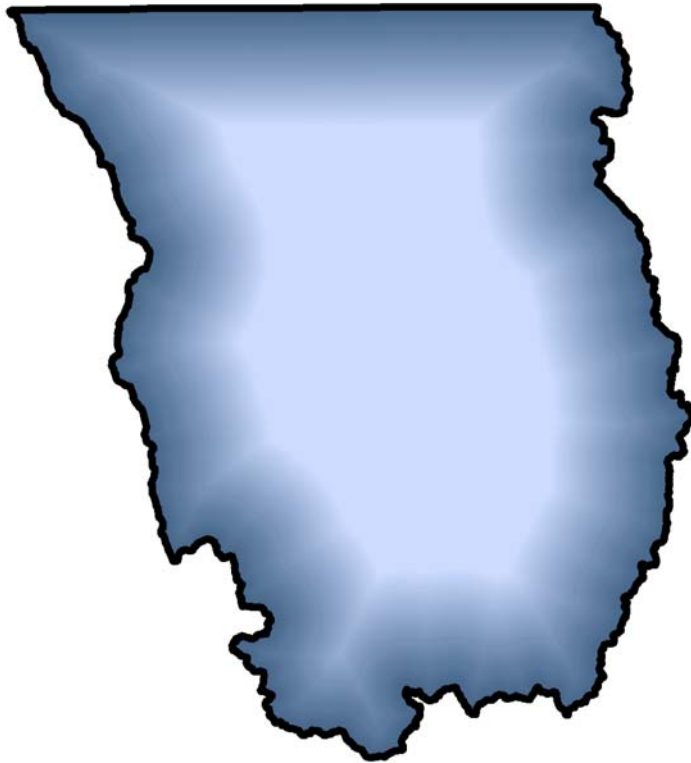


SECTION 8:

CACHE COUNTY – COMMUNITY RISK ASSESSMENTS



General Background Information

Cache County is located in extreme Northern Utah and is bordered by Box Elder County to the west and Rich County on the east. The County, covering roughly 1,172 square miles, is nestled between the Bear River Mountain's to the east and the divide of the Wellsville Mountains on the west. Cache Valley, a fertile agricultural area characterized by hundreds of farms and dairies, extends to the foothills of these ranges.

Cache County gained its name from the fur trading days when trappers such as Jim Bridger and Eteinne Post trapped beaver along the Bear and Logan Rivers and "cached" their pelts in large holes that they dug throughout the area. Settlement of the area began around 1855 when Brigham Young sent families from The Church of Jesus Christ of Latter-Day Saints to establish settlements in the valley. Since the wild grass was ideal for grazing, twenty-three men and two women were sent to Cache Valley to begin a cattle ranch on the Blacksmith Fork River. It was named Elkhorn Ranch after the antler hanging over the main gate. The plans were for 3,000 cattle to remain in the valley during the summer, and then winter further south in warmer climates. Unfortunately, the winter snows fell early that year. In a desperate attempt to save the cattle from the cold, the ranchers drove them to Box Elder County in a raging blizzard. The snow drifts were four feet deep in the valley and even deeper in the mountains. One of the rancher's feet froze and only 420 cattle survived. Within two years these ranchers left Cache Valley.

The early settlers of Elkhorn Ranch and the later Maughan's Fort weren't the first people to live in Cache Valley. Shoshoni Indians hunted and fished in "Willow Valley," as it was first called for the great willow trees that lined the stream and river banks.

In the early 1900's the fertile soil in Cache Valley attracted further settlement and soon transformed the valley into a major agricultural center for farming and ranching. Today, agriculture is still a viable part of Cache County's economy as evidenced by numerous farms, ranches, and dairy operations along with cheese factories and beef and pork processing plants. Utah State University located in Logan City has long been a significant part of the valley's economy and continues to grow as a major research university and area employer. Recent economic development includes several light manufacturing firms that have increased employment opportunities and a growing tourism industry which takes advantage of the County's countless scenic and outdoor recreation opportunities.

Table 8-1: Cache County Participating PDM Jurisdictions			
Cache County	Amalga Town	Clarkston Town	Cornish Town
Hyde Park City	Hyrum City	Lewiston City	Logan City
Mendon City	Millville City	Newton Town	Nibley City
North Logan City	Paradise Town	Providence City	Richmond City
River Heights City	Smithfield City	Trenton Town	Wellsville City



CACHE COUNTY FLOODING

Background

Portions of Cache County are at threat from both riverine and flash flooding. The Bear River flows through Cache Valley, which is located on the western side of the County, and is where the majority of residents live. Many small drainages feed the Bear River, with most streams converging at Cutler Marsh before exiting the valley via Cutler Dam, and into Box Elder County. The two main tributaries of the Bear River located in Cache County are the Logan and Blacksmith Fork Rivers. The Logan River is the largest tributary of the Bear. Other tributaries of the Bear that generally enter the valley through the eastern part of the county are Summit Creek, Little Bear River, Spring Creek, Cherry Creek, High Creek and the Cub River. All of these streams and rivers, to some degree, have had some history of flooding.

Phase II of the National Pollutant Discharge Elimination System (NPDES) administered by EPA has requirements for communities to more carefully manage their storm water discharge. While driven more by water quality concerns, this provides an important opportunity for communities to better manage their storm water systems. This is critically important because for many communities an ever increasing threat to residents comes from the potential for man-made canal failure flooding. As more development has occurred, existing irrigation canals have been increasingly relied on to accommodate storm water discharge. Irrigation officials are quick to point out that the canals were never designed for such use. Most canals have lower capacities and a narrowing channel the further you go down the canal. While this design makes sense for irrigation use, it is exactly the opposite of how you would design a canal to accommodate storm water discharge. The positions of many canals in Cache County also make them susceptible to blockage by debris or ice that can result in canal failure outflows. Cache County has had a couple of near misses in this regard. Another consideration is the connection between floods and landslides. As water saturation increases, mud/sediment/debris flows can be catastrophic.

In terms of potential damage to developed residential, commercial and industrial areas, the Logan & Blacksmith Fork Rivers pose the most significant threat for residents of Cache County. Both of these rivers drain large areas and have steep well defined stream channels. Flood level flows are produced when high temperatures occur during the early spring and accelerate the watershed snowmelt rate. Often this threat can be escalated when combined with early spring rains.

A number of dams are located on the Logan River in the canyon upstream of the City of Logan. Due to their relatively small size, they do little to moderate flood potential for downstream development.

The Bear River enters Cache County on the north near Preston, Idaho. Winding through the valley it eventually enters Cutler Reservoir. The risk from rising flood waters of the Bear River through Cache County is relatively minor. Land located in the Bear River flood plain has a high water table which makes development difficult. Most of adjacent land near the Bear is used for agricultural purposes. Farmers and ranchers have seemingly adapted their agricultural activities to mitigate the cyclical high flows effects of the Bear River. Much of the adjacent agricultural

uses along the Bear are operated under lease agreements with PacifiCorp who owns most of Cutler Reservoir. See the “FEMA Flood Zone” map on page 165.

History of Flooding in Cache County

In terms of historical flooding impact on development, most events have been documented on streams and rivers that drain the mountainous eastern portion of Cache County and flow into western Cache Valley. Most of the significant flooding that has historically impacted developed land has occurred on the Logan and Blacksmith Fork Rivers. However, noteworthy flooding has occurred on some of the smaller streams and creeks that enter the valley near the towns of Providence, Smithfield, and Richmond.

Location	Date	Description
Amalga	1980	No information available
Clarkston	1917	No information available
	Aug 1958	Crop damage, road damage
	Aug 1961	Crop & road damage, flooded homes
	1980, 1981	No information available
Hyde Park City	1993	Lower Canal failure, home flooded and property damage.
Logan	1882	No information available
	May 1907	Logan River flooding, basements of homes near river flooded. Most flooding in Logan’s recorded history.
	May 1957	Agricultural flooding in lower fields
	May 1958	Crop and road damage
	July 1962	Crop damage
	Sept 1963	Road damage
	June 1964	Crop damage, 2 inches rain in 24 hours
	1969	No information available
	1971	Low lying farms flooded, stream banks eroded, basements flooded.
	1972, 1976	No information available
	1977	Dry Canyon Flooding
	1978, 1980, 1981	No information available
	Spring 1983	Several bridges destroyed, undercutting of embankments, Canyon Road Landslide, culverts and roads.
	Aug 1997	Dry Canyon flash flooding
	1998	Flooding on the Blacksmith Fork River backed up Spring Creek and property damage occurred.
April-June 2005	Heavy rain, wet snowpack, and flooding in the southwest area of the City	

Table 8-2: Cache County Flood History 1847-2005		
Location	Date	Description
Mendon	April 2005	No information available
Millville	April 2005	Flooded homes and/or property from the Blacksmith Fork River.
Nibley	April 2005	Flooded homes and property from the Blacksmith Fork River
Providence	Aug 1959	Cloudburst flooding of dozens of homes near Spring Creek.
	2003	Flooding along Spring Creek
Richmond	April 2005	Flooding due to excess runoff through restricted culvert.
Smithfield	June 1964	A number of homes flooded by Summit Creek after intense storm
	June 2009	Flooding of homes, one business, and school
FEMA Flood insurance study for Logan City, 2-17-81; Local Surveys (see appendix A); Butler & Marsell, 1972; Division of Comprehensive Emergency Management, 1981; Cache County Risk Assessment Meeting, 2008.		

Table 8-3: Cache County Flood Hazard Assessment: Hazard Profile

Frequency	Some flooding occurs nearly every year in Cache County
Severity	Moderate
Location	Generally along rivers, streams, and canals.
Seasonal Pattern	Spring flooding as a result of snowmelt. Mid-late summer cloudburst events.
Duration	A few hours or up to three weeks for snowmelt flooding
Speed of Onset	1-6 hours
Probability of Future Occurrences	High - for delineated floodplains there is a 1% chance of flooding in any given year.

Localized flooding has been fairly common for many years. Damage from flooding has been relatively minor overall, but devastating to individual home and property owners. The majority of flooding in Cache County has occurred on agricultural land.

Following a development pattern like many other Utah and western communities, many early European settlements in Cache County were located near the mouths of canyons. Early settlers located there for easy access to water that could be diverted for irrigation of crops and pastures as well as fertile soils well suited for agriculture. Richmond, Smithfield, Logan, Providence Millville and Hyrum are all located near the mouths of canyons that drain some portion of the adjacent Bear River Range. The Logan River has the largest drainage basin next to the Bear at 524 square miles. The Blacksmith Fork drainage basin is the next largest at roughly 287 square miles.

