CHAPTER 20

American Sedimentation Law and Physical Processes

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20.1 INTRODUCTION

20.1.1 Recent Trends in American Sedimentation Law

This chapter, more than any other in the first edition of Manual 54, deserves to be updated and expanded. As the population of the United States grows, there is more demand for government to provide infrastructure, and to balance the pressure of urban expansion with regulatory objectives such as hazard mitigation and the environment. New theories of legal liability such as inverse condemnation have changed the way that government carries out this mission. In essence, the power we delegate to government and the decisions it makes on our behalf and with our participation add up to priorities that change society. This driving force is at least as great as the pursuit of science when it comes to breakthroughs in the application of sedimentation engineering concepts.

20.2 MANUAL 54: SEDIMENTATION ENGINEERING (VANONI 1975)

20.2.1 General Summary

After devising the problem, author C. E. Busby, when writing Chapter VII of Manual 54 entitled "American Sedimentation Law and Physical Processes" (1975), mapped out these physical processes of sedimentation, how they relate to supreme court case-law, and how engineering practice responded. He used the following concise yet well informed outline.

20.2.2 Legal Concepts Applied to Water, Air and Land

Erosion damage is part of the sedimentation process and possession or right to possession is the basis for rights in land and water. "In American jurisprudence, one cannot own the water as it runs in a stream or moves in the air, for one cannot legally possess it in these natural states. This has given rise to legal concepts as old as Roman Law; that these moving waters are the property of no one (res nullius) or of all people (res communes)."

20.2.3 Erosion and Sedimentation Processes Vary Geographically

The difference between natural rate and artificial rate produced by man is seen as significant in determining legal liability, and the concept of what is a public stream is changing as the needs of the public change.

20.2.4 Land Pattern Affects Process and Legal Consequences

As in common law, jurisdictions that shape land ownership tracts per settlements of the original states by metes and bounds or by sections and townships virtually ignore drainage lines for younger settlements. There are also public geographic boundaries such as counties, municipalities, states, and the nation, which include national forests, public parks, and wildlife refuges that may have ownership boundaries wherein governmental powers may be exercised over natural resources and people. This deals mainly with sovereign control of development and use.

20.2.5 Water Pattern Affects Process and Legal Consequences

Bearing in mind that the facts make the case, natural water patterns depend largely on slope, soil, bedrock, gullies, and stream channels and are superimposed by the invisible cultural pattern of water supply and rights of use, as defined and classified in law. Diffused surface waters, vagrant floodwaters, and watercourses defined as either navigable or non-navigable were originally based, per common law, on the ebb and flow of the tide. There is a need to bring law and science closer together in terms of reality and process.

20.2.6 Sources of Law

Water laws have been subject to local customs down through the ages, which has had a marked influence on such laws as they evolve. The old "cujus est solum" theory affects all water supplies because it affects every land ownership tract. Geographically, riparian laws are adapted according to the character of the land. Precipitation runoff plays a main part in common law, a partially unsound theory based on ownership per title to soil rights in turn expanding to ownership of all waters on and under titled soil, as well as the space above and the minerals below. Scientific fact brings into play other moving resources such as water, oil and gas, air and wildlife. Constitutional provisions within the broad scope of the law are veering away from older unscientific concepts and judicial administration toward more scientific concepts and executive administration. Due to this trend, the engineering and legal professions are increasing in importance due to development and application of basic scientific data within the broad framework of legal administrative processes and standards in the field of social engineering.

20.2.7 Rights in Land and Diffused Surface Waters

Busby's chapter includes a section on this topic.

20.2.7.1 Definitions of Supplies and Interests Applicable engineering principles are at the core of water cycles related to diffused and defined surface waters. "Engineers know that water is usually conveyed in some sort of 'channel' as soon as it starts to move over the land." Due to the law of streams, sediment deposits may be in one's "possession" during one year and in transit and out of possession during another.

20.2.7.2 Common Enemy Rule The so-called absolute property right in land is qualified by exceptions in several states in the interest of the rights or needs of neighbors. The rule of reason ableness incorporates more science into law due to sound reasoning with consideration of relevant scientific fact, method and technique when supported by local custom and practice.

20.2.7.3 Civil Law Rule Problems arising out of land improvement have led to the adoption of the reasonable use rule which states "that the upper landowner may not unduly collect, concentrate, and discharge diffused surface waters on the lower land in increased velocity and volume, so as to do substantial injury to the lower lands." This rule of reason law tends to balance the relative interests of upper, lower, and adjacent landowners as to damage resulting from harmful runoff. The task at hand for engineers is to define (for the courts) these rights and the interests thereof per scientific measure, evaluation and prediction of runoff and damage.

20.2.7.4 Reasonable Use Rule In effect, the reasonable use rule says that a landowner may use his own land as he pleases provided he does not unreasonably interfere with the like rights of others. Reasonableness and unreasonableness are questions of fact.

20.2.7.5 Rules Governing Pollution Damage by Sediments to Lower Lands and Diffused Surface Waters It has been upheld that the upper landowner is not liable for damage to lower lands caused by diffused surface waters carrying soil and rock when they constitute part of the "natural formation of the land." He is liable for resulting damage if he places other soil and rock where the natural drainage of such water will carry it to lower tracts of land or where it interferes with normal drainage, though there are exception.

20.2.7.6 Rules Governing Pollution Damage by Sediments to Navigable Waters and Adjacent Lands Works of improvement must adhere to the non-obstruction of navigable waters. It is of special interest to lawyers and engineers to interpret Section 10 of the Rivers and Harbors Act of 1899 that states, "That the creation of any obstruction not affirmatively authorized by Congress, to the navigable capacity of any of the waters of the United States is hereby prohibited" further to include industrial solids in suspension but not in solution. This applies to organic waste that reacts chemically on discharge into a stream, so as not to remain permanently as an obstruction in the form of a shoal deposit.

20.2.8 Rights in Land and Defined Surface Waters

The following excerpts outline Busby's findings on these subjects.

20.2.8.1 Definitions of Supplies and Interests Conditions under which riparian rights are acquired and lost are important to engineers and their clients due to the fact that engineers are called on to render services in measuring and appraising land and water resources and evaluating property damage from control and use.

20.2.8.2 Rights to Riparian Land as Deposited Sediment Sediments affect the position of a channel in the flood plain by changing channel capacity as well as the topography of the surrounding flood plain. Rights to deposited sediments in flood plains or stream channels may be gained or lost by changes in the position of the channel itself, due to the action caused by both water and sediment.

20.2.8.3 Riparian Rights Gained or Lost by Accretion This riparian right refers to permanent changes made to the land when a stream or river recedes below the watermark, exposing deposits recognized as accretions. For instance, an island "rising" in a river unconnected to the riverbank belongs to the owner of the bed at that particular place. In general the rule is that the State owns the bed of a navigable watercourse unless that State permits the adjacent riparian owner to own the bed subject to the navigation servitude.

20.2.8.4 Riparian Rights Gained or Lost by Avulsion Although the rule varies from state to state, generally speaking, when the tract of land is severed by sudden change in the channel of a given stream that does not indicate that the right to that tract has been lost. Basic riparian rights may be lost when the thread of the stream is no longer the natural boundary. The original owner may opt to ditch the stream back to its former

channel if done so within a reasonable amount of time and without trespassing on the land of another and without causing undue harm to another's land.

20.2.8.5 Rights to Be Free from Undue Damage Caused by Obstructions; Major Works of Improvement, Sediment Wedges, and Similar Causes; Definition of Influences Causing Undue Damages Environmental influences causing undue damage to lands, waters, and other resources are multiple in nature:

1. Construction of major works of improvement
2. Fluctuations in reservoir and other surface water levels
3. Severe erosion and high sediment yields of upstream watershed lands
4. Unwise use and treatment of upstream watershed lands
5. Backwater effects of dams, reservoirs, and sediment wedges
6. Combinations of environmental influences and their consequences

20.2.8.6 Rules Governing Recovery of Damages Caused by Obstructions and Sediment Wedges Discussion of sedimentation and other forms of related damage recognized in law due to court decisions related to taking of property by overflow, erosion, sediment deposition, and rise in groundwater table, with sediment depositions mapped out by date.

20.2.8.7 Other Rights Rights to be free from undue damage caused by obstructions such as major works of improvement, sediment wedges, and similar cases are outlined, with definitions of influences that cause undue damages; rules governing the recovery of damages caused by obstructions and sediment wedges.

20.2.9 Key Questions

The key questions the original Chapter VII addresses are:

1. Rights in and to sediments, as land (property), recognized in law as arising out of natural and artificial changes in the movement of water
2. Rights to legal damages recognized in law as arising out of artificial changes in the movement or effects of water and wind, with special reference to sedimentation; and
3. Powers of government recognized in law necessary to regulate land and water use to prevent undue change by sedimentation to resources and to the health, safety, and welfare of the community?[1]

20.2.10 Further Topics

In addition, the original chapter reiterates historical documentation that involves trends in sedimentation law due to legal consequences, as it relates to land development and land use, dating back to original settlements, colonies, Indian boundaries, water boundaries and their authorities at that time. Legal concepts are reviewed as they apply to the possession of water, air, and land, and how changes in erosion and the sedimentation process vary geographically. Busby concludes that resource management hinges on natural boundaries and cultural ownership. His well-referenced chapter deals with theories of property ownership and the use of legal boundaries, which ultimately leads to a definition of today's changing law as it pertains to water supplies, sedimentation, and saline processes.

20.3 RECENT TRENDS IN AMERICAN SEDIMENTATION LAW

Within the law pertaining to sediment engineering, recent trends involve riparian matters pertaining to the environment and conservation. Water law has evolved from water consumption to quality control, covering a wide spectrum of engineering—from dairy operations on creeks to mining techniques to building dams. As a result of these ecological concerns, unresolved legal issues materialize as they pertain to changes in physical boundaries due to consequences of natural hazards such as unexpected floods, unprecedented weather, and subsequent sediment transport.

Conservation systems and programs that are designed to reduce soil losses from erosion to acceptable levels are on the rise. Stringent guidelines, amending old laws, provide a mechanism for encouraging landowners to reduce erosion and siltation. For example, federal policy discourages conversion of wetlands to farmland, because the remaining wetlands have important ecological and hydrologic value (USEPA, 1998).

