.

___**The Quake Hunters** (45 min.)
A good mystery story, explaining how a 300-year old Cascadia earthquake was finally dated by finding records in Japan about a rogue tsunami in January 1700.

___**Raging Planet; Tidal Wave** (50 min.)
Produced for the Discovery Channel in 1997, this video shows a Japanese city that builds walls against tsunamis, talks with scientists about tsunami prediction, and has incredible survival stories.

___**Raging Sea: KGMB-TV Tsunami Special**. (23.5 min.)
Aired 4-17-99, discussing tsunami preparedness in Hawaii.

___**The Restless Planet** (60 min.)
An episode of "Savage Earth" series. About earthquakes, with examples from Japan, Mexico, and the 1989 Loma Prieta earthquake in California.

___**Tsunami and Earthquake Video** (60 min.)
Includes "Tsunami: How Occur, How Protect," "Learning from Earthquakes," and "Computer modeling of alternative source scenarios."

___ **Tsunami: Killer Wave, Born of Fire** (10 min.)
NOAA/PMEL.
Features tsunami destruction and fires on Okushiri Island, Japan; good graphics, explanations, and safety information. Narrated by Dr. Eddie Bernard, (with Japanese subtitles).

___**Tsunami: Surviving the Killer Waves** (13 min.)
Two version...one with breaks inserted for discussion time.

___**Tsunami Warning** (17 min.)
San Mateo (California) Operational Area Office of Emergency Services.
This is a good public service program, specifically made for San Mateo County. Citizens are told what to do in cases of tsunami watches or tsunami warnings, with specific inundation zones identified for the expected 20-foot tall tsunami. An evacuation checklist is provided, as well as locations of safe evacuation sites. This video gives the impression that all tsunamis are teletsunamis (generated at a source more than 1000 km from the coastline) which therefore provide time for warnings. Locally-generated tsunamis are not discussed.

___**Understanding Volcanic Hazards** (25 min.)
Includes information about volcano-induced tsunamis and landslides.

___**The Wave: a Japanese Folktale** (9 min.)
Animated film to help start discussions of tsunami preparedness for children.

___**Waves of Destruction** (60 min.)
An episode of the "Savage Earth" series. Tsunamis around the Pacific Rim.

___**The Wild Sea: Enjoy It...Safely** (7 min.)
Produced by the Ocean Shores (Washington) Interpretive Center, this video deals with beach safety, including mention of tsunamis.

Check the title(s) you would like and indicate the date of your program. The video(s) will be mailed one week before the program date. You will be responsible for return postage.

Name:

Organization:

Mailing address:

City, State, Zip:

email:

Conferences and Training

(from: Disaster Research #319, #320, and #321)

June, 2000, Tallahassee, Emergency Management (Disaster) Planning Workshop

An "Emergency Management (Disaster) Planning Workshop for Business, Industry, and Government", sponsored by the American Red Cross [Florida] Capital Area Chapter and others, will be held in Tallahassee, Florida, June 5, 2000. For more information, see http://www.tallytown.com/redcross; or call the Disaster Services Office, American Red Cross, 187 Office Plaza Drive, Tallahassee, FL 32301; (850) 878-6080. (**Note**: A self study version of this workshop is available for $85.00. To order, contact the Disaster Services Office at the address above.)

June and July, 2000, San Francisco, Emergency Preparedness and Continuity Planning

--June 1-2 and 8-9, 2000: "Communication Essentials for Environmental Managers"

--July 11-14, 2000: "Financial Support for Emergency Preparedness and Planning"

These courses are offered by University of California-Berkeley Extension and will be held in San Francisco. For more information, contact: Environmental Management/ Continuing Education in Engineering, University Extension, University of California, Berkeley, CA 94720; (510) 643-7143; http:www.unex.berkeley.edu.

August, 2000, Seattle, Association of Contingency Planners International Symposium

The Association of Contingency Planners (ACP) International Symposium, "Planning for the Inevitable," will be held in Seattle, Washington, August 14-16, 2000. For more information, contact: Washington State-Pacific Northwest Chapter, ACP, PO Box 1144, Renton, WA 98057; (425) 865-2797; http://www.acp-was-state.org/ symposium.