Analysis of areas of Cache County mapped by FEMA for communities that participate in the National Flood Insurance Program indicate some conflict related to existing development located in what has been determined to be the 100-year floodplain. These delineated and digitized

floodplains were overlaid onto current county parcel data. In this way, parcels with structures in the floodplain could be identified and tallied, and potential losses to life and property could be estimated.

While FEMA floodplains are a great planning tool for hazard mitigation, there is much of Cache County that has never been mapped by FEMA. An August 2003 report entitled Flood Hazard Identification Study: Bear River Association of Governments by the U.S. Army Corps of Engineers was completed to help communities without floodplain data. This study generally identified areas of flooding concern for municipalities lacking data (See Appendix B for the full report). However, this report was only intended to give communities very general estimates of where flood risk may exist. Also, many flooding events happen outside of the FEMA 100-year floodplain delineations (around 40%). There are other ways that flooding occurs as well, such as canals, reservoirs/ponds, wildfire, incorrect grading, and plugged sewer and storm water systems (Scott Stoddard, personal communication, 11/13/08). FEMA is currently updating Cache County's floodplain data, which will be useful for communities in identifying their risk to floods. Below is a discussion of flooding risks for communities in Cache County. Only those communities thought to be at risk for flooding have been included.

Amalga has delineated 100-year floodplains, but does not participate in the National Flood Insurance Program. There are several structures which could be at risk from flooding on the very north end of municipal boundaries, and on the southeast side along the Bear River.

Clarkston also has some homes in flood prone areas. City Creek, Myler Creek, and Clarkston Creek drainages could affect 24 structures in the town.

Cornish does not participate in the NFIP. However, the Army Corps of Engineers (2003) states that the east side of the town has moderate flood risk for low lying areas near the Bear River.

Hyde Park City has a number of existing homes located in the 100 year flood plain along the stream that drains Hyde Park Canyon. In addition, development near the Logan Northern and Hyde Park Canals is a potential risk for flooding. The 2003 Cache County Storm Water Analysis report concluded that these canals through Hyde Park have deficient capacity to carry predicted flows resulting from a 10-year storm event of 3 hour duration. The problem areas predicted by this model are where the canal intersects 200 South, Center Street and 300 North in Hyde Park City (JUB Engineering, 2003).

During the 2009 update process, BRAG digitized floodplains for **Hyrum City**, being one of the largest cities in the region. During that process, it was concluded that Hyrum could have about 50 structures at risk from flooding. Several of those structures are along the banks of the Blacksmith Fork River, at the base of the canyon, and several are in floodplains below Hyrum Dam on the Little Bear River edges. However, the majority of structures at risk can be found along the Hyrum Canal which runs north and south between 200 and 300 East on the south of Main Street, and between 100 and 200 East north of Main Street.

Lewiston has about a dozen structures at risk from flooding. The municipal boundaries are flanked by the Cub River on the east and the Bear River on the west. There are also several smaller drainages into these rivers that pose threats as well.

In terms of the relative hazard from flooding, older residential development along the Logan River in the lower portions of **Logan City** commonly referred to as the “Island” area represents one of the most significant threats in Cache County. A number of older homes are located in the 100 year floodplain of the Logan River. In addition a number of newer (post 1970) homes have been constructed near the river in the floodplain (along Sumac and Thrushwood Drives).

Some homes in the Country Manor Subdivision along the Blacksmith Fork River are located in the 100 year floodplain as well. The Logan City Golf Course is also located in the 100 year floodplain. The golf course can accommodate flooding with a flood water storage device and is designed to moderate flooding downstream.

A number of canals make their way through Logan City. Potential for failure is significant for all canals. If storm water management is not properly addressed, the risk to life and property near canals increases as more development puts further demands on systems beyond their designed capabilities. According to a canal company representative, the Northwest Field/Benson Canal experiences difficulty accommodating demand with any storm event that totals ½ inch of precipitation in one hour. The canal has a permitted flow rate of 40.3 cfs and a calculated capacity of 60 cfs. The canal has potential to pick up 363 cfs in predicted storm water flows when measured near the airport (City of Logan, 2001).

In May 1996 the Logan and Northern Canal failed above Crockett Avenue pump house. City officials were forced to divert flows down Crockett Avenue into the Logan River to prevent damage to adjacent residences (City of Logan, 2001). Landslides are often inextricably linked to floods. In recent years, particularly in 2005 and 2009, landslides along the Logan and Northern Canal in the Island area caused damages to homes and property, and caused the deaths of three individuals in 2009. The canal sustained damages as well, and flooding from the damaged canal only added complications to clean up efforts.

A large portion of lower **Mendon Town** is mapped in the 100 year flood plain. Small streams that drain a portion of the eastern slope of the Wellsville Mountains flow through Mendon. Several steep drainages on the west which could pose threats are Deep Canyon, Thimbleberry Canyon, and Bird Canyon. Bird canyon drainages particularly pose the greatest threat to residents and property.

Another issue that poses a flooding threat for Mendon inhabitants comes from the town’s proximity to the Wellsville-Mendon Canal. Mendon is located on the lower stretches of the canal that begins at Hyrum Dam. The canal runs North-South uphill of Mendon Town. Site specific flood problems have occurred with this canal. Overtopping and bank erosion occurred in 1982. Flooding problems occurred when heavy rain fell on frozen ground.

The Lower Millville Providence Canal was demonstrated to have deficient capacities to accommodate a 10 year, 3 hour duration storm event as it flows though **Millville City**; when it

was modeled for the Cache County Storm Water Analysis report. Channel capacity for the canal was found to be deficient at 50 North, 150 North, 400 North and 2200 South in Millville City. In 2003, Millville, along with Nibley, experienced flooding from the Blacksmith Fork River. This section of river is not a natural waterway, but has a form similar to a canal, with banks built up on either side with past breach of high water flows. Potential losses can also be found on the northwest section of municipal boundaries, near the confluence of the Blacksmith Fork River and the Logan River. There are also several structures at risk on the very south end of the municipal boundaries where the Millville Canyon drainage empties into the Blacksmith Fork River. Millville floodplain analysis reveals at least 7 residential structures that intersect the delineated floodplain.

Newton Town is bordered on the east side by Newton Creek. This poses threats to several structures near that drainage.

Nibley City participates in the NFIP. Analysis of available data reveals significant potential losses in the delineated floodplain. There are two floodplain segments that enter the city from the southeast. One segment extends north along the Blacksmith Fork River drainage to the northern boundary of the city limit. The other extends southeast to northwest to 3200 South St. Our analysis shows potential risk to at least 123 residential properties with an estimated value of 23.4 million dollars. This is especially true where flooding occurred in 2003 at the confluence of Highway 165 and the Canal. The Canal also flanks the municipality on the northwest which could affect several structures closer to Highway 89-91 in the event of a flood.

Paradise has an online Flood Insurance Rate Map (FIRM), but does not participate in the NFIP. Paradise participated in the past but is now listed on FEMA's Community Status Book Report as "Not Participating" and the 2003 study conducted by the Army Corps of Engineers did not address Paradise flood risk. Analysis of the digitized floodplain shows several structures at risk along the Paradise Canal with an estimated 4.1 million dollars in potential losses to residential property.

Providence participates in the NFIP and has a current designation of NSFHA (No Special Flood Hazard Area). The FIRM created in the 1970's was rescinded by FEMA and any flood management resides with the municipality. Due to annexations of previously unincorporated areas in northern Providence, FEMA Zone A floodplains that used to be in the county are now within city boundaries. Comparisons of aerial imagery and current parcel data show recent development in the floodplain that extends from Spring Creek. The Cache County Storm Water Analysis report also suggests that capacity deficiency exists on the Lower Millville Providence Canal as the canal nears 500 South, 400 South, 200 South, 100 South and 100 North. Deficiencies also exist on the Upper Millville Providence Canal near 580 South, 300 South, 200 South, Center St., 200 North (JUB Engineering, 2003).

Lower portions of **Richmond City** are located in the 100 year floodplain. The flood threat comes from City Creek, a small tributary that drains a portion of the fairly steep mountains to the east of Richmond City. Richmond has about 50 structures at risk, mostly along City Creek, and a few more to the north along Cherry Creek. Even though a large portion of the city is identified as being in the 100 year flood plain, no significant flooding has occurred historically on City

Creek. A large portion of the stream flow can be diverted into an irrigation canal above Richmond City. This may help to moderate the impacts of high stream flows.

Although there are several canyons east of **River Heights** that could create risk for flooding, according to the Army Corps of Engineers (2003), there appears to be little risk. Where there were concerns with the Dry Canyon drainage, a large detention basin has been constructed to mitigate potential flooding and debris flows. However, floodplain delineation could be useful for the city, and could be used to learn about flood prevention.

Residential development in **Smithfield City** along Summit Creek is also threatened by significant flooding potential. There are over 200 structures in the floodplain, with the majority in the Summit Creek drainage through the middle of town. However, in post-settlement history the impacts to Smithfield residences have been minimal from Summit Creek. During the 1983 flooding that impacted nearly the whole state; Smithfield did experience some rising flows in Summit Creek that were contained by sandbagging. There are also some structures in the floodplain in the drainage north of Saddleback Road.

The Logan Northern Canal flows through much of Smithfield City. Although minimal property damage has occurred, the canal has some sections that have been problematic and vulnerable to bank overflow. Most of the problems are associated with debris accumulation and/or storm surge water levels. Problem areas include around 400 South and about 400 East, 100 South to Center Street and 50th East, 300 to 400 North, and 50th West. During the 1983 floods, a large debris flow almost reached the Logan, Hyde Park, and Smithfield Canal. Had the canal be blocked, significant flooding would have occurred.

The Cache County Storm Water Analysis Report concluded that the Logan, Hyde Park & Smithfield Canal as it passes though Smithfield City is deficient in capacity to accommodate a 10-year storm event of 3 hour duration. The report modeled such a storm event and analyzed drainage capacity of the canal. Potential problem areas were identified where the canal intersects 600 South, 400 South, 200 South, and 200 North in Smithfield (overtopping near 200 North would cause minor damage because it would flow onto Birch Creek Golf Course). Further, the Logan Northern Canal was found deficient as it intersects 300 South, 200 East (150 S.), and Center Street in Smithfield City (JUB Engineering, 2003).

Trenton Town does not participate in the National Flood Insurance Program. According to the Army Corps of Engineers, flooding could be problematic east of town from the Bear River. Ransom Hollow Creek could also create flooding issues during a 100-year flood event.