On 7 January, 1998, the U.S. Environmental Protection Agency released its first national report on the quality of sediments in the nation's rivers and streams. Although the report discovered that the majority of watersheds do not pose adverse risks, it cited that 7% of the surveyed watersheds have contaminated sediments. Every state in the union has some level of sediment contamination affecting its streams, lakes and harbors. This fact goes hand in hand with the trend toward laws supporting a watershed-wide consideration of environmental elements. Bearing in mind that impervious areas affect how water runs off the land, the development and maintenance of properly engineered drainage basins continues to play an important part in the future of water science.

20.4 KEY TREND-SETTING COURT DECISIONS

One of the most difficult problems in the field of sedimentation law is how to arrive at a final accounting of legal damage in the face of a physical process that changes over a span

[1] "Sedimentation Law" (Vanoni 1975).

of years, during which natural processes of control become established (Busby, 1975). In fact, sedimentation law evolves around the concept that legal components of a stream change as the needs of the public change. In the 1970s, public interest was already shifting to smaller watersheds. As a result, sedimentation law is connected to key trend-setting court decisions as they relate to individual cases.

20.5 PUBLIC LIABILITY AND NATURAL HAZARDS: COMMON LAW AND REGULATORY "TAKINGS"—FUTURE DIRECTIONS

Bearing in mind that the original chapter on this subject was written by an attorney, the authors of this revision, in order to maintain that same caliber of legal expertise, dedicate this portion of this chapter to the work of an expert in the field of law. In 1992, Jon A. Kusler, Executive Director for the Association of State Wetland Managers, Inc., in Berne, New York, an association dedicated to the protection and management of the nation's wetlands, prepared a book for the scientific community on the subject of natural hazards law. The draft entitled "Public Liability in Natural Hazards" was prepared for the National Science Foundation pursuant to Grant CES-8612277 and submitted to the foundation in 1992. The authors of Chapter 20 obtained permission from Kusler to quote portions of the draft for the purpose of documenting recent trends in sedimentation law.

Therefore, this portion of the revised chapter quotes extensively from the work of Kusler (1992). Kusler examined more than 1,000 flood and drainage-related cases. More generally, he addressed public liability, responsibility and defense. These hazard-related cases (both regulatory and nonregulatory) reveal that new legal issues, such as inverse condemnation, have come into existence.

Through Kusler's exhaustive research, it became apparent that tort-related hazard law has a rapidly changing nature. "Many state and federal statutory modifications in tort liability have been and are now being legislatively adopted. To some extent, the issue then becomes not simply the present status of law but: what should government liability be?"

Kusler's book is primarily a legal treatise designed to help public and private lawyers and agency employees understand when and where governments (federal, state, local) may be liable for actions or inactions with regard to natural hazard losses and avoidance of future losses. It was also designed for natural hazard policy-makers and managers, legislators, scientists, and others interested in the scope of government liability and possible techniques for limiting liability while, at the same time, reducing natural hazard losses.

To summarize his findings, we begin with an overview of public liability due to natural hazards including court cases addressing specific hazards. Although loss of life caused by natural hazards has been reduced in the United States from natural disasters, property losses continue to take heavy tolls, in the United States and abroad, due to both private and public developments in hazardous areas subject to floods, erosion, earthquakes, landslides and mudslides, hurricanes, tornadoes, wild-fires, and other natural disasters.

According to Kusler's findings

> when private individuals are damaged by natural hazards, they increasingly file liability suits against governments claiming that governments have caused the damages, contributed to the damages, or (in some instances) failed to prevent or provide adequate warnings of natural hazards. In determining the liability of governmental units for damages due to governmental activities which increase natural hazards or for damages due to mitigation measures, courts apply general common law and constitutional rules of liability. However, there are several aspects of theses cases which are somewhat unique to natural hazards: an emphasis upon the "duties" of landowners rather than simply "rights"; the highly technical nature of suits; strong public health and safety and nuisance issues; and the existence of a variety of government programs to economically or otherwise compensate those injured by natural hazards.

Kusler also pointed out that landowners may opt to sue governments for regulating their property through zoning, building codes, special codes, and so forth. However, the success rate of this type of lawsuit is very low. It is well to note that allegations against the government concerning cause or increased damages to property or individuals form the basis for both types of suits. However, natural hazard losses versus reduced property values and options in the use of private land vary.

There has been an increase in the last part of the 20th Century of successful lawsuits against governments for government activities that increased natural hazard losses, such as the increase of erosion and flood flows, resulting in damages to private individuals. However, there were few successful cases that dealt with nonstructural hazard mitigation measures such as mapping, warning systems, evacuation measures, government regulations and insurance programs.

It is important to point out that most successful suits involving liability have revolved around situations in which governments have been responsible for directly increased flood or drainage problems to private properties located adjacent to public lands or public works projects, such as bridges, and roads, or through hazard reduction measures. Again, a modest number of suits have addressed situations in which governments were responsible for increased damages from mudslides and landslides and sometimes from snow, weather prediction, modification, and erosion. Very few suits have addressed other natural hazards such as earthquakes and volcanoes.

In most tort-related cases, the courts have held private individuals and governments increasingly liable for

natural-hazard and nonnatural-hazard-related injuries caused by "unreasonable" conduct which causes injury to individuals or to private property. "This trend toward increased successful liability suits for unreasonable conduct (usually based upon a theory of negligence) is particularly pronounced for governmental units not because governmental units are now being treated more harshly than private individuals but because the defense of government sovereign immunity has been eroded during this period, and increasingly, courts hold governmental units to the same standard of reasonable care as private individuals. See *Shipp v. City of Alexandria*, 392 So. 2d 1078, 1079 (La., 1980) Court agreed with "the modern trend . . . for public bodies to be treated in the same manner as private individuals unless policy considerations suggest otherwise."

This trend is due to legislative policy rather than a willingness of courts to entertain suits against governments. Some expansion has been due to changes in standing which allow damaged individuals to bring suits under preexisting theories of action, which were formerly unable to be utilized. The Civil Rights Act of 1871 has been a standard for individuals claiming violation of their "civil rights" under Section 1983 of this original act. This is the result of U.S. Supreme Court decisions interpreting the Civil Rights Act of 1871 as applying to local government actions.

Liability litigation is a dynamic, evolving area of law. In its broader context, lawsuits against governments by private individuals based on natural hazard losses or based on government actions to reduce such hazards are broken into two principal forms.

First are suits by private individuals who suffer from natural hazard losses they claim were caused by governments. These suits are generally for damages and are based mostly upon common law tort or to a lesser extent on contract theories. Some suits are also based upon statutory or constitutional grounds.

Second are the less common cases by private individuals who are prevented by governments through the adoption of regulations from engaging in filling, construction of dams, houses roads or otherwise using, subdividing or selling hazard-prone lands. These cases are based on the 5th Amendment or the 14th Amendment of the U.S. Constitution, or similar provision in state constitutions. These cases are mostly to compel issuance of permits or they are filed for damages due to the partial or complete taking of private property without payment of just compensation.

There have been almost no successful lawsuits based upon regulatory takings in hazard area contexts despite a widespread perception among governmental units that regulatory "takings" are a significant problem.

Both case types require the proof of specific damages and they both require proof of causation. In addition, both types of cases have, at their core, the basic duties as well as rights of private landowners and individuals (both private and public) to other landowners and individuals.

Due to a lack of hard and fast rules for negligent or nonnegligent conduct, the site-specific nature of negligent actions encourages a large number of suits. However, negligence depends, to a considerable degree, upon the circumstances and negligence is also, to a considerable degree, what a judge or jury says it is in a specific circumstance.

Of course, advancements both in knowledge concerning hazards and in modelling techniques make it more difficult for landowners to prove that a particular activity on adjacent land substantially increases flooding, subsidence, erosion or other hazards on his or her land. "This was particularly true when the increase was due to multiple activities on many lands such as increased flooding due to development throughout a watershed. Today, sophisticated modelling techniques greatly facilitate proof of causation and allocation of fault." See, e.g., *Lea Company v. North Carolina Board of Transportation*, 304 S.E. 2d 164 (N.C., 1983).

The contexts in which government liability for hazard-related actions may arise can be summarized into four categories:

- Natural hazard injuries that occur on public lands or in public buildings.
- Offsite impacts of various government activities on public lands.
- Government actions not related to public ownership or management of lands which increase natural hazard losses.
- Tightly regulating private activities within hazard areas to prevent hazard area occupants from increasing hazards on adjacent lands or regulating to reduce onsite losses.

The federal government, states, and local governments can all be sued for negligence, nuisance, breach of contract, or the "taking" of private property without payment of just compensation.

1. Local governments are the most vulnerable to such liability suits based upon natural hazards due to the fact that they are the very units of government undertaking most activities resulting in increased natural hazards or "takings of private property" and are "least protected by defenses such as sovereign immunity and statutory exemptions from tort actions." It is at the local level that most hazardous lands are managed and occur (road construction and maintenance for example).
2. States may be sued for negligence, trespass, takings and contract theories. Limited land use controls limits cases against state governments.
3. Federal liability is much broader with regard to federal land use. Congress has specifically exempted federal agencies for liability for negligence with regard to flood control measures by the Flood Control Act of 1936. However, federal agencies may be sued for

uncompensated taking of private property under the 5th Amendment. For example, agencies may be held liable for permanently flooding private land or other activities of both a nonregulatory or regulatory nature that are a taking.

There are three phases of a natural disaster: predisaster, during-disaster, and postdisaster:

1. Prior to a disaster, inadequately designed, constructed, operated and maintained warning systems, emergency evacuation plans, and hazard reduction structures (such as groins, dams, and dikes), may result in damage and as a result cause public liability. A lawsuit might occur at this point if issuance of regulatory permits over a period of years without adequate consideration of natural hazards might in some jurisdictions result in liability.
2. During the time of an actual disaster, if government activities are undertaken without "reasonable care" a public liability may arise. Both loss of life and property loss during a disaster can impose huge demands upon government resources in a relatively short period of time. Actions with potential for liability include issuance of warnings, rescue, construction of emergency levees, emergency releases form dams, evacuation, fire-fighting, and destruction of buildings or other structures to prevent further damage.
3. Such post disaster activities such as clean-up, debris removal, repair of structures can put governments in a negligent position.

Rules of liability which apply to private landowners in their use of hazard areas is also relevant to the validity of government regulations which very tightly controls private actions in hazard areas (Kusler 1992). For example, the U.S. Supreme Court decision, Lucas v. South Carolina Coastal Council held that when a regulation denies all "economically viable use of land" such a regulation is not a taking only. In this case, constitutional and common law merge because the state background principles of nuisance and property law would not allow such uses.

