

Economic Analysis of a Major Flood in the American River/South Stream Group of Sacramento

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Introduction

Flood control has been a major economic issue for Sacramento since its earliest settlement, and is still a major element of the planning and infrastructure decisions the region is making. The potential physical and economic damage to the region from a major flood are far beyond anything we have ever experienced, and can have very long term effects on the region's economic future.

The importance of the flood potential is often underestimated because the thinking is too narrow, failing to view the full extent of economic impacts which will result. One often hears about "minor flooding" and "insured structural damage" as the consequences of floods, but this view encompasses only a small part of the total economic impact of a flood. This study provides a more comprehensive view of impacts by including all of the aspects of generation of income and employment, business productivity, government services, education, overall quality of life, and long term economic potential.

Definitions of Economic Impacts

An economic view of a major flood event goes far beyond the physical damage to flooded structures, to include a wide range of functional and operational dislocations created by the event. This view includes a wide range of indirect, induced, and incidental impacts which affect income, wealth, productivity, and quality of life to the regional economy. These damages may occur to businesses and households distant from the flood itself, and occur over a long time period. Many of these types of damages are not readily predictable or quantifiable, but are nevertheless a real cost of a flood.

This report is intended to illustrate the full range of losses including these "incidental damages" aspects of a flood, damages not covered by flood insurance, damage far beyond what any federal and state assistance programs may compensate, disruptions which are long term and from which some may never recover. This is not intended to be a scare story; it is based on actual reports, interviews, and studies of flood events elsewhere.

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Direct Damage to Structures and Property

The most direct and widely known measures of damages are to structures and property. These direct losses have been estimated for a “100-year flood” in the American River watershed by the U.S. Army Corps of Engineers, and the data are listed in the table. The data is based on a 1991 study, and therefore does not include structures built since that time, which include a number of new State of California buildings, new commercial structures on the K-Street Mall, the expanded Convention Center, new office buildings in North Sacramento near Arden, new buildings at CSUS, and the new Granite Regional Office Park.

Direct Damages	
Residential	\$ 5,473,580,000
Commercial and Industrial	\$ 1,644,990,000
Public	\$ 361,270,000
Emergency	\$ 10,750,000
Auto	\$ 276,200,000
Total	\$ 7,766,790,000

Source: US Army Corps of Engineers, American River Watershed Investigation Feasibility Report, 1991.

The table shows that the damages would exceed \$7.76 billion, including:

- Losses to residential structures would exceed \$5.47 billion
- Commercial and industrial losses would be over \$1.64 billion
- Losses to public agencies including State Government, Sacramento County, the City of Sacramento, and local governments including school districts, fire districts, libraries, and many others would exceed \$361 million
- Emergency services would cost over \$10.7 million
- Damages to automobiles and other vehicles would exceed \$276 million

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Some of these losses may be covered by various types of flood insurance or other personal property or automobile insurance, but it would be a gross miscalculation to assume that insurance would immunize any of these entities against loss. Many insurance policies do not cover flood damage at all; others would cover much less than the full extent of damage. While households who have recently financed a home purchase may have been required to obtain flood insurance, others may have no insurance at all. Even those who have insurance may find that the coverage does not cover the full value of the losses to the structure, or will not cover the full replacement cost if the structure is damaged beyond repair.

There are no accurate estimates of the degree of insurance coverage, or the extent of uninsured losses, for the geographical area of this potential flood event. Estimates on the order of 60 percent damage coverage are sometimes used, which would indicate a potential loss to the region of about \$3.1 billion in uninsured losses from direct structural damages.

