OAHU CIVIL DEFENSE AGENCY
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET HONOLULU, HAWAII 96813

Executive Summary

The Purpose of Hazard Mitigation

Hazard mitigation is action taken to permanently reduce or eliminate long-term risk to people and their property from the effects of natural hazards. The purpose of multi-hazard mitigation is twofold:

1) to protect people and structures from harm and destruction; and
2) to minimize the costs of disaster response and recovery.

Costs of Past Disasters in the Hawaiian Islands
1959 - 2003

Date	Disaster	Location	Amount of Damage*
9/10-11/92	Hurricane Iniki	Kauai, Hawaiian Islands	$1.6 billion
12/11/87-1/21/88	Flash Floods	East Oahu	$35 million
11/23/82	Hurricane Iwa	Kauai, Oahu	$239 million
1/7-16/80	High Surf, Winds, Flooding	Statewide	$27.6 million
1/8-10/80	Kona Storm	Maui	$12.9 million
5/23/60	Tsunami	Hilo, Hawaii	$23 million
8/4-6/59 (Kauai)	Hurricane Dot	Kauai, Hawaii, Oahu	$6 million
4/1946	Tsunami	Hilo, Hawaii	$2.6 million

*dollars given in the year damage occurred

Hazard Mitigation Planning as Required by The Disaster Mitigation Act of 2000

Hazard mitigation planning is the process that analyzes a community's risk from natural hazards, coordinates available resources, and implements actions to reduce risks. 44 CFR Part 201, Hazard Mitigation Planning, establishes criteria for State and local hazard mitigation planning authorized by §322 of the Stafford Act, as amended by §104 of the Disaster Mitigation Act of 2000. After November 1, 2003, local governments seeking Pre-Disaster Mitigation (PDM) funds through a State application will have to have an approved local mitigation plan prior to the approval of local mitigation project grants. States will also be required to have an approved Standard State mitigation plan in order to receive PDM funds for State or local mitigation projects after November 1, 2004.

The Standard State Mitigation Plan will also be required for non-emergency assistance provided under the Stafford Act, including Public Assistance restoration of damaged facilities and Hazard Mitigation Grant Program funding. A State with a FEMA-approved Enhanced State mitigation plan at the time of a disaster declaration is eligible to receive increased funds under the Hazard Mitigation Grant Program, based on 20 percent of the total estimated eligible Stafford Act assistance.

Therefore, the development of State and local multi-hazard mitigation plans is key to maintaining eligibility for future FEMA mitigation and disaster recovery funding

The Mitigation Planning Process

The development of the Pre-Disaster Hazard Mitigation Plan for Honolulu involved a significant broad-based participation of the Mayor, the City Council, Oahu Civil Defense Agency, the City & County Dept. of Planning & Permitting, the Oahu Disaster Mitigation Council (formerly Oahu Project Impact) and its public and private partners, many State agencies, such as State Civil Defense, the Dept. of Land and Natural Resources, the Dept. of Transportation, the State Hazard Mitigation Forum and its affiliated State Multi-Hazard Science Advisory Committee, HECO (electric utility), professional organizations, such as the Hawaii Geographic Information Coordinating Council, the American Institute of Architects, the Structural Engineers Association of Hawaii, the American Meteorology Society, and federal partners such as the FEMA Pacific Area Office, NOAA and USGS.

Risk and Vulnerability Assessments

Vulnerability assessments in this plan identify the hazards that affect Oahu, assess the risk of disaster losses, and evaluate the vulnerability of community assets.

