2018 Georgia Hazard Identification and Risk Assessment

April 2018

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Approval and Implementation

Hazard Identification and Risk Assessment and appendices, including the Consequence Analysis, have been approved and implemented by:

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1.0 INTRODUCTION

1.1 Purpose

The purpose of this document is to provide a statewide overview of how various natural, human-caused, and technological hazards impact the State of Georgia. This Hazard Identification and Risk Assessment (HIRA) undertakes an all-hazards identification, classification, and vulnerability indexing process to ensure hazard analysis is comprehensive and all encompassing.

For the purposes of this HIRA, a natural hazard is defined as an event or physical condition that has the potential to cause fatalities, injuries, property and infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss. In addition, a human-caused hazard includes any disastrous event caused directly and principally by one or more identifiable deliberate or negligent human actions, while a technological hazard is a hazard originating from technological or industrial conditions, including accidents, dangerous procedures, or failures.

These hazards can be intensified by societal behavior and practices, such as building in a floodplain, along a seacoast, or an earthquake fault. All of these hazards may cause loss of life, injury, illness or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage if the extent, magnitude, and impact is significant. While it is impossible to prevent and mitigate all hazards, the impacts of these hazards can, at a minimum, be mitigated or, in some instances, prevented entirely.

Georgia is not immune to any of these hazard types. Tropical cyclones and related coastal flooding, winter storms, and river flooding affect Georgia on a recurring basis. The coastal counties in the state are vulnerable to hurricane storm surge. Other damages associated with hurricanes and tropical storms include inland flooding, damaging winds and tornadoes. This type of flooding poses an additional health risk as it involves the overflow of storm sewer systems and is usually caused by inadequate drainage following heavy rain, or an extreme storm surge. In addition, Georgia is home to numerous pieces of critical infrastructure that are vulnerable to both human caused hazards, such as a cyber compromise or terrorism, and technological hazards, such as an infrastructure failure or transportation accidents.

Identifying the risk and vulnerability for a community is critical when determining how to allocate finite resources to carry out feasible and appropriate mitigation actions. The hazard analysis involves identifying all of the hazards that potentially threaten Georgia, and then analyzing them individually to determine the degree of threat posed by each hazard. Addressing risk and vulnerability through hazard mitigation measures will reduce societal, economic, and environmental exposure to natural hazard impacts.

For multi-hazard identification, all hazards that may potentially impact the state should be identified, including natural, human-caused, and technological hazards, as well as cascading emergencies- situations when one hazard triggers others sequentially. For example, severe flooding that damages buildings that store hazardous, water-reactive chemicals could result in critical contamination problems that would dramatically

escalate the type and magnitude of events. Dam failures may occur as a result of an earthquake, creating a dangerous flash flooding scenario for communities located in dam inundation areas.

(1) *Federal Emergency Management Agency. "Threat and Hazard Identification and Risk Assessment Guide*

1.2 HIRA Updates

This 2018 HIRA consolidates, updates, and streamlines content from the 2014 Georgia's Hazard Mitigation Strategy (HMS) Update and the Georgia 2018 Threat and Hazard Identification and Risk Assessment (THIRA). This HIRA includes:

- Addition of human-caused and technological hazards;
- Completion of a consequence analysis for the top 13 hazards;
- Restructuring, consolidating, and renaming of hazards and hazard groups;
- Update of all maps and data to encompass changes since Georgia's 2014 HMS Update; and
- Amendment to critical facility data and structures information to include Georgia's Geographic Information System (GIS) data sets.

The information in this section has been reviewed and revised by the State's Subject-Matter Experts (SME). The SMEs have validated the information contained within this section adequately represents the risk and vulnerability in Georgia.

2.0 HAZARD IDENTIFICATION

In order to fulfill the planning guidelines outlined in the Disaster Mitigation Act (DMA) 2000 and the Emergency Management Accreditation Program (EMAP), this HIRA addresses natural hazards, human caused hazards, and technological hazards.

The previously approved Georgia 2014 HMS Update focused on natural hazards and the Georgia 2018 THIRA focused on manmade, while this Georgia 2018 HIRA update expands to all hazards.

For the purposes of the Georgia 2018 HIRA, hazards have been grouped by hazard type (natural, human-caused, and technological) as well as by similarity of hazard events, occurrences, and typical impacts.

As part of the 2018 HIRA update, "epidemic" was added as a natural hazard, in order to align with its inclusion in the THIRA. In addition, human caused-hazards and technological hazards were added to the overall vulnerability assessment to align with the THIRA and meets the requirements of EMAP accreditation.

It should be noted that the below hazards are not a complete listing of all hazards that may occur in Georgia. This listing accurately represents the hazards that impact Georgia most frequently and have the potential to cause fatalities, injuries, property and infrastructure damage, agricultural loss, damage to the environment, interruption of

business, or other types of harm or loss. The following hazards are not addressed in the HIRA:

- Landslides
- Tsunamis

The hazards listed above were considered and discussed but it was decided that these hazards would not be included in the HIRA due to:

- The low frequency of occurrence;
- The minimal probability of occurrence; and/or
- The lack of resources to devote to further research the likelihood of potential occurrence or impact.

Table 1: Hazard Identification and Hazard Grouping

Natural Hazards		
Severe Weather • Thunderstorms • High Winds • Lightning • Hail • Tornadoes	**Inland Flooding** • River Flooding • Flash Flooding • Urban Flooding	**Tropical Cyclone** • Storm Surge • High Winds • Heavy Rainfall • Tornadoes
Winter Weather • Snow • Extreme Cold • Ice • Blizzard • Freezing Rain • Sleet	**Drought/Wildfire** • Extreme Heat • Wildfires • Smoke • Water Shortage	**Geologic Hazards** • Sinkholes • Earthquakes • Landslides
Infectious Diseases • Infectious Diseases • Food Borne Diseases • Agricultural Disease Outbreaks • Novel Disease Outbreaks		
Human Caused Hazards		
Cybersecurity Attack • Hacking/Phishing • Infrastructure Disruptions • Ransomware/Malware Attacks • Network Intrusion/Disruption • Transportation	**Active Shooter** • Explosives/Improvised Explosive Devices • Vehicle Ramming • Sniper Attack • Hostage Taking	**Radiological Release** • Radiological Release Technical • Radiological Release Hostile
Hazardous Material Release • Transportation-Related • Storage-Related, Spills, And Leaks		

Technological Hazards		
Dam Failure • Downstream Flooding • Erosion • Property Damage • Environmental Damage • Transportation Disruption • Infrastructure Disruption	**Infrastructure Failure** • Communications • Transportation • Energy • Public Works	

Table 2: Hazard Identification Process

Hazard of Concern	How and Why hazard was Identified
Severe Weather • Thunderstorms • High Winds • Lightning • Hail • Tornadoes	• Review of historical disaster declarations and the National Weather Service (NWS) National Center for Environmental Information (NCEI) Storm Events Database • 29 out of 42 declared disaster events in Georgia were Severe Weather events
Inland Flooding • River Flooding • Flash Flooding • Urban Flooding	• Review of historical disaster declarations and NWS NCEI Storm Events Database • Flooding impacts Georgia nearly every year and results in the majority of the damages associated with hazard events • 17 out of 42 declared disaster events in Georgia were flood events
Tropical Cyclone • Storm surge • High Winds • Heavy Rain fall • Tornado	• Review of historical disaster declarations and NWS NCEI Storm Events Database • NWS NCEI hurricane data • 6 out of 42 declared disaster events in Georgia were hurricane, tropical storm, or coastal events
Winter Weather • Snow • Ice • Freezing Rain	• Review of historical disaster declarations and NWS NCEI • 4 out of 42 declared disaster events in Georgia were winter weather related events
Drought/Wildfire • Extreme Heat • Wildfires	• Review of historical disaster declarations, NWS NCEI Storm Events Database, U.S. Drought Monitor and Drought Impact Reporter • The entire State of Georgia is subject to the effects of drought
Geologic Hazards • Sinkholes • Earthquake	• Review of historical data, including United States Geological Survey • Earthquakes have impacted Georgia in the past. Between 1811 and 2013, there have been 11 earthquake events with epicenters near Georgia
Infectious Diseases: • Infectious Diseases • Food Borne Diseases • Agricultural Disease Outbreaks • Novel Disease Outbreaks	• Numerous bodies of water located in the state that assist with the breeding of mosquitos and other waterborne pathogens
Cybersecurity Attack • Hacking/Phishing • Infrastructure Disruptions • Ransomware/Malware Attacks • Network Intrusion/Disruption	• Most of Georgia's critical infrastructure is linked to some technology-based platform, which is a key vector of attack in a cybersecurity incident

• Transportation	
Active Shooter • Explosives/Improvised Explosive Devices • Vehicle Ramming • Sniper Attack • Hostage Taking	• Terrorist attacks can occur anywhere • Georgia is an attractive target due to it's to major urban areas, seaports and tourism.
Radiological Release (Technical, Hostile) • Individuals (Physical and Psychological Health) • Property • Environment • Infrastructure • Agriculture • Zoological • Economy	• Georgia contains 6 counties within the 10-mile Emergency Planning Zone • 76 counties within the 50-mile Ingestion Pathway Zone of nuclear power plants located within Georgia and adjacent states.
Hazardous Material Release • Injury • Loss of life • Property damage • Environmental damage	• Over 900 reports of oil and hazmat releases reported in 2017 • 528 on the State's hazardous site inventory
Dam Failure • Downstream Flooding • Erosion • Property Damage • Environmental Damage • Transportation Disruption • Infrastructure Disruption	• Georgia has 4489 Dams • In Georgia all major rivers are dammed at least once • Numerous smaller dams, including agricultural exist
Infrastructure Failure • Communications • Transportation • Energy • Water/Wastewater	• Georgia is home to numerous pieces of critical infrastructure across all identified sectors

2.1 Disaster History

Georgia is vulnerable to tropical storms and hurricanes that form in the Atlantic Ocean and the Gulf of Mexico. On July 4, 1994, Tropical Storm Alberto stalled over Georgia, bringing up to 25 inches of rain in less than 24 hours. Thirty-four people were killed, more than 50,000 were displaced from their homes and at least 400 coffins were forced from water-logged graves into flooded streets.

