Multi-Jurisdictional Hazard Mitigation Plan

Salt Lake County | Volume 1

Salt Lake County
Emergency Management

3380 South 900 West
Salt Lake City, UT 84119

2025

THIS PAGE INTENTIONALLY LEFT BLANK

Executive Summary

Natural disasters, such as earthquakes, wildfires, and severe weather events, pose significant danger to life and property in Salt Lake County. Hazard mitigation planning is the process communities can use to identify and assess the risks posed by these hazards and implement measures to reduce the potential impacts of those hazards. It has been recognized that taking action before a natural disaster can substantially reduce the damage caused by these hazards and increase the overall resilience of the community to natural disasters.

Mitigation planning is a collaborative process that provides local governments a framework to reduce or eliminate long-term risk from hazards. Salt Lake County has joined with 23 cities and towns, 2 school districts, and 1 community college for this effort. The planning process includes establishing a planning team to review data on past hazard events and possible future events, evaluate current capabilities, and develop strategies to address hazards. To inform his process, participants from each jurisdiction have collaborated with local emergency managers, planning and development departments, floodplain managers, economic development staff, health and human services departments, public works, city administrators, and geographic information system (GIS) specialists. Participants also consulted existing planning documentation to integrate this plan with other community planning efforts.

Mitigation plans are updated every 5 years. This plan updates the 2019 Salt Lake County Hazard Mitigation Plan and reaffirms the participant's commitment to reducing hazard risk. It is organized in two volumes. Volume 1 contains comprehensive details on each step of the planning process, profiles of each hazard identified by the planning team as having the potential to affect the county, an evaluation of previous mitigation strategies, and the mitigation strategies for the next 5-year planning cycle. Because each community may face different hazards or have unique vulnerabilities to hazards, Volume 2 contains annexes for individual participating jurisdictions. These annexes describe jurisdiction-specific hazard histories and vulnerabilities, an evaluation of the status of previously identified mitigation actions, and new mitigation strategies that have been identified.

This document will describe each stage of the planning process, which includes building the planning team, creating an outreach strategy for identifying community stakeholders and seeking public input, conducting a risk assessment, documenting capabilities, developing and prioritizing mitigation actions, and establishing a strategy for implementing them. Once adopted, this plan makes communities eligible for various grant funding programs to implement identified mitigation actions. Twenty-seven jurisdictions participated in this planning update.

Promulgation

This plan is promulgated as “Salt Lake County’s Multi-Jurisdictional Hazard Mitigation Plan.” It is designed to comply with all applicable federal, state, and local ordinances and resolutions and provides guidance for preparing for and mitigating hazards that threaten the community.

This plan has been constructed using the best available information from a planning perspective. It is recognized that as new information becomes available, decisions and actions may differ from those envisioned when the plan was developed.

Salt Lake County fully supports the plan and urges all officials, employees, and others involved in the total emergency management effort, individually and collectively, to do their share in making Salt Lake County a disaster-resistant and resilient community.

This plan supersedes all previous hazard mitigation plans.

Promulgated this ____ day of _________, 2025.

Authority

Federal Authority

Public Law (PL) 93-288, as amended, established the basis for federal hazard mitigation activity in 1974. A section of this act requires identifying, evaluating, and mitigating hazards as a prerequisite for state receipt of future disaster assistance outlays. Since 1974, many additional programs, regulations, and laws have expanded on the original legislation to establish hazard mitigation as a priority at all levels of government. When the Stafford Act amended PL 93-288, several additional provisions were added that provided for the availability of significant mitigation measures in the aftermath of presidentially declared disasters. The current Stafford Act is the “Robert T. Stafford Disaster Relief and Emergency Assistance Act,” as amended in August 2016.

State Authority

- The Governor’s Emergency Operation Directive
- The Robert T. Stafford Disaster Relief and Emergency Assistance Act, amendments to Public Law 93-288, as amended
- Title 44, Code of Federal Regulations, Federal Emergency Management Agency Regulations, as amended
- State Emergency Management Act of 1981, Utah Code 53-2, 63-5
- Disaster Response Recovery Act, 63-5A

- Executive Order of the Governor, Executive Order 11
- Emergency Interim Succession Act, 63-5B

Utah State Code

In Utah Code 53-2-104, it is stated that the Utah Division of Emergency Management shall prepare, implement, and maintain programs and plans to provide for:

1. Prevention and minimization of injury and damage caused by disasters
2. Identification of areas particularly vulnerable to disasters
3. Coordination of hazard mitigation and other preventive and preparedness measures designed to eliminate or reduce disasters
4. Assistance to local officials in designing local emergency action plans
5. Coordination of federal, state, and local emergency activities; Coordination of emergency operations plans with emergency plans of the federal government; and
6. Other measures necessary, incidental, or appropriate to this chapter

Local Authority

Local governments play an essential role in implementing effective mitigation. For this plan, local governments include cities, counties, and special service districts with elected boards. Each local government will review all present and potential damage, losses, and related impacts associated with natural hazards to determine the need or requirement for mitigation action and planning. In the cities in Salt Lake County, the local executives are responsible for carrying out plans and policies, including the county Mayor and city or town mayors and administrators. Local governments must be prepared to participate in the post-disaster hazard mitigation team process and pre-mitigation planning as outlined in this document to effectively protect their citizens. All jurisdictions in Salt Lake County participated in the development of this plan.

THIS PAGE INTENTIONALLY LEFT BLANK.

Table of Contents

List of Figures

List of Tables

Introduction

Purpose and Scope

The four purposes of this plan are:

1. To identify threats to the community
2. To create mitigation strategies to address those threats
3. To develop long-term mitigation planning goals and objectives
4. To fulfill federal, state, and local hazard mitigation planning obligations

Mitigation actions minimize conditions that have an undesirable impact on our citizens, the economy, the environment, and the well-being of Salt Lake County and surrounding municipalities. This mitigation plan is intended to enhance the awareness of elected officials, agencies, and the public of these hazards and their associated threats to life and property. The plan also details what actions can be taken to help prevent or reduce hazard vulnerability to each jurisdiction.

Hazard mitigation is often a neglected aspect of emergency management. When local governments place a low priority on mitigation implementation activities relative to the perceived threat, some important mitigation measures may be neglected in favor of higher-priority activities. Mitigation success can be achieved. However, if accurate information is conveyed through complete hazard identification and impact studies and followed by effective mitigation management. Hazard mitigation is the key to greatly reducing long-term risk to people and property from natural hazards and their effects.

Salt Lake County and all participating jurisdictions, coupled with their respective citizens, stakeholders, and partner agencies, prepared this local hazard mitigation plan intending to guide hazard mitigation planning in reducing the casualties and costs of natural disasters by providing comprehensive hazard identification, risk assessment, capability, and vulnerability analysis, mitigation strategies, and an implementation schedule. This plan demonstrates the community's commitment to reducing risks from hazards and serves as a tool to help decision makers direct mitigation activities and resources. This plan was also developed to make Salt Lake County and participating jurisdictions eligible for certain federal disaster assistance, specifically, the Federal Emergency Management Agency's (FEMA) Hazard Mitigation Grant Program, Building Resilient Infrastructure in Communities (BRIC), and Pre-Disaster Mitigation program, and to earn points for the National Flood Insurance Program's Community Rating System (CRS), which could lower flood insurance premiums in CRS communities.

This mitigation plan is a revision of the 2019 Salt Lake County Multi-Jurisdictional Multi-Hazard Mitigation Plan. The 2019 plan was reviewed to evaluate its strengths, weaknesses, and utility. The hazards, vulnerabilities, and risks were examined regarding their impact, severity, and how they may affect the population. Updates also describe hazard impacts that have occurred since the last plan revision. The planning team considered previously unidentified hazards including in the plan update. A capabilities assessment was conducted to identify potential mitigation needs and further align the mitigation plan with other community planning efforts. The revision process included a review of proposed mitigation goals, objectives, and actions to determine their validity and how effective they have been or will be at reducing vulnerability in the county. New priorities have been set to support the identified changes. The mitigation plan was also evaluated to support the state mitigation plan goals and objectives and other local planning efforts. Finally, an implementation strategy and timeline will assign the responsibility and schedule for tracking the implementation of the identified mitigation actions. The mitigation plan will be adopted through the regular legal process and establish authority and guide all mitigation activities outlined in the plan.

This plan also used current county, city, and applicable private hazard mitigation, emergency operations plans, census data, and available GIS and assessor's data as resources for the planning team. Salt Lake County Emergency Management staff, planning team members, county, city, and applicable emergency managers/planners, subject matter experts, recruits from other jurisdictions, such as other local government units, the private sector, non-governmental organizations, academia, airports, and the military were consulted during this planning activity. This plan also demonstrates that the public and all community stakeholders have proactively offered opportunities for participation in the planning process. Examples of participation include relevant involvement in any planning process, attendance at meetings, contributing research, data, and other information, and commenting on drafts of the plan.

This plan was developed in accordance with the requirements of the FEMA Section 322 regulations, 44 Code of Federal Regulations Part 201, the Utah Division of Emergency Management (Utah DEM), and local planning agencies. FEMA regulations were followed during the development of this plan. Salt Lake County Emergency Management (SLCo EM) will conduct monitoring, evaluation, updates, and implementation annually or following any natural disaster. (Any changes made after the annual review will have to be promulgated by the county council. A major revision will occur every five years. Each adopting jurisdiction may also participate in annual or interim plan reviews, updates, and revisions and would also need changes to be promulgated by their local executive leadership.

Background

Salt Lake County is vulnerable to natural and technological (human-caused) hazards threatening our citizens' health, welfare, and security. Action taken to reduce or eliminate the long-term risk to human life and property from these hazards is known as mitigation. The losses of life and property and the cost of response to and recovery from potential disasters can be substantially reduced when attention is turned to mitigation of the impacts and effects before they occur or re-occur.

Hazard mitigation planning is identifying hazard risks and vulnerabilities and establishing goals, policies, and procedures to implement risk-reducing actions. This plan represents a collaborative effort of many participants in our community with the mission to engage community stakeholders in developing a comprehensive approach to reduce long-term hazard risk by identifying and implementing effective mitigation strategies.

Mitigation planning creates safer communities by reducing loss of life and property damage and protecting community assets from the negative impacts of hazards. Implementing mitigation strategies can also reduce the cost of disaster response and recovery by:

- Identifying cost-effective actions that reduce risk
- Focusing resources on the greatest vulnerabilities
- Building partnerships between jurisdictions
- Increasing public awareness of hazards and risk
- Communicating planning priorities
- Aligning risk-reduction efforts with other community plans and objectives
- Establishing eligibility for mitigation grant programs

Hazard mitigation is any cost-effective action that reduces, limits, or prevents the vulnerability of people, property, and/or the environment to potentially damaging, harmful, or costly hazards. Hazard mitigation actions, which can be used to eliminate or minimize the risk to life and property, fall into three categories:

1. Those that keep the hazard away from people

2. Those that keep people, property, and structures away from the hazard

3. Those that do not address the hazard but rather reduce the impact of the hazard on the victims, such as insurance

Local mitigation plans are required to be updated every five years. This plan will update the 2019 Salt Lake County Multi-Jurisdictional Multi-Hazard Mitigation Plan. This mitigation plan is a collaborative effort that will serve all of Salt Lake County, including each of the participating jurisdictions and special service districts in the county. The revision of this plan supports the State Hazard Mitigation Plan mission, which is “to permanently reduce the region’s vulnerability to natural hazards.”

The plan is intended to promote sound public policy and protect or reduce the vulnerability of the citizens, critical facilities, infrastructure, private property, and the natural environment in the region. The framework of this plan will now serve as a tool to guide, plan, and allocate resources across multi-jurisdictional boundaries. It will assist jurisdictions in assessing their resilience to disasters and disruptions. It will serve as a guide to prioritize mitigation and preparedness efforts, allocate funding, guide development in innovative ways, and effectively use and share scarce resources. It represents the county’s commitment to reducing risks from natural hazards.

How To Navigate This Plan

This plan has been set up in two volumes so that elements that are jurisdiction-specific can be easily distinguished from those that apply to the whole planning area:

- Volume 1 includes all federally required elements of a disaster mitigation plan that apply to the entire planning area. This includes the description of the planning process, public involvement strategy, goals and objectives, countywide hazard risk assessment, countywide mitigation actions, and a plan maintenance strategy. The following appendices at the end of Volume 1 include information and explanations to support the main content of the plan:

- **Appendix A**: List of Acronyms
- **Appendix B:** Meeting Documentation
- **Appendix C**: Public Outreach Survey Documentation
- **Appendix D**: Plan Effectiveness Evaluation Form

- Volume 2 includes all federally required jurisdiction-specific elements in the annexes of each participating jurisdiction.

All planning partners will adopt Volume 1 in its entirety and their respective jurisdiction-specific annex in Volume 2.

Community Profile

Geography, Land Use, and Development

Geography

At approximately 807.37 square miles, including 65.09 square miles of water area, Salt Lake County is the fifth smallest county in Utah by land area. Tooele County borders Salt Lake County to the west, while Summit County borders it to the east. To the north lie Davis and Morgan Counties, with Utah County to the south. The Great Salt Lake occupies much of the northwest corner of the county. The Wasatch and Oquirrh Mountains form the eastern and western borders of the county, respectively (Figure 1).

Land Use and Development

Salt Lake County has 23 cities and towns: Alta, Bluffdale, Brighton, Copperton, Cottonwood Heights, Draper, Emigration Canyon, Herriman, Holladay, Kearns, Magna, Midvale, Millcreek, Murray, Riverton, Sandy City, Salt Lake City, South Jordan, South Salt Lake, Taylorsville, West Jordan, West Valley City, and White City. The Greater Salt Lake Municipal Services District (MSD) provides municipal services, such as staffing and administrative support for member communities, which include Brighton, Copperton, Emigration Canyon, Kearns, Magna, White City and Unincorporated Salt Lake County. The MSD also provides planning and zoning, business licensing, and code enforcement services to member communities. Animal Control Services, Parks Maintenance and operations, and Public Works Operations for the MSD are contracted with Salt Lake County. Salt Lake County's land ownership is approximately 79.4% private, 6% federal, and 10% state. 4.6% of this area is water. Figure 2 shows the locations of lakes, rivers, and canals in the county.

A significant portion of Salt Lake County is currently zoned for low-density residential development. Some higher densities are allowed in eastern Salt Lake City, while the southern areas of Salt Lake County are zoned for lower housing density. Industrial land uses are planned for West Salt Lake City, along the I-15 corridor, northern West Valley City, the western portion of North Salt Lake, and the west side of Salt Lake County. Areas primarily for commercial use include Salt Lake City's central business district and along primary transportation corridors, including I-15, I-215, State Street, 400 South, Highland Drive, 3500 South, 4500 South, and 7200 South.

Additional commercial land use nodes are dispersed throughout Salt Lake County to serve adjoining residential communities. Many public and private lands remain undeveloped because of specific environmental constraints, such as steep slopes and prime wetlands. Some areas currently used for industrial or mining activity may be redeveloped for commercial and residential purposes. Kennecott Utah Copper Corporation currently owns much of this land.

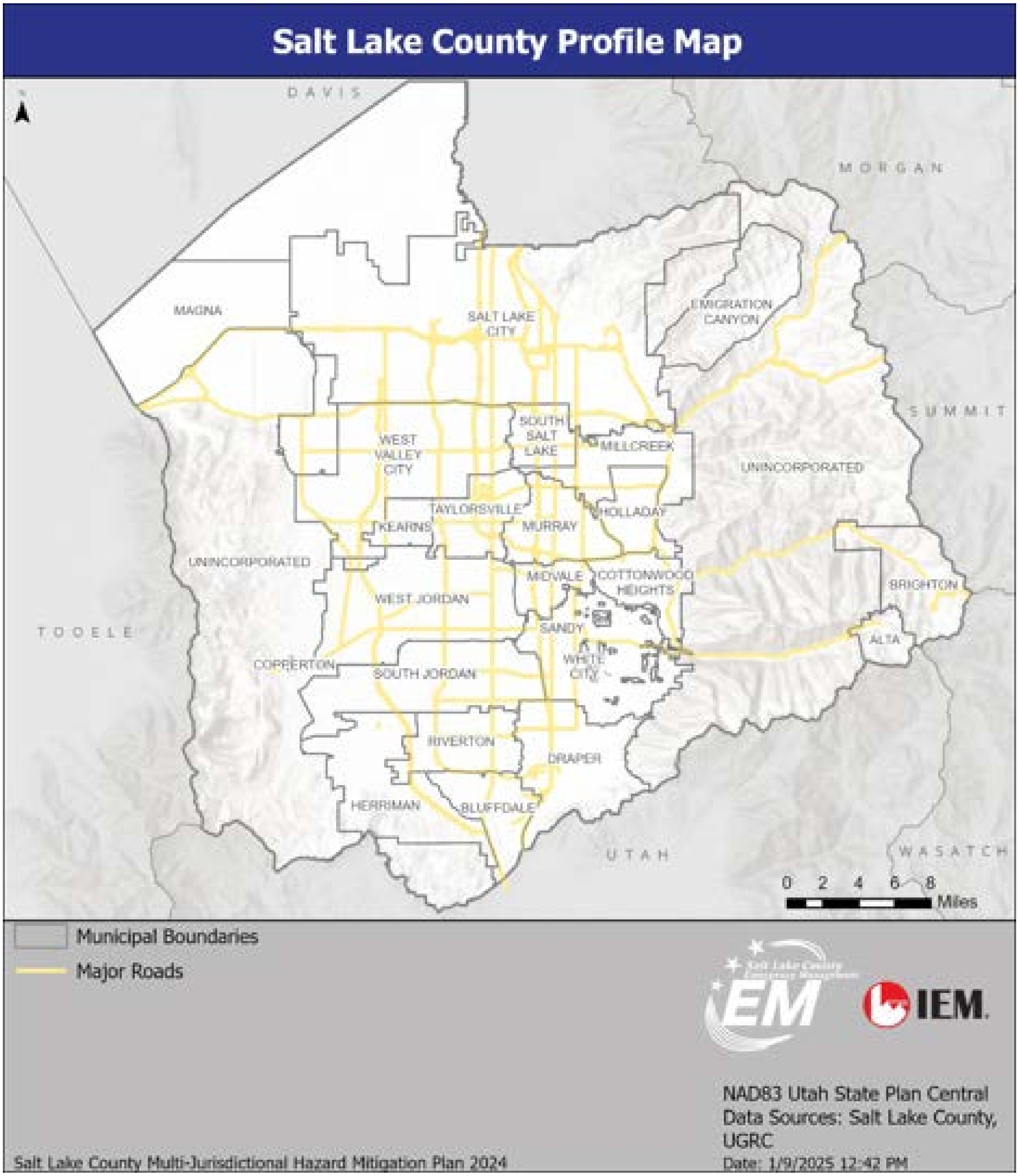


Figure 1: Salt Lake County Profile Map

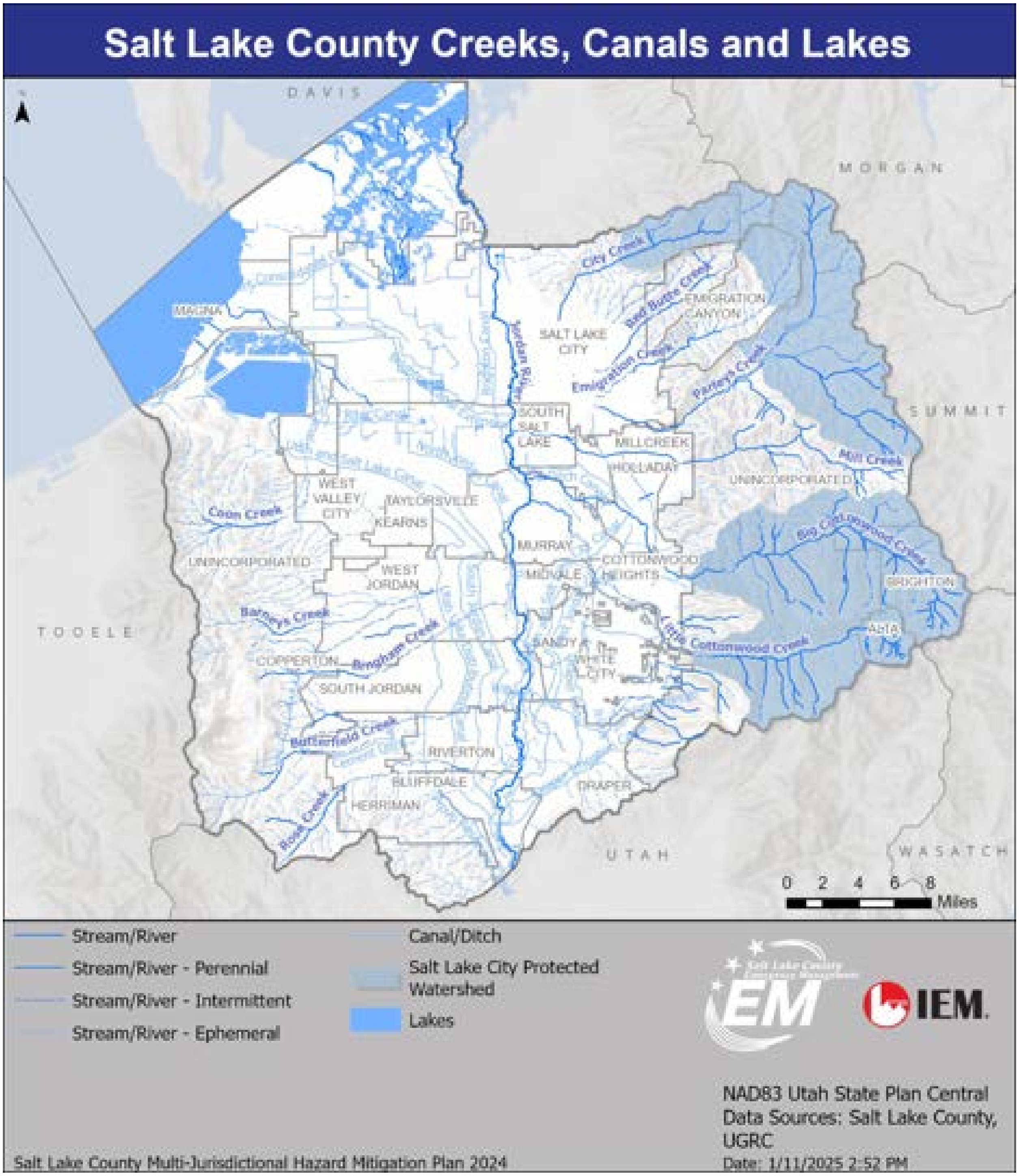


Figure 2: Map of Salt Lake County Rivers and Lakes

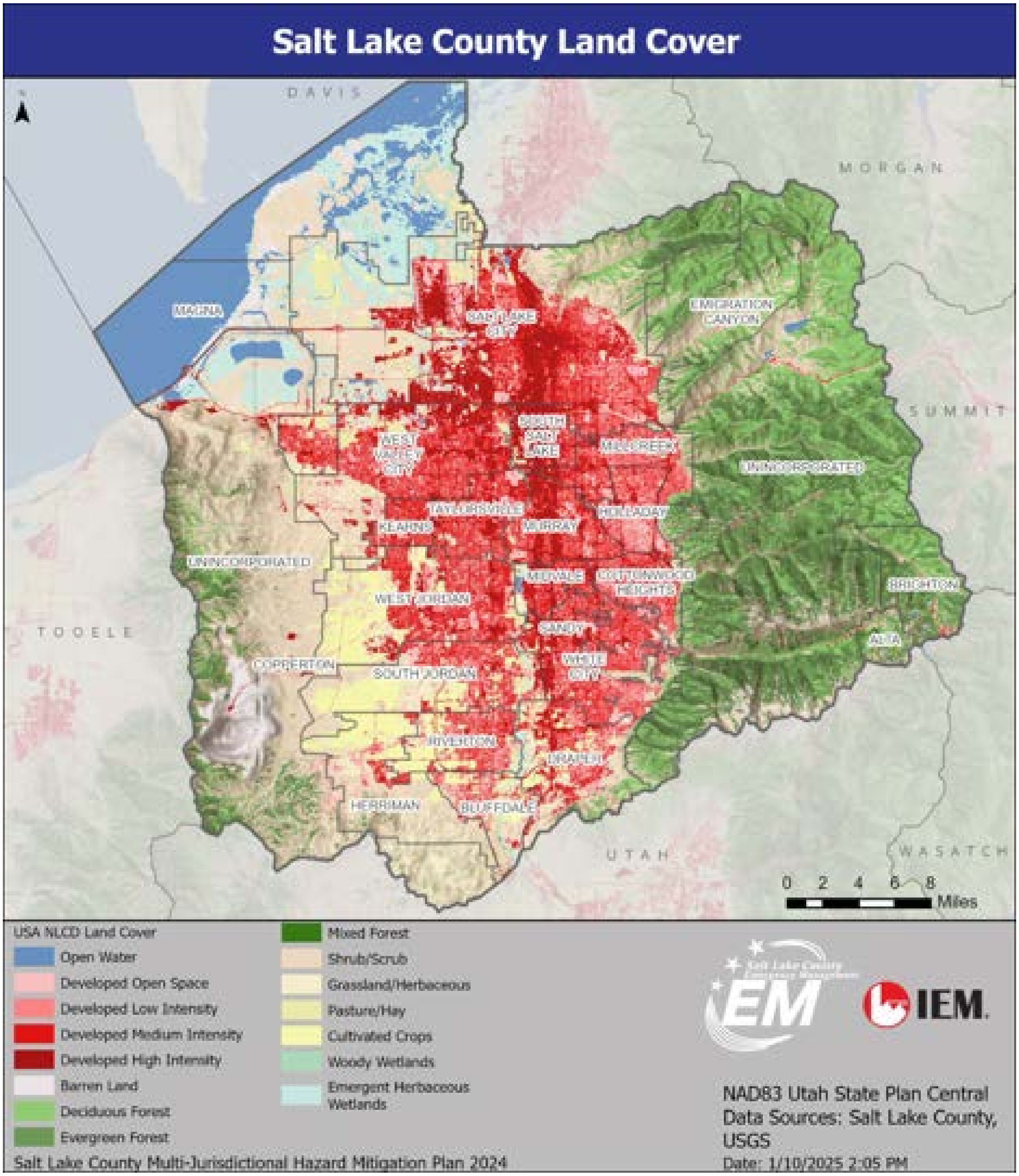


Figure 3: Types of Land Cover in Salt Lake County

Climate and Weather

The Salt Lake City Climate Book is a long-term project that maintains historical climate records for the Salt Lake City Weather Forecast Office and the region it serves. It includes temperature, precipitation, and snowfall records, including averages, minimums, maximums and extremes. Table 1 summarizes the records available through this source, including monthly average temperatures, normal monthly precipitation, and normal snowfall.[1]

Table 1: Temperature and Precipitation in Salt Lake City

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Temperature (˚F)	31.4	36.6	45.8	51.8	61.5	71.6	81.1	79.1	68.4	54.6	41.7	32.2
Average Maximum Temperature (˚F)	38.6	44.7	55.3	61.9	72.6	84.1	94.0	91.7	80.6	65.5	50.7	39.0
Average Minimum Temperature (˚F)	24.2	28.6	36.3	41.8	50.4	59.1	68.2	66.6	56.3	43.6	32.8	25.3
Normal Precipitation (inches)	1.43	1.30	1.75	2.16	1.82	0.95	0.49	0.58	1.06	1.26	1.32	1.40
Normal Snowfall (inches)	12.7	10.7	5.9	2.9	0.1	0	0	0	0	0.5	7.0	12.1

Table 2, Figure 4, and Figure 5 provide, respectively, a climate overview, climate averages, and weather data for Salt Lake County.

Table 2: Climate Overview of Salt Lake County and the United States[2]

Climate Metric	Salt Lake, Utah	United States
Rainfall	19.6 in.	38.1 in.
Snowfall	54.2 in.	27.8 in.
Precipitation	90.2 days	106.2 days
Sunny	226 days	205 days
Avg. July High	91.4°F	85.8°F
Avg. Jan Low	22.8°F	21.7°F
Comfort Index (higher = better)	7.1	7
UV Index	4.7	4.3
Elevation	5599 ft.	2443 ft.

[1] National Weather Service, Salt Lake City Weather Forecast Office. https://www.weather.gov/slc/climatebook#PDFS.
[2] Bestplaces.net. “Salt Lake County Climate Overview.” 2024. https://www.bestplaces.net/climate/county/utah/salt_lake.

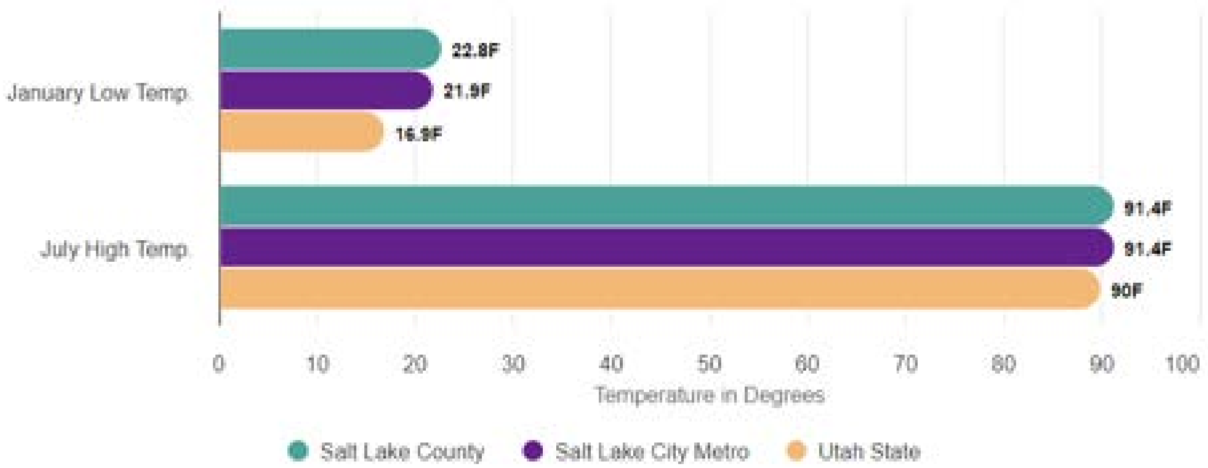


Figure 4: High and Low Temperatures in Salt Lake City, Salt Lake County, and the state of Utah[3]

Figure 5: Climate Chart for Salt Lake City[4]

Population

According to the United States Census, Salt Lake County continues to be the most populous county in Utah, with a population of 1,185,813 in 2023. It has grown steadily over the past 13 years (see Table 3).[5] The 2024 estimated population of Salt Lake County is 1,185,057, with a growth rate of -0.06% in the past

[3] Ibid.

[4] The blue line shows the average low temperature, and the red line shows the average high temperature. USClimateData.com. "Climate Salt Lake City – Utah." 2024. https://www.usclimatedata.com/climate/salt-lake-city/utah/united-states/usut0225.

[5] U.S. Census. "Quick Facts Salt Lake County Utah." 2024. https://www.census.gov/quickfacts/fact/table/saltlakecountyutah/HSG445222.

year, according to the most recent United States census data. The 2010 population was 1,032,997, which has grown by 14.72% since then.[6]

Table 3: Population Growth Rates for Salt Lake County Utah, 2010–2023[7]

Year	Population	Growth	Growth Rate
2023	1,185,813	-756	-0.06%
2022	1,186,569	257	0.02%
2021	1,186,312	-671	-0.06%
2020	1,186,983	28,398	2.45%
2019	1,158,585	9,636	0.84%
2018	1,148,949	11,676	1.03%
2017	1,137,273	16,522	1.47%
2016	1,120,751	18,061	1.64%
2015	1,102,690	12,350	1.13%
2014	1,090,340	10,679	0.99%
2013	1,079,661	15,521	1.46%
2012	1,064,140	16,438	1.57%
2011	1,047,702	14,705	1.42%
2010	1,032,997	0	0%

Salt Lake County's population increased in 10 of the 13 years between 2010 and 2023. The largest annual population increase was 2.4% between 2019 and 2020. The county's largest decline in growth was between 2020 and 2021, when the population growth rate saw no increase. Between 2010 and 2022, the county grew by an average of 1.2% per year (see Figure 6).[8]

---

[6] World Population Review.com. "Salt Lake County, Utah Population 2024." 2024. https://worldpopulationreview.com/us-counties/utah/salt-lake-county.
[7] Ibid.
[8] USA Facts. "Our Changing Population Salt Lake County, Utah." 2024. https://usafacts.org/data/topics/people-society/population-and-demographics/our-changing-population/state/utah/county/salt-lake-county/#:~:text=Salt%20Lake%20County%27s%20population%20increased%2010%20out%20of,grew%20by%20an%20average%20of%201.2%25%20per%20year.

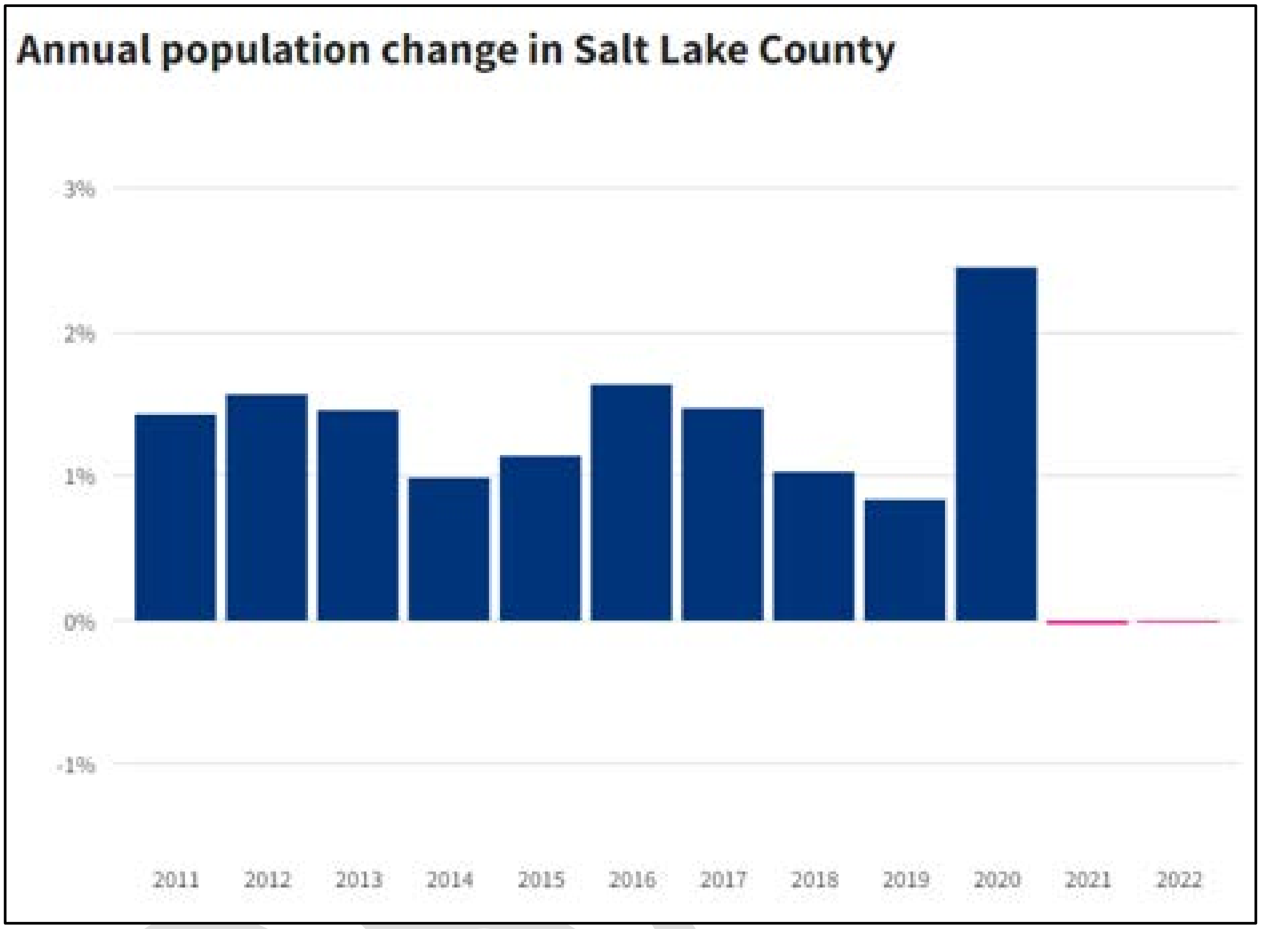


Figure 6: Population Growth Rates for Salt Lake County, 2011–2022[9]

City Populations

Salt Lake County contains two of the largest cities in the state: Salt Lake City, which has a population of approximately 209,593 (a 4.9% increase from 2020, when it was 199,723), and West Valley City, which has a population of approximately 134,470 (−4.1% decrease from 2020, when it was 140,238), according to the 2023 census data.[10] Figure 7 shows the current daytime population density in the county, followed by the nighttime population in Figure 8 based on LandScan data from Oak Ridge National Laboratory. LandScan data are the community standard for global population data. It is derived through the use of available data and satellite imagery to map geographic areas with superimposed layers of information to represent an "ambient" (24-hour average) population.

[9] USA Facts. "Our Changing Population: Salt Lake County, Utah." 2024. https://usafacts.org/data/topics/people-society/population-and-demographics/our-changing-population/state/utah/county/salt-lake-county/#:~:text=Salt%20Lake%20County%27s%20population%20increased%2010%20out%20of,grew%20by%20an%20average%20of%201.2%25%20per%20year

[10] U.S. Census. "Quick Facts Salt Lake City and West Valley City Utah." 2024. https://www.census.gov/quickfacts/fact/table/westvalleycitycityutah,saltlakecitycityutah/HSG445222

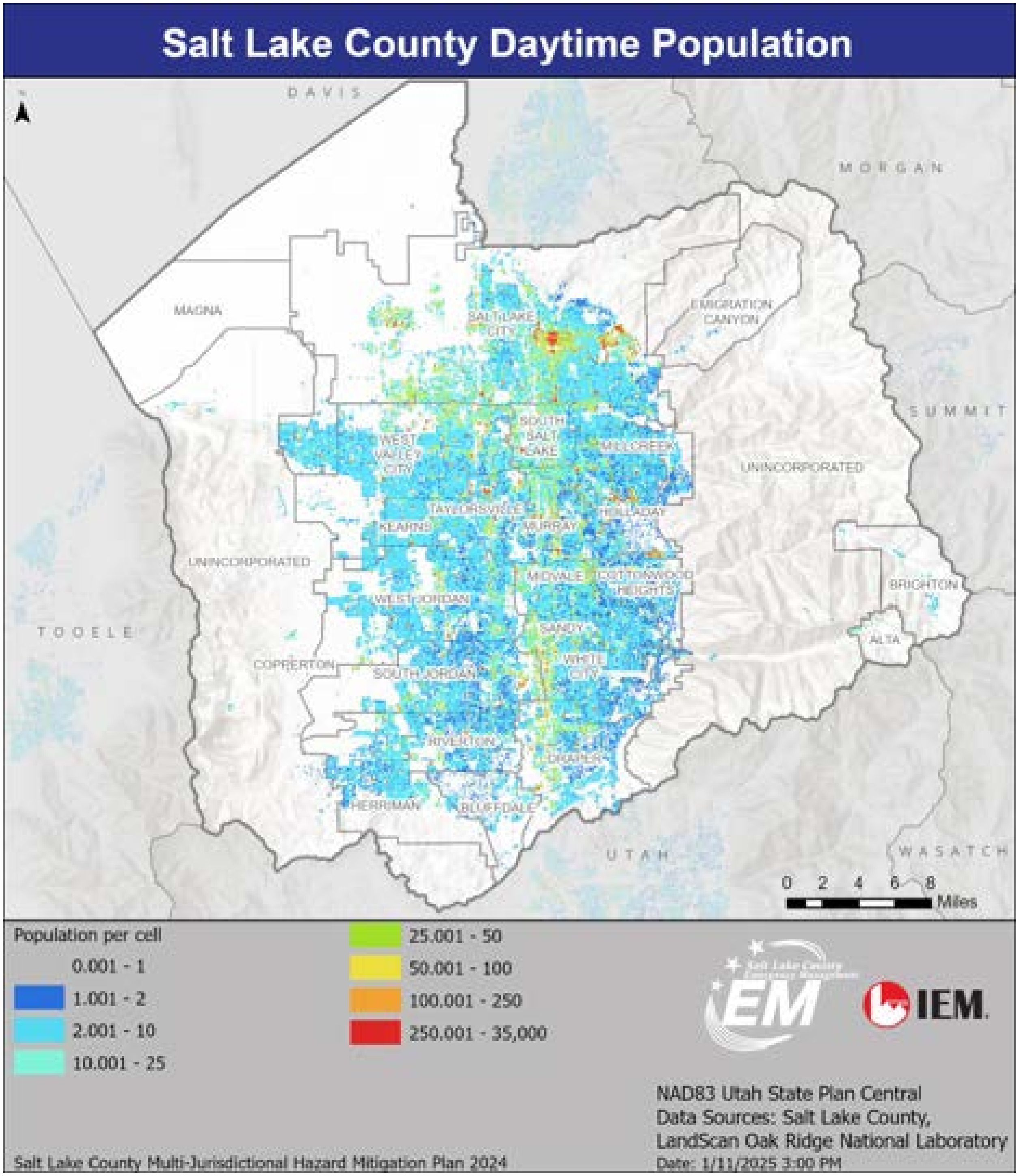


Figure 7: Population Density of Salt Lake County

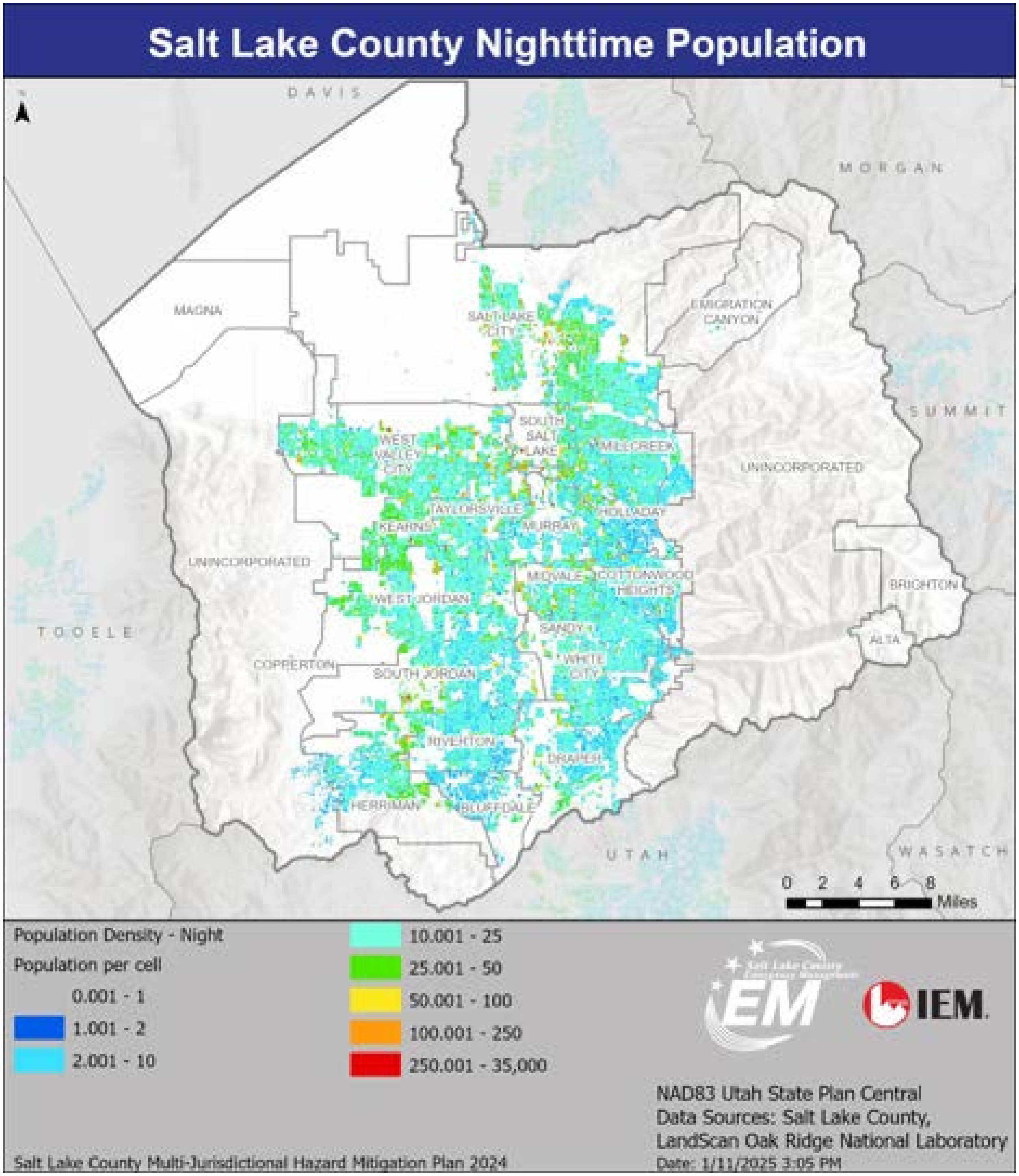


Figure 8: Nighttime Population of Salt Lake County

Table 4 and Table 5 list Salt Lake County population and household projections, indicating continued growth of 55% from 2015 to 2065, as determined by The University of Utah's Kem C. Gardner Policy Institute.[11]

Population Projections

Table 4: Population Projections for Salt Lake County, 2015–2065[12]

County	2015	2025	2035	2045	2055	2065	Absolute Change 2015–2065	Percent Change 2015–2065
Salt Lake County	1,094,650	1,249,961	1,361,099	1,470,574	1,594,804	1,693,513	598,863	55%

Table 5: Household Projections for Salt Lake County, 2015–2065[13]

County	2015	2025	2035	2045	2055	2065	Absolute Change 2015–2065	Percent Change 2015–2065
Salt Lake County	379,320	454,929	521,352	579,472	635,143	689,490	310,170	82%

Population by Age and Gender

Figure 9 lists the 2024 statistical population data for Salt Lake County based on age and gender, indicating the median age is 32.3. Approximately 12.2% of the population are over age 65. Overall, 49.4% are females, and 50.6% are males. Figure 10 shows the distribution of seniors by census tract.

[11] Hanson, Janelle. "Utah in 2065." The University of Utah, Kem C. Gardner Policy Institute. October 21, 2016. https://attheu.utah.edu/facultystaff/utah-in-2065/.
[12] Ibid.
[13] Ibid.

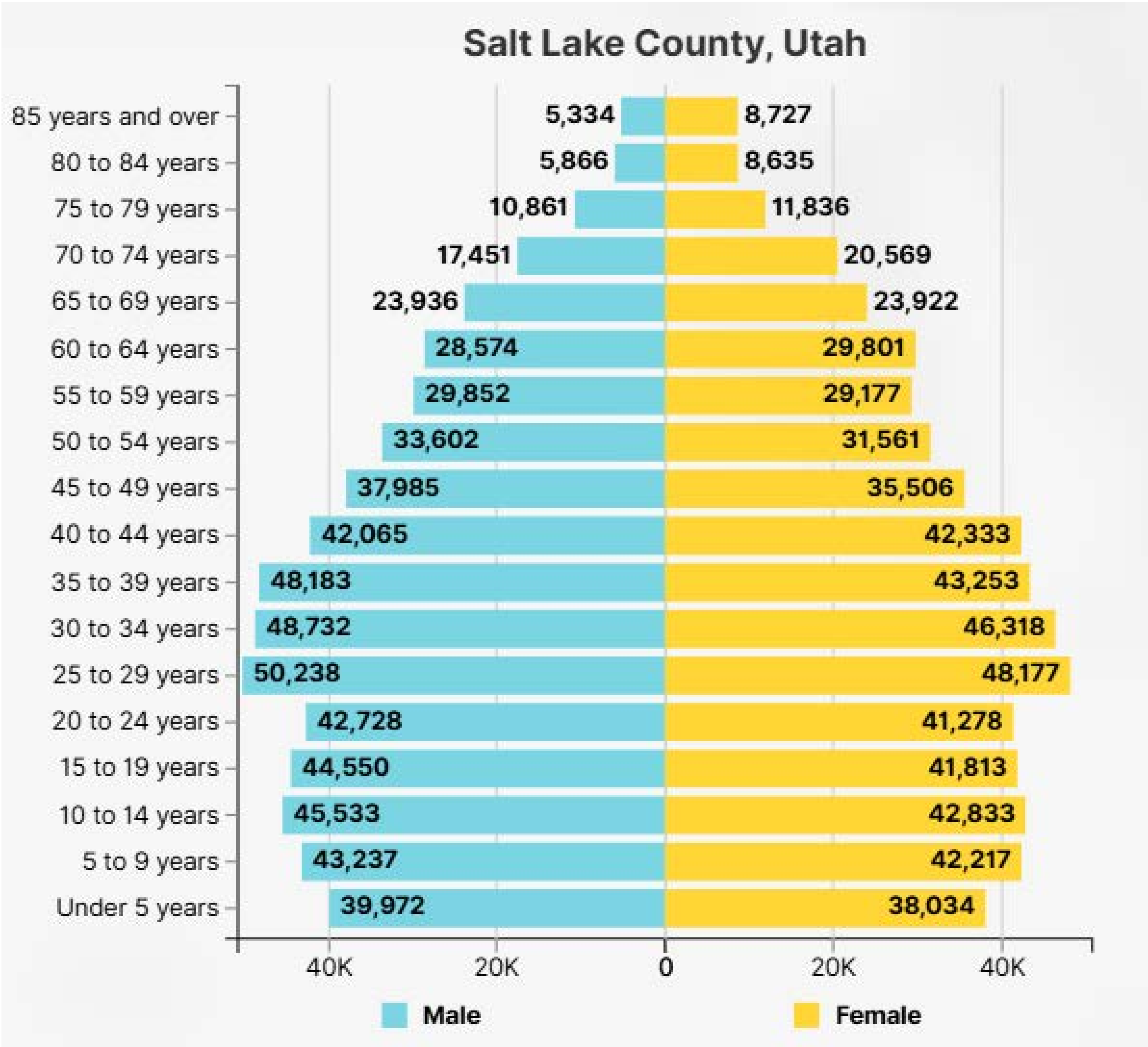


Figure 9: Salt Lake County Population by Gender and Age[14]

[14] US Census Bureau. "Salt Lake County, Utah Population Pyramid." 2024 https://data.census.gov/profile/Salt_Lake_County,_Utah?g=050XX00US49035.

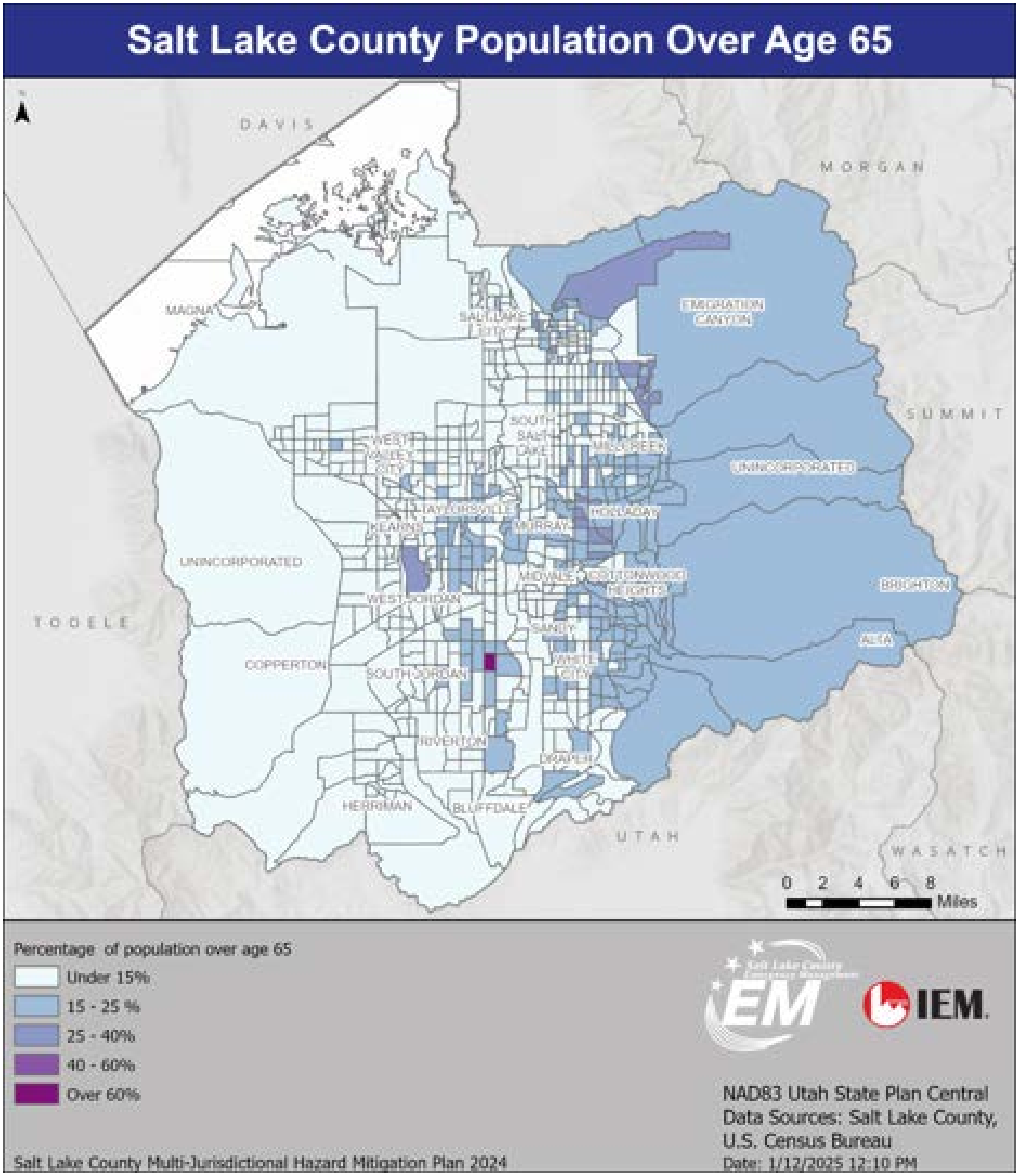


Figure 10: Population 65 Years Old and Older in Salt Lake County by Census Tract

Population by Race

Figure 11 illustrates the Salt Lake County population by race. Of the population, 880,344, or 74.56%, are white; 106,540, or 9.02%, identify as another race; 94,251, or 7.98%, identify as two or more races;

49,060, or 4.16%, are Asian; 21,531, or 1.82%; are Black or African American; 18,674, or 1.58%, are Native Hawaiian or Pacific Islander; and 10,243, or 0.87%, are Native American.

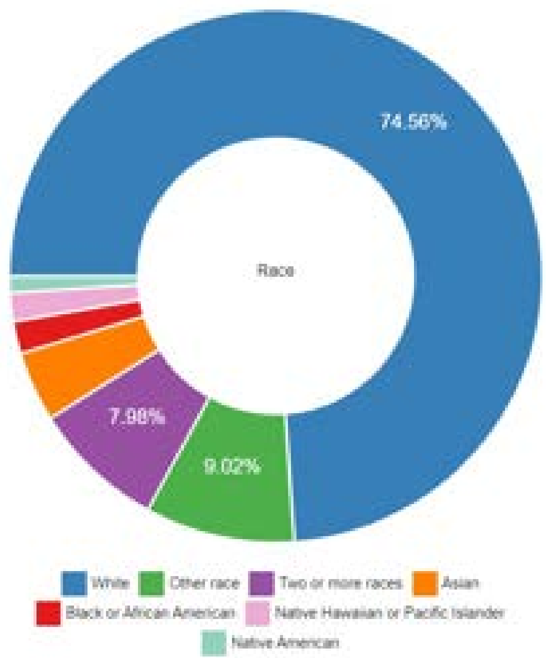


Figure 11: Population by Race of Salt Lake County[15]

Population by Educational Attainment

Figure 12 illustrates the educational attainment levels of the Salt Lake County population. For residents over 25 years old, 25,107 (3.33%) have less than a ninth-grade education, and 36,846 (4.88%) attained a ninth- to twelfth-grade education. High school graduates make up 22.34% of the population (168,538 individuals). Some college, associate degree, bachelor's degree, and graduate degree attainment totals 523,933, or 69.46%.[16]

[15] Ibid.
[16] Ibid.

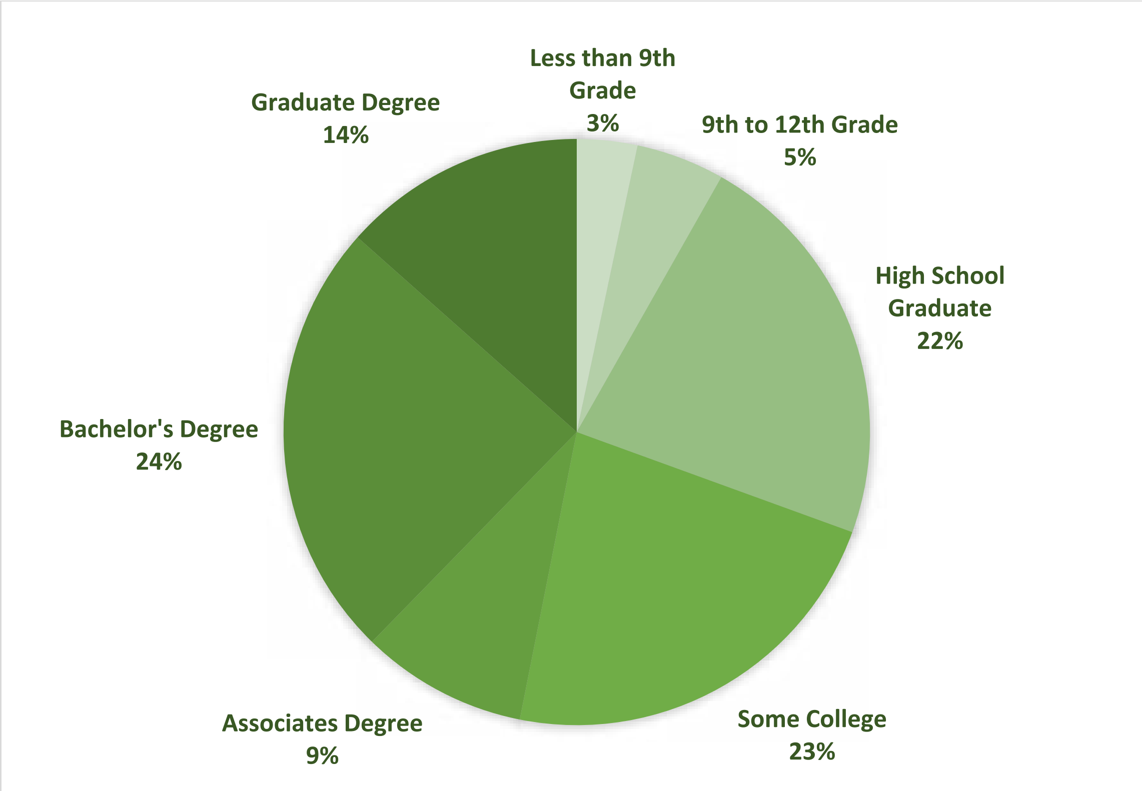


Figure 12: Educational Attainment in Salt Lake County[17]

Housing

For 2018–2022, the United States Census Bureau reports an owner-occupied housing unit rate for Salt Lake County of 67.1%, with 458,880 housing units, as of July 1, 2023. The median value of owner-occupied housing units for 2018–2022 was $440,400. The median selected owner costs for a monthly mortgage was $1,939, while the median gross rent was $1,394.[18]

Economy

Employment

Salt Lake County is the backbone of Utah's economy, making up approximately 39% of the labor force and 47% of the non-farming job market. The trade and transportation industry, the largest employment division in the county, supplies approximately 20% of the county's employment share. Trade is the second major source of employment, followed by government and education, health, and social services. Salt Lake is a regional center for the finance, healthcare, and high-tech industries. Major employers include the University of Utah, the state of Utah, Intermountain Healthcare, Granite School District,

[17] Ibid.
[18] U.S. Census. "Salt Lake County Utah." 2024. https://www.census.gov/quickfacts/fact/table/saltlakecountyutah/HSG445222.

Jordan School District, Salt Lake County, Wal-Mart, Discover Financial Services Inc., Delta Airlines, the United States Postal Service, Salt Lake City School District, and Salt Lake City.

Table 6: Non-Farm Employment in Salt Lake County, 2023–2024[19]

July 2023	June 2024	July 2024	% Change Over Year
798,540	817,886	815,309	2.1%

Table 7: Employment Share In Salt Lake City Area (Non-Farming Jobs)[20]

Employment Type	July 2024 (thousands)	Change from July 2023 to July 2024 (thousands)	Change from July 2023 to July 2024
Total Nonfarm	841.8	24.3	3.0%
Trade/Transport/Utilities	161.1	1.9	1.2%
Prof/Business Services	149.8	3.9	2.7%
Government	116.4	5.3	4.8%
Education/Health/Social Services	99.5	5.2	5.5%
Leisure/Hospitality	72.7	2.4	3.4%
Financial Activities	64.3	0.6	0.9%
Manufacturing	66.4	2.3	3.6%
Mining, Logging, and Construction	63.6	3.5	5.8%
Information	24.5	0.0	0.0%
Other Services	22.5	-0.8	-3.4%

The unemployment rate measures those people who reside in a county, are jobless and available to take a job, and have actively sought work in the past four weeks. The unemployment rate is a proxy for the availability of labor. An unemployment rate between 4.0% and 4.8% may be considered balanced in terms of excess, balance, and shortage.

According to the United States Bureau of Labor Statistics, the unemployment rate in Salt Lake County in July 2024 was 3.6%, up from July 2023 at 2.6%.[21]

[19] Utah.gov. Department of Workforce Services. "Non-Farm Employment." 2024. https://jobs.utah.gov/wi/data/library/employment/countyemployment.html.
[20] United States Bureau of Labor Statistics. "Salt Lake City Area Economic Summary." August 29, 2024. https://www.bls.gov/regions/mountain-plains/summary/BLSSummary_SaltLakeCity.pdf.
[21] Utah.gov. Department of Workforce Services. "Seasonal Adjusted Unemployment Rates." 2024. https://jobs.utah.gov/wi/data/library/employment/countyunemployment.html.

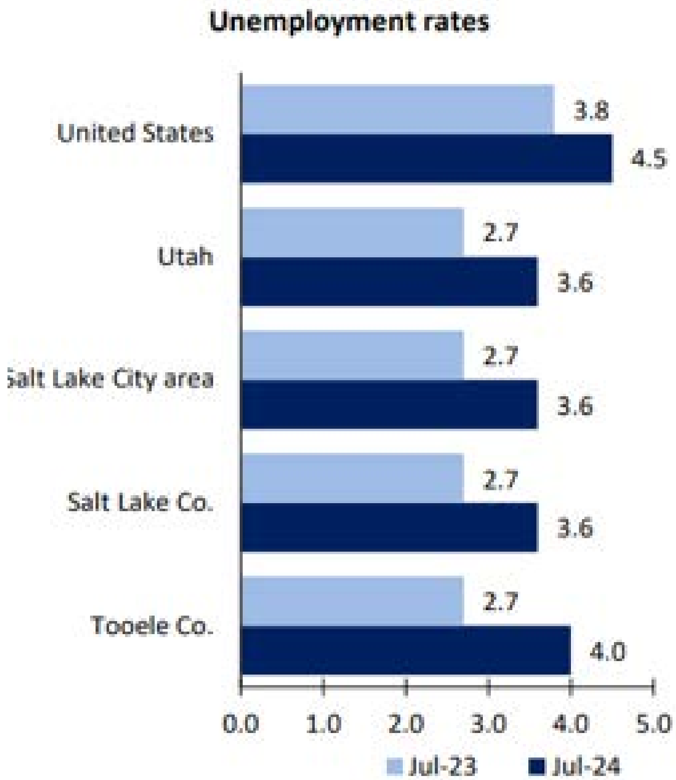


Figure 13: Unemployment Rates in the United States and Selected Areas[22]

Looking ahead, Table 8 shows the employed population in the county is projected to increase by 72% from 2015 to 2065.[23]

Table 8: Employment Projections for Salt Lake County, 2015–2065[24]

County	2015	2025	2035	2045	2055	2065	Absolute Change 2015–2065	Percent Change 2015–2065
Salt Lake County	844,316	1,053,362	1,182,092	1,293,225	1,385,240	1,454,567	610,251	72%

Income

According to the Bureau of Labor Statistics, the average weekly wage for all industries in the Salt Lake City area is $1,130.

[22] U.S. Bureau of Labor Statistics. "Salt Lake City Area Economic Summary." August 29, 2024. https://www.bls.gov/regions/mountain-plains/summary/BLSSummary_SaltLakeCity.pdf.
[23] Hanson, Janelle. "Utah in 2065." The University of Utah, Kem C. Gardner Policy Institute. October 21, 2016. https://attheu.utah.edu/facultystaff/utah-in-2065/.
[24] Ibid.

Table 9: Average Hourly Wages for Selected Occupations[25]

Occupation	Salt Lake City	United States
All Occupations	$31.67	$31.48
Software Developers	$58.13	$66.40
General and Operations Manager	$55.06	$62.18
Training and Development Specialists	$34.79	$34.60
Market Research Analysts and Marketing Specialists	$32.15	$40.00
Electricians	$29.38	$32.60
Paralegals and Legal Assistance	$28.20	$31.95

Poverty

A measure of poverty takes income and family size into account and has both immediate and long-lasting effects on health. Income assesses the financial resources available to individuals or families for necessities (e.g., food, clothing, and healthcare) to maintain or increase their well-being. Persons living in poverty are worse off than persons in more affluent households for many indicators tracked by the Utah Department of Health and Human Services Public Health Indicator Base Information System (PHIBIS). The Utah Public Health Data Resources reports poverty statistics based on the 2022 Model-based Small Area Income & Poverty Estimates (SAIPE) for school districts, counties, and states. The poverty threshold for a family of four, including two children, was $29,678 in 2022. Poverty thresholds are updated annually using the Consumer Price Index for All Urban Consumers (CPI-U) to allow for changes in the cost of living. They do not vary geographically. PHIBIS reports that the percentage of persons living in poverty in Salt Lake County is 7.7%. In addition, Utah has a lower percentage of children in poverty than the U.S. as a whole, 8.5% vs. 16.3% in 2022.[26]

Critical Facilities and Infrastructure

Critical facilities include structures from which public safety actions and other essential services are provided. Although not an exhaustive list of facilities that perform important community functions, this plan identifies critical facilities such as emergency operations centers, fire stations, hospitals, police stations, schools, and other county facilities. County facilities include community assets, such as recreation centers, libraries, public works, parks, cultural venues, public health facilities, justice centers, and senior centers.

[25] U.S. Bureau of Labor Statistics. "Salt Lake City Area Economic Summary." August 29, 2024. https://www.bls.gov/regions/mountain-plains/summary/BLSSummary_SaltLakeCity.pdf.
[26] Utah.gov. "Health Indicator Report of Utah Population Characteristics: Poverty, Children Age 17 and Under." Utah Department of Health and Human Services, Public Health Indicator Based Information System (IBIS). 2022. https://ibis.utah.gov/ibisph-view/indicator/view/ChldPov.html.

Table 10: Count of Critical Facilities by Jurisdiction

Name	Emergency Operations Centers	Fire Stations	Hospitals	Police Stations	Schools	County Facilities
Alta	1	0	0	1	0	1
Bluffdale	1	2	0	2	7	1
Brighton	0	1	0	0	0	0
Copperton	0	1	0	0	0	1
Cottonwood Heights	1	2	0	1	7	10
Draper	1	3	1	1	21	7
Emigration Canyon	0	1	0	0	0	0
Herriman	1	2	0	1	12	6
Holladay	1	1	0	1	16	8
Kearns	0	1	0	1	11	11
Magna	0	2	0	1	7	8
Midvale	1	2	0	1	15	10
Millcreek	0	3	2	1	20	14
Murray	1	4	2	2	28	16
Riverton	1	3	1	1	12	10
Salt Lake City	2	14	5	9	85	32
Sandy City	1	5	2	1	35	7
South Jordan	1	3	0	1	22	9
South Salt Lake	2	3	1	3	24	16
Taylorsville	1	2	0	2	17	16
Unincorporated	0	1	0	0	3	3
West Jordan	1	5	1	1	42	15
West Valley City	1	6	1	2	37	16
White City	0	0	0	0	1	1
Salt Lake Community College	0	0	0	0	9	0
Jordan School District	0	0	0	0	68	0
Canyons School District	0	0	0	0	47	0

STATE-OWNED FACILITIES

Salt Lake County has 1,463 state-owned facilities with an insured value of approximately $7.3 billion.

Transportation

As of 2023, the Salt Lake County International Airport was the 21st busiest airport in the United States, operating as a major hub for Delta Air Lines and SkyWest Airlines. Although not visible in Figure 14, the South Valley Regional Airport in West Jordan also is available for public use.

Salt Lake County can be traversed on several interstate highways, including I-15, I-80, and I-215. Numerous other freeways, expressways, and significant arterial routes interconnect in the county, including SR-68, SR-201, and SR-154. The county also contains many bike paths for active transportation.

The county is also heavily networked with bus and commuter rail lines operated by the Utah Transit Authority (UTA) (Figure 14 and Figure 15). The FrontRunner commuter rail line, TRAX light rail system, and many bus routes are all used for public transportation throughout Salt Lake County.

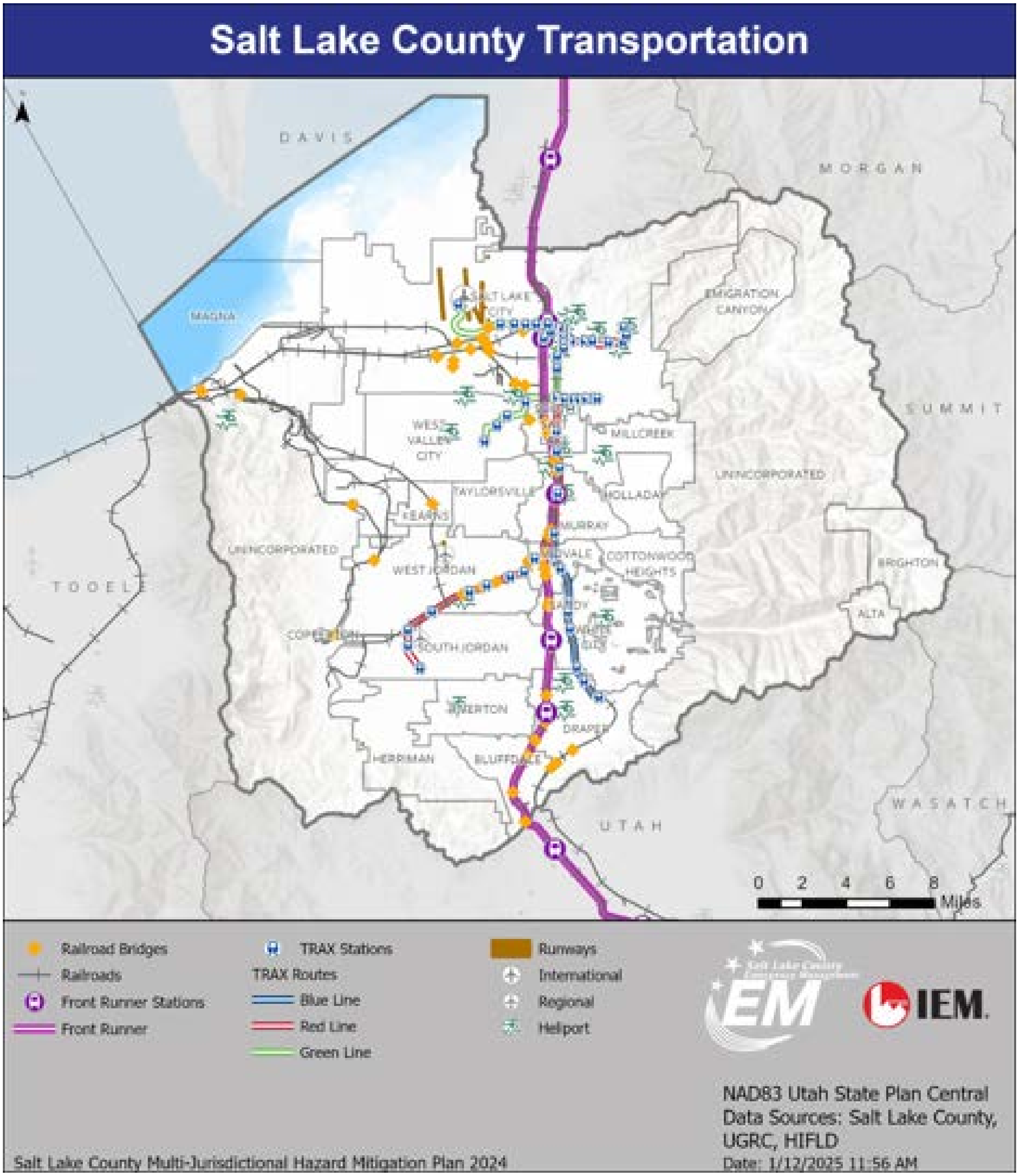


Figure 14: Railways in Salt Lake County

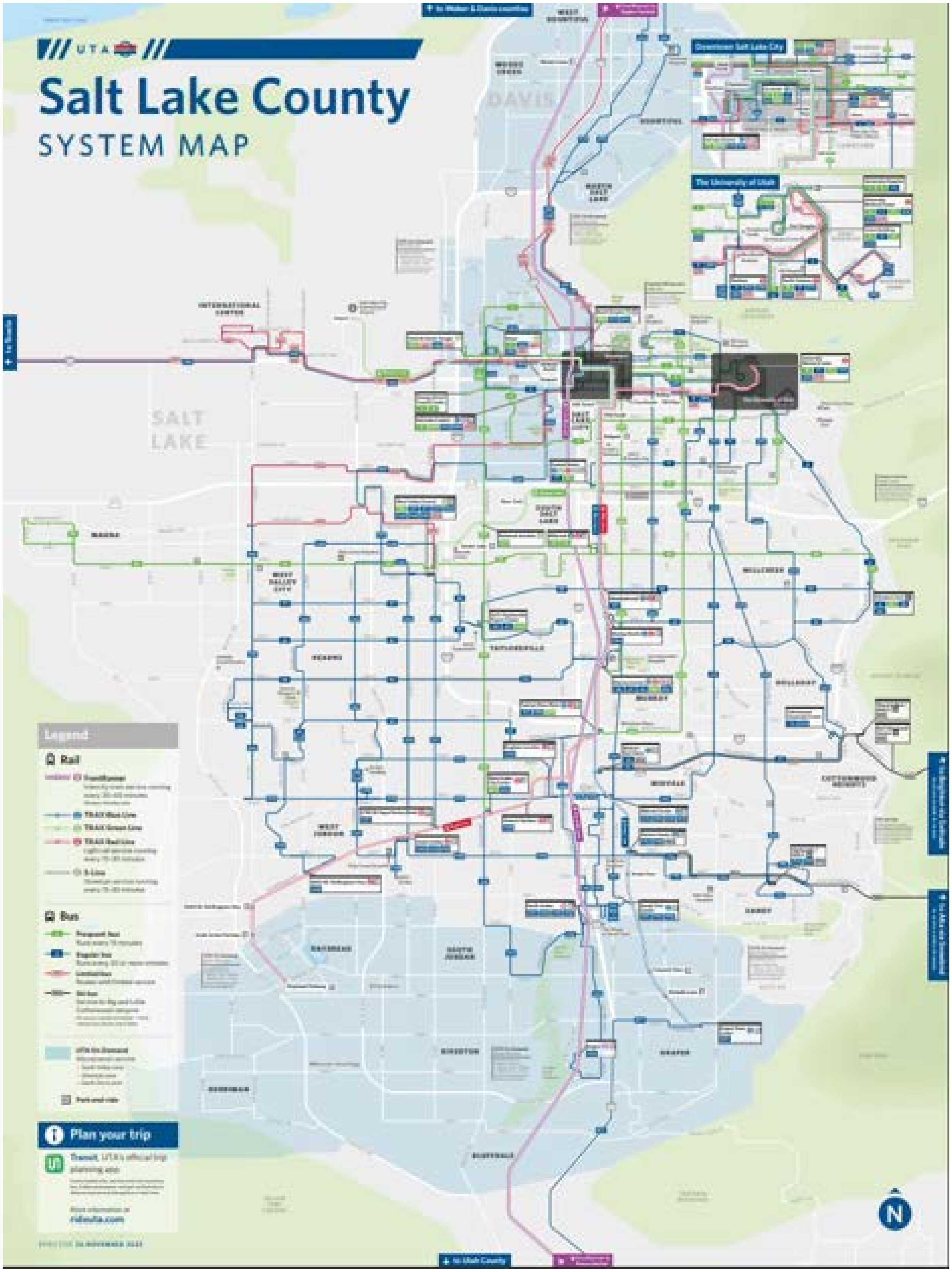


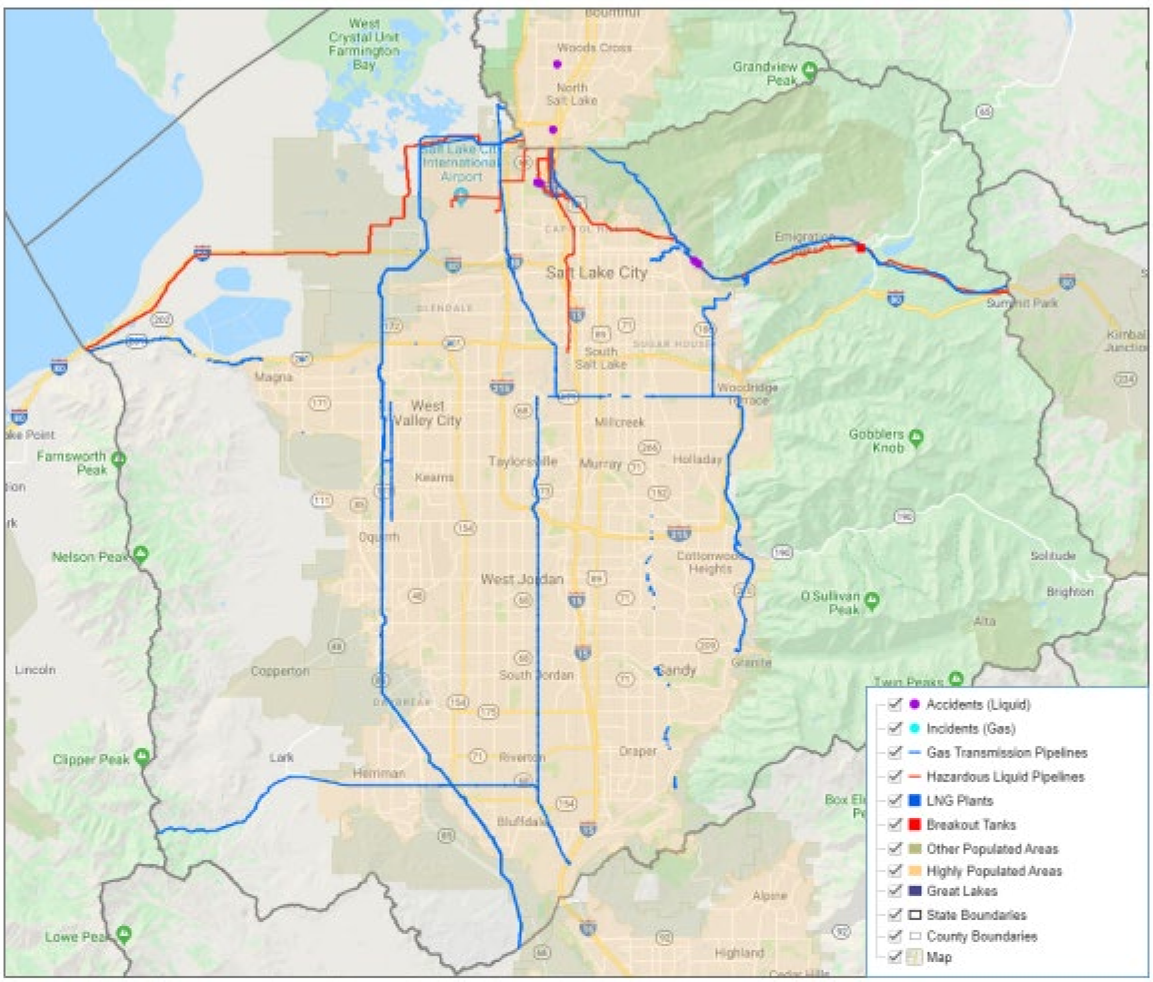
Figure 15: Map of the Salt Lake County Transit System

Water Control Structures

According to the 2024 Utah Enhanced State Hazard Mitigation Plan, there are approximately 266 High Hazard Potential Dams (HHPDs) in the state and 28 in Salt Lake County. The largest concentration of high and significant hazard dams is in the Wasatch Front counties, including the Salt Lake City metropolitan area. The Wasatch Front is a region in north central Utah of mostly contiguous cities and towns along the Wasatch Mountains. It stretches from Santaquin in the south to Pleasant View in the north. The Wasatch Front is the most highly populated region in Utah, with 80% of its residents in this area. The National Levee Database also maps five levee systems (160 levee structures) in the county.

Pipelines

The National Pipelines Mapping System has a public map viewer that can be used to view gas transmission and hazardous liquid pipelines in Salt Lake County (Figure 16).



Source: https://pvnpms.phmsa.dot.gov/PublicViewer/

Figure 16: Pipelines in Salt Lake County

Communications

The major newspapers in the county include the Salt Lake Tribune and Deseret News, although many others are in circulation in the county. There are approximately 17 full-power television stations in the Salt Lake City market. There are also approximately 30 trunked radio systems in Salt Lake County (Table 11).

Table 11: Trunk Radio Systems in Salt Lake County[27]

System Name	Type	City
Alpha Communications	DMR Motorola Connect Plus (TRBO)	Salt Lake City
Brian Leifson	Motorola Type II Smartnet	Salt Lake City
Brigham Young University	DMR Motorola Connect Plus (TRBO)	Provo
Church of Jesus Christ of Latter-Day Saints	Project 25 Phase II	Salt Lake City
City Creek Center	DMR Motorola Capacity Plus Single Site (TRBO)	Salt Lake City
Delta Airlines	DMR Motorola Capacity Plus Single Site (TRBO)	Salt Lake City
Discover Cardtronics	DMR Motorola Capacity Plus Single Site (TRBO)	West Valley City
eBay Data Center	DMR Conventional Networked	South Jordan
Enbridge Gas	DMR Tier 3 Standard	Multiple
Frito Lay Plant	DMR Motorola Capacity Plus Single Site (TRBO)	West Valley City
Geneva Rock and Cement	DMR Motorola Capacity Plus Multi-Site (TRBO)	Orem
Henkel Corporation	LTR Standard	Salt Lake City
Herriman City	DMR Motorola Capacity Plus Single Site (TRBO)	Herriman
Hill Air Force Base	Project 25 Phase II	Various
Hogle Zoo	DMR Motorola Capacity Plus Single Site (TRBO)	Salt Lake City
Hyatt Regency Salt Lake City	DMR Motorola Capacity Plus Single Site (TRBO)	Salt Lake City
Intel Corporation	Motorola Type II	Salt Lake City
Intermountain Health Care Hospitals	NXDN NEXEDGE 4800	Salt Lake City
Jordan School District	DMR Motorola Capacity Plus Single Site (TRBO)	West Jordan
Kennecott Utah Copper (Capacity Plus)	DMR Motorola Capacity Plus Multi-Site (TRBO)	Magna
Kennecott Utah Copper (Connect Plus)	DMR Motorola Connect Plus (TRBO)	Magna
Kennecott Utah Copper (P25)	Project 25 Phase II	Magna
Kilgore Companies	NXDN Icom IDAS Type C	Various
Little America	DMR Motorola Capacity Plus Multi-Site (TRBO)	Salt Lake City
McIntosh Communications (DMR)	DMR Motorola Capacity Plus Multi-Site (TRBO)	Salt Lake City

[27] RadioReference.com. https://www.radioreference.com/ DMR = Digital Mobile Radio, LTR = Logic Trunked Radio, MPT 1327 is an industry standard for trunked radio communications networks, NEXEDGE is a model of radio from Kenwood, NXDN = Next Generation Digital Narrowband, TRBO is a digital radio format.

System Name	Type	City
McIntosh Communications (Ensign Peak)	LTR Standard	Salt Lake City
My Patriot Supply	DMR Motorola Capacity Plus Single Site (TRBO)	Salt Lake City
National Security Agency Data Centers	Project 25 Phase II	Multiple
Northrop Grumman Systems	DMR Motorola Capacity Plus Single Site (TRBO)	Magna
Peak Wireless Services	NXDN NEXEDGE 9600	Multiple
Peak Wireless Services (DFA)	NXDN NEXEDGE 4800	Various
Progressive Leasing	DMR Motorola Capacity Plus Single Site (TRBO)	Draper
RPAI Southwest Management	DMR Motorola Capacity Plus Single Site (TRBO)	Salt Lake City
Salt Lake City Public Safety	Motorola Type II	Salt Lake City
Salt Lake County Public Works	Motorola Type II Smartnet	Salt Lake City
Salt Palace Convention Center	DMR Motorola Capacity Plus Single Site (TRBO)	Salt Lake City
Snowbird Ski Resort	DMR Conventional Networked	Alta
South Valley Sewer District	DMR Motorola Capacity Plus Multi-Site (TRBO)	Bluffdale
South Valley Water Reclamation	DMR Motorola Capacity Plus Single Site (TRBO)	West Jordan
Staker Parson Construction	DMR Motorola Capacity Plus Single Site (TRBO)	Riverton
Sun Communications	DMR Motorola Capacity Plus Single Site (TRBO)	Salt Lake City
Sunroc Construction	DMR Motorola Capacity Plus Multi-Site (TRBO)	Spanish Fork
Tesoro Companies	DMR Conventional Networked	Salt Lake City
Tesoro Refinery	DMR Motorola Capacity Plus Single Site (TRBO)	Salt Lake City
UCS Wireless (900)	DMR Motorola Capacity Plus Multi-Site (TRBO)	Salt Lake City
UCS Wireless (UHF)	DMR Motorola Capacity Plus Multi-Site (TRBO)	Salt Lake City
Unified Fire Authority	Project 25 Phase II	Salt Lake City
Unified Fire Authority (BD10)	Motorola Type II	Salt Lake City
United Parcel Service	DMR Tier 3 Capacity Max	Salt Lake City
United Parcel Service Delivery	DMR Motorola Capacity Plus Single Site (TRBO)	West Valley City
University of Utah Hospitals	NXDN NEXEDGE 4800	Salt Lake City
Utah Communications Authority	Motorola Type II SmartZone Omnilink	Various
Utah Communications Authority (P25)	Project 25 Phase II	Statewide
Utah Transit Authority	MPT-1327 Standard	Salt Lake City
Wasatch Front T-3	DMR Tier 3 Capacity Max	Salt Lake City

Planning for the Future

Salt Lake County anticipates continued population growth over the next 30 years, expected to reach 1,385,240 by 2055. Salt Lake County is also influenced by growth in neighboring counties. According to the Wasatch Choice 2050 Plan, the Wasatch Front region could reach almost 5 million by 2050. This growth necessitates the development of key infrastructure guided by long-range planning. To that end, the Wasatch Front Regional Council (WFRC) is responsible for coordinating the transportation planning process for the region. WFRC is an association of governments comprised of elected officials from Box Elder, Davis, Morgan, Salt Lake, Tooele, and Weber Counties. The WFRC has facilitated the development of the Wasatch Choice 2050 Plan, which is the communities' shared vision for transportation investments, development patterns, and economic opportunities. The Wasatch Choice 2050 Plan envisions transportation investments and interrelated land and economic development decisions that achieve desired local and regional outcomes.[28]

Four key strategies represent the overarching themes in the Wasatch Choice 2050 Plan and help achieve the regional goals. The key strategies of the Wasatch Choice 2050 Plan are as follows.

- **Provide Transportation Choices:** Help us have real options for getting around and increase the number of easily reached destinations.
- **Support Housing Options:** Support affordable housing types and locations that work best for our lives.
- **Preserve Open Space:** Preserve sufficient and easily accessible open lands that provide recreational opportunities.
- **Link Economic Development with Transportation and Housing Decisions:** Create a synergy between these three key building blocks. Enable shorter and less expensive travel to afford us more time and money. Efficiently use infrastructure to save taxpayer dollars. Provide housing options and increase housing affordability. Improve the air we breathe by reducing auto emissions.

Wasatch Choice is implemented through the Comprehensive Economic Development Strategy, Local Planning, and Regional Transportation Plan (RTP). The following maps from the 2019–2050 RTP show the region's vision for future transportation and land use.

[28] Wasatch Choice 2050 Plan. "Goals and Strategies." https://wasatchchoice.org/.

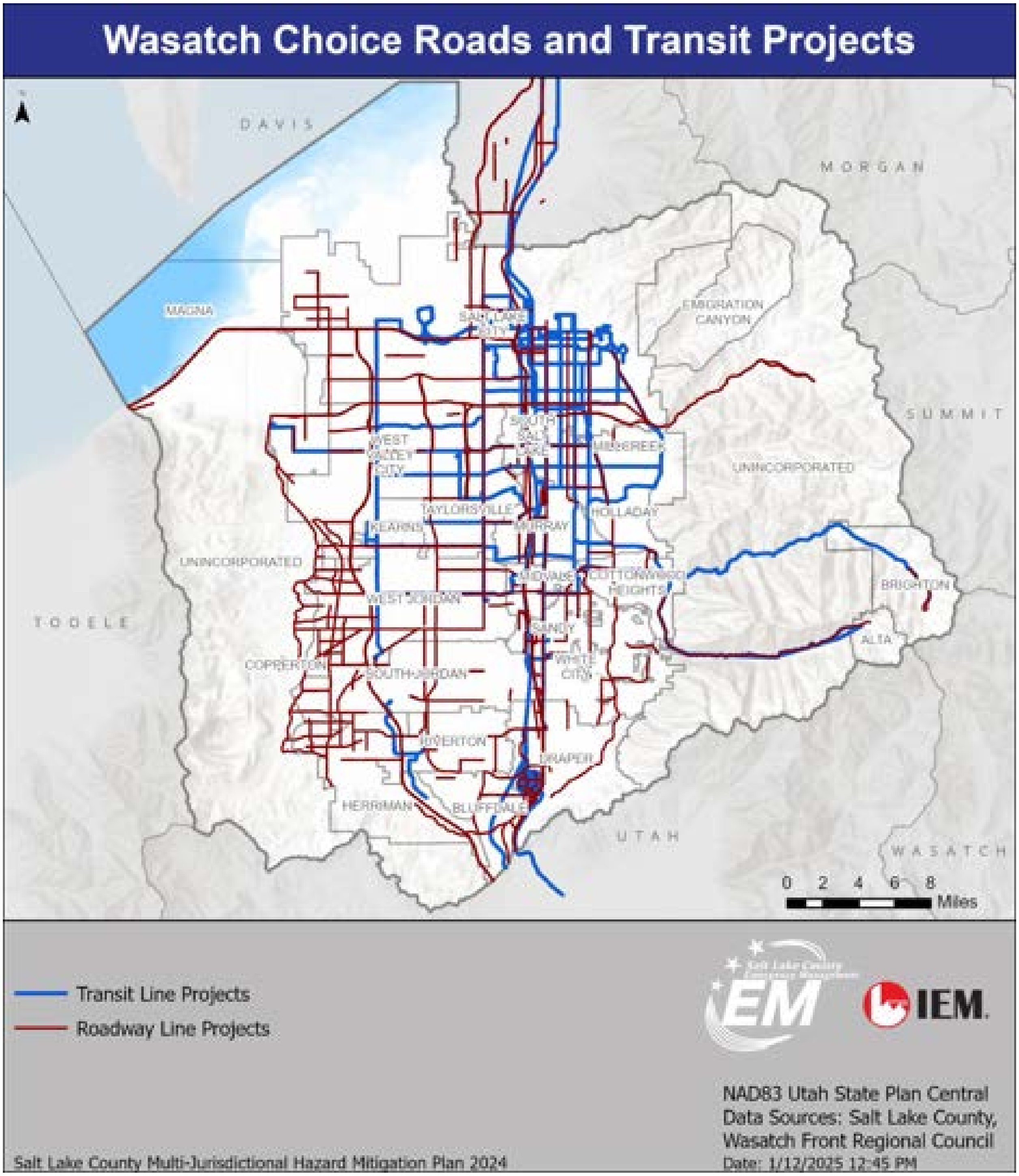


Figure 17: Map of Wasatch Choice Roads and Transit[29]

The regionally significant land uses include a hierarchy of centers (Figure 18). Centers are the hearts of a community and are locations where communities anticipate welcoming more buildings, even as they may

[29] Wasatch Choice 2050 Plan. "Transportation Map." https://wasatchchoice.org/vision-map/#mapList=vision.transportation.landuse.econdev.recreation.olympics&selectedMap=vision&sideBarClosed=false&x=-12450274&y=4979018&scale=288895.

maintain lower levels of density elsewhere. The locations vary in scale but, in all cases, are denser than their surrounding area, walkable, and offer a mix of uses. Because of these traits, residents in or near centers drive shorter distances and are likelier to walk, bike, and ride transit. Overall, this reduces traffic congestion and air emissions. In addition, they are typically good candidate locations for providing various housing options, including units that impact housing affordability.

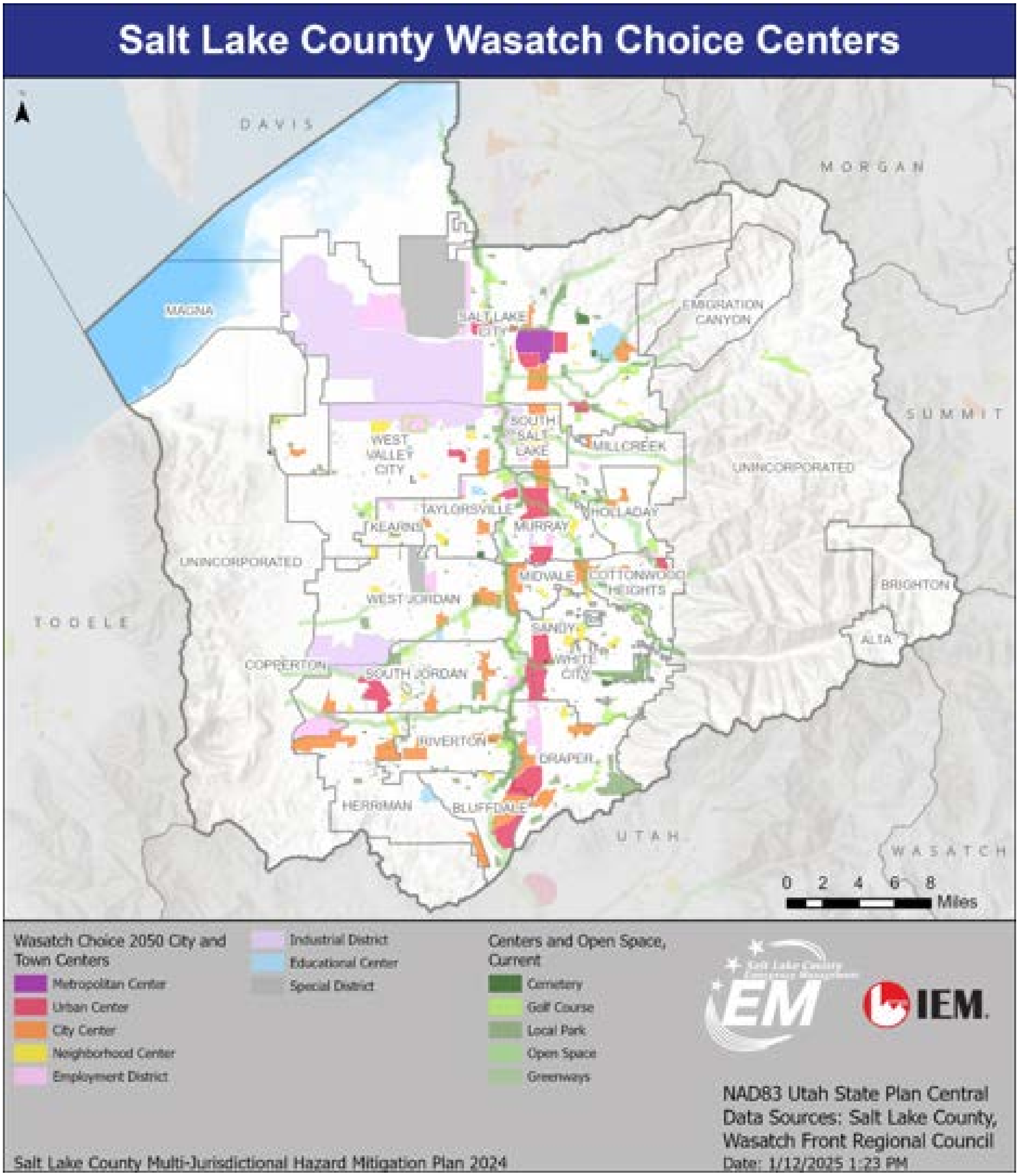


Figure 18: Map of Wasatch Choice Land Use[30]

The economic development map (Figure 19) shows several important regional policy and geographic considerations: Utah State Economic Clusters, Opportunity Zones, Community Development Areas

[30] Wasatch Choice 2050 Plan. https://wasatchchoice.org/vision-map/#mapList=vision.transportation.landuse.econdev.recreation.olympics&selectedMap=landuse&sideBarClosed=false&x=-12450274&y=4979018&scale=288895.

(CDA) and Regional Development Areas (RDA), and Transit-Oriented Developments (TODs). Utah's industry clusters are aerospace and defense, energy, financial services, life sciences, outdoor products and recreation, and software and IT. Nurturing industry clusters helps the state and Salt Lake County sustain a competitive business advantage. Opportunity Zones are areas determined by the U.S. Census Bureau as "low-income communities." Designated Opportunity Zones incentivize private sector investments in housing and economic development in these areas by providing tax incentives. CDAs and Community Reinvestment Areas (CRAs) are public financing tools. They temporarily use the increase in tax revenue spurred by land reinvestment to pay for infrastructure improvements. By doing so, they further encourage land reinvestment. TODs refer to housing, jobs, and commercial developments centered around transit. Development that is well integrated with transit choices provides additional transportation choices and positively impacts the economy through increased accessibility to jobs and housing. TODs help reduce household transportation costs, congestion, and air pollution.

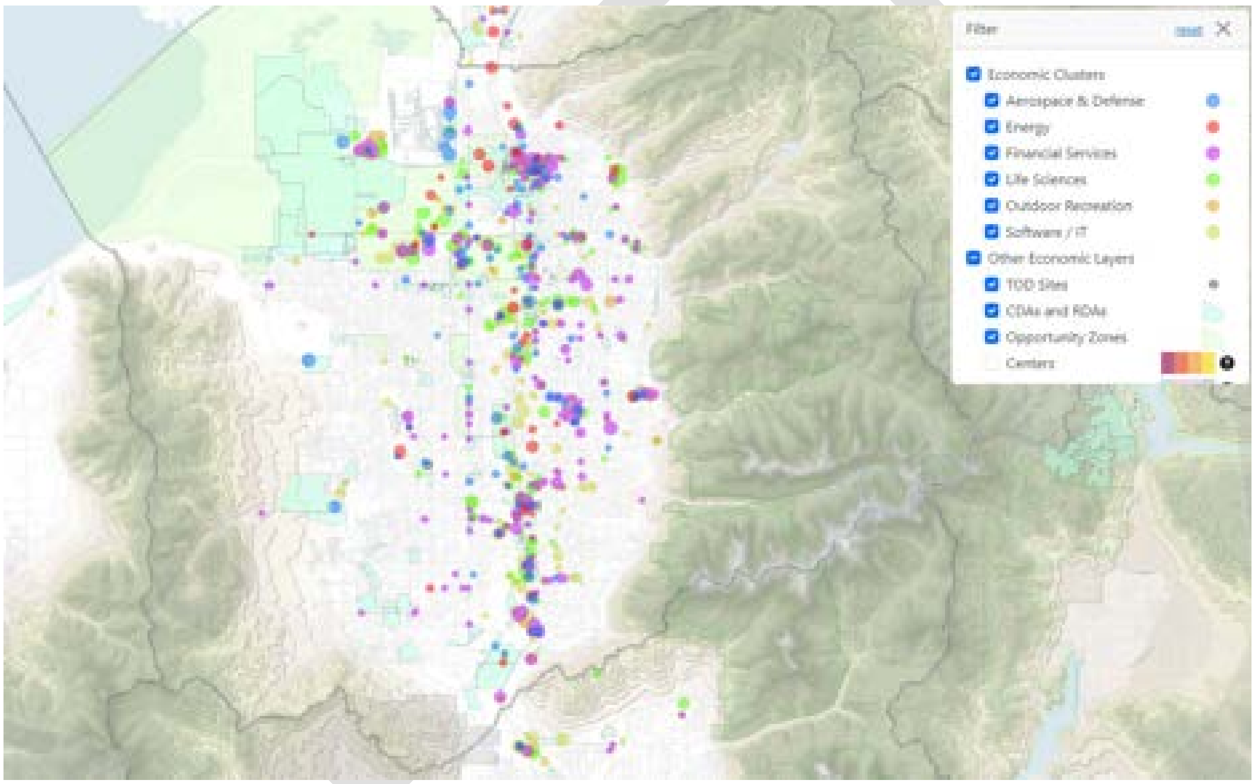


Figure 19: Map of Wasatch Choice Economic Development[31]

The Wasatch Front region is a stunning natural setting. As growth continues, one challenge is to ensure that residents have sufficient open space and recreational opportunities that are easy to access. Open space can manifest itself in several ways: natural, untouched landscapes; mountain trails; bird sanctuaries; rivers and lakes; places of solitude; playgrounds; paved urban trails; neighborhood pocket parks; regional urban parks; sports complexes; and community gathering places, among many more.

[31] Wasatch Choice 2050 Plan. "Economic Opportunities." https://wasatchchoice.org/vision-map/#mapList=vision.transportation.landuse.econdev.recreation.olympics&selectedMap=landuse&sideBarClosed=false&x=-12450274&y=4979018&scale=288895.

Besides the mental and physical health benefits for people using these spaces, open space is critical green infrastructure.

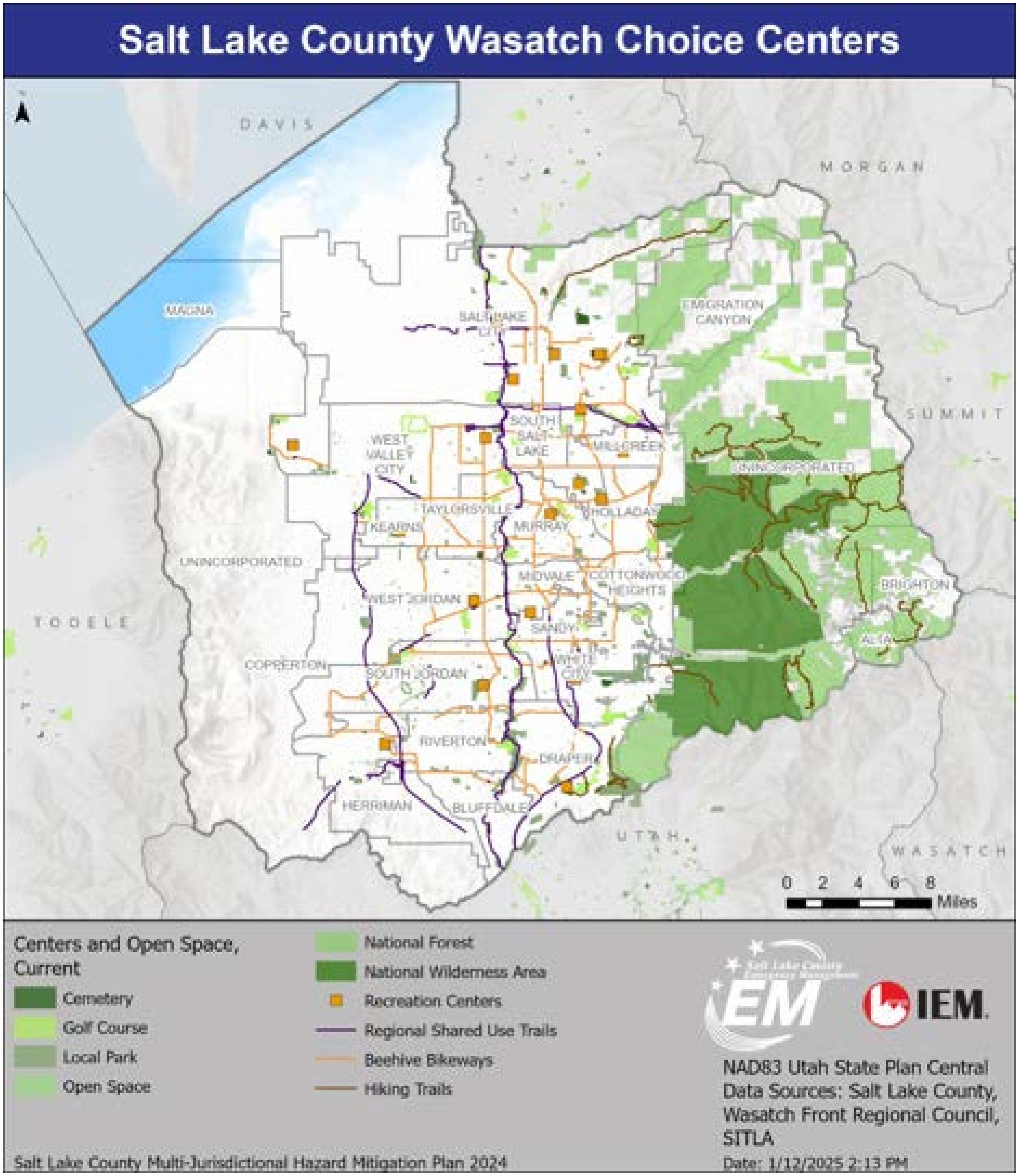


Figure 20: Recreation Centers in Salt Lake County

As the region grows, diverse open space and recreation opportunities must be planned to maintain the quality of life that many residents enjoy. Setting local goals for park space per household is one way to focus attention on providing recreational spaces in growth areas. Parks are becoming even more important as the region densifies with high rates of multifamily residential development. Establishing goals and intentions is a great step, but energy and funding must also be put into making new parks become a reality.

In addition, recreation planning should look to enhance access to these spaces by walking and biking. This can be accomplished by linking these spaces through a biking and walking network, such as the 100-mile Golden Spoke network of off-street paved pathways consisting of the Provo River Parkway, Murdock Canal Trail, Jordan River Parkway, Legacy Parkway Trail, Denver & Rio Grande Western Trail, and Ogden River Trail.

Planning Process

Hazard mitigation plans serve as the foundation of an effective mitigation program. A robust whole-community planning process is important for gathering vital stakeholder input and building partnerships to implement mitigation actions. An inclusive planning process ensures that local jurisdictions and countywide participants are involved and can provide meaningful input. By soliciting information from a broad range of stakeholders, the plan update meets the requirements outlined by FEMA in the Local Mitigation Planning Policy Guide. It reflects the plan participants' unique risks, vulnerabilities, goals, and strategies.

This section describes each stage of the planning process used to develop the 2025 Salt Lake County Multi-Jurisdictional Hazard Mitigation Plan (MJHMP). This process provided a framework for document development. It included organizing resources, assessing risk, developing the mitigation plan, drafting it, reviewing and revising it, and adopting and submitting the plan for approval.

Plan Update Approach

Hazard mitigation planning in the United States is guided by the statutory regulations described in the Disaster Mitigation Act of 2000 (DMA 2000) and implemented through 44 Code of Federal Regulations (CFR) Part 201 and 206. FEMA's guidelines outline a four-step planning process for developing and approving hazard mitigation plans.

To develop the MJHMP, a planning process was created based on the various federal guidance documents and regulations, including FEMA's Local Mitigation Planning Handbook, which shows that the MJHMP planning process includes four core components: organizing resources, assessing risk, developing the mitigation action strategy, and adopting and implementing the plan.

Salt Lake County Emergency Management (SLCo EM) gathered letters of commitment from the participating jurisdictions during the summer of 2024. Once participating jurisdictions were identified, IEM facilitated the Kickoff Meeting with SLCo EM staff and jurisdictional planning partners to address the purpose of the mitigation plan and the planning process, establish a schedule for future meetings, and explain the importance of public and stakeholder involvement. In addition, they identified project objectives and data needs, refined plan boundaries, collected background information, identified project issues and challenges, discussed networking with essential partners, and facilitated discussion of the public outreach strategy and project management. This meeting also emphasized the need for public outreach, particularly to vulnerable populations.

Following the Kickoff Meeting, the SLCo EM staff facilitated two presentations with executive leaders of participating jurisdictions, one with the Salt Lake County Council on October 15 and another with the Council of Mayors on October 17. These meetings were an opportunity to introduce the purpose of the mitigation plan and the planning process and explain the importance of public and stakeholder involvement. SLCo EM also facilitated a meeting with the participating jurisdictions' Public Information Officers (PIOs) on September 30 to help engage them in outreach efforts.

Figure 21: Mitigation Plan Announcement in the Salt Lake County Government Center

The Risk Assessment Review Meeting gave plan participants an opportunity to provide input about past and potential hazard impacts on each jurisdiction. The Mitigation Strategy Meeting gave plan participants the opportunity to discuss the approach to mitigation across the planning area and included a brainstorming session to propose measures to reduce the current and future vulnerabilities described in the risk assessment stage of the plan. Plan participants were also invited to attend the Final Review and Plan Adoption Meetings and an Executive Leadership Meeting to conduct the closeout proceedings.

Figure 22: Salt Lake County Hazard Mitigation Plan Kickoff Meeting

Local Jurisdiction Plan Participation

The 2025 Salt Lake County MJHMP update was developed with support from many agencies, organizations, and individuals. SLCo EM is responsible for the plan update. Grant funding for the project was received by the Unified Fire Authority, which manages SLCo EM using a 50-year charter created with Salt Lake County in 2004. SLCo EM organized the planning participants and facilitated meetings and public outreach, and UFA provided additional staff, resources, and administrative support. SLCo EM hired IEM International, Inc. (IEM) to update the 2019 plan. IEM provided technical and outreach assistance throughout the planning process, including updating the base plan, facilitating meetings, and developing and incorporating forms to garner stakeholder input. Salt Lake County was joined by the Cities, Towns, and Special Districts listed in Table 12.

The IEM team worked with each participating jurisdiction throughout the planning process to identify hazards of concern and mitigation actions specific to each jurisdiction. The county representatives worked with available county staff outside meetings to obtain feedback and provide input about specific concerns, capabilities, and actions for each jurisdiction.

Many of the participating cities have a dedicated Emergency Manager or designee who serves as the primary participant in the mitigation planning process. As noted in the Community Profile, the Greater Salt Lake Municipal Services District provides municipal type services to the municipalities of Copperton, Emigration Canyon, City of Kearns, Magna City, White City, the Town of Brighton, and unincorporated areas in the county. The municipalities' emergency planning needs are such that they do not require a full-time emergency planner.

The MSD has a Municipal Emergency Management Services and Reimbursement agreement with the Unified Fire Authority (UFA) to hire emergency planning specialists who share the work of an emergency planner on a part-time, pro-rata basis. UFA has hired two emergency planning specialists who provide emergency planning services to the municipalities, the unincorporated county, and the MSD for an agreed-upon proportion of time. Midvale City also shares a municipal planner via contract with UFA. The UFA municipal planners performed the role of participating in the mitigation planning process on behalf of the municipalities, and coordinated with SLCo EM, the MSD, and other municipal executives or representatives as needed.

Table 12 outlines the schedule of activities for plan participation, detailing the levels of involvement from all participating jurisdictions. It indicates which jurisdictions aim to meet the optional High Hazard Potential Dam (HHPD) element. Those jurisdictions marked as pursuing this element are in areas designated as HHPDs. Special districts are labeled as N/A since they are encompassed in a specific city, and that city will fulfill the requirements for the HHPD element.[32]

[32] National Inventory of Dams, "Salt Lake County." https://nid.sec.usace.army.mil/#/dams/search/sy=@countyState:salt%20lake%20@hazardId:(4)&viewType=map&resultsType=dams&advanced=false&hideList=false&eventSystem=false.

Table 12: Participating Jurisdictions

Jurisdiction	Participant in the 2019 Plan	Participant in the 2025 Plan	Seeking to Meet Optional HHPD Element
Alta	Yes	Yes	No
Bluffdale	Yes	Yes	Yes
Brighton	Yes	Yes	Yes
Copperton	Yes	Yes	No
Cottonwood Heights	Yes	Yes	No
Draper	Yes	Yes	Yes
Emigration Canyon	Yes	Yes	No
Herriman	Yes	Yes	Yes
Holladay	Yes	Yes	Yes
Kearns	Yes	Yes	No
Magna	Yes	Yes	No
Midvale	Yes	Yes	Yes
Millcreek	Yes	Yes	No
Murray	Yes	Yes	No
Riverton	Yes	Yes	Yes
Salt Lake City	Yes	Yes	Yes
Sandy City	Yes	Yes	Yes
South Jordan	Yes	Yes	Yes
South Salt Lake	Yes	Yes	Yes
Taylorsville	Yes	Yes	No
West Jordan	Yes	Yes	No
West Valley City	Yes	Yes	No
White City	Yes	Yes	No
Salt Lake Community College	Yes	Yes	N/A
Salt Lake County	Yes	Yes	Yes
Jordan School District	No	Yes	N/A
Canyons School District	No	Yes	N/A

Organizing Resources

As part of this step, the IEM team reviewed and incorporated, as appropriate, various existing plans, studies, reports, and other technical data/information into the MJHMP update. Suggestions for important data to include were collected from the participating jurisdictions and stakeholders. Table 13 lists the existing resources and how they were incorporated in the MJHMP update, especially in the hazard profiles.

Table 13: Existing Resources and Their Use in the Plan Update[33]

Existing Resource	Used in Plan
A Strategic Plan for Earthquake Safety in Utah	Identification of potential earthquake mitigation actions and statistical data added to various sections of the hazard profiles
Earthquake Safety in Utah	Identification of potential earthquake mitigation actions and statistical data added to various sections of the hazard profiles
Federal Emergency Management Agency	How-to Guidelines for each section of the plan
National Climate Data Center	Statistics and research information for each jurisdiction relating to drought and severe weather conditions as part of the hazard profiles' previous occurrence sections
National Weather Service (NOAA/NCEI)	Each natural hazard profile includes statistical data related to previous occurrences of disasters in the jurisdictions that were reported.
Salt Lake County 2019 Hazard Mitigation Plan	To update all sections of the plan
Salt Lake County and Municipalities Emergency Operations Plans/ Comprehensive Emergency Management Plans	Histories, mitigation actions, public input; GIS, assessor, transportation, property, and infrastructure data
Salt Lake County Wildfire Preparedness Plan 2019	Descriptions of communities at risk, access concerns, resources and values at risk, and potential mitigation actions.
State of Utah Drought Response Plan 2022	Prior drought mitigation action review.
University of Utah Seismic Station	Earthquake data and statistical data added to various sections of the hazard profiles
Utah 2024 State Hazard Mitigation Plan	Climate Change sections of Hazard Profiles, maps, and figures relevant to sections
Utah Avalanche Center	Snow and avalanche statistical data added to various sections of the hazard profiles
Utah Department of Transportation	Traffic, accidents, hazardous materials transportation information, and statistical data added to various sections of the avalanche and other hazard profiles
Utah Division of Emergency Management	GIS data, flood data, Hazus data for floods, and earthquake data added to various sections of the hazard profiles
Utah Division of Forestry, Fire, and State Lands	State wildfire information and statistical data added to various sections of the hazard profiles.
Utah Geologic Survey	GIS data, geologic information added to various sections of the hazard profiles
Utah Geospatial Resource Center	GIS data and statistical data added to various sections of the hazard profiles
Utah Natural Hazards Handbook	Identification of natural hazard risks for Salt Lake County and statistical data added to various sections of the hazard profiles

[33] GIS = geographic information system, Hazus = Hazards United States, NCEI = National Centers for Environmental Information, NOAA = National Oceanic and Atmospheric Administration.

Existing Resource	Used in Plan
Utah Seismic Safety Commission Report and Recommendations: 2024	Identification of potential earthquake mitigation actions.
Utah State University	Climate data and statistical data added to various sections of the hazard profiles
Utah Statewide Fire Risk Assessment Project	Evaluation of fire risk assessment for Salt Lake County and potential mitigation actions and statistical data added to various sections of the hazard profiles
Utah Wildfire Risk Assessment	Division of Forestry, Fire, and State Lands primary mechanism to deploy wildfire risk information. Provides baseline information needed to support mitigation and prevention efforts across the state.
Wasatch Front Unreinforced Masonry Risk Reduction Strategy	Identification of potential earthquake mitigation actions and reducing risks posed by URM buildings.

Identifying the Hazards

Hazard identification was initiated through an extensive process that used the following multi-disciplinary cross-sector representation:

- Salt Lake County Emergency Management
- Consulting Planning Team
- Local Emergency Managers
- Local Emergency Planning Committee
- Public Works Staff
- Community Stakeholders
- Public individuals
- Elected officials
- Special Service Districts
- Utah Division of Emergency Management
- Utah Geological Survey
- Utah Geospatial Resource Center

The hazard identification process was aided by FEMA's how-to guidance documents, FEMA 386-1,2,3,7, FEMA Post Disaster Hazard Mitigation Planning Guidance DAP-12, the Disaster Mitigation Act of 2000, 44 CFR Parts 201 and 206, the Interim Final Rule, and the Local Mitigation Plan Review Tool. The risk assessment process also drew on assistance from local Geographical Information Systems (GIS) departments using the best available data.

The identification process for each participating jurisdiction encompassed natural hazards that consistently affected each area before and during the planning process based on the history of occurrences, probability, and risk. These specific hazards were identified based on a hazard identification risk assessment that identified the natural hazards listed below as being the most prevalent and posing the most risk to the county. Although it is recognized that dam failure is not a natural hazard, the potential impact on Salt Lake County from a catastrophic dam failure would likely be so severe that inclusion into the Plan was warranted. Municipal jurisdictions contributed to the risk assessment analyses performed for the county when in an identified hazard boundary. Upon initial review of this plan, specific hazards associated with severe weather were renamed and split into separate hazards to identify better and address their unique considerations per Utah DEM and FEMA recommendations.

The 2025 MJHMP addresses the 19 natural and human-made hazards most applicable to Salt Lake County and includes the following:

NATURAL HAZARDS

- Avalanche
- Drought
- Earthquake
- Extreme Cold
- Extreme Heat
- Flooding
- Heavy Rain
- Severe Winter Weather
- High Wind
- Landslide/ Slope Failure
- Lightning
- Public Health Epidemic-Pandemic
- Radon
- Tornado
- Wildfire

MAN-MADE AND TECHNOLOGICAL HAZARDS

- Civil Disturbance
- Dam Failure
- Hazardous Materials
- Terrorism and Cyberterrorism

Changes in Priorities

Since the approval of the 2019 Salt Lake County Hazard Mitigation Plan, Salt Lake County, its jurisdictions, and its special districts have experienced several federally declared disasters, including the COVID-19 pandemic, the September 2020 high wind event, and the 2020 Magna earthquake. As part of this Plan update, additional emphasis is included in the risk assessment on how the identified hazards may be impacted by changes in climate conditions, including an increasing number of extreme heat events and the subsequent effects on wildfire and drought hazards. The effects of long-term drought on the Great Salt Lake has drawn the attention of various sectors statewide and is also a priority.

An additional change in priority is the passing of Utah House Bill 48 (Wildland Urban Interface Modifications), which became law in March 2025 and takes effect in January 2026. This law aims to mitigate wildfire risks through homeowner education, lot assessments, risk-based fees, and defensible space and home-hardening requirements. Fees from lot assessments will be used to cover assessment costs and support mitigation efforts. This program demonstrates the prioritization of mitigating wildfire risk.

These and other changes in priorities were considered during the vulnerability assessment and in the development of mitigation strategies and apply to the county, jurisdictions, and special districts. The other plan participants did not identify any additional priority changes from the last plan update.

Assessing Risk and Vulnerabilities

Each hazard identified was profiled with the most current available information and data, including the occurrence and probability ranking of future hazard events and a summary of each jurisdiction's vulnerability to each hazard. In profiling hazards, IEM researched hazards with the plan participants to review all-natural and community-identified hazards and occurrences. All possible resources for information and data were considered, such as the current MJHMP, Master/General/Comprehensive Plans, Community Wildfire Protection Plans, Comprehensive Emergency Management Plan (CEMP), Strategic Plans, and similar sources. IEM provided Hazus models for the risk assessment.

IEM developed hazard profiles of each jurisdiction's vulnerability to specific hazards based on hazard assessments. This assessment identifies critical facilities and infrastructure by type and hazard area, describes land use and development trends to inform future land use policy and decisions, and explains how potential climate variation may impact the jurisdiction's current and future vulnerability for each hazard.

Evaluating Participant Capabilities

This update documents the effectiveness of the county's efforts to integrate mitigation into other planning efforts since the previously approved plan. IEM conducted a capability assessment to inventory existing plans, policies, procedures, programs, and other initiatives that are currently in place to support hazard mitigation. Jurisdictional participation in the NFIP was analyzed by working with local and state floodplain managers and NFIP administrators to collect information. Collecting and assessing this information identifies high-risk areas, properties, and populations and allows jurisdictions to determine mitigation actions that will most efficiently and effectively protect the community. The plan participants formulated and wrote a community description for the plan, using past plans, current and past studies, and the institutional knowledge of stakeholders, municipalities, and the public.

Developing Mitigation Goals and Actions

The Mitigation Strategy was evaluated, and updated goals and objectives were outlined in existing mitigation plans. This step is particularly important as Salt Lake County has experienced changes in risk severity and increased frequency of hazard events.

Maintaining the Plan

The plan implementation section identifies ways to incorporate mitigation strategies into existing planning practices, policies, and programs to institutionalize hazard mitigation in Salt Lake County's program. The plan maintenance process will also clearly indicate the method and schedule to be used over the next five years to monitor, evaluate, and update the plan, including timelines and responsibilities.

Table 14: Plan Participation Schedule of Activities

Meetings and Assignments	Salt Lake County	Alta	Bluffdale	Brighton	Copperton	Cottonwood Heights	Draper	Emigration Canyon	Herriman	Holladay	Kearns	Magna	Midvale	Millcreek	Murray	Riverton	Salt Lake City	Sandy	South Jordan	South Salt Lake	Taylorsville	West Jordan	West Valley City	White City	Salt Lake Community College	Jordan School District	Canyons School District
09/05/2024 Hazard Mitigation Plan (HMP) Kickoff Meeting	X	–	–	X	X	X	X	X	–	X	X	X	X	X	X	X	X	X	X	X	X	X	X	–	X	X	X
09/30/2024 Public Information Officer HMP Information Meeting	X	–	–	–	–	X	–	–	X	X	X	–	–	X	–	–	X	–	–	X	–	–	–	–	–	–	–
10/02/2024 Risk Assessment Meeting	X	X	–	X	X	X	–	X	–	X	X	X	X	X	–	–	X	–	X	X	X	X	–	–	X	X	–
10/21/2024 Mitigation Strategy Meeting	X	X	–	X	x	–	–	X	X	X	X	X	X	–	–	X	X	–	–	X	X	X	–	–	–	X	X
Letter of Intent Submitted	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Public Outreach Activities	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	
Completed Planning Process Form	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Submitted Mitigation Actions Status Update	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Submitted Risk Assessment Form	X	X	X	X	X		X	X		X	X	X	X	X		X	X	X	X	X	X	X			X	X	
Submitted Mitigation Strategy and 2024 Mitigation Actions	X	X		X	X			X	X	X	X	X	X	X				X	X	X	X		X	X			
Submitted Capabilities Assessment Form/NFIP Assessment Form	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Participated in Draft Plan Review	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Completed Plan Adoption																											

Stakeholder Engagement

One of the first steps in the planning process was to identify and invite key agencies and stakeholders to participate in the plan update. Per the Local Mitigation Planning Policy Guide, stakeholders were categorized in the following ways:

4. Local and regional agencies involved in hazard mitigation activities.

   Examples include public works, emergency management, local floodplain administration, and GIS departments.

5. Agencies that have the authority to regulate development.

   Examples include zoning, planning, community, and economic development departments, building officials, planning commissions, or other elected officials.

6. Neighboring communities

   Examples include adjacent local governments, including special districts, such as those affected by similar hazard events or that may share a mitigation action or project that crosses boundaries. Neighboring communities may be partners in hazard mitigation and response activities or where critical assets, such as dams, are located.

7. Representatives of businesses, academia, and other private organizations.

   Examples include private utilities or major employers that sustain community lifelines.

8. Representatives of nonprofit organizations, including community-based organizations, which work directly with and/or support underserved communities and socially vulnerable populations.

   Examples include housing, healthcare, and social service agencies.

Another factor that was considered while developing the list of participants to engage in this plan update was community lifelines. Community lifelines are the most fundamental services in the community that, when stabilized, enable all other aspects of society to function (Figure 23). A thorough understanding of lifelines allows decision makers to identify key priorities, understand the root causes of the issues, and implement effective measures to reduce risk and respond to a catastrophic incident.

Figure 23: FEMA Community Lifelines[34]

For this plan update, each jurisdiction was asked to identify internal and external stakeholders who could support the plan update. The IEM team also helped identify stakeholders, including those representing underserved and vulnerable populations. These stakeholders were given multiple opportunities to participate through meetings, e-mails, phone calls, and reviewing the draft plan. When appropriate, IEM conducted meetings directly with the participating jurisdictions to ensure that all information included in the plan was identified. A list of stakeholders that were given the opportunity to participate in the plan update is included in Table 15. The stakeholder types have been adapted to preserve space and/or increase clarity.

Table 15: Stakeholders Given the Opportunity to Participate

Jurisdiction/Agency/ Organization	Type of Stakeholder	Description
Alta	Local Emergency Management	Local and regional agencies involved in hazard mitigation activities
American Red Cross	Disaster Nongovernmental Organization	Nonprofit organization serving underserved populations
Big Cottonwood Canyon Improvement District	Water Utility Company	Representatives of businesses, academia, and other private organizations
Bluffdale	Local Emergency Management	Local and regional agencies involved in hazard mitigation activities
Brighton	Local Emergency Management	Local and regional agencies involved in hazard mitigation activities
Canyons School District	Higher Education	Representatives of businesses, academia, and other private organizations
Town of Copperton	Local Emergency Management	Local and regional agencies involved in hazard mitigation activities

[34] FEMA. "Community Lifelines." https://www.fema.gov/emergency-managers/practitioners/lifelines.

Jurisdiction/Agency/ Organization	Type of Stakeholder	Description
Copperton Improvement District	Water Utility Company	Representatives of businesses, academia, and other private organizations
City of Cottonwood Heights	Local Emergency Management	Local and regional agencies involved in hazard mitigation activities
Cottonwood Improvement District	Water Utility Company	Representatives of businesses, academia, and other private organizations
Davis County Emergency Management	Local Emergency Management	Neighboring community
Daybreak Community Association	Private Dam Owner	Representatives of businesses, academia, and other private organizations
City of Draper	Local Fire Department and Emergency Management	Local and regional agencies involved in hazard mitigation activities
Draper Irrigation Company	Private Dam Owner	Representatives of businesses, academia, and other private organizations
City of Emigration Canyon	Local Emergency Management	Local and regional agencies involved in hazard mitigation activities
Emigration Canyon Improvement District	Water Utility Company	Representatives of businesses, academia, and other private organizations
Granger-Hunter Improvement District	Water Utility Company	Representatives of businesses, academia, and other private organizations
Greater Salt Lake Municipal Services District	Floodplain/Stormwater Management, Municipal Administrative Services for newly incorporated cities and towns	Local and regional agencies involved in hazard mitigation activities
City of Herriman	Local Emergency Management	Local and regional agencies involved in hazard mitigation activities
Herriman City Dam	Local Government Public Dam Owner	Agencies that have the authority to regulate development
Holladay	Local Emergency Management	Local and regional agencies involved in hazard mitigation activities
Jordan Basin Improvement District	Public Sanitary Sewer Service	Representatives of businesses, academia, and other private organizations
Jordan School District	Higher Education	Representatives of businesses, academia, and other private organizations
Jordan Valley Water Conservancy District	Water Utility Company	Representatives of businesses, academia, and other private organizations

Jurisdiction/Agency/ Organization	Type of Stakeholder	Description
Kearns	Local Emergency Management	Local and regional agencies involved in hazard mitigation activities
Kennecott Utah Copper LLC	Private Dam Owner	Representatives of businesses, academia, and other private organizations
City of Magna	Local Emergency Management	Local and regional agencies involved in hazard mitigation activities
Magna Water District	Water Utility Company	Representatives of businesses, academia, and other private organizations
Metropolitan Water District of Salt Lake City & Sandy City	Water Utility Company	Representatives of businesses, academia, and other private organizations
Midvale	Local Emergency Management	Local and regional agencies involved in hazard mitigation activities
Millcreek	Local Emergency Management	Local and regional agencies involved in hazard mitigation activities
City of Murray	Department of Public Works	Local and regional agencies involved in hazard mitigation activities
City of Murray	Fire Department and Emergency Management	Local and regional agencies involved in hazard mitigation activities
Murray City Power	Electrical Power Utility Company	Representatives of businesses, academia, and other private organizations
Murray City Wastewater	Wastewater Treatment Plan	Representatives of businesses, academia, and other private organizations
Murray City Water	Water Utility Company	Representatives of businesses, academia, and other private organizations
National Weather Service Weather Forecast Office, Salt Lake City	Warning Coordination Meteorology	Representatives of businesses, academia, and other private organizations
City of Riverton	Local Emergency Management	Local and regional agencies involved in hazard mitigation activities
Riverton City Dam	Local Government Public Dam Owner	Agencies that have the authority to regulate development
Rocky Mountain Power/ PacifiCorp	Electric Utility Company	Representatives of businesses, academia, and other private organizations
Salt Lake City	Local Emergency Management	Local and regional agencies involved in hazard mitigation activities
Salt Lake City Corporation	Local Government Utility and Dam Owner	Agencies that have the authority to regulate development

Jurisdiction/Agency/ Organization	Type of Stakeholder	Description
Salt Lake City Public Utilities	Local Government Utility and Dam Owner	Agencies that have the authority to regulate development
Salt Lake City Urban Forestry	Local Government Forestry Service	Local and regional agencies involved in hazard mitigation activities
Salt Lake Community College	Higher Education	Representatives of businesses, academia, and other private organizations
Salt Lake County Aging and Adult Services	Social Service Agency	Community-based organization serving underserved populations
Salt Lake County Animal Services	County Animal Shelter	Local and regional agencies involved in hazard mitigation activities
Salt Lake County Emergency Management	County Emergency Management	Local and regional agencies involved in hazard mitigation activities
Salt Lake County Facilities Management	County Buildings and Facilities	Local and regional agencies involved in hazard mitigation activities
Salt Lake County Flood Control	Public Works Department	Local and regional agencies involved in hazard mitigation activities
Salt Lake County Health Department	Public Health Agency	Local and regional agencies involved in hazard mitigation activities
Salt Lake County Human Services	Human Services Department	Local and regional agencies involved in hazard mitigation activities
Salt Lake County Information Technology Department	County Information Technology	Local and regional agencies involved in hazard mitigation activities
Salt Lake County Mayor's Office for New Americans	Salt Lake County Government	Representatives of nonprofit organizations, including community-based organizations, which work directly with and/or support underserved communities and socially vulnerable populations such as immigrants and refugees
Salt Lake County Office of Regional Development	County Development	Local and regional agencies involved in hazard mitigation activities
Salt Lake County Public Works	Public Works Department	Local and regional agencies involved in hazard mitigation activities
Salt Lake Valley Emergency Communications Center	Unified Emergency Communications System, 911 services, and police, fire, and medical dispatching	Representatives of businesses, academia, and other private organizations
Salvation Army	Disaster Non-Governmental Organization	Nonprofit organization serving underserved populations
Sandy City	Fire Department and Emergency Management	Local and regional agencies involved in hazard mitigation activities
Sandy City Dam	Local Government Utility and Dam Owner	Agencies that have the authority to regulate development

Jurisdiction/Agency/ Organization	Type of Stakeholder	Description
South Despain Ditch Company	Private Dam Owner	Representatives of businesses, academia, and other private organizations
South Jordan	Local Emergency Management	Local and regional agencies involved in hazard mitigation activities
South Salt Lake	Local Emergency Management	Local and regional agencies involved in hazard mitigation activities
SST Healthcare Coalition	Social Services Agency	Local and regional agencies involved in hazard mitigation activities
Summit County Emergency Management	Local Emergency Management	Neighboring community
City of Taylorsville	Local Emergency Management	Local and regional agencies involved in hazard mitigation activities
Taylorsville-Bennion Improvement District	Water Utility Company	Representatives of businesses, academia, and other private organizations
Tooele County Emergency Management	County Government	Neighboring community
Unified Fire Authority	Local Fire Department	Local and regional agencies involved in hazard mitigation activities
University of Utah, Information Technology	State University System	Representatives of businesses, academia, and other private organizations
Utah County Emergency Management	Local Emergency Management	Neighboring community
Utah Department of Health and Human Services	Social Services Agency	Agencies that have the authority to regulate development
Utah Department of Transportation	State Transportation Agency	Agencies that have the authority to regulate development
Utah Division of Emergency Management	State Emergency Management	Local and regional agencies involved in hazard mitigation activities
Utah Division of Water Rights Dam Safety Section	State Dam Safety Agency	Agencies that have the authority to regulate development
Utah Earthquake Program/Division of Emergency Management	State Emergency Management	Local and regional agencies involved in hazard mitigation activities
Utah State Floodplain Management	State Flood Management	Agencies that have the authority to regulate development
Utah Transit Authority	Public Transportation	Agencies that have the authority to regulate development
West Jordan	Local Emergency Management	Local and regional agencies involved in hazard mitigation activities

Jurisdiction/Agency/ Organization	Type of Stakeholder	Description
West Valley City	Local Emergency Management	Local and regional agencies involved in hazard mitigation activities
White City	Local Emergency Management	Local and regional agencies involved in hazard mitigation activities
White City Water Improvement District	Water Utility Company	Representatives of businesses, academia, and other private organizations

Furthermore, IEM and Salt Lake County met with Amy Van Horn, the Bureau of Reclamation's (BOR) Emergency Management Coordinator, to discuss the dam failure hazard profile. Data sources and current draft maps were evaluated, and BOR's feedback was considered when determining how best to profile this hazard.

Coordination with Other Agencies, Partners, and Stakeholders

A major priority was updating the plan to meet the mitigation planning requirements outlined in FEMA's Local Mitigation Planning Policy Guide. This included an increased emphasis on stakeholder engagement, evaluating the impacts and potential mitigation measures for community lifelines, addressing climate change, and expanding mitigation actions to address all hazards profiled in the plan.