Identifying and Profiling Hazard Events

Hazards are physical conditions or events that have the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of loss. The intent of this document is to present the current state of knowledge of natural hazards significant within the City & County of Honolulu. Hazards assessed in this plan include:

Detailed information is given in these sections on previous occurrences of natural hazard events and available analysis of probabilities of future events. A very brief synopsis of each follows:

Strong Winds

High winds from trade winds, which blow 70% of the time, Kona winds (30% of the time, and winds from hurricanes and tropical storms passing through Hawaiian waters all affect the island of Oahu. Tradewinds predominate from the northeast and generally range from 10 – 25 miles per hour, although occasional extreme events reach 40 - 50 miles per hour when the sub-tropical high pressure cell north of the islands intensifies. Damaging Kona winds have reached velocities of 50 miles per hour for several days on end. Kona storms generally form in the region bounded by 15° - 35° N and 175° E – 140° W and move erratically, though with a slow tendency toward the west.

Hurricanes

One of the most damaging and potentially catastrophic events that occur in the Hawaii is a hurricane. A hurricane is defined as a large circulating windstorm covering hundreds of miles that forms over warm ocean water. To be officially classified as a hurricane, the sustained wind speeds must exceed 74 miles per hour.

Hurricane Annual Odds of Occurrence by Saffir Simpson Category Incorporating NASA and HHRF Sponsored Research

Hurricane Category	Sustained Wind	3-sec. Peak Gust	Anywhere in Hawaii	Oahu Only
1	74 to 94 mph	82 to 108 mph	1 in 25	1 in 80
2	94 to 110 mph	108 to 130 mph	1 in 50	1 in 320
3 or 4	110 to 155 mph	130 to 191 mph	1 in 75	1 in 400
Any Hurricane	Greater than 74 mph	Greater than 82 mph	1 in 15	1 in 55

Terrain or topographic amplification of wind speed has been a significant additional contributing factor in the past hurricane loss experiences of Hawaii. In a recent NASA-funded investigation, 1:6000 scale physical models of selected developed portions of Hawaii were constructed based on a 10-meter digital elevation model, and tested in a boundary-layer wind tunnel to determine wind velocity accelerations (or decelerations) for various terrain conditions. Most of the existing residential structures in Hawaii are under-designed for high wind, depending on their construction type and topographic location. High expected hurricane losses on Oahu make hurricanes the hazard of greatest risk.

Landslide / Debris Flows

Honolulu combines several of the essential components for debris-flow hazards: steep hillsides, heavy rainfall, and strong pressure for residential development in upland areas. Debris flows are dangerous because they occur suddenly and move rapidly by flowing or avalanching down hillslopes and channels. They generally occur during or immediately after severe rainfall of more than 3 inches in a peak 6-hour period.

Rock Falls

The State has identified 66 highway sites on Oahu that have a high risk of rockfall or landslide. A review of the transportation system on Oahu indicates that many miles of highways and roadways pass through mountainous terrain, where steeply cut slopes are found adjacent to the roadways. A multitude of these cut slopes were excavated using blasting methods to make room for roadway corridors. Most often, blasting created instability in the rock formation and thus increased the potential for rockfalls. The hazard potential of a rockfall is greatest where a highway winds through a heavily populated area or in a location where a highway serves as the sole thoroughfare for the surrounding communities.

Earthquakes

Seismic hazard on Oahu was historically underestimated. In the late 1980's, Oahu was recognized to be in a region of moderate seismic hazard, and building standards were improved in 1990 based on work conducted by members of the Hawaii State Earthquake Advisory Committee of State Civil Defense. The most current seismic design code available is the International Building Code (IBC). These provisions incorporate state of the art seismic hazard mapping of Hawaii developed by the U.S. Geological Survey (USGS) and the Hawaii State Earthquake Advisory Committee. Based on an analysis incorporating soil site factor mapping and Hawaii construction cost data, projected earthquake average annual loss is about $20 million on Oahu.