Further proceedings on this case remanded a decision of the South Carolina Supreme Court holding that a Beachfront Management Act, designed to address flooding and erosion problems, prevented a landowner from erecting any permanently habitable structure on the barrier island parcels. This case was, therefore, not a taking of private property without first payment of just compensation.

Kusler's findings that pertain to flood hazard court cases are varied but all cases illustrate the fact that much of the landscape is subject to one natural hazard or another.

As a result of the broad incidence of flood and drainage problems and the foreseeability of the problems, most natural hazard-related liability suits against governments have been the result of flood or drainage damages. Cases illustrating various types of situations in which governments have been sued for flooding or drainage damages include the following:

- Pumpelly v. Green Bay Co., 80 U.S. (13 Wall) 166 (S. Ct., 1971). State is liable for taking of private property due to flooding private lands by state reservoir.
- Rodriques v. State, 472 P. 2d 509 (Haw., 1970). State is liable for damage due to inadequate maintenance of drainage culverts which were blocked by sandbars and tidal action.
- United States v. Kansas City Life Insurance Co., 70 S. Ct. 885 (S. Ct., 1950). Federal government is liable for maintaining the Mississippi River at an artificially high level that raised the low water table blocking drainage of properties and destroying the agricultural value of lands.
- Ducey v. United States, (713 F. 2d 504 9th Cir., 1983). Federal government is potentially liable for failure to provide warnings for flash flood areas for an area subject to severe flooding in Lake Mead National Recreation Area.
- Coates v. United States, 612 F. Supp. 592 (D.C. Ill., 1985). Federal government is liable for failure to give adequate flash flood warning to campers in Rocky Mountain National Park and to develop adequate emergency management plan.
- Barr v. Game, Fish and Parks Commission, 497 P. 2d 340 (Col., 1972). State agency is liable for negligent design of dam and spillway inadequate to convey maximum probable flood; "act of God" defense inapplicable because of the foreseeability of the hazard event.
- Masley v. City of Lorain, 358 N.E. 2d 596 (Oh., 1976). City is not liable for increased flooding due to urbanization including lots and streets but may be liable for inverse condemnation for damages due to storm sewer system.

It is well to note that a relatively large number of challenges have been made to floodplain regulations that restrict private development in flood hazard areas. For reference, see Kusler (1971, 1984).

- Linquist v. Omaha Realty, Inc. 247 N.W. 2d 684 (S.D., 1976). Court held that resolution of Rapid City city council of June 1972, prohibiting issuance of building permits for one block on each side of Rapid Creek after the devastating flood until a study was completed by the planning commission, was a valid exercise of police powers and not a taking.
- Cappture Realty corp. v. Board of Adjustment, 313 A. 2d 624 (N.J., 1973). Court upheld interim zoning ordinance declaring a 1-year moratorium (with a 1-year extension) on construction in flood-prone area unless special exception permit was obtained.
- Foreman v. State Department of Natural Resources, 387 N.E. 2d 455 (Ind., 1979). Court sustained an injunction

prohibiting defendants from making deposits on a floodway and requiring removal of deposits previously made as not a taking of property.

Although hurricanes are generally foreseeable they are difficult to predict in specific terms. Two examples of lawsuits filed against governments based upon claims that they have increased various types of hurricane damage are listed below:

- Alain-Lebreton, Co., v. Dept. of Army, etc., 670 F. 2d 43 (1982). No taking occurred in decision by local levee district and by Corps of Engineers not to locate hurricane protection levees on certain lands although levees were provided on other lands.
- Annicelli v. Town of South Kingstown, 463 A. 2d 133 (R.I., 1983). Court held that prohibition of construction on a heavily developed barrier island subject to hurricane damage was a taking of property where environmental values rather than hazards were heavily emphasized in regulation.

A modest number of lawsuits have been filed against governments for actions that increased erosion damages. The following court cases map out entitlements, limitations, and inverse condemnation decisions:

- Owen v. U.S., 851 F. 2d 1404 (Fed. Cir., 1988). Erosion allegedly caused by government dredging in river which caused collapse of house could constitute a compensable taking.
- Ballam v. U.S., 552 F. Supp. 390 (D. S.C., 1982). Erosion caused by wave wash along coastal water was a "continuous taking." Plaintiff was entitled to damages for valued land lost through erosion and for cost of protecting property from future erosion. However, recovery was limited to changes within 6-year statute of limitation period.
- Souza v. Silver Dev. Co., 164 Cal. App. 3d 165, 210 Cal. Rptr. 146 (Cal., 1985). City held not liable under a theory of inverse condemnation for city's use of creek as part of storm drainage system which caused stream bank erosion due to inadequate proof of causation.
- Baskett v. U.S., 8 Cl Ct. 201 (Cl. Ct., 1985). Government potentially liable for flooding and erosion but no liability due to lack of proof of causation.

Challenges made to erosion-related regulations sometimes prohibit removal of sand and gravel or prohibiting or setting minimum standards for development in erosion-prone areas, such as the following case:

- Rolleston v. State, 266 S.E. 2d 189 (Ga., 1980). Court held that Georgia's beach was constitutional and that denial of permit for landowner to construct a bulkhead while permitting others to build bulkheads, was not a taking.

In some instances there are special issues with regard to hazard-related litigation. We will discuss what this means in relation to flooding and subsequent sedimentation liability.

Unprecedented weather beyond scientific foreseeability can bring expensive lawsuits into play, imposing hefty liabilities upon the government. This makes reasonableness of actions difficult at best. Courts and juries must decide whether events are foreseeable, bearing in mind reasonable and unreasonable actions due to possibility of occurrence and hazard mitigation options available.

The issue in determining the reasonableness of government actions is not simply whether hazards are foreseeable (because they are becoming increasingly foreseeable) but under what degrees of risk individuals and governments must take actions to protect others. For example, there is always a mathematical possibility that a dam will be overtopped and destroyed by a truly extraordinary rainfall or an earthquake (e.g., once in 500 years, 1000 years) killing many. See, for example, Barr v. Game, Fish and Parks Commission, 497 p. 2d 340 (Col., 1972) in which the court held an agency responsible for a "maximum probable" flood.

Insofar as the "Good Samaritan" doctrine applies to governments in hazard contexts, courts and juries alike face difficult decisions even according to classic negligence theory, which is that governments are liable for lack of due care when they act as good Samaritans and undertake actions that they are not required to undertake such as, e.g., Indian Towing v. United States 765 S. Ct. 122 (S. Ct., 1955). Because issues of overall equity and public policy are considered by the courts, complication arises in the application of strict legal doctrines. For instance, if a landowner living in a floodplain sues the government over a faulty warning system, the landowner may collect twice from the government: once for the faulty warning system and a second time for alleged losses.

The almost total lack of successful landowner actions against the government due to inadequate maps, warning systems, flood insurance, disaster assistance and other nonstructural mitigation measures suggest that courts are reluctant to find governmental units liable in such contexts.

The trend in recent years at all levels is to shift government costs of occupancy of flood hazard areas to the landowner. In 1965, the Federal Task Force on Flood Control recommended "those who occupy the floodplain should be responsible for the results of their own actions." (A Unified National Program for Managing Flood Losses, H.R. Doc. No. 465, p. 3, 89th Congress 2d sess. 1966) (U.S. House of Representatives 1966). To date, cost-sharing requirements for federal flood loss reduction and reduced federal spending on flood damage issues support this philosophy. The interdependencies of liability suits with various hazard mitigation and disaster assistance programs such as FEMA's Project Impact suggest improved approaches for better coordination of liability and hazard mitigation and disaster assistance efforts across a broad spectrum (FEMA 2000b).

According to Kusler's findings, the relationship of court decisions to public policy support major hazard-related government programs that consist of laws and administrative guidelines that include the following key elements:

- A land planning and regulatory element preventing or controlling private and/or public development in high risk areas and establishment of a performance standard for development in low risk areas. Areas consistent with federal standards are given incentives on state and community levels of federally subsidized flood insurance. Federal agencies directly plan and control public/private activities on federal lands. Also, a limited measure of federal control is provided in some hazard areas such as flooding, subsidence and erosion through the Army Corps of Engineers Section 10 and Section 404 permit programs as well as by a variety of licensing statutes and federal permits. "The principal goal of these planning and regulatory efforts at all levels of government is to prevent private and public landowners from using their lands in a manner that will increase natural hazards on other lands, threaten public safety, or increase government natural hazard costs in other ways. Please note that these efforts are designed to prevent future problems while the common law tends to operate after-the-fact.
- Hazard prediction, mapping, warning and evacuation planning elements, not regulatory in nature tend to help inform the public and private sectors and other decision-makers just where hazards fall and the severity of risk per location. "Tort law and cases to date are, overall, consistent with government programs to encourage private and public actions to reduce potential losses since the overall trend in tort law is toward a reasonable use standard." Reasonable use standards require landowners to reasonably foresee hazards and take actions according and consistent to the foreseeable risk. "Tort law and contract-based actions such as the implied warranty of suitability for new residence help give teeth to and implement these non-regulatory efforts."
- Hazard reduction elements that include the construction of dikes, levees, reservoirs, beach nourishment, erosion control works, etc. Although smaller structures and projects have been accomplished at the state and local levels, most major hazard reduction measures in the case of flooding and erosion has been the responsibility of the federal government. "Tort law tends to discourage or add to the costs of such hazard reduction elements. As has been discussed, most successful tort cases to date have arisen with the design, operation, and maintenance of such structural measures. Most of the successful inverse condemnation cases have also arisen with these structures." In order to reduce potential liability suits, the government has been motivated to construct hazard reduction measures.
- A disaster-assistance element that includes assistance and rescue at the actual time of disasters such as emergency foods, medical care, temporary shelter, and post-disaster loans and grants also includes federally subsidized flood and erosion insurance. "Most of the funding for such disaster assistance efforts comes from the federal government while relief efforts are carried out on the state and local levels.

As a result of a Federal Task Force on Flood Control Policy in 1965 (Task Force on Federal Flood Control Policy, A unified National Program for Managing Flood Losses, H.R. Doc. No. 465, p. 3, 89th cong., 2d sess. 1966), a key policy for flood plain areas is, "Those who occupy the flood plain should be responsible for the results of their own actions." The upshot of this task force report serves as a blueprint for floodplain management at the national level over the past three decades. During the 1970s and 1980s, progress was made by reducing federal spending on hazard reduction measures by requiring that landowners in hazardous areas conduct their activities in a manner that keeps losses to a minimum:

- Flood loss reduction measures such as dams, dikes, and levees require a local cost share 25%.
- Emphasis upon nonstructural loss reduction measures such as flood plain regulations and warning systems funded privately.
- Cost-bearing by those in hazard areas directly related to potential losses.