The following agencies and partners were instrumental in the update process:

- American Red Cross (vulnerable population engagement)
- VOAD, Salvation Army Region 2 (disadvantaged and underserved population engagement)
- Federal Emergency Management Agency (How-to Guides)
- National Weather Service (hazard profile)
- National Centers for Environment Information (hazard profile)
- Sewer Districts
- Utah Division of Emergency Management (GIS data, flood data, Hazus data for floods and earthquakes)
- Utah Geological Survey
- (GIS data, geologic information, various hazard reports)
- Utah Division of Forestry, Fire, and State Lands (fire data)
- Utah Avalanche Center Snow and Avalanches (annual reports)
- Utah Department of Transportation (traffic data and information)
- University of Utah Seismic Station (earthquake data)
- Utah State University (climate data)

- Salt Lake Valley Emergency Communications Center (Emergency Alert Systems)
- Salt Lake County Departments and municipalities (Emergency Operations Plans, histories, mitigation actions, public input, GIS, assessor, transportation, property and infrastructure)

Although a multitude of stakeholders were given the opportunity to participate, not all could. The stakeholders listed in Table 16 participated directly in the plan by attending meetings, completing the digital stakeholder survey, and/or reviewing the draft plan. This stakeholder outreach was considered a success because of the broad range of stakeholders that participated and their active engagement and participation in the planning process.

Table 16: Stakeholders That Participated in the Planning Update[35]

Name	Title	Agency/ Jurisdiction	Type of Stakeholder
Yasmin Abbyad	EM Coordinator	City of South Salt Lake	Local and regional agencies involved in hazard mitigation activities
Brent Adamson	Emergency Manager	Herriman	Local and regional agencies involved in hazard mitigation activities
Maridene Alexander	Communications Manager	MSD	Local and regional agencies involved in hazard mitigation activities
Tess Alexander	EM Community Preparedness	Salt Lake City	Representatives of nonprofit organizations, including community-based organizations, which work directly with and/or provide support to underserved communities and socially vulnerable populations
Greg Anderson	Manager	Kearns Improvement District	Local and regional agencies involved in hazard mitigation activities
Isaac Astill	Executive Director of Auxiliary Services	Salt Lake City School District	Local and regional agencies involved in hazard mitigation activities
Molly Austin	Emergency Manager	Town of Alta	Local and regional agencies involved in hazard mitigation activities
Dean Ayala	District Engineer	Mt. Olympus Improvement District	Neighboring communities; Representatives of businesses, academia, and other private organizations
Tim Bachman	Community Emergency Response Team Coordinator	Millcreek	Representatives of nonprofit organizations, including community-based organizations, which work directly with and/or provide support to underserved communities and socially vulnerable populations

[35] EM = Emergency Management, JIC = Joint Information Center, MSD = Municipal Services District, PIO = Public Information Officer, SLCo = Salt Lake County, SLCo EM = Salt Lake County Emergency Management, UDEM = Utah Division of Emergency Management, UFA = Unified Fire Authority, UPD = Unified Police Department.

Name	Title	Agency/ Jurisdiction	Type of Stakeholder
Tereza Bagdasarova	Board of Directors	South Salt Lake Chamber of Commerce	Representatives of businesses, academia, and other private organizations
Carmen Bailey	Deputy Director – Public Lands	Salt Lake City	Local and regional agencies involved in hazard mitigation activities; Agencies that have the authority to regulate development
Scott Baird	Department Director	SLCo Public Works	Local and regional agencies involved in hazard mitigation activities
Kevin Barjenbruch	Warning Coordination Meteorologist	NOAA/National Weather Service Salt Lake City	Local and regional agencies involved in hazard mitigation activities
Mike Barker	City Manager	Draper	Local and regional agencies involved in hazard mitigation activities
Tara Behunin	Division Director	SLCo EM	Local and regional agencies involved in hazard mitigation activities
Chris Bell	Deputy Director – Sustainability	Salt Lake City	Local and regional agencies involved in hazard mitigation activities
Richard Bell	Deputy Chief	West Jordan Police	Local and regional agencies involved in hazard mitigation activities
Leon Berrett	Operations Associate Director	SLCo Public Works	Local and regional agencies involved in hazard mitigation activities
Lance Bess*	Emergency Manager	Cottonwood Heights	Internal EM Manager
Dan Blanchard	Safety and Emergency Manager	Utah Department of Corrections	Local and regional agencies involved in hazard mitigation activities
Paul Brenneman	Emergency Manager	Cottonwood Heights	Local and regional agencies involved in hazard mitigation activities
Roger Brooks	Emergency Manager	Granite School District	Representatives of nonprofit organizations, including community-based organizations, which work directly with and/or provide support to underserved communities and socially vulnerable populations
Tina Brown	Public Information Officer	SLCo EM	Agencies that have the authority to regulate development
Brian Buckhout	EM Municipal Planner	UFA/SLCo EM	Local and regional agencies involved in hazard mitigation activities
Don Buckley*	Emergency Manager	Draper City	Local and regional agencies involved in hazard mitigation activities
David Bullock	Facilities Manager	Jordan School District	Local and regional agencies involved in hazard mitigation activities
Michael Bullock	Deputy Chief	Sandy Fire Department	Local and regional agencies involved in hazard mitigation activities

Name	Title	Agency/ Jurisdiction	Type of Stakeholder
Jared Bunch	City Engineer	Holladay	Local and regional agencies involved in hazard mitigation activities
Karen Burnett	Geographic Information Systems (GIS) Director	Draper	Local and regional agencies involved in hazard mitigation activities
Gary Carter	Planning Section Chief	Salt Lake City Fire Department	Local and regional agencies involved in hazard mitigation activities
Chris Catalano	Emergency Manager	Millcreek	Local and regional agencies involved in hazard mitigation activities
Kellie Challburg	Assistant City Manager	Draper	Local and regional agencies involved in hazard mitigation activities
Brian Clegg	Director	West Jordan Public Works	Local and regional agencies involved in hazard mitigation activities
John Crofts	Utah Earthquake Program Manager	UDEM	Local and regional agencies involved in hazard mitigation activities
Kelly Colopy	Director	SLCo Human Services	Local and regional agencies involved in hazard mitigation activities
Scott Cooley	Public Works Director	Draper	Local and regional agencies involved in hazard mitigation activities
Julie Crookston	Deputy Director – Public Services	Salt Lake City	Agencies that have the authority to regulate development
Matt Dahl	City Manager	Midvale	Local and regional agencies involved in hazard mitigation activities
Greg Davenport	Director	West Jordan Public Utilities	Local and regional agencies involved in hazard mitigation activities
Braden Davis	Pipeline Technician	HF Sinclair	Representatives of businesses, academia, and other private organizations
Amy DeNeff	Emergency Manager	Sandy City	Local and regional agencies involved in hazard mitigation activities
Alex DeSmet*	Warning Coordination Meteorologist	Salt Lake City National Weather Service	Local and regional agencies involved in hazard mitigation activities
Jason Draper	Chief Engineer Floodplain Administrator	Salt Lake City Public Utilities	Local and regional agencies involved in hazard mitigation activities
Tal Ehlers	EM Program Manager	Utah Transit Authority	Agencies that have the authority to regulate development
Chet Ellis	Division Chief/Deputy Director	UFA	Local and regional agencies involved in hazard mitigation activities
John Evans	Fire Chief	West Valley City	Local and regional agencies involved in hazard mitigation activities

Name	Title	Agency/ Jurisdiction	Type of Stakeholder
Rich Ferguson	Police Chief	Draper	Local and regional agencies involved in hazard mitigation activities
Jed Fin	Deputy Fire Marshall	Murray City	Local and regional agencies involved in hazard mitigation activities
Katy Fleury	Brand Manager	SLCo	Local and regional agencies involved in hazard mitigation activities
John Flynt	EM Director	Salt Lake Community College	Local and regional agencies involved in hazard mitigation activities
Ben Ford	Wastewater Superintendent	Murray City	Local and regional agencies involved in hazard mitigation activities
Cory Fralick	Director	West Jordan Public Services	Local and regional agencies involved in hazard mitigation activities
Aaron Frisk	Water Superintendent	Murray City	Local and regional agencies involved in hazard mitigation activities
John Gallagher	Instrumentation process Control Technician	Jordan Basin Improvement District	Agencies that have the authority to regulate development
Ann Garcia	Economic Development and Housing Manager	Holladay City	Representatives of businesses, academia, and other private organizations
Valerie Greensides	Project Coordinator	UFA	Agencies that have the authority to regulate development
Michelle Hale	Program Director	Office of Preparedness & Response. Utah Department of Health and Human Services	Local and regional agencies involved in hazard mitigation activities
Jeremy Hart	Associate Director	SLCo Aging and Adult Services	Local and regional agencies involved in hazard mitigation activities
Brian Hartsell	Associate General Manager	MSD	Local and regional agencies involved in hazard mitigation activities
Nick Haskin	Emergency Manager	Murray City	Local and regional agencies involved in hazard mitigation activities
Carrie Hecht	Special Operations Facilitator	SLCo Animal Services	Local and regional agencies involved in hazard mitigation activities
Ember Herrick	Emergency Manager	Davis County	Local and regional agencies involved in hazard mitigation activities
Colin Hilton	Director	Olympic Oval	Local and regional agencies involved in hazard mitigation activities
Tom Holstrom	Assistant Manager	Central Valley Water	Representatives of businesses, academia, and other private organizations
Levi Hughes	Chief	UPD – Kearns Precinct	Local and regional agencies involved in hazard mitigation activities

Name	Title	Agency/ Jurisdiction	Type of Stakeholder
Cheri Jackson	Council Member	Millcreek	Representatives of nonprofit organizations, including community-based organizations, which work directly with and/or provide support to underserved communities and socially vulnerable populations
Ryan Jakeman	Facility Coordinator	Canyons School District	Local and regional agencies involved in hazard mitigation activities
Paul Jerome	Assistant Chief Administrative Officer	West Jordan Administration	Agencies that have the authority to regulate development
Allison Jester	Emergency Manager	Holladay City	Local and regional agencies involved in hazard mitigation activities
Brad Jewett	Intelligence Specialist	UFA – representing Midvale City	Agencies that have the authority to regulate development
Jason Jones	Emergency Manager/Police Department	Riverton	Local and regional agencies involved in hazard mitigation activities
Catherine Kanter	Deputy Mayor	SLCo Mayor's Office	Local and regional agencies involved in hazard mitigation activities
Mason Kemp	Mitigation Planning Lead	UDEM	Local and regional agencies involved in hazard mitigation activities
Jeff King	Emergency Manager Coordinator	Jordan Valley Water Conservancy District	Neighboring communities; Representatives of businesses, academia, and other private organizations
Chad Korb	Deputy Director – Information Management Services	Salt Lake City	Local and regional agencies involved in hazard mitigation activities
Jonathan LaFollette	PIO	Herriman City	Local and regional agencies involved in hazard mitigation activities
Robert Lambert	Battalion Chief	Draper	Local and regional agencies involved in hazard mitigation activities
Scott Langford	Director	West Jordan Community Development	Agencies that have the authority to regulate development
David Larsen*	Emergency Manager	Sandy City	Local and regional agencies involved in hazard mitigation activities
Michael Lasko	Community Member	Millcreek	Representatives of nonprofit organizations, including community-based organizations, which work directly with and/or provide support to underserved communities and socially vulnerable populations

Name	Title	Agency/ Jurisdiction	Type of Stakeholder
Korban Lee	Chief Administrative Officer	West Jordan Administration	Agencies that have the authority to regulate development
Robert Lewis	Captain	SLCo Animal Services	Local and regional agencies involved in hazard mitigation activities
Debbie Lyons	Director – Sustainability	Salt Lake City	Local and regional agencies involved in hazard mitigation activities
Mac Lund	External Relations and Government Operations	American Red Cross	Representatives of nonprofit organizations, including community-based organizations.
Marie Magers	PIO	West Jordan Public Affairs	Local and regional agencies involved in hazard mitigation activities
Savannah Mailloux	GIS Specialist	UFA	Agencies that have the authority to regulate development
Robert Martin	Assistant Facilities Coordinator	Canyons School District	Local and regional agencies involved in hazard mitigation activities
Robert Markle	Deputy Public Works Director	Draper	Local and regional agencies involved in hazard mitigation activities
Michelle McGaughey	Emergency Preparedness Bureau Manager	SLCo Health Department	Local and regional agencies involved in hazard mitigation activities
Kathryn McMullin	Emergency Manager	Summit County	Local and regional agencies involved in hazard mitigation activities
Dan McDougal	Director of Risk and Asset Management	Taylorsville–Bennion Improvement District	Local and regional agencies involved in hazard mitigation activities
Mark McGrath	Long-Range Planner	Taylorsville	Local and regional agencies involved in hazard mitigation activities
Scott McNeil	Logistics Section Officer	SLCo EM	Local and regional agencies involved in hazard mitigation activities
Jaime Milano	Emergency Operations Support Specialist	West Valley City	Local and regional agencies involved in hazard mitigation activities
John Miller	Director of Public Works	Millcreek	Local and regional agencies involved in hazard mitigation activities
Dan Moore	Enforcement Coordinator	Health Department	Local and regional agencies involved in hazard mitigation activities
Jeffory Mulcahy	Emergency Manager	West Jordan	Local and regional agencies involved in hazard mitigation activities
Scott Neal	Safety Coordinator	Jordan Basin Improvement District	Agencies that have the authority to regulate development
Kristie Overson	Mayor	Taylorsville	Local and regional agencies involved in hazard mitigation activities
Steve Pearson	Deputy Fire Chief	Draper	Local and regional agencies involved in hazard mitigation activities

Name	Title	Agency/ Jurisdiction	Type of Stakeholder
Andrew Peedle	Environmental Health and Safety Manager	Danone US, LLC	Representatives of businesses, academia, and other private organizations
Jamie Petersen	Region 1 Liaison	UDEM	Local and regional agencies involved in hazard mitigation activities
Audrey Pierce	EM Critical Infrastructure	Salt Lake City	Local and regional agencies involved in hazard mitigation activities
Zach Posner	Chief Information Officer	Salt Lake City IT	Local and regional agencies involved in hazard mitigation activities
Randy Porter	Police Chief	Granite School District Police	Representatives of nonprofit organizations, including community-based organizations, which work directly with and/or provide support to underserved communities and socially vulnerable populations
Deff Puls	Fire Marshall	Murray City	Local and regional agencies involved in hazard mitigation activities
Steve Quinn	Planning and Intelligence Officer	UFA	Agencies that have the authority to regulate development
Stephanie Rennick	Emergency Preparedness Bureau Planner	SLCo Health Department	Local and regional agencies involved in hazard mitigation activities
William Reyes	EM Planning Coordinator	Herriman	Local and regional agencies involved in hazard mitigation activities
Ian Roberts	Capital Outlay Manager	Jordan School District	Neighboring communities
Dave Rostrom	Facility Services Director	Jordan School District	Neighboring communities
Alex Rudowski	Grading, Floodplain & Stormwater Manager	Greater Salt Lake Municipal Services District	Local and regional agencies involved in hazard mitigation activities
Aaron Sainsbury	Emergency Manager	South Jordan	Local and regional agencies involved in hazard mitigation activities
Carly Sands	Community Support Liaison	UDEM	Local and regional agencies involved in hazard mitigation activities
Kevin Schmidt	Director	Kearns Oquirrh Park	Agencies that have the authority to regulate development
David Schuld*	Internal EM Manager	SLCo	Local and regional agencies involved in hazard mitigation activities
Nathan Scown	Operations Manager	Metropolitan Water District of Salt Lake and Sandy	Agencies that have the authority to regulate development
Darren Shepherd	Manager	Holliday Water Company	Neighboring communities; Representatives of businesses,

Name	Title	Agency/ Jurisdiction	Type of Stakeholder
			academia, and other private organizations
Ty Shepherd	Division Chief/ Emergency Manager	Salt Lake City	Local and regional agencies involved in hazard mitigation activities
Rina Shipley	Information Security Engineer	SLCo IT	Local and regional agencies involved in hazard mitigation activities
Tom Simons	EM Operations Captain	Salt Lake City	Local and regional agencies involved in hazard mitigation activities
Wade Skinner	Emergency Manager Program Manager	Rocky Mountain Power/PacifiCorp	Representatives of businesses, academia, and other private organizations
Roger Snow	Chair	Kearns Community Council	Neighboring communities
Liz Sollis	Communications Director	SLCo Mayor's Office	Local and regional agencies involved in hazard mitigation activities
Robert Stafford	Fire Department Assistant Chief	Salt Lake City	Local and regional agencies involved in hazard mitigation activities
Zach Stevens	Operations Manager	Mt. Olympus Improvement District	Representatives of businesses, academia, and other private organizations
Troy Stout	Assistant General Manager	Granger Hunter Improvement District	Local and regional agencies involved in hazard mitigation activities
Isaac Talbot	Emergency Manager	Central Valley Water Reclamation Facility	Representatives of businesses, academia, and other private organizations
Jon Teerlink	Director of Community and Economic Development	Holladay City	Agencies that have the authority to regulate development
Shazelle Terry	General Manager	Jordan Valley Water Conservancy District	Representatives of businesses, academia, and other private organizations
Scott Thomas	Administrator	Jordan School District Auxiliary Services	Neighboring communities
Tim Tomer	Facilities/Safety Program Manager	SLCo Aging and Adult Services	Nonprofit Organization serving underserved population
Chris Trevino	Deputy Chief	West Jordan Fire	Local and regional agencies involved in hazard mitigation activities
Erik Van Duren	Operations Specialist	SLCo EM	Local and regional agencies involved in hazard mitigation activities
Madison Warner	EM Municipal Planner	UFA/SLCo EM	Local and regional agencies involved in hazard mitigation activities
Martin Webb	Emergency Manager	Salt Lake Valley Emergency	Local and regional agencies involved in hazard mitigation activities

Name	Title	Agency/ Jurisdiction	Type of Stakeholder
		Communications Center	
Rebecca Weis	Planning Specialist	UFA	Agencies that have the authority to regulate development
Ben White	City Engineer	Taylorsville	Local and regional agencies involved in hazard mitigation activities
Dustin Willie	Police Lieutenant	Draper	Local and regional agencies involved in hazard mitigation activities
Matt Wilson	EM Planning Coordinator	Salt Lake City	Local and regional agencies involved in hazard mitigation activities
Eric Witt	EM Training Specialist	Salt Lake City	Local and regional agencies involved in hazard mitigation activities
Steve Wooldridge	Police Lieutenant	Salt Lake City	Local and regional agencies involved in hazard mitigation activities
Hannah Youell	Salt Lake City EM PIO/JIC Coordinator	Salt Lake City	Local and regional agencies involved in hazard mitigation activities
Michael Yei	Internal EM Manager	SLCo	Local and regional agencies involved in hazard mitigation activities
Jay Ziolkowski	Emergency Manager	Taylorsville	Local and regional agencies involved in hazard mitigation activities

*Indicates a person who replaced someone previously in that position during the planning process

Neighboring counties (Davis, Utah, Tooele, and Summit) had an opportunity to review the plan and provide feedback. In addition, hazard mitigation plans for the adjacent counties (Davis County, Tooele County, and the Mountainland Pre-Disaster Hazard Mitigation Plan) were reviewed to identify region-wide risks and mitigation opportunities.

Public Outreach

Public participation is a vital planning requirement for a FEMA-approved hazard mitigation plan. The public outreach strategy engaged the whole community throughout the planning process. It gave decision makers access to diverse perspectives, knowledge, and individual lived experiences to incorporate during the drafting stage and before final approval of this MJHMP. IEM developed and shared the public outreach strategy with the county planning working groups that engaged the public and assessed their understanding of the identified risks and their interest in mitigation opportunities.

The IEM planning team drafted and shared a public survey in English and Spanish. Each participating jurisdiction reviewed and shared the survey on multiple occasions in different venues and in-person and online formats (see Figure 24). Besides posting links to the survey on county and city websites and sharing on social media, the survey was also announced on KUER radio on October 19, 2024. A news article was published by KSL.com on October 30 that also announced the mitigation plan to the public and provided a link to the survey.[36] A half-page announcement about the plan update and a link to the survey were included in the City Journal Community Newspaper, which was mailed to residents in 14 participating cities, including 2 printed in Spanish.

Figure 24: Social Media Graphic for Public Outreach Survey

The public survey asked the public about their hazards of concern, assessed their understanding of the assets at risk, solicited information on what areas or community assets are more vulnerable, what they are doing in terms of mitigation, what mitigation actions they would support the community undertaking and any specific suggestions for mitigation actions. The feedback insight into what community assets are of concern to the public and suggestions of mitigation actions the public would support.

SLCo EM and IEM facilitated a meeting with the participating jurisdictions' Public Information Officers (PIOs) to help engage them in the public outreach efforts. The PIOs helped post the survey on city social media pages, which significantly boosted community engagement with the survey. More details on outreach can be found in the jurisdictional annexes.

Vulnerable Populations

Engaging socially vulnerable populations and disadvantaged communities was an important component of the public survey process. The public outreach strategy provided opportunities for vulnerable populations and underserved communities to be involved in the plan's development. Each survey participant selected the any groups they identified themselves as being a member of, demonstrating that non-English speaking populations, the elderly, parents of youth, persons with disabilities, low-income individuals and other vulnerable or disadvantaged groups were engaged by the survey. Offering the survey in Spanish was essential for reaching non-English speaking residents of the county. The County

[36] KSL.com. "Utah residents need to prepare for these 5 kinds of emergencies." October 30, 2024. https://www.ksl.com/article/51160262/utah-residents-need-to-prepare-for-these-5-kinds-of-emergencies.

Office for New Americans shared the survey with immigrant and refugee communities and feedback from those responses were considered during the drafting of the mitigation strategy for each jurisdiction.

SLCo EM participated in the Salt Lake County Senior Expo on October 11. This was a key opportunity to engage with one of the county's vulnerable populations. SLCo EM staff discussed the planning process and hazard concerns with attendees, and they also provided reference materials and access to the public survey. Information was also shared at a community event in Copperton (see Figure 26).

Figure 25: Public Outreach at Salt Lake County Senior Expo

Figure 26: Public Outreach at Copperton Town Days

Draft Plan Review

Besides efforts to inform residents and stakeholders about the Hazard Mitigation Plan update and public survey, a draft of the updated mitigation plan was made available for the public to review it and provide feedback. An announcement of the draft plan (Figure 27) and link to a feedback form was shared by Salt Lake County Emergency Management and Salt Lake County government and was also reshared by Bluffdale, South Salt Lake, Millcreek, Midvale, East Millcreek Community Council, and Association of Community Councils Together. The draft was made available on December 19, 2024, and public comment was open through January 15, 2025.

Figure 27: Announcement of Public Comment Period for Draft Plan

Table 17 summarizes the public outreach for each jurisdiction during the planning process. Additional documentation of public outreach can be found in **Appendix C** and in the individual jurisdictional annexes in Volume 2.

Table 17: Public Outreach Conducted by Jurisdiction

Jurisdiction	Description of Outreach Efforts
Salt Lake County (SLCo)	Posted notification of Hazard Mitigation Plan update and access to survey on County website and social media page. Shared on SLCo Emergency Management (EM) social media pages and website. SLCo EM also promoted awareness of the plan update on local news media, including a televised report and written article on KSL News and public service announcement on KUER radio. SLCo EM also placed posters at the county government building and hosted a table at the Salt Lake County Senior Expo.
Alta	Shared notification of plan update and access to survey in Town of Alta Newsletter by email in October 2024. Flyer was posted in town office.
Bluffdale	Posted link to Draft Plan for public review on city social media page.

Jurisdiction	Description of Outreach Efforts
Brighton	Municipal Services District (MSD) and County social media posts.
Copperton	Table with survey flyers at community event. Also shared on MSD social media.
Cottonwood Heights	Posted notification of Hazard Mitigation Plan update and access to survey on city social media page.
Draper	Reposted Salt Lake County Emergency Management social media posts of Hazard Mitigation Plan update and access to survey. Announcement and link to survey in City Journal mailed to residents.
Emigration Canyon	Shared on MSD social media, which serves the city.
Herriman	Posted notification of Hazard Mitigation Plan update and access to survey on city social media page and city website. Announcement and link to survey in City Journal mailed to residents.
Holladay	Shared notification of plan update and access to survey by an email blast to residents. Posted a flyer in Senior Center and Recreation Center. Announcement and link to survey in City Journal mailed to residents.
Jordan School District	Posted notification of Hazard Mitigation Plan update and access to survey on social media page and on the school district website.
Kearns	Posted notification of Hazard Mitigation Plan update and access to survey on city social media page. Also shared on MSD social media, which serves the city.
Magna	Shared on MSD social media, which serves the city.
Midvale	Posted notification of Hazard Mitigation Plan update and access to survey on city social media pages and website. Also posted notification of draft for public comment. Announcement and link to survey in City Journal mailed to residents.
Millcreek	Posted notification of Hazard Mitigation Plan update and access to survey on city social media page. Also posted notification of plan draft for public comment. Announcement and link to survey in City Journal mailed to residents.
Murray	Announcement and link to survey in City Journal mailed to residents.
Riverton	Posted notification of Hazard Mitigation Plan update and access to survey on city social media pages. Announcement and link to survey in City Journal mailed to residents.
Salt Lake City	Reposted Salt Lake County Emergency Management social media post of Hazard Mitigation Plan update and access to survey. Also included announcement and link to survey in community newsletter.
Sandy City	Announcement and link to survey in City Journal mailed to residents.
South Jordan	Announcement and link to survey in City Journal mailed to residents.
South Salt Lake	Posted notification of Hazard Mitigation Plan update and access to survey on city social media pages and website. Also posted announcement of draft for public comment on social media. Posted notification of Hazard Mitigation Plan update and access to survey in CivicAlerts notification. Announcement and link to survey in City Journal mailed to residents.
Taylorsville	Posted survey in lobby of City Hall. Announcement and link to survey in City Journal mailed to residents.
West Jordan	Announcement and link to survey in City Journal mailed to residents.

Jurisdiction	Description of Outreach Efforts
West Valley City	Posted notification of Hazard Mitigation Plan update and access to survey on city social media page. Announcement and link to survey in City Journal mailed to residents.
White City	Shared on MSD social media which serves the city.

Feedback from the Public Survey

After several months of public outreach in Salt Lake County, approximately 564 community members responded to the Salt Lake County MJHMP Public Survey. The following summarizes the responses and comments received. A copy of the full survey and additional summary results are available in **Appendix C**.

LEVEL OF CONCERN ABOUT SPECIFIC HAZARDS

When participants were asked about specific natural hazards that may impact Salt Lake County, they were most often very concerned about earthquakes and drought.

Among the technical and human-made hazards identified, 327 respondents were somewhat or very concerned about radon, 156 were somewhat or very concerned about dam failure, 346 were somewhat or very concerned about terrorism, 478 were somewhat or very concerned about cyberterrorism, and 424 were somewhat or very concerned about a potential hazardous materials (HAZMAT) incident.

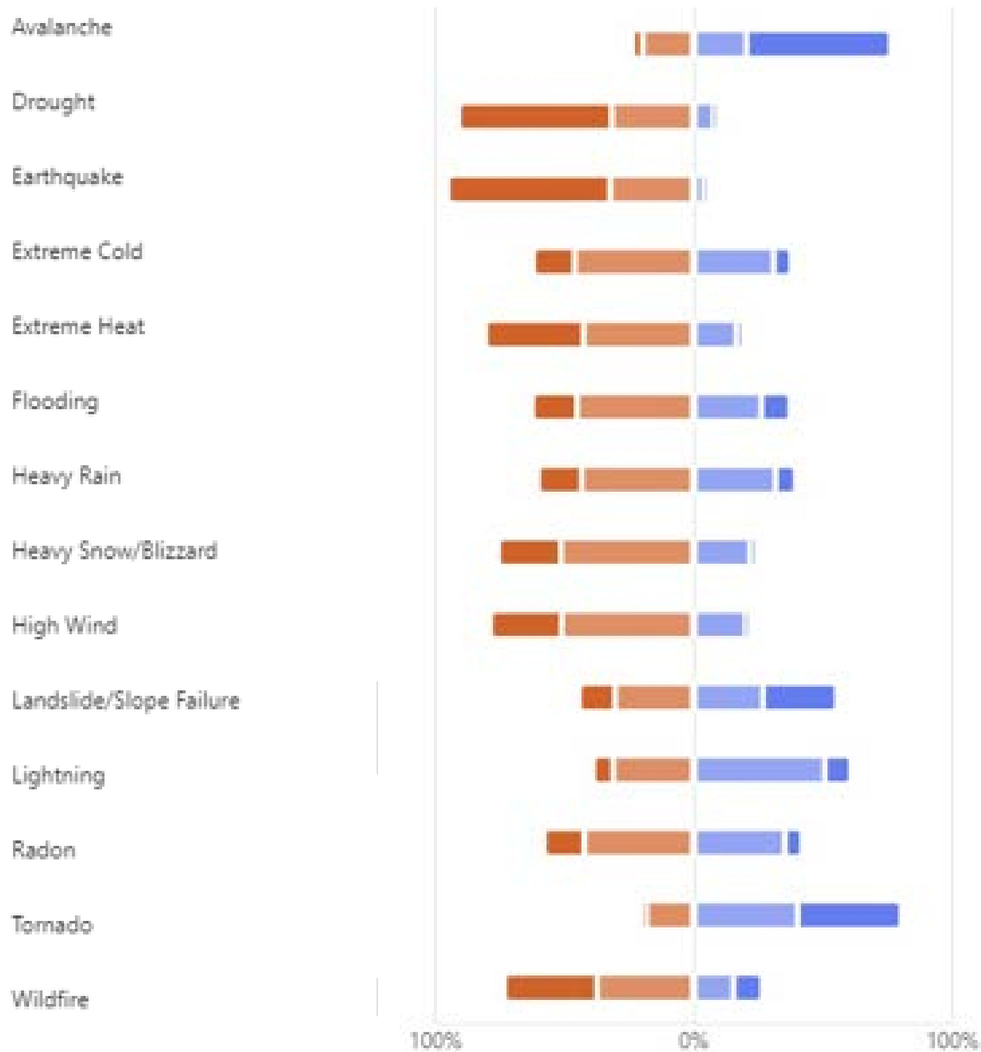


Figure 28: Survey Results on Concerns About Specific Hazards

HAZARD INSURANCE COVERAGE

Question #10 asked respondents what residential insurance coverage they currently have for natural hazards; 286 stated they have fire insurance, 131 have windstorm insurance, 173 have earthquake insurance, 89 have flood insurance, and 20 have landslide insurance.

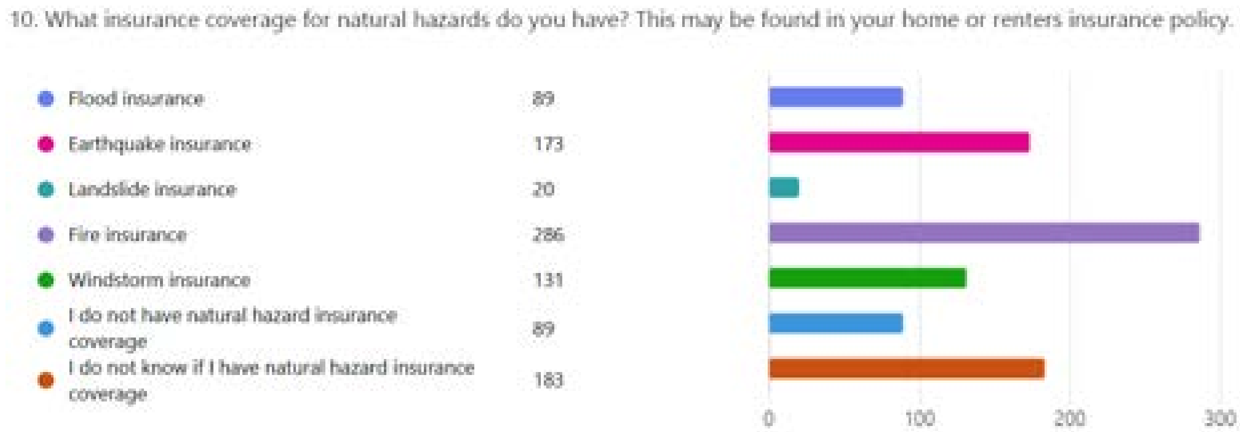


Figure 29: Survey Results on Hazard Insurance Coverage

WHERE RESPONDENTS LIVE OR WORK

Question #14 asked where respondents lived or worked at the time of the survey. Results can be sorted to determine whether there are geographic trends in responses to the other questions.

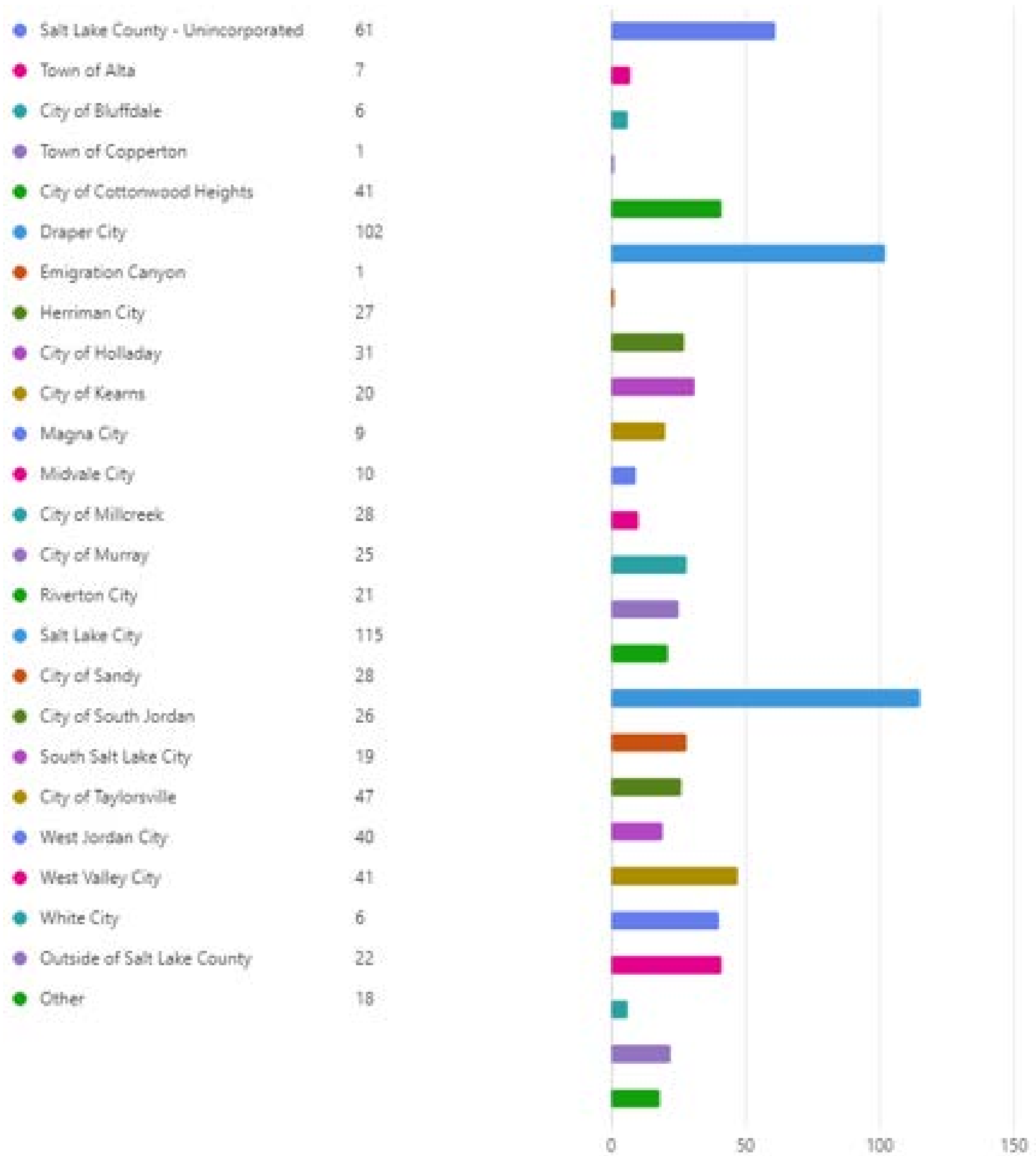


Figure 30: Survey Results on Where Respondents Live and Work

VULNERABLE POPULATIONS

Question #13 invited respondents to identify if they belonged to one or more vulnerable population categories. The intent of this question was to determine whether vulnerable populations were reached by the survey and had an opportunity to voice their unique concerns about natural hazards.

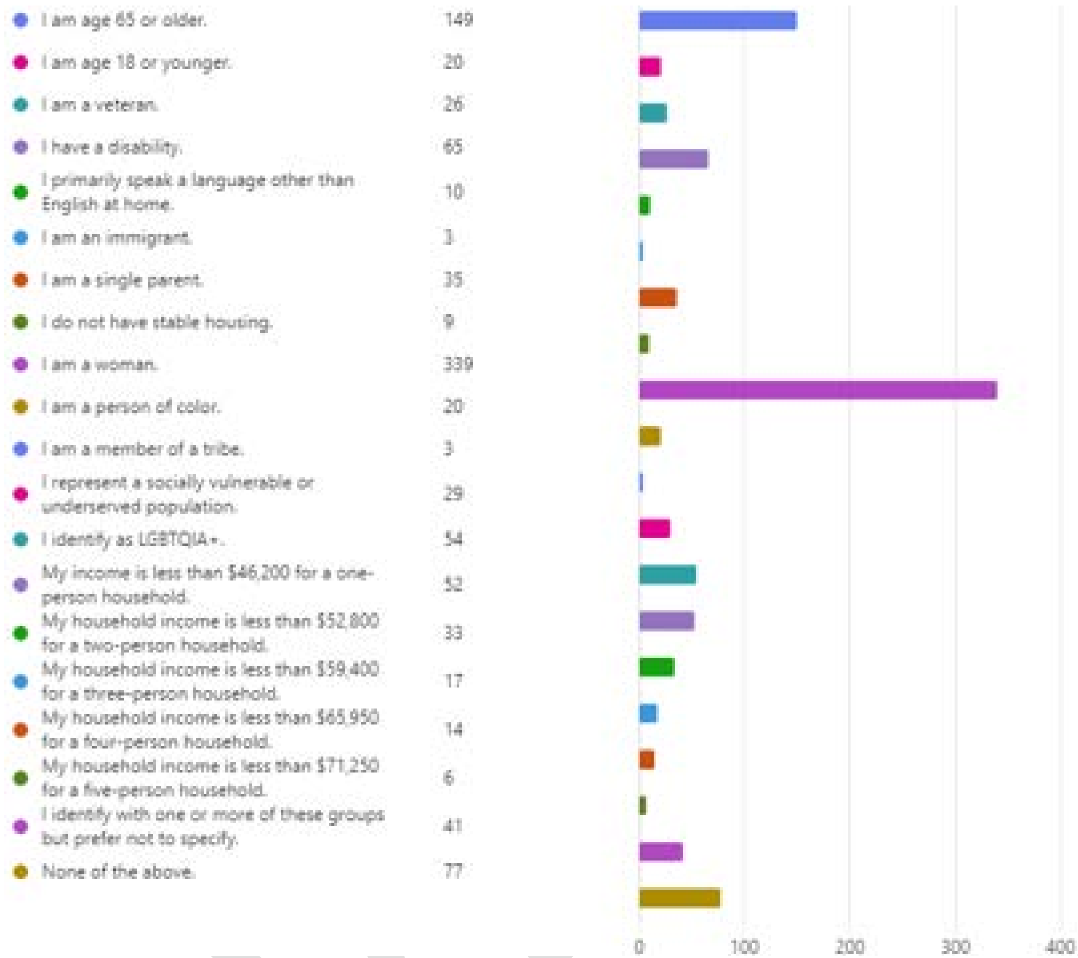


Figure 31: Survey Results on Vulnerable Populations

PARTS OF THE COMMUNITY MOST AT RISK

Question #4 asked, “What parts of your community (including buildings, people, economic activities and events, and natural areas) are most at risk of these hazards?” Of the 563 respondents, 101 identified “people” as most at risk, with buildings and homes also frequently selected.

MITIGATION IDEAS

Question #8 asked, “What other types of hazard mitigation activities would you support your community in taking? Be specific if you know an area or structure that needs mitigating.” Of the 558 respondents, 43 said they would support “community activities” and water and earthquake mitigation activities.

PROTECTION FROM FUTURE DISASTERS

Question #5 asked, “What at-risk areas (including structures, infrastructures, and natural areas) or people in your community would you like to see protected from future disasters? Be specific, if known.” Of the 560 response respondents, 78 answered protecting natural areas from future disasters and homes and buildings.

Risk Assessment

The Hazard Identification and Risk Assessment (HIRA) measures the potential impact of hazards on life, property, and economic activity. It intends to identify, as much as practicable, given the existing or available data, a community's qualitative and quantitative vulnerabilities. The risk assessment provides a clearer understanding of the impacts of natural hazards on the community. They also serve as a foundation for developing and prioritizing mitigation actions aimed at reducing damage from areas that might have significant impacts (see the section on **Mitigation Strategy**). This includes increased preparedness, faster response times, and improved allocation of resources to the most vulnerable areas.

This risk assessment followed the methodology described in the FEMA Local Mitigation Planning Handbook 2023, which outlines a five-step process:

1. **Identify Hazards:** This step helps clarify the hazards that may occur in the planning area.
2. **Describe Hazards:** This step includes gathering more information about the hazards, including where they can happen, the impact of past occurrences, and the potential frequency and intensity of future occurrences.
3. **Identify Community Assets:** This step evaluates which assets are most vulnerable to loss during a disaster, considering any development changes since the previous plan was created.
4. **Analyze Impacts:** This step describes how each hazard could affect the assets of each community.
5. **Summarize Vulnerability:** This step synthesizes all the analyses and uses the risk assessment to draw conclusions. Based on these conclusions, the planning team can develop a strategy to increase the resilience of residents, businesses, the economy, and other vital assets.

Methodology

The information gathered during the Multi-Jurisdictional Hazard Mitigation Plan (MJHMP) planning process related to the five steps has been incorporated into the following discussions in this chapter:

- **Hazard Identification:** This involves identifying and prioritizing the natural hazards that threaten Salt Lake County, including assets in other jurisdictions, such as levees and upstream dams, which can also affect your area. The reasoning for omitting some hazards from further consideration also is given in this discussion.
- **Hazard Profiles:** Each natural hazard that threatens Salt Lake County has a separate hazard profile that includes its location, extent/magnitude/severity, previous occurrences, and likelihood of future events. The previous plan identified severe weather as a hazard. This plan has broken this category into separate hazards—heavy rain, high wind, extreme heat, and lightning—to provide more detail on each and additional information on events since the last plan update. Extreme cold has been separated from severe winter weather and is now presented as a stand-alone hazard profile. No other new hazards have been added since the last plan.

- **Identify Assets:** Identify the assets in Salt Lake County at risk of hazards. Information includes people, structures, community lifelines, and other critical facilities; natural, historic, and cultural resources; and the economy and other activities that have value to the community.
- **Analyze Impacts:** Determine where hazards overlap with assets identified in the previous step, including descriptions of the assets' vulnerabilities and describing potential impacts.
- **Summarize Vulnerability:** Information from hazard profiles, vulnerability assets, changes in development, potential impacts, and losses are summarized to help Salt Lake County understand the most significant risks and vulnerabilities.

Identifying Hazards

According to FEMA guidance, identifying hazards is the first step in developing a risk assessment. Salt Lake County plan participants reviewed previously prepared hazard mitigation plans and relevant documents to identify natural hazards that could affect the county. Based on a review of the prior plan and consideration of recent events, 19 different hazards were identified.

Table 18: Hazards Identified for 2025 Hazard Mitigation Plan

Avalanche	Flooding	Public Health Epidemic/Pandemic	Dam Failure
Drought	Heavy Rain	Radon	Civil Disturbance
Earthquake	High Wind	Severe Winter Storm	Hazardous Materials Incident
Extreme Cold	Landslide/ Slope Failure	Tornadoes	Terrorism/ Cyberterrorism
Extreme Heat	Lightning	Wildfire	

The following information is provided for each hazard:

- **Hazard Description:** A brief introduction of the mechanisms behind the hazard.
- **Location:** An indication of geographic areas most likely to experience the hazard.
- **Magnitude/Extent:** A description of the potential magnitude and extent of the hazard, accompanied by the likelihood of the hazard occurring (or a time frame of recurrence, if available).
- **Historical Events:** Similar to location, a chronological summary of recent hazard occurrences, including extent or damage cost, if available.
- **Probability of future occurrences:** Likelihood of this event occurring in Salt Lake County, based on return intervals or past annual frequency.
- **Climate Change Considerations:** When applicable, a brief overview indicating how the hazard profile may change over time due to climate changes.
- **Secondary Hazards/Cascading Impacts:** A brief overview of secondary hazards often associated with the hazards.

- **Vulnerability Analysis:** A description of which assets—including structures, systems, populations, and other assets as defined by the plan participant—are at risk from each hazard. Vulnerability may be expressed in quantitative terms, such as replacement cost, or qualitatively, such as type of structure value, depending on available data. This section also discusses the impacts of hazards, which are the potential consequences of a hazard event, including land use and development changes. These impacts can include the following:
  - Modeled estimates of potential structural and economic losses, including values of community assets exposed to the hazard
  - Impacts on vulnerable populations
  - Changes in development and whether these changes represent a change in vulnerability since the 2019 plan
  - Effects on FEMA Community Lifelines

Hazard descriptions were based on information from local, state, and federal agencies that study these hazards. These sources were also used to identify the locations and extent of hazards that could impact people, structures, or other assets in Salt Lake County. These sources were identified in the

Planning Process section of this plan.

For each hazard profiled, a review of past events was conducted. This involved examining historical records of hazards that have previously affected the county and/or cities and towns, such as the National Centers for Environmental Information (NCEI) Storm Events Database. Hazards that may affect the county in the future were identified by gathering information from local, state, and federal agencies; accounts from newspapers or local media; state and regional weather records; conversations with the public and local officials; surveys; and meetings with personnel in the planning area. Information about federal Disaster Declarations in Salt Lake County was updated and compiled into Table 19, which provides a baseline for consideration in the hazard prioritization process.

Each participating jurisdiction considered these 19 hazards and evaluated which consistently affected its area based on the history of occurrences and probability. The jurisdictions used forms to identify the hazards they wished including in their risk assessment and briefly explained any that they decided to omit. They also identified community assets, critical facilities, or infrastructure in the community that are at risk from each hazard. Participants also described changes in development, such as changes in population or land use, which could affect their vulnerability to hazards. Details of these jurisdiction-specific hazards and an analysis of the vulnerabilities and potential impacts of each are described in the annexes in Volume 2 of this plan.

Past Disaster Declarations

Table 19: Past Disaster Declarations

Disaster Declaration Code	Incident Period	Date Declared	Description
FM-5408-UT	08/14/2021–08/18/2021	08/14/2021	Parleys Canyon fire
4578-DR-UT	09/07/2020–09/08/2020	01/12/2021	Severe storm, straight-line winds
DR-4548-UT	03/18/2020–04/17/2020	07/09/2020	Earthquake and aftershocks
DR-4525-UT	01/20/2020–05/11/2023	04/04/2020	COVID-19 pandemic
EM-3478-UT	01/20/2020–05/11/2023	03/13/2020	COVID-19
FM-2991-UT	06/29/2012–06/30/2012	06/29/2012	Rose Crest fire
DR-4011-UT	04/18/2011–07/16/2011	08/08/2011	Flooding
FM-2859-UT	09/19/2010	09/19/2010	Machine Gun fire
EM-3223-UT	08/29/2005–10/01/2005	09/05/2005	Hurricane Katrina evacuation
DR-1285-UT	08/11/1999	08/16/1999	Tornado, severe thunderstorms, hail
DR-720-UT	08/17/1974	08/17/1984	Severe storms, mudslides, landslides, flooding
DR-680-UT	04/13/1983	04/30/1983	Severe storms, landslides, flooding

Prioritization of Hazards

Each plan participant completed a Calculated Priority Risk Index (CPRI) based on the following criteria to identify how each plan participant is uniquely at risk of the hazards profiled.

Table 20: Calculated Priority Risk Criteria

Risk Index Factor	Degree of Risk Level		Criteria	Factor Weight for Degree of Risk Level
Probability of Future Events	1	Unlikely	Less than 1 percent probability of occurrence in the next year or a recurrence interval of greater than every 100 years.	30%
	2	Occasional	1 to 10 percent probability of occurrence in the next year or a recurrence interval of 11 to 100 years.	
	3	Likely	11 to 90 percent probability of occurrence in the next year or a recurrence interval of 1 to 10 years.	
	4	Highly Likely	91 to 100 percent probability of occurrence in the next year or a recurrence interval of less than 1 year.	
Spatial Extent	1	Limited	Less than 10% of the planning area could be impacted.	10%
	2	Small	10%–25% of the planning could be impacted	
	3	Significant	25%–50% of the planning area could be impacted.	
	4	Extensive	50%–100% of the planning area could be impacted.	
Severity of Life/Property Impact	1	Negligible	Less than 5% of the affected area's critical and non-critical facilities and structures are damaged/destroyed. Only minor property damage and minimal disruption of life. Temporary shutdown of critical facilities.	30%
	2	Limited	More than 5% and less than 25% percent of property in the affected area is damaged/destroyed. Complete shutdown of critical facilities for more than one day but less than one week.	
	3	Critical	More than 25% and less than 50% of property in the affected area was damaged/destroyed. Complete shutdown of critical facilities for over a week but less than one month.	
	4	Catastrophic	Over 50% of critical and non-critical facilities and infrastructures in the affected area are damaged/destroyed. Complete	

Risk Index Factor	Degree of Risk Level		Criteria	Factor Weight for Degree of Risk Level
			shutdown of critical facilities for more than one month.	
Warning Time	1	Self-defined	More than 24 hours	10%
	2	Self-defined	12 to 24 hours.	
	3	Self-defined	6 to 12 hours.	
	4	Self-defined	Less than 6 hours.	
Duration	1	Brief	Up to 6 hours.	10%
	2	Intermediate	Up to one day.	
	3	Extended	Up to one week.	
	4	Prolonged	More than one week.	
Response Capacity	1	High	Significant resources and capability to respond to this kind of event; staff are trained, experienced, and ready.	10%
	2	Medium	Some resources and capability to respond to this kind of staff; some staff may be trained, experienced, and ready while others may need additional support.	
	3	Low	Limited resources and capability to respond to this kind of event; additional staff or staff training needed.	
	4	None	No resources and capability to respond this kind of event; additional outside support would be required.	

RISK FACTOR (RF) EQUATION

RF Value = [(Probability x 0.30) + (Spatial Extent x 0.10) + (Severity of Life/Property Impact x 0.30) + (Warning Time x 0.10) + (Duration x 0.10) + (Response Capacity x 0.10)]

The Calculated Priority Risk Index for Salt Lake County

The following represents the overall risk of each hazard in Salt Lake County. Those with a risk factor value greater than or equal to 2.5 are considered high risk. Risk factors ranging from 2.0 to 2.4 are considered moderate risk, and those below 2.0 are considered low risk. The highest possible risk factor value is 4.

Table 21: Calculated Priority Risk Index for Salt Lake County

Type of Hazard Event	Probability of Future Events	Spatial Extent	Severity of Life/Property Impact	Warning Time	Duration	Response Capacity	Risk Factor Value
Avalanche	4	1	2	4	2	1	2.6

Type of Hazard Event	Probability of Future Events	Spatial Extent	Severity of Life/Property Impact	Warning Time	Duration	Response Capacity	Risk Factor Value
Drought	4	4	2	1	4	1	2.8
Earthquake	3	4	4	4	3	2	3.4
Extreme Heat	4	4	3	1	3	1	3
Extreme Cold	3	4	2	1	3	1	2.4
Flooding	4	3	3	3	3	1	3.1
Landslide/Slope Failure	2	1	2	4	1	2	2
Radon	4	4	2	1	4	2	2.9
Heavy Rain	4	3	2	3	1	1	2.6
High Wind	4	3	3	3	2	1	3
Lightning	4	2	2	4	1	1	2.6
Severe Winter Weather	4	3	2	2	2	1	2.6
Tornado	2	2	3	4	1	2	2.4
Wildfire	4	3	3	4	3	1	3.2
Dam Failure	2	2	3	2	2	3	2.4
Civil Disturbance	2	1	2	4	2	2	2.1
Cyberattack	2	3	3	4	3	2	2.7
Hazardous Materials Incident (Transportation & Fixed Facility)	3	1	2	4	1	1	2.2
Public Health Epidemic/ Pandemic	3	4	3	1	4	1	2.8
Terrorism	2	1	3	4	2	1	2.3

Vulnerability Assessment

A vulnerability assessment evaluates the assets potentially at risk from the identified hazards, including structures, populations, infrastructure, and other assets in hazard-prone areas. Impacts are the consequences or effects of each hazard on each community's assets and the losses a community may incur in the event of a disaster. Evaluating the assets at risk and potential impacts provides the foundation for determining where hazard mitigation resources are most needed. The FEMA Local Mitigation Planning Handbook provides a framework for conducting a vulnerability assessment.[37]

[37] FEMA. "Local Mitigation Planning Handbook." May 2023. https://www.fema.gov/sites/default/files/documents/fema_local-mitigation-planning-handbook_052023.pdf.

ASSET IDENTIFICATION

The vulnerability assessment relied on asset data from the county to provide a measure of the potential impacts of hazards on community assets. Assets refer to people, critical facilities, infrastructure, or other resources of value in the county and cities. When local data were unavailable, state or federal sources were consulted. Geospatial data are indispensable in determining which assets might be exposed to specific hazards. Geospatial analysis can be conducted by overlaying the community's assets on a map of the spatial extent of a natural hazard to determine areas of exposure and potential losses. For hazards without a defined spatial extent, maps of past occurrences can provide a reference for general risk in the county.

COMMUNITY LIFELINES

Lifelines are essential services in a community that, when maintained, allows all other aspects of society to function effectively. Community lifelines are essential for the well-being of any community, providing support and assistance to individuals who need help, especially during times of crisis. FEMA Community Lifelines are a critical component of emergency management in the United States. These lifelines are designed to address the essential needs of a community during and after a disaster. Community Lifelines help create a sense of safety and security in a community. They provide a safety net for individuals who may be struggling and offer comfort and reassurance that help is available when needed. Without these lifelines, communities would be significantly more vulnerable to crises and emergencies. There are eight lifelines, each with a specific focus.

Figure 32: FEMA Community Lifelines[38]

LOSS ESTIMATES

Hazus is a standardized risk modeling tool that estimates potential damage, economic losses, and other impacts from earthquakes, floods, tsunamis, and hurricanes. Hazus software relies on Esri's ArcGIS for Desktop technology. It includes nationwide datasets for general building stock, critical facilities,

[38] FEMA. "Community Lifelines." https://www.fema.gov/emergency-managers/practitioners/lifelines.

transportation, and other infrastructure data. The models estimate the potential damage to various assets based on a defined hazard scenario.

For this plan update, Hazus 6.1 was used to model 100-year (1% annual chance) and 500-year (0.2% annual chance) flood scenarios and an earthquake scenario based on a USGS ShakeMap scenario of a 6.2 magnitude earthquake on the Warm Springs Fault. Salt Lake County Division of Emergency Management (SLCo EM) provided GIS data for critical facilities, including 68 fire stations, 36 police stations, 16 hospitals, 18 emergency operations centers (EOCs), 218 county facilities, and 422 schools. These locations are shown in Figure 33–Figure 38. For the Hazus models of earthquake and flood scenarios, data on the county critical facilities were used to augment the default Hazus facility data. Other economic, transportation, utility, and building loss estimates were based on the default inventory data from Hazus 6.1.

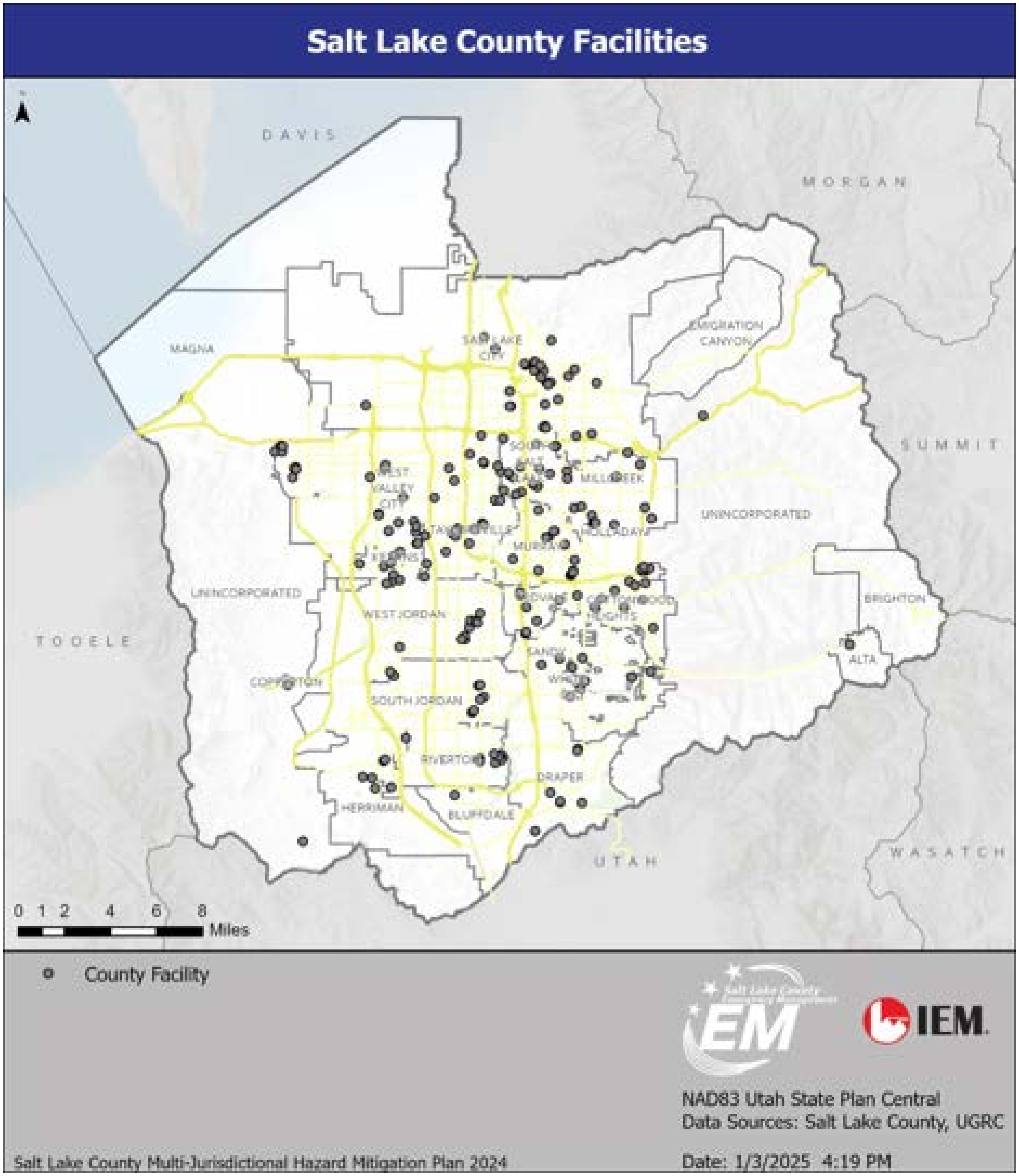


Figure 33: Salt Lake County Facilities

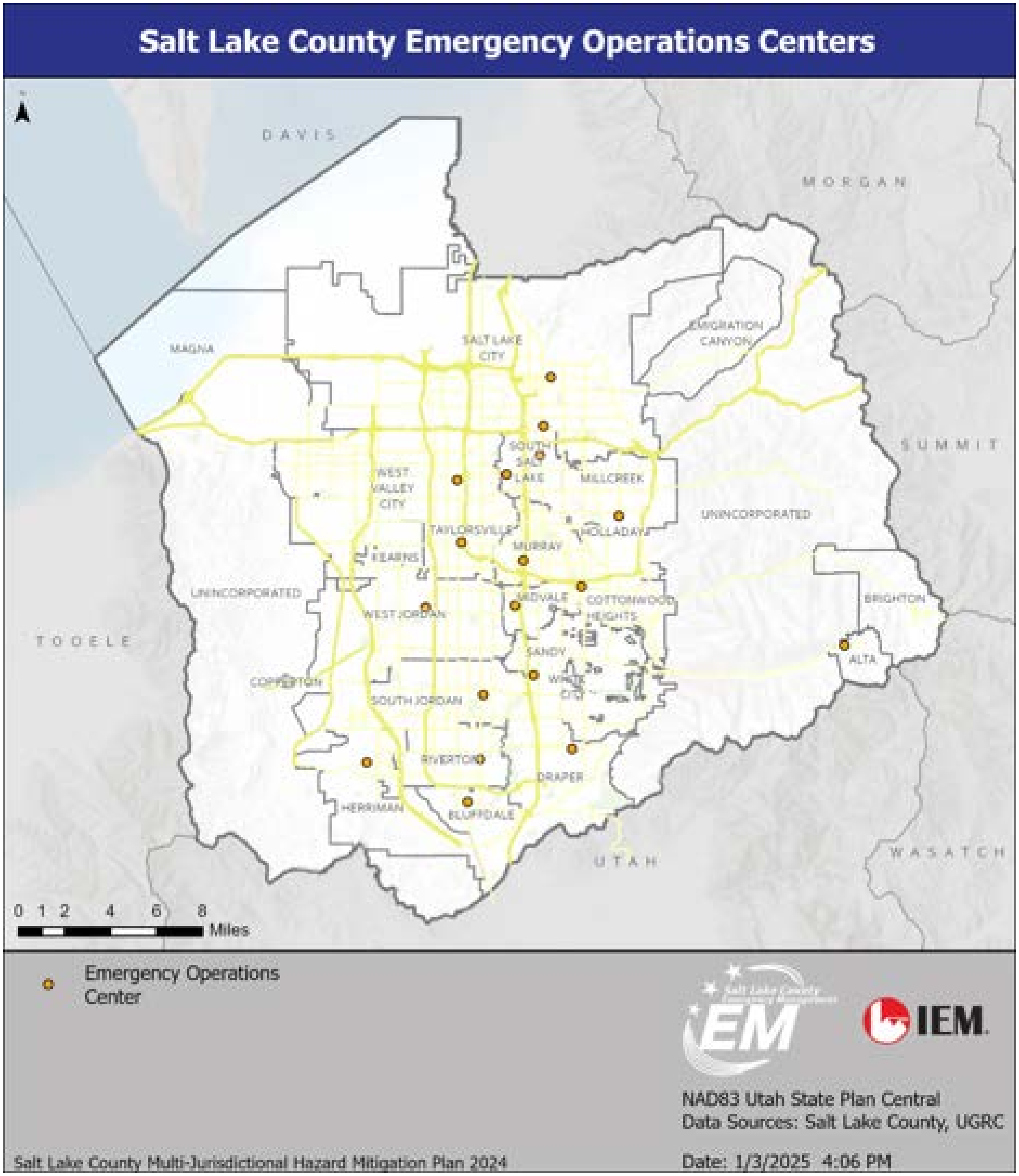


Figure 34: Emergency Operations Centers in Salt Lake County

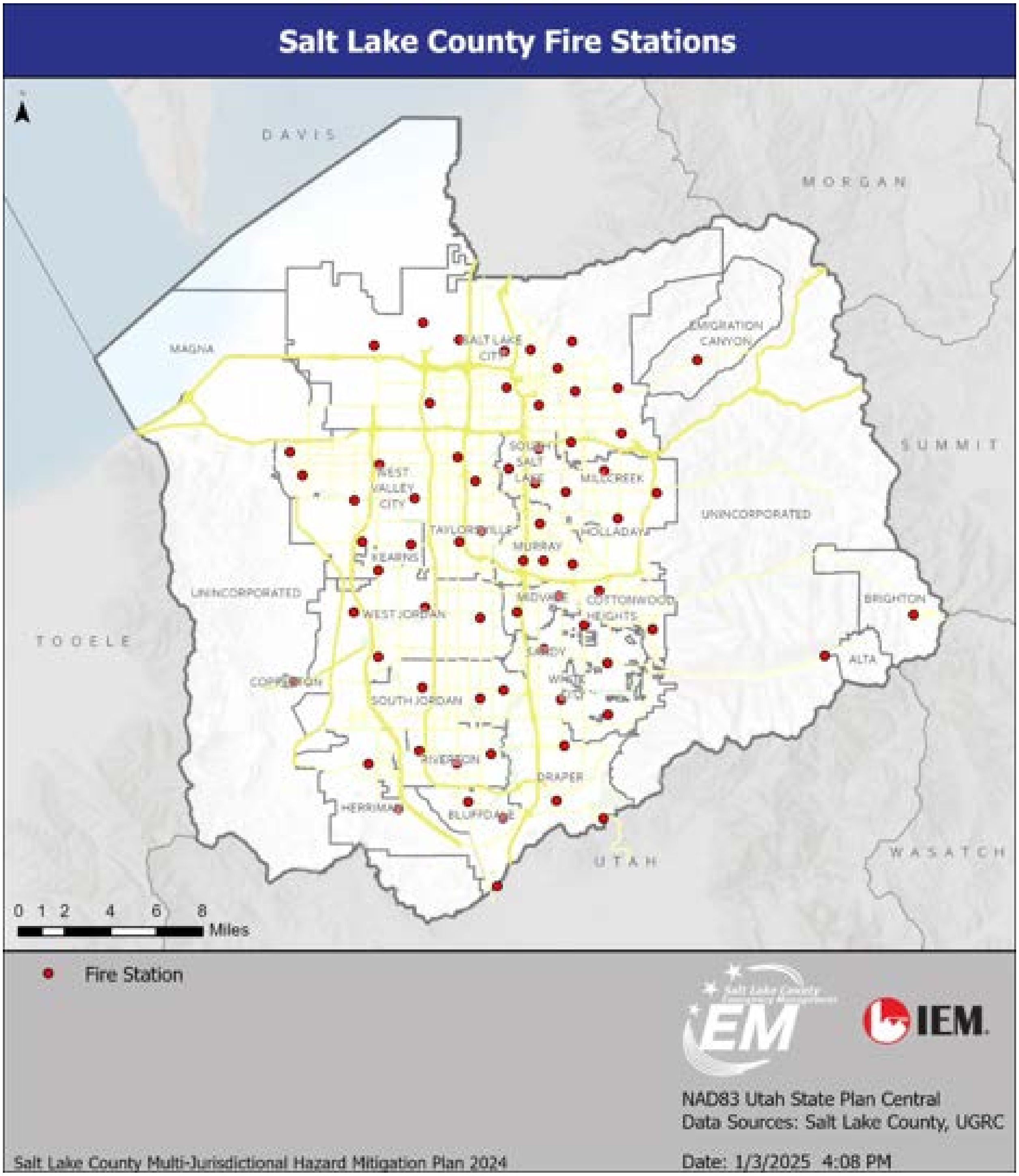


Figure 35: Fire Stations in Salt Lake County

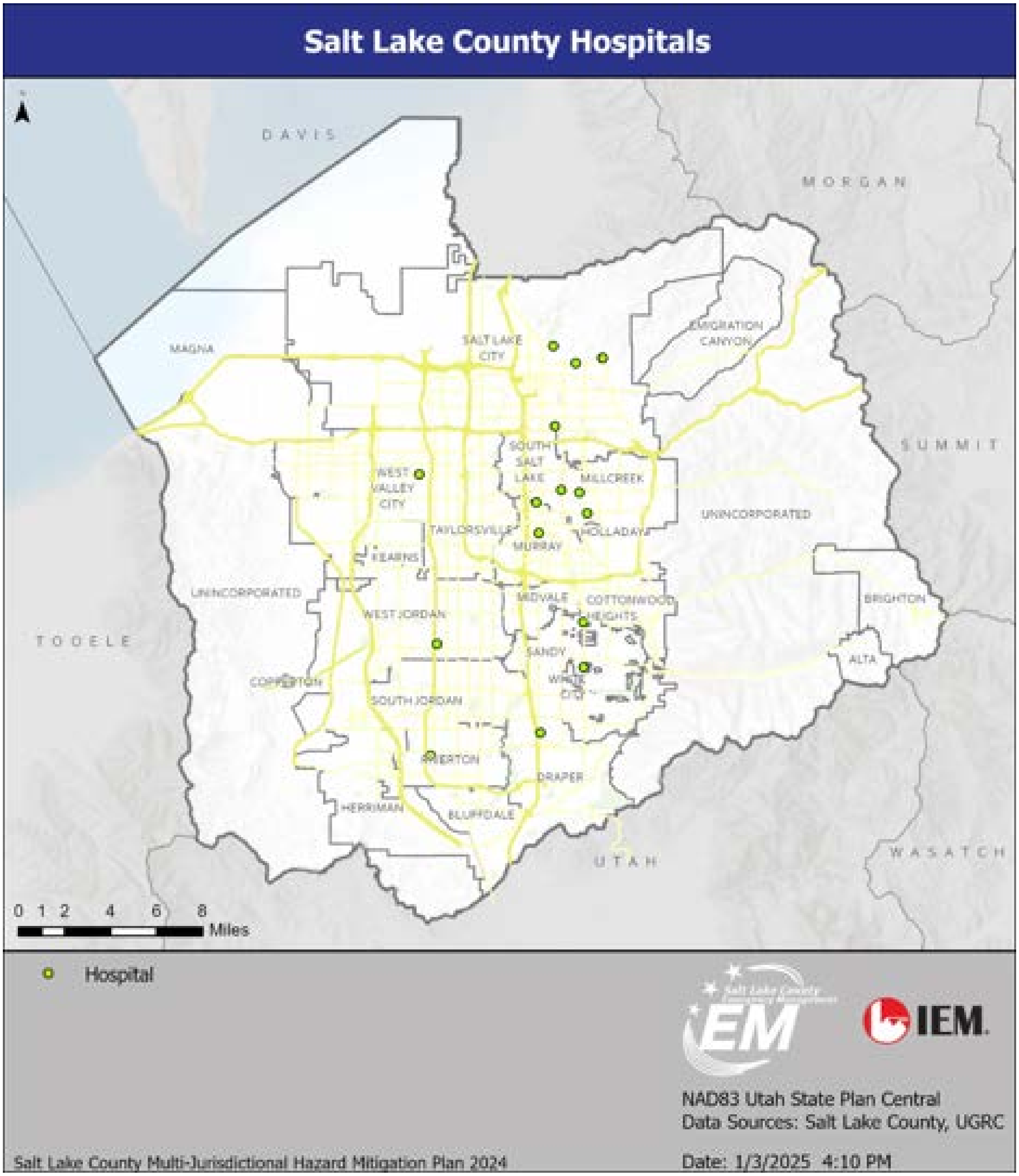


Figure 36: Hospitals in Salt Lake County

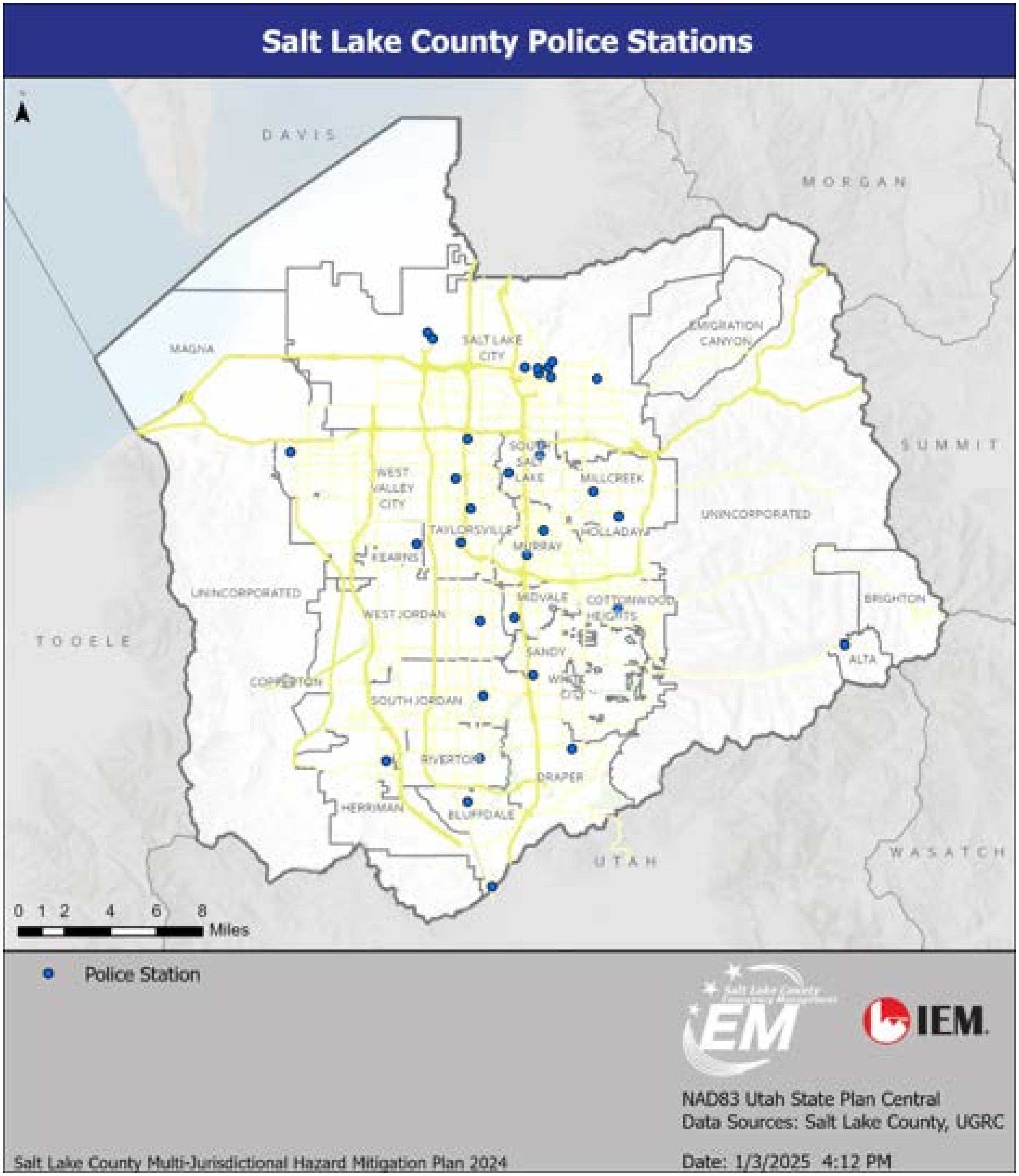


Figure 37: Police Stations in Salt Lake County

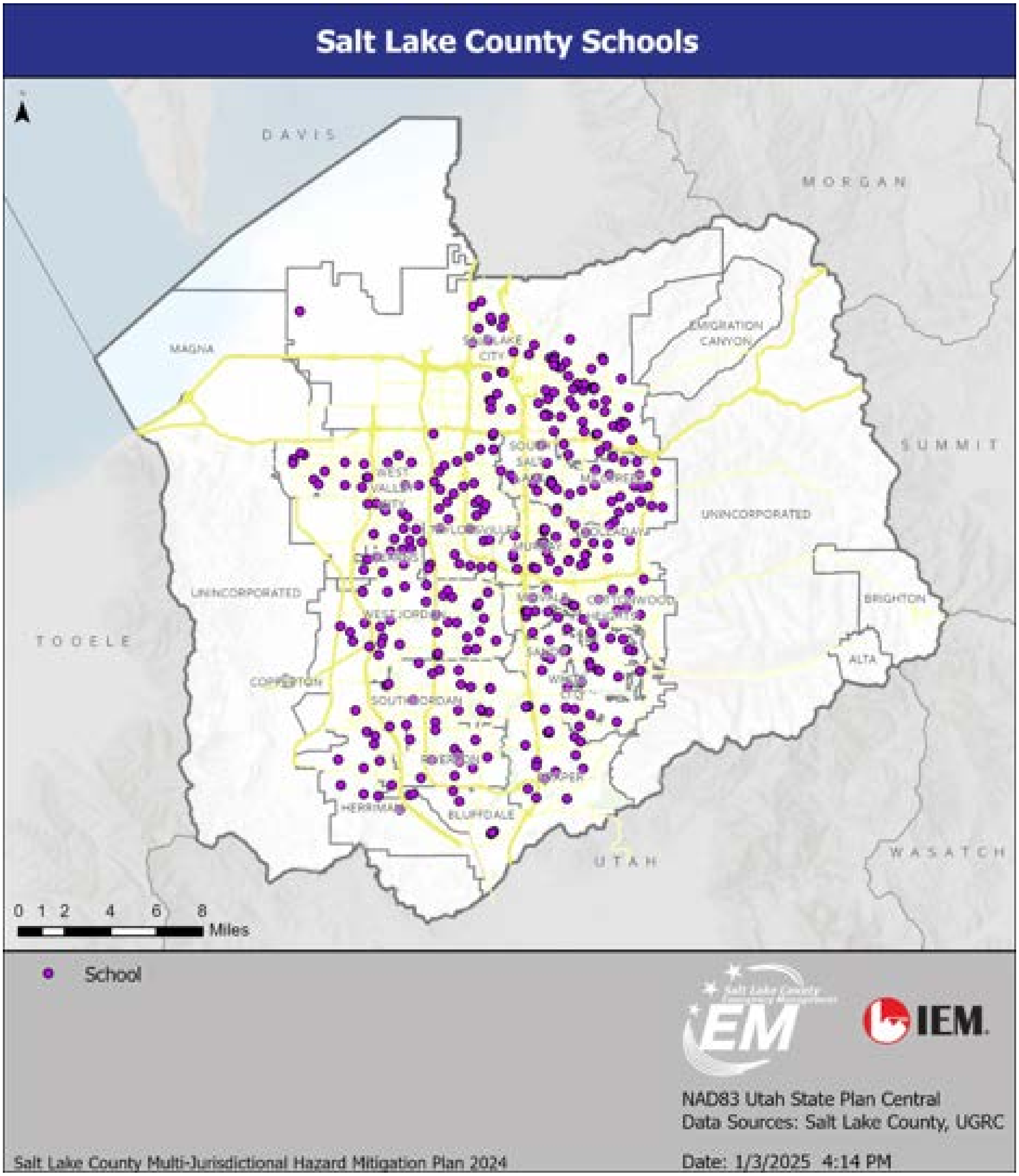


Figure 38: Schools in Salt Lake County

NATIONAL RISK INDEX

The National Risk Index (NRI) is an online dataset developed by FEMA and its partners that defines a baseline understanding of risk of all communities across the United States. This interactive online tool can compare risks across the countywide planning area with the rest of the United States regarding expected annual loss, social vulnerability, and community resilience. Figure 39 illustrates how these three factors contribute to a composite score. The data for each hazard are pulled from different datasets. Dollars are in terms of 2022 dollars. Images in each hazard profile are screen captures taken directly from the NRI.

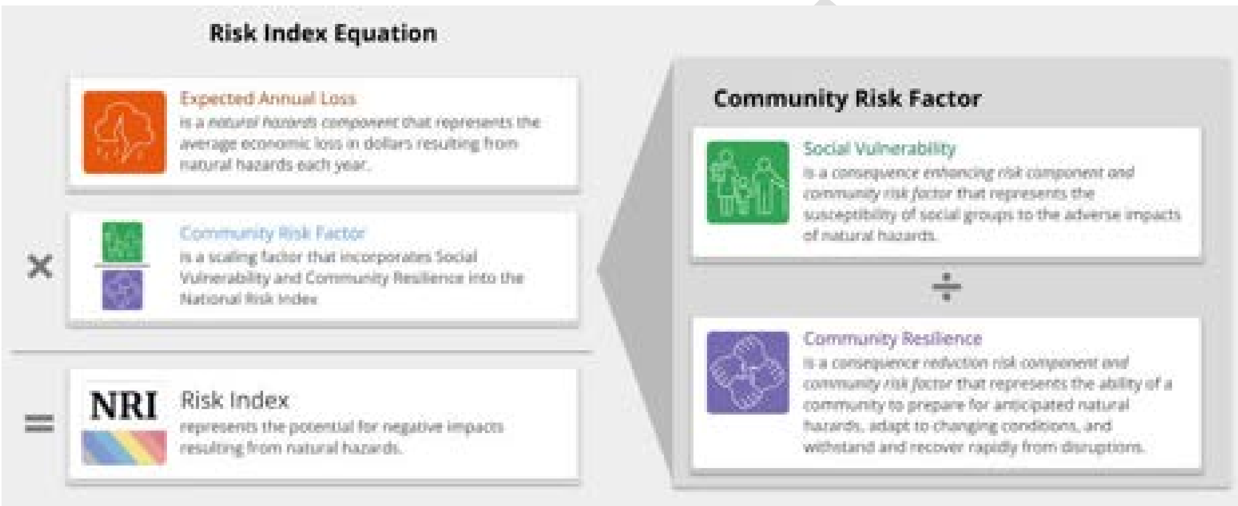


Figure 39: FEMA National Risk Index Equation

Ratings are described using qualitative terms ranging from “Very Low” to “Very High.” No specific numeric values determine the rating, as scores are relative.[39] The following defines the NRI categories at a national level:

- **Very High:** 80th to 100th percentiles
- **Relatively High:** 60th to 80th percentiles
- **Relatively Moderate:** 40th to 60th percentiles
- **Relatively Low:** 20th to 40th percentiles
- **Very Low:** 0 to 20th percentiles

Ratings do not always reflect the local experience, including Salt Lake County. However, this tool can serve as a baseline to understand risk and see how risks in Salt Lake County differ from those in the rest of the United States.

Vulnerable Populations

Some social groups are more susceptible to the impacts of natural hazards, which affects their capacity to prepare for, respond to, and recover from hazard events. Historically, people in these groups have

[39] FEMA, National Risk Index. “Determining Risk.” https://hazards.fema.gov/nri/determining-risk.

experienced disproportionate losses or economic impacts, disruption of livelihood, injuries, or death. Characteristics of socially vulnerable groups might include age, gender, income, race, ethnicity, language, or disabilities. For each hazard, care was given to identify populations that might be more susceptible to the effects of that hazard.

Several tools were referenced to help identify socially vulnerable populations in Salt Lake County. Social vulnerability is included in the NRI overall risk rating equation. This is based on the Social Vulnerability Index (SVI) from the Centers for Disease Control and Prevention (CDC). The SVI is a place-based index, database, and mapping application that provides a reference for understanding which areas are most likely to experience social vulnerability. It uses 16 variables from the U.S. Census 5-year American Community Survey to identify communities needing additional support. These are grouped into four themes and combined into a single measure of overall vulnerability, as shown in Figure 40.[40] The maps in Figure 41–Figure 45 show the areas in Salt Lake County with high percentages of socially vulnerable populations based on the four themes.

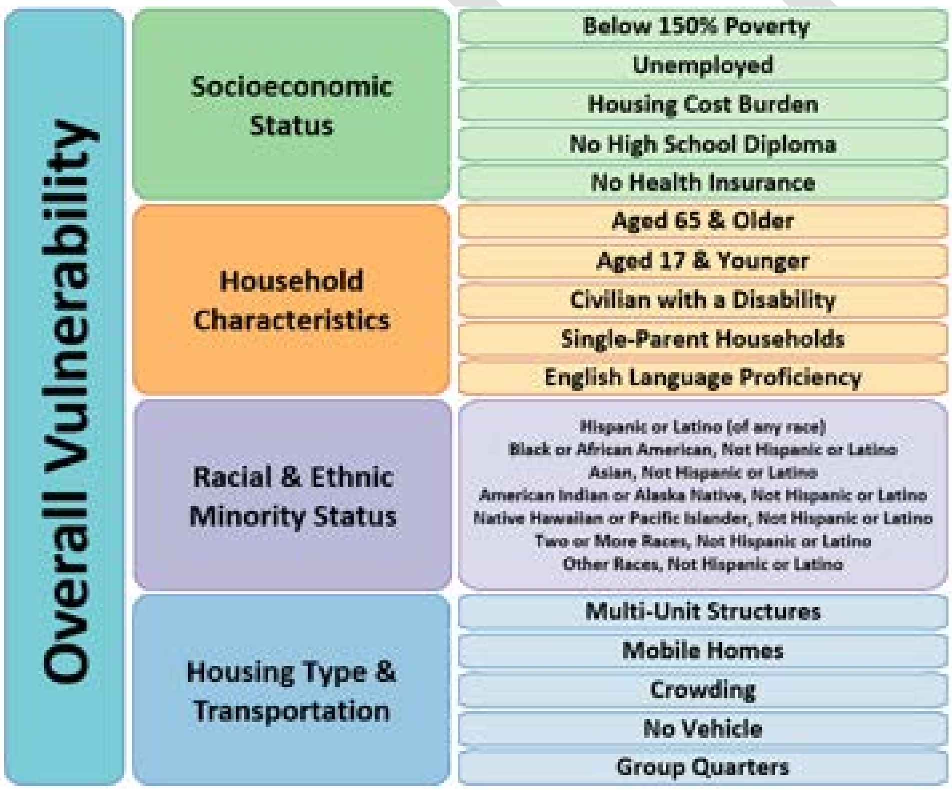


Figure 40: Themes and Variables in the Social Vulnerability Index

[40] CDC/ATSDR. "Social Vulnerability Index." 2022. https://www.atsdr.cdc.gov/place-health/php/svi/index.html.

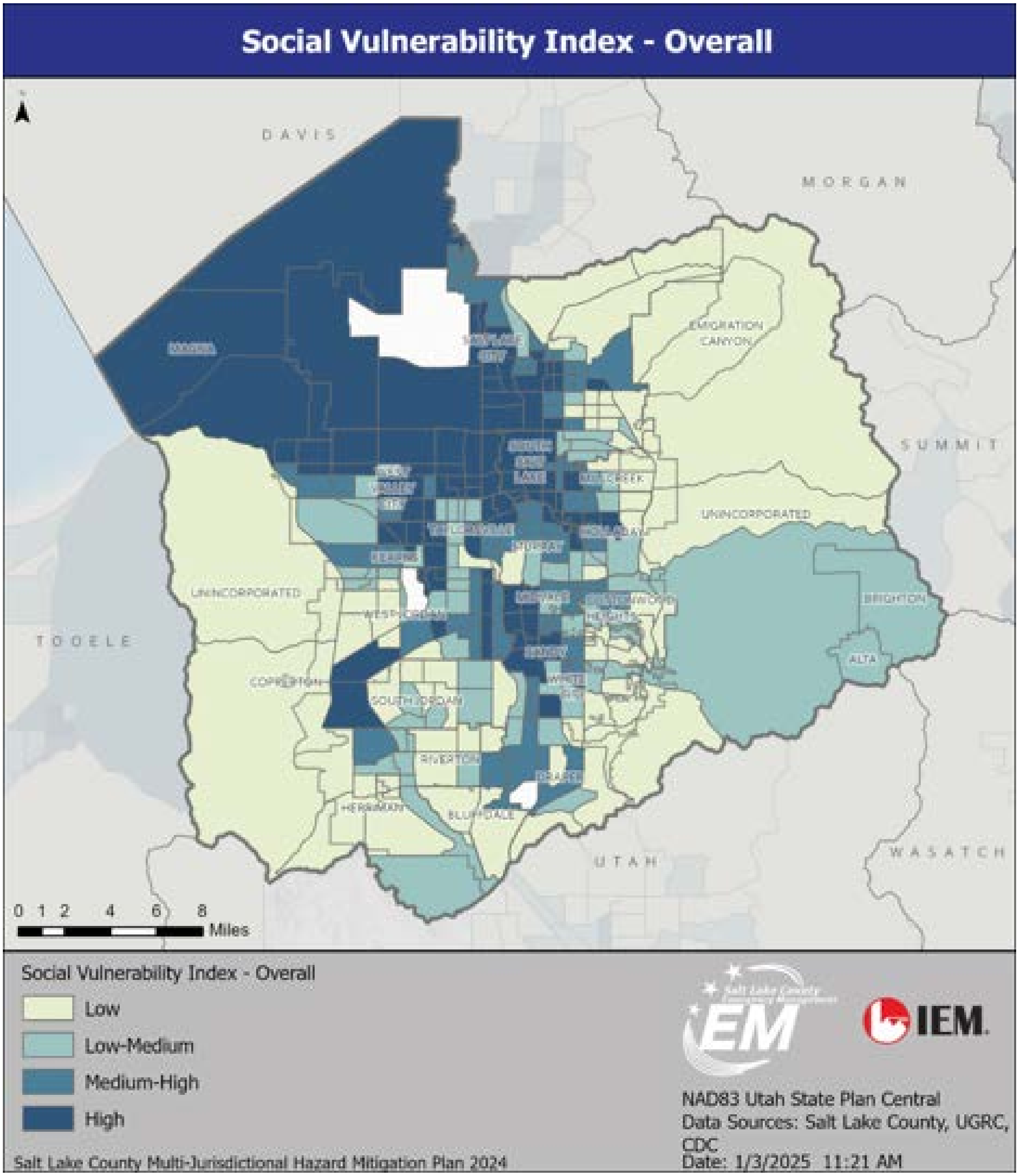


Figure 41: SVI – Overall Vulnerability Score by Census Tract for Salt Lake County

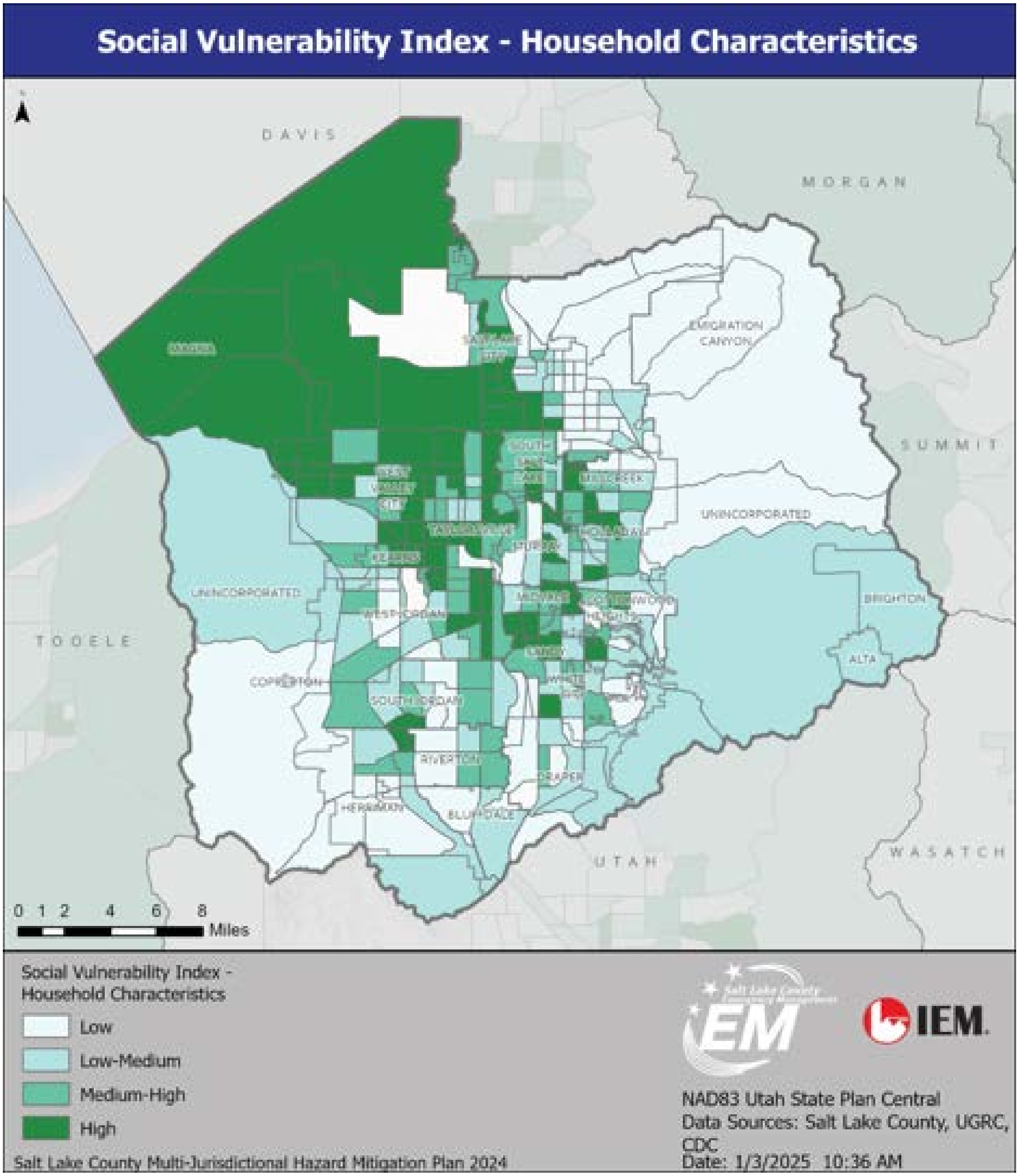


Figure 42: SVI – Household Characteristics by Census Tract for Salt Lake County

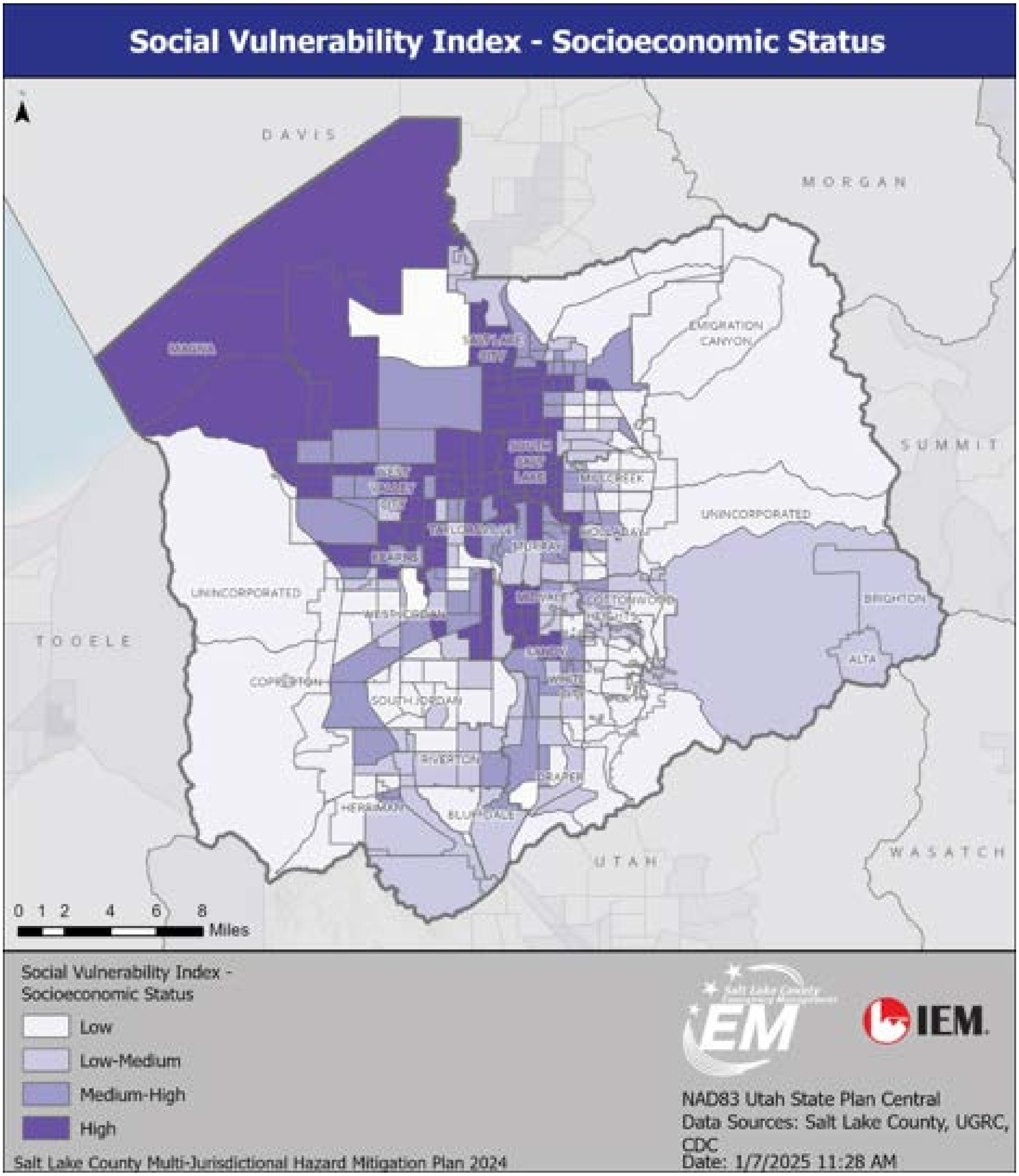


Figure 43: SVI – Socioeconomic Status by Census Tract for Salt Lake County

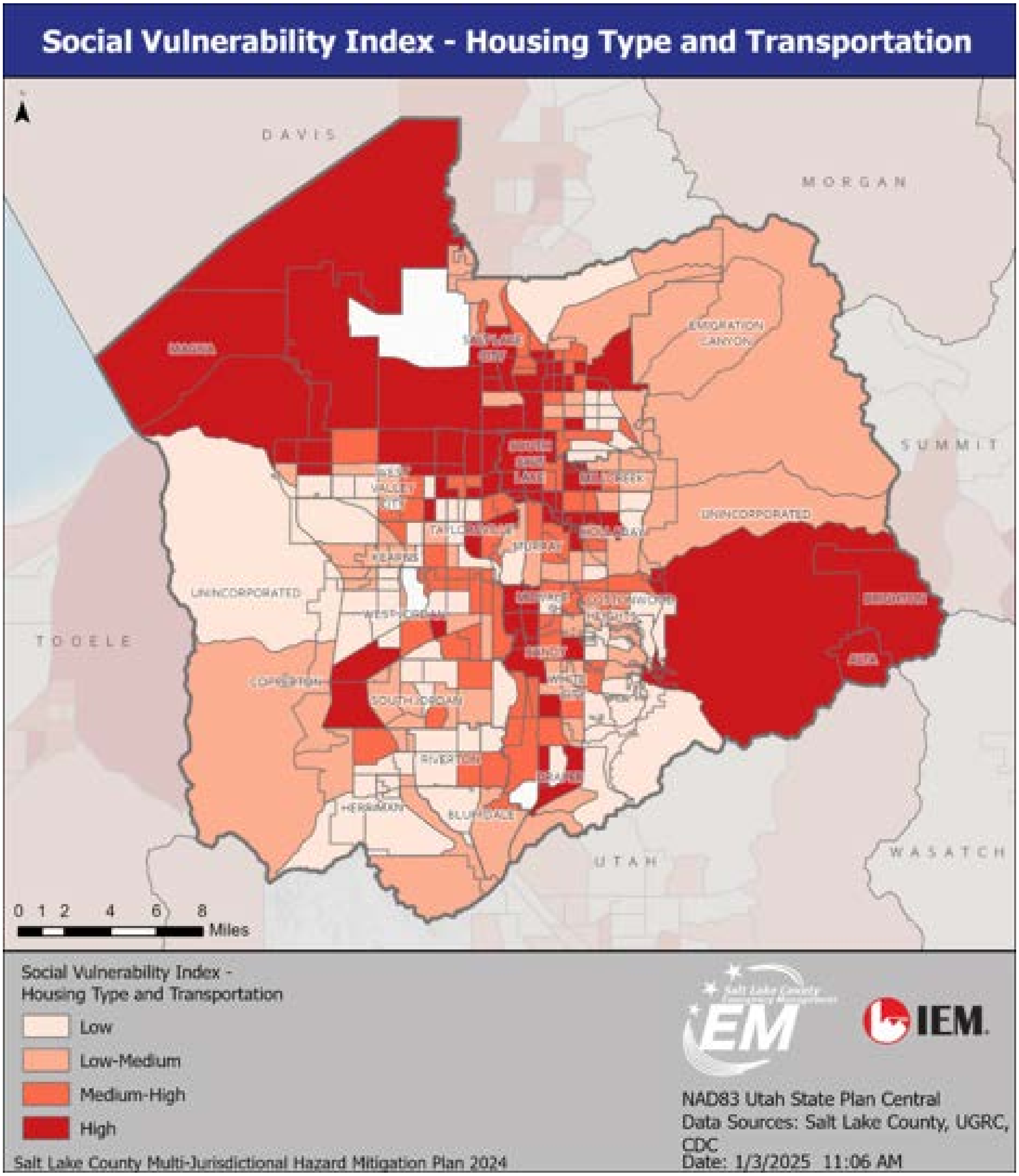


Figure 44: SVI – Housing Type and Transportation by Census Tract for Salt Lake County

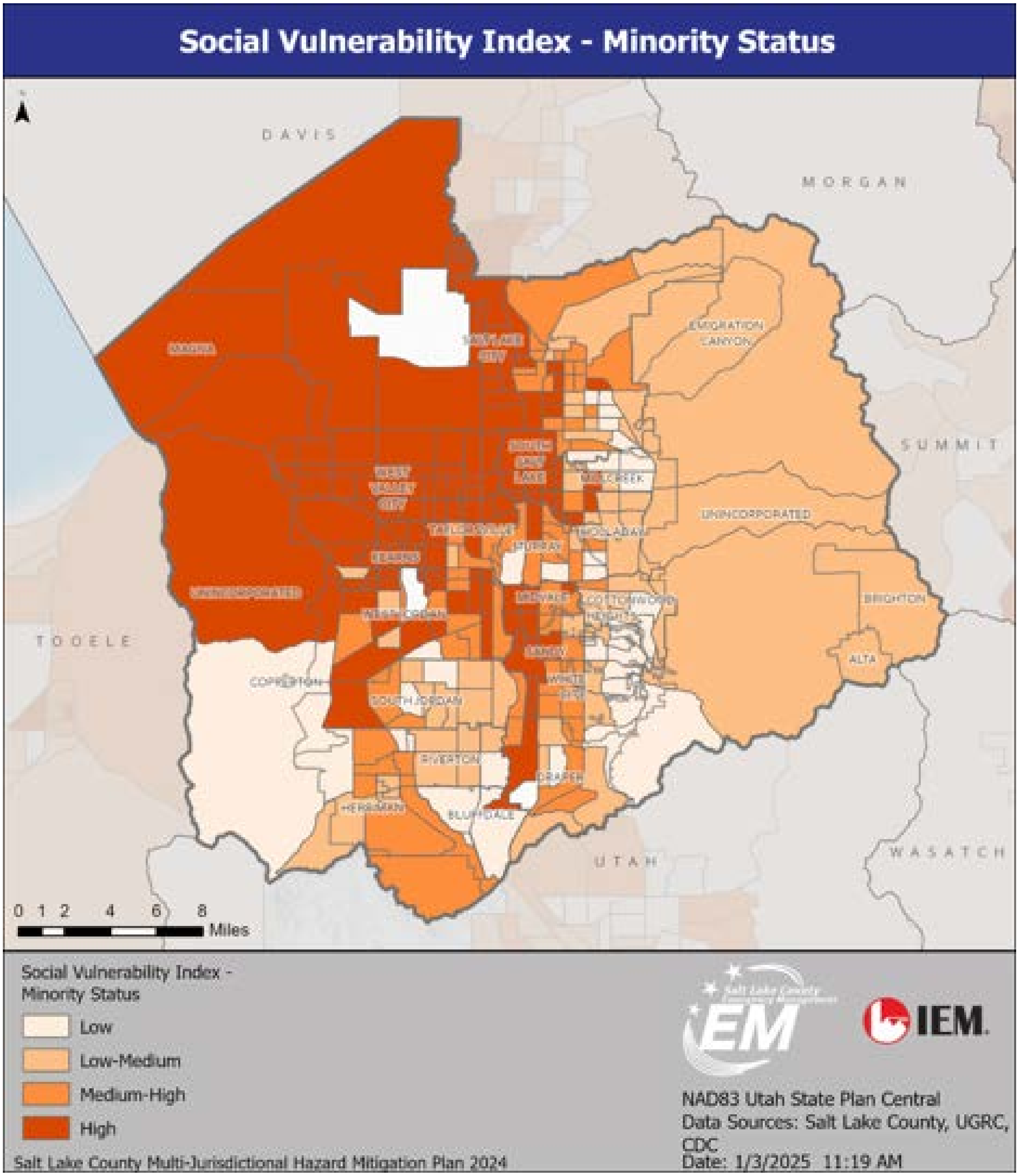


Figure 45: SVI – Minority Status by Census Tract for Salt Lake County

The Climate and Economic Justice Screening Tool is another method for identifying vulnerable populations. This interactive mapping tool identifies overburdened and underserved census tracts that are considered disadvantaged. Tracts that meet one or more categories of burden and the associated socioeconomic threshold are identified as disadvantaged. Figure 46 shows disadvantaged tracts in Salt Lake County.

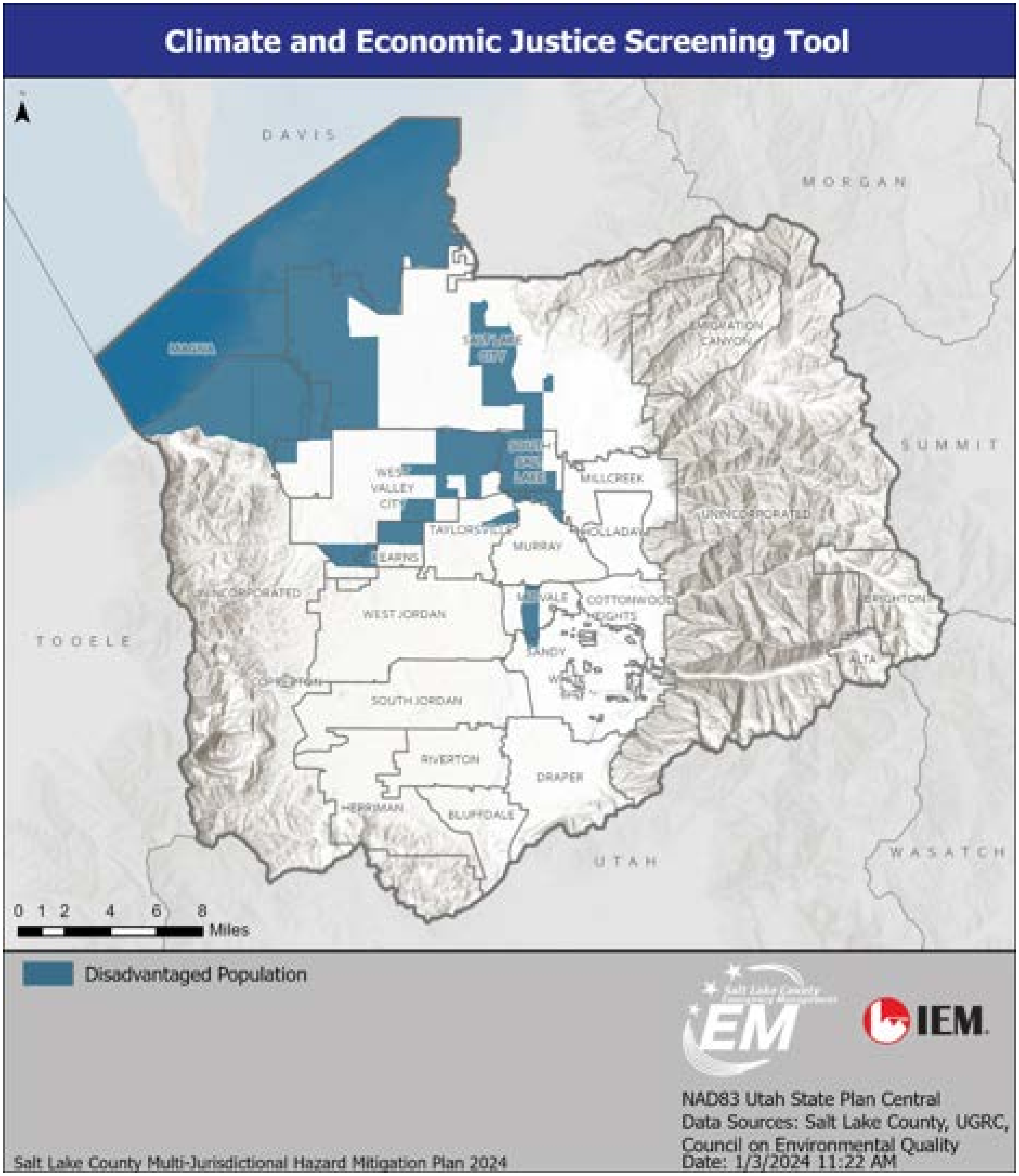


Figure 46: Disadvantaged Populations by Census Tract in Salt Lake County[41]

Indicators of disadvantaged status in one or more census tracts in Salt Lake County include the following:

[41] As determined by the Climate and Economic Justice Screening Tool, https://www.arcgis.com/home/item.html?id=b82df3b058204ccea64619efcd8065d2#.

- Projected wildfire risk
- Projected flood risk
- Expected population loss rate from natural hazards
- Asthma
- Low life expectancy
- Formerly used defense sites
- Proximity to hazardous waste facilities
- Proximity to risk management plan facilities
- Proximity to Superfund sites
- Underground storage tanks and releases
- Toxic concentrations in wastewater discharge
- Diesel particulate matter exposure
- Traffic proximity and volume
- Historic underinvestment in home loans
- Housing cost
- Lack of green space
- Homes containing lead paint
- Linguistic isolation
- Percentage of people with less than a high school diploma
- Low median income (comparison of median income in the tract to median incomes in the area)
- Low income (household income is less than or equal to twice the federal poverty level)

Avalanche

Hazard Description

A snow avalanche is the rapid downslope movement of a mass of snow, ice, and debris. Snow avalanches occur in the mountains of Utah during the winter and spring due to snow accumulation and unstable snowpack conditions. Avalanches can be extremely destructive due to the forceful energy of rapidly moving snow and debris and the resulting burial of areas in run-out zones. Avalanches can damage property, interrupt communication, and block transportation routes and streams. They often lead to injury and death, causing more fatalities than any other natural hazard in Utah. Over the past 25 years, an average of four people have been killed by avalanches in the state each year.

Although most avalanches occur in undeveloped areas, recreational endeavors—hiking, hunting, mountain climbing, skiing, snowboarding, snowmobiling, and other wintertime activities—bring the population into avalanche-prone areas. Due to the immense popularity of these activities, avalanches are actively mitigated in well-traveled areas. People venturing into the backcountry are at higher risk. Homes and businesses along the foothills and in mountain areas have been damaged by avalanches. Avalanches can occur naturally or be triggered artificially by explosives or people, such as snowmobilers, backcountry skiers, or other outdoor recreationists. The weather and terrain are two main natural factors that affect avalanche activity.

Weather events create a layered snowpack. When strong layers or slabs of snow form on top of weak layers, the snowpack can become unstable. The amount of snow, accumulation rate, wind speed, direction, moisture content, and snow crystal type all contribute to snowpack stability conditions. Most natural avalanches occur during or within 24 hours after a storm. In Utah, the avalanche potential is greatest from December through April.

Terrain factors affecting avalanches include slope angle, elevation, aspect, shape, and roughness. The slope angle is the primary factor influencing avalanche probability, with most occurring between 30 and 45 degrees (the optimum angles). The elevation and aspect dictate the depth, temperature, and moisture characteristics of the snowpack. The slope shape and roughness contribute to stability. For example, bowl-shaped slopes are more prone to avalanches than ridges. Boulders, shrubs, and trees contribute to the roughness of the slope and provide some stability.

Types of avalanches include wet and dry slab. Wet-slab avalanches occur most often on south-facing slopes in warming conditions. Dry slab avalanches occur mostly on north-facing slopes in mid-winter. Wind can accelerate snow deposition, leading to larger or more frequent avalanches. The two primary factors impacting avalanche activity are weather and terrain. Large, frequent storms deposit snow on steep slopes, creating avalanche hazards. Other factors that contribute to slope stability are the amount of snow, accumulation rate, moisture content, wind speed and direction, and type of snow crystals.

Avalanche paths may not experience a serious avalanche for years or even decades, but the potential remains, especially during above-average snowfall years. In Utah, 100 avalanche deaths occurred from 1958 to 2022. By comparison, there have been 61 deaths from lightning since 1950.

Topography also plays a vital role in avalanche dynamics. As shown in Figure 47 and as reported by the Utah Avalanche Center (UAC), slope angles between 30 and 45 degrees are optimal for avalanches. The risk of avalanches declines on slope angles below 30 degrees. At 50 or more degrees, they tend to produce sluff or loose snow avalanches that account for only a small percentage of avalanche deaths and property damage annually.[42]

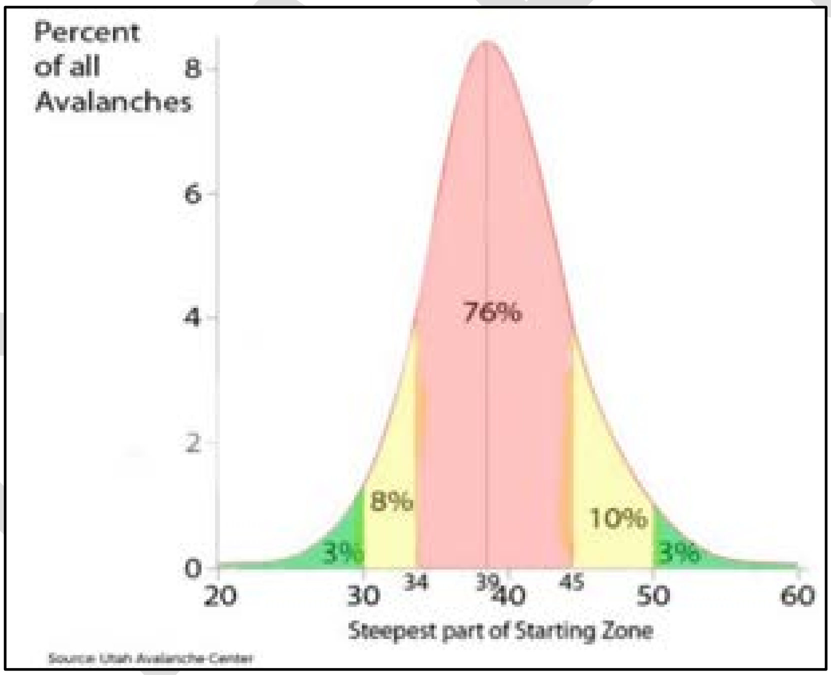


Figure 47: Factors Impacting Avalanche Activity[43]

[42] Ibid.
[43] Utah Avalanche Center, Utah Hazard Mitigation Plan. "Avalanche." 2024. https://hazards.utah.gov/avalanche/.

Hazard Profile

Potential Impact			Probability		
		Catastrophic		X	Highly Likely
		Critical			Likely
	X	Limited			Occasional
		Negligible			Unlikely
Location	Occur in localized areas in canyons and foothills, primarily in the canyons of the Wasatch Mountains				
Seasonal Conditions	Winter, spring				
Conditions	Vary based on weather conditions, slope, aspect, and landform				
Duration	Initial impact seconds, possibly days, if avalanche impacts roads or structures				
Secondary Hazards	Traffic restrictions and limited access to and from canyon communities could disrupt emergency services in the canyon, mutual aid response to or from the canyon, or EMS transport out of the canyon				
Analysis Used	National Weather Service, Utah Avalanche Center, Utah Division of Emergency Management, local input, and review of historic events and scientific records				

Magnitude/Extent

Internationally, there is no standard method of evaluating avalanche size and magnitude. Different scales that have been proposed use various measures, such as the volume of snow transported relative to the avalanche path, potential or kinetic energy, deposit depth, or measures of other observable factors, such as the mass of the avalanche or water content of the debris.

Although all avalanche classification systems developed thus far have drawbacks, the Canadian system provides a compromise among the alternatives and is a practical tool for communication among most parties regarding avalanche magnitude.

Table 22: Canadian Snow Avalanche Size Classification System and Typical Factors[44]

Size	Description	Typical Mass (Tons "t")	Typical Path Length (Meters "m")	Typical Impact Pressure (Kilo-pascals "kPa")
5	Largest snow avalanches known; could destroy a village or a forest of 40 hectares	10^5	3000	1000
4	Could destroy a railway car, large truck, several buildings, or a forest with an area of up to 4 hectares (40,000 m^2)	10^4	2000	500
3	Could bury a car, destroy a small building, or break a few trees	10^3	1000	100
2	Could bury, injure, or kill a person	10^2	100	10

[44] Canadian Snow and Avalanche Center. "Snow and Avalanche Glossary." 2023. https://www.avalanche-center.org/Education/glossary/avalanche-size.php.

Size	Description	Typical Mass (Tons "t")	Typical Path Length (Meters "m")	Typical Impact Pressure (Kilo-pascals "kPa")
1	Relatively harmless to people	<10	10	1

The North American Public Avalanche Danger Scale is another tool forecasters use to communicate the potential for avalanches to cause harm or injury to backcountry travelers.

Table 23: North American Public Avalanche Danger Scale[45]

Danger Level	Travel Advice	Likelihood of Avalanche	Avalanche Size and Distribution
5 – Extreme	**Extraordinarily dangerous conditions.** Avoid all avalanche terrain.	Natural and human-triggered avalanches certain.	Very large avalanches in many areas.
4 – High	**Very dangerous avalanche conditions.** Travel in avalanche terrain not recommended.	Natural avalanches likely; human-triggered avalanches very likely.	Large avalanches in many areas, or very large avalanches in specific areas.
3 – Considerable	**Dangerous avalanche conditions.** Careful snowpack evaluation, cautious route-finding, and conservative decision-making is essential.	Natural avalanches possible; human-triggered avalanches likely.	Small avalanches in many areas; or large avalanches in specific areas; or very large avalanches in isolated areas.
2 – Moderate	**Heightened avalanche conditions on specific terrain features.** Evaluate snow and terrain carefully; identify features of concern.	Natural avalanches unlikely; human-triggered avalanches possible.	Small avalanches in specific areas or large avalanches in isolated areas.
1 – Low	**Generally safe avalanche conditions.** Watch for unstable snow on isolated terrain features.	Natural and human-triggered avalanches unlikely.	Small avalanches in isolated areas or extreme terrain.

The UAC forecasts include the overall danger rating using the scale in Table 23 and a "Danger Rose" (Figure 48), which provides additional information on avalanche danger based on aspect and elevation. This tool is used to inform the public, particularly outdoor recreationists, regarding avalanche danger.

[45] Avalanche.org. "North American Public Avalanche Danger Scale." 2010. https://avalanche.org/wp-content/uploads/2018/08/10_ISSW_Statham_etal_DangerScale.pdf.

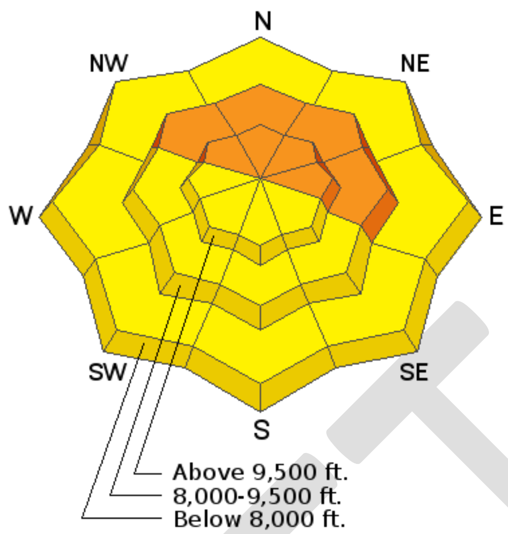


Figure 48: Avalanche Danger Rose[46]

Location

The risk of avalanches in Salt Lake County exists primarily in the Wasatch Range mountains—due to their high use for recreation and increasing development—although avalanches occur throughout Utah's mountainous areas. Avalanche risk in Salt Lake County is centered around the Big and Little Cottonwood Canyons. The town of Alta and the town of Brighton are especially at risk from the impacts of avalanches. The following maps from the UAC show the locations of known avalanche paths (Figure 49), and all reported avalanche events from 2009 to 2024 and the locations of all reported avalanche fatalities in the Salt Lake County Region (Figure 50).

[46] Utah Avalanche Center. "Danger Rose Tutorial." https://utahavalanchecenter.org/danger-rose-tutorial#:~:text=Avalanche%20Danger%20Rose%20We%20designed,make%20it%20easier%20to%20visualize.

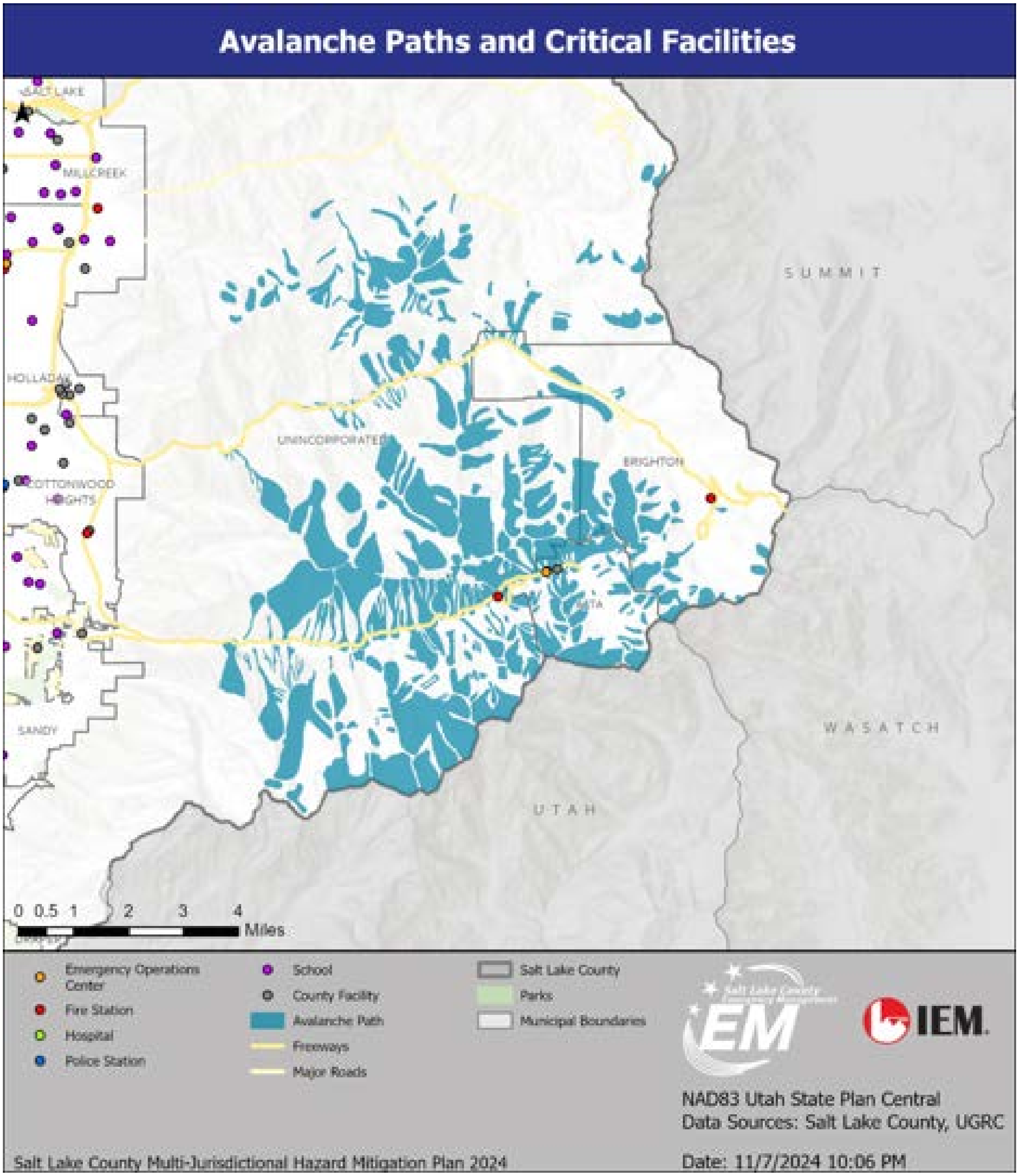


Figure 49: Historical Avalanche Paths in Salt Lake County

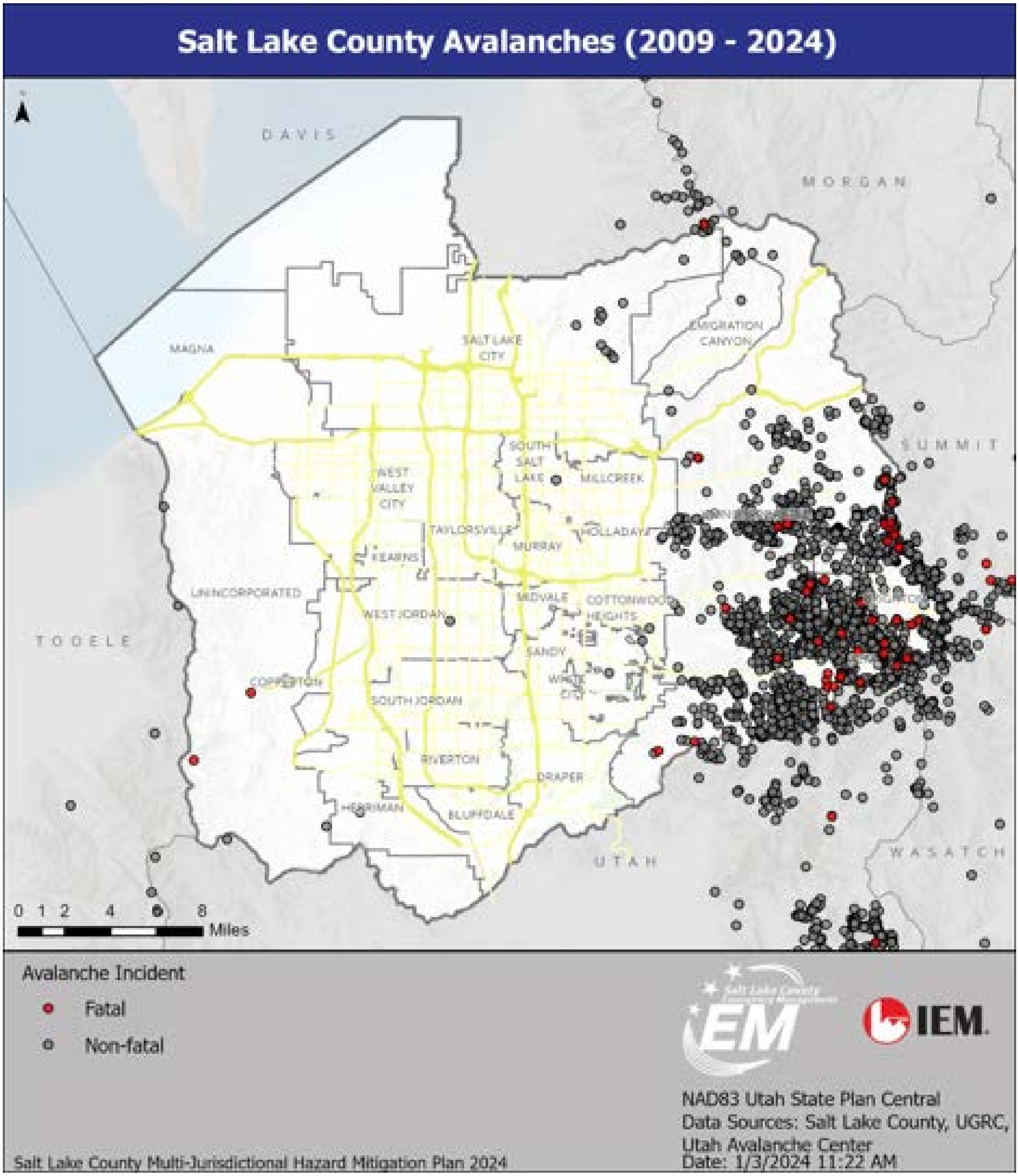


Figure 50: Locations of Avalanche Fatalities in and near Salt Lake County

Highway 210 in Little Cottonwood Canyon has the highest avalanche hazard-rating index of any major roadway in the country. When the Utah Department of Transportation (UDOT) and the town of Alta's Marshal agree that conditions are unsafe, the town goes into an Interlodge Alert. All occupants (including visitors and residents) must remain indoors until conditions are deemed safe. During large storm cycles, an Interlodge Alert can last days until the storm cycle is over and proper avalanche control work has been performed.

The town's General Plan (dated November 2005, Updated 2013) covers Highway 210 access and possible mitigation activities to keep this critical road open. It also provides background on the Little Cottonwood Canyon Road Committee, a group consisting of representatives from Alta, Snowbird, Salt Lake County (including the Unified Fire Authority), UDOT, Utah Transit Authority (UTA), and U.S. Forest Service (USFS). It meets monthly to discuss access, use, and safety and security issues related to the canyon road.

The town of Brighton can also be affected by avalanche. Highway 190 could be deemed impassable due to avalanche or closed during UDOT avalanche control operations. Residents and skiers may become isolated from the rest of the county.

UDOT is responsible for managing the threat of avalanches on Utah's state and federal highways. The average daily traffic in Big and Little Cottonwood Canyons frequently exceeds the capacity of those roads, and slow-moving traffic conditions pose a significant threat to public safety if avalanche conditions are present. To address these safety concerns, the UDOT Avalanche Safety Plan establishes a process to develop avalanche hazard forecasts, conduct avalanche control and stability evaluations, and perform avalanche rescue.[47] When conditions are met, UDOT coordinates with the Unified Police Department (UPD) and the town of Alta to implement backcountry access closures where avalanche control work is planned. Following the complete evacuation of avalanche control areas, UDOT uses explosives and artillery to trigger avalanches that threaten public roads. Previously, UDOT used howitzers for avalanche control. In an effort to reduce the amount of artillery fired in the canyon and to enhance safety and efficiency, UDOT has installed remote-controlled avalanche mitigation equipment in Little Cottonwood Canyon. The Remote Avalanche Control System (RACS) uses wireless communications to Wyssen Avalanche Towers that deploy explosive charges that hang just over the ground to trigger an avalanche. These towers were expected to be operational for the 2024/2025 winter season.[48] Additional details on these procedures, maps of known avalanche paths, staging areas, and other details are available in the Safety Plan. Road and backcountry closures are announced on UDOT's Avalanche Safety webpage (see Figure 51) and social media sites.[49] Further details on backcountry closure zones are detailed in the Avalanche Safety Backcountry Policy, as shown in Figure 52.[50]

[47] UDOT. "Highway Avalanche Safety Plan for Big and Little Cottonwood Canyon." 2012. https://drive.google.com/file/d/1j-haYETjb3g2-xNq8qKetTDkT4OMuM4w/view.
[48] UDOT. "Mount Superior Avalanche Mitigation Project." https://udotinput.utah.gov/j0248.
[49] UDOT. "Avalanche Safety." https://udot.utah.gov/connect/current-conditions/avalanche/.
[50] UDOT. "Avalanche Safety Backcountry Closure Policy." http://www.udot.utah.gov/avalanche.

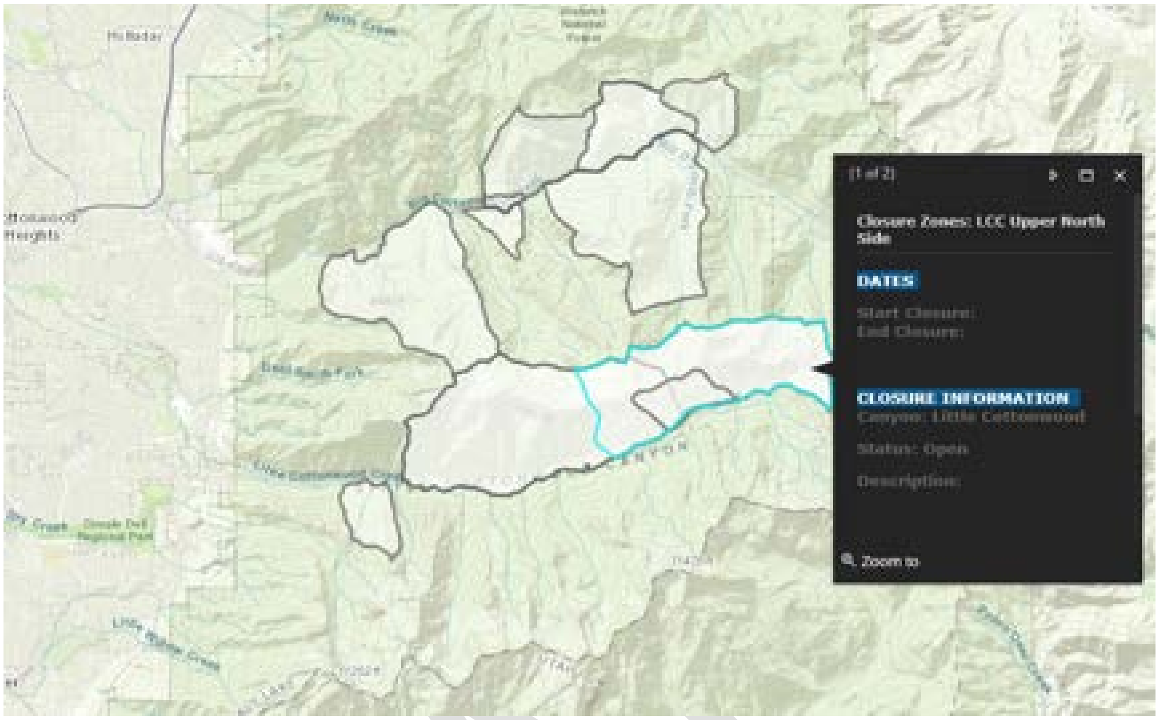


Figure 51: Utah Department of Transportation Backcountry Closure Areas

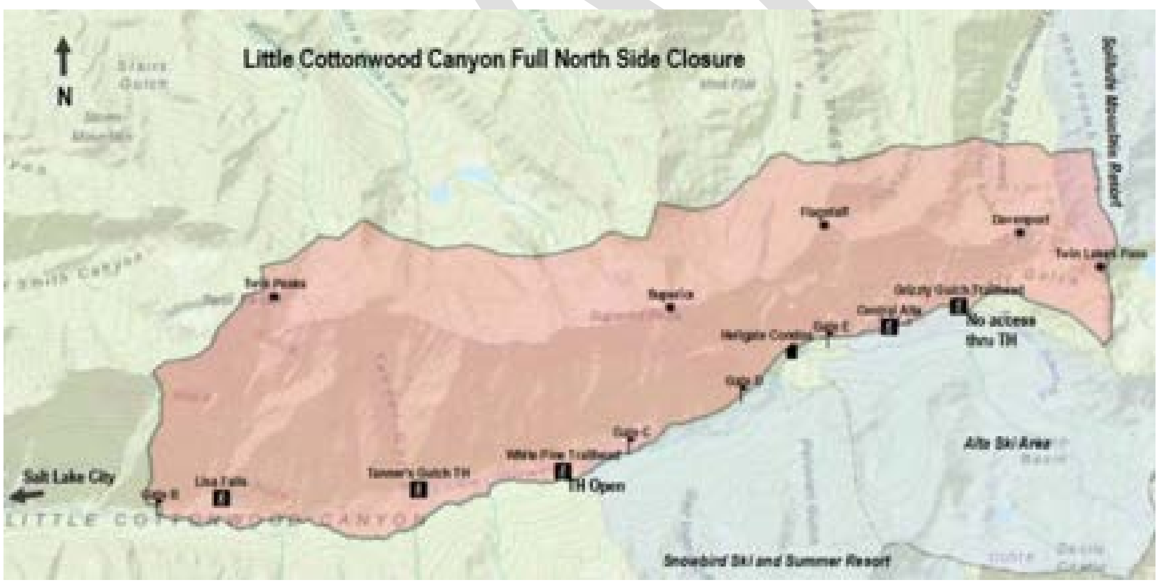


Figure 52: Example of Backcountry Closure Area[51]

Historical Events and Probability of Future Occurrences

Since January 1, 2019, the Salt Lake region has had over 2,400 avalanches. Avalanches are one of the deadliest types of natural disasters in Utah. According to the database of the National Centers for Environmental Information (NCEI) at the National Oceanic and Atmospheric Administration (NOAA),

[51] Ibid.

avalanches caused 128 deaths in the state between 1996 and 2022, accounting for 70% of severe weather-related deaths.[52]

According to data from the UAC, there have been 51 injuries and 57 deaths in the Salt Lake County region from all recorded avalanches since 1965. From 2009 to 2018, the region had approximately 2,151 reported avalanches, averaging approximately 215 reported events per year. According to NOAA, from 1996 to 2018, there have been only two events with significant recorded property damage, totaling $70,000.