A summary of historic events felt on Oahu

Event	Epicenter		Richter Magnitude	Honolulu Intensity
Date	Latitude	Longitude	M	Modified Mercalli Intensity Ave.
1871 Feb 19	20.7	157.0	7.0	6.5
1948 Jun 28	21.2	157.9	4.6	6.0
1938 Jan 22	21.2	156.1	6.8	5.5
1973 Apr 26	19.9	155.1	6.2	5.0
1981 Mar 5	21.4	156.8	5.0	5.0
1895 Dec 8	Oahu vicinity		--	5.0
1861 Dec 5	Molokai-Lanai vicinity		--	5.0

Tsunamis

The Hawaiian Islands have a long history of destruction due to tsunamis and are particularly vulnerable to tsunamis originating in the north and the southeast Pacific Ocean. Twenty-six tsunamis with flood elevations greater than 3.3 ft (1 m) have made landfall in the Hawaiian Islands during recorded history, and 10 of these had significant damaging effects on Oahu. This translates into a recurrence interval of one large tsunami reaching Hawaiian shores every 7 yr and one damaging tsunami reaching Oahu every 19 yr.

Floods

The major flooding events in Hawaii are caused by storms, storm surge, high surf and tsunamis. In the City & County of Honolulu, from about 1915 to 2000, floods caused by rainstorms, including *tsunamis, and hurricanes* have claimed more than 140 lives and inflicted more than $55 million dollars of direct and indirect damage. Some of the largest rainfall counts and most severe flooding events have occurred in the last several years.

High Surf

The Oahu Civil Defense Agency classifies high surf as a condition of very dangerous and damaging waves ranging in height from 10 ft to 20 ft or more. These waves result from open ocean swell generated by storms passing through the north and south Pacific Oceans. High waves from hurricanes present a more complex hazard, as they may coincide with high tide, storm surge, and wind and wave setup, to produce a combined threat. High waves from hurricanes generally occur during hurricane season between June 1 and December 1. High waves from hurricanes most often hit the eastern shores as hurricanes approach the islands from the east, and south- and west-facing shorelines as the storm passes to the south and west. The hazards associated with high waves include debris overwash, flooding, erosion, high wave energy and turbulence in the nearshore zone, and strong currents.

Coastal Erosion

The beaches of Hawaii are vital economic, environmental, and cultural resources. A healthy, wide sandy beach provides protection against the effects of storm surge, tsunami flooding, and high surf impacts. Coastal erosion and beach loss are chronic and widespread problems in the Hawaiian Islands. Typical erosion rates in Hawaii are in the range of 15-30 cm/yr. Recent studies on Oahu have shown that nearly 24% or 17 miles of an original 72 miles of sandy shoreline (1940s) has been either significantly narrowed or lost. The cost of the beach loss at Waikiki has been

estimated would be about $700,000 to $1 million per year, in order to maintain the beach in its current state.

Drought Hazards

Water Supply Sector Areas of Risk to Drought Impacts

For Oahu, the area where the frequency of moderate drought (16% - 24% probability) is found in a horizontal belt stretching from Kahaluu westward to the central saddle area. The pronounced severe drought areas (8% to 20% probability) lie in a large region from Waimea on the north shore through the central saddle area, covering Wahiawa and Mililani.

Agricultural and Commerce Sector Areas of Risk to Drought Impacts

The drought prone area (>8% probability) lies mainly in the central saddle region between the Koolau and Waianae mountains. This is the area where agricultural activity thrives. The area where severe drought occurred more frequently lies in the rain-shadow of the Koolau Range near the town of Mililani and Wahiawa. This is the low rainfall region and an intense agricultural zone.

Environmental, Public Health and Safety Sector Areas of Risk to Drought Impacts

For Oahu, the area of moderate drought tends to concentrate along a horizontal belt from Kahaluu to the central interior. This belt covers communities at risk on the coast and those near Wahiawa and Mililani, as well as the actual wildland fire zone near Waikele. The area of high frequency of severe drought is located in the central saddle region, in an area where wildland fire occurred or communities from fire risk are high.