October, 2000, Honolulu, GDIN Technology Conference

The First International GDIN (Global Disaster Information Network) Information Technology Exposition and Conference will be held in Honolulu, Hawaii October 9-11, 2000. For more information, contact: GDIN Information Technology Conference, PO Box 134008, Ann Arbor, MI 48113-4008; email: wallman@erim-intf.com; http://www.erim-int.com/CONF/GDIN.html

October, 2000, Vancouver, B.C., 13th Annual Emergency Preparedness Conference

To be held October 17-19, 2000, sponsored by Emergency Planners and Managers Association of British Columbia and others. For more information, contact: Emergency Preparedness Conference, 700 West 57th Avenue, Vancouver, BC. V6P 1S1; (604) 322-8365; (604) 322-8359 fax; email: ccox@vanhosp.bc.ca; http://epma.bc.ca/epc/

August, 2001, Seattle, International Tsunami Symposium 2001

The International Tsunami Symposium 2001 (ITS 2001) will be held in Seattle, Washington, August 7-10, 2001. For more information, contact: E. N. Bernard, NOAA-PMEL, 7600 Sand Point Way NE, Seattle, WA 98115-6349; (206) 526-6800; fax (206) 526-4576; email: bernard@pmel.noaa.gov; http://www.pmel.noaa.gov/its2001.

UH/CEDMHA Certificate in Disaster Management and Humanitarian Assistance

The University of Hawaii is now offering a graduate-level seminar entitled "Disaster Management and Humanitarian Assistance" (DMHA), which constitutes the foundation course for a certificate program on this subject. Developed and conducted in collaboration with the Center of Excellence in Disaster Management and Humanitarian Assistance (CEDMHA), also in Hawaii, the DMHA Certificate Program is intended to provide professionals with the training they need to work effectively in this area. Numerous seminars are planned to be incorporated into the program, and the developers hope eventually to create a full-fledged graduate major, to offer the courses via distance learning, and to conduct intensive summer sessions for professionals who do not have time to take the courses in a traditional classroom setting. For more information about this program, contact: Anthony J. Marsella, Program Associate Director, Center of Excellence in Disaster Management and Humanitarian Assistance, c/o Tripler Army Medical Center, 1 Jarrett White Road (MCPA-DM), Tripler AMC, HI 96859-5000 (808) 433-7035; Fax: (808) 433-1757; E-mail: pr@coe-dmha.org WWW: http://coe-dmha.org

New Tsunami Mitigation Materials
Added to the DGER Library, April and May, 2000

compiled by

Connie J. Manson

Note: **Free reprints of these materials are available**. (See page 2 for ordering information)

Videos

BFA Educational Media, 1998?, The wave--A Japanese folktale: Phoenix Learning Group, 1 video, 9 min.

General works

Newton, Lesley, 1990, Devastation! The world's worst natural disasters: DL Publishing, Inc., 159 p.

A well-illustrated volume about a host of geologic hazards, including earthquakes and tsunamis.

Technical Reports on Earthquakes and Tsunamis

British Columbia

Boxwell, J. E.; Hutchinson, Ian; Clague, J. J.; Bobrowsky, P. T.; Lopez, G., 2000, Diatom biostratigraphy as a tool to detect tsunamis in Kakawis Lake, Vancouver Island, Canada [abstract]: Geological Society of America Abstracts with Programs, v. 32, no. 6, p. A-5.

Clague, J. J.; Bobrowsky, P. T.; Hamilton, T. S., 1994, A sand sheet deposited by the 1964 Alaska tsunami at Port Alberni, British Columbia: Estuarine, Coastal and Shelf Science, v. 38, p. 413-421.

Washington

Bourgeois, Joanne; Johnson, S. Y., 2000, Paleoseismology on the Snohomish River delta, Washington--Effects of Seattle fault rupture (c. A.D. 900) and other earthquakes [abstract]: Geological Society of America Abstracts with Programs, v. 32, no. 6, p. A-5.

Sherrod, B. L., 1998, Late Holocene environments and earthquakes in southern Puget Sound: University of Washington Doctor of Philosophy thesis, 159 p.