According to FEMA, Disaster Declarations for States and Counties there were no Federally declared avalanche disasters from 01/01/2019 through 06/03/2025.[53] In addition, no state declarations have been made for the state of Utah due to an avalanche.[54]

On Thursday, May 9, 2024, two men died in an avalanche in the Big Willow drainage of the Wasatch Mountains. A group of 3 men were hiking toward Lone Peak following a significant, late-season storm. The avalanche broke around the lead hiker, who was partially buried but could dig himself out. The other two hikers were completely buried. The friend used a transceiver to locate the other two and worked to unbury them, but neither survived.

On Monday, April 17, 2023, a man died after being buried by a roof avalanche outside a cabin in the town of Brighton. It is believed he was attempting to clear or remove snow from the roof when the avalanche occurred. The following day, the UPD found him partially buried after they were called to perform a welfare check when the man failed to show up for work.

On Monday, March 27, 2023, a group of six snowmobile riders were recreating in Pole Canyon in the Oquirrh Mountains. Four left to return home while the other two continued toward the top of Flat Top mountain. An avalanche occurred while the two who had remained were descending. One could ride safely out of the path and the other was buried. The man called the rest of his party, contacted search and rescue, and began searching for his companion. He was eventually found deceased. It was noted that the UAC does not forecast avalanche conditions for the Oquirrh Mountains and has minimal data for that range.

On February 6, 2021, eight people in two groups went skiing in the Wilson Glades area, beginning at the Butler Fork Trailhead in Big Cottonwood Canyon. The two groups were ascending when the avalanche was triggered. Six people were caught and fully buried. Two survived, while the other four did not.

On January 21, 2016, a group of skiers were skiing along Gobblers Knob between Big Cottonwood and Millcreek Canyons. An avalanche, about 600 feet wide, was triggered, and two of the skiers were caught. One skier was partially buried and sustained minor injuries. The other skier, a 49-year-old male, was killed after being fully buried by the avalanche.

[52] “Avalanche.” Utah Hazard Mitigation Plan. 2024. https://hazards.utah.gov/avalanche/.
[53] FEMA, Disaster Declarations for States and Counties.” https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties.
[54] Utah Department of Public Safety, “Utah Disaster History.” https://dem.utah.gov/utah-disaster-history/.

On March 14, 1998, Little Cottonwood Canyon had 6 avalanches. Vehicles were swept from the road, causing injuries to 5 people and $50,000 in property damage.

In 1983, a large avalanche completely covered Highway 210, buried several automobiles, and wiped out the first floor of the Peruvian Lodge. A Salt Lake City motorist was seriously injured in a 1998 avalanche in Little Cottonwood Canyon.

The number and severity of avalanches each year depend on many factors, such as previous snow conditions, amount of new snowfall, wind speeds, wind direction, snow density, and avalanche control work success, mostly occurring in the Wasatch Mountain range. It is reasonable to expect that avalanche occurrence frequency will continue to be in line with past events. Based on the average of 215 events occurring annually, the probability of future events is highly likely.

Table 24: Avalanche Fatalities in Salt Lake County, 2019–2023[55]

Date	Deaths	Region	Place	Trigger
12/15/2019	1	Salt Lake County	Dutch Draw	Snowboarder
01/08/2021	1	Salt Lake County	Dutch Draw	Skier
01/30/2021	1	Salt Lake County	Squaretop	Skier
02/06/2021	4	Salt Lake County	Wilson Glade	Skier
03/27/2023	1	Salt Lake County	Pole Canyon	Snowmobiler
04/17/2023	1	Salt Lake County	Brighton	Unknown
05/09/2024	2	Salt Lake County	Big Willow	Skier

Climate Change Considerations

The Utah State 2024 Hazard Mitigation Plan states that climate change will affect avalanche risk in Utah. Projections for higher temperatures suggest that the snowline will move to higher elevations, leaving less snow cover at lower elevations. As the snow cover declines, the spatial extent of possible avalanches will decline. The risk of impacts on roads and infrastructure will decline as the spatial extent declines. However, wintertime backcountry enthusiasts may follow the snowpack, and exposure may persist. The relationship between changing snowpack and avalanche deaths and injuries is likely complex.[56]

Climate change can have a significant impact on the natural hazard of avalanches related to the amount or timing of snowfall events and the variability in temperatures. Snowpack can become less stable leading to an increase in frequency and intensity of avalanches as global temperatures increase. Melting and refreezing of snowpack can cause weaker layers that are prone to collapse while more intense and frequent weather events, such as heavy snow followed by rapid warming can trigger avalanches in the Wasatch Mountains. The changing climate could cause a shorter and more variable snow season which can lead to a higher likelihood of avalanches occurring outside the traditional winter months posing new

[55] Utah Hazard Mitigation. “Avalanche Fatalities 2019–2023.” Utah Avalanche Center. 2024. https://hazards.utah.gov/avalanche/.
[56] Utah Hazard Mitigation. “Climate Change Considerations.” Utah Avalanche Center. 2024. https://hazards.utah.gov/avalanche/.

challenges for communities on and around the Wasatch Mountains. Recreationists may not be accustomed to these changing conditions or may feel safer after higher temperatures and underestimate the avalanche risk.

Secondary Hazards

Avalanches tend to be localized events causing immediate injury or death but do not have secondary impacts affecting the rest of the county. Nonetheless, avalanche events can damage roadways and other transportation infrastructure, producing traffic restrictions and restricting access of essential and critical emergency services delivery for canyon communities. Radio or other communications towers could also be damaged. In addition, large avalanches can disrupt vegetation and soils along waterways, which can negatively impact the watershed.

Vulnerability Assessment

As previously mentioned, avalanche risk in Salt Lake County is primarily found in the Wasatch Mountains, particularly in Big and Little Cottonwood Canyons. The town of Alta and town of Brighton are particularly at risk. State Highway 210 follows Little Cottonwood Creek for the length of Little Cottonwood Canyon and serves as the primary access route to the town. Culvert blockages, bank erosion, landslides, and avalanches can all close the town's only arterial connection with the rest of the county. Although the town of Alta only has a population of 225,[57] it has a significant, fluctuating tourist population due to ski resorts and other mountain recreation sites, which would be greatly impacted if an avalanche blocks Highway 210. Resorts saw a record 7.1 million skier visits in the 2022–2023 season. Figure 53 illustrates the increase in ski recreation in the state in recent years. 44% of those skier days are from Utah residents, but the remainder are from outside the area.

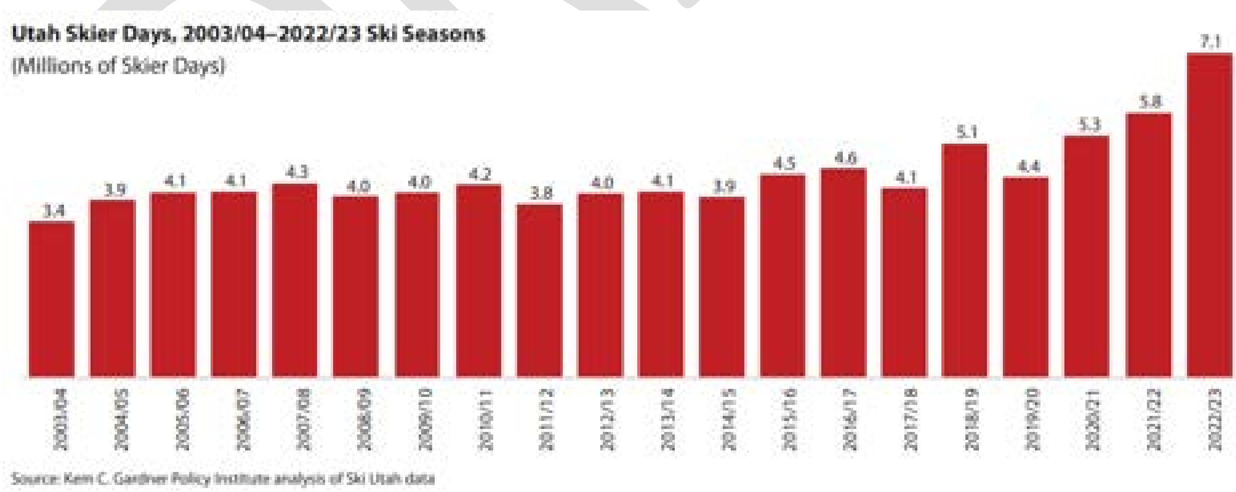


Figure 53: Skier Days in Utah, 2003–2023[58]

[57] World Population Review. Alta, Utah Population. 2024. https://worldpopulationreview.com/us-cities/utah/alta.
[58] Kem C. Gardner Policy Institute. The University of Utah. The Economic Contributions of Utah's Ski Industry. Fact Sheet, April 2024. https://d36oiwf74r1rap.cloudfront.net/wp-content/uploads/2024/05/Ski-Industry-FS-May2024.pdf.

According to the 2019 Utah State Hazard Mitigation Plan, the following 95 structures are vulnerable to avalanche events: 56 commercial, 38 residential, and 1 government with a value of $57,700,210.

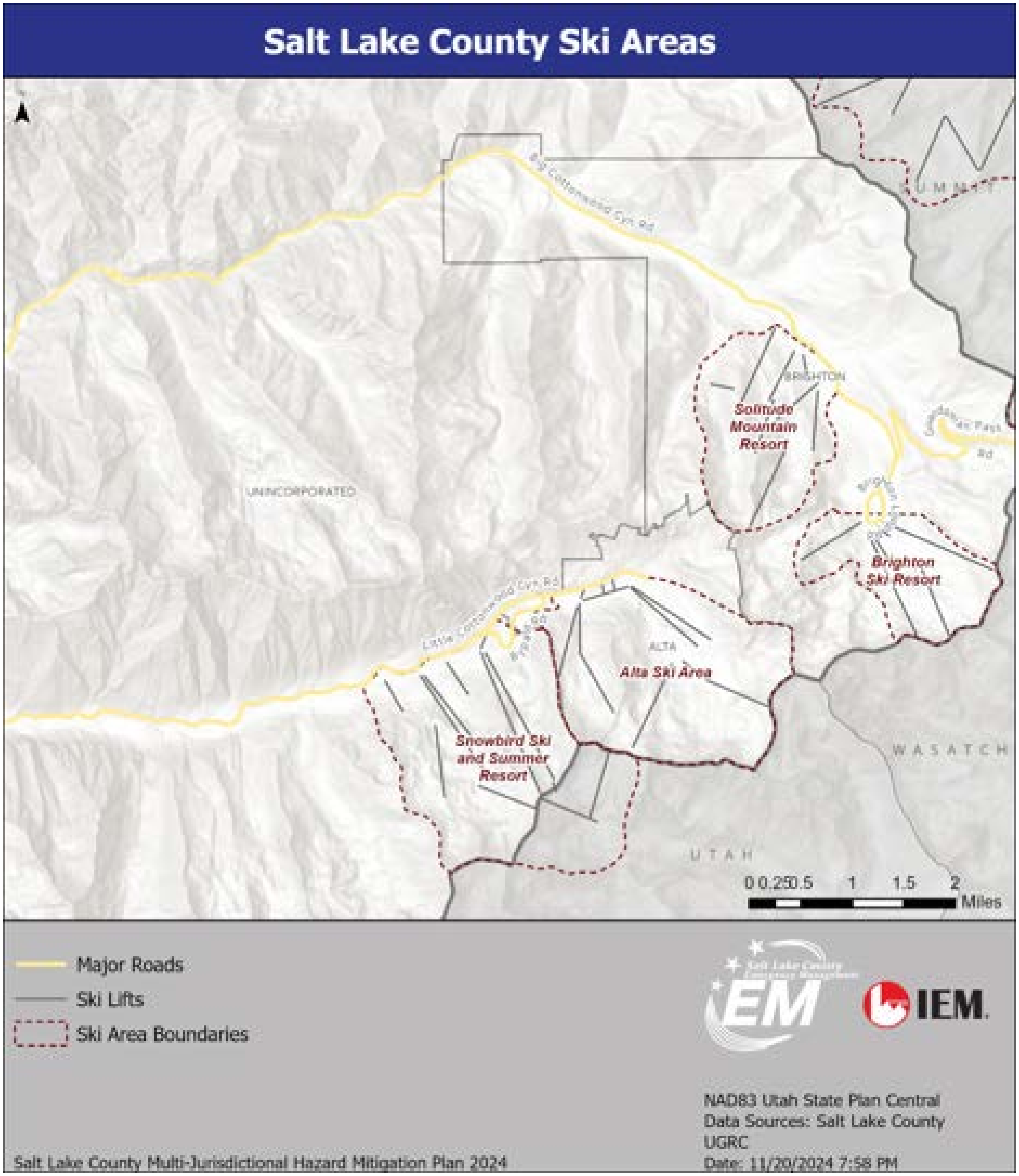


Figure 54: Ski Resort Infrastructure in Salt Lake County

ESTIMATED IMPACTS AND POTENTIAL LOSSES

In Salt Lake County, avalanche risks are concentrated in the Wasatch Mountains and more specifically in Big and Little Cottonwood Canyons. The towns of Alta and Brighton are especially vulnerable due to their geographic locations and routes to access the towns. The influx of tourists, especially during ski season, heightens the impacts avalanches have on human lives and the local economy. Population trends can significantly impact avalanche risks, as an increased population can lead to more people in mountainous areas for recreation or residence. An increased population density in mountainous areas leads to more infrastructure, such as roads and buildings, which can be impacted by avalanches. This increase in population density coupled with tourists and seasonal residents can strain local emergency response systems. The changes in land use due to development can also alter avalanche paths and potentially increase the risk to human life and property.

The most direct impacts on the populations in these avalanche prone areas is the risk of injury or death if caught in an avalanche. Structures in Big and Little Cottonwood Canyon could be damaged or destroyed by an avalanche. Transportation routes have been closed and damaged by avalanches in the past and will likely be impacted in the future. Road closures isolate people in the upper part of the canyons from emergency services and other resources they might typically access in the valley communities. It may also impede people from traveling to or from work. Avalanches can also impact services the community depends on, including communications towers, power distribution, and water systems in canyon areas. Furthermore, damage to facilities or road closures can have significant economic impacts on businesses dependent on winter recreation.

The National Risk Index (NRI) includes data on the expected annual losses (EALs) from individual natural hazards, historical loss, and overall risk at a county and Census tract level. Salt Lake County's EAL value due to avalanches is $2 million, with a risk score of 96.6 and a rating of Very High compared with the rest of the United States (Figure 55).

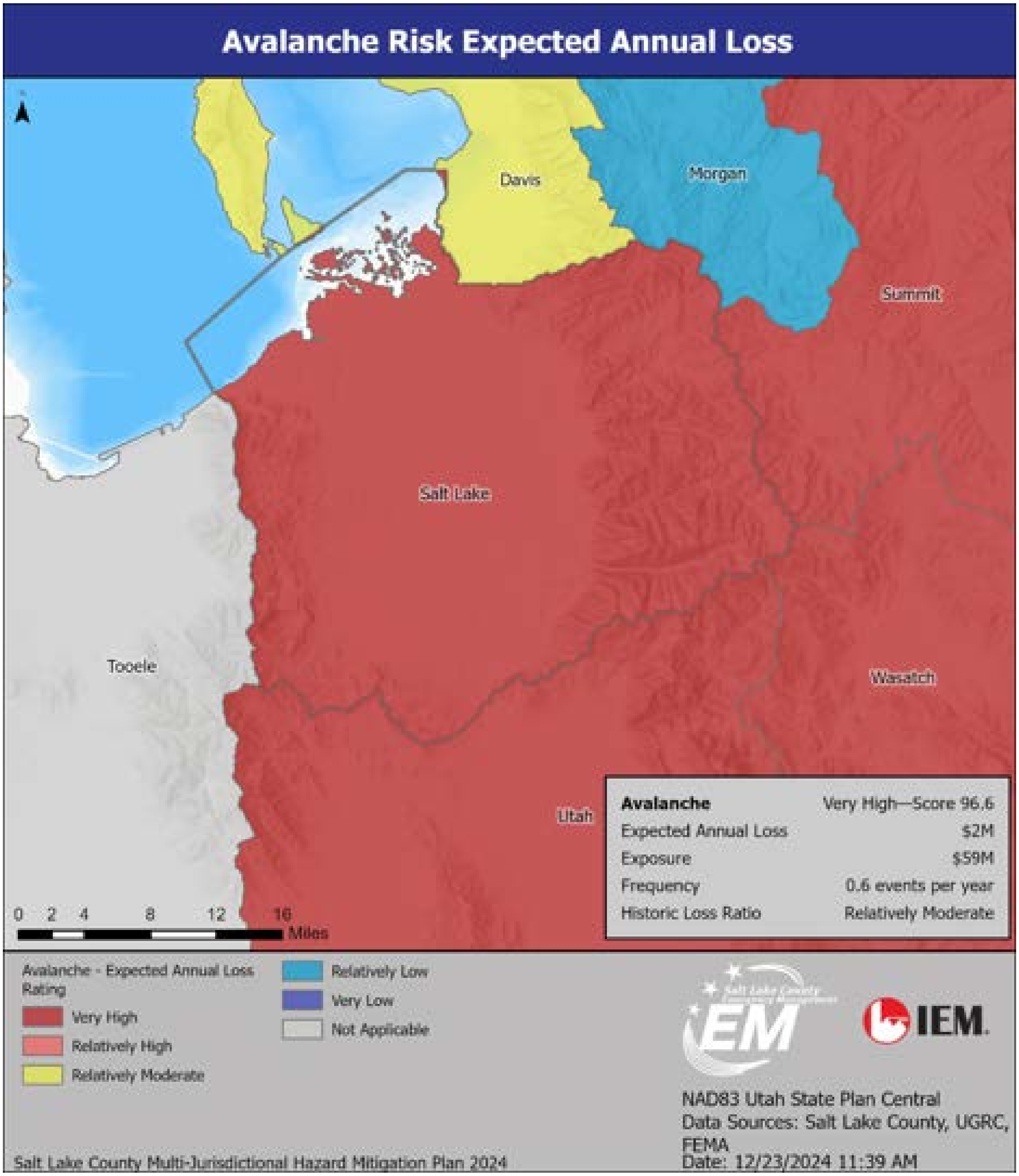


Figure 55: Expected Annual Loss from Avalanche in Salt Lake County[59]

[59] FEMA, National Risk Index. "Salt Lake County Expected Annual Loss Avalanche Risk Score, Map and Legend." https://hazards.fema.gov/nri/map.

VULNERABLE POPULATIONS

The Utah State 2024 Hazard Mitigation Plan states that victims of avalanche hazards are primarily backcountry skiing or snowmobile enthusiasts, who are often specially trained and equipped to avoid or survive the avalanche hazard and are typically undertaking a calculated risk of injury or death vs. the reward of fresh powder snow. However, outdoor recreation industries and destinations have seen significant increase in visitors since COVID-19. Those who are new to outdoor recreation might have less understanding or awareness of avalanche hazards and proper precautions.

Although ski towns, such as the town of Alta, might have a relatively small permanent population, they also often have significant, fluctuating tourist populations during the winter months, which increases the likelihood of population impacts. In addition, the American Institute for Avalanche Research and Education reports that 90 percent of avalanche victims die in slides triggered by themselves or a member of their group. Avalanche closures and mitigation in high-risk areas, such as Little Cottonwood Canyon are designed to limit risk to populations on roads and those staying at ski areas. Road closures can isolate these populations from critical support, including medical care, ambulances, food, fuel, and other supplies. Although the permanent residents in Alta and Brighton were not identified as vulnerable or underserved communities, tourists and other visitors to the canyon might have unique challenges. Visitors in the canyon may need to shelter in place during Interlodge Alert conditions with minimal resources. They might have few options for food, clothing, and shelter during Interlodge or canyon road closures. Some may not have access to their daily medications. Some could be visiting from other countries and may not speak English and might have difficulty understanding information regarding Interlodge Alerts or other safety information. The resorts and related businesses may also employ seasonal workers that might have limited access to resources, may live outside canyons, or have language barriers.

COMMUNITY LIFELINES

The main lifelines for avalanches are food, hydration, shelter, transportation, communications, and safety and security. A primary focus during times of high avalanche risk is ensuring that the safety of residents and recreationists. Emergency services provided by Unified Fire Authority and the town of Alta Marshal could be impeded by an avalanche. Road closures would prohibit transport of patients by EMS. Closures also may impede normal staffing/shift changes. Heavy snowfall and avalanches can damage communications equipment. During the 2022 season, communication to anyone outside the canyon was disrupted. Enforcement of Interlodge alerts and providing adequate food, hydration, and shelter for those in the affected area is a priority. During prolonged Interlodge conditions, food and water for people sheltering in the canyon may become scarce. Closure of roadways for avalanche control efforts when necessary, helps maintain the safety of motorists but limits egress and access to resources for those farther up the canyon.

CHANGES IN DEVELOPMENT

Although the residential populations of the town of Alta and the town of Brighton have not grown significantly, record numbers of visitors to the canyon ski resorts have been recorded since the last plan update, which totaled 6.75 million skier visits between Utah's 15 ski areas in the 2023–2024 ski season.[60] The increased volume of recreationists represents an overall increase in vulnerability. No significant developments are underway in the area most at risk of avalanche, but future development, such as changes to road infrastructure, expansion or re-routing of ski infrastructure, or other modifications to the landscape, could affect avalanche risk. In 2022, UDOT announced plans to construct a gondola from the base of Little Cottonwood Canyon to the Snowbird and Alta ski resort areas. The gondola is intended to alleviate traffic congestion and will operate in a separate alignment from the road. However, this development has been controversial, and many residents have protested the gondola. It is not yet clear how construction of the gondola may affect vulnerability to avalanche.

An increase in avalanche vulnerability can increase loss of life and property and negatively affect the reputation of the ski resort area. Climate changes could affect snow levels and might decrease tourism, and businesses may move out of those areas. In addition, people may move to a different area that is less prone to avalanches if the likelihood continues to increase. New Wyssen avalanche towers installed near Alta may increase effectiveness of avalanche mitigation,[61] possibly reducing potential impacts of avalanches. Overall, due to an increased volume of visitation to avalanche prone areas, vulnerability to avalanches has increased since the last plan update.

VULNERABILITY SCORE

To analyze Salt Lake County's vulnerability to avalanches, the NRI was used as a primary tool during the 2024 update. The NRI defines risk as the potential for negative impacts due to a natural hazard. It determines a community's risk relative to other communities by examining the EAL and social vulnerability in a given community in relation to its resilience. Salt Lake County's NRI Avalanche risk rating is shown in Figure 56. Salt Lake County has a Relatively High Avalanche risk and a risk score of 92.8.

[60] Stefanich, Logan. "Here's what's new at Utah's 15 ski resorts in what's anticipated to be another busy season." KSL.com. November 13, 2024. https://www.ksl.com/article/51189141/heres-whats-new-at-utahs-15-ski-resorts-in-whats-anticipated-to-be-another-busy-season.

[61] Wyssen Avalanche Towers Protect Alta Ski Area. https://www.wyssenavalanche.com/en/wyssen-avalanche-towers-protect-alta-ski-area/.

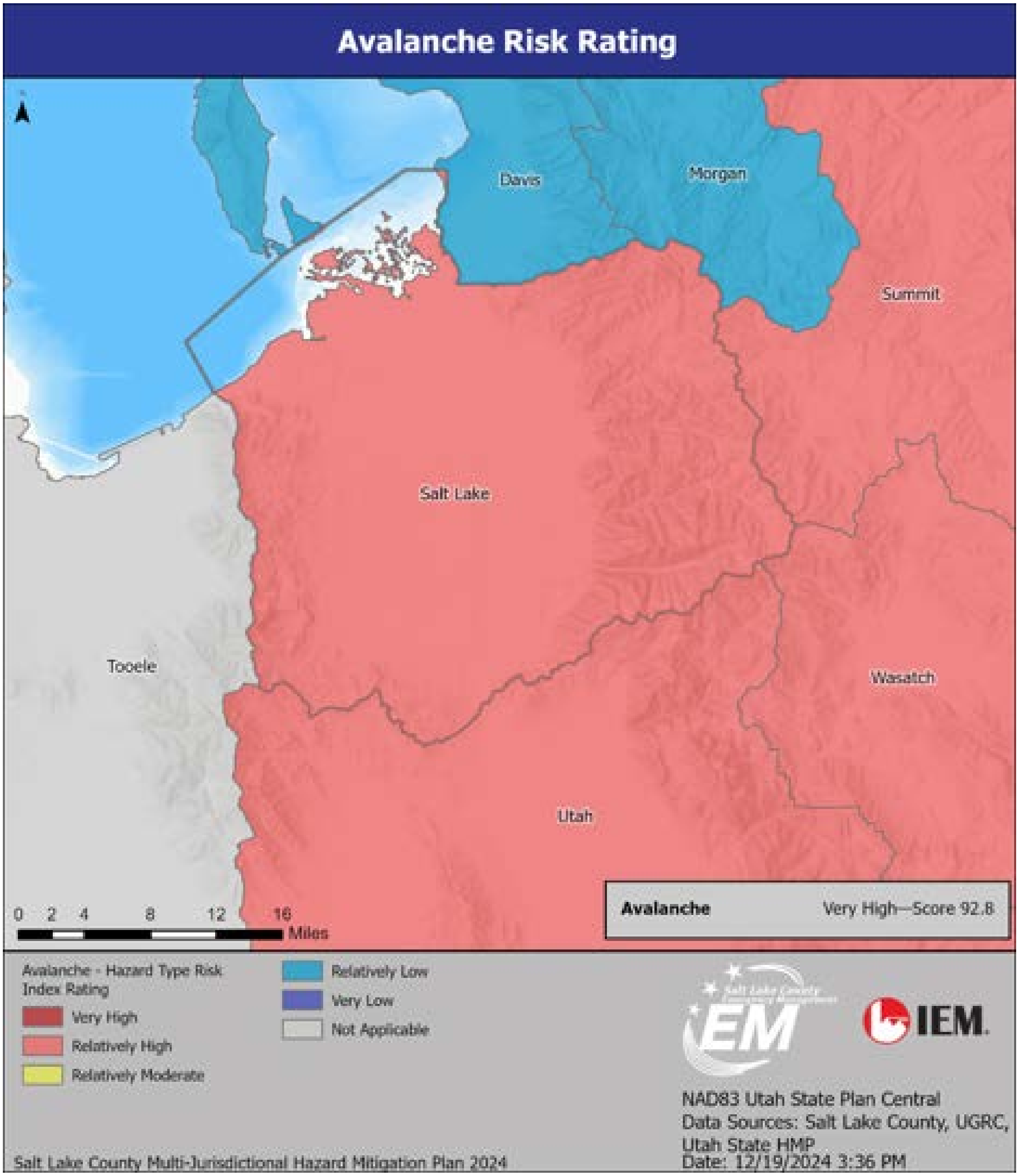


Figure 56: National Risk Index Avalanche Risk Map, Legend, and Score for Salt Lake County[62]

[62] FEMA, National Risk Index. "Salt Lake County Avalanche Score, Map and Legend." https://hazards.fema.gov/nri/map.

Dam Failure

Figure 57: Mountain Dell Dam[63]

Hazard Description

A dam is an artificial barrier that can store water, wastewater, or liquid-borne materials for many reasons—flood control, human water supply, irrigation, livestock water supply, energy generation, recreation, or pollution control.

Dams are usually human-made and, therefore, not inherently considered natural hazards; however, dam failures can occur because of natural events. The impacts of a dam failure can be like natural flood events, although they are often more sudden and violent than normal stream floods. Dam failure causes include breach from flooding, overtopping, ground shaking from earthquakes, settlement from liquefaction, slope failure, and slumping, internal erosion from piping, failure of foundations and abutments, outlet leaks or failures, and internal weakening caused by vegetation and rodents. Possible effects include flooding, silting, loss of water resources, and loss of property and life.

There are two types of dam failures: "rainy day" and "sunny day" failures. Rainy day failures occur because floodwaters overstress the dam, spillway, or outlet capacities. The floodwaters eventually flow over the top of the dam and erode the structure from the top down. The breach flows of the dam are added to the floodwaters from the rainstorm to produce a flood with a large proportion and destructive power. Sunny day failures are due to seepage and erosion inside the dam that removes fine material, creating a large void that can cause the dam to collapse or overtop and wash away. Sunny day failures

[63] https://www.wikiwand.com/en/articles/Mountain_Dell_Dam

can be the most dangerous because they can happen quickly without warning to owners or downstream residents.

Dam failures can also result from a combination of causes, including the following:

- Failure of upstream dams on the same waterway
- Improper maintenance
- Negligent operation
- Internal erosion caused by embankment or foundation leakage or piping, root growth, or rodent/wildlife activity
- Earthquake/seismic activity
- Prolonged periods of rainfall and flooding, which cause overtopping
- Improper design
- Inadequate spillway capacity resulting in excess overtopping flows
- Intentional structural attacks and cyberattacks

Hazard Profile

Potential Impact		Catastrophic	**Probability**		Highly Likely
	X	Critical			Likely
		Limited		X	Occasional
		Negligible			Unlikely
Location	Dams are located throughout the county, with most representing high and moderate hazards in the eastern and southern portions				
Seasonal Conditions	Rainy day failure: anytime Sunny day failure: spring and late summer				
Conditions	Rainy day failures happen mainly during heavy precipitation events and might have some warning time. By contrast, sunny day failures can happen anytime, without warning.				
Duration	Hours or days, depending on the spillway type and area, maximum cubic feet per second (cfs) discharge, overflow or breach type, and dam type				
Secondary Hazards	Raw sewage/health risks, electrical fires, and gas spills				
Analysis Used	Review of Bureau of Reclamation inundation maps and plans, Flood Insurance Study, and Utah Division of Water Rights				

Location

Salt Lake County Emergency Management (SLCo EM) provided data on dams from the Dam Safety Database Information Viewer maintained by the Utah Division of Water Rights.[64] Figure 59 shows the

[64] Utah Division of Water Rights. "Dam Safety Database Information Viewer." https://www.waterrights.utah.gov/cgi-bin/damview.exe?Startup.

location of all 72 dams in Salt Lake County. The county has 28 high-hazard, 34 significant-hazard, and 10 low-hazard dams (Figure 58), with an average age of 47 years.

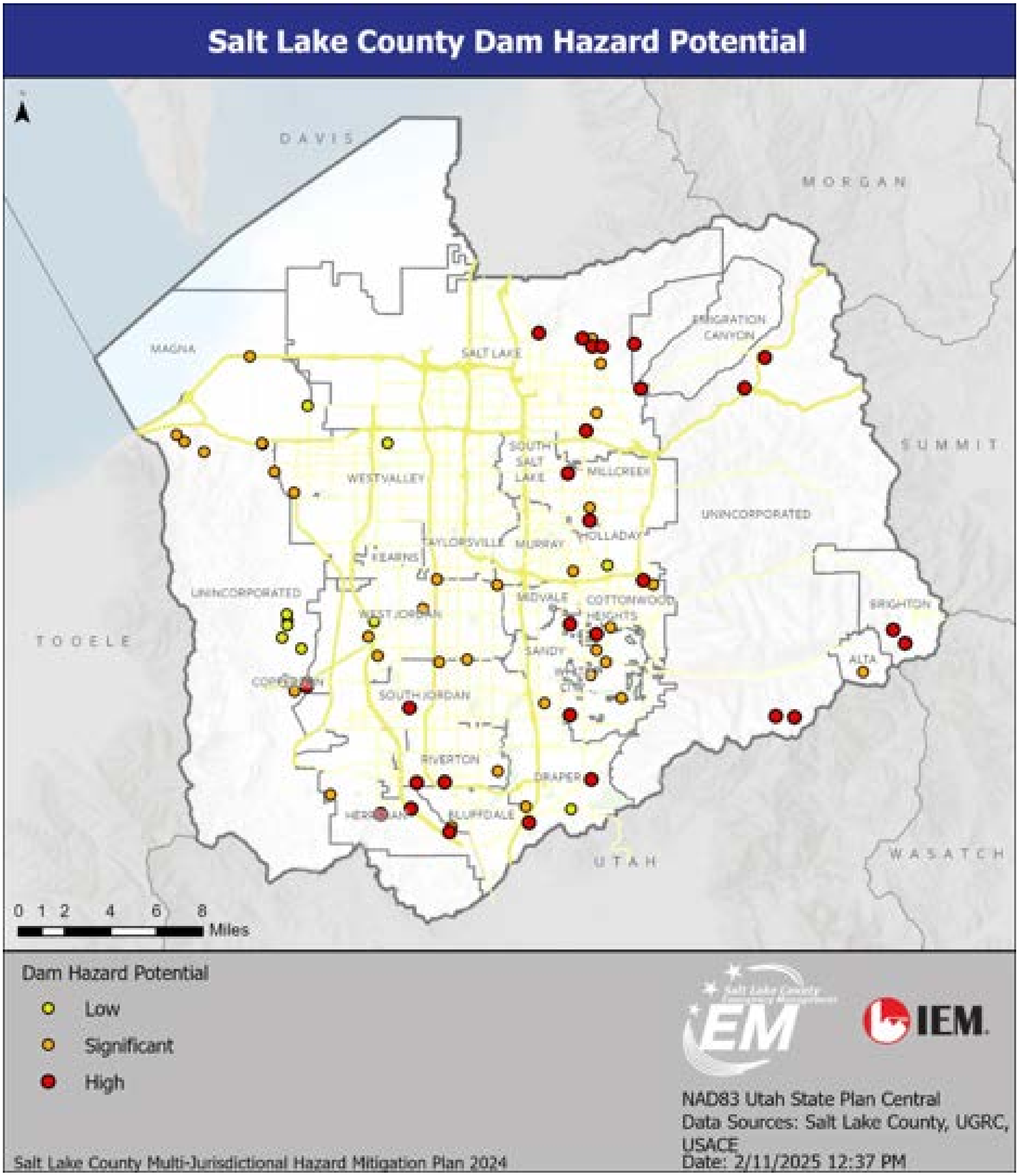


Figure 58: Location of Dams

Utah Division of Water Rights and Utah Geospatial Resource Center have mapped potential dam inundation areas for 32 high or significant hazard dams in Salt Lake County, shown in Figure 59. These map features were generated using cross sections to model how water would flow if a dam were to fail. Dam inundation areas have not been delineated for all dams, particularly significant and low hazard dams. Community planners have to infer where flood hazard areas exist downslope of dams.

Floods, earthquakes, ground shaking, surface faulting, and landslides all pose a concern for causing a dam incident. A special concern of dam safety is not only the safety of dams to the community but also the safety of dams themselves in case of other hazards or failures of upstream dams. A GIS overlay analysis of the 28 high-hazard dams and potential inundation areas was conducted and revealed that 14 dams are in the inundation areas of other dams (Figure 59).

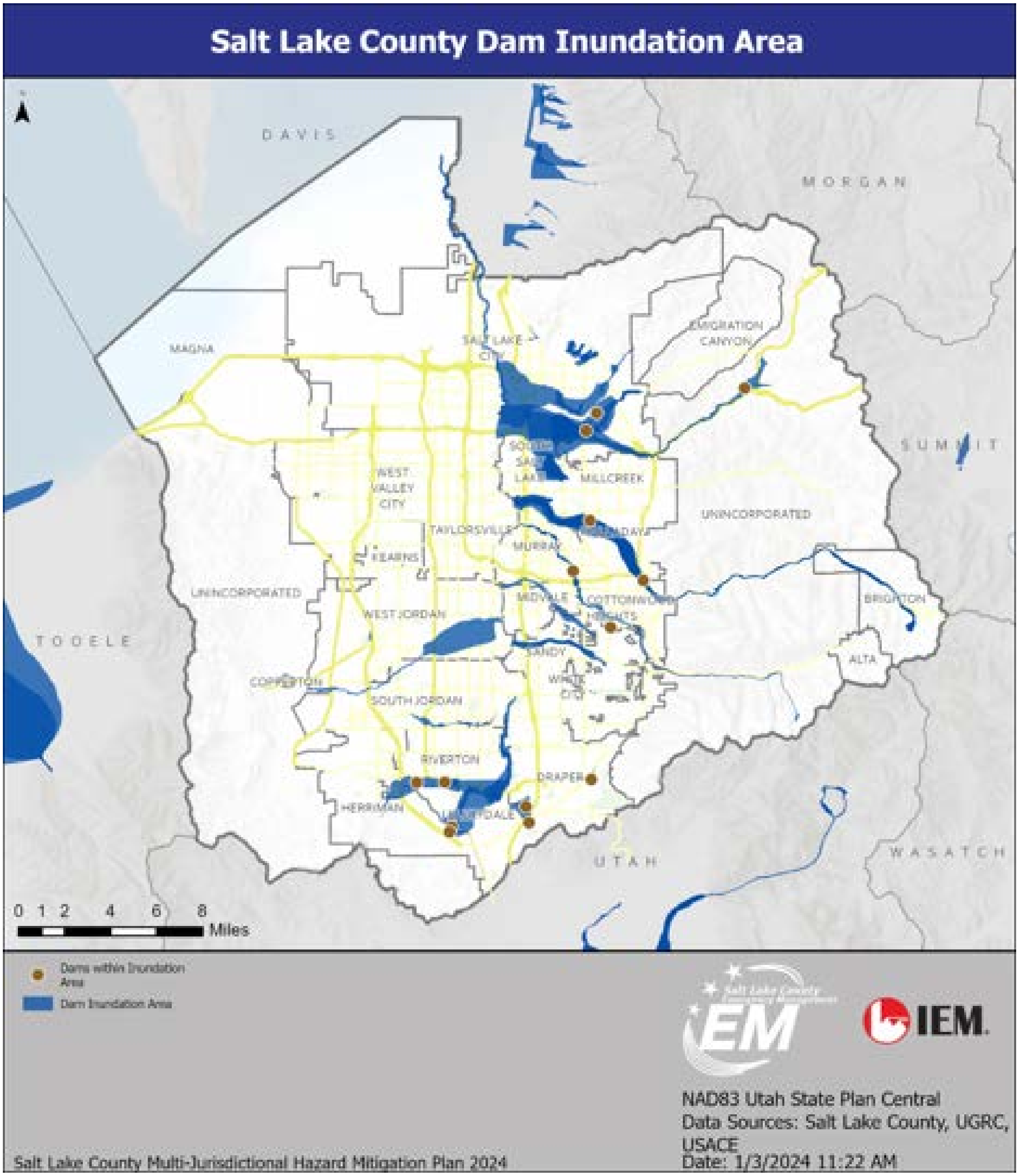


Figure 59: Dams in the Dam Inundation Area of Salt Lake County

Levees can experience failures under similar conditions to dam failures. Figure 60 shows the location of levees in Salt Lake County.

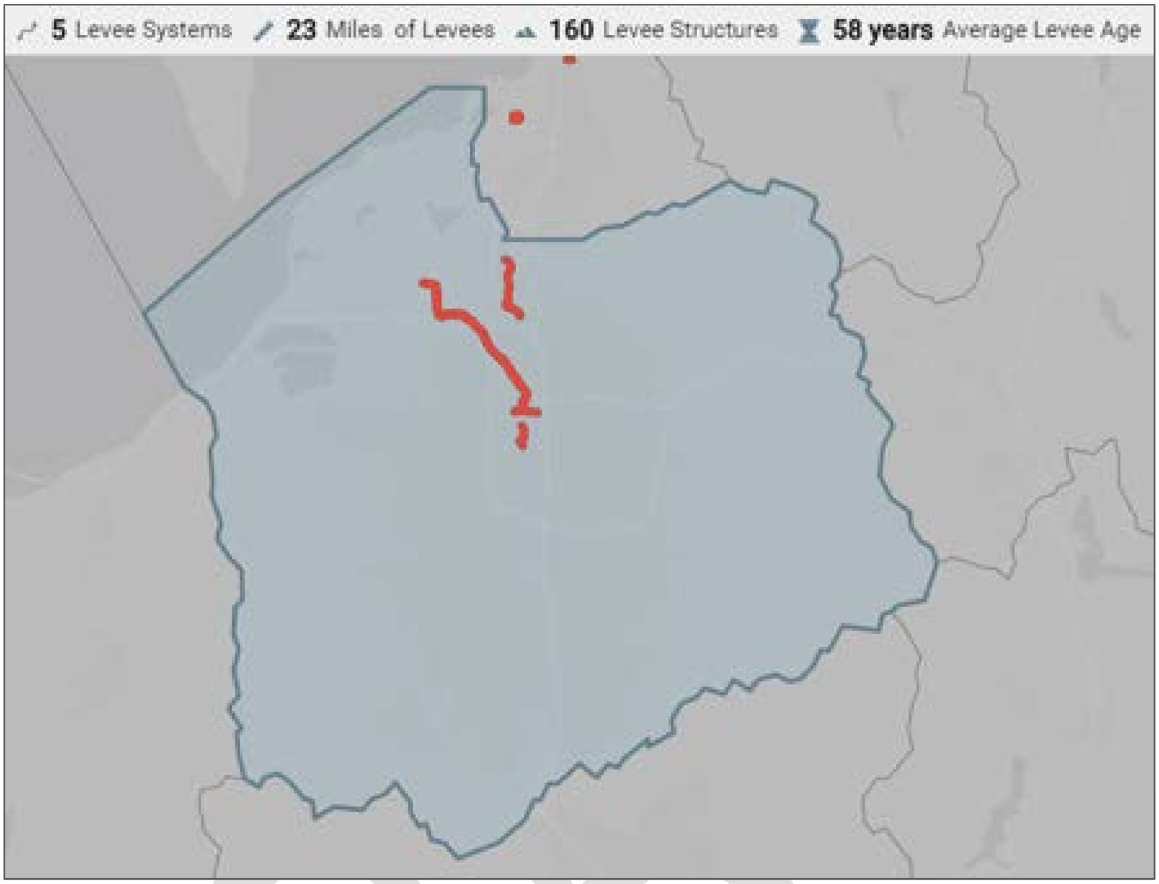


Figure 60: Levees in Salt Lake County[65]

Magnitude/Extent

The severity of a dam or levee failure depends on the area protected by the dam or levee, the volume and velocity of water that breaches the structure, and the structures and population in the protected area. A dam or levee breach will usually flood protected areas, generating impacts like those seen in areas in the floodplain and not generally protected by a levee. Table 25 provides dam failure classifications.

Table 25: Army Corps of Engineers Hazard Profile Classification

Hazard Category (a)	Direct Loss of Life (b)	Lifeline Losses (c)	Property Losses (d)	Environmental Losses (e)
Low	None (rural location, no permanent structures for human habitation)	No disruption of services (cosmetic or rapidly repairable damage)	Private agricultural lands, equipment, and isolated buildings	Minimal incremental damage
Significant	In rural locations, only transient or day-use facilities	Disruption of essential facilities and access	Major public and private facilities	Major mitigation required

[65] National Levee Database. 2024. https://levees.sec.usace.army.mil/search.

Hazard Category (a)	Direct Loss of Life (b)	Lifeline Losses (c)	Property Losses (d)	Environmental Losses (e)
High	Certain (one or more) extensive residential, commercial, or industrial development	Disruption of essential facilities and access	Extensive public and private facilities	Extensive mitigation cost or impossible to mitigate

- Categories are assigned to overall projects, not individual structures at a project.
- The loss of life potential is based on inundation mapping of the area downstream of the project. Analyses of loss of life potential should take into account the population at risk, time of flood wave travel, and warning time.
- Indirect threats to life caused by the interruption of lifeline services are due to project failures or operational disruption, such as the loss of critical medical facilities or access to them.
- Property losses include damage to project facilities and downstream property and indirect impacts due to the loss of project services, such as the loss of a dam and navigation pool or the loss of water or power supply.
- The environmental impact downstream is caused by the incremental flood wave produced by the project failure, beyond what would normally be expected for the magnitude flood event under which the failure occurs.

The hazard rating does not reflect the dam's condition or likelihood of failure; rather, it indicates the potential for loss of life or property damage from failure and should be prioritized for monitoring. Of the 72 dams in Salt Lake County, 28 are high hazard potential dams (HHPDs), meaning if they fail there is a high probability of loss of life and extensive property loss (see Table 26 for a breakdown of dam hazard ratings in Salt Lake County).

Table 26: Salt Lake County Dams by Hazard Rating

Low Hazard	Significant Hazard	High Hazard
10	34	28

The 2024 Utah Enhanced State Hazard Mitigation Plan provides an inventory of all high-hazard dams by county and owner type in Utah. In Salt Lake County, ownership of these high-hazard dams is distributed among local governments, private entities, public utilities, and the state (see Table 27).

Table 27: High-Hazard Dam Ownership in Salt Lake County

High-Hazard Dams	Local Government	Federal	Private	Public Utility	State
28	61%	–	36%	4%	–

Figure 61 shows dam failure rankings in Salt Lake County and the surrounding northern counties.

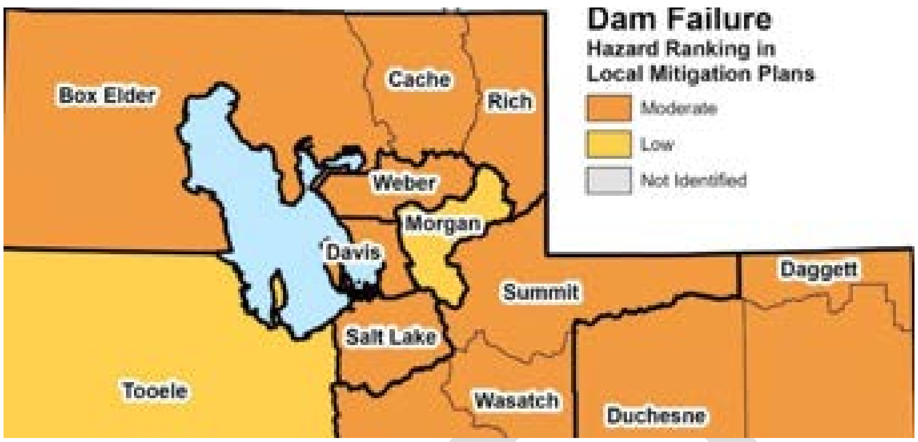


Figure 61: Map of Dam Failure Rankings for Salt Lake County and Surrounding Counties[66]

Table 28 provides a listing of all HHPDs in Salt Lake County with additional details about ownership, size, age, capacity, hazard classification, date of last inspection and whether an Emergency Action Plan (EAP) has been completed for each.

[66] Utah Enhanced State Hazard Mitigation Plan. "Figure 4-37 Dam Failure Rankings from LHMP." 2024. https://hazards.utah.gov/state-of-utah-hazard-mitigation-plan/

Table 28: High-Hazard Dams in Salt Lake County[67]

Dam	Owner	Purpose	Height (ft.)	Year Completed	NID Storage (acre-ft.)	Hazard Classification	Last Inspection	EAP Prepared
Salt Lake County – Sugarhouse	Salt Lake County Public Works	Flood risk reduction	35	1984	120	High	7/13/2022	Yes
Salt Lake County Chandler Drive (#13)	Salt Lake County Public Works	Flood risk reduction	128	1977	52	High	9/21/2022	Yes
Salt Lake County – Scott Avenue	Salt Lake County Public Works	Flood risk reduction	12	1987	71	High	7/13/2022	Yes
Salt Lake County Shriners (#12)	Salt Lake County Public Works	Flood risk reduction	59	1978	17	High	9/21/2022	Yes
Twin Lakes (Salt Lake)	Salt Lake City Corporation	Water supply	62	1914	575	High	8/3/2023	Yes
Salt Lake County Federal Heights (#1a)	Salt Lake County Public Works	Flood risk reduction	23	1978	16	High	9/21/2022	Yes
Salt Lake County – Creekside Park (Big Cottonwood)	Salt Lake County Public Works	Flood risk reduction	16	1969	90	High	7/13/2022	Yes
Salt Lake County – Rotary Glen Park	Salt Lake County Public Works	Flood risk reduction	25	1986	5	High	7/13/2022	Yes
Salt Lake County – Big Cottonwood (Spencer's)	Salt Lake County Public Works	Flood risk reduction	31	1984	132	High	7/13/2022	Yes
Lake Mary – Phoebe	Salt Lake City Corporation	Water supply	72	1915	742	High	8/3/2023	Yes
Red Pine	Salt Lake City Corporation	Irrigation	20	1929	100	High	8/16/2023	Yes
Red Butte Dam	Salt Lake City Corporation	Water supply	128	1930	565	High	9/8/2023	Yes

[67] EAP = Emergency Action Plan, NID = National Inventory of Dams.

Dam	Owner	Purpose	Height (ft.)	Year Completed	NID Storage (acre-ft.)	Hazard Classification	Last Inspection	EAP Prepared
Mountain Dell	Salt Lake City Corporation	Water supply	105	1916	3506	High	9/8/2023	Yes
Little Dell	Salt Lake City Corporation	Water supply	224	1993	25,000	High	9/8/2023	Yes
Ensign Downs Db (Aka Victory Road Db)	Salt Lake City Public Utilities	Flood risk reduction	23	1991	1.75	High	9/8/2022	Yes
Kennecott Mine Bingham Creek	Kennecott Utah Copper, LLC	Water supply	77	1965	2140	High	7/11/2023	Yes
White Pine	South Despain Ditch Company	Irrigation	54	1933	350	High	8/25/2023	Yes
Oquirrh Lake Dam/Kennecott Daybreak	Daybreak Community Association	Recreation	17	2006	1100	High	10/31/2023	Yes
Sandy City – East Sandy Elementary	Sandy City	Flood risk reduction	5	2002	10	High	5/25/2023	Yes
Jordan Valley Water Purification Upper	Jordan Valley Water Conservancy District	Water supply	44	1981	550	High	10/31/2023	Yes
Draper Pressure Irrigation Project	Draper Irrigation Company	Water supply	18	1993	50	High	5/4/2023	Yes
Sandy City – Storm Mountain Db	Sandy City	Flood risk reduction	9	1990	19	High	5/25/2023	Yes
Juniper Canyon Detention Basin 3	Herriman City	Flood risk reduction	49	2020	61	High	8/4/2022	Yes
Sandy City – Flat Iron Mesa	Sandy City	Flood risk reduction	7	Undetermined	4	High	5/25/2023	Yes
Riverton City – Black Ridge Reservoir	Riverton City	Irrigation	32	2009	77	High	9/27/2023	Yes

Dam	Owner	Purpose	Height (ft.)	Year Completed	NID Storage (acre-ft.)	Hazard Classification	Last Inspection	EAP Prepared
Riverton City – 4200 West Pond	Riverton City	Water supply	12	2000	47	High	9/27/2023	Yes
Riverton City – 3200 West Pond	Riverton City	Water supply	16	2000	94	High	9/27/2023	Yes
Point of the Mountain Raw Water Reservoir	Metropolitan Water District	Water supply	18	2006	136	High	5/3/2023	Yes

DAM SAFETY INSPECTION IN UTAH

The 2024 Utah Enhanced State Hazard Mitigation Plan declares that the Utah State Engineer has been charged with regulating non-federal dams since 1919. Utah started its Dam Safety Section in the 1970s in the State of Utah Engineer's Office to administer all non-federal dams in response to the Federal Dam Safety Act. In 1990, the legislature directed the State Engineer to regulate all dams in the state, including federally owned dams, except for those owned by the Bureau of Reclamation.

The frequency of dam inspection is designated based on the hazard rating: The Utah Division of Water Rights inspects high-hazard dams every year, moderate-hazard dams every two years, and low-hazard dams every five years.

Dams may be classified according to the type of construction material used, the methods employed in construction, the slope or cross-section of the dam, the way the dam resists the forces of the water pressure behind it, the means used for controlling seepage, the storage characteristics (on a watercourse, off-stream, above, or below ground level), and occasionally, their purpose. The materials used for building dams include earth, rock, tailings from mining or milling, concrete, masonry, and combinations.[68]

Dams may also have a safety condition rating assigned to them, based on a 4-tier scale. Table 29 provides descriptions of the safety condition ratings and a count of dams identified within each category in Salt Lake County. Three high hazard dams have been rated as "poor" and are also considered high hazard potential. These are Lake Mary-Phoebe, Red Pine, and Mountain Dell. Ten high hazard dams in Salt Lake County are rated "fair." The remaining 15 are considered "satisfactory." Most of the significant hazard dams do not have a condition rating, with the exception of one dam rated fair: Salt Lake County School Pond – 14.

Table 29: Dam Condition Rating Descriptions

Condition Rating	Definition	Dams in Salt Lake County
Satisfactory	No existing or potential dam safety deficiencies are recognized.	15
Fair	No existing dam safety deficiencies are recognized for normal loading conditions. Rare or extreme hydrologic and/or seismic events may result in a dam safety deficiency.	11
Poor	A dam safety deficiency is recognized for loading conditions that may realistically occur. Remedial action is necessary. Poor may also be used when uncertainties exist as to critical analysis parameters, which identify a potential dam safety deficiency. Further investigations and studies are necessary.	3
Unsatisfactory	A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution.	0
Not Rated or not available	A condition rating was not recorded or is otherwise unavailable	45

[68] Utah Hazard Mitigation. "Dam Failure." 2024. https://hazards.utah.gov/dam-failure/.

Historical Events and Probability of Future Occurrences

Based on the FEMA Disaster Declarations Database, Salt Lake County has received no designation for dam failure disaster declarations since the last plan update. No record was found of any historical dam failure incidents in Salt Lake County either; however, incidents have occurred in other parts of Utah, according to the 2024 Utah Enhanced State Hazard Mitigation Plan.

Dam failure incidents are infrequent and usually coincide with events that cause them, such as earthquakes, flooding, excessive rainfall, and snowmelt. There is a “residual risk” associated with dams and levee failures. Residual risk is the risk that remains after safeguards have been implemented. For dams and levees, the residual risk is correlated with events beyond those the facility was designed to withstand. However, the probability of any dam or levee failure in Salt Lake County is occasional in today’s regulatory environment.

Climate Change Considerations

Several recent and high-profile dam incidents related to an unexpected high runoff event have raised serious concerns about the impact of climate change on dam safety across the nation. More recently, evidence has mounted that climate change is making extreme weather events more frequent and extreme. The 2024 Utah Enhanced State Hazard Mitigation Plan[69] references studies that found climate change has already doubled the probability of an event sufficiently large enough to cause catastrophic flooding. In addition, changing the snow/rain regime could increase sudden runoff by another 200%–400%.

Extreme weather events, such as heavy rainfall and rapid melting of snowpack can become more frequent and intense as global temperatures rise. These events can lead to higher water inflows into reservoirs, which can exceed the capacity of dams, increasing pressure on the structure. Changes in precipitation patterns, along with more frequent severe storms, can cause erosion and sediment buildup around dam sites, potentially leading to dam failure.

Secondary Hazards

Dam failure can have a cascading impact on other hazards, including storms, seismic events, landslides, wildfires, and flooding. Given the relatively higher risk of an earthquake in Salt Lake County, this hazard is of particular concern for dams.

As mentioned previously, a dam failure can threaten downstream dams and may contribute to additional failures. If damage is caused to hazardous material storage facilities in the inundation zone, dam failure could also release hazardous materials.

Dam failure may cause extreme erosion along canyon waterways, resulting in steep, unstable slopes that may later be subject to landslides or other slope failure.

---

[69] Utah State Enhanced Mitigation Plan. 2024 https://hazards.utah.gov/state-of-utah-hazard-mitigation-plan/.

Vulnerability Assessment

Thirty-two dams in Salt Lake County have delineated dam failure inundation boundaries. This includes all but one of the high hazard dams: Juniper Canyon Detention Basin 3. These zones were used to determine potential exposure of community assets to dam failure. This includes a count of structures, population, and critical facilities within areas that may be flooded following a dam failure. This analysis does not account for depth or velocity of flooding, models of potential damage to structures based on construction or occupancy type, or estimated economic losses from flooding following a dam failure as used in the Hazus flood model.

Using the available dam inundation boundaries, and USA Structures building dataset from FEMA Geospatial Resource Center, an overlay analysis was conducted to determine which structures within Salt Lake County are potentially exposed to dam failure. Table 31 provides a count of structures that were identified within one or more inundation boundaries, grouped by jurisdiction. In addition, estimates of the number of people potentially affected by dam failure were also calculated using U.S. Census Bureau 2022 American Community Survey census block data (Table 32). For census blocks where only a portion overlaps a dam inundation boundary, a proportional percentage of the population of that block was included in the summarized population count.

For those dams that did not have dam inundation boundaries delineated, and for assets that were not included in the mapping analysis, a qualitative description of assets downstream of the dam and potential impacts was considered.

It should also be noted that there are limitations to the dam inundation boundaries. In addition to not having boundaries delineated for all dams, this dataset is based on hydraulic models that make assumptions regarding how water will flow following a failure, which may not capture all variables. Accuracy of input data, as well as changes in land use, soil characteristics, and other conditions, can affect the precision and accuracy of inundation maps. The nature of the dam breach is variable, and the size and cause of the breach can introduce uncertainty regarding the impacts. Although this analysis provides useful guidance for planning, it may not capture all potential vulnerabilities.

Table 30: Potential Dam Inundation Area in Salt Lake County[70]

Total Area	Potential Inundation Area	Potential Inundation Area Percent
805.18 sq mi.	38.67 sq mi.	4.80%

Table 31: Structures Within Potential Dam Inundation Areas, by Jurisdiction and Occupancy Type

Jurisdiction	Residential	Commercial	Industrial	Gov	Education	Other	Total
Town of Alta	0	0	0	0	0	0	0

[70] 2019 Utah State Hazard Mitigation Plan. "Dam Failure 2019." https://site.utah.gov/dps-emergency/wp-content/uploads/sites/18/2019/02/5-Dam-Failure.pdf.

Jurisdiction	Residential	Commercial	Industrial	Gov	Education	Other	Total
Town of Brighton	35	40	0	5	0	50	130
Bluffdale	1,796	43	22	23	2	80	1,966
Copperton	0	0	0	0	0	0	0
Cottonwood Heights	562	83	6	15	5	13	684
Draper	80	29	0	5	9	2	125
Emigration Canyon	0	0	0	0	0	0	0
Herriman	119	0	0	8	2	9	138
Holladay	1,481	88	0	19	4	79	1,671
Kearns	0	0	0	0	0	0	0
Magna	0	0	0	0	0	0	0
Midvale	703	47	0	3	1	22	776
Millcreek	1,042	229	71	22	0	85	1,449
Murray	1,406	295	131	23	11	98	1,964
Riverton	1,821	8	1	39	18	45	1,932
Salt Lake City	20,693	1,422	709	182	223	597	23,826
Sandy City	1,995	219	21	9	16	58	2,318
South Jordan	418	45	0	5	2	1	471
South Salt Lake	3,413	532	289	56	27	315	4,362
Taylorsville	0	0	0	0	0	0	0
West Jordan	3,544	104	76	27	33	87	3,871
West Valley City	0	2	8	1	1	1	13
White City	0	0	0	0	0	0	0
Unincorporated Salt Lake County	237	6	3	20	0	11	277
Total	**39,345**	**3,192**	**1,337**	**462**	**354**	**1,553**	**46,243**

Table 32: Population Estimated to be Within the Dam Inundation Area by Jurisdiction

Jurisdiction	Population Estimated in Dam Inundation Areas
Town of Alta	0
Town of Brighton	8
Bluffdale	5,298
Copperton	0
Cottonwood Heights	2,949
Draper	1,366
Emigration Canyon	0

Jurisdiction	Population Estimated in Dam Inundation Areas
Herriman	1,031
Holladay	6,813
Kearns	0
Magna	0
Midvale	2,255
Millcreek	6,993
Murray	7,954
Riverton	8,274
Salt Lake City	66,715
Sandy City	8,224
South Jordan	2,992
South Salt Lake	15,219
Taylorsville	10
West Jordan	13,415
West Valley City	266
White City	0
Unincorporated Salt Lake County	1,267
Total	**150,050**

Using the list of critical facilities identified in the Community Profile, an overlay was also implemented to identify critical facilities that have potential exposure to dam failure. There are 73 critical facilities in the inundation boundaries of dams in Salt Lake County. A detailed breakdown of these facilities follows. Other city structures and government service facilities in the inundation areas also may be impacted, but these were not included in the mapping. Additional vulnerability is discussed within the jurisdictional annexes.

- **Three emergency operations centers (EOCs):** Bluffdale, South Salt Lake, and the Municipal Services District
- **Nine fire stations:** Murray Station #82, Bluffdale Station #91, Sandy Station #35, Salt Lake City Station #4, Salt Lake City Station #8, Salt Lake City Station #6, Salt Lake City Station #3, UFA Station #108, and South Salt Lake Station #42
- **Four hospitals:** Holy Cross Hospital Salt Lake, Holy Cross Hospital Jordan Valley, KPC Promise Hospital of Salt Lake, and Marian Center
- **Four police stations:** South Salt Lake Police Department, West Jordan Police Department, Bluffdale Police Department, and Granite School District Police Department
- **Fifty-two schools (count per city):** Bluffdale (1), Midvale (1), Murray (4), Riverton (2), Salt Lake City (36), Sandy City (3), and West Jordan (5)

- **Thirty-nine county facilities (count per city):** Cottonwood Heights (1), Holladay (2), Midvale (1), Murray (1), Riverton (1), Salt Lake City (13), unincorporated county (7), South Salt Lake (4), and West Jordan (9)

ESTIMATED IMPACT AND POTENTIAL LOSSES

The impact of dam failure hazards on people in Utah is similar to riverine flooding, but the potential magnitude and sudden onset of flooding can be especially catastrophic. Impacts range from death and physical harm to displacement and property damage to inconvenience. Homes, businesses, and other structures downstream of the failure can be damaged or destroyed. Road closures, congestion, and possible water supply and wastewater services loss are likely.

Dam failures can occur suddenly, but those downstream might have some warning to evacuate. Individuals living near or just downstream of dams, particularly in low-lying areas, are most vulnerable to dam failure and potential flooding. Homes may be damaged or destroyed, resulting in potential long-term displacement for residents. Some of these households may require public sheltering assistance.

Significant structural and infrastructural losses can result from a dam failure. Homes, businesses, and government service facilities can be damaged. Damage is often worst close to the dam site because of the volume and velocity of water released. Over 46,000 structures are located in potential inundation areas in Salt Lake County. Besides the costs of rebuilding structures, significant economic impacts are likely due to lost inventory or revenue during business closures. Employees may lose wages or experience long-term job loss, and financial hardship may exacerbate slow economic recovery. Businesses not directly impacted by a dam failure may incur losses due to transportation or other infrastructure interruptions or an inability for employees to return to work.

Besides the direct damage and loss of life that may occur from a dam or levee failure, there are many possible consequences for community assets. Disruption of a public water supply or wastewater treatment facility could lead to reduced water quality, water shortages, exposure to sewage, and other health hazards. Damage or disruption to major roads, railroads, power, communications, or other public utilities could delay vital services. Debris, sediment, and other material deposited following a dam failure can require extensive cleanup efforts. Natural environmental resources, such as wildlife habitat and recreation areas, can also be damaged. Historical structures and cultural resources such as community centers, recreation facilities, parks, and trails can also be damaged or destroyed. Community events and activities at these sites may be postponed or canceled.

Major transportation corridors that could be impacted include Little Cottonwood Canyon Rd, Big Cottonwood Canyon Rd, I-215 East Belt, I-80 through Parleys Canyon to the intersection with I-15, Bangerter Highway in the southern part of the county, Mountain View Corridor near Riverton and Herriman, and various segments of I-15. TRAX and FrontRunner lines are roughly parallel to the I-15 corridor and also may be affected. Other utility lines and infrastructure likely run along these transportation routes.

The Mitigation Planning Team identified additional significant community assets that may be impacted by dam failure. These include areas of particular concern, critical facilities, critical infrastructure, areas of future development, major employers, or economic sectors, cultural or historic facilities, and significant populations or natural resources. More detailed information on jurisdictional assets is presented in their individual annex in Volume 2.

VULNERABLE POPULATIONS

Individuals with access and functional needs, disabilities, elderly individuals, and those lacking access to reliable transportation might have difficulty evacuating even if given notice of a potential dam failure. Those who speak a language other than English might have difficulty understanding emergency alerts and the proper actions to take if a dam failure is imminent. Those with low household incomes might have significant difficulty finding alternative housing if displaced from their homes.

CHANGES IN DEVELOPMENT

Population growth has increased steadily in Salt Lake County, with an estimated 2.6% growth rate since 2020, according to the U.S. Census Bureau. Most of this growth has occurred in the south and western parts of the county, on the outer edges of urban growth. Since most of the significant and high hazard dams are in the central or eastern parts of the county, this growth has not increased the vulnerability of the county to dam failure.

Still, this growth puts a strain on emergency response systems, making it challenging to evacuate residents in a timely manner. Increased population density can also lead to many changes in land use, such as deforestation or urbanization, which can alter flow patterns and increase the likelihood of the overtopping of a dam or dam failure due to erosion.

According to the 2024 Utah Enhanced State Hazard Mitigation Plan, the largest concentration of high- and significant-hazard dams in the state is in the Wasatch Front counties, including Salt Lake County. The National Levee Database also maps 5 levee systems (160 levee structures) in the county. As the county's population grows and shifts, situations arise where development in areas downstream from dams causes the hazard potential for some of these structures to increase, such as from a significant hazard to a high hazard. The number of high-hazard dams should be monitored over time to determine whether this might be a trend. Localized changes in growth or development in parts of the county may indicate changes in vulnerability and are addressed in the jurisdictional annexes. The overall vulnerability to dam failure in the county has remained the same since the last plan update.

COMMUNITY LIFELINES

The 2024 Utah Enhanced State Hazard Mitigation Plan articulates that any and possibly all community lifelines will be impacted in the aftermath of a dam incident, such as a high-hazard dam failure. The immediate concern is for the safety and security of the people in inundation areas. It is reasonable to expect that access to food, water, shelter, and healthcare will be compromised for many people. Dam failures are notoriously destructive, and impacts on aboveground power distribution, if not generation, can be expected. The same can be said for transportation, especially due to damaged roadways and railways. Cellular communications may fare better. Inundation zones are relatively narrow and elongated; thus, unaffected transmission towers may be able to service inundated areas. The release of hazardous materials is an area of uncertainty. What seems certain is widespread impact. Articulating precisely what these impacts mean and how to mitigate them is a difficult-to-fill knowledge gap.

VULNERABILITY SCORE

The NRI does not include data on the relative risk of dam failure.

Drought

Hazard Description

According to the National Integrated Drought Information System, drought is a deficiency of precipitation over an extended period, resulting in a water shortage for some activity, group, or environmental sector.[71] Although yearly variations in recorded precipitation are normal, a drought exceeds these norms, marked by significantly low precipitation for an extended period or over a large area. Although most natural hazards are sudden and cause immediate impacts, droughts begin gradually and can last for extended periods, often resulting in profound socioeconomic impacts. Figure 62 shows the effects of drought on the soil. [72]

Droughts can be categorized based on their unique characteristics and are often viewed as different phases of a single prolonged event (see Figure 63).

Figure 62: Effects of Drought on Soil

- **Meteorological Drought:** A measure of the departure of precipitation from normal for a particular location
- **Agricultural Drought:** Where the amount of moisture in the soil no longer meets the needs of a particular crop
- **Hydrological Drought:** When surface and subsurface water supplies are below normal

[71] Drought Basics. “Defining Drought.” https://www.drought.gov/what-is-drought/drought-basics.
[72] Photo credit: Underground Brittle Dry - Free photo on Pixabay.

- **Socioeconomic Drought:** Prolonged and severe dry conditions that impact sectors beyond the agricultural community, such as the community drinking supply and other social and economic enterprises

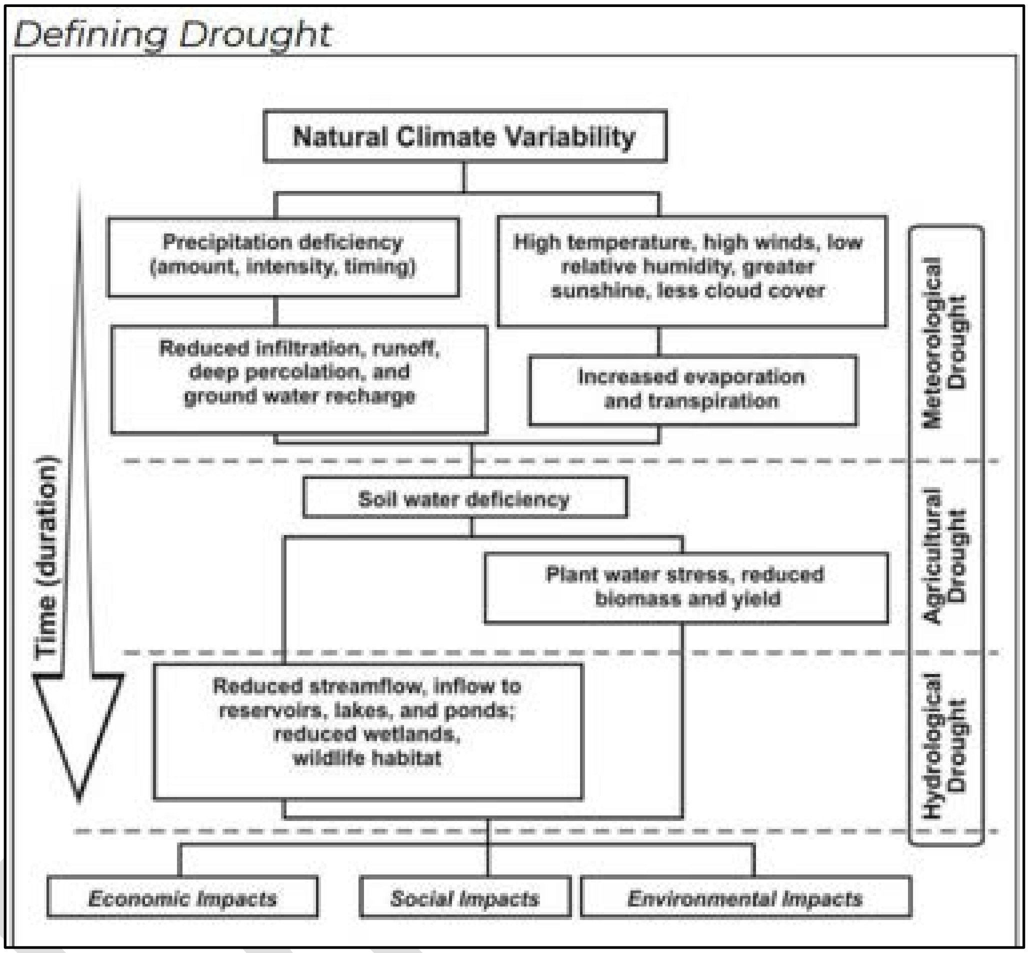


Figure 63: United States Drought Monitor Process for Defining Drought[73]

Hazard Profile

Although the agricultural community is usually the most heavily impacted by drought, extended droughts can also have direct and indirect impacts on economic, social, or environmental sectors. When drought begins to affect the general population, reservoirs, wells, and aquifers often reach low levels, necessitating conservation measures. These measures can include water-use restrictions, secondary water systems, water recycling, and xeriscaping. Additional conservation options include establishing emergency water agreements with neighboring water districts or transporting water from external sources (see Table 33).

[73] Utah Division of Water Resources. "Drought Response Plans: Triggers and Actions." June 28, 2022. https://water.utah.gov/wp-content/uploads/2022/07/Drought-Response-Plan-070822.pdf.

Table 33: Characteristics of Drought in Salt Lake County

Potential Impact		Catastrophic	**Probability**	X	Highly Likely
		Critical			Likely
	X	Limited			Occasional
		Negligible			Unlikely
Location	Countywide				
Seasonal Pattern	Impacts typically noticeable in summer, conditions can be year-round				
Conditions	Meteorological Drought: Lack of precipitation Agricultural Drought: Lack of water for crop production Hydrologic Drought: Lack of water in the overall water supply Socioeconomic Drought: Lack of water sufficient to support the population				
Duration	Months, years				
Secondary Hazards	Wildfires, dust storms, air quality				
Analysis Used	National Weather Service, Utah Climate Center, Utah Division of Water Resources, newspapers, local input				

Magnitude/Extent

The United States Drought Monitor provides a map that identifies drought-affected areas and classifies them by intensity, ranging from D1 (least intense) to D4 (most intense) (see Table 34). Drought is defined as a moisture deficit severe enough to have social, environmental, or economic effects. D0 areas are not in drought but are experiencing abnormally dry conditions that could develop into drought or are still recovering from a past drought and are not yet back to normal.

The Palmer Drought Severity Index (PDSI), developed by Wayne Palmer in 1965, measures drought severity based on temperature, precipitation, and soil moisture (Utah Division of Water Resources 2007a). The PDSI is considered the “semi-official” drought index due to its standardization across various climates. It uses zero to represent normal conditions, with values ranging from 6 to −6 (see Table 35). Negative numbers indicate dry periods, while positive numbers represent wet periods.

Table 34: Drought Classification[74]

Category	Description	Possible Impacts	Ranges				
			Palmer Drought Severity Index (PDSI)	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Objective Drought Indicator Blends (Percentiles)
D0	Abnormally Dry	Going into drought: • short-term dryness slowing planting, growth of crops or pastures Coming out of drought: • some lingering water deficits • pastures or crops not fully recovered	-1.0 to -1.9	21 to 30	21 to 30	-0.5 to -0.7	21 to 30
D1	Moderate Drought	• Some damage to crops, pastures • Streams, reservoirs, or wells low, some water shortages developing or imminent • Voluntary water-use restrictions requested	-2.0 to -2.9	11 to 20	11 to 20	-0.8 to -1.2	11 to 20
D2	Severe Drought	• Crop or pasture losses likely • Water shortages common • Water restrictions imposed	-3.0 to -3.9	6 to 10	6 to 10	-1.3 to -1.5	6 to 10
D3	Extreme Drought	• Major crop/pasture losses • Widespread water shortages or restrictions	-4.0 to -4.9	3 to 5	3 to 5	-1.6 to -1.9	3 to 5
D4	Exceptional Drought	• Exceptional and widespread crop/pasture losses • Shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less	0 to 2	0 to 2	-2.0 or less	0 to 2

Table 35: Palmer Drought Severity Index Classification and Range

Range	Palmer Classification
4.0 or higher	Extremely Wet
3.0 to 3.99	Very Wet
2.0 to 2.99	Moderately Wet
1.0 to 1.99	Slightly Wet
0.5 to 0.99	Incipient Wet Spell
0.49 to −0.49	Near Normal
−0.5 to −0.99	Incipient Dry Spell
−1.0 to −1.99	Mild Drought
−2.0 to −2.99	Moderate Drought
−3.0 to −3.99	Severe Drought
−4.0 or lower	Extreme Drought

Location

Utah is the second driest state in the United States, and drought has a significant impact on the region. The lack of water affects agriculture and industry, limiting economic activity and reducing the availability of water for irrigation and culinary purposes. Severe drought leads to the depletion of agricultural lands and soil deterioration. In the Wasatch Front Region, the risk of drought is particularly high.

[74] National Drought Mitigation Center, U.S. Drought Monitor. “Drought Classification.” 2024. https://droughtmonitor.unl.edu/About/AbouttheData/DroughtClassification.aspx.

Salt Lake County falls in two climatic regions: the North Central Region and the Northern Mountains Region. Although the two regions exhibit distinct characteristics, they often experience similar drought periods, experiencing mild drought (PDSI ≥ −1) every 2.6–3.3 years, moderate drought (PDSI ≥ −2) every 3.7–5.2 years, and severe drought (PDSI ≥ −3) every 6.9–8.5 years. The Northern Mountain Region typically experiences droughts less frequently (Utah Division of Water Resources 2007a). The Northern Mountain Region experiences more severe drought conditions at its peak than the Western Region. This may be because the Northern Mountains Region simply has more water to lose, as the Wasatch and Uinta Mountains receive significantly more precipitation on average. Figure 64 depicts a recent snapshot of the extent of drought in the State of Utah. Figure 65 shows a time series of drought conditions for Salt Lake County since January 2000. Extreme and exceptional drought conditions occurred from 2021 to 2023.

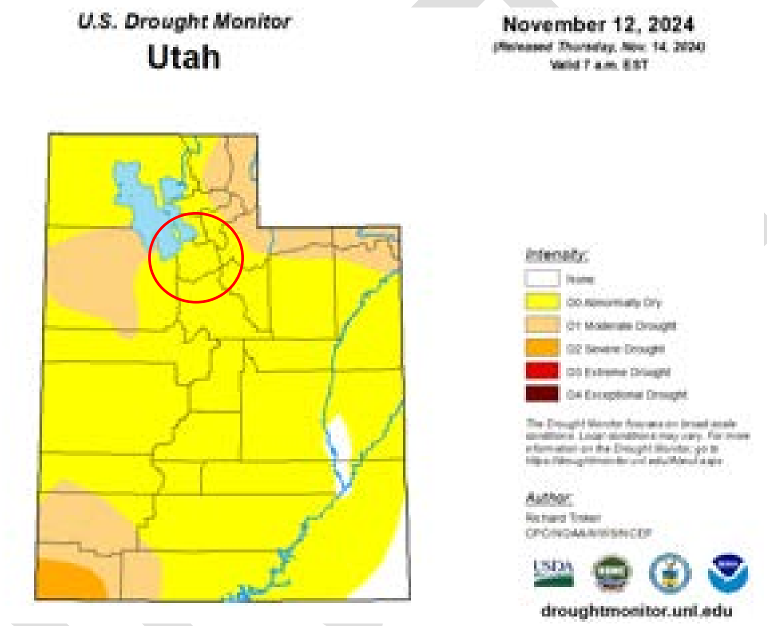


Figure 64: U.S. Drought Monitor Categories for the State of Utah, November 2024

Figure 66 shows precipitation between October 17, 2024, and December 13, 2024, as a percentage of the historical average (1991–2020) for the same period. Green/blue shades indicate higher than normal precipitation, while brown shades indicate lower than normal precipitation.

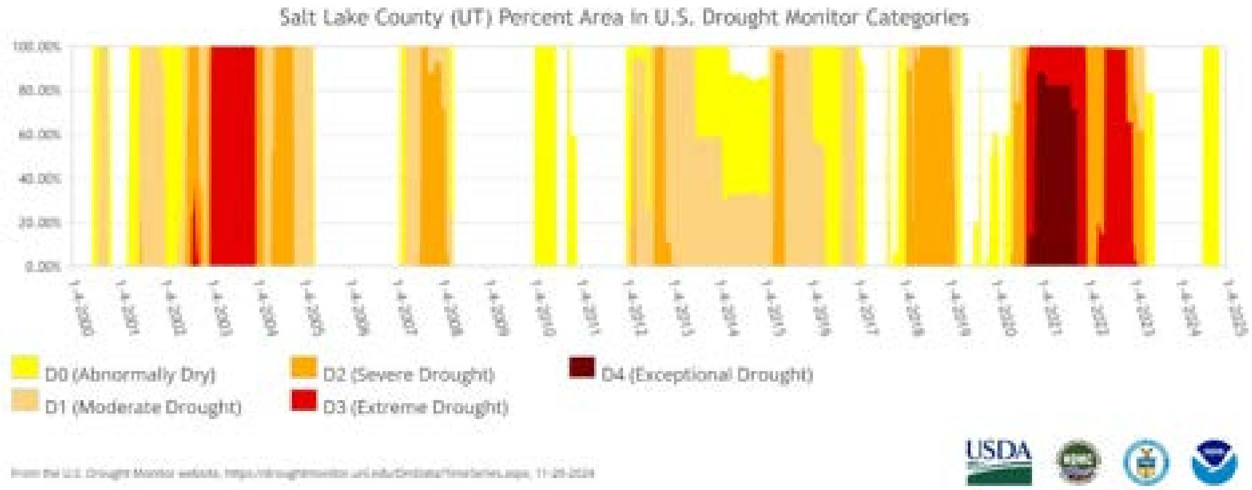


Figure 65: Percent of Salt Lake County in Drought Monitor Categories, 2000–2024

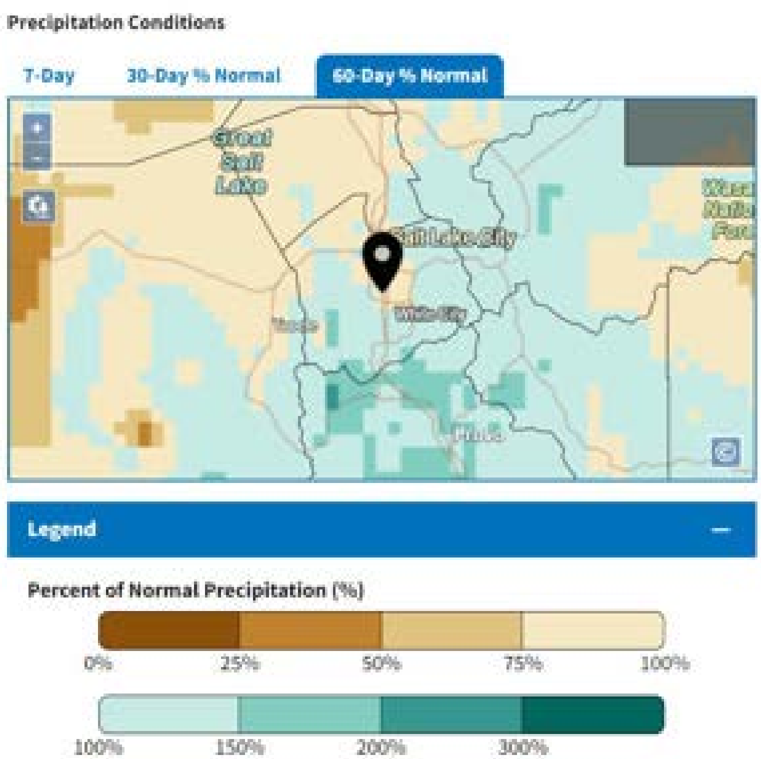


Figure 66: Precipitation for October–December 2024 Compared with the 60-Day Percentage of Normal Precipitation, 1991–2020[75]

[75] NOAA, National Integrated Drought Information System. "Drought Conditions for Salt Lake County." Drought.gov. 2024. https://www.drought.gov/states/utah/county/salt%20lake.

Historical Events and Probability of Future Occurrences

Based on the FEMA Disaster Declarations Database, Salt Lake County has received no designation for drought Disaster Declarations since the last plan update. However, Governor Spencer Cox issued an Executive Order declaring a State of Emergency due to drought on March 17, 2021, and again on April 21, 2022, due to drought conditions affecting the entire state. Since 2019, 14 USDA drought-related Disaster Declarations have been recorded for Salt Lake County.[76]

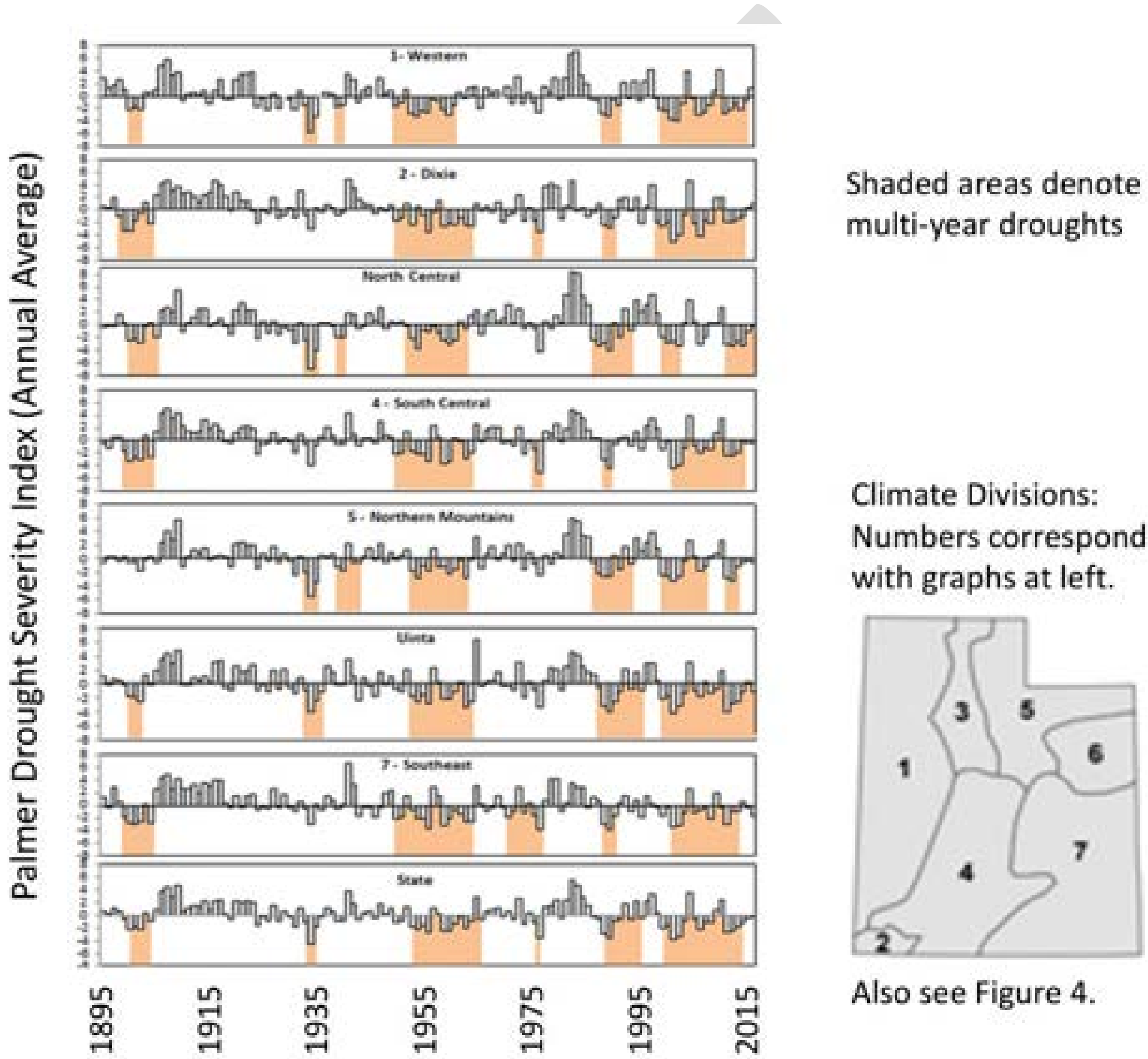


Figure 67: Palmer Drought Severity Index by Region[77]

Figure 67 provides a historical reference for multiyear droughts since 1895. The most severe drought in history for the North Central and Northern Mountains Regions occurred in 1934, during the height of the

[76] U.S. Department of Agriculture, Farm Service Agency. “Disaster Designation Information.” https://www.fsa.usda.gov/resources/disaster-assistance-program/disaster-designation-information.
[77] Utah Hazard Mitigation, Utah Department of Public Safety. “Utah Enhanced State Mitigation Plan 2024.” https://hazards.utah.gov/state-of-utah-hazard-mitigation-plan/.

Great Depression and coinciding with the same drought period (1930–1936) that caused the “Dust Bowl” on the Great Plains. The longest drought period ranged from 11 years for the North Central region (1953–1963) to 6 years for the Northern Mountains, which occurred twice, from 1900 to 1905 and from 1987 to 1992 (Utah Division of Water Resources 2007a). In 2018, a severe drought plunged virtually the entire state into moderate drought, with many areas in extreme drought. This drought peaked in September 2018 and reached −6.16 on the PDSI scale.

Droughts and water shortages will undoubtedly remain a significant concern for Salt Lake County in the future, particularly with the increasing public demand for water. The expected doubling of the population over the next 20 years makes water shortages a virtual certainty. New zoning ordinances, like the use of secondary water for irrigation and mandatory no watering days, are already in force.

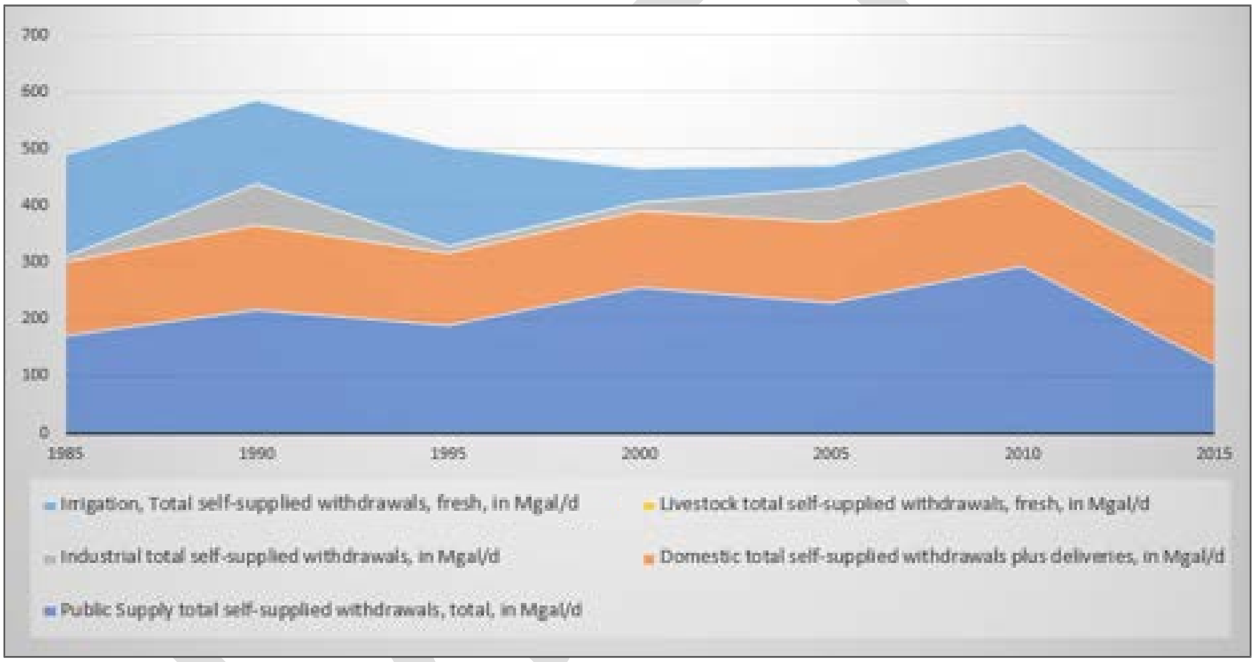


Figure 68: Annual Water Use by Category for Salt Lake County (Based on USGS data)[78]

Table 36: Annual Water Use by Category for Salt Lake County (Based on USGS data)[79]

Year	Public Supply Total Self-Supplied Withdrawals, in Mgal/d	Domestic Total Self-Supplied Withdrawals Plus Deliveries, in Mgal/d	Industrial Total Self-Supplied Withdrawals, in Mgal/d	Livestock Total Self-Supplied Withdrawals, Fresh, in Mgal/d	Irrigation, Total Self-Supplied Withdrawals, Fresh, in Mgal/d
1985	172.9	129.27	10.68	0.21	180.28
1990	218.54	149	72.19	0.15	146.41

[78] United States Geological Survey (USGS), National Water Information System. 2024. https://waterdata.usgs.gov/ut/nwis/water_use/.
[79] Ibid. (Data were not available for this entry, so the average between the 1995 and 2005 amounts was inserted as the best approximate value. Data provided represents the most current available data.)

Year	Public Supply Total Self-Supplied Withdrawals, in Mgal/d	Domestic Total Self-Supplied Withdrawals Plus Deliveries, in Mgal/d	Industrial Total Self-Supplied Withdrawals, in Mgal/d	Livestock Total Self-Supplied Withdrawals, Fresh, in Mgal/d	Irrigation, Total Self-Supplied Withdrawals, Fresh, in Mgal/d
1995	189.95	127.73	11.7	0.43	173.7
2000	258.39	134.125*	15.13	0.19	59.78
2005	231.12	140.52	61.77	0.15	37.83
2010	295.7	146.83	56.08	0.09	47.58
2015	123.69	141.33	65.82	0.09	28.77

Salt Lake Valley is a largely urban area with a growing population. Most of its development uses municipal water sources, principally wells completed in the basin-fill aquifer system. The population growth and concomitant increase in municipal groundwater pumping could significantly decrease the amount of groundwater discharged from the principal aquifer system (where most wells are completed) to the shallow unconfined aquifer system.

The shallow unconfined aquifer overlies confining beds above the principal aquifer system in the central and northern parts of the valley and provides water to springs and approximately 58,000 acres (23,500 hm2) of wetlands in groundwater discharge areas. Decreased recharge to the shallow unconfined aquifer from the principal aquifer due to increased groundwater pumping could reduce water supply to these springs and wetlands. In addition, water supply to the springs and wetlands is affected by climatic conditions and the level of the Great Salt Lake. Drought conditions from 1999 to 2004 reduced groundwater aquifer recharge across the state, including in the Great Salt Lake area, which negatively impacted the Salt Lake Valley wetlands. In 2005 and 2008, the water levels of the Great Salt Lake dropped close to the historic low reached in 1963, causing some parts of the Salt Lake Valley wetlands to dry up.

To evaluate the potential impacts of drought and increased development on the Salt Lake Valley wetlands, researchers used existing data to estimate a water budget and develop regional, three-dimensional, steady-state, and transient MODFLOW models to evaluate changes in the water budgets for wetland areas. These efforts focused on wetlands around the margins of the Great Salt Lake, although the results may apply to all the wetlands in Salt Lake Valley. The modeling suggests that subsurface inflow into the wetland areas would be most affected by decreased subsurface inflow due to long-term (20-year) drought conditions. This decline would also cause changes in Great Salt Lake levels, with subsurface inflow also decreasing due to higher municipal and industrial well withdrawals over the same period. Therefore, the worst-case scenario for the wetlands would be a combination of those conditions. To meet the goal of the U.S. Environmental Protection Agency (EPA) of no net loss of wetlands, the Salt

Lake Valley wetland areas must be managed to maintain their current water budget, estimated at 52,420 acre-feet per year (65 hm3/yr) of recharge in 2010.[80]

The 2012–2016 drought, although less severe, impacted much of the state for 4 straight years. Another drought from 2018–2019 was short-lived but felt across the entire state.

From 2019 to 2023, Utah experienced a statewide record for dryness and warmth. The driest year on record was 2020, and by the end of the year, 90% of the state was in extreme or exceptional drought. Dry conditions since 2000 have resulted in record-low water levels in the Great Salt Lake. The most intense period of drought since 2000 occurred the week of January 26, 2021, where 69.99% of Utah land was categorized as D4.[81]

The drought that began in 2020 has broken many records for its severity, drawing attention not only from Utah's water managers but also the Governor, State Legislature, and the community at large. Drought conditions remained significant through the beginning of 2022, and the drought's impacts continue to be of grave concern.[82]

Figure 69 shows forecasts for total precipitation (left image) and abnormal precipitation (right image) from December 2023 to February 2024 in the Western United States.[83] The map legend indicates that Utah's total precipitation for the observed time frame was between 0 and 10 inches, with abnormal precipitation at 0–2 inches.

[80] Yidana, Sandow, Mike Lowe, and Rich Emerson. "Wetlands in Northern Salt Lake Valley, Salt Lake County, Utah – An evaluation of the threats posed by groundwater development and drought." 2010. https://www.researchgate.net/publication/268257262_Wetlands_in_Northern_Salt_Lake_Valley_Salt_Lake_County_Utah_-_An_evaluation_of_the_threats_posed_by_groundwater_development_and_drought.
[81] U.S. Department of Agriculture, Farm Service Agency. "Disaster Designation Information." https://www.fsa.usda.gov/resources/disaster-assistance-program/disaster-designation-information.
[82] Utah Division of Water Resources. "Drought Response Plans: Triggers and Actions." June 28, 2022. https://water.utah.gov/wp-content/uploads/2022/07/Drought-Response-Plan-070822.pdf.
[83] Utah Climate Center. "Seasonal Drought Forecast For the Intermountain West." Bureau of Reclamation, Utah State University. 2024. https://climate.usu.edu/westernDrought/.

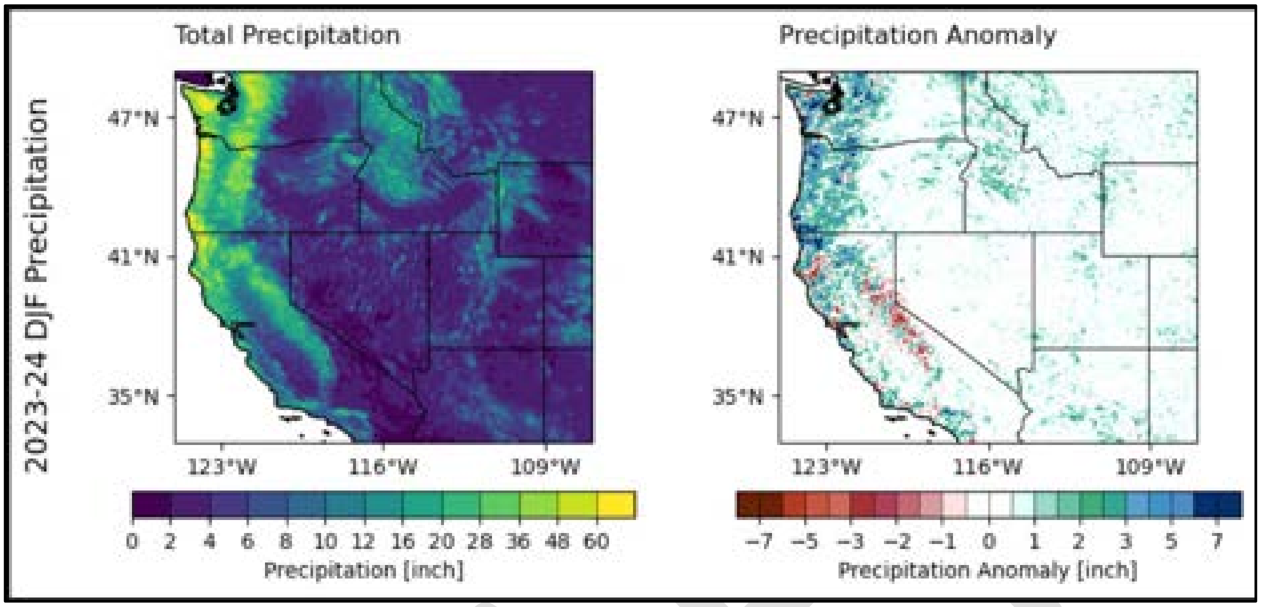


Figure 69: Seasonal Drought Forecast for the Intermountain West, 2023–2024[84]

The National Risk Index reports a frequency of 39.2 events annually for Salt Lake County. Based on these records, probability of future occurrences is highly likely.

Climate Change Considerations

Utah is unique in the amount of natural precipitation it receives. Because drought is an ever-present threat, resilience must be built into planning. Climate change has caused the state to become warmer and drier, highlighting the need to identify areas for improvement to better respond to the challenges and unmet needs caused by drought conditions.[85]

In Salt Lake County, climate change can have a significant impact on the natural hazard of drought. Rising temperatures and shifting precipitation patterns can lead to more frequent and severe droughts in the area. Average temperatures in Utah can rise and reduce snowpack and cause earlier snowmelt—further impacting the availability of water during the year. Higher temperatures can also cause more rain than snow to fall, further reducing the snowpack that many communities may rely on for water.

According to the 2024 Utah Enhanced Hazard Mitigation Plan[86] statement on climate, higher temperatures caused by climate change are expected to exacerbate drought conditions. Estimates of additional temperature changes by 2100 vary, largely depending on global emissions of greenhouse gases. However, temperature increases driven by climate change will almost certainly continue, along with the associated intensification of drought conditions. The Climate Mapping for Resilience and

---

[84] Ibid.
[85] Utah Division of Water Resources. “Drought Response Plans: Triggers and Actions.” June 28, 2022. water.utah.gov/wp-content/uploads/2022/07/Drought-Response-Plan-070822.pdf.
[86] Utah Department of Public Safety, Utah Hazard Mitigation. “Utah Enhanced State Hazard Mitigation Plan.” https://hazards.utah.gov/state-of-utah-hazard-mitigation-plan/.

Adaptation (CMRA) tool projects an increase in days per year with no precipitation (Figure 70) and the maximum number of consecutive dry days (Figure 71) compared with historical averages.

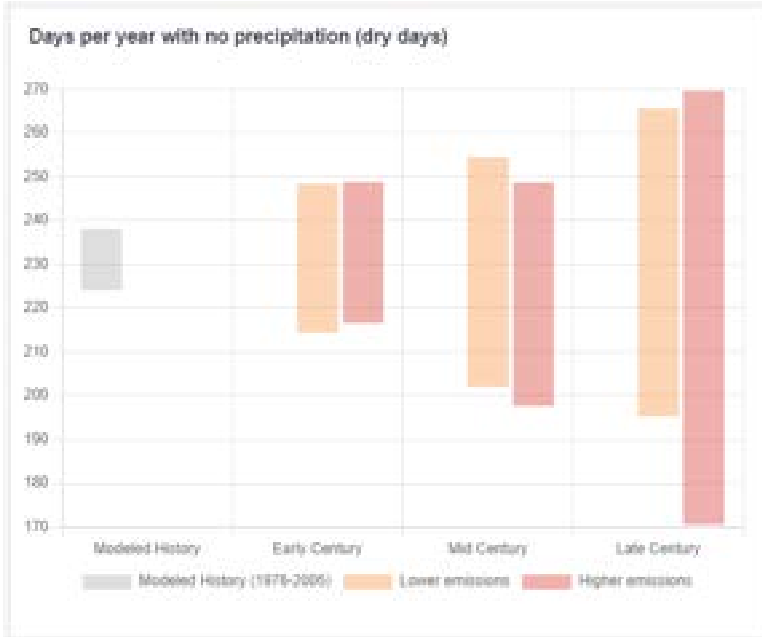


Figure 70: CMRA Projected Days Per Year with No Precipitation[87]

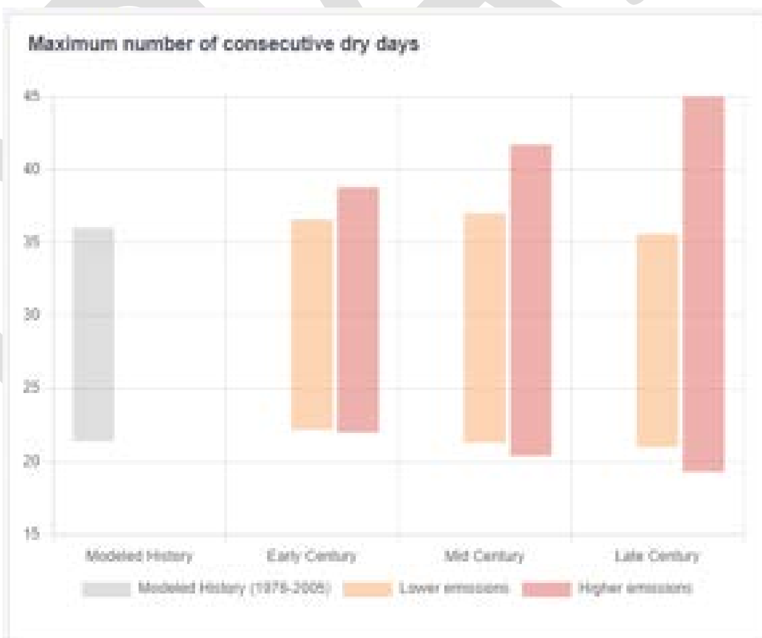


Figure 71: CMRA Projected Maximum Number of Consecutive Dry Days[88]

Figure 72 shows the water-year precipitation changes standardized to reflect climate anomalies. The observed period (blue) reveals the signature cyclic behavior of northern Utah's climate cycle, which can

[87] CMRA = Climate Mapping for Resilience and Adaptation.
[88] CMRA = Climate Mapping for Resilience and Adaptation.

be traced to slow variations in the western tropical Pacific along with jet stream position. The predicted water-year climate anomaly (red) projects wetter-than-average winters by 2020.[89]

[89] Utah State University, Utah Climate Center. “Northern Utah’s Climate Variability and Prediction.” 2024. https://climate.usu.edu/snowForecast.php.

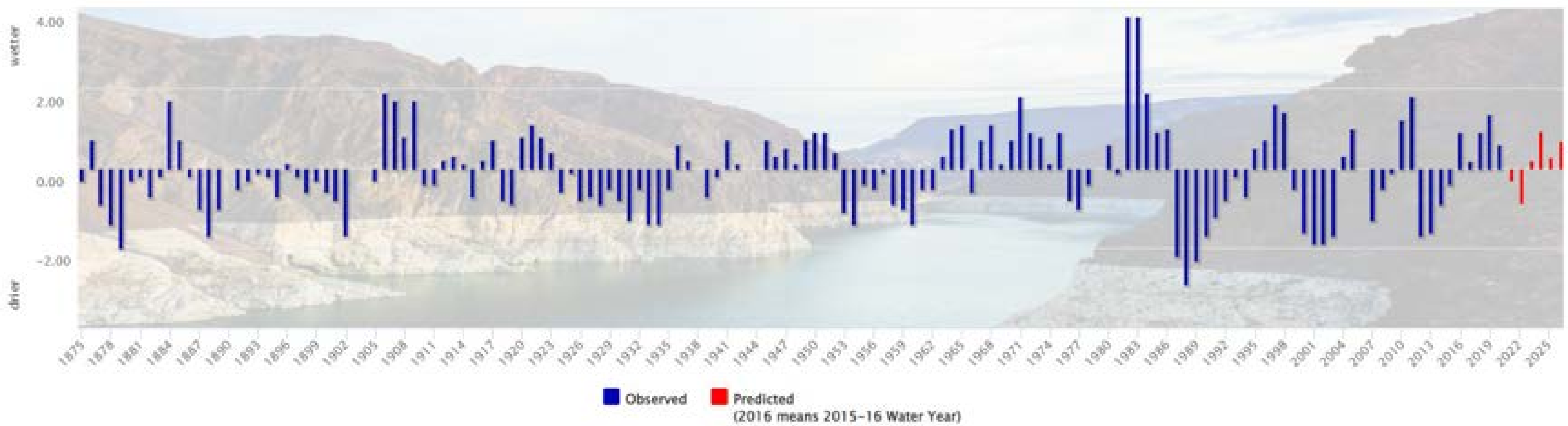


Figure 72: Climate Variability and Prediction for Northern Utah[90]

[90] Ibid.

Secondary Hazards

Wildfires are the most common secondary hazard associated with drought. Prolonged lack of precipitation dries out vegetation, making it increasingly susceptible to ignition and fueling more extreme fire behavior as drought conditions persist. This vulnerability also extends to crops. Loss of forests and trees exacerbates erosion, leading to heavy silting of streams, reservoirs, and rivers, which causes severe damage to aquatic life, irrigation, and power development. Droughts can also create optimal conditions for dust storms, significantly reducing air quality for both humans and animals. Low stream flows can lead to higher temperatures, oxygen depletion, disease, and loss of spawning areas for fish resources. Drought is often accompanied by extreme heat. Temperatures of 90ºF and higher increase the risk of sunstroke, heat cramps, and heat exhaustion in humans and heat-related injuries in pets and livestock.

The Great Salt Lake, partially in the northwest corner of the county, is a significant regional natural, economic, and cultural resource. The lake has lost over half its volume since the 1980s due to prolonged droughts along with variations in precipitation and water consumption. As more of the lakebed is exposed, severe dust storms and reduced air quality become more likely. Contaminants in the soil that may become airborne could also pose health risks to the populations of nearby cities.

Lower water levels in lakes and reservoirs can degrade water quality and promote the growth of harmful cyanobacteria, or algal blooms, which can be lethal to pets and pose health risks to humans.

Vulnerability Assessment

Droughts can have wide-ranging impacts that may affect large areas and cross jurisdictional boundaries. Droughts can last anywhere from a few weeks to several years, with impacts primarily experienced as water shortages and agriculture-related losses. More specifically, droughts can reduce municipal water supplies, lower agricultural yields, damage natural resources and wildlife habitat, and limit recreation opportunities. It is a hazard that can affect all populations, structures, and infrastructure.

Water is a critical resource for everyday household use, including drinking, cooking, and cleaning. It is also critical for day-to-day business operations in manufacturing and agriculture. Drought can lead to water supply shortages for various community activities, resulting in use restrictions or higher costs. These shortages may disproportionately affect low-income households, making it harder for them to afford the increased water expenses.

The 2024 Utah State Hazard Mitigation Plan conducted drought vulnerability rankings for each county in the state, based on local hazard mitigation plans (LHMPs). Each LHMP was reviewed to gather data on how each jurisdiction viewed their vulnerability to drought. The frequencies and severities of drought as reported in the LHMPs were gathered to establish a drought hazard ranking. This ranking is based on a combination of severity and probability/frequency, both categorized from 0 to 4. The numbers were then combined to calculate a ranking from 0 to 8. The map in Figure 73 shows the drought hazard ranking for each county as reported in the LHMPs.

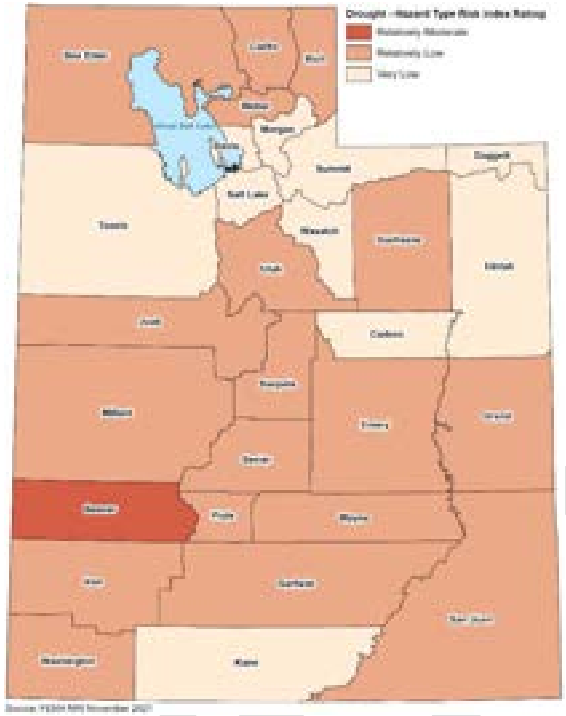


Figure 73: Risk Index Rating for Drought for Utah Counties

Table 37 lists the agriculture statistics for Salt Lake County from the 2023 Agriculture Census, the most current agriculture census data available.

Table 37: Salt Lake County Agricultural Statistics[91]

Farms	Total Acres	Market Value of Products Sold	Estimated Market Value of Land and Buildings (Average per Farm)
592	61,965	24,102,000	1,013,467

The 2019 Utah State Hazard Mitigation Plan also lists 1,463 state-owned facilities in Salt Lake County that are vulnerable to the effects of drought, with an insured value of $7,274,528,270.

ESTIMATED IMPACT AND POTENTIAL LOSSES

Population growth and land use can significantly impact drought conditions by placing a strain on water resources. The demand for water rises as the population increases, which can lead to the over-extraction of water from aquifers, rivers, and lakes. This can exacerbate drought conditions, especially when water is already scarce. Urbanization and agricultural expansion also can place a strain on water reservoirs

91 National Agricultural Statistics Service Mountain Region, Utah Field Office. “2023 Utah Agricultural Statistics.” USDA National Agricultural Statistics Service.gov. https://www.nass.usda.gov/Statistics_by_State/Utah/Publications/Annual_Statistical_Bulletin/2023-Agricultural-Statistics.pdf.

while reducing the natural capacity to retain water, further intensifying drought conditions. Residents and businesses could be affected by water shortages, restrictions, or increases in costs for water.

Drought is unpredictable, making it challenging to identify the areas most threatened and provide loss estimate values. However, historical drought records demonstrate that agriculture is typically the economic sector most impacted by drought. These losses can have repercussions throughout the county and neighboring jurisdictions. For example, the agriculture sector was the hardest hit during the 2002 drought, suffering a loss of 6,110 jobs and almost $120 million in income statewide. It also caused an estimated $100 million drop in livestock sales and $50 million in hay sales. Drought-related fires are thought to have contributed to the $50 million drop in tourism sales. The combined effects of the drought in these three sectors resulted in a loss of over 6,100 jobs and $120 million in income during 2002. Construction, manufacturing, and wholesale trade also were impacted by drought. In its drought report, the Utah Division of Water Resources notes that significant data gaps hinder the quantification of drought impacts in all sectors of the economy and society. It recommends monitoring tax revenues and other economic indicators at all levels of government to improve evaluation methods and gain a clearer understanding of drought impacts.

Drought can also affect local economies by reducing recreation opportunities. Lower stream level flows and declining reservoir and lake levels may limit access to recreation sites, while some have been closed entirely due to algal blooms. Changes in the appearance quality of recreation sites also may decrease demand, leading to fewer visitors and resulting in economic losses for tourism and recreation-related industries. The Great Salt Lake contributes to lake effect snow, which influences snow levels at Utah ski resorts. The lake’s reduction in size may limit this lake effect, potentially reducing the snowpack in the nearby mountains. This could lead to less desirable ski conditions, resulting in a significant economic impact on these winter recreation sites.

Drought does not typically damage structures, critical facilities, or infrastructure; however, during severe or prolonged drought, soil may contract due to decreased soil moisture. This contraction could damage structural foundations or building walls.

Many natural systems can be negatively impacted by drought. It can cause higher concentrations of pollutants or other contaminants in water or increased nutrient concentrations and turbidity in the water supply. Algal levels also may increase, and when combined with warm temperatures, this can cause dangerous algal blooms. Reduced water supply and poor water quality also harm habitats for fish and other wildlife. Grass, trees, and other vegetation can dry out, which further alters ecosystems. Drier vegetation also poses wildfire risks, including ignition risk and rate of spread. Drought can also cause soil erosion and contribute to dust storms.

The NRI includes data on the EALs to individual natural hazards, historical loss, and overall risk at a county and census tract level. Salt Lake County’s NRI EAL value for drought is $19 million, with a risk score of 40.6 and a rating of Very Low percentile compared with the rest of the United States (Figure 74). This low rating can likely be attributed to relatively low amounts of agricultural production in Salt Lake County, which is typically the source of most drought losses.

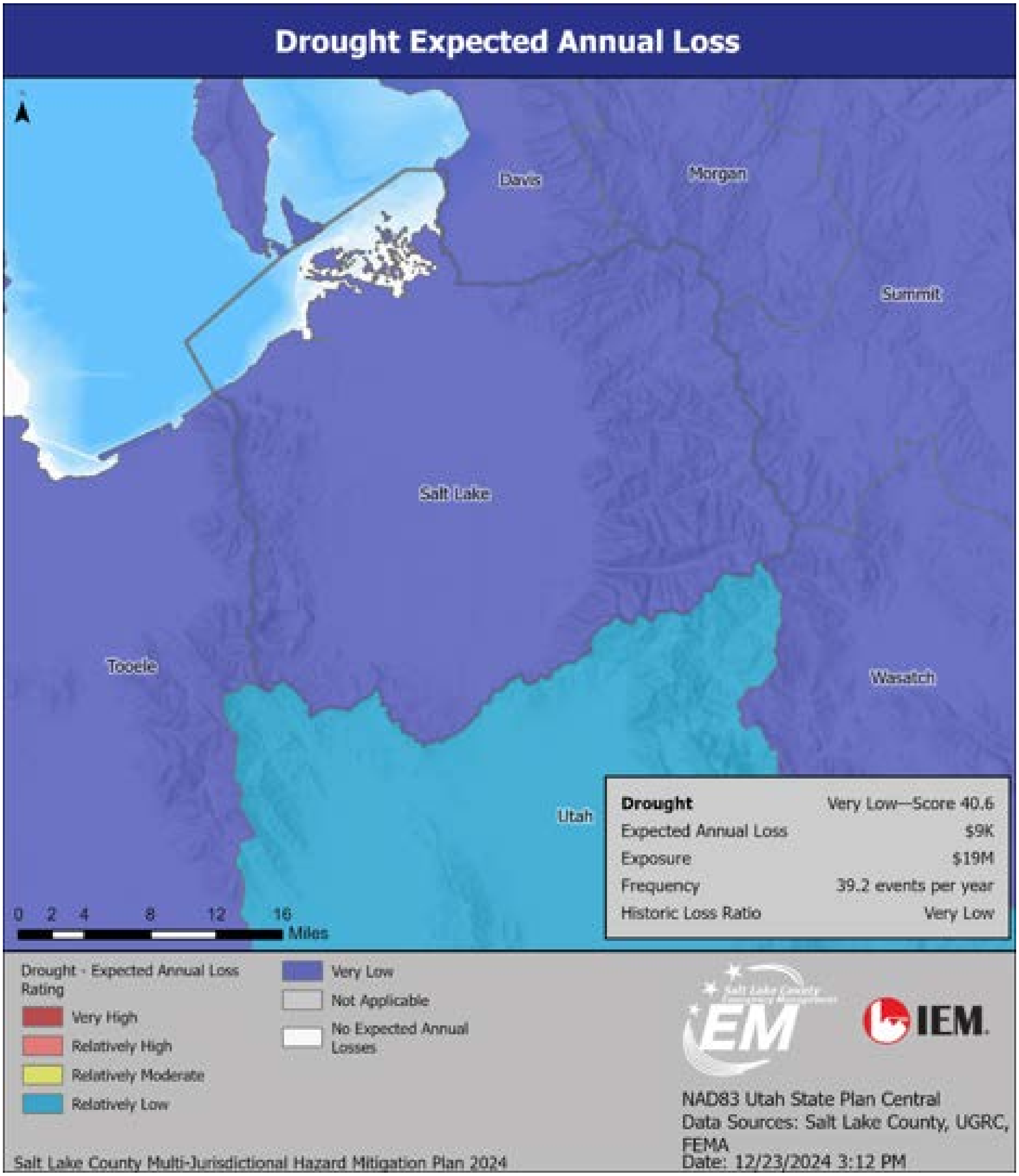


Figure 74: National Risk Index Expected Annual Loss from Drought in Salt Lake County[92]

[92] FEMA, National Risk Index. "Salt Lake County Expected Annual Loss Drought Risk Score, Map and Legend." https://hazards.fema.gov/nri/map.

VULNERABLE POPULATIONS

Drought can impact both surface water and groundwater availability and can have direct, disastrous effects on human populations. The indirect consequences of drought—such as unemployment, lower tax revenues, higher food prices, reduced outdoor recreation opportunities, higher energy costs as water levels in reservoirs decrease and consumption increases, and water rationing—are often not fully known. This complex web of impacts can affect people and economies well beyond the area physically experiencing drought. These impacts may be more significant for some populations, such as lower-income households who may be more strained by increased costs and economic losses. Individuals with underlying health conditions, the elderly, young children, and other medically vulnerable individuals may be more affected by drought-related poor air quality conditions and dust storms.

During a drought, all living organisms, including humans, animals, and crops, require access to essential resources like food, water, and shelter to survive and thrive. Without them, they become stressed and eventually die. Drought also affects shelter, as soil contractions can lead to structural damage in buildings, bridges, and other infrastructure.

COMMUNITY LIFELINES

The main lifelines for drought are food, hydration, shelter, and water systems. Crops and animals require water to thrive and grow; without it, they become stressed and ultimately die. Shelter is also affected, as drought can severely damage structural integrity as the soil pulls away from beams, buildings, bridges, and other structures. Mitigating future droughts will require conservation, creative solutions, and innovation to maintain the standard of living Salt Lake County has come to rely on.

CHANGES IN DEVELOPMENT

Experts agree that a long-term drought strategy is essential to securing Utah's water future, as water demand will continue to rise with population growth. Coupled with climate change, which acts as a magnifier, droughts can become more unpredictable and prolonged. The long-term record of reservoir levels, precipitation inputs, and projected population growth raises growing concerns about Utah's water supply, as shrinking resources face increased demand. In the last five years, Salt Lake County has seen 2.6% growth in population and significant residential and commercial development. New people and businesses put pressure on Salt Lake County's water supply on the demand side, but the county is also facing pressure on the supply side with state reservoirs reflecting wet and dry cycles. Although these fluctuations affect long-term water security and availability, residents may soon face mandatory water conservation measures, highlighting the growing vulnerability to drought.[93]

Potential impacts on the county include a decline in agriculture-related economic opportunities, food scarcity, loss of life or property, and worsened air quality. Changes in population patterns may occur as

[93] Jensen, Marcus. "State Climate Officer Explains the Winter Snow Surge and What it Means for Utah's Water Future." Utah State University, Utah State Today. January 17, 2023. https://www.usu.edu/today/story/?story=state-climate-officer-explains-the-winter-snow-surge-and-what-it-means-for-utahs-water-future.

people relocate seeking improved economic opportunities and quality of life. Changes in land use and development may also lead to changes in agriculture zoning.

VULNERABILITY SCORE

To analyze the county's vulnerability to drought, the NRI was used as a primary tool during the 2024 Hazard Identification and Risk Assessment (HIRA) update. The NRI defines risk as the potential for negative impacts from a natural hazard. It determines a community's risk relative to other communities by examining the EAL and social vulnerability in a given community in relation to that community's resilience. As shown in Figure 75, Salt Lake County has a very low NRI drought risk rating, with a risk score of 36.9.

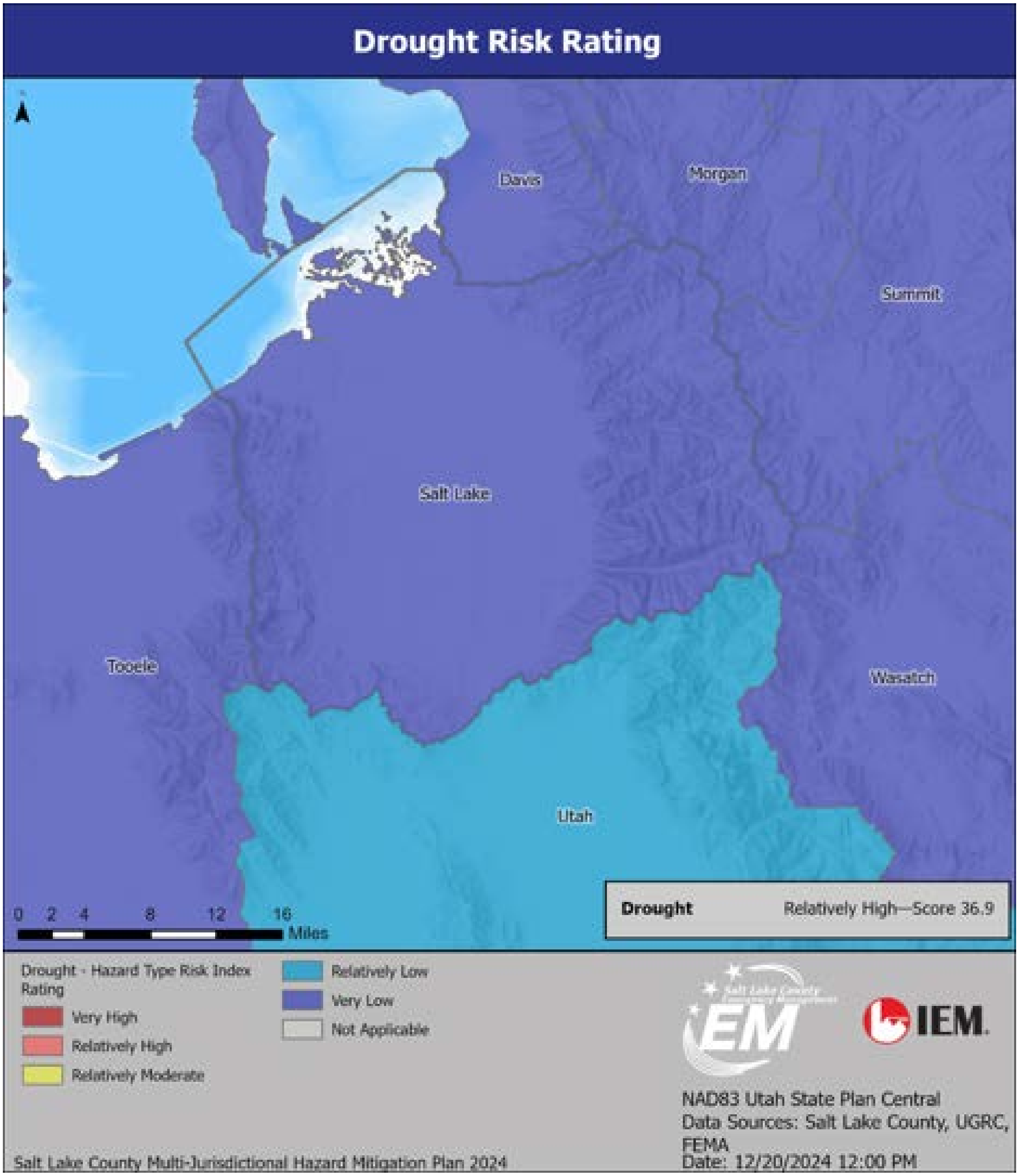


Figure 75: National Risk Index Drought Risk Map, Legend, and Score for Salt Lake County[94]

[94] FEMA, National Risk Index. "National Risk Index Salt Lake County Drought Score, Map and Legend." https://hazards.fema.gov/nri/map.

Earthquake

Hazard Description

The Utah Geologic Survey defines an earthquake as the abrupt, rapid shaking of the earth caused by sudden breakage of rocks that can no longer withstand the stresses building up deep beneath the Earth's surface. The rocks break along zones of weakness, called faults. Seismic waves are then transmitted outward, causing further ground shaking or vibrations.

The Richter scale measures the magnitude of earthquakes on a seismograph. Generally, an earthquake must be at least a magnitude 2.0 to be felt by humans, and about magnitude 5.5 before significant damage occurs. The amount of damage from an earthquake depends on soil type, rock type, groundwater depth, and topography. Other factors include the type of construction in an area and the population density. Figure 77[95] shows the effects of an earthquake on a market in the city of Magna.

Figure 76: Effects of the 2020 Magna Earthquake

GROUND SHAKING

Ground shaking is caused by the passage of seismic waves generated by an earthquake. Shaking can vary in intensity but is the greatest secondary hazard because it affects large areas and stimulates many other hazards associated with earthquakes. Moderate to large earthquake events generally produce trembling for about 10 to 30 seconds. Aftershocks can occur erratically for weeks or even months after the main earthquake event.

Seismic waves move the Earth's surface laterally and vertically and vary in frequency and amplitude. High-frequency, small-amplitude waves cause more damage to short, stiff buildings. Low-frequency, large-amplitude waves have a greater effect on high-rise buildings. The intensity depends on geologic features, such as bedrock and rock type, topography, and the location and magnitude of the earthquake. Other significant factors include groundwater depth, basin shape, sediment thickness, and the degree of sediment consolidation.

95 Photo courtesy of SLCo EM.

SURFACE FAULT RUPTURE AND TECTONIC SUBSIDENCE

Surface fault rupture is caused by relative movement between blocks in the Earth's crust. In Utah, this results in the formation of scarps or steep breaks in the slope. The 1934 Hansel Valley earthquake resulted in a surface displacement of approximately 1.6 feet. Earthquakes with a magnitude of 6.5 or greater could cause surface faulting with heights of 16 to 20 feet and break segments ranging from 12 to 44 miles long. Surface displacement generally occurs over a zone hundreds of feet wide called the zone of deformation and can cause severe damage to building foundations or lifelines (roads, pipelines, communications lines) that cross the fault. Tectonic subsidence, or down dropping and tilting of the valley floor, generally depends on the amount of surface fault rupture and can cause flooding by tilting lakebeds or dropping the ground surface below the water table. The greatest amount of subsidence will be in the fault zone and will gradually diminish out into the valley.

Hazard Profile

Potential Impact	X	Catastrophic	**Probability**		Highly Likely
		Critical		X	Likely
		Limited			Occasional
		Negligible			Unlikely
Location	Ground shaking will be felt throughout the county. Surface fault rupture can be found in areas of known historic fault movements. Liquefaction can be expected in areas of high to moderate liquefaction potential.				
Seasonal Pattern	None.				
Conditions	Liquefaction potential in areas with shallow groundwater. Soil comprised of old lakebed sediments. Historic movement along faults. Intermountain seismic zone, Wasatch Fault.				
Duration	Actual ground shaking will be under one minute; aftershocks can occur for weeks or even months.				
Secondary Hazards	Fire, landslide, rock falls, avalanche, flooding, hazardous material release, transportation and infrastructure disruptions, essential service disruptions (communications, utilities)				
Analysis Used	Review of hazard analysis plans and other information provided by the University of Utah Seismograph Station, Utah Geological Survey, United States Geological Survey, FEMA, Hazus, Utah Division of Emergency Management, Utah Geospatial Resource Center				

Magnitude/Extent

Currently, the most-used magnitude scale is the moment magnitude (Mw) scale, with the following classifications of magnitude:

- **Great:** Mw > 8
- **Major:** Mw = 7.0–7.9
- **Strong:** Mw = 6.0–6.9
- **Moderate:** Mw = 5.0–5.9

- **Light:** Mw = 4.0–4.9
- **Minor:** Mw = 3.0–3.9
- **Micro:** Mw < 3

Estimates of moment magnitude roughly match the local magnitude scale (ML), commonly called the Richter scale. One advantage of the moment magnitude scale is that, unlike other magnitude scales, it does not saturate at the upper end. That is, there is no value beyond which all large earthquakes have about the same magnitude. For this reason, moment magnitude is now the most frequently used estimate of large earthquake magnitudes.

Another commonly used intensity scale is the Modified Mercalli intensity scale, with ratings defined as follows.[96]

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest,especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	*<.17*	*.17-1.4*	*1.4-3.9*	*3.9-9.2*	*9.2-18*	18-34	34-65	65-124	>124
PEAK VEL. (cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	*16-31*	*31-60*	*60-116*	*>116*
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Figure 77: Earthquake Intensity Scale[97]

[96] USGS. The Modified Mercalli Intensity Scale. https://www.usgs.gov/programs/earthquake-hazards/modified-mercalli-intensity-scale.
[97] Earthquake Hazards Program. "EQ Magnitude, Energy Release, and Shaking Intensity." U.S. Geological Survey. https://www.usgs.gov/media/images/eq-magnitude-energy-release-and-shaking-intensity-3.

The Intermountain Seismic Belt (ISB) contains the Wasatch Fault—one of the longest and most active normal faults in the world—with a potential for earthquakes with a magnitude up to 7.5. The largest earthquakes in Utah occur in the ISB, with at least 35 earthquakes of magnitude 5.0 or greater occurring since 1850.

According to the U.S. Geological Survey (USGS), the range of earthquake magnitude experienced in Salt Lake County since 1962 is .01 to 5.7.

Location

Utah's earthquake hazard is greatest in the ISB, which extends 800 miles from Montana to Nevada and Arizona, and trends from north to south through the center of Utah.[98]

The Wasatch Fault traces along the base of the Wasatch Mountain Range. It comprises 10 segments that act independently, meaning that a part of the fault ruptures separately as a unit during an earthquake. The Salt Lake City segment traverses Salt Lake County from north to south, roughly along the eastern foothills of the Wasatch Mountains. In the Salt Lake City segment of the Wasatch Fault are three smaller segments from north to south known as the Warm Springs Fault, the Virginia Street Fault, and the East Bench Fault. Other faults in Salt Lake County include the West Valley Fault zone and the East Great Salt Lake Fault zone. Each of these fault zones has a much longer return interval (2,500 years or more) and is not expected to produce a major quake in the near future. Table 38 describes the characteristics of these fault zones and Figure 78 shows the location of each in the county.

Table 38: Fault Zones in Salt Lake County

Name	Fault Type	Length (km)	Time of Most Recent Deformation	Recurrence Interval
East Great Salt Lake Fault zone, Antelope Island section	Normal	35	586 201/-241 cal yr B.P.	4,200 years
Wasatch Fault zone, Salt Lake segment	Normal	43	1,300 ± 650 cal yr B.P.	1,300 years
West Valley Fault zone, Granger segment	Normal	16	1,500 ± 200 cal yr B.P.	2,600–6,500 years
West Valley Fault zone, Taylorsville segment	Normal	15	2,200 ± 200 cal yr B.P.	6,000–12,000 years
Cal yr B.P.= calendar years before present				

[98] Utah Geological Survey, 1996. "The Wasatch Fault," Public Information Series 40, pi-40.pdf.