In September 1999, Georgia, along with Florida, South Carolina and North Carolina, experienced large evacuation as Hurricane Floyd bore down on the southeastern coastline. An estimated three million people took to the highways to flee Floyd's forecasted path, jamming interstates in search of safety and shelter.

Western Georgia took a hit from Hurricane Katrina on August 29, 2005, with bands of heavy rain and damaging winds. 18 tornadoes in one day touched down in Georgia when Katrina's remnants passed through the state, killing two people and destroying numerous homes and businesses. In addition, the price of gasoline rose as high as $6 per gallon, due to consumer panic after oil pumps were disrupted in the Gulf of Mexico. Georgia also became the destination of more than 100,000 evacuees from the Gulf States.

Hurricane Matthew began impacting coastal portions of Georgia on the morning of Friday, October 7th as a category 3 major hurricane. After weakening to a category 2, the center of the hurricane moved north and northeast, generally parallel to the southeast Atlantic coast. The center of the storm passed Brunswick, Georgia just 60 miles offshore before passing Savannah, Georgia only 35 miles offshore. The worst impacts began Friday evening and lasted through Saturday morning, and included record-breaking storm surge flooding, extreme rainfall, and sustained hurricane-force winds. This was the first time that hurricane-force impacts had occurred on the Georgia coast since Hurricane David in 1979.

Major to record-breaking flooding occurred along the Georgia coast. Sea Camp Dock at Cumberland Island briefly reached major flood stage on Friday afternoon. St. Simon's Island came within 3 inches of major flood stage early Saturday morning. The Savannah River at Fort Pulaski broke a 37-year record by nearly 4 inches early Saturday morning. All of this flooding was caused by excessive storm surge.

Hunter U.S. Army Airfield received 17.49 inches of rainfall between 11:00 AM Thursday and 10:00 AM Saturday. Savannah International Airport received 11.51 inches. The record for daily rainfall in the Savannah area was 9.02 inches, which occurred on September 16, 1924. Average annual rainfall in Savannah is 47.96 inches. Parts of Savannah received more than one-third of their yearly total over this period. Widespread amounts of 6-10 inches of rainfall were reported, with parts of Bryan, Chatham, Effingham, and Glynn counties receiving 10-16 inches.

Widespread hurricane-force wind gusts were observed, and in some counties lasted for almost 5 straight hours. The highest wind gusts were recorded on Tybee Island: a 94 MPH wind gust at 4:19 AM and a 96 MPH wind gust at 4:38 AM on Saturday morning. Tropical storm-force wind gusts of 39 MPH or greater occurred in Appling, Bacon, Bulloch, Candler, Charlton, Chatham, Evans, Glynn, Jeff Davis, Liberty, McIntosh, Screven, Ware, and Wayne counties. Hurricane-force winds of 74 MPH or greater occurred in multiple portions of Chatham and Bryan counties.

Hurricane Irma made landfall as a major hurricane in southwest Florida on September 10, 2017. Irma moved northward through the day on September 10th, gradually losing intensity but continuing to bring widespread wind damage and heavy rainfall along its track. By the morning of Monday, September 11th, then-Tropical Storm Irma moved into Georgia with a very large wind field containing at least tropical storm force wind gusts (39+mph). These high winds lasted several hours across most of the state, which resulted in many thousands of downed trees and caused 1.5 million customers in Georgia to lose power. Given the extensive damage, power was not restored to many

areas for several days. With generally dry conditions prior to Irma's arrival, flooding issues in North and Central Georgia were relatively minor, though portions of southern and coastal Georgia experienced more significant flooding as well as coastal storm surge.

Widespread sustained winds of 30-45 mph with gusts in the 50-65 mph range downed numerous trees and power lines across the area. Many trees fell onto homes and businesses, causing additional damage. Unfortunately, at least two people were killed in North Georgia due to falling trees with several others sustaining injuries. The heaviest rainfall totals were confined to far southeast Georgia, where some areas received 9-13 inches of rainfall. In North and Central Georgia, most areas received 3-5 inches of rainfall. Despite the fact that much of the area was on the side of Irma typically favorable for tornadoes, no tornadoes were reported across Georgia during Irma's passage. The primary reason for this lack of tornadoes was the fact that an unseasonably cool and stable air mass was in place across the area. In fact, high temperatures were only in the 60s that day, which set record cool high temperatures for September 11th for many locations. These cool temperatures eliminated any instability that would have supported tornado-producing tropical convection associated with Irma.

Wildfires spread quickly and change direction rapidly, igniting brush, trees and homes. On April 16, 2007, a downed power line ignited drought-parched forest floors in southern Georgia, which led to the largest and most devastating wildfires in state history. Nearly 564,000 acres were consumed in Georgia and Florida, and 18 homes were destroyed. More than 3,300 firefighters from 44 states, Canada and Puerto Rico came in to battle the blazes.

In 2017 wildfires engulfed 19,411 acres across North Georgia and the West Mims Fire on the Georgia/Florida line burned an estimated 130,942 acres.

A spring 2009 flood in southern Georgia brought federal disaster declarations to 46 counties and in September 2009, continuous rain resulted in flooding that statistically should only happen every 500-years. Several counties throughout northern Georgia were affected, most of them in and around metro Atlanta. The flood is blamed for at least 10 deaths and $500 million in damage. Some 20,000 homes, businesses and other buildings suffered major damage, and 23 counties received federal disaster declarations.

Georgia is at risk for terrorist attacks. While Georgia has not experienced a large-scale attack, they can occur without warning. During the 1996 Olympics, a bombing occurred at Centennial Olympic Park, killing four and injuring 111. The next year, an Atlanta-area health clinic and a gay nightclub were bombed by the same man. In June 2009, a Georgia Tech student was convicted of conspiring to provide material support for terrorism and was sentenced to 13 years in federal prison.

Pandemics can spread rapidly, leaving little time to prepare once an outbreak starts. In June 2009, the World Health Organization declared H1N1 influenza a pandemic. Nearly 50 people died and more than 800 were hospitalized in Georgia because of the virus. The Centers for Disease Control and Prevention has noted cases of avian flu in humans in the United States. Georgia ranks as the nation’s leading producer of poultry products.

2.2 Federally Declared Disasters (1998-2017)

(DR-1209) March 11, 1998: Georgia Severe Storms, Tornadoes and Flooding.

(DR-1271) April 20, 1999: Georgia Severe Storms and Tornadoes.
Public Assistance - Dollars Approved: $1,868,757.98

(DR-1311) January 28, 2000: Georgia Winter Storm.
Public Assistance - Dollars Approved: $36,909,135.59

(DR-1315) February 15, 2000: Georgia Tornadoes.
Public Assistance - Dollars Approved: $2,043,473.79

(DR-1554) September 18, 2004: Georgia Hurricane Ivan.
Individual Assistance - Dollars Approved: $4,243,819.01
Public Assistance - Dollars Approved: $11,948,606.45

(DR-1560) September 24, 2004: Georgia Tropical Storm Frances.
Public Assistance - Dollars Approved: $15,368,109.08

(DR-1686) March 03, 2007: Georgia Severe Storms and Tornadoes.
Individual Assistance - Dollars Approved: $1,354,036.12
Public Assistance - Dollars Approved: $49,626,587.97

(DR-1750) March 20, 2008: Georgia Severe Storms and Tornadoes.
Individual Assistance - Dollars Approved: $1,351,662.70
Public Assistance - Dollars Approved: $3,559,480.70

(DR-1761) May 23, 2008: Georgia Severe Storms and Flooding.
Individual Assistance - Dollars Approved: $2,458,564.00
Public Assistance - Dollars Approved: $10,736,846.73

(DR-1833) April 23, 2009: Georgia Severe Storms, Flooding, Tornadoes, and Straight-line Winds.
Individual Assistance - Dollars Approved: $4,420,415.46
Public Assistance - Dollars Approved: $21,173,785.47

(DR-1858) September 24, 2009: Georgia Severe Storms and Flooding.
Individual Assistance - Dollars Approved: $58,999,961.95
Public Assistance - Dollars Approved: $59,803,987.85

(DR-1973) April 29, 2011: Georgia Severe Storms, Tornadoes, Straight-line Winds, and Associated Flooding.
Individual Assistance - Dollars Approved: $5,549,148.17
Public Assistance - Dollars Approved: $21,099,213.39

(DR-4165) March 06, 2014: Georgia Severe Winter Storm.
Public Assistance - Dollars Approved: $46,113,875.93

(DR-4215) April 20, 2015: Georgia Severe Winter Storm.
Public Assistance - Dollars Approved: $11,143,534.24

(DR-4259) February 26, 2016: Georgia Severe Storms and Flooding.
Public Assistance - Dollars Approved: $19,748,473.22

(DR-4284) October 08, 2016: Georgia Hurricane Matthew.
Individual Assistance - Dollars Approved: $6,593,971.53
Public Assistance - Dollars Approved: $87,883,499.14

(DR-4294) January 25, 2017: Georgia Severe Storms, Tornadoes, and Straight-line Winds.
Individual Assistance - Dollars Approved: $620,724.39
Public Assistance - Dollars Approved: $12,332,467.88

(DR-4297) January 26, 2017: Georgia Severe Storms, Tornadoes, and Straight-line Winds.
Individual Assistance - Dollars Approved: $2,960,695.39
Public Assistance - Dollars Approved: $16,933,081.48

(DR-4338) September 15, 2017: Georgia Hurricane Irma.
Individual Assistance - Dollars Approved: $12,696,704.44
Public Assistance - Dollars Approved: $585,260.17

Source: https://www.fema.gov/data-visualization-disaster-declarations-states-and-counties

3.0 RISK ASSESSMENT

This section details the risk assessment process and the methods used to rank hazard risks. Results from this process and accompanying methods will be presented in hazard-specific sections that follow.