Oregon

Beaulieu, J. D.; Olmstead, D. L., 1999, Geologic hazards--Reducing Oregon's losses: Oregon Department of Geology and Mineral Industries Special Paper 32, 27 p.

Beaulieu, J. D.; Olmstead, D. L., 1999, Mitigating geologic hazards in Oregon--A technical reference manual: Oregon Department of Geology and Mineral Industries Special Paper 31, 60 p.

Bell, E. J.; Westerlund, F. V., 1999, Inventorying buildings and critical structures using statistical sampling and remote sensing: University of Washington Department of Urban Design and Planning [under contract to] U.S. Geological Survey, 1 v.

Darienzo, M. E.; Peterson, C. D.; Clough, Charles, 1994, Stratigraphic evidence for great subduction-zone earthquakes at four estuaries in northern Oregon: Journal of Coastal Research, v. 10, no. 4, p. 850-876.

Perry, S. C.; Weldon, R. J., II, 2000, Causes of elevated seismic response on the southern edge of the Willamette Basin, Oregon--One explanation, one mystery [abstract]: Seismological Research Letters, v. 71, no. 2, p. 246.

Silva, W. J.; Wong, I. G.; Li, Sylvia; Gregor, Nick, 2000, Incorporating site response into earthquake hazard microzonation maps [abstract]: Seismological Research Letters, v. 71, no. 2, p. 247.

Spangle Associates, 1998, Using earthquake hazard maps--A guide for local governments in the Portland metropolitan region: Spangle Associates, 45 p.

California

Dengler, L A., 1995, Regional earthquake hazard maps for the Gorda plate section of the Cascadia subduction zone and public dissemination of hazard information: Humboldt State University [under contract to] U.S. Geological Survey, 1 v.

Ichinose, G. A.; Anderson, J. G.; Satake, Kenji; Schweickert, R. A.; Lahren, M. M., 2000, The potential hazard from tsunami and seiche waves generated by large earthquakes within the Lake Taho, California-Nevada [abstract]: Seismological Research Letters, v. 71, no. 2, p. 228.

Schweickert, R. A.; Lahren, M. M.; Karlin, R. E.; Smith, K. D.; Howle, J. F., 2000, Lake Tahoe basin (LTB)--Asymmetric half-graben with active faults, megalandslides, and tsunamis [abstract]: Geological Society of America Abstracts with Programs, v. 32, no. 6, p. A-67.

Japan

Yabe, G., 1994, Tsunami resistant construction and design. *In* Savidis, S. A., editor, Earthquake resistant construction and design--Proceedings of the second international conference: A. A. Balkema, v. 2, p. 1107-1112.

New Zealand

Lowe, David J.; de Lange, Willem P., 2000, Volcano-meteorological tsunamis, the c. AD 200 Taupo eruption (New Zealand) and the possibility of a global tsunami: Holocene, v. 10, no. 3, p. 401-407.

Other Technical Reports

Mofjeld, H. O.; Titov, V. V.; Gonzalez, F. I.; Newman, J. C., 2000, Analytic theory of tsunami wave scattering in the open ocean with application to the North Pacific: U.S. National Oceanic and Atmos-pheric Administration NOAA Technical Memorandum OAR PMEL-116, 38 p.

Cook, Benjamin; Petroff, Catherine, 1996, The development of an on-line, interactive, tsunami- information resource. *In* Edge, B. L., editor, Coastal engineering 1996, proceedings of thetwenty-fifth international conference: American Society of Civil Engineers, v. 2, p. 1443-1451.

Geist, E. L.; Bilek, S. L., 2000, Effect of depth dependent shear modulus on tsunami generation [abstract]: Seismological Research Letters, v. 71, no. 2, p. 227.

Hatori, Tokutaro, 1986, Classification of tsunami magnitude scale: University of Tokyo Earthquake Research Institute Bulletin=Tokyo Daigaku Jishin Kenkyusho Iho, v. 61, no. 3, p. 503-515 (in Japanese).

Murty, T. S.; Loomis, H. G., 1980, A new objective tsunami magnitude scale: Marine Geodesy, v. 4, no. 3, p. 267-282.

Special Journal Issues

Tephra, v. 17, 1999

Includes:

17 July 1998 Saundaun tsunami, by W. P. de Lange, p. 42-50.

Huge submarine avalanches--Is there a risk of giant waves and, if so where?, by Keith Lewis, Jean-Yves Collot, and Derek Goring, p. 21-29.