Indirect Damages and Losses

The direct damages described above are massive in dollar amount, but may not indicate the real extent of the personal losses and financial damage to households and businesses. A very long list of losses occur in indirect, induced, and incidental ways which are almost never covered by insurance. Examples of the indirect, induced, and incidental damages would include the following:

Losses to families and households:

- Loss of heirlooms, photographs, videotapes, computer files
- Loss of family income and employment
- Damage to furniture, appliances, clothing, other losses which may not be insured, especially for renters
- Damage to automobiles, recreational vehicles, lawn and garden equipment
- Disruption and costs related to evacuation and lack of access to one's residence
- Effect of extended periods of interruption of utilities, public services
- Disruption to education including schools, colleges and universities
- Permanent loss of housing due to demolition of structures which are contaminated or damaged beyond economical repair

Business Losses

- Damage to inventory, equipment, and records
- Losses during periods of interruption of utilities and public services
- Losses resulting from inaccessibility to customers and employees

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- Extended periods of closure during repairs of structures
- Permanent closure of businesses which cannot survive a lengthy rebuilding interval or which have inadequate capital to re-establish themselves

Local Government and Public Utilities

- Costs of emergency services, rescue services, emergency repairs
- Unscheduled replacement of previously serviceable systems including sewers, drainage systems, water distribution facilities
- Repairs to streets, highways, freeways, light rail systems
- Damage to parks and recreational facilities
- Damage to public housing, redevelopment project areas
- Damage to school buildings, yards, parking, and libraries
- Loss of school revenues due to reduced or interrupted attendance
- Damage to fire, police, administrative and legislative facilities
- Loss of revenues from retail sales taxes, business taxes, reduced property tax assessments, other tax revenue sources.
- Long term revenue losses associated with lower levels of new business development
- Planning, policy, and infrastructure costs associated with demolition, replanning, and rebuilding of areas damaged beyond repair

Incidental Damages

In the above list, many of the economic impacts are from incidental damage, that is, not directly related to water damage at the site. For example, many residences, although not actually flooded, will be isolated by flooded transportation routes, left without utilities and public services, have extended closure of schools and shopping facilities, and may be without income as places of employment are either flooded or inaccessible.

Many business and government centers not flooded may nevertheless be isolated from employees and customers, have utility interruptions, find suppliers or customers no longer in business, and other impacts.

There is no data or methodology for estimating the value of many of these personal and business losses, but years after a flood these are the things flood survivors reflect on with the greatest sense of loss, far outweighing the expensive damage to structures.

Areas At Risk

The damages created by a flood can extend far beyond the actual flood area. Flooding of transportation routes, interruption of utilities and public services, and

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disruption of business relationships with suppliers and customers will likely occur throughout the region, and be felt in areas far beyond any actual flooding.

The most widespread and long term damages are likely to be generated by media exposure to a statewide and national public. In the long run, Sacramento may be viewed as a damaged economy, vulnerable to flooding, and unattractive for businesses and industries looking for expansion locations. These long run effects can result in a region whose economy does not participate in the new industries and business trends, whose existing plants do not receive major corporate attention for upgrading and expanding, and whose long term prospects for increased employment, income, and quality of life are impaired for many years.

Long Term Impacts

Longer term economic effects include businesses which are never re-established, residents who leave the area permanently, structures which must be demolished leaving vacant areas for years, and a public image of the which makes it difficult to attract new businesses and industries into the region. These losses are not limited to the areas actually flooded; in fact, the entire economic region will have economic impacts ranging from disruption of utilities, transportation, and work force availability during the actual flood, to longer term reduction of economic vitality and loss of key businesses. It is likely that even firms and residents who do rebuild are likely to shift their new location to areas not vulnerable to flooding, including areas in the region outside Sacramento City and County.

Level of Flooding

Estimates of flood damage based on direct damage to structures typically relate the amount of damage to the level of flooding. While this assumption may be correct for direct structural damages, it is not a good indicator for the levels of indirect and induced damages. In a home, water levels of only a few feet are enough to destroy carpets, furniture, appliances, and wall materials, creating near-worst-case damages. For a business, a few feet can ruin inventory, equipment, business machines and records. For an automobile dealer or a general aviation airport, a level just high enough to inundate engines creates the worst case level of impact.