The **unincorporated areas** of Cache County have many structures located in the 100-year floodplain (approximately 395). Generally, as can be expected, these structures are located in drainage areas along the Little Bear, Blacksmith Fork, Logan, Bear, and Cub Rivers. Susceptible structures along the Little Bear River can be found from Hyrum Reservoir, to Paradise Town, and south along both the South and East Forks of the river. There are also structures at risk below Hyrum Dam, and in the lower drainages of the river north of Wellsville and east of Mendon. Structures are also at risk along the Hyrum Canal north of Paradise, and east of the town below Green Canyon.

The Wellsville Mountain drainages above Mendon and Wellsville also have many structures at risk from floods. Where drainages meander towards the valley bottom, and alongside the Wellsville-Mendon Canal, there are also structures in the 100-year floodplains.

The Blacksmith Fork and Logan River drainages also pose risk to several structures. Floodplains south and east of Nibley and below Millville Canyon could also be destructive to homes. There are also several cabin properties in Blacksmith Fork Canyon that are in 100-year floodplains. These are all on the south side of Highway 101. In the unincorporated areas along the Logan River, structures at risk are located west of Logan municipal boundaries where the river deposits into Cutler Marsh.

The drainages of both the Bear and Cub Rivers are lined with property with structures that could be susceptible to flooding. If 100-year flood events didn't affect the structures, it's quite possible that some could be damaged from a high water table in those areas. However, it is difficult to determine whether or not structures on these large parcels of land are at risk. Parcels with structures were all extracted if the property intersects 100-year floodplains, but it is not reasonable in an analysis of this extent to look individually at each structure. South of Amalga along the Bear River has structures at risk, as well as structures east and south of Lewiston municipal boundaries.

Several structures near Newton along Newton Creek, and some east and south of Clarkston along Clarkston Creek are also at risk.

Floodplains surrounding Cherry Creek and City Creek near Richmond also pose risks to several structures. There are also structures along High Creek along High Creek Road, and south of Cove in the same drainage, before High Creek merges with the Cub River.

Structures along Summit Creek, in the canyon and east of Smithfield City boundaries, are also located in the floodplain. Risk is also evident in the Summit Creek drainage west of town, where the creek merges with the Bear River.

Wellsville has about 110 structures currently located in the 100-year floodplain. These structures are located in drainages running through town from the east and south benches into the Little Bear River. There are also some structures at risk along the Little Bear River and on the north end of town along the Lower Wellsville-Mendon Canal.

Assessing Vulnerability: Addressing Repetitive Loss Properties

There are no repetitive loss properties in Cache County (FEMA, 2008).

Assessing Vulnerability: Identifying Assets & Estimating Losses

Table 8-4: Cache County Residential and Commercial Development at Risk from Floods						
Jurisdiction	~Residents at Risk*	Residential Units at Risk		Commercial Units at Risk		
		# Units	\$ Value**	# Units	\$ Value**	\$ Potential Revenue

						Loss***
Amalga°	29	9	1,485,341	1	8,904,160	691,653
Clarkston	78	24	2,346,564	0	0	0
Hyde Park	104	32	6,950,838	0	0	0
Hyrum	159	49	7,074,574	1	985,535	691,653
Lewiston	39	12	2,059,999	0	0	0
Logan	554	171	28,831,562	22	15,346,551	15,216,366
Mendon	168	52	8,272,739	0	0	0
Millville	29	9	1,416,206	6	4,175,410	4,149,918
Newton	26	8	928,587	0	0	0
Nibley	402	124	23,504,788	4	1,622,105	2,766,612
North Logan	126	39	6,760,725	0	0	0
Paradise°	87	27	4,183,286	1	1,000	691,653
Providence	Insufficient Data					
Richmond	165	51	7,187,444	0	0	0
Smithfield	693	214	31,069,483	2	340,250	1,383,306
Unincorporated	1,251	386	81,268,823	9	6,082,487	6,224,877
Wellsville	350	108	19,221,619	5	690,327	3,458,265
River Heights	Not participating in NFIP - No Floodplain Data (See Appendix ?)					
Trenton	Not participating in NFIP - No Floodplain Data (See Appendix ?)					
Cornish	Not participating in NFIP - No Floodplain Data (See Appendix ?)					
Notes: All residential and commercial units and values were derived from Cache County parcel data.						
*Based on average persons per household for Cache County from 2000 Census data, which is 3.24. Numbers were adjusted for multi-family residential units accordingly.						
**Current Market Value						
***Derived from 2002 Survey of Business Owners for Cache County, US Census Bureau. Average firm receipts totaled \$691,653.						
°Has a Flood Insurance Rate Map, but does not participate in NFIP.						
Communities not listed do not have any potential residential or commercial losses according to this assessment.						

Jurisdiction	Critical Facilities	Roads			Rail Lines	
		Type	Miles	\$ Value*	Miles	\$ Value**
Amalga°	None	PLR	0.3	896,730	0	0
	None	SH	0.2	989,724	0	0
Hyrum	None	SH	0.1	875,874	0.1	157,324
Lewiston	None	SH	0.8	4,962,672	0.1	132,454
Logan	Riverside Pre-school	SH	1.1	6,470,118	0.3	508,350
Mendon	None	PLR	0.01	25,950	0	0
	None	SH	0.3	2,079,624	0	0
Millville	None	SH	0.2	1,118,022	0	0

Newton	None	SH	0.002	14,358	0	0
Nibley	None	SH	0.878	5,265,990	0	0
Richmond	None	SH	0.2	950,388	0.1	148,467
Smithfield	None	SH	0.1	764,130	0.2	264,644
Unincorporated	None	PLR	3.7	11,099,220	1.6	2,599,266
	None	SH	3.9	23,467,638	0	0
Wellsville	Willow Valley Middle School	SH	0.1	810,228	0.1	149,300
Paradise ^o	None	PLR	0.04	124,194	0	0
Providence	Insufficient Data					
River Heights	Not participating in NFIP - No Floodplain Data (See Appendix ?)					
Trenton	Not participating in NFIP - No Floodplain Data (See Appendix ?)					
Cornish	Not participating in NFIP - No Floodplain Data (See Appendix ?)					
<p>IH = Interstate Highway (6 lanes), SH = State Highway (4 lanes), PLR = Paved Local Roads (2 lanes)</p> <p>*Average building cost for roads = \$1.5 million per lane-mile (Utah's Unified Transportation Plan, 2007-2030, UDOT & Utah MPO's)</p> <p>**Average building cost for rail lines = \$300.00 per foot, minimum, or \$1,584,000 per mile, minimum (Jim Marshall, Manager Special Projects Industry & Public, Union Pacific Railroad, Utah, personal communication)</p> <p>^oHas a Flood Insurance Rate Map, but does not participate in the NFIP.</p> <p>Communities not listed do not have any potential losses according to this assessment.</p>						

Assessing Vulnerability: Analyzing Development Trends

Many of the municipalities in Cache County do not have adequate ordinances or regulations in place to restrict development in flood prone areas. Development pressure in flood prone areas intensifies as more development occurs and new development is pushed to marginal areas. This is especially true with the cities in the Logan Urbanized Area.

Development is occurring near the numerous irrigation canals, which is to be expected. Canals cut through most communities and are difficult, if not impossible, to avoid. This is not necessarily a problem. Properly designed and utilized canals are not necessarily a flood risk. They were designed to transport irrigation water; not storm water. As development occurs in the sub basins near canals, the dramatically increased runoff generated by the added impervious surface area has to go somewhere. A great deal of this urban runoff ends up in the canals. As has been noted, these canals are built to handle less water as it moves through the system. The canal usually has the highest capacity near the water source, which is at the highest elevation. As water is used for agriculture and other purposes, the amount of water in the canal decreases. These canals are built to carry water being used downstream. Flood and storm water management systems should be built the opposite of canal design. As elevation decreases, capacity to hold water in storm water systems should increase.

Existing storm water management systems in many cities rely on these canals to accommodate storm water flows. Many of these canal systems are at capacity for storms of near normal precipitation. Higher than normal storms will put demands on the canal systems that they cannot accommodate. Some problems have already occurred and many more are likely to happen if

jurisdictions do not get a handle on alternative methods of storm water management. The most reasonable approach is to require all new development to accommodate its own storm water on-site.

In many circumstances the communities that are at risk from overtopping canals are not necessarily the ones creating the problem. Often canals will flow through one or more communities. It's generally the community farthest downstream that has the problems. The upstream communities may be the ones generating the most storm water outflows into the canal, but it's the one at the end of the system that is more likely to get flooded. The solution must include regional cooperation.

Another important aspect to consider with flood risk in Cache County is wildfire damage. When steep slopes along the east bench and other foothills of the county are cleared of vegetation by wildfire, flooding and mud slides/earth flows can threaten the life and property of residents, not to mention the infrastructure and emergency access issues that could arise.

While there are many communities in Cache Valley that could see substantial growth in the next few years, several seem more likely than the rest. These include Logan, Nibley, Providence, North Logan, Smithfield, Hyrum, Hyde Park, and Wellsville (listed in order of high numerical growth for 2000-2007). While existing homes may be in flood-prone areas in these communities, some could have more risk to future development than others. Only those that are thought to have future development at risk from flooding are included in the following text.

Logan City could be vulnerable in the future north of Icon along the Logan River. Also, residential and commercial infill south of Highway 89-91 in the Blacksmith Fork drainage and the Spring Creek drainage could be problematic, as the two streams join with the Logan River downstream.

On the north end of Providence City, the Spring Creek drainage is currently being built on with new homes. As this development continues, more homes may be at risk to flooding. As the north east end of the city continues to develop with commercial and residential structures, this drainage could threaten lives and property.

North Logan City has been one of the fastest growing communities in the valley. New developments have begun to dot the eastern bench and farmland throughout the municipality. Floodplains originating from Green Canyon could easily be built out, specifically west of the Hyde Park and Smithfield Canal.

While currently there doesn't seem to be any developments in Smithfield which would build out in the 100-year floodplain, infill could be placed at risk. There are still large empty lots in the floodplain, particularly south of Highway 218 in the Summit Creek drainage, where houses could still be built placing residents and property at risk.

In general, structures built near to the Hyrum Canal would be in the 100-year floodplain. This canal runs from the East Fork of the Little Bear River through Hyrum City, and eventually into Spring Creek before returning back to the Little Bear River near Cutler Marsh. There is land

along the canal and near to Highway 101 and also 300 North, which is close to infrastructure and fairly new housing, and could developed in the near future.