Overview of tsunami hazard in New Zealand, by W. P. de Lange and Rodger Fraser, p. 3-9.

Paleotsunami--Now you see them, now you don't, by Catherine Chague-Goff and James Goff, p. 10-12.

Regional tsunami studies--Canterbury & Otago, by Derek Todd, p. 56-58.

The tsunami warning system in the Pacific--New Zealand's place, by Tom Finnimore, p. 59-60.

Tsunami--The experience, by Mauri McSeveney, p. 36-41.

Tsunami and tsunami hazard, by W. P. de Lange and Terry Healy, p. 13-20.

Tsunami hazard and inundation modelling for the Firth of Thames, by Louise Chick and W. P. de Lange, p. 51-55.

Volcanoes and tsunami hazard--Implications for New Zealand, by W. P. de Lange and Gegar Prasetya, p. 30-35.

Natural Hazards Review, v. 1, no. 2, May 2000

Includes:

Disasters as agents of social change in recovery and reconstruction, by Eve Passerini

Politics of hazard mitigation, by C. S. Prater and M. K. Lindell

Businesses and disasters--Empirical patterns and unanswered questions, by G. R. Webb, K. J. Tierney, and J. M. Dahlhamer

Knowledge transfer between researchers and practitioners, by Alice Fothergill

Creating hazard resilient communities through land-use planning, by R. J. Burby, R. E. Deyle, D. R. Godschalk, and R. B. Olshansky

Hazard warning systems--Review of 20 years of progress, by J. H. Sorensen

Insurance as cornerstone for public-private sector partnerships, by Howard Kunreuther

Science of Tsunami Hazards, v. 18, no. 1, 2000.

Includes:

Predominance of long periods in large Pacific tsunamis, by Kuniaki Abe, p. 15-34.

Records of prehistoric tsunamis from boulder deposits--Evidence from Australia, Jonathan Nott, p. 3-14.

Tsunami mitigation for the City of Suva, Fiji, by Gajendra Prasad, Jack Rynn, and Atu Kaloumaira, p. 35-54.

Slide Sets Available from EERI
(Earthquake Engineering Research Institute)

Earthquake Engineering Research Institute
499 14th Street, Suite 320
Oakland, CA 94612-1934
510 451-0905
510 451-5411 fax
email: eeri@eeri.org

IDNDR-I (Available for free loans from *TsuInfo*)

International Decade for Natural Disaster Reduction. A review of natural hazards and their physical characteristics, hazards mitigation strategies, and emergency management. Annotated, 40 slides, 35 mm. $70

USD-I (Available for free loans from *TsuInfo*)

U.S. Decade for Natural Disaster Reduction. Provides an overview of the U.S. Decade program, including slides on floods, severe storms, drought, tornadoes, hurricanes, wildfires, landslides, tsunamis, volcanoes, and an extended section on earthquakes and earthquake preparedness. Annotated, 20 slides, 35mm. $35

IMPL-I

Implementation of Loss Reduction Measures: Physical Development. Illustrates the basic concepts of the implementation process. Most of the slides are generic and applicable to any natural disaster; however, they relate specifically to earthquakes because of their potential for causing great sudden loss in financial as well as human terms. Annotated, 30 slides, 35 mm. $53

IMPL-II

Implementation of Loss Reduction Measures: Emergency Response and Recovery. Identifies physical development issues and describes steps that every community should take to reduce the potential for damage *before* a damaging event strikes. Clarifies action to improve emergency response and recovery. Annotated, 32 slides, 35mm. $56

Technology Transfer-I

Technology Transfer to Reduce Community Vulnerability to Earthquakes. Another generic set on hazards. It can be used to define the objectives of technology transfer programs to reduce community vulnerability (i.e., correction or elimination of flaws in planning and development that make a community susceptible to damage and economic loss from the physical effects of natural hazards). They can also be used to help define a community's needs for certain types of technology. Annotated, 20 slides, 35 mm. $30

Directories

NATIONAL TSUNAMI HAZARD MITIGATION PROGRAM STEERING GROUP

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