In fact, economic impacts can even occur to families and businesses which receive no water intrusion into their structure. Being surrounded by water and therefore unable to access employment or customers, damage to streets, roads and freeways which serve the location, loss of utilities, closing of schools and colleges, and other external effects can create significant economic losses even though no direct structural damage occurs.

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Disaster Relief and Financial Recovery Programs

After major disasters, assistance programs from a variety of Federal, State, and other sources are initiated to help residents, businesses, and local governments to get back into operation, and can provide a real economic boost. Economic analysis of these effects show, however, that while the assistance programs make a real difference in supporting repairs to structures and assistance to displaced populations, they fall far short of fully compensating even the direct repair costs, and are nowhere near overcoming full range of private and public damages or offsetting the long run effects.

A brief summary of major programs would include the following:

Small Business Administration Loans for businesses and homeowners: Provide loans to restore or replace structures, personal property, business operating losses.

FEMA Housing Assistance Programs: Provide disaster housing, temporary accommodations during evacuations, emergency housing repair, mortgage or rental assistance, individual family grants, and unemployment assistance. FEMA mortgage or rental assistance may require 6 months to deliver.

FEMA Public Assistance Programs: Compensates losses to Federal, State, and local government agencies.

The National Flood Insurance program administers the distribution of claims on flood insurance policies, in order to assure a timely claims payment process. The typical time required is two months after the claim is filed.

Employment and Economic Security Programs. State and Federal programs provide extended unemployment, job retraining, temporary employment in disaster repair projects, and other programs for displaced workers.

Sources:

Miner & Duekmejjan, State and Federal Disaster Relief, May 19, 2000

Alan Draves, The 1997 Flood in Grand Forks, ND. www.draves.com

The Federal Emergency Management Agency, www.fema.gov

State of South Dakota Flood Information Site, <http://www.state.sd.us/floods.htm>

Minnesota Department of Economic Security, <http://www.des.state.mn.us/general/disaster.htm>

The economic impacts of the assistance programs varies widely. Many of the programs are loan programs or loan guarantees. These loans represent new debt which the households or businesses have to repay, in addition to the previous loans they already have in effect. While the Federally-administered loans are typically at below market interest rates and help create a quick-recovery potential, they; also create a long-term drain on future income and earnings. The grant programs by contrast create net increases to the region's income, and stimulate overall economic recovery and growth.

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No matter what the source of recovery funding, a delay is inevitable. Even with the most responsive agencies, there is a delay of weeks to months in distribution of funds. Even then, the property owner has to obtain qualified contractors in construction, repair of heating, air conditioning, and appliances; auto repair; and other expertise. A disaster of the magnitude would far outpace the available skills locally, and require a large-scale mobilization of resources from outside the region.

A final concern is that most of the programs are administered and partly funded by State and local government agencies. In the Sacramento case, these agencies themselves are among those impacted by the flooding, which may delay the timely distribution of disaster assistance.

Although the disaster relief programs help get public services and economic activities operating again, and mitigate the most severe personal and business losses, they are not designed to overcome all losses, and leave many uncompensated short and long term losses and dislocations which affect the community's economic and social well being for years after the flood event.

The Sacramento Scenario

The flooding scenario for the American River and South Sacramento Streams area is based on an approximation of the risks of a 100-year flood event in this flood basin. The areas affected by the flooding are identified in a map titled American River and South Sacramento Streams Group Benefit Zones, provided by the Sacramento Area Flood Control Authority (SAFCA). The map shows areas which may be significantly flooded, may experience direct shallow flooding, or may be affected by prolonged inaccessibility or interruption of utilities. Areas both north and south of the American River are shown as being at risk. Both areas may not actually flood in any particular flood event, but are at similar levels of risk.

SAFCA estimates that significant portions of the flooded area would be inundated for a minimum of three weeks.