Hyde Park has one major flood hazard on the north end of town which is currently flanked by development. Some of this development is fairly recent, and could continue into the floodplain.



CACHE COUNTY WILDFIRES

Background

Wildfire has always had an impact on Cache County inhabitants. In August of 2007, four wildfires burned hillsides east of Providence, River Heights, and Logan City fueled by dry grasses and juniper. Some people were evacuated from their homes while others were told to be ready just in case. Luckily, no homes were lost. To a certain extent, living with wildfires will always be a part living in Cache County.

Many of the communities in Cache County are located along the base of the Bear River Mountains in Cache Valley. Paradise, Millville, Providence, River Heights, Logan, North Logan, Hyde Park City, and Richmond all have wild land-urban interface or potential interface with wildfire high risk areas. Wellsville and Mendon on the east side of the valley have potential wildfire-urban conflict for development along the base of the Wellsville Mountains. **See the “Wildfire Hazard” map on page 166.**

In addition a number of cabins are located on private in-holdings or long-term leases in the Cache National Forest.

History of Wildfires in Cache County

The following graphic illustrates the number and rough locations of wild fires in Cache County in the period from 1973 to 2008.

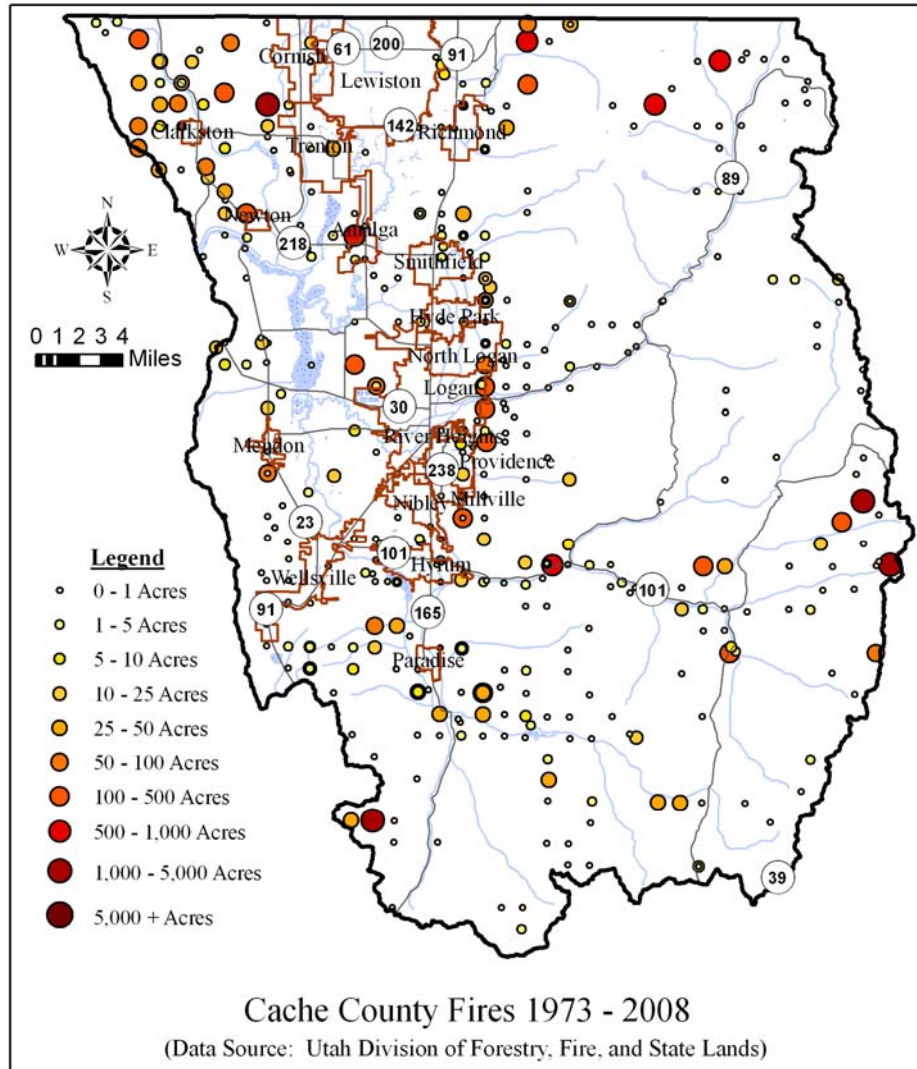


Table 8-6: Cache County Wildfire Hazard Assessment: Hazard Profile

Frequency	Annually (to some extent)
Severity	Severe
Location	Mostly along the Bear River Mountains east of Cache Valley or the Wellsville Mountains west of Cache Valley.
Seasonal Pattern	Generally the worst from early July to mid September (depends on drought conditions)
Duration	A few hours to two weeks
Speed of Onset	1-12 hours
Probability of Future Occurrences	High (Based on data from 1973-2008, there is an 11.4% chance a fire of at least 1,000 acres will occur every year)

As seen in the potential loss estimates in the following charts, eastern Cache County communities are at the most risk from wildfires. **Hyde Park, Hyrum, Logan, Millville, North**

Logan, Providence, Richmond, and River Heights all have development in the high and extreme wildfire potential areas. Logan, being the largest city in the county, has about 380 structures at risk from wildfire, Providence has 113, and Millville has 106. These wildfire threatened structures are all located on the eastern bench areas where vegetation types are conducive to wildfire. This was evident in 2007, when there were four fires on the west-facing slopes above Providence, River Heights, and Logan.

Trenton and Wellsville also border some high to extreme wildfire potential areas, although to a much lesser extent. These threats come from the western sides of both towns, where vegetation types could fuel a potential wildfire in the future.

In **unincorporated Cache County**, the Scare Canyon and Hardware Park developments in the southeast part of the County have about 120 cabins and a large number of developable lots. About 38 cabins are located in Logan Canyon along U.S. 89; many in the Birch Glen area.

Assessing Vulnerability: Identifying Assets & Estimating Losses

Table 8-7: Cache County Residential and Commercial Development at Risk from Wildfire						
Jurisdiction	~Residents at Risk*	Residential Units at Risk		Commercial Units at Risk		
		# Units	\$ Value**	# Units	\$ Value**	\$ Potential Revenue Loss***
Hyde Park	194	60	16,181,028	0	0	0
Hyrum	42	13	3,229,660	0	0	0
Logan	1,234	381	113,096,570	2	39,180	1,383,306
Millville	343	106	17,854,712	0	0	0
North Logan	120	37	12,135,787	0	0	0
Providence	363	112	34,425,709	1	74,600	691,653
Richmond	32	10	2,268,814	0	0	0
River Heights	26	8	2,263,807	0	0	0
Trenton	3	1	151,700	0	0	0
Wellsville	16	5	1,434,633	28	2,873,428	19,366,284
Unincorporated	492	152	32,236,196	15	2,361,488	10,374,795

Notes: All residential and commercial units and values were derived from Cache County parcel data.
 *Based on average persons per household for Cache County from 2000 Census data, which is 3.24. Numbers were adjusted for multi-family residential units accordingly.
 **Current Market Value
 ***Derived from 2002 Survey of Business Owners for Cache County, US Census Bureau. Average firm receipts totaled \$691,653.
Communities not listed do not have any potential residential or commercial losses according to this assessment.

Table 8-8: Cache County - Other Facilities at Risk from Wildfire			
Jurisdiction	Critical	Roads	Rail Lines

	Facilities	Type	Miles	\$ Value*	Miles	\$ Value**
Hyrum	none	SH	0.2	1,100,880	0	0
Logan	none	SH	0.3	1,782,750	0	0
Trenton	none	SH	0.05	276,312	0	0
Wellsville	none	SH	1.1	6,673,074	0	0
Unincorporated	none	PLR	2.3	6,772,044	3.3	5,212,147
		SH	35.1	210,819,396		
IH = Interstate Highway (6 lanes), SH = State Highway (4 lanes), PLR = Paved Local Roads (2 lanes) *Average building cost for roads = \$1.5 million per lane-mile (Utah's Unified Transportation Plan, 2007-2030, UDOT & Utah MPO's) **Average building cost for rail lines = \$300.00 per foot, minimum, or \$1,584,000 per mile, minimum (Jim Marshall, Manager Special Projects Industry & Public, Union Pacific Railroad, Utah, personal communication) Communities not listed do not have any potential losses according to this assessment.						

Assessing Vulnerability: Analyzing Development Trends

The areas that expose development to the most risk from wildfires are often the most desirable places to live. These places afford residents good views, access to public lands, open space and a connection with nature. Most jurisdictions have found it difficult to restrict, limit or modify development proposals for these areas. Areas not listed below do not likely have wildfire risk to future development.

In the northeast and east side of Hyde Park, new development is occurring, and will likely continue in wildfire prone areas along the bench. Agricultural lands are being subdivided east of the canal, and it's quite possible that Hyde Park along with other communities in the valley will continue to annex up to the U.S. Forest Service boundaries. If this is the case, the city could grow into these high fire risk areas.

Hyrum City could also have risk to new structures if built in fire prone areas at the bottom of Blacksmith Fork Canyon.

Logan City is also expanding to the eastern edges of the municipal boundaries and alongside U.S. Forest Service boundaries. East of the Hyde Park and Smithfield Canal, more housing is being constructed, where hillside vegetation could pose serious risk to residents and their homes. Also, on the hillsides south of Dry Canyon there could be more homes built near recently developed lots, as well as the lots east of River Heights.

Millville also has a similar situation, where development could continue east of recent development to the border of land owned and managed by the State of Utah Division of Wildlife Resources.

North Logan City still has some land on the eastern side of municipal boundaries which are not wildfire prone. However, as this continues near U.S. Forest Service boundaries, these hillsides could prove destructive to new development if a wildfire ensues.

Providence City could also have issues in the future with eastern bench development in wildfire prone areas.

Future development that could be at risk in the future from wildfires in the unincorporated parts of the county are the following: All of the east benches in the valley from the state line on the north to Hyrum City, land surrounding Avon and along the Little Bear River and tributaries, the west benches between Mendon and Wellsville. Also, the south end of the valley is at risk from wildfire including future development near Powder Mountain, La Plata Ranch, and Scare Canyon.