But, rules evolve as the nation shifts from large national debts and growing budget deficits to a stronger economy. The rules, over a period of centuries, compensate one landowner for damages his or her actions may impose on other landowners (nuisance) or other individuals (negligence). As society continues to demand a high level of public and individual safety, the protection of this demand grows legislatively. Not only is the moral ethic ingrained in our national fiber to help those plighted by floods but America's high standard of protection for public health and safety is supported by tort and contract-related liability cases.

The nuisance suit in conjunction with broader regulations for land use when it comes to protection of the environment allows landowners to prevent industrial uses in a residential area. **Common law** practice enables private citizens who own land to prevent some types of potential water polluters through suits based upon riparian rights. However, due to limited abilities, common law suits are not able to allow governments or private sectors a broad planning objective.

Goals for the ***reasonable*** use of both private and public hazardous areas are both explicit and implicit in most government natural hazard programs. All hazard prevention and use measures tend to encourage or support "reasonable" use. "In general, both public and private landowners are responsible for 'unreasonable' conduct in light

of the conduct of others." Courts consistently uphold that landowners have no property right to use their land in situations where actions would not be permitted under ***common law***.

In general, disaster assistance and subsidized insurance are limited and, therefore, larger damage awards for specific damages and losses are available through *liability suits*, which are for the most part inefficient. In the situation where disaster insurance is not offered, governments may be sued for confirmed damages. But liability suits take an average of 4 to 10 yr to settle and most landowners are too poor to pursue this costly, hard-to-prove-fault type of legal action. Liability suits also may result in double-dipping, whereby lawyers and landowners get paid from policies and suits. In addition, this type of case adds to the cost of hazard measures themselves. The most successful liability suits have been the result of negligent design or badly operated hazard reduction measures such as a faulty dam or erosion control gone awry. Overall, the government views liability cases as a threat to its budget and hazard-reducing programs.

- For example, a community at risk might reduce that risk with the construction of a dike reducing flood elevations below natural levels, where the community has raised natural flood heights substantially over a period of years through bridge construction.
- Flood warning systems, evacuation plans, and other loss-reduction techniques can reduce liability potential if properly designed, operated, and maintained.
- Government insurance and disaster assistance programs can reduce the number of suits filed if customers are quickly compensated for their losses.
- Direct-pay compensation programs are relevant in some courts as a cause of action under the facts. See North Carolina Supreme Court, in ***Responsible Citizens v. City of Asheville***, 302 S.E. 2d 204 (N.C., 1983), which upheld floodplain regulations against constitutional due process and taking challenges and which noted that plaintiffs were "benefitted" by enactment of the regulations because they qualified the community and the plaintiff for federal flood insurance.
- Regulation may somewhat reduce lawsuits by provision of a general standard of care for governments, private architects, and the like rather than a nebulous unquantified standard of "reasonableness" in a given circumstance.

Loss reduction and mitigation programs enhance the potential for successful lawsuits in some contexts:

- Government subsidy policies for disaster victims in high-risk areas can increase liability awards.
- Regulations can increase potential liability for public and private individuals who fail to comply with government regulations.
- Various mapping and hazard prediction techniques as part of insurance parcels and zoning, warning, or other loss-reduction programs can increase foreseeability of hazards.
- New techniques improperly applied or failure of application when affordable and available and when not applied before a disaster, foreseen or not, thus causing high death rates, may be considered "unreasonable" and result in adverse liability decisions.

Disaster assistance and loss reduction measures such as flood control, avalanche control, and storm drains, when applied in a professional, timely, and expert fashion, tremendously reduce potential government losses in liability suits. This involves decision making for structural hazard reduction measures because of the high incidence of successful suits related to such measures; administrative measures; education on the local level; prevention of double-dipping; beefed-up government lawsuits against negligent private landowners who cause public liability; and recovery of government losses per legal rules to discourage hazard-related losses. See ***United States v. St. Bernard Parish*****,** 756 F. 2d 1116 (5th Cir. 1985).

Subrogation, a familiar insurance concept is defined in Black's Law Dictionary as follows:

> A legal fiction through which a person who, not as a volunteer or in his own wrong, pays the debt of another, is substituted to all rights and remedies of the other, and the debt is treated as still existing for his benefit.

The Standard Flood Insurance policy that is issued by the Federal Government specifically states that:

> In the event of any payment under this policy, the Insurer shall be subrogated to all the Insured's rights of recovery therefore against any party, and the Insurer may require from the Insured an assignment of all rights of recovery against any party for loss to the extent that payment therefore is made by the Insurer.

Government agencies that compensate landowners with disaster assistance, flood insurance and the like can potentially become the subrogees of rights of actions for flood, erosion, and other types of damage caused to the recipients of the disaster assistance, insurance, or payments by private individuals or any other public entities. See, e.g., ***United States v. Dold*****,** 462 F. Supp. 801 (D.C., S.D., 1978).

See also ***United States v. St. Bernard Parish***, 756 F. 2d 1116 (5th Cir., 1985) in which the U.S. government sought over $100 million from various Louisiana public and private defendants for flood damages which the federal government alleged were caused by failure to adopt and administer floodplain regulations that met the minimum standards of the N.F.I.P. "In this case, the U.S. Court of Appeals held that no 'contract' right existed between the federal government and the parishes which could serve as the basis for a subrogation

suit." It also held that the government could pursue damages under common law subrogation theories permitted by Louisiana law. Ultimately the federal government and the parishes settled this case.

Although by the 1990s there were few federal subrogation suits, the suits that were initiated in the 1980s attracted a great deal of attention across the nation and had an educational and enforcement value much greater than the actual recovery monies. They set a precedent for future suits, particularly if legislative changes provided an express contract basis for such suits.

The goal (in liability suits) should be not only to reduce government liability but also to promote responsible government and decision-making with natural hazards factored into the process. More specifically, administrative, legislative, and judicial approaches to achievement of these goals are paramount.

20.6 VARIOUS DEFENSES

Defenses based upon rules of law are decided by the courts, by judges. Defenses built on fact are decided either by juries or by judges in a trial without a jury. The general rule of thumb for cases based on the former defense (rules of law) is to raise questions/challenges during the preliminary pleadings stage through a process known as "demurrer's" or requests for "summary judgment" because at this stage, if successful results materialize, the case can be dismissed before trial. "From a government perspective, an early victory in a natural hazards liability-related case is especially desirable due to the high costs of expert witnesses and attorney's fees if the case goes to trial." The latter case based on questions of fact, such as "act of God" cases, must be proved during trial.

In any case, plaintiffs suing governments under all theories of action (common law, statutory, constitutional) must prove that:

- the government owed them a duty;
- the government breached said duty;
- the plaintiff suffered damages; and
- the breach of duty was the cause of the damages.

The burden of proof is on the plaintiff to "prove all of the essential facts that form the basis for his or her liability claim. This is true for all theories of action."

The most common successful challenges to a plaintiff's proof of essential facts in tort-based cases include the failure to establish "unreasonableness" when it comes to defendants actions in relation to negligence or to establish causation. On the other hand, the most common successful challenge to a plaintiff's proof of facts in a hazard-related regulatory takings case is the failure to show that regulations, as applied, deny all economic use of land.

The government cannot take private property in a hazard-prone area without just compensation. The hitch is that governments can reduce private land values through regulations adopted for proper goals when those regulations are adequately related to those goals. Courts are agreed that such land reductions labeled as "damages," often more severe than those serving as the basis for tort actions, are noncompensable as long as there is no physical interference with respect to the use of private land. So long as due process and equal protection have been a provision, and there is no taking of private property, courts are increasingly applying a "denial of all economic use test" in these cases. That being said, differences in allowable impacts as well as in the nature of these impacts; such as physical interference versus permissible uses, explain, in part, the great number of successful liability suits against governments operating as landowners, and on the other spectrum, the very small number of successful takings cases against governments acting as regulators of private property.

Governments claim that there is no breach of duty in tort-related, contract-related, or fact-driven cases. "Since most hazard-related cases are based upon claims of negligence, governments can rebut an allegation and attempted proof of breach of duty by establishing the reasonableness of government conduct in the circumstances taking into account the nature of the activity, the foreseeability of the hazard, the severity of the hazard, the possible impacts of government actions on landowners, and other factors." Constitutionally based suits in general are a judicial question, breach or no breach. See ***Belair v. Riverside County Flood Control District***, 253 Cal. Rptr. 693 (Cal., 1988), in which a determination of "negligence" in construction and maintenance of levees was necessary to establish an inverse condemnation claim.

Causation is straightforward in constitutionally based regulatory takings cases, as reductions in property values are caused by regulations but causation is hard to prove when the validity of basic regulations and impacts upon private lands is the issue.

Bearing in mind that no property will be taken if there is no damage, a plaintiff must prove damages in an inverse condemnation case. Exceptions exist when property is taken through public entry onto private land when no damages can be shown for such entry. See ***City of Austin v. Teague***, 570 S.W. 2d 389 (Tex., 1978) whereby the court held that regulations took property with no awards because plaintiff failed to prove specific damages.

20.7 SOVEREIGN IMMUNITY

There is no taking without proof that regulations deny all economic uses. Courts have quite often held that landowners cannot show a taking until they have exhausted all administrative remedies proving once and for all that they are "deprived" of all economic uses. This lies under the category of "Sovereign Immunity" which continues to be the most essential defense to tort suits against governments. See *Little v. City of Myrtle Beach*, 279 S.E. 2d 131 (S.C., 1981), whereby the city was not liable for alleged defects or negligent management of drainage facilities that caused flooding, due to sovereign immunity.

Sovereign immunity is a doctrine adopted by American courts from English common law after the American Revolution was won. It is based upon the concept that the "king can do no wrong," or at the very least, that the king is not responsible for his wrong. This concept has of course been broadly criticized as inappropriate for a nation without a king and particularly, a nation with strong egalitarian principles and strong restraints upon government action vis-à-vis the Constitution. Nonetheless, in the 19th century, the doctrine was applied to all levels of government and in 1834, the Supreme Court held that sovereign immunity applied to the federal government. See ***United States v. Clarke***, 33 U.S. (8 Pet.) 436 (S. Ct., 1834). At the state level, courts have held that states have nearly complete sovereign immunity and municipalities and counties less. See, e.g., ***Heffner v. Montgomery County***, 545 A.2d 67 (Md., 1968).