Dams

There are three types of dams: detention, storage, and diversion. Detention dams are constructed to retard and minimize the effects of flood runoff. Storage dams are constructed to impound water during periods of surplus supply for use during periods of drought. This water is for crop irrigation, livestock watering, and municipal and industrial water supply. Diversion dams are constructed to provide hydraulic head for diverting water from streams and rivers into ditches, canals, or other water conveyance. A majority of Oahu's 21 existing dams were built by private plantation owners in the early 1900's for irrigation and not flood control; there were no standards at that time. Two factors influence the potential severity of a full or partial dam failure: the amount of water impounded, and the density, type, and value of development and infrastructure located downstream.

Hazardous Materials

A major Superfund Amendments and Reauthorization Act provision is Title III, or SARA Title III, also referred to as Emergency Planning and Community Right-to-Know Act (EPCRA). EPCRA established guidelines for Federal, State and local governments, and industry regarding emergency planning and providing communities with information on hazardous chemicals within their jurisdiction. The Hawaii Emergency Planning and Community Right-to-Know Act became law in 1993 (HRS 128E). A Hawaii State Emergency Response Commission (HSERC) was formed and each of the four counties in Hawaii was designated as an emergency planning district. A Local Emergency Planning Committee (LEPC) was established in each county. Functions of the LEPC include preparing a hazardous material emergency response plan, reviewing the plan annually, evaluating resources to mitigate an emergency, receiving emergency response notifications, and receiving and processing requests for information from the general public.

Summary of Vulnerable Assets

Vulnerable Area	Ownership	Natural Hazards	Primary Problems/Effects	Mitigation Benefits
Power lines, traffic signals, power substations, highway signs	HECO	High winds, Kona storms Hurricanes	Utility and transportation disruption, navigation impeded, business interruption; social/family stress	Public safety, minimize power outages, economic recovery
Residential homes	Private	High winds, Kona storms Hurricanes, erosion	Damage, loss of property	Public safety, reduce costs of recovery, rebuilding & repair
Schools and Shelters	Public/private	High winds, hurricane	Loss of life, damage to building and contents, disruption of social well-being, shelter facilities at risk	Public safety, protect structure
Coastal hotels/resorts	Private	Coastal erosion, storm surge, high wind & surf	Erosion removes sand and compromises structural integrity, damage to lower floors, social/economic disrupt.	Prevent costly damage, prevent impact of erosion on beaches/dune systems
Public beaches and facilities	Federal, County State	Coastal erosion, storm surge, high wind & surf	Flood debris deposited on beach, coastal erosion	Minimize social disruption, protect beaches and dunes
Port/harbor damage	Public/private	Storm surge, high surf, erosion, overwash	Facility flood inundation, hazardous materials released, foundation / structural damage, waterborne debris, interrupted intermodal commerce, loss of supplies to Island, business interruption, natural resource damage	Maximize social well-being, minimize business disruption, prevent costly damage, protect natural resources
Coastal roads	County, State	Overwash, erosion, storm surge, high surf	Evacuation difficulties, inter-island access difficulties, loss of safety/health services	Prevent costly road repair, business interruption, protect beaches and dunes
Downed trees	County, private	High winds, hurricanes, Kona Storms	Damage to buildings, cars, power outages, business interruption, transportation disruption, debris cleanup	Public safety, prevent costly debris cleanup, business interruption
Historical buildings	County, state, Private	High winds, storm surge	Economic & social hardship, loss of cultural resources	Protect cultural resources
Sewage Treatment Plants	County	Storm surge, high surf	Environmental damage, economic & social hardship	Public safety, avoid environmental damage

Critical facilities include the essential facilities that provide emergency services and other facilities providing services to the public that are necessary to preserve public welfare. These have priority during initial recovery efforts.