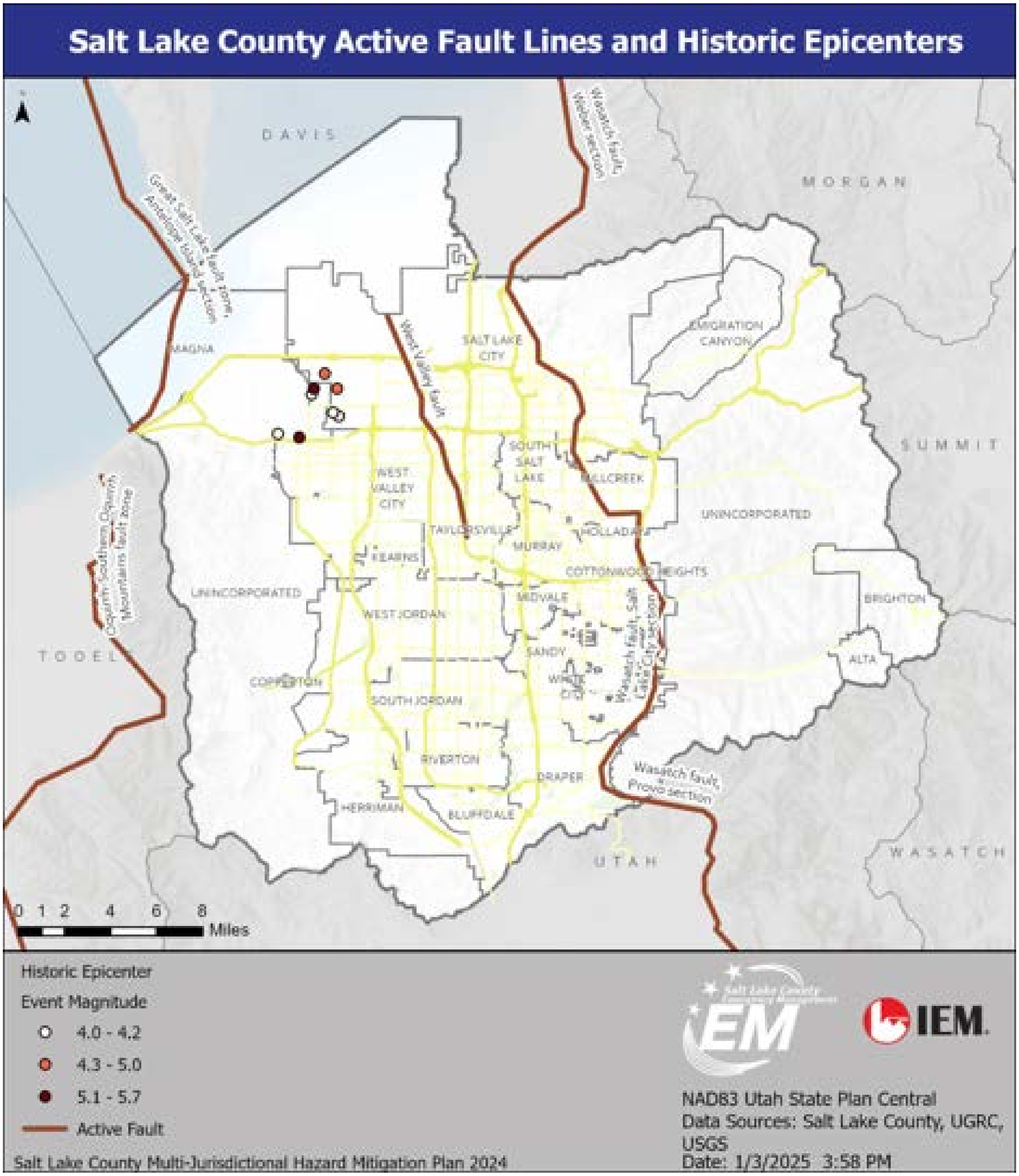


Figure 78: Active Fault Lines and Historic Epicenters in Salt Lake County

Liquefaction is a major hazard associated with earthquakes in Utah. It may occur when ground shaking causes water-saturated sandy soils to lose strength and soil to behave like a viscous liquid rather than a solid. Liquefaction can cause buildings to sink or tilt, underground storage tanks to rise, and other types of slope failures to occur. As shown in Figure 79, the Salt Lake Valley is located atop the ancient Lake Bonneville lakebed, which is made up of unconsolidated sandy soils. Much of the valley is also subject to shallow groundwater. Both contribute to a large area of the north and central part of the county, where liquefaction potential is moderate to high.

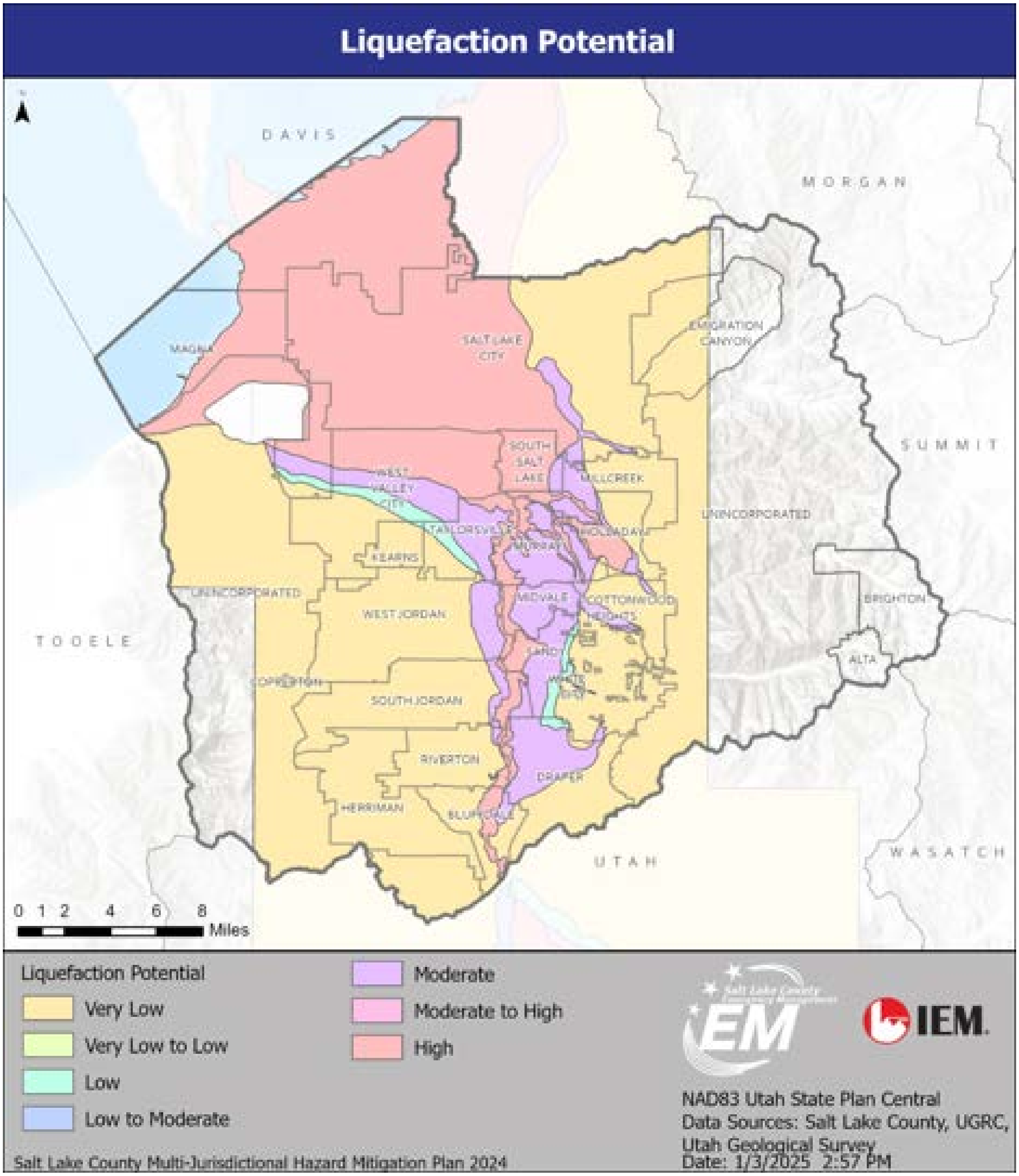


Figure 79: Liquefaction Potential in Salt Lake County

Historical Events and Probability of Future Occurrences

Utah experiences approximately 700 earthquakes each year, approximately six with a magnitude of 3.0 or greater. On average, a moderate, potentially damaging earthquake (magnitude 5.5–6.5) occurs in the state every 10 years. Large earthquakes (magnitude 6.5–7.5) occur on average every 50 years. Based on this recurrence interval, probability is considered to be likely. The history of seismic activity in Utah and along the Wasatch Front suggests that it is not a matter of *if* but *when* an earthquake will occur.

At least 26 large-magnitude (~6.5 or greater), surface-rupturing earthquakes have occurred in the past 6,500 years. On average, a large earthquake occurs every 300 years. The most recent large earthquake took place about 300 years ago in the Nephi segment. The Weber segment experienced a large earthquake about 500 years ago. The Salt Lake City segment has an average recurrence time of about 1,300 years between large earthquakes; however, the last major earthquake affecting most of the Salt Lake City segment occurred about 1,400 years ago. Enough energy has accumulated on the Salt Lake City segment to produce a magnitude 7.0+ earthquake.[99]

Magna Earthquake, March 18, 2020: A 5.7 magnitude earthquake rattled homes from southern Idaho to Millard County, causing significant damage to multiple buildings and displacing some residents. According to the USGS, the quake happened at 7:09 a.m., with the epicenter just north of Magna, between the city and Antelope Island near the edge of the Great Salt Lake. The quake forced the Salt Lake City International Airport to shut down operations for several hours, streets were closed, hazardous materials crews considered evacuating all of Magna due to a chemical leak at Kennecott, and damage was reported to structures in Magna, Kearns, West Valley City, and downtown Salt Lake City. Emergency officials called it the largest earthquake in Utah since a 5.9 magnitude quake hit St. George in 1992. An estimated 2.8 million people felt the shaking.[100]

[99] Utah Seismic Safety Commission, Utah Division of Emergency Management, et al. "Putting Down Roots in Earthquake Country, 2nd Ed." 2022. https://ugspub.nr.utah.gov/publications/non_lib_pubs/putting-down-roots.pdf.
[100] PBS News.org. "5.7-magnitude quake shakes Utah, Salt Lake airport closed." March 18, 2020. https://www.pbs.org/newshour/nation/5-7-magnitude-quake-shakes-utah-salt-lake-airport-closed.

Figure 80: Damage Following the Magna Earthquake[101]

Based on the FEMA Disaster Declarations Database, Salt Lake County received an Earthquake and Aftershocks Major Disaster Declaration on December 31, 2020, for the incident period March 18, 2020, to April 17, 2020, and the county was designated for individual and public assistance.

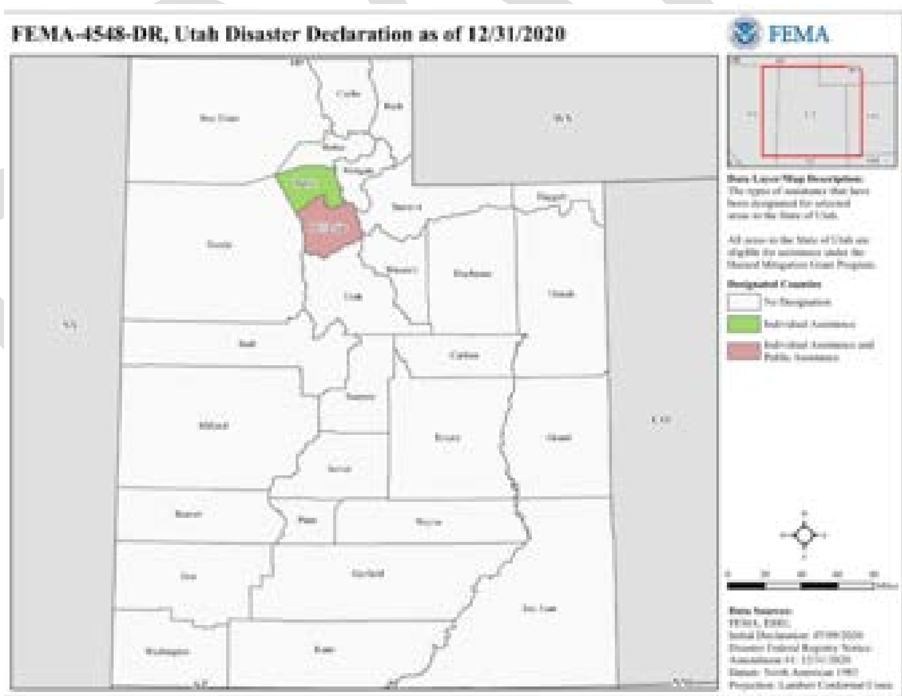


Figure 81: FEMA DR-4548 Utah Disaster Declaration for Earthquake and Aftershocks, December 31, 2020[102]

[101] Photo provided by SLCo EM.
[102] FEMA Disasters and Other Declarations. “Utah Earthquake and Aftershocks: DR-4548-UT.” 2024. https://www.fema.gov/disaster/4548.

Figure 82 illustrates <M4 earthquake events occurring in and around Salt Lake County between 2010 and 2024, including the Magna earthquake in 2020.

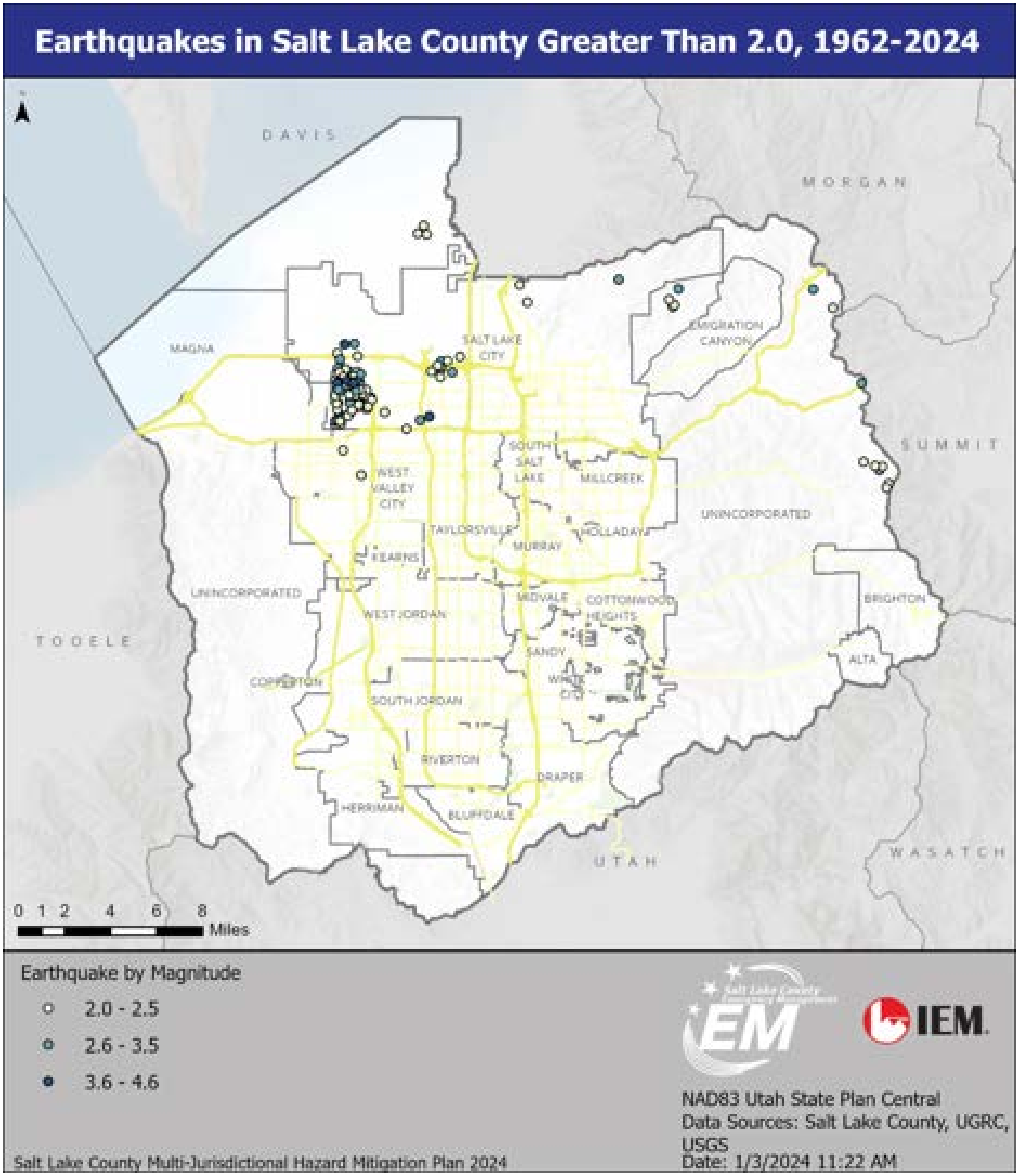


Figure 82: Earthquakes in Salt Lake County Greater than 2.0, 1962–2024

Although no surface-faulting earthquakes have occurred on the Wasatch Fault in recent history, evidence of many prehistoric events exists in the geologic record.[103] The segments between Brigham City and Nephi have a composite recurrence interval (average time between earthquake events) for large surface-faulting earthquakes (magnitude 7.0–7.5) of 300–400 years. The average repeat time on an individual segment is 1,200–2,600 years. The most recent surface-faulting earthquakes occurred about 500 years ago in the Provo and Weber segments, and about 350 years ago in the Nephi segment.

According to USGS records, more than 159 recorded earthquakes of 2.0 magnitude or greater occurred in or immediately around Salt Lake County from 1962 through 2024. Significant earthquakes have occurred in Salt Lake County in the last 50 years. In 1962, a 5.2 Richter magnitude quake jolted the Magna area. In 1992, a magnitude 4.2 quake shook the southern portion of the county.

The two largest measured earthquakes to occur in Utah were the Richfield earthquake of 1901, with a magnitude of 6.5, and the Hansel Valley earthquake of 1934, with a magnitude of 6.6. The Hansel Valley earthquake produced MM intensities of VIII in Salt Lake City, with many reports of broken windows, toppled chimneys, and structures twisted on their foundations. A clock mechanism weighing more than 2 tons fell from the main tower of the Salt Lake City County Building and crashed through the building. The only death that occurred during the event was caused when the walls of an excavation collapsed on a public works employee south of downtown Salt Lake City.

Utah's most damaging earthquake was of a smaller magnitude (5.7), occurring near Richmond in Cache Valley in 1962. This earthquake damaged over 75% of the houses in Richmond, as well as roads and various other structures. The damage was about $1 million (in 1962), which would be about $7,768,300 today with inflation.

The Working Group on Utah Earthquake Probabilities assessed the likelihood of large earthquakes in the Wasatch Front region. The assessment indicates there is an 18% probability of a M6.75 earthquake on the Wasatch Fault in the next 50 years, and a combined 43% probability in the next 50 years based on all faults in the region. For an M6.0 earthquake, the probability is 18% along the Wasatch Fault and 57% in the region.[104] The National Seismic Hazard model shows the potential for peak ground accelerations having a 2% probability of being exceeded in 50 years (Figure 83). The Wasatch Fault is the most active in the region.

[103] Utah Geological Survey, Public Information Series 40. "The Wasatch Fault." 1996. https://ugspub.nr.utah.gov/publications/public_information/pi-40.pdf.
[104] U.S. Geological Survey. "Fact Sheet 2016–3019: Earthquake Forecast for the Wasatch Front Region of the Intermountain West." April 2016. ussc.utah.gov/pages/download.php?direct=1&noattach=true&ref=1279&ext=pdf&k=.

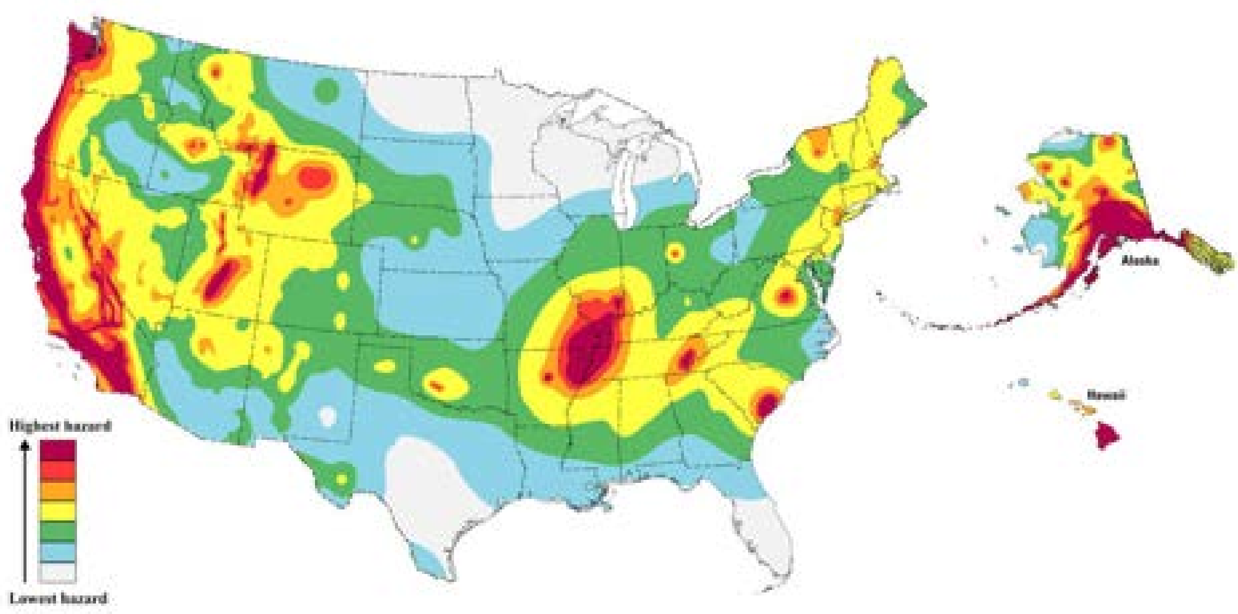


Figure 83: National Seismic Hazard Model[105]

Climate Change Considerations

Recent geological studies have shown that climate change, specifically rising rainfall rates and glacial melting, could exacerbate seismic activity, including earthquakes. Geologists have identified the correlation between the frequency of earthquakes and annual rainfall cycles. Changing climate conditions, such as a warmer atmosphere, can retain more water vapor, leading to higher levels of precipitation. As precipitation levels increase rainfall, the Earth's crust is compressed, both vertically and horizontally, stabilizing it. When this water disappears in the winter, the effective "rebound" destabilizes the region and increases the number of earthquakes that occur.[106]

Secondary Hazards

Secondary hazards from earthquake events can include liquefaction, slope failure, flooding, avalanches, sensitive clays, subsidence, and valley fever.

SOIL LIQUEFACTION

Liquefaction can occur when water-saturated, cohesionless, sandy soils are subjected to ground shaking. The soils "liquefy" or become like quicksand, lose bearing capacity and shear strength, and readily flow on the gentlest of slopes. Liquefaction is common in areas of shallow groundwater and sandy or silty sediments. Liquefaction can produce lateral spreading and flows, where surface soil layers break up and move independently. Displacement of up to three feet may occur, accompanied by ground cracking and

---

[105] Earthquake Hazards Program. "National Seismic Hazard Model." March 9, 2022. U.S. Geological Survey. https://www.usgs.gov/programs/earthquake-hazards/science/national-seismic-hazard-model.

[106] Blackett, Matthew and The Conversation. "Scientist Find a Possible Connection Between Climate Change and Earthquake Risk." Inverse. February 20, 2024. https://www.inverse.com/science/climate-change-volcano-earthquake-connection.

differential vertical displacement. Soil may move downhill, pulling apart roads, buildings, pipelines, and buried utilities. Bearing capacity will lessen and can cause buildings to settle or tip, while lightweight buoyant structures, such as empty storage tanks may “float” upward. Liquefaction can also cause the foundation materials beneath earthfill dams to liquefy and fail, the flooding of low-lying areas by groundwater, the backup of gravity-fed systems, and the formation of sand boils. Sand boils are deposits of sandy sediment ejected to the surface during an earthquake along fissures. Liquefaction can occur during earthquakes of magnitude 5.0 or greater.

SLOPE FAILURE

Ground shaking can cause rock falls and landslides in mountainous or canyon areas. Rock falls are the most common slope failure and can occur up to 50 miles away from a 6.0 magnitude earthquake. Landslides occur along steep slopes and benches in wet, unconsolidated materials. During a 6.0 magnitude earthquake, landslides typically occur within 25 miles of the source.

FLOODING

Flooding can occur due to tectonic subsidence and tilting, dam failure, seiches (waves generated in standing bodies of water) in lakes and reservoirs, surface-water diversion or disruption, and increased groundwater discharge.

AVALANCHES

Avalanches can be triggered by ground movement. The most vulnerable areas include those with steep terrain, high precipitation, high earthquake potential, high population density, and heavy backcountry use.

SENSITIVE CLAYS

Sensitive clays are a soil type that lose strength and are subject to collapse when shaken. The resulting type of ground failure is similar to liquefaction.

SUBSIDENCE

Subsidence involves a settling or sinking of loose granular materials, such as sand and gravel that do not contain clay. Ground displacement caused by surface fault rupture can cause tectonic subsidence. This is a broad, permanent tilting of the valley floor down toward the fault scarp. This can alter stream flows, cause flooding along lake and reservoir shorelines, and disrupt gravity-flow systems.[107]

VALLEY FEVER

Valley fever is an illness caused by the fungus *Coccidioides*, which grows in soils in areas with low rainfall, high summer temperatures, and moderate winter temperatures, such as the project site. It is found most often in the southwestern United States, especially Arizona, Utah, Texas, and California.

[107] Utah Geological Survey, Geologic Hazards, Utah Faults. https://geology.utah.gov/hazards/earthquakes/utah-faults/#toggle-id-2.

Exposure typically occurs in connection with ground-disturbing activities that release fungal spores, which are then inhaled. Earthquakes disturb soil-enabling spores, allowing them to spread into the air.

Most people who are exposed to the fungus do not develop symptoms or have relatively mild flu-like symptoms. Common symptoms include fever, cough, headache, rash, muscle aches, and joint pain. Symptoms of advanced coccidioidomycosis may include skin lesions, chronic pneumonia, meningitis, and bone or joint infection. Symptoms may appear between one and three weeks after exposure. Some patients have reported having symptoms for six months or longer, especially if the infection is not diagnosed early. Valley fever is not known to spread from person to person or between people and animals.

Vulnerability Assessment

Earthquakes can cause extensive damage to Salt Lake County. Moderate earthquakes have caused costly damage in the past, and there is the potential for stronger earthquakes with even more pronounced effects. A strong earthquake will cause significant structural damage and is likely to damage infrastructure, interrupt other services, and disrupt lives in this and neighboring counties. Structural damage can cause injury or death to building occupants. Widespread damage to buildings and infrastructure will disrupt businesses and other community activities and might lead to significant economic losses. Recovery will take substantial resources and costs and could take years.

The vulnerability of people and infrastructure to earthquake hazards in Salt Lake County was obtained from the modeling program Hazus 6.1. The Hazus earthquake scenario entails a magnitude 6.2 earthquake occurring in Salt Lake County with an epicenter on the Warm Springs Fault in the northern part of the county. The vulnerability and loss estimates in this section are based on this scenario. Hazus evaluates the probability of damage to buildings and infrastructure and impacts on the population based on models of earthquake ground-shaking intensity.

ESTIMATED LOSSES AND POTENTIAL IMPACTS

CRITICAL INFRASTRUCTURE

Critical infrastructure (i.e., schools, emergency operation centers, county facilities, fire stations, hospitals, and police stations) across most of the Salt Lake jurisdiction experienced severe peak ground acceleration based on the Hazus loss estimation model for a magnitude 6.2 earthquake. South Salt Lake and most of Millcreek, Magna, West Valley City, Holladay, Murray, Taylorsville, and Kearns experienced very strong peak ground acceleration in the same model. Areas experiencing strong peak ground acceleration in the Hazus model include western portions of Magna and South Jordan; northern portions of the unincorporated areas of the county, Riverton, and Draper; southern portions of West Valley City, Kearns, Taylorsville, Murray, and Holladay; eastern portions of Emigration Canyon, West Jordan, and Magna; and most of West Jordan, Midvale, Cottonwood Heights, Sandy City, and White City. The remainder of the county experienced moderate peak ground acceleration in the Hazus model. An examination of the building and contents loss scenario for a magnitude 6.2 earthquake shows that most losses will occur in the southern portion of Salt Lake City and the northern portion of West Valley City.

Figure 84–Figure 89 show the locations of the different categories of critical facilities in relation to peak ground acceleration values. Table 39 lists the number of facilities that may be damaged and how long they may lack functionality.

Table 39: Expected Damage to Essential Facilities

Classification	Total	Number of Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on Day 1
Hospitals	16	7	0	5
Schools	422	146	4	170
Emergency Operations Centers	18	6	0	8
Police Stations	33	16	0	11
Fire Stations	67	22	0	31

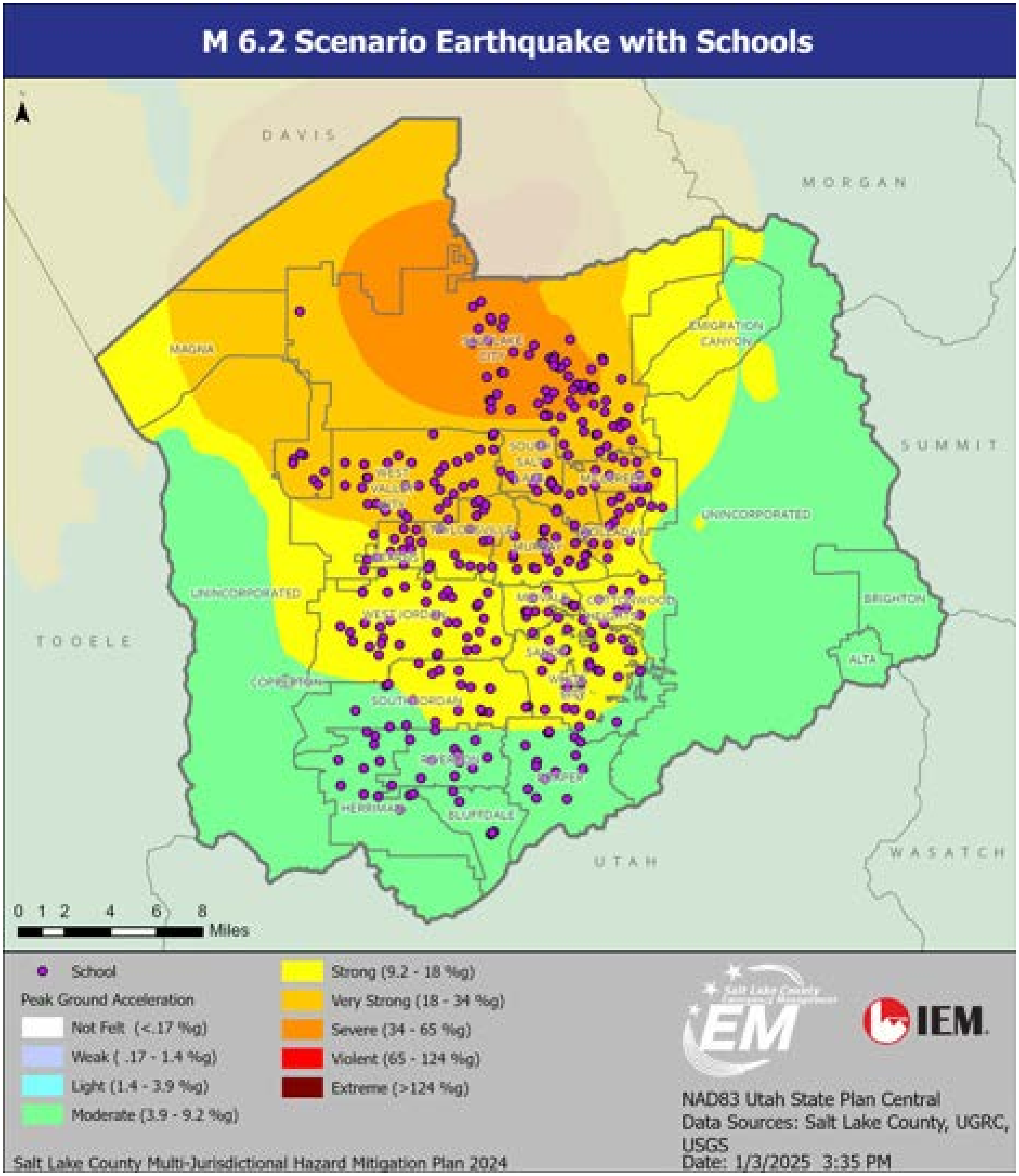


Figure 84: Schools in Salt Lake County in the M 6.2 ShakeMap Scenario

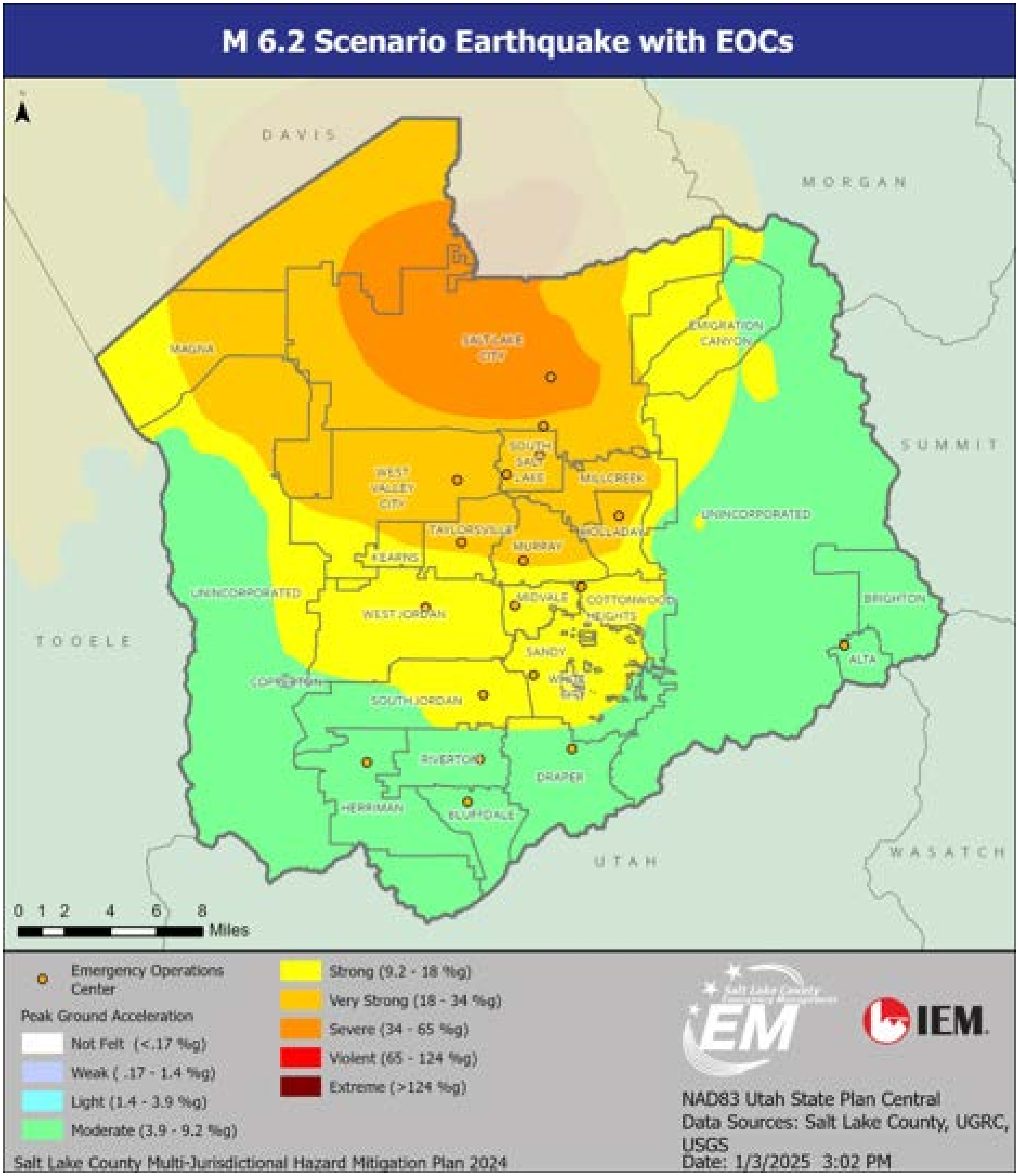


Figure 85: Emergency Operations Centers in Salt Lake County in the M 6.2 ShakeMap Scenario

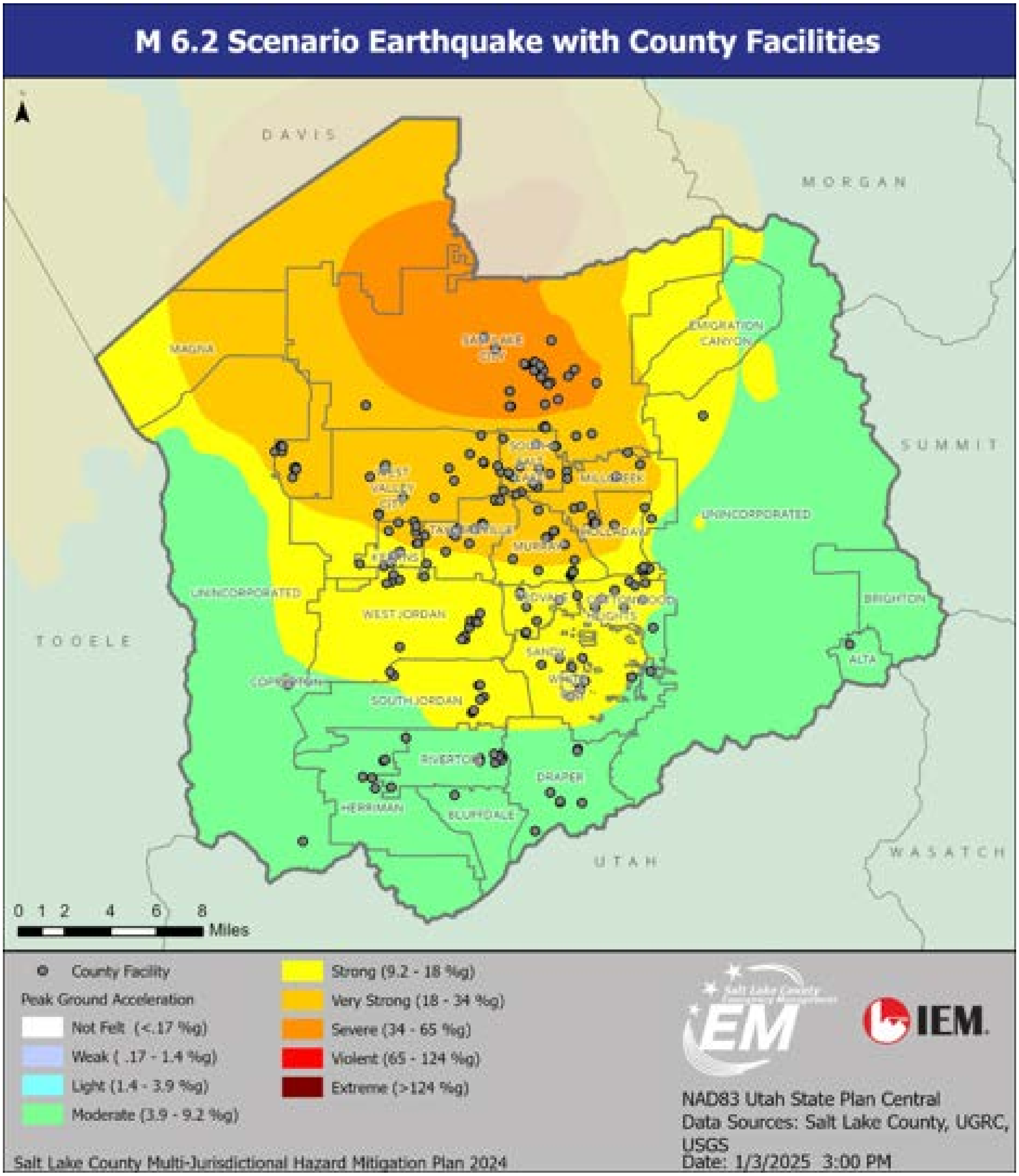


Figure 86: County Facilities in Salt Lake County in the M 6.2 ShakeMap Scenario

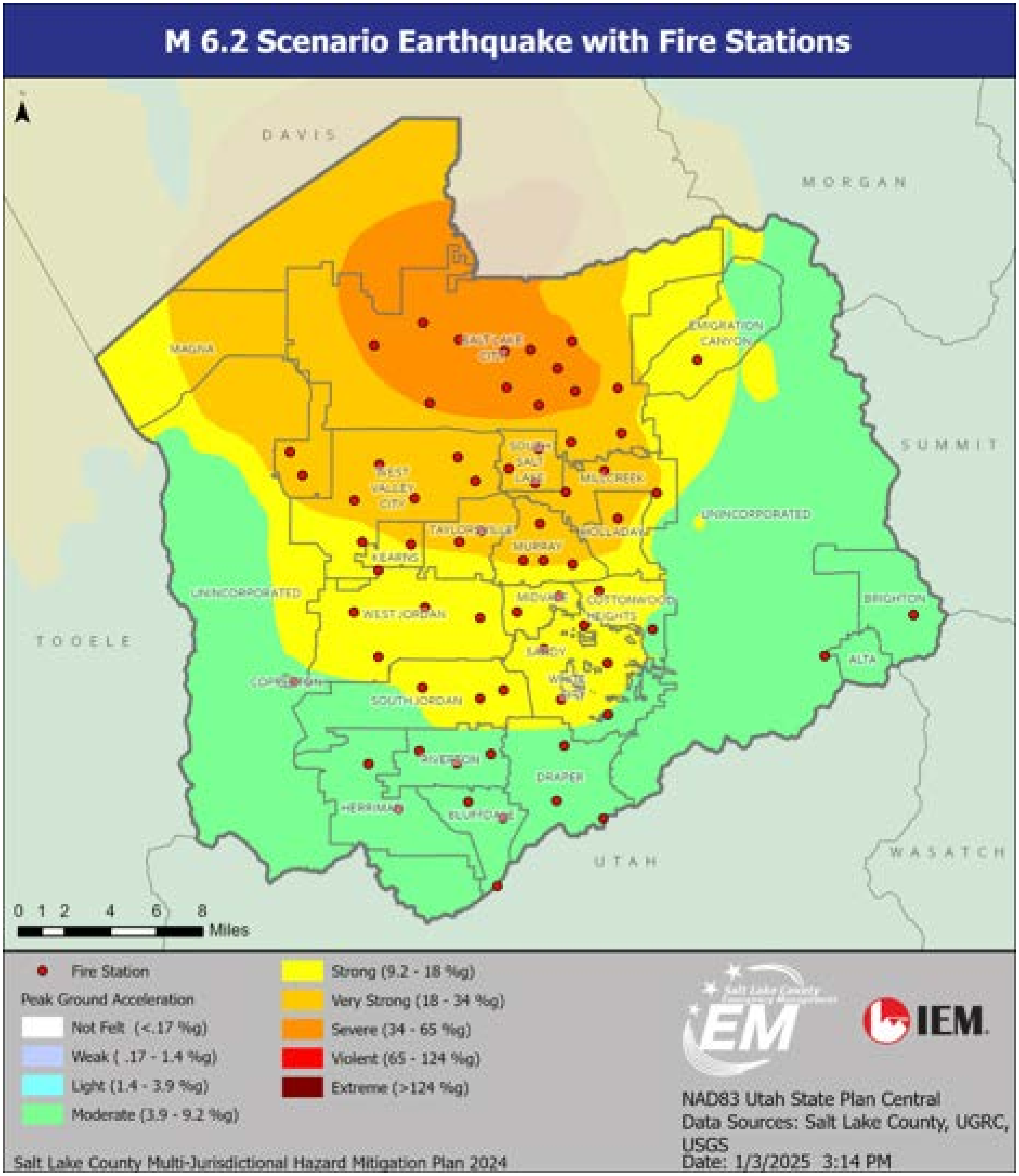


Figure 87: Fire Stations in Salt Lake County in the M 6.2 ShakeMap Scenario

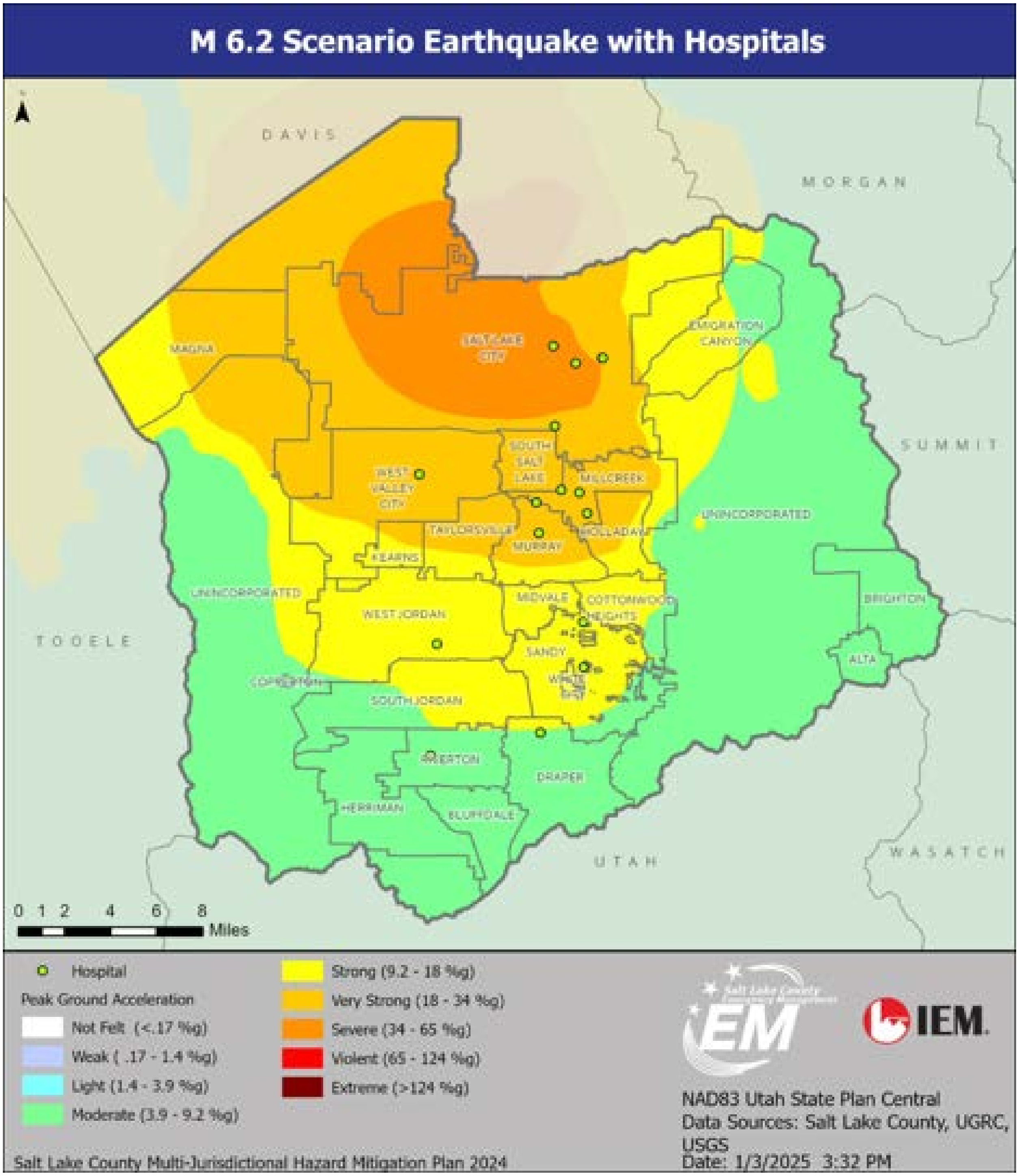


Figure 88: Hospitals in Salt Lake County in the M 6.2 ShakeMap Scenario

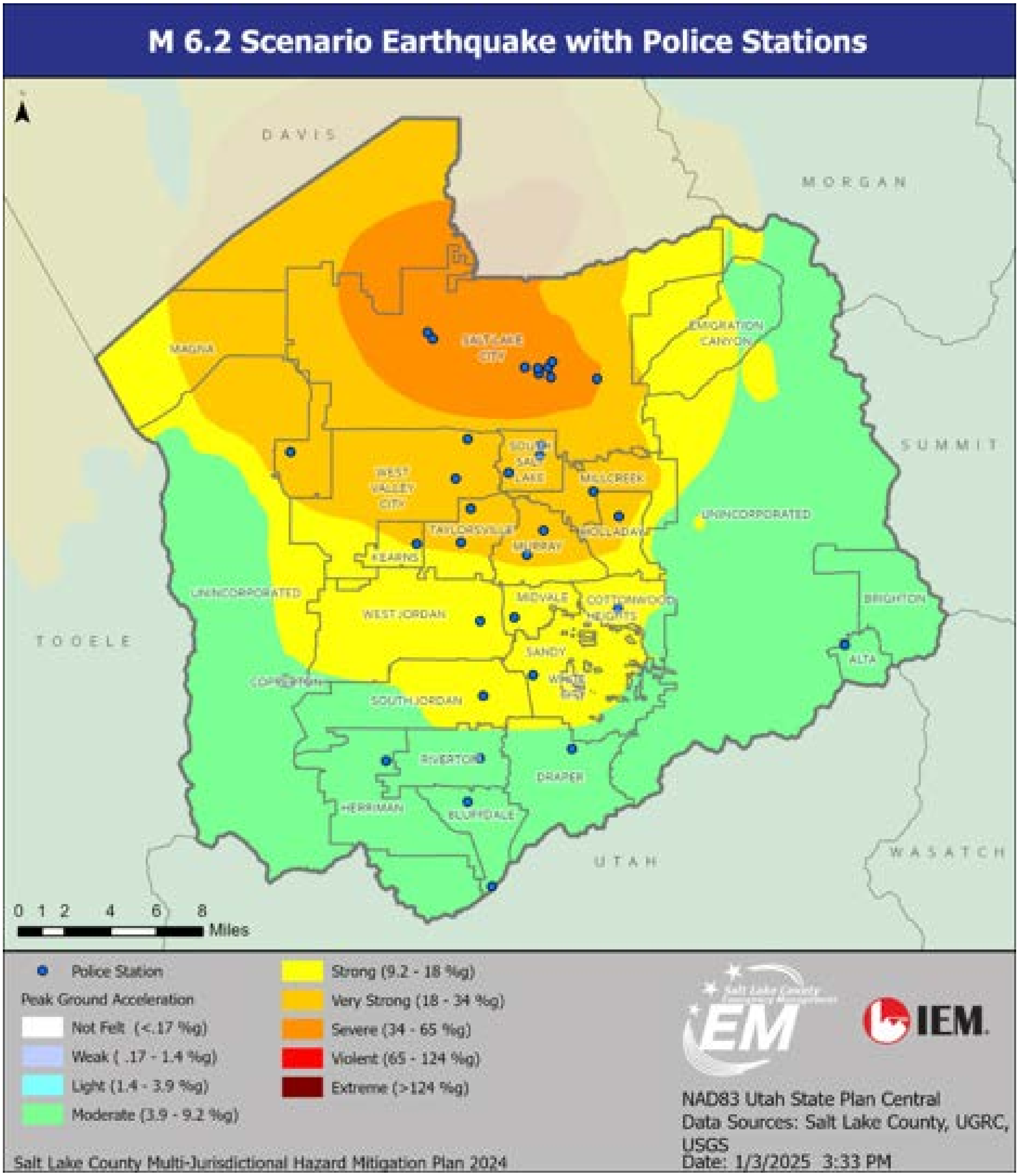


Figure 89: Police Stations in Salt Lake County in the M 6.2 ShakeMap Scenario

STRUCTURAL LOSSES

The economic loss estimated for the earthquake is approximately $13.7 billion, which includes building- and lifeline-related losses based on the region's available inventory. Hazus estimates that there are 360,000 buildings in the county with a replacement value of over $172 billion. An estimated 56,217 buildings will be at least moderately damaged in this scenario, which is over 16% of the buildings in the region. Over 6,000 will be damaged beyond repair. The following sections provide more detailed information about these losses, which can be broadly grouped into three categories: direct building, business interruption, and transportation and utility lifeline losses.

Direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. Business interruption losses are the losses associated with the inability to operate a business due to damage sustained during the earthquake, including temporary living expenses for individuals displaced from their homes by the earthquake. Table 40 shows the direct and indirect losses for the county based on different building occupancy types.

Table 40 summarizes the expected damage and loss. The building-related losses were $12,546,760,000, 22% of which were related to business interruptions in the region. By far, the largest loss was sustained by the residential occupancy category, accounting for 36% of the loss.

Table 40: Building-Related Economic Loss Estimates (in Millions)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Business Interrup-tion Losses	Wage	$0.00	$91.43	$386.44	$33.58	$91.23	$602.68
	Capital-Related	$0.00	$38.87	$344.99	$20.86	$17.44	$422.16
	Rental	$94.93	$176.80	$208.32	$24.11	$56.57	$560.73
	Relocation	$332.75	$98.55	$319.13	$123.22	$297.46	$1,171.10
	Subtotal	**$427.68**	**$405.65**	**$1,258.88**	**$201.77**	**$462.70**	**$2,756.67**
Direct Losses	Structural	$624.74	$209.17	$582.07	$339.12	$255.66	$2,010.76
	Non-structural	$1,445.45	$820.17	$1,334.90	$963.97	$780.28	$5,344.77
	Content	$388.33	$173.04	$641.09	$650.22	$326.17	$2,178.84
	Inventory	$0.00	$0.00	$152.95	$98.82	$3.95	$255.71
	Subtotal	**$2,458.52**	**$1,202.38**	**$2,711.01**	**$2,052.13**	**$1,366.06**	**$9,790.08**
Total		**$2,886.20**	**$1,608.03**	**$3,969.89**	**$2,253.90**	**$1,828.76**	**$12,546.75**

Table 41 shows the potential structural losses for each jurisdiction based on the Hazus model. Large cities and urban areas are the most financially affected by the effects of an earthquake. Major urban areas, such as Salt Lake City and West Valley City, can expect high structural and income losses. Jurisdictions, such as Millcreek, Murray, and Cottonwood Heights can expect structural and building losses with a need for extensive repairs, especially for businesses and residential sectors. Although the model did not project significant structural damage for Alta, Brighton, and Copperton, these communities may be affected by secondary hazards, such as earthquake-induced avalanches, dam failure, or landslides, leading to road closures and the disruption of power and communications services.

The table shows significant losses in the larger urban areas of Salt Lake County, with Salt Lake City experiencing the largest loss at $9,407,870,930, reflecting widespread damage in both the residential and business sectors. West Valley City reports $851,62,700 in losses, with significant inventory and building losses resulting in a major loss of building assets. Other significantly impacted areas include the jurisdictions of Millcreek and Murray, with Millcreek experiencing significant structural and building losses ($435,019,240) and Murray experiencing a large income loss ($25,011,510).

Jurisdictions, such as Cottonwood Heights, Kearns, Sandy, South Jordan, and Taylorsville, can expect to experience moderate losses per the Hazus loss estimation model, with losses ranging from $35,964.36 to $78,365.44. Although these areas experience a substantial loss across various categories, it is not considered catastrophic. The unincorporated areas of the county experience the lowest total losses in the model, $5,827.50, with minor impacts in categories, such as inventory and wage loss. Unincorporated areas are typically less densely populated, leading to lower overall losses.

Figure 90 and Figure 91 show the areas in the county with the highest losses.

Table 41: Approximated Hazus Loss Estimation by Jurisdiction (in Thousands)

Name	Total Loss	Wage Loss	Structural Loss	Rent Loss	Relocation Loss	Non-structural Loss	Inventory Loss	Income Loss	Content Loss	Building Loss
Alta	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Bluffdale	$2,508.93	$0.63	$151.15	$2.63	$0.00	$726.64	$6.91	$0.19	$318.60	$785.50
Brighton	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Copperton	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Cottonwood Heights	$49,130.52	$35.53	$7,753.55	$115.88	$44.55	$6,841.72	$63.91	$40.30	$2,961.67	$7,608.81
Draper	$13,094.25	$6.28	$735.12	$25.00	$0.86	$2,419.96	$41.15	$7.24	$1,032.62	$2,642.69
Emigration Canyon	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Herriman	$2,665.82	$0.72	$100.28	$3.71	$0.00	$971.05	$4.60	$0.36	$447.94	$1,038.71
Holladay	$146,157.89	$68.77	$28,995.10	$226.65	$221.39	$13,466.27	$145.04	$52.61	$5,482.66	$15,273.70
Kearns	$42,721.10	$38.55	$6,421.93	$110.00	$127.43	$8,506.71	$31.80	$10.14	$3,548.20	$9,613.29
Magna	$45,009.31	$14.76	$6,822.80	$153.78	$267.32	$11,005.88	$102.30	$12.56	$4,584.70	$12,572.39
Midvale	$78,365.44	$43.36	$10,233.31	$145.88	$63.11	$6,611.46	$200.01	$35.45	$2,743.24	$7,354.13
Millcreek	$435,019.24	$535.75	$76,022.84	$709.44	$749.17	$29,323.69	$439.66	$287.67	$13,026.38	$33,067.43
Murray	$311,163.29	$206.48	$51,390.22	$582.91	$499.65	$25,011.51	$548.38	$168.25	$10,583.85	$28,350.81
Riverton	$8,983.12	$4.02	$726.46	$15.81	$3.01	$2,920.66	$24.88	$2.67	$1,259.86	$3,195.75
Salt Lake City	$9,407,870.93	$2,982.29	$1,488,824.51	$5,779.22	$10,294.12	$177,593.20	$5,816.60	$2,629.52	$81,944.58	$201,958.90
Sandy City	$71,489.35	$34.39	$8,523.28	$146.37	$48.02	$13,395.09	$118.74	$34.73	$5,640.83	$14,872.44
South Jordan	$35,964.36	$16.72	$2,402.09	$81.05	$22.09	$11,540.07	$75.86	$16.72	$4,950.44	$12,737.76
South Salt Lake	$736,755.28	$292.53	$131,455.63	$726.88	$808.69	$22,423.04	$1,034.29	$265.50	$10,350.39	$25,230.33
Taylorsville	$205,392.83	$146.45	$27,870.49	$487.39	$467.93	$25,685.85	$285.90	$101.86	$10,388.38	$28,953.34
Unincor-porated	$5,827.50	$0.99	$511.75	$6.99	$4.58	$1,367.53	$3.39	$1.06	$642.52	$1,493.74
West Jordan	$91,720.71	$81.91	$8,957.20	$238.80	$153.31	$22,556.17	$281.66	$45.21	$9,625.33	$25,263.29

Name	Total Loss	Wage Loss	Structural Loss	Rent Loss	Relocation Loss	Non-structural Loss	Inventory Loss	Income Loss	Content Loss	Building Loss
West Valley City	$851,629.70	$481.36	$152,025.55	$1,816.84	$2,333.75	$76,916.91	$1,100.29	$391.64	$32,010.19	$87,186.38
White City	$5,295.40	$1.87	$839.65	$5.41	$1.25	$375.00	$5.63	$1.85	$173.03	$415.50

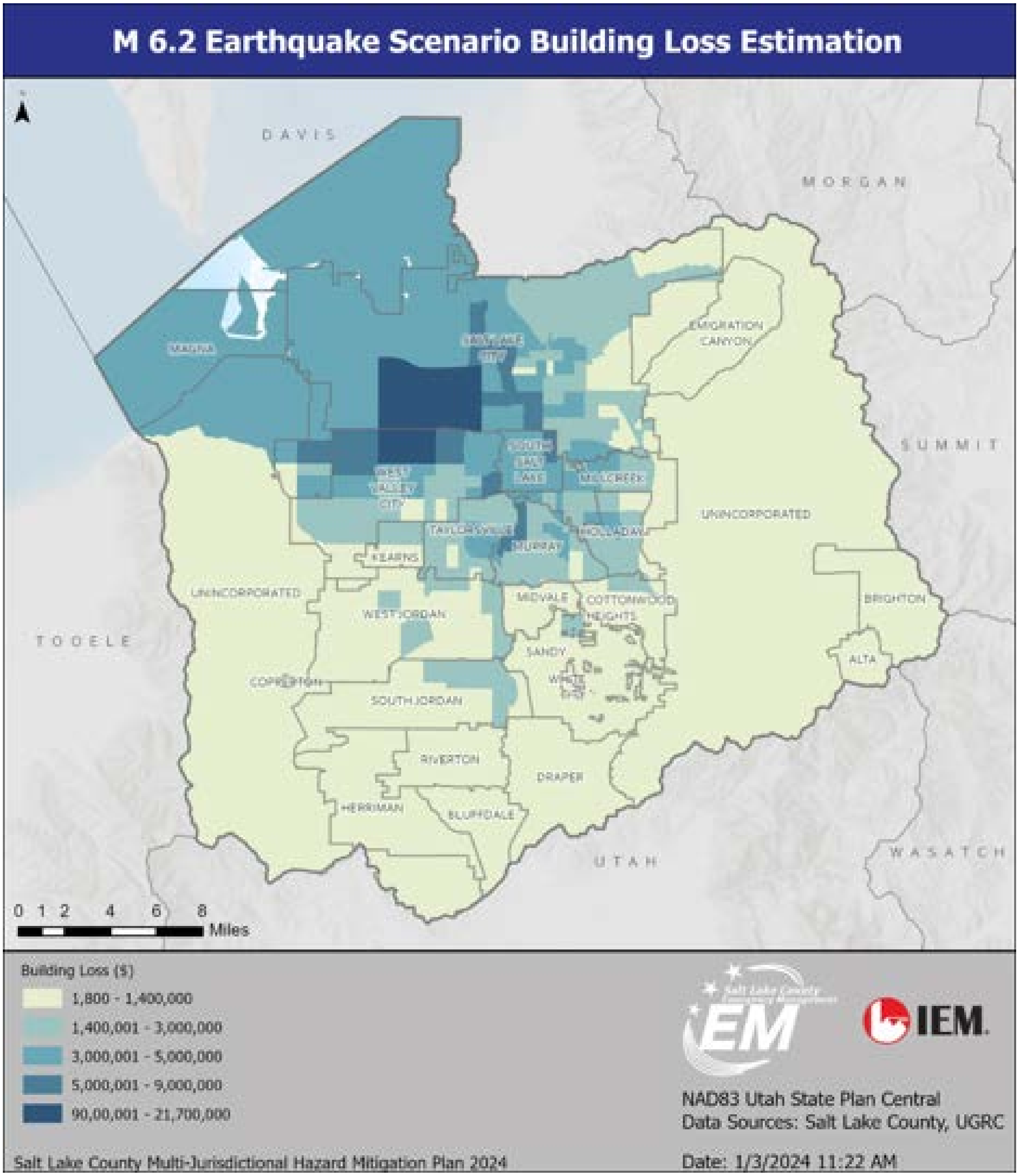


Figure 90: Building Loss Estimates in Salt Lake County in the M 6.2 ShakeMap Scenario

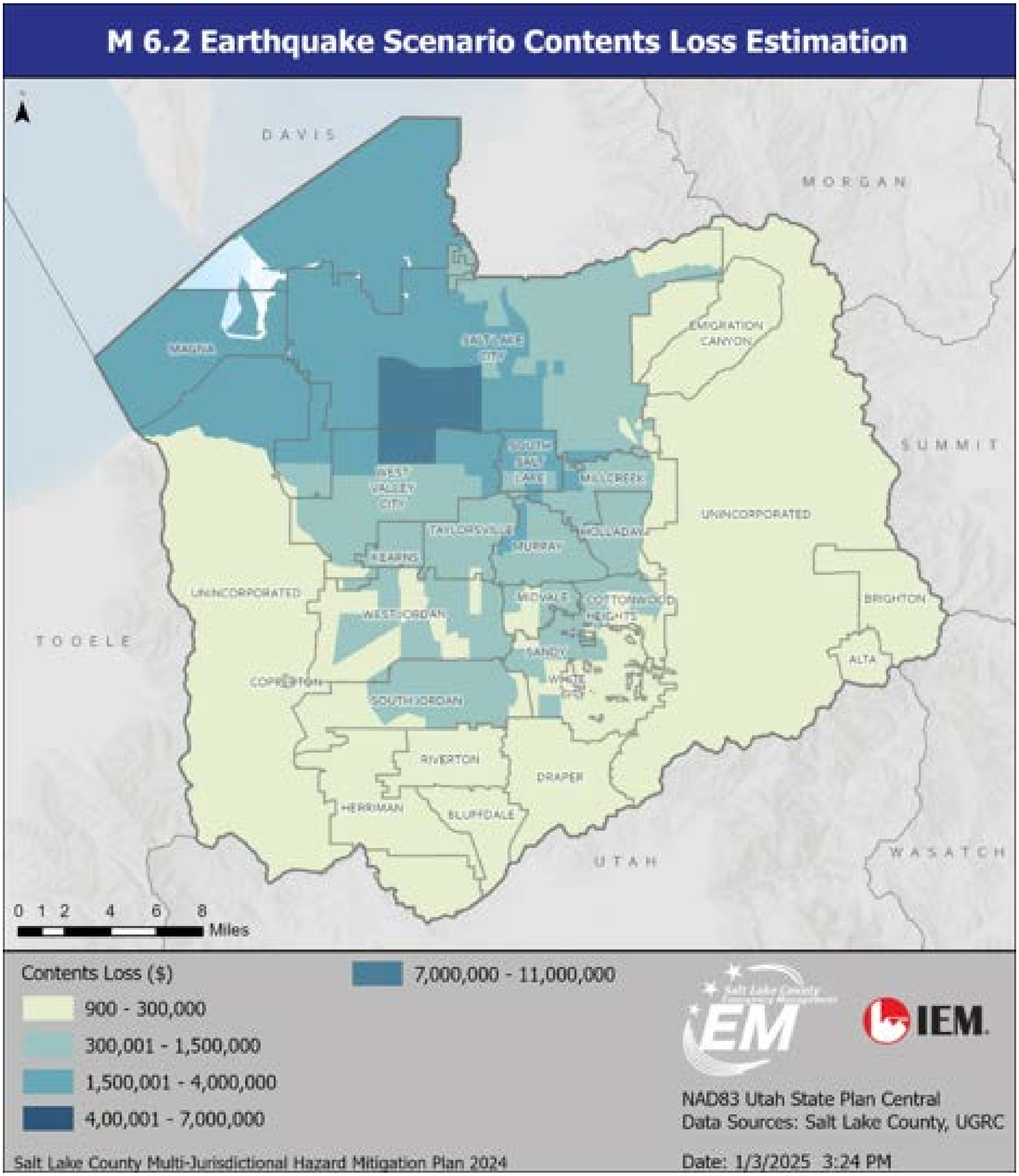


Figure 91: Contents Loss Estimates in Salt Lake County in the M 6.2 ShakeMap Scenario

Table 42 shows the extent of damage expected for different types of structures in the region. Hazus estimates that about 56,217 buildings will be at least moderately damaged. This is over 16% of the buildings in the region. An estimated 6,437 buildings will be damaged beyond repair.

Table 42: Expected Building Damage by Occupancy Type

Occupancy Type	None		Slight		Moderate		Extensive		Complete	
	Count	%	Count	%	Count	%	Count	%	Count	%
Agriculture	246.76	0.10	39.64	0.06	22.89	0.07	11.70	0.07	5.01	0.08
Commercial	10,027.91	4.17	3,245.53	5.10	2,534.53	7.61	1,562.17	9.49	632.85	9.83
Education	269.04	0.11	65.55	0.10	69.19	0.21	39.03	0.24	12.19	0.19
Government	5,134.03	2.14	1,201.71	1.89	962.40	2.89	592.29	3.60	225.57	3.50
Industrial	3,230.14	1.34	1,339.66	2.11	1,339.49	4.02	1,075.74	6.54	417.97	6.49
Other Residential	12,296.04	1.34	5,784.62	9.10	4,554.51	13.67	2,710.81	16.47	950.02	14.76
Religion	733.82	0.31	182.80	0.29	116.31	0.35	91.47	0.56	31.60	0.49
Single Family	208,493.27	86.72	51,734.64	81.35	23,726.53	71.20	10,371.70	63.03	4,161.87	64.65
Total	**240,431**		**63,594**		**33,326**		**16,455**		**6,437**	

POPULATION IMPACTS

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodation in temporary public shelters. The model estimates that 6,735 households will be displaced due to the earthquake, with 4,458 individuals seeking temporary shelter in public shelters.

Hazus also estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four severity levels that describe the extent of the injuries:

- **Severity Level 1:** Injuries will require medical attention, but hospitalization is not needed.
- **Severity Level 2:** Injuries will require hospitalization but are not considered life-threatening
- **Severity Level 3:** Injuries will require hospitalization and can be life-threatening if not promptly treated.
- **Severity Level 4:** Victims are killed by the earthquake.

Table 43 provides a summary of the casualties estimated for this earthquake. The casualty estimates are provided for three times of day: 2:00 a.m., 2:00 p.m., and 5:00 p.m. These times represent the periods of the day when different sectors of the community are at their peak occupancy loads. The 2:00 a.m. estimate considers that the residential occupancy load is maximum, the 2:00 p.m. estimate considers that the educational, commercial, and industrial sector loads are maximum, and 5:00 p.m. represents peak commute time.

Table 43: Salt Lake County Earthquake Scenario Casualty Estimates

Time	Category	Level 1	Level 2	Level 3	Level 4
2 a.m.	Commercial	26.97	7.15	1.08	2.13
	Commuting	0.08	0.10	0.17	0.03
	Educational	0.00	0.00	0.00	0.00
	Hotels	2.98	0.73	0.10	0.19
	Industrial	27.01	7.27	1.11	2.18
	Other Residential	1291.46	324.93	46.47	91.27
	Single Family	2749.04	682.78	98.69	194.03
	Total	**4,098**	**1,023**	**148**	**290**
2 p.m.	Commercial	1959.21	514.34	78.24	152.75
	Commuting	0.70	0.90	1.56	0.30
	Educational	550.07	132.73	19.33	37.56
	Hotels	0.58	0.14	0.02	0.04
	Industrial	199.45	53.69	8.22	16.01
	Other Residential	431.92	111.30	16.51	31.06
	Single Family	877.87	225.28	33.85	63.68
	Total	**4,020**	**1,038**	**158**	**301**
5 p.m.	Commercial	1458.40	379.78	58.19	111.58
	Commuting	15.09	19.47	33.67	6.48
	Educational	81.03	17.48	2.29	4.38
	Hotels	0.89	0.22	0.03	0.06
	Industrial	124.65	33.55	5.14	10.01
	Other Residential	515.62	132.97	19.74	37.14
	Single Family	1109.14	283.62	42.55	80.05
	Total	**3,305**	**867**	**162**	**250**

TRANSPORTATION AND UTILITY LIFELINE LOSSES

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. Hazus does not compute losses for business interruptions due to lifeline outages. Losses for the transportation and utility systems are displayed separately in Table 44–

Table 49.

Table 44: Expected Damage to Transportation Systems

System	Component	Number of Locations				
		Locations/ Segments	With at Least Moderate Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	368	0	0	368	368
	Bridges	611	9	0	605	605
	Tunnels	0	0	0	0	0
Railways	Segments	287	0	0	287	287
	Bridges	74	0	0	74	74
	Tunnels	0	0	0	0	0
	Facilities	6	0	0	6	6
Light Rail	Segments	4	0	0	4	4
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	50	0	0	50	50
Bus	Facilities	2	1	0	2	2
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	4	0	0	4	4
	Runways	5	0	0	5	5

Table 45: Transportation System Economic Losses (in Millions)

System	Component	Inventory Value	Economic Loss	Loss Ratio
Highway	Segments	$4,634.60	$0.00	$0.00
	Bridges	$3,442.01	$144.30	$4.19
	Tunnels	$0.00	$0.00	$0.00
	Subtotal	**$8,076.61**	**$144.30**	
Railways	Segments	$4,009.38	$0.00	$0.00
	Bridges	$327.45	$4.38	$1.34
	Tunnels	$0.00	$0.00	$0.00
	Facilities	$15.98	$4.56	$28.54
	Subtotal	**$4,352.81**	**$8.94**	
Light Rail	Segments	$1,106.21	$0.00	$0.00
	Bridges	$0.00	$0.00	$0.00
	Tunnels	$0.00	$0.00	$0.00
	Facilities	$285.50	$83.92	$18.88

System	Component	Inventory Value	Economic Loss	Loss Ratio
	Subtotal	**$1,391.71**	**$83.92**	
Bus	Facilities	$3.55	$0.73	$20.70
	Subtotal	**$3.55**	**$0.73**	
Ferry	Facilities	$0.00	$0.00	$0.00
	Subtotal	**$0.00**	**$0.00**	
Port	Facilities	$0.00	$0.00	$0.00
	Subtotal	**$0.00**	**$0.00**	
Airport	Facilities	$971.61	$270.27	$27.82
	Runways	$79.05	$0.00	$0.00
	Subtotal	**$1,050.67**	**$270.27**	
Total (Millions of Dollars)		**$14,875.35**	**$14,875.34**	**$478.16**

Table 46: Expected Utility System Facility Damage

System	Number of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	With Functionality > 50%	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Wastewater	10	4	0	3	10
Natural Gas	1	0	0	1	1
Oil Systems	2	1	0	1	2
Electrical Power	10	5	0	6	79
Communications	41	4	0	39	41

Table 47: Expected Utility System Pipeline Damage (Site-Specific)

System	Total Pipelines Length (miles)	Number of Leaks	Number of Breaks
Potable Water	4,616	0	0
Wastewater	2,770	0	0
Natural Gas	38	0	0
Oil	0	0	0

Table 48: Expected Potable Water and Electric Power System Performance

System	Total # of Households	Number of Households Without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	405,229	0	0	0	0	0
Electric Power		31,015	18,222	6,502	411	44

Table 49: Utility System Economic Losses (in Millions)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	$0.00	$0.00	0.00
	Facilities	$0.00	$0.00	0.00
	Distribution Lines	$148.58	$0.00	0.00
	Subtotal	**$148.58**	**$0.00**	
Wastewater	Pipelines	$0.00	$0.00	0.00
	Facilities	$1,337.24	$162.27	12.13
	Distribution Lines	$89.15	$0.00	0.00
	Subtotal	**$1,426.39**	**$162.27**	
Natural Gas	Pipelines	$149.30	$0.00	0.00
	Facilities	$129.54	$0.53	0.41
	Distribution Lines	$59.43	$0.00	0.00
	Subtotal	**$338.27**	**$0.53**	
Oil Systems	Pipelines	$0.00	$0.00	0.00
	Facilities	$0.20	$0.03	14.23
	Subtotal	**$0.20**	**$0.03**	
Electrical Power	Facilities	$1,976.58	$508.30	25.72
	Subtotal	**$1,976.58**	**$508.30**	
Communications	Facilities	$4.02	$0.40	9.97
	Subtotal	**$4.02**	**$0.40**	
Total (Millions of Dollars)		**$3,894.04**	**$671.53**	

FIRE FOLLOWING EARTHQUAKE

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight them, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burned area. For this scenario, the model estimates five ignitions, burning about 0.02 square miles of the region, displacing approximately 157 people and causing $8 million in building damage.

DEBRIS GENERATION

Hazus estimates the amount of debris that will be generated by the earthquake. The model classifies the debris into two general categories: a) brick/wood and b) reinforced concrete/steel. This distinction is made because of the different types of material-handling equipment required to handle the debris. The model estimates that 2,258,000 tons of debris will be generated—70% reinforced concrete/steel and 30% brick/wood—requiring an estimated 90,320 truckloads (25 tons/truck) for removal.

VULNERABLE POPULATIONS

When buildings collapse, contents fall, or roads and bridges are damaged, people may be trapped or injured, with severe injuries potentially resulting in death. Entire communities may become displaced and emergency services may be strained beyond their capacity. This can cause lasting effects on people's physical and emotional well-being.

Long-term disruption of infrastructure and utility systems, interruption of government services, and lasting economic impacts are difficult for the entire community. However, vulnerable populations may experience more severe effects from these losses. Lower-income households may live in older or less well-maintained housing that may suffer more damage, placing residents more at risk of injury. They may struggle to find temporary housing and lack the financial reserves needed to sustain them through wage losses from business closures or other economic hardships. Elderly or other medically vulnerable populations and people with disabilities might have more difficulty receiving their normal care and services. Language barriers may make it more difficult for some to seek or access recovery services.

COMMUNITY LIFELINES

Any and possibly all community lifelines could be impacted by an earthquake. The immediate concern is for the safety and security of the people in the areas with the highest shaking intensity. It is reasonable to expect that access to food, water, shelter, and healthcare will be compromised for many people. Earthquakes are destructive to power distribution networks, water systems, roadways and railways, and communications systems. The release of hazardous materials is also a possibility.

CHANGES IN DEVELOPMENT

In Salt Lake County, development and population growth can have profound impacts on earthquakes, especially as more people and infrastructure are concentrated in areas prone to seismic activity with the potential for large earthquakes. Increased development will lead to more buildings and a denser population that will become vulnerable to the impacts of an earthquake. This is particularly true for areas located along the Wasatch Fault. Vulnerability to earthquakes partially overlaps with areas of high population growth and development in Salt Lake County. Downtown Salt Lake City and cities and towns in the northwest section of the county, like Magna, have seen large increases in population and are at significant risk of strong earthquakes. The development in southern Salt Lake County is at much lower risk.

Older buildings, typically those built before 1975, used different construction processes that will not hold up during an earthquake. Unreinforced masonry (URM) homes with brick walls and/or a brick chimney are common in Salt Lake County and are particularly susceptible to damage from earthquakes.

On December 22, 2020, FEMA announced an award of more than $3.7 million to Salt Lake City. The funds are the federal cost share for the “Fix the Bricks” mitigation project to address the threat of structural collapse of residential URM structures during an earthquake event.[108] The project funds the seismic retrofitting of 216 residential URM structures, including seismic wall-to-roof retrofits, URM chimney bracing, and marketing efforts to inform the public about the project. This project aims to reduce the likelihood of structural collapse, enabling occupants to escape and reducing injury and loss of life. FEMA is providing a 75% federal cost share for the $5 million project. Funding is provided through FEMA’s Pre-Disaster Mitigation grant program, which is designed to assist states, U.S. territories, federally recognized tribes, and local communities in implementing a sustained pre-disaster natural hazard mitigation program. The goal is to reduce overall risk to the population and structures from future hazard events while reducing reliance on federal funding in future disasters.[109]

This program can reduce earthquake vulnerability. However, in 2024, the Fix the Bricks program currently has a three-to-five-year waiting list of homeowners seeking mitigation assistance funding. For these individuals, vulnerability remains the same.

Figure 92: Salt Lake County Building Earthquake Repair Project[110]

[108] SLC.gov. “Fix the Bricks – Salt Lake City Seismic Retrofit.” 2024. https://www.slc.gov/housingstability/city-housing-programs/fix-the-bricks/.
[109] FEMA. “FEMA Provides Salt Lake City $3.7 Million for Seismic Retrofitting,” Press Release. December 22, 2020. https://www.fema.gov/press-release/20210318/fema-provides-salt-lake-city-37-million-seismic-retrofitting.
[110] SLC.gov. “Fix the Bricks – Salt Lake City Seismic Retrofit.” 2024. https://www.slc.gov/housingstability/city-housing-programs/fix-the-bricks/.

VULNERABILITY SCORE

To analyze the county's vulnerability to earthquakes, the NRI was used as a primary tool during the 2024 update. The NRI defines risk as the potential for negative impacts from a natural hazard. It determines a community's risk relative to other communities by examining the EAL and social vulnerability in a given community in relation to that community's resilience. Salt Lake County's NRI earthquake risk rating is shown in Figure 93. Salt Lake County has a relatively high earthquake risk, with a risk score of 99.6.

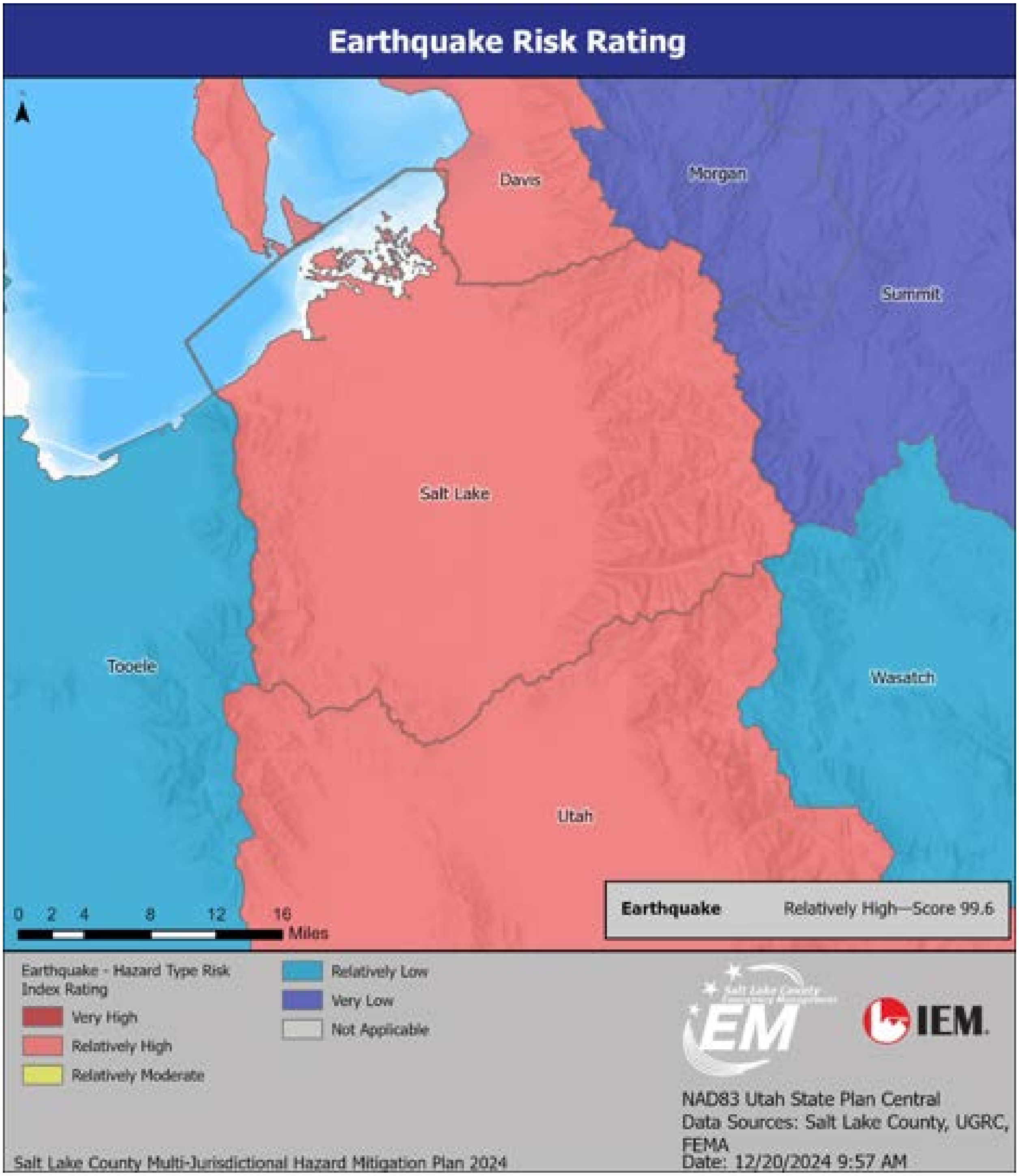


Figure 93: National Risk Index Earthquake Risk Map, Legend, and Score for Salt Lake County[111]

[111] FEMA, National Risk Index. "Salt Lake County Earthquake Score, Map and Legend." https://hazards.fema.gov/nri/map.

Extreme Cold

Figure 94: Image of Salt Lake County in Cold Weather[112]

Hazard Description

Utah frequently experiences extreme temperatures. Winter months often feature temperatures below zero degrees Fahrenheit; however, prolonged periods of extremely cold weather occur infrequently. An exception was January 2013, which was the coldest month on record for Salt Lake City since 1949. Extreme cold in the region can cause hypothermia and frostbite—with the young, elderly, homeless, and animals especially vulnerable—and can also disrupt agriculture, livestock, and crops. Wind chill can enhance the effects of extreme cold.

Hazard Profile

Potential Impact		Catastrophic	**Probability**		Highly Likely
	X	Critical		X	Likely
		Limited			Occasional
		Negligible			Unlikely
Location	Can occur in areas throughout the county				
Seasonal Pattern	Winter months				
Conditions	Vary based on latitude, elevation, aspect, and landforms				
Duration	Extreme cold conditions generally last for several hours; some conditions can persist for days.				
Secondary Hazards	Secondary hazards include transportation disruption and infrastructure damage and failure, including power outages.				
Analysis Used	National Centers for Environmental Information, National Weather Service, Utah Division of Emergency Management, local input, and review of historic events and scientific records				

[112] https://pixabay.com/photos/salt-lake-city-utah-wasatch-vista-4928290/.

Magnitude/Extent

The wind chill temperature is how cold people feel when they are outside based on the rate of heat loss from exposed skin. As wind speed increases, it draws heat from the body, driving down skin temperature and eventually internal body temperature, which makes people feel much colder. The wind chill chart (Figure 95) shows how cold temperatures feel at various wind speeds.[113]

The lowest temperature ever recorded in Salt Lake City was -22ºF on January 25, 1949; the average minimum temperature in January in the county is 23ºF. These temperatures were recorded at the local weather station at the Salt Lake City International Airport. Utah recognizes Code Blue Alerts, which counties issue when temperatures are expected to drop to 18ºF, including wind chill, for 2 or more hours during a 24-hour period.

Wind Chill Chart

Temperature (°F)

Wind (mph) / Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes; 10 minutes; 5 minutes

Wind Chill (°F) = 35.74 + 0.6215T - 35.75($V^{0.16}$) + 0.4275T($V^{0.16}$)

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Figure 95: National Weather Service Wind Chill Chart

Location

The entire region of Salt Lake County can be affected by extreme cold events. Temperatures and wind chill conditions vary with elevation and other local differences.

Historical Events and Probability of Future Occurrences

As previously mentioned, the lowest temperature ever recorded in Salt Lake City was -22ºF in 1949. NOAA recorded three cold/wind chill events in Salt Lake County from 1996 to 2024; however, NOAA did not record any deaths, injuries, or property damage as a result of such events. Despite this, it is important to note that these data do not capture all possible deaths or illnesses related to extreme cold. For example, in 2023, a local news article reported that at least 8 unsheltered people had died during the

[113] National Weather Service. "Understanding Wind Chill." https://www.weather.gov/safety/cold-wind-chill-chart.

previous winter.[114] Future occurrences are considered to be likely based on a recurrence interval of one event approximately every 9 years.

According to FEMA's Disaster Declarations for States and Counties, there were no federally declared extreme cold events from January 1, 2019, through June 3, 2025.[115] In addition, no state declarations have been made for the state of Utah due to extreme cold.[116]

Utah Code 35A-16-703, which became effective in 2023, establishes conditions for the Utah Department of Health and Human Services to identify Code Blue events. Code Blue Alerts disseminate details to the public and provide information to assist individuals experiencing homelessness during the event. This may include information regarding expansions of shelter capacity, provisions of temporary shelter (warming centers), or distributions of clothing and blankets.

Climate Change Considerations

Evidence for increasing temperatures from climate change often focuses on extreme heat events. As noted in the Utah Enhanced State Hazard Mitigation Plan, there is also a possibility that future low temperatures may be less cold. Although this may reduce human health impacts from extreme cold, it could have other negative impacts. For example, warmer winters contribute to bark beetle infestations and tree die-off in forests. This is detrimental to various natural ecosystems and can also increase the risk of wildfire.

Climate change can cause higher temperatures which shorten the winter season, resulting in less snowpack for the year. This shift can affect water resources, local ecosystems that thrive on cold weather, and winter recreational activities. This ultimately results in shorter and less severe winters. Although this may reduce some of the health risks associated with extreme cold, it can drastically impact the economy, as Salt Lake County thrives on the ski industry.

Secondary Hazards

Freezing temperatures can lead to various infrastructure disruptions. They can cause insulators to fail and conductors to break. Extreme cold has the added effect of making people turn up their heaters, which can cause a circuit overload and a resulting power outage. People turning on their lights and heaters in anticipation of the power being restored may extend an outage. These activities create high-power demand on fusing that might not be able to handle the stress of the load. Extreme cold can also cause water in pipes to freeze, leading to burst pipes and water damage.

[114] Fredde, Ashley, "Utah Bill Aimed to Prevent Homeless Deaths in Winter Headed to Gov. Cox's Desk," KSL.com, March 8, 2023. https://www.ksl.com/article/50594793/utah-bill-aimed-to-prevent-homeless-deaths-in-winter-headed-to-gov-coxs-desk.
[115] FEMA, "Disaster Declarations for States and Counties." https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties.
[116] Utah Department of Public Safety, "Utah Disaster History." https://dem.utah.gov/utah-disaster-history/.

Vulnerability Assessment

All residents and infrastructure systems in the planning area are vulnerable to extreme cold, which is likely to affect the entire county. Extremely cold conditions may last for hours or even days. People are particularly vulnerable to extreme cold. Prolonged exposure can lead to hypothermia, frostbite, and death. Windy conditions can increase these risks.

Structures are not typically directly affected by extreme cold but may be affected by secondary hazards. Extreme cold can freeze water in pipes, causing them to burst. This can damage water delivery systems and structures and roadways. Extreme cold can also impact power systems through increased demand.

Extreme cold can damage crops or harm livestock, resulting in economic losses. It can also be harmful to wildlife or other natural systems.

ESTIMATED IMPACT AND POTENTIAL LOSSES

Extreme cold can lead to health concerns, especially for the unhoused, outdoor workers, and those who are medically vulnerable due to preexisting conditions or disabilities. Extreme cold can contribute to infrastructure disruption including frozen pipes, damage to water systems, power outages, and disruption to transportation networks. Residents could face hardship from lack of water service or power. Older homes may be less energy efficient. Elderly residents or lower-income households may be more severely affected by service disruptions. Businesses, government offices, and schools might have to close due to power outages or transportation disruptions, which can cause economic losses. People might miss work or school.

The NRI includes data on the EALs due to individual natural hazards, historical losses, and overall risk at the county and Census tract levels. The NRI refers to extreme cold hazards as “cold wave risk.” Salt Lake County’s NRI EAL value for cold waves is $4,000, with a risk score of 32.9 and a rating of “very low” compared with the rest of the United States.

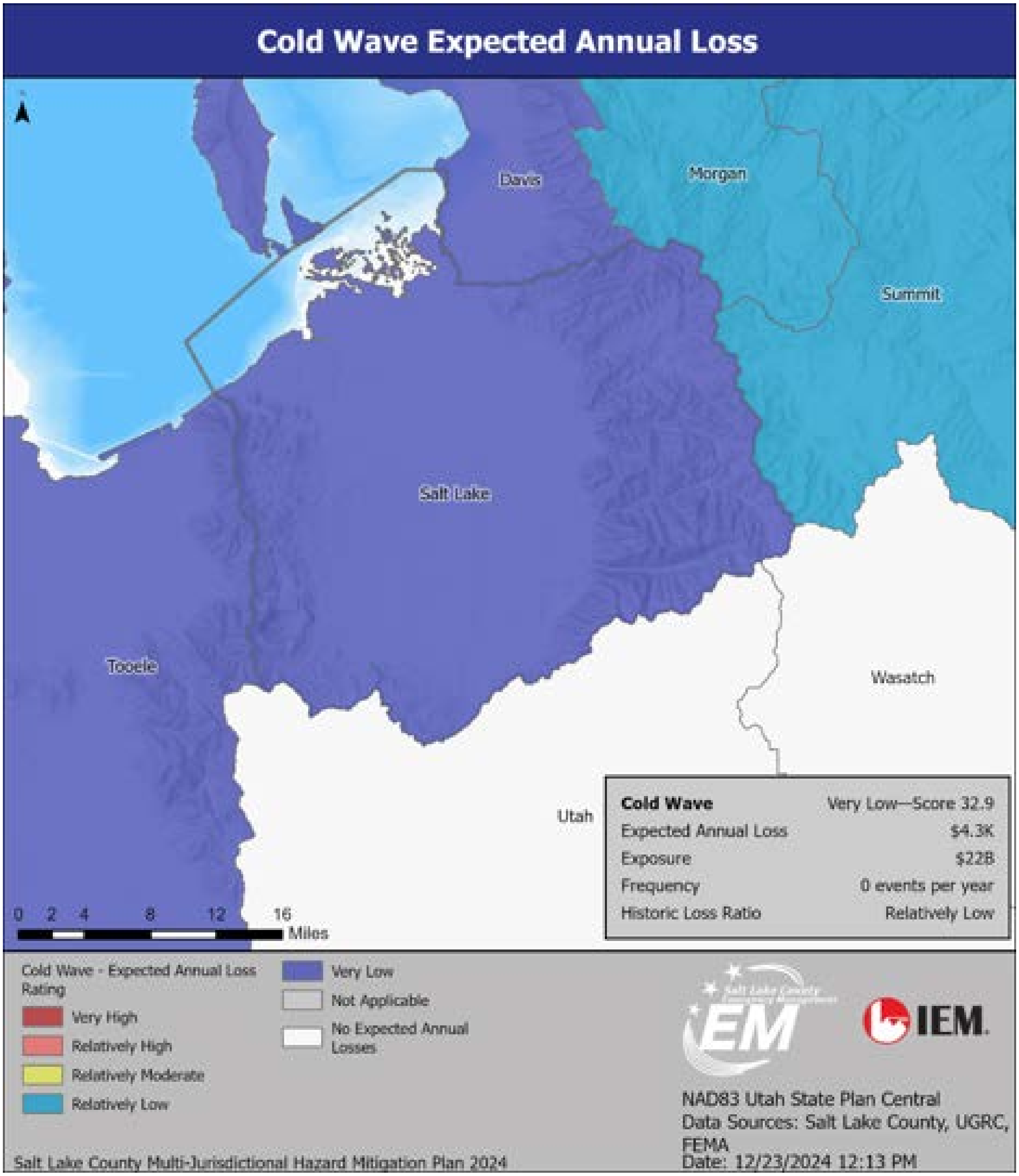


Figure 96: National Risk Index Expected Annual Loss from Extreme Cold in Salt Lake County[117]

[117] Federal Emergency Management Agency. "National Risk Index." 2023. https://hazards.fema.gov/nri/map.

VULNERABLE POPULATIONS

Unhoused populations face the greatest risk of illness or death from exposure to extreme cold. Code Blue Alerts seek to provide emergency shelter for these individuals.

Homebound individuals, such as the elderly or persons with disabilities, who rely on home health supplies or other caregiving services also may be at risk if the power supply or other services are disrupted.

Low-income households are more likely to experience the impacts of extreme cold. They may lack adequate housing or may live in older homes that might have poor heating systems or lack insulation. Residents may be reluctant to use heat systems due to high energy costs. They may also face greater risks from seeking alternative heat sources. About 20% of winter fatalities occur inside the home, primarily when space heaters catch fire or people suffer from carbon monoxide poisoning from using alternative heating devices without proper ventilation.[118]

COMMUNITY LIFELINES

Extreme cold can disrupt services across the safety and security, energy, transportation, and water sectors. The importance of these lifelines cannot be overstated. In a disaster, communities can be left without access to necessities, such as food, water, and shelter. The lifelines help ensure that these needs are met and that people have the resources they need to survive. By providing access to medical care, public health services, and transportation, the lifelines enable people to receive the care they need and safely evacuate if necessary. In addition, the hazardous materials lifeline helps to ensure that dangerous materials are managed safely, reducing the risk of further harm. Community lifelines help create a sense of safety and security in a community. They provide a safety net for individuals who may be struggling and offer comfort and reassurance that help is available when needed. Without these lifelines, communities would be much more vulnerable to crises and emergencies.

CHANGES IN DEVELOPMENT

Since the last plan update, there has been a significant rise in cost of living, coupled with inflation, which has contributed to an increase in the county's unhoused population and made more individuals at risk of homelessness and extreme cold. The overall population size in the county has increased, which represents a rise in the number of people potentially exposed to the hazard. Extreme cold particularly affects unhoused populations, and the Salt Lake County Point-in-Time Count Summary indicates that the overall number of people experiencing homelessness in Salt Lake County has risen since 2018.[119] This also represents an increase in vulnerability to this hazard.

In Salt Lake County, development and population growth can have profound impacts on extreme cold as the growing population is increasing the demand for energy during the winter months, and this might strain the system. This could lead to blackouts or brownouts during periods of extreme cold. The

[118] Utah Department of Public Safety, Division of Emergency Management. "Utah Enhanced State Hazard Mitigation Plan 2024." 2024. https://hazards.utah.gov/state-of-utah-hazard-mitigation-plan/.
[119] Smith, Alex. "Salt Lake County CoC Point-in-Time Count Summary, 2018–2022." End Utah Homelessness, Salt Lake Valley. 2022. https://endutahhomelessness.org/wp-content/uploads/2022/08/SLC-PIT-Summary-2018-2022.pdf.

increased density of buildings and infrastructure may also make it more difficult to clear accompanying snow and ice, impacting both transportation and emergency response times.

An increase in infrastructure due to population growth can exacerbate the negative air quality effects of temperature inversions in the Salt Lake Valley. During an inversion, cold air at the surface gets trapped under a layer of warmer air and pollutants can build up to unhealthy levels near the surface. These inversions are often strongest in winter months and often coincide with periods of extreme cold temperatures. The unique topography and meteorology of the valley are important factors in the formation of temperature inversions, an increase in population, transportation networks, and other development contribute to the levels of emissions and other pollutants in the air.

VULNERABILITY SCORE

In the 2024 update, the NRI was used as the primary tool for analyzing the county's vulnerability to severe winter weather. The NRI defines risk as the potential for negative impacts as a result of a natural hazard and determines a community's risk relative to other communities by examining the EAL and social vulnerability of a given community in relation to that community's resilience. Salt Lake County's NRI cold wave risk rating is shown in. The county has a “very low” cold wave risk rating, and a risk score of 30.2.

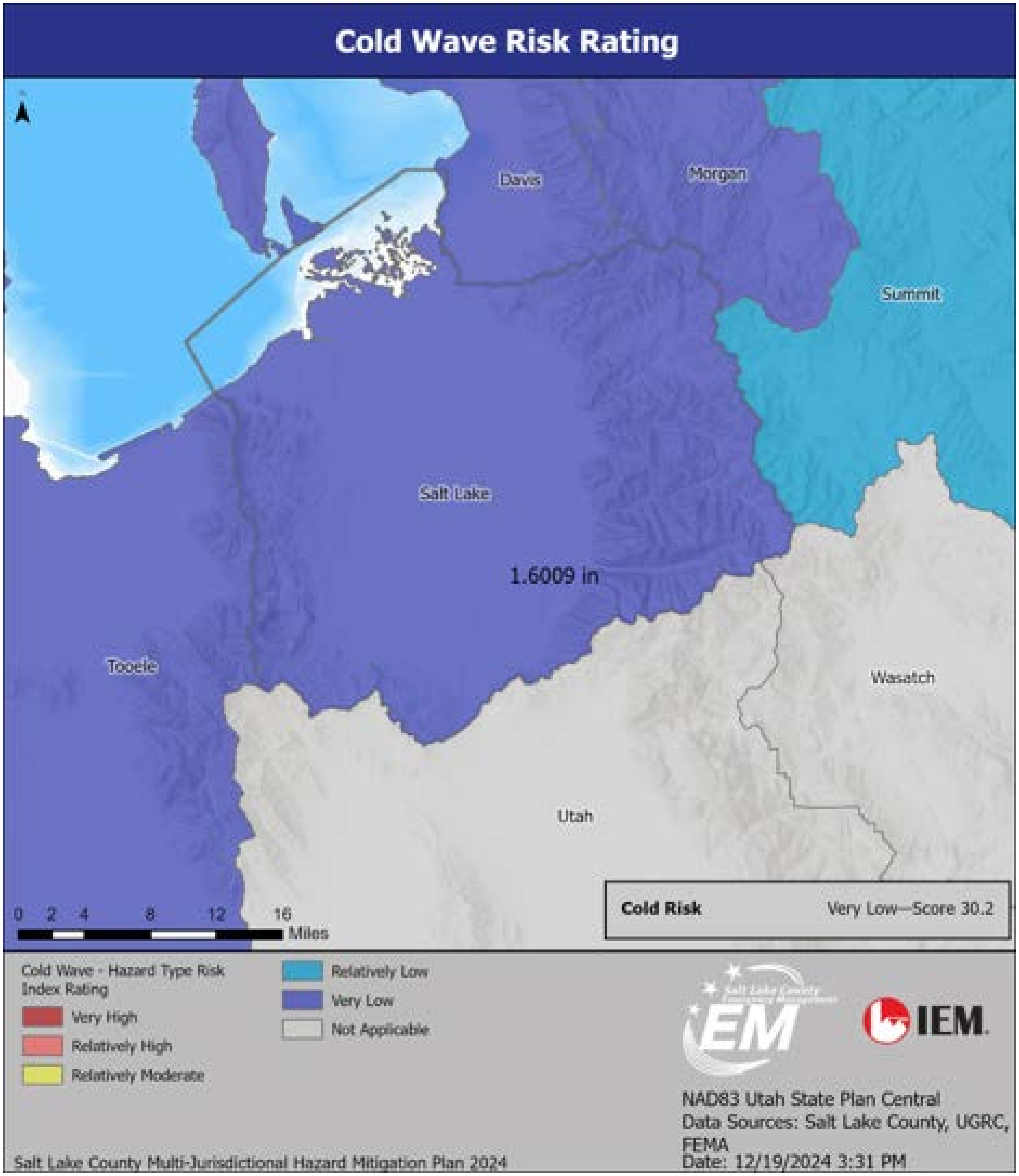


Figure 97: National Risk Index Cold Wave Risk Map, Rating, and Score for Salt Lake County[120]

[120] FEMA. "National Risk Index." 2023. https://hazards.fema.gov/nri/map.

Extreme Heat

Figure 98: Image of Hot Sun[121]

Hazard Description

Temperatures in Utah can be extreme. Summer temperatures are regularly in the 90s and exceed 100 degrees Fahrenheit on many days. Drastic temperature changes also occur, even in a matter of hours. Extreme heat can cause severe physical stress or illness in people.

Extreme heat is summertime weather that is substantially hotter and/or more humid than average for a location at that time of year. Extreme heat causes discomfort and can affect personal health through heat cramps, heat exhaustion, or heat stroke. This can particularly affect vulnerable populations, such as the very young, elderly, poor, and homeless. Extreme heat places a substantial burden on power grids through widespread use of evaporative coolers and air-conditioning. This strain can lead to brownouts or blackouts, leaving many without power.

Hazard Profile

Potential Impact		Catastrophic	**Probability**	X	Highly Likely
	X	Critical			Likely
		Limited			Occasional
		Negligible			Unlikely
Location	Can occur in areas throughout the county				
Seasonal Pattern	Summer months				
Conditions	Vary based on latitude, elevation, aspect, and landforms				
Duration	Extreme heat generally persists for days				
Secondary Hazards	Drought, wildfire, health conditions				

121 https://pixabay.com/photos/sunset-sun-sky-clouds-orange-2180346/.

Potential Impact			**Probability**		
		Catastrophic		X	Highly Likely
	X	Critical			Likely
		Limited			Occasional
		Negligible			Unlikely
Analysis Used	National Climate Data Center, National Weather Service, Utah Division of Emergency Management, local input, and review of historic events and scientific records				

Magnitude/Extent

The heat index is a measure of what different temperatures feel like to the human body. It combines air temperature with relative humidity because humidity reduces the body's ability to cool itself through the evaporation of perspiration. Humidity is typically low in Salt Lake County.

The highest temperature ever recorded in Salt Lake City was 107ºF on July 17, 2022. This year also had the highest number of days in one month with a temperature of 100ºF or greater, and 29 days above 95ºF.[122] The average maximum temperature in July in the county is around 91ºF.

NWS Heat Index — Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution | Extreme Caution | Danger | Extreme Danger

Figure 99: National Weather Service Heat Index Chart

Location

The entire county is at risk of extreme heat events. Most of the development in Salt Lake County has taken place in the central valley. Communities with dense development and with limited open green

[122] National Weather Service. "Salt Lake City Climate Book." 2024. https://www.weather.gov/slc/climatebook#PDFS.

space are at greater risk during extreme heat events. Urban areas tend to absorb more heat and release it slower during the evening than rural areas, leading to overall higher temperatures. This is known as the urban heat island effect. Temperatures tend to be lower at the higher elevations in the mountainous areas of the county, but these areas can be affected when temperatures exceed typical levels.

One cascading impact of extreme heat is wildfire risk. The Wildfire Urban Interface include communities, such as Hi-Country Estates One and Two and Mt. Aire in unincorporated Salt Lake County, Draper, and Emigration Canyon. These areas are at high risk of wildfires that result from drought related to extreme heat.

Historical Events and Probability of Future Occurrences

Based on the FEMA Disaster Declarations Database, Salt Lake County has received no designation for extreme heat disaster declarations since the last plan update. The NCEI Storm Events Database includes two excessive heat events in 2021 affecting the Salt Lake Valley and Great Salt Lake Desert areas. On June 6, 2023, average temperatures were 19 degrees above average.

As previously stated, the highest temperature ever recorded in Salt Lake City was 107ºF in 2022. NOAA has not recorded any extreme heat events or any corresponding deaths or injuries in Salt Lake County. However, mild events have occurred with moderate regularity and will continue to occur. The Climate Risk and Resilience Portal (ClimRR) Heat Index Explorer provides a visual overview of the projected increase in maximum summer heat index values (Figure 100).[123]

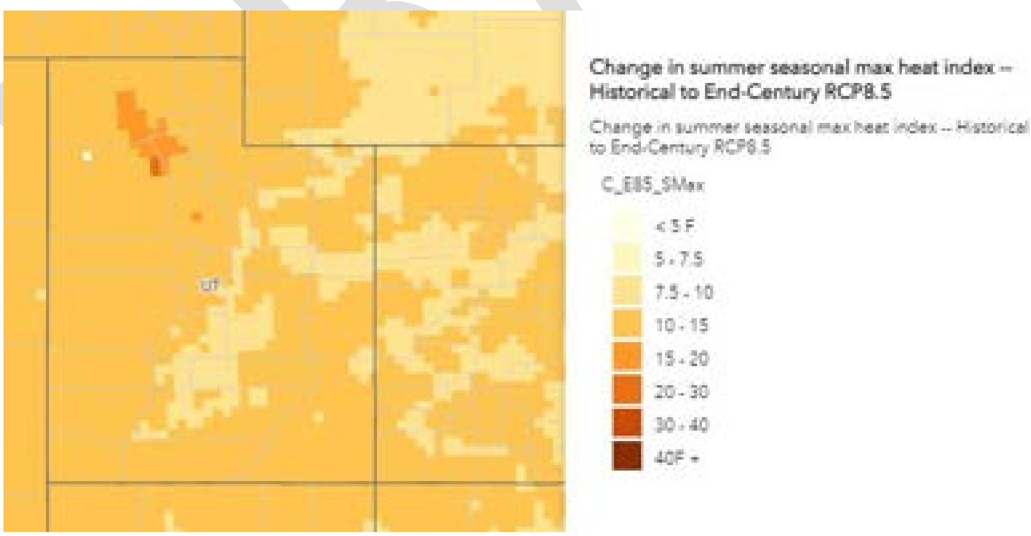


Figure 100: Projected Changes in the Heat Index for Utah Until 2021 by the Climate Risk and Resilience Portal

[123] Argonne National Laboratory. "ClimRR Heat Index Explorer." 2023. Climate change can also have a significant impact directly on the natural hazard of extreme heat. Climate change can cause warmer summer temperatures, which increases the hotter seasons while decreasing colder seasons resulting in less snowpack for the year. This shift can affect water resources, local ecosystems that thrive on cold weather, and winter recreational activities. This ultimately results in shorter and less severe winters, which can drastically impact the economy, as Salt Lake County thrives on the ski industry during the winter months. https://disgeoportal.egs.anl.gov/portal/apps/webappviewer/index.html?id=06a52da514364cfab2eab106c247f6c3.

Salt Lake County experiences temperatures above 100˚F nearly every summer and 8 days each year on average. The record for the number of days over 100˚F was broken in 2022, with 34 days. The frequency of past events indicates that future probability is highly likely.

Climate Change Considerations

Climate change can also have a significant impact on the natural hazard of extreme heat. Climate change can cause higher summer temperatures, which lengthens the hotter seasons and shortens colder seasons resulting in less snowpack for the year. This shift can affect the availability of water in the summer months.

There is strong evidence that extreme heat will continue to increase with worsening climate change. The CMRA tool provides projections for future conditions of various hazards based on lower and higher emission scenarios for early, mid-, and late century. This tool projects a significant increase in the number of days with maximum temperatures exceeding 100ºF in mid- and late century for both emission models (Figure 101). It also projects an increase in the annual highest maximum temperature and in cooling-degree days, a measure of the energy needed for air-conditioning or refrigeration.[124]

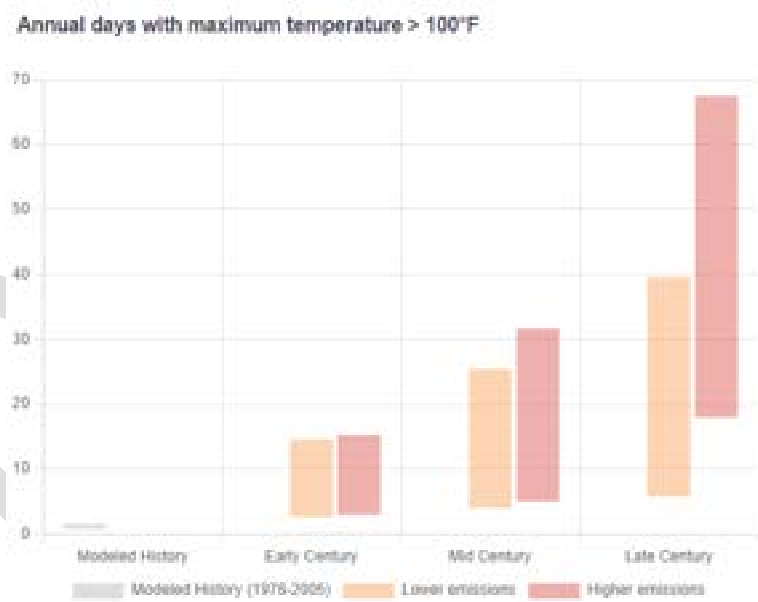


Figure 101: Projected Number of Days Each Year with Temperatures Exceeding 100ºF

Secondary Hazards

One of the most significant secondary hazards associated with excessive heat events is the failure of motorized systems, such as ventilation systems used to control temperatures inside buildings. In other parts of the country, extreme heat has contributed to widespread power outages. Heat can cause roads to buckle and may cause road closures for emergency repairs. Extreme heat can also raise the risk of

[124] NOAA. "Climate Mapping For Resilience and Adaptation." 2022. https://livingatlas.arcgis.com/assessment-tool/explore/details.

wildfires as vegetation dries out, which allows fires to ignite and spread more rapidly. Furthermore, extreme heat can exacerbate drought conditions.

Vulnerability Assessment

The primary concern with extreme heat is heat-related illnesses, such as dehydration, heat exhaustion, and heat stroke. This is especially concerning for the county in the summer event season. There are many summer events in the county, and if temperatures continue to increase and there are not adequate resources (EMS staff, drinking water, restrooms, shade), it can pose significant health issues. The entire population may be at risk of the effects of heat, but extreme heat might have disproportionate impacts on some populations. Extreme heat can increase demand for power and water resources. Increased demand for healthcare services can put a strain on providers. In addition, the population may not contribute as much to the local economy (eating out, festivals, etc.) because of the heat.

ESTIMATED IMPACT AND POTENTIAL LOSSES

Extreme heat can have significant health impacts on the individuals, including severe sickness and possibly death. Individuals particularly at risk are discussed in the section on Vulnerable Populations.

Heat can cause spikes in energy use as demand for air-conditioning increases. This can strain power grids and may lead to outages during peak use. Increased energy use raises financial costs for residents and businesses. Damage to roadways from heat-related buckling can require costly emergency repairs and may cause secondary disruptions while transportation routes are closed.

Natural systems can also be impacted by extreme heat. Rising temperatures can affect wildlife habitats, diminish the health of vegetation, and disrupt ecosystems. Extreme heat can contribute to an increase in evaporation rates, reduce water availability for agriculture and recreation, and exacerbate the effects of drought. Therefore, heat can lead to agricultural losses.

The NRI includes data on the EALs attributed to individual natural hazards, historical losses, and overall risk at the county and Census tract levels. Salt Lake County’s NRI EAL value for heat waves is $2.1 million, with a risk score of 95.3 and a rating of “relatively high” compared with the rest of the United States (Figure 102).

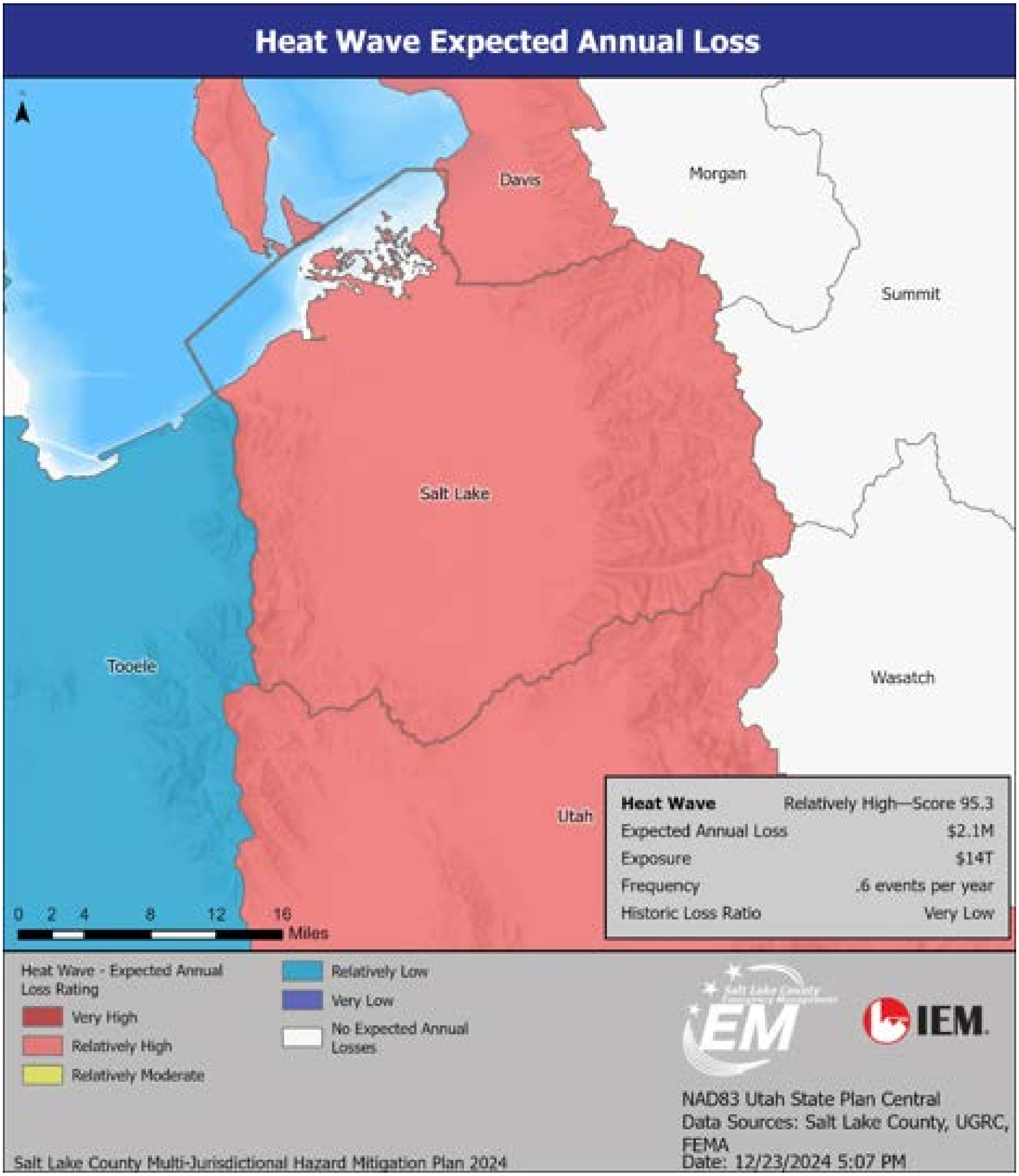


Figure 102: National Risk Index Expected Annual Loss from Heat Waves in Salt Lake County[125]

[125] FEMA. "National Risk Index." 2023. https://hazards.fema.gov/nri/map.

VULNERABLE POPULATIONS

Several populations are more vulnerable to extreme heat events, face isolation and exposure during extreme heat events, or can suffer more secondary effects of the hazard. Young children and the elderly are more susceptible to extreme heat due to their bodies' inability to regulate temperature as effectively. The chronically ill and elderly might have underlying health conditions or take prescription medications that interfere with the body's ability to dissipate heat. Even young and healthy individuals can succumb to heat if they participate in strenuous physical activities during hot weather. Males tend to experience a higher rate of dehydration than females. Outdoor workers may not have enough breaks, adequate hydration, or a place to adequately cool themselves.

Extreme heat can disproportionately affect people with socioeconomic disadvantages. Lower-income households may not have functioning air-conditioning or may be reluctant to use it due to energy costs. Unhoused populations are highly vulnerable to severe weather hazards. These individuals may seek access to public spaces to escape the heat.

COMMUNITY LIFELINES

Extreme heat primarily affects public health, which may impact demands on the health and medical lifeline, but it can also affect the energy and transportation lifelines. The importance of these lifelines cannot be overstated. In a disaster, communities can be left without access to necessities, such as food, water, and shelter. The lifelines help ensure that these needs are met and that people have the resources they need to survive. By providing access to medical care, public health services, and transportation, the lifelines enable people to receive the care they need and safely evacuate if necessary. Community lifelines help create a sense of safety and security in a community. They provide a safety net for individuals who may be struggling and offer comfort and reassurance that help is available when needed. Without these lifelines, communities would be much more vulnerable to crises and emergencies.

CHANGES IN DEVELOPMENT

In Salt Lake County, development and population growth can have profound impacts on extreme heat as the growing population is increasing the demand for energy during the summer months, and that may strain the system. This could lead to blackouts or brownouts during periods of extreme heat. An increase in infrastructure due to population growth can exacerbate the effects of extreme heat by creating urban heat islands, which can lead to more significant temperature fluctuations and more intense heat waves.

High levels of increased development and density, especially in outlying cities and towns like Herriman and South Jordan, can lead to increased temperatures during extreme heat events. Removing vegetation and increasing the amount of pavement and buildings traps heat at ground level, increasing the vulnerability of those who cannot find a place to cool off.

Potential impacts from extreme heat are loss of life/property, poor air quality, and power grid failure. As the population in Salt Lake County continues to grow, the potential for these negative impacts increases. Energy demands also may rise. In addition, the unhoused population has also grown in recent years, which creates more of a challenge to provide enough cooling centers in the county and the staffing needed to adequately manage the cooling centers. Overall vulnerability to extreme heat has increased since the last plan update.

VULNERABILITY SCORE

In the 2024 update, the NRI was used as the primary tool for analyzing the county's vulnerability to severe weather. The NRI defines risk as the potential for negative impacts as a result of a natural hazard and determines a community's risk relative to other communities by examining the EAL and social vulnerability of a given community in relation to that community's resilience. Salt Lake County's NRI heat wave risk rating is shown in Figure 103. The county has a "relatively moderate" heat wave risk rating, and a risk score of 94.6.

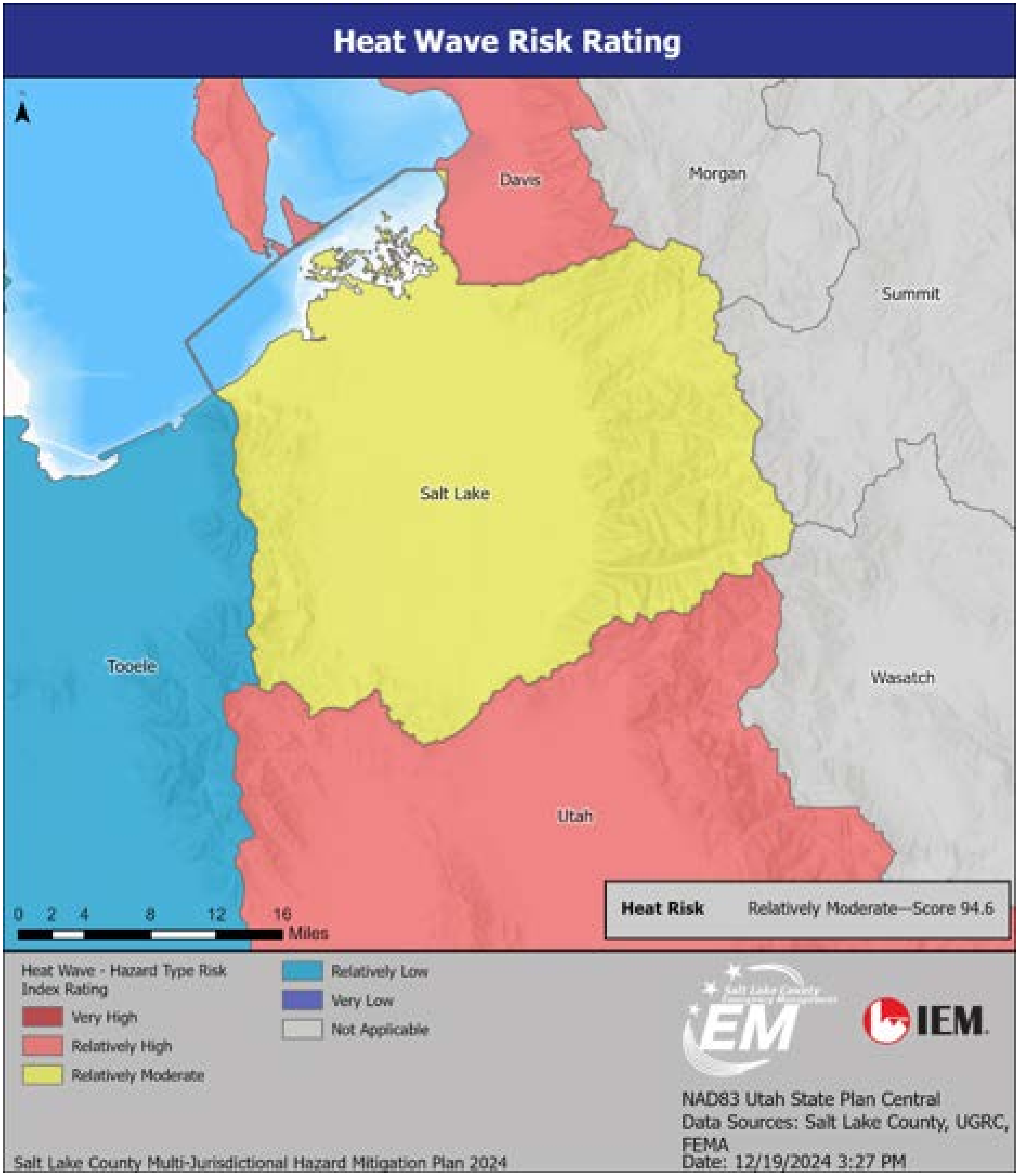


Figure 103: National Risk Index Heat Wave Risk Map, Rating, and Score for Salt Lake County[126]

[126] FEMA. "National Risk Index." 2023. https://hazards.fema.gov/nri/map.

Flooding (Urban/Flash Flooding and Riverine Flooding)

Hazard Description

Floods can be caused by fast snowmelt, heavy rainfall, or failure of natural or engineered impoundments onto riverbanks and adjacent floodplains. Floodplains are lowland areas near rivers, lakes, reservoirs, oceans, and low-terrain urban areas that are subject to recurring floods. Stream flooding occurs when the peak discharge, or rate of flow in cubic feet per second (cfs), is larger than the channel of the river or storm sewer capacity. In Salt Lake County, floods are typically localized events running out of mountain canyons. Urban areas are also prone to flooding because urban development, such as buildings, streets, and parking lots, prevent water infiltration into the soil and greatly increase runoff. Undersized piping, human-made drainage channels, or debris that obstructs passageways may further contribute to flooding. Flood damage includes saturation of land and property, erosion, deposition of mud and debris, and fast-flowing water. Most injuries and deaths occur from fast-moving floodwaters while most property damage results from inundation by sediment-filled water.

Figure 104: Image of Flooded Park[127]

SPRING RUNOFF/SNOWMELT FLOODS

These are caused by rapid spring snowmelt of mountain snowpack. Intense spring rainfall contributes to the flood scenario, causing additional rapid river rises. These events can last for weeks during the spring (generally April–June) and may cause loss of life and extensive damage affecting property owners and municipalities. Snowmelt risk is greatest when snowpack is at or above normal levels and/or accompanied by an abrupt warming trend.

---

[127] https://pixabay.com/photos/flood-park-bench-flooded-red-123222/.

FLASH FLOODS

Flash floods are caused by intense thunderstorms and the resulting heavy rainfall. Heavy rainfall may occur in areas of sparse vegetation, steep slopes, and impervious surfaces, and is then channeled into smaller waterways or conduits. Once runoff begins to accumulate across the basin, its volume and speed typically increase rapidly. Flash flood events, while often short-lived, are very dangerous for those caught in a confined area, such as a canyon, when the flood occurs. Flash flooding has caused 34 fatalities in Utah since 1950. In 2015, there were 20 fatalities, including seven at Zion National Park.

Areas of localized flooding may occur in urban areas not associated with existing waterways. Rain may accumulate in low-lying areas with no outlet or where storm drains have become overwhelmed. These types of floods and the resulting impacts are difficult to anticipate due to the uncertainty of when and where such storms will occur.

LONG-TERM RAINFALL EVENTS

These rain events typically occur in the fall or winter months. They are produced by large synoptic weather systems originating out of the south, southwest, or west that produce rainfall for an extended period. The rainfall may cause some snow to melt, potentially causing more significant runoff. This occurs mainly in the southern half of the state.

POST-FIRE DEBRIS FLOW FLOODING

Enhanced runoff conditions from a fire-damaged watershed can cause debris flow flooding. As fires burn, they destroy vegetation and leave soil in a hydrophobic state, resulting in greater peak flows. This issue is discussed further in the section on Wildfire.

Hazard Profile

Potential Magnitude		Catastrophic	**Probability**	X	Highly Likely
	X	Critical			Likely
		Limited			Occasional
		Negligible			Unlikely
Location	Largely in and along floodplains; debris flows can cause natural damming of water if nearby streams become blocked				
Seasonal Conditions	Spring, heavy rainfall, and spring snowmelt runoff				
Conditions	Thunderstorms with heavy rainfall, extended wet periods				
Duration	Flooding can last anywhere from hours to days and even months				
Secondary Hazards	Raw sewage/health risk, electrical fires, gas spills				
Analysis Used	Review of Flood Insurance Study, Flood Insurance Rate Maps, U.S. Army Corps of Engineers Flood Study, Hazus				

Magnitude/Extent

Floods can range in magnitude from minor to catastrophic. The frequency and severity of flooding are measured using a discharge probability, which is the probability that a certain river discharge (flow) level will be equaled or exceeded in a given year. Flood studies use historical records to determine the probability of occurrence for the different discharge levels. The flood frequency equals 100 divided by the discharge probability.

- **1% Special Flood Hazard Area – SFHA (1% annual chance of flooding, sometimes referred to as a 100-year flood):** Applies to an area that has a 1% chance, on average, of flooding in a given year. However, a 100-year flood could occur two years in a row, or once every 10 years. This flood hazard area is also referred to as the base flood. Some agencies use the term "1% annual exceedance probability."
- **0.2% Special Flood Hazard Area (0.2% annual chance of flooding, sometimes called a 500-year flood):** A 0.2% floodplain is an area at risk of flooding from a creek or other waterway overflowing during a 0.2% (500-year) flood. Structures in a 0.2% area have a minimum of a 0.2% chance of flooding in a given year.

Location

Flooding in Salt Lake County is typically the result of excessive snowmelt runoff and/or heavy rainfall. Snowmelt flooding is usually the result of rapid melting of snowpack, occurring from April through June along the major existing streams and waterways. High-intensity, short-duration heavy rainfall occurs over a relatively small area in the summer months. However, flooding can also occur due to non-thunderstorm rainfall events.

The major waterways in the county include the Jordan River, Big and Little Cottonwood Creeks, Parley's Creek, Emigration Creek, Red Butte Creek, City Creek, and Millcreek. Smaller waterways include Bingham Creek, Midas Creek, Rose Creek, Corner Canyon Creek, Dry Creek, Wood Hollow, Willow Creek, and Barney's Creek. All can flood. However, significant flood mitigation measures implemented following the major floods of 1983–1984 have greatly reduced the flood threat.

The flow of the Jordan River from Utah Lake into Salt Lake County is controlled, somewhat reducing the flood potential upstream of the major Jordan River tributaries. Parley's Creek has flood storage capacity at Mountain Dell and Little Dell Reservoirs and is routed through a retention basin in Sugarhouse Park. Big and Little Cottonwood Creeks have a number of smaller flood storage lakes and ponds providing some flood protection, such as Wheeler Historic Farm. In Salt Lake City, Emigration Creek and Red Butte Creek come together at 700 East and 1300 South and can be discharged in or bypass Liberty Park pond. Parley's Creek discharges to the 1300 South drain at State Street.

Areas to monitor include 1300 South between 700 East and State Street, 700 West, and North Temple Streets. Retention ponds are also used to store runoff from commercial and residential development areas.

Maps visually showing the probable boundaries of a 100-year (1% annual chance) and 500-year (0.2% annual chance) flood event can be found in the Vulnerability Assessment portion of this hazard profile.

Historical Events and Probability of Future Occurrences

Based on the FEMA Disaster Declarations database, Salt Lake County has received no designation for flooding Disaster Declarations since the last plan update.

According to NOAA data, there have been 44 flood/flash flood events in Salt Lake County since 1996. Property damage was approximately $31.627 million, with an additional $1,000 in crop damage.

Figure 105: Image of a Flooded Road[128]

The following flood events are of notable significance:

- **April 13, 2023:** A State of Emergency was declared for Salt Lake County over the spring runoff flooding that affected the Wasatch Front. The areas most affected by the flooding were along Red Butte Creek, Emigration Creek, City Creek, Big Cottonwood Creek, Little Cottonwood Creek, and Millcreek. Voluntary evacuations along Emigration Creek in downtown Salt Lake City included the evacuation of up to 40 homes.
- **2017:** Thunderstorms producing heavy rainfall moved into the Salt Lake Valley in the early morning hours of July 26 and persisted for three to four hours, producing widespread flash flooding.
- **2015:** Heavy rain caused road, parking lot, and basement flooding in the Sugarhouse and Foothill areas of Salt Lake City.
- **2014:** Heavy rain during the early morning hours of August 20 led to flooding in West Jordan and Murray.
- **2011:** Large snowpack meant larger resulting spring runoff flows.
- **2010:** Spring snowmelt combined with heavy rains caused several streams to overtop their banks.

[128] Pixabay. https://pixabay.com/photos/flooded-road-flood-flooding-storm-5330617/.

- **1987:** Great Salt Lake reached its all-time maximum water level (4,211.6 feet).
- **1983:** Large snowpack was coupled with a rain-on-snow event (City Creek diverted down State Street).
- **1983/1984:** Large snowpack overwhelmed Utah Lake and affected Jordan River downstream, causing the flooding of City Creek in downtown Salt Lake City.
- **1952:** Rapid melt of a large snowpack

Utah has received seven Presidential Disaster Declarations related to flooding: in 1983, 1984, two in 2005 (in Southern Utah), two in 2012, and one in 2017. Following the events of 1983–1984, an enormous amount of mitigation was completed along the urban areas of the Wasatch Front. An advanced water-monitoring network of stream gauges, snow telemetry (SNOTEL

) sites, and automated stream flow gates provided warnings of elevated flows. The State of Utah constructed a county flood control project that installed pumps on the Great Salt Lake to pump excess water into the west desert. Figure 106 shows the Salt Air Resort, now a concert venue called the Great Saltair, on the southeast shore of the Great Salt Lake during the flood years of the 1980s.

Figure 106: Flooding of the Great Salt Lake at the Saltair Resort

During the past 149 years, the Great Salt Lake peaked above 4,211 feet three times: 4,211.60 feet in June 1873, 4,211.50 feet in June 1986, and 4,211.60 feet in June 1987. Figure 107 shows statistical data on Great Salt Lake elevations from 2007 to 2024.

Figure 107: Elevations of the Great Salt Lake, 2007–2024[129]

Depending on the amount of snowfall in the winter and its melting speed, flows can vary dramatically from year to year. Nevertheless, flood mitigation is on every jurisdiction's mind each spring, and a myriad of mitigation plans are in place to prevent damage. There is no question that flooding will continue to occur in the future. As previously stated, NOAA data recorded 32 flooding events from 1996 to 2018, for an average of approximately 1.4 flooding events per year. Salt Lake County is highly likely to experience at least this average amount of flooding going forward.

Climate Change Considerations

Climate change can have a significant impact on flooding. Climate change can alter precipitation patterns and increase the intensity of severe storms. This combined with population growth and urbanization can lead to severe flooding. Higher temperatures can also lead to more precipitation falling as rain rather than snow, which can also cause higher runoff and increased risk of flood. All of these changes can lead to more frequent severe flash floods, especially in urban areas with impervious surfaces that prevent the natural absorption of water.

The 2024 State Enhanced Hazard Mitigation Plan states that for decades, climate change experts, government reports, and academic literature have predicted an increase in precipitation intensity. The theoretical basis for these predictions was strong, though studies of actual trends in precipitation records did not detect significant changes in precipitation in the state of Utah.

[129] Utah.gov, Utah Division of Water Resources. "Great Salt Lake Elevation Chart." 2024. https://greatsaltlake.utah.gov/current-conditions.

One clear trend in precipitation with implications for flooding is the change in snowpack. Since 1955, the snowpack has peaked earlier, with a reduced season length. These trends are expected to continue into the foreseeable future. Due primarily to increasing air temperature, the proportion of precipitation that falls as snow will continue to decline. Warmer conditions are simply less likely to produce snow. Also, warmer conditions cause the snow line, the lowest elevation at which snow falls, to recede. As the snow line moves upward, the area receiving snowfall is reduced.

Secondary Hazards

One of the most problematic secondary hazards for flooding is bank erosion, which in some cases can be more harmful than the flooding itself. This is especially true in the upper courses of rivers with steep gradients, where floodwaters may pass quickly without causing much damage but may scour the banks, edging properties closer to the floodplain or causing them to fall in. This may also occur in areas with soft soils that are prone to erosion. Hazardous materials spills are a secondary hazard of flooding if storage tanks rupture and spill into streams, rivers, or storm sewers. If flooding is severe enough, infrastructure failure can occur, delaying the delivery of vital services. If enough residential structures are impacted, this can put extreme stress on emergency housing and shelter capabilities, not to mention the social fabric of the community.

Vulnerability Assessment

The vulnerability of people and infrastructure to flooding hazards in Salt Lake County was obtained from the modeling program Hazus. The Hazus flooding scenarios, which are the basis for the vulnerability and loss estimates in this section, entail both a 100-year and a 500-year flood occurring in Salt Lake County (1% and 0.2% annual risk, respectively). Hazus uses FEMA FIRM boundaries and digital elevation model data to generate flood depth grids and then uses these depth grids, general building stock data, and damage functions to estimate the level of damage to structures and other social and economic impacts on the region.

Hazus estimates that there are 360,243 buildings in the region with a replacement value of $172 billion. Of the building exposure, 61% is from residential structures. There are 16 hospitals, 67 fire stations, 33 police stations, 18 EOCs, and 422 schools.

ESTIMATED IMPACT AND POTENTIAL LOSSES

ESSENTIAL FACILITY DAMAGE

Hazus estimates that there are 2 fire stations, 3 schools, and 4 county facilities in the area of the 100-year flood scenario (1% annual chance) for Salt Lake County. There is 1 EOC, 22 county facilities, three fire stations, and 13 schools in the 500-year flood scenario (0.2% annual chance). No essential facility is estimated to receive substantial or moderate damage from a 100-year event. For a 100-year event, 3 schools and 2 fire stations are estimated to receive at least moderate damage during the scenario, and 1 fire station and 3 schools are estimated to experience loss of use. For a 500-year event, 1 EOC, 3 fire stations, 2 police stations, and 9 schools are estimated to receive at least moderate damage during the scenario; 4 schools are estimated to receive at least substantial damage; and 2 fire stations and 8 schools are estimated to experience loss of use.