CACHE COUNTY LANDSLIDES

Background

Landslide occurrences are common for portions of Cache County. The most frequent problems are associated with debris flows on alluvial fans in many of the canyon drainages. Also important to consider is the link between flooding and landslides. Saturated soils only add to the problems associated with landslides, and a combination of the flooding and landslides can be very destructive. See the “Landslide Potential” map on page 167.

History of Landslides in Cache County

Table 8-9: Historical Cache County Landslides 1850-1978 (incomplete)			
Year	Location	Type	Description
2009	Logan City at about 400 N. and Canyon Road	Landslide	Hillside on Logan and Northern Canal slid into several homes, collapsing one home, with 3 casualties. Canal also broke on the slide.
2005	Logan City on Canyon Road	Landslide	Crocket Avenue and Canyon Road; hillside slid into the canal and into the back of one home.
1983	Logan City on Crockett Avenue	Landslide	Crocket Avenue; mudslide above the canal, caused canal to overflow, sending mud and water down the street. No property damage.
1978	Logan Bluff Landslide Zone	Landslide	Occurred on the Logan and Northern Canal.
1977	Logan Bluff Landslide Zone	Landslide	Occurred on the Logan and Northern Canal.
1976	Logan Bluff Landslide Zone	Landslide	Occurred on the Logan and Northern Canal.
1973	Logan Bluff Landslide Zone	Landslide	Occurred on the Logan and Northern Canal.
1959	Logan Canyon	Debris Flow	
Pre-1943	Logan Bluff Landslide Zone	Landslide	Logan and Northern Canal at or east of 1100 East Canyon Road. Three separate events.
1929	Logan Canyon	Rock Fall	Rock loosened by recent rain.
1929	Logan Canyon	Rock Fall	Rock loosened by recent rain (a few days later than the first).
Pre-1919	Logan Bluff Landslide Zone	Landslide	Logan and Northern Canal between 1100 and 1500 East Canyon Road. Two separate events.

1916	Logan Bluff Landslide Zone	Landslide	Occurred on the Logan and Northern Canal at approximately 500 East Canyon Road.
1904	Logan Bluff Landslide Zone	Landslide	Occurred on the Logan and Northern Canal.
1899	Logan Bluff Landslide Zone	Landslide	Occurred on the Logan and Northern Canal.
1895	Hyrum Canal near Logan	Landslide	
1890	Bear River west of Smithfield	Landslide	Crossed the Bear River and resulted in a twisted bridge.
1881	Battle Creek Hill	Landslide	
1874	Hyrum Canyon	Rock Fall	A ledge of rocks fell on two people who were killed.
Sources: Elliott and Kirschbaum, 2007, and the Cache County Working Group Risk Assessment Meeting, 7/14/08.			

During the wet years of 1982 & 1983 an abnormally high numbers of landslides occurred in Cache County. A rather large land mass slid into the Porcupine Reservoir upstream of the right abutment. A slide near Nibley Road east of Hyrum occurred in the back yard of a residential home. A slide on College Hill below Utah State University blocked the Logan and Northern Irrigation Canal causing some limited flooding. The road up Millville Canyon was displaced 4 feet by a slide. A debris flow from Dry Creek above Smithfield reached the Logan, Hyde Park and Smithfield Canal (south of 300 South).

Table 8-10: Cache County Landslide Hazard Assessment: Hazard Profile

Frequency	Periodic
Severity	Moderate
Location	Generally located in areas with steeper slopes. Debris flows mostly occur at the mouth of canyon drainages.
Seasonal Pattern	Generally the worst in the wetter spring months.
Duration	Up to two weeks
Speed of Onset	No warning
Probability of Future Occurrences	High

Debris flows present a significant threat for development located in the mouths of the many steep canyons located in Cache County. The dynamics of this threat changes depending on the upslope drainage conditions. Wildfire that removes sediment stabilizing vegetation can dramatically increase the risk of debris flows. The other indirect threat comes from canal flooding caused by debris flow blockage.

While there is no data that can predict landslide potential completely, the Utah Geological Survey created a landslide susceptibility map for the entire state in 2007. This is the most accurate dataset to date, and was used for this analysis. However, the Utah Geological Survey is

in the process of finalizing a more accurate geological hazards study specifically for Cache County. In the next update of this plan, the newer data could provide a more accurate potential loss analysis for geological hazards.

Hyrum could have potential losses from landslides on the eastern side of municipal boundaries in the new subdivision along Highway 101.

Large portions of the “Island” area and the Utah State University campus in **Logan** are located on landslide areas. Landslides on these Lake Bonneville sediments are fairly common, as is evident in the landslide history chart for Cache County. Logan also has several drainages north and south of Dry Canyon where landslides could damage many structures.

Some of the largest landslides and those that pose the greatest threat to human life and property in Cache County are the following: Utah State University (USU) and the Island area have a large landslide area which could threaten human life and cause damage to homes and infrastructure. Particularly in the Island area of Logan City, historical landslides have covered roads and damaged homes. As seen in Table 8-9, multiple landslides near Canyon Road, Crockett Avenue, and the Logan and Northern Canal have occurred. On July 11, 2009 a landslide occurred on the hillside along which the Logan and Northern Canal runs, which destroyed a home downhill. Three individuals died in the slide. It has yet to be determined what the cause of the landslide was.

According to USU campus planning, the section of campus at the top of the large landslide prone area at the base of Logan Canyon has not had any major landslide activity throughout most of the Universities history. Edith Bowen and Hillcrest Elementary Schools are both located on the upper end of this slide. While they are listed as potential losses in Table 8-11, they are not thought by USU campus planning to be at great risk. Logan also has several large landslide areas on the southeast, where homes are being built on the foothills at the base of several small drainages.

Nibley only has one structure at risk on the south end of the municipality.

North of Spring Creek and uphill from the Von Baer Park in **Providence**, there are several landslide susceptible areas with homes. The City also has landslide areas at the base of the smaller drainages on the east bench where there is newer development.

On Canyon Road and Robin Street in **Smithfield**, several homes are at risk from landslides.

Trenton has one structure at risk from landslides on the far south end of the municipal boundary.

Wellsville City only has one commercial area that could be at risk from landslide. This is on the far southwest edge of the municipality. However, how much risk the actual commercial structures have from landslides is questionable.

Unincorporated areas at risk from landslides in Cache County are the following: Northeast of Hyrum City in the Blacksmith Fork River drainage, west of Paradise Town near the Little Bear

River drainage, between Mendon and Wellsville along the western bench, surrounding and south of Avon on the western and eastern hillsides, west of Newton near the county line, and a few scattered homes along the east bench from Smithfield to the Idaho State line.

Assessing Vulnerability: Identifying Assets & Estimating Losses

Table 8-11: Cache County Residential and Commercial Development at Risk from Landslides						
Jurisdiction	~Residents at Risk*	Residential Units at Risk		Commercial Units at Risk		
		# Units	\$ Value**	# Units	\$ Value**	\$ Potential Revenue Loss***
Hyrum	246	76	9,921,491	7	1,392,436	4,841,571
Logan	2,731	843	140,455,406	8	3,334,310	5,533,224
Nibley	3	1	389,500	0	0	0
Providence	272	84	25,341,474	0	0	0
Smithfield	19	6	1,431,900	0	0	0
Trenton	3	1	80,600	0	0	0
Wellsville	0	0	0	1	40,000	691,653
Unincorporated	214	66	26,218,174	6	481,767	4,149,918

Notes: All residential and commercial units and values were derived from Cache County parcel data.
 *Based on average persons per household for Cache County from 2000 Census data, which is 3.24. Numbers were adjusted for multi-family residential units accordingly.
 **Current Market Value
 ***Derived from 2002 Survey of Business Owners for Cache County, US Census Bureau. Average firm receipts totaled \$691,653.
Communities not listed do not have any potential residential or commercial losses according to this assessment.

Table 8-12: Cache County - Other Facilities at Risk from Landslides						
Jurisdiction	Critical Facilities	Roads			Rail Lines	
		Type	Miles	\$ Value*	Miles	\$ Value**
Hyrum	Canyon Elementary School	SH	0.2	1,156,494	0	0
Logan	Edith Bowen Elementary School, Hillcrest Elementary School,	SH	0.9	5,342,394	0	0
Trenton	None	SH	0.3	2,049,654		0
Unincorporated	None	PLR	0.4	1,312,143	0.8	1,342,435
		SH	0.6	3,433,866		

IH = Interstate Highway (6 lanes), SH = State Highway (4 lanes), PLR = Paved Local Roads (2 lanes)
 *Average building cost for roads = \$1.5 million per lane-mile (Utah's Unified Transportation Plan, 2007-2030, UDOT & Utah MPO's)
 **Average building cost for rail lines = \$300.00 per foot, minimum, or \$1,584,000 per mile, minimum (Jim Marshall, Manager Special Projects Industry & Public, Union Pacific Railroad, Utah, personal communication)
Communities not listed do not have any potential losses according to this assessment.

Assessing Vulnerability: Analyzing Development Trends

Increasing development occurring in the mouths of canyons along the Bear River Range should be of critical concern to local land use officials. This land is often the most desirable to develop, with views of the valley, and wildlife close by.

Logan Canyon and Dry Canyon already have significant development in high landslide susceptibility areas. There are still large tracts of land north and south of Dry Canyon, but the majority of it is owned by one entity and may not be developed in the near future. However, south of Dry Canyon in several small drainages, housing will probably continue to be built, placing structures and residents in harm's way.

Providence has a similar situation, where northeastern drainages with landslide prone areas will continue to threaten new development on the benches. This land is currently farmland which will be fairly easy to develop, and is close to new subdivisions.

Also of concern is the new development on the east side of Hyrum City, where housing will probably replace the current farmland. Subdivisions could be easily expanded to the east and south which is all a large landslide area.



CACHE COUNTY EARTHQUAKES

Background

Cache County is located in a seismically active region within the Intermountain Seismic Belt. The most damaging earthquake in Utah's post-European settlement history occurred near Richmond City. In 1962 a 5.7 magnitude earthquake damaged nearly three-fourths of the homes in the town. Damage to homes and buildings occurred in many surrounding areas of Cache Valley (Christenson, 1992). Some geological evidence suggests that an earthquake of seven plus magnitude has occurred in recent geological history on the West Cache Fault Zone. **See the “Earthquake Fault Zone” and “Liquefaction Potential” maps on pages 168-170.** Logan City also suffered from a smaller earthquake of a 3.7 magnitude on July 21, 1950.