It is interesting to note that over time, the courts have provided a variety of explanations for adherence to this doctrine (Huffman, 1988, p. 449). For example, in 1868, the U.S. Supreme Court in the Siren, 74 U.S. (7 Wall.) 152, 154 (1868) observed that it was "obvious that the public service would be hindered and the public safety endangered" if the state could be sued and "consequently controlled" by its citizens. The Court also argued in another case that without sovereign immunity "government would be unable to perform the varied duties for which it was created." See ***Nicholos v. U.S.,*** 74 U.S. (7 Wall.) 122, 126 (1896).

During the last three decades of the 20th century, exceptions to the general rule involving sovereign immunity even at common law, have been rapidly expanded by judicial or legislative action or a combination of both. See ***Kind v. Johnson City***, 478 S.W.2d 63 (Tenn., 1971) where sovereign immunity defense does not apply to nuisances; and see ***Callaway v. City of Odessa***, 602 S.W.2d 330 (Tex., 1980) where the city may be liable when negligence becomes a nuisance although immune for negligence. "Sovereign immunity has also not been a defense to governmental violation of constitutional rights, including violation of due process and taking of private property." On the state and local levels, lawsuits involve the government when regarded in a proprietary role in connection with negligence.

See ***Enghauser Manufacturing Company v. Eriksson Engineering Ltd.,*** 451 N.E.2d 228 (Oh., 1983), for example of a judicial abrogation of sovereign immunity doctrine. In this case, the Ohio Supreme Court abolished municipal immunity and held that a municipality could held liable for negligently planning, designing and constructing a bridge and roadway that resulted in flooding of industrial property. Equally or even more important, Congress and state legislatures have adopted Tort Claim Acts and other legislation that restricts the defense of sovereign immunity with regard to tort claims. The trend is to duty to the individual versus public duty.

There are four situations in which governments are generally subject to a special duty of care to a particular plaintiff or class of plaintiffs:

- legislative intent: when the terms of a legislative enactment evidence an intent to identify and protect a particular and circumscribed class of persons;
- failure to enforce: where governmental agents responsible for enforcing statutory requirements possess actual knowledge of a statutory violation, fail to take corrective action despite a statutory duty to do so, and the plaintiff is within the class the statute intended to protect;
- rescue doctrine: when governmental agents fail to exercise reasonable care after assuming a duty to earn or come to the aid of a particular plaintiff;
- special relationship: where a relationship exists between the governmental agent and any reasonably foreseeable plaintiff, wetting the injured plaintiff from the general public and the plaintiff relies on explicit assurances given by the agent or assurances inherent in a duty vested in a governmental entity. (Id. at 1260)

See also Glannon (1982).
Statutory exceptions include acts and modifications:

- Federal Statutory Exceptions and the jurisdiction of the Court of Claims were expanded by the Tucker Act in 1887 and by later acts to follow, including claims based upon the Constitution, law of Congress, regulations of executive departments or contracts with the U.S., and patent infringements. 24 Stat. 505 (1887); 36 Stat. 85 (1910); 28 U.S.C.A. 1498 (1973); 28 U.S.C.A. 1346 (1976).
- In 1946, Congress adopted the Federal Tort Claims Act, which was a general waiver of sovereign immunity for "injury or loss of property or personal injury or death caused by the negligent or wrongful act or omission of any employee of the Government while acting within the scope of his office or employment, under circumstances where the United States, if a private citizen, would be liable to claimant in accordance with the law of the place where the act or omission occurred," 60 Stat. 812, title 4 (1946); 28 U.S.C.A. at 2672 (1965). This act is mentioned because it contains 13 exceptions, 2 of which are particularly relevant to claims that are a result of natural hazards. The first and more important is the "discretionary function" exception, which excepts from the act any claim based upon the failure to exercise or perform a discretionary function or duty, whether or not the discretion involved involves abuse (emphasis added), 28 U.S.C.A. 2680(a) (1965). The second exception excepts from the act any claim "arising out of misrepresentation, deceit, or interference with contract rights"(emphasis added), 28 U.S.CC.A. 2680(h) (1965).

U.S. courts are deciding if weather forecasts are the exercise of a discretionary function. The courts have consistently held that forecasts are, in themselves, discretionary. See, e.g. ***Brown v. United States***, 790 F. 2d 199 (1st Cir., 1986): N.O.A.A. could not be sued for failure to predict a hurricane. But, in ***Pierce v. United States***, 659 F. 2d 617, 621 (6th Cir.,

1982), the 6th Circuit held that "(s)ince the FAA has undertaken to advise requesting pilots of weather conditions, thus engendering reliance … it is under a duty to see that information which it furnishes is accurate and complete."

An extremely important statutory exemption for negligence is contained in section 702c of the Federal Flood Control Act of 1936, 33 U.S.C.A. 702c (1986). Section 702c exempts the federal government for liability for "negligence" associated with the design, operation, and maintenance of any given federal flood control facility.

When federal flood forecasts and federal floodplain mapping are characterized as "flood control" measures by lower federal courts, they are not subject to tort actions for negligence. Flooding is by far the most common basis for hazard-related liability suits against the government; therefore, the federal government has been principally responsible for the construction of all major flood control dams, dikes, levees, sea walls, and channelization projects. It is no surprise that this exception has acted to bar many lawsuits and has been challenged a number of times by claimants involved. See ***United States v. James***, 106 s. Ct. 3116 (S., Ct., 1986), where private tort actions for damages based upon federal negligence at a flood control facility was interpreted by the U.S. Supreme Court. The court held that the Corps of Engineers could not be held liable in situations where recreational water users were swept into dams when the Corps opened these structures in order to control flooding.

20.8 STATUTES OF LIMITATIONS

In general, statutes of limitations applying to architects and engineers now start to run from the time of construction rather than from an injury. See ***Klein v. Catalano,*** 437 N.E. 2d 514 (Mass., 1982).

Limitations that begin running at the time of design or construction provide a low probability of recourse for someone damaged by design errors or negligence during a severe but very infrequent flood, erosion event, or other natural disaster. The probability in these cases is only 1 in 20, according to Kusler, that a negligence action would arise for a 100-yr event within the time period allocated by a 5-yr statute of limitations where the statute begins to run from the initial design rather than from the time of injury.

20.9 HAZARD MITIGATION MEASURES BASED UPON TORT THEORIES

Courts have repeatedly held that governments at all levels must use reasonable care. Most successful cases against the government involve situations where mitigation measures increased natural hazards and damaged individuals not intended as the beneficiaries of such measures. A good example is a flood control measure that floods upstream properties (a nonbeneficiary).

Examples where courts have held that the basic decision to protect or not is not subject to liability, under theories of either no duty or discretionary function, include the following cases:

- ***Tri-Chem, Inc. v. Los Angeles County Flood Control District***, Los Angeles County, 132 Cal. Rptr. 142 (Cal. App., 1976), where the State has no duty to construct a flood control system for an area that acts as a natural sump.
- ***Deville v. Calcasieu Parish Gravity Drainage Dist.*** No. 5, 422 so. 2d 631 (La., 1982), where the city was not liable for a child falling into a storm drain where the drainage district normally maintained the drain and the city maintained it only during floods.
- ***Goldstein v. County of Monroe***, 432 N.Y. S. 2d 966(N. Y.A.D. 4th Dept., 1980), where a municipal corporation is not liable for failing to restrain waters between the banks of a creek or to keep a channel free from obstructions it did not cause.

A decision worth examining is the Supreme Court case ***Julius Rothschild and Co. v. State of Hawaii***, 655 p. 2d 877 (Haw., 1982) due to in-depth discussion of factors concerning reconstruction of a two-span bridge with the capacity to convey a 25-yr storm. A flash flood caused warehouse damage and the plaintiff argued that the replacement span was inadequate in light of a hydraulic design report prepared by a firm contracted by the state prior to the reconstruction. The report had recommended replacement of the bridge deck consistent with a 50-yr frequency design criterion.

In another case, ***PDTC Owners Ass'n v. Coachella Valley County Water Dist***., 443 F. Supp. 338 (D. Cal, 1978), the court held that owners of land damaged by flooding could not recover compensation from the water district under the Fifth and Fourteenth Amendments for failure to construct a levee large enough to protect landowners from a 50-yr flood. The levee in question had been constructed of sand and provided protection only from a 30-yr flood. The court held that the landowners might be able to recover any damages for negligent construction and maintenance. Also, in ***Vanguard Tours, Inc. v. Town of Yorktown***, 442 Y.Y.S. 2d 19 (N.Y., 1981) the city was not liable for failure to install a drainage system that adequately disposed of surface waters, but the city must rather use care in maintenance of such systems.

Such cases lead to the subject of adequacy of the design which all boils down to reasonableness of care and implied warranties. In cases where the actual construction of a government measure is faulty, nondiscretionary task and government forces may be held liable for negligence of government employees or contractors not properly supervised. See ***Price v. United States***, 530 F. Supp. 1010 (S.D. Miss., 1981), where the Corps of Engineers was liable for the negligence of

a contractor who dredged an area subject to hurricane damage, thus creating a deep hole, and subsequently failed to provide warnings. In general, operation or administration of a hazard mitigation measure is considered ministerial and governments are responsible for negligence.

By the same token, maintenance of a mitigation measure is considered ministerial and governmental units are responsible for negligence. See ***Carlotto Ltd. V. County of Ventura***, 121 Cal. Rptr. 171 (Cal., 1975), where a California court held a county liable for inadequate maintenance of a "debris basin." "The county had failed to maintain the debris basin behind the dam with the result that only 2.5 acre feet of its entire 12.7 acre feet of water storage remained and damages resulted."

20.10 MORE ON THE TAKINGS ISSUE: EXPANDED STATUS AND TRENDS IN TORT AND TAKINGS LAWS

Successful regulatory takings cases in connection with hazard-related regulations are outnumbered 500 to 1 by successful tort cases holding governmental units liable for increasing losses due to hazards. Lopsided fear of "taking" is out of proportion due to several factors:

First, takings cases are given inordinate attention by the press. Supreme Court decisions receive front-page press coverage across America. Unfortunately, it is a sign of the times, more often than not, that the press coverage is inaccurate, speculative, and paranoia-driven.

Second, there is a deep-seated belief that "taking" private property without just compensation is morally wrong. This ethic contrasts with negligence, breach of contract, or other typical torts that do not carry the same weight as a moral stigma. The U.S. Constitution prohibits "taking" without compensation.