Table 50 and Table 51 list the facilities in the 1% annual chance and 0.2% annual chance floodplain across various jurisdictions in Salt Lake County. For the 1% annual chance floodplain, most areas, such as Alta, Bluffdale, Brighton, and Copperton, have no facilities at risk. However, Herriman, Millcreek, Salt Lake City, and Sandy City each has one county facility in the 1% annual chance floodplain. Millcreek and Salt Lake City also have one fire station in the 100-year floodplain while West Valley City has three schools at risk.

Much like the 1% annual chance floodplain, the 0.2% annual chance floodplain contains very few jurisdictions with facilities in it. However, Salt Lake City has a significant number of facilities, including 1 fire station, 4 schools, and 6 county facilities. The South Salt Lake area also has a notable presence, with 1 EOC, 1 fire station, 3 schools, and 5 county facilities. Other areas at risk include Millcreek, with 1 fire station and 2 schools, and West Valley City, with 3 schools and 1 county facility. The areas of Cottonwood Heights, Herriman, Murray, Sandy, Taylorsville, and West Jordan each have at least one county facility in the 0.2% annual chance floodplain. Figure 108 to Figure 114 show the locations of these facilities.

School facilities were summarized in the jurisdictions where they are located. No Jordan School District facilities were identified in SFHAs. One school is in the 0.2% SFHA in Draper, which is in the Canyons School District.

Table 50: Facilities in the 1% Annual Chance Floodplain by Jurisdiction

Name	Emergency Operations Centers	Fire Stations	Hospitals	Police Stations	Schools	County Facilities
Alta	0	0	0	0	0	0
Bluffdale	0	0	0	0	0	0
Brighton	0	0	0	0	0	0
Copperton	0	0	0	0	0	0
Cottonwood Heights	0	0	0	0	0	0
Draper	0	0	0	0	0	0
Emigration Canyon	0	0	0	0	0	0
Herriman	0	0	0	0	0	1
Holladay	0	0	0	0	0	0
Kearns	0	0	0	0	0	0
Magna	0	0	0	0	0	0
Midvale	0	0	0	0	0	0
Millcreek	0	1	0	0	0	1
Murray	0	0	0	0	0	0

Name	Emergency Operations Centers	Fire Stations	Hospitals	Police Stations	Schools	County Facilities
Riverton	0	0	0	0	0	0
Salt Lake City	0	1	0	0	0	1
Sandy City	0	0	0	0	0	1
South Jordan	0	0	0	0	0	0
South Salt Lake	0	0	0	0	0	0
Taylorsville	0	0	0	0	0	0
Unincorporated	0	0	0	0	0	0
West Jordan	0	0	0	0	0	0
West Valley City	0	0	0	0	3	0
White City	0	0	0	0	0	0

Table 51: Facilities in the 500-Year (0.2% annual chance) Floodplain by Jurisdiction

Name	Emergency Operations Centers	Fire Stations	Hospitals	Police Stations	Schools	County Facilities
Alta	0	0	0	0	0	0
Bluffdale	0	0	0	0	0	0
Brighton	0	0	0	0	0	0
Copperton	0	0	0	0	0	0
Cottonwood Heights	0	0	0	0	0	3
Draper	0	0	0	0	1	1
Emigration Canyon	0	0	0	0	0	0
Herriman	0	0	0	0	0	1
Holladay	0	0	0	0	0	0
Kearns	0	0	0	0	0	0
Magna	0	0	0	0	0	0
Midvale	0	0	0	0	0	0
Millcreek	0	1	0	0	2	1
Murray	0	0	0	0	0	1
Riverton	0	0	0	0	0	0
Salt Lake City	0	1	0	0	4	6
Sandy City	0	0	0	0	0	1
South Jordan	0	0	0	0	0	0
South Salt Lake	1	1	0	0	3	5

Name	Emergency Operations Centers	Fire Stations	Hospitals	Police Stations	Schools	County Facilities
Taylorsville	0	0	0	0	0	1
Unincorporated	0	0	0	0	0	0
West Jordan	0	0	0	0	0	1
West Valley City	0	0	0	0	3	1
White City	0	0	0	0	0	0

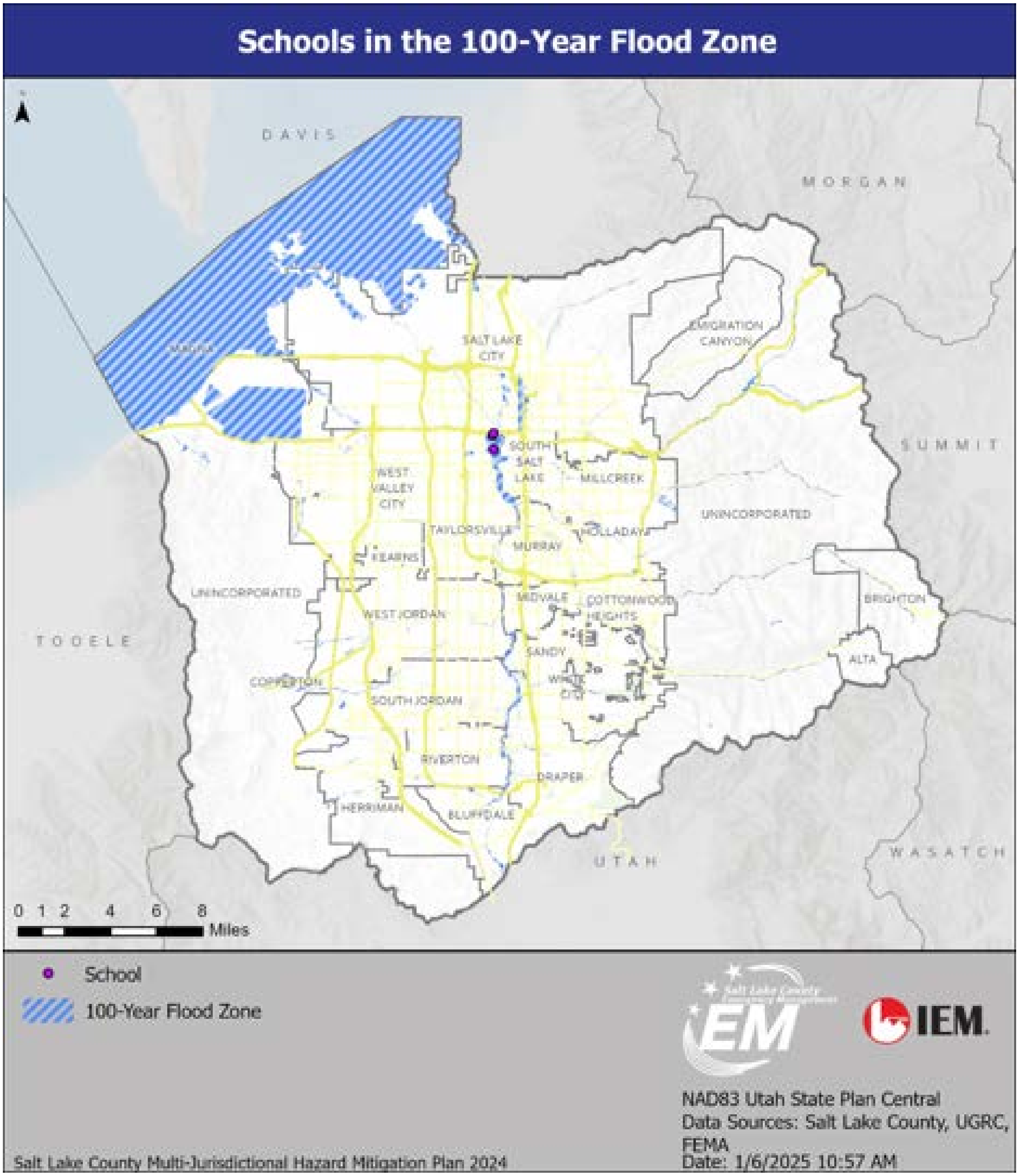


Figure 108: Schools in the 100-Year (1% Annual Chance) Flood Zone

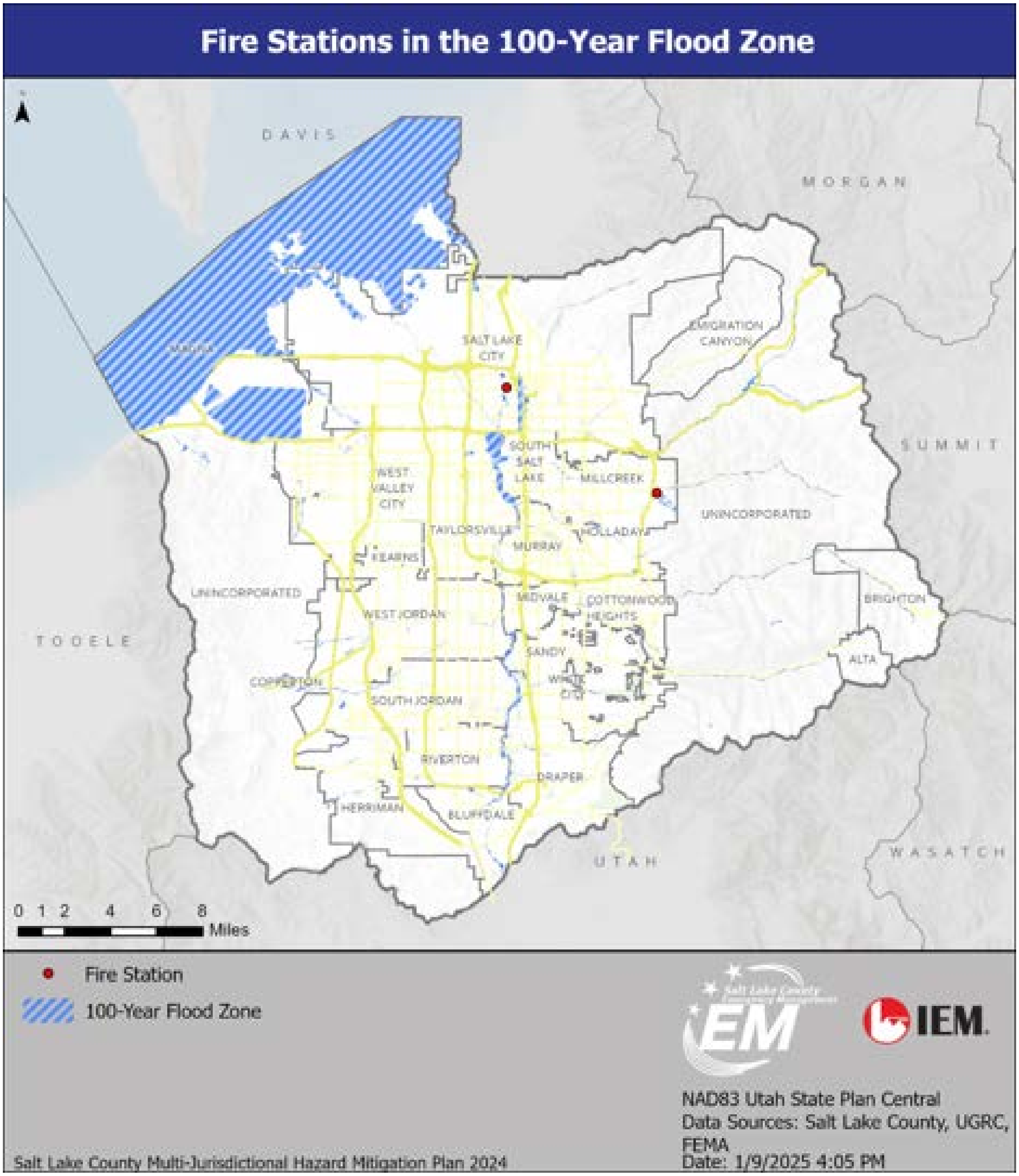


Figure 109: Fire Stations in the 100-Year (1% Annual Chance) Flood Zone

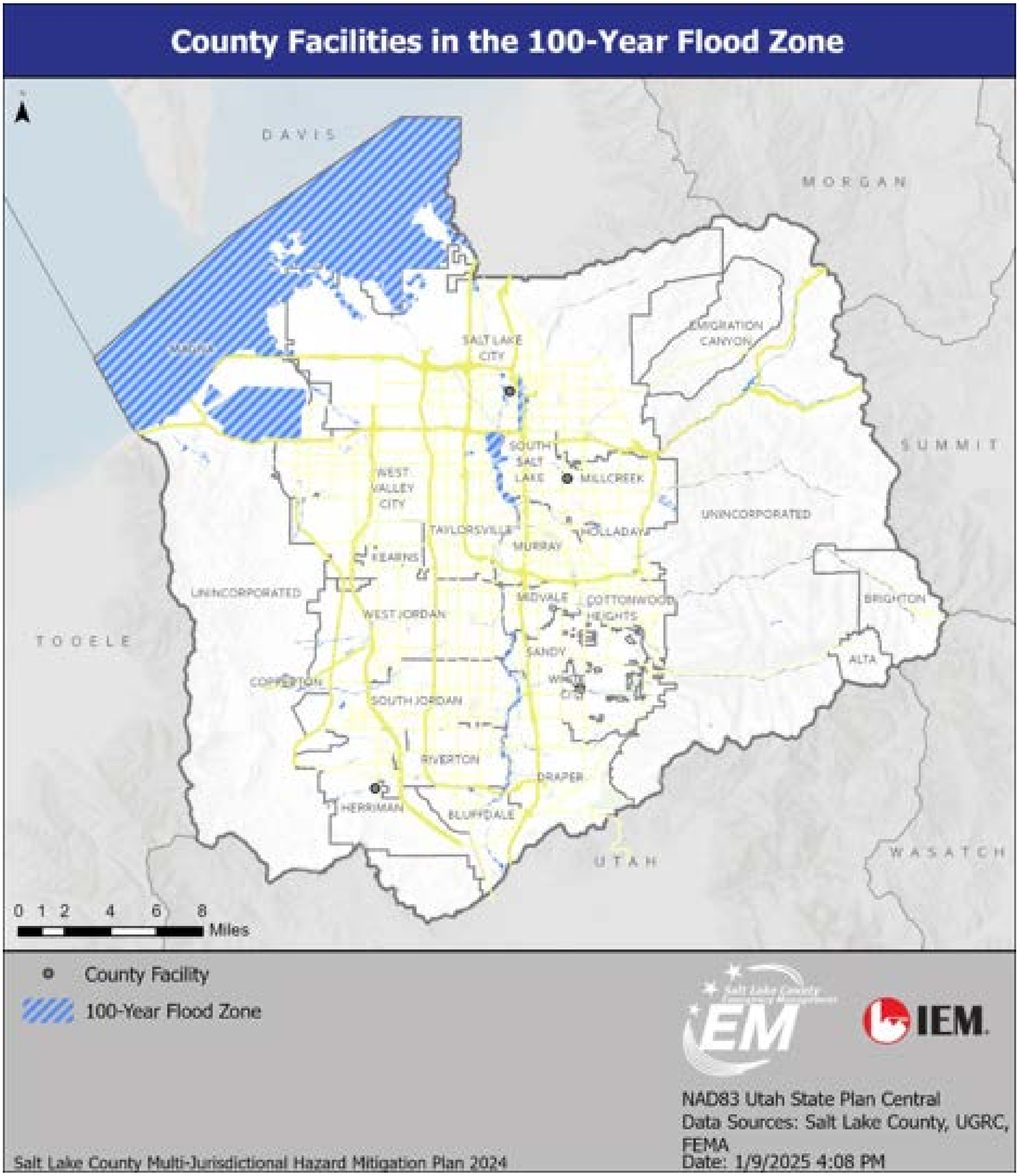


Figure 110: County Facilities in the 100-Year (1% Annual Chance) Flood Zone

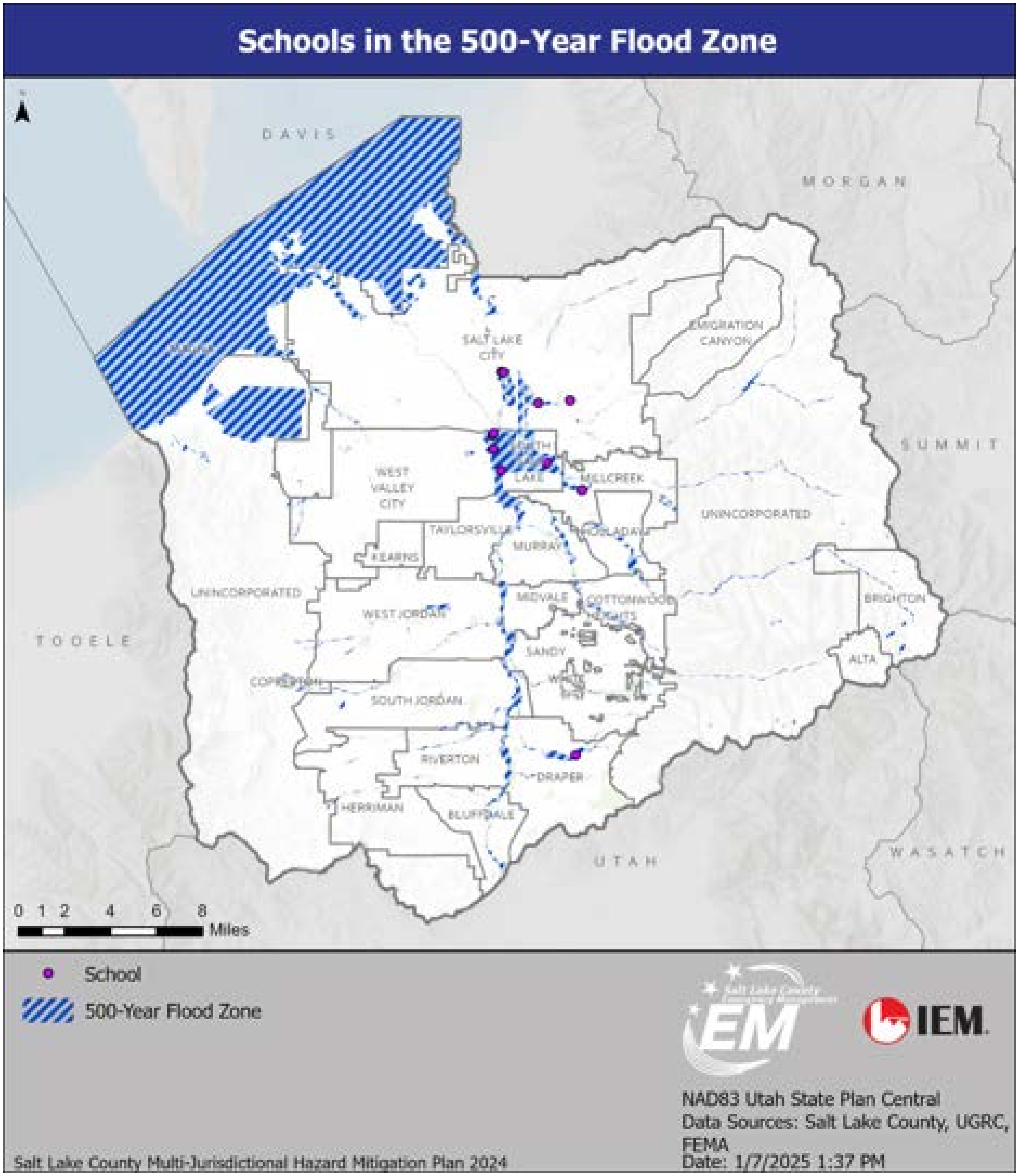


Figure 111: Schools in the 500-Year (0.2% Annual Chance) Flood Zone

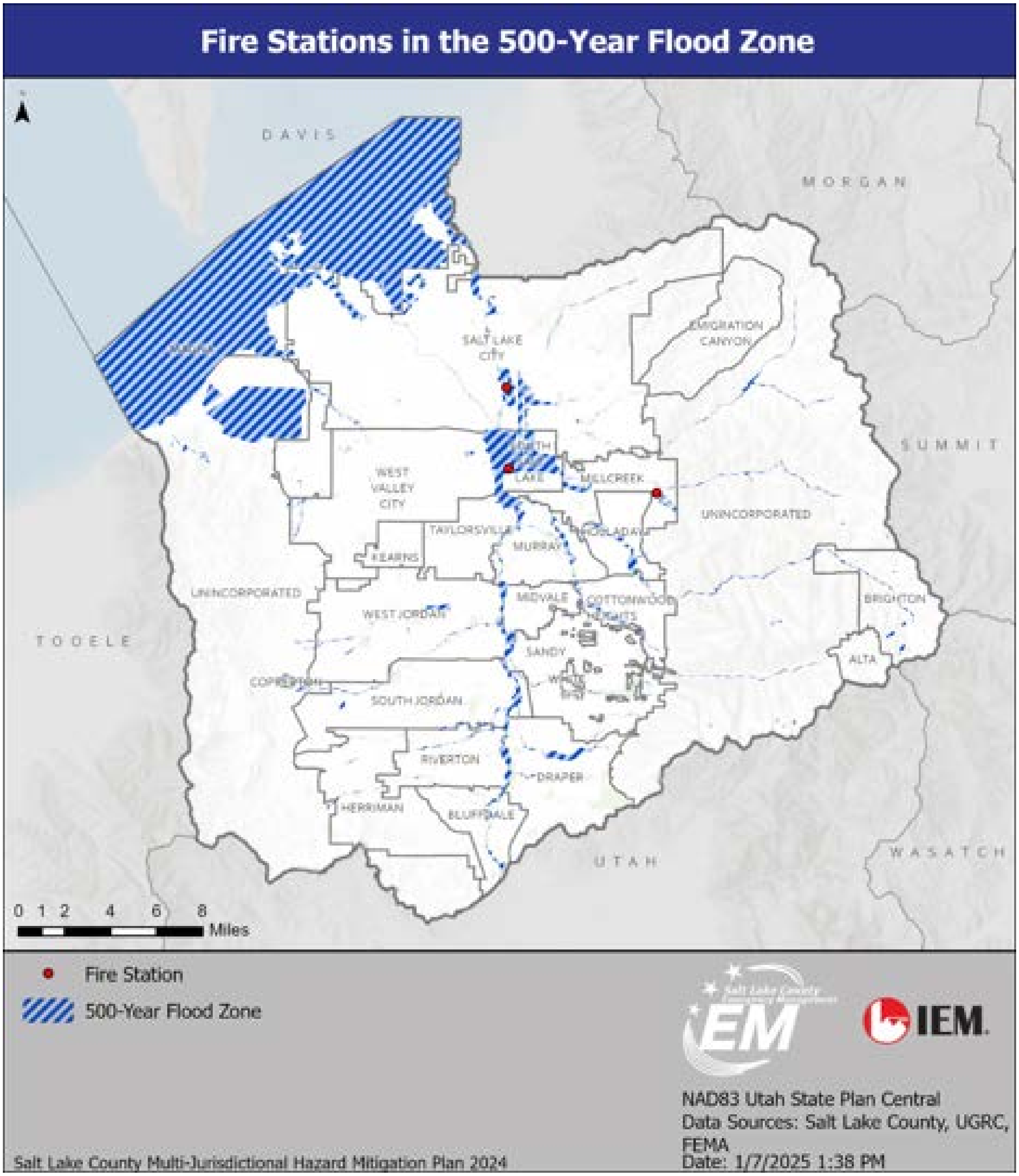


Figure 112: Fire Stations in the 500-Year (0.2% Annual Chance) Flood Zone

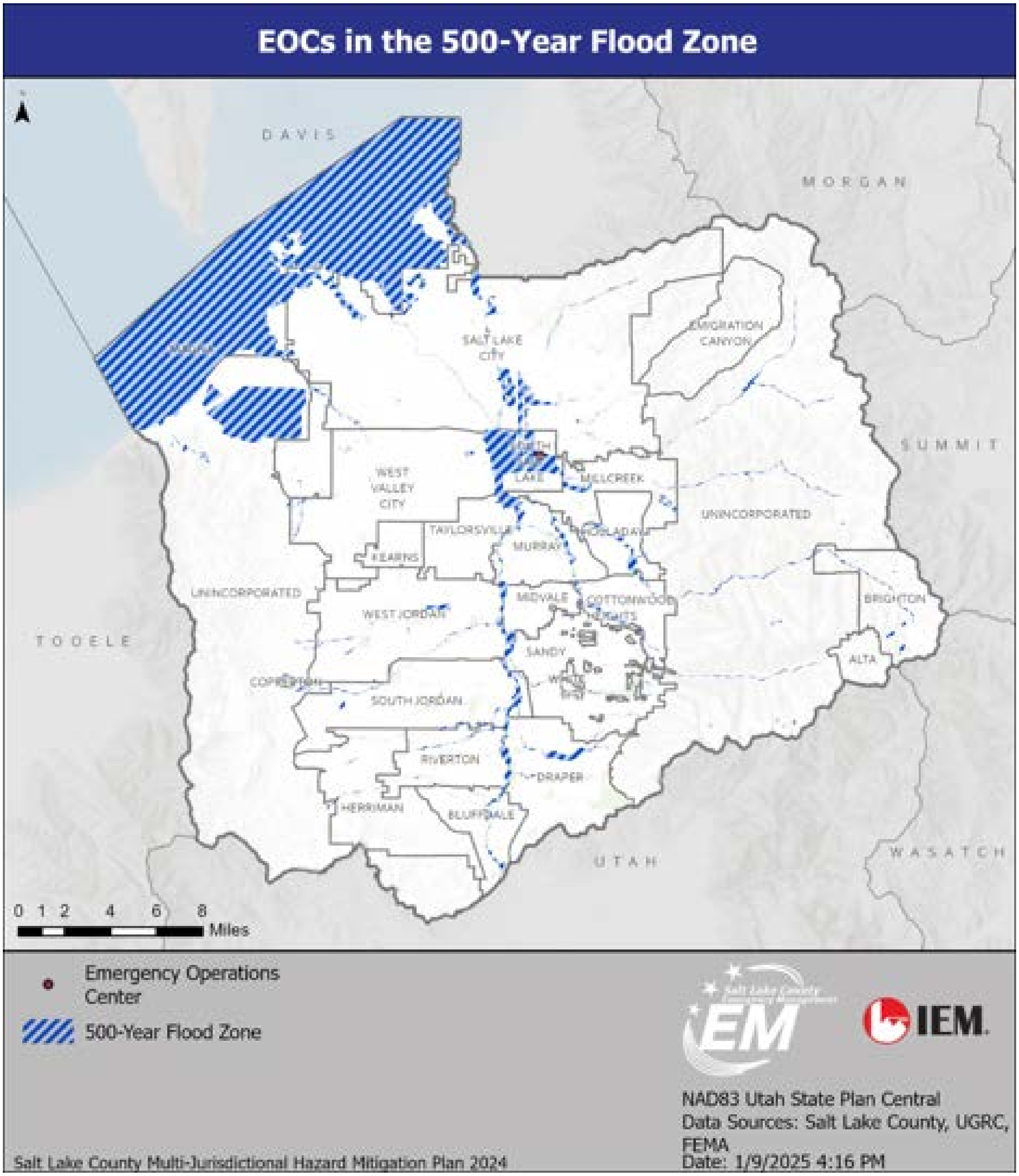


Figure 113: Emergency Operations Centers in the 500-Year (0.2% Annual Chance) Flood Zone

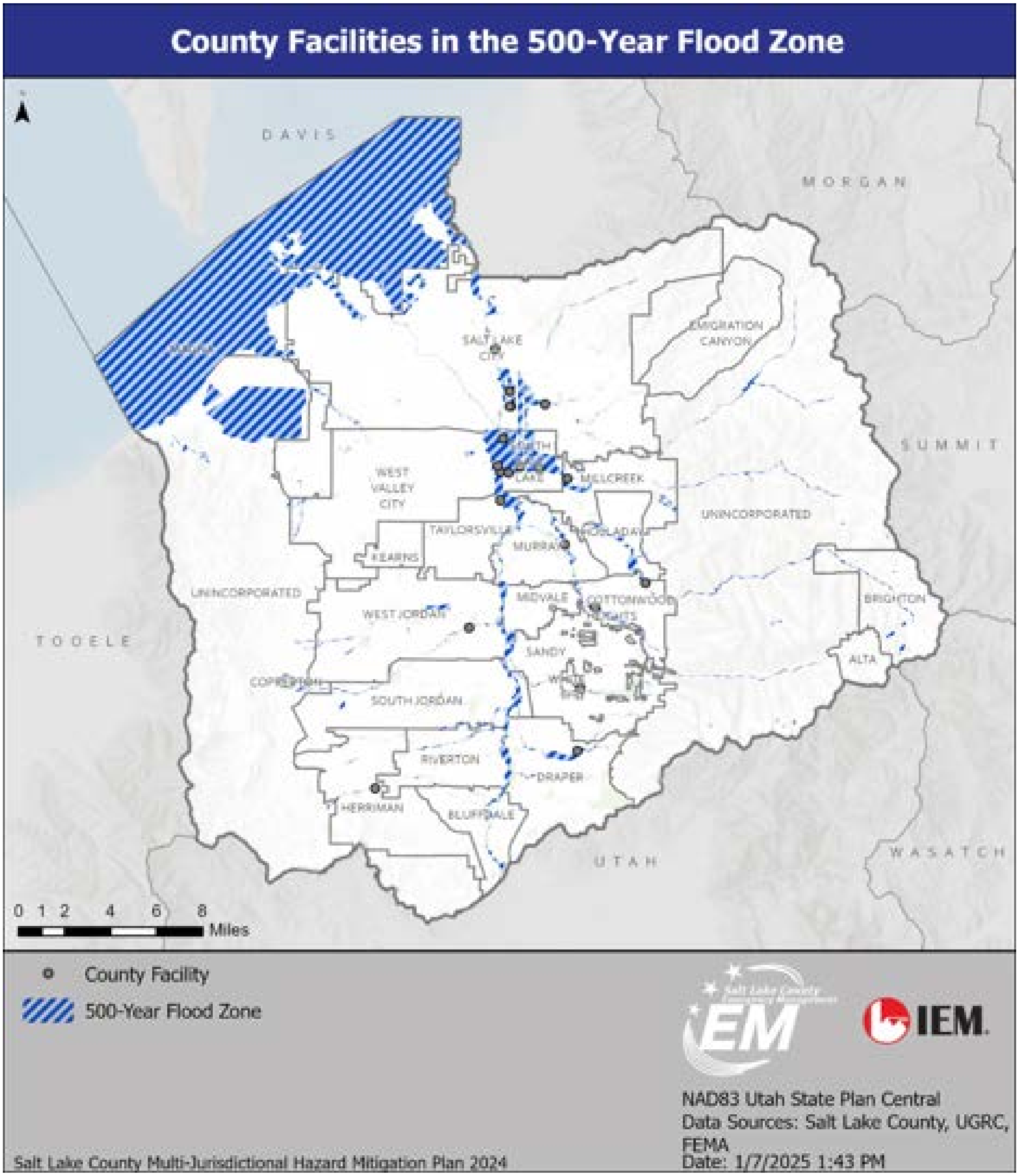


Figure 114: County Facilities in the 500-Year (0.2% Annual Chance) Flood Zone

ECONOMIC LOSS

For a 1% annual chance event, the estimated economic loss is $882 million, which represents 4.08% of the replacement value of the scenario buildings. Residential occupancies make up 21.82% of the losses. For a 0,.2% annual chance event, the estimated economic loss is $3.74 billion, which represents 12.10%

of the replacement value of the scenario buildings. Residences make up 22.46% of the losses for the 500-year scenario.

Economic loss is measured by building losses, which can be broken up into two categories: direct building loss and business interruption loss. Direct building losses are based on the estimated costs to repair or replace damage caused to the building and its contents by flooding. Business interruption losses are those associated with the inability to operate a business because of the damage from the flood. This includes income and wage losses, relocation losses, and rental losses, including temporary living expenses for people displaced from homes because of the flood. Of the estimated losses for the 100-year event, 57% were business-related losses.

The Hazus loss estimation for a 100-year flood shows West Valley City experiencing the highest loss at $240,346,000, with significant losses reported in Millcreek ($62,084,000), Brighton ($60,644,000), and Salt Lake City ($100,225,000). Several areas, such as Alta, Copperton, Kearns, and White City, experienced no losses in the 100-year Hazus loss estimation model. Other notable losses include Cottonwood Heights with $29,283,000, Holladay with $35,703,000, and South Salt Lake with $39,331,000. Less significant losses were noted in areas like Bluffdale ($3,080,000), Draper ($9,938,000), and Riverton ($5,885,000).

The Hazus loss estimation for a 500-year flood shows Draper and South Salt Lake experiencing the highest loss at $344,540,000 and $901,473,000, respectively, with significant losses in Millcreek ($737,529,000), Cottonwood Heights ($169,963,000), and Salt Lake City ($399,620). Much like the 100-flood loss estimation, areas such as Alta, Copperton, and Kearns experienced no losses in the Hazus model. Other notable losses included Bluffdale ($7,534,000) and Magna ($2,728,000).-

Table 52 and Table 53 show the estimated direct losses and business interruption losses for each jurisdiction in the planning area for the 1% annual chance (100-year) and 0.2% annual chance (500-year flood) scenarios, respectively.

Table 52: Loss Estimates for a 100-Year Flood Event (in Thousands)

Name	Building Loss	Content Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Income Loss	Wage Loss	Total Loss
Alta	$0	$0	$0	$0	$0	$0	$0	$0
Bluffdale	$634	$695	$65	$172	$198	$50	$1,266	$3,080
Brighton	$8,715	$14,292	$2	$2,208	$16,790	$1,883	$16,754	$60,644
Copperton	$0	$0	$0	$0	$0	$0	$0	$0
Cottonwood Heights	$9,667	$8,093	$746	$2,133	$2,848	$972	$4,824	$29,283
Draper	$3,837	$2,254	$57	$861	$631	$354	$1,944	$9,938
Emigration Canyon	$2,826	$5,532	$0	$934	$6,910	$717	$6,566	$23,485
Herriman	$3,334	$6,071	$3	$1,390	$918	$476	$16,599	$28,791
Holladay	$10,093	$9,713	$394	$3,042	$3,450	$1,580	$7,431	$35,703
Kearns	$0	$0	$0	$0	$0	$0	$0	$0
Magna	$1,238	$759	$200	$311	$22	$123	$75	$2,728
Midvale	$411	$1,303	$288	$227	$687	$162	$1,080	$4,158
Millcreek	$25,167	$18,638	$1,289	$3,521	$2,279	$1,258	$9,932	$62,084
Murray	$5,863	$11,483	$1,093	$2,089	$4,200	$1,012	$13,046	$38,786
Riverton	$865	$901	$37	$508	$391	$133	$3,050	$5,885
Salt Lake City	$10,477	$18,191	$2,487	$7,703	$14,385	$4,250	$42,732	$100,225
Sandy City	$11,334	$7,561	$471	$1,915	$1,009	$744	$3,769	$26,803
South Jordan	$3,706	$4,677	$270	$1,663	$2,843	$1,287	$5,076	$19,522
South Salt Lake	$3,189	$6,612	$906	$3,018	$4,933	$1,420	$19,253	$39,331
Taylorsville	$2,135	$1,600	$16	$852	$1,521	$867	$1,098	$8,089
Unincorporated	$16,937	$25,802	$3,181	$4,400	$5,727	$2,281	$71,048	$129,376
West Jordan	$2,819	$3,299	$123	$768	$742	$423	$5,578	$13,752
West Valley City	$33,941	$62,987	$3,846	$18,788	$30,131	$11,970	$78,683	$240,346
White City	$0	$0	$0	$0	$0	$0	$0	$0
Total	**$157,188**	**$210,463**	**$15,474**	**$56,503**	**$100,615**	**$31,962**	**$309,804**	**$882,009**

Table 53: Loss Estimates for a 500-Year Flood Event (in Thousands)

Jurisdiction	Building Loss	Content Loss	Inventory Loss	Relocation Cost	Income Loss	Rental Income Loss	Wage Loss	Total Loss
Alta	$0	$0	$0	$0	$0	$0	$0	$0
Bluffdale	$1,595	$1,577	$174	$542	$386	$174	$3,086	$7,534
Brighton	$8,715	$14,292	$2	$2,208	$16,790	$1,883	$16,754	$60,644
Copperton	$0	$0	$0	$0	$0	$0	$0	$0
Cottonwood Heights	$38,301	$44,373	$1,250	$12,791	$27,112	$5,714	$40,422	$169,963
Draper	$80,368	$71,901	$192	$16,635	$16,128	$5,972	$153,344	$344,540
Emigration Canyon	$2,826	$5,532	$0	$934	$6,910	$717	$6,566	$23,485
Herriman	$3,334	$6,071	$3	$1,390	$918	$476	$16,599	$28,791
Holladay	$41,270	$33,656	$4,288	$10,570	$7,289	$4,748	$24,784	$126,605
Kearns	$0	$0	$0	$0	$0	$0	$0	$0
Magna	$1,238	$759	$200	$311	$22	$123	$75	$2,728
Midvale	$3,211	$14,102	$319	$5,122	$17,362	$3,858	$37,532	$81,506
Millcreek	$203,497	$217,414	$4,811	$32,856	$82,354	$19,000	$177,597	$737,529
Murray	$21,193	$30,158	$3,056	$7,790	$12,713	$4,302	$41,161	$120,373
Riverton	$14,305	$9,560	$211	$3,261	$887	$965	$4,551	$33,740
Salt Lake City	$68,217	$88,216	$8,773	$32,548	$48,643	$16,208	$137,015	$399,620
Sandy City	$18,623	$13,667	$812	$3,677	$2,363	$1,493	$9,360	$49,995
South Jordan	$10,843	$14,301	$755	$7,523	$15,558	$4,623	$33,215	$86,818
South Salt Lake	$122,851	$302,803	$47,431	$60,375	$116,217	$35,214	$216,582	$901,473
Taylorsville	$2,731	$2,076	$19	$2,037	$3,328	$2,046	$2,669	$14,906
Unincorporated	$18,272	$26,872	$3,284	$4,652	$5,918	$2,390	$71,360	$132,748
West Jordan	$64,769	$40,332	$1,574	$9,304	$5,587	$4,066	$20,363	$145,995
West Valley City	$39,185	$69,425	$4,003	$22,339	$33,370	$14,350	$88,282	$270,954
White City	$0	$0	$0	$0	$0	$0	$0	$0
Total	**$765,344**	**$1,007,087**	**$81,157**	**$236,865**	**$419,855**	**$128,322**	**$1,101,317**	**$3,739,947**

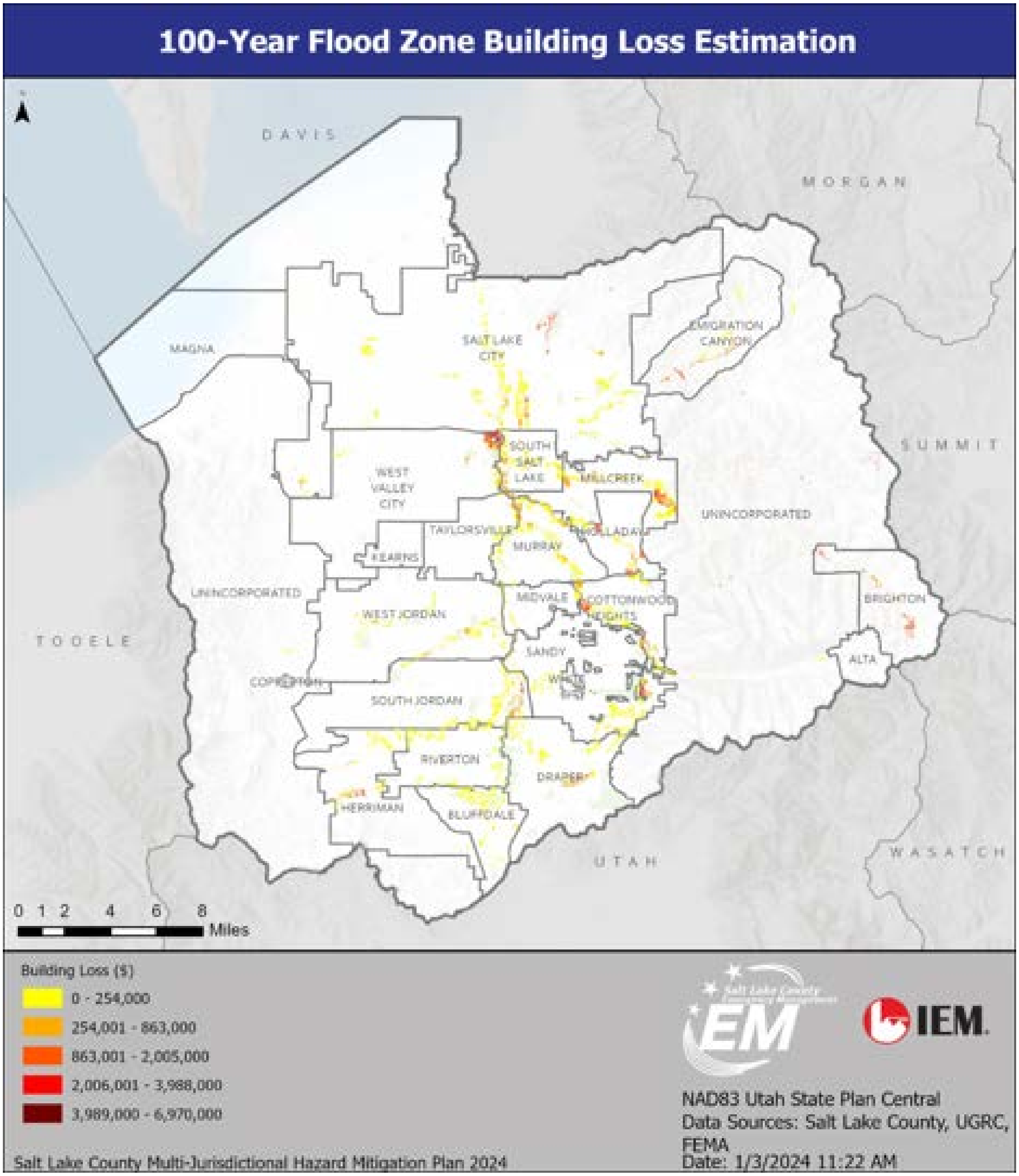


Figure 115: Estimated Building Losses for the 100-Year (1% Annual Chance) Flood Scenario

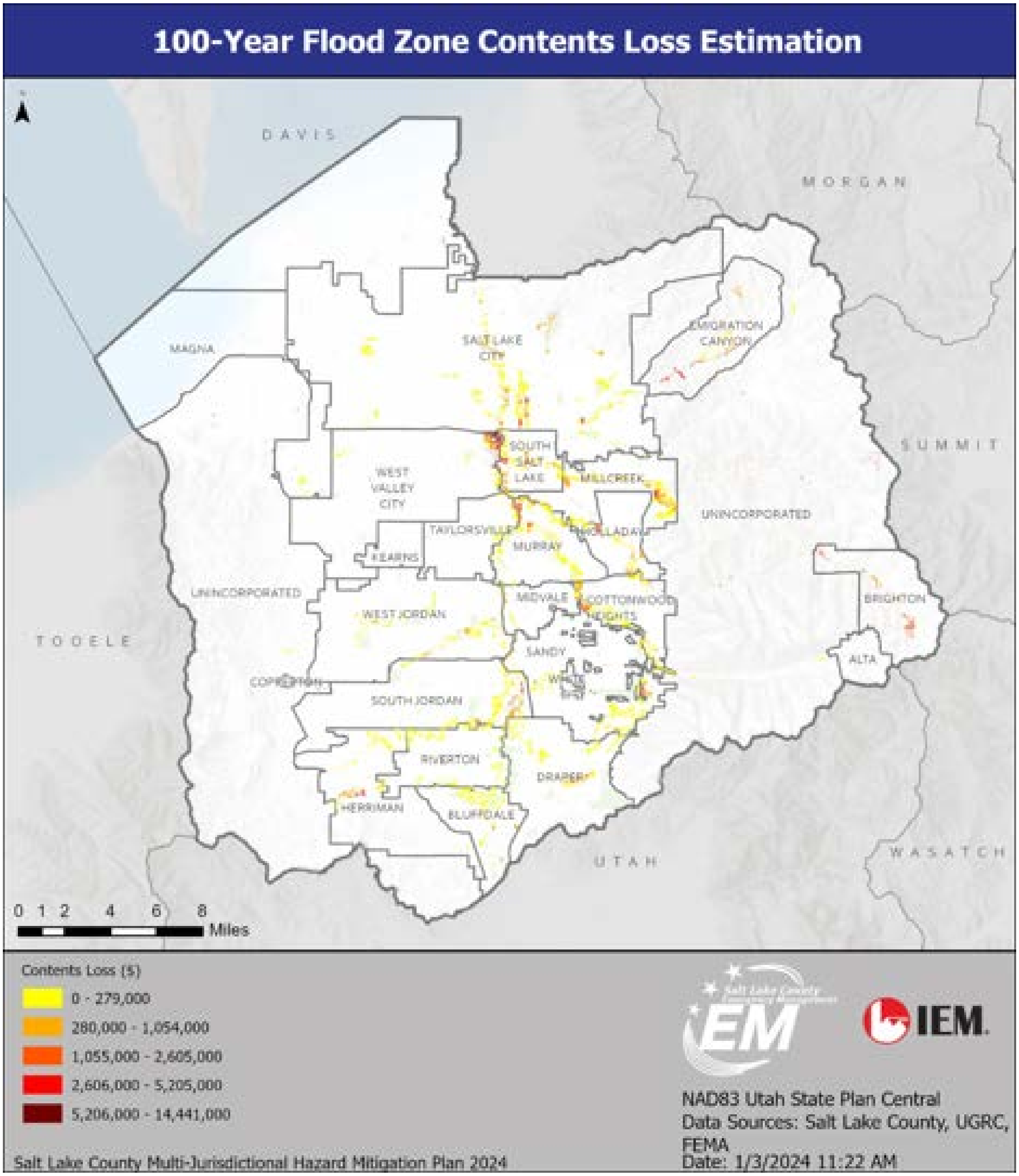


Figure 116: Estimated Contents Losses for 100-Year (1% Annual Chance) Flood Scenario

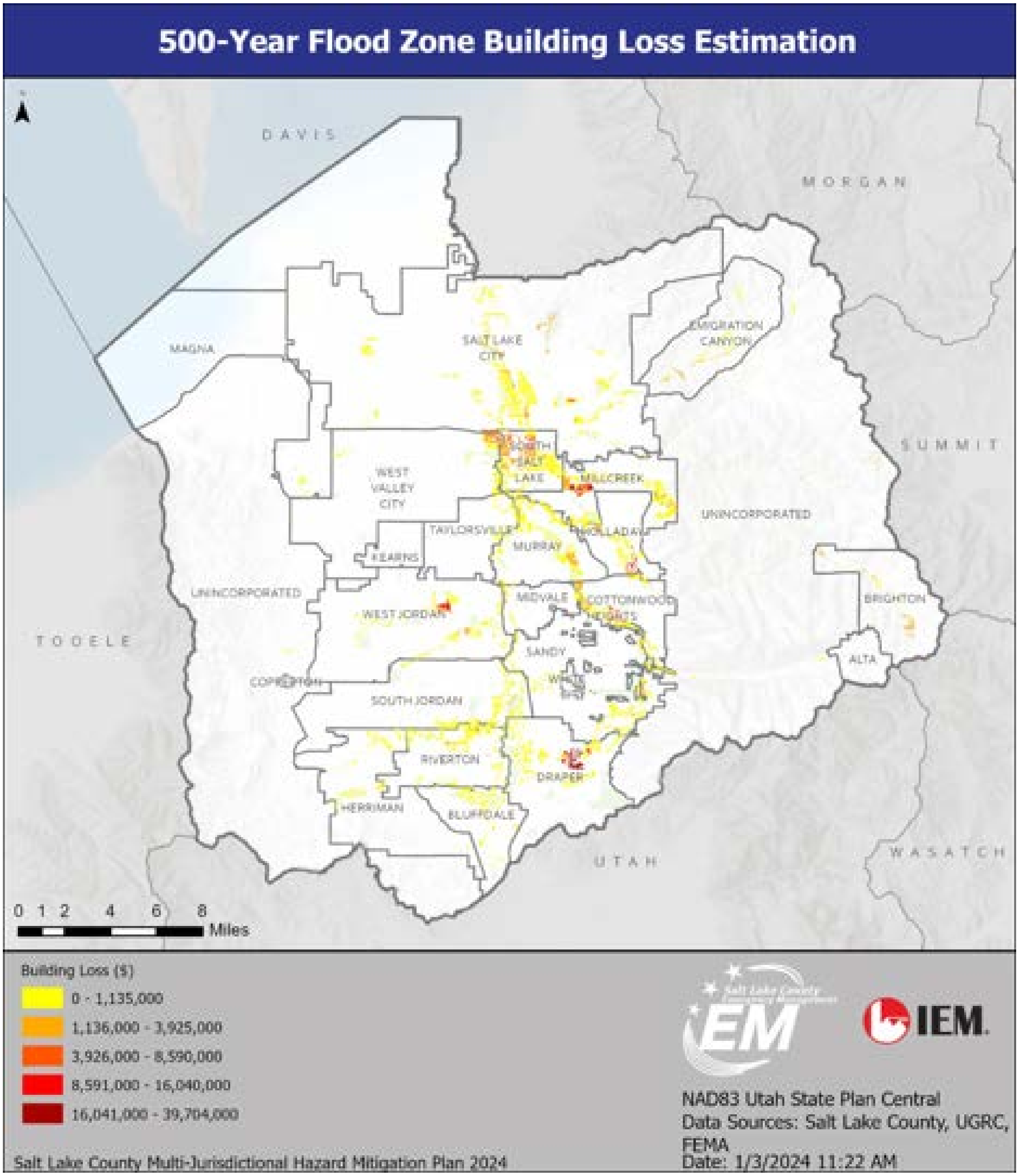


Figure 117: Estimated Building Losses for the 500-Year (0.2% Annual Chance) Flood Scenario

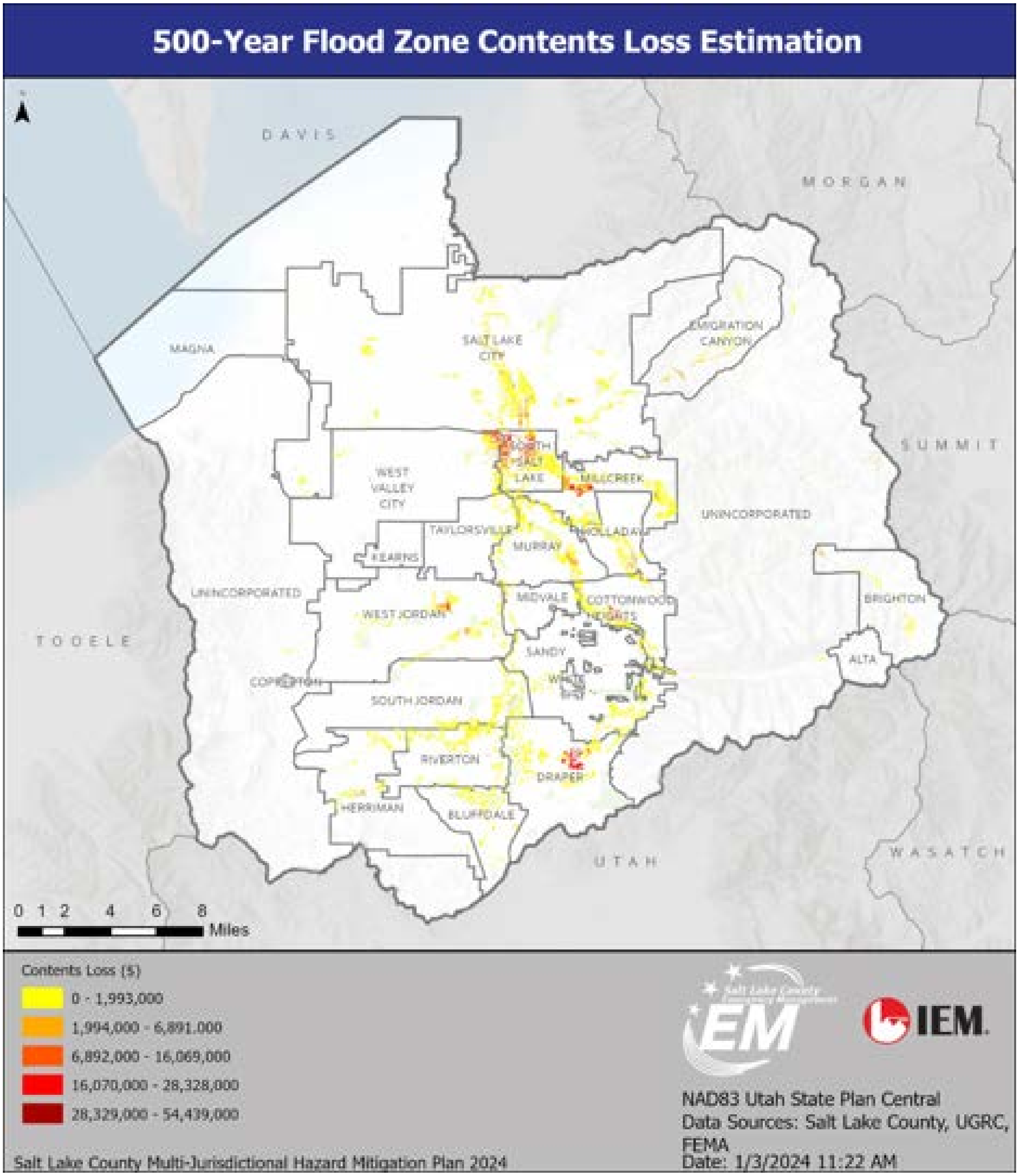


Figure 118: Estimated Contents Losses for the 500-Year (0.2% Annual Chance) Flood Scenario

DIRECT BUILDING DAMAGE AND LOSS

For a 100-year flood scenario, Hazus estimates that about 352 buildings will be at least moderately damaged and 30 will be completely destroyed. For a 500-year flood scenario, Hazus estimates that about 1,773 buildings will be at least moderately damaged and about 806 will be completely destroyed. Table

54–Table 57 show the number of buildings damaged by occupancy type and building type for both the 100-year and 500-year scenarios.

Table 54: Expected Building Damage by Occupancy for the 100-Year Flood Scenario

Occupancy	1–10		11–20		21–30		31–40		41–50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	1	33	2	67	0	0	0	0	0	0	0	0
Commercial	6	33	7	39	1	6	0	0	0	0	4	22
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	32	78	5	15	0	0	0	0	0	0	4	10
Industrial	5	45	3	27	3	27	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0	0	0	0	0
Residential	81	20	151	37	80	20	49	12	21	5	22	5
Total	**125**		**168**		**84**		**49**		**21**		**30**	

Table 55: Expected Building Damage by Building Type for the 100-Year Flood Scenario

Occupancy	1–10		11–20		21–30		31–40		41–50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	15	88	1	6	0	0	0	0	0	0	1	6
Manufactured Housing	12	48	4	16	2	8	0	0	3	12	4	16
Masonry	22	22	39	39	18	18	12	12	3	3	7	7
Steel	9	82	2	18	0	0	0	0	0	0	0	0
Wood	63	20	119	38	62	20	37	12	15	5	16	5

Table 56: Expected Building Damage by Occupancy Type for the 500-Year Flood Scenario

Occupancy	1–10		11–20		21–30		31–40		41–50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	1	33	2	67	0	0	0	0	0	0	0	0
Commercial	40	26	36	24	2	1	6	4	0	0	69	45
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	49	65	14	19	0	0	0	0	0	0	12	16
Industrial	114	48	83	35	39	16	2	1	0	0	1	0
Religion	0	0	0	0	0	0	0	0	0	0	0	0
Residential	331	18	376	20	181	10	114	6	112	6	724	39
Total	**535**		**511**		**222**		**122**		**112**		**806**	

Table 57: Expected Building Damage by Building Type for the 500-Year Flood Scenario

Occupancy	1–10		11–20		21–30		31–40		41–50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	47	57	22	27	10	12	0	0	0	0	3	4
Manufactured Housing	15	47	4	13	2	6	0	0	3	9	8	25
Masonry	170	23	153	21	67	9	31	4	28	4	277	38
Steel	29	60	14	29	3	6	0	0	0	0	2	4
Wood	263	19	309	22	136	10	88	6	81	6	510	37

As shown in Table 58 and Table 59, the building-related losses for a 100-year flood event were $81.22 million. About 55% of the estimated losses were related to business interruptions in the region. Residential occupancies made up 39.74% of the loss. For a 500-year event, the building-related losses were $227.77 million. About 59% of the estimated losses were related to business interruptions in the region, and residential occupancies made up 36.39% of the loss.

Table 58: Building Related Economic Loss Estimates for a 100-Year Flood Event (In Millions)

Category	Area	Residential	Commercial	Industrial	Other	Total
Building Loss	Building	$94.28	$28.88	$15.64	$18.38	$157.19
	Content	$51.39	$64.12	$38.80	$56.15	$210.46
	Inventory	$0.00	$7.09	$5.58	$2.81	$15.47
	Subtotal	**$145.67**	**$100.09**	**$60.02**	**$77.34**	**$383.12**
Business Interruption	Income	$3.31	$76.59	$1.29	$19.43	$100.62
	Relocation	$21.41	$17.52	$2.03	$15.53	$56.50
	Rental Income	$14.20	$13.15	$0.39	$4.22	$31.96
	Wage	$7.83	$68.51	$1.75	$231.72	$309.80
	Subtotal	**$46.75**	**$175.77**	**$5.46**	**$270.90**	**$498.88**
All	**Total**	**$192.42**	**$275.86**	**$65.48**	**$348.24**	**$882.00**

Table 59: Building-Related Economic Loss Estimates for a 500-Year Flood Event (In Millions)

Category	Area	Residential	Commercial	Industrial	Other	Total
Building Loss	Building	$427.69	$164.16	$98.68	$74.81	$765.34
	Content	$224.19	$361.86	$247.73	$173.31	$1,007.09
	Inventory	$0.00	$42.12	$35.47	$3.57	$81.15
	Subtotal	**$651.88**	**$568.14**	**$381.88**	**$251.69**	**$1,853.58**
Business Interruption	Income	$17.98	$332.38	$6.97	$62.53	$419.86
	Relocation	$80.42	$93.82	$15.00	$47.63	$236.87

Category	Area	Residential	Commercial	Industrial	Other	Total
	Rental Income	$47.33	$66.60	$2.71	$11.66	$128.32
	Wage	$42.33	$397.06	$11.02	$650.91	$1,101.32
	Subtotal	**$188.06**	**$889.86**	**$35.70**	**$772.73**	**$1,886.37**
All	**Total**	**$839.94**	**$1,458.00**	**$417.58**	**$1,024.42**	**$3,739.95**

DEBRIS REMOVAL

Table 60 shows how much debris would be generated by flooding and how many loads it would take to remove it, based on a capacity of 25 tons per load. One truck can likely haul one load per hour. A second debris removal issue is landfill space. At a weight-to-volume ratio of one ton per cubic yard, 50,000 tons would cover more than 10 acres to a depth of three feet.

For a 100-year flood, debris from finishes, structures, and foundations totals 12,464 tons. The debris significantly increases with all category types in a 500-year flood, resulting in 49,267 tons. This highlights the substantial increase in debris and the associated removal efforts required for more severe flood events in the county.

Table 60: Debris Generation and Removal

Category	100-year Flood	500-year Flood
Finishes	4,028	12,861
Structures	4,326	17,967
Foundations	4,110	18,438
Totals	**12,464**	**49,267**

SOCIAL IMPACT

Hazus estimates the number of households expected to be displaced from their homes due to the flood and the associated potential evacuation and how many displaced individuals will require accommodations in temporary public shelters. Displacement includes households evacuated from in or very near the inundated area. For a 100-year flood event, the model estimates that 3,119 households (9,356 individuals) will be displaced due to the flood. Of these, 2,043 individuals will seek temporary shelter in public shelters. For a 500-year flood event, the model estimates that 11,720 households (35,159 individuals) will be displaced due to the flood, with 4,089 individuals seeking temporary shelter.

Major flooding can impact the community by displacing residents and business owners; damaging and disrupting infrastructure, including roads and bridges, water treatment facilities, and wastewater treatment facilities; and causing health risks due to contaminated public water supplies and private wells. Heavy rains, severe flooding, or other types of emergency events could damage sewer systems and cause an overflow of untreated wastewater into communities and the environment. Severe flooding can put drinking water wells at increased risk of contamination from floodwater that may contain sewage. In addition, floodwater and standing water can be dangerous and expose vulnerable populations to infectious diseases, chemical hazards, and injuries. Flooded homes may be contaminated with mold or sewage, which can cause health risks.[130]

Flooding can also lead to road closures. Banks can erode ground under roadways, which may cause long-term transportation disruptions while roads are rebuilt or repaired. Deaths and injuries typically occur when motorists become trapped in floodwaters. This can, though not always, occur when motorists ignore the advice of officials and drive through flooded areas. Flooding can also damage power, water, or communications infrastructure, causing further disruptions for residents and businesses.

NFIP PARTICIPATION

Salt Lake County and all cities participate in NFIP. Table 61 shows the number of NFIP policies in place for each jurisdiction in the county and the number of past losses and payments. 402 properties have experienced losses totaling $1,727,734.

Table 61: NFIP Policies for Salt Lake County and Jurisdictions

Community	Number of Policies	Total Coverage	Number of Losses	Total Net Payment
Alta	0		0	$0.00
Bluffdale	13	$4,215,000	1	$0.00
Brighton	1	$98,000	0	$0.00
Cottonwood Heights	124	$26,434,000	5	$3,554.26
Draper (Salt Lake County)	79	$26,517,000	11	$156,544.70
Draper (Utah County)	5	NA	0	$0.00
Emigration Canyon	1	$350,000	0	$0.00
Herriman	29	$8,072,000	1	$14,071.50
Holladay	106	$25,804,000	6	$20,061.95
Kearns	1	$350,000	0	$0.00
Magna	1	$350,000	0	$0.00
Midvale	27	$5,756,000	0	$0.00
Millcreek	131	$39,395,000	3	$20,627.98
Murray	212	$48,856,000	54	$256,826.36
Riverton	28	$8,275,000	14	$28,777.17
Salt Lake City	187	$74,054,000	177	$407,411.90
Salt Lake County	99	$28,219,000	100	$751,554.06
Sandy City	45	$14,722,000	9	$41,053.73
South Jordan	52	$16,509,000	6	$1,222.99
South Salt Lake	33	$12,569,000	2	$1,929.33
Taylorsville	35	$17,917,000	2	$4,112.10

130 Centers for Disease Control and Prevention. Floods, "Guidelines for Septic and Onsite Wastewater Systems." February 6, 2024. https://www.cdc.gov/floods/safety/guidelines-for-septic-and-onsite-wastewater-systems.html.

Community	Number of Policies	Total Coverage	Number of Losses	Total Net Payment
West Jordan	34	$10,466,000	5	$14,082.83
West Valley City	107	$32,229,000	6	$5,903.28
White City	0		0	$0.00
Total	1,350	$401,157,000	402	$1,727,734.14

Table 62: Repetitive Loss (RL) Statistics for Salt Lake County[131]

Category	Zone A	V Zones	B, C, X Zones	Total Claims
RL Buildings (Total)	1	0	2	3
RL Buildings (Insured)	0	0	2	2
RL Losses (Total)	2	0	4	6
RL Losses (Insured)	0	0	4	4
RL Payments (Total)	$5,301.80	$0.00	$15,681.20	$20,983.00
RL Payments (Insured)	$0.00	$0.00	$15,681.20	$15,681.20

NATIONAL RISK INDEX

The NRI includes data on the EALs to individual natural hazards, historical loss, and overall risk at a county and census tract level. Salt Lake County's NRI EAL value for riverine flooding is $4.5 million, with a risk score of 92.7 and a relatively moderate percentile compared with the rest of the United States (Figure 119).

[131] Provided by the state floodplain program manager, citing the Utah 2024 State Enhanced Hazard Mitigation Plan. "Table 4-36-Flood Insurance Statistics for Utah Counties."

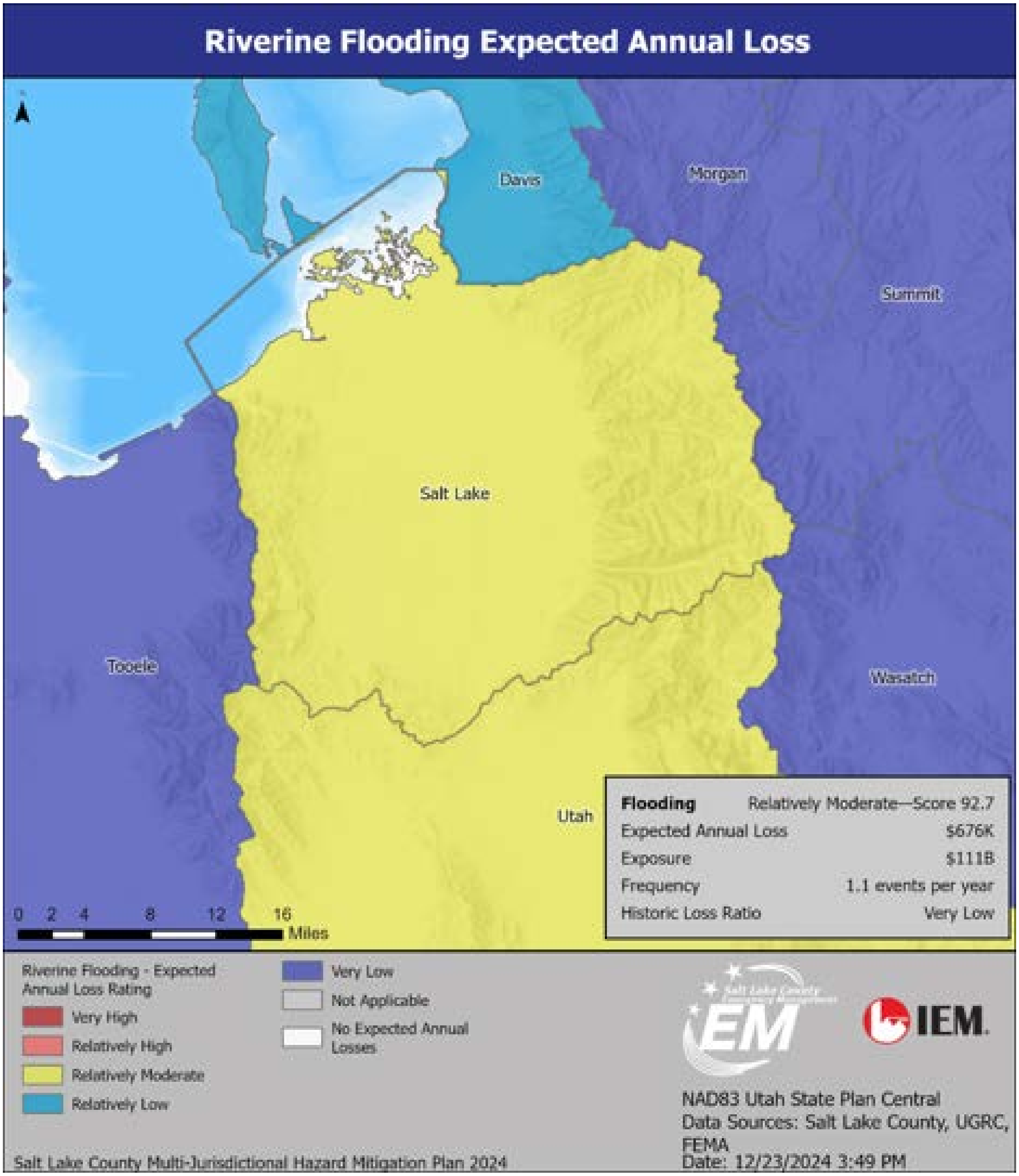


Figure 119: National Risk Index Expected Annual Loss from Riverine Flooding in Salt Lake County[132]

[132] FEMA, National Risk Index. "Salt Lake County Expected Annual Loss Riverine Flooding Risk Score, Map and Legend." https://hazards.fema.gov/nri/map.

VULNERABLE POPULATIONS

The 2024 Utah State Enhanced Hazard Mitigation Plan states vulnerability to the impacts of flooding is not distributed evenly across the population. People living in floodplain areas are most vulnerable to displacement. Perhaps the most extreme example of this is unhoused people taking refuge in floodplain areas. These people are both physically exposed to hazards and defined as socially vulnerable. In addition, the current housing availability crisis and increasing homelessness have exposed a growing number of underserved individuals to this hazard.

Where flood damage is especially severe, it can also disrupt livelihoods. This might have a more significant impact on low-income households with fewer financial resources to sustain them following a disaster. They may also have more difficulty finding temporary living arrangements if displaced by flooding.

Children are notoriously vulnerable to being swept away by floodwaters. Individuals with disabilities or access and functional needs also might have difficulty evacuating areas affected by flooding.

COMMUNITY LIFELINES

All lifelines are assigned to flooding because of the high impact of loss of life and property during these incidents. Law enforcement officers, emergency medical services, and rescue attempts may be delayed or impossible because of road flooding and blockage from debris. Due to these same problems, businesses and stores will be closed, causing food insecurities and preventing access to daily necessities. Power outages may make communication impossible, and some people will not be able to call for help. Hazardous materials may leak into the water and ground, causing current and future problems for people, crops, and livestock.

CHANGES IN DEVELOPMENT

In Salt Lake County, development and population growth can have profound impacts on flooding, as the growing population leads to the creation of impervious surfaces like roads and buildings. This reduces natural water absorption and increases runoff during storms. This can cause higher flood risks, especially in areas with inadequate drainage systems. In addition, an increased population may start to settle in areas that are highly prone to flooding, such as near rivers and streams. This increases the risk and impact of flooding on infrastructure and the population.

The Surplus Canal levee system provides protection for a large portion of Salt Lake City from approximately 2900 S to the Salt Lake City International Airport. The U.S. Army Corps of Engineers (USACE) conducted an inspection of this federally authorized levee system in 2019. Preliminary information suggests similar deficiencies found in the 2012 inspection. These deficiencies resulted in an unacceptable rating for the levee systems in Salt Lake County. Through the Surplus Levee Deficiency Rehabilitation Project, Salt Lake County Flood Control is working to bring the Surplus Canal levee systems back into USACE compliance. To do so, it must address the unacceptable encroachment violations, including those on privately owned property. The project is currently working to identify all encroachments on property owned by the county or other government entities, acquire property within 10 feet of the land-side toe of the levee, relocate fences outside USACE jurisdiction, and remove all encroachments on the newly acquired property. Salt Lake County is taking a phased approach to acquire the property needed to fully address the deficiencies. The project commenced the phased approach in 2017, with initial mapping, project development, and coordination with USACE and local agencies to bring the levee into compliance. The second phase (2018–2021) involved residential property acquisitions. Phase 3 (2021–2025) will conclude the project with commercial property acquisitions.[133] These flood mitigation measures may decrease future vulnerability to flood for the affected areas; however, population increases in the county have heightened vulnerability.

Figure 120: Surplus Levee Right of Way Map for Salt Lake County[134]

VULNERABILITY SCORE

To analyze the county's vulnerability to flooding, the NRI was used as a primary tool during the 2024 HIRA update. The NRI defines risk as the potential for negative impacts as a result of a natural hazard and determines a community's risk relative to other communities by examining the EAL and social vulnerability in a given community in relation to that community's resilience. Salt Lake County's NRI riverine flooding risk rating is shown in Figure 121. Salt Lake County has relatively moderate riverine flooding risk and a risk score of 93.

[133] Salt Lake County. "Flood Control, Surplus Canal Deficiency Rehabilitation Project." 2024. https://www.saltlakecounty.gov/flood-control/surplus-canal-deficiency-rehabilitation-project/.
[134] Salt Lake County. "Surplus Levee Right of Way Map." 2024. https://slco.maps.arcgis.com/apps/webappviewer/index.html?id=ef1f645b00a54ba1931c6d73871495df.

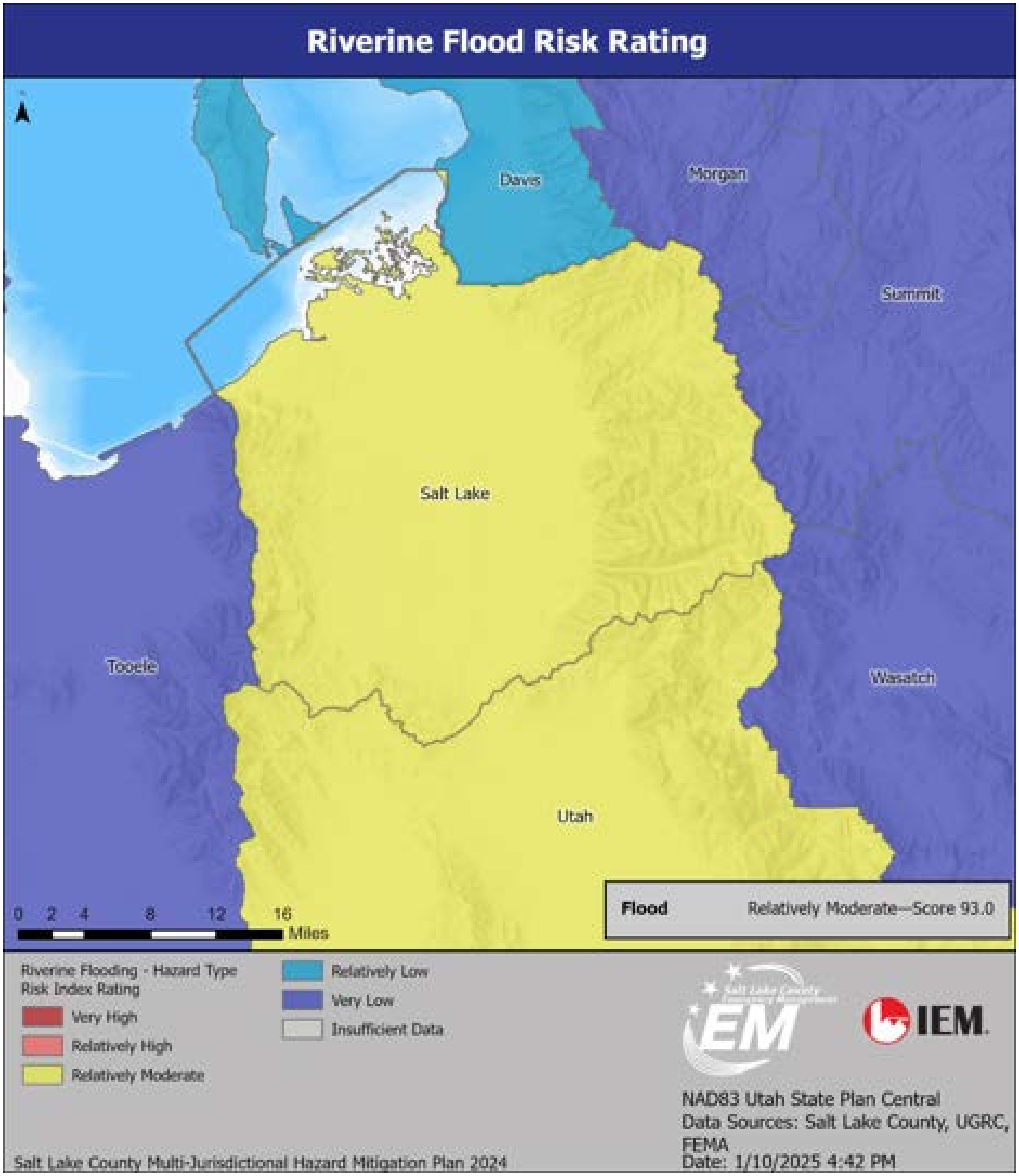


Figure 121: National Risk Index Riverine Flooding Risk Map, Legend, and Score for Salt Lake County[135]

[135] FEMA, National Risk Index. "Salt Lake County Riverine Flooding Score, Map and Legend." https://hazards.fema.gov/nri/map.

Heavy Rain

Hazard Description

Heavy amounts of precipitation from rain can cause flash flood events. The Wasatch Front has been susceptible to these types of storms because of proximity to the mountain ranges. Much of the valley's development has occurred on old alluvial fans from the canyon mouths. During heavy rain events, water and debris collect on these alluvial fans, damaging residential and commercial property and infrastructure. In 2017, near Salt Lake City International Airport, 1.97 inches of rainfall was recorded; this was the wettest day on record for the month of March and the sixth wettest day since records began in 1874.

Figure 122: Image of Heavy Rain[136]

According to NOAA, atmospheric rivers are narrow channels of wind pulling a large, condensed amount of moisture from the ocean before dumping it all once it reaches land. In the western United States, California gets the brunt of the moisture dump. As the storm makes its way over the Sierra Nevada Mountains and further east, Utah will typically see a good amount of precipitation from what is left.[137]

Hazard Profile

Potential Impact		Catastrophic	**Probability**		Highly Likely
	X	Critical		X	Likely
		Limited			Occasional
		Negligible			Unlikely

[136] https://pixabay.com/photos/windshield-rain-glass-surface-5366584/.
[137] Fox, Derick. "What is an Atmospheric River and What can Utahns Expect?" ABC4. February 1, 2024. https://www.abc4.com/utah-weather/utah-weather-stories/atmospheric-river-explained/.

Location	Can occur in areas throughout the county
Seasonal Pattern	Year-round
Conditions	Vary based on latitude, elevation, aspect, and landforms
Duration	Heavy rain generally lasts hours; some conditions can persist for days
Secondary Hazards	Flooding
Analysis Used	National Climatic Data Center, National Weather Service, Utah Avalanche Center, Utah Division of Emergency Management, local input, and review of historic events and scientific records

Magnitude/Extent

The rainfall rate is a measure of the amount of rain that falls during a period, such as millimeters or inches per hour. The Manual of Surface Weather Observation Standards includes the following general categories to classify rainfall intensity.[138]

Table 63: Rainfall Intensity Scale

Description	Rate
Light Rain	Less than 0.1”/hour
Moderate Rain	0.1 to 0.3”/hour
Heavy Rain	0.3 to 2”/hour
Violent Rain	>2”/hour

Location

The entire area of Salt Lake County can be affected by most heavy rain events; however, low-lying areas and valleys are most prone to the effects. Communities with poor, obstructed, or limited stormwater drainage systems are at greater risk during heavy rain events. Heavy rain events occur mostly in the fall or winter months and are produced by large synoptic weather systems originating out of the South, Southwest, or West that produce rainfall for an extended period. Snow may also melt due to rainfall, which primarily occurs in the southern half of the state.

Historical Events and Probability of Future Occurrences

Based on the FEMA Disaster Declarations Database, Salt Lake County has received no designation for heavy rain disaster declarations since the last plan update.

According to the NWS, historical rainfall data for Salt Lake City shows an average of 1.71 inches in October with 13 average rain days, 1.77 inches in November with 16 average rain days, and 2.07 inches in December with 19 average rain days.

[138] “Rain Rate Intensity Classification.” Barani. January 19, 2020. https://www.baranidesign.com/faq-articles/2020/1/19/rain-rate-intensity-classification.

Although rain obviously occurs frequently as part of natural weather processes, rains heavy enough to be classified specifically as “heavy rain” events in the NCEI records have occurred 9 times from 1996 to 2024, approximately 1 event every 3 years, a rate likely to continue. The probability of future occurrences is likely. Property damage from these 9 events was $1,567,000, with $12,000 in crop damage.

On August 13–14, 2024, two days of intense thunderstorms and heavy rainfall caused flooding across the Salt Lake City metro area. UDOT reported flooding across northern Utah. Streets in metro Salt Lake City turned into rivers as many storms brought heavy rain, and hail caused many road closures in Salt Lake and Wasatch counties.

On August 18, 2021, NWS issued a Flood Warning for urban and small stream flooding in the valley, and the downpour caused Utah Highway Patrol to close Interstate 215 East Belt at 3300 South due to “significant flooding” in the area. Crews waded into the nearly knee-high pool of rainwater and used industrial pumps to remove it from the road. Flooding also occurred at the intersection of 3300 South and 700 East.

On March 23, 2017, heavy rain fell across the Salt Lake Valley. At the Sunnyvale Apartments on 3940 South 764 West, two families had to evacuate their apartments due to flooding. Relatively close by at the Salt Lake City International Airport, 1.97 inches of rainfall was recorded; this was the wettest day on record for the month of March and the sixth wettest day since records began in 1874.

On August 8, 2006, about 1.3 inches of rain fell in one hour from Murray to East Millcreek. On several occasions, around 2 inches of rain has fallen at multiple locations in the county.

Climate Change Considerations

Climate change can have a significant impact on heavy rain. Higher temperatures can cause the atmosphere to hold more moisture, leading to more intense and frequent heavy rainstorms. Heavy precipitation can cause flash flooding in Salt Lake County, overwhelming stormwater systems and damaging infrastructure. Climate change can also alter precipitation patterns and increase the intensity of rainstorms, leading to heavy rainstorm events.

The 2024 Utah Enhanced State Hazard Mitigation Plan states climate models consistently indicate that increased convective storms are a likely outcome of climate change, with worsening severe storm activity increasing with worsening climate change.

Secondary Hazards

The most significant secondary hazard associated with heavy rain events is localized flooding. Heavy rain can also be accompanied by high wind, which can cause falling and downed trees, downed power lines, and associated power outages. Rapidly melting snow combined with heavy rain can overwhelm natural and human-made drainage systems, causing overflow and property destruction.

According to Commonwealth Edison (ComEd), “Weather-related events cause 70 percent of all power outages.” Power outages usually last anywhere from a few minutes to a few hours. In extreme cases, power outages have lasted a few days or even weeks. Severe weather-induced power failures may come from rain that damage insulators and other components vital for maintaining a functioning circuit.

Vulnerability Assessment

Weather events are inherently unpredictable, with the severity and precise locations of an event subject to change. Conditions can evolve quickly, making it challenging to pinpoint specific areas, facilities, structures, or systems that may be affected by heavy rain. Due to the broad reach of this hazard, heavy rains can impact all populations, structures, critical facilities, infrastructure, and the economy. All critical facilities are vulnerable, including fire stations, police stations, hospitals, schools, and all 218 county facilities. Utilities, such as power and communications networks and transportation systems and road networks, also are vulnerable. The extent of the impact and the severity of the damage will vary considerably from one event to another.

ESTIMATED IMPACT AND POTENTIAL LOSSES

Heavy rain can cause localized flooding and subsequent water damage to nearby structures. Prolonged heavy rain can overwhelm storm drainage systems, causing further damage. Low-lying areas, such as bridge underpasses, may be more likely to experience flooding. Vehicles may lose traction or be unable to travel roadways safely. Flooding or unsafe driving conditions may require road closures, potentially blocking major transportation routes. Transportation disruptions also may delay emergency response.

Power outages and other service disruptions may occur as a secondary effect of heavy rainstorms. These outages negatively impact county residents and business operations, resulting in economic losses. Critical facilities may require backup power systems to continue operations during power outages.

Attendees at outdoor events, such as sporting or recreation activities, farmers markets, and other community events, might have difficulty finding shelter during fast-moving storm events.

The NRI does not include data on the EALs for heavy rain. Based on the damage recorded in NCEI, $1,579,000 in losses have been incurred in the last 28 years in Salt Lake County. This averages approximately $56,393 per year.

VULNERABLE POPULATIONS

The following populations are most vulnerable to a heavy rain event, face isolation and exposure during these events, or could suffer more secondary effects of the hazard.

Severe weather, like heavy rain, typically affects people who are outdoors. Those without access to shelter, such as outdoor workers in construction or agriculture, are particularly affected. Individuals who are unhoused are especially vulnerable to the dangers posed by heavy rains.

Those dependent on powered medical devices also are particularly vulnerable to power outages caused by severe weather events. Elderly residents or those with disabilities or mobility difficulties might have difficulty seeking shelter or addressing damage caused by heavy rain. Individuals with low incomes may face more significant challenges recovering if their residences are damaged or if they lose wages from business or other economic impacts of storms.

COMMUNITY LIFELINES

Heavy rain can disrupt transportation and energy lifelines. The importance of these lifelines cannot be overstated. In a disaster, communities can be left without access to necessities, such as food, water, and shelter. The lifelines help ensure that these needs are met and that people have the resources they need to survive. By providing access to medical care, public health services, and transportation, the lifelines help ensure that people can receive the care they need and safely evacuate if necessary. In addition, the Hazardous Materials lifeline helps to ensure that dangerous materials are managed safely, reducing the risk of further harm. Community lifelines help create a sense of safety and security in a community. They provide a safety net for individuals who may be struggling and offer comfort and reassurance that help is available when needed. Without these lifelines, communities would be much more vulnerable to crises and emergencies.

CHANGES IN DEVELOPMENT

In Salt Lake County, development and population growth have significant implications for managing heavy rainstorm events. Impervious surfaces like parking lots, buildings, and roads will increase as population grows and this increases water runoff in the county. This can overwhelm stormwater systems and increase the likelihood of urban flooding. Development in flood-prone areas also can increase the risk of being impacted by a heavy rain event. Salt Lake City and communities south along Route 15 already have a high level of impervious surfaces, generally between 50% and 100%, according to the U.S. Environmental Protection Agency. In the past five years, suburban and exurban communities in the western part of the county—like Herriman, West Jordan, and South Jordan, which used to have very low levels of impervious surfaces—have started to add more with increased development. As development continues, so does the chance of increased runoff from heavy rain events.

Potential impact from heavy rains includes loss of life/property and flooding. Rain combined with snowmelt runoff can contribute to potential flooding. In addition, population growth, new construction of homes and businesses, and construction or changes in transportation routes provide new economic opportunities but may also indicate an increase in exposure to heavy rain. Changes in land use and development may be impacted as residential zoning may change for areas experiencing significant precipitation. Overall, vulnerability to heavy rain has increased since the last plan update.

VULNERABILITY SCORE

The NRI does not provide data to define risks associated with a heavy rain hazard.

High Wind

Hazard Description

High wind can occur with or without a storm and are unpredictable. According to NWS, "High wind has sustained winds speeds of 40 miles per hour (mph) lasting for 1 hour or longer, or wind of 58 mph or greater for any duration."[139] Salt Lake County has experienced high winds in the past and can expect future events.

Figure 123: Damage from a High Wind Event in 2020[140]

According to the NWS definition, straight-line winds are defined as "any wind that is not associated with rotation, used mainly to differentiate them from tornadic winds."[141] Straight-line winds are responsible for most thunderstorm wind damage, and their speeds can exceed 125 mph. Other damaging winds originating from thunderstorms include downbursts and microbursts. Utah has also experienced downslope wind events, which occur when wind generated as a deep layer of air is forced over a barrier. According to the NWS, a downslope flow is defined as "a thermally driven wind directed down a mountain slope and usually occurring at night, part of the along-slope wind system."[142] Winds accelerate down mountain slopes and generate high winds in a wave region formed at the base of the terrain. A downslope windstorm in December 2011 generated many reports of 60–80 mph winds, and maximum gusts of 80–100 mph in the Bountiful/Centerville area, resulting in loss of power and significant damage in the region. In October 2020, a severe windstorm with wind gusts reaching up to 89 mph caused extensive damage across Salt Lake County leading to power outages for many residents, with some lasting over a week. The State of Utah declared a state of emergency due to the situation. Tragically, one individual in

[139] National Oceanic and Atmospheric Administration (NOAA), National Weather Service (NWS). "National Weather Service Glossary." https://forecast.weather.gov/glossary.php.
[140] Provided by SLCo EM.
[141] Ibid.
[142] Ibid.

South Salt Lake lost their life. Canyon winds can bring wind gusts greater than 100 mph through the canyon mouths into the populated areas of the Wasatch Front. Winds are usually strongest near the mouths of canyons and have resulted in the loss of power resulting in loss of electricity in homes and businesses. Winds have also damaged roofs, destroyed and knocked down large trees and fences, overturned tractor trailers and railroad cars, and downed small airplanes.

Figure 124: Wind Damage in Salt Lake County Following a Storm in 2020[143]

Hazard Profile

Potential Impact		Catastrophic	**Probability**	X	Highly Likely
	X	Critical			Likely
		Limited			Occasional
		Negligible			Unlikely
Location	High wind can occur in areas throughout the county.				
Seasonal Pattern	High wind can occur year-round.				
Conditions	High winds vary based on latitude, elevation, aspect and landforms.				
Duration	High Wind hazard generally lasts hours; some conditions can persist for days.				
Secondary Hazards	Potential secondary hazards include wildfire and flooding.				
Analysis Used	National Climate Data Center, National Weather Service, Utah Avalanche Center, Utah Division of Emergency Management, local input, and review of historic events and scientific records				

143 Photo courtesy of SLCo EM.

Extent/Magnitude

The Beaufort Wind Scale was developed to estimate wind speeds based on their effects by visual observations. Initially used by sailors based on sea conditions, it is still in use today to estimate wind strengths.

Table 64: Beaufort Wind Scale[144]

Force	Speed (mph)	Speed (knots)	Description	Specifications
0	0–1	0–1	Calm	Calm; smoke rises vertically
1	1–3	1–3	Light Air	Direction of wind shown by smoke drift, but not by wind vanes
2	4–7	4–6	Light Breeze	Wind felt on face; leaves rustle; ordinary vanes moved by wind
3	8–12	7–10	Gentle Breeze	Leaves and small twigs in constant motion; wind extends light flag
4	13–18	11–16	Moderate Breeze	Raises dust and loose paper; small branches are moved
5	19–24	17–21	Fresh Breeze	Small trees in leaf begin to sway; crested wavelets form on inland waters
6	25–31	22–27	Strong Breeze	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty
7	32–38	28–33	Near Gale	Whole trees in motion; inconvenience felt when walking against the wind
8	39–46	34–40	Gale	Breaks twigs off trees; generally, impedes progress
9	47–54	41–47	Severe Gale	Slight structural damage occurs (chimneypots and slates removed)
10	55–63	48–55	Storm	Seldom experienced inland; trees uprooted; considerable structural damage occurs
11	64–72	56–63	Violent Storm	Very rarely experienced; accompanied by widespread damage
12	72–83	64–71	Hurricane	See Saffir-Simpson Hurricane Scale.

Location

The entire region of Salt Lake County can be affected by most high wind events and their effects. Wind events are most damaging to areas that are heavily wooded and areas with exposed property and aboveground utility lines.

144 NOAA, NWS. “Beaufort Wind Scale.” https://www.weather.gov/mfl/beaufort.

Historical Events and Probability of Future Occurrences

Based on the FEMA Disaster Declarations Database, one high wind event has occurred during the period of January 1, 2019, through June 3, 2025.[145] The event was declared on January 21, 2021, from events that occurred on September 7 and 8, 2020, and categorized as straight-line winds. A severe windstorm with gusts up to 89 mph caused extensive damage and prolonged power outages in Salt Lake County, leading the State of Utah to declare a state of emergency. About 1,000 trees were knocked down in Salt Lake City alone. As many as 170,000 homes and businesses lost power. Areas with the most power outages included Millcreek, northeast Salt Lake City, South Salt Lake, Murray, Holladay, and northern Taylorsville.[146]

NOAA data records indicate that the highest wind event recorded in the county occurred on January 8, 2005, with gusts up to 99 knots (113.93 mph), This level of wind exceeds the limits of the Beaufort Wind Scale.

According to NCEI data, there have been 264 days with high wind events from 1956 to 2024 (68 years), totaling $10.6 million in property damage and $365,800 in crop damage. These also resulted in 2 deaths and 48 injuries. There were 8 strong wind events that resulted in $36,000 in damage. The NRI defines “strong wind” as consisting of “winds, often originating from thunderstorms that are classified as exceeding 58 mph.”[147] 186 thunderstorm wind event days caused 15 injuries and resulted in over $5 million in property damage and $65,600 in crop damage. Damage of $16,127,400 averages to approximately $237,168 in losses per year. The median property damage amount for all high, strong, and thunderstorm wind events is $0, indicating that the data are skewed upwards by a smaller number of higher costing events. For example, three events that took place on August 1, 2006, May 2, 2001, and March 20, 2000, totaled approximately $4,500,000 by themselves, although most events caused little to no property damage.

Since 2019, the time of the last mitigation plan update, 103 wind events have been recorded, totaling $4,929,000 and resulting in 1 death and 12 injuries. Most of these were from a single event in September 2020, described below. Figure 126 shows the location and strength of past wind events in the county. The frequency of events is an indicator that probability of future occurrences is highly likely.

On September 8, 2020, a weather pattern abnormal for September developed, triggering a significant downslope flow wind event. Based on climatology and previous case study findings, this type of event most commonly occurs during the winter months. Downslope wind events are often confined to areas near canyon mouths and usually impact only isolated areas with extreme winds. This event was unusual in both the early fall timing and the extensive spatial coverage of the damage. High winds were reported as far south as the Tooele Valley, with high wind reports all along the Interstate 15 corridor stretching north into the Cache Valley. Because trees still had their full canopy, the tree damage all along the

[145] FEMA, Disaster Declarations for States and Counties.” https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties.
[146] Gonzalez, Norma, Taylor Stevens, and Sean P. Means. “Utah declares state of emergency after windstorm knocked down thousands of trees.” The Salt Lake Tribune. September 9, 2020. https://www.sltrib.com/news/2020/09/09/utahs-winds-are-dying/.
[147] FEMA, National Risk Index, “Strong Wind.” https://hazards.fema.gov/nri/strong-wind.

Wasatch Front was extreme, with an estimated 4,500 trees damaged in Salt Lake County alone. Current estimates put the cost at $8.9 million for the region. The storm led to 1 fatality, 20 direct injuries, and 4 indirect injuries. Over 180,000 power outages were reported along the Wasatch Front, with power restorations taking up to a week in some locations due to extensive damage. Schools and recreation facilities were closed.

Figure 125: Windstorm Damage in Salt Lake County, September 2020[148]

Very strong winds developed across much of Utah on April 16, 2018, ahead of a cold front, with wind damage reported in parts of the Wasatch Front. Maximum recorded wind gusts included 73 mph at SR-201 at I-80, 65 mph at Baccus, 63 mph at Flight Park South, and many other reported gusts in the 50 mph to 62 mph range. The gusts blew down multiple trees, and one fell on a house in Murray. Trampolines became airborne and landed in yards, over fences, and on the roof of a home in one case. Total damage was recorded as $50,000, and more than 7,500 power outages were reported.

On August 1, 2006, severe thunderstorm winds up to 75 mph impacted the southern part of Salt Lake County in conjunction with Utah County Storms. Trees up to 12 inches in diameter snapped in East Millcreek, and large trees were uprooted in the Sugarhouse area. Numerous power poles also were downed in the southern portion of county. According to a regional insurance claim estimate, the reported damage was approximately $2 million.

On May 2, 2001, strong canyon winds developed along the Wasatch Front, lasting until the early morning of May 4. The storm caused an estimated $3 million in property damage between Davis and Salt Lake counties and several hundred thousand dollars damage to trees. The worst damage was reported in Sandy City and Cottonwood Heights. A semi-truck was overturned on I-15 in Centerville on May 3, and a large tree smashed into a house in Farmington. No injuries were reported.

[148] Photo provided by SLCo EM.

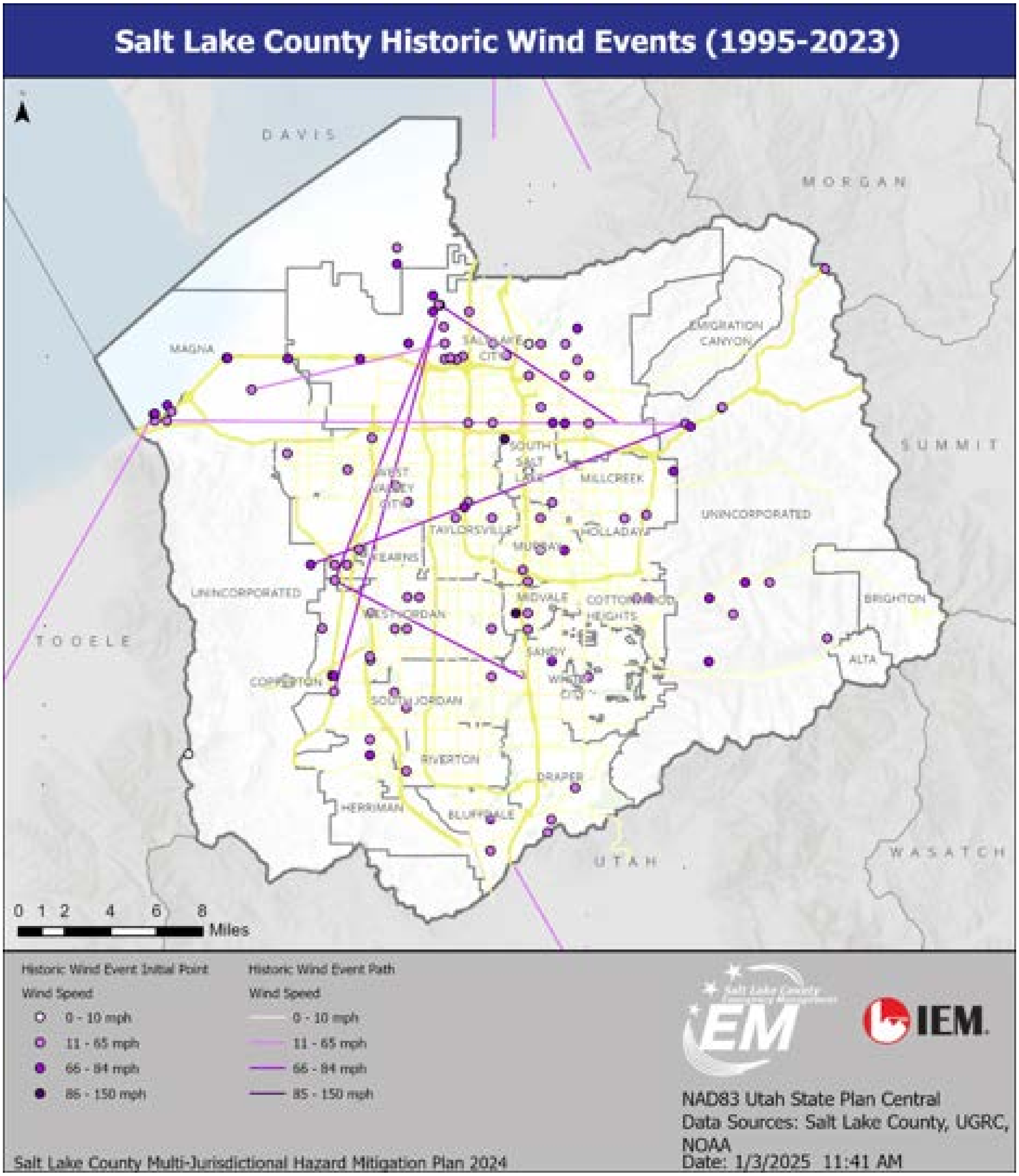


Figure 126: Historic Wind Events in Salt Lake County, 1995–2003

Climate Change Considerations

Climate change can have a significant impact on the natural hazard of high winds. Higher temperatures can cause more intense and frequent weather systems—including high wind events—while increased moisture in the atmosphere can lead to more frequent severe storms, such as thunderstorms, which often bring high winds. The change in climate will exacerbate the frequency and intensity of high wind events in Salt Lake County.

The 2024 State Enhanced Hazard Mitigation Plan states that research on climate change and its effects on severe weather in Utah does not provide clear evidence of how increased convective activity will impact future wind events. However, climate models consistently indicate that increased convective storms are a likely outcome of climate change, with worsening tornado activity, and strong evidence exists that extreme heat will continue to increase with worsening climate change.

Secondary Hazards

The most significant secondary hazards associated with high winds are fallen trees, downed power lines, and the resulting power outages. According to ComEd, “Weather-related events cause 70 percent of all power outages.” Power outages usually last anywhere from a few minutes to a few hours. In some extreme cases, power outages have lasted a few days or even a few weeks. Severe weather-induced power failures can come from the following sources:

- High and moderate winds lead to power outages by blowing objects into power lines and other components, causing an interruption of services. Both high winds (more than 55 mph) and moderate winds (35–55 mph) may be sufficient to cause power outages.
- Momentary outages may occur if an object, such as a tree limb, is blown onto a power line, disrupting electrical services. If high wind coincides with warm temperatures and low humidity, it can pose an increased risk of fire danger. A Red Flag Warning may be issued to warn fire officials, firefighters, and the public of potentially dangerous fire weather conditions that may affect power lines.

Vulnerability Assessment

High winds can cause widespread damage that affects multiple jurisdictions at the same time. They can cause personal injury and structural damage to homes and business, and they can disrupt service from multiple community lifelines. Due to the widespread and unpredictable nature of severe weather, all populations, structures, and infrastructure are potentially at risk of the impacts of high wind. All critical facilities—such as fire and police stations, hospitals, and schools—are vulnerable. All 218 county facilities are also vulnerable to damage or disruptions. Utilities—such as power and communications networks, transportation systems, and road networks—also are vulnerable.

ESTIMATED IMPACT AND POTENTIAL LOSSES

Residents can face injury or death related to high wind events, most often caused by trees or limbs falling on homes or vehicles. People residing in mobile homes or RV parks are particularly vulnerable to injury or death from high wind events. People outdoors may be harmed by wind-driven debris. Others face isolation and exposure during severe storms, or they could suffer from secondary effects of the hazard.

Trees uprooted by wind or fallen limbs can cause significant damage to homes and other structures and vehicles. Mobile and manufactured homes are particularly vulnerable to damage. High wind can damage roof materials, gutters, or other exterior fixtures. Windows can be broken by windblown debris.

Critical facilities may experience damage by wind-driven debris or downed trees. They may also be affected by wind-driven damage to power lines, producing power outages that cause disruptions to operations. In addition, response times can be delayed by interruptions to transportation networks.

Power infrastructure, particularly aboveground power lines and substations, are particularly vulnerable to damage during high winds. Other utility facilities, such as water or communications systems, may be disrupted while power is out. Debris can block roadways, and power outages can disable traffic signals, which can create difficulty navigating transportation networks. Removing debris after the event can be time-consuming and costly.

Wind-related damage and secondary hazards, such as utility disruption, can also have negative impact on businesses. Significant economic impacts can result from physical damage to structures, building contents, and revenue and wage losses when businesses are inoperable due to power and/or communications outages. Debris removal can be costly to local governments and may strain local resources.

The NRI includes data on the EALs to individual natural hazards, historical loss, and overall risk at a county and census tract level. Salt Lake County’s NRI EAL value for strong wind is $741,000 with a risk score of 76.6 and a rating of relatively moderate percentile compared with the rest of the United States (Figure 127).

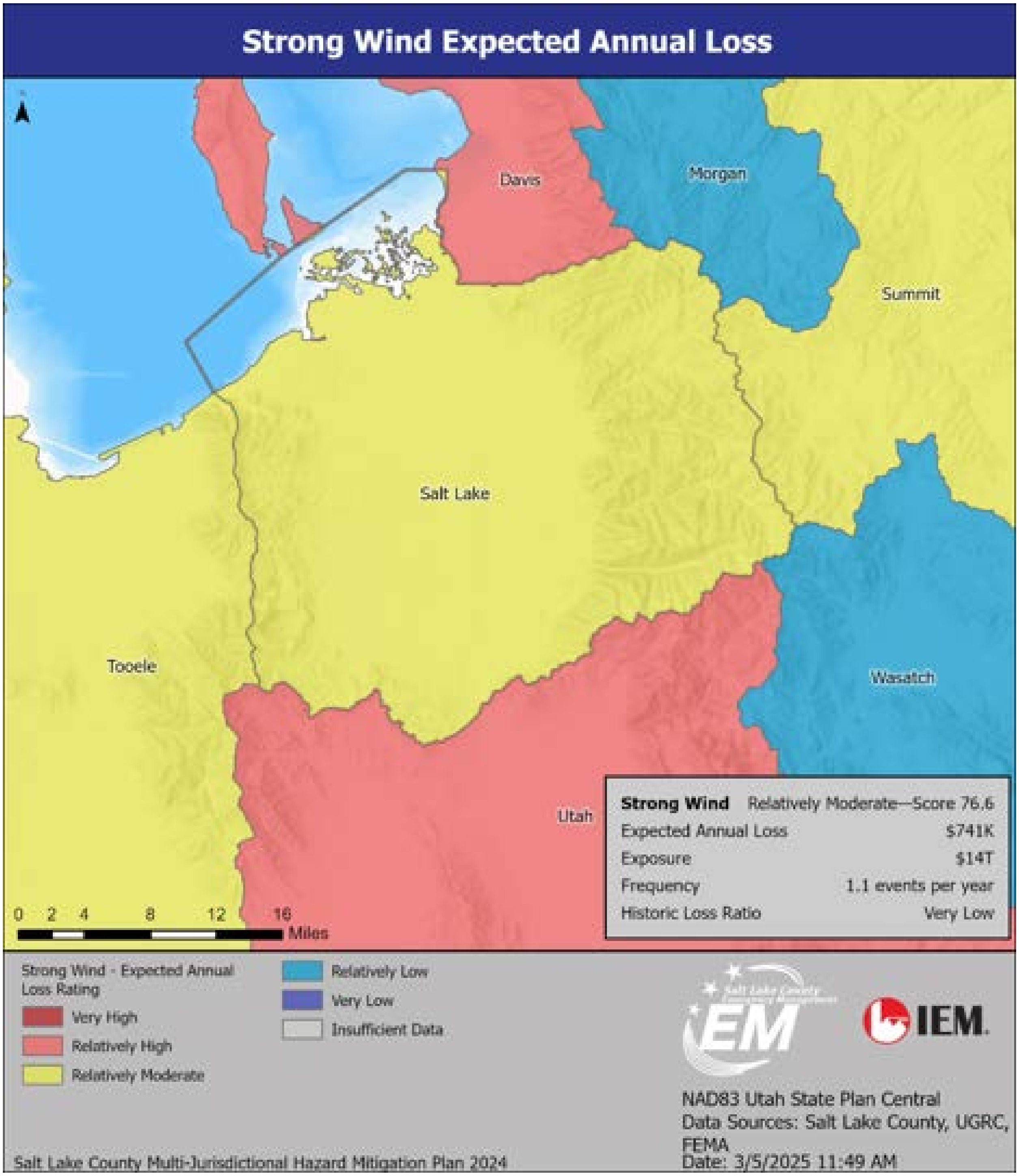


Figure 127: National Risk Index Expected Annual Loss from Strong Wind in Salt Lake County[149]

[149] FEMA, National Risk Index. "Salt Lake County Expected Annual Loss Strong Wind Risk Score, Map and Legend." https://hazards.fema.gov/nri/map.

VULNERABLE POPULATIONS

The 2024 State Enhanced Hazard Mitigation Plan states that people living in less-wind resistant housing, such as mobile homes, are more vulnerable to wind hazard. Outdoor workers, outdoor recreationists, or unhoused populations might have difficulty seeking adequate shelter during a wind event and are vulnerable to injury from wind effects. Elderly residents or people with disabilities may be negatively affected by power outages if they rely on power for medical devices or for ingress and egress to their homes. They may be isolated from critical support services if debris or other damage leads to roadway closures. They might have difficulty addressing debris cleanup.

COMMUNITY LIFELINES

High winds can disrupt safety and security, energy, transportation, and food, hydration and shelter lifelines. The importance of these lifelines cannot be overstated. In a disaster, communities can be left without access to necessities, such as food, water, and shelter. The lifelines help ensure that these needs are met, and that people have the resources they need to survive. By providing access to medical care, public health services, and transportation, the lifelines help ensure that people can receive the care they need and safely evacuate if necessary. In addition, the Hazardous Materials lifeline helps to ensure that dangerous materials are managed safely, reducing the risk of further harm. Community Lifelines help create a sense of safety and security in a community. They provide a safety net for individuals who may be struggling and offer comfort and reassurance that help is available when needed. Without these lifelines, communities would be much more vulnerable to crises and emergencies.

CHANGES IN DEVELOPMENT

In Salt Lake County, development and population growth have significant implications for high wind events. Population growth and development increases infrastructure, such as buildings, roads, and especially powerlines, which can increase the risk associated with high winds. In addition, urbanization can exacerbate these risks by creating wind tunnels which increases the potential for wind damage. The concentration of development in certain areas can also change localized wind patterns, which can lead to higher wind speeds and more frequent wind-related incidents.

Potential impacts from increase in high wind vulnerability include loss of life and property, power failure, and decreased air quality. Overall growth in population and new building construction in Salt Lake County results in a higher number of people potentially exposed to high wind. Changes in local economies may affect whether a community is financially able to recover from a high wind event. In 2020, the county had a high wind event that caused extensive damage in the county with debris in roads, trees down, and power failures (in some areas for over a week), forcing employees to miss work. Changes in land use and development may require stricter building codes for new builds to withstand extreme weather events. Overall vulnerability high wind has increased since the last plan update.

VULNERABILITY SCORE

To analyze the county’s vulnerability to severe weather, the NRI was used as a primary tool during the 2024 HIRA update. The NRI defines risk as the potential for negative impacts as a result of a natural hazard and determines a community's risk relative to other communities by examining the EAL and social vulnerability in a given community in relation to that community's resilience. Salt Lake County's NRI strong wind risk rating is shown in Figure 128. Salt Lake County has relatively moderate strong wind risk and a risk score of 72.6.

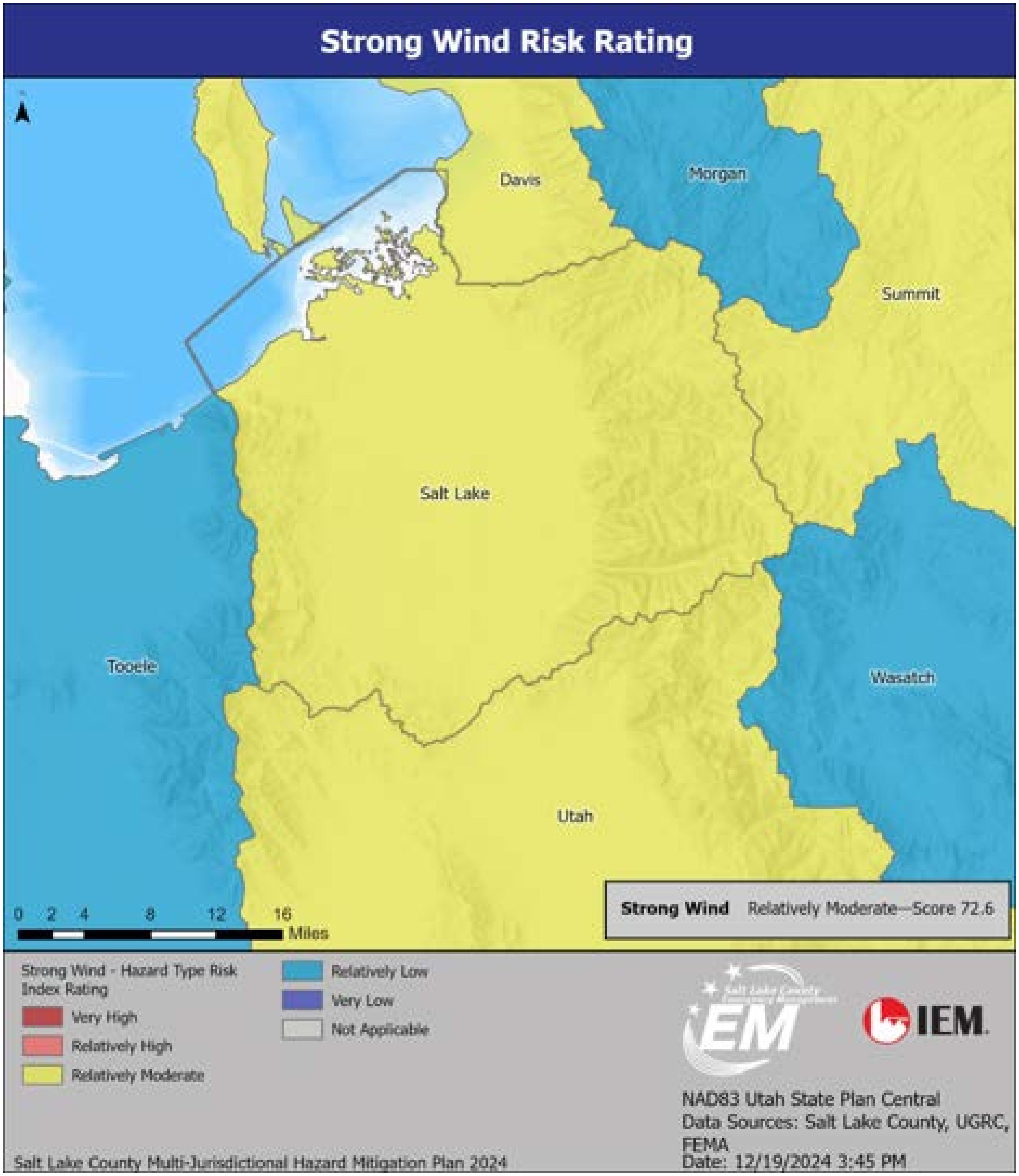


Figure 128: National Risk Index Strong Wind Risk Map, Legend, and Score for Salt Lake County[150]

[150] FEMA, National Risk Index. "Salt Lake County Strong Wind Score, Map and Legend." https://hazards.fema.gov/nri/map.

Landslide/Slope Failure

Hazard Description

Slope failure is any ground disturbance on a sloped surface. Slope failures, also known as landslides, are classified according to the type of movement and material involved. Movement types include falls, topples, slides, lateral spreads, and flows. Materials include rocks, debris (coarse-grained soil), and earth (fine-grained soil). The most common slope failures in Utah include rock falls, rock topples, debris slides, debris flows, earth slides, and earth flows.

Figure 129: Image of a Landslide[151]

A landslide is a mass of earth or rock that moves downslope by flowing, spreading, sliding, toppling, or falling. Landslides are one of Utah's most common natural hazards, primarily in areas with moderate to steep slopes or weak slope materials. Most landslides are associated with precipitation events with sustained above-average precipitation, individual intense rainstorms, or snowmelt events. Erosion, removal of vegetation by wildfires, and earthquake-induced ground shaking increase the likelihood of landslides. Human activities, such as grading slopes or increasing soil moisture through landscape irrigation, can also trigger landslides.

[151] https://unsplash.com/photos/brown-and-gray-rocky-mountain-fsj6Ly_lqOs.

Figure 130: Diagram of an Idealized Landslide with Commonly Used Terminology[152]

Rock falls and topples are downslope movements of loosened blocks or boulders from a bedrock area. These generally occur along steep canyons with cliffs, deeply incised stream channels in bedrock, or steep bedrock road cuts. The most significant damage from rock falls is to roads, railroads, and aboveground pipelines.

Debris slides and flows occur in steep mountainous areas and involve relatively rapid, viscous flows of coarse-grained soil, rock, vegetation, and other surface materials. Debris flows contain more water than slides and are potentially more dangerous because they can form quickly, move at high speeds, and travel long distances. Debris flows generally remain in stream channels but can flow outward from canyon mouths for a considerable distance, potentially damaging buildings, bridges, roads, railroads, and pipelines. Areas impacted by wildfires may be more likely to experience debris flows because vegetation no longer holds soils in place.

Earth slides and flows are composed of fine-grained material; earth slides contain less water than earth flows. Earth slides and flows vary in size, including some of the largest earth slides in Utah's history. Like other landslides, earth slides and flows can damage anything in their path.

Slumps are common along road embankments and river terraces. They slide along a curved plane away from the upper part of a slope, leaving a scarp. They generally do not travel far from the source area.

The distribution of landslides is dependent on geology, topography, and climate. They are most common in the Middle Rocky Mountain's physiographic province and the High Plateaus section of the Colorado Plateau province. As previously mentioned, weak rock types, steep slope gradients, and relatively abundant precipitation are the primary contributors to landslides. Vegetative cover, slope, aspect, and ground shaking from earthquakes can also influence slope stability. Nearly all landslides in Utah are

[152] Beukelman, Gregg. "Landslide Hazards in Utah." Utah Geological Survey. 2011. https://ugspub.nr.utah.gov/publications/public_information/pi-98.pdf.

reactivations of preexisting landslides. Risk can be reduced by avoiding development in areas of known landslide risk and/or stabilizing landslides.

Hazard Profile

Potential Impact		Catastrophic	**Probability**		Highly Likely
		Critical		X	Likely
	X	Limited			Occasional
		Negligible			Unlikely
Location	Typically in canyon mouths and foothills and areas of recent wildfire activity				
Seasonal Pattern	Spring and summer months				
Conditions	Typically caused by the stress release of over-weighted soils or loosening of rock and debris by wind, water, or ground shaking				
Duration	Landslides/rock falls: hours to months; debris flows: instantaneous				
Secondary Hazards	Flooding (natural dams), traffic accidents				
Analysis Used	Information and maps provided by Utah Geological Survey, Utah Division of Emergency Management, Utah Geospatial Resource Center				

Magnitude/Extent

Several factors can influence an area's susceptibility to landslide including the steepness of the slope, the type of soil and rock present, the amount of precipitation the area receives, and impacts from human development. Landslides in Salt Lake County can vary in size and by speed and force of the sliding mass. They can be affected by erosion and landscape changes, or secondary hazards, such as debris flows following a wildfire.

The extent and magnitude of a landslide in Salt Lake County would depend on the size and speed of the landslide and the specific location and elevation of the impacted area. Landslide hazard is primarily located in the mountainous areas of the county. A large portion of the county is in an area of moderate susceptibility to landslide. Landslides may occur in parts of the county where little to no development exists and damage would be negligible. However, some may occur in areas where it can disrupt transportation, damage property, and could lead to injury. The extent of landslide susceptibility is shown in Figure 132–Figure 137.

The Rio Tinto Landslide was the single largest natural disaster in Salt Lake County's history. The North Salt Lake City landslide was categorized as a "major" landslide. Due to the nature of Salt Lake County's topography and development encroaching into steeper areas, the magnitude of damage is likely to increase. Many landslide or slope failure events may be minor and cause little to no damage, but it is also possible that future landslides can cost hundreds of thousands of dollars to hundreds of millions of dollars in damage.

Location

Landslides and debris flows are most common in the foothills along the base of the Wasatch Mountain Range and are caused by wet climatic conditions. Some major landslide areas include the Grand View Peak rockslide in upper City Creek Canyon, the Little Valley Red Rock landslide in Draper, and the shallow disrupted landslides in and near Steep Mountain in Draper. As urbanization spreads into geologically unstable areas of the county, the risk to life and property increases. Figure 132–Figure 137 show the locations of critical facilities in relation to landslide susceptibility in the county.

Figure 131 provides information on the varying scales used in each of the following maps.

Landslide Susceptibility	Susceptibility Description	
High		Areas of existing shallow and deep landslides.* Slope angle and geologic map unit are not considered in this category.
Moderate		Areas that have slopes prone to landsliding based on observed landslide slope angles. The category includes slopes greater than 7° (12%) to greater than 18° (32%) depending on the geologic unit.**
Low		Areas that have slopes that may produce landslides. The category includes slopes from 5 - 7° (9 - 12%) for lower slope-angle threshold ranging up to 13 - 18° (23 - 32%) for the upper slope-angle threshold depending on the geologic unit.**
Very Low		Areas that are unlikely to produce landslides. The category includes slopes less than 5° (9%) to less than 7° (12%) depending on the geologic unit.**

Figure 131: Landslide Susceptibility Scale

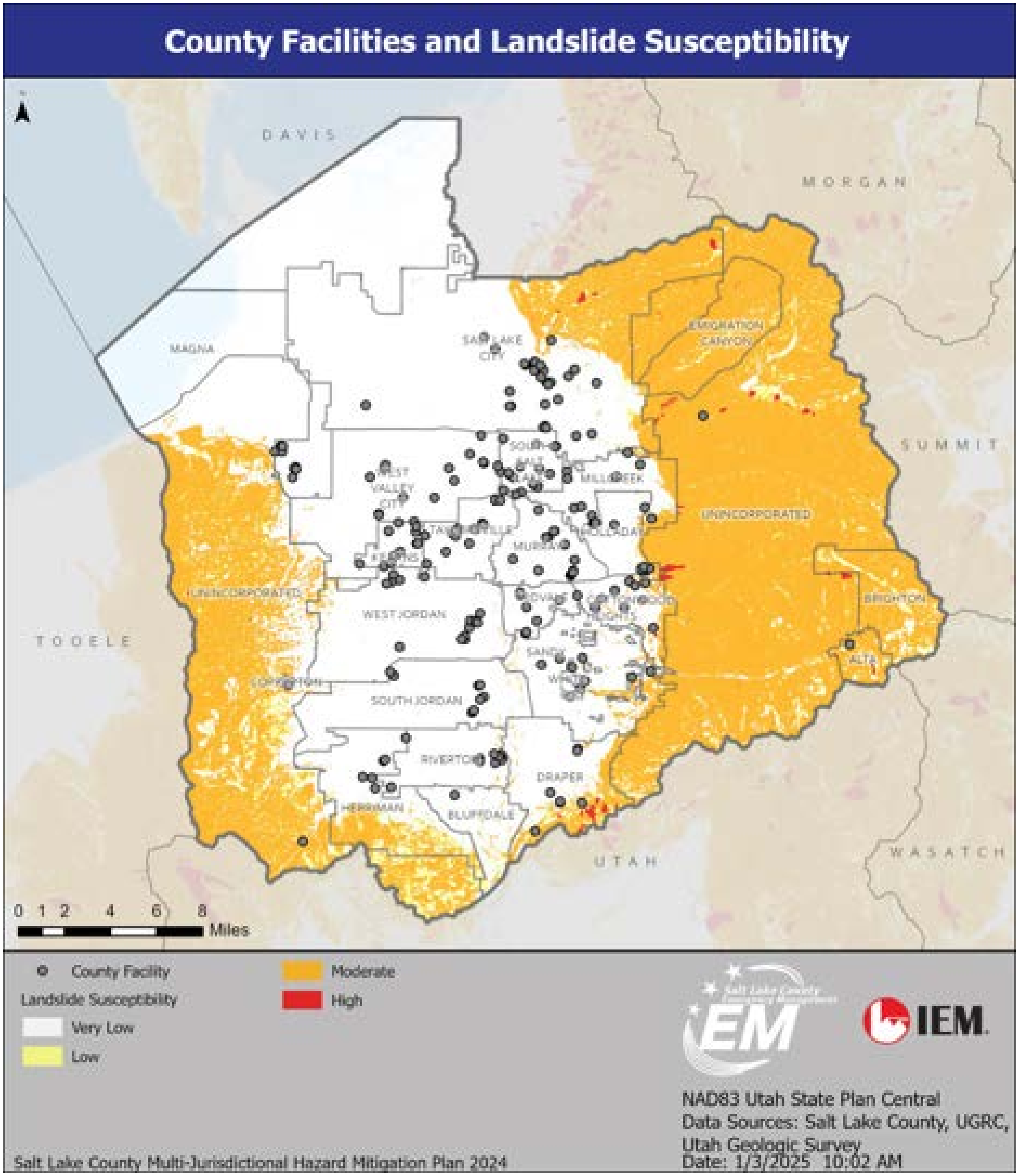


Figure 132: Salt Lake County Facilities in Areas Susceptible to Landslides

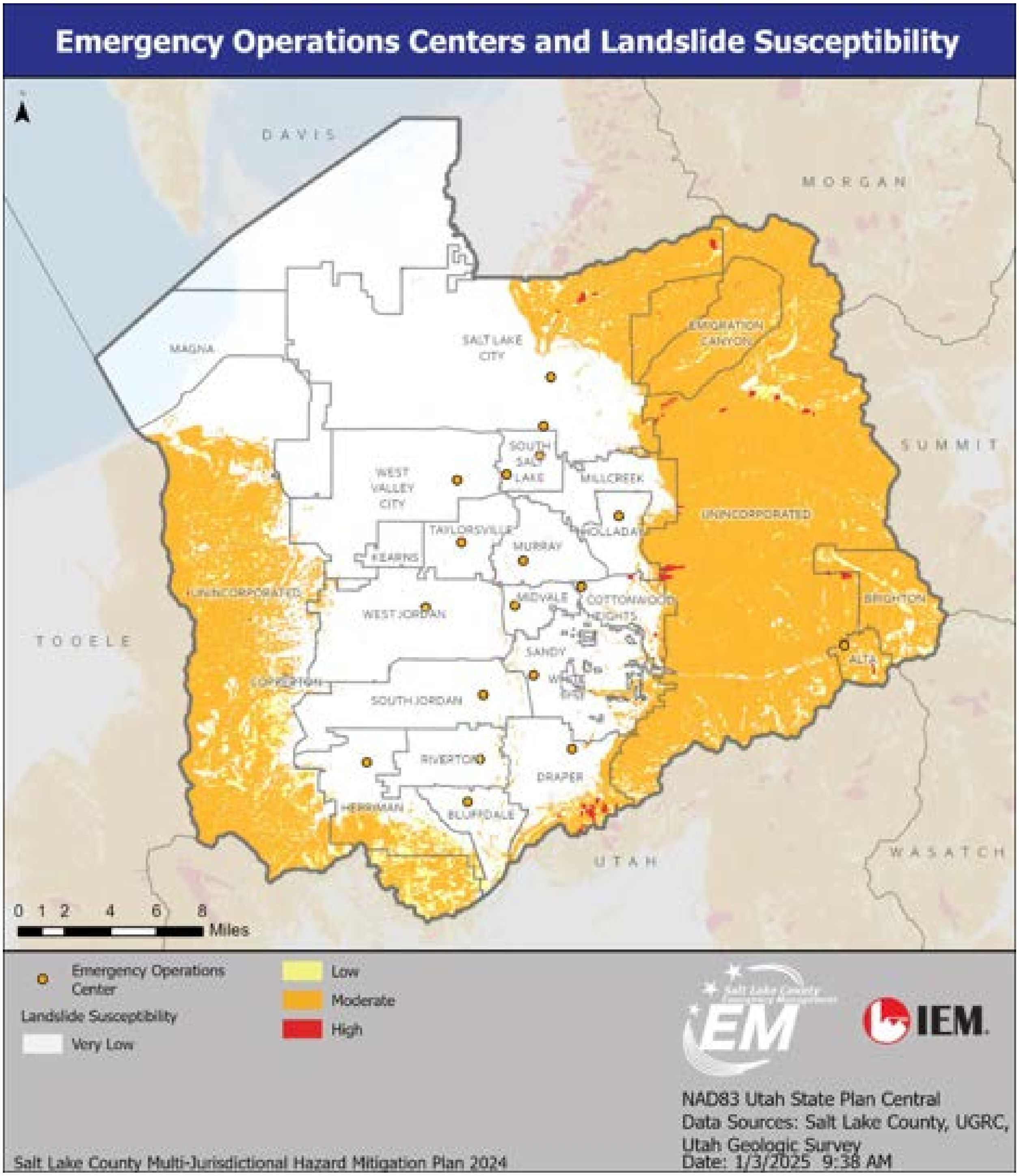


Figure 133: Emergency Operations Centers Areas Susceptible to Landslides in Salt Lake County

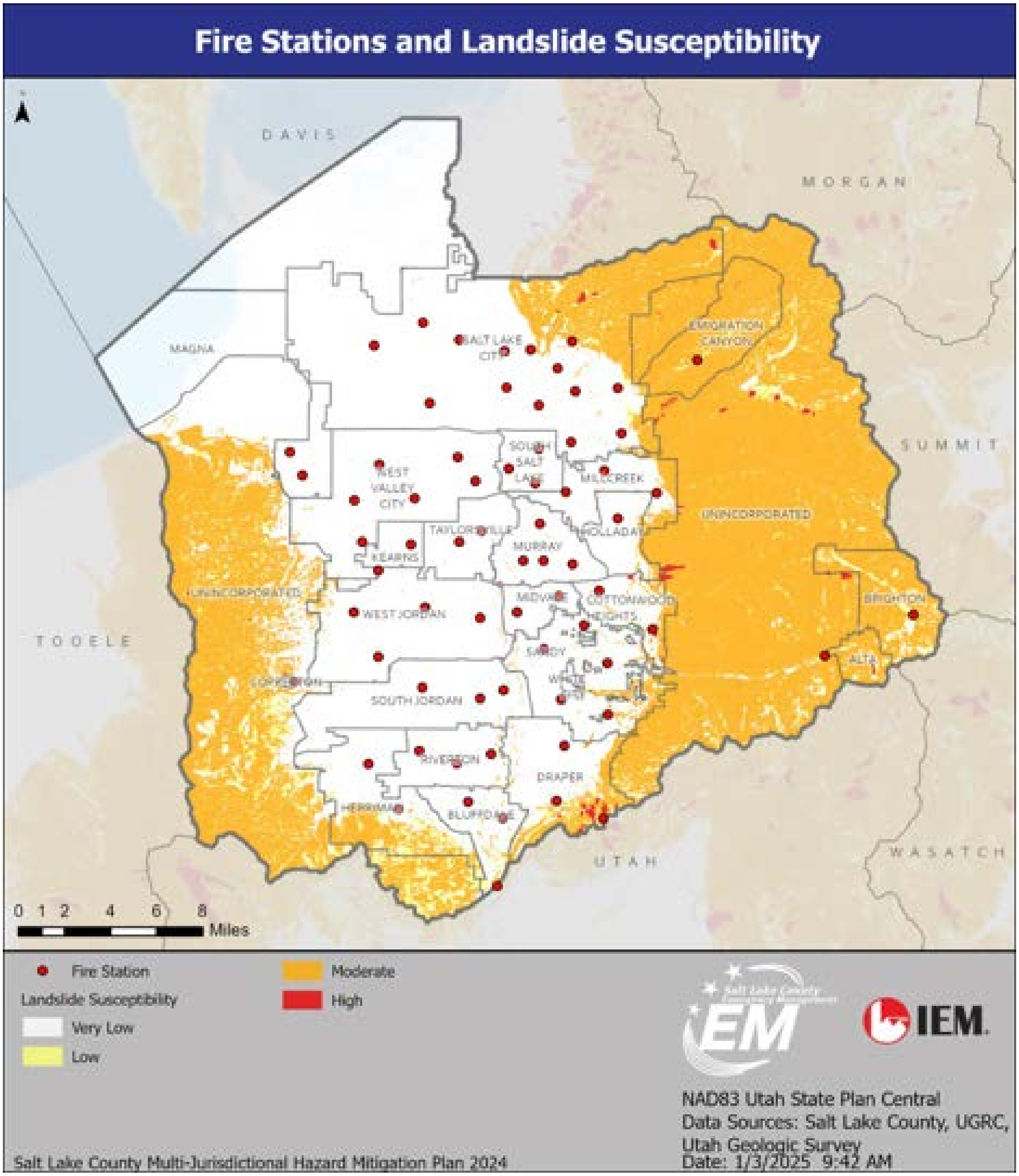


Figure 134: Fire Stations in Areas Susceptible to Landslides in Salt Lake County

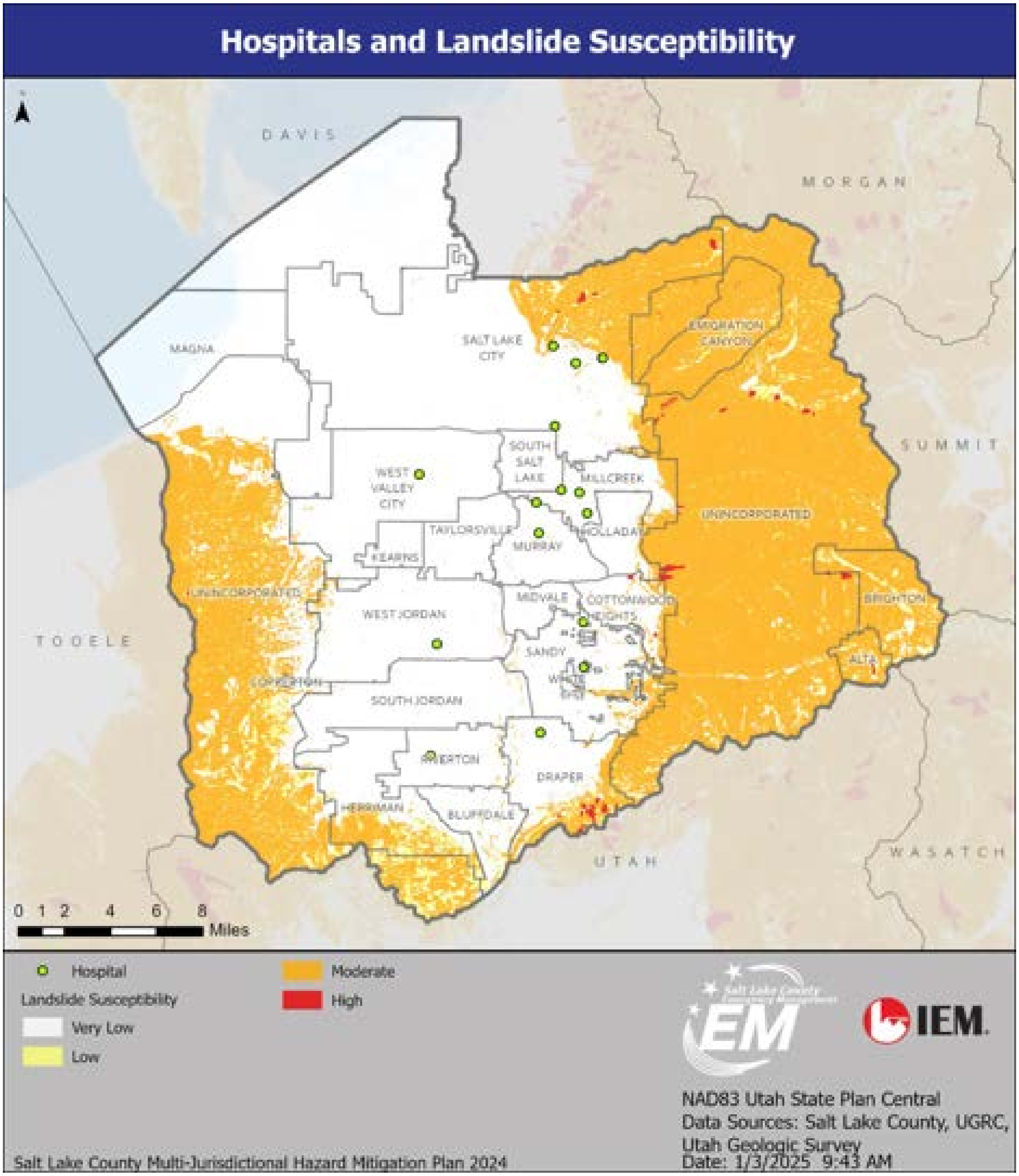


Figure 135: Hospitals in Areas Susceptible to Landslides in Salt Lake County

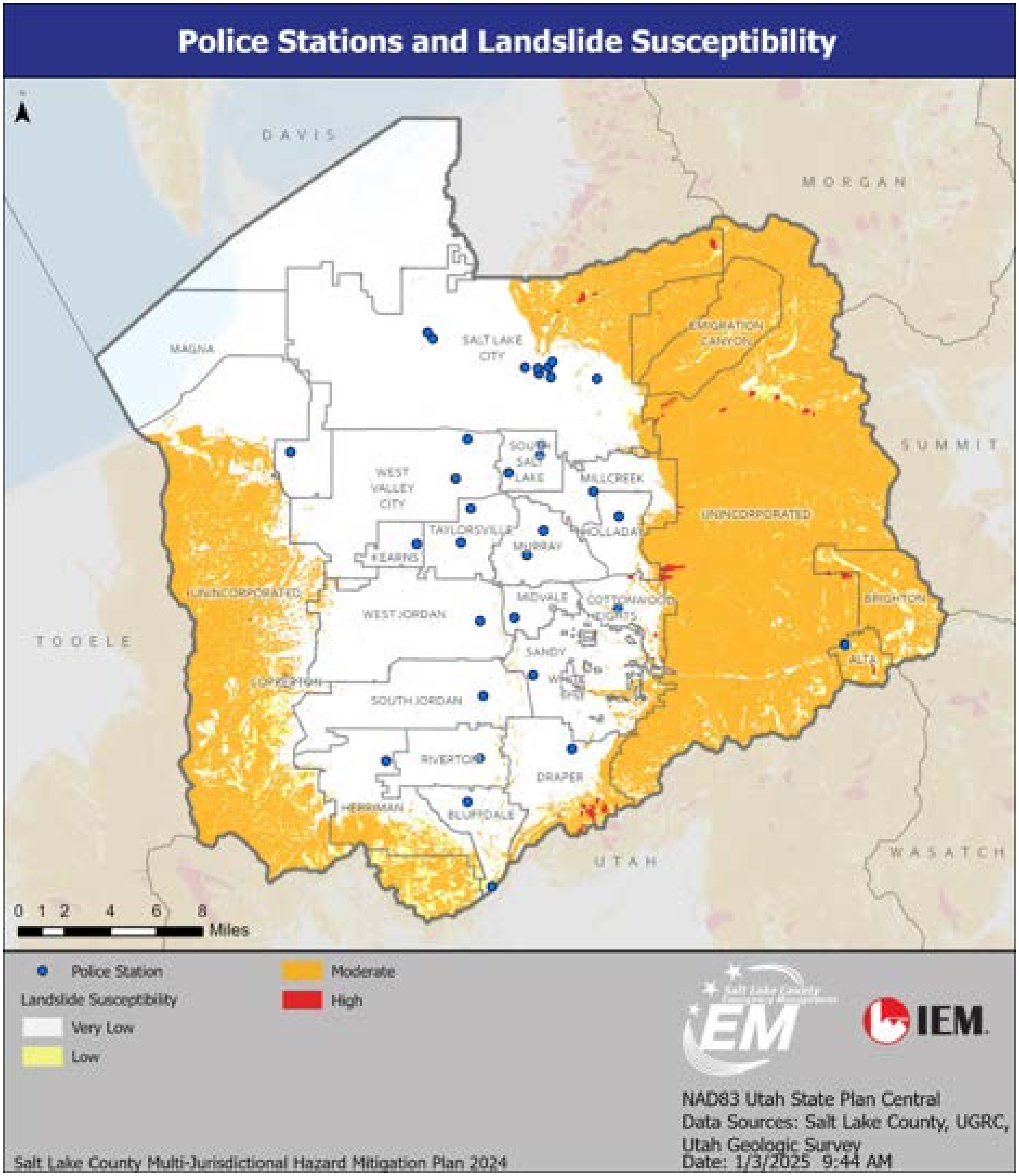


Figure 136: Police Stations in Areas Susceptible to Landslides in Salt Lake County

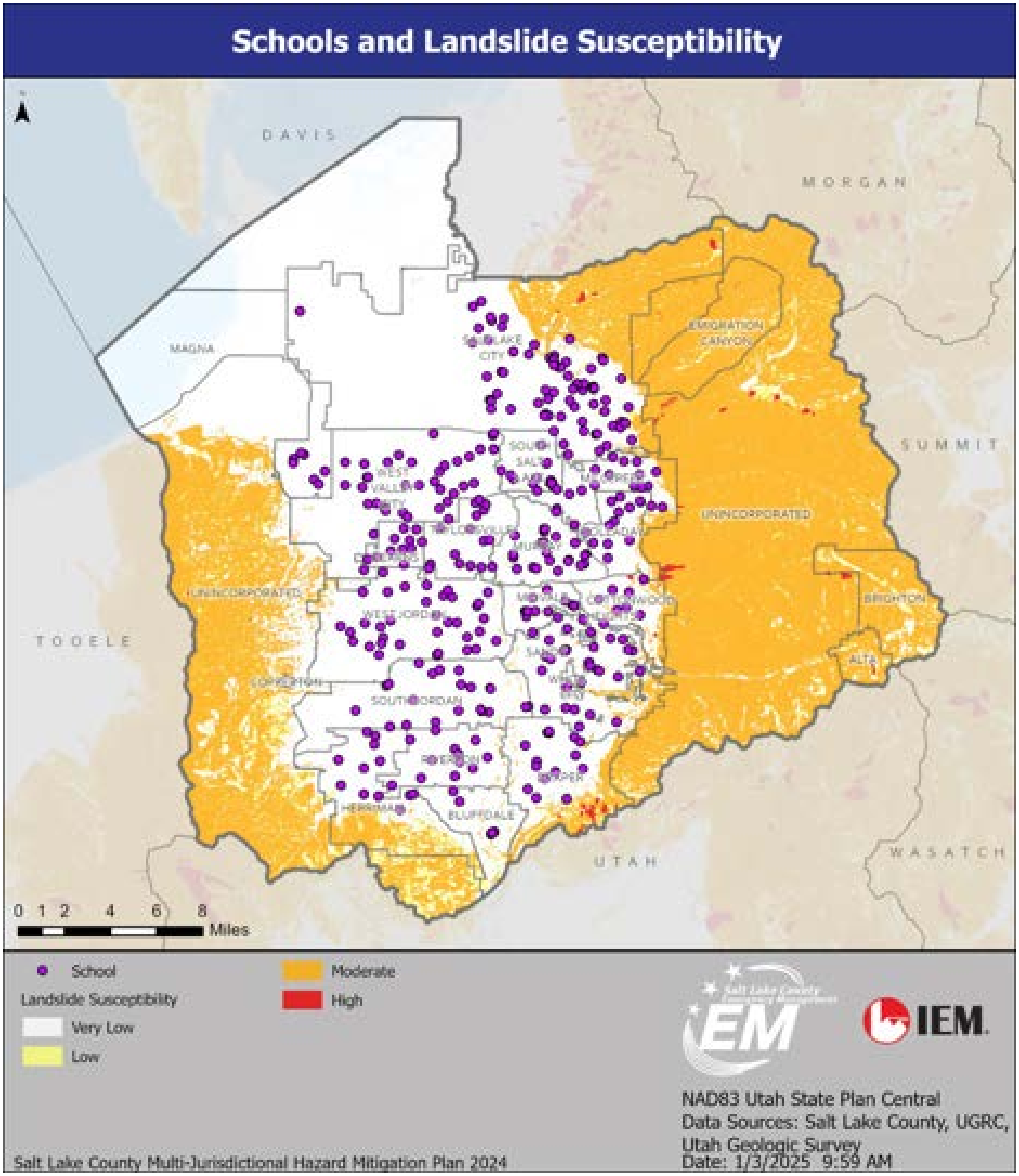


Figure 137: Schools in Areas Susceptible to Landslides in Salt Lake County

According to the 2019 Utah State Hazard Mitigation Plan, 56% of all slope failures in Salt Lake County occurred on hillsides with slopes of 31%–60%. In addition, 1.63 square miles of the county are categorized as “High Hazard” in terms of landslide susceptibility, 320 square miles are “Moderate,” 25 square miles are “Low,” and 373.9 square miles are “Very Low.”