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Estimates of the direct impacts on population and employment of have been created by comparing the SAFCA Map with the Sacramento Area Council of Governments (SACOG) residential analysis district maps, and are shown in the adjacent table. Since the SACOG zones cannot be matched exactly with the flood contours, the estimates are of limited precision and should be viewed as approximations.

Population Directly Affected by Flooding

The table shows that about 97,000 residents will experience high levels of flooding, mostly in the southern portions of Land Park, Pocket Area, Meadowview south of Elder Creek and 43rd Avenue, and South Sacramento south of Florin

Impact of a Major Flood on the Sacramento Economy		
Community Areas	Population at Risk	Potential Direct Job Loss
Higher Flood Areas		
Land park-Pocket-Meadowview south of 43rd Avenue including Greenhaven, Florin, Meadowview	46,074	17,674
South Sacramento south of Florin Road and west of Hwy 99	50,950	15,148
Subtotal High Flood Areas	97,024	32,821
Lower Flood Areas		
Land park-Pocket-Meadowview north of 43rd Avenue	69,111	7,851
South Sacramento West of Highway 99 and north Florin Road, East of 99 along Elder Creek to 65th, and along Power Inn Road south to Fruitridge, Fruitridge from Power Inn to 65th	50,950	19,476
Downtown Sacramento except for: J, K, and Capital west of 12th street, The SP railyard area, and "Poverty Ridge" on 22nd street between P and V	33,541	84,025
East Sacramento most of the area north of Folsom Blvd, Power Inn Road south to Fruitridge	58,002	47,315
Rancho Cordova north of Jackson Highway and west of Mayhew	24,025	4,355
Arden-Arcade south of El Camino and west of Fulton Avenue, and American River Drive east to Arden Way	9,495	12,655
North Sacramento east of the Natomas East Main Drainage Canal and south of Arcade Creek	30,043	33,891
Subtotal Lower Flood Areas	275,167	209,567
Grand Total All Flood Areas	372,191	242,388
Percentage of Sacramento County	31%	46%

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Road and west of Hwy 99. In these areas, damage will occur to most structures, and many structures will be heavily damaged.

A much larger population, over 275,000, will experience lower levels of flooding. The table lists the areas, including most of the remaining areas of Land Park, Pocket, Meadowview and South Sacramento; most of Downtown Sacramento; East Sacramento north of Folsom Blvd; Rancho Cordova west of Mayhew; the southwestern corner of Arden-Arcade; and North Sacramento east of the Natomas East Main Drainage Canal and south of Arcade Creek.

The total population directly affected is estimated at about 372,000 people, including most of the population of the City of Sacramento and about 31% of the Sacramento County population.

Direct Employment Effects

The direct employment effects are also shown in the table.

Almost all employment in the Pocket and Meadowview areas will be severely affected, including Florin Road businesses and auto dealers, Sacramento Executive Airport, Campbell's Soup, and Southgate Shopping center. Lower levels of flooding will directly affect Sacramento City College, the Sacramento Zoo, and other businesses in Land Park and along Broadway including the DMV and CHP facilities.

In Downtown Sacramento, the region's most concentrated employment location, nearly all businesses and State of California agencies will be in the flooded area, except for a strip west of 14th street between L and N (which includes Capitol Mall) and the SP Railyard. Richards Blvd will also flood.

Examples of employers affected include State agencies such as the Attorney General's Office, Water Resources Board, Department of Consumer Affairs, Housing and Community Development, PERS, EDD, Legislative Office Building, Department of Transportation, Food and Agriculture, Secretary of State, Energy Commission, and the Superior Court. (State agencies and departments in or near the Capitol will not be flooded, but will not be accessible.)

Local government buildings in the flooded area will include the City of Sacramento and County of Sacramento administrative offices, Police and Sheriff's offices, central jail, downtown library, SHRA, municipal and superior courts, the Convention Center, and Memorial Auditorium.