Hazard Identification - In this step the hazards that could impact your community are separated from those that cannot. This requires a review of all hazards and their causes to determine whether they may be a threat to your community. This may require the consultation of the scientific community, historical records and government agencies.

Risk Assessment - In this step the level of risk for each hazard is examined. This may involve speaking with hazard experts, researching past occurrences and possible scenarios. The likelihood of the hazard occurring and the potential impacts of the hazard on people, property, the environment, business and finance and critical infrastructure should be examined.

Risk Analysis - The information collected in the risk assessment step will be analyzed in this step. The desired outcome of the risk analysis is the ranking of the hazards. This highlights the hazards that should be considered a current priority for your emergency management program.

Monitor and Review - It is important to remember that a HIRA is an ongoing process and hazards and their associated risks must be monitored and reviewed.

3.1 Ranking Methodology

In this section, the methodology of scoring vulnerability for a hazard will be explained as it relates to each hazard. The discussion of the methodology is critical to understanding how and why hazards are prioritized in Georgia.

A standardized methodology, which allows for greater flexibility and room for subject matter expertise was developed to compare different hazards' risk at the State level. This method prioritizes hazard risk based on a blend of quantitative factors extracted from multiple data sources.

These factors include Frequency (Table 3), Likelihood of Occurrence and Consequences of Hazard (Tables 4-11) which include:

- Social Impacts (fatalities, injuries, and evacuation) (Tables 4-6);
- Property Damage (hazard on buildings, structures and crops) (Table 7);
- Critical Infrastructure Service Disruptions/Impact (Table 8);
- Environmental Damage (Table 9);
- Business/Financial Impact (Table 10) and
- Psychosocial Impact (Table 11)

Likelihood of hazard occurrence (Table 3) was rated on a scale of one (1) through (6), in which the probability of future occurrence ranged from less than a one percent chance in the next 100 years (score of 1) to near 100 percent probability of happening within 12 – 60 months (score of 6).

Table 3 Likelihood of hazard occurrence

Frequency	Category	Percent Chance	Description
1	Rare	Less than a 1% chance of occurrence in any year.	Hazards with return periods >100 years.
2	Very Unlikely	Between a 1% - 2% chance of occurrence in any year.	Occurs every 50 – 100 years and includes hazards that have not occurred but are reported to be more likely to occur in the near future.
3	Unlikely	Between 3% – 10% chance of occurrence in any year.	Occurs every 20 – 50 years
4	Probable	Between 11% – 50% chance of occurrence in any year.	Occurs every 5 – 20 years
5	Likely	Between 51% – 99% chance of occurrence in any year.	Occurs >5 years.
6	Almost Certain	100% chance of occurrence in any year.	The hazard occurs annually.

Social Impacts are the direct negative consequences of a hazard on the physical health of people. The social impacts sub variable is further divided into the fatality rate, injury rate and evacuation rate. Add all three together to get the social impact score.

- Fatalities Table (4) was rated on a scale of (0) through (4), in which the probability of a fatality is not likely (score of 0) to catastrophic more than 50 (Score of 4).
- Injuries Table (5) was rated on a scale of (0) through (3), in which the probability of an injury is not likely (score of 0) to severe more than 100 (Score of 3).
- Evacuation Table (6) was rated on a scale of (0) through (3), in which the probability of an evacuation is not likely (score of 0) to severe more than 500 (Score of 3).

Table 4 Fatalities

Consequence	Category	Description
0	None	Not likely to result in fatalities within the community.
1	Minor	Could result in fewer than five fatalities within the community.
2	Moderate	Could result in 5 to 10 Fatalities within the community.
3	Severe	Could result in 11 to 50 fatalities within the community.
4	Catastrophic	Could result in 50+ fatalities within the community.

Table 5 Injuries

Consequence	Category	Description
0	None	Not likely to result in injuries within the community.
1	Minor	Could injure fewer than 25 people within community.
2	Moderate	Could injure 26 to 100 people within the community.
3	Severe	Could injure 100+ people within the community.

Table 6 Evacuation

Consequence	Category	Description
0	None	Not likely to result in an evacuation shelter-in-place orders, or people stranded.
1	Minor	Could result in fewer than 100 people being evacuated, sheltered-in-place or stranded.
2	Moderate	Could result in 100 - 500 people being evacuated, sheltered-in-place or stranded.
3	Severe	Could result in more than 500 people being evacuated, sheltered-in-place or stranded.

Property Damage is the direct negative consequence of a hazard on buildings, structures and other forms of property, such as crops

Table (7) was rated on a scale of (0) through (3), in which the probability of property damage is not likely (score of 0) to widespread damage (Score of 3).

Table 7 Property Damage

Consequence	Category	Description
0	None	Not likely to result in property damage within the community.
1	Minor	Could cause minor and mostly cosmetic damage.
2	Moderate	Localized severe damage (a few buildings destroyed).
3	Severe	Widespread severe damage (many buildings destroyed).

Critical Infrastructure Service Impact are the negative consequences of a hazard on the interdependent, interactive, interconnected networks of institutions, services, systems and processes that meet vital human needs, sustain the economy, protect public safety and security, and maintain continuity of and confidence in government.

Table (8) was rated on a scale of (0) through (3), in which the probability of critical infrastructure service impact is not likely (score of 0) to severe (Score of 3).

Table 8 Critical Infrastructure Service Impact (CI)

Consequence	Category	Description
0	None	Not likely to disrupt critical infrastructure services.
1	Minor	Could disrupt 1 critical infrastructure service.
2	Moderate	Could disrupt 2 – 3 critical infrastructure services.
3	Severe	Could disrupt more than 3 critical infrastructure services.

Environmental Damage is the negative consequences of a hazard on the environment, including the soil, water, air and/or plants and animals.

Table (9) was rated on a scale of (0) through (3), in which the probability of environmental damage is not likely (score of 0) to severe (Score of 3).

Table 9 Environmental Damage

Consequence	Category	Description
0	None	Not likely to result in environmental damage.
1	Minor	Could cause localized and reversible damage. Quick clean up possible.
2	Moderate	Could cause major but reversible damage. Full clean up difficult.
3	Severe	Could cause irreversible environmental damage. Full clean up not possible.

Business/Financial Impact that have a negative economic consequences of a hazard.

Table (10) was rated on a scale of (0) through (2), in which the probability of business/financial impact is not likely (score of 0) to severe (Score of 2).

Table 10 Business/Financial Impact

Consequence	Category	Description
0	None	Not likely to disrupt business/financial activities.
1	Moderate	Could result in losses for a few businesses.
2	Severe	Could result in losses for an industry.

Psychosocial Impact is the negative response of the community or a subset of the community to a hazard caused by their perception of risk. This includes human responses such as self-evacuation, mass panic and other potential undesirable responses.

Table (11) was rated on a scale of (0) through (2), in which the probability of Psychosocial Impact is not likely (score of 0) to severe (Score of 2).

Table 11 Psychosocial Impact

Consequence	Category	Description
0	None	Not likely to result in significant psychosocial impacts.
1	Moderate	Significant psychosocial impacts including limited panic, hoarding, self-evacuation and long-term psychosocial impacts.
2	Severe	Widespread psychosocial impacts, e.g. mass panic, widespread hoarding, self-evacuation and long-term psychological impacts.

3.2 Composite Hazard Index

The total consequence value can be obtained by adding the values obtained from each of the sub variables.

Table 12 Total Consequence

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/Financial Impact	Psycho-social Impact	Sub-variable Total
0	0	0	0	0	0	0

Once the consequence values have been added up, they are put into groups as shown in the table below. This gives equal weight to consequence and frequency.

Table 13 Consequence Groups

Sub Total Variable	Consequence	Description
1 - 4	1	**Minor**
5- 6	2	**Slight**
7- 8	3	**Moderate**
9 - 10	4	**Severe**
11 - 12	5	**Very Severe**
+13	6	**Catastrophic**

Risk Analysis

Once you have completed the Frequency and Consequence Work Sheets, you can now begin to prioritize your hazards by using the HIRA equation:

Risk = Frequency * Consequence

Table 14 Risk Analysis

Level Of Risk	
< 5	Very Low
6 -10	Low
11- 15	Moderate
16- 20	High
21- 25	Very High
> 25	Extreme

4.0 VULNERABILITY ANALYSIS

Vulnerability includes all populations and assets (environmental, economic, and critical facilities) that may be at risk from natural, human-caused, and technological hazards. Vulnerability analysis measures the level of assets, populations, or resources within a given region, city, or town. Their vulnerability is a function of the built environment, local economy, demographics, and environmental uses of a given region.

4.1 Facility Analysis

The damage and/or destruction of Georgia's six (6) critical lifeline sectors (Communications, Emergency Services, Energy, Information Technology, Transportation Systems, and Water/Wastewater Systems) represents enormous

economic, social, and general functional costs to a community, while also impeding emergency response and recovery activities.

Approximately 1.5 million people live within 75 miles of the Gulf of Mexico and in the 11 counties closest to the Atlantic Ocean in Georgia. These areas are the most vulnerable to hurricanes. A nonfunctional road can have major implications for a community: general loss of productivity; disruption of physical access preventing residents from getting to work or other daily activities; prevention of emergency vehicles from reaching destinations; associated health and safety implications; and potential access difficulties causing the disruption of important lifeline supplies, such as food and other deliveries to the community.

Damaged or destroyed utility lines and facilities, including electricity, computer and satellite links, gas, sewer, and water services can cripple a region after a disaster. Power lines are often badly damaged or destroyed, resulting in the loss of power for days, weeks, or even months. This is particularly critical considering modern societies' dependence on electricity. In addition to basic modern household appliances being affected, public water supplies, and water treatment and sewage facilities can also be impacted. Electric pumps cannot pump drinking water into an area without power, and even if they could, the water delivery system could be breached in several areas. The loss of level elevated water tanks also results in a lack of safe drinking water. Even disaster victims who do get water may have to boil it to eliminate waterborne pathogens introduced to the supply in breached areas.