Historical Events and Probability of Future Occurrences

Based on the FEMA Disaster Declarations Database, there have not been any slope failure disaster declarations in Salt Lake County for landslide and slope failure since the last plan update.

Landslides and slope failures are likely to continue to occur periodically in Salt Lake County. In addition, subsidence may occur in City Creek, Emigration, Parley's, and Big Cottonwood Canyons due to the prevalence of dissolvable limestone. Subsidence may also occur in the Avenues area of Salt Lake City and the Taylorsville–Kearns area due to collapsible soils that are compactable upon wetting (Mulvey 1992).

Little Cottonwood Canyon Landslide: A landslide occurred on Tuesday afternoon, May 2, 2023, in Little Cottonwood Canyon, covering the entire roadway on SR-210 near mile marker 7. A second landslide from the same source occurred on top of the first approximately one hour later. The road was closed all day on May 2nd for avalanche mitigation, meaning that no cars were on the road, and therefore no injuries were reported. The type of landslide was debris flow, approximately 100 feet wide and 4 feet deep, according to UDOT. Elevated groundwater levels from the melting of above-normal snowpack led to spring flow at the source. The impacts from the landslide included minor damage to the road and damaged or destroyed guard rails. No people were injured, and no buildings were damaged.

Figure 138: Landslide in Big Cottonwood Canyon, August 2021[153]

Draper Springtime Road Landslide: On Saturday morning, April 22, 2023, a landslide occurred on Springtime Road in Draper, Salt Lake County. Two homes collapsed when the hill they were on slid and fell into the small valley below; fortunately, these homes were evacuated in October 2022 due to unstable slope conditions. The landslide was reported to be the width of two tennis courts at the top, with a length of more than three football fields. The homes were not built on natural slopes, rather they had been

[153] Photograph provided by SLCo EM/Unified Fire Authority.

constructed on building pads engineered to fill the ravine. Besides the two that were damaged, two other homes were ordered to evacuate. The landslide and debris fell onto Ann's Trail, which remains closed.

Emigration Canyon Landslides: Record snowpack and subsequent warmer weather caused flooding and 10–15 landslides through April 2023 in Emigration Canyon, along with several small snow avalanches. A local emergency was declared in the city of Emigration Canyon on April 13th. The earthflow landslide damaged two homes, one of which had considerable damage. Emigration Canyon Road was closed periodically during the spring months of 2023 due to avalanches and landslides.

City Creek Canyon Landslides: A cluster of historical landslides remains visible from the hairpin turn in Bonneville Boulevard in lower City Creek Canyon in Salt Lake City. The Utah Geological Survey and the Salt Lake City Surveyor have monitored the movement of the largest and most destructive of these landslides since June 1998. Over that time, the toe of the landslide has moved intermittently approximately 24 feet, and the main scarp has offset the ground surface by nearly the same amount. Like most recurrently active landslides in northern Utah, movement typically occurs between March and June as groundwater levels rise following the melting of the snowpack. Four houses at the top of the slide are threatened, and efforts to protect one house have cost over $300,000 to date. In 2006, the landslide reactivated again, moving approximately 2 feet, despite drier-than-normal conditions in Salt Lake City.[154]

Bingham Canyon Landslides: Two landslides occurred in 2013 at Rio Tinto's Bingham Canyon Mine. The first occurred on April 10, 2013, at 9:30 p.m. and moved around 65–70 million cubic meters of dirt and rock down the side of the mining pit. Officials at the mine anticipated the slide and took precautions. This is the largest recorded landslide in the United States not connected to volcanism. On September 11, 2013, 100 workers were evacuated when a second, smaller landslide occurred. No injuries occurred during either landslide.[155]

Climate Change Considerations

Climate change can have a significant impact on the natural hazard of landslides. Higher temperatures can cause more intense and frequent weather events, including an increase in precipitation patterns and heat waves. This can lead to more intense and frequent rainfall, which can destabilize slopes and saturate unstable soils. In addition, increased melting of snowpack can raise groundwater levels, reducing slope stability in vulnerable areas.

The 2024 State Enhanced Hazard Mitigation Plan states climate change will continue to alter the landslide risk in Utah. The amount, timing, and type of precipitation in Utah are expected to change during the remainder of the twenty-first century. In general, projections of precipitation suggest that by 2100, northern Utah will receive increased precipitation. More important to landslide risk, the timing and type of precipitation is likely to change. A shift from snow-dominated precipitation to rain-dominated precipitation is well underway and expected to continue. Increased winter temperatures may increase the likelihood of landslides. Warmer winter temperatures reduce the extent of frozen soil, even if the snowpack exists. If

[154] 2019 Utah State Hazard Mitigation Plan.
[155] Ibid.

heavy rain falls on snow at low- to mid-elevations when the snowpack is present and the soil is not frozen, there is a greater landslide risk. In addition, the projected increase in extreme precipitation events, in both summer and winter, will increase the landslide risk.[156]

Secondary Hazards

Landslides can often enter water courses, increasing turbidity and polluting water supplies. Landslides can also block or alter river courses, disrupt large volumes of soil, contaminate the air, and cause long-term forest or other vegetation loss. These environmental changes can lead to an increased risk of vector-borne diseases or bacteria, potentially impacting human health long after the landslide disaster has occurred. Other potential impacts on infrastructure include broken and failed railways, roadways, bridges, and even utility lines, which could lead to loss of power or delay the delivery of vital services to certain parts of the county.

Vulnerability Assessment

Landslides may occur in the Wasatch Mountains in eastern Salt Lake County, the Oquirrh Mountains in the western part of the county, and the Traverse Mountains to the south. As shown in the landslide susceptibility maps, the cities along the east bench of the Wasatch Mountains, including Salt Lake City, Emigration Canyon, Millcreek, Holladay, Cottonwood Heights, Sandy, Draper, the canyon communities of Brighton and Alta, and the southern part of Herriman City, all have areas of moderate to high landslide susceptibility. The western part of the county has less area in incorporated cities at risk of landslides. Smaller areas of susceptibility are found along the Jordan River and creeks in Cottonwood Heights and Sandy City. Structures in these areas are primarily residential; homes and other structures near these areas may be at risk of damage from landslides. Swift-moving slope failures can cause injury or death for those in the affected area.

Landslides can damage homes or other structures, block major transportation routes, and disrupt power and water infrastructure and services. Some landslides affect only small areas that include a few structures. Landslides affecting primary transportation routes can have impacts beyond the immediate area by blocking emergency services and the delivery of goods and services.

Landslide susceptibility is highest in the mountainous areas of the county, which tend to have lower density development and assets. Limited data are available to understand where landslides are most likely to occur, but all structures, populations, and assets in the susceptibility areas should be considered at possible risk to impacts from landslides.

ESTIMATED IMPACT AND POTENTIAL LOSSES

Landslides can damage or block major roadways, including I-80, Emigration Canyon Rd., Highway 190 in Big Cottonwood Canyon, and Highway 210 in Little Cottonwood Canyon. City Creek Canyon Rd, Mill Creek Canyon Rd., or Wasatch Boulevard could also be affected. Several of these routes have only one outlet, so residents or recreationists above the slide could become isolated until roadways are cleared.

[156] 2024 Utah State Hazard Mitigation Plan.

Many residential streets in the foothills are small, dead-end spur roads that may be difficult to access following a landslide; this could cause the emergency response to be delayed due to transportation limitations.

Landslides can also damage aboveground utility infrastructure including power lines or substations, water treatment facilities, or water lines. Disruption of these services can affect residents and businesses beyond the area directly impacted by the landslide. Much of the eastern mountains of Salt Lake County are part of the Salt Lake City watershed; landslides in this area could impact the water supply for residents.

Prolonged closure of roads can have significant economic impacts due to reduced access to recreation areas. Recreation areas, parking lots, trails, and other improvements can also be damaged by landslides. This may reduce tourism to the area and strain budgets to repair amenities.

The 2024 State Enhanced Hazard Mitigation Plan affirms the assessment of the vulnerability of assets to geologic hazards is limited by data availability. Ideally, the vulnerability of assets to geologic hazards would be based on the type, location, construction, height, and age of assets.

The following tables provide the potential estimated impacts on Salt Lake County from landslide and slope failure. These data are taken from the previous plan due to time constraints and the assumption that the change in hazard risk is minimal. Four fire stations and two county facilities are in moderate susceptibility zones. The daytime population in the county in high or moderate landslide-susceptibility areas is approximately 23,573 people; the nighttime population in high or moderate landslide-susceptibility areas is approximately 24,443 people.

Table 65 and Table 66 provide estimated values for infrastructure, populations, and residences vulnerable to landslides, respectively, in incorporated and unincorporated Salt Lake County. The tables include the number of units or total length of the vulnerable infrastructure and the estimated replacement costs as provided by Hazus lost estimation software. The tables also provide estimates for the total area, population, and buildings vulnerable to landslides for individual cities, although not all identifiable areas are specifically listed. Note that replacement costs have likely increased from the time this analysis was completed.

Table 65: Infrastructure Vulnerable to Landslides, Salt Lake County

Item	Length (Miles) or Number of Units	Replacement Cost
Highways/Interstates	46.86 miles	$259,322,175
Highway Bridges	38 bridges	$33,527,413
Railway Segments	4.98 miles	$5,716,617
Railway Bridges	1 bridge	$23,520
Water Distribution Lines	609.38 miles	$19,621,849
Gas Lines	243.64 miles	$7,848,732
Sewer Lines	365.61 miles	$11,773,110

Item	Length (Miles) or Number of Units	Replacement Cost
Total Estimated Infrastructure Replacement Cost		**$337,833,416**

Table 66: Vulnerability Assessment for Landslides, Incorporated Salt Lake County

Incorporated Areas	Acres Affected	Population Affected	Structures in Areas of Moderate or Greater Hazard	
			Residential Structures (Replacement Value)	Commercial Structures (Annual Sales)
Alta	2,477	986	322 ($65,881,200)	0
Bluffdale	1,457	3,626	1,061 ($217,080,600)	1 ($110,705)
Copperton	14,390	510	215 ($43,989,000)	1 ($9,785)
Cottonwood Heights	1,296	5,982	2,014 ($412,064,400)	93 ($38,368,162)
Draper	2,816	8,318	2,380 ($486,948,000)	26 ($7,143,464)
Emigration Canyon	11,281	3,562	1,378 ($281,938,800)	25 ($12,583,730)
Kearns	10	109	31 ($6,342,600)	1 ($85,797)
Herriman	2,508	4,139	1,242 ($254,113,200)	0
Holladay	397	1,721	506 ($103,527,600)	23 ($3,371,052)
Magna	40	254	157 ($32,122,200)	0
Midvale	11	53	18 ($3,682,800)	0
Millcreek	4	54	20 ($4,092,000)	0
Murray	35	258	88 ($18,004,800)	4 ($2,407,223)
Riverton	75	362	88 ($18,004,800)	2 ($120,490)
Salt Lake City	15,701	15,762	6,327 ($1,294,504,200)	176 ($47,480,280)
Sandy City	1,567	8,199	2,301 ($470,784,600)	77 ($15,535,108)

Incorporated Areas	Acres Affected	Population Affected	Structures in Areas of Moderate or Greater Hazard	
			Residential Structures (Replacement Value)	Commercial Structures (Annual Sales)
South Jordan	72	213	60 ($12,276,000)	0
South Salt Lake	0	0	0	0
Taylorsville	19	179	55 ($11,253,000)	2 ($346,531)
West Jordan	368	439	171 ($34,986,600)	0
West Valley City	65	59	17 ($3,478,200)	0
Salt Lake Community College	0	0	N/A	N/A
Canyons School District	0	0	N/A	N/A
Jordan School District	0	0	N/A	N/A

The NRI includes data on the EALs to individual natural hazards, historical loss, and overall risk at the county and Census tract level. Salt Lake County's NRI EAL value for Landslide is $440K with a risk score of 97.3 and a "Relatively High" rating compared with the rest of the United States (Figure 139).

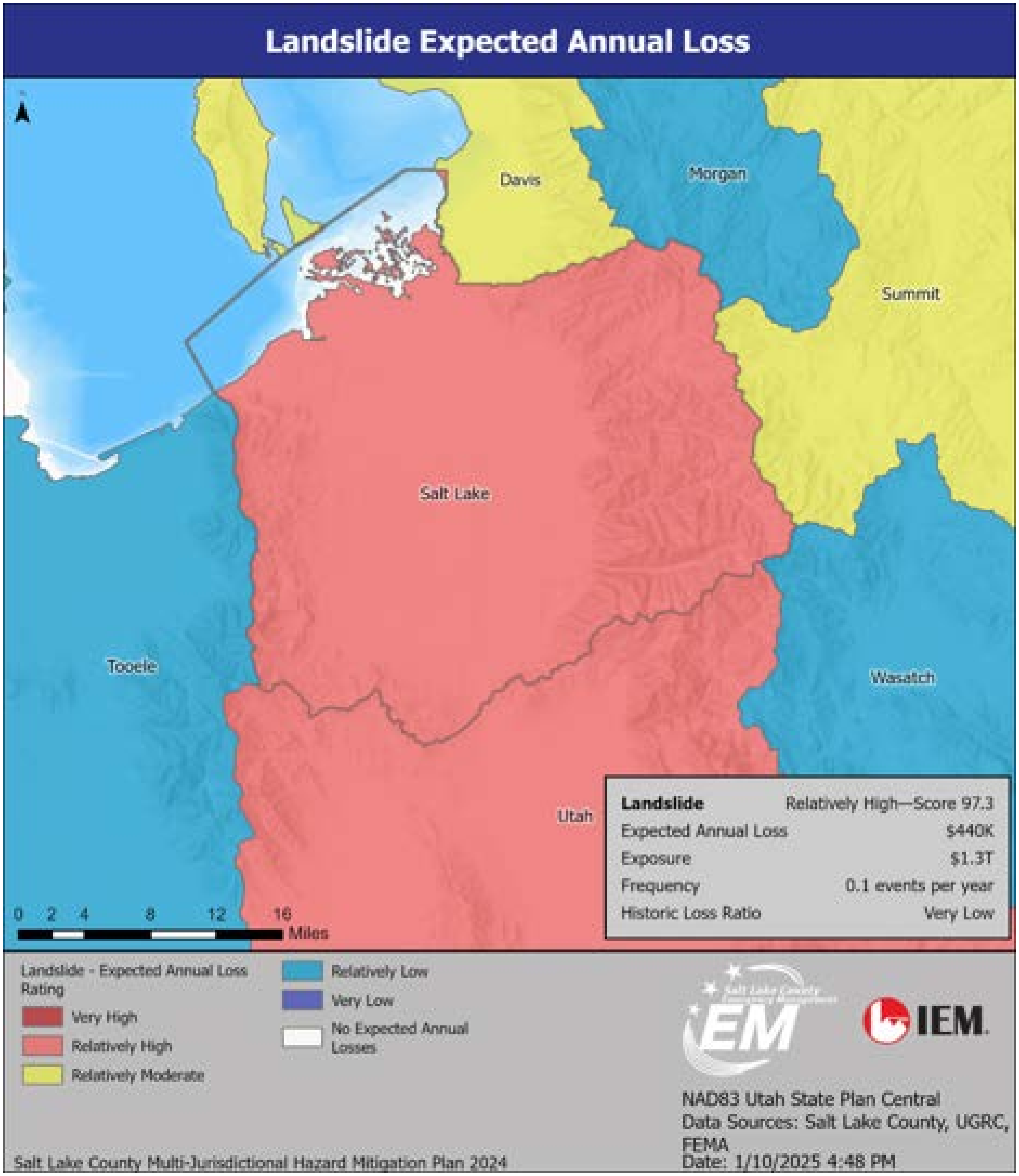


Figure 139: FEMA National Risk Index Salt Lake County Expected Annual Loss from Landslides[157]

[157] FEMA, National Risk Index. https://hazards.fema.gov/nri/map.

VULNERABLE POPULATIONS

All populations in the planning area located near identified hazard areas are at risk. Elderly residents or those with mobility limitations or other disabilities will likely have more difficulty evacuating from an imminent landslide.

COMMUNITY LIFELINES

Landslides can disrupt food, hydration, and shelter if a slide damages residences. Transportation, energy, water, and communications lifelines can also be impacted. These lifelines are of critical importance. In a disaster, communities may lose access to necessities, such as food, water, and shelter. Lifelines help ensure that these needs are met, and that people have the essential resources they need to survive. By providing access to medical care, public health services, and transportation, the lifelines help ensure that people receive the care they need and safely evacuate if necessary. In addition, the Hazardous Materials Lifeline helps to ensure that dangerous materials are managed safely, reducing future risk.

CHANGES IN DEVELOPMENT

Salt Lake County's development and population growth can have significant impacts on the hazard of landslides. Population growth may increase the amount of infrastructure that must be constructed on or near slopes prone to landslides, and this can destabilize the soil and increase the likelihood of landslides. Urbanization can also lead to changes in natural water drainage patterns, causing increased runoff and erosion—further destabilizing slopes and contributing to landslide occurrences. These increases in vulnerability are most prominent in the foothills of the Oquirrh Mountains to the west of Salt Lake County. Developments in western Herriman and South Jordan in these foothills add structures and infrastructure that could be damaged in landslides.

The population of Salt Lake County is predicted to grow over the next 30 years, reaching almost 5 million by 2050. This growth necessitates the development of key infrastructure elements guided by long-range planning. To address the challenges of population growth on housing availability, many communities have updated their plans and implemented the Wasatch Choice Vision (previously known as Wasatch Choices 2040 and Wasatch Choice 2050) in unique and meaningful ways, including coordinating the planning and location of land use, housing, transportation, economic development, and open space to increase the quality of life. These efforts may reduce the risk of landslide and slope failure and the county's future vulnerability in areas of new development.[158] However, risk remains where development has already occurred, and it is not always known where landslides may occur before development. Due to population growth and new construction, the overall vulnerability to landslide and slope failure has increased since the last plan update.

VULNERABILITY SCORE

To analyze the county's vulnerability to landslides, the NRI was used as a primary tool during the 2024 HIRA update. The NRI defines risk as the potential for negative impacts as a result of a natural hazard and determines a community's risk relative to other communities by examining the EAL and social

[158] Wasatch Choice Vision, 2024. https://wasatchchoice.org/.

vulnerability in a given community in relation to that community's resilience. Salt Lake County's NRI landslide risk rating is shown in Figure 140. Salt Lake County has a relatively high landslide risk and a risk score of 95.9.

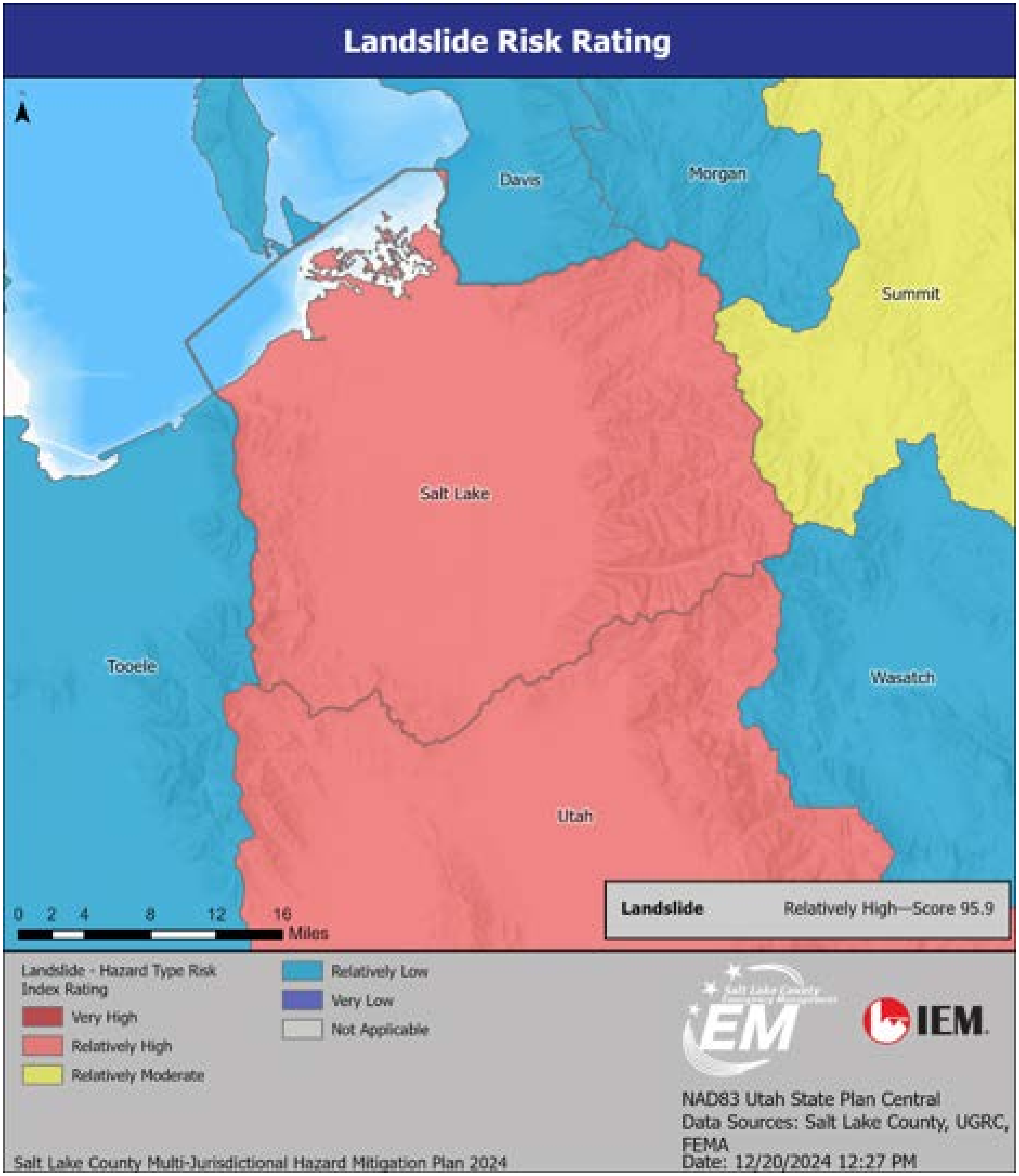


Figure 140: National Risk Index Landslide Risk Map and Score for Salt Lake County[159]

159 FEMA, National Risk Index. "National Risk Index Salt Lake County Landslide Score, Map and Legend." https://hazards.fema.gov/nri/map.

Lightning

Hazard Description

Lightning is the discharge of atmospheric electricity from a thunderstorm. It can travel at speeds up to 140,000 mph and reach temperatures approaching 54,000 degrees Fahrenheit.[160] Lightning is often perceived as a minor hazard. According to NWS, lightning is a major cause of storm-related deaths in the United States. NWS Storm Data recorded an average of 43 reported lightning fatalities per year in the United States between 1989–2018.[161] In addition, lightning can produce damage to infrastructure and buildings.

Figure 141: Image of lightning[162]

Hazard Profile

Potential Impact			Probability		
		Catastrophic		X	Highly Likely
	X	Critical			Likely
		Limited			Occasional
		Negligible			Unlikely
Location	Can occur in areas throughout the county				
Seasonal Pattern	Year-round				
Conditions	Vary based on latitude, elevation, aspect and landforms				
Duration	Severe weather hazards generally last hours; some conditions can persist for days				

[160] International Association of Wildland Fire. "Advise on Lightning Safety and Firefighting." https://www.iawfonline.org/article/advice-on-lightning-safety-and-firefighting-2/.
[161] National Weather Service (NWS). "How Dangerous Is Lightning?" https://www.weather.gov/safety/lightning-odds.
[162] https://pixabay.com/photos/summer-thunder-storm-lightning-storm-3465247/.

Potential Impact		Catastrophic	**Probability**	X	Highly Likely
	X	Critical			Likely
		Limited			Occasional
		Negligible			Unlikely
Secondary Hazards	Wildfire, power outage				
Analysis Used	National Climate Data Center, National Weather Service, Utah Avalanche Center, Utah Division of Emergency Management, local input, and review of historic events and scientific records				

Magnitude/Extent

Lightning can occur anywhere in the county. Although more common in the summer, lightning can strike at any time of year. Lightning strikes can cause severe injury or death in this area. Lightning routinely occurs without causing significant damage. However, in 1997, lightning resulted in $300,000 in property damage in Salt Lake County. Damage of this magnitude is considered rare and has not occurred since. Table 67 provides information on lightning activity levels (LALs).

Table 67: Lightning Activity Scale[163]

Level	Description
LAL 1	No thunderstorms.
LAL 2	Isolated thunderstorms. Light rain will occasionally reach the ground. Lightning is very infrequent, with 1 to 5 cloud-to-ground strikes in a 5-minute period.
LAL 3	Widely scattered thunderstorms. Light to moderate rain will reach the ground. Lightning is infrequent, with 6 to 10 cloud-to-ground strikes in a 5-minute period.
LAL 4	Scattered thunderstorms. Moderate rain is commonly produced. Lightning is frequent, with 11 to 15 cloud-to-ground strikes in a 5-minute period.
LAL 5	Numerous thunderstorms. Rainfall is moderate to heavy. Lightning is frequent and intense, with greater than 15 cloud-to-ground strikes in a 5-minute period.
LAL 6	Dry lightning (same as LAL 3 but without the rain). This type of lightning has the potential for extreme fire activity and is normally highlighted in fire weather forecasts with a Red Flag Warning.

Location

The entire region of Salt Lake County can be affected by lightning events. Utah ranks 31st in total lightning count and 39th in lightning density in the Vaisala 2024 Annual Lightning Report. Although the number of strikes is relatively low, lightning does occur regularly in the planning area.

[163] National Weather Service, "LALs (L)ightning (A)ctivity (L)evels Numbered 1 through 6." https://www.weather.gov/media/rnk/fire/LAL.pdf

Historical Events and Probability of Future Occurrences

Based on the FEMA Disaster Declarations Database, Salt Lake County has received no designation for lightning disaster declarations since the last plan update.

Lightning routinely strikes without causing significant damage, but 11 events recorded from 1996 to 2018 have caused significant damage, injury, or death. During this time span, NCEI[164] recorded 4 deaths, 10 injuries, and $351,200 in property damage. NCEI did not indicate any new events since the last plan update in 2019. It is certain that lightning events will continue to strike routinely in the county. Based on a recurrence interval of one significant event every two years, future probability is highly likely.

"On May 24, 2000, an 11-year-old girl was killed, and six other children were injured when lightning struck them as they were leaving Midvalley Elementary School in Midvale. The children were walking across the playground, heading for their bus, when the lightning struck. The victim was still alive as she was transferred to the hospital but died later from her injuries. One other child was hospitalized but recovered." The other children suffered minor injuries. Shortly afterward, also in Midvale, a 36-year-old man was injured by lightning as he left the shelter of his home for his car.[165]

On August 13, 1997, lightning struck a chimney and sparked a fire in the Aix La Chapelle Condominiums in Holladay. Several units received heavy fire damage, $300,000 in total.[166]

Climate Change Considerations

Climate change may influence the occurrence of lightning by altering atmospheric conditions. This may create favorable conditions for thunderstorms, which are accompanied by lightning. The increased frequency and intensity of thunderstorms due to higher temperatures could lead to more lightning events.

The 2024 State Enhanced Hazard Mitigation Plan[167] states that research related to climate change and impacts on severe weather in Utah present no clear indications about the impact of increased convective storm activity on the frequency of lightning.

Secondary Hazards

Lightning often occurs along with wind and heavy rain associated with thunderstorms. The most significant secondary hazards associated with these severe storms are falling and downed trees, downed power lines, and power outages.

According to the Edison Electric Institute, "70% of power outages in the U.S. are weather related."[168] Power outages usually last anywhere from a few minutes to a few hours. In some extreme cases, power

---

164 NOAA, NCEI. Storm Events Database. "Salt Lake City." https://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=5178474.
165 Ibid.
166 Ibid.
167 Utah Enhanced State Mitigation Plan. 2024. https://hazards.utah.gov/state-of-utah-hazard-mitigation-plan/.
168 Generator Source. "The Many Causes of Power Failure." https://www.generatorsource.com/Causes_of_Power_Failures.aspx.

outages have lasted a few days or even a few weeks. Thunderstorms increase the chance of lightning striking a vital part of a power grid. Rain may damage components vital for maintaining a functioning circuit.

Lightning can also ignite wildfires, particularly if vegetation is dried out due to drought or extreme heat. Utah experiences a monsoon season from July into September, during which seasonal wind and pressure changes cause warm, moist air to flow into Utah. Hot, unstable air rises and can cause thunderstorms along with lightning. Monsoon season coincides with wildfire season. Hot summer temperatures begin to dry out fuels which can easily be ignited by a lightning strike.

Vulnerability Assessment

Lightning strikes only impact a small area, but it is impossible to know where ahead of time. A large area is at risk of a lightning strike during every thunderstorm. If thunder can be heard, lightning is close enough to strike and shelter should be sought. Because it is impossible to know where lightning will strike, all people, structures, and infrastructure are considered vulnerable to lightning. All residents are at risk, but those who are recreating or working outdoors and those who are unhoused, face a higher likelihood of harm from lightning. All critical facilities, including all 218 county facilities, are also vulnerable to damage or disruption from lightning. Utilities, such as power and communications networks and transportation systems and road networks, also are vulnerable.

The 2024 State Enhanced Hazard Mitigation Plan states that lightning is one of the deadliest severe weather events in Utah, cumulatively killing more people than any other hazard and injuring roughly twice as many people as any other severe weather hazard.

ESTIMATED IMPACTS AND POTENTIAL LOSSES

The primary concern for lightning is risk of injury or death. Most injuries and deaths associated with lightning strikes occur when people are outdoors. This can affect outdoor workers, outdoor recreationists, or those without stable housing. However, almost one-third of lightning-related injuries occur indoors. Males are four times more likely than females to be struck by lightning, and the average age of a person struck by lightning is 37 years.[169]

Lightning can contribute to damage to power lines and other power infrastructure. Power outages can affect operations for emergency responders, medical facilities, and homes and businesses. Critical facilities may experience damage to electrical systems from power surges due to lightning. Lightning can also damage communications towers and antennas, which can disrupt signals and hinder the operations of government services, emergency responders, and businesses. Lightning can damage trees, and resulting debris may obstruct roadways.

[169] Center for Disease Control (CDC). “Lightning Strike Victim Data.” April 2024. https://www.cdc.gov/lightning/data-research/index.html.

The NRI includes data on the EALs to individual natural hazards, historical loss, and overall risk at a county and census tract level. Salt Lake County's NRI EAL value for lightning is $676K with a risk score of 92.0 and a rating of "relatively high" compared with the rest of the United States (Figure 142).

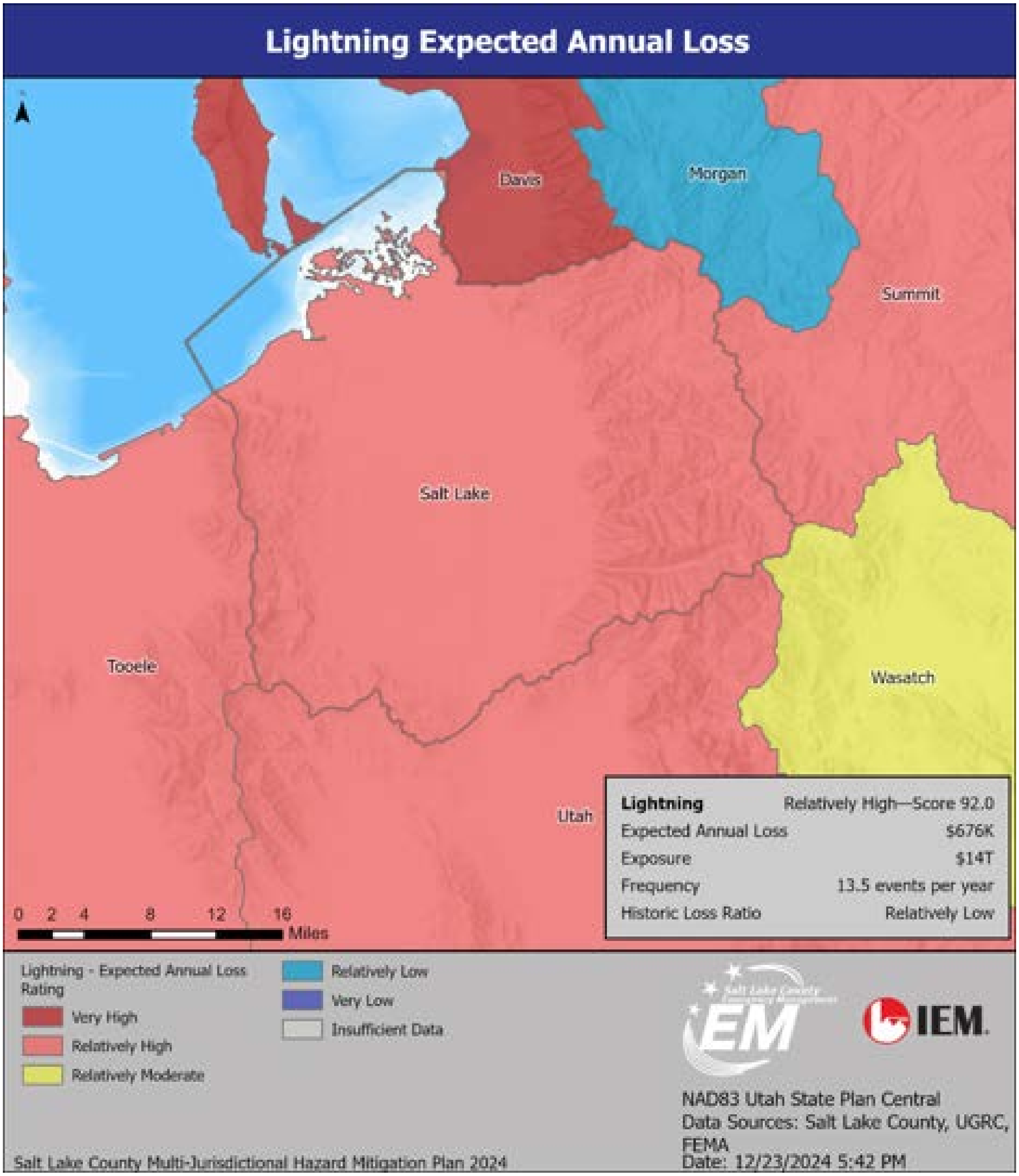


Figure 142: FEMA National Risk Index Salt Lake County Expected Annual Loss from Lightning[170]

[170] FEMA. National Risk Index. "Salt Lake County Expected Annual Loss Lightning Risk Score, Map and Legend." https://hazards.fema.gov/nri/map.

VULNERABLE POPULATIONS

Besides outdoor workers and other people without shelter during a storm, individuals with disabilities may face challenges seeking shelter during storms, and the elderly may require additional support and assistance during and after the storm.

COMMUNITY LIFELINES

Lightning can impact several FEMA Community Lifelines. Safety and Security may be compromised due to potential injury from lightning and disruption to emergency response in the case of power outages. Health and Medical services also may be affected by power outages, which can disrupt medical facilities and individuals reliant on electricity-powered medical equipment. Lightning also can disrupt the Energy lifeline by contributing to power outages, which impacts services for residents and businesses. The Communications lifeline can be affected by lightning producing damage to infrastructure, including 911, dispatch, and responder communications abilities.[171]

CHANGES IN DEVELOPMENT

Salt Lake County's development and population growth can have significant impacts on the hazard of lightning. Urbanization can lead to the construction of taller structures, increase population density, and concentrate infrastructure, attracting lightning and increasing the potential for damage and injury from lightning strikes. Larger cities that are continuing to develop, like West Valley City and West Jordan, are starting to build taller structures that are at higher risk from lightning strikes. Increased outdoor activities and recreational areas due to population growth can also lead to higher exposure to the hazard of lightning.

Potential impacts from an increase in vulnerability to lightning could cause loss of life/property and power failure from increase in severe storms related to climate change. Increased population patterns may lead to more people recreating outdoors, thus increasing vulnerability to lightning strikes. Overall vulnerability to lightning has remained the same since the last plan update.

VULNERABILITY SCORE

To analyze the county's vulnerability to severe weather, the NRI was used as a primary tool during the 2024 HIRA update. The NRI defines risk as the potential for negative impacts because of a natural hazard and determines a community's risk relative to other communities by examining the EAL and social vulnerability in a given community in relation to that community's resilience. Salt Lake County's NRI lightning wave risk rating is shown in Figure 143. Salt Lake County has relatively high lightning risk, and a risk score of 90.3.

---

[171] FEMA. "Community Lifelines Implementation Toolkit," Version 2.0. November 2019. https://www.fema.gov/sites/default/files/2020-05/CommunityLifelinesToolkit2.0v2.pdfv.

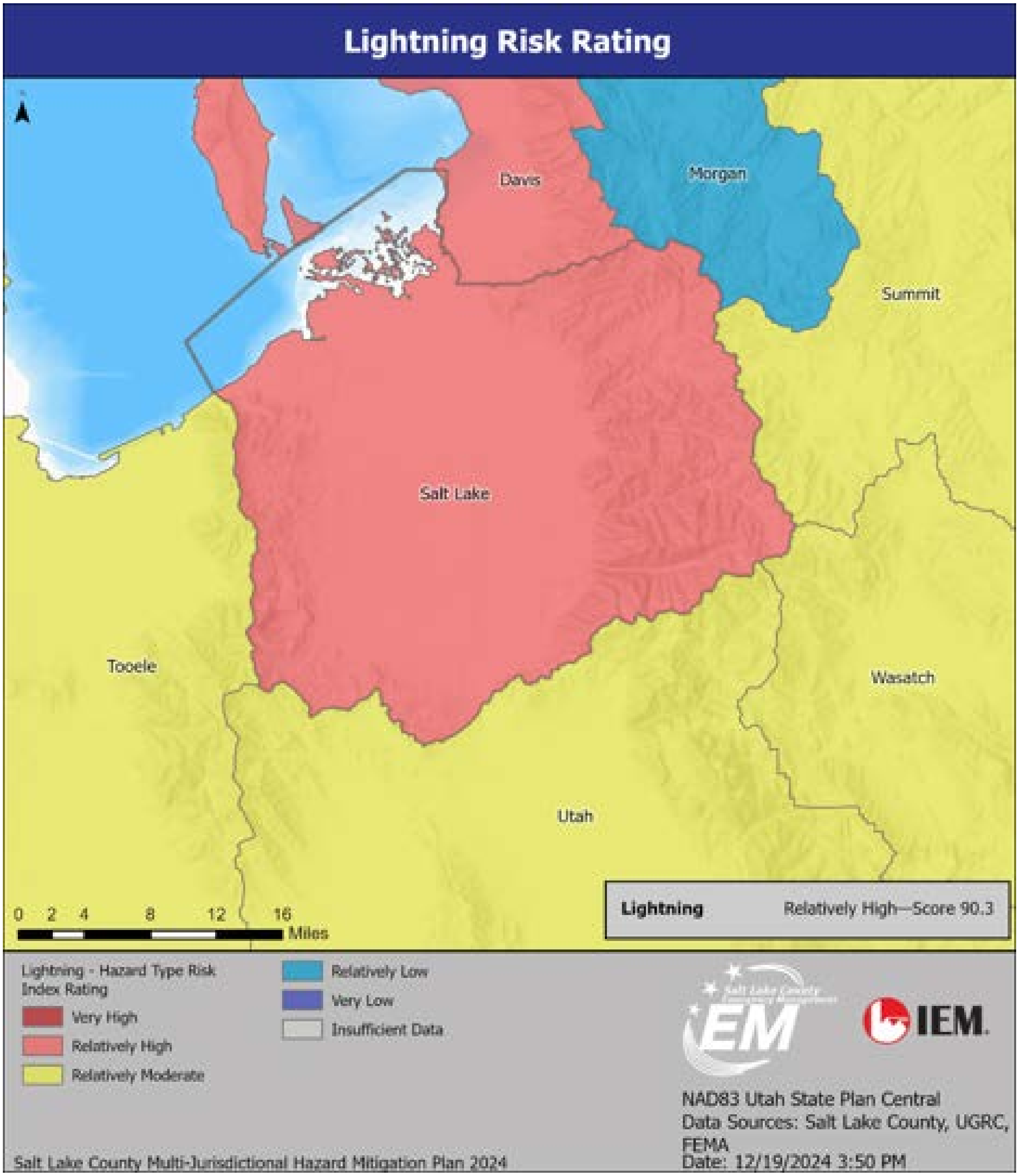


Figure 143: National Risk Index Lightning Risk Map, Legend, and Score for Salt Lake County[172]

[172] FEMA, National Risk Index. "Salt Lake County Lightning Score, Map and Legend." https://hazards.fema.gov/nri/map.

Public Health/Epidemic/Pandemic

Hazard Description

An epidemic is a sudden increase in disease cases above what is typically expected in a specific geographic area. It often occurs in a community or region and can spread quickly among the population.

Figure 144: Testing During the COVID-19 Pandemic[173]

A pandemic is an epidemic that has spread over multiple countries or continents, affecting many people. It typically involves a new infectious agent against which the population has little or no immunity, leading to widespread transmission.

Based on their characteristics and ability to spread, the following human diseases could also contribute to a severe epidemic or pandemic and should be noted:

- Methicillin-resistant staphylococcus
- West Nile virus
- H1N1 influenza
- Severe acute respiratory syndrome
- Measles
- Hepatitis
- Tuberculosis
- E. coli
- Lyme disease

[173] https://unsplash.com/photos/people-standing-near-white-table-during-daytime-zRGqHTHP-HQ.

- Hantavirus
- Leptospirosis
- COVID-19

Hazard Profile

Potential Impact	X	Catastrophic	**Probability**		Highly Likely
		Critical		X	Likely
		Limited			Occasional
		Negligible			Unlikely
Location	The entire county could be affected. Higher-density areas may be more vulnerable.				
Seasonal Pattern	Some are seasonal, such as West Nile Virus in warmer months, while others may occur year-round.				
Conditions	Disease may spread faster in areas where people congregate. Some populations may be more susceptible or experience more severe consequences.				
Duration	Outbreak can last weeks, months, or years.				
Secondary Hazards	Supply chain interruption and/or shortages and economic losses; healthcare systems and supplies may be overwhelmed.				
Analysis Used	Review of historic events, hazard analysis plans, local input, and other information provided by the Utah Division of Emergency Management				

Magnitude/Extent

The potential magnitude of pandemics or epidemics in Salt Lake County can vary widely depending on the disease's transmissibility, population density, and public health measures in place. In mild cases, effective interventions and vaccination could limit the impact on a few hundred manageable cases. However, a moderate outbreak might lead to thousands of infections, strain healthcare services, and increase morbidity. In severe scenarios, a highly transmissible and lethal pathogen could overwhelm the healthcare system, resulting in tens of thousands of cases and significant fatalities, prompting quarantines and long-term economic disruptions. Beyond immediate health impacts, such events can have lasting effects on mental health, job stability, and access to healthcare, highlighting the importance of preparedness and community cooperation in addressing public health crises.

The Pandemic Severity Index (PSI) measures the severity of pandemics and their potential global health impact, focusing primarily on influenza. It assesses diseases based on factors like the severity of illness caused, the transmissibility of the virus, and the impact on healthcare systems.

	Pandemic Severity Index		
Interventions by Setting	**1**	**2 and 3**	**4 and 5**
Home			
Voluntary isolation of ill at home (adults and children); combine with use of antiviral treatment as available and indicated	Recommend	Recommend	Recommend
Voluntary quarantine of household members in homes with ill persons (adults and children); consider combining with antiviral prophylaxis if effective, feasible, and quantities sufficient	Generally not recommended	Consider	Recommend
School			
Child social distancing –dismissal of students from schools and school-based activities, and closure of child care programs	Generally not recommended	Consider: ≤ 4 weeks	Recommend: ≤ 12 weeks
–reduce out-of-school contacts and community mixing	Generally not recommended	Consider: ≤ 4 weeks	Recommend: ≤ 12 weeks
Workplace/Community **Adult social distancing**			
–decrease number of social contacts (e.g., encourage teleconferences, alternatives to face-to-face meetings)	Generally not recommended	Consider	Recommend
–increase distance between persons (e.g., reduce density in public transit, workplace)	Generally not recommended	Consider	Recommend
–modify, postpone, or cancel selected public gatherings to promote social distance (e.g., stadium events, theater performances)	Generally not recommended	Consider	Recommend
–modify workplace schedules and practices (e.g., telework, staggered shifts)	Generally not recommended	Consider	Recommend

Figure 145: Pandemic Severity Index

Location

Epidemics and pandemics can emerge in various locations, often influenced by several factors that affect susceptibility. In Utah, specific locations may be more susceptible to epidemics and pandemics due to population density, travel patterns, and healthcare access. Urban centers, such as Salt Lake City, Provo, and Ogden have higher population densities, making them more vulnerable to the rapid spread of infectious diseases, especially during crowded events. College campuses, such as the University of Utah and Salt Lake Community College, can also be hotspots for outbreaks due to the concentration of students in communal living spaces. In addition, popular tourist areas, such as Park City and Zion National Park, face increased risks from visitors who may introduce various pathogens. Regions with fewer healthcare facilities may struggle to manage outbreaks effectively, while rural areas, despite lower population densities, could face challenges due to limited access to medical resources. Lastly, transportation hubs near significant highways or airports can facilitate individual interactions, increasing the risk of disease transmission.

Historical Events and Probability of Future Occurrences

Table 68 provides information on historical health outbreaks in Utah.[174]

Table 68: Historical Health Incidents, Utah

Disease	Date	Deaths/Cases	Etiology
Diphtheria	1880	749 deaths	*Corynebacterium diphtheriae*; poor hygiene practices
Spanish Flu[175]	1918	2915 deaths	H1N1 virus with genes of avian origin
Rheumatic Fever	1985–1986	136 cases	Streptococcus bacteria; untreated strep throat
Hantavirus	1993–2017	38 cases	Infected rodents
West Nile Virus[176]	1999–2023	497 cases	Mosquitos
Measles	2011	13 cases	Morbillivirus
Hepatitis C	2013	4800 potentially exposed, seven infected	Exposure to blood from unsafe injection practices; unsafe healthcare; unscreened blood transfusions; injection drug use; sexual practices that lead to exposure to blood
Hepatitis A	2018	295 cases, two deaths	Ingestion of food or water contaminated by an infected person’s feces

[174] DeBry, Robert J. & Associates. “7 Serious Disease Outbreaks in Utah History.” KSL.com. March 19, 2020. https://www.ksl.com/article/46727920/7-serious-disease-outbreaks-in-utah-history.

[175] Fields, Lauren. “The 1918 Spanish Flu Killed 50 Million People Worldwide. Here’s How it Affected Utah.” Deseret News. December 22, 2018. https://www.deseret.com/2018/12/23/20661936/1918-flu-utah-spanish-influenza-pandemic/.

[176] Centers for Disease Control and Prevention. “West Nile Virus.” https://www.cdc.gov/west-nile-virus/data-maps/historic-data.html.

Disease	Date	Deaths/Cases	Etiology
COVID-19[177]	2020–2022	1,090,346 cases, 5,293 deaths	Exposure to coronavirus2, also called SARS-CoV-2

Salt Lake County Specific: Like many other US cities during the late 19th and early 20th centuries, Salt Lake City was a hotbed for **typhoid**. People hunted, camped, picnicked, and polluted near the seven mountain streams that provided the city with most of its water. Sheep and cattle grazed near the watershed, barnyards were built near water sources, and flies had easy access to the open privies and manure piles.

Typhoid was also quickly passed by finger contamination when an ill person or even a recovered victim handled food and did not wash his or her hands carefully after using the restroom. In 1923, a Salt Lake City woman working in a delicatessen was ill with what was later diagnosed as "walking typhoid." She had diarrhea and was getting weaker, but she did not want to leave her boss shorthanded; she also needed the money. She stayed on the job, serving food between her frequent trips to the lavatory and her less frequent or thorough handwashing. One day, four adults and two young people came into town from their westside farm to see a double feature at a movie theater. Afterward, they visited the delicatessen and bought some food to take home for their evening meal. The young people left on dates while the adults shared the deli food. The four adults came down with typhoid, and two died.

Some 188 cases of typhoid (13 deaths) were traced to the woman carrier, but no one knows for sure how many people contracted the disease, took it home, possibly to another state, and spread it even further. The problem was compounded by the fact that a drugstore near Salt Lake City's tourist district bought food from the delicatessen and served it to countless people. Eventually, the deli was tracked down as the outbreak's source and quarantined. Reports of typhoid soon subsided.

Before 1900, doctors had seen more typhoid fever than any other disease and treated it in various ways. Some felt it was best to starve the patient; others felt hot water was the cure. Salt Lake City Cemetery records from 1850 to 1894 record 924 deaths due to typhoid, but the actual number was probably higher. Many deaths among typhoid-prone adolescents and young adults who died in the summer and fall when typhoid is most common were attributed to "diarrhea" or "fever." Many people recognized the connection between typhoid and contaminated food and drink, but little action was taken until health boards were established. Even then, educating the public to take simple precautions was difficult.

When the housefly was implicated as a typhoid carrier in the late 19th century, Dr. Theodore B. Beatty, state health commissioner, began a crusade against the pest. He distributed literature, gave talks and demonstrations at schools, and helped make "Swat the Fly" a standard greeting. A contest offered prizes to whoever killed the most flies. The winner brought in 707 quarts of dead flies, an estimated 9.5 million, and received the $1,000 prize donated by a Salt Lake City businessman; in one year, Utahns captured

[177] Johns Hopkins University and Medicine. "Coronavirus Resource Center." https://coronavirus.jhu.edu/region/us/utah.

3,715 quarts of flies. The fly menace was lessened, but real progress was made when attention gradually turned to eradicating their breeding grounds.

Following the example of some eastern cities, Salt Lake City instituted a water chlorination program in 1915. It gradually expanded until 1927, when daily testing of chlorinated water was done at all city water intake points. Reactions to chlorination varied. Mothers worried when they could not taste the chlorine, fearing that the water they gave their children was unsafe. Others said chlorine made the water unpalatable and killed their goldfish. During the prohibition era, some complained that it ruined the taste of their home brew and bathtub gin.

Gradually, with increasing use of sanitary methods—improved sewer systems, purer water, and laws regulating the handling and dispensing of foods—plus the use of a vaccine discovered by Almoth Wright of London in 1906–1907, typhoid was controlled.[178]

The **1918 influenza outbreak**, known as the Spanish Flu, significantly impacted communities worldwide, including Salt Lake City. The pandemic, which emerged in the final stages of World War I, reached Salt Lake City in the autumn of 1918 when the region was still recovering from the war.

The first cases were reported in late September, and by October, the virus had spread rapidly, particularly affecting healthy young adults. Influenza often led to pneumonia, resulting in high mortality rates due to the limited medical resources of the time.

Local health officials launched a public health campaign promoting mask-wearing, social distancing, and gathering restrictions. Schools and theaters closed, and strict quarantine measures were implemented. Despite these efforts, the city faced thousands of cases and over 500 deaths, overwhelming the healthcare system.

The pandemic also caused economic disruption as businesses and schools closed and communities united to support one another. As the outbreak waned in early 1919, Salt Lake City reflected on the importance of public health preparedness and effective communication.

The legacy of the 1918 influenza outbreak remains a poignant reminder of community resilience in the face of public health challenges.[179]

In 1985, Salt Lake County faced an outbreak of acute rheumatic fever (ARF), a serious condition stemming from untreated streptococcal throat infections that notably affected children and adolescents. The 99 verified cases were in 20 of Utah's 29 counties; the most significant outbreaks occurred in Salt Lake County and Utah County. ARF can lead to severe complications, including rheumatic heart disease, emphasizing the need for early diagnosis and treatment of strep throat.

---

[178] Murphy, Miriam B. "Salt Lake City Had Its Typhoid Mary." History to Go, History Blazer. April 1996. https://historytogo.utah.gov/typhoid-mary/.
[179] University of Michigan Center for the History of Medicine and Michigan Publishing, University of Michigan Library. "Influenza Encyclopedia: Salt Lake City, UT." https://www.influenzaarchive.org/cities/city-saltlakecity.html.

Local health officials, schools, and healthcare providers collaborated to identify cases and educate the community about the symptoms of strep throat and the importance of antibiotic treatment to prevent ARF. This outbreak highlighted the necessity of monitoring communicable diseases and ensuring proper healthcare access to prevent serious complications associated with bacterial infections. As a result, measures were reinforced to guarantee that children received appropriate medical attention for throat infections.[180]

Beginning in late 2016, communities across the United States reported a significant increase in **hepatitis A** infections, with over 22,000 cases documented nationwide by July 2019. Although some areas continue to face this outbreak, Utah officially declared its outbreak over in February 2019 after nearly 300 cases had been recorded. This success was primarily attributed to innovative strategies implemented by the Salt Lake County Health Department (SLCo HD). Of the cases in Utah, about 200 were reported in Salt Lake County, primarily among individuals experiencing homelessness or using illicit drugs, which complicated efforts to provide treatment.[181]

The first case of COVID-19 in Utah was documented in early March 2020. By November 2023, Salt Lake County had experienced 419,514 confirmed cases, 18,930 hospitalizations, and 1,909 deaths during the pandemic.[182] COVID-19 demonstrated how disease outbreaks can evolve rapidly and have wide-ranging public health impacts, disrupt supply chains, and contribute to economic losses.

Several interrelated factors shape the probability of future occurrences of epidemics and pandemics. Globalization and increased travel enable the rapid spread of disease across borders, while urbanization creates densely populated environments where infections can thrive. Climate change also plays a role, as shifting climates may expand the habitats of vectors like mosquitoes, potentially increasing diseases, such as malaria and dengue fever. In addition, zoonotic diseases—those that jump from animals to humans—become more likely as humans encroach on wildlife habitats. Antimicrobial resistance further complicates matters, making infections more challenging to treat and control. The strength of public health infrastructure is crucial, as more robust systems can effectively contain outbreaks. With these various elements at play, the risk of future epidemics and pandemics remains significant, highlighting the need for proactive global health measures and improved surveillance to mitigate potential threats.

Figure 146 displays a list of priority pathogens that could cause the next pandemic. The list was compiled by more than 200 scientists from 50 countries. Although these pathogens may not currently be active in the United States, they could emerge or reemerge due to various modes of travel and transportation.

[180] Centers for Disease Control and Prevention. 1987. "Acute Rheumatic Fever – Utah." *MMWR*. 36(8);108–10,115. https://www.cdc.gov/Mmwr/preview/mmwrhtml/00000880.htm.
[181] Shapiro, Michelle. "Field Notes: Salt Lake County Stops Hepatitis A Outbreak." National Association of County & City Health Officials. September 30, 2019. https://www.naccho.org/blog/articles/field-notes-salt-lake-county-stops-hepatitis-a-outbreak.
[182] Utah Coronavirus Dashboard. https://coronavirus-dashboard.utah.gov/overview.html.

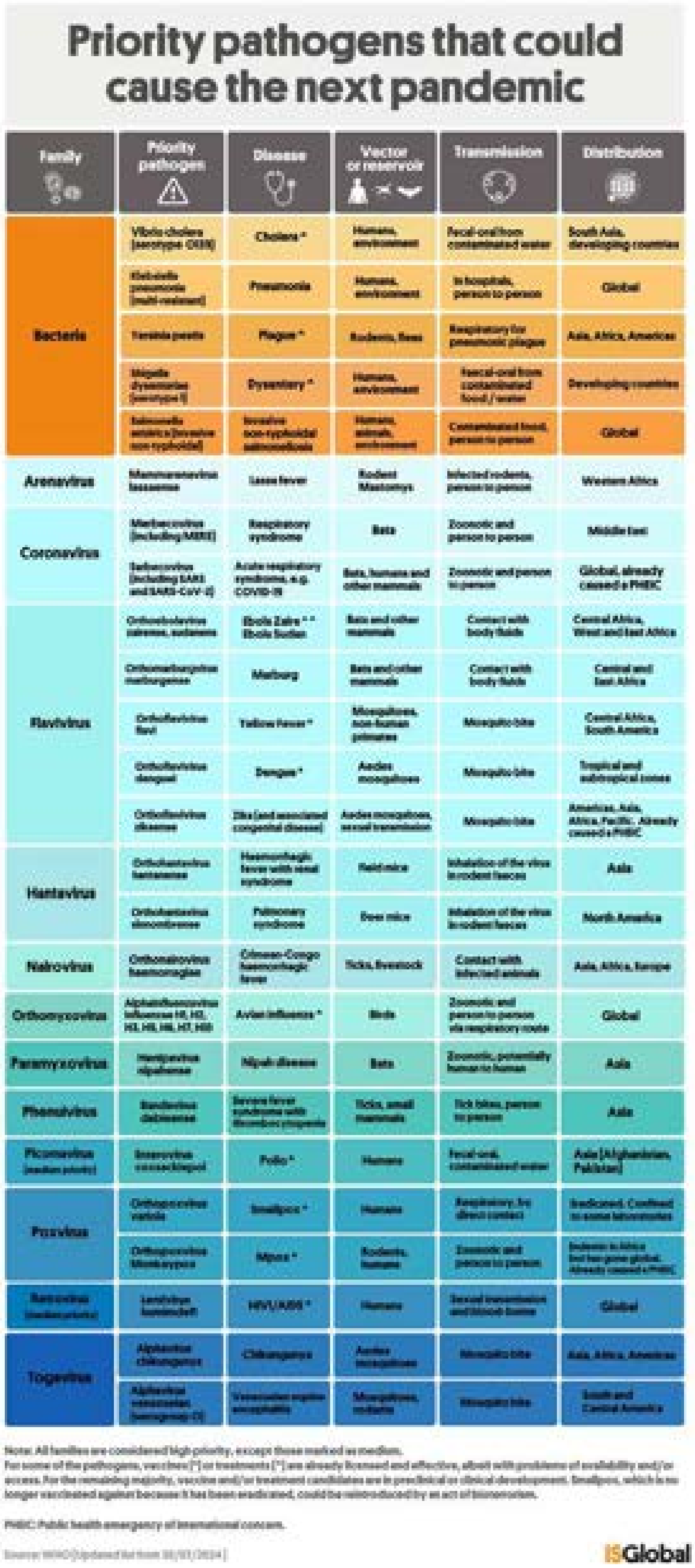


Figure 146: Emerging or Reemerging Priority Pathogens[183]

Climate Change Considerations

Climate change significantly influences the incidence of pandemics and epidemics through various interconnected ways. As climate shifts alter habitats, humans come into closer contact with wildlife, increasing the risk of zoonotic diseases. Higher temperatures and changing precipitation patterns expand the ranges of disease-carrying vectors like mosquitoes and ticks, introducing new diseases to vulnerable populations. Furthermore, climate-induced migration from rural to urban areas often results in crowded living conditions where infections can spread quickly. Extreme weather events disrupt public health infrastructure, exacerbating disease transmission, while food insecurity linked to climate change can heighten susceptibility to infections. These factors create an environment where infectious diseases can emerge and spread more readily, highlighting the urgent need for integrated public health strategies considering climate impacts.

Secondary Hazards

Epidemics and pandemics often generate a range of secondary hazards that can exacerbate the initial health crisis. One significant issue is the impact on mental health, as individuals may experience increased anxiety, depression, and stress due to isolation and fear of the disease. Economic disruption is another primary concern; job losses and business closures can lead to heightened poverty and financial instability. Healthcare systems can become overwhelmed, resulting in diminished care quality for infected individuals and those with other medical needs. Supply chain disruptions may cause shortages of essential items, while social unrest can arise from economic hardship and misinformation. Vulnerable populations often face more significant risks during these times, experiencing heightened challenges in access to healthcare and essential resources. In addition, environmental concerns may arise from inadequate waste management practices, and educational disruptions can hinder children's development, particularly in low-income families. All these secondary hazards were evident during the recent COVID-19 pandemic. The combination of these secondary hazards underscores the interconnectedness of public health crises and highlights the need for comprehensive strategies to mitigate their far-reaching impacts.

Vulnerability Assessment

In Salt Lake County, certain areas and populations are particularly vulnerable to public health outbreaks and epidemics. Low-income communities often face limited access to healthcare, preventive services, and health education, making them more susceptible. Housing conditions, especially in crowded areas, can facilitate the spread of infectious diseases due to increased close contact among residents. High population density, particularly in urban centers like downtown Salt Lake City, further contributes to this risk. In addition, the elderly, who might have compromised immune systems, and children in schools—frequent sites for outbreaks—are at increased risk. Uninsured or underinsured individuals may delay seeking medical help due to financial constraints, exacerbating their vulnerability. Furthermore, specific

[183] Sarukhan, Adelaida. "A New List of Priority Pathogens that Could Cause the Next Pandemic." IS Global Barcelona Institute for Global Health. August 29, 2024. https://www.isglobal.org/en/healthisglobal/-/custom-blog-portlet/a-new-list-of-priority-pathogens-that-could-cause-the-next-pandemic.

ethnic and racial groups may experience disparities in health access, while individuals with preexisting health conditions face higher susceptibility to severe outcomes during health crises.

ESTIMATED IMPACTS AND POTENTIAL LOSSES

In the event of an epidemic or pandemic, Salt Lake County could face significant challenges impacting public health, the economy, and social structures. Healthcare facilities might become overwhelmed, leading to shortages of critical resources, such as beds and medical equipment, which could increase morbidity and mortality rates. Economically, local businesses—especially in hospitality, retail, and services—could suffer considerable losses due to forced closures and reduced customer traffic, resulting in higher unemployment rates. The education sector might also be affected, with school closures disrupting learning and exacerbating disparities between high- and low-income families. Mental health issues could arise as individuals deal with the stress and anxiety associated with illness and financial strain. In addition, demand for social services might increase, stretching resources and support systems thin. Public transportation could see reduced ridership, complicating access to essential services, while public safety resources might be tasked with enforcing public health measures. Overall, the multifaceted impacts of an epidemic or pandemic could create lasting challenges for the community.

VULNERABLE POPULATIONS

In Salt Lake County, certain populations are particularly vulnerable during public health outbreaks. Children are at higher risk due to their developing immune systems and close interactions in schools and childcare settings. The elderly also face significant threats, as age often correlates with increased severity of illness. Individuals with chronic health conditions, such as diabetes, heart disease, or respiratory ailments, are more susceptible to complications from infections. Low-income communities may struggle with limited access to healthcare, nutritious food, and stable housing, further increasing their risk. In addition, people with compromised immune systems, including those undergoing medical treatments, are at increased danger. Those experiencing homelessness often lack proper hygiene and healthcare access, increasing their vulnerability. Minority communities may also face unique cultural and socioeconomic challenges that impact their health during outbreaks. Lastly, while essential for response efforts, healthcare workers face a heightened risk of exposure due to their front-line roles.

COMMUNITY LIFELINES

In Salt Lake County, various FEMA community lifelines could be significantly impacted by an epidemic or pandemic. The Safety and Security lifeline may face strain as public health concerns limit the capacity of law enforcement and emergency services, impacting their response to other emergencies. The Health and Medical lifeline is directly affected as healthcare systems become overwhelmed with increased patient loads, shortages of medical supplies, and healthcare worker fatigue. The Food, Hydration, and Shelter lifeline may experience disruptions in supply chains, leading to food shortages and challenges in providing clean water. The Energy lifeline could also suffer from workforce shortages in the energy sector, affecting power supplies. Communication become crucial as the need for accurate public health information increases, putting pressure on communication systems to counter misinformation. The Transportation lifeline may be disrupted by travel restrictions, complicating logistics for healthcare and essential services. Lastly, due to the need for proper disposal of medical waste and personal protective equipment (PPE), the functioning of the Hazardous Waste Community Lifeline becomes a concern.

CHANGES IN DEVELOPMENT

Epidemics and pandemics can significantly shape Salt Lake County development trends through various channels. For instance, public health crises often prompt increased funding for healthcare infrastructure, leading to facility enhancements and better emergency preparedness. This, in turn, influences urban planning and resource allocation. Economically, such events can disrupt local businesses, particularly in sectors like tourism, resulting in shifts in real estate development and job markets. Changes in population dynamics may occur as people relocate for better opportunities or living conditions, further impacting housing and urban growth. In addition, the rise of remote learning during health crises can drive investments in technology infrastructure in educational institutions. As communities reassess transport needs, there might be a shift toward sustainable mobility solutions. Greater emphasis may be placed on mental health and community support services, affecting funding for related facilities and public spaces.

Epidemics and pandemics can significantly reshape land use development by prioritizing public health and community resilience. For instance, an increased demand for open spaces may prompt cities to improve parks and recreational areas, promoting social distancing and overall well-being. In addition, the rise in remote work could lead to a decline in traditional office spaces, encouraging developers to repurpose commercial properties for residential or collaborative work environments. There may also be a surge in the construction of healthcare facilities, with zoning regulations adjusted to support this need. Communities might focus on mixed-use developments to create vibrant neighborhoods that minimize commuting and encourage local living. Furthermore, urban planning could incorporate sustainable practices and infrastructure to withstand future health crises better. These changes aim to foster healthier, more adaptable communities that can effectively respond to emerging public health challenges.

In addition, a pandemic or epidemic can significantly reshape future land development by introducing various challenges and shifts in priorities. Economic slowdowns often accompany such crises, leading to reduced investment in real estate and delayed projects due to financial uncertainty. Public health concerns can also prompt governments to implement new regulations that alter zoning laws. Developers might favor locations that minimize reliance on crowded infrastructure as commuting patterns evolve. Moreover, the construction industry could face supply chain disruptions, increasing project costs and timelines.

Salt Lake County's development and population growth can have significant impacts on public health especially pandemics and epidemics as increased population density can facilitate the spread of infectious disease as people are more likely to come into contact with each other. Urbanization is especially problematic where healthcare resources may be stretched to its limits especially in the context of pandemics. Population growth might also have an impact on public health as the influx of population may strain public health services.

Salt Lake County plans several future land development initiatives to accommodate its growing population and enhance community well-being. Key projects include transit-oriented developments encouraging public transportation by creating mixed-use spaces near transit hubs. In addition, there is a strong focus on affordable housing initiatives to tackle the housing crisis through partnerships with developers. The county is also investing in expanding parks and recreational facilities to improve the quality of life for residents. Urban renewal projects are in place to revitalize targeted neighborhoods, while sustainable development practices are being integrated into new projects. Furthermore, transportation improvements and designated economic development zones aim to enhance infrastructure and attract businesses, fostering job creation in the region. For the latest updates, consulting the Salt Lake County planning department or local government resources is advisable.

VULNERABILITY SCORE

Given Salt Lake County's moderate social vulnerability, high EAL, and high community resilience to overall hazards, its vulnerability to an epidemic or pandemic may still be significant.[184] Although the high community resilience can help in the aftermath of a public health crisis, the high EAL indicates that the potential impact of an infectious disease outbreak is substantial. In addition, the moderate social vulnerability suggests that there are underlying factors that could exacerbate the impact of a public health crisis.

[184] FEMA. "National Risk Index." https://hazards.fema.gov/nri/map.

Radon

Hazard Description

Radon is a radioactive gas released from the nuclear decay process of uranium and radium, which are trace elements of many soils. Small particles of uranium in rocks and soil decay into radium, which, breaks down further into radon. Alpha, beta, and gamma radiation are emitted. Radon is odorless, colorless, and tasteless. As it moves up through the ground, radon can enter a home through cracks and gaps in walls and floors, cavities inside walls, and gaps around service pipes and water supply connections. Though relatively harmless at low levels, radon is classified by the EPA as a known human carcinogen and is considered the leading cause of non-smoking lung cancer in the United States. Small radioactive particles are inhaled and become lodged in the lungs, damaging DNA. Because radon is tasteless, odorless, and invisible, it presents unique challenges in minimizing daily exposure to this naturally occurring radiation.

Figure 147: Image of How Radon Enters Homes[185]

Nearly 18,000 deaths in the United States each year are caused by radon gas, according to the Huntsman Cancer Institute and other cancer centers. Since 2005, the Office of the Surgeon General has warned the public of the dangers of radon, especially its cancer-causing abilities. Radon can be detected through an inexpensive test and can be mitigated through proper ventilation of excessive radon and installation of systems to prevent radon from entering the home. Thirty-three percent of Utah homes have

[185] https://www.epa.gov/system/files/styles/huge/private/images/2021-10/how-radon-enters-home.jpg?itok=yhnoFgEF. Radon Media Resources for Partners and Stakeholders | US EPA indicates these infographics are available to use for public education.

dangerously high levels of radon. Radon is the leading cause of lung cancer in nonsmokers. Smokers living in high radon homes have nine times the risk of lung cancer.[186]

Utah also has high levels of uranium, the source of radon, in the ground, leading to high levels of gas in the state. Found in most Utah homes, radon can enter a home through cracks and gaps in walls and floors if not properly vented. In fact, 21,000 Americans and an estimated 200–300 Utahns die annually from radon-induced lung cancer.[187]

The danger of high exposure to radon in mines was known back in the 1500s, yet the presence of radon in indoor air was not documented until 1950. In 1970, research was initiated to address sources of indoor radon, determinants of concentration, health effects, and approaches to mitigation. A widely publicized incident in Salt Lake County escalated the problem of indoor radon in 1984, and investigation intensified, with the EPA taking a strong lead to educate states through its State Indoor Radon Grant.

EPA's grant has been partially funding the Indoor Radon Program at the Utah Division of Radiation Control (DRC), which enables the DRC to respond to a continuous stream of public telephone and email inquiries, provide education to homeowners and professionals, conduct "target area" indoor radon assistance and surveys, and offer individualized assistance to homeowners and public agencies concerning all aspects of the indoor radon hazard problem. The DRC's primary goal is to ensure that radiation exposure to individuals is kept to the lowest practical level. A vital mechanism in reducing radiation exposure and potentially saving lives is the Indoor Radon Program. Radiation risk to the American public from radon gas is undisputed. Radon is the leading environmental cause of cancer mortality in the United States and the seventh leading cause of cancer mortality overall. The Harvard School of Public Health in the Center for Risk Analysis has ranked radon as the highest of ten risks of death in homes in the United States, ahead of falls and home fires. Radon awareness in Utah has grown steadily in the past decade.

Hazard Profile

Potential Impact		Catastrophic	**Probability**	X	Highly Likely
		Critical			Likely
	X	Limited			Occasional
		Negligible			Unlikely
Location	Region wide				
Seasonal Conditions	Year-round, continuous				
Conditions	Buildings over top of soils containing high amounts of decaying uranium, which is commonly found in Utah				
Duration	Years				
Secondary Hazards	Unknown				
Analysis Used	Information and maps provided by the Utah Geological Survey and the Utah Division of Radiation Control				

[186] UtahRadon.org. "Working to Protect Utahns from the Dangers of Radon." 2024. https://utahradon.org/.
[187] Ibid.

Magnitude/Extent

Radiation is measured in curies. A curie is a rate of disintegration of 1 gram of radium. Radon is measured in picocuries per liter, shown as pCi/L. The 2019 Utah State Hazard Mitigation Plan maps the counties in the state according to radon, pCi/L, which shows the range of magnitude that can be found in the county (Figure 148).

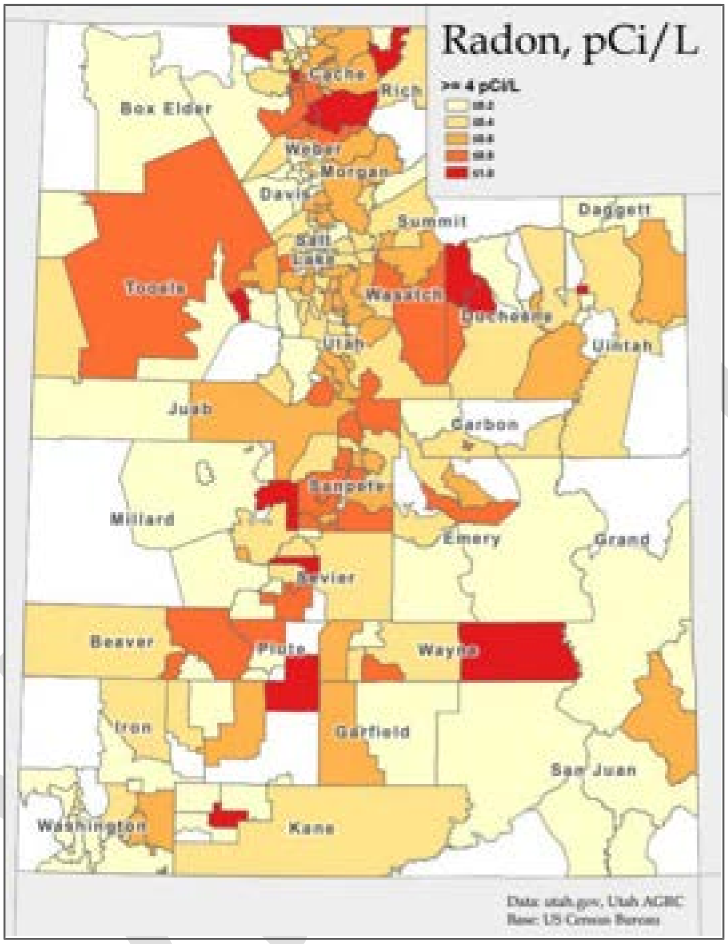


Figure 148: Radon, pCi/L Range of Magnitude by County in Utah

The 2024 Utah State Enhanced Hazard Mitigation Plan maps the counties in the state according to radon geological hazard significance ranking in LHMPs. Salt Lake County hazard ranking for radon is moderate (Figure 149).

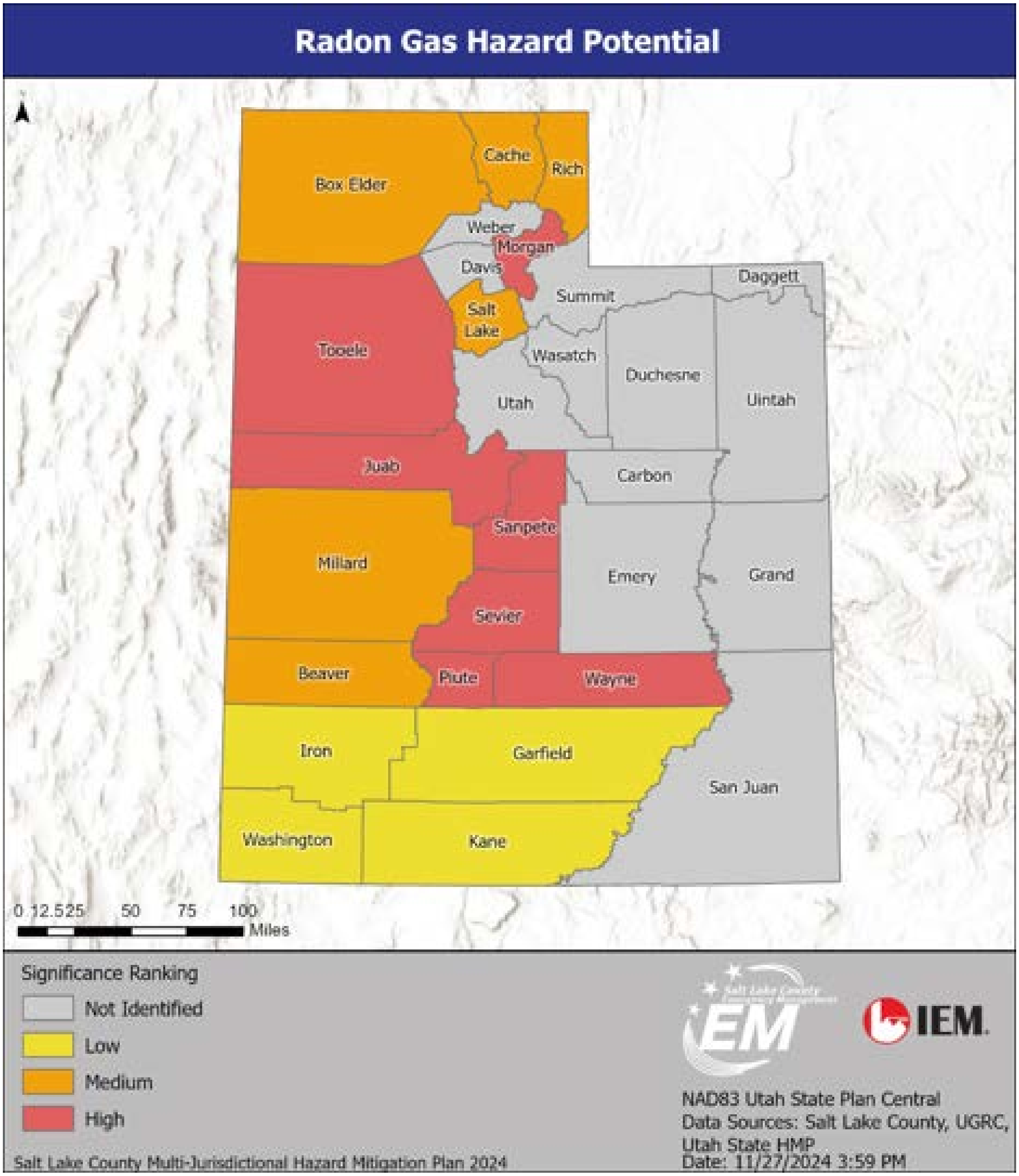


Figure 149: Radon Hazard Ranking in Local Mitigation Plans by County in Utah

Location

Due to the types of geologic formations found in Salt Lake County, radon gas is likely present in higher concentrations in homes in the Wasatch and Oquirrh Mountains and their foothills. Sites further from the mountains and foothills generally have lower concentrations of radon. Radon does not pose a threat to infrastructure. Through collections of tests performed by various households in the county, households containing higher levels of radon were indeed found to roughly follow the patterns predicted by geologic formation. One exception is the area just south of Interstate 80 in western Salt Lake City. Utah Department of Environmental Quality provides data on radon test results summarized by zip code. Figure 150 shows the average radon score by zip code in Salt Lake County. Homes confirmed to have 4 pCi/L or higher are considered to have elevated radon levels and are recommended to take action. Figure 151 shows the percentage of homes with elevated radon levels.

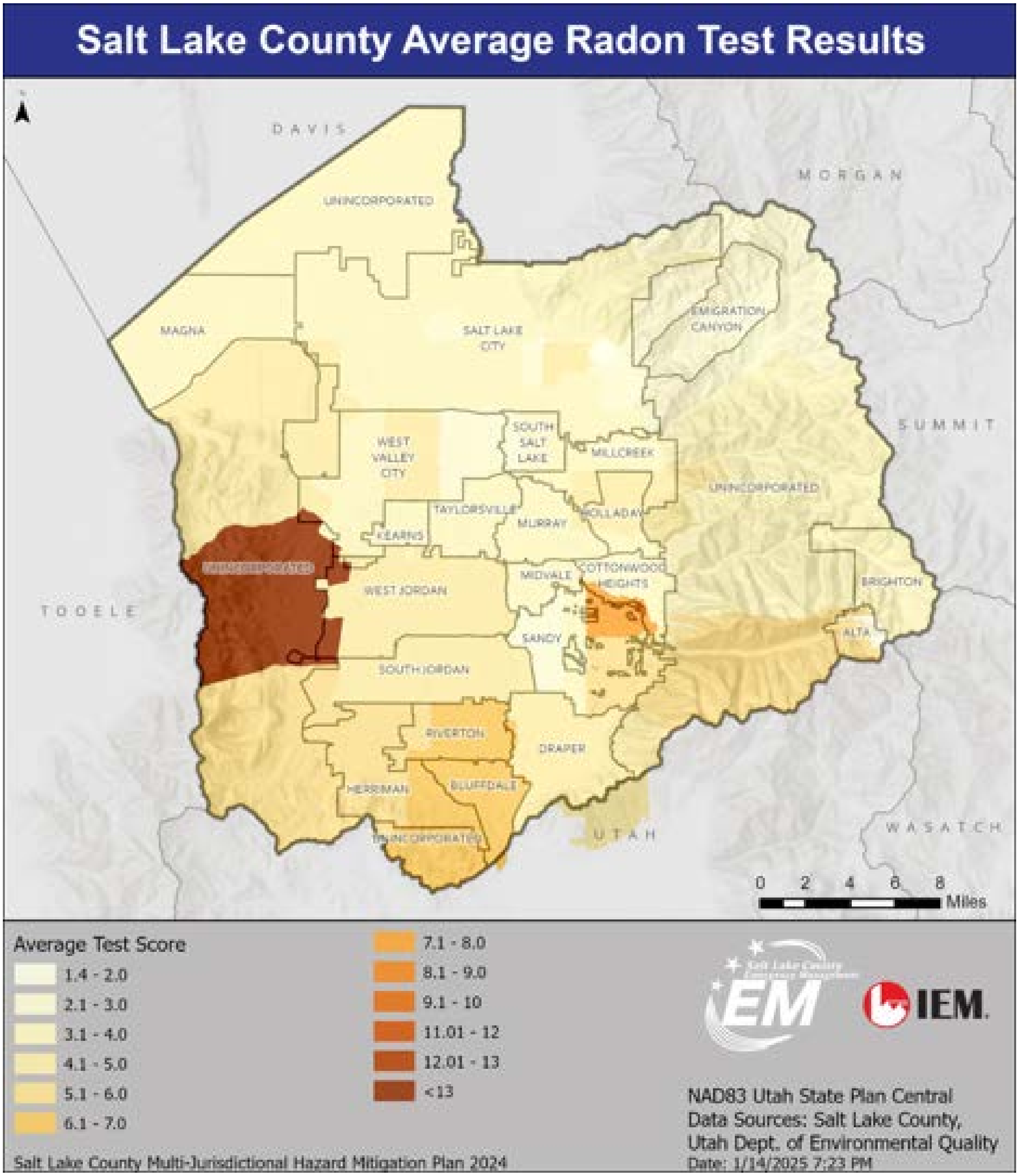


Figure 150: Average Radon Test Results for Salt Lake County

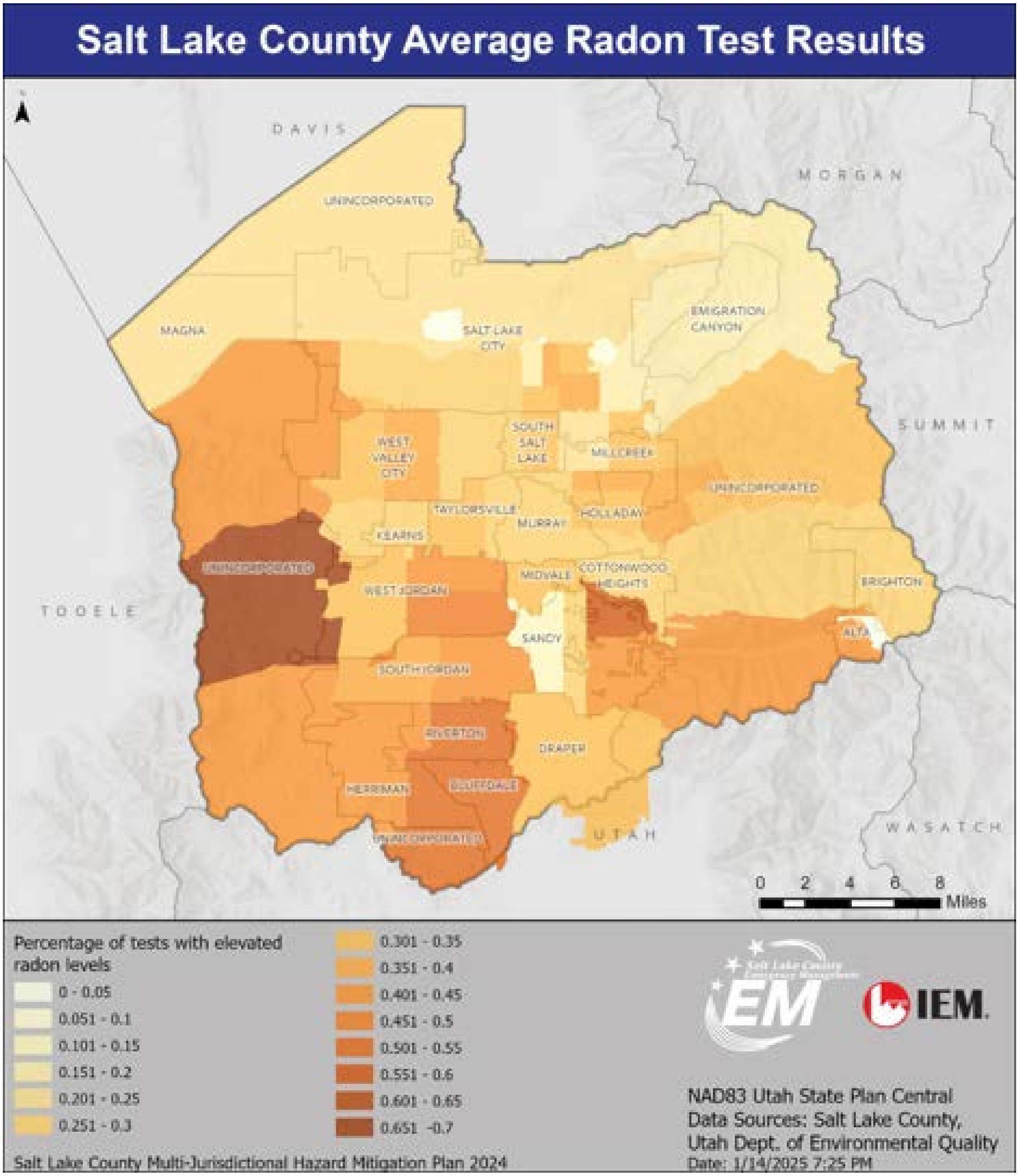


Figure 151: Percentage of Tests in Salt Lake County with Elevated Radon Levels

Historical Events and Probability of Future Occurrences

According to FEMA's Disaster Declarations for States and Counties, there were no federally declared radon disasters from January 1, 2019, through June 4, 2025.[188] In addition, no state declarations have been made for the state of Utah due to radon.[189]

According to the EPA, nearly 1 in 3 homes checked in seven states and on three tribal lands had screening levels over 4 pCi/L, the EPA's recommended action level for radon exposure.

A family whose home has radon levels of 4 pCi/L is exposed to approximately 35 times as much radiation as the Nuclear Regulatory Commission would allow if that family was standing next to the fence of a radioactive waste site (25 millirem limit, 800 millirem exposure).

An elementary school student that spends 8 hours per day and 180 days per year in a classroom with 4 pCi/L of radon will receive nearly 10 times as much radiation as the Nuclear Regulatory Commission allows at the edge of a nuclear power plant (25 mrem limit, 200 mrem exposure).

The Utah Department of Public Health tracks the results for indoor radon levels in each county every year. Figure 152 shows the percentage of radon tests performed per year from 2006 to 2021, and the test result by category. The chart categories are blue, indicating results less than 2 pCi/L; yellow, indicating 2 to 3.9 pCi/L, and red, indicating greater or equal to 4 pCi/L. The 2021 radon test results showed 34.7 percent of results were greater or equal to 4 pCi/L, 30.4 percent of results were between 2 to 3.9 pCi/L, and 34.9 percent of results were less than 2 pCi/L.

[188] FEMA, "Disaster Declarations for States and Counties." https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties.
[189] Utah Department of Public Safety, "Utah Disaster History." https://dem.utah.gov/utah-disaster-history/.

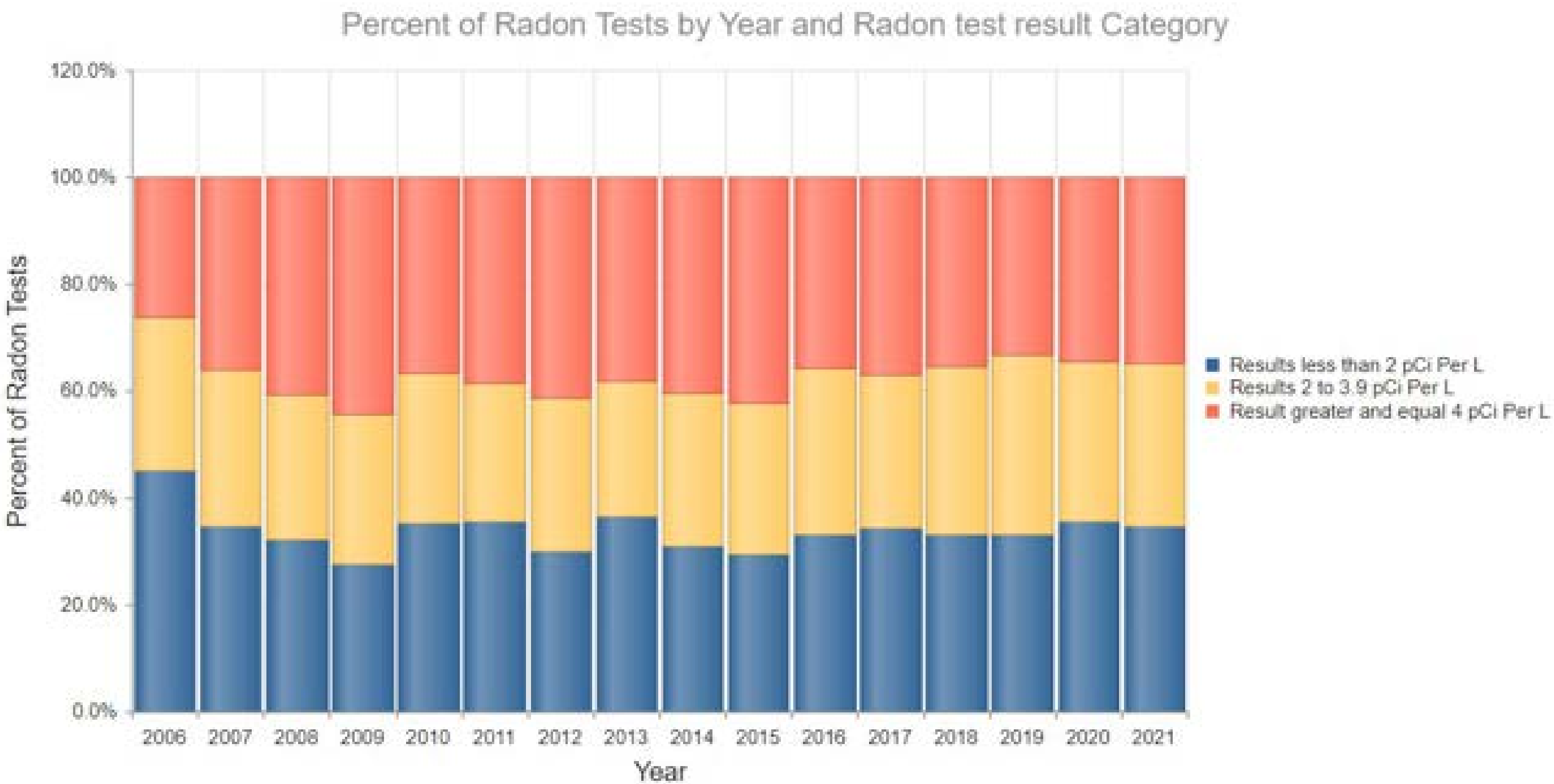


Figure 152: Salt Lake County Radon Test Results, 2006–2021[190]

[190] Utah Environmental Public Health Tracking. "Salt Lake County Results (2006–2021)." 2024. https://ibis.utah.gov/epht-view/query/result/radon/RadonNumberTest/Percent.html.

The Salt Lake County Board of Realtors is currently maintaining a database of radon readings in homes. County ordinances require homes with unacceptable radon levels to undergo mitigation procedures before sale. This should eventually make all homes safe; however, the county will continue to experience radon exposure for the foreseeable future. Because radon is always present in the soil, the probability of future occurrences is highly likely.

Climate Change Considerations

There has been study in arctic climates that thawing of the permafrost layer that normally acts as a barrier to radon can lead to increased vulnerability. However, the effects of climate change on radon exposure in Utah are not well understood.

Climate change can have an impact on radon levels in Salt Lake County by altering soil and atmospheric conditions as higher temperatures and changes in precipitation patterns can affect the movement of radon gas in the soil. Increased rainfall can lead to higher groundwater levels, which can increase radon movement especially into buildings.

Secondary Hazards

No secondary hazards from radon are known at this time.

Vulnerability Assessment

Radon does not impact infrastructure, but all humans and households exposed in the county are at risk. These figures can be seen in the Salt Lake County Demographics portion of this plan. As previously stated, radon decays into radioactive particles that can be trapped in the lungs when inhaled. These particles release small bursts of energy that damage lung tissue and may lead to lung cancer. Most EPA lifetime safety standards for carcinogens are established based on a 1 in 100,000 risk of death. Most scientists agree that the risk of death for radon at 4 pCi/L is approximately 1 in 100. At the 4 pCi/L EPA action guideline level, radon carries approximately 1,000 times the risk of death as any other EPA carcinogen. It is important to note that the action level is not a safe level because there are no “safe” levels of radon gas. Radon is the second leading cause of lung cancer in the United States. Only smoking causes more deaths from lung cancer, and smoking combined with radon is a particularly serious health risk. Chances of getting lung cancer are higher from the combination of smoking and radon than from either source alone. Although not every individual exposed to radon will develop lung cancer, the likelihood of developing it increases with higher radon concentrations and prolonged exposure. The amount of time between exposure and onset of the disease is usually many years.

ESTIMATED IMPACT AND POTENTIAL LOSSES

The most pronounced impact of radon is the health impacts on the population. Radon exposure contributes to chronic disease and death. According to the Utah State Hazard Mitigation Plan, radon gas is estimated to have caused 5,630 deaths between 1973 and 2015 and is considered Utah’s most deadly geologic hazard.

Although radon does not cause direct structural losses to buildings or infrastructure, it does have a societal cost. Treatment of lung cancer or other healthcare costs for affected individuals are significant. The Utah Geological Survey reported that the estimated 5,630 fatalities in Utah lung cancer cases caused by radon would have an estimated cost of between $2.7 to 3.6 million.[191]

Residences, government offices and other public buildings, schools, businesses, and other structures across the county are vulnerable to radon. The concentration may vary by location, soil characteristics, and construction characteristics. Installation of radon mitigation systems in existing buildings or including them in new construction will incur costs to building owners, but these costs may offset potential later health costs.

VULNERABLE POPULATIONS

All populations in Salt Lake County can be exposed to radon gas and are considered vulnerable. However, some may be exposed to higher concentrations, exposed for longer durations, or have other characteristics that put them at greater risk to radon-related illness. People who live in rented housing may be less aware of their exposure and might have restrictions on installing mitigation systems. Lower-income families may not have access to financial resources to address radon concentrations in their homes. Language barriers may limit some individuals' awareness of the effects of radon. Other social vulnerability characteristics may affect individuals' decisions about seeking medical care for radon-related illness, such as limited income or lack of access to health insurance.

Children may be more vulnerable, because their lungs are smaller, still developing, and they tend to breathe more rapidly. Elderly individuals might have underlying health conditions or weakened immune systems that may contribute to vulnerability to radon. They also might have physical limitations, particularly if they have a disability or limited mobility, and might have more prolonged exposure to radon. They might have challenges adequately ventilating their homes, which may contribute to radon buildup.

Individuals who have a history of smoking face compounded risks from radon exposure and are more likely to develop cancer than either smoking or radon alone.

COMMUNITY LIFELINES

Radon is not likely to disrupt the day-to-day operations of Community Lifelines.

CHANGES IN DEVELOPMENT

Salt Lake County's development and population growth can have impacts on radon exposure, as construction can disturb the ground and release radon gases trapped in the soil. Increased urbanization can also lead to changes in soil ventilation and water drainage patterns, affecting the movement of radon gases. This urbanization is happening most acutely in northwest, south, and southwest Salt Lake County.

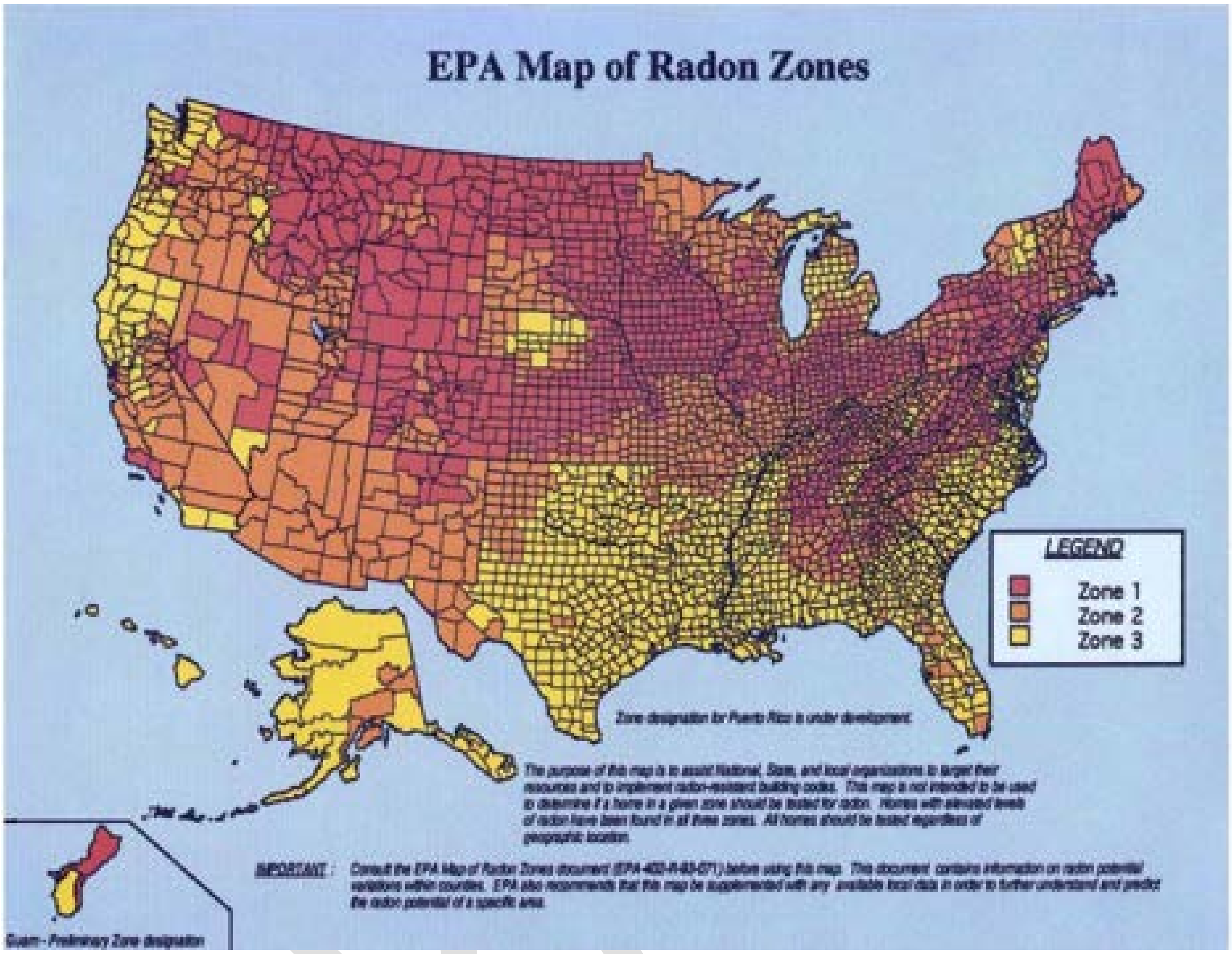
[191] Utah Geological Survey, Geologic Hazards. "Costs of Geologic Hazards." https://geology.utah.gov/hazards/info/costs/#tab-id-4.

Potential impacts from increased vulnerability to radon exposure is loss of life and decreased air quality and soil erosion. Changes in population patterns may lead to populations seeing an increase in health issues for radon exposure. People may move to an area with lower or no levels of radon. Changes in land use and development can lead to changing building inspection requirements to prevent radon exposure. Overall vulnerability to radon exposure has stayed the same since the last plan update.

VULNERABILITY SCORE

The NRI does not include any data on the relative risk of radon. The EPA created a map (Figure 153) to identify radon potential across the country.[192] Salt Lake County is in Zone 2, which has moderate potential for elevated radon levels, with averages between 2 and 4 pCi/L.

[192] U.S. Environmental Protection Agency. "Radon Zones Map." May 2024. https://www.epa.gov/system/files/documents/2024-05/radon-zones-map_text_link.pdf.



	Zone 1 (red zones)	Highest potential; average indoor radon levels may be greater than 4 pCi/L (picocuries per liter)
	Zone 2 (orange zones)	Moderate potential; average indoor radon levels may be between 2 and 4 pCi/L
	Zone 3 (yellow zones)	Low potential; average indoor radon levels may be less than 2 pCi/L

Figure 153: EPA Map of Radon Zones in the United States

Severe Winter Weather

Figure 154: Snowplow Clearing Road After a Heavy Snow[193]

Hazard Description

Severe winter weather in Salt Lake County includes heavy snow, lake effect snow, snow squalls, and blizzards. Significant snowstorms are characterized by the rapid accumulation of snow, often accompanied by high winds, cold temperatures, and low visibility.

Heavy snow generally means snowfall accumulating 4" or more in depth in 12 hours or less, or snowfall accumulating 6" in depth in 24 hours or less.[194] Salt Lake County also experiences lake effect snow. As cold air moves over the warmer water of the Great Salt Lake, warmth and moisture are transferred into the lowest portion of the atmosphere. The air rises and clouds form and grow into narrow bands that produce heavy snow downwind of the lake.

A snow squall is often associated with a strong cold front. Snow squalls move in and out quickly and typically last less than an hour. Although they typically do not lead to large accumulations of snow, the combination of gusty winds, white-out conditions, and cold temperatures can create icy roads in just a few minutes. Reduced visibility and slick roads create extremely dangerous conditions for motorists.

A blizzard is categorized as a snowstorm with winds of 35 mph or greater and/or visibility of less than one-quarter mile for 3 or more hours. The strong winds during a blizzard blow about falling and already existing snow, creating poor visibility and impassable roadways. Blizzards can cause property damage. Blizzard conditions not only cause power outages and loss of communication but also make

[193] https://pixabay.com/photos/road-cleaning-blizzard-snow-drifts-2582429/.
[194] National Weather Service Forecast Glossary. https://forecast.weather.gov/glossary.php?word=HEAVY%20SNOW.

transportation difficult. Blowing snow can reduce visibility to less than one-quarter mile, and the resulting disorientation makes even travel by foot dangerous if not deadly.

Figure 155: Snow in the Wasatch Mountains[195]

Hazard Profile

Potential Impact		Catastrophic	**Probability**	X	Highly Likely
	X	Critical			Likely
		Limited			Occasional
		Negligible			Unlikely
Location	Can occur in areas throughout the county				
Seasonal Pattern	Winter months				
Conditions	Vary based on latitude, elevation, aspect, and landforms				
Duration	Severe weather hazards generally last hours; some conditions can persist for days				
Secondary Hazards	Secondary hazards can include the potential for avalanches, flooding, transportation failure, and infrastructure damage and failure, including power outages				
Analysis Used	National Centers for Environmental Information, National Weather Service, Utah Avalanche Center, Utah Division of Emergency Management, local input, and review of historical events and scientific records				

Magnitude/Extent

Although many of these events occur and cause little to no significant impact, there have been several occasions in the state's history that demonstrate the potential magnitude of these hazard events. There have been many other occasions where significant ice buildup has occurred, or 2 to 3 feet of snow has fallen along with gusts over 70 mph. In the Blizzard of 1997, up to 4 feet of snow fell in some places,

[195] Pixabay. https://pixabay.com/photos/snow-mountain-winter-nature-3304547/.

many avalanches were triggered, and gusts of up to 77 mph were experienced, resulting in 50 injuries, several deaths, and approximately $40 million in damage in the state.

The NWS Winter Storm Severity Index is a tool to assist forecasters in describing the possible significance of weather-related impacts of winter storms. It aims to convey the complexities and hazards associated with winter storms and the potential societal effects on the public. The classification tool and description of potential impacts are shown in Figure 156.

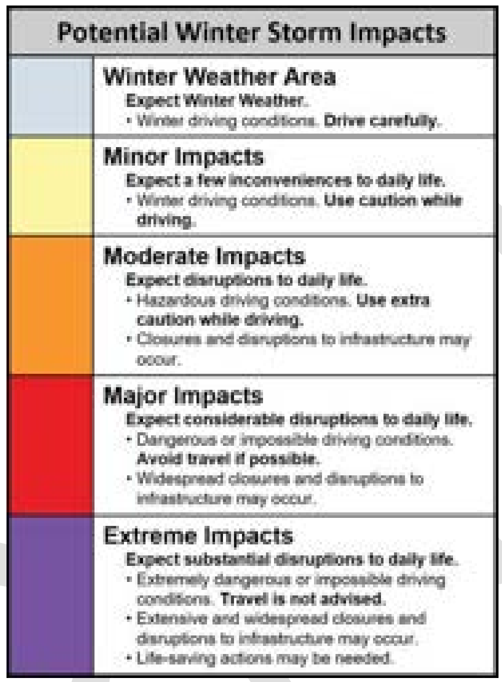


Figure 156: Winter Storm Severity Index

Location

Salt Lake County can be affected by severe winter weather events. A storm could affect the entire county or only a portion of it. Snow accumulation totals and other conditions vary with elevation, aspect, landforms, and other local variations.

Historical Events and Probability of Future Occurrences

Based on the FEMA Disaster Declarations Database, Salt Lake County has received no severe winter weather disaster declarations since the last plan update.

According to NOAA data from 1996 to 2024, there have been 477 days with a blizzard, ice storm, winter weather, or winter storm event, totaling 13 deaths, 267 injuries, and $47,096,000 in damage. However, 3 of the deaths, 50 of the injuries, and $40,000,000 of the damage occurred in one event on January 11, 1997. If this outlier is removed from the data, there is an average of approximately 0.43 deaths, 9.43 injuries, and $308,522 in property damage per year, although these averages are likely still skewed upwards by a small number of high-impact events. Based on the frequency of past events, future occurrences are highly likely.

On January 9, 2024, snow squalls developed and moved southward through Northern Utah during the evening hours on January 9 and January 10, impacting the evening commutes. Utah Highway Patrol reportedly responded to 101 vehicle accidents on January 9, and 143 vehicle accidents on January 10. A portion of these were included in estimates of $75,000 in property damage. Surprisingly, no injuries were reported with these accidents.

On March 7, 2002, a ferocious cold front moved across Northern Utah with lightning, small hail, and heavy snow. Very heavy snow along with strong winds made driving treacherous several hours after the frontal passage. Around 200 accidents occurred in the Salt Lake Valley on the 8th, with 2 weather-related traffic fatalities and about 50 injuries. Approximately $140,000 in damage were recorded. Some of the snow totals in the mountains included 31" at Alta, 26" at Snowbird, 25" at Solitude, 15" at Trial Lake, and 12" at Sundance. Snowfall in the valleys and benches included 8" in Holladay and Olympus Cove, 7" in Sandy City and Laketown, 6" in Centerville and Brigham City, and 5" at the Salt Lake City International Airport.

In the Blizzard of 1997, up to 4 feet of snow fell in some places, many avalanches were triggered, and gusts of up to 77 mph were experienced, resulting in 50 injuries, several deaths, and approximately $40 million in damage in the state. There have been many other occasions where significant ice buildup has occurred, or 2 to 3 feet of snow has fallen along with gusts over 70 mph.

HEAVY SNOW/LAKE EFFECT SNOW

According to NOAA data from 1996 to 2024, there have been 243 days with a reported heavy or lake effect snow event. There were 6 deaths, 161 injuries, and $3,272,950 in property damage from these hazards during this period. This averages to approximately one death every four years and seven injuries and $142,302 in property damage per year. However, most events cause no death, injury, or significant property damage and these averages are influenced by a small number of high-impact events.

On March 24, 2023, the snowpack in Salt Lake City was measured at 26", tying a decades-long record and making the winter of 2022–2023 one of the wettest in Utah's history, according to Natural Resources Conservation Service data. NWS reported the snowstorm delivered 4" in the valleys, with nearly 2 feet at the top of Little Cottonwood Canyon, and lake effect snow bands along the northern Wasatch Front and in parts of Salt Lake County.[196]

On February 18, 2018, the Salt Lake and Tooele Valleys saw widespread heavy snowfall. Snowfall totals included 25" in Sandy City, 23" in Cottonwood Heights, 17.5" in Tooele, 15" in Olympus Cove, and 14" in Taylorsville. On February 19, Tooele recorded 13" of snow, which broke the calendar day record of 8" set in 1945.

---

[196] Dunphey, Kyle. “The snowiest winter in decades continues, with more storms on the way.” Deseret News. March 24, 2023. https://www.deseret.com/utah/2023/3/24/23655000/utah-friday-storm-snowpack-record/.

On December 5, 1996, a storm system combined with a moist westerly flow to spread heavy snow to much of the state. The valleys received from 6 to 11", while the mountains received from 1 to 2 feet of snow. The highest total for the mountains was at the Park City ski resort in neighboring Summit County, where 23" accumulated. The wet snow helped trigger 6 avalanches during and shortly after the storm. A 37-year-old man snowmobiling near Bountiful Peak in neighboring Davis County was killed when he was overcome by one of these slides. There were also about 100 traffic accidents with 20 known injuries during this storm.

Climate Change Considerations

Utah State University Researcher and Assistant State Climatologist Jon Meyer stated that the jet stream—the fast and narrow current of air flowing from west to east that directs storms across the Western United States—has returned. After several years of the jet stream pushing many storms to the north or east of Utah, the jet stream has shifted and has had a major impact on winter weather conditions. The stronger winter storms are consistent with research undertaken by the Utah Climate Center that identified atmospheric dynamics that exist in the Western Pacific and define 6-year dry and wet phases for Northern Utah's weather. The winter storms begin as a Pacific low-pressure system, with moisture concentrated into narrow bands, which scientists refer to as atmospheric rivers—narrow corridors of much higher atmospheric humidity than in typical storms.[197]

Climate change can have a significant impact on severe winter weather in Salt Lake County by shortening the winter season due to higher temperatures. As temperatures rise, winters become milder, leading to fewer days with extreme cold temperatures and more precipitation falling as rain rather than snow. This shift will have an effect on water resources, as decreased snowpack will lead to a decline in the water supply. Milder winters will also have an impact on local ecosystems and winter recreational activities.

Secondary Hazards

The most significant secondary hazards associated with severe winter weather include structural damage from snow loads, wind damage, impacts on life safety, disruption of traffic, economic impact, loss of ability to evacuate, taxing first-responder capabilities, and disruption of services, such as power, water, and communications. Snow accumulation is often accompanied by a heightened risk of avalanche in the days following the storm.

Vulnerability Assessment

All residents, structures, and infrastructure systems in the planning area are vulnerable to severe winter weather. Winter storms occur frequently in Salt Lake County but with varying levels of severity and impacts.

---

[197] Jensen, Marcus. "State Climate Officer Explains the Winter Snow Surge and What It Means for Utah's Water Future." Utah State University, Utah State Today. January 17, 2023. https://www.usu.edu/today/story/?story=state-climate-officer-explains-the-winter-snow-surge-and-what-it-means-for-utahs-water-future.

The 2023 State Enhanced Hazard Mitigation Plan states that winter storms are considered deceptive killers because most deaths are indirectly related to the storm. Fatalities occur to individuals involved in traffic accidents caused by slick roads and are also the result of heart attacks brought on by the exertion of shoveling snow and hypothermia due to prolonged exposure to the cold. The NOAA reports that of all fatalities related to ice and snow, about 70% occur in automobiles and 25% are a result of people caught out in the elements. Most winter storm fatalities occur in males over age 40. Fifty percent of all exposure-related deaths are people over age 60 and more than 75% of victims are male. Some winter fatalities occur inside the home, primarily when people leave space heaters on, which then catch fire. Others die of carbon monoxide poisoning from furnaces or other heating devices that are not properly ventilated.[198]

All critical facilities are vulnerable to damage or reduced functionality due to severe winter weather, including all 218 county facilities, fire stations, police stations, schools, hospitals, and EOCs. Utilities, such as power and communications networks and transportation systems and road networks also are vulnerable.

ESTIMATED IMPACT AND POTENTIAL LOSSES

Disruptions to transportation networks from snowy, slick conditions or poor visibility are common during winter months. These can cause traffic delays throughout the valley. Vehicle collisions and slide offs are possible and may lead to injury. Emergency response can be delayed by traffic and poor driving conditions. Canyons and foothill areas tend to have higher snow accumulations due to higher elevation and roads may become impassable.

Severe storms may also contribute to power outages if distribution systems are damaged by wind or heavy snow and ice accumulation. Outages can be life-threatening to individuals who depend on electricity for life support. They can also disrupt operations for other utility services and communications networks and affect emergency response and other critical facilities. In addition, power outages can cause life-threatening situations if residents use alternative means to heat their homes without the use of proper ventilation.

Transportation delays from severe winter storms can have economic impacts by slowing the delivery of goods and services, delaying employees to report to work, and other reductions in business operations. Furthermore, power outages may contribute to losses if businesses cannot open until power is restored.

The NRI includes data on the EALs to individual natural hazards, historical loss, and overall risk at a county and census tract level. Salt Lake County’s NRI EAL value for winter weather is $1.1 million with a risk score classified as very high (97.9), compared with the rest of the United States (Figure 157). This value is primarily due to population loss (injuries or fatalities), monetized into a population equivalence value.

[198] Utah State Enhanced Hazard Mitigation Plan. 2024.

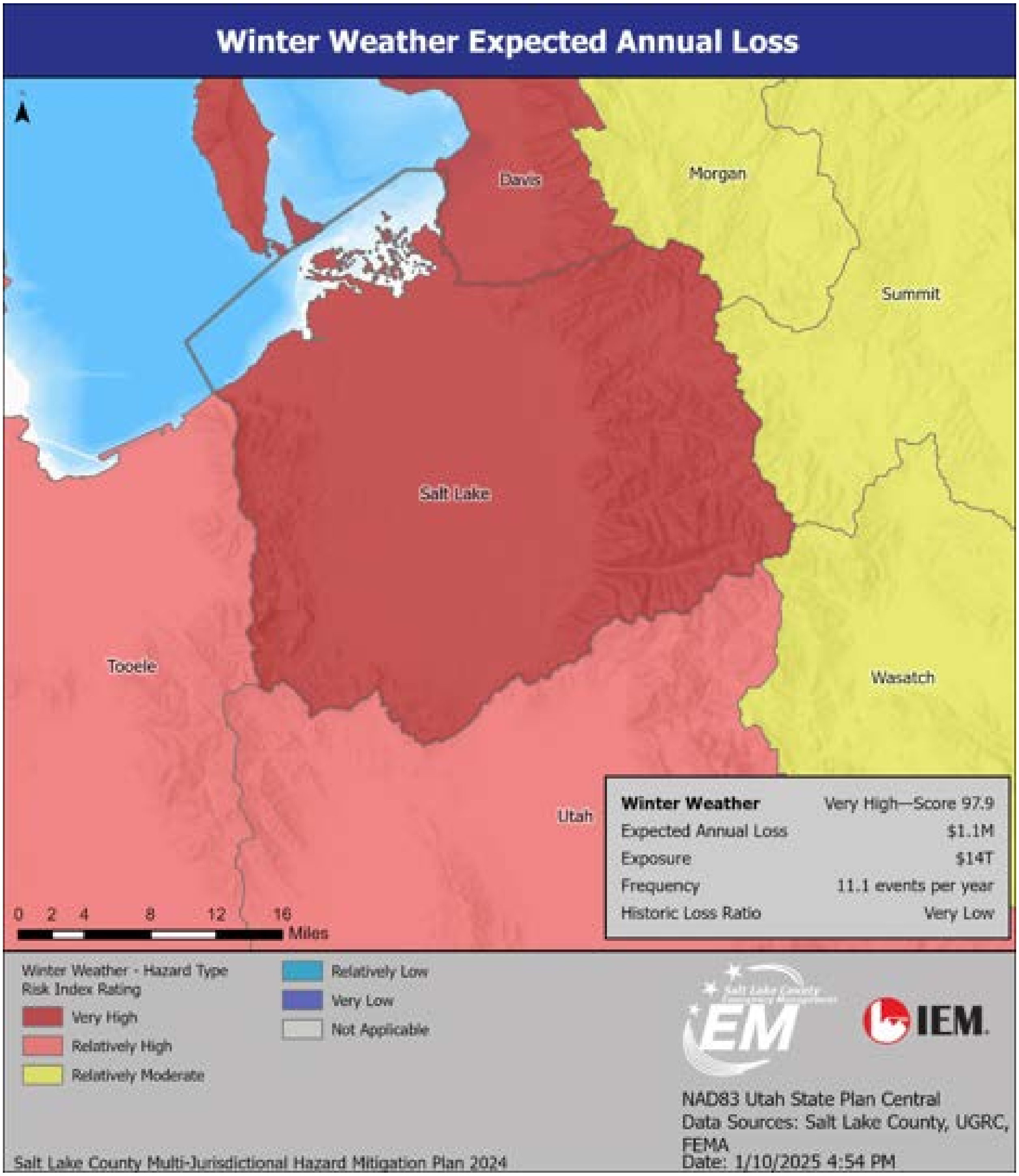


Figure 157: National Risk Index Expected Annual Loss from Winter Weather in Salt Lake County[199]

199 FEMA, National Risk Index. “Salt Lake County Expected Annual Loss Winter Weather Risk Score, Map and legend.” https://hazards.fema.gov/nri/map.

VULNERABLE POPULATIONS

Unhoused individuals and others without adequate shelter may be especially vulnerable to hypothermia or frostbite if exposed to the cold and wet conditions of winter storms. Motorists may become stranded in poor driving conditions and can also experience hypothermia if isolated for long periods, particularly if they leave their vehicles.

Some residents in canyon communities or on the benches may become isolated due to limited transportation routes, which may become impassable during or immediately following a storm. The elderly and persons with disabilities or life-threatening illnesses are particularly vulnerable if they depend on caregivers who cannot travel through winter storms. Power outages can be life-threatening to those dependent on electricity for life support.

Low-income households, linguistically isolated populations, and other disadvantaged groups tend to suffer greater losses during hazard events. They may be more severely impacted by interruption of services, economic losses, or lack of access to needed resources. Table 69 provides a breakdown of vulnerable populations for which data were available.

Table 69: Salt Lake County Vulnerable Populations[200]

Population Under 5	Population Over 65	Foreign Born	Language Other than English	Population with Disability	No Health Insurance	Population in Poverty
79,892	133,703	12.9%	21.6%	11.4%	9%	9.4%

COMMUNITY LIFELINES

Severe winter weather particularly disrupts transportation lifelines, and can also disrupt energy, communications, food, hydration and shelter, and safety and security lifelines. The importance of these lifelines cannot be overstated. In a disaster, communities can be left without access to necessities, such as food, water, and shelter. The lifelines help ensure that these needs are met and that people have the resources they need to survive. By providing access to medical care, public health services, and transportation, the lifelines help ensure that people can receive the care they need and safely evacuate if necessary. In addition, the Hazardous Materials lifeline helps to ensure that dangerous materials are managed safely, reducing the risk of further harm. Any or all of these lifelines could be disrupted following a severe winter storm. The severity of the storm may determine how long it will take to restore the various services. Community lifelines help create a sense of safety and security in a community. They provide a safety net for individuals who may be struggling and offer comfort and reassurance that help is available when needed. Without these lifelines, communities would be much more vulnerable to crises and emergencies.

[200] United States Census Bureau. "American Community Survey Data, Health." 2023. https://data.census.gov/profile/Salt_Lake_County,_Utah?g=050XX00US49035#health.

CHANGES IN DEVELOPMENT

Salt Lake County's development and population growth can increase the potential for damage and disruptions from severe winter weather. As the population grows, so does the demand for heating during the winter months, which can place a strain on the energy grid. An overall population increase in the county represents an increase in potential exposure to this hazard.

VULNERABILITY SCORE

The NRI was used as a primary tool during the 2024 HIRA update to analyze the county's vulnerability to severe winter weather. The NRI defines risk as the potential for negative impacts as a result of a natural hazard and determines a community's risk relative to other communities by examining the EAL and social vulnerability in a given community in relation to that community's resilience. Salt Lake County's NRI winter weather risk rating is shown in Figure 158. Salt Lake County is rated as having a very high winter weather risk, with a score of 97.4.

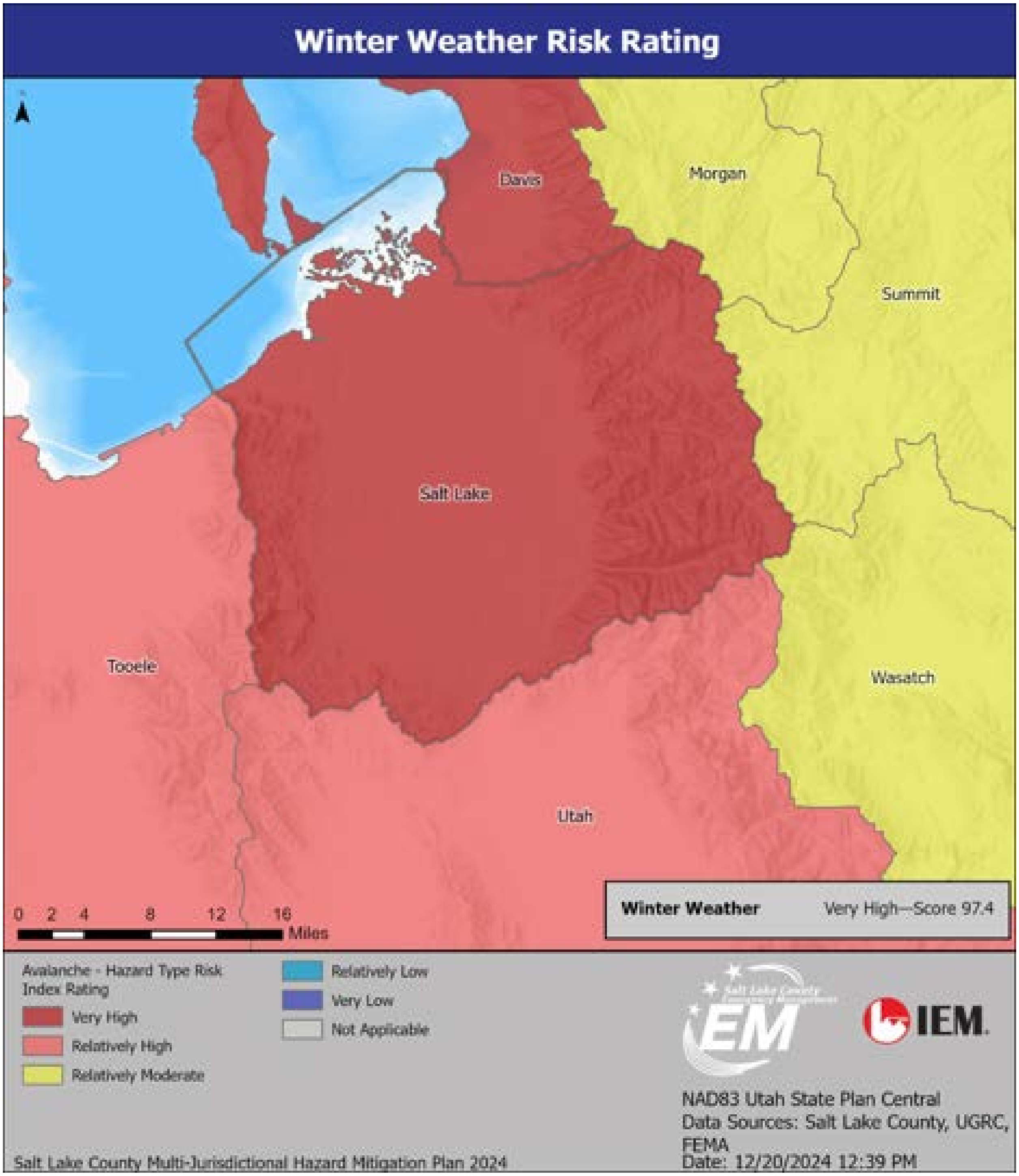


Figure 158: National Risk Index Winter Weather Risk Map, Rating, and Score for Salt Lake County[201]

201 FEMA, National Risk Index. "Salt Lake County Winter Weather Score, Map, and Legend." https://hazards.fema.gov/nri/map.

Tornado

Figure 159: Image of a Tornado[202]

Hazard Description

A tornado is a narrow, violently rotating column of air that extends from the base of a cumulonimbus cloud to the ground. The visible sign of a tornado is the dust and debris that is caught in the rotating column made up of water droplets. Tornadoes are the most violent of all atmospheric storms. The following are common elements in tornado formation:

- Very strong winds in the mid- and upper levels of the atmosphere
- Clockwise turning of the wind with height (i.e., from southeast at the surface to west aloft)
- Increasing wind speed in the lowest 10,000 feet of the atmosphere (e.g., 20 mph at the surface and 50 mph at 7,000 feet)
- Very warm, moist air near the ground with unusually cooler air aloft
- A forcing mechanism, such as a cold front or leftover weather boundary from previous shower or thunderstorm activity

Tornadoes can form from individual cells in severe thunderstorm squall lines or from an isolated super-cell thunderstorm. Weak tornadoes can sometimes form from air that is converging and spinning upward, with little more than a rain shower occurring in the vicinity. The most extreme tornadoes can attain wind

[202] https://en.wikipedia.org/wiki/File:Stovepipe_Tornado_near_Yuma,_Colorado.jpg.

speeds of more than 300 mph, stretch more than 2 miles across, and stay on the ground for dozens of miles.

Types of tornadoes include landspouts, multiple vortex tornadoes, and waterspouts. Other tornado-like phenomena that exist in nature include dust devils, fire whirls, and steam devils. Downbursts are frequently confused with tornadoes, though their actions are dissimilar.

Hazard Profile

Potential Impact		Catastrophic	**Probability**		Highly Likely
		Critical		X	Likely
	X	Limited			Occasional
		Negligible			Unlikely
Location	A tornado event is possible anywhere in the county.				
Seasonal Pattern	Most of tornado and funnel cloud activity in the county has occurred during the late spring to early fall period of the year.				
Conditions	Tornadoes can often form from individual cells in severe thunderstorm squall lines.				
Duration	Tornadoes can last from a few seconds to an hour, although most last less than 10 minutes.				
Secondary Hazards	Potential secondary hazards include hazardous material releases, structural fires, and infrastructure failure if key facilities are damaged.				
Analysis Used	National Centers for Environmental Information, local input, and review of historic events and scientific records.				

Magnitude/Extent

Tornadoes were originally categorized using the Fujita Scale (F-Scale) or Pearson Fujita Scale, introduced in 1971, based on a relationship between the Beaufort Wind Scales (B-Scales) (measure of wind intensity) and the Mach scale (measure of relative speed). The Fujita Scale is used to rate the intensity of a tornado by examining the damage caused by the tornado after it has passed over a human-made structure. The F-Scale categorizes each tornado by intensity and area. The scale is divided into six categories, F0 (Gale) to F5 (Incredible). Table 70 outlines each of the F-Scale categories.

Table 70: Fujita Tornado Damage Scale[203]

Scale	Wind Speed (mph)	Typical Damage
F0	<73	Light damage: Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged
F1	73–112	Moderate damage: Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads

[203] National Oceanic and Atmospheric Administration (NOAA) Storm Prediction Center. “Fujita Tornado Damage Scale.” https://www.spc.noaa.gov/faq/tornado/f-scale.html.

Scale	Wind Speed (mph)	Typical Damage
F2	11–57	Considerable damage: Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground
F3	15–06	Severe damage: Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown
F4	20–60	Devastating damage: Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated
F5	26–18	Incredible damage: Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yards); trees debarked; incredible phenomena

The primary limitations of the F-Scale rating system are a lack of damage indicators, no account of construction quality and variability, and no definitive correlation between damage and wind speed. These limitations have led to the inconsistent rating of tornadoes and, in some cases, an overestimate of tornado wind speeds. These limitations led to the development of the Enhanced Fujita Scale (EF-Scale) by the Texas Tech University Wind Science and Engineering Center and a national forum of meteorologists and wind engineers. The EF-Scale takes into account more variables than the original F-Scale did when assigning a wind speed rating to a tornado. The EF-Scale became operational on February 1, 2007.