Private sector firms affected will include Sutter Hospital, Blue Diamond, the Holiday Inn and Hyatt hotels, Pacific Telephone, EDS, the Sacramento Bee, Crystal Cream & Butter, Downtown Ford, motels near Richards Blvd at I-5, and Federal Express. (Downtown Plaza and businesses on Capitol Mall would not be

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flooded, but would be inaccessible and below-ground parking structures will be flooded.)

In East Sacramento, flooding would directly affect major employers including California State University, Mercy General Hospital, the Sacramento Rapid Transit district, Sacramento Medical Foundation, and Sutter Memorial Hospital.

Along the US-50 corridor major employers affected would include the State Teachers' Retirement System, and in Rancho Cordova, most of the business and industrial employment along Folsom Blvd west of Mayhew Road including the Carol Miller Justice Center, the California Center, and the Red Cross headquarters. Adjacent areas along Power Inn Road (including the new Granite Regional Office Park) and on Fruitridge and Elder Creek roads would also be flooded.

In North Sacramento, major affected employers would include the Woodlake Inn, the Royal Oaks Post Office, CALTRANS, the Hilton Hotel, the USAA Insurance complex, Wonder Bread Bakery, and California Plaza. The light rail line through North Sacramento would also be flooded. Flooding would reach Arden Fair, Howe About Arden, the Century Theatres, Harold Ford, Cal Expo, Point West, the Kaiser facility on Response Road, the DoubleTree Inn, Red Lion Inn, and the adjacent retail and office activities along Arden Way and Howe Avenue,

Nearly 243,000 employees would be directly or indirectly affected for the duration of the flooding. This would include virtually all of the employment in the City of Sacramento, and about 46% of employment in Sacramento County. The administrative activities of the City and County governments, and the State of California governments, would be substantially brought to a standstill. Even offices not actually reached by flooding would be isolated by inundation of the surrounding areas, flooding of below-grade portions of all major freeways, and interruption of light rail.

The effect on State of California departments and agencies could become critical for the entire State if the duration of the flooding extends beyond a few days. State agencies within the affected area provide payroll, retirement benefits, medical benefits, vehicle registration, criminal justice processes, and other activities which affect populations throughout California.

A further problem may arise from the fact that State, County, and City agencies which are the primary delivery system for State and Federal assistance programs would themselves be impacted or even temporarily incapacitated. This could prolong the time before assistance programs could go into full production, and extend the disruption and economic losses to the region.

Indirect and Induced Employment Impacts

The employment effects within the flooded areas are not the full extent of the economic impacts. Two additional kinds of measurable economic impacts will also result:

Indirect effects. Indirect effects are the results of purchases of materials and services from other local “supplier firms”. This includes all of the items used in production, including materials, utilities, government services, buildings and machinery, accountants, attorneys, medical services for their employees, and all other operational inputs. These diverse supplier firms, even if located far from flooded areas, will experience reductions if their clients or customers are flooded.

Induced effects occur when employees spend their income in consumption activities, including housing, transportation, food, entertainment, medical care, and all the other retail and household services activities. A reduction in many categories of retail sales will occur due to interruption of employment and income. (A few businesses will experience the opposite problem: overwhelming demand. Examples include home repair, lumber and hardware, auto repair, appliances, furniture, fast foods, home loans, and insurance claims.)

The economic impacts of changes in consumption and production can be measured using economic models called Input-Output, or Leontief, models. These models are based on detailed studies of how payments for goods and services flow through local economies. The model used in this study is an Input-Output model called IMPLAN (acronym for Impact Analysis for Planning), created at the University of Minnesota for measuring local economic impacts. The model has been specifically calibrated for Sacramento County, using data from a detailed survey called the Employment Security Survey (ESS 202) by the U.S. Department of Commerce Bureau of Economic Analysis.