- Oahu Emergency Operations Center
- Police and Fire Stations
- Schools and Emergency Shelters
- Hospitals
- City Hall and Municipal Office Building
- Water & Wastewater Plants
- Sewage Pumping Stations
- Power Plants
- Power Stations
- Access Roads to the above Facilities
- Communications Facilities
- Facilities that produce, use, or store highly volatile, flammable, explosive, toxic or water-reactive materials

Summary of Hazards Relevant to Oahu

Hazard	Siting Issues	Building Issues	Locations	Plan Sections	Hazard/Loss Analysis Method
Hurricane Wind, Wave, and Rain	No	Higher standards needed for particular topographic conditions. Create wind and rain resistant envelope.	Coastal areas have higher winds due to open exposure, Inland areas may be affected by topography, per an on-going City mapping project	4 5 6	Probabilistic Windspeed and Vulnerability Analysis of Oahu residential construction database
Landslides/ Debris Flow	Yes	residential development in upland areas	steep hillsides, and heavy rainfall	7	Historical Losses and Mitigation Costs
Earthquakes	Avoid unstable slopes	Adopt an updated building code, such as the International Building Code recommended by State Civil Defense	Moderate seismic hazard throughout Oahu	8	State-of-the-art maps used for a probabilisitic ground motion hazard basis for the HAZUS Annualized Average Loss analysis
Tsunamis	Avoid VE zones for critical facilities	Elevate, locate on higher part of lot; location of structure on lot	All coastal areas	9	Historical Event Losses on Oahu
Hurricane Storm Surge/ Flooding	Avoid, for critical facilities	Elevate, locate on highest part of lot; location of structure on lot	East and South shores at higher risk.	5 10	Deterministic Storm Exposure
Coastal Flooding	Wave Zones (V, VE zones) - Attempt to Avoid, for critical facilities – Avoid Flood zones (A, AE, Z zones) – for critical facilities – Avoid	Lowest horizontal structural member above Base Flood Elevation (BFE)	Along coastal areas and adjacent to stream floodways	10	Probabilistic 100-yr. and 500-yr. per Flood Insurance Rate Maps
High Surf	Yes	Lowest horizontal structural member above BFE	North-facing shorelines where winter swells arrive in heights often exceeding 20 ft	11	Historical Losses
Coastal Erosion	Yes - Establish erosion zone setebacks	Location of structure on lot	Sandy coastlines.	12	Historical Rates
Droughts	Yes	No	Primarily the central region between the Koolau and Waianae mountains	13	Standardized Precipitation Index (SPI)
Technological Failure Hazards	Yes	No	Existing older dams; Variety of HAZMAT locations	14 15	Deterministic Scenarios

Risk Assessment

This is the process or method for evaluating risk associated with a specific hazard. Here, risk is defined as the potential losses associated with a hazard, defined in terms of expected annual loss, resulting from the probability of occurrence, magnitude and severity, asset exposure and vulnerability, and consequences.

Losses linked directly to a hazard event include all damages, deaths and injuries, loss of habitation, shelter demand and employment losses due to the closure of damaged facilities. This includes physical destruction of buildings, transportation and utility systems, crops, and natural resources and employment losses due directly to the closure of damaged facilities, including the cost of post-disaster cleanup.

Average Annualized Loss (AAL) is an objective measure of future losses averaged on an annual basis, calculated as the sum of the expected loss for each event (i.e., sum of the products of the estimated loss from each event and that event's rate of occurrence). In cases where there is insufficient confidence in the probability estimates of rare events and where sufficient past data is available, the average annualized loss is based on historical losses. This information is used in assessing the relative contributors to total natural hazard losses and determining the priorities for hazard mitigation measures.

Formula Expression: $AAL = \sum L_i \times P_i$

L_i = Estimated Loss for Event *i*
P_i = Annual Probability of Event *I*

Relative Hazard Severity to the City & County of Honolulu Based on Average Annual Loss Estimates	
Hurricane	**$80 to $110 Million / Year**
Earthquake	**$20 Million / Year**
Debris Flow and Rockfall	**$1 to $5 Million / Year**
Flood	**$1 to $2 Million / Year**
Coastal Erosion	**$0.75 to $1 Million / Year**
Tsunami	**$0.25 to $0.50 Million / Year**

Land Use Planning and Development Trends in the City & County of Honolulu

The City and County of Honolulu guides and directs land use and growth through a three-tier system of objectives, policies, planning principles, guidelines and regulations. The General Plan forms the first tier of this system, consisting primarily of statements of objectives and policies.