History of Earthquakes in Cache County

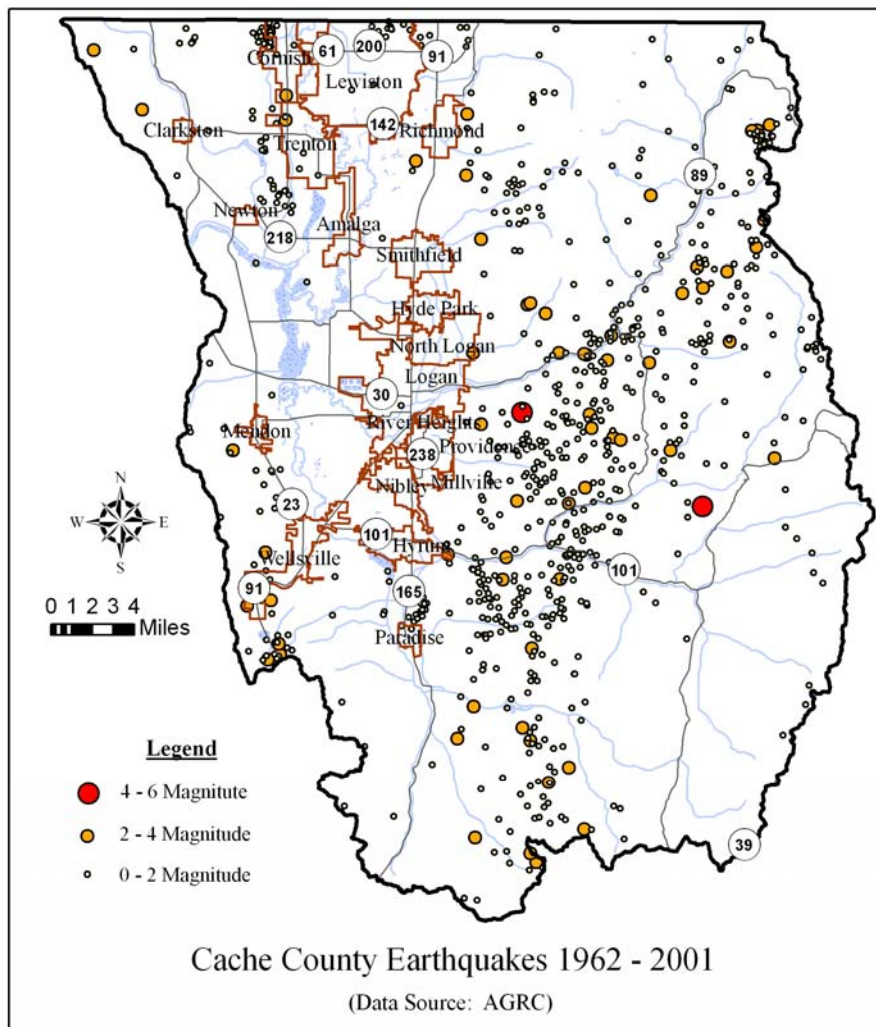


Table 8-13: Cache County Earthquake Hazard Assessment: Hazard Profile

Frequency	Low magnitude events occur frequently. Larger magnitude events are rare (although not necessarily on geological time).
Severity	Potentially Catastrophic
Location	Entire county with highest frequency in the Bear River Mountain Range. Surface fault rupture is likely to occur in fault zones, and liquefaction would impact large areas of land in the lower elevations.
Seasonal Pattern	None
Duration	A few minutes with potential aftershocks
Speed of Onset	No warning
Probability of Future Occurrences	Based on 1962-2001 data, there is a 20.5% chance every year of an earthquake of 3.0 magnitude or greater.

Three important fault zones exist in Cache County. The East Cache Fault bounding the eastern portion of Cache Valley, the West Cache Fault bounding the western valley, and the nearby Wasatch Fault. The majority of Cache County’s population is located near the Eastern Cache Fault. Evidence points to the Temple Fork Fault as the most active in Cache County. Although miles away from the epicenter, this fault is thought to be associated with the 1962 Richmond Earthquake.

While a geological fault may not be very wide physically, damage around the fault can be detrimental. This is often referred to as the “damage zone (Susanne Janecke, personal communication, 9/25/08).” This damage zone is now thought to be much larger than recognized previously. While geologists used to recommend a general fault buffer of fifty feet on either side of the fault, they now recognize a much larger damage zone. According to the Utah Geological Survey, up thrown sides of well defined quaternary faults require planning for a 250 foot damage zone; while down thrown sides of well defined faults require planning for a 500 foot damage zone. For those faults not well defined, a general 1,000 foot damage zone should be considered (Richard Giraud, personal communication, 10/6/08; Christopher Duross, personal communication, 10/30/08; Christensen et al., 2003). Because of data and time limitations in this plan, a standard 500 foot damage zone was analyzed for well defined quaternary faults, and a standard 1,000 foot damage zone was analyzed for those faults that are not well defined.

Liquefaction is also a major concern for Cache County, as well as much of the Bear River Region. During an earthquake, soils susceptible to liquefaction such as those containing current or historical stream and lake sandy deposits can threaten lives and damage homes and infrastructure (Utah Geological Survey, 2008). These soils can lift structures, tilt foundations, and cause major damage to infrastructure. Generally speaking, liquefaction susceptible areas in Cache County are along stream drainages and marsh/wetland areas. For this plan, two liquefaction studies were used for determining potential losses. One study was done by Utah State University and the Utah Geological Survey in 1994, and was digitized in 2001, which covered the entire county. The other was done in 2001 by the Utah Geological Survey at a more detailed scale, and only encompassed the more populated areas of the county.

The latter study is titled “Seismic-Hazard Mapping of the Central Cache Valley, Utah - A Digital Pilot Project” by McCalpin and Solomon. It provides more recent analysis and mapping of earthquake hazards for the Newton, Smithfield, Wellsville and Logan 7.5-minute USGS quadrangles. The information contained in this report is considered more accurate and the delineations more defensible.

Fault Damage Zone Potential Losses

Cornish has several structures located on the fault west of town alongside the municipal boundary.

Hyde Park has a large fault zone on the east edge of town. New subdivisions which are slowly growing east could potentially place residents and property in danger during an earthquake. There are currently 52 residential structures at risk in Hyde Park.

Hyrum has one structure at risk from fault damage in the Black Smith Fork drainage at the bottom of the canyon.

On the east side of **Logan City**, old and new structures have been built along the fault damage zone, including those on the northeast end of the Logan Golf and Country Club. There are also several structures north and south of the base of Dry Canyon that could be at risk as well.

Mendon's new development on the east side of town along Mendon Road and 600 North has homes in the fault damage zone. Including several other structures north and south of this development, here are currently 27 structures total at risk in Mendon.

Millville has one structure at risk from fault zone damage on the east side of municipal boundaries.

North Logan has 96 structures in the fault damage zone along several faults on the east side of the municipality. Mostly recent developments along the Logan, Hyde Park, and Smithfield Canal are in the damage zone.

Structures built alongside Spring Creek in at the base of Providence Canyon in **Providence** are in fault damage zones.

Smithfield City has about 250 structures at risk in fault damage zones along the eastern side of town. Many of these are north, east, and southeast of Birch Creek Golf Course.

There are about 10 structures in **Trenton Town** are located in fault damage zones. These structures are on the east bench of Little Mountain.

51 structures in **Wellsville** are in fault damage zones. Most of these are in the southern and southeast edges of municipal boundaries. Included with these structures is most of the new development on the west side of Highway 89-91 right before you enter Wellsville Canyon.

Unincorporated areas of Cache County could sustain damage to about 148 structures in the event of an earthquake, including several businesses. Areas of concern are generally the following: Southeast of Wellsville almost in a straight line to Paradise, southeast and northeast of Paradise, east of Smithfield and Richmond, northeast of Richmond, west of Newton and north of Mendon, southwest of Mendon, and scattered cabins and homes in Ant Flats and in various other unincorporated areas.

Liquefaction Potential Losses (County –wide analysis)

Along the Bear River in **Amalga**, liquefaction during an earthquake threatens about 26 structures. These are located mostly on the southeast side of town with several structures on the northern end.

There are several structures at risk from liquefaction on the east side of **Cornish** near the Bear River

Hyrum only has one structure at risk from liquefaction below Hyrum Dam.

Lewiston has approximately nine structures at risk from liquefaction near to the Bear and Cub River's on the west and east sides of town.

Logan has the largest population in the county, much of which can be found along the Logan River. In this countywide liquefaction potential analysis, it is suggested that about 2,800 structures are at risk. These structures are located mostly along the Logan River drainage, and the confluence of the Blacksmith Fork River and Spring Creek with the Logan River. However, the study which was done in 2001 only lists about 740 structures at risk for Logan. Each of these studies was done using different criteria, so it is not certain which is more accurate.

Millville has several structures on the northwest end of municipal boundaries at risk from liquefaction.

Nibley also has many potential losses from liquefaction. Approximately 450 structures are at risk on the northeast side of town, and on the west side of the Blacksmith Fork River.

Along the west side of **Providence** mostly east of Highway 165, there could be as many as 180 structures at risk from liquefaction.

On the lower west portion of **River Heights**, about 42 structures are at risk. These are generally on the southeast side of the Logan River.

Trenton has about a dozen structures at risk along the western side of the Bear River drainage on the east side of town.

Unincorporated areas at risk from liquefaction generally consist of those low elevation areas near the Bear, Cub, Logan, Blacksmith Fork, and Little Bear River's. These structures are distributed fairly even along these river corridors from the Idaho-Utah border, south to Wellsville

City and Hyrum Dam. There are approximately 288 structures at risk in the unincorporated areas of the county.

Wellsville City has about 115 structures at risk from liquefaction mainly along the Little Bear River drainage and in the drainage below and surrounding Wellsville Reservoir.

Liquefaction Potential Losses (Mid-county analysis)

Logan has almost 740 structures at risk from liquefaction according to this 2001 study. These are located mostly on the south end of town along the Logan River and where Spring Creek and the Blacksmith Fork River join the Logan River.

Mendon has several structures on the very east edge of municipal boundaries that may be at risk.

Millville has eight structures at risk from liquefaction, seven

There are about 37 structures in **Newton Town** which are at risk from liquefaction along The Slough and Newton Creek.

Nibley has several structures at risk on the north end of municipal boundaries in the liquefaction zone along the Blacksmith Fork River.

Providence has one structure at risk on the very east municipal boundary.