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Impacts of Flooding on Employment and Income		
Employment Impact		
Direct Employment Government, Medical, Retail	(242,388)	
Indirect Employment Purchases of materials, services	(14,776)	
Induced Employment consumption by employees	(64,418)	
Total Employment Impact	(322,311)	
Income Impact		
	Annual	Weekly
Direct Employment Government, Medical, Retail	\$ (8,047,562,566)	\$ (160,951,251)
Indirect Employment Purchases of materials, services	\$ (376,864,571)	\$ (7,537,291)
Induced Employment consumption by employees	\$ (1,461,367,442)	\$ (29,227,349)
Total Income Impact	\$ (9,885,781,478)	\$ (197,715,630)
Source: Computed from SAFCA and SACOG data using IMPLAN model. Impacts are for Sacramento County only.		

Computations from the model are reported in the adjacent table. The model shows that the loss of 242,388 jobs directly attributable to flooding will have large effects on other firms which supply the flooded firms, and which serve the retail needs of their employees. The total employment impact will be 322,311 jobs, including the indirect and induced effects.

The income impacts are also shown in the table. The income losses from employers with direct flood impacts have an annual value of about \$8 billion per year, or about \$161 million per week. If the indirect and induced losses are added, the total income losses rise to about \$9.9 billion per year, or about \$198 million per week.

The actual losses would depend in part on how long the flooding persists, and how long it takes to restore transportation and public utilities, repair structures, replace damaged business inventory and equipment, and other aspects of restoring previous levels of employment and business activity.

SAFCA has estimated that significant portions of the flooded area would be inundated for a minimum of three weeks; the economic income loss would total about \$593 million for this period. This does not include the interval necessary to restore public services and transportation, repair or rebuild damaged buildings, and re-supply businesses and restore normal operations. Many employers will have operations disrupted for much longer periods, and some may never reopen.

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Incidental Impacts Beyond the Flooding

Transportation. Even low levels of flooding can create major interruptions in the region's transportation system, including:

- Blocking of both light rail lines: in East Sacramento, Downtown, and North Sacramento
- US-50 at the below grade area between 65th street and Stockton Blvd exit
- I-5 at below grade areas near Sutterville Road
- US-99 at below grade areas near Fruitridge
- Downtown I-5 at below grade area at J street exit
- Flooding of the RT bus facilities downtown

Loss of electricity as substations and underground utility services are flooded. Outages may extend far beyond the areas of actual flooding.

Air travel at Sacramento International Airport may diminish substantially. Much of the region will have difficulty getting there due to freeway closures. Closure of State agencies and departments will reduce travel demand.

Low income renters will be especially affected, since most will have no insurance coverage and will lack the financial resources to immediately re-establish households. Inability to get to work, or employers closed or out of business, will create longer term impacts.

Older homes which cannot be feasibly repaired may remain vacant for months, and ultimately demolished. Some homes inundated by water with fuel or chemical contaminants will be declared unfit for habitation and ordered destroyed.

Schools damaged by flooding will be subject to stringent inspections for health risks. Inspections and repairs will extend the disruption of the school term. Some schools will not be repairable.

Some Colleges and Universities are located at higher risk sites and may suffer extensive damage. California State University, Sacramento and Sacramento City College will be among the most vulnerable. Long term disruption for some students is possible.

Some industrial and commercial businesses which are flooded will create unusual hazards by leaking fuels, oils, chemicals, waste products, and other hazards. These events will create areas of high risk in flooded homes and businesses, and may delay re-entry of residents and repair of structures.

Erosion and settlement of land areas, including settlement of roads and structure foundations, may cause long term problems which delay or prevent rebuilding of

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damaged structures. Settlement problems may affect some structures not directly damaged by flooding.

Long Term Impacts.

The longer term impacts of flooding can best be illustrated by reviewing floods which have occurred elsewhere. The most studied flood is the Grand Forks, North Dakota-Minnesota area flooding of April 1997. That was part of the greater Red River Flood, which affected hundreds of cities and towns throughout the states of North and South Dakota, Minnesota, and Canada, one of the worst natural disasters in US history, according to FEMA.