Because the EF-Scale was revised from the original F-Scale to better reflect examinations of tornado damage, it considers how most structures are designed. Tornado ratings are assigned based on estimated wind speeds and related damage. When tornado-related damage is surveyed, it is compared with a list of Damage Indicators and Degree of Damage, which help better estimate the range of wind speeds produced by the tornado. From that, a rating is assigned, with six categories from EF0 to EF5, representing increasing degrees of damage. Table 71 lists the six categories of the EF-Scale.

The EF-Scale offers a set of wind estimates (not measurements) based on damage. Its uses three-second gusts estimated at the point of damage based on a judgment of eight levels of damage to the 28 indicators listed in Table 71. These estimates vary with height and exposure. Standard measurements are taken by weather stations in open exposures. Table 71 also describes the EF-scale ratings.

Table 71: Enhanced Fujita Scale for Tornado Damage[204]

EF-Scale Number	Intensity Phrase	Wind Speed (mph)	Type of Damage Done
EF0	Light tornado	65–85	Light damage: Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over

204 NOAA. Enhanced Fujita Scale for Tornado Damage. https://www.spc.noaa.gov/efscale/ef-scale.html.

EF-Scale Number	Intensity Phrase	Wind Speed (mph)	Type of Damage Done
EF1	Moderate tornado	85–110	Moderate damage: Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken
EF2	Significant tornado	111–135	Considerable damage: Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground
EF3	Severe tornado	136–165	Severe damage: Entire stories of well-constructed houses destroyed; severe damage to large buildings, such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance
EF4	Devastati ng tornado	166–200	Devastating damage: Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated
EF5	Incredible tornado	>200	Incredible damage: Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yards); high-rise buildings have significant structural deformation; incredible phenomena

Location

Some tornadoes can have wind speeds greater than 250 mph with a damage zone 50 miles long and greater than a mile wide. Currently, the most intense tornado in Utah's history has been an F3 on August 11, 1993, in the Uinta Mountains. No recorded tornado has been greater than an F2 in Salt Lake County specifically. However,. Although they are less common in the Intermountain Region, an average of three tornadoes per year occur in Utah. Examples are the Salt Lake City tornado August 11, 1999, and the Manti tornado in 2002. Most tornadoes in Utah typically have winds of less than 110 mph (F2 or smaller), are no wider than 60 feet, and are on the ground for no longer than a few minutes.

Tornado distribution for the region suggests many tornadoes are funnel clouds aloft encountering the increasing elevation of the region's foothills and mountains, as can be seen in Figure 160. Several of the tornadoes impacting Salt Lake County have specifically struck Magna City. A tornado event is possible anywhere in or immediately around the planning region, however.

Historical Events and Probability of Future Occurrences

Based on the FEMA Disaster Declarations Database, Salt Lake County has received no designation for tornado disaster declarations since the last plan update.

According to National Oceanic Atmospheric Administration (NOAA) data from 1965 to 2024 (60 years), there have been 1 death, 80 injuries, and $170,165,000 in property damage in Salt Lake County from 18 tornado or funnel cloud events—an average of one event every 3 years. However, the most recent recorded event occurred in 2001. This would indicate that, although a tornado remains possible in a given year, the expected frequency of this hazard for the near future is likely to be less than one event every 3 years. Based on this recurrence interval, the probability of a future tornado is likely.

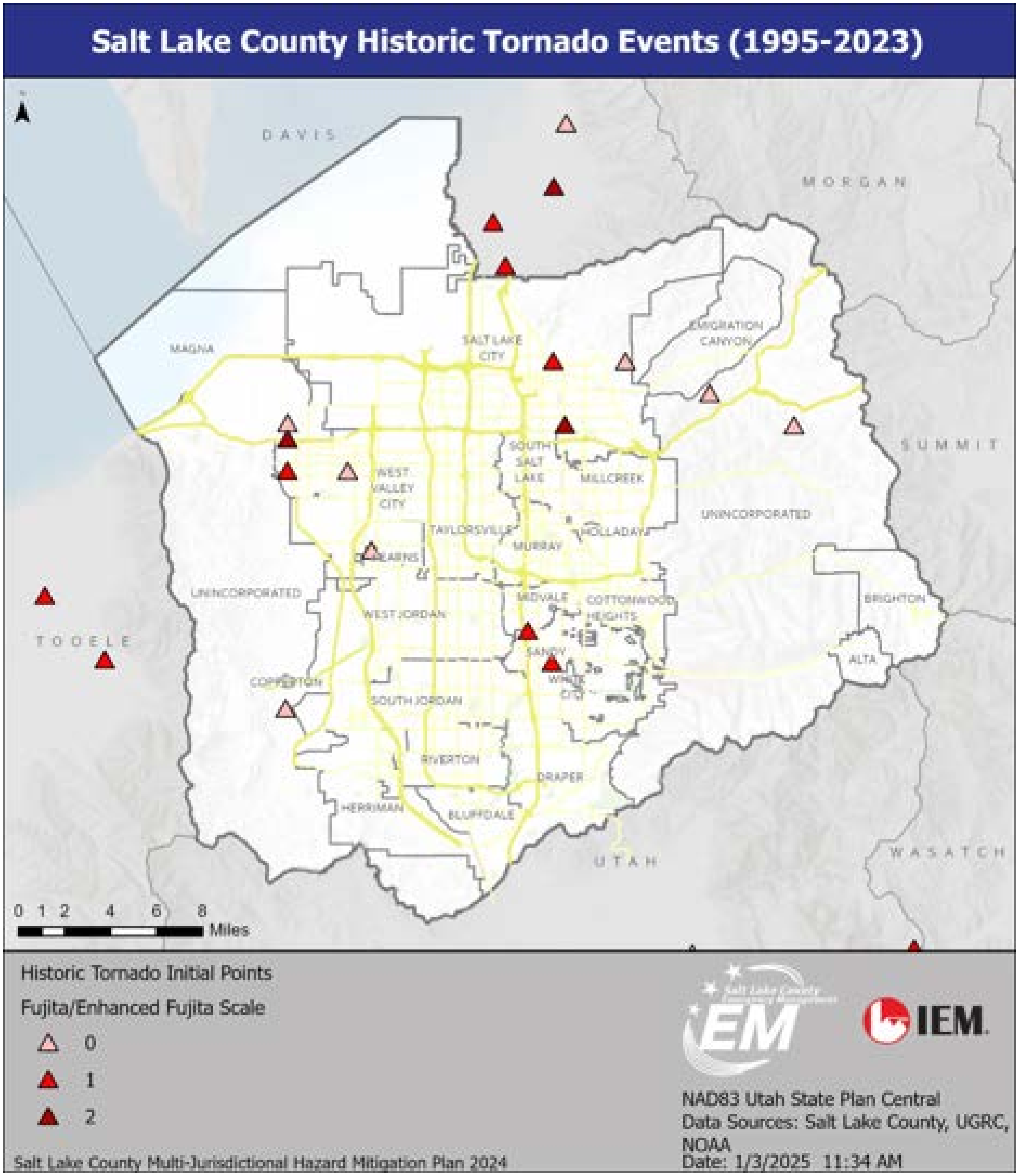


Figure 160: Tornadoes in Salt Lake County, 1995–2023

Historically, atmospheric conditions have not been favorable for tornado development in Utah due to a dry climate and mountainous terrain. Despite this fact, interactions of the relatively cool air of the Great Salt Lake and relatively warm air of urban areas could create situations more favorable for tornado development. This phenomenon possibly contributed to the formation of the August 11, 1999, Salt Lake City tornado.[205] Around lunch time, a tornado touched down in the southwest portions of Salt Lake City. The tornado intensified to an F2 on the Fujita scale and moved northeast through the metropolitan area of Salt Lake City. It caused widespread damage at the Delta Center, then ripped across an outdoor retailer's convention tent, where the lone fatality occurred along with many of the injuries. After blowing out many windows in the Wyndham Hotel, the tornado continued its northeast track, knocking down scaffolding and shearing off a crane where the Assembly Hall of the Church of Jesus Christ of Latter-Day Saints (LDS) was being constructed. Next, it skirted the Capitol, ripping out several large trees there and in historic Memory Grove. It then moved into the residential area known as The Avenues, damaging hundreds of trees and ripping the roofs off of several homes, before finally lifting back into the clouds. All told, there was 1 fatality, 80 injured, and 300 buildings and homes sustained damage, with 34 homes deemed uninhabitable. At least 500 trees were totally destroyed, with 300 more damaged. Many vehicles were damaged or totaled as well. The $170 million in damage caused by this tornado makes it the costliest disaster in Salt Lake County history. This event caused the only human losses to tornado events ever recorded in Salt Lake County.

Figure 161: Explosion of a Power Substation During a Tornado in Salt Lake City, August 11, 1999

[205] American Meteorological Society (AMS). "Tornadogenesis and Operational Considerations of the 11 August 1999 Salt Lake City Tornado as Seen from Two Different Doppler Radars." August 1, 2001. https://journals.ametsoc.org/view/journals/wefo/16/4/1520-0434_2001_016_0377_taocot_2_0_co_2.xml.

Figure 162: Path of a Tornado Across Salt Lake City, August 11, 1999[206]

Climate Change Considerations

The 2024 State Enhanced Hazard Mitigation Plan concludes that an ongoing trend in worsening tornado activity especially in this century is clearer, but little information exists to describe likely consequences for Utah.

Climate change can impact the frequency and intensity of tornadoes in Salt Lake County by altering atmospheric conditions. As temperatures increase, so do evaporation and moisture in the atmosphere. This creates favorable conditions for the formation of thunderstorms and tornadoes. The potential for tornado activity may increase due to climate change.

Secondary Hazards

Tornadoes can lead to widespread utility failure, thus exposing vulnerable populations to extreme temperatures. Tornado events may also be accompanied by strong thunderstorms, straight-line winds, and heavy rain, which can also cause significant property damage.

Vulnerability Assessment

Tornadoes are not confined to specific areas in the county, but they are generally more likely in the valley than in the mountains. Areas not directly impacted by a tornado can experience the disruption of water,

[206] https://en.wikipedia.org/wiki/1999_Salt_Lake_City_tornado#/media/File:1999_Salt_Lake_City_Tornado_path.jpg.

transportation, and communications systems and economic losses. All populations, structures, critical facilities, and infrastructure are vulnerable to the dangers posed by tornadoes. Tornadoes pose a significant threat to the safety of county residents. Individuals exposed to the storm can be struck by flying debris, falling limbs, or downed trees, causing serious injury or death. Tornadoes can cause significant structural damage and can destroy critical facilities and infrastructure.

ESTIMATED IMPACT AND POTENTIAL LOSSES

Tornadoes can cause substantial structural damage. Even lower intensity or magnitude tornadoes can damage roofs, siding, gutters, windows. Stronger tornadoes can completely destroy residences and other structures. Manufactured homes are more vulnerable than site-built structures and are likely to suffer extensive damage. Structures can also be damaged or crushed by falling trees, resulting in physical harm to the occupants. Tornadoes can destroy or make residential structures uninhabitable, and displaced residents may require public shelter or relocation. Large or intense tornadoes may result in a dramatic population fluctuation because people cannot return to their homes or jobs and must seek shelter and/or work outside the affected area.

Significant debris and downed trees can block roads and make it impossible for emergency response vehicles to access areas of the community. Downed power lines may make roadways unsafe, preventing first responders from answering calls for assistance or rescue.

Tornadoes often cause widespread power outages, increasing the risk to more vulnerable portions of the population who rely on power for health and/or life safety. Extended power outages can increase structure fires and/or carbon monoxide poisoning as individuals attempt to cook or heat their home with alternate, unsafe cooking or heating devices, such as grills.

First responders must enter the damaged area shortly after the tornado passes to begin rescue operations and to organize cleanup and assessment efforts; therefore, they are exposed to downed power lines, unstable debris, hazardous materials, and generally unsafe conditions, elevating the risk of injury to first responders and potentially diminishing emergency response capabilities. Damaged facilities, loss of communications, and damaged emergency vehicles and equipment may significantly impact emergency operations and services. When the community is affected by significant property damage, funding will be required for infrastructure repair and restoration, temporary services and facilities, overtime pay for responders, and day-to-day operating expenses. City or county departments may be damaged or destroyed, delaying response and recovery efforts for the entire community.

Tornadoes can lead to significant economic losses related to structural damage and disruption to services. Businesses that are uninsured or underinsured might have difficulty reopening, resulting in a net loss of jobs for the community and a potential increase in the unemployment rate. Extended restoration of roads and utilities may further slow economic recovery. Displaced residents may not be able to return to work immediately, further slowing economic recovery. Lost wages contribute to hardship for the population and affect lower-income households more severely.

Private sector entities that the city and its residents rely on, such as utility providers, financial institutions, and medical care providers, may not be fully operational and require assistance from neighboring communities until full services can be restored. Economic disruption negatively impacts the programs and services the community provides due to short- and long-term losses in revenue. Damage to infrastructure may slow economic recovery since repairs may be extensive and lengthy. Residential structures destroyed by a tornado may not be rebuilt for years, reducing the community's tax base.

Recreation activities may be unavailable, and tourism can be unappealing for years following a large tornado that has devastated directly related local businesses.

The economic and financial impacts of a tornado event on the community will depend on the scale of the event, what is damaged, costs of repair or replacement, lost business days in impacted areas, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event planning done by government, businesses, and citizens will contribute to the overall economic and financial conditions in the aftermath of a tornado event.

Critical facilities are the buildings, land, equipment, and activities provided on the public's behalf by government and/or private organizations. These facilities are important components to a municipality's quality of life. Critical Facilities are necessities for the health, safety, well-being, and stability of communities. Critical infrastructure systems are essential for life safety and economic viability, including transportation, power, communications, and water and wastewater systems (Figure 163). Any of these facilities and their associated functions can be damaged or disrupted by a tornado.

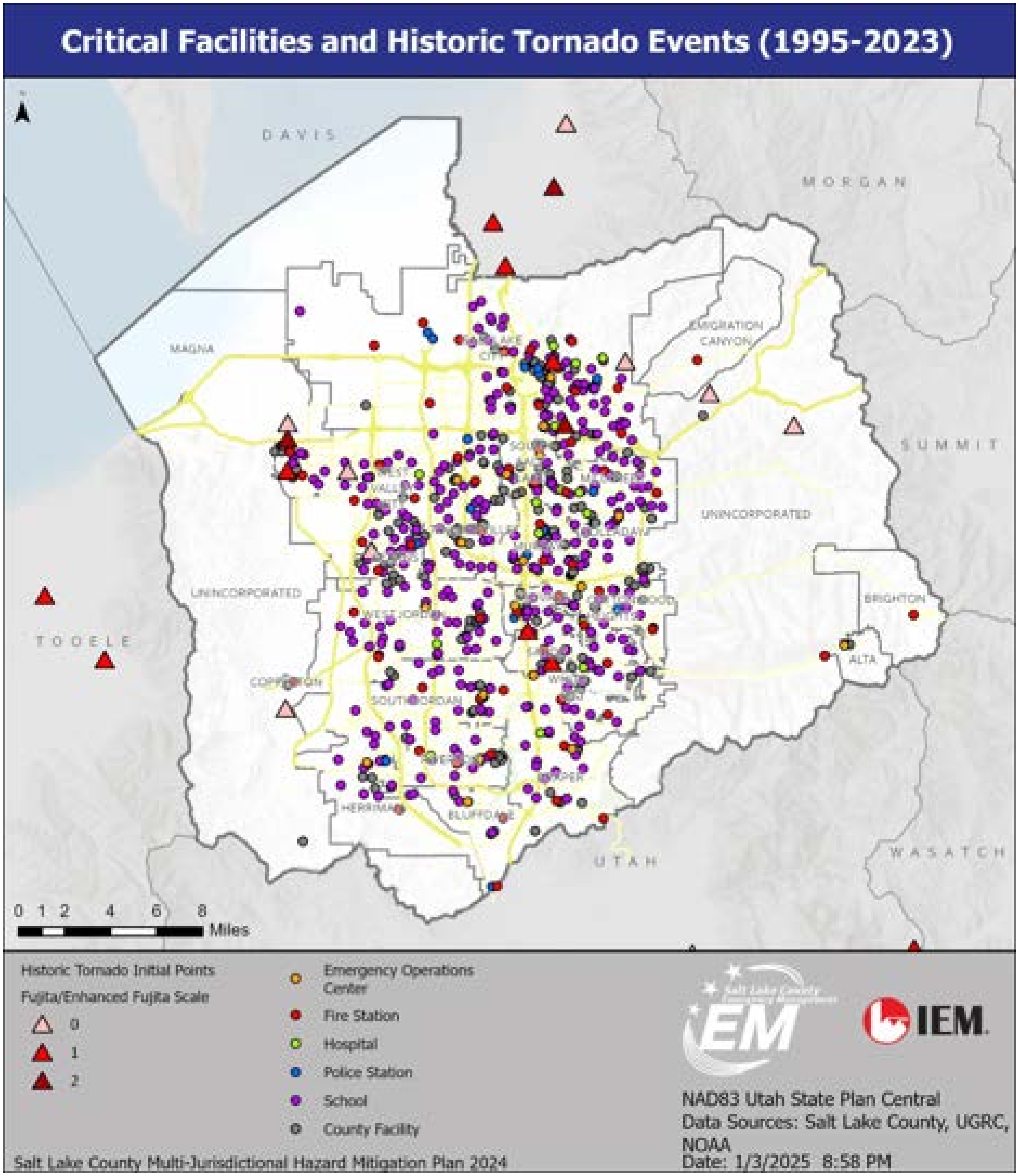


Figure 163: Critical Facilities in Relation to Tornadoes in Salt Lake County, 1995–2023

The NRI includes data on the EALs to individual natural hazards, historical loss, and overall risk at a county and census tract level. Salt Lake County's NRI EAL value for Tornado is $3.4 million with a risk score of 81.4 and a rating of "relatively moderate" compared with the rest of the United States (Figure 164).

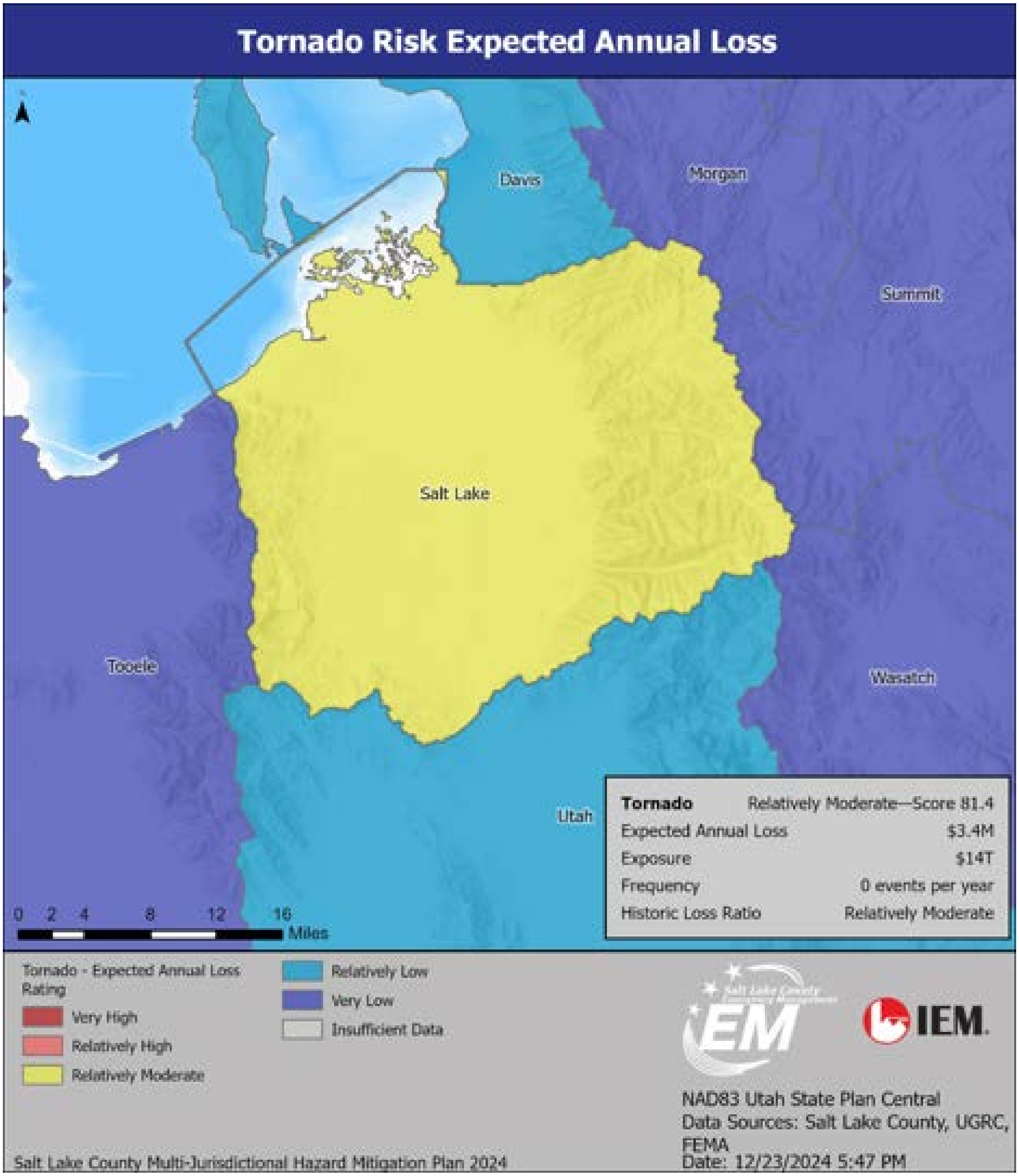


Figure 164: National Risk Index Expected Annual Loss from Tornadoes in Salt Lake County[207]

[207] FEMA, National Risk Index. "Salt Lake County Expected Annual Loss Tornado Risk Score, Map and Legend." https://hazards.fema.gov/nri/map.

VULNERABLE POPULATIONS

FEMA defines vulnerability as susceptibility to physical injury, harm, damage, or economic loss. Tornadoes can pose a significant risk to the population and can create dangerous situations. Providing and preserving public health and safety is often difficult. Impacts to vulnerable populations can include greater susceptibility to tornado impact, injuries and even death due to limited mobility and decreased ability to respond rapidly to tornado warnings or evacuate. Other barriers include the lack of a safe place to go during tornadoes.

The following populations are most vulnerable to a severe weather event, face isolation and exposure during severe storms, or could suffer more secondary effects of the hazard. The elderly and functional needs populations are considered most vulnerable because they require extra time or outside assistance to seek shelter and are more likely to seek or need medical attention, which may not be available due to isolation during or after an event. Those with a language barrier who might not be able to follow warning messages would be vulnerable as well. Those living in mobile homes would be especially vulnerable to injury from heavy winds and tornado activity. Table 72 provides a breakdown of vulnerable populations.

Table 72: Salt Lake County Vulnerable Populations[208]

Population Under 5	Population Over 65	Foreign Born	Language Other Than English	Population with Disability	No Health Insurance	Population in Poverty	Population in Mobile Homes
79,892	133,703	12.9%	21.6%	11.4%	9%	9.4%	7,199

The population in a car at the time of a tornado would also be vulnerable. According to the 2023 American Community Survey, 23.1 percent of the population in Salt Lake County transported to work by car, truck, or van.

COMMUNITY LIFELINES

Any or all of the lifelines could be disrupted following a tornado. The severity of the tornado may determine how long it takes to restore the various services. The importance of these lifelines cannot be overstated. In a disaster, communities can be left without access to necessities, such as food, water, and shelter. The lifelines help ensure that these needs are met, and that people have the resources they need to survive. By providing access to medical care, public health services, and transportation, the lifelines help ensure that people can receive the care they need and safely evacuate if necessary. In addition, the Hazardous Materials lifeline helps to ensure that dangerous materials are managed safely, reducing the risk of further harm. Any or all these lifelines could be disrupted following a tornado. Community lifelines help create a sense of safety and security in a community. They provide a safety net for individuals who may be struggling and offer comfort and reassurance that help is available when needed. Without these lifelines, communities would be much more vulnerable to crises and emergencies.

[208] U.S. Census Bureau. "American Community Survey Data." 2023. https://data.census.gov/profile/Salt_Lake_County,_Utah?g=050XX00US49035#health.

CHANGES IN DEVELOPMENT

The changes in development that would increase vulnerability of Salt Lake County to tornadoes would be increase in population since the last plan update. As more people and infrastructure are concentrated in the area, the potential for damage and disruption of services from tornadoes can increase. Urbanization can also create wind tunnels and increase the potential for wind damage in high-density areas.

The 2024 State Enhanced Hazard Mitigation Plan states Salt Lake County is one of the fastest growing counties in the state in terms of percent increase, and because of this, more and more people and assets are being exposed to severe weather hazards, thus potentially increasing vulnerability to certain hazards.[209] Although the likelihood of a tornado is unchanged, an increase in population represents an increase in vulnerability to tornadoes since the last plan update.

VULNERABILITY SCORE

To analyze the county's vulnerability to tornadoes, the NRI was used as a primary tool during the 2024 Hazard Identification & Risk Assessment (HIRA) update. The NRI defines risk as the potential for negative impacts because of a natural hazard and determines a community's risk relative to other communities by examining the EAL and social vulnerability in each community in relation to that community's resilience. Salt Lake County's NRI Tornado risk rating is shown in Figure 165. Salt Lake County has relatively moderate Tornado risk and a risk score of 78.5.

[209] Utah 2024 State Enhanced Hazard Mitigation Plan.

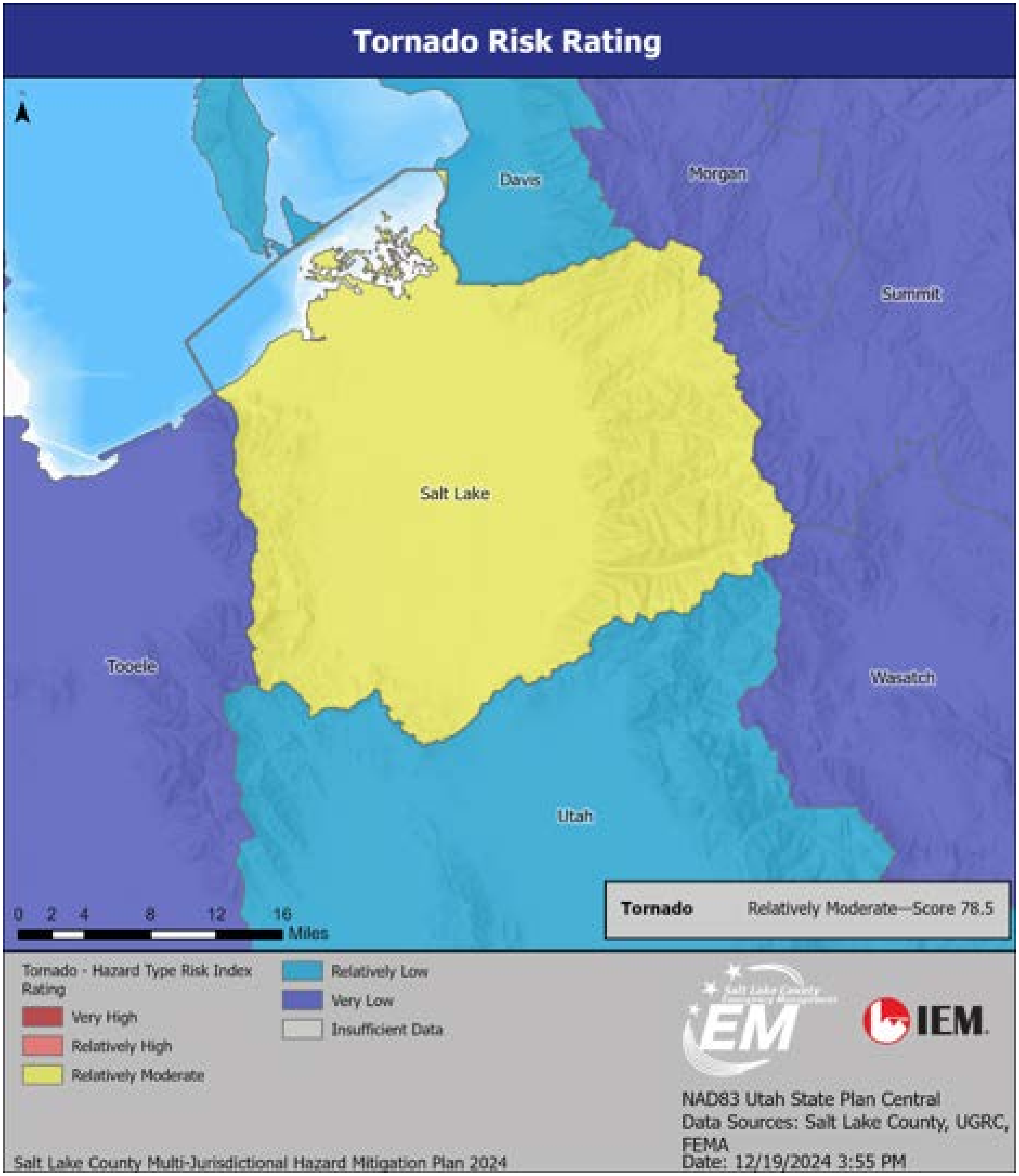


Figure 165: National Risk Index Tornado Risk Map, Legend, and Score for Salt Lake County[210]

[210] FEMA, National Risk Index. "Salt Lake County Tornado Score, Map and Legend." https://hazards.fema.gov/nri/map.

Wildfire

Hazard Description

Figure 166: Wildland Firefighters at Work

Fire is a natural process in wildland areas. However, wildfires are particularly concerning in the wildland–urban interface (WUI). The WUI is the line, location, or zone where structures or other human development meet or intermingle with undeveloped wildland or vegetative fuel. Examples include homes, storage sheds, recreational facilities, transmission lines, and other buildings. Significant human development has occurred in the WUI in Salt Lake County, leading to many residents occupying fire-prone areas. Approximately 65 percent of Utah's wildfires are started by lightning, although 35 percent are initiated by human activity.

Wildfire removes vegetation that protects soil from excessive rainfall and the resulting runoff. It also damages soil by making it hydrophobic or water-repellent. These conditions contribute to the depletion of wildlife resources, soil erosion, water runoff, and, in some cases, severe slope failures and debris flows. Past wildfires in Salt Lake County have also significantly impacted watersheds. State and local agencies have worked together to enhance ordinances and other measures to protect watersheds in the county.

Providing adequate fire protection in the WUI can be difficult. Local suppression methods and resources may not be suited to wildfire suppression, and personnel can become easily overwhelmed when multiple structures are threatened simultaneously. The energy output from a wildfire can make protecting homes nearly impossible and pose tremendous danger to firefighters and homeowners.

The three conditions that affect fire behavior are topography, vegetation, and weather.

- **Topography:** Topography includes factors, such as slope, aspect, and elevation. Fires spread faster upslope due to the proximity of fuel to flames. Aspect also influences fuel moisture content. Fuels tend to be drier on south- and west-facing slopes. Higher elevations are associated with cooler temperatures, higher relative humidity, and changes in vegetative fuel types.
- **Vegetation:** The type of surrounding vegetation significantly influences how quickly a fire will spread. For example, light grasses burn rapidly, whereas heavy, dense fuels like Douglas Fir burn slowly but more intensely. Different fuels vary in their rates of spread, intensity, and resistance to control.

Size, continuity, and compactness also affect the fuel's rate of spread. Large fuels do not burn as readily as small fuels and take more heat to ignite. Small fuels ignite more easily, allowing fire to spread rapidly. Continuity describes how a fuel is arranged horizontally. Fuel broken up in patches burns unevenly and more slowly than uniform fuels. Compactness refers to how fuel is placed vertically. Compact fuels burn more slowly than tall, deep fuels, which have greater access to oxygen.

- **Weather:** Weather (temperature, humidity, precipitation, and wind) affects how easily a fuel ignites, how intensely it burns, and how easy it is to control. High temperatures heat fuels and reduces water content, which increases flammability. A decrease in relative humidity causes a proportionate reduction in fuel moisture, promoting easier ignition and more intense burning. The wind carries the heat from a fire into unburned fuels, drying them out and causing them to ignite more easily. The wind can also blow embers into unburned areas ahead of the primary fire, potentially starting spot fires.

Figure 167 illustrates the key factors contributing to an area's wildfire vulnerability: vegetation and fuel sources, topography, and weather conditions.[211] Possible ignition sources should also be considered. Many wildfires in Utah are caused by lightning, but more are due to human influences. Most human-caused wildfires are accidental ignition from faulty electrical systems or damaged power lines, sparks from vehicles or machinery, improperly extinguished campfires, or weed burning. Wildfire can also be caused by intentional acts of arson.

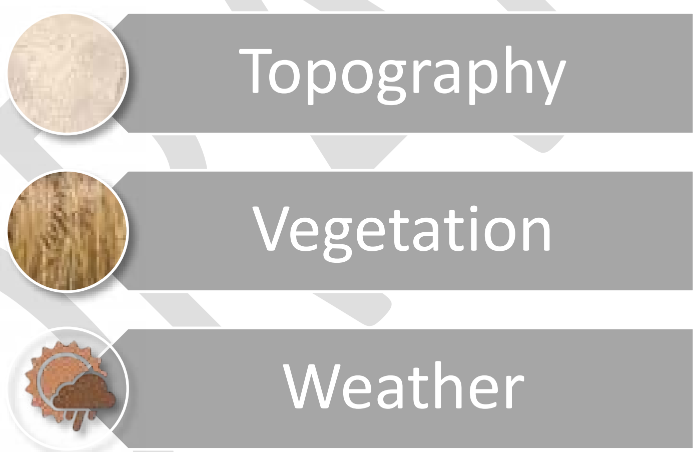


Figure 167: Key Factors of an Area's Vulnerability to Wildfire

Hazard Profile

Potential Impact		Catastrophic	**Probability**	X	Highly Likely
	X	Critical			Likely
		Limited			Occasional
		Negligible			Unlikely
Location	Wildland–urban interface (WUI) zones near the foothills and in forested areas; WUI in canyons in the Wasatch, Oquirrh, and Traverse Mountains;				

[211] First Street. "Does Salt Lake County have Wildfire Risk?" https://firststreet.org/county/salt-lake-county-ut/49035_fsid/fire.

	undeveloped areas along the Jordan River; and undeveloped islands in urban areas (Dimple Dell)
Seasonal Pattern	June–October
Conditions	Areas affected by drought, heavily overgrown and dry brush and debris, lightning, and human triggers
Duration	Days to months, depending on the climate, fuel load, and available resources (financial, manpower) to extinguish the fire
Secondary Hazards	Debris flows, erosion, traffic accidents, air pollution, destruction of natural resources
Analysis Used	Review of plans and data provided by the US Forest Service, Utah Division of Forestry, Fire, and State Lands, FEMA, Utah Geospatial Resource Center, Utah Wildfire Risk Assessment Portal, and Utah Division of Emergency Management

Magnitude/Extent

Utah uses the following fire danger rating scale:[212]

- **Low:** Grasses and brush are not easily ignited by small firebrands. Dead and down timber fires spread slowly along the ground with little danger of spotting.
- **Moderate:** Fire in open grasslands can burn briskly and spread rapidly on windy days. Timber fires spread at a slow to moderate pace.
- **High:** Fires can ignite easily from various causes. Unattended brush and campfires are prone to escape, and fire spreads rapidly, with short distance spotting common.
- **Very High:** Fires ignite easily from any cause, spreading rapidly immediately after ignition and intensifying quickly. Spot fires that start new fires are a constant danger.
- **Extreme:** All fires are potentially serious because they ignite, spread, and burn intensely. It is often too dangerous for firefighters to use direct attack suppression tactics.

Location

The areas of Salt Lake County most likely to experience significant destruction from a wildland fire include the foothills and bench areas on or near the Wasatch Range, Traverse Mountain, and the Oquirrh's. These WUI areas are most susceptible due to the amount of forested lands and the increasing population growth spreading into the foothills. Another area concern is vegetation type, such as sagebrush, mountain scrub oak, cheatgrass, pinyon and juniper trees, and riparian vegetation. Sagebrush and mountain shrubs in the county burn hot and fast and spread quickly. During prime burning conditions (hot, dry, and windy), the pinyon-juniper class is also prone to burning.

As population growth continues, the pressure to develop in WUI areas will likely increase the threats associated with wildfire. To reduce these threats, mitigation measures must be identified and enforced. The Risk to Potential Structures map (Figure 168) represents the likelihood of a wildfire and fire intensity,

---

[212] Utah Fire Info. "Fire Danger." https://utah-fire-info-utahdnr.hub.arcgis.com/pages/fire-danger.

with generalized consequences for a home on each pixel. For every location on the landscape, it poses the hypothetical question, “What would be the relative risk to a house if one existed here?” This allows for comparing wildfire risk between areas with existing homes and areas where new construction may be proposed.[213]

[213] Utah Wildfire Risk Assessment, Salt Lake County Summary Report. https://wildfirerisk.utah.gov/.

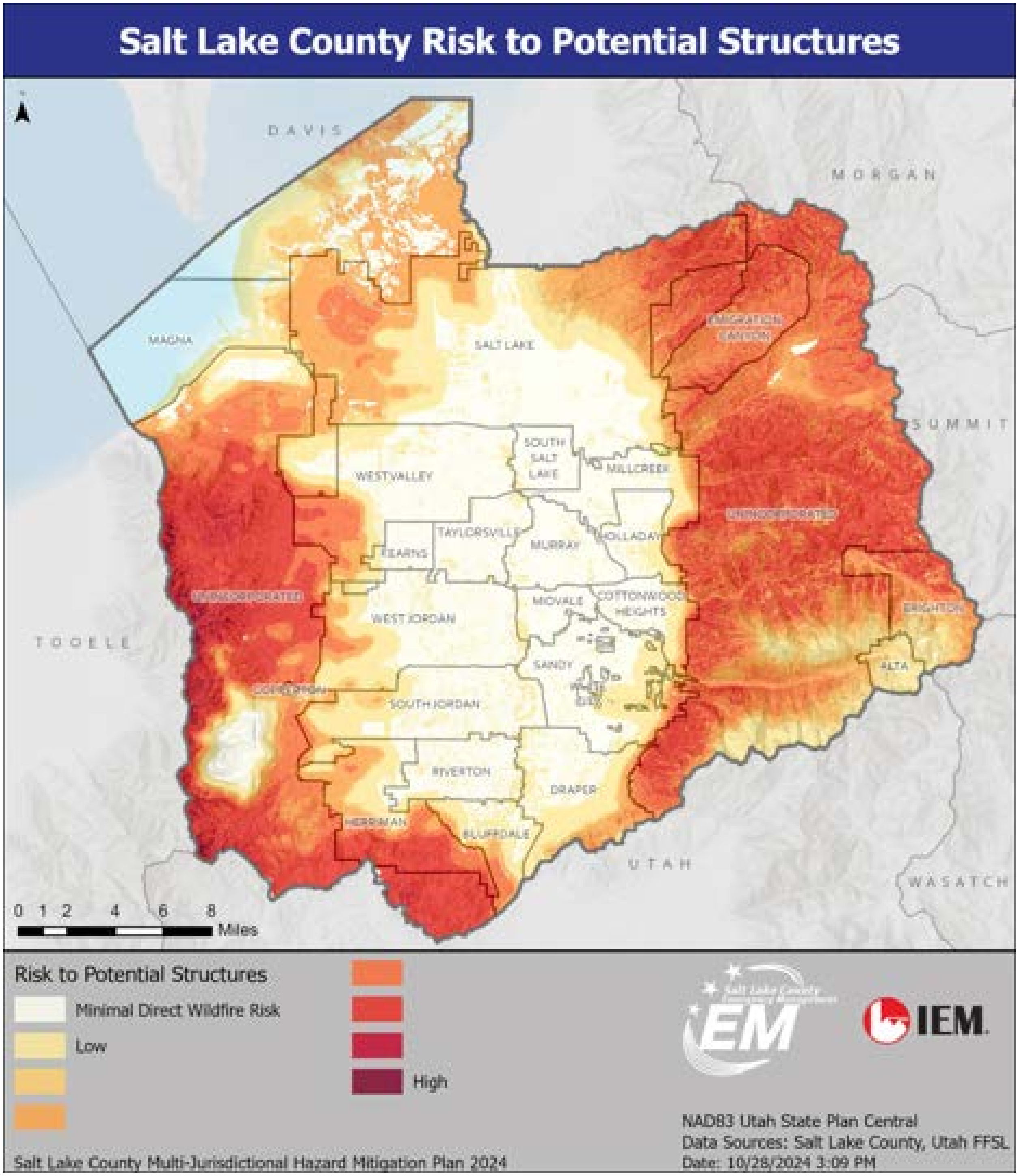


Figure 168: Wildfire Risk to Potential Structures

Figure 169 shows the wildfire hazard potential for Salt Lake County, based on the Utah Wildfire Risk Explorer. This index quantifies the relative potential for wildfires that may be difficult to control and can be used to prioritize areas where fuel treatments are needed.

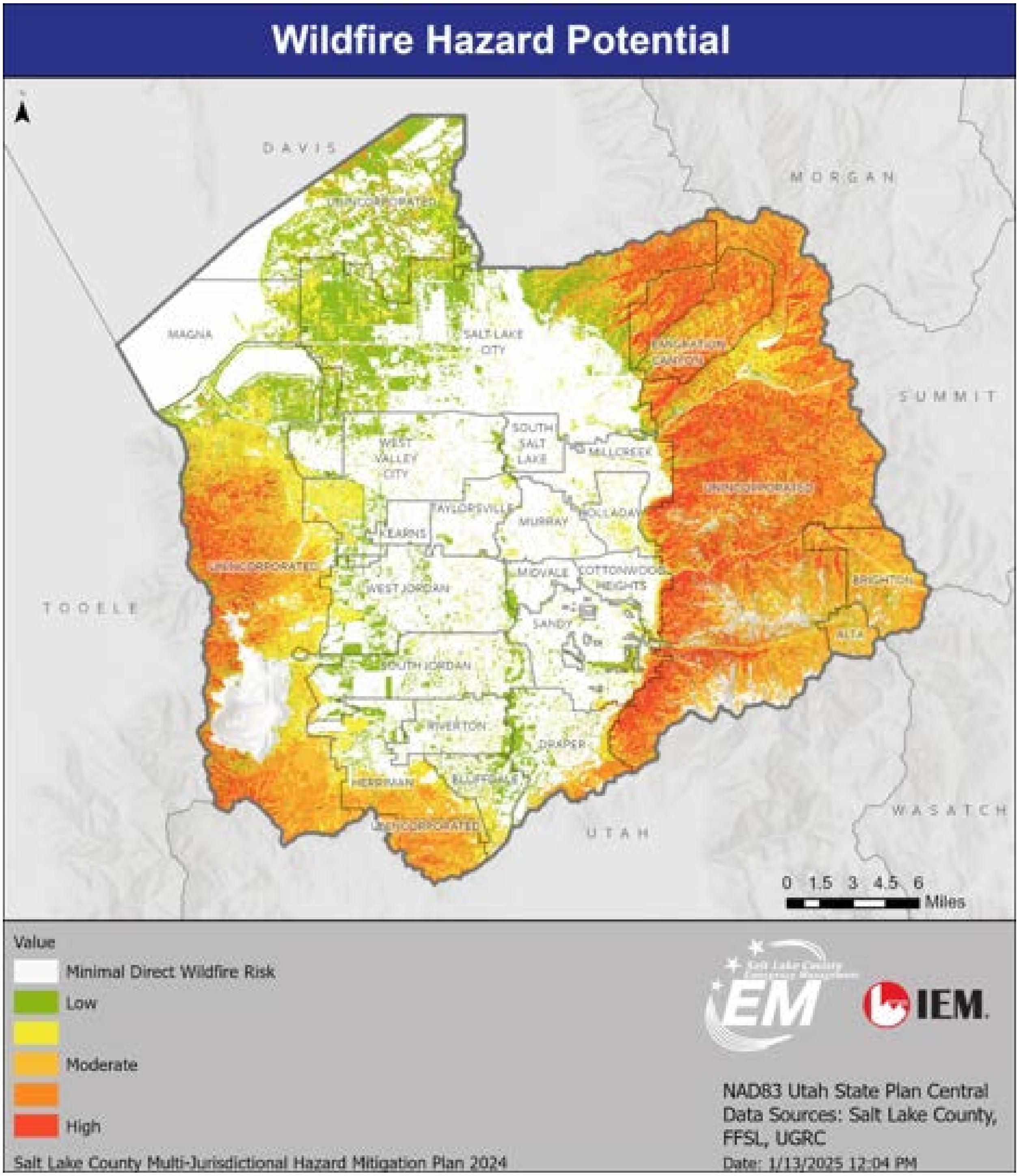


Figure 169: Wildfire Hazard Potential[214]

[214] Ibid.

Table 73: Wildfire Hazard Potential Area by Category

	Wildfire Hazard Potential Category	Acres	Percent
	Minimal Direct Wildfire Impacts	223,886	43.3 %
	Very Low	0	0.0 %
	Low	6,231	1.2 %
	Moderate	51,345	9.9 %
	High	122,449	23.7 %
	Very High	112,591	21.8 %
	Total	**516,502**	**100.0 %**

Historical Events and Probability of Future Occurrences

According to FEMA's Disaster Declarations database, Salt Lake County experienced one federally declared wildfire disaster on August 14, 2021.[215] According to NOAA, there have been 18 wildfire events in Salt Lake County from 2010 to 2024 (Salt Lake and Tooele Valleys, Great Salt Lake Desert and Mountains, Wasatch Mountains I-80 North, Wasatch Mountains South of I-80, Great Salt Lake Desert and Mountains, Salt Lake Valley, Wasatch Mountains I-80 North, Wasatch Mountains South of I-80). Figure 170 shows additional data from Utah Forestry Fire and State Lands, including fire perimeters and fire origin points from 1999 to 2020.

[215] FEMA, Disaster Declarations for States and Counties." https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties.

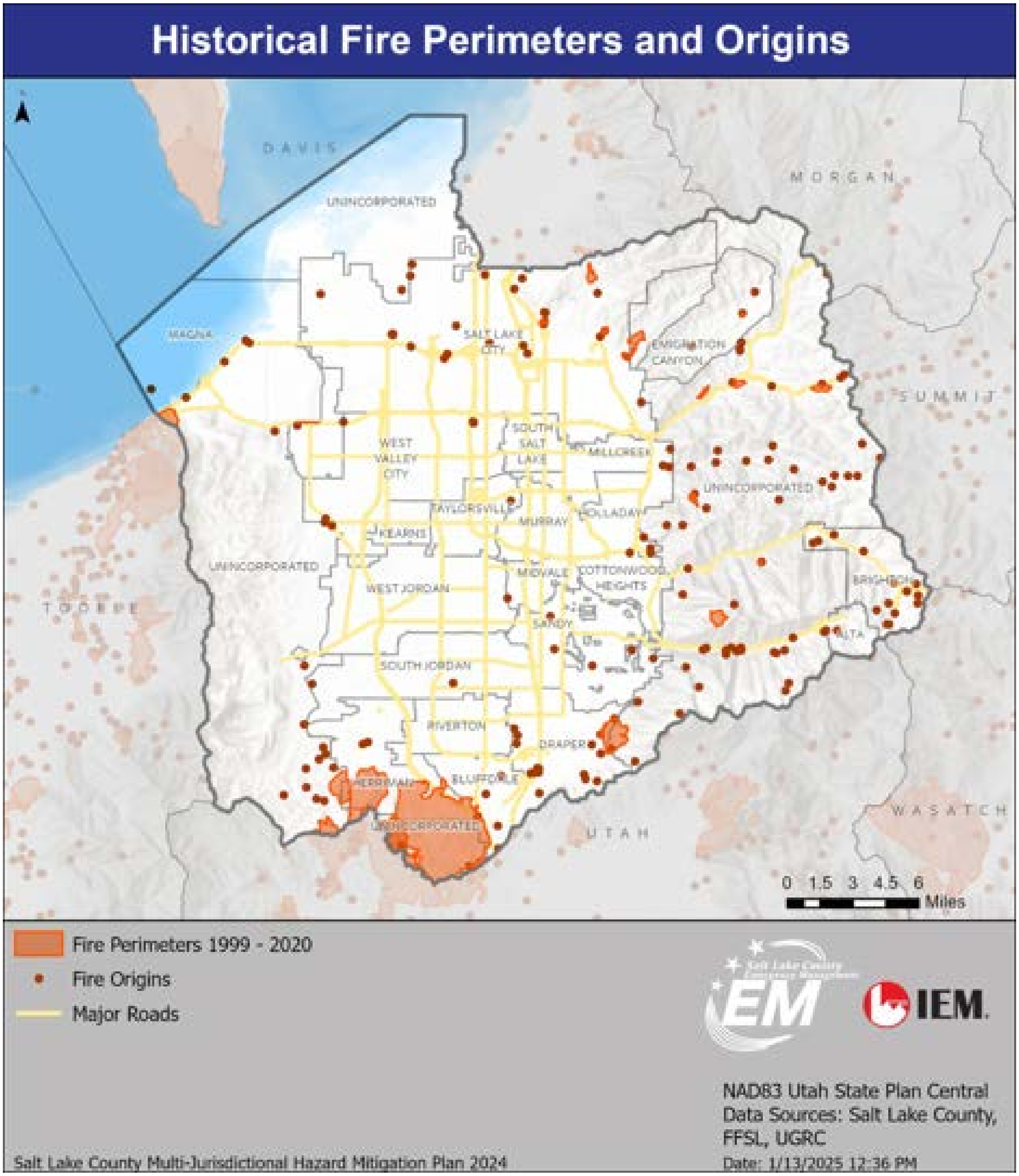


Figure 170: Historical Fire Perimeters and Origin Points

Figure 171 presents data on human-caused wildfires and the number of fires from October to May by year. Figure 172 shows the frequency of fires by month and whether a local, state, or federal agency reported them.

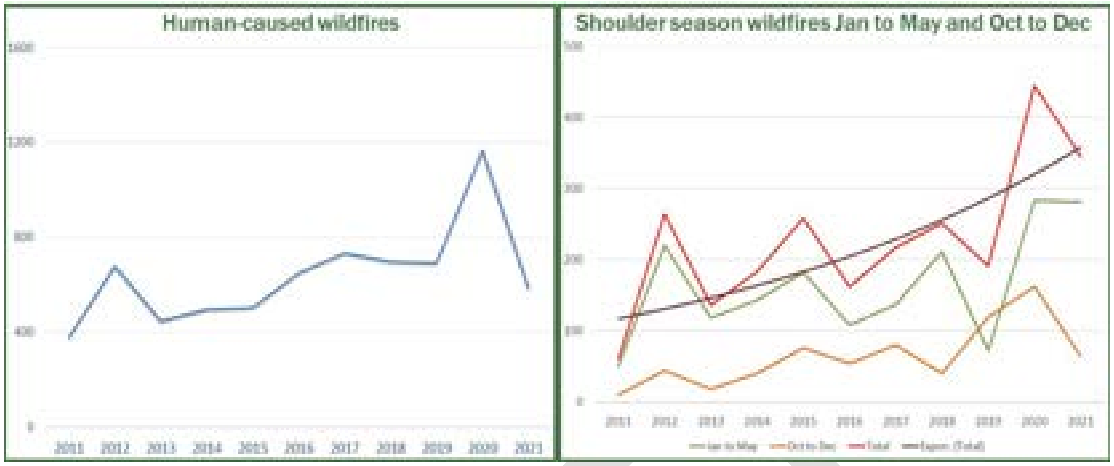


Figure 171: Wildfire Data for Utah, 2011–2021[216]

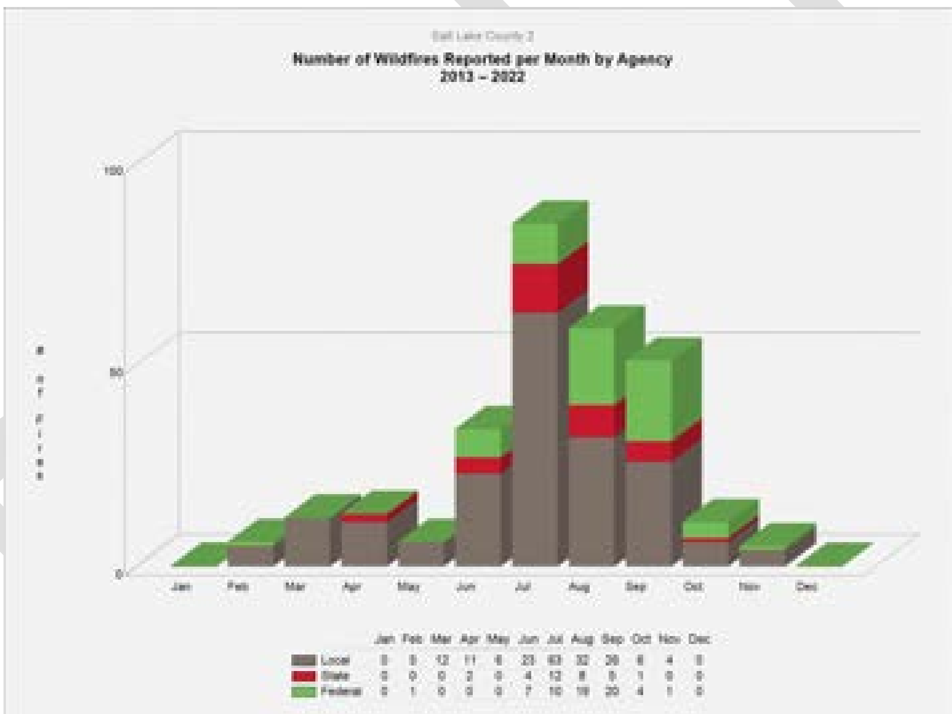


Figure 172: Number of Wildfires Reported per Month by Agency[217]

Several notable wildfires have occurred in Salt Lake County recently. On July 20, 2024, the Sandhurst Fire began near Ensign Peak above the Utah Capitol building in northern Salt Lake City. Several roads were closed to allow emergency response crews access. Twenty-two homes were evacuated, and several radio towers and the City Creek watershed protection were a concern. The fire burned 203 acres before it was contained.

[216] Utah Division of Forestry, Fire, and State Lands. “Fire Program Overview and Strategic Plan.” 2022. https://ffsl.utah.gov/fire/catastrophic-wildfire-risk-reduction/.
[217] Utah Wildfire Risk Explorer. “Area of interest summary report for Salt Lake County.” https://wrap.wildfirerisk.utah.gov/.

On August 14, 2021, sparks from a vehicle started a fire in Parley's Canyon. Thousands of homes were evacuated near Lambs Canyon, Mill Creek Canyon, and Summit Park in neighboring Summit County. Interstate I-80 was temporarily closed to traffic. The fire was initially estimated at over 2,000 acres, but more accurate mapping indicated that the fire burned 538 acres. No structures were destroyed.

The Neff's Canyon fire in the Mount Olympus Wilderness area burned from September through October 2020, scorching over 60 acres. The timber and oak brush fire started about 1 mile up the Neff's Canyon trail when a lightning strike ignited underground embers, which smoldered for days before spreading to nearby foliage. More than 150 firefighters were involved in the initial efforts to combat the fire, creating firebreaks and clearing debris.

Containment of the fire was slow in the early weeks, primarily due to the difficult terrain of the canyon, which made it challenging for fire managers to access steep and rocky areas with equipment and personnel. Ultimately, the fire was extinguished in October, aided by a rainstorm.[218] In April 2015, a brush fire occurred in the Avenues area of Salt Lake City. Another fire occurred in Herriman City in 2016, destroying two homes and causing evacuations. In neighboring Tooele County, the Dollar Ridge Fire destroyed 90 homes. These fires prompted significant fire responses, required many citizens to evacuate, and created the threat of debris flows in the following years. The Dollar Ridge Fire received a Fire Management Assistance Declaration.

According to historical averages, there is a nearly 100 percent chance of a wildfire occurrence in the next year. As previously stated, NOAA data indicate that there have been 14 recorded days with a wildfire event in Salt Lake County from 2010 to 2024. This averages out to approximately one wildfire event every year. The USDA Forest Service ranks the wildfire potential for most of Salt Lake County as "Very High" or "High" (see Figure 173).

[218] The City Journals, "Neff's Canyon Fire Awakens Residents to Dangers of the Wildland Urban Interface." https://www.holladayjournal.com/2020/10/26/332713/neff-s-canyon-fire-awakens-residents-to-dangers-of-the-wildland-urban-interface.

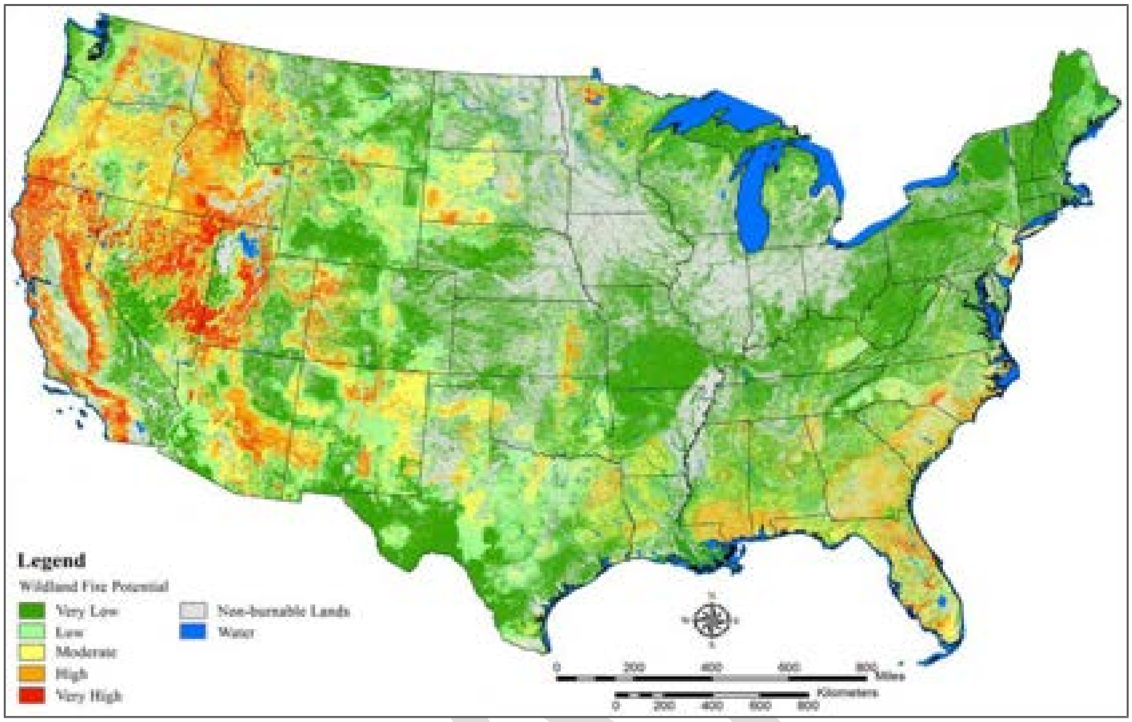


Figure 173: Wildland Fire Potential in the United States[219]

Figure 174 shows another measure of fire probability based on the Utah Wildfire Risk Assessment. Burn probability is the annual probability of a wildfire burning in a specific location. It is based on fire behavior models that simulate thousands of possible fire seasons. These simulations are based on past observations and include factors, such as the probability of a fire occurring, weather, topography, and ignition. It does not predict or forecast fire danger conditions nor represent information about the potential intensity of a fire if one occurs.[220]

[219] From Dillon, Greg, et al. "Fire Potential: A Tool for Assessing Wildfire Risk and Fuel Management Needs." Proceedings of the Large Wildland Fires Conference. US Forest Service. 2015. https://www.fs.usda.gov/rm/pubs/rmrs_p073/rmrs_p073_060_076.pdf.

[220] Utah Wildfire Risk Explorer. "Area of interest summary report for Salt Lake County." https://wrap.wildfirerisk.utah.gov/Map/Pro#map-themes.

Figure 174: Burn Probability in Salt Lake County

Table 74: Burn Probability Categories and Acreage[221]

	Burn Probability Category	Acres	Percent
	Minimal Direct Wildfire Impacts	147,845	28.6 %
	0 to 1-in-46,425	45,128	8.7 %
	1-in-46,425 to 1-in-10,000	6,906	1.3 %
	1-in-10,000 to 1-in-4,643	9,294	1.8 %
	1-in-4,643 to 1-in-2,154	13,335	2.6 %
	1-in-2,154 to 1-in-1,000	21,691	4.2 %
	1-in-1,000 to 1-in-464	33,454	6.5 %
	1-in-464 to 1-in-215	62,428	12.1 %
	1-in-215 to 1-in-100	128,477	24.9 %
	1-in-100 to 1-in-10	47,728	9.2 %
	> 1-in-10	215	0.0 %
	Total	516,501	100.0 %

The probability of extreme fire behavior (Figure 175) represents the likelihood of flame lengths exceeding 11 feet, considered the threshold for extreme fire behavior during fire operations.[222]

[221] Ibid.
[222] Utah Wildfire Risk Explorer. https://wrap.wildfirerisk.utah.gov/Map/.

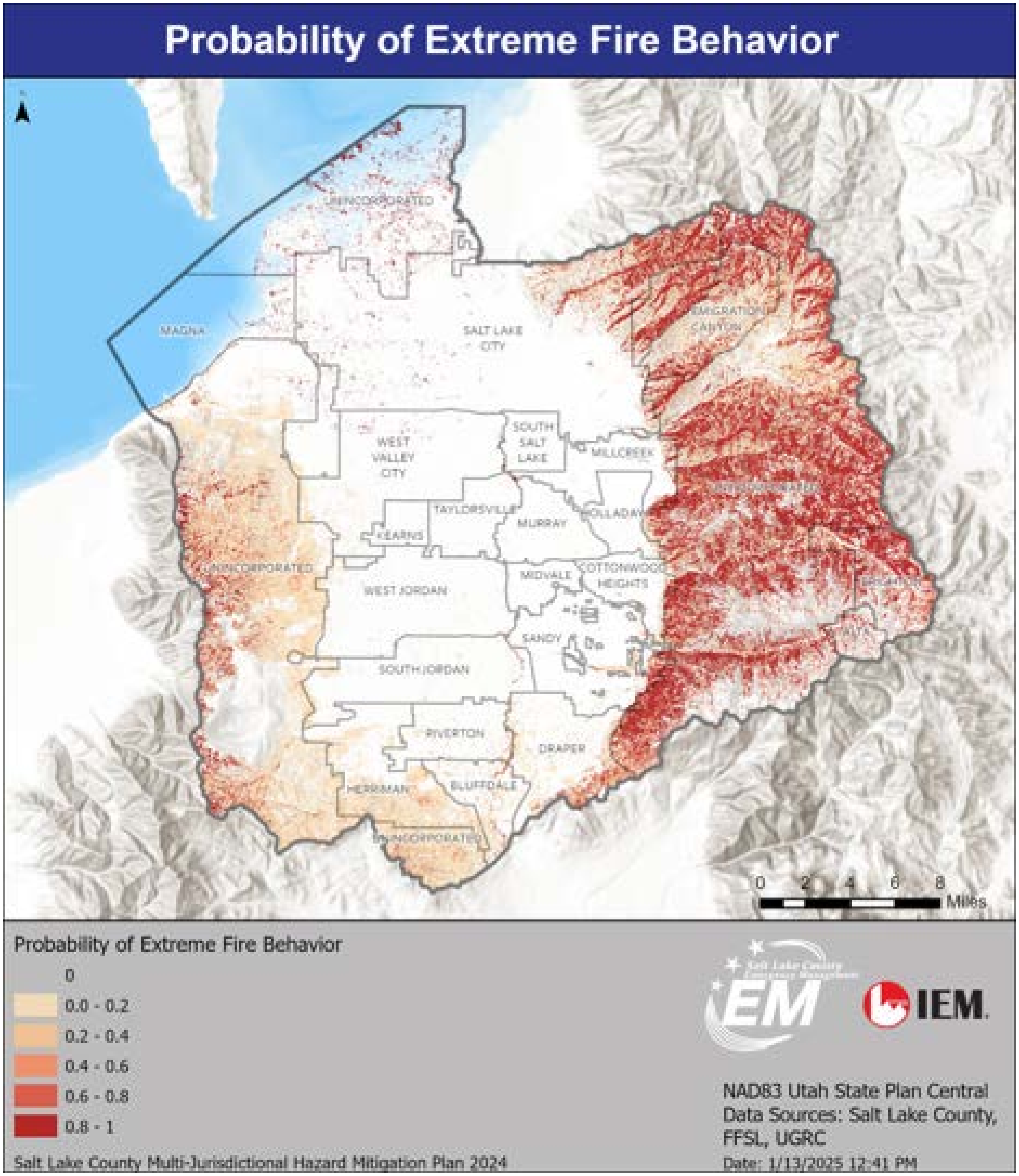


Figure 175: Potential for Extreme Fire Behavior in Salt Lake County

Climate Change Considerations

Climate change can have a significant impact on wildfires in Salt Lake County by creating conditions that are more conducive to wildfires. As temperatures rise, the potential for prolonged droughts also increases, making vegetation more flammable and conducive to the start of wildfires. Changes in precipitation patterns can also lead to longer fire seasons and more intense fire behavior.

As climate conditions have warmed, wildfires have become more intense and destructive, especially in the western United States. Fire can play an important role in ecosystems, and forest management policies have shifted to allow more natural fire cycles. However, rising temperatures and periods of drought, which contribute to changes in fuels and create dangerous fire conditions, have complicated this natural cycle. Higher temperatures also allow invasive species like the bark beetle to thrive. These beetles have killed thousands of square miles of trees, making them more susceptible to wildfire and increasing the likelihood of faster-spreading fires.[223]

Since the early 20th century, Utah's temperature has increased by more than 2.5°F. The 2024 Utah Enhanced State Hazard Mitigation Plan projects that warming temperatures and increasing drought incidents in the western United States will increase the number of acres burned by wildfires. In addition, early spring onsets, snowmelts, and reduced seasonal snowpacks are projected to heighten fire risk.[224]

Secondary Hazards

The most direct impacts of a wildfire are damage or complete loss of property, injury, or even death. Secondary impacts can include poor air quality due to smoke in nearby areas. This can be particularly harmful for elderly individuals or others with chronic heart or lung conditions. Damage to the environment, wildlife, and natural resources also are significant. Much of the mountainous area in western Salt Lake County is a watershed, and fire can impact the quality of the water supply. As the area is a major outdoor recreation and tourism hub, a major fire can also have significant economic impacts. The risk of debris flows after a fire in mountainous areas is high for several years after a fire until vegetation is reestablished.

Vulnerability Assessment

The risk of wildfire to the people and property of Salt Lake County is a significant concern. The county has large areas of forested land, with high fuel loads near developed areas. Of the 516,502 acres in Salt Lake County, 235,040 (46%) are in High or Very High Wildfire Hazard Potential areas. These factors—combined with compounding weather conditions, such as high heat, drought, and high wind—create the potential for natural and human-caused fires that can lead to property damage and loss of life.

In the risk assessment framework (Figure 176), wildfire hazard is measured by two primary factors: 1) burn probability (or likelihood of burning), and 2) fire intensity (measured as flame length, fire line intensity, or similar measures). Figure 168–Figure 175 and Table 74 provide various examples of probability and intensity. This section aims to identify assets potentially exposed to wildfire hazards to assess vulnerability.

---

[223] USGS. "Wildfire and Climate Change." https://www.usgs.gov/science-explorer/climate/wildfire.
[224] Utah Hazard Mitigation. "Climate Change Considerations." 2024 Utah State Hazard Mitigation Plan. https://hazards.utah.gov/state-of-utah-hazard-mitigation-plan/.

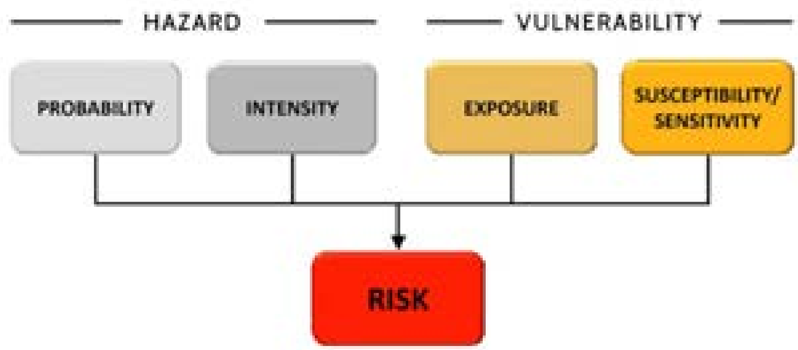


Figure 176: Fire Risk Assessment Framework[225]

An analysis based on the Utah Wildfire Risk Assessment Portal was conducted to identify each county's wildfire threat risk. The results show the threat based on the percentage of land falling under various threat categories, ranging from VVL (Very, Very Low) to VVH (Very, Very High). Seven Utah counties have 25 percent or more of their land classified as a high wildfire threat, with Salt Lake County having the highest percentage, at 59.8 percent.

Table 75: Salt Lake County Wildfire Threat, 2024[226]

VVL%	VL%	L%	LM%	M%	HM%	H%	VH%	VVH%	High Totals
1.2%	8.9%	6.2%	9.5%	14.3%	18.0%	15.3%	11.2%	15.4%	59.8%

Growing counties are recommended to follow FEMA's Firewise construction recommendations for all new development areas to minimize wildfire risk. The Firewise program encourages and supports neighborhoods in mitigating wildfire hazards. There are currently 28 Firewise communities in Utah.

Table 76: Firewise Communities in Salt Lake County[227]

Title	Number of Residents	First Year
Emigration Canyon	850	2002
Hi-Country Estates Phase 1	88	2016
Mt. Aire	100	2017
Town of Brighton	299	2021

In 2005, Utah identified almost 600 communities and their surrounding natural resources as "at risk" from wildland fire. The annually updated list comprises communities in Utah that wildland fire officials have determined to be at risk from wildland fire. The "Overall Score" represents the sum of multiple risk factors analyzed for each community. Risk factors include fire history, local vegetation, and firefighting

225 Utah Department of Natural Resources, Forestry, Fire, and State Lands. "Utah Wildfire Risk Assessment." https://ffsl.utah.gov/fire/utah-wildfire-risk-assessment/.
226 2024 Utah State Hazard Mitigation Plan.
227 Firewise USA. 2024, Interactive Map. nfpa.maps.arcgis.com/apps/Viewer/index.html?appid=c4a788340df748f18d98d8363145bb67.

capabilities. The Overall Score can range from 0 (no risk) to 12 (extreme risk). This score allows Utah's fire prevention program officials to assess relative risk and create opportunities for communication with communities on the list.

Table 77: Communities at Risk – Forestry, Fire, State Lands (2019)[228]

Community at Risk	Fire Occurrence	Structure Hazard	Fuel Hazards	Values Protected	Fire Protection Capability	Overall Score
Alta	1	2	1	2	2	6
Bluffdale	2	1	1	2	0	6
Brighton	2	2	2	3	1	10
Copperton	1	0	1	2	0	4
Cottonwood Heights	1	0	1	2	0	4
Draper (see Suncrest)	NA	NA	NA	NA	NA	NA
Emigration Canyon	2	1	3	3	0	9
Herriman	2	0	1	2	0	5
Hi-Country Estates I	2	0	1	2	0	5
Holladay	1	0	1	2	0	4
Lambs Canyon	2	2	2	2	0	8
Little Cottonwood	1	2	2	2	0	7
Mount Aire	2	1	2	2	0	7
Olympus Cove	1	0	1	2	0	4
Salt Lake City	2	0	1	2	0	5
Sandy City	1	0	1	2	0	4
Suncrest (Draper)	1	0	2	3	0	6

Access to some areas in the WUI can be challenging for emergency response. Some communities have private roads with limited access. Some roads are unimproved and may be impassable during winter months. Others are single lane, so access for large heavy vehicles like fire engines is difficult. Some are dead-end spur roads with limited ability to turn around.

The 2019 Salt Lake County Wildfire Preparedness Plan estimate the following properties at risk and their estimated value.

- Residential Land: $41,698,494,520
- Residential buildings: $72,369,023,500
- Commercial Land: $19,878,556,430

[228] Utah Department of Natural Resources, Forestry, Fire, and State Lands. "2019 Communities at Risk." https://ffsl.utah.gov/fire/wildfire-community-preparedness/communities-at-risk/https://ffsl.utah.gov/fire/wildfire-community-preparedness/communities-at-risk/, https://drive.google.com/file/d/1VQeWa63cO1eydm9uvuPDqdGnyzLIQLue/view.

- Commercial Buildings: $52,976,176,180

ESTIMATED IMPACT AND POTENTIAL LOSSES

Fire can damage or destroy structures, including homes, businesses, critical facilities, and other community assets. In strong winds, embers can travel several miles from the main fire and may ignite secondary fires when they encounter flammable dry vegetation, rooftops, or debris.

Residents closest to the fire may be evacuated; longer-term displacements are likely if residences are damaged. Some households may need to seek public shelter. Homes in the foothills may be on dead-end spur roads that may be more difficult to navigate in an evacuation due to narrow lanes and higher traffic volumes. These areas may also be more problematic for fire trucks to reach. Individuals closest to the wildfire are at risk of burns, other injuries, or death. Poor air quality and smoke inhalation can affect individuals across a large area and are particularly harmful to those with underlying health conditions.

Fires can damage utility systems, such as power lines and substations, communications towers, water treatment facilities, and other infrastructure systems. Roads and other transportation networks may require closure, which can cause widespread disruption as people seek alternative routes. Some canyon communities only have one major access road, which may leave residents isolated from services and, during an evacuation, may cause traffic delays. Emergency response may be delayed by power or communications disruptions if roadways are inaccessible or responding agencies are overwhelmed.

Wildfires can also have significant economic consequences. Businesses can experience direct damage to facilities, inventory, or equipment. Fire can also disrupt power, communications, other utility services, and transportation networks, which can further interrupt business operations. Businesses closed by evacuations or other interruptions will experience a loss in revenue. Businesses that remain open may be short-staffed due to employees' inability to report to work. The canyons and forests are vital to Salt Lake County's recreation and tourism industries. Fires restrict access to these areas during the event and may lead to long-term reductions in visits to the affected areas. The cost of fire suppression, repairs to damaged facilities, and economic losses can all make recovery difficult for a community. A large-scale fire can strain the community's financial resources and further slow economic recovery.

As one might expect, the effect of wildfires on the environment is typically devastating. Significant vegetation and wildlife habitats can be destroyed, requiring a long time to regenerate. Ash and debris can diminish water quality and affect the water supply. Furthermore, when land is stripped of vegetation, soil stability is reduced and erosion increases, which could further threaten structures or impact water supplies and quality. This also contributes to secondary hazards, such as slope failure or debris flows.

The NRI includes data on the EALs from individual natural hazards, historical loss, and overall risk at a county and census tract level. Salt Lake County's NRI EAL value for wildfire is $24 million, with a risk score of 99.4 and a rating of Relatively High percentile compared with the rest of the United States (Figure 177).

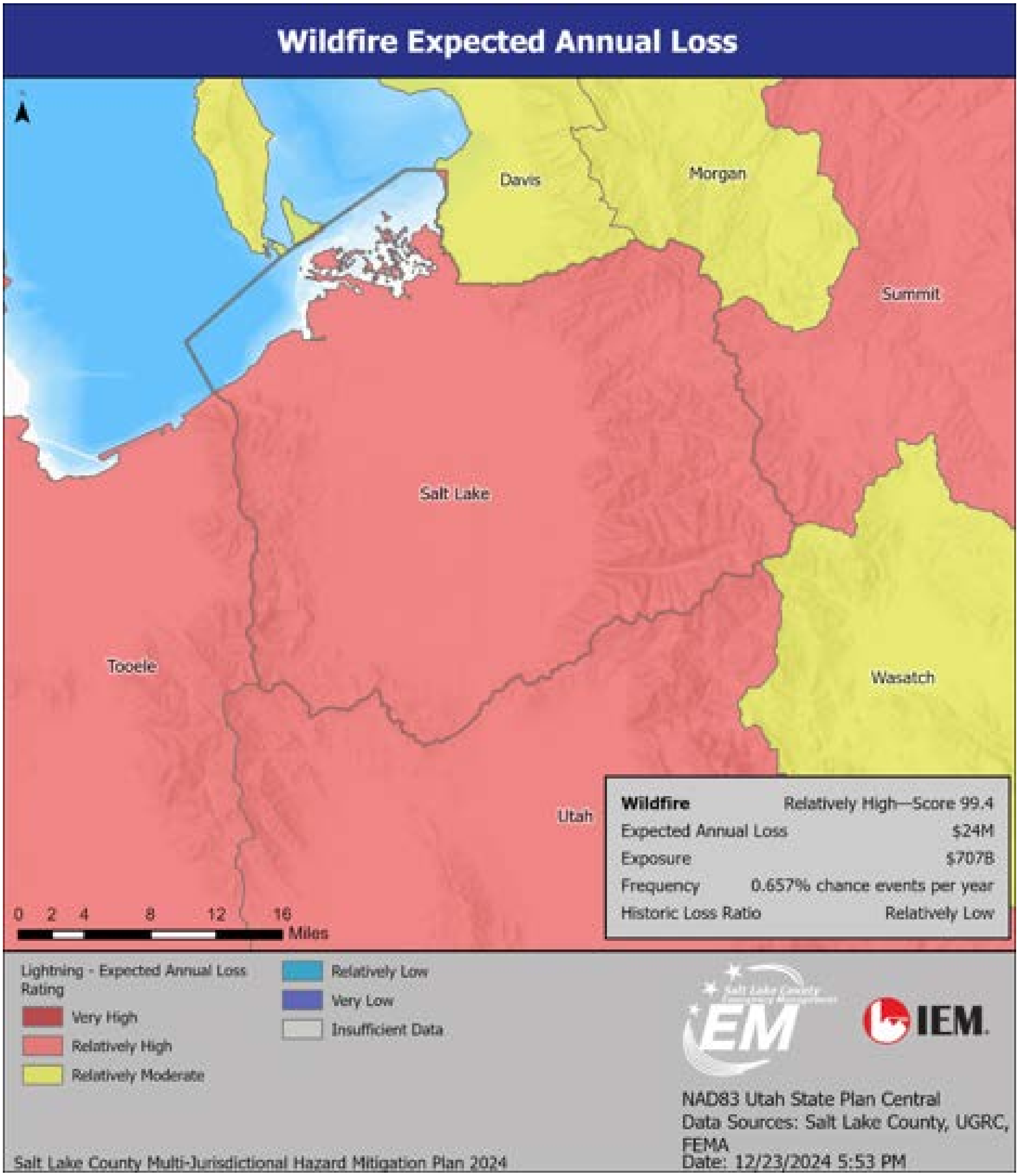


Figure 177: National Risk Index Expected Annual Loss from Wildfires in Salt Lake County[229]

229 FEMA, National Risk Index. "Salt Lake County Expected Annual Loss Wildfire Risk Score, Map and Legend." https://hazards.fema.gov/nri/map.

VULNERABLE POPULATIONS

Social vulnerability is an indicator of an individual's ability to cope with and recover from trauma. For a given exposure, populations with high social vulnerability tend to experience impacts more severely. Social and economic factors can make it more difficult for some people to prepare for, respond to, and recover from wildfires. Vulnerable populations may lack access to resources, experience cultural and institutional barriers, have limited mobility, or have medical conditions exacerbated by stress or smoke conditions.

People over the age of 65 and individuals with disabilities are more susceptible to air pollution and particulates associated with wildfire smoke. These individuals also may experience challenges if evacuations are required. Language barriers can make it difficult to follow directions during an evacuation or to access support after a disaster. Race and ethnicity are strongly correlated with disparities in health and access to aid and resources. Wildfires disproportionately impact people with low incomes due to factors, such as inadequate housing and a diminished ability to evacuate or afford relocation expenses.

Diminished air quality is an environmental impact that can result from a wildfire and pose potential health risks. Smoke plumes from wildfires can contain potentially inhalable carcinogenic matter. Particles of soot and ash that are too small for the respiratory system to filter can cause immediate and possibly long-term health effects. Older adults or those with compromised respiratory systems may be more vulnerable to diminished air quality after a wildfire event.

In addition, fire protection in WUI areas is difficult because the tactics used for wildfire suppression cannot be used for structure protection and suppression. The energy emitted from a wildfire is hazardous to firefighters and homeowners, making protecting homes almost impossible. One-third of all firefighter deaths occur while fighting wildfires. Many believe that WUI areas significantly increase firefighter risks. Legally, federal wildland protection agencies are seldom responsible for protecting structures. State forestry agencies' legal responsibility for protecting structures in non-federal wildlands varies widely.

Table 78 provides statistics on vulnerable populations living in Salt Lake County. Figure 178 illustrates the areas in Salt Lake County with vulnerable populations, based on the indicators under 5 years old, limited English proficiency, and over 65 years old.

Table 78: Salt Lake County Vulnerable Populations at Risk of Wildfire[230]

Indicator	Number		Percent	
Families in poverty	14,238	±1,027	5.1%	±0.4%
People with disabilities	116,735	±2,910	9.9%	±0.3%
People over 65 years	133,703	±2,776	11.3%	±0.3%
People under 5 years	79,892	±2,713	6.8%	±0.2%
People of color	364,456	±15,081	30.9%	±1.3%
Black	21,531	±2,346	1.8%	±0.2%
Native American	10,243	±1,394	0.9%	±0.1%
Hispanic	225,177	±7,575	19.1%	±0.7%
Difficulty with English	38,373	±2,383	3.5%	±0.2%
Households with no car	21,291	±1,297	5.2%	±0.3%
Mobile homes	7,151	±719	1.8%	±0.2%

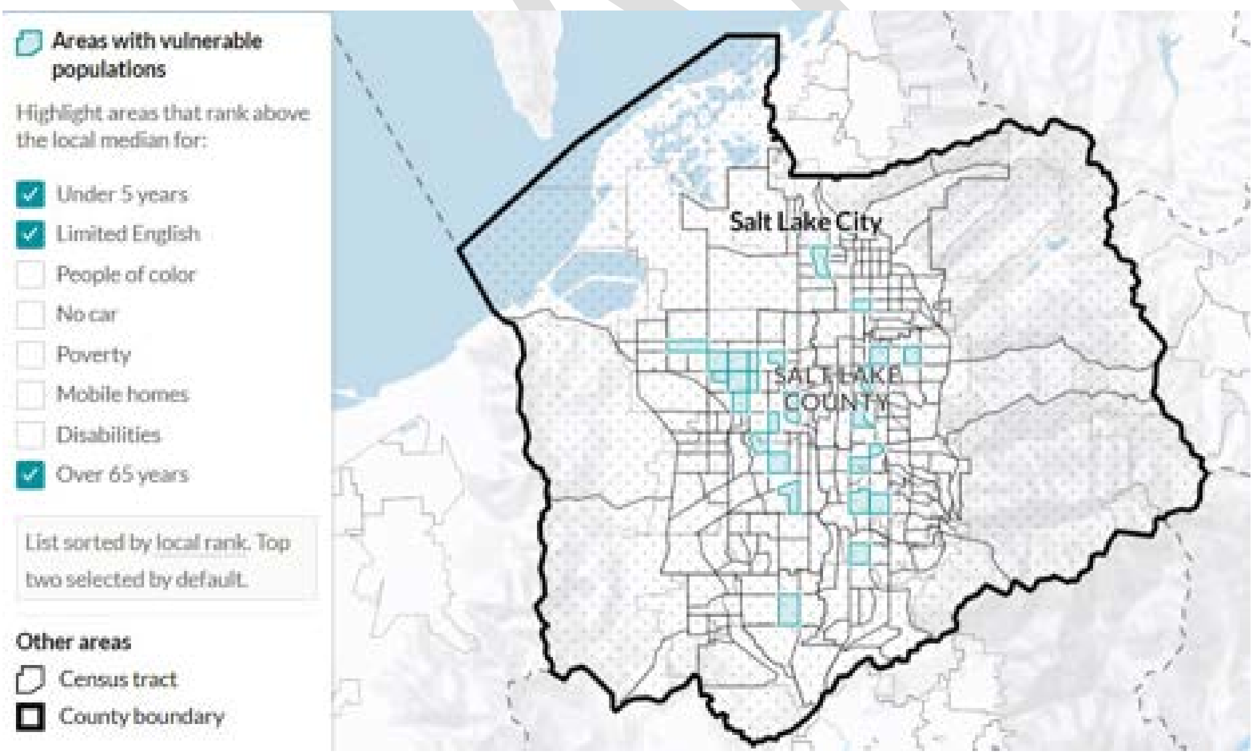


Figure 178: Three Populations Vulnerable to Wildfire in Salt Lake County[231]

COMMUNITY LIFELINES

Wildfires can strain food, hydration, and shelter lifelines for those evacuated. Safety and security lifelines also may be strained when responding to the fire and enacting evacuation procedures. Damage caused by the fire may also disrupt energy, transportation, communications, and water systems.

CHANGES IN DEVELOPMENT

Salt Lake County's development and population growth can have significant impacts on wildfires. Population increases will lead to more demands for housing and infrastructure. This need can lead to more development in wildfire-prone areas, increasing the risk of wildfires on infrastructure and the populace.

Salt Lake County continues to experience growth and development in the WUI. According to the U.S. Census, it was the most populous county in the state, with a population of 1,185,813 in 2023, reflecting steady growth over the past 13 years. However, the estimated 2024 population is slightly lower at 1,185,057, with a growth rate of -0.06 percent in the past year, according to the latest census data. Since 2010, when the population was 1,032,997, Salt Lake County has grown 14.72 percent.[232]

Growth increases vulnerability to wildfire, as the county's high projected population growth coincides with significant wildfire threats. These wildfire threats are most acute near the Wasatch and Oquirrh Mountains, where fires can quickly start and grow. Development is happening particularly quickly along the southwest border of Salt Lake County, where it meets the Oquirrh Mountains and where a significant wildfire risk exists. This growth is also increasing residents' exposure to wildfires and may leave many newcomers to Salt Lake County unaware of the risk. Besides direct risk, this growth could lead to more disruptions associated with evacuations, air quality, and public health concerns. Overall, vulnerability to wildfire has increased since the last plan update.

VULNERABILITY SCORE

The NRI was used as a primary tool during the 2024 update to analyze the county's vulnerability to wildfire. The NRI defines risk as the potential for negative impacts from a natural hazard. It determines a community's risk relative to other communities by examining the EAL and social vulnerability in a given community in relation to its resilience. Salt Lake County's NRI wildfire risk rating is shown in Figure 179. Salt Lake County has a relatively high wildfire risk, with a risk score of 99.2.

[230] Wildfire Risk. "Salt Lake County Vulnerable Populations at risk from Wildland Fire." 2024. https://wildfirerisk.org/explore/vulnerable-populations/49/49057/.
[231] Wildfire Risk. "Wildfire Risk Vulnerable Populations Map, Salt Lake County by Three Indicators." 2024. https://wildfirerisk.org/explore/vulnerable-populations/49/49057/.
[232] World Population Review.com. 2024. https://worldpopulationreview.com/us-counties/utah/salt-lake-county.

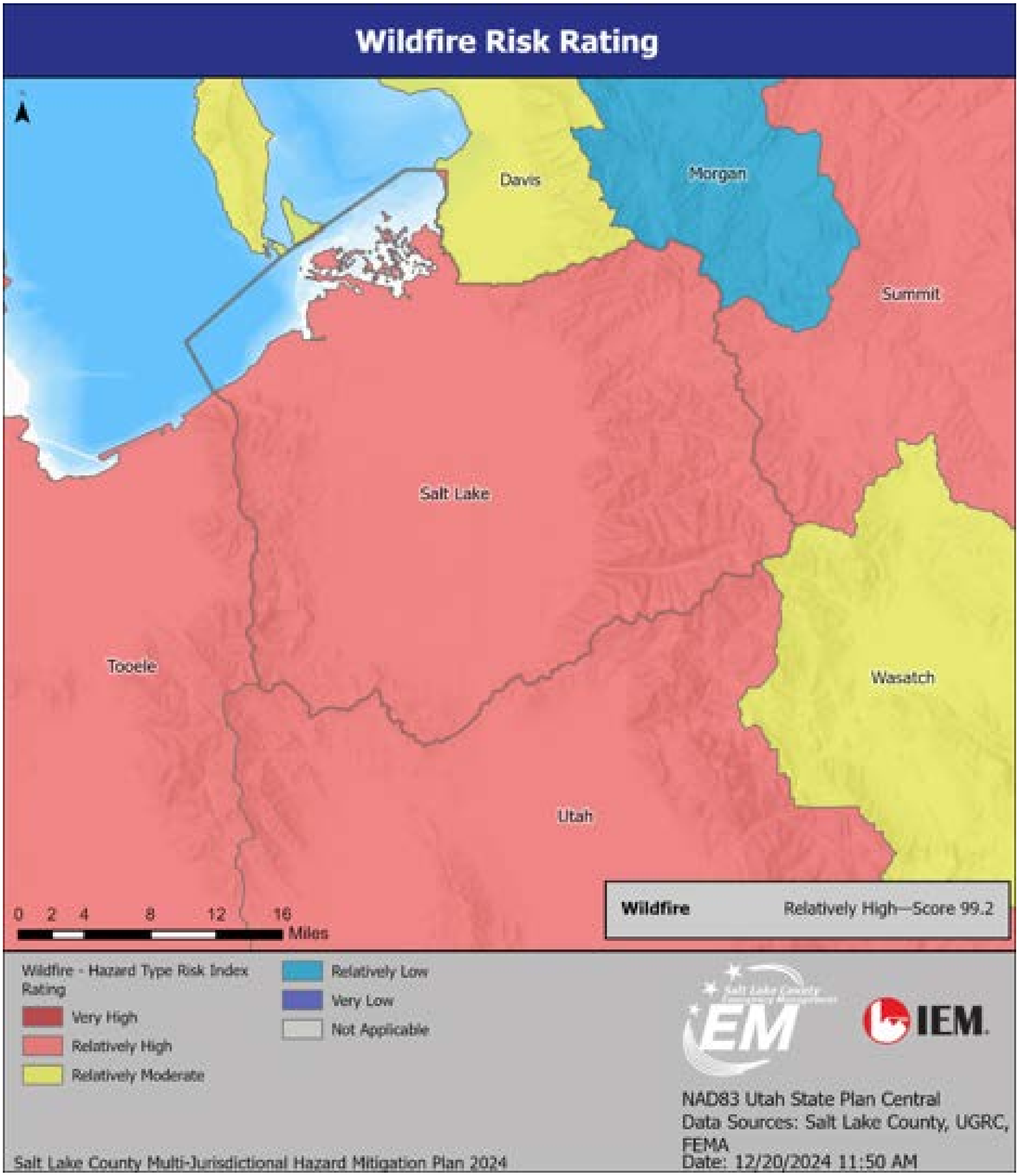


Figure 179: National Risk Index Wildfire Risk Map, Legend, and Score for Salt Lake County[233]

233 FEMA, National Risk Index. "Salt Lake County Wildfire Score, Map and Legend." https://hazards.fema.gov/nri/map.

Civil Disturbance

Figure 180: Civil Unrest, Salt Lake City, 2020[234]

Hazard Description

Civil disturbance or disorder is a wide-ranging phenomenon encompassing any incident involving large groups of individuals participating in activities that disrupt public order and put the safety of the public, businesses, or critical infrastructure at risk. This can include rioting, looting, and violent demonstrations or protests.

Civil disorder can be the spontaneous impact of a triggering event, such as the looting seen following disasters (e.g., 2005 Hurricane Katrina in New Orleans), or it can be a specific hazard unrelated to any other hazard (e.g., 1999 World Trade Organization riots in Seattle). It can arise from peaceful events, gatherings, or demonstrations or be preplanned and intentional. Civil disturbances are rooted in highly complex social, economic, and political interactions.

The right of public assembly is protected by the First Amendment of the United States Constitution; accordingly, emergency managers must be careful to protect the rights of their citizenry. Individuals participating in civil disorder will exploit actual or perceived infringements on this right to gain public sympathy for their cause. Therefore, the most effective way to reduce politically motivated civil disorder is to stop it before it occurs. This involves significant planning by emergency managers and robust intelligence from law enforcement entities.

[234] Photo courtesy of SLCo EM.

Once civil disorder erupts, responders have access to a range of nonlethal tools designed to manage riots effectively. These include equipment, such as helmets, body armor, and gas masks, which are essential for protecting against physical harm and tear gas. Crowd control tools, such as batons, shields, and pepper spray, can be used to manage and disperse crowds if necessary. Communications devices like two-way radios and earpieces are crucial for maintaining contact and coordination among first responders. Nonlethal weapons, such as rubber bullets, bean bag rounds, and stun grenades can be used for crowd control and dispersal, while armored vehicles can be used to transport and protect first responders in volatile situations. Finally, to ensure the safety of the public, first responders, and other protesters, lethal force may be considered as a last resort.

CIVIL DISTURBANCE DURING DISASTERS

Civil disorder, primarily in the form of looting, often occurs during or immediately after a disaster. Other types of civil disorder, such as rioting, are exceedingly rare after a disaster.

Civil disorder during disasters arises from a range of motivating factors. One factor contributing to civil disorder during disasters is the disruption of environmental and social norms, which creates an atmosphere of chaos. This can lead to the rationalization of acts that would normally be considered unacceptable. This behavior change, combined with a displaced or overburdened police force, can escalate civil disorder after disasters. Another factor contributing to disaster-related civil disorder is resource scarcity when individuals either lack basic supplies or fear losing access to them. Disasters often disrupt a community's ability to provide citizens with food, clothing, and potable water. Fearing for their survival, people may loot to obtain these necessities. Lastly, it has been argued that civil disorder during disasters stems from social inequalities. There is a strong correlation between lower socioeconomic status and crime, with evidence suggesting that these conditions are worsened during and immediately following disasters, leading to an increase in crime rates and incidents of looting.

Differing opinions exist regarding the frequency of looting during disasters. Some argue that the scale of looting is often exaggerated, with perceptions of widespread looting influenced by misinterpreted behavior, misunderstandings over property ownership, exaggerated claims, and sensational media coverage. In addition, it is widely observed that in the aftermath of disasters, prosocial behaviors, such as citizens volunteering to help and feed one another, far outweigh antisocial behavior like looting. Nonetheless, looting does exist in many disasters to some degree. Looting can be traced back to various social issues but is likely influenced by a combination of factors. Although looting is often seen as opportunistic theft during chaotic events, its historical and cultural contexts play a significant role in understanding its roots.

Due to the stress caused by the impacts of a disaster, the affected populace is already under considerable duress. Therefore, responders and emergency managers must exercise caution when responding to these events. Shifting search and rescue operations to trained strike teams could help free up police resources, allowing law enforcement to focus on preventing looting. Establishing disaster recovery operations quickly and efficiently is crucial for meeting the basic needs of residents. In addition, public information campaigns are vital for informing citizens and alleviating fears.

POLITICALLY MOTIVATED CIVIL DISORDER

Politically motivated civil disorder occurs when a large group of individuals disturb public order to bring about political or social change. This can be preplanned in response to a significant social event or happen spontaneously at large gatherings. This type of civil disorder can lead to rioting, looting, or unauthorized gatherings that disrupt public order.

Politically motivated civil disorder can arise for various reasons, such as attempts to address socioeconomic inequalities, advocate for changes in laws, exploit chaotic situations, or pursue anarchist objectives. It can occur in the following scenarios, among others: peaceful marches and parades, planned summits and major political events, and large gatherings at concerts and sports arenas.

In politically motivated civil disorder, the initial targets often serve as symbolic acts of defiance against institutions seen as upholding the societal norms participants wish to change. This includes destructive behavior toward police forces and their equipment, firefighters and their equipment, and other symbols of law and order. This destructive behavior often morphs into crimes of opportunity, such as looting and theft, and finally, aggression toward the public and peacekeepers.

In recent years, politically motivated civil disorder and those who participate in it have become increasingly organized. These individuals often attach their cause to otherwise innocuous or peaceful demonstrations, seeking to exploit a police force already stretched thin with other responsibilities. Anarchist groups like the Black Bloc incorporate guerilla tactics into their operations, such as concealing their identities and using misdirection to evade police, to maximize the opportunity to cause damage. Another tactic used by these groups is inciting violence in the larger crowd. Exploiting existing tensions surrounding various issues—such as hunger, unemployment, lack of community services, poor housing, and labor issues—can elevate tensions in a large group. When tensions are high, a seemingly minor incident, rumor, or act of injustice can quickly incite a crowd to violence.

Magnitude/Extent

The magnitude or extent of civil disturbances in Utah can vary depending on the situation. Like any other area, Salt Lake County can experience a range of civil disturbances, from peaceful protests and demonstrations to more severe incidents, such as riots or civil unrest. Factors, such as population size, current social and political issues, and law enforcement response, can play a role in the extent of civil disturbances in Salt Lake County.

Location

Though civil unrest can occur anywhere, it is more likely in locations with high levels of inequality, lack of access to education and economic opportunities, political instability, ethnic or religious tensions, and a history of unresolved conflicts. In addition, issues, such as police brutality, government corruption, and lack of trust in institutions, can also make a community more vulnerable to civil disturbances.

Historical Events and Probability of Future Occurrences

Although civil disturbances and riots of significant magnitude are not highly likely in a given year, they remain a possibility in Salt Lake County. For instance, in February 2016, a civil disturbance arose following an altercation between police and a teenage male, which resulted in the teen being shot. A crowd soon gathered and began to throw rocks and yell obscenities at the police. This led to the arrest of four people who failed to obey commands to evacuate. In another example, at a rowdy celebration during the 2002 Winter Olympics in Salt Lake City, a crowd attempted to force its way into a beer tent and evade security. The situation escalated, requiring 75 to 100 police in full riot gear to regain control of the area. At least 30 people were arrested.

On June 1, 2020, Salt Lake City experienced significant protests in response to police brutality and the death of George Floyd. The protests began peacefully during the day but escalated as night fell. Demonstrators marched through the streets, chanting slogans and holding signs calling for justice and an end to racial inequality. However, as the evening progressed, tensions rose, and clashes between the police and protesters resulted in vandalism and destruction of property. A 7-11 store, the State Capitol building, City Creek Mall, a police station, and other locations were vandalized. The National Guard was deployed to help restore order.[235]

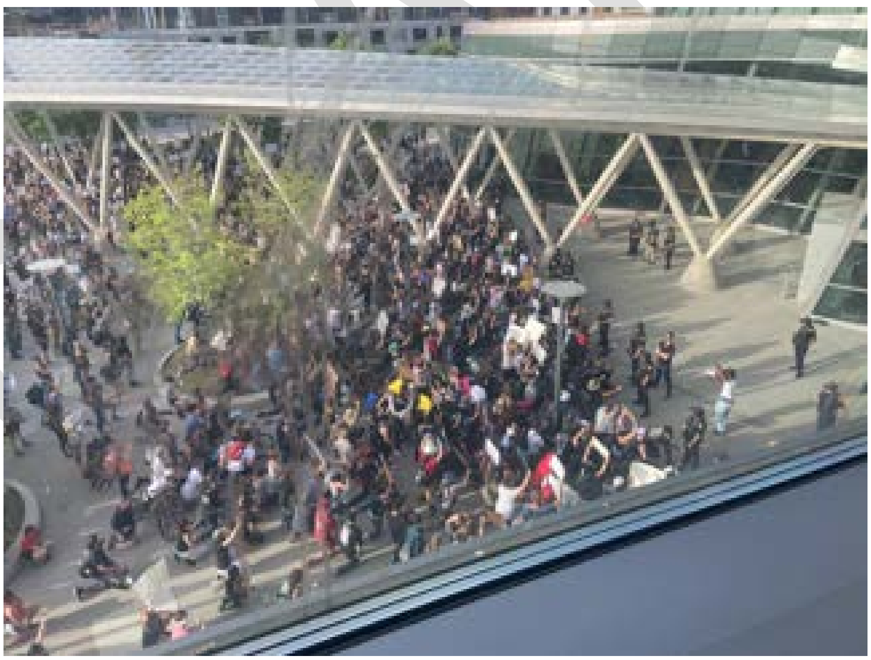


Figure 181: Protest Outside Salt Lake City Public Safety Building, June 2020[236]

On April 29, 2024, an Israel–Hamas protest took place at the University of Utah. Over 200 protestors gathered and set up tents. Officers from the University of Utah, Salt Lake City, West Valley City, Utah Highway Patrol, and the UPD dispersed the crowd and cleaned up the tents, pallets of water, toilet paper,

[235] McGurk, Nick. "Salt Lake DA: 40–50 Arrested, Police and Protester Actions Being Examined." ABC 4. June 1, 2020. https://www.abc4.com/news/salt-lake-city-protests/salt-lake-district-attorney-40-50-arrested-police-and-protestor-actions-being-examined/.
[236] Photo courtesy of SLCo EM.

buckets of human waste, and other debris left by the protestors. More than 21 people were arrested for trespassing, disorderly conduct, failure to disperse, and resisting arrest. The protestors violated the Utah State Law Administrative Code and the University of Utah Speech Policy by setting up structures overnight on campus.[237]

According to the Southern Poverty Law Center, as of 2023, 20 hate and antigovernment groups were being tracked in Utah, including five with a significant presence in Salt Lake City: The Active Club, Eagle Forum, Mom Army Salt Lake City, Utah Constitutional Militia, and Utah Patriots.[238] In addition, seven groups are statewide. Although civil disturbances could arise from any contentious situation or gathering of predisposed people, Salt Lake County needs to remain aware of groups with the potential to spark these events.

Climate Change Considerations

Civil disturbances and violent protests or riots can have localized short-term environmental impacts, such as damage to buildings and infrastructure, leading to increased waste and emissions from fires. However, in the larger context of climate change, the direct impact of civil disturbances and violent riots is relatively minor. Although civil disturbances and violent riots can have immediate environmental consequences, their effects on climate change are minimal compared with other human activities.

Secondary Hazards

Civil disturbances can have far-reaching impacts on the climate through secondary or cascading events. These disturbances can disrupt crucial infrastructure, such as power plants, transportation networks, and industrial facilities, leading to increased emissions of greenhouse gases and other pollutants. In addition, civil disturbances can contribute to deforestation through land clearing and illegal logging, reducing the capacity of forests to absorb carbon dioxide and thereby increasing levels of greenhouse gases in the atmosphere. The displacement of populations due to civil disturbances can also lead to increased demand for resources and energy in host communities, putting pressure on natural resources and contributing to environmental degradation and climate change. Furthermore, the economic impacts of civil disturbances, such as damage to businesses and infrastructure, loss of livelihoods, and increased poverty, can further exacerbate pressure on natural resources and contribute to environmental degradation and climate change. These examples highlight the interconnectedness of civil disturbances and their potential impact on the climate.

Vulnerability Assessment

Although civil disorder is inherently a threat to the public, its many hazardous impacts also threaten public safety. Salt Lake County, like any other area, has the potential for civil disturbances. Social tensions, public demonstrations, and other forms of civil unrest can contribute to the county's vulnerability by

[237] University of Utah Communications. "University of Utah Campus Protest Recap." The University of Utah. May 1, 2024. https://attheu.utah.edu/facultystaff/university-of-utah-campus-protest-recap/.
[238] Southern Poverty Law Center. "In 2023, 20 Hate and Antigovernment Groups were Tracked in Utah." https://www.splcenter.org/states/utah.

creating social tensions, disrupting public order, and potentially leading to unrest and conflict. Public demonstrations and other forms of civil unrest can strain resources and infrastructure, impacting the community's safety and security. In addition, civil disturbances can affect the functioning of essential services and disrupt daily life, making it necessary for residents to stay informed and prepared to follow guidance from local authorities.

ESTIMATED IMPACTS AND POTENTIAL LOSSES

IMPACT ON SALT LAKE COUNTY RESIDENTS

During a civil disturbance, residents can be impacted in several ways. They may experience disruptions to essential services, such as transportation, healthcare, and utilities. There is also potential for property damage, personal injury, and emotional distress. Civil disturbances can also lead to economic repercussions, including loss of income and damage to businesses. Injuries and fatalities also are possible.

IMPACT ON ESSENTIAL FACILITIES AND OTHER PROPERTY

Essential facilities may be impacted if they are near or the target of civil disorder or riots. Businesses are often the focus of civil disruption, as individuals will target these establishments for looting and vandalism. In addition, in scenarios where supplies are limited, these businesses are often looted for their goods. Any building/edifice where the riot or disorder occurs may be vulnerable to damage.

IMPACT ON CRITICAL INFRASTRUCTURE

Civil disturbances can lead to various impacts and losses to a community's critical infrastructure. This can include damage to transportation systems, such as roadways, bridges, and public transit facilities, and disruption to communications networks, including phone lines and internet services. In addition, civil disturbances can damage power plants, electrical grids, and water supply systems, leading to power outages and water supply disruptions. These disruptions can significantly impact the daily lives of community members and hinder the delivery of essential services.

IMPACT ON OPERATIONS

First responders are particularly at risk during civil disruptions. They are often the first individuals on the scene, which puts them in direct danger of injury. In addition, responders are seen as part of the authority being protested, making them potential targets. Civil disturbances can also overwhelm local emergency response services, impacting their ability to manage the situation effectively. This can lead to increased call volumes, communications challenges, physical damage to facilities, and the need for heightened security measures. Emergency operation centers may need to coordinate with law enforcement and other agencies to effectively manage civil disturbances.

IMPACT ON ENVIRONMENT

Civil disturbances can have several impacts on the environment. These include increased pollution from burning vehicles, buildings, and other materials and the use of chemical agents to disperse crowds.

Habitat destruction is also a concern, as unrest can destroy natural habitats, such as forests and wetlands. In addition, large gatherings during civil disturbances can increase the generation of waste, including litter and potentially hazardous materials. Furthermore, civil disturbances can disrupt ecosystems and wildlife, leading to the displacement of animals and the destruction of natural resources.

VULNERABLE POPULATIONS

The populations most vulnerable to social disturbances generally include marginalized communities, such as low-income individuals, ethnic minorities, refugees, and people with disabilities. These groups often face systemic barriers and discrimination, making them more susceptible to the negative impacts of social disturbances. In addition, individuals who lack access to education, healthcare, and social support systems are also at heightened risk during times of social unrest. However, all individuals and infrastructures near a civil disorder are vulnerable to injury or damage.

COMMUNITY LIFELINES

Civil disturbances can impact several community lifelines, including safety and security, food, hydration, shelter, health and medical services, energy, communications, and transportation. These disturbances can disrupt law enforcement and emergency services, compromising public safety. In addition, they can cause shortages of essential resources, such as food, water, and shelter due to damaged infrastructure or restricted access. Health and medical services may be overwhelmed, while energy distribution and communications networks can be disrupted, leading to power outages and compromised access to information. Furthermore, transportation systems may be delayed, hindering the movement of goods, services, and people and emergency response and evacuation efforts.

CHANGES IN DEVELOPMENT

Civil disturbances can significantly impact future land use and development in a community. These disturbances can lead to damage to infrastructure, businesses, and residential properties, which may cause a decline in property values. As development and population increase in Salt Lake County more structures, property, and lives are at risk of damage and loss from civil disturbances. As a result, developers and investors may be hesitant to invest in the affected areas, leading to a slowdown in development and revitalization efforts. Civil disturbances can also create a sense of insecurity and instability, which may discourage businesses and residents from moving into the area. This can alter land use patterns, with certain regions being abandoned or repurposed for other uses. Overall, civil disturbances can hinder the long-term growth and development of a community, requiring significant time and effort to rebuild and restore trust with investors and developers.

VULNERABILITY SCORE

The county’s diverse population, including various political and social viewpoints, can lead to tensions and potential conflicts. In addition, large public gatherings and events may present opportunities for civil disturbances. Recent social and political movements have created conditions that can lead to civil unrest.

Based on Salt Lake County's moderate social vulnerability, high EAL, and high community resilience to overall hazards, the community's vulnerability to civil disturbance is moderate to high. Although its moderate social vulnerability may help mitigate some impacts, the high EAL and high community resilience to overall hazards suggest that the community may still be significantly vulnerable to civil disturbances.

Hazardous Materials

Figure 182: Image of Hazardous Materials in Storage[239]

Hazard Description

Hazardous materials, also known as HAZMAT, threaten human health, safety, and the environment and are classified as physical or health hazards. Physical hazardous materials can explode, catch fire easily, or react dangerously with water or other substances. They include explosives, flammable gases and liquids, organic peroxides, oxidizers, pyrophoric materials, and unstable/reactive materials. Health hazard materials are those that can cause harm to human health if ingested, inhaled, or absorbed through the skin. They include toxic, highly toxic, and corrosive substances. These materials come in various forms, including gases, liquids, and solids. HAZMAT can be found in many settings, such as workplaces, homes, and transportation systems. Hazardous materials are classified based on the National Fire Protection Association (NFPA) codes and standards.

- HAZMAT Incident—**Fixed Site** is defined as an uncontrolled release of hazardous material originating from a building, structure, or fixed equipment that can pose a risk to life, health, safety, property, or the environment.
- HAZMAT Incident—**Transportation** is defined as the uncontrolled release of a hazardous material during transport that can pose a risk to life, health, safety, property, or the environment.

Magnitude/Extent

Hazardous materials can have a devastating and enduring impact on communities. Exposure to these substances may lead to various health issues, ranging from minor irritations to serious illnesses or even fatalities. In addition, HAZMAT spills can severely damage the environment by contaminating the air, soil,

---

239 https://unsplash.com/photos/a-large-group-of-red-barrels-sitting-next-to-each-other-ETgEwZXbooU.

and water. Cleanup can take weeks, months, or even years to complete, depending on the extent of the spill.

Beyond their physical impact, HAZMAT incidents can lead to considerable psychological and economic harm in a community. Evacuations, property loss, and interruptions to everyday life can significantly affect individuals and families. In addition, these incidents can have a ripple effect on the local economy, reducing productivity and revenue for businesses and industries. Information on various HAZMAT incident levels can be found in Table 79.

Table 79: HAZMAT Incident Levels[240]

Incident Level	Type	Description
Incident Level 1	Minor Hazard	The hazardous material poses a low risk and can usually be handled by the local fire department or HAZMAT team without extra assistance.
Incident Level 2	Moderate Hazard	The hazardous material poses a moderate threat to human health and the environment. Additional resources and specialized equipment may be required to manage the situation.
Incident Level 3	Serious Hazard	A hazardous material significantly threatens human health and the environment. These situations often require a large-scale response with multiple agencies and specialized equipment.
Incident Level 4	Severe Hazard	A significant threat to humans and the environment requires a massive response from multiple agencies, specialized equipment, and significant resources.
Incident Level 5	Catastrophic Hazard	The hazardous material poses an extreme threat to human health and the environment.

The seriousness of a hazardous material incident is assessed based on several factors, including the type and number of hazardous materials involved, the location and scale of the release or spill, and the potential effects on human health, the environment, and property. Other influencing factors include weather conditions, population density, and how quickly emergency services can respond. Generally, these incidents can vary in severity from minor spills that can be rapidly contained and cleaned to significant events that might have enduring and devastating impacts on the surrounding area.

Location

Hazardous materials incidents occur more frequently than commonly thought and can occur anywhere worldwide. Certain regions are particularly susceptible due to factors, such as industrial facilities dealing with hazardous substances, natural disasters, and individuals' mistakes. Such incidents can lead to serious damage to property and infrastructure, disturb everyday life, and, tragically, even loss of life.

For example, regions with a high density of industrial facilities that manage hazardous materials are more vulnerable to incidents, including spills, leaks, or explosions. Such events can cause environmental harm,

[240] Lone Star HAZMAT. "What is Meant by the Different HAZMAT Incident Levels?" https://lonestarhazmat.com/what-is-meant-by-the-different-hazmat-incident-levels/.

injuries, fatalities, and disruptions to the local economy and community. Salt Lake County contains several chemical plants, as detailed in Table 80, which put the area at risk of incidents involving hazardous materials and potential contamination. In addition, the county has many pipelines transporting natural gas, natural gas liquids, condensate, crude oil, petroleum, and petrochemical products.

Table 80: Petrochemical Companies in Salt Lake County[241]

Corporation	
Ecolab	Tata Chemicals
Linde	Solenis
Air Liquide	Kao Corporation
Johnson Matthey	Alpha Plastics
PPG	Rentech
Huntsman Corp	Hempel
Wurth	Headwaters
Solvay	Brody Chemical
Daikin	Tronox
Innophos	ChemTreat
IFF	Chemtrade
PPG Industries	Incitec Pivot
Bridgestone Global	Asphalt Materials
INVISTA	Western Explosive Systems

Figure 183 shows the gas transmission and hazardous liquid pipelines in Salt Lake County.

[241] Glassdoor. "Top Chemical Manufacturing Companies in Salt Lake City, UT." https://www.glassdoor.com/Explore/browse-companies.htm?overall_rating_low=3.5&page=1&locId=755&locType=M&locName=Salt%20Lake%20City,%20UT&industry=200068&filterType=RATING_OVERALL.

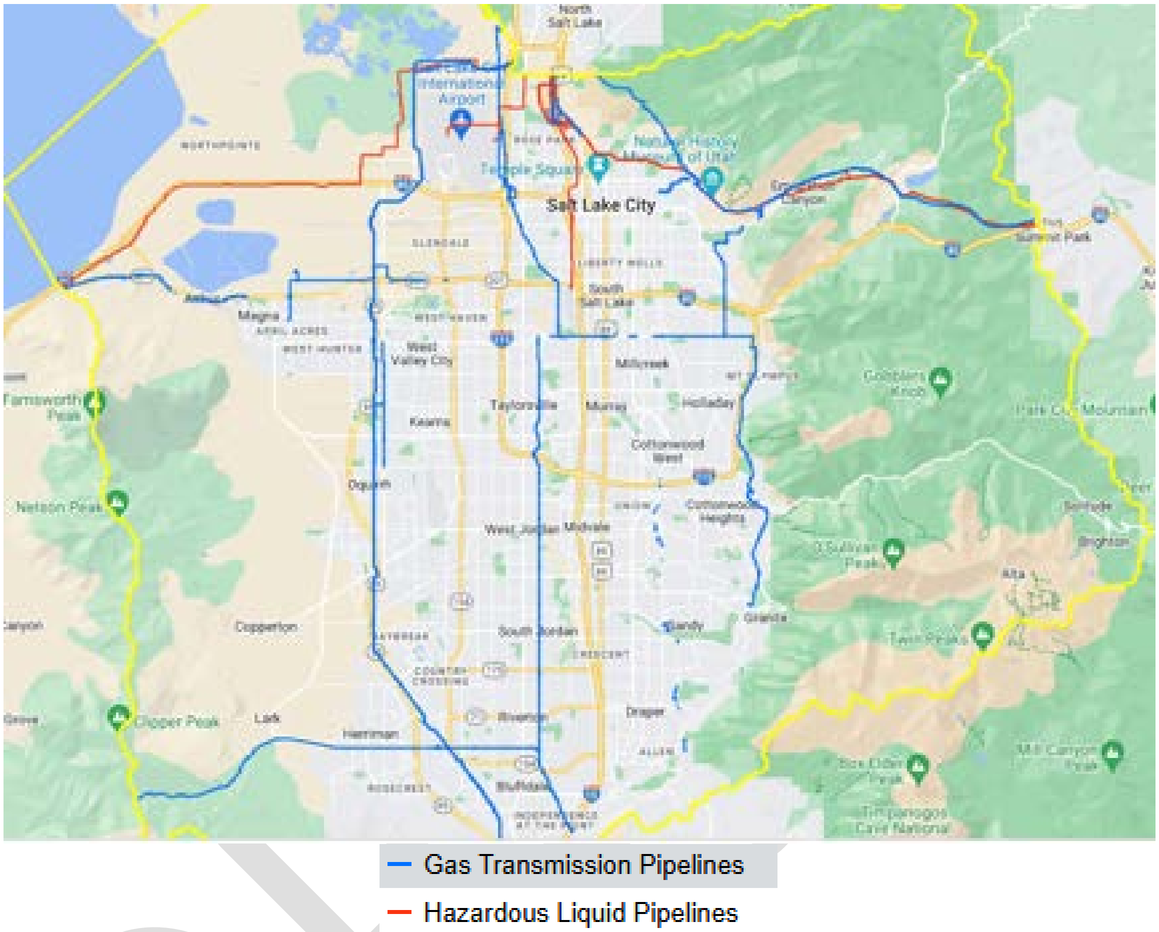


Figure 183: Pipelines That Carry Gas and Hazardous Liquids in Salt Lake County[242]

Historical Events and Probability of Future Occurrences

From January 1, 2018, to October 28, 2024, at the time of writing, Salt Lake County experienced 2,368 HAZMAT incidents. Fortunately, there were no injuries, fatalities, or evacuations. However, eleven incidents were considered serious, as detailed in Table 81.[243]

Table 81: HAZMAT Transportation Incidents, Salt Lake County[244]

Report Number	Carrier	Incident City	Date	Commodity	Hazardous Class	Shipper
2018030143	Jackson Energy	Midvale	01/18/2018	Diesel fuel, Gasoline, Casinghead	3	Chevron Products

[242] National Pipeline Mapping System. "Public Viewer." https://pvnpms.phmsa.dot.gov/PublicViewer/.
[243] Pipeline and Hazardous Materials Safety Administration. "Incident Report Database." https://portal.phmsa.dot.gov/analytics/saw.dll?Portalpages&PortalPath=%2Fshared%2FPublic%20Website%20Pages%2F_portal%2FHazmat%20Incident%20Report%20Search.
[244] N.O.S. = not otherwise specified.

Report Number	Carrier	Incident City	Date	Commodity	Hazardous Class	Shipper
2018100372	Saia Motor Freight Line, LLC	Salt Lake City	10/05/2018	Hydrochloric acid	8	Univar USA Inc.
2019060242	Quality Carriers	Salt Lake City	03/02/2019	Flammable liquids N.O.S.	3	Akzo Nobel
2021070759	Tesoro Corporation	Salt Lake City	07/12/2020	Petroleum crude oil	3	Tesoro Corporation
021010605	FedEx Freight, Inc.	Salt Lake City	12/30/2020	Corrosive liquid, acidic, inorganic, N.O.S.	8	Steen Research LLC
2021120260	Tesoro Refining & Marketing Company	Salt Lake City	10/13/2021	Petroleum crude oil	3	Tesoro Corporation
2022050252	YRC Inc.	West Valley City	11/27/2021	Paint including paint, lacquer, enamel, stain, shellac, varnish, polish, liquid filler, and liquid lacquer base	3	Sumter Coatings Inc.
2022040362	FedEx Freight, Inc.	Salt Lake City	03/30/2022	Combustible liquid, N.O.S.	2	PAK Technologies
203010095	FedEx Freight, Inc.	Salt Lake City	12/23/2022	Corrosive liquid, acidic, Inorganic N.O.S.	8	Applied Specialty Inc.
2023010542	FedEx Freight, Inc.	Salt Lake City	01/03/2023	Corrosive liquid, base, organic, N.O.S.	8	BPC, Seatex (C8)
2024020576	FedEx Freight, Inc.	Salt Lake City	02/06/2024	Flammable liquids, N.O.S.	3	Baker Petrolite LLC.

SUPERFUND SITES

A Superfund site is a location identified by the EPA as contaminated by hazardous waste. These areas seriously threaten human health and the environment, often containing toxic chemicals, heavy metals, and other harmful substances.

The presence of a Superfund site in a community can have serious repercussions. Residents may be exposed to harmful contaminants, which can lead to various health issues, such as cancer, birth defects, respiratory problems, and neurological conditions. Moreover, the pollution can negatively affect local ecosystems, endangering wildlife and disrupting the natural environment.

Superfund site cleanup tends to be complicated, lengthy, and costly. It may include activities, such as digging up contaminated soil, purifying polluted water, and disposing of hazardous waste. Generally, taxpayers pay the expenses; the entire process can span years or even decades.

Table 82: Superfund Sites, Salt Lake County

Site	City	NPL[245] Status	Description
700 South 1600 East PCE Plume	Salt Lake City	Final	The 700 South 1600 East PCE Plume site is near the George E. Wahlen U.S. Department of Veterans Affairs (VA) Medical Center in Salt Lake City, Utah. In the late 1970s and early 1980s, the VA operated a dry-cleaning service that used tetrachloroethylene (PCE), leading to soil and groundwater contamination through improper disposal. PCE was first detected in the groundwater at 32 µg/L in the 1990s, exceeding the drinking water standard of 5.0 µg/L. This prompted EPA investigations in 1999, finding concentrations between 11 and 320 µg/L. By 2010, dissolved PCE was found in residential springs. On September 18, 2012, officials supported listing the site on the National Priorities List (NPL) due to exposure concerns. It was officially added to the Superfund NPL in May 2013, with the VA responsible for cleanup.[246]
Davenport and Flagstaff Smelters	Sandy City	Deleted	The Davenport and Flagstaff smelters site is about 15 miles southeast of Salt Lake City, Utah, at the mouth of Little Cottonwood Canyon. Established around 1870, the smelters processed lead and silver ore from nearby Alta, Utah, leading to soil contamination. Both smelters were decommissioned by 1879, and the area transitioned from agricultural use to residential and commercial development in the 1970s and 1980s. Cleanup efforts are ongoing at the site.[247]
Kennecott North Zone/Tailings	Magna	Proposed	The Kennecott North Zone is an industrial area at the northern edge of the Oquirrh Mountains, near Magna and the Great Salt Lake. Major transport routes, including I-80, pass through the site. Since 1906, the area has processed ores, such as copper, lead, and gold, producing hazardous waste that has contaminated soils, water, and wetlands. Key contaminants include arsenic, cadmium, lead, and selenium. On January 18, 1994, the EPA proposed adding the North Zone to the NPL. A 1995 agreement between Rio Tinto Kennecott Copper (RTKC), the EPA, and Utah Department of Environmental Quality (UDEQ) allowed RTKC to undertake cleanup projects while deferring the NPL listing. The 2002 Record of Decision (ROD) outlined a cleanup strategy targeting surface materials threatening workers and wildlife. It included long-term efforts to treat groundwater and

[245] National Priorities List.
[246] U.S. Environmental Protection Agency. "700 South 1600 East PCE Plume Salt Lake City, UT." https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0800743.
[247] U.S. Environmental Protection Agency. "Davenport and Flagstaff Smelters Sandy, UT." https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.Cleanup&id=0801257#bkground.

Site	City	NPL[245] Status	Description
			remediate inaccessible waste. The ROD included detailed summaries of the necessary actions.[248]
Kennecott South Zone/Bingham	Copper-ton	Non-NPL, Superfund Alternative Approach	The Kennecott South Zone, located 25 miles southwest of Salt Lake City in the Oquirrh Mountains, includes the Bingham Mining District, the Bingham Canyon open pit mine, waste rock dumps, and the Copperton Mill. Mining began in the 1860s and continues today, resulting in hazardous waste that contaminates soils, sludge, surface water, and groundwater, impacting nearby wetlands and the Great Salt Lake. Cleanup efforts are ongoing. Although not on the NPL, the site is considered NPL-caliber and is being managed through the Superfund Alternative Approach.[249]
Midvale Slag	Midvale	Deleted NPL	The 446-acre Midvale Slag site in Midvale and Murray City, Utah, hosted five lead and copper smelters from 1871 to 1971. After the facilities were demolished in the 1970s, the area was contaminated with heavy metals, and ongoing cleanup and maintenance efforts continue.[250]
Murray Smelter	Murray City	Proposed NPL	The 142-acre Murray Smelter site in Murray City, Utah, was once the largest lead smelter in the U.S. Owned by ASARCO, it operated two smelters: the Germania Smelter (1872–1902) and the Murray Smelter (1902–1949). Smelting byproducts include slag, arsenic, and cadmium, leading to contamination of soil, sediment, and groundwater with heavy metals. The cleanup is complete, and ongoing maintenance activities are in place.[251]
Petrochem/ Ekotek	Salt Lake City	Deleted NPL	The 7-acre Petrochem Recycling Corp./Ekotek site in northern Salt Lake City, Utah, has a history of oil refining, hazardous waste management, and used oil recycling. Improper practices contaminated the groundwater and soil with hazardous substances. After cleanup, the EPA removed the site from NPL in 2003, but groundwater monitoring is ongoing.[252]
Portland Cement	Salt Lake City	Final NPL	The 71-acre Portland Cement site in Salt Lake City, Utah, was used from 1963 to 1983 to deposit approximately 500,000 cubic yards of cement kiln dust, which contains heavy metals, such as arsenic, lead, and chromium. The site also saw the disposal of chromium-bearing bricks, leading to soil, air, and groundwater contamination. Cleanup has occurred, and ongoing maintenance activities are in place.[253]

[248] U.S. Environmental Protection Agency. "Kennecott (North Zone) Magna, UT." https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.Cleanup&id=0800636#bkground.
[249] U.S. Environmental Protection Agency. "Kennecott (South Zone) Copperton, UT." https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.Cleanup&id=0800601#bkground.
[250] U.S. Environmental Protection Agency. "Midvale Slag, Midvale, UT." https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.Cleanup&id=0800641#bkground.
[251] U.S. Environmental Protection Agency. "Murray Smelter Murray City, UT." https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.Cleanup&id=0800697#bkground.
[252] U.S. Environmental Protection Agency. "Petrochem Recycling Corp./Ekotek Plant Salt Lake City, UT." https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0800649.
[253] U.S. Environmental Protection Agency. "Portland Cement (KILN Dust 2 & 3) Salt Lake City, UT." https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0800690.

Site	City	NPL[245] Status	Description
Rose Park Sludge Pit	Salt Lake City	Deleted NPL	The Rose Park Sludge Pit is in Rosewood Park, Salt Lake City, Utah. From the 1930s to 1957, the Utah Oil and Refining Company disposed of acidic waste in an unlined pit, covering around 5 acres and reaching depths of 20 feet. This waste contaminated the soil and groundwater. After cleanup, the EPA removed the site from the NPL in 2003, and maintenance continues.[254]
Sharon Steel	Midvale	Deleted NPL	The 470-acre Sharon Steel Corp. (Midvale Tailings) site in Midvale, Utah, operated as a smelting and ore milling facility from 1906 to 1971, producing lead, copper, and zinc. In 1982, UDEQ intervened after discovering residents were using contaminated tailings in gardens and sandboxes. Testing revealed high levels of lead and arsenic in the groundwater. Contamination impacted air, soil, and water. After cleanup efforts, the EPA removed the site from the NPL in 2004.[255]
Utah Power & Light	Salt Lake City	Final NPL	The 2.2-acre Utah Power & Light/American Barrel Co. site in Salt Lake City operated from 1870 to 1987 for barrel storage, wood treatment, and coal gasification. These activities produced hazardous byproducts, contaminating soil and groundwater. Cleanup has been completed, and maintenance activities continue.[256]
Wasatch Chemical	Salt Lake City	Final NPL	The 18-acre Wasatch Chemical Co. site in Salt Lake City, Utah, was used from 1957 to 1971 for warehousing and producing industrial chemicals. From the 1970s to 1992, it blended and packaged pesticides, herbicides, and fertilizers, discharging wastewater on-site and contaminating the soil and groundwater. The cleanup is complete, but operation and maintenance activities are ongoing.[257]

Climate Change Considerations

Climate change may increase the likelihood and intensity of hazardous waste incidents. Extreme weather events, such as tornadoes, floods, and wildfires, can damage infrastructure, disrupt waste management systems, and lead to hazardous materials leaking into the environment. In addition, rising temperatures can intensify chemical reactions that produce hazardous waste and raise the volatility of certain substances. Furthermore, climate change can modify ecosystems, create new pathways for hazardous waste to enter the food chain, and impact human and animal health. Therefore, it is essential to

[254] U.S. Environmental Protection Agency. “Rose Park Sludge Pit Salt Lake City, UT.” https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.Cleanup&id=0800663#bkground.
[255] U.S. Environmental Protection Agency. “Sharon Steel Corp. (Midvale Tailings) Midvale, UT.” https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.Cleanup&id=0800694#bkground.
[256] U.S. Environmental Protection Agency. “Utah Power & Light/American Barrel Co. Salt Lake City, UT.” https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0800680.
[257] U.S. Environmental Protection Agency. “Wasatch Chemical Co. (Lot 6) Salt Lake City, UT.” https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.Cleanup&id=0800596#bkground.

incorporate climate change considerations into a comprehensive strategy to prevent and address hazardous waste incidents, safeguarding public health and the environment.

Secondary Hazards

Secondary hazards from hazardous materials incidents can significantly amplify the risks associated with the initial event. One major concern is the potential for fires and explosions, especially if flammable materials are involved, which can extend the danger beyond the original site. In addition, chemical reactions can produce toxic gases, contaminate the air, and pose serious health risks to first responders and nearby residents. Environmental contamination is another critical issue, as hazardous substances can seep into soil and waterways, leading to long-term ecological damage and affecting drinking water supplies. The health of emergency personnel can also be compromised during their response efforts. Evacuations may be necessary, causing panic and posing logistical challenges. Increased traffic from fleeing citizens and arriving emergency responders can create further hazards and accidents. In addition, structural damage from the incident can cause dangerous collapses. Public panic fueled by misinformation can also complicate response efforts.

Vulnerability Assessment

Salt Lake County is significantly vulnerable to hazardous materials in various locations, including industrial sites, transportation routes, and waste management facilities. The proximity of residential areas to these sites increases the risk of exposure to toxic substances in the event of accidental releases or spills. The effects of hazardous materials incidents include physical harm from inhalation or coming into contact with released substances. If substances ignite or explode, injury or property damage may result. The county's geographical features along the Wasatch Range, coupled with emissions from the US Magnesium refinery, cause air quality concerns, including ground-level ozone particle pollution.[258] According to a 2023 report by the American Lung Association, the Salt Lake City region experienced more unhealthy air pollution in three categories: ozone, short-term particle pollution, and annual particle pollution. This report listed Salt Lake City among the nation's most air-polluted cities, ranking it 10th for ozone and 19th for short-term particle pollution.[259] Salt Lake County's geography, coupled with emissions from refineries, results in an increased potential impact of hazardous materials on public health and the environment.

ESTIMATED IMPACTS AND POTENTIAL LOSSES

In a significant hazardous materials incident in Salt Lake County, the estimated losses could be substantial, affecting the local economy and community health. The immediate financial impact may include emergency response costs, damage to infrastructure, and the potential for long-term environmental rehabilitation. In addition, businesses nearby might face temporary closures, leading to job losses and decreased revenue. The public health ramifications could be severe, with possible evacuation

[258] NOAA Research. "One Facility Makes a Big Contribution to Salt Lake's Winter Brown Cloud." January 25, 2023. https://research.noaa.gov/one-facility-makes-a-big-contribution-to-salt-lakes-winter-brown-cloud/.
[259] NOAA Chemical Sciences Laboratory. "Finding Helps Explain Salt Lake City's Persistent Air Quality Problems." January 25, 2023. https://csl.noaa.gov/news/2023/368_0125.html.

orders, health-related emergencies, and long-term effects on air and water quality. This incident could also strain local resources and emergency services, highlighting the need for robust preparedness and response protocols to mitigate such risks.

VULNERABLE POPULATIONS

Populations vulnerable to hazardous materials incidents often include those living near industrial facilities, transportation routes for hazardous goods, and areas prone to natural disasters. Communities with lower socioeconomic status may face heightened risks due to inadequate emergency preparedness and response resources. In addition, children, senior citizens, and individuals with preexisting health conditions are particularly susceptible to the adverse effects of hazardous materials exposure, as their physical resilience may be compromised. Furthermore, marginalized groups might experience barriers in accessing timely information and medical care during incidents, amplifying their vulnerability and potential health impacts.

COMMUNITY LIFELINES

Several of community lifelines can be significantly impacted in a hazardous materials incident, affecting the overall response and recovery efforts. The Safety and Security lifeline may be strained as authorities work to protect the public from exposure and containment of hazardous materials. Meanwhile, the Health and Medical lifeline could become overwhelmed as hospitals and medical facilities are forced to handle potential casualties requiring immediate care due to exposure or contamination. The Food, Hydration, and Energy lifelines also may be disrupted if the incident involves contamination of local water supplies or facilities producing critical resources. Lastly, the Transportation lifeline may face challenges as roadways are restricted or closed for cleanup and safety measures, hampering emergency responders and the flow of supplies needed for recovery efforts. The interconnected nature of these lifelines highlights the need for a coordinated response to minimize the impact of such incidents on the community.

CHANGES IN DEVELOPMENT

Salt Lake County’s development and population growth have significant impacts on the release of hazardous materials, since the increase in infrastructure can raise the potential for accidents to occur. Urbanization can also lead to increased population near areas where hazardous materials are present, increasing the likelihood of accidental exposure. In northwest Salt Lake County, there is a combination of hazardous waste sites and population growth that could expose more individuals to hazardous material spills or contamination.

Future development in Salt Lake County may face significant challenges due to the risks associated with hazardous materials incidents. The presence of industrial facilities and transportation routes for hazardous substances poses a potential threat to public safety and the environment. Such incidents can lead to long-term consequences, including contamination of land and water resources, which may deter new investments and slow down redevelopment efforts. Zoning regulations may become more stringent because of past incidents, leading to restrictions on where certain businesses can operate. In addition, community concerns about safety could push policymakers to prioritize environmental assessments and disaster preparedness, ultimately reshaping development plans.

Future land development in Salt Lake County could be significantly impacted by incidents involving hazardous materials. Such events can contaminate soil and water resources, limiting land usability for residential, commercial, or recreational purposes. Areas that have experienced spills or accidents may be designated as hazardous zones, leading to increased regulatory scrutiny and potentially costly remediation processes. Developers may face restrictions on building permits, and the perception of risk can deter investment and development in affected regions. In addition, prioritizing environmental safety measures may lead to more stringent planning and development guidelines, potentially reshaping community layouts and infrastructure design. As awareness of environmental issues grows, future projects may increasingly require comprehensive risk assessments and sustainable practices to mitigate the effects of any hazardous incidents.

VULNERABILITY SCORE

The vulnerability score is likely moderate to high for a community experiencing frequent minor HAZMAT incidents alongside several petrochemical plants and hazardous pipelines. This assessment considers several key factors. First, the high EALs suggest significant financial impacts that can strain community resources and hinder long-term resilience strategies. Although the community exhibits moderate social vulnerability, indicating some degree of cohesion and support, existing disparities can foster tensions. However, the community's high resilience to overall hazards provides a crucial buffer, suggesting that it has robust infrastructure and preparedness measures.[260] Ultimately, while risks remain elevated due to industrial presence and historical incidents, high resilience may mitigate these vulnerabilities, leading to a complex but manageable risk profile.

[260] FEMA. "National Risk Index." https://hazards.fema.gov/nri/map.