The second tier of the system is formed by the Development Plans, which are adopted and revised by ordinance. These plans address eight geographic regions of the island: the Primary Urban Center, Central Oahu, Ewa, Waianae, North Shore, Koolauloa, Koolaupoko and East Honolulu. The development plans for East Honolulu, Waianae, North Shore, Koolauloa, and Koolaupoko are now referred to as *Sustainable* Community Plans.

The third tier of the system is composed of the implementing ordinances, including the Land Use Ordinance (Honolulu's zoning code) and the City's Capital Improvement Program. Mandated by the City Charter, these ordinances constitute the principal means for implementing the City's plans. These ordinances are required to be consistent with the General Plan, the Development Plans (or *Sustainable* Community Plans), and each other.

In addition to these three Charter-mandated tiers, the development plans are supplemented by two planning mechanisms that are not required by the Charter, including the functional planning process and special area planning. Functional planning activities, some of which are mandated by state or federal regulations, provide long-range guidance for the development of public facilities such as the water system, wastewater disposal, and transportation. Special area plans are intended to give specific guidance for neighborhoods, communities or specialized resources.

Mitigation Strategy

The Public Safety Objectives of the City General Plan are to protect the people of Oahu and their property against natural disasters and other emergencies, traffic and fire hazards, and unsafe conditions.

Policy 1: Keep up-to-date and enforce all City and County safety regulations.
Policy 2: Require all developments in areas subject to floods and tsunamis to be located and constructed in a manner that will not create any health or safety hazard.
Policy 3: Participate with State and Federal agencies in the funding and construction of flood- control projects.
Policy 4: Cooperate with State and Federal agencies to provide tsunami warning and protection for Oahu.

Policy 5: Cooperate with State and Federal agencies to provide protection from war, civil disruptions, and other major disturbances.
Policy 6: Reduce hazardous traffic conditions.
Policy 7: Provide adequate fire protection and effective fire prevention programs.
Policy 8: Provide adequate search and rescue and disaster response services.
Policy 9: Design safe and secure public buildings.
Policy 10: Provide adequate staff to supervise activities at public facilities.
Policy 11: Develop civil defense plans and programs to protect and promote public health, safety and welfare of the people.
Policy 12: Provide educational materials on civil defense preparedness, fire protection, traffic hazards and other unsafe conditions.

Benefits of Mitigation Efforts

Risk management is the process by which the results of an assessment are integrated with political, economic, and engineering information to establish programs, projects and policies for reducing future losses. Expected benefits are the losses avoided because of a mitigation activity for hazard events of different intensities, multiplied by the probability of each of these events occurring. Losses avoided include but are not limited to: reduced loss of life, injury, and damage to property (including historic properties); reduced impacts on environmental, social, and recreational values; reduced community disruption and business interruption; and future expenditures on disaster relief. Most benefits of mitigation are costs and losses avoided through the reduction in loss probabilities and a reduction in loss amounts/value. Such as reduced:

- Loss of life, injury and pain
- Property destruction and damage
- Community disruption, personal and local infrastructure.
- Business interruption, including closures, shutdowns, un- (and under-) employment.
- Loss of culturally and historically important items.
- Expenditure on disaster relief by both governments and private organizations.

Pre-Disaster Mitigation Planning Projects

- Mapping hazards and incorporating them into planning documents, potential loss estimates, and zone considerations
- Assessing inventories of public facilities
- Refining and updating building codes and zoning requirements
- Training & Education
- Developing loss mitigation incentives to the public

Pre-Disaster Mitigation Projects

- Relocating Critical Facilities in high hazard zones, developing new facilities, or arranging use of alternative staging sites
- Retrofitting or upgrading critical buildings and infrastructure to resist natural hazards
- Improving reliability or redundancy of infrastructure to mitigate essential service outages and lifeline interruptions from natural hazards like rockfalls, debris flows, earthquakes and hurricanes