Although not a complete representation of all the possible types of facilities, this dataset is a good representation of critical and state facilities in Georgia.

Table 15 Types of Facilities

State Owned Holdings:	13,464
State route miles	17,912
Interstate miles	1,247
Law Enforcement	763
Fire Stations	1899
Hospitals	233
Dispatch Centers	199
First Responder's Communication Towers	517
Fixed Gateways	178
TV Digital Station Transmitters	37
AM Transmission Towers	193
FM Transmission Towers	512
Cellular Towers	613
City Halls	125
Housing Units	4,114,448
Mobile Homes	381,978
Airports	454
Dams	4489
Fishing and Boating Access/Marinas	816

It should be noted that Law Enforcement was used in place of Correctional Institutions, Fire Stations in place of Emergency Medical Services (EMS), and Schools to capture all schools including higher education and as a result the school layer was more comprehensive compared to the Colleges and Universities data. The State Facilities dataset overlaps several of the critical facilities, as they are state-owned facilities.

Many privately-owned buildings and structures (such as hospitals, power plants, and certain industrial facilities) are critical to societal function, especially during emergencies and disasters. Thus, critical facilities data collection extended to a broader array of critical facilities than would be available by only using state-owned facilities.

5.0 CONSEQUENCE ANALYSIS

The Consequence Analysis (CA) investigates the impact of each identified hazard on various elements of the community and state infrastructure of Georgia. The impact of each hazard is evaluated in terms of disruption of operations, recovery challenges, and overall wellbeing to all Georgia's residents and first responders. The CA supplements the hazard profile by analyzing specific impacts. The most probable hazards would have on the State of Georgia. The CA analyzes the impact on the following:

1. Public
2. Responders
3. Continuity of operations (including delivery of services)
4. Property, facilities, and infrastructure
5. Environment
6. Economic condition of the state
7. Public confidence in governance

The following subsections present a description of each type of hazard Georgia may experience. The information presented in this section has been expanded upon to include human-caused and technological hazards. Facility data has been included in the vulnerability analysis as applicable.

Impacts from extreme weather events have become more frequent during the past half-century, and this trend is projected to continue. For instance, more frequent intense precipitation events may translate into more frequent flash flooding episodes. The National Climate Assessment and Development Committee documented that the average temperature across the United States increased 1.5°F since 1895, with the majority of the increase since 1980. Weather events have and will continue to become more intense and frequent, and will result in health and livelihood related impacts; such as water supply, agriculture, transportation, and energy. The impact of dynamic storm events includes, but is not limited to, more frequent and intense heat waves, increases in ocean and freshwater temperatures, frost-free-days, heavy downpours, floods, sea level rise, droughts, and wildfires.

National Climate Assessment and Development Advisory Committee (NCADAC) May 2014 Climate Assessment Report. http://ncadac.globalchange.gov/

5.1 Severe Weather

5.1.1 Description: Severe Weather events can include thunderstorms, lightning, hail, tornadoes and high winds individually and in combination covering large areas of the state. While most events related to severe weather are limited in terms of their impact, duration, and spatial extent, severe weather remains one of the most common disaster types in the State of Georgia. Below are descriptions of each type of event which make up Severe Weather:

Thunderstorms: Thunderstorms are formed when moist air near the earth's surface is forced upward through some catalyst (convection or frontal system). As the moist air rises, the air condenses to form clouds. Because condensation is a warming process, the cloud continues to expand upward. When the initial updraft is halted by the upper troposphere, both an anvil shape and a downdraft form. This updraft and downdraft forms a "cell." Each thunderstorm cell has the ability to extend several miles across its base and to reach 40,000 feet in altitude. Thunderstorm cells can compound and move abreast to form a squall line of cells, extending farther than any individual cell's potential. Georgia experiences thunderstorms an average of 50 to 80 days per year.

High Winds: Sustained convective winds of 35 knots (40 mph) or greater lasting for one hour or longer, or winds (sustained or gusts) of 50 knots (58 mph) for any duration (or otherwise locally/regionally defined), on a widespread or localized basis.

The NCEI divides wind events into several types including High Wind, Strong Wind, Thunderstorm Wind, Tornado and Tropical Cyclone. For the purpose of this risk assessment, the Wind hazard will include data from High Wind, Strong Wind and Thunderstorm Wind.

Lightning: Lightning occurs when the difference between the positive and negative charges of the upper layers of the cloud and the earth's surface becomes great enough to overcome the resistance of the insulating air. The current flows along the forced conductive path to the surface (in cloud to ground lightning) and reaches up to 100 million volts of electrical potential. In Georgia, lightning strikes peak in July, with June and August experiencing the next highest numbers of strikes.

Hail: Hail is a type of precipitation that forms during the updraft- and downdraft-driven turbulence within the cloud. The hailstones are formed by layers of accumulated ice (with more layers creating larger hailstones) that can range from the size of a pea to the size of a grapefruit. Hailstones span a variety of shapes but usually are spherical.

Tornado: A tornado is a violently rotating column of air in contact with the surface of the ground. Exceptionally large tornadoes may not exhibit the classic "funnel" shape but can appear as a large, turbulent cloud near the ground or a large rain shaft. Most significant tornadoes stem from the right, rear quadrant of large thunderstorm systems where the circulation develops between 15,000 and 30,000 feet.

5.1.2 Previous Major Occurrences: In Georgia, an average of 442 severe weather events per year occurred from 1960 to 2012. These events in total have caused 990 injuries, 168 fatalities, and more than $1.2 billion in damages. In total, 1,438 tornado

events occurred between 1952 and 2012 in Georgia, This equates to a historic average of approximately 24 events per year. These events have caused a total of 2,940 injuries, 153 fatalities, and more than $1.7 billion in damages. Georgia averaged approximately 811,240 clouds to ground lightning flashes per year.

5.1.3 Impact on Public: Severe Weather covers a wide section of natural disasters and has one of the most consequential effects on the state's citizens. Below are descriptions of the impacts that make up Severe Weather and descriptions of their impact on the public.

Thunderstorms: Thunderstorms cause an extensive amount of damage having high winds, rain, hail, flooding, and excessive lightning. They can cause heavy damage, destruction, and injury to the public. Thunderstorms can cause destruction of property, power failures, flooding, and even injury or death. Additionally, thunderstorms present some risk to those who are exposed to the elements during such events.

High Winds: High winds can damage private and public property, such as vehicles, food sources, trees, and powerlines, as well as cause bodily injury from flying debris. Power outages can lead to disruption of employment, businesses, commerce, communication, and food resources. High winds may also cause buildings and structures to collapse, which may cause injury or death.

Lightning: According to the Vaisala U.S. National Lightning Detection Network, from 1997 to 2011 Georgia averaged approximately 811,240 clouds to ground lightning flashes per year. While lightning frequently occurs, only 18 lightning deaths were reported in 2002–2011, although this is the fifth highest total in the United States.

Hail: Hail storms mostly endanger crops but have been known to damage automobiles, aircraft, and structures. Hail stones can vary in diameter, and in Georgia hail of up to 2.75 inches has been recorded. Individuals caught in a hail storm could suffer injury or death depending on the size of the hail

Tornado: Destructive because of strong winds and windborne debris, tornadoes can topple buildings, roll mobile homes, uproot vegetation, and launch objects hundreds of yards. The biggest threats to people caused by tornadoes results from flying debris and from being tossed about in the wind, which may cause injury or death.

5.1.4 Impacts to Public Health: Severe Weather covers a wide section of natural disasters and has one of the most consequential effects on the state and its population. Below are descriptions of the impacts of these individual events and their impact on public health:

Thunderstorms: Potential health concerns include damage to homes, fire caused by lightning, and a number of fatalities. There can also be localized flooding and the need for swift water rescues. Significant portions of the population may be displaced by the destruction and those individuals may not have access to personal documents or medical records. Shelter and basic necessities will be of major concern to the public and their health.

High Winds: The damage of high winds may cause chemical and hazardous materials to spread to sources of food, water, and areas utilized by the public as well as animals.

Lightning: Potential public health concerns include lightning fatalities and long-term physical and mental effects for survivors. Homes and buildings can be set ablaze causing significant property damage.

Hail: Hail storms mostly endanger crops but have been known to damage automobiles, aircraft, and structures.

Tornado: Tornadoes can have a significant impact on homes, businesses, and agricultural products. Losses may impact food stability in the state or region. There will also be an increased demand for medical treatment for traumatic injuries. Significant portions of the population may be displaced by the destruction.

5.1.5 Impact on Responders: Severe Weather covers a wide section of natural disasters and has one of the most consequential effects on the state and its citizens. Below are descriptions of the impacts of these individual events and their impact on responders:

Thunderstorms: Exposure to lightning, flooding, and high winds may cause injuries to first responders. Vehicles and resources may be damaged, leading to impaired response activities. First responders may be unable to access roadways due to flooding, trees down, or debris. Extreme caution may need to be exercised if thunderstorms produce major rains or hail. Visibility may also decrease significantly, greatly impacting transport activities.

High Winds: High winds may also destroy property and resources of first responders. High winds may create power outages that can hinder critical communications, access, or usability of resources. Injuries to first responders and equipment may be caused by flying debris, further challenging response operations. The ability of first responders to conduct their duties may be hindered by high winds, especially if trees, powerlines, and/or debris have impacted roadways and transit.

Lightning: Lightning can cause power outages and damage communication equipment. It may also damage response vehicles or buildings. Lightning may start fires on buildings and homes which will require actions by all types of response teams.

Hail: Hail can cause damage to buildings and vehicles. Large hail can injure and possibly kill responders.

Tornado: First responders can be injured resulting in employee absenteeism that impacts the overall capacity to respond to an event. In addition, the deposit of debris on major roadways, the location of the event, damage to equipment or facilities may increase the amount of time required for first responders to complete rescue operations. Exposed wires or hazardous materials may cause injury to first responders in the process of conducting search and rescue operations.