Third, successful takings cases could have severe political repercussions for bureaucrats and legislators who authorize the very taking itself. These law abiders must answer to an electorate on this sensitive issue of "taking."

Fourth, a regulatory "taking" has its limits mainly due to the fact that governments are not positioned with established administrative procedures or funding for payment in conjunction with a regulatory taking. Usually, each case is handled individually through legislative appropriation. Unappropriated funds prove disruptive to government operations. However, a large unanticipated expense for a blizzard or even a large tort liability award due to highway construction, for example, is usually not an issue because eminent domain funds already exist.

Fifth, misunderstandings abound on government levels due to unclear concepts of what is or is not a taking. This inability to adjust measures to avoid "takings" is partly due to a lack of clear judicial guidance on the takings issue. The case-by-case approach to taking issues utilized by the court system involves a variety of tests to determine whether actions to "take" property are contributing factors.

Almost all hazard-related takings cases (regulatory and nonregulatory) deal with flood losses or floodplain regulations. This is due to the pervasiveness of flood and erosion problems throughout the United States as well as the many contexts in which government actions may increase flood damages on privately held lands.

Courts have traditionally held that governments may, in some instances, destroy private property during a disaster to prevent the spread of the disaster or may require the razing or raze private structures which are dangerous after a disaster.

See ***Boland v. City of Rapid City***, 315 N.W. 2d 496 (S.D., 1982) where the city had the power to destroy flood-damaged private houses after the Rapid City Flood of 1972 to alleviate public health problems but the city also had the burden to prove that houses created public health problems a nuisance. The city had not done this and was liable for a "taking."

In ***Oswalt v. County of Ramsey***, 371 N.W. 2d 241 (Minn., 1985) the court held that a landowner was entitled to compensation for the county's refusal of a permit to repair a flood-damaged house. The house was a valid nonconforming use under an ordinance, but the county had failed to consider the "useful life" of the proposed improvement for purposes of amortization and had instead, in effect, condemned the use by refusing to issue a building permit.

20.11 UPSTREAM VERSUS DOWNSTREAM LEGAL ISSUES

Unlike land, water is transient and moves.It recognizes no political boundaries. Therefore, water is legally and historically a public resource although water rights can be obtained. Private rights to water are often incomplete and subject to the public's common needs (CSI 1999). The transfer of water rights must go through the proper legal channels for the state; for example, ***Tyler v. Wilkinson*** is a case that adopted the reasonable use standard.

Other boundary disputes that went to the U.S. Supreme Court include the following:

- ***Georgia v. South Carolina***, 497 U.S. 376 (1990), a suit over the location of a boundary along the Savannah River, downstream from the city of Savannah and at the river's mouth, and the lateral seaward boundary. Historically, the treaty between these states declared

that "where there is no island in the river, the boundary is midway between the banks, and where there is an island, the boundary is midway between the island and the South Carolina shore (Georgia v. South Carolina)." The Special Master (above) submitted two Reports, making several boundary recommendations, but both states filed exceptions.

> Either state stands to lose riverbed as a result of natural erosion by the river; likewise, each state has the potential of acquiring additional riverbed as a result of accretion and erosion. For example, if an island existed in 1787 but was subsequently eliminated by gradual erosion, the boundary would be moved to the advantage of South Carolina, and the riverbed previously owned by Georgia would then be owned by South Carolina (Georgia Exceptions 56).

Part of Georgia's fourth exception included the small, unnamed islands upstream and downstream from Pennyworth Island. Georgia's exception was overruled and The Special Master's determination adopted a "forever after" boundary on behalf of South Carolina due to the theory that the South Carolina shore, over time, would create a regime of continually shifting jurisdiction, by creating a new "northern branch or stream" for even the smallest emerging island, thus frustrating the original state treaty [497 U.S. 376, 377]. The avoidance of sudden boundary changes and respect for settled expectations that generally attend the drawing of interstate boundaries, cf. ***Virginia v. Tennessee***, 148 U.S. 503, 522–525, pp. 394–398, was cited.

- ***Oklahoma v. New Mexico***, 501 U.S. 221 (1991), was concerned with an enlargement of the Ute Reservoir and a violation of the 200,000 acre-feet limitation law on New Mexico's constructed reservoir capacity available for conservation storage downstream from Conchas Dam, and with a so-called "desilting pool" exempt from the Article IV limitation, because it was not allocated solely to "sediment control." Floods from Canada affected the storage basin in the downstream states. The Court abandoned the literal text of the Compact and searched for a new interpretation of the "originating" due to the fact that the Compact would otherwise allow New Mexico to lay claim to any water originating above Conchas Dam, including tributaries that arose in boundary states.

20.12 ACT OF GOD DEFENSE

Since the sixteenth century, courts have recognized "act of God" as a common law defense to negligence, nuisance, trespass and even, in some instances, takings cases. The act of God defense has also been incorporated into some statures. See 33 U.S.C.A. 1321(a)(12)(1986), "an act occasioned by an unanticipated grave natural disaster."

The "act of God" defense is based upon the belief that one should not be held responsible for what cannot be reasonably anticipated or guarded against. It is a defense that must be affirmatively pleaded and proven by the defendant. It is a defense that was at one time much more broadly allowed by the courts. Today the defense is most often narrowly construed. See, e.g., ***Sabine Towing and Transp. Co., Inc. v. U.S.***, 666 F.2d 561 (Ct. Cl., 1981). (Spring runoff was not "act of God" which would excuse an oil spill.)

Cases dealing with "act of God" defenses focus on two important hazard issues that are common to all such cases: the predictability of various hazards, and the magnitude of events, such as destructive force and return frequency, which need to be addressed by public and private landowners.

Verifying "act of God" is another story. In order to prove such a case, the defendant must establish, to the satisfaction of the jury or court, that (1) the event falls within the legal definition of "act of God" and (2) the "act of God" and not the defendant's negligence was the proximate cause of the disaster.

Courts are in agreement that the defendant must more specifically prove that

- the event is an act of mother nature (hurricanes, storms, earthquakes, floods), not caused by human agency;
- the event is "extraordinary" in magnitude or size;
- the event and resulting damages could not reasonably have been anticipated or prevented; and
- the event was the proximate cause of the damage or injury.

The difficulty arises in the proof. Was the event an act of nature? An "act of God" is defined as an event that is due directly and exclusively to natural causes without human intervention. Kusler cites ***Northwestern Bell Tel. Co. v. Henry Carlson Co.***, 165 N.W. 2d 346, 349 (S.D., 1969). See also ***Dempsey v. City of Souris***, 279 N.W. 2d 418 (N.D., 1979), as another example of events that fall under the "act of God" category. Although meteorological events (hurricanes, storms, tornadoes, lightening) and geological/geomorphological events (erosion, landslides, earthquakes) continue to occur as they have throughout history, the actual causative elements of many events are no longer totally natural. Rains fall naturally but the height, velocity, and volume of floodwaters depend upon watershed uses, dams, dikes, levees, and many other alterations. Similarly, erosion has often been greatly impacted by human activities, as have landslides, mudslides, and wildfires.

Some courts have required that in order for an event to be classified as an "act of God" the event must be "unprecedented." An example cited is the Alabama Supreme Court decision in ***Bradford v. Stanley***, 355 So. 2d 328, 330 (Ala.,

1978) which observed that: "In its legal sense an act of God applies only to events in nature so extraordinary that the history of climatic variations and other conditions in the particular locality affords no reasonable warning of such events." However, with historical techniques now available, the occurrence of events over the last several thousand years is sometimes documented. In much of the world as we know it, there are historical written records of catastrophic floods, hurricanes, earthquakes, and other terrible storms that date back thousands of years. Paleo-flood studies combined with carbon dating and supplementary dating methods provide additional documentation. In addition, studies of tree rings, sediments, and soil science are providing quite specific documentation for large-scale hazard events at given locations.

If events are not unprecedented, courts have held that they must be at least extraordinary from a scientific and not simply a layman's perspective. One example is the U.S. Court of Appeals, District of Columbia Circuit in ***Shea-S&M Ball v. Massman-Kiewit-Early***, 606 F. 2d 1245 (1979), which rejected the "act of God" defense by a contractor where waters from his construction site overflowed during heavy rains resulting in damage on a second construction site. In this case, the court found insufficient evidence in the record to support a finding of an act of God and they noted that "The record is completely devoid of any evidence of the normal range of rainfall in Washington, D.C., and (they contended that) the amount of rain that actually fell during the time periods when the floods occurred" (Id. At 1248). The court, therefore, concluded that heavy rainfalls are not considered acts of God unless they are unusual and extraordinary and quoted with approval from an earlier case, *Garner v. Ritzenberg*, 167 A.2d 353, 354–65 (D.C., 1961):

> We take judicial notice that rains of heavy intensity and average duration are occurrences of common experience. This event was described as a flash flood. People often use that expression in describing accumulations of rainwater running off along natural or artificial contours of the ground; but that imports no particular legal significance. Such events, though infrequent, are to be expected. They do not create the widespread devastation commonly associated with earthquakes, tornadoes, hurricanes or extraordinary floods. The occasional filling of low-level or basement areas by rainwater is a probable and foreseeable result of a heavy rain. To classify it as an act of God is an unwarranted extension of that doctrine not supported by the authorities.

Due to the fact that predictability of events has become more accurate through modeling techniques for flooding, earthquakes, volcano eruption, hurricane tracking, etc., courts do not require that such events be specifically predictable with a "foreseeable" date and place; it is enough that such events could have been expected. Therefore, events with particular assigned recurrence intervals have persuaded a number of courts to consider the foreseeability of hazard events in a new light.

One such example resulted in a rejection. In ***Barr v. Game, Fish and Parks Commission***, 497 p. 2d 340 (Col., 1972) the Colorado Court of Appeals rejected an "act of God" defense for flooding, erosion, and silt deposition damage caused by construction of a dam with an adequate spillway by the Colorado Game, Fish and Parks Commission. The court held that a "maximum probable storm, by definition, is both maximum and probable." In the end, the court agreed (Id., at 344) with the lower court that had concluded,

> (W)ith modern meteorological techniques, a maximum probable storm is predictable and a maximum probable flood is foreseeable. Thus being both predictable and foreseeable to the defendant in the design and construction of the dam, the defense of an act of God is not available to them. In short, the flood that occurred in June of 1965 could not be classified as an act of God.