Assessing Vulnerability: Identifying Assets & Estimating Losses

Table 8-14: Cache County Residential and Commercial Development at Risk in Geological Fault Damage Zones						
Jurisdiction	~Residents at Risk*	Residential Units at Risk		Commercial Units at Risk		
		# Units	\$ Value**	# Units	\$ Value**	\$ Potential Revenue Loss***
Cornish	10	3	751,346	0	0	0
Hyde Park	168	52	12,890,389	0	0	0
Hyrum	3	1	279,600	0	0	0
Logan	262	81	25,258,683	0	0	0
Mendon	87	27	5,384,000	0	0	0
Millville	3	1	104,186	0	0	0
North Logan	311	96	33,582,355	0	0	0
Providence	19	6	3,186,733	1	74,600	691,653
Smithfield	807	249	53,180,718	0	0	0
Trenton	32	10	1,411,565	0	0	0
Wellsville	165	51	11,212,782	1	40,000	691,653
Unincorporated	470	145	26,931,849	3	168,901	2,074,959

Notes: All residential and commercial units and values were derived from Cache County parcel data.

*Based on average persons per household for Cache County from 2000 Census data, which is 3.24. Numbers were adjusted for multi-family residential units accordingly.

**Current Market Value

***Derived from 2002 Survey of Business Owners for Cache County, US Census Bureau. Average firm receipts totaled \$691,653.

Communities not listed do not have any potential residential or commercial losses according to this assessment.

Table 8-15: Cache County - Other Facilities at Risk in Geological Fault Damage Zones

Jurisdiction	Critical Facilities	Roads			Rail Lines	
		Type	Miles	\$ Value*	Miles	\$ Value**
Logan	none	SH	0.2	1,362,432	0	0
Mendon	none	PLR	0.1	346,389	0	0
Trenton	none	SH	0.7	4,450,344	0.7	1,164,630
Wellsville	none	SH	0.2	1,140,582	0	0
Unincorporated	none	PLR	1.6	4,799,853	1.3	2,019,850
		SH	2.2	13,060,896	0	0

IH = Interstate Highway (6 lanes), SH = State Highway (4 lanes), PLR = Paved Local Roads (2 lanes)

*Average building cost for roads = \$1.5 million per lane-mile (Utah's Unified Transportation Plan, 2007-2030, UDOT & Utah MPO's)

**Average building cost for rail lines = \$300.00 per foot, minimum, or \$1,584,000 per mile, minimum (Jim Marshall, Manager Special Projects Industry & Public, Union Pacific Railroad, Utah, personal communication)

Communities not listed do not have any potential losses according to this assessment.

Table 8-16: Cache County Residential and Commercial Development at Risk from Liquefaction (Utah State University and Utah Geological Survey Data, 1994 - Countywide)

Jurisdiction	~Residents at Risk*	Residential Units at Risk		Commercial Units at Risk		
		# Units	\$ Value**	# Units	\$ Value**	\$ Potential Revenue Loss***
Amalga	81	25	3,803,631	1	8,904,160	691,653
Cornish	29	9	1,235,234	0	0	0
Hyrum	3	1	27,135	0	0	0
Lewiston	29	9	1,832,025	0	0	0
Logan	8,712	2,689	244,321,327	120	72,293,304	82,998,360
Millville	6	2	290,173	7	5,464,280	4,841,571
Nibley	1,464	452	66,036,199	6	5,456,400	4,149,918
Providence	492	152	34,942,707	29	24,850,667	20,057,937
River Heights	136	42	5,414,354	0	0	0
Trenton	36	11	1,031,749	0	0	0

Unincorporated	914	282	43,454,665	6	1,206,610	4,149,918
Wellsville	363	112	13,995,690	3	465,077	2,074,959

Notes: All residential and commercial units and values were derived from Cache County parcel data.

*Based on average persons per household for Cache County from 2000 Census data, which is 3.24. Numbers were adjusted for multi-family residential units accordingly.

**Current Market Value

***Derived from 2002 Survey of Business Owners for Cache County, US Census Bureau. Average firm receipts totaled \$691,653.

Communities not listed do not have any potential residential or commercial losses according to this assessment.

Table 8-17: Cache County - Other Facilities at Risk from Liquefaction (Utah State University and Utah Geological Survey Data, 1994 - Countywide)

Jurisdiction	Critical Facilities	Roads			Rail Lines	
		Type	Miles	\$ Value*	Miles	\$ Value**
Amalga	None	PLR	0.4	1,131,543	0	0
		SH	0.1	770,970		
Cornish	None	SH	0.1	541,074	0.3	507,637
Lewiston	None	SH	0.6	3,668,910	0.2	268,767
Logan	Logan South Campus High School, Wilson Elementary School	PLR	0.6	1,742,559	2.3	3,590,114
		SH	3.2	19,300,326		
Millville	None	SH	0.8	4,529,652	0	0
Nibley	None	SH	1.7	9,983,196	1.3	2,002,841
Providence	None	SH	0.5	3,183,858	0	0
River Heights	None	SH	0.05	271,038	0	0
Trenton	None	SH	1.2	7,327,200	0	0
Wellsville	None	SH	0.4	2,141,862	0.5	791,723
Unincorporated	None	PLR	4.2	12,734,061	1.6	2,553,280
		SH	3.1	18,695,724		

IH = Interstate Highway (6 lanes), SH = State Highway (4 lanes), PLR = Paved Local Roads (2 lanes)

*Average building cost for roads = \$1.5 million per lane-mile (Utah's Unified Transportation Plan, 2007-2030, UDOT & Utah MPO's)

**Average building cost for rail lines = \$300.00 per foot, minimum, or \$1,584,000 per mile, minimum (Jim Marshall, Manager Special Projects Industry & Public, Union Pacific Railroad, Utah, personal communication)

Communities not listed do not have any potential losses according to this assessment.

Table 8-18: Cache County Residential and Commercial Development at Risk from Liquefaction (Utah Geological Survey Data, 2001 - Newton, Wellsville, Smithfield, and Logan Quadrangles Only)

Jurisdiction	~Residents at Risk*	Residential Units at Risk		Commercial Units at Risk		
		# Units	\$ Value**	# Units	\$ Value**	\$ Potential Revenue Loss***
Logan	2,330	719	73,951,112	22	18,283,661	15,216,366

Mendon	0	0	0	1	171,480	691,653
Millville	3	1	149,500	7	5,464,280	4,841,571
Newton	120	37	4,495,742	0	0	0
Nibley	78	24	3,673,208	0	0	0
Providence	3	1	677,200	0	0	0

Notes: All residential and commercial units and values were derived from Cache County parcel data. Only municipalities that had parcels overlapping high liquefaction areas were analyzed. Unincorporated parcels were not included in this analysis, because of incomplete liquefaction data outside of the above mentioned quadrangles.

*Based on average persons per household for Cache County from 2000 Census data, which is 3.24. Numbers were adjusted for multi-family residential units accordingly.

**Current Market Value

***Derived from 2002 Survey of Business Owners for Cache County, US Census Bureau. Average firm receipts totaled \$691,653.

Communities not listed do not have any potential residential or commercial losses according to this assessment.

Table 8-19: Cache County - Other Facilities at Risk from Liquefaction (Utah Geological Survey Data, 2001 - Newton, Wellsville, Smithfield, and Logan Quadrangles Only)

Jurisdiction	Critical Facilities	Roads			Rail Lines	
		Type	Miles	\$ Value*	Miles	\$ Value**
Logan	none	SH	0.5	2,863,476	1.5	2,306,350
Mendon	none	0	0	0	0.1	136,416
Millville	none	SH	0.1	458,952	0	0
Newton	none	SH	0.1	590,880	0	0

IH = Interstate Highway (6 lanes), SH = State Highway (4 lanes), PLR = Paved Local Roads (2 lanes)

*Average building cost for roads = \$1.5 million per lane-mile (Utah's Unified Transportation Plan, 2007-2030, UDOT & Utah MPO's)

**Average building cost for rail lines = \$300.00 per foot, minimum, or \$1,584,000 per mile, minimum (Jim Marshall, Manager Special Projects Industry & Public, Union Pacific Railroad, Utah, personal communication)

Communities not listed do not have any potential losses according to this assessment.

Cache County HAZUS MH Analysis

HAZUS MH is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS MH is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates can be used by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The results of the model ran for Cache County simulates a 2,500 year event with an earthquake magnitude of 7.0.

Table 8-20: HAZUS MH Casualties

Casualties Summary Report					
<i>October 24, 2008</i>					
Injury Severity Level					
	Severity 1	Severity 2	Severity 3	Severity 4	Total
Cache					
Casualties - 2am					
<i>Commuting</i>	0	0	0	0	0
<i>Commercial</i>	6	2	0	1	8
<i>Educational</i>	0	0	0	0	0
<i>Hotels</i>	4	1	0	0	6
<i>Industrial</i>	10	3	0	1	14
<i>Other-Residential</i>	193	49	6	12	260
<i>Single Family</i>	363	92	13	26	494
Total Casualties - 2am	575	147	20	39	782
Casualties - 2pm					
<i>Commuting</i>	0	1	1	0	1
<i>Commercial</i>	356	105	17	34	513
<i>Educational</i>	225	67	11	22	325
Casualties - 2pm					
<i>Hotels</i>	1	0	0	0	1
<i>Industrial</i>	71	21	3	7	103
<i>Other-Residential</i>	18	5	1	1	24
<i>Single Family</i>	57	15	2	4	78
Total Casualties - 2pm	729	212	35	68	1,044
Casualties - 5pm					
<i>Commuting</i>	12	19	29	6	67
<i>Commercial</i>	319	94	16	30	458
<i>Educational</i>	59	17	3	6	84
<i>Hotels</i>	1	0	0	0	2
<i>Industrial</i>	45	13	2	4	64
<i>Other-Residential</i>	73	19	2	5	99
<i>Single Family</i>	143	36	5	10	194
Total Casualties - 5pm	652	199	58	60	969

Table 8-21: HAZUS MH Injury Classification Scale

Injury Severity	Injury Description
Severity 1	Injuries requiring basic medical aid without requiring hospitalization
Severity 2	Injuries requiring a greater degree of medical care and hospitalization, but not expected to progress to a life threatening status
Severity 3	Injuries that pose an immediate life threatening condition if not treated adequately and expeditiously. The majority of these injuries are a result of structural collapse and subsequent collapse or impairment of the occupants.
Severity 4	Instantaneously killed or mortally injured