5.1.6 Continuity of Operations: GEMA/HS maintains a Continuity of Operations Plan (COOP). In the event of Severe Weather that affects the state's operations, the Agency will enact the COOP appropriately to the situation. To date, there have been few or no major incidents that have shut down state, county, or municipal governmental operations. While expectation is minimal, this threat may impact GEMA/HS ability to implement their COOP based on the hazard's potential to cause power outages and transportation difficulties. If activation of alternate facilities was is, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.

5.1.7 Delivery of Services: Severe Weather covers a wide section of natural disasters and has one of the most consequential effects on the state and its citizens. Below are descriptions of the impacts of these individual events and their impact on the delivery of services:

Thunderstorms: Delivery of services may be impaired by flooding, downed power lines, and destruction of roadways and resources. The ability to deliver goods and services can be impacted locally, regionally, or statewide depending on the magnitude of the event.

High Winds: Any items in the path of high winds such as cars, trucks, planes, crops, and light buildings such as mobile homes may be destroyed or permanently damaged. The delivery of goods and services can be severely impacted if debris falls into roadways obstructing passage and access.

Lightning: In Georgia, lightning strikes peak in July, with June and August experiencing the next highest number of strikes. The area around Metro Atlanta experienced the most identified lightning strikes, perhaps because urban areas strikes arew more widely reported.

Hail: Hail can knock down trees and power lines which can block roadways and hinder response vehicles.

Tornado: Buildings and homes may be damaged by tornadic winds which can cause injuries and casualties. Roads may become blocked slowing response vehicles and the delivery of services may be impacted by dangerous conditions or lack of adequate access to transportation options, causing food, water, and resource systems to be delayed or halted, as well as personal transportation by the public.

5.1.8 Property, Facilities, and Infrastructure: Severe Weather covers a wide section of natural disasters and has one of the most consequential effects on the state and its citizens. Below are descriptions of the impacts of these individual events and their impact on property, facilities, and infrastructure:

Thunderstorms: Public utility equipment such as power lines and transformers are most at risk from thunderstorms and their by-products. If power lines are downed it can create a cascading effect for isolated power outages or full-scale blackouts depending on the severity of the weather. Properties and critical facilities also may face foundational and physical damage due to flooding, lightning strikes, or excessive winds, delaying response and recovery operations. Power outages and physical

damage to structures may cause energy supply and water supply systems to be disrupted or fail. Sewage systems may be compromised and taken off grid.

High Winds: High winds can cause minor to extreme damage to property. Excessive winds can uproot and topple trees, lift cars, break windows, and knock out powerlines, leading to power outages to critical facilities. Transportation pathways may become obstructed by hazardous and nonhazardous debris, slowing down response and recovery activities.

Lightning: Lightning can damage buildings and cause fires. Damage to buildings can have severe effects on the infrastructure of communities. Also, many types of buildings such as hospitals, fire and rescue buildings, and other government facilities can be damaged.

Hail: Large Hail can cause significant roof and building damage and vehicles can be damaged and windows broken.

Tornado: Damages from lower intensity tornadoes (EF-0) can range from chimney damage to uprooted shallow trees. A significant tornado (EF-2) would cause damage to roofs on frame houses, complete destruction of mobile homes and large trees and utility lines snapping. A devastating tornado (EF-4) would result in well-constructed houses being leveled, weak foundations blown away for some distance, and cars thrown. Mobile homes within the state are especially vulnerable. Communications or power infrastructure may be damaged or destroyed, resulting in service disruptions. Tornadoes may also disrupt transportation services.

5.1.9 Impact on Environment: Severe Weather covers a wide section of natural disasters and has one of the most consequential effects on the state and its population. Below are descriptions of the impacts of these individual types and their impact on the environment:

Thunderstorms: Waste and debris from damaged structures can contaminate sources of water, food, and safety. In addition, debris and by-products of thunderstorms can impact the environment by: possibly spreading pollution; damaging sewer and wastewater treatment plants; and disturbing the wildlife and natural areas.

High Winds: High winds on the environment affects foliage, trees, animals, cars, and structures, leading to the chance of hazardous and dangerous chemicals and materials being introduced into local waterways, agriculture, public and private spaces, and can affect fragile ecosystems.

Lightning: Lightning strikes may ignite wooded areas or fields, leading to destruction of agricultural crops, critical ecosystems, and natural habitats.

Hail: Hail storms mostly endanger crops but have been known to damage automobiles, aircraft, and structures.

Tornado: Tornadoes may cause significant damage to the environment by exposing hazardous materials, causing contamination of water or food sources, or uprooting

vegetation. Animals may be injured by flying debris or being lifted by the tornado. Agricultural crops may be lost due to contamination or being uprooted.

5.1.10 Impact on State Economy: Severe Weather covers a wide section of natural disasters and has one of the most consequential effects on the state and its citizens. Below are descriptions of the impacts of these individual events and their impact on the state's economy:

Thunderstorms: Resources from all levels of the state will be utilized. Local and state governments will face adverse fiscal consequences. State employees and government agencies may not be able to go to work reducing the ability to respond quickly.

High Winds: State and local resources may be costly for recovery from high wind damage. While federal grant reimbursements help cover the costs of damage, there is still an adverse fiscal impact on local governments.

Lightning: Large events can place a heavy burden on the state's economy and budget. Federal resources may need to be sought. Homes and buildings can be set ablaze causing significant property damage.

Hail: Hail storms mostly endanger crops but have been known to damage automobiles, aircraft, and structures. This can have a very large impact on car dealerships, and individual cars and trucks. Many of these vehicles will have to be repaired or replaced. Damage to crops will be one of the largest losses to the state.

Tornado: Tornadoes pose a fiscal impact on the local and state governments, even if some of those costs can be recouped through federal grant reimbursements. Local, county, and state resources may be drained by the response to a tornado.

5.1.11 Public Confidence in the State's Governance: Immediate, effective, and direct actions are necessary to build and foster public confidence in state governance. Efficiency in response and recovery operations is critical in keeping public confidence high. Ineffective response can decrease the public's confidence in the state's ability to respond and govern.

5.2 Inland Flooding

5.2.1 Hazard Description: Inland Flooding events can include river flooding, flash flooding and urban flooding, individually and in combination, covering large areas of the state. While most events related to inland flooding are limited in terms of their impact, duration, and spatial extent, inland flooding remains one of the more common hazards in the State of Georgia. Below are descriptions of each type of event:

River Flooding: Flooding is a temporary overflow of water on normally dry lands adjacent to the source of water (river, stream, or lake). The causes of flooding include mass sources of precipitation such as tropical cyclonic systems, frontal systems, and thunderstorms combined with other environmental variables such as changes to the physical environment, topography, ground saturation, soil types, basin size, drainage patterns, and vegetative cover. Adverse impacts can include structural damage,

temporary backwater effects in sewers and drainage systems, death of livestock, agricultural crop loss, loss of egress and access to critical facilities due to roads being washed-out or overtopped, and unsanitary conditions resulting from materials being deposited during recession.

Flash Flooding: Flash flooding rapidly peaks and recedes giving insufficient time for evacuations. The more dangerous flash floods are common to the mountainous, impermeable surfaces of northern Georgia.

Urban Flooding: Urban flash flooding can present dangerous conditions, especially with roads that are washing out or overtopped. Also, debris can clog rivers and creeks, causing flooding in areas that typically don't have flooding. Insufficient or damaged culverts can become clogged and create areas of flooding locally.

5.2.2 Previous Major Occurrences: In total, 1,601 inland flooding events occurred between 1960 and 2012 in Georgia. This equates to a historic average of approximately 26 events per year. These storms in total have caused 51 injuries, 69 fatalities, and more than $854 million in damages.

The worst flooding event in Georgia since recordkeeping began stemmed from a decaying tropical system, previously known as Tropical Storm Alberto. The system produced torrential rainfall and resulted in some of the worst flooding ever observed across portions of Georgia, Alabama, and Florida during July 1994. By far, the worst flooding occurred along Georgia's Flint and Ocmulgee Rivers and their tributaries. Across the entire three-state area affected by the flooding, 17 NWS river forecast locations set new record flood stages, some breaking the old record by 5–7 feet. The flooding from Tropical Storm Alberto took a significant toll on human life, killing 33 people. Of that total, 31 deaths occurred in Georgia and the other two in Alabama. In addition, approximately 50,000 people were forced from their homes by the flooding. More than 18,000 dwellings were damaged or destroyed, and nearly 12,000 people applied for emergency housing.

Flooding occurred in 2009 in northwest Georgia and the Atlanta area. This storm was considered an "Epic" storm that typically only has a 1 in 500 chance of occurring each year. The Atlanta area received 9 to 12 inches of rain during this event and there was approximately $225 million in damages.

5.2.3 Impact on Public: Depending upon the location of rainfall, inland flooding can occur in all areas of the state. Rural areas typically suffer crop damage or damage to roads. Many of the fatalities, as is typical with flooding events, occur as a result of flash flooding, and most occur in vehicles.

5.2.4 Impacts to Public Health: Inland flooding can have a significant effect on communities, especially those near larger rivers or creeks. Flood waters become filled with all types of toxic waste if it remains for a long period of time. Citizens are in grave danger during flash flooding events. Many become trapped in their homes and cars.

5.2.5 Impact on Responders: Fire, police, and emergency responders are often called on to evacuate people from a flood area if flooding is imminent. First

responders may face challenges with transportation and access to a location due to flooded or obstructed roadways. Flash floods and mudslides due to heavy rainfall can also injure first responders, as well as delay response operations. Coordinating response to flooding events can be a significant effort by first responders especially in the event of flash floods.

5.2.6 Continuity of Operations: GEMA/HS maintains a Continuity of Operations Plan (COOP). In the event of Inland Flooding that affects the state's operations, the Agency will enact the COOP appropriately to the situation. To date, there have been few or no major incidents that have shut down state, county, or municipal governmental operations. While expectation is minimal, this threat may impact GEMA/HS ability to implement their COOP based on the hazard's potential to cause power outages and transportation difficulties. If activation of alternate facilities was is, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.