Therefore, the court concluded that the above dam should have been designed to meet the requirements of the maximum probable flood—200,000 cfs at this point of the stream. Proving that the event in and of itself was the proximate cause of the damage or injury is often difficult due to the fact that the defendant's actions (as in a negligence case) may also be part of the proximate cause. For example, storm waves from a hurricane may badly erode a beach, but the actual damage may also be caused, at least in part, by defendants' construction of a groin or seawall along another portion of the same beach.

There is a general rule in place that states that when a natural event concurs with acts of the defendant to produce the injury, the defendant is not liable if the event would have independently produced the damage without the defendant's transactions. Some well-documented cases include ***Fairbrother v. Wiley's, Inc.,*** 331 P. 2d 330 (Kan., 1958). The Maryland Court of Appeals in ***Mark Downs, Inc. v. McCormick Properties, Inc.,*** 441 A. 2d 1119, 1128–29 (Md., 1982) noted that an "act of God" will excuse mortal man from responsibility "only if God is the sole cause … where God and man collaborate in causing flood damage, man must pay at least for his share of the blame." Where the acts of man and the acts of God combine to cause damage, courts have generally held man responsible for the total damage. See also ***National Weeklies, Inc. v. Jensen***, 235 N.W. 905, 906 (Minn., 1931) in which the court stated:

> If the damage done was solely the result of an act of God, the city was not liable. If the negligence of the city approximately contributed and an act of God combined to produce the result, the city is liable.

"Act of God" has been a defense principally in tort cases. In some instances, however, it has been recognized as a defense in contract cases—for example, ***Firpine Prods. Co. v. Atchison, T. and S. F. Ry.***, 124 F. Supp. 906 (D.C. Mo., 1954). Other courts have disagreed with its application in contract contexts. For example, the Alabama Supreme

Court in ***Alpine Construction Company v. Water Works Bd. Of Birmingham***, 377 So. 2d 954, 956 (Ala., 1979) stated that

> Where one by his contract undertakes an obligation which is absolute, he is bound to perform within the terms of the contract or answer in damages, despite an act of God, unexpected difficulty, or hardship, because these contingencies could have been provided against by his contract.

20.13 FORENSIC GEOLOGY

Some turning points in forensic geology include the extensive use of aerial photography. According to *Forensic Geology,* by Raymond C. Murray and John C.F. Tedrow, the American Society of Photogrammetry has listed over 100 ways in which aerial photography serves a useful function from archaeological discoveries to finding modern burial sites. Altered soil conditions are key during court cases.

> During the course of an investigation, it is sometimes critical to establish the time of a certain activity, such as the filling in of wetlands, the digging of a borrow pit, the time a forest was cut, or when a structure was built or demolished. An aerial or ground photograph, with date, gives indisputable evidence as to the presence of physical features or landscape conditions at a specific time. (Murray, 1992)

Federal agencies such as the U.S. Geological Survey and the U.S. Department of Agriculture and military and commercial establishments take aerial photographs periodically. Aerial photographs are available through these various agencies, but the most comprehensive sets, including archives, may be obtained from the U.S. Department of Agriculture, ASCS, Aerial Photography Field Office, 2222 West 2300 South, Salt Lake City, Utah 84130.

20.14 FUTURE DIRECTIONS

The complex law of public liability for natural hazards is not easily summarized. According to Kusler, there are vast differences in the law of liability under tort, contract, and constitutional theories from state to state, particularly with regard to the sovereign immunity defense and the nuances of particular causes of action such as trespass. Although the precise theories and rules of law vary, overall theories of liability are identical, such as situations in which as government unit can be held liable for a particular act. A good example is found in local government, which in most states can be held liable for flooding private land by construction of public access. Of course, the law varies from state to state, but such an action could be based upon nuisance, violation of riparian rights, trespass, negligence, or inverse condemnation.

There is a general status of law throughout the nation, but particular attention should be rendered when it comes to jurisdiction. When it comes to reducing natural hazard losses through structural measures such as dams or nonstructural measures such as warning systems and regulations, officials, scholars and landowners are increasingly confused with regard to the liability potential of reducing natural hazards. It is a huge undertaking to reduce private losses from private use of public lands that are subject to flood, earthquake, or other hazards at the risk of damaging other private parcels. Flood control measures have a high potential for liability, while regulations are low-risk. However, a wide variety of low-cost measures are available to help reduce potential liability.

The majority of liability suits to date have involved governmental activities on public lands that cause damage to adjacent privately owned lands due to inadequate design, operation, or maintenance of roads, airports, utilities, reservoirs, dikes, dams, erosion-control structures, mudslide and landslide structures, or storm-water facilities. The lawsuits have been based upon nuisance, trespass, negligence, violation of riparian rights, strict liability, negligence or inverse condemnation theories of action.

> Although there is the potential for successful negligent suits based upon various nonstructural mitigation actions not related to government ownership and use of land such as inaccurate hazard maps, inadequate warning systems, inaccurate hazard predictions, inadequate dissemination of hazard information, inadequate emergency services, and inadequate administration or enforcement of regulations, few suits based upon such inadequacies have succeeded to date for several reasons. These actions are considered "discretionary" in nature by the courts and are also partially or wholly protected by sovereign immunity or statutory exemptions. (Kusler, unpublished work, 1992)

The *takings* issue is popular with the press because it is a strong political issue, but courts have overwhelmingly upheld hazard regulations against constitutional challenges. In the hundreds of appellate-level cases that involve constitutional challenges to regulations, courts have only held regulations unconstitutional as a taking of property in a few cases where regulations prevented all uses in relatively low-risk areas or an attempt was made to apply regulations retroactively to abolish hazard-prone structures without adequate documentation of the nuisance aspects. It is clear that natural hazard regulations can reduce property values without a taking and that performance-oriented hazard regulations do not, in general, pose a threat of "taking." Theories and cause of action for tort and inverse condemnation actions have been expanded to hold government liable for "unreasonable" conduct, much like a private citizen. Defenses such as sovereign immunity and "act of God" have been narrowed (see the *Act of God* section).

Advances in hazard-related technology and science deem hazard events more predictable and susceptible to various sorts of mitigation. As these options increase, the standard of care for "reasonable" conduct and also the potential for successful suits increases. Because of this fact, the "sovereign immunity" defense has been judicially or legislatively modified, particularly with regard to the actions of local governments. Therefore, it is possible to suggest trends in sedimentation law and possible future directions:

- Government actions that increase flooding, drainage, erosion, and landslide, problems that arise on private owned lands, will likely continue to pose inverse condemnation threat to governments.
- Government defenses will most likely narrow to engulf liability suits that relate to sovereign immunity, act of God, and inverse condemnation.
- The U.S. Supreme Court and lower courts will scrutinize land use regulations in terms of their impact on private landowners.

It is suggested, in Kusler's extensive work, that the best overall approach to reducing liability is through informed decision-making that considers the hazard-loss implications of government acts and takes actions based upon this analysis. The best way to avoid negligence-based liability is through "reasonable conduct in the circumstances."

From a scientific and engineering perspective, disasters equal moritoria to assess damages in greater detail. This includes probability of reoccurrence, and development of a mitigation plan. Speed in such studies is essential but the undertaking is often limited by availability of experts who are often in short supply after a major disaster. However, precise design and location of development must often be modified and re-modified to reduce impacts on other lands and to ensure the safety and structural integrity of the damaged area.

Examples of theories that have been modified on the judicial level and that apply to the reasonableness standard include the following:

- The "common enemy" doctrine for surface waters has been replaced by a reasonable use standard in most states;

  A recent case in Missouri, in fact, overturns the "common enemy rule": "Landowners who erect levees and otherwise back up DSW [downstream water] onto their neighbors can only do so with immunity if their actions are 'reasonable' (common law approaches to water rights 'invite' lawsuits if certainty is sought)." In addition, a cautionary as to DSW: common law includes a "line of cases" known as the Natural Drainage Rule which states that natural drainage patterns and flow rates cannot be altered unilaterally without consent of impacted neighbors (Missouri Water Law).

  For example, drainage decisions for the Illinois wetlands have been affected by the passage of the wetlands provisions of the Food Security Act of 1985 due to the fact that the remaining wetlands have important ecological and hydrologic value. Federal policy discourages conversion of wetlands to farmlands. The Illinois Drainage Law was revised in December 1997.

- Strict liability for dams has been replaced with a reasonable use standard in some states.
- The doctrine of caveat emptor ("let the buyer beware") has been replaced with one of implied warranty of suitability, incorporating a concept of reasonable anticipation of natural hazards on the part of sellers and protection of reasonable expectations of buyers.
- Reasonableness of activities has become a principal issue in many inverse condemnation suits.

The "reasonableness" standard is used more widely because it reduces each circumstance to a common denominator standard for liability assessment. It is flexible and fact-specific. In most cases, it incorporates basic concepts of fairness. In the context of natural hazards, it is consistent with the goal of responsible use of public or private lands.

In summary, Kusler recommends a status and certain trends prevalent in the courts at the time of his research (unpublished work, 1992). The bottom line, despite widespread concern about government liability for regulation of private activities in hazard contexts, is that virtually all successful liability cases to date (reported in thousands of decisions, some of which have been mentioned) have involved government activities that caused or increased natural hazard losses or failure of governments to remedy or warn of natural hazards on public lands.

Theories and grounds for tort and inverse condemnation actions have been expanded to hold government liable for "unreasonable" conduct, much like a private individual. Defenses such as sovereign immunity and "act of God" have been narrowed. Based on all factors considered, it is possible, according to Kusler, to suggest trends in law as well as a clear path for future of American sedimentation law and the physical processes thereof.

- The greatest tort liability or inverse condemnation threat to governments will continue to be liability suits; subsidence can also be predicted as mitigation measures improve causing more regulations to be adopted that will ultimately help establish a standard of "reasonable" care conduct.
- All other hazards fall under the same category (see recent developments in "Project Impact").
- The government and the individual will most likely fall into the same standard of care for nondiscretionary "unreasonable conduct."

- Governmental units will be expected to uphold an increasingly high standard of care for "reasonable" conduct.
- Foreseeability limits may occur along with counter legislative caps on government liability through "tort-claim acts."
- The U.S. Supreme Court as well as the lower courts, will more carefully examine land use regulations, not just related to hazard (again, see Project Impact in Recent Developments, next section).

In reducing potential government liability, there is a broad range of options available to maintain government responsibility, including administrative actions, legislative changes, and judicial responses.

Kusler concludes his survey with the theory that courts should continue to take a factually-specific, pragmatic approach to natural hazard cases and should tackle many unresolved legal issues with "the goal of encouraging responsible, equitable, and reasonable private and public conduct."