That was a spring flood, with heavy rainfall throughout an extensive watershed augmented by melting snow, a scenario not unlike the floods which repeatedly inundated Sacramento in its earlier days. Although the Grand Forks event was aggravated by uncontrolled fires in its downtown area, the result of electrical short circuits and other failures initiated by the flood, the damage scenario is not too different from that which Sacramento might experience.

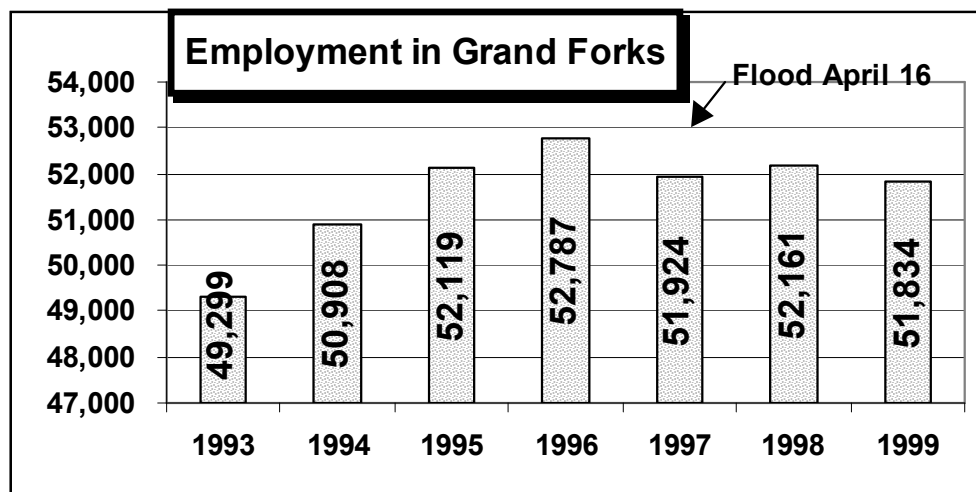
A brief chronology of the Grand Forks event is given below:

The Grand Forks Experience

- **Wednesday, April 16, 1997** Evacuation notices issued. Evacuation of hospitals, elderly and disabled from their homes, and other at-risk populations begins.
- Evacuation shelters fill as 46,000 people are evacuated in Grand Forks (90% of population).
- 4 days later. Some areas allow residents to return. They find 8600 homes with damage (75% of total) and 1616 apartments damaged (28% of total).
- **23 Days Later.** Drinkable water and utilities restored to most of City.
- FEMA brings in mobile homes to replace uninhabitable houses.
- Distribution underway of what ultimately totals \$266 million in relief funding from FEMA, SBA, HUD, Interior Department, Department of Transportation, Department of Agriculture, Army Corps of Engineers. Although funds are soon available from many programs, repairs and rebuilding are slowed because of insufficient materials and labor to accomplish the massive rebuilding.
- **Summer of 1997.** Demolition of unrepairable houses contaminated with fuel, sewage, and other contaminants begins. Giant "house crusher" machine brought in to speed process. Some entire neighborhoods are leveled.
- **October 1998 (18 months later).** The last of the streets are reopened; some older streets undermined by water or collapse of sewer systems had to be dug out and regraded.

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- Large areas of downtown are vacant land after demolition of older buildings which were not feasible to rebuild.
- Some office buildings are repaired but vacant because the businesses formerly in the area no longer exist, or have moved outside the area.
- Some retail areas just reopening. Many original businesses did not survive.
- **1999.** Many neighborhoods and business areas where buildings were demolished are still rebuilding. Many residents were unable to repair or rebuild their homes, and have moved outside the area. Large mobile home parks established as temporary housing are now permanent residences.
- The latest population data show that the resident population has dropped from a pre-flood high of 101,298, to 97,823, a decline of about 3%.