5.2.7 Delivery of Services: Inland Flooding can cause road and bridge closures, as well as disrupt transit service. If any of these shutdowns occur, the ability to deliver goods and services efficiently will be impacted. Exposure to water may also damage or destroy physical goods such as food, clothing, and hygiene products.

5.2.8 Property, Facilities, and Infrastructure: Inland Flooding can cause significant property damage to homes and businesses. This in turn impacts the market value of flooded property. In addition, floods can impact schools, hospitals, and other municipal infrastructure which impacts the public's ability to use these services. Water sources can become contaminated with toxic and dangerous chemicals, or fecal matter. Because water and sewer systems may be disrupted, solid-waste collection and disposal may also be impacted, causing dangerous public health risks.

5.2.9 Impact on Environment: Inland Flooding can impact the environment by spreading pollution, damaging water and wastewater treatment plants, and creating debris. In addition, the standing water following a flooding event can cause the spread of mosquitoes, disease, and other pollutants.

5.2.10 Impact on State Economy: Repeated inland flooding can have a devastating effect on property value which can have a detrimental effect on local tax bases. Inland flooding also places a significant drain on response resources, which can become costly during a large flooding event.

5.2.11 Public Confidence in the State's Governance: Ineffective flooding response can decrease the public's confidence in the state's ability to respond and govern. Multi-level government response requires direct actions that must be immediate and effective to maintain public confidence. Efficiency in response and recovery operations is critical in keeping public confidence high.

5.3 Tropical Cyclone

5.3.1 Hazard Description: An intense tropical weather system with a well-defined circulation, producing maximum sustained winds of 74 mph or greater. Hurricane

intensity is classified into five categories using the Saffir-Simpson Hurricane Scale. Winds in a hurricane range from 74 to 95 mph for a Category 1 hurricane to greater than 156 mph for a Category 5 hurricane. Hurricanes can cause catastrophic damage to coastlines and areas several hundred miles inland. Hurricanes can produce winds exceeding 155 miles per hour as well as tornadoes and microbursts. Additionally, hurricanes can create storm surges along the coast and cause extensive damage from heavy rainfall. Floods and flying debris from the excessive winds are often the deadly and destructive results of these weather events. Tropical Cyclone events can include storm surge, high winds, heavy rainfall and tornados individually and in combination covering large areas of the state. Below are descriptions of each of these type of events:

Storm Surge: An abnormal rise in sea level accompanying a hurricane or other intense storm, and whose height is the difference between the observed sea surface and the level that would have occurred in the absence of the cyclone. Storm surge that is produced by a tropical cyclone is a function of both geography and the cyclone's characteristics. Tropical cyclone characteristics affecting storm surge values include the intensity of the hurricane, angle of approach, and forward speed.

High Winds: Extremely dangerous winds will cause extensive damage: Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.

Heavy Rainfall: Heavy rainfall can be described as a large amount of rain in one area for an extended amount of time which can cause significant flooding, contributing to flash floods, mudflows, or overtopping levees and dams.

Tornado: A tornado is a violently rotating column of air (seen only when containing condensation, dust, or debris) in contact with the surface of the ground. Exceptionally large tornadoes may not exhibit the classic "funnel" shape but can appear as a large, turbulent cloud near the ground or a large rain shaft. Destructive because of strong winds and windborne debris, tornadoes can topple buildings, roll mobile homes, uproot vegetation, and launch objects hundreds of yards. Most significant tornadoes (excluding some weak tornadoes and coastal waterspouts) stem from the right, rear quadrant of large thunderstorm systems where the circulation develops between 15,000 and 30,000 feet.

5.3.2 Previous Major Occurrences: Between 1800 and 1850, three major hurricanes made landfall on the Georgia Coast in 1804, 1813, and 1824 causing a combined total of more than 600 fatalities.

Between 1851 and 1899, 17 tropical cyclones, three that became major hurricanes (in 1854, 1893, and 1898), made landfall on the Georgia Coast, with the number of fatalities nearing 2,700. From 1900 to 1949, four tropical cyclones (1911, 1928, 1940, and 1947) made landfall on the Georgia Coast.

5.3.3 Impact on Public: A large portion of Georgia's population is located in the coastal region of the state. During summer months, the population in this area

increases significantly during the tourist season. Damage to homes, businesses, infrastructure, government facilities, and roadways can cause serious disruption to response operations. High winds, flooding and flying debris can have long-term consequences to all affected areas.

5.3.4 Impacts to Public Health: Toxic waste and materials can be introduced into flooding waters, contaminating water supplies as well as standing water. Extreme flooding, storm surge, and high winds may cause death or injury for humans and animals. Toxic flood waters can lead to the spread of disease. Mosquitoes may spread infection to humans and other animals.

5.3.5 Impact on Responders: First responders face many hazards such as flooding, high winds, and storm surge, which may cause personal injury, disease, or death. Coordinating an evacuation in advance of a significant hurricane or tropical storm event requires enhanced response coordination and causes a substantial strain on resources. Critical facilities and roadways may flood, lose power, or become damaged or destroyed. Emergency vehicles may become inoperable or inaccessible, reducing response and recovery operations.

5.3.6 Continuity of Operations: GEMA/HS maintains a Continuity of Operations Plan (COOP). In the event of Tropical Cyclone that affects the state's operations, the Agency will enact the COOP appropriately to the situation. To date, there have been few or no major incidents that have shut down state, county, or municipal governmental operations. While expectation is minimal, this threat may impact GEMA/HS ability to implement their COOP based on the hazard's potential to cause power outages and transportation difficulties. If activation of alternate facilities was is, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.

5.3.7 Delivery of Services: The ability to deliver goods and services efficiently will be impacted depending on the magnitude of the storm. Flooding and high winds cause damage to roadways and bridges, disrupting the availability of response units. Many businesses in the hurricane evacuation zone will have to shut down, causing loss of business and causing financial hardships. First response vehicles may become damaged, destroyed, or inoperable under extreme conditions.

5.3.8 Property, Facilities, and Infrastructure: Depending upon the magnitude and impact of the storm, widespread destruction to property, facilities, and infrastructure may occur. Public and private structures that are damaged may face significant recovery efforts and costs. Hurricanes and tropical storms can impact roads, bridges, schools, and healthcare facilities by water damage from storm surge. Communication systems such as TV and radio towers and internet systems can be damaged or destroyed. Power outages and the disruption of transportation can delay emergency response teams.

5.3.9 Impact on Environment: Hurricanes and tropical storms can cause significant devastation to coastal communities. Beach erosion and stream blockage can negatively impact the environment near the coast. Strong winds and flooding can cause damage to animals and crops.

5.3.10 Impact on State Economy: Georgia has a significant tourist industry and a major hurricane or tropical storm could cause damage to beaches, historical sites, and other areas that tourists frequent. The costs of response and recovery efforts are significant and can have cascading impacts on the state economy at large.

5.3.11 Public Confidence in the State's Governance: Ineffective response both before and after a hurricane or tropical storm can decrease the public's confidence in the state's ability to respond and govern. Governmental response across local, state, regional, and federal levels requires direct actions that must be immediate and effective to maintain public confidence.

5.4 Winter Weather

5.4.1 Hazard Description: Winter Weather events can include extreme cold, blizzards, snow, ice, freezing rain and sleet individually and in combination covering large areas of the state. While most events related to Winter Weather are limited in terms of their impact, duration, and spatial extent, Winter Weather typically affects the northern part of the state annually. Below are descriptions of each type of event:

Snow: Precipitation in the form of ice crystals, mainly of intricately branched, hexagonal form and often agglomerated into snowflakes, formed directly from the freezing of the water vapor in the air

Ice: Frozen water, the solid state of water

Freezing Rain: Rain that falls as a liquid but freezes into glaze upon contact with the ground

Sleet: Pellets of ice composed of frozen or mostly frozen raindrops or refrozen partially melted snowflakes

Blizzard: A blizzard means the following conditions are expected to prevail for a period of 3 hours or longer: 1) Sustained wind or frequent gusts to 35 miles an hour or greater; and 2) Considerable falling and/or blowing snow

Extreme Cold: Below normal weather temperatures that may lead to serious health problems.

5.4.2 Previous Major Occurrences: In total, 3,958 winter weather events occurred from 1960 to 2012 in Georgia. This equates to a historic average of approximately 65 events per year. These storms in total have caused 415 injuries, 40 fatalities, and more than $413 million in damages.

5.4.3 Impact on Public: Freezing temperatures and heavy snow accumulation may cause dangerous travel conditions leading to collisions and injury on roadways, individuals not being able to go to work, or accessing critical community facilities. Powerlines can become overloaded with heavy snow which can break and lead to a loss of electricity and heat in homes and businesses. Children and the elderly are especially susceptible to severe cold in their homes with loss of heat. This can cause a dangerous situation for pets that remain outdoors.

5.4.4 Impacts to Public Health: Extremely cold weather with low temperatures can lead to hypothermia, frost bite and could possibly lead to death. Individuals without shelter or a heating system are susceptible to these conditions.

5.4.5 Impact on Responders: First responders must protect themselves from exposure to freezing conditions for prolonged periods of time. Deteriorating road conditions create a delivery of service challenge. First responders' duties will include managing evacuation of people from snow impacted areas, directing traffic, closing down roads, operating shelters, and taking care of the injured and sick. Equipment may also be damaged or destroyed due to cold temperatures, heavy wind, ice, and heavy snowfall, which may lead to a decrease in response capabilities.

5.4.6 Continuity of Operations: GEMA/HS maintains a Continuity of Operations Plan (COOP). In the event of Winter Weather that affects the state's operations, the Agency will enact the COOP appropriately to the situation. To date, there have been few or no major incidents that have shut down state, county, or municipal governmental operations. While expectation is minimal, this threat may impact GEMA/HS ability to implement their COOP based on the hazard's potential to cause power outages and transportation difficulties. If activation of alternate facilities was is, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.