Injury Classification Scale. Source: FEMA HAZUS-MH MR3 User's Manual

Table 8-22: HAZUS MH Building Damage

Building Damage by Count by General Occupancy						
<i>October 24, 2008</i>						
	# of Buildings					
	None	Slight	Moderate	Extensive	Complete	Total
Cache						
<i>Other Residential</i>	368	714	929	605	291	2,907
<i>Education</i>	4	6	11	8	5	34
<i>Agriculture</i>	4	6	9	5	3	27
<i>Government</i>	3	5	10	7	4	29
<i>Single Family</i>	4,031	7,069	6,414	1,734	777	20,025
<i>Religion</i>	5	8	13	9	5	39
<i>Commercial</i>	44	77	161	122	71	475
<i>Industrial</i>	14	23	54	44	27	161

Table 8-23: HAZUS MH Shelter Summary Report

Shelter Summary Report		
<i>October 24, 2008</i>		
	# of Displaced Households	# of People Needing Short Term Shelter
Box Elder	1,083	240
Cache	1,997	514
Rich	16	3
Total	3,096	757
Region Total	3,096	757

Table 8-24: HAZUS MH Transportation System Losses

Transportation System Dollar Exposure									
<i>October 24, 2008</i>									
	<i>All values are in thousands of dollars</i>								
	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Runway	Total
Cache									
<i>Segments</i>	1,052,354	79,322	0						1,131,676
<i>Bridges</i>	26,583	129	0						26,712
<i>Tunnels</i>	0	0	0						0
<i>Facilities</i>		0	0	1,068	0	0	5,341	91,375	6,409
Total	1,078,937	79,451	0	1,068	0	0	5,341	91,375	1,256,173

Table 8-25: HAZUS MH Utility System Losses

		Utility System Dollar Exposure						
October 24, 2008								<i>All values are in thousands of dollars</i>
		Potable Water	Waste Water	Oil Systems	Natural Gas	Electric Power	Communication	Total
Cache								
	<i>Facilities</i>	0	326,340	98	0	0	980	327,418
	<i>Pipelines</i>	63,855	38,313	0	25,542			127,711
	Total	63,855	364,653	98	25,542	0	980	455,129

Assessing Vulnerability: Analyzing Development Trends

Smithfield, Hyde Park, North Logan, Logan, Providence, and Millville are all growing to the east on the valley benches. Quaternary Faults on the east side of Cache Valley are generally located near these benches. Each of these communities is allowing development in close proximity to these faults, and many residents and homes could be placed at risk in the event of an earthquake.

On the south end of Wellsville near newer developments, a fault cuts across municipal boundaries. If the larger parcels within this damage zone are subdivided, people could be placed at risk and the community could suffer financial losses.

Unincorporated areas that may be at risk in fault damage zones in the near future could be east of Paradise along the bench, and Petersboro between Mendon and Valley View Highway,

Liquefaction could affect many new structures if built in high potential zones. Farm ground between Nibley and Millville could be developed in the near future. All of this ground is in high liquefaction potential areas. Also, new development in and out of Logan municipal boundaries north of the Logan River, and east and west of 1000 West would also be in high liquefaction potential zones. Any other developments between Providence, Millville, Nibley, and Logan would also be at risk.



CACHE COUNTY DAM FAILURE

Background

There are 225 regulated dams located in Cache County. Most of these dams are small detention ponds, small agricultural reservoirs, or livestock watering facilities and most pose a minimal threat to human safety or property.

Of the 225 regulated dams 215 are designated as “low hazard” by the State of Utah Division of Water Rights. As defined by state statute, low hazard dams are those dams which, if they fail, would cause minimal threat to human life, and economic losses would be minor or limited to damage sustained by the owner of the structure.

A total of 5 dams have been designated as “moderate hazard” by the State of Utah in Cache County. Moderate Hazard dams which, if they fail, have a low probability of causing loss of human life, but would cause appreciable property damage, including damage to public utilities.

The State of Utah has rated 5 dams in Cache County as “high hazard” which means that, if they fail, have a high probability of causing loss of human life or extensive economic loss, including damage to critical public utilities.

Dam failure inundation maps and emergency action plans for each of the high risk dams can be found on the Utah Division of Water Right’s website at: <http://waterrights.utah.gov/cgi-bin/damview.exe?Startup>. See the “Dam Failure” map on page 171.

History of Dam Failure in Cache County

No significant dam failures have occurred in Cache County.

Table 8-26: Cache County Dam Failure Hazard Assessment: Hazard Profile

Frequency	Rare
Severity	Potentially Catastrophic
Location	Areas downstream of failed dam.
Seasonal Pattern	Anytime. Highest risk in spring during snowmelt.
Duration	A few hours
Speed of Onset	No warning
Probability of Future Occurrences	Low

Assessing Vulnerability: Identifying Assets & Estimating Losses

While individual dam breaching would cause damage to community’s downstream, collective damages from several dams in Cache County should be considered. For example, if Porcupine Dam was to breach, water would flow into Hyrum Dam which could cause flooding and/or a breach, which could eventually overload Cutler Dam capacities and could cause flooding or dam

breach. If an upstream dam breaches, much more could be at stake than may be shown on individual dam inundation maps and collective effects should be acknowledged.

Hyrum Dam

Hyrum Dam and Reservoir are located directly south of Hyrum City on the Little Bear River. The dam is rated as a high hazard facility and the inundation area flows westerly towards Wellsville five miles away, and then into Cutler Marsh.

Logan City – Dry Canyon

This dam was newly constructed to mitigate flooding and potential from the Dry Canyon drainage. Many newer homes were constructed at the bottom of this canyon which can become flooded in the spring months. It is high risk, and many homes west of the dam could be damaged if the dam was breached.

Logan First Dam

This facility located near the mouth of Logan Canyon has a high hazard rating. The inundation area consists of most of the Island area, much of the landscape around the Logan River Golf Course and County Fairgrounds, and continuing west towards Cutler Reservoir. There is a significant population as well as large numbers of homes and businesses within the inundation area.

Porcupine Dam

Porcupine Dam is located about eight miles upriver from the town of Paradise on the east fork of the Little Bear River. The dam has a high hazard rating. There is no inundation map associated with this dam. This dam was recently drained and some reinforcement work performed.

Newton Dam

Newton dam was constructed by the Bureau of Reclamation on Clarkston Creek three miles north of the town of Newton. This facility has a high hazard rating. There is no inundation map associated with this dam.

Tony Grove Lake Dam

This dam was renovated several years ago for seismic retrofitting and inlet/outlet construction. It has a high hazard rating, but would not likely affect any residential or commercial structures in the event of a failure.

Hyrum has about 51 units at risk in the event of a failure of Hyrum Dam. These structures are northwest of Hyrum Reservoir in lower elevation areas.

Logan City has many structures at risk below First Dam, particularly in “The Island” area of town, and west along the Logan River drainage to and past 1000 West. About 1,600 structures are at risk in the event of a dam breach, which would ultimately fill the entire valley bottom of “The Island.”

Paradise Town flanks the edge of the Little Bear River drainage area on the west side of town. This drainage could be completely covered in water if Porcupine Dam breached. Five structures are at risk.

Nine structures are at risk from dam breach of First Dam in **River Heights**. These structures are on the south side of the Logan River on the low elevation lands just inside municipal boundaries.

Wellsville City could suffer losses of about 93 structures in the event of a failure at Hyrum Dam. All along the Little Bear River drainage there could be flooding, causing damage and risk to property and residents.

If all dam inundation maps are looked at collectively, 336 structures may be at risk in **unincorporated areas**. These structures would be in the following areas: In the Logan River drainage west of Logan City, The East Fork of the Little Bear River drainage and areas surrounding Avon and along the west side of Paradise to Hyrum Reservoir, below Hyrum Dam in the Little Bear River drainage above and below Wellsville, and almost all of the low elevation areas in between Logan, Nibley, Wellsville, and Mendon north to Valley View Highway.

Table 8-27: Cache County Residential and Commercial Development at Risk from Dam Failure						
Jurisdiction	~Residents at Risk*	Residential Units at Risk		Commercial Units at Risk		
		# Units	\$ Value**	# Units	\$ Value**	\$ Potential Revenue Loss***
Hyrum	162	50	7,400,518	1	87,746	691,653
Logan	4941	1525	157,188,587	80	32,238,331	55,332,240
Paradise	16	5	750,420	0	0	0
River Heights	29	9	1,462,212	0	0	0
Wellsville	288	89	7,467,000	4	629,575	2,766,612
Unincorporated	1063	328	51,031,841	8	1,387,253	5,533,224

Notes: All residential and commercial units and values were derived from Cache County parcel data.
 *Based on average persons per household for Cache County from 2000 Census data, which is 3.24. Numbers were adjusted for multi-family residential units accordingly.
 **Current Market Value
 ***Derived from 2002 Survey of Business Owners for Cache County, US Census Bureau. Average firm receipts totaled \$691,653.
Communities not listed do not have any potential residential or commercial losses according to this assessment.

Table 8-28: Cache County - Other Facilities at Risk from Dam Failure						
Jurisdiction	Critical Facilities	Roads			Rail Lines	
		Type	Miles	\$ Value*	Miles	\$ Value**
Logan	Riverside Preschool, Wilson Elementary School	PLR	0.2	456,564	0.7	1,068,595
		SH	2.1	12,471,186	0	0
Wellsville	None	SH	0.7	4,095,732	0.8	1,336,224

Unincorporated	None	PLR	3.1	9,228,216	2.1	3,343,944
		SH	2.8	16,846,968	0	0
<p>IH = Interstate Highway (6 lanes), SH = State Highway (4 lanes), PLR = Paved Local Roads (2 lanes)</p> <p>*Average building cost for roads = \$1.5 million per lane-mile (Utah's Unified Transportation Plan, 2007-2030, UDOT & Utah MPO's)</p> <p>**Average building cost for rail lines = \$300.00 per foot, minimum, or \$1,584,000 per mile, minimum (Jim Marshall, Manager Special Projects Industry & Public, Union Pacific Railroad, Utah, personal communication)</p> <p>Communities not listed do not have any potential losses according to this assessment.</p>						

Assessing Vulnerability: Analyzing Development Trends

Any new development that is located in the floodplain increases the exposure to risk from dam failure in terms of human life and property. Dam inundation areas are generally much larger than the floodplain and should be noted when considering large developments. However, given the relatively low probability of catastrophic dam failures, most jurisdictions are unwilling to regulate development in dam failure inundation areas. Areas that may be developed in the near future which could place people and property at risk are the following:

West of 1000 West in Logan City near the Logan River, northwest of Nibley City in low-elevation valley bottoms, and along the river bottoms west of Paradise City and Avon.