Employment in Grand Forks had been increasing at a rate of about 2.4% per year for several years prior to the flood. During 1997, the year in which the flood occurred, employment dropped nearly 2%, despite the massive expenditures of Federal, state, and insurance funds for rebuilding the region. Employment is falling even more rapidly now that the emergency expenditures are running out.

Grand Forks families know many things Sacramento families will hopefully never have to learn.

- Place valued personal items like photographs and financial records as high as possible, in the top of closets or on refrigerators so lower levels of flooding do not reach them.
- Mattresses, carpets, and stuffed furniture are almost never safe to reuse, even if the flood water was not contaminated.
- Don't check out appliances and heating/cooling systems, by turning them on and trying them. This can destroy the motor, create an electric shock

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potential, or start a fire. The motor should be tested by an electrician before power is applied. If it is not possible to disassemble the motor soon after the flood water recedes, it actually may be better to keep the motor submerged in clean water until it can be repaired.

- Some types of insulation used in walls absorb and trap moisture. It will dry out so slowly that it may be impossible to clean and repaint the walls. Either the interior walls or the outside siding will all have to be torn out and the insulation removed.
- Salt can be used as a nontoxic disinfectant in lieu of chlorine or other chemicals, but don't use it on concrete; it may make concrete chip, fragment, or flake – not good for a house built on a concrete slab.

Conclusion.

A flood creates a very great level of damages to a community, far beyond the level envisioned in discussions of flood insurance and structural damage. The economic impacts on employment, disruption of transportation and public services, personal lives, and business operations extend so far beyond the areas actually flooded that it is difficult to envision the total damages to our region. It is impossible to quantify the potential of these damages, especially the long term damage to the region's future.

Even the quantifiable parts of damages can be staggering.

- Direct damage to structures of residents, businesses, public agencies, and automobiles will exceed \$7.76 billion. Assumptions about insurance coverage indicate that about \$3.1 billion will not be covered, representing a net loss to residents and businesses.
- A 100-year flood will directly affect the homes of about 372,000 residents, nearly all of the population of the City of Sacramento and 31% of Sacramento County's population. About 97,000 of these residents will have severe flooding.
- The places of employment of about 242,000 employees will be affected by flooding, and another 80,000 employees will be affected indirectly or through reduction in household retail and other consumption. This employment reduction of 322,000 during the flood interval will create economic losses of nearly \$198,000 million per week. A three-week flood event would create a loss of \$593 million. This does not include the interval necessary to restore public services and transportation, repair or rebuild damaged buildings, and re-supply businesses and restore normal operations. Many employers will have

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operations disrupted for much longer periods, and some may never reopen.

These estimates do not include problems outside the flood areas which are impacted by disruptions to transportation (all of the major freeways serving downtown and light rail will be flooded), utility outages, or problems with access to employees or customers.

When the water is gone, the problems persist. Repairs to structures and public services will take months or years. Many structures will be contaminated or damaged beyond economical repair and will have to be demolished. Many businesses will not be able to re-establish their operations, even with Federal and State assistance. Many residents will never be able to return to their homes or will struggle for years to restore their lives, especially renters with no insurance protection. Schools and other public services will be affected for years. The region may live under the cloud of the negative media exposure and be unable to regain its current economic potential for a very long time.

In its early years, Sacramento was flooded a number of times, and even that unsophisticated and struggling frontier economy rallied behind costly and time consuming construction of levies and even raised the level of downtown buildings to try to avoid experiencing flooding again. The decision to make such an investment was easy for them, because they had first-hand knowledge of the full extent of damages which flooding creates.

Their extraordinary level of expenditures and effort to achieve flood protection has paid off for the region for many years, and the region has benefited from the existence of a vigorous downtown anchoring a robust regional economy. The example of South Forks, and the data on potential damages in Sacramento, should help us to make good flood protection decisions without the cost of the first-hand experience.