20.15 SUMMARY AND RECENT DEVELOPMENTS

In Arnold, Missouri, the total amount of Federal disaster assistance granted after the devastating floods of 1993 was well over $2 million. After the floods of 1995, the fourth largest flood in the history of Arnold, the damage was less that $40,000 due to the nonstructural mitigation, which culminated in the acquisition of flood-prone or flood-damaged properties (FEMA, 1995). The 1995 flood was much less severe due to the fact that most of the affected areas had been bought out by the government so the residents were no longer in harm's way. Therefore, the Arnold, Missouri case illustrates the value of acquisition and highlights the value of planning as a mitigation tool.

The unprecedented flood of 1993 offered a long-term solution that included the creation of land use plans that included changes to lessen the impacts of future disasters by following organizational plans implemented as land use strategies. This, along with capital improvement plans to obtain the necessary funds to accomplish the desired goals, in combination with the city's ability to facilitate a solution to sustaining flood damages, was documented in 1995 as part of an ongoing accomplishment.

FEMA's effort to reduce risk through mitigation culminates in a reduction in potential damages. The community of Darlington, Wisconsin experienced indirect benefits in connection with FEMA's mitigation efforts. Darlington's environment was rendered safer, its aesthetic quality was heightened, and the natural function of its floodplain was restored resulting in the city's economic development potential to increase.

> The mitigation projects in the Midwest ranged in size and complexity from one to two home elevations to Valmeyer, Illinois which relocated a significant portion of the town to a new location, to Wakenda, Missouri which acquired and demolished all the town's structures, and disincorporated. What all these projects hold in common is that they reflect the communities' visions of themselves. Communities must be aware of their risks and plan accordingly, weighing mitigation alternatives with community needs (FEMA, 1995).

In May of 1995, the most expensive floods in the history of the National Flood Insurance Program (NFIP) took place in Louisiana, when $584 million was paid out in claims. The severe floods, which ravaged at least 14 states from Florida to Maine in mid-September 1999, culminated in claims averaging $21,237 per claim. At this writing, more than $310 million has been settled for 14, 614 flood damage claims. Although an unprecedented amount of claim money has been paid, the statistics report that the majority of Hurricane Floyd flood victims unfortunately did not have flood insurance; that, for example, in the state of North Carolina (the state hit hardest by Hurricane Floyd), only $1,000 policies were in force at the time of the disaster. "Nationwide, only about one-fourth of households in special flood hazard areas have flood insurance," then-Federal administrator Jo Ann Howard pointed out. She went on to say that the money paid out comes from premium income, and not tax dollars, and that the more that property owners take responsibility for their own protection against hazards by purchasing flood insurance, the fewer landowners will need to rely on disaster relief funded by U.S. taxpayers. She assured the public at large that flood insurance not only reduces government expenditures for disaster relief in great amounts, but provides victims of disasters with much greater compensation. She also said that while disaster grants are helpful, they are also very limited, and that disaster loans have to be repaid with interest. Therefore, it is a win-win situation when landowners take rainy day responsibility for future hazard damages by purchasing flood insurance. Howard noted that high-risk areas engulf properties currently located outside of known high-risk zones due to the fact that in recent years, floods (the most common type of natural disaster) have been reported in places that never experienced them in their histories.

Aside from the benefits of hazard insurance policies, Howard encouraged communities to get involved in further actions to reduce damage through FEMA's public awareness effort, ***Project Impact***—an effort devoted to building disaster resistant communities, its motto being "educating people to elevate, floodproof, or otherwise move structures out of harm's way" (FEMA 2000a).

20.15.1 Project Impact

The Federal Emergency Management Agency (FEMA) is changing the way America deals with disasters. Project Impact assists communities to protect themselves from the devastating effects of natural disasters by taking actions to dramatically reduce disruption and loss of properties and life. Project Impact

operates on a common-sense damage-reduction approach, basing its work and planning skills on three simple principles:

- Preventive actions decided at the local level;
- Private sector participation; and
- Long-term efforts and investments in prevention measures.

This unique experiment began with seven pilot communities across the country that partnered with FEMA for expertise and technical assistance on national and regional levels to include federal agencies and states in the equation. FEMA, using all available mechanisms to put the latest technology and mitigation practices into the hands of local communities (businesses, schools, private sectors) and governments, has expanded from the original seven pilot communities to 200 Project Impact communities. More than 1,100 businesses have joined FEMA's growing partnerships. The incentive for disaster-resistant communities across the land has been able to bounce back from a natural disaster with far less loss of property and consequently much less cost for repairs. The estimates are in that for every dollar spent in damage prevention, two are saved in repairs. (FEMA 2000b).

Former FEMA Director James Lee Witt outlined key provisions to Congress of the Fiscal Year 2001 budget. Besides asking Congress to authorize $971 million, FEMA also requested an additional $2.6 billion in emergency contingency funds for future disasters. Witt reminded Congress that with their support, Project Impact communities were established in every state in the union. He requested $30 million for the following fiscal year in order to continue expansion of this initiative for the express purpose of building a nation of disaster-resistant communities (FEMA 2000c).

As of February 15, 2000, Congress approved additional buyout funds from a separate emergency contingency fund for 13 states from Florida to Maine hit by Hurricanes Floyd, Irene and Dennis. FEMA announced that an additional $215 million was made available for buyouts and relocation of properties damaged by these floods. These funds must be matched by 25 percent of nonfederal funding and can be used only for primary residences that are deemed uninhabitable due to the disaster(s) (FEMA 2000d).

In addition to extra government fundings, projects related to the removal of structures from flood hazard areas were undertaken, such as the state of Iowa's case study, entitled The Benefit of Hazard Mitigation Projects in Iowa, which tracked 128 hazard mitigation projects or initiatives pursued by Iowa communities, counties, or the state, resulting in an anticipated overall government savings of $100 million. At this time, since 1993, Iowa has been impacted three times by floods. Many of the federally funded acquisition projects that removed properties avoided the subsequent impact of flooding, resulting in savings within a 2 to 3-yr period (FEMA 1999).

Successes in relation to reducing costs, overall costly court cases that result in taking of high-risk disaster prone lands, and unforeseen flood damages such as erosion and sedimentation problems due to unforeseeable natural disasters in unknown risk areas rests on sound public policy and strong support systems, such as FEMA's *Project Impact,* the NFIP insurance claims programs, and a demonstration of reasonable use of private and public lands by the citizens as well as by the government.

The Government Performance and Results Act (GPRA) requires that agencies submit annual performance plans to Congress along with fiscal year budget requests, and they must also prepare an annual performance report at the end of each fiscal year (FY) on how well their goals were met. The FY 1999 Annual Performance Plan was the Department of the Interior's first official plan submitted to Congress and Interior's first opportunity to report on their accomplishments. Further, their current plan and their proposal for their subsequent plan have been combined into a single presentation in order for trends in performance to be measured side by side with trends according to current results.

To make use of today's science for America's tomorrow, and science in general for a changing world, the strategic direction for the U.S. Geological Survey combined and enhanced diverse programs, capabilities, and talents, increased customer involvement in an effort to strengthen science leadership, and continued its reputation for contribution to the resolution of complex issues. As a world leader in the natural sciences with a vision of scientific excellence and responsiveness to society's needs, the USGS continues to have a mission to serve the nation by providing reliable scientific information. Its linkage to the bureau strategic plan, budget, and departmental goals is housed in its main mission objective: hazards, and environment and natural resources. Its most important product is quality science that is both relevant to a changing world and effectively communicated. Peer reviews and program evaluations will continue to measure its capabilities. The USGS sums up the future of hazard-related industry in general with its plans to meet the challenges of the 21st century with renewed vigor and a clarified sense of purpose and mission. "Understanding the delicate balance between the earth's natural resources and America's need for continued growth will enable us to make better decisions for future generations' enjoyment of this precious land," said Dr. Charles Groat, then-USGS Director, in defense of budget increases for science to provide reliable information and tools in order to accurately forecast a better tomorrow (USGS 2000).

20.15.2 Polluted Sediments and Sediments as Pollutants

Since the creation of nationwide regulations, such as the Federal Water Pollution Control Act Amendments of 1972, amended in 1977 and heretofore referred to as the Clean Water Act, legal liability has been assigned to situations where pollutants attach to sediment particles. However, the

legal framework for polluted sediments has emerged primarily from relatively recent environmental laws rather than from the body of law that examines the effects of sedimentation processes on changes in geography. For this reason, on the subject of polluted sediments, the authors recommend consulting reference materials that pertain to environmental law.

In addition to pollutants that attach to sediment, the individual particles can sometimes be recognized as pollutants by certain regulations. For example, introduction of high silt concentrations through surface erosion can affect fisheries, other aquatic species or habitats. This area of law and regulation is similarly beyond the scope of this chapter.

20.16 CONCLUSION

Sedimentation policy, in connection with the problems of property rights and damages due to flood disasters, stems from the changing tide of sedimentation engineering concepts and how those efforts must accommodate a constantly changing world that effects any given community subject to disasters. Engineering—the core of the vast field of water law and sedimentation—plays a vital role when it comes to recent trends in American sedimentation law and the physical processes it is based on. Key trend-setting court decisions serve to remind the powers that be of reasonable use standards and ethical practices. When it comes to public liability and natural hazards, hazard mitigation and awareness programs, insurance plans, and cooperation between government agencies and private citizens are key. Although Statutes of Limitation draw a line in the sand after certain disclosures, if reasonable use can be challenged, inverse condemnation can be considered. For the most part, "act of God" defenses occur when flood damage is unprecedented. Forensic geology is a valuable accuracy tool for technically proving physical changes. Overall, the new wave of sedimentation engineering demonstrates the benefits of reasonable use and cooperative awareness for both private and public lands that are interwoven with social controls, government regulations, and other legal agreements.

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References to legal literature within the text (**in bold**) are made in the following order from left to right: (1) Court Decision Name or Law Review Name; (2) volume number of the set of reports; (3) name of the set of reports, in abbreviated form; (4) page number or numbers of the volume; and (5) date of the decision or law review. If there are citations to two or more sets of reports, then repeat these items for (1) each such report, (2) set of abbreviations, and (3) page numbers. Finally comes the date of the decision or report in parentheses. The same applies to Law Reviews except that the volume number comes first, the full name of the Law Review, and then the page number and date, if any. Some Reviews are not quoted by date and page numbers because these are not always necessary.

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