Terrorism

Hazard Description

FEMA defines terrorism as "the use of force or violence against persons or property in violation of the criminal laws of the United States for purposes of intimidation, coercion, or ransom."[261] This definition encompasses various violent acts, including those committed by individuals, groups, or governments, intended to instill fear and achieve political or ideological goals. Terrorists use threats to create fear, spread propaganda, and gain attention. Terrorism includes international terrorism, domestic terrorism, transnational terrorism, and cyberterrorism. For this plan, this hazard definition includes active shooter situations, which may be either randomly or intentionally directed and could impact significant numbers of people. Figure 185 shows a stack of newspapers after a terrorist event.[262]

Figure 184: Newspapers After a Car Bombing

- **International Terrorism:** Violent, criminal acts committed by individuals and/or groups who are inspired by or associated with designated foreign terrorist organizations or nations (state-sponsored). Activities transcend national boundaries or are sponsored by international groups.
- **Domestic Terrorism:** Committed by homegrown groups who have no ties or connections outside the United States. These groups are generally motivated by political, racial, ethnic, economic, health, and other grievances.
- **Transnational Terrorism:** Actions in which victims, perpetrators, and sites of violence represent different states and nationalities, such as the current war between Israel and Palestine.[263]
- **Cyberterrorism:** Any premeditated, politically motivated attack against information systems, programs, and data that threatens violence or results in violence.[264]

---

[261] FEMA. "Terrorism," in Are You Ready? – A Guide to Citizen Preparedness. Homeland Security Advisory System. Last updated April 25, 2023. https://www.fema.gov/pdf/areyouready/terrorism.pdf.
[262] Stock photo from https://ieminc4.sharepoint.com/design.
[263] Crenshaw, Martha. "Rethinking Transnational Terrorism." United States Institute of Peace. February 2020. https://www.usip.org/sites/default/files/2020-02/pw_158-rethinking_transnational_terrorism_an_integrated_approach.pdf.
[264] Awati, Robert, et al. "Cyberterrorism." TechTarget Network. Last updated February 2024. https://www.techtarget.com/searchsecurity/definition/cyberterrorism#:~:text=Cyberterrorism%20is%20usually%20defined%20as,violence%20or%20results%20in%20violence.

- **Active Shooter:** An emergency scenario in which an individual or individuals are actively engaged in killing or attempting to kill people in a populated area.[265] This type of situation is extremely dangerous and requires immediate action to ensure the safety and security of everyone involved.

Magnitude/Extent

Terrorist events typically, but not always, aim to impact large numbers of people. The extent of damage or casualties can vary widely, depending on terrorist intent, the setting, victim response, and law enforcement response time. Even those who are not directly impacted by the event may still be psychologically affected through fear, concern for safety, and reduced activity. Therefore, a terrorist or active shooter event in Salt Lake County may directly or indirectly have an impact on the community's citizens.

Location

Terrorists employ various methods to enter a country, including air travel, border crossings, waterways, and illicit means like human trafficking or smuggling. Terrorism can occur anywhere, but certain types of terrorism are more prevalent in specific locations.

International terrorism typically occurs in locations with high-value targets, such as military or civilian government facilities, international airports, major cities, and prominent landmarks. In addition, terrorists may target large public gatherings, water and food supplies, utilities, and corporate centers. International terrorists can also spread fear by sending explosives or chemical or biological agents through the mail.

Historically, domestic terrorism usually occurs in cities with high levels of poverty and racial tension, which are more prone to civil unrest.

Transnational terrorism is a global threat that can occur in various parts of the world, such as the Middle East, South Asia, Africa, Europe, and North America. Terrorist groups often cross borders and employ various tactics like bombings, kidnappings, assassinations, and cyberattacks to achieve their goals. Their operations pose a significant threat to multiple countries and their citizens, necessitating international cooperation and intelligence sharing to counter these threats effectively.

It is crucial to recognize that any entity or individual using technology is vulnerable to cybersecurity threats. However, certain areas are more susceptible than others. For instance, cybercriminals often target organizations that handle sensitive data, such as financial records, medical information, or personally identifiable information (PII). The finance, healthcare, and government sectors are frequent targets due to the sensitive nature of the data they manage. Cyberattacks can also impact small businesses and individuals, emphasizing the importance of safeguarding devices and information.

[265] Emergency Services and Continuity Planning. "Active Shooter Response." Sonoma State University. https://emergency.sonoma.edu/emergency-procedures/active-shooter-response.

Active shooter situations can occur in various locations, such as schools, workplaces, shopping malls, concert venues, and places of worship. These locations are often targeted because they are usually crowded and might have limited security measures in place.

Historical Events and Probability of Future Occurrences

The most recognized forms of terrorism include:

1. Religious terrorism
2. Political terrorism
3. Ideological terrorism
4. State-sponsored terrorism
5. Criminal terrorism

Acts of terrorism include threats of terrorism, assassinations, kidnappings, hijackings, bomb scares and bombings, cyberattacks, and the use of chemical, biological, nuclear, and radiological weapons.[266]

The following tables provide information on terrorism and active shooter incidents in Salt Lake County.[267]

Table 83: Salt Lake County Terrorism Incidents

Date	Location	Perpetrator Group	Deaths	Injuries	Target Type
11/03/2016	Draper	White supremacists/ nationalists	0	1	Private citizens and property
07/01/2010	Sandy City	Animal Liberation Front (ALF)	0	0	Business
05/05/2010	Salt Lake City	ALF	0	0	Business
06/14/2004	West Jordan	Earth Liberation Front (ELF)	0	0	Business
05/15/1995	Murray	ALF	0	0	Business
06/10/1995	Salt Lake City	ALF (suspected)	0	0	Business
02/20/1987	Salt Lake City	Anti-technology extremists	0	1	Business
10/08/1981	Salt Lake City	Anti-technology extremists	0	0	Educational institution
08/20/1980	Salt Lake City	White supremacists/ nationalists	2	1	Private citizens and property
09/05/1975	Salt Lake City	Weather Underground, Weathermen	0	0	Business
05/13/1970	Salt Lake City	Left-wing militants	0	0	Military

[266] Awati, Robert, et al. "Cyberterrorism." TechTarget Network. Last updated February 2024. https://www.techtarget.com/searchsecurity/definition/cyberterrorism#:~:text=Cyberterrorism%20is%20usually%20defined%20as,violence%20or%20results%20in%20violence.
[267] University of Maryland National Consortium for the Study of Terrorism and Responses to Terrorism. "Global Terrorism Database." https://www.start.umd.edu/gtd/search/Results.aspx?search=Salt+Lake+City&sa.x=30&sa.y=17.

Table 84: Active Shooter Incidents in Salt Lake County[268]

Date	Location	Event Description
02/12/2007[269]	Salt Lake City	One notable incident occurred at the Trolley Square Mall in Salt Lake City in 2007, where a gunman opened fire, resulting in five casualties and four injured. No motive was determined.
04/15/1999[270]	Salt Lake City	The LDS Family History Library shooting took place on April 15, 1999, in Salt Lake City. A man entered the library and randomly shot and killed two people and wounded at least five before being apprehended by police. The incident was a tragic and shocking event for the community and highlighted the importance of security and safety measures in public spaces.
01/14/1999[271]	Salt Lake City	The Triad Center shooting took place in Salt Lake City on January 14, 1999. A gunman opened fire at the Triad Center office complex, resulting in multiple casualties. The incident shocked the local community and prompted discussions about improving security measures to prevent such tragic events.

Probability: The increase in political disturbances, both foreign and domestic, is a cause for concern in the United States as it could increase the chances of terrorism and active shooter incidents in the future. Political tensions can often lead to violent acts and extremist ideology, which could lead to terrorism.[272] Moreover, the global rise of populist movements has fueled anti-immigrant and anti-minority sentiment, which can increase the risk of domestic terrorism.

Foreign interference in domestic politics can also pose a serious threat. It is not uncommon for foreign powers to fund extremist groups or carry out attacks in other countries to destabilize their governments. Such actions can cause significant harm and increase the likelihood of retaliatory attacks.

Salt Lake County has several community assets that could be at risk of terrorism. These include major events and venues, such as the Salt Palace Convention Center and the University of Utah; expo centers; amphitheaters and other concert venues; chemical plants and refineries, Salt Lake International Airport, extensive waterways, and power plants. Currently, the chance of a terrorist attack is low. However, due to population density, economic activity, and political climate, areas with larger populations or higher levels of economic activity may be considered more attractive targets for terrorist groups and active shooters.

[268] LDS = Church of Jesus Christ of Latter-Day Saints.
[269] LaPlante, Matthew D., et al. “Emotionless Killer Gunned Down Victims Randomly.” The Salt Lake Tribune. February 13, 2007. https://archive.sltrib.com/article.php?id=5218341&itype=NGPSID.
[270] Deseret News staff. “LDS Library Shooting Leaves Three Dead, Including Suspect.” Deseret News. April 15, 1999. https://www.deseret.com/1999/4/15/19440335/lds-library-shooting-leaves-three-dead-including-suspect/.
[271] Dobner, Jennifer, et al. “KSL Shooter Known to Police; She Has History of Mental Troubles.” Deseret News. January 15, 1999. https://www.deseret.com/1999/1/15/19423490/ksl-shooter-known-to-police-br-she-has-history-of-mental-troubles/.
[272] Doxsee, Catrina, et al. “Pushed to Extremes: Domestic Terrorism amid Polarization and Protest.” Center for Strategic & International Studies. May 17, 2022. https://www.csis.org/analysis/pushed-extremes-domestic-terrorism-amid-polarization-and-protest.

Climate Change Considerations

Although terrorism itself does not cause climate change, with the possible exception of nuclear explosions, its indirect effects can contribute to it. Active shooter events have no impact on climate change. However, there is the potential for climate change to be a driver of future terrorism. Climate change can affect access to basic resources, such as water, food, and shelter and lead to economic hardships.[273] Policies, regulations, or other limitations causing reduced access to these resources may contribute to political contention.[274] Control of or access to these resources could lead to violent conflict or acts of terrorism. The indirect effects of terrorism are outlined in the Secondary Hazards section.

Secondary Hazards

Nuclear events, such as nuclear explosions or nuclear accidents, can significantly impact the climate. The most immediate and direct effect is the release of large amounts of energy, which can cause localized heating and cooling effects. However, the more significant long-term effects are due to the release of radioactive particles into the atmosphere. These particles can travel long distances and significantly impact the Earth's climate, particularly in the area downwind of the event. Radioactive particles can absorb and scatter sunlight, which can lead to a cooling effect on the Earth's surface. The particles can also absorb and emit heat, warming the atmosphere. The exact climate effects of a nuclear event depend on various factors, including the size and location of the event, the type of nuclear material involved, and the weather conditions at the time of the event.

Biological toxins, or biotoxins, are toxic substances produced by living organisms, such as bacteria, fungi, and plants. Although these toxins do not directly contribute to climate change, their release into the environment can indirectly impact the climate and the environment. For example, releasing biotoxins into water sources can lead to the growth of harmful algal blooms, which can deplete the oxygen in the water and harm aquatic life. Similarly, the release of biotoxins into soil can have negative impacts on soil quality and crop production. The use of biotoxins as weapons can also have indirect effects on the climate by contributing to political instability and conflict, which can lead to displacement, migration, and changes in land use. These changes can, in turn, impact the Earth's climate and the environment. In addition, the spread of infectious diseases caused by biotoxins can lead to changes in human behavior and land use, which can indirectly impact the climate. Although biotoxins do not directly affect the Earth's climate, their release and use can indirectly impact the environment and climate.

Chemical releases of sarin and ricin are highly toxic chemical compounds that can devastate human health but do not directly affect the Earth's climate. These chemicals are not greenhouse gases and do not deplete the ozone layer. However, their release into the environment can indirectly impact the climate and the environment. For example, if released into water sources, they can contaminate the water and harm aquatic life. Similarly, if released into the soil, they can contaminate crops and other plants. Using

[273] Spadaro, Paola Andrea. 2020. "Climate Change, Environmental Terrorism, Eco-Terrorism and Emerging Threats." *Journal of Strategic Security*. 13(4). https://www.jstor.org/stable/26965518?seq=3.
[274] Silke, Andrew and John Morrison. 2022. "Gathering Storm: An Introduction to the Special Issue on Climate Change and Terrorism." *Terrorism and Political Violence*. 34(5), 883–893. https://www.tandfonline.com/doi/full/10.1080/09546553.2022.2069444.

these chemicals can also indirectly impact the climate by contributing to political instability and conflict, leading to displacement, migration, and changes in land use. These changes can, in turn, impact the Earth's climate and the environment. However, it is important to note that the primary impact of sarin and ricin is on human health and safety rather than the climate or the environment.

Radiological dispersion, which refers to the release of radioactive material into the environment, can indirectly impact the Earth's climate, causing shifts in atmospheric conditions that lead to changes in weather patterns and temperatures. In addition, these particles can absorb and scatter sunlight, which can lead to a cooling effect on the Earth's surface. However, it is important to note that radiological dispersion primarily affects human health and safety rather than the climate or environment. The release of radioactive material can have significant short-term and long-term impacts on human health, the environment, and ecosystems.

In the immediate aftermath of 9/11, there were some short-term effects on the climate. The attacks resulted in the collapse of the World Trade Center towers, which released large amounts of dust and debris into the air. This dust and debris contained various pollutants, including asbestos, lead, and other toxic materials, which can negatively impact air quality and public health. In addition, the burning of jet fuel and other materials at the attack site released large amounts of carbon dioxide and other greenhouse gases into the atmosphere, which can contribute to long-term climate change. However, these climate effects were relatively minor compared with the overall impacts of the attacks on human life, infrastructure, and the economy.

Vulnerability Assessment

It is crucial to understand that a community's vulnerability to terrorist attacks depends on several factors, including social and economic inequality, political instability, and religious or ideological tensions. The availability of weapons and resources also affects terrorists' ability to carry out attacks.

Table 85: Terrorism Vulnerability[275]

Hazard	Application Mode	Hazard Duration	Extent of Effects: Static/Dynamic	Mitigating and Exacerbating Conditions
Conventional Bomb	Detonation of explosive device on or near the target; delivery is by person, vehicle, or projectile	Instantaneous; additional secondary devices may be employed, extending the duration of the hazard until the attack site is deemed clear	The extent of damage is determined by the type and quantity of explosive material. The effects are typically static, except for cascading consequences, incremental structural failures, etc.	Energy declines logarithmically as a function of distance from the seat of the blast. Terrain, forestation, structures, etc., can provide protection by absorbing and/or deflecting energy and debris. Exacerbating conditions include ease of access to the target, lack of barriers/shielding, poor construction, and ease of concealment of the device.
Chemical Agent	Liquid/aerosol contaminants can be dispersed using sprayers or other aerosol generators. Liquids can also vaporize from puddles/containers or munitions.	Chemical agents may pose viable threats for hours or weeks, depending on the agent and conditions.	Contamination can spread from the initial target area through people, vehicles, water, and wind. If not remediated, chemicals may be corrosive or cause long-term damage.	Air temperatures can affect the evaporation of aerosols. Ground temperatures affect the evaporation of liquids. Humidity can enlarge aerosol particles, reducing inhalation hazards. Precipitation can dilute and disperse agents, but dispersed vapors can also enlarge the target area. The micro-meteorological effects of buildings and terrain can alter the travel and duration of agents. Shielding in the form of sheltering in place can protect people and property from harmful effects.
Biological Agent	Liquid or solid contaminants can be dispersed using sprayers/aerosol generators or by point-of-line sources, such as munitions, covert deposits, and moving sprayers.	Biological agents may pose viable threats for hours to years depending on the agent and conditions.	Depending on the agent used and the effectiveness of deployment, contamination can be spread by wind and water. Infection can also be transmitted by human or animal vectors.	The altitude at which the release agent is used, along with the effectiveness of deployment, can affect aboveground contamination and dispersion. Sunlight destroys many bacteria and viruses, while light to moderate winds can break up aerosol clouds. The micro-meteorological effects of buildings and terrain can influence aerosolization and how agents travel. Enclosed structures extend the lifespan of biological agents due to the lack of ultraviolet radiation.
Radiological Agent	Radioactive contaminants can	Contaminants may remain	Initial effects will be localized to the site of the	Radiation exposure depends on the duration of exposure, distance from the source, the radiation level,

[275] Salt Lake County Hazard Mitigation Plan. 2021.

Hazard	Application Mode	Hazard Duration	Extent of Effects: Static/Dynamic	Mitigating and Exacerbating Conditions
	be dispersed using sprayers/aerosol generators or by point-of-line sources, such as munitions, covert deposits, and moving sprayers.	hazardous for seconds to years depending on the isotope used.	attack. Depending on meteorological conditions, subsequent behavior or radioactive contaminants may be dynamic.	and the degree of shielding between the source and the target.
Nuclear Bomb	Detonation of nuclear device underground, on the surface, in the air, or at high altitude	Light/heat flash and blast/shock wave lasts for seconds; nuclear radiation and fallout hazards can persist for years. The electromagnetic pulse from a high-altitude detonation lasts for seconds and affects only unprotected electronic systems.	Initial light, heat, and blast effects of a subsurface, ground, or air burst are static and are determined by the device’s characteristics and employment; the fallout of radioactive contaminants may be dynamic depending on meteorological conditions.	The harmful effects of radiation can be reduced by minimizing the duration of exposure. Light, heat, and blast energy decrease logarithmically as a function of distance from the seat of the blast. Terrain, forestation, structures, etc. can provide shielding by absorbing and/or deflecting radiation and radioactive contaminants.

ESTIMATED IMPACTS AND POTENTIAL LOSSES

During a terrorist attack, a community's infrastructure and residents could face various impacts. Infrastructure, such as transportation systems, communications networks, and utilities may be damaged, leading to disruptions in daily life. Access to essential and critical emergency services may be impeded. People may experience physical harm, emotional trauma, and loss of life or property. It could also incite widespread fear, anxiety, and a sense of insecurity among community members. The attack could also lead to economic repercussions, affecting businesses and disrupting the overall productivity of the community. Overall, a terrorist attack event can have far-reaching and long-lasting impacts on a community, affecting the physical and emotional well-being of residents and the functionality of the infrastructure.

The impacts of an active shooter event on a community can be profound and long-lasting. The immediate effects may include loss of life, physical injuries, and emotional trauma for those directly involved. In addition, the community may experience fear, anxiety, and a sense of vulnerability. Individuals and the community can experience long-term psychological effects and economic impacts due to decreased property values and potential loss of business activity. Rebuilding a sense of safety and security can take time and require significant resources, including mental health support, community outreach, and efforts to prevent future incidents.

VULNERABLE POPULATIONS

Specific populations in Salt Lake County are more vulnerable to terrorist attacks, including active shooter situations. These populations include children and students in schools and educational institutions; employees and customers in public places, such as shopping malls, restaurants, and entertainment venues; residents in densely populated urban areas; individuals in healthcare facilities, such as hospitals and clinics; participants in large public events and gatherings; individuals in religious institutions, such as churches, mosques, and synagogues; the homeless population; and individuals in temporary shelters. However, anyone can become a victim of terrorism or an active shooter, regardless of race, religion, ethnicity, or nationality.

COMMUNITY LIFELINES

During a terrorist event, all lifelines—safety and security, food, hydration and shelter, health and medical, energy (power and fuel), communications, transportation, water systems, and hazardous materials—are all at risk. Explosives, radiological devices, and nuclear bombs can cause substantial damage to structures and infrastructures, blocking evacuation routes and complicating access to essential and critical emergency services, law enforcement, medical aid, and essential items like food and water. Biological and chemical assaults can also destroy crops, poison livestock, and contaminate water supplies and soil, making food production challenging for years. Explosives can cause power outages, disrupting transportation, communications, and fuel supplies. Therefore, protecting citizens and critical assets from these worst-case scenarios in the United States is crucial.

CHANGES IN DEVELOPMENT

Terrorism and active shooters can profoundly impact community development. These acts of violence can create fear, distrust, and instability, hindering economic growth, discouraging investment, and disrupting social cohesion. Unfortunately, as areas in Salt Lake County grow, they could be increasingly attractive targets for those looking to harm people and property. Growing communities in the county, particularly those growing quickly, like Magna and Herriman, should be aware of this risk. The aftermath of such events often leads to increased security measures, which can limit public access to essential services and public spaces. In addition, the psychological trauma experienced by individuals and communities can impede progress and development.

Table 86 provides information on population, household, and employment projections from 2025 to 2065 in Salt Lake County, all of which could be affected by terrorism or active shooter incidents.

Table 86: Future Development Projections for Salt Lake County [276]

2025	2035	2045	2055	2065	Absolute Change 2025–2065	Percent Increase Change 2025–2065
Population Projections						
1,249,961	1,361,099	1,470,574	1,594,804	1,693,513	443,552	35%
Household Projections						
454,929	521,352	579,472	635,143	689,490	234,561	52%
Employment Projections						
1,053,362	1,182,092	1,293,225	1,385,240	1,454,567	401,205	38%

Terrorism and active shooter events can significantly impact population growth, household growth, and employment growth in a community. These events can create an atmosphere of fear and uncertainty, potentially hindering population growth as individuals may be reluctant to move to or remain in the affected area. Household growth also may be impacted as families choose to relocate to safer areas, leading to a decrease in new households in the community.

Regarding employment growth, terrorism and active shooter incidents can lead to declining business investment and economic activity in the affected area. This can lead to job losses and fewer employment opportunities, impacting overall employment growth in the community. In addition, businesses may be hesitant to establish or expand operations in an area that has experienced such events, further impacting employment growth.

Terrorism can significantly impact future land use and development trends in a community. In the aftermath of a terrorist attack, there may be increased emphasis on security measures and considerations in future land use planning and development. This could lead to stricter building codes, stronger security infrastructure requirements, and limitations on certain types of development in high-risk

[276] Salt Lake County Hazard Mitigation Plan. 2021.

areas. In addition, zoning regulations may be changed to enhance security and protect critical infrastructure. As a result, future growth may be influenced by the need to mitigate security risks, which could impact the layout and design of communities.

VULNERABILITY SCORE

Given Salt Lake County's moderate social vulnerability, high EAL, and high community resilience to overall hazards,[277] its vulnerability to a terrorist attack or active shooter event remains significant. Although its high community resilience can be beneficial in the aftermath of an attack, its high EAL indicates that the impact of an attack could be substantial. In addition, its moderate social vulnerability suggests the existence of underlying factors that could exacerbate the impact of a terrorist attack. Therefore, despite the resilience of the county, addressing its underlying vulnerabilities and their potential impact is vital to enhancing overall preparedness and response capabilities.

[277] FEMA. "National Risk Index." https://hazards.fema.gov/nri/map.

Capability Assessment

The capability assessment allows each jurisdiction to evaluate its current programs, funding, staffing, and other resources that can support the accomplishment of the mitigation strategy. A thorough understanding of existing capabilities helps decision makers identify feasible mitigation actions. This assessment also provides an opportunity to identify gaps in capabilities and consider ways to expand and improve policies and programs.

The assessment evaluates four types of capabilities:

1. **Planning and Regulatory:** The codes, ordinances, policies, laws, plans, and programs that guide growth and development.
2. **Administrative and Technical:** The staff, skills, and tools that implement resources and mitigate actions. This may include the private sector, community-based organizations, and other partner agencies.
3. **Financial:** The funding resources available for mitigation.
4. **Education and Outreach:** Programs and processes used to communicate risks and encourage risk reduction.

All participating jurisdictions conducted an assessment of their capabilities. Some of the findings are presented in through , with additional details available in the jurisdictional annexes.

Planning and Regulatory

Jurisdictions have the authority to create policies, programs, and regulations that protect and serve their residents. Local policies are typically outlined in community plans, enacted through local ordinances, and enforced by governmental bodies. Many communities have developed plans specifically aimed at enhancing disaster resistance. A major goal of these plans is to coordinate existing activities so that individual objectives are integrated into a comprehensive course of action.

Table 87: Assessment of the Planning and Regulatory Capabilities of Salt Lake County

Plan	Does it address hazards? (Y/N)	How can it be used to implement mitigation actions?	When was it last updated? When will it next be updated?
General Plan	Y	Incorporate goals identified in this plan into the county's Hazard Mitigation Plan (HMP) update.	May 10, 2022, reviewed annually.
Capital Improvement Plan (CIP)	Y	Incorporate goals identified in this plan into the county's HMP update.	Salt Lake County (SLCo) Flood Control CIP is updated annually.

Plan	Does it address hazards? (Y/N)	How can it be used to implement mitigation actions?	When was it last updated? When will it next be updated?
Climate Change Adaptation Plan	N/A	N/A	N/A
Community Wildfire Protection Plan	Y	Incorporate goals identified in this plan into the county's HMP update, specifically with the wildland–urban interface (WUI). It can also shed light on WUI building codes and/or development, since there are significantly more people living and/or building in these areas than in 2019.	December 1, 2019. Update planned for 2025.
Economic Development Plan	N/A	N/A	N/A
Land Use Plan	Y	Incorporate land use planning ideas into potential mitigation actions.	June 2020 and July 2017 (Wasatch Canyons Plan and Resource Management Plan). Reviewed annually.
Local Emergency Operations Plan	Y	Incorporate actions from the county level into mitigation actions in the county's HMP update.	2022. Reviewed annually.
Stormwater Management Plan	Y	Primarily incorporates information on hazardous waste, which can be used to develop mitigation actions for the plan update. Municipal Services District (MSD) is responsible for Unincorporated Salt Lake County stormwater.	May 2020. Reviewed annually.
Transportation Plan	Y	Can incorporate historical context to aid in new mitigation actions. MSD is responsible for Unincorporated Salt Lake County transportation.	May 2020 and May 2022. Reviewed annually.
Substantial Damage Plan	Y	It can include EM/activation information to improve coordination between agencies and jurisdictions.	2022. Reviewed annually.
Other? (Describe)	Y, Regional Hydrology and Hydraulics Study	Unknown	March 2020 for the Southwest and Northwest quadrants of SLCo. In progress for Eastside SLCo in 2024.

Jurisdictions manage land use by adopting and enforcing zoning laws, subdivision regulations, land development ordinances, building codes, building permit requirements, and stormwater management ordinances. When well-prepared and effectively administered, these regulations can help mitigate hazards.

Table 88: Assessment of the Regulations and Ordinances of Salt Lake County

Regulations and Ordinances	Does it effectively reduce hazard impacts?	Is it adequately administered and enforced?	When was it last updated? When will it next be updated?
Building Code	Y. Salt Lake County has adopted the International Building Code (IBC 2021) and the International Residential Code (IRC 2021), along with any amendments, as adopted by the state.	Y	2025
Flood Insurance Rate Maps	Y	No	November 19, 2021
Floodplain Ordinance	Y	No	August 3, 2021
Subdivision Ordinance	N/A	N/A	N/A
Zoning Ordinance	N/A	N/A	N/A
Natural Hazard-Specific Ordinance (Stormwater, Steep Slope, Wildfire)	Y	Unknown	August 3, 2021
Acquisition of Land for Open Space and Public Recreation Use	N/A	N/A	N/A
Prohibition of Building in At-Risk Areas	Y	Y	
Other? (Describe)	None		

Administrative and Technical Capabilities

Although legal, regulatory, and fiscal capabilities provide the foundation for effectively developing a mitigation strategy, successful implementation depends on the presence of appropriate personnel. Administrative and technical capabilities emphasize the availability of human resources responsible for executing all aspects of hazard mitigation. These resources include technical experts, such as engineers and scientists and personnel with specialized skills in areas like grant writing and project management.

Table 89: Assessment of the Administrative Capabilities of Salt Lake County

Administrative Capability	In Place? (Y/N)	Is staffing adequate?	Is staff trained on hazards and mitigation?	Is coordination between agencies and staff effective?
Chief Building Official	Y	No, there is a shortage of building inspectors statewide. MSD manages this.	Yes, but additional training is needed.	Yes
Civil Engineer	Y	Yes, SLCo Flood Control operates countywide.	Yes	Yes

Administrative Capability	In Place? (Y/N)	Is staffing adequate?	Is staff trained on hazards and mitigation?	Is coordination between agencies and staff effective?
Community Planner	Y	See MSD staffing levels.	Yes, but more training is needed.	Yes
Emergency Manager	Y	No. The statewide mandate for local jurisdictions to have emergency managers has resulted in many local jurisdictions having an emergency manager who wears multiple hats or only works part-time.	Yes, but more training is needed.	Yes, but improvements could always be made.
Floodplain Administrator	Y	SLCo Flood Control operates countywide.	Yes	Yes
Geographic Information System (GIS) Coordinator	Y	Yes, though additional staff with expertise in emergency management would be beneficial.	Yes, but there are gaps at the county level. Currently, we have one GIS Specialist for county EM. Other county GIS staff are not as familiar with EM and corresponding workflows.	Yes, but there is room for improvement.
Planning Commission	Y	No, there are vacancies on the planning commission boards.	They may be familiar with local risks, but because these are volunteer boards, more formal training would help.	No, it could be improved for better situational awareness.
Fire Safe Council	Y	Yes	Valley fire chiefs are aware of risks but may focus more on fire-related hazards. More extensive training would be beneficial.	Yes, though better communication across agencies and jurisdictions is needed.
CERT (Community Emergency Response Team)	Y	Varies by jurisdiction in terms of engagement. A revamp is underway to improve coordination and set more precise expectations.	Yes, though more training would be helpful.	Yes, but participation varies by jurisdiction.
Active VOAD (Voluntary Agencies Active in Disasters)	Y	Staffing shelters can sometimes be challenging due to the voluntary nature.	Yes, though additional training would be helpful.	Yes, but it is always possible to improve relationships.
Other? (Please describe)	None			

Table 90: Assessment of the Technical Capabilities of Salt Lake County

Technical Capability	In Place? (Y/N)	How has it been used to assess/mitigate risk in the past? (Answer or N/A)	How can it be used to assess/mitigate risk in the future?
Mitigation Grant Writing	Y	We have applied for mitigation funds with assistance from the Salt Lake County Division of Emergency Management and the county's grant writer.	We can use the county grant writer and geographic information system (GIS) staff to help with future grant applications. GIS staff can provide the demographic and mapping data to support the geographic needs, while the county grant writer can craft the narrative for the grant application.
Hazard Data and Information	Y	In the past, we have used Hazus and various GIS tools to identify local hazards in the county.	This data can be used to track mitigation progress over time, ensuring that it is an ongoing process rather than just a review every 5 years.
GIS	Y	We use GIS in various ways to identify, monitor, and prepare for hazards. Local dashboards, WebEOC, and Crisis Track, are integrated to track and share information.	More data integration is needed to track mitigation activities over time. Improved situational awareness for all local jurisdictions, agencies, and partners is crucial so everyone is aligned on expectations.
Mutual Aid Agreements	Y	Mutual aid agreements help in scenarios where local jurisdictions are overwhelmed or need additional resources.	These agreements should be reviewed more frequently to ensure that no overlap exists with other jurisdictions.
Other? (Please describe)	None		

Financial Capabilities

Identifying current and potential funding sources is critical to the mitigation planning process. Planning partners can select and implement financially viable actions to reduce future disaster risks by exploring, identifying, and assessing various funding options.

FEMA's Hazard Mitigation Assistance (HMA) grants are available to fund eligible mitigation measures to reduce future disaster losses. Eligible applicants include state agencies, local governments, special districts, federally recognized tribes, and private nonprofit organizations.

This plan adheres to federal guidelines to ensure that participants remain eligible for specific mitigation funds. As outlined in the Code of Federal Regulations (CFR) Title 44, Part 201.6 (§201.6), local governments must have a Federal Emergency Management Agency (FEMA)-approved plan to apply for and receive hazard mitigation project grant funds. These funds support various hazard mitigation programs, including the following:

- Hazard Mitigation Grant Program (HMGP)
- HMGP Post Fire Program (HMGP-PF)
- Building Resilient Infrastructure and Communities (BRIC)
- Flood Mitigation Assistance (FMA)
- Safeguarding Tomorrow Revolving Loan Fund Program

It is essential to consider multiple funding sources, as mitigation actions can and should be financed through various avenues. Potential funding opportunities include federal agencies; state, local, and tribal programs; and private funding sources. lists federal, state, and local funding opportunities.

Table 91: Assessment of the Financial Capabilities of Salt Lake County[278]

Funding Resource	In Place? (Y/N)	Has it been used in the past and for what types of activities?	Could it be used to fund future mitigation actions?	Can this be used as the local cost match for a federal grant?
Capital Improvement Project Funding	Y	Yes, Flood Control Improvement Projects	Y	Y
General Funds	Y	Countywide UPDES/ MS4 Program	Y	Y
Hazard Mitigation Grant Program (HMGP/404)	Y	Yes, Flood Control Improvement Projects	Y	Y
Building Resilient Infrastructure & Communities (BRIC)	Y	Levee Stability Study	Y	
Flood Mitigation Assistance (FMA)	Y	Yes, Flood Control Improvement Projects	Y	Y
Public Assistance Mitigation (PA Mitigation/406)	N/A	N/A	Y	N
Community Development Block Grant (CDBG)	Y	Yes, Stormwater Improvement Projects	Y	Y
Natural Resources Conservation Services (NRCS) Programs	Y	Yes, Flood Control Improvement Projects	Y	Y
U.S. Army Corps (USACE) Programs	Y	Federal Recognized Levee System	Unknown	Unknown
Property, Sales, Income, or Special Purpose Taxes	Y	Flood Control Levee	Unknown	Unknown

278 MSD = Municipal Services District, SLCo = Salt Lake County, UPDES = Utah Pollution Discharge Elimination System.

Funding Resource	In Place? (Y/N)	Has it been used in the past and for what types of activities?	Could it be used to fund future mitigation actions?	Can this be used as the local cost match for a federal grant?
Stormwater (SW) Utility Fee	N	No, it would be implemented by the MSD. SW Utility Fee Study conducted in 2018.	N/A	N/A
Fees for Water, Sewer, Gas, or Electric Services	N/A	N/A	Unknown	Unknown
Impact Fees from New Development and Redevelopment	N	No, it would be implemented by the MSD. SW Utility Fee Study conducted in 2018.	N/A	N/A
General Obligation or Special Purpose Bonds	Y	Implemented by SLCo Flood Control and MSD	Y	Y
Federal-funded Programs (Please describe)	Unknown	N/A	Y	N
Private Sector or Nonprofit Programs	N/A	N/A	Unknown	Unknown
Other?	None			

Education and Outreach Program Capabilities

Regular engagement with the public on hazard mitigation issues offers a valuable opportunity to directly connect with community members. Assessing this outreach and educational capability highlights the important relationship between the government and the community, promoting a two-way dialogue. Such interactions help build a more resilient community, grounded in education and active public involvement.

Table 92: Assessment of the Education and Outreach Capabilities of Salt Lake County[279]

Education and Outreach Capability	In Place? (Y/N)	Does it currently incorporate hazard mitigation?	Could it be used to support mitigation in the future?
Community Newsletter(s)	Y	Yes, newsletters were used during the 2023 spring runoff emergency response.	Yes

[279] CERT = Community Emergency Response Team, EM = Emergency Management, MSD = Municipal Services District, SLCo = Salt Lake County.

Hazard Awareness Campaigns (such as Firewise, StormReady, Severe Weather Awareness Week, and School Programs)	Y	Yes. StormReady outreach was used during the 2023 spring runoff emergency response.	Yes
Public Meetings/Events (Please describe.)	Y	Yes. Public meetings/events used during the 2023 spring runoff emergency response.	Yes
Emergency Management Listserv	Y	Yes	Yes
Local News	Y	Yes. Used during the 2023 spring runoff emergency response.	Yes
Distributing Hard Copies of Notices (e.g., public libraries, door-to-door outreach)	Y	Yes. Door-to-door outreach was used during the 2023 spring runoff emergency response. SLCo EM has various mitigation materials that are handed out during outreach events, like preparedness events and CERT activities.	Yes
Insurance Disclosures/ Outreach	N/A	N/A	Yes
Organizations that Represent, Advocate for, or Interact with Underserved and Vulnerable Communities (Please describe.)	Y	SLCo EM has various mitigation materials that are handed out during outreach events, like preparedness events and CERT activities.	Yes
Social Media (Please describe.)	Y	Yes, social media was used during the 2023 spring runoff emergency response. We distribute hazard mitigation information through SLCo EM's social media pages, including Facebook, X, and Instagram.	We could leverage social media by posting more frequently, creating videos, etc.
Other? (Please describe.)	None		

Opportunities to Expand and/or Improve Capabilities

Actions that can expand and improve existing authorities, plans, policies, and resources for mitigation include budgeting for mitigation actions, passing policies and procedures for mitigation actions, adopting and implementing stricter mitigation regulations, approving mitigation updates, and making additions to existing plans as new needs are recognized. Table 93 lists the opportunities for the Salt Lake County.

Table 93: Opportunities to Expand and/or Improve the Capabilities of Salt Lake County

Capability Type	Opportunity to Expand and/or Improve
Planning and Regulations	The community wildfire protection plan will be updated in 2025. Areas in Draper have repeatedly flooded every year.
Administrative and Technical	The building official needs more staff to address inspections with the statewide shortage. County employees have to be better integrated into EM so requiring certain FEMA courses during the onboarding process would help, especially in the event of an activation.
Financial	The county grant writer could get more training/knowledge on EM-specific grants so they know what is needed as far as the narrative, data, and additional information for a successful grant application.
Education and Outreach	The public does not seem to be fully aware of what county EM does vs. a local EM so spreading that awareness/knowledge, whether that is at local preparedness fairs, special events, or social media would help with clarifying that. In addition, we would like mitigation to be a discussion more frequently instead of just when the plan update occurs. We would like to have information posted on our website to track mitigation efforts, get public feedback, and engage the community in mitigation efforts for situational awareness.

Jurisdictional Capabilities

Each participating jurisdiction also completed a detailed assessment of its planning and regulatory, administrative and technical, financial and educational and outreach capabilities. The jurisdictional annexes in Volume 2 provide the details regarding these capabilities.

National Flood Insurance Program (NFIP) Capabilities

Flooding is the costliest natural hazard in the United States, and recent federal regulations have led to rising flood insurance premiums for homeowners nationwide. Community participation in the National Flood Insurance Program (NFIP) allows access to additional grant funding to address flood-related issues. By assessing a jurisdiction's current NFIP status and compliance, planners can better understand local flood management efforts, identify areas for improvement, and explore available grant funding opportunities.

Salt Lake County currently participates in the NFIP. The designated Floodplain Administrator is the Director of Planning and Development. The Great Salt Lake Municipal Services District (MSD) Grading, Floodplain & Stormwater Manager implements the provisions of the NFIP on behalf of the unincorporated county, in addition to the communities of Brighton, Copperton, Emigration Canyon, Kearns, Magna, and White City. MSD staff are knowledgeable in current trends and stay apprised of the latest bulletins, including taking training like the National Disaster & Emergency Management University (formerly the Emergency Management Institute)'s course 273: Managing Floodplain Development Through the NFIP. Other MSD staff, including engineering/permitting staff, could use the 273 course. In addition, the Grading, Floodplain & Stormwater Manager is in the process of becoming a Certified Floodplain Manager

(CFM). CFMs play a crucial role in managing and mitigating flood risks by promoting floodplain management regulations in adherence to local, state, and federal best practices and requirements.

The most recent Flood Damage Prevention Ordinance was adopted on November 22, 2022. It includes the higher standard that structures must be built 1 foot above the Base Flood Elevation (BFE). The MSD is responsible for implementing this ordinance. In addition, the latest update included a clear reference to the migratory bird production area (MBPA) in the county. The latest Community Assistance Visit, during which FEMA audited the county's program, was in June 2022. During that visit, FEMA identified that the ordinance could be enforced more effectively in MBPAs. According to Utah law, duck clubs must approve ordinances that make changes in MBPAs. The MSD is working with the duck clubs to get their approval for an ordinance change that would allow for wetproofing so that they do not have to apply for a variance to perform wetproofing when they want to improve their structures. In addition, the ordinance could be updated to include more specific language regarding enforcement and inspections.

MSD is also responsible for issuing development permits in the special flood hazard area. This includes reviewing proposals for subdivisions to ensure that they minimize flood damage and reduce exposure to flood damage. The Engineering Division conducts the technical review using an electronic permitting portal. The portal automatically indicates whether a parcel is approximately in the regulatory floodway or the Special Flood Hazard Area (SFHA). In addition, staff are trained in how to flag parcels as some parcels particularly in the canyon area may not be mapped accurately. If anywhere on the parcel touches the floodplain, developers are required to obtain a floodplain permit. Prior to issuing a permit, the Grading, Floodplain & Stormwater Manager reviews all permits and ensures compliance with floodplain management regulations. GIS supports the identification of parcels and can track the number of buildings in the SFHA.

The Grading, Floodplain & Stormwater Manager is responsible for making substantial damage/substantial improvement determinations. This process occurs as part of the permitting process. MSD reviews the scope of a project during the permit process. When proposed costs are within 40–60% of the cost of the structure itself, the MSD uses the assessed value of the structure from the Salt Lake County assessor and requests a cost estimate for all labor and materials to make a substantial damage/substantial improvement determination. These estimates are compared with the cost of the structure, and a determination is made based on the value of the structure, not the land, before any damage. If structures are declared substantially damaged/substantial improvements, they must be brought into compliance or a variance may be issued. Variances are typically only issued in the duck club areas. Staff are always actively pursuing additional opportunities, both in-house and through in-person training, on how to make substantial damage/substantial improvement determinations.

The latest Flood Insurance Rate Map (FIRM) became effective on November 19, 2021. MSD also supports floodplain mapping, including Risk MAP and Letters of Map Amendment or Revisions as needed. FEMA is currently in the process of revising the BFE around Salt Lake to include V Zones. The Grading, Floodplain & Stormwater Manager and the SLCo Flood Control Engineering support flood insurance outreach and public awareness about the availability of flood insurance. The MSD advocates for obtaining flood insurance through conversations during permit applications, including conversations on the statistics of flooding during a 30-year mortgage and the likelihood of flood events. Additional outreach could be conducted to promote flood insurance across the unincorporated county. Obtaining flood insurance is one way to reduce the exposed risk to flooding.

The NFIP's Community Rating System (CRS) is a voluntary program that recognizes and incentivizes community floodplain management activities that exceed the minimum NFIP requirements. Communities participating in the CRS receive discounted flood insurance premiums, reflecting the reduced flood risk from their proactive flood management efforts. The CRS has three main goals: to reduce flood damage to insurable properties, reinforce and enhance the insurance aspects of the NFIP, and encourage a comprehensive approach to floodplain management. Currently, according to the FEMA Community Status Book Report, no Salt Lake County planning jurisdictions currently participate in the National Flood Program, and they do not qualify for discount premiums based on the CRS class.

Mitigation Strategy

The heart of the mitigation plan is the mitigation strategy, which serves as the long-term blueprint for reducing the potential losses identified in the risk assessment. The mitigation strategy describes how the community will accomplish the overall purpose, or mission, of the planning process. In this section, mitigation goals were reevaluated and updated, and mitigation actions/projects were updated/amended, identified, evaluated, and prioritized.

Plan participants assessed and included a comprehensive range of hazard mitigation strategies/actions, including strategies from FEMA documents, strategies from the 2019 Salt Lake County Hazard Mitigation Plan, and suggestions from participating communities and their respective stakeholders during workshops and meetings with individual agencies that took place throughout the county in the fall of 2024.

Mitigation Goals

The mitigation planning team has organized resources, assessed hazards and risks, and documented mitigation capabilities. The resulting goals, objectives, and mitigation actions were developed based on these tasks. The team held a series of meetings designed to develop mitigation strategies as described further in this section. The goals for this mitigation plan are statements that accomplish the following:

- Represent the desires of the entire community
- Include all members of the community, both public and private
- Are achievable in the future, whether near-term or long-term

Goals form the basis for objectives and actions to be taken and are not dependent on implementation feasibility. The following are Salt Lake County's goals, listed in order of priority:

- **Goal 1:** Protect the lives, health, and safety of the county's citizens before, during, and after a disaster.
- **Goal 2:** Protect and eliminate and/or reduce damage and disruptions to critical facilities, structures, and infrastructure from hazards.
- **Goal 3:** Enhance and protect the communications and warning systems in the county.
- **Goal 4:** Promote education and awareness programs, campaigns, and efforts designed to encourage citizens and both public and private entities to mitigate and become more resilient to disasters.
- **Goal 5:** Ensure and promote ways to sustain government and private sector continuity of services during and after a disaster.
- **Goal 6:** Advocate, support, and promote the continued coordination and integration of disaster planning efforts throughout the county.

- **Goal 7:** Advocate, support, and promote the use of laws and local regulations and ordinances aimed at mitigating hazards and enhancing resilience.
- **Goal 8:** Preserve and protect natural systems, natural resources, and other environmental assets against the effects of hazards.

Mitigation Action Plan

The action plan helps prioritize mitigation initiatives according to a benefit/cost analysis of the proposed projects (44 Code of Federal Regulations [CFR], Section 201.6(c)(3)(iii)). The action plan also provides a framework for how the proposed projects and initiatives will be implemented and administered over the next five years. Countywide mitigation actions will be listed using this table in Volume 1: Mitigation Strategies, while actions for each participating jurisdiction will be listed in their respective annexes in Volume 2. Each mitigation project identified during the 2025 plan update for the county and its jurisdictions has been organized based on the following parameters.

Mitigation Action Benefit Parameters

Benefit ratings were defined as follows:

- **High:** Project will provide an immediate reduction of risk exposure for life and property.
- **Medium:** Project will have a long-term impact on the reduction of risk exposure for life and property or provide an immediate reduction in the risk exposure for property.
- **Low:** Long-term benefits of the project are difficult to quantify in the short term.

Mitigation Action Cost Estimate Parameters

Although the preference is to provide definitive costs (dollar figures) for each mitigation strategy/action, this is not possible for every mitigation strategy/action. Therefore, the estimated costs for the mitigation initiatives identified in this plan were identified as high, medium, or low, using the following ranges:

- **High:** Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases). (Estimated over $500,000)
- **Medium:** The project could be implemented with existing funding but would require a reapportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years. (Estimated $50,000–$500,000)
- **Low:** The project could be funded under the existing budget. It is part of or can be part of an ongoing existing program. (Under $50,000)

Mitigation Funding Sources

Potential mitigation funding sources, such as grants, are referenced for each action; however, these are not intended to be an exhaustive list of funding opportunities. As efforts to complete actions progress, the best available funding sources will be evaluated and pursued. When grant funding may be suitable, specific grants are listed. Many actions involve efforts that fall within the regular functions of county and municipal governments and the duties of their staff. The terms city budget or local budget, which refer to local funds and operating budgets, may be utilized where appropriate. Additional relevant funding sources are listed where applicable (denoted by “staff time” or “applicable operating budgets”).

The planning team acknowledges that BRIC was abolished on April 4, 2025. However, as federal policy was actively changing during the development of this plan, references to BRIC were still included in the mitigation actions tables for the county (Table 95) and individual jurisdictional annexes in Volume 2. If BRIC is replaced in the future, projects identified with BRIC should be reviewed for application to the replacement program.

Mitigation Action Time Frame Parameters

Although the preference is to provide definitive project completion dates, this is not possible for every mitigation strategy/action. Therefore, the parameters for the timeline (projected completion date) are as follows:

- **Short Term:** To be completed in 1–3 years.
- **Medium:** To be completed in 3–5 years.
- **Long Term:** To be completed in more than 5 years.
- **Ongoing**: Currently being implemented under existing programs but without a definite completion date.

Mitigation Action Prioritization Process

The action plan must be prioritized according to a benefit/cost analysis of the proposed projects (44 CFR, Section 201.6(c)(3)(iii)). The benefits of proposed projects were weighed against estimated costs as part of the project prioritization process. The benefit/cost analysis was not as detailed as required by FEMA for project grant eligibility under the Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation (PDM) grant program. A less formal approach was used because some projects may not be implemented for up to 10 years, and associated costs and benefits could change dramatically in that time. Therefore, for each project, a review was conducted of the apparent benefits versus the apparent cost. Parameters were established for assigning subjective ratings (high, medium, and low) to the costs and benefits of these projects.

The priorities are defined as follows:

- **High Priority:** A project that addresses many goals or hazards, has benefits that exceed costs, has funding secured or is an ongoing project, and meets eligibility requirements for the HMGP or PDM grant program. High-priority projects can be completed in the short term (1–5 years).
- **Medium Priority:** A project that addresses multiple goals and hazards, has benefits that exceed costs, and is grant-eligible under HMGP, PDM, or other grant programs, although funding has not yet been secured. The project can be completed in the short term once funding is secured. Medium-priority projects will become high-priority projects once funding is secured.
- **Low Priority:** A project that addresses few goals, mitigates the risk of one or few hazards, has benefits that do not exceed costs or are difficult to quantify, lacks secured funding, is not eligible for HMGP or PDM grant funding, and has a long-term timeline for completion (1–10 years). Low-priority projects may be eligible for other sources of grant funding from other programs.

For many of the strategies identified in this action plan, the partners may seek financial assistance under the HMGP or HMA programs, both of which require detailed benefit/cost analyses. These analyses will be performed on projects at the time of application using the FEMA benefit/cost model. For projects not seeking financial assistance from grant programs that require detailed analysis, the partners reserve the right to define "benefits" according to parameters that meet the goals and objectives of this plan.

Mitigation Strategies and Alternatives

When completing forms for this plan update, participants were also asked to document alternative mitigation actions that were considered. Alternatives considered for Salt Lake County include the following:

Construct avalanche sheds.

Develop a wildfire early warning system.

Develop a countywide emergency management communication system.

Develop green flood protection systems in annual flood areas.

Increase the size of bridges and culverts.

Review of Previous Mitigation Actions

The planning process includes an opportunity to evaluate mitigation actions identified in the last mitigation plan. This enables participants to identify successes of previous actions, challenges that might have impeded progress, and opportunities to expand future mitigation projects. Because the implementation of this plan is critical to creating greater community resilience, the completion of mitigation actions is an important indicator of implementation and activity in the county. Table 94 presents all mitigation actions from the 2015 and 2019 multijurisdictional hazard mitigation plans (MJHMPs) and identifies (a) actions have been completed, (b) those that are either ongoing or are incomplete and will be carried forward into the 2025 mitigation actions, and (c) any that are no longer relevant and will be deleted.

In this section, mitigation actions/projects were updated/amended, identified, evaluated, and prioritized. This section is organized as follows:

- **Status Update of Previous Mitigation Actions:** Table 94 presents a review of mitigation actions and their status from the 2015 and 2019 MJHMPs:
  - **Completed:** Project has been completed in full.
  - **Ongoing:** Work on this action has been initiated and will be continued in 2025.
  - **Incomplete:** Work on this action has not begun due to funding or other limitations and will be carried forward into the Mitigation Action Plan.
  - **Deleted:** This action was not completed and was deleted. These might have been deemed no longer relevant or unfeasible. Some were rewritten as new mitigation actions to address changes in approach.

2025 Mitigation Actions

Table 95 identifies actions carried forward from the previous mitigation plan and new actions identified during this 2025 update process. Actions that have been carried forward might have minor revisions to address new funding sources, new partnerships, changes in priority, or additional clarification.

Table 94:Status of Previous Mitigation Actions from the 2015 and 2019 Multijurisdictional Hazard Mitigation Plans[280]

Action	Hazard(s)	Lead Agency	Support Agency(ies)	Status	Is this action carried forward to the 2025 Mitigation Action Plan?
Develop an enhanced emergency notification communication system for the county.	All hazards	SLCo EM	Local jurisdiction emergency management	Ongoing. SLCo EM preparing IPAWS (Integrated Public Alert and Warning System) templates and identifying streamlined communications platforms.	Yes
Coordinate conservation, preservation, and mitigation actions with community development and community planning divisions to ensure integration of programs across all communities.	Dam/levee failures, drought, earthquakes, floods, hazardous materials incidents (transportation and fixed facility), wildfires	SLCo PW & Municipal Services, MSD	SLCo EM, all participating jurisdictions	Ongoing.	Yes
Enhance security at critical public safety and technology infrastructure sites. Develop and implement a critical infrastructure and key resources (CIKR) security/hardening program.	All hazards	SLCo EM, local jurisdiction emergency management	SLCo PW Operations	Ongoing; have completed security updates to the Emergency Coordination Center (ECC) with card access and cameras. SLCo EM is in the process of creating a new access and lobby management policy. Ongoing; SLCo PW Operations has increased the number and quality of security cameras at public works yards.	Yes, reworded in 2025 action plan
Enhance interoperable radio communications systems throughout the county.	All hazards	SLCo EM, local jurisdiction emergency management	All jurisdictions in the county	Ongoing; SLCo PW Operations is in the process of upgrading two-way radios.	Yes
Elevate and/or mitigate roadways in low-lying areas prone to overland flooding.	Floods (flash and riverine)	SLCo PW & Municipal Services, local PW/engineering departments, MSD		Ongoing; SLCo PW Operations road maintenance/ improvements are ongoing for local jurisdictions.	Yes
Conduct flood-specific impact studies (Eastside Canal and Creek Study).	Floods (flash and riverine), severe thunderstorms	SLCo PW & Municipal Services, local PW/engineering departments, MSD		In progress; 80% complete.	Yes
Work with communities not currently in the National Flood Insurance Program (NFIP) to adopt the program.	Floods (flash and riverine)	SLCo PW & Municipal Services, MSD	SLCo EM, local jurisdiction emergency management	Complete; all newly incorporated cities have joined the NFIP.	No; complete
Develop a countywide program to purchase repetitive loss properties and develop a program to monitor locations of buyouts; encourage local jurisdictions to institute a buyout plan for flood-prone structures or those susceptible to landslides and other geological concerns.	Floods (riverine), earthquakes, landslides	SLCo PW & Municipal Services, MSD	SLCo EM, local jurisdiction emergency management	Incomplete.	Yes
Develop and implement a water conservation plan.	Drought, extreme heat incidents	SLCo Office of Regional Development, SLCo PW & Municipal Services, MSD	SLCo EM, local jurisdiction emergency management	Incomplete.	Yes
Provide information to property owners in flood-prone areas, including the need for NFIP coverage.	Floods (flash and riverine)	SLCo EM, SLCo PW & Municipal Services, local emergency management	Local jurisdictions	Ongoing; SLCo Flood Control maintains Runoff Ready website and social media posts.	Yes

[280] BRIC = Building Resilient Infrastructure and Communities, Department of Natural Resources, EM = Emergency Management, IPAWS = Integrated Public Alert and Warning System, MSD = Municipal Services District, , NFIP = National Flood Insurance Program, NRCS = Natural Resources Conservation Service, PW = Public Works, SLCo = Salt Lake County, UDOT = Utah Department of Transportation, UFA = Unified Fire Authority, UPDES = Utah Pollution Discharge Elimination System

Action	Hazard(s)	Lead Agency	Support Agency(ies)	Status	Is this action carried forward to the 2025 Mitigation Action Plan?
Develop and implement public education programs on disaster awareness.	All hazards	SLCo EM, local jurisdiction emergency management		Ongoing. SLCo EM has conducted earthquake preparedness education campaigns for the public through the Great Utah ShakeOut drill that is held annually.	Yes
Procure generators and transfer switches for schools, public facilities, and critical facilities, including generators/redundant backup power at traffic signals in key locations.	All hazards	SLCo EM, local jurisdiction emergency management	SLCo PW & Municipal Services	Ongoing; UFA did some BRIC work for seismic upgrades that included generators. Generators were installed at stations 103, 107, and 113. Seismic upgrades were completed at stations 107, 109, 110, 112, 115, and 116. Nonstructural upgrades were completed at 20 stations. PW Operations: ongoing. We have a few portable generators but need more.	Yes
Assess and prioritize burying utilities (especially in areas where new development is occurring).	Dam failures, floods (flash and riverine), high winds and tornadoes, landslides, severe thunderstorms, severe winter storms, wildfires	SLCo PW & Municipal Services, MSD	Local jurisdiction PW/ Engineering	Incomplete.	Yes
Commodity flow allocation study for rail and road transportation.	Hazardous materials incidents	SLCo EM, Local Emergency Planning Committee (LEPC)	SLCo Office of Regional Development	Incomplete.	Yes
Move electrical panels, mechanical, and generators above base flood elevation (BFE) in facilities in flood-prone areas.	Floods (flash and riverine)	SLCo PW & Municipal Services, local PW/engineering departments, MSD		Incomplete.	Yes
Enhancement and expansion of green space.	Floods (flash and riverine)	SLCo PW & Municipal Services, local PW/engineering departments, MSD		Incomplete; lack of funding.	Yes
Emergency operations center enhancements for situational awareness and coordination.	All hazards	SLCo EM		Ongoing; WebEOC and Crisis Track integration.	Yes
Integrate WebEOC and other technological enhancements and integration throughout the county.	All hazards	SLCo EM, local jurisdiction emergency management		Ongoing; implementing Crisis Track and WebEOC training for local jurisdictions/agencies.	Yes
Construct snow sheds for avalanche mitigation in Little Cottonwood Canyon.	Avalanches	SLCo PW & Municipal Services, SLCo EM	UDOT	Ongoing; Phase 2 of UDOT's work.	Yes
Enhance and continue to promote the implementation of the community emergency response teams (CERTs) and other related programs.	All hazards	SLCo EM, local jurisdiction emergency management		Ongoing.	Yes
Establish functional and access needs registry or similar program.	All hazards	SLCo EM, local jurisdiction emergency management	Salt Lake County Department. of Human Services	Ongoing; with the Special Needs Registry dissolving, SLCo EM needs to establish a system.	Yes
Mutual aid agreement development and/or updates.	All hazards	SLCo EM, local jurisdiction emergency management	All participating jurisdictions in the county	Ongoing; PW has a mutual aid interlocal agreement; all Salt Lake County municipalities and Salt Lake County have signed it.	Yes
Develop and implement countywide green infrastructure plan.	All hazards	SLCo PW & Municipal Services, MSD	All participating jurisdictions in the county	Incomplete.	Yes

Action	Hazard(s)	Lead Agency	Support Agency(ies)	Status	Is this action carried forward to the 2025 Mitigation Action Plan?
Evaluate capability and capacity for all local governments to provide and sustain emergency power to critical infrastructure resources under their control.	All hazards	SLCo EM, local jurisdiction emergency management	All participating jurisdictions in the county	Ongoing.	Yes
Continue implementing and improving Salt Lake County's disaster recovery program by developing and updating key plans, strategies, and recovery protocols.	All hazards	SLCo EM	All participating jurisdictions in the county	Ongoing.	Yes
Retrofit critical facilities and infrastructure to withstand avalanches.	Avalanches	SLCo PW & Municipal Services, MSD, local governments, ski resorts, private owners	SLCo EM, local jurisdiction emergency management	Ongoing; UDOT installed 16 new remote avalanche control systems (RACS) on Mt. Superior in Little Cottonwood Canyon in summer 2024.	Yes
Bring deficient high-hazard dams up to current industry standards.	Floods (flash and riverine), dam failures	Salt Lake County and all participating jurisdictions	Salt Lake County, local governments, and dam owners	In progress. HHPD grant was used to help rehabilitate the Lake Mary-Phoebe Dam.	Yes
Increase the size of culverts and bridges.	Floods (flash and riverine)	SLCo PW & Municipal Services, local PW/engineering departments, MSD, canal districts		In progress but lacks funding.	Yes
Remove debris and vegetation from floodway and drainage structures through a systematic maintenance program.	Floods (flash and riverine)	SLCo PW & Municipal Services, local PW/engineering departments, MSD, canal districts		Ongoing; lack of funding and personnel. SLCo PW Operations assists.	Yes
Improve flood resistance through enhancement of wing walls, flood barriers, foundations, etc. at likely flood impact points.	Floods (flash and riverine)	SLCo PW & Municipal Services, local PW/engineering departments, MSD, canal districts		Incomplete.	Yes
Construct debris basins, flood retention ponds, and energy flow dissipaters to control the flow and release of floodwaters.	Floods (flash and riverine)	SLCo PW & Municipal Services, local PW/engineering departments, MSD, canal districts		Incomplete; lack of funding.	Yes
Construct temporary debris traps and other flood-mitigating structures in wildfire-burned areas.	Floods (flash and riverine), wildfires	SLCo PW & Municipal Services, local PW/engineering departments, MSD	Utah Department of Natural Resources (DNR), NRCS, UDOT	Incomplete.	Yes
Retrofit critical facilities and infrastructure to withstand earthquakes and other geologic hazards.	Earthquakes	SLCo PW & Municipal Services, local PW/engineering departments, MSD, owners of facilities		UFA station retrofits are ongoing; SLCo PW Operations: master plan for update of PW yard is complete but needs funding to move forward.	Yes
Retrofit businesses, residential structures, infrastructure, and public buildings (especially in historic districts) to withstand moderate earthquakes and other geologic hazards.	Earthquakes	Owners of facilities, SLCo PW & Municipal Services, local PW/ engineering departments, MSD		Incomplete.	Yes
Use flexible piping when extending water, sewer, or natural gas service.	Earthquakes	Utility companies, SLCo PW & Municipal Services, local PW/engineering departments, MSD		Incomplete.	Yes
Install shutoff valves and emergency connector hoses where water mains cross fault lines.	Earthquakes	Utility companies, SLCo PW & Municipal Services, local PW/ engineering departments, MSD		Incomplete.	Yes

Action	Hazard(s)	Lead Agency	Support Agency(ies)	Status	Is this action carried forward to the 2025 Mitigation Action Plan?
Encourage all new construction to meet enhanced standards for wind loading, snow loading, and other weather-related hazards.	Severe weather	Facility owners, SLCo PW & Municipal Services	Local PW/ engineering departments, MSD	Incomplete.	Yes
Plan for and maintain adequate road and debris clearing capabilities.	Severe weather	SLCo PW & Municipal Services	Local PW/ engineering departments, MSD	Ongoing; SLCo PW Operations has an emergency action plan to respond to disasters, including road and debris clearing.	Yes
Install pump stations in strategic locations to mitigate flooding.	Floods (flash and riverine)	SLCo PW & Municipal Services, canal districts	Local PW/ engineering departments, MSD	In progress; currently bidding out City Drain Pump Station.	Yes
Collaborate with private canal companies to mitigate drainage, leakage, and capacity issues.	Floods (flash and riverine)	SLCo PW & Municipal Services, local PW/engineering departments, MSD, canal districts		Incomplete; lack of funding and personnel.	Yes
Conduct levee upgrades and certification.	Floods (flash and riverine)	SLCo PW & Municipal Services	Local PW/ engineering departments, MSD	Ongoing; making progress on the accreditation of the Surplus Canal levee system.	Yes
Assess high-pressure pipelines to ensure that they meet seismic standards; conduct upgrades as needed.	Earthquakes	Utility companies, SLCo PW & Municipal Services	Local PW/ engineering departments, MSD	Incomplete.	Yes
Promote Firewise initiative and develop community wildfire protection plans (CWPP) in at-risk communities.	Wildfires	Salt Lake County UFA	All participating communities in the county	Ongoing.	Yes
Promote the Fix the Bricks program throughout the county.	Earthquakes	Salt Lake County and all participating jurisdictions	State of Utah	Incomplete; Salt Lake City, the State of Utah, and FEMA use the "Fix the Bricks" program to fund residential retrofits of unreinforced masonry dwellings (URMs) in an effort to mitigate the effects of a large-scale earthquake by minimizing the risk of post-earthquake personal injury and reducing the need for outside assistance. Currently this program is primarily focused on Salt Lake City. A similar program or expansion of the existing program would be beneficial to other jurisdictions in the county with URMs.	No
Help county jurisdictions procure Flood Mitigation Assistance (FMA) grants.	Floods	SLCo EM	All participating jurisdictions in the county	Incomplete.	Yes
Assist Emergency Managers in designing pandemic mitigation programs.	Public health epidemics/pandemics	SLCo EM, Salt Lake County Health Department	All participating jurisdictions in the county	Complete; County Health Department updates plans annually for pandemics and infectious diseases. SLCo EM has developed a Public Health Annex as part of its Comprehensive Emergency Management Plan to address pandemics and infectious diseases.	No
Conduct seminar to assist Emergency Managers in public education about radon kits.	Radon	SLCo EM	Salt Lake County Health Department	Incomplete; was not a priority during COVID-19 and there has not been a discussion on radon education since.	Yes

2025 Mitigation Action Plan

Table 95: 2025 Mitigation Action Plan[281]

#	Action	Hazard(s)	Goals	Lead Agency	Potential Partners	Benefits (Losses Avoided)	Cost Estimate	Funding Source	Time Frame	Priority	New or Carried Forward	Comments
1	Enhance interoperable radio communications systems throughout the county.	Avalanches, civil disturbances, dam failures, drought, earthquakes, extreme heat, floods, hazardous materials incidents, heavy rain, high winds, landslides, lightning, public health epidemics, radon, severe winter weather, terrorism, tornadoes, wildfires	2, 3, 5	SLCo Fleet Services, UFA Communications Division, Utah Communications Authority	Partners include but are not limited to the MSD, SLCo EM, UPD, State of Utah, NGO partners, Sheriff's Office	Improved communication between different agencies, common operating platform	Medium	General funds, HSGP grants	Short term	Medium	Carried forward	Additional efforts are needed to continue improving interoperable communications throughout the county and to create redundant systems should the primary communications infrastructure fail. Additional efforts include but are not limited to ensuring enhanced interoperability with local participating jurisdictions, agencies, and key partners. This is especially important for communities in remote or isolated areas.
2	Develop an enhanced emergency notification communication system for the county.	Avalanches, civil disturbances, dam failures, drought, earthquakes, extreme heat, floods, hazardous materials incidents, heavy rain, high winds, landslides, lightning, public health epidemics, radon, severe winter weather, terrorism, tornadoes, wildfires	1, 3	SLCo EM	Partners include but are not limited to the MSD, UFA, UPD, local jurisdiction emergency management, State of Utah, Sheriff's Office, UDOT	Early notification of impending wildfire to decrease loss of life, improved relationships with the public and stakeholders, provide faster delivery of information with templates and plans ready for use	Medium	General funds, HSGP grants, BRIC grant	Short term	High	Carried forward	Estimation of $1 million, with costs shared between local jurisdictions/ agencies and the county. SLCo EM has been working on developing IPAWS templates and identifying streamlined communication.
3	Develop and implement public education programs on disaster awareness.	Avalanches, civil disturbances, dam failures, drought, wildfires, earthquakes, extreme heat, floods, hazardous materials incidents, heavy rain, high winds, landslides, lightning, public health epidemics, radon, severe winter weather, terrorism, tornadoes, wildfires	1, 4, 6, 7, 8	SLCo EM	Partners include but are not limited to local jurisdiction emergency management, UFA, UPD, Sheriff's Office, SLCo PW, State of Utah, local hospitals, local utilities, NGO partners	Improved understanding of local resources, improved relationships with the public and stakeholders, outlined plans/standard operating procedures (SOPs) for programs, improved education and understanding for the public on local hazards and ways in which they can prepare themselves, their home, and loved ones	Low	General funds, HSGP grants, SHSP grant	Short term	Medium	Carried forward	

281 CERT = Community Emergency Response Team, CWPP = community wildfire protection plan, DNR = Division of Natural Resources, ECC = Emergency Coordination Center, EMPG = Emergency Management Performance Grant, ESPG = energy storage and power generation, HAZMAT = Hazardous materials, HHPD = High Hazard Potential Dam, HMA = Hazard Mitigation Assistance, HSGP = Homeland Security Grant Program, EM = Emergency Management, IT – Information Technology, MSD = Municipal Services District, NGO = Nongovernmental Organizations, NWS = National Weather Service, PW = Public Works, SAIC = Statewide Information & Analysis Center, SHSP = State Homeland Security Program, SLC = Salt Lake City, SLCo = Salt Lake County, Utah DEM = Utah Division of Emergency Management, UDOT = Utah Department of Transportation, UFA = Unified Fire Authority, UPD = Unified Police Department USACE = U.S. Army Corps of Engineers

#	Action	Hazard(s)	Goals	Lead Agency	Potential Partners	Benefits (Losses Avoided)	Cost Estimate	Funding Source	Time Frame	Priority	New or Carried Forward	Comments
4	Integrate WebEOC, Crisis Track, Geographic Information System (GIS), and other technological enhancements throughout the county.	Avalanches, civil disturbances, dam failures, drought, wildfires, earthquakes, extreme heat, floods, hazardous materials incidents, heavy rain, high winds, landslides, lightning, public health epidemics, radon, severe winter weather, terrorism, tornadoes, wildfires	1, 2, 3, 4, 5, 6	SLCo EM	Partners include but are not limited to local jurisdiction emergency management, UFA, UPD, SLCo PW, SLCo Health Department, State of Utah, UDOT, local hospitals, local utilities	Common operating platform for stakeholders, increased situational awareness, improved response time	Low	General funds, HSGP grants, Emergency Operations Center Grant Program	Long term	Medium	Carried forward	Existing software requiring updates to documentation/ training. Revised to include Crisis Track and GIS as additional technologies to consider.
5	Enhance and continue to promote the implementation of CERT and SAFE Hubs.	Avalanches, civil disturbances, dam failures, drought, wildfires, earthquakes, extreme heat, floods, hazardous materials incidents, heavy rain, high winds, landslides, lightning, public health epidemics, radon, severe winter weather, terrorism, tornadoes, wildfires	1, 4, 5	SLCo EM	Local jurisdiction emergency management, State of Utah, NGO partners	Improved awareness of local resources, coordination across jurisdictions and agencies	Low	General funds, municipal budgets	Short term	Medium	Carried forward	Revised to include SAFE Hubs (previously S.A.F.E. Neighborhoods), a rebrand with a new public awareness campaign and information for all partners.
6	Establish access and functional needs registry and improve incorporation of those with access and functional needs in plans.	Avalanches, civil disturbances, dam failures, drought, wildfires, earthquakes, extreme heat, floods, hazardous materials incidents, heavy rain, high winds, landslides, lightning, public health epidemics, radon, severe winter weather, terrorism, tornadoes, wildfires	1, 4	SLCo EM	Partners include but are not limited to local jurisdictions, MSD, UFA, UPD, Sheriff's Office, SLCo Aging and Adult Services, SLCo Health Department	Improved situational awareness for the public and stakeholders, greater understanding of resources available for those with access and functional needs	Low	General funds, HSGP grants	Short term	High	Carried forward	The State of Utah's Access and Functional Needs Registry is dissolving in 2025. The county needs a way to account for those with access and functional needs, including incorporation into plans/SOPs.
7	Implement Emergency coordination center enhancements for situational awareness and coordination.	Avalanches, civil disturbances, dam failures, drought, wildfires, earthquakes, extreme heat, floods, hazardous materials incidents, heavy rain, high winds, landslides, lightning, public health epidemics, radon, severe winter weather, terrorism, tornadoes, wildfires	1, 2, 5	SLCo EM	UFA	Improved situational awareness, improved building security to prevent bad actors, and a shared understanding across different agencies of ECC expectations by position for activations	Medium	General funds, HSGP grants, Emergency Operations Center Grant Program	Ongoing	High	Carried forward	Enhancements may include technological and communication improvements in the Joint Information Center (JIC), Call Center, Plans Room, and Operations Room. The Salt Lake County ECC requires significant enhancements to ensure situational awareness and improved coordination across the valley. These improvements include enhancing our building security, improving situational awareness on various monitors throughout the building, and positioning checklists/ guides for those entering the ECC for an activation.
8	Develop mutual aid agreements and/or updates for sheltering, points of distribution (PODs), and public works.	Avalanches, civil disturbances, dam failures, drought, wildfires, earthquakes, extreme heat, floods, hazardous materials incidents, heavy rain, high winds, landslides, lightning, public health epidemics,	5, 6, 7	SLCo EM	Partners include but are not limited to local jurisdiction emergency management, SLCo Parks and Recreation, SLCo PW	Common understanding of resources available, the regular review of the agreement ensures that it is updated with the latest information and the agreement is in place	Low	General funds	Ongoing	Medium	Carried forward	SLCo PW has established a mutual aid interlocal agreement, signed by all Salt Lake County municipalities and the County PW department itself, to ensure coordinated support and resource sharing. The county also aims to update and initiate memorandums of understanding (MOUs) PODs and facility use for

#	Action	Hazard(s)	Goals	Lead Agency	Potential Partners	Benefits (Losses Avoided)	Cost Estimate	Funding Source	Time Frame	Priority	New or Carried Forward	Comments
		radon, severe winter weather, terrorism, tornadoes, wildfires				before an incident takes place						emergency sheltering to strengthen preparedness and response capabilities.
9	Evaluate capability and capacity for all local governments to provide and sustain emergency power to critical infrastructure resources under their control.	Avalanches, civil disturbances, dam failures, drought, wildfires, earthquakes, extreme heat, floods, hazardous materials incidents, heavy rain, high winds, landslides, lightning, public health epidemics, radon, severe winter weather, terrorism, tornadoes, wildfires	2, 3, 5, 6	SLCo EM	Partners include but are not limited to local jurisdictions emergency management, local utilities, local hospitals, NGO partners	Ensures emergency plans are in place, tests systems before an incident occurs to identify and resolve issues	Medium	General fund, SLCo EM budget, EMPG	Long term	High	Carried forward	
10	Continue implementing and improving Salt Lake County's Disaster Recovery Program by developing and updating key plans, strategies, and recovery protocols.	Avalanches, civil disturbances, dam failures, drought, wildfires, earthquakes, extreme heat, floods, hazardous materials incidents, heavy rain, high winds, landslides, lightning, public health epidemics, radon, severe winter weather, terrorism, tornado, wildfire	1, 5	SLCo EM	Partners include but are not limited to local jurisdiction emergency management, MSD, SLCo PW, SLCo Health Department, SLCo IT, SLCo Sheriff's Office, UPD, UFA, NGO partners, Utah DEM	A recovery program with updated plans and policies will facilitate quicker recovery, minimize long-term social and economic impacts, and provide a unified response and recovery support for incidents through the Emergency Support Functions and Recovery Support Functions to stabilize community lifelines and maintain continuity of essential functions.	Medium	SLCo EM budget, EMPG	Ongoing	High	Carried forward	SLCo EM needs to develop a formal Recovery Plan and collaborate with local, private, and NGO partners. The plan should include training, exercises, and implementation strategies to test and continuously improve its effectiveness.
11	Construct snow sheds for avalanche mitigation in Little Cottonwood Canyon.	Avalanche	1, 2	UDOT	SLCo EM, local jurisdictions, UFA, UPD, State of Utah, local utilities	Diminish road closure time, preserve life and safety from avalanches (personal injuries, car/infrastructure damage, injury to first responders and UDOT staff)	High: $72–$90 million	HMA, general funds	Long term	Medium	Carried forward	
12	Retrofit critical facilities and infrastructure to withstand avalanches.	Avalanche	1, 2	SLCo PW & Municipal Services	Partners include but are not limited to the MSD, local jurisdictions emergency management, ski resorts, private owners, UDOT, SLCo EM, local utilities, State of Utah	Ensures resilience for critical infrastructure in the event of an avalanche, facilitates safe egress/ingress for visitors and first responders on roads, provides shelter in the event of an avalanche	Medium	PDM, ski resort revenue, private funds	Long term	Medium	Carried forward	UDOT installed 16 new Remote Avalanche Control Systems (RACS) on Mt. Superior in Little Cottonwood Canyon, summer 2024.
13	Develop a countywide single source of information-sharing/gathering for intelligence.	Civil disturbance, terrorism	1, 2, 3, 5, 6, 8	SLCo EM	Partners include but are not limited to local jurisdiction public safety agencies, SLCo Sheriff's Office, UPD, SIAC	Improved coordination between local agencies/ jurisdictions	Medium	HSGP grant, general funds	Short term	Medium	New	Have one common operating platform to be used by all agencies in Salt Lake County to collect suspicious activity reports; develop a public awareness campaign to educate the public on how and what to report. $100K

#	Action	Hazard(s)	Goals	Lead Agency	Potential Partners	Benefits (Losses Avoided)	Cost Estimate	Funding Source	Time Frame	Priority	New or Carried Forward	Comments
14	Coordinate conservation, preservation, and mitigation actions with community development and community planning divisions to ensure integration of programs across all communities.	Dam/levee failure, drought, earthquake, flood, hazardous materials incident (transportation and fixed facility), wildfire	1, 4, 5, 6	SLCo EM SLCo PW & Municipal Services, MSD	Partners include but are not limited to local jurisdictions, UFA, UPD, Sheriff's Office, State of Utah, local utilities, local hospitals, local school districts	Common understanding of mitigation efforts, tracking of mitigation efforts over time	Medium	General fund, PDM, BRIC	Ongoing	High	Carried forward	
15	Assess and prioritize the burying of utilities especially in areas where new development is occurring).	Dam failure, flood (flash and riverine), high wind and tornado, landslide, severe thunderstorm, severe winter storm, wildfire	1, 2, 3, 5	SLCo PW & Municipal Services, local utility owners	Partners include but are not limited to the MSD, local PW/ engineering departments, UDOT, State of Utah, local utilities, local hospitals, local school districts	Prevents costly utility damage, lower maintenance costs, aesthetic improvements for Salt Lake County's natural scenery, increased energy capacity	High	Private sector funds, HMA grants	Long term	Medium	Carried forward	
16	Bring deficient high hazard dams up to current industry standards.	Dam failure	1, 2	Dam owners/ water companies, SLCo Flood Control Engineering	Partners include but are not limited to SLCo EM, local jurisdiction emergency management, Utah Dam Safety Section, Utah DEM, Salt Lake City public utilities	Life and safety (personal injuries, safety of first responders), damage to critical infrastructure	High	General funds, HHPD Grant	Long term	High	Carried forward	Salt Lake City completed work on Mountain Dell Dam (5 miles east of Salt Lake City next to Interstate 80) to mitigate existing leaks. Seismic activity is a threat to all of the dams in the county, and retrofitting may be needed to decrease the risk of failure due to an earthquake.
17	Rehabilitate Lake Mary-Phoebe Dam Structure.	Dam Failure	1, 2	Salt Lake City Corporation	Salt Lake County EM, Utah Division of Water Rights Dam Safety Section, Salt Lake City Public Utilities, Local Governments	Reinforce the dam structure, including addressing spalling and deterioration as indicated in dam inspection reports to decrease the risk of failure.	High	Salt Lake County General Fund, HHPD Grant, HMGP Grant	Short term	High	Carried forward from Addendum	
18	Enhance Spillway Capacity of Lake Mary-Phoebe Dam Structure.	Dam Failure	1, 2	Salt Lake City Corporation	Salt Lake County EM, Utah Division of Water Rights Dam Safety Section, Salt Lake City Public Utilities, Local Governments	Upgrade spillway capacity to manage extreme flood events, as suggested in the dam safety inspection and construction reports and reduce potential losses from failure.	High	Salt Lake County General Fund, HHPD Grant, HMGP Grant	Short term	Medium	Carried forward from Addendum	
19	Implement seepage control measures for Lake Mary-Phoebe Dam.	Dam Failure	1, 2	Salt Lake City Corporation	Salt Lake County EM, Utah Division of Water Rights Dam Safety Section, Salt Lake City Public Utilities, Local Governments	Implement pressure grouting to reduce seepage, as outlined in the Lake Mary–Phoebe Dam inspection and annual reports.	Medium	Salt Lake County General Fund, HHPD Grant,	Short term	High	Carried forward from Addendum	
20	Coordinate a project with Brighton Ski Resort and the U.S. Forest Service to improve the downstream channel	Dam Failure	1, 2, 8	Salt Lake City Corporation	Salt Lake County, Local Governments, Salt Lake City Corporation, Utah Division of Water Rights Dam Safety Section, Salt Lake City Public Utilities,	Work is needed on outlet channel to facilitate testing of outlet gates and prevent debris from entering spillway.	High	Salt Lake County General Fund, HHPD Grant, PDM grant	Long term	High	Carried forward from Addendum	According to Lake Mary – Phoebe Dam Annual Engineer Inspection reports, Salt Lake City Public Utilities is unable to release more than 15 cfs under normal conditions from the dam due to downstream limitations.

#	Action	Hazard(s)	Goals	Lead Agency	Potential Partners	Benefits (Losses Avoided)	Cost Estimate	Funding Source	Time Frame	Priority	New or Carried Forward	Comments
	of Lake Mary–Phoebe Dam.				Brighton Ski Resort, U.S. Forest Service							Flows higher than 15 cfs would blow out culverts and severely damage the access trail. This needs to be resolved so that the outlet gates can be tested over their full range annually. Watershed crews will continue to remove debris from the spillway and downstream channel. Special attention needs to be paid to maintaining the log boom so that debris does not enter the spillway. Significant work is needed for the outlet channel as woody vegetation continues to encroach on the channel and has potential to obstruct flows.
21	Conduct risk studies or engineering assessments to determine approaches to address issues identified in dam safety inspection reports.	Dam Failure	1, 2	SLCo EM	Salt Lake County Public Works Flood Control Engineering, Utah Division of Water Rights Dam Safety Section, Salt Lake City Public Utilities, Local Governments	Reduce potential losses from failure of HHPDs.	Medium	Salt Lake County General Fund, HHPD Grant, HMGP Grant	Medium	Medium	New	HHPDs with a safety condition rating of fair: SLCO Chandler Drive #13, SLCO Scott Ave., SLCO Shriners #12, SLCO Federal Heights #1a, SLCO Creekside Park, SLCO Rotary Glen Park, SLCO Big Cottonwood, White Pine, Jordan Valley Water Purification Upper, and Sandy City Storm Mountain. HHPDs with a safety condition rating of poor: Lake-Mary Phoebe, Red Pine, and Mountain Dell.
22	Rehabilitate or complete other safety projects for high hazard dams based on dam safety reports or risk studies.	Dam Failure	1, 2	SLCo EM	Salt Lake County Public Works Flood Control Engineering, Utah Division of Water Rights Dam Safety Section, Salt Lake City Public Utilities, Local Governments	Reduce potential losses from failure of HHPDs.	High	Salt Lake County General Fund, HHPD Grant, HMGP Grant	Long term	High	New	See above.
23	Xeriscape government-owned properties.	Drought	2, 8	SLCo Facilities Management	Partners include but are not limited to water companies/ districts, local jurisdictions, MSD, State of Utah, UFA, UPD, Sheriff's Office, local utilities	Decreased cost of landscape irrigation, decreased water use	High	General funds, SLCo Facilities Management, State of Utah, local jurisdictions, MSD	Short term	Low	New	
24	Develop and implement a water conservation plan.	Drought, extreme heat	2, 4, 5	SLCo PW	Partners include but are not limited to SLCo PW & Municipal Services, MSD, SLCo EM, SLCo Office of Regional Development, local jurisdictions, State of Utah, UFA, UPD, local hospitals, local utilities, local school districts	Decreased water use, improved tracking/ understanding of where water is going, and greater education on how water can be conserved on an individual, department, or agency level	Low	General funds	Short-term	Medium	Carried forward	A Water Element is being added to the General Plan, which might integrate with a water conservation plan. SLCo Regional Planning and Transportation Director would be a point of contact for this.
25	Develop and implement countywide plan to track green	Drought, extreme heat, flood, heavy rain	2	SLCo Office of Regional Development	Partners included but are not limited to the MSD, SLCo PW, Municipal	Central repository of information on green infrastructure projects in	High	General funds, HMA grants	Long term	Medium	Carried forward	Revised from 2019 plan to include tracking of green infrastructure projects in an effort to improve

#	Action	Hazard(s)	Goals	Lead Agency	Potential Partners	Benefits (Losses Avoided)	Cost Estimate	Funding Source	Time Frame	Priority	New or Carried Forward	Comments
	infrastructure projects and improve energy efficiency throughout the county.			(Environmental Sustainability), Facilities Management	Services District, local jurisdictions, State of Utah, UFA, UPD, local hospitals, local utilities, local school districts	Salt Lake County, improved energy efficiency, improved water and air quality						energy efficiency throughout the county.
26	Retrofit critical facilities and infrastructure to withstand earthquakes and other geologic hazards.	Earthquake	1, 2, 5	MSD	Partners include but are not limited to local PW/engineering departments, facility owners, UFA, SLCo EM, UPD, State of Utah, local hospitals, local utilities, local school districts	Improved facility/ infrastructure resilience, expanded lifespan, maintaining building codes/standards, saves lives, can maintain essential services in the event of an incident, reduces economic impact if it were to go down	High	PDM, HMGP, capital improvement budgets, bonds, state and local funds		High	Carried forward	Ongoing UFA fire station retrofits. For SLCo PW Operations, the master plan for the update of the yard is complete but more funding is needed to move forward.
27	Retrofit businesses, residential structures, infrastructure, and public buildings (especially in historic districts) to withstand moderate earthquakes and other geologic hazards.	Earthquake	1, 2, 5	MSD, Municipal Governments	Partners include but are not limited to facility owners, local PW/ engineering departments, local utilities, local hospitals, local school districts, State of Utah, Salt Lake Chamber of Commerce	Improved facility/ infrastructure resilience, expanded lifespan, maintaining building codes/standards, saving lives, maintaining essential services in the event of an incident, reducing economic impact	High	PDM, HMGP, capital improvement budgets, bonds, state and local funds	Ongoing	High	Carried forward	
28	Use flexible piping when extending water, sewer, or natural gas service to reduce damage from ground motion.	Earthquake	1, 2, 5	SLCo PW & MSD	Partners include but are not limited to the local utility companies, water districts, local PW/ engineering departments, UFA, UPD, State of Utah, SLCo EM, local hospitals,	Easier installation, versatility, reduced leak potential, durability, cost savings	High	PDM, HMGP, capital improvement budgets, bonds, state and local funds, utility companies	Ongoing	High	Carried forward	
29	Consider funding sources and development of programs for retrofitting unreinforced masonry structures, similar to Salt Lake City's "Fix the Bricks" program.	Earthquake	1, 2	MSD	Partners include but are not limited to the State of Utah, UFA, UPD, local jurisdictions, SLCo, local utilities, local hospitals, local school districts	Reduce structural damage, reduce personal injury from structural damage in an earthquake, reduce need for outside assistance post-earthquake	High	BRIC, PDM, HMGP, Community Development Block Grant Mitigation (CDBG-MIT)	Ongoing	High	New	Salt Lake City, the State of Utah, and FEMA use the "Fix the Bricks" program to fund residential retrofits of URMs in an effort to mitigate the effects of a large-scale earthquake by minimizing post-earthquake personal injury and requirement for outside assistance. Currently this program is primarily focused on Salt Lake City. A similar program or expansion of an existing program would be beneficial to other jurisdictions in the county with URMs.
30	Install shutoff valves and emergency connector hoses where water mains cross fault lines.	Earthquake	1,2, 5	Local Water Districts	Partners include but are not limited to the SLCo PW, Municipal Services, MSD, utility companies, local PW/ engineering departments, local utilities, local school districts, State of Utah, local hospitals	Backup of water supply, prevents water waste if a pipe were to be damaged, ensures that valves and connector hoses are up to code	High	PDM, HMGP, capital improvement budgets, bonds, state and local funds, utility companies	Ongoing	High	Carried forward	

#	Action	Hazard(s)	Goals	Lead Agency	Potential Partners	Benefits (Losses Avoided)	Cost Estimate	Funding Source	Time Frame	Priority	New or Carried Forward	Comments
31	Assess high-pressure pipelines to ensure that they meet seismic standards, and conduct upgrades as needed.	Earthquake	1, 2, 3, 5	Local pipeline companies, MSD Engineering Division	Partners include but are not limited to the SLCo PW, MSD, local utility companies, local PW/ engineering departments	Ensures pipelines are up to code and regularly reviewed, identifies a way to perform inspections and track pipelines over time for everyone's awareness	High	Private sector funds, HMA grants	Long term	Medium	Carried forward	
32	Procure generators and transfer switches for schools, public facilities, and critical facilities.	Extreme heat, extreme cold	2, 5	SLCo EM	Partners include but are not limited to SLCo Facilities Management, local school districts, NGO partners, local utilities, local hospitals, water districts, MSD, State of Utah, UFA, UPD, Sheriff's Office	Provides backup generators for cooling centers and code blue centers, accurate inventory of what the county must provide to other agencies or jurisdictions as needed	Medium	General funds, HMA grants	Long term	Medium	Carried forward	
33	Elevate and/or mitigate roadways in low-lying areas that are prone to overland flooding.	Flooding (flash and riverine)	2, 5	SLCo PW, UDOT, Office of Regional Development	Partners include but are not limited to the MSD, local PW/ engineering departments, State of Utah, SLCo EM, water districts	Keeps roads open for locals and emergency services, ensures adequate egress/ingress, increases resilience in the event of flooding	High	PDM, HMGP, FMA, NRCS, capital improvement budgets, bonds, state and local funds	Long term	High	Carried forward	SLCo PW Operations road maintenance/ improvements are ongoing for local jurisdictions.
34	Conduct flood-specific impact studies (Eastside Canal and Creek Study).	Flooding (flash and riverine), severe thunderstorm	1, 2, 4, 6	SLCo PW & Municipal Services Flood Control and Engineering	Partners include but are not limited to local PW, SLCo EM, water districts, local utilities	Improves understanding of flood impacts on areas throughout the county, provides blueprint for mitigation activities in those areas for improved resilience	Medium	PDM, HMGP, FMA, NRCS, capital improvement budgets, bonds, state and local funds		High	Carried forward	
35	Provide information and the need for NFIP coverage to property owners in flood-prone areas.	Flooding (flash and riverine)	4	SLCo EM	Partners include but are not limited to SLCo PW & Municipal Services, MSD, local jurisdiction emergency management	Improved education and resilience in flood-prone areas, greater understanding of flood risk by locals, managed inventory of who does or does not have NFIP coverage	Low	General funds, HMA grants		Medium	Carried forward	
36	Move electrical panels, mechanical equipment, and generators above base flood elevation (BFE) in facilities in flood-prone areas.	Flooding (flash and riverine)	2, 5	SLCo Facilities Management, SLC0 PW & Municipal Services	Partners include but are not limited to the MSD, local PW/ engineering departments, local school districts, local hospitals, local utilities, State of Utah, SLCo EM	Improved resilience in flood-prone areas, better educated on flood-proofing critical infrastructure/ facilities	Medium	PDM, HMGP, FMA, capital improvement budgets, bonds, state and local funds	Short term	High	Carried forward	
37	Enhance and expand green space, particularly in areas of past flooding.	Flooding (flash and riverine), heavy rain	1, 2	Salt Lake County Real Estate	Partners include but are not limited to the SLCo PW, Municipal Services Flood Control Engineering division, MSD, local PW/ engineering departments, SLCo EM, UFA, UPD, State of Utah, water districts, local utilities,	Reduced costs (from not having to rebuild the area post-flooding), improved tracking/ monitoring of areas prone to flooding	High	General funds, HMA grants	Long term	Medium	Carried forward	

#	Action	Hazard(s)	Goals	Lead Agency	Potential Partners	Benefits (Losses Avoided)	Cost Estimate	Funding Source	Time Frame	Priority	New or Carried Forward	Comments
					local school districts, local hospitals							
38	Improve flood resistance through enhancement of wing walls, flood barriers, foundations, etc. at likely flood impact points.	Flooding (flash and riverine)	1, 2	SLCo PW & Municipal Services Flood Control and Engineering	Partners include but are not limited to the MSD, local PW/ engineering departments, canal districts, water districts, local school districts, local hospitals, local utilities, State of Utah, UDOT	Erosion control/ support ensures that roads are clear for emergency services and locals near flood-prone areas, reduces likelihood of costly repairs, easy to install, long-lasting	High	PDM, HMGP, FMA, capital improvement budgets, bonds, state and local funds	Long term	High	Carried forward	
39	Construct temporary debris traps and other flood-mitigating structures in wildfire-burned areas.	Flooding (flash and riverine), wildfire, heavy rain	1, 2	SLCo PW & Municipal Services Flood Control and Engineering	Partners include but are not limited to the MSD, local PW/ engineering departments, canal districts, Utah DNR, NRCS, UDOT, local school districts, local utilities, UFA, local fire departments, State of Utah	Keeps roads open for emergency services, ensures adequate egress/ingress, improves community resilience, prevents further damage to areas downstream from flooding, reduces recovery/damage costs	High	PDM, HMGP, FMA, capital improvement budgets, bonds, state and local funds	Long term	High	Carried forward	Example: constructing a diversion at Millcreek to a drainage area.
40	Increase the size of culverts and bridges in areas SLCo has identified as past or potential flooding concerns.	Flooding and Heavy Rain	1, 2	SLCo PW & Municipal Services Flood Control Engineering	Partners include but are not limited to SLCo EM, local PW/ engineering departments, water districts, local utilities, MSD, State of Utah, UDOT	Allows for larger runoff during spring melt season, reduces the amount of debris buildup	High	PDM, HMGP, FMA, NRCS, capital improvement budgets, bonds, state and local funds	Long term	Medium	Carried forward	
41	Help local jurisdictions procure FMA grants.	Flooding	1, 2, 4, 6	SLCo EM, Utah DEM	Local jurisdictions, SLCo PW, MSD, local school districts, local hospitals, State of Utah, water districts, local utilities, private dam owners, SLCo EM	Improved understanding of available grants and how money can be used for mitigation efforts	Low	FMA	Long term	Medium	Carried forward	SLCo EM will track mitigation activities on their website for the public and local agencies/ jurisdictions to see what work is underway. This will help in seeing what has occurred over time for the next plan update.
42	Conduct Surplus Canal rehabilitation to address deficiencies.	Flooding		SLCo PW & Municipal Services–Flood Control Engineering	FEMA, State of Utah, Salt Lake City, MSD, Salt Lake City airports, SLCo EM, water districts, local utilities	Improve the 300 deficiencies identified in 2017	High: $500K+	FEMA's BRIC grant, State of Utah, SLCo, local jurisdictions	Long term	High	New	SLCo Flood Control is working to bring the Surplus Canal levees back into USACE compliance, determine all encroachments on property currently owned by the county or other government entities, acquire property within 10 feet of the landside toe of the levee, relocate fences outside USACE jurisdiction, and remove all encroachments on the newly acquired property.
43	Remove debris and vegetation from floodway and drainage structures through a systematic maintenance program.	Flooding	1, 2	SLCo PW & Municipal Services Flood Control Engineering	Partners include but are not limited to the MSD, local PW/ engineering departments, canal districts, State of Utah, local utilities, water districts, SLCo EM	Improved tracking/ maintenance of debris and vegetation in floodway/ drainage structures	Medium	PDM, HMGP, FMA, capital improvement budgets, bonds, state and local funds	Ongoing	Medium	Carried forward	Lack of funding and personnel. SLCo PW Operations assists.

#	Action	Hazard(s)	Goals	Lead Agency	Potential Partners	Benefits (Losses Avoided)	Cost Estimate	Funding Source	Time Frame	Priority	New or Carried Forward	Comments
44	Install pump stations in strategic locations to mitigate flooding.	Flooding	1, 2	SLCo PW & Municipal Services Flood Control and Engineering	Partners include but are not limited to the MSD, local PW/ engineering departments, canal districts	Redundancy, prevents further damage, reduces recovery costs	Medium	PDM, HMGP, FMA, NRCS, capital improvement budgets, bonds, state and local funds	Ongoing	High	Carried forward	SLCo PW currently bidding out City Drain Pump Station.
45	Construct debris basins, flood retention ponds, and energy flow dissipaters to control the flow and release of floodwaters.	Flooding (flash and riverine)		SLCo PW & Municipal Services Flood Control and Engineering	Local PW/ engineering departments, MSD, canal districts, water districts, local utilities, SLCo EM	Redundancy, prevents further damage, reduces recovery costs	High	FMA, capital improvement budgets, HMGP, PDM	Ongoing	Medium	Carried forward	
46	Collaborate with private canal companies to mitigate drainage, leakage, and capacity issues.	Flooding, dam failure, levee failure	1, 2	SLCo PW & Municipal Services Flood Control and Engineering	MSD, local PW/ engineering departments, canal districts, water districts, State of Utah, private dam owners, SLCo EM	Prevents further damage, reduces recovery costs, enables a common understanding of the issues between relevant parties	High	PDM, HMGP, FMA, NRCS, capital improvement budgets, bonds, state and local funds	Ongoing	High	Carried forward	Lack of funding and personnel.
47	Conduct levee upgrades and certification.	Flooding, dam failure (levee failure)	1, 2	SLCo PW & Municipal Services Flood Control and Engineering	MSD, local PW/ engineering departments, SLCo EM, State of Utah, water districts, local utilities, UDOT	Reduces flooding, keeps roads open for emergency services, preserves critical infrastructure/ historical structures, lowers recovery costs	High	PDM, HMGP, FMA, NRCS, capital improvement budgets, bonds, state and local funds	Long term	High	Carried forward	Making progress and the accreditation of the Surplus Canal levee system. The levees along the Surplus Canal do not currently meet FEMA levee certification criteria as defined in the CFR Section 65.10 using the current effective FEMA base flood magnitude of 4,500 cfs. Levee upgrades and improvements include, but are not limited to: Storm drainpipes that penetrate the levees should be provided with closure devices per FEMA standards to prevent river water from flooding land behind levee enclosures. This action should be given a high priority to increase levee performance during a flood event and to facilitate certifying the levees. In certain locations, channel dredging activities have destabilized the toe of the canal banks, which has destabilized the reaches of the canal banks. To stabilize the canal banks, the canal banks should be modified and future channel dredging should be performed in a manner that will not destabilize the banks.

#	Action	Hazard(s)	Goals	Lead Agency	Potential Partners	Benefits (Losses Avoided)	Cost Estimate	Funding Source	Time Frame	Priority	New or Carried Forward	Comments
48	Conduct public awareness campaign on Tier 2 reporting software for chemical reporting.	Hazardous materials incidents	1, 2, 4, 5, 6, 7, 8	SLCo EM, LEPC	Partners include but are not limited to UFA, UPD, local jurisdictions, Sheriff's Office, Rio Tinto, State of Utah, SLCo Health Department, Utah Department of Environmental Quality, water districts, local utilities, local school districts, local fire departments	Improved understanding of Tier 2 reporting and how local agencies/ jurisdictions can find and submit information, a common operating platform for hazardous materials reporting	Low	General funds, SLCo EM, LEPC, local jurisdictions, State of Utah	Long term	Medium	New	
49	Conduct a commodity flow allocation study for rail and road transportation.	Hazardous materials incidents	2, 5	SLCo EM, LEPC	Partners include but are not limited to local jurisdiction emergency management, SLCo Planning and Transportation, SLCo Housing and Community Development, SLCo Economic Development, UFA, UPD, local fire departments, State of Utah, local utilities, water districts, SLCo Health Department	Improved situational awareness, greater preparation in the event of a HAZMAT incident, improved response plans	Medium	General funds, HSGP grants	Short term	Low	Carried forward	A commodity flow allocation study will help identify potential sources of hazardous materials and where incidents may occur. It will also address the communication gap between intelligence groups, fire agencies, and local jurisdictions. The study will improve coordination between different agencies, which will then strengthen emergency response plans throughout the county.
50	Ensure that all new construction meets enhanced standards for wind loading, snow-loading, and other weather-related hazards.	High wind, heavy snow, heavy rain, tornado.	1, 2, 5	MSD and SLCo Public Works & Municipal Services	MSD, utility companies, local public works/engineering departments, local school districts, State of Utah, UFA, UPD	Ensure that new construction is up to code, increased community resilience, reduced recovery costs	Medium	General funds, HMA grants	Ongoing	Medium	Carried forward	
51	Enact countywide regulations and codes for development to reduce landslide and slope failure damage to critical infrastructure and buildings.	Landslides, slope failures	1, 2, 4, 7, 8	MSD	SLCo EM, UFA, SLCo Office of Regional Development, local jurisdictions, local fire departments, local utilities, school districts	Reduce the likelihood of landslides and critical infrastructure/ building damage, ensure that future development is up to code and follows policy to avoid repetitive loss properties	Medium	SLCo, MSD, State of Utah	Long term	Medium	New	
52	Leverage WebEOC and GIS to track the spread of contagious disease.	Public health epidemics/ pandemics	1, 2, 5, 6, 8	SLCo Health Department	SLCo EM, UFA, MSD, UPD, Sheriff's Office, local jurisdictions	Use GIS and WebEOC software to maintain situational awareness and track illnesses throughout the county	Low	SLCo EM, local jurisdictions, SLCo Health Department, UT Department of Environmental Quality	Short term	Medium	New	County/local jurisdictions already have existing software; improved training/documentation required.

#	Action	Hazard(s)	Goals	Lead Agency	Potential Partners	Benefits (Losses Avoided)	Cost Estimate	Funding Source	Time Frame	Priority	New or Carried Forward	Comments
53	Create public awareness campaigns and public education programs on radon risks and increase public support for home testing for radon.	Radon	1, 2, 4, 8	SLCo EM, SLCo Health Department	Partners include but are not limited to Aging & Adult Services, SLCo Health Department, local jurisdictions, State of Utah	Decrease radon-caused cancer deaths, increase engagement/ understanding with the public on what SLCo can do or help with	Low	SLCo Health Department, local jurisdictions, State of Utah	Short term	Low	New	
54	Conduct seminar to assist Emergency Managers in public education about radon kits.	Radon	1, 4	SLCo EM, SLCo Health Department	State of Utah, local jurisdictions, Aging & Adult Services	Increased understanding of radon risk and ways in which emergency management agencies can assist/educate the public	Low	SLCo EM operating budget	Short term	Low	Carried forward	SLCo EM will conduct a half-day seminar to help Emergency Managers educate their citizens about procuring radon testing kits. Salt Lake County Health Department will provide a presentation. This goal wasn't a priority for the SLCo Health Department during the COVID-19 pandemic, and there has not been a discussion on radon education since.
55	Develop a road resurfacing project that includes permeable pavement for areas with rain-based flooding to reduce roadway flooding.	Heavy Rain	1, 2, 5, 8	SLCo PW & Municipal Services, MSD	SLCo Parks and Recreation, local jurisdictions, UDOT, State of Utah	Reduce pollutants discharged in runoff, reduce road maintenance time/costs, improve traction on roads	High	SLCo, UDOT, FMA, HMGP	Long term	Low	New	
56	Create a public education program for property owners to learn about tree maintenance and high-strength windows.	High Winds	1, 4	SLCo EM	Partners include but are not limited to Aging & Adult Services, SLCo PW, UFA, local jurisdictions, MSD, State of Utah, NWS	Reduce damage to critical infrastructure during high wind events, prevent personal injuries (people driving on roads or walking in the neighborhood), improve relationships with stakeholders and the public	Low	SLCo PW, SLCo EM, UFA	Short term	Low	New	
57	Plan for and maintain adequate road and debris clearing capabilities.	Severe weather: high wind, heavy rain, tornado	1, 2, 5	SLCo PW & Municipal Services	MSD, local PW/ engineering departments, UDOT	Ensures roads are open for emergency services	Medium	General funds, HMA grants, state funds, UDOT	Ongoing	Medium	Carried forward	SLCo PW Operations has an emergency action plan to respond to disasters, including road and debris clearing.
58	Develop a severe winter weather mitigation program to maintain access to primary roadways and evacuation routes.	Severe winter weather: heavy snow, blizzards	1, 2, 5, 8	SLCo PW & Municipal Services, MSD	SLCo EM, local jurisdictions, UDOT	Emergency services (e.g., police, fire, and paramedics) can utilize roads to provide their services	Medium	MSD, local jurisdictions	Short term	High	New	A severe winter storm with heavy snowfall requires roadway clearance for the public and emergency vehicles. The primary efforts will be to keep the roads open by clearing snow.

#	Action	Hazard(s)	Goals	Lead Agency	Potential Partners	Benefits (Losses Avoided)	Cost Estimate	Funding Source	Time Frame	Priority	New or Carried Forward	Comments
59	Improve communication to the public and stakeholders on available resources when a Code Blue alert is in effect during severe winter weather.	Severe winter weather	1, 3, 4, 6, 7	SLCo EM, SLCo Office of Homelessness and Criminal Justice Reform	Partners include but are not limited to local jurisdiction emergency management, MSD, State of Utah, NWS	Prevent further damage to critical infrastructure, ensure that homeless individuals have warming resources available, reduce pressure on local homeless resource providers with standard protocols to follow during a Code Blue alert	Low	SLCo EM, SLCo Health Department, State of Utah	Short term	Low	New	
60	Conduct public awareness campaign about lightning safety.	Severe weather: lightning	1, 2, 4	SLCo EM	Partners include but are not limited to NWS, SLCo Parks and Recreation, UFA, SLCo PW, local jurisdictions, MSD, State of Utah	Lightning strike awareness for the public	Low	SLCo, MSD, local jurisdictions, NWS	Short term	Low	New	
61	Enhance security at critical public safety and technology infrastructure sites.	Terrorism	1, 2, 3, 5, 6	SLCo EM	Local jurisdictions, UPD, UFA, MSD, SLCo IT, SLCo PW, SLCo Clerk's Office, Sheriff's Office	Increased security protocols (in both technology and policy) for staff/first responders, clear expectations/ understanding for local jurisdictions and the public	Medium	SLCo EM, local jurisdictions, UPD, Sheriff's Office, UFA, MSD, general funds, HSGP grants	Short term	Medium	Carried forward	Revised verbiage from previous mitigation action that addressed the CIKR Security/Hardening Program.
62	Improve outreach for "see something, say something" QR code to deter terrorist acts.	Terrorism (including cyberattacks)	1, 2, 4, 5, 6, 7, 8	SLCo EM,	Partners include but are not limited to SLCo Sheriff's Office, UPD, UFA, MSD, local jurisdictions, SLCo IT	Ensure that residents and local agencies/ jurisdictions are aware of local intelligence resources and how to report suspicious activity, encourage QR code use/ outreach at special events in the county	Low	SLCo EM, local jurisdictions	Short term	Medium	New	
63	Develop a countywide intelligence group/ division to monitor and analyze threats in advance of an incident.	Terrorism (including cyberattacks)	1, 2, 4, 5, 6, 7, 8	SLCo EM	Local jurisdictions, SLCo Sheriff's Office, SIAC, Department of Homeland Security (DHS), Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF), Federal Bureau of Investigation (FBI)	Central group to collect and analyze information, development of SOPs for intelligence, greater collaboration	Low	Energy Storage and Power Generation (ESPG) grant, SHSP	Short term	Medium	New	This would be a core group of stakeholders who meet on a regular basis to share and collaborate on intelligence data.
64	Review critical infrastructure facilities to ensure that building materials are up to code and tornado resistant.	Tornadoes	1, 2, 5, 7, 8	MSD	Partners include but are not limited to the SLCo EM, local jurisdictions, SLCo PW, State of Utah, UFA, UPD, SLCo Facilities Management	Ensure that critical infrastructure facilities are operational/ functional in the event of a disaster, preserve life and safety	Medium	SLCo EM, MSD, local jurisdictions, UFA	Short term	Low	New	
65	Promote the Firewise initiative and regularly review/update the community wildfire protection plans (CWPPs) for at-risk communities.	Wildfires	1, 2, 4, 6	Salt Lake County Fire Warden	Partners include but are not limited to UFA, SLCo EM, local jurisdictions, State of Utah	Increased awareness of plans (for the public and stakeholders), improved eligibility for grants/other funding sources, regular review of CWPP	Low	SLCo EM, MSD, local jurisdictions, Community Wildfire Assistance Grant, Fire Prevention and Safety Grant	Short term	Medium	Carried forward	

NFIP-Specific Mitigation Actions and Implementation

The following mitigation strategy demonstrates Salt Lake County and its participating jurisdictions' continued support and compliance with National Flood Insurance Program (NFIP) requirements, as appropriate.

- Countywide Action—Help County Jurisdictions Procure FMA Grants

Other priorities in Salt Lake County related to NFIP participation include:

1. Increased Community Rating System (CRS) participation throughout the county
2. Increase in the number of flood insurance policies
3. Increased number of Certified Floodplain Managers (CFMs) in the county
4. Post-flood damage estimate training for county and municipal staff
5. Acquisition of severe repetitive loss and repetitive loss properties
6. Higher regulatory standards, including higher freeboard, cumulative substantial damage and substantial improvement threshold, and enforcing floodplain regulations in areas of known urban, typically shallow depth, flooding.

NFIP participation, compliance, and status information for each participating jurisdiction can be found in Volume 2 in the respective capability assessments.

Plan Implementation and Maintenance

Evaluating, updating, and monitoring this plan are critical to maintaining its value and success in the county's hazard mitigation efforts. A hazard mitigation plan must present a plan maintenance process that includes the following (44 Code of Federal Regulations [CFR] Section 201.6(c)(4)):

- A section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan over a five-year cycle
- A process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate
- A discussion on how the community will continue public participation in the plan maintenance process

This section details the formal process that will ensure that the Salt Lake County Multi-Jurisdictional Hazard Mitigation Plan remains an active and relevant document and that the planning partners maintain their eligibility for applicable funding sources. The plan's format allows sections to be reviewed and updated when new data become available, resulting in a plan that will remain current and relevant.

Plan Implementation

The effectiveness of the hazard mitigation plan depends on its implementation and incorporation of its action items into partner jurisdictions' existing plans, policies, and programs. Salt Lake County Emergency Management will assume lead responsibility for **implementation** and **monitoring** of this plan maintenance strategy. Although the county will have primary responsibility, plan implementation and **evaluation** will be a shared responsibility among all planning partners and agencies identified as lead agencies in the mitigation action plans. Completion of this strategy is the responsibility of each planning partner. This was conveyed to each planning partner as an expectation at the beginning of the planning process. Many of the mitigation actions developed by the participating jurisdictions include elements of mitigation implementation including the National Flood Insurance Program (NFIP), the Utah Wildland-Urban Interface Code, the Building Code Effectiveness Grading System (BCEGS), and Community Rating System (CRS), all of which have been implemented.

Incorporation into Other Planning Mechanisms

Plan integration is the process by which the prior and current mitigation plans are incorporated into other planning mechanisms. These can include efforts to manage local land use development and community decision-making, such as budgets, comprehensive plans, capital improvement plans, economic development plans, and other long range or strategic plans.

The plan participants identified which planning mechanism the 2019 mitigation plan was integrated into in the jurisdictional annexes. Salt Lake County identified previous plan integration as shown in Table 96.

Table 96: Previous Plan Integration for Salt Lake County

Plan	Description
Comprehensive Emergency Management Plan (CEMP)	The CEMP incorporated information from the previous HMP update as far as operations, planning, and coordination between various departments/agencies. The HMP update will also inform additional annexes of the CEMP for damage assessments, terrorism, etc.
Salt Lake County West General Plan	The West General Plan included information on hazards specific to the west side of Salt Lake County as far as land use, housing, the environment, water, transportation, utilities, and the economy.

Once the Salt Lake County Multi-Jurisdictional Hazard Mitigation Plan is promulgated, participating jurisdictions will include this plan's information in existing programs and plans. These could include the general or master plan, emergency response or operations plans, municipal codes, capital improvements plan, or community design guidelines, among others. All municipal planning partners are committed to creating a linkage between this hazard mitigation plan and their jurisdiction-specific plans. The jurisdictional annexes in Volume 2 provide additional detail regarding into which local plans the participants have incorporated information from the previous mitigation plan, and those in which they may incorporate information from this updated mitigation plan. Potential future integration options for Salt Lake County are in Table 97.

Table 97: Future Plan Integration for Salt Lake County[282]

Plan	Description
Community Wildfire Protection Plan (CWPP) Update	The HMP update can be integrated into the 2025 update of the CWPP to incorporate mitigation actions. This will help in accountability and the continuous discussion of mitigation. SLCo EM and the UFA's wildland division will be the main points of contact.
Comprehensive Emergency Management Plan – Damage Assessment Annex	Hazard information along with key stakeholders/agencies identified in the HMP update can inform the damage assessment annex to provide a framework for city/county program integration. SLCo EM will be the main point of contact.
County General Plan – Water Element	SB passed in 2022 and SB 76 passed in 2023 require counties to develop a water use and preservation element that is integrated with their land use planning and development (General Plan). This could integrate information or actions relating to drought.
Salt Lake County Resource Management Plan	Identifies goals and objectives for managing natural resources on public lands and potential mitigation actions for hazards.
Wasatch Canyons General Plan	Long range plan for the development of communities in the Wasatch Canyon areas of Salt Lake County.

The information on hazard, risk, vulnerability, and mitigation in this plan is based on the best science and technology available at the time this plan was prepared. The comprehensive plans of participating jurisdictions are considered to be integral parts of this plan. The county and partner municipalities have

[282] SLCo EM = Salt Lake County Emergency Management, UFA = Unified Fire Authority.

also planned for the impact of natural hazards through adoption of zoning ordinances. The plan development process provided the county and the municipalities with the opportunity to review and expand on policies in these planning mechanisms. The planning partners used their comprehensive plans (when applicable) and the hazard mitigation plan as complementary documents that work together to achieve the goal of reducing risk exposure to the citizens of the planning area. An update to a comprehensive plan may trigger an update to the hazard mitigation plan.

Some action items do not have to be implemented through regulation. Instead, they may be implemented through the creation of new educational programs, continued interagency coordination, or increased public participation. As information becomes available from other planning mechanisms that can enhance this plan, that information will be incorporated through the update process.

Maintenance Schedule and Evaluation Process

Periodic monitoring and updates of this plan are required to ensure that the plan's goals are kept current and that local mitigation strategies are being carried out. This portion of the plan outlines the procedures for completing revisions and updates. The plan will also be revised to reflect lessons learned or to address specific hazard incidents arising from a disaster.

Annual Review Procedures

County jurisdictions will be responsible for annual reviews of the mitigation strategies described in this plan, as required by Utah DEM, or as situations dictate, such as following a disaster declaration. Salt Lake County Emergency Management, which will regularly monitor the plan, is responsible for making revisions and updates to Volume 1 of this plan. SLCo EM will notify plan participants when annual reviews will take and provide opportunity for them to participate. This process may include the county organizing a mitigation planning committee composed of individuals from the jurisdictions and organizations responsible for implementing the described mitigation strategies. Each participating jurisdiction will be responsible for tracking the status of mitigation actions identified in their annex.

Progress toward the completion of the strategies will be assessed and adjustments may be made, as needed. If Salt Lake County Emergency Management, the participating jurisdictions, or Utah DEM determines that a modification of the plan is warranted, an amendment to the plan may be initiated as described below.

PLAN EFFECTIVENESS EVALUATION

Appendix D has a form for supporting plan maintenance. The participating jurisdictions of the mitigation plan can use this form to evaluate the effectiveness of the plan during the five-year update cycle. If recommended changes are identified, plan participants can amend the plan or integrate the finding into the next plan update.

Plan Amendments

The Salt Lake County Emergency Management Hazard Mitigation Officer, the Local Mitigation Committee, or the Mayor/City Manager of an affected community will initiate amendments and updates to the Plan.

Upon initiation of an amendment to the plan, Salt Lake County Emergency Management will forward information on the proposed amendment to all interested parties including but not limited to all affected city or county departments, residents, and businesses. Depending on the magnitude of the amendment, the full planning committee may be reconstituted.

At a minimum, the information will be made available through public notice in a newspaper of general circulation or on the Salt Lake County Emergency Management website. The review and comment period for the proposed plan amendment will last for no less than 30 days.

At the end of the comment period, the proposed amendment and all review comments will be forwarded to participating jurisdictions for consideration. If no comments are received from the reviewing parties in the specified review period, such will be noted accordingly. Salt Lake County Emergency Management will review the proposed amendment along with comments received from other parties and submit a recommendation to the Utah State Hazard Mitigation Officer and FEMA in 60 days of the end of the comment period.

In determining whether to recommend approval or denial of a plan amendment request, the following factors will be considered:

- There are errors or omissions made in the identification of issues or needs during the preparation of the plan.
- New issues or needs have been identified which were not adequately addressed in the plan.
- There has been a change in information, data, or assumptions from those on which the plan was based.
- The nature or magnitude of risks has changed.
- There are implementation problems, such as technical, political, legal, or coordination issues with other agencies.

Upon receiving the recommendation of Salt Lake County Emergency Management, a public hearing will be held. Salt Lake County Emergency Management will review the recommendation (including the factors listed above) and any oral or written comments received at the public hearing. Following that review, Salt Lake County Emergency Management will take one of the following actions:

1. Adopt the proposed amendment as presented.
2. Adopt the proposed amendment with modifications.
3. Defer the amendment request for further consideration and/or hearing.

4. Reject the amendment request.

Five-Year Plan Review

Local hazard mitigation plans must be reviewed, revised if appropriate, and resubmitted for approval to remain eligible for benefits under the Disaster Mitigation Act (44 CFR, Section 201.6(d)(3)). The planning partnership intends to update the hazard mitigation plan on a five-year cycle from the date of initial plan adoption. This cycle may be accelerated to less than five years based on the following triggers:

- A Presidential Disaster Declaration that impacts the planning area
- A hazard event that causes loss of life
- A comprehensive update of the county's or participating municipality's comprehensive plan

Typically, the same process that was used to create the original plan will be used to prepare the update. The update will, at a minimum, include the following elements:

- The update process will be convened through a steering committee.
- The hazard risk assessment will be reviewed and, if necessary, updated using best available information and technologies.
- The action plans will be reviewed and revised to account for any actions completed, dropped, or changed and to account for changes in the risk assessment or new partnership policies identified under other planning mechanisms (such as the comprehensive plan).
- The draft update will be sent to appropriate agencies and organizations for comment.
- The public will be given an opportunity to comment on the update before adoption.
- The partnership governing bodies will adopt their respective portions.

Continued Public Involvement

Public involvement in the planning process has been and will be critical to the development of the plan and its updates. The plan will be available on the Salt Lake County Emergency Management website to provide opportunities for public participation and comment. The plan will also be available for review at the office of Salt Lake County Emergency Management.

Salt Lake County Emergency Management has been designated as the lead agency in preparing and submitting the Salt Lake County Multi-Jurisdictional Hazard Mitigation Plan, which includes coverage for all areas in Salt Lake County. Limited resources make it difficult to identify and individually contact all the people and agencies that may stand to benefit from the plan. Because of this, the following course of action has been established and will include all jurisdictions and special districts in the planning area.

- **Step 1:** Salt Lake County Emergency Management will publicly advertise all requests for input and meetings directly related to the mitigation planning process. Meetings of the Mitigation Planning Team where plan items are discussed and where actions are taken will not receive special notifications as they are already advertised according to set standards. All interested parties are welcome and invited to attend such meetings and hearings, because they are public and open to all.

- **Step 2:** The county has established a mailing list of many local agencies and individuals that might have an interest in the plan. Each identified agency or person will be mailed a notice of the hearings and open houses.
- **Step 3:** Comments, both oral and written, will be solicited and accepted from any interested party. Comments, as far as possible, will be included in the final draft of the plan. However, Salt Lake County Emergency Management reserves the right to limit comments that are excessively long, due to the size of the plan.
- **Step 4:** Specific to risk assessment and hazard mitigation, needs analysis, and capital investment strategies, Salt Lake County Emergency Management will also make initial contact and solicitation for input from each incorporated jurisdiction in the region. All input is voluntary. Staff time and resources may not allow personal contact with other agencies or groups; however, comments and strategies are welcomed as input to the planning process from any party by regular mail, fax, email, and phone call. In addition, every public jurisdiction advertises and conducts public hearings on their planning and budget, where most of these mitigation projects are initiated. Input can be received from these prime sources by the region as well.

Each plan participant will be responsible for advertising this opportunity to continue to participate in the plan maintenance and update process. SLCo EM will send out biannual outreach reminders to the plan participants and discuss this component of the plan maintenance process in the county emergency managers meeting, which includes all city, county, school, and special district emergency managers. At a minimum, the plan participants will share information on social media. The plan participants will evaluate if any of the information should be incorporated into the plan during the annual review process and the plan update process (see Table 98).

Table 98: Strategies for Continued Public Involvement by Plan Participants

Plan Participant	Continued Public Involvement Methodology
Salt Lake County	• Maintain the mitigation plan on the Salt Lake County website, including specific information for the public on how to provide input on the plan to the Salt Lake County Emergency Management. • Remind plan participants biannually via email and at the county emergency managers meeting to solicit public input on the mitigation plan. • Work with the PIO associates from participating cities and stakeholders to coordinate social media post information and resources. • Twice a year, use social media to share the link to the hazard mitigation plan, including the public feedback contact information. • Publish a StoryMap to educate the public about hazards and provide updates on the mitigation action status. • Share wildfire information and encourage feedback on the hazard mitigation plan at classes on WUI mitigation, including defensible space and home hardening.

Plan Participant	Continued Public Involvement Methodology
	• Work with the Salt Lake County Health Department to develop and host public education campaigns for vulnerable populations, including classes and posting flyers in public locations, and document feedback.
Town of Alta	• Twice a year, use social media or the website to share the link to the hazard mitigation plan, including the feedback email address. • Incorporate the hazard mitigation plan and the opportunity to provide feedback into public awareness and education campaigns on weather-related hazards. • Once a year, post notices about the hazard mitigation plan in an email newsletter used to communicate with residents.
Town of Brighton	• Twice a year, use social media, the website, or community newsletter to share the link to the hazard mitigation plan, including the public feedback contact information. • Share the mitigation plan link and request feedback during public education awareness campaigns on extreme cold or other hazards. • Share the hazard mitigation plan and request feedback in the town email newsletter.
Bluffdale	• Twice a year, use social media (Facebook) or the website to share the link to the hazard mitigation plan, including the public feedback contact information. • Share information about the hazard mitigation plan and opportunities to provide feedback through Bluffdale's Prep & Prosper preparedness classes.
Copperton	• Twice a year, use social media, the website, or community newsletter to share the link to the hazard mitigation plan, including the public feedback contact information. • Share information about the hazard mitigation plan, including the request for public feedback at Copperton Town Days or a similar event.
Cottonwood Heights	• Twice a year, use social media or the website to share the link to the hazard mitigation plan, including the public feedback contact information. • Add information on hazards, including linking to the hazard mitigation plan and requesting public feedback, in the city newsletter.
Draper City	• Twice a year, use social media (Facebook), the website, or community newsletter (Draper Forward) to share the link to the hazard mitigation plan, including the public feedback contact information. • Share information with homeowners and renters as part of the hazard public education campaign for weather-related hazards.
Emigration Canyon	• Twice a year, use social media or the website to share the link to the hazard mitigation plan, including the public feedback contact information. • Promote mitigation, including soliciting feedback on the mitigation plan during community wildfire prevention events and outreach campaigns to residents.
Herriman	• Twice a year, use social media (Facebook), the website, or community newsletter to share the link to the hazard mitigation plan, including the public feedback contact information. • Share public education about hazards and the opportunity to submit feedback on the mitigation plan through the Herriman Connection newsletter included in the utility bill.

Plan Participant	Continued Public Involvement Methodology
Holladay	• Twice a year, use social media (Facebook, Instagram) or the website to share the link to the hazard mitigation plan, including the public feedback contact information. • Share the hazard mitigation plan at CERT trainings and during the annual emergency preparedness fair and solicit feedback. • Share public education campaign information through the city e-newsletter or the Emergency Preparedness website and monthly messages and provide an opportunity for public feedback.
Kearns	• Twice a year, use social media or the website to share the link to the hazard mitigation plan, including the public feedback contact information. • Share the hazard mitigation plan and request public feedback through public education and awareness campaigns in the city newsletter.
Magna	• Twice a year, use social media or the website to share the link to the hazard mitigation plan, including the public feedback contact information. • Share the link to the hazard mitigation plan and information on how to provide feedback via the monthly online newsletter.
Midvale	• Twice a year, use social media (Facebook, Instagram), the website, or City Journal newsletters to share the link to the hazard mitigation plan, including the public feedback contact information. Share the mitigation plan and request public feedback via the public awareness program.
Millcreek	• Twice a year, use social media (Facebook, Instagram, and X) or the website to share the link to the hazard mitigation plan, including the public feedback contact information. • Share mitigation information, including a link to the hazard mitigation website, which includes the request for public feedback, in either the weekly e-newsletter or the monthly Millcreek News mailed to residents. • Encourage public feedback on the mitigation plan at community trainings with Unified Fire Authority, St. Mark's Hospital, University of Utah Health, and CERT classes. • Share the mitigation plan and request public feedback via the public awareness program for hazards, such as drought, extreme heat, and radon.
Murray	• Twice a year, use social media (Facebook, Instagram, etc.), the website, or a community newsletter to share the link to the hazard mitigation plan, including the public feedback contact information. • Share the mitigation plan and solicit feedback through public awareness campaigns on weather hazards, dam failure, wildfires, and more. This can include the city newsletter, social media, or in-person training such as CERT. • Share mitigation information and solicit feedback on the current plan during the Emergency Operations Plan update, community outreach, and at an Emergency Fair.
Riverton	• Twice a year, use social media to share the link to the hazard mitigation plan, including the public feedback contact information. • Share the mitigation plan and solicit feedback on the plan through an education campaign conducted via social media, the Riverton Connect App, the Riverton Recap email newsletter, and the Riverton Review included in the utility bill, and include information about hazards, such as

Plan Participant	Continued Public Involvement Methodology
	dam failure, earthquake, extreme cold, high wind, lightning, radon, severe winter weather, tornado, and wildfire.
Salt Lake City	• Twice a year, use social media or the website to share the link to the hazard mitigation plan, including the public feedback contact information. • Use a monthly Featured News post on the website to share information about the hazard mitigation plan with residents, including options to provide feedback. • Include the hazard mitigation plan link at public training events such as CERT classes.
Sandy City	• Twice a year, use social media, the website, and a community newsletter (Sandy Journal) to share the link to the hazard mitigation plan, including the public feedback contact information. • Share information about the mitigation plan through Be Ready Sandy and encourage feedback.
South Salt Lake	• Twice a year, use social media or the website to share the link to the hazard mitigation plan, including the public feedback contact information. • Use city “On the Move” newsletter and the Emergency Management “Monthly Preparedness Tips” to share information about the hazard mitigation plan and public education campaigns for hazards • Include a link to the hazard mitigation plan and feedback information at CERT and amateur radio classes.
Taylorsville	• Twice a year, use social media (X, Facebook, Instagram) or the website to share the link to the hazard mitigation plan, including the public feedback contact information. • Share information about the hazard mitigation plan and educational materials about hazards, such as drought, earthquake, flooding, and severe weather in an email newsletter and the printed Taylorsville Newsletter mailed with the City Journal.
West Jordan	• Provide a link to the hazard mitigation plan and request for feedback via social media (Facebook) and the website. Share a reminder at least twice a year. • Share information about the hazard mitigation plan at Citizen Readiness Corps meetings.
White City	• Twice a year, use social media (Facebook) or the website to share the link to the hazard mitigation plan, including the public feedback contact information.
West Valley City	• Twice a year, use social media (Facebook and X) or the website to share the link to the hazard mitigation plan, including the public feedback contact information. • Share information about the mitigation plan via the Neighborhood Network newsletter or at an in-person event like WestFest.
Salt Lake Community College	• Twice a year, use social media or the website to share the link to the hazard mitigation plan, including the public feedback contact information. • Share the mitigation plan and request public feedback on the SLCC Mobile app during a public education campaign on earthquake, wildfire, and other hazards. • Integrate hazard mitigation information as part of other

Plan Participant	Continued Public Involvement Methodology
Jordan School District	• Twice a year, use social media (Facebook, Instagram, and X) or the website to share the link to the hazard mitigation plan, including the public feedback contact information. • Twice a year, use the parent portal (Skyward) or Jordan School Safety to conduct a public awareness campaign and include the hazard mitigation plan link and information with the request for public feedback to be sent to Salt Lake County Emergency Management. • Use the Skyward parent portal and district website (Jordan School Safety) to share hazard mitigation information with parents and students.
Canyons School District	• Twice a year, use social media, the website, and the newsletter to share the link to the hazard mitigation plan, including the public feedback contact information. • Use Parent Square email, text, app notifications and in-person meetings with Community Councils or via the S.A.F.E. Neighborhoods Program to share hazard mitigation information with parents and students. • Share information on how to promote safety at home and school via social media.

Overarching Policies

The following policies will guide Salt Lake County Emergency Management staff in making access and input to the Salt Lake County Multi-Jurisdictional Hazard Mitigation Plan as open and convenient as possible.

PARTICIPATION

All citizens of the region are encouraged to participate in the planning process, especially those who may reside in identified hazard areas. Salt Lake County Emergency Management will take whatever actions possible to accommodate individuals including the impaired, non-English speaking, persons of limited mobility, and others with special needs.

ACCESS TO MEETINGS

Adequate and timely notification to all area residents will be given as outlined above to all hearings, forums, and meetings.

ACCESS TO INFORMATION

Citizens, public jurisdictions, agencies and other interested parties will have the opportunity to receive information and submit comments on any aspect of the plan, and/or any other documents prepared for distribution by Salt Lake County Emergency Management that may be adopted as part of the plan by reference. Salt Lake County Emergency Management may charge a nominal fee for printing of documents that are longer than three pages.

TECHNICAL ASSISTANCE

Residents and local jurisdictions may request assistance in accessing the program and interpretation of mitigation projects. Salt Lake County Emergency Management staff will assist to the extent practical; however, limited staff time and resources may prohibit staff from giving all the assistance requested. Salt Lake County Emergency Management will be the sole determiner of the amount of assistance given all requests.

FUTURE REVISIONS

Future revisions of the plan shall include the following:

- Continuation of the search for more specific mitigation actions
- An analysis of progress of the plan as it is revised

THIS PAGE INTENTIONALLY LEFT BLANK

Appendix A: List of Acronyms

Appendix A: List of Acronyms

Acronym	Meaning
ALF	Animal Liberation Front
ARF	acute rheumatic fever
ATF	Bureau of Alcohol, Tobacco, Firearms and Explosives
BCEGS	Building Code Effectiveness Grading System
BFE	Base Flood Elevation
BOR	Bureau of Reclamation
BRIC	Building Resilient Infrastructure in Communities
CDA	Community Development Area
CDBG	Community Development Block Grant
CDC	Centers for Disease Control and Prevention
CEMP	Comprehensive Emergency Management Plan
CERT	Community Emergency Response Team
CFM	Certified Floodplain Manager
CFR	Code of Federal Regulations
CIKR	critical infrastructure and key resources
CIP	Capital Improvement Plan
ClimRR	Climate Risk and Resilience Portal
CMRA	Climate Mapping for Resilience and Adaptation
ComEd	Commonwealth Edison
COVID	Coronavirus disease
CPI	Consumer Price Index
CPI-U	Consumer Price Index for All Urban Consumers
CPRI	Calculated Priority Risk Index
CRA	Community Reinvestment Area
CRS	Community Rating System
CWPP	Community Wildfire Protection Plan
DEM	Division of Emergency Management
DHS	U.S. Department of Homeland Security
DMA 2000	Disaster Mitigation Act of 2000
DMR	Digital Mobile Radio
DNR	Division of Natural Resources
DRC	Utah Division of Radiation Control
EAL	Expected annual loss
EAP	Emergency Action Plan
ECC	Emergency Coordination Center
ELF	Earth Liberation Front
EM	Emergency management

Acronym	Meaning
EMPG	Emergency Management Performance Grant
EMS	Emergency Medical Services
EOC	Emergency Operations Center
EOP	Emergency Operations Plan
EPA	U.S. Environmental Protection Agency
ESPG	Energy Storage and Power Generation
FBI	Federal Bureau of Investigation
FEMA	Federal Emergency Management Agency's
FIRM	Flood Insurance Rate Map
FMA	Flood Mitigation Assistance
GIS	Geographic Information System
HAZMAT	Hazardous materials
Hazus	Hazards United States
HHPD	High Hazard Potential Dam
HIRA	Hazard Identification and Risk Assessment
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HMGP-PF	HMGP Post Fire Program
HMP	Hazard Mitigation Plan
HSGP	Homeland Security Grant Program
IBC	International Building Code
IPAWS	Integrated Public Alert and Warning System
IRC	International Residential Code
ISB	Intermountain Seismic Belt
IT	Information Technology
JIC	Joint Information Center
LAL	Lightning Activity Level
LDS	Church of Jesus Christ of Latter-Day Saints
LEPC	Local Emergency Planning Committee
LHMP	Local Hazard Mitigation Plan
LTR	Logic Trunked Radio
MBPA	Migratory Bird Production Area
MDS	Municipal Services District
MJHMP	Multi-Jurisdictional Hazard Mitigation Plan
ML	Local magnitude scale
MOU	Memorandum of Understanding
MSD	Municipal Services District
NCEI	National Centers for Environmental Information

Acronym	Meaning
NFIP	National Flood Insurance Program
NFPA	National Fire Protection Association
NGO	Nongovernmental Organization
NID	National Inventory of Dams
NOAA	National Oceanic and Atmospheric Administration.
NPL	National Priorities List
NRCS	Natural Resources Conservation Service
NRI	National Risk Index
NWS	National Weather Service
NXDN	Next Generation Digital Narrowband
PA	Public Assistance
PCE	Tetrachloroethylene
PDM	Pre-Disaster Mitigation
PDSI	Palmer Drought Severity Index
PHIBIS	Public Health Indicator Base Information System
PII	Personally Identifiable Information
PIO	Public Information Officer
POD	Point of Distribution
PPE	Personal Protective Equipment
PSI	Pandemic Severity Index
PW	Public Works
RACS	Remote Avalanche Control System
RDA	Regional Development Area
RL	Repetitive Loss
ROD	Record of Decision
RTKC	Rio Tinto Kennecott Copper
RTP	Regional Transportation Plan
SAIC	Statewide Information & Analysis Center
SAIPE	Small Area Income & Poverty Estimates
SFHA	Special Flood Hazard Area
SHSP	State Homeland Security Program
SIAC	Statewide Information & Analysis Center
SLC	Salt Lake City
SLCo	Salt Lake County
SLCoEM	Salt Lake County Emergency Management
SNOTEL	Snow Telemetry
SOP	Standard Operating Procedure
SVI	Social Vulnerability Index

Acronym	Meaning
TOD	Transit-Oriented Development
TRBO	(a digital radio format developed by Motorola)
UAC	Utah Avalanche Center
UDEM	Utah Division of Emergency Management
UDEQ	Utah Department of Environmental Quality
UDOT	Utah Department of Transportation
UFA	Unified Fire Authority
UPD	Unified Police Department
UPDES	Utah Pollution Discharge Elimination System
URM	Unreinforced masonry
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
UTA	Utah Transit Authority
VA	U.S. Department of Veterans Affairs
VOAD	Voluntary Agencies Active in Disasters
VVH	Very, Very High
VVL	Very, Very Low
WFRC	Wasatch Front Regional Council
WUI	Wildland–Urban Interface

THIS PAGE INTENTIONALLY LEFT BLANK

Appendix B: Meeting Documentation

Appendix B: Meeting Documentation

See attachment.

Appendix C: Public Outreach Survey Documentation

Appendix C: Public Outreach Survey Documentation

See attachment.

Appendix D: Plan Effectiveness Evaluation Form

Appendix D: Plan Effectiveness Evaluation Form

Plan Section	Question	Comments
Planning Process	Have there been local staffing changes or additional staff that should be invited to join the mitigation planning team?	
	Are there additional partners or stakeholders that should be invited to participate in the hazard mitigation planning process? List organization, title, and name if applicable.	
	Has there been any public outreach or feedback from the community on hazard mitigation or the hazard mitigation plan?	
	Have you integrated the current hazard mitigation plan into any other planning mechanisms? List and describe if so.	
Hazard Profiles	Has a natural and/or human-caused disaster occurred in this reporting period? If so, describe it and suggest next steps.	
	Are there natural and/or human-caused hazards that have not been addressed in this plan which should be?	
	Are additional maps/data or new hazard studies available? If so, what have they revealed?	
	Have there been changes in development patterns that could influence the effects of hazards or create additional risks?	
	How has the vulnerability analysis changed as a result of implementing mitigation actions?	
Mitigation Strategy	What different or additional resources (financial, technical, and human) are available now for mitigation planning and action?	
	Must the goals be adjusted?	
	Should new mitigation actions be added to the Mitigation Action Plan?	

Plan Section	Question	Comments
	What mitigation actions have been implemented? Any success stories or lessons learned?	
	Should the mitigation actions in the Mitigation Action Plan be reprioritized, deleted, or revised?	
	Are the available resources sufficient for performing the mitigation actions in the Mitigation Action Plan? If not, what additional resources are needed?	

THIS PAGE INTENTIONALLY LEFT BLANK