Mitigation Measures for the City & County of Honolulu:

1. Update the Building Code. The City Department of Planning & Permitting is undertaking a building code update that will incorporate state-of-the art hazard information on topographic amplification of hurricane winds for design purposes. The most current seismic design code is the International Building Code (IBC). These provisions incorporate a vastly improved seismic hazard mapping of Hawaii developed by the U.S. Geological Survey (USGS) and the Hawaii State Earthquake Advisory Committee. The Office of the Director of Civil Defense has recommended that all counties adopt the seismic provisions of the IBC 2000, stating, "the IBC 2000 better represents the interest of earthquake mitigation and public safety for the State of Hawaii."
2. Continue participating in the NFIP (Also consider applying to the Community Rating System to earn homeowner premium discounts)
3. Address the shortage of almost 60,000 hurricane shelters on Oahu
   - Establish shelter criteria for public buildings with assembly occupancies
   - Establish State funding for retrofit of existing shelters currently not rated for hurricanes
4. Upgrade distribution power pole criteria to NESC, in accordance with American Lifelines Association
5. Inspect and replace weathered wood poles with NESC-conforming poles
6. Conduct evaluations of critical public facilities in high hazard zones to determine vulnerabilities
7. Establish a policy for strengthening of critical public facilities when replacing enclosure elements
8. Develop an updated south coast inundation analysis using newly available storm surge and wave models
9. Develop Hurricane Loss Estimation Modeling for public agency use statewide

10. Develop a GIS building inventory database for use in detailed loss estimation assessments
11. Establish a low-cost plywood shutter Hawaii standard for hurricanes
12. Establish a Post-Disaster Technical Clearinghouse for all-hazard emergency management
13. Continue with disaster preparedness education for immigrant minority groups on Oahu
14. Conduct GIS-based hazard mapping of soil and geologic conditions
15. Delineate potential liquefaction hazard zones on Oahu
16. Define coastal erosion hazard zones and if necessary, special setback limits
17. Incorporate all-hazard assessments in land development application process
18. Implement a periodic code update process for critical infrastructure based on American Lifelines Association
19. Improve redundancy of electrical power transmission
20. Address the eight target repetitive flood loss structures when future HMGP opportunities occur
21. Require inspections of existing legacy dams. Require dam failure inundation analyses using the M2M model
22. Establish additional flood and debris-flow warning systems on Oahu
23. Improve mandatory disclosure of hazard risks in real estate transactions

Plan Maintenance and Implementation

For the purpose of active maintenance of the Plan, the City & County of Honolulu's Oahu Civil Defense Agency (OCDA) has created a broadly based community resource comprised of public, institutional, private, professional, and industry groups with interests in hazard mitigation, the Oahu Disaster Mitigation Council (ODMC).

An electronic version of the Plan exists on a public website, MotherNature.com, that is hosted by the University of Hawaii's Social Science Research Institute, along with an email link to OCDA. This enables further public input and requests for information to be gathered.

Because the Plan incorporates a significant compendium of information on natural hazards and vulnerabilities affecting public safety, it is anticipated that it will be used as a primary template to produce a wide range of public information products to be disseminated at public outreach events that are a normal part of OCDA activities. .

City workshops at the departmental level are taking place to further emphasize the need to incorporate natural hazard consideration in the planning of public facilities. Such workshops would be incorporated as an adjunct to the annual disaster response exercises that are conducted annually by OCDA. This may also allow to summary discussion of mitigation-related efforts undertaken to be incorporated in an updated Plan.

Implementation of mitigation actions (whether or not FEMA funded) through planning integrated within existing city programs is considered a key to long-term success. City departments with public facility responsibilities are the initiators of capital improvement and repair and maintenance projects at the City level. The ODMC can therefore function as a communication link and discussion forum for responsive planning and to recognize opportunities for mitigation projects that may acquire FEMA support, and thereby quicken solutions to facility site and building issues.