5.4.7 Delivery of Services: Emergency response by first responders is compromised depending on the severity of the winter weather event. Deteriorating road conditions may lead to roadway and bridge closures, as well as transit service disruptions. Slick roads and icy conditions lead to increased vehicle accidents. Businesses may have to shut down, which leads to the disruption of goods and services.

5.4.8 Property, Facilities, and Infrastructure: Snow and ice can impact access to homes and critical facilities such as hospitals, schools, and supermarkets. Power loss can lead to disruption of critical infrastructure and technology. State and local transportation systems, government services, and communications may be disrupted during winter weather conditions. Roads and bridges may be heavily impacted by winter weather which can cause detours and delays. Roads and bridges can be completely obstructed by downed trees, powerlines, and snow accumulation.

5.4.9 Impact on Environment: Vegetation and trees can be damaged with heavy snow and ice accumulation. Flooding may occur after the rapid melting of snow. Animals are susceptible to exposure to extreme cold, which may lead to illness or death. Flooding can lead to the release of foreign materials and dangerous chemicals which may leak into natural environments and water reservoirs, thus causing further damage.

5.4.10 Impact on State Economy: Winter Weather costs local and state governments a great deal of money and assets, possibly requiring assistance from the federal government. The removal of excess snow and debris is expensive to remove. Businesses may not be able to open, thus causing a loss in revenue.

5.4.11 Public Confidence in the State's Governance: The public's confidence in the states government is affected by immediate local and state response through direct and effective actions. Efficiency in response and recovery operations is critical in keeping public confidence high.

5.5 Drought/Wildfire

5.5.1 Hazard Description: Drought is a normal, recurrent feature of climate consisting of a deficiency of precipitation over an extended period of time (usually a season or more). This deficiency results in a water shortage for some social or environmental sector. Drought should be judged relative to some long-term average condition of balance between precipitation and evapotranspiration in a particular area that is considered "normal." Because the impacts of drought conditions are largely dependent on the human activity in the area, the spatial extent of droughts can span a few counties to the entire state. Temporal characteristics of droughts are drastically different from other hazards due to the possibility of extremely lengthy durations as well as a sluggish rate of onset.

Extreme Heat: Extreme heat can cause significant damage to the local environment by dehydrating vegetation and wildlife, which would create a cascading effect to the surrounding environment. Extreme temperatures may severely decrease the yield of Georgia's cash crops. Extreme heat can be associated with drought and prolonged heat waves. Livestock are adversely affected by extreme heat and may suffer medical problems or death.

Wildfires: A wildfire is an uncontained fire that spreads through the environment. Wildfires have the ability to consume large areas, including infrastructure, property, and resources. Not only do the flames harm the environment, but the massive volumes of smoke spread by certain atmospheric conditions also affect the health of nearby populations. Wildfires result from the interaction of three crucial elements: fuel, ignition (heat), and oxygen. Natural and manmade forces cause the three crucial elements to coincide in a manner that produces wildfire events.

Smoke: Smoke is suspended carbon particles in air resulting from the combustion of wood, peat, coal or other organic matter. Smoke can cause health issues for people, even far away from fires.

Water Shortage: The loss of water due to evaporation, drought and over use by local populations is of major concern to local communities that rely on this water for survival.

5.5.2 Previous Major Occurrences: Because droughts are "creeping" disasters, only large-scale events are considered notable. One of the most severe drought events in Georgia occurred in 1977 and resulted in a federal disaster declaration. The drought spanned most of the Midwestern and Southeastern United States and doomed many harvests of hay, corn, soybean, cotton, and peanut. The declaration included 130 of Georgia's 159 counties, with costs to farmers topping $300 million (figure not inflation-adjusted).

On April 16, 2007, a downed power line ignited drought-parched forest floors in southern Georgia, which led to the largest and most devastating wildfires in state history. Nearly 564,000 acres were consumed in Georgia and Florida, and 18 homes were destroyed. More than 3,300 firefighters from 44 states, Canada and Puerto Rico came in to battle the blazes.

In 2017 wildfires engulfed 19,411 acres across North Georgia and the West Mims Fire near the Georgia/Florida border burned an estimated 130,942 acres.

5.5.3 Impact on Public: Extreme heat can have large impacts on the wellbeing of those more vulnerable to severe conditions, such as the elderly and young children. Loss of electricity may impact air conditioning and cooling mechanisms in homes, leading to increased indoor temperatures. In the case of wildfires, not only do the flames harm the environment, but the massive volumes of smoke spread by certain atmospheric conditions also affect the health of nearby populations.

5.5.4 Impacts to Public Health: Physical effects of heat can cause major health problems, dehydration, and may lead to death. People begin to suffer heat-related illness when their bodies are unable to compensate and properly cool. Heat stroke may increase the body temperature to 106 degrees Fahrenheit or higher. Very high body temperatures may damage the brain or other vital organs.

5.5.5 Impact on Responders: First responders need to take necessary measures to avoid the effects of extreme heat and wildfire suppression such as drinking plenty of water and getting proper rest. Emergency responders are susceptible to heat stroke and severe dehydration as a result of fire or extreme heat. There is also the possibility of extreme heat damaging instruments or equipment necessary for response activities.

5.5.6 Continuity of Operations: GEMA/HS maintains a Continuity of Operations Plan (COOP). In the event of Drought/Wildfire that affects the state's operations, the Agency will enact the COOP appropriately to the situation. To date, there have been few or no major incidents that have shut down state, county, or municipal governmental operations. While expectation is minimal, this threat may impact GEMA/HS ability to implement their COOP based on the hazard's potential to cause power outages and transportation difficulties. If activation of alternate facilities was is, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.

5.5.7 Delivery of Services: Wildfires can cause death or injury to people and animals, damage or destroy structures, and disrupt community services including transportation, gas, power, communications, and other services.

5.5.8 Property, Facilities, and Infrastructure: Drought has a significant effect on the water supply which is a major component to the infrastructure of communities. Wildfire can affect property of the state and its citizens. Droughts have severely affected municipal and industrial water supplies, stream-water quality, recreation, hydro power generation, navigation, and agricultural production.

The wildfires that cause the greatest loss of life and property are those located in the Wildland-Urban Interface. Wildland-Urban Interface has been defined in many ways, but from a fire management perspective, it is commonly considered an area where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

5.5.9 Impact on Environment: Storage projects are often used to mitigate drought and improve ecosystem services. These projects involve diverting floodwaters from a stream, river, or other body of water into a conduit such as a canal, pipe, or wetland and storing them in an above-ground storage facility. Water is then slowly released, reducing flood risk as well as facilitating groundwater recharge/seepage.

5.5.10 Impact on State Economy: Drought has had major effects on the state's economy over many years. Reduction in crop and grass production affects our food supply as well as the food supply for farm animals. Fighting and putting down wildfires cost the State a good deal of funds each year. Proximity to wooded areas, exposes many of the state's facilities to wildfire and the cost to replace them.

5.5.11 Public Confidence in the State's Governance: Effective and timely actions by the state and local communities will bolster the public's confidence in the state's governance.

5.6 Geologic Hazards

5.6.1 Hazard Description: Earthquakes are defined as the sudden motion or trembling of the Earth's surface caused by an abrupt release of slowly accumulated strain. This release typically manifests on the surface as ground shaking, surface faulting, tectonic uplifting and subsidence, or ground failures, and tsunamis.

Sinkholes are generally defined as a natural depression or hole in the surface topography formed by mechanisms such as the gradual removal of soluble bedrock by percolating water, the collapse of cave roofs (due to some seismic activity), or the lowering of the water table. These natural phenomena occur in areas where the subsurface rock consists of evaporates (salt, gypsum, and anhydrite) and carbonates (limestone and dolomite).

Landslides occur when masses of rock, earth or debris move down a slope. Debris and mud flows are rivers of rock, earth, and other debris saturated with water. They develop when water rapidly accumulates in the ground, during heavy rainfall or rapid snowmelt, changing the earth into a flowing river of mud or "slurry." They can flow rapidly, striking with little or no warning at avalanche speeds. They also can travel several miles from their source, growing in size as they pick up trees, boulders, cars and other materials.

5.6.2 Previous Major Occurrences:

Table 16 Earthquakes

Year	Magnitude	Area Affected	Remarks
1811-1812	7.3-7.8	New Madrid	Rerouted MS River; Damage in Richmond; Felt in Boston
1886	6.9	Charleston, SC	V-VIII intensity
1914	5.0	North Georgia	Caused little damage
1964	4.5	Lake Sinclair	Tremors every 2-3 years
1972	4.5	Clarks Hill Reservoir	Quakes felt every 20 seconds
1976		Toombs County	V intensity
1985	3.0-3.5	Columbus	
1996	2.4	DeKalb County	Norris Lake area
2003	4.9	North Georgia/ Alabama border	Some power outages; Felled trees; Minor household damage
2010	2.8	Northwestern Georgia	Dalton area
2013	2.5-2.8	Georgia / South Carolina border	Thurmond Lake area
2015	2.6	Eatonton	Lake Oconee area
2017	2.7	Sparta, Georgia	Intensity IV; Minor household damage
2018	2.7	Northwestern Georgia	Intensity III; reported by over 100 people

Sinkholes: There have been no significant losses from sinkholes in the State of Georgia since at least 1960. However, one notable sinkhole event exists in recent history. During the 1994 flooding of Albany, Georgia from Tropical Storm Alberto, numerous sinkholes formed under the floodwaters. Notable sinkholes occurred in Riverside and Oakview Cemeteries in downtown Albany, where a combination of flood waters and subsiding terrain released disturbed gravesites.

Landslides: An exact historical record is difficult to determine as many landslide and debris flow events are minor, do not cause significant damage or go unreported. Spatial Hazard Events and Losses Database for the United States (SHELDUS) data from 1952 to 2012 list one event occurring in Rabun County in 2004. Property losses from this event were estimated at $100,000. This event was triggered by excessive rainfalls from Hurricane Ivan as it passed through the State. In August 2013, heavy rains created a mudslide in Sandy Springs, GA that closed a local road. The road was closed for one year while a retaining wall was constructed at a cost of approximately $1 million. Residents reported eight other mudslides in the area.

5.6.3 Impact on Public: Geologic hazards may cause injury or death to the public by causing vehicle accidents, falling/flowing debris, or structure failure.

5.6.4 Impacts to Public Health: After a geologic hazard event, people may be seeking medical treatment for injuries or services that are interrupted from the event such as water, wastewater, or power. Fires or hazardous material releases could also be a result of a geologic hazard event.

5.6.5 Impact on Responders: The extent of the damage caused by a geologic hazard event could impact the responders' ability to access the damaged area and to transport people and resources to and from the area. Equipment, facilities, or other resources may be damaged from the event which could affect the responders' ability to respond by limiting speed and efficiency.

5.6.6 Continuity of Operations: GEMA/HS maintains a Continuity of Operations Plan (COOP). In the event of geologic hazard that affects the state's operations, the Agency will enact the COOP appropriately to the situation. To date, there have been few or no major incidents that have shut down state, county, or municipal governmental operations. While expectation is minimal, this threat may impact GEMA/HS ability to implement their COOP based on the hazard's potential to cause power outages and transportation difficulties. If activation of alternate facilities was is, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.

5.6.7 Delivery of Services: Delivery of services may be affected by dangerous transportation conditions, including waterways, causing resources to be delayed or halted in their delivery to the public. Ground shaking or land subsidence could damage or destroy the goods or services that need to be delivered.

5.6.8 Property, Facilities, and Infrastructure: All critical facilities in the planning area are exposed to an earthquake hazard. All critical facilities in northwest Georgia and the coastal plain region are susceptible to sinkholes. All critical facilities in northeast Georgia may be affected by landslides. Transportation routes (roads, bridges, and waterways), pipelines, and buildings can collapse or be disrupted during a geologic hazard event.

5.6.9 Impact on Environment: Geologic hazard events have the potential to trigger secondary hazards such as fire, flash flooding, hazardous materials release, and dam failures. Toxins released during these events can have a detrimental effect on the environment by impacting bodies of water, groundwater, animals, livestock, and crops.

5.6.10 Impact on State Economy: Local, county, and state resources may be exhausted during the initial response. Reimbursement from the federal government should be possible if the local, county, or state government is overwhelmed but this will take time to process. If the event is severe, it may disrupt the private sector's ability to operate therefore impacting the overall State economy.

5.6.11 Public Confidence in the State's Governance: Governmental response must be immediate and effective to maintain public confidence. If the State is disorganized in its response operations or takes too long to begin recovery operations, the public may lose confidence in the government's ability to manage the event.

5.7 Infectious Diseases

5.7.1 Hazard Description: Georgia has a list of diseases that are required by law to be reported to the Department of Public Health thus enabling public health follow-up for patients and to identify outbreaks. All Georgia physicians, laboratories, and other health care providers are required by law (O.C.G.A. 31-12-2) to report patients with the conditions listed under Notifiable Disease Reporting Requirements. Both laboratory confirmed and clinical diagnoses are reportable within the specified time interval. This is particularly important to do in a timely way for any disease or condition that may require immediate public health intervention. Disease reporting also provides a better understanding of disease trends and patterns in Georgia to support program and policy decision-making and resource allocation.

5.7.2 Previous Major Occurrences: Every year the Georgia Department of Public Health investigates hundreds of notifiable disease cases and outbreaks. Some examples of larger occurrences from 2017 include Zika, Legionella, and Mumps.

5.7.3 Impact on Public: Depending on the scale of outbreak and type of disease, residents of the State of Georgia may be at risk of illness or death if they are exposed to the disease. Population density may play a role in the spread of disease.

5.7.4 Impacts to Public Health: An epidemic will have significant impacts on public health. Specific impacts to residents will be dependent upon the type of disease or infection that is spread.

5.7.5 Impact on Responders: Any responder could be affected by the illness which he/she is investigating due to the infectious nature of the pathogen.

5.7.6 Continuity of Operations: GEMA/HS maintains a Continuity of Operations Plan (COOP). In the event of Infectious Diseases that affects the state's operations, the Agency will enact the COOP appropriately to the situation. To date, there have been few or no major incidents that have shut down state, county, or municipal governmental operations. While expectation is minimal, this threat may impact GEMA/HS ability to implement their COOP based on the hazard's potential to cause power outages and transportation difficulties. If activation of alternate facilities was is, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.

5.7.7 Delivery of Services: Epidemics may, under extreme circumstances or large outbreaks, cause disruption of services in the event of employee absenteeism.

5.7.8 Property, Facilities, and Infrastructure: It is highly unlikely that an epidemic would have direct effects on critical infrastructure or other facilities or structures. However, under very extreme cases of absenteeism, it is possible that regular maintenance or repairs would not be performed, resulting in disrepair.

5.7.9 Impact on Environment: In some cases, disease outbreak is caused by infections spread from animals to humans. Under these circumstances, infections may be spread as the result of normal care (proximity) to sick animals or consumption of byproducts of infected animals. Infected animals may die as a result

of the disease; timely removal of infected animal carcasses may help to reduce the spread of the disease among animals. It is unlikely that an epidemic would have any additional direct impacts on the environment.

5.7 10 Impact on State Economy: Depending on the scale of outbreak and type of disease, a localized infectious disease outbreak could impact the State of Georgia significantly. In the event residents and workers became infected from an epidemic, employee absenteeism would increase and the length of time necessary to recoup and regain lost time and money could be six months or longer.

5.7.11 Public Confidence in the State's Governance: Governmental response, on all levels – state and local – requires direct actions that must be immediate and effective to maintain public confidence. If government functionality is reduced by absenteeism, the public's confidence in governance may be reduced. The ability of the Department of Public Health to perform critical functions will directly impact the community's perception of government during an epidemic. Maintenance of these operations will be critical to response and recovery operation.

5.8 Cyber Attack on Critical Infrastructure Sectors

5.8.1 Hazard Description: Cyber infrastructure in the United States is becoming more prone to threats and attacks as more businesses and services are becoming automated and leveraging technology through use of the internet to process the exchange of goods and services to constituents.

The cyber ecosystem comprises a variety of diverse participants – private firms, non-profits, governments, individuals, processes, and cyber devices (computers, software, and communications technologies) – that interact for multiple purposes. Today in cyberspace, intelligent adversaries exploit vulnerabilities in firewalls and networks servers and create incidents that propagate at machine speeds to steal identities, resources, and advantage. Ransomware, Malware, and Distributed Denial of Service (DDOS) attacks are three of the primary methods of compromising information technology systems. The rising volume and virulence of these attacks have the potential to degrade our economic capacity and threaten basic services that underpin our modern way of life. Cyber Infrastructure is owned and managed by both the public and private sector, and includes several structures that improve living conditions and commerce, including schools, hospitals, roads, bridges, dams, sewers, and energy systems.

In 2012, in an effort to mitigate risk by lowering the vulnerability of state employees and facilities to cyber-attacks. The State of Georgia created the cybersecurity board and working group housed at the Georgia Technology Authority (GTA).

5.8.2 Cyber Attack Trends: Cybercrime such as identify theft and hacking/breach attempts have risen to an all-time high. Cyber criminals launched the largest DDoS attack in 2016. Most of the attack took place in the United States (70%). Industry trends indicate a decline in Malware attacks yet a rapid increase in Ransomware intrusions. In 2017 alone, an astonishing 638 million Ransomware attacks were documented in the US.

Supervisory Control and Data Acquisition (SCADA) systems are becoming an emerging innovation in City Management and Public Works departments. The SCADA concept was developed as a universal means of remote access to a variety of local control modules, which could be from different manufacturers allowing access through standard automation protocols. In practice, large SCADA systems have grown to become very similar to distributed control systems in function, but using multiple means of interfacing with the plant. They can control large-scale processes that can include multiple sites, and work over large distances. It is one of the most commonly-used types of industrial control systems, however there are concerns about SCADA systems being vulnerable to cyberwarfare/cyberterrorism attacks.

So far, the most common threat to agents have been unintentional threats caused by publicly released worms/viruses, accidents and incidents caused by disgruntled employees, former employees, and others that have worked within the organization. SCADA systems are used in distribution systems such as electrical power grids, water distribution and wastewater collection systems, oil and natural gas pipelines, and railway transportation systems. These control systems, which are often highly interconnected and mutually dependent systems, are critical to the operation of the U.S. critical infrastructures.

There are three broad categories of documented attacks on SCADA systems, other industrial control systems or critical infrastructures.

(1) Intentional targeted attacks such as gaining unauthorized access to computers within the network infrastructure, performing a DDOS attack, or spoofing.
(2) Unintentional consequences or collateral damage from worms, viruses or control system failures
(3) Unintentional consequences caused by internal personnel or mechanisms. This may include the testing of inappropriate software on operational systems or unauthorized system configuration changes.

The first category of attacks, the intentional targeted attacks, have the most potential for damage, however are the least frequently occurring. An intentional targeted attack requires detailed knowledge of the system and supporting infrastructure and are almost always caused by an insider with personal grievances.

5.8.3 Large Scale Cyber Attacks Impacting Georgia

August 2003: CSX Train Signaling System5 and the Sobig Virus. The Sobig computer virus arrived in an e-mail with an attachment that when opened infected the computer and sent itself on to other victims using e-mail addresses from the victim's address book.

Therefore, the virus rapidly spread itself to other machines and made it difficult to trace back to the source. The virus also infected the computer by opening a back door that let a hacker gain access without detection. Spammers used the back door to upload applications that sent spam anonymously. Sobig was blamed for shutting down train signaling systems throughout the east coast of the U.S. The virus infected the computer system at CSX Corp.'s Jacksonville, Florida headquarters, shutting

down signaling, dispatching, and other systems. Trains between Pittsburgh, PA; Florence, SC and Atlanta, GA were halted because of dark signals, and one regional Amtrak train from Richmond, Virginia to Washington and New York was delayed for more than two hours. Long distance trains were also delayed between 4 - 6 hours.

March 2008: Hatch Nuclear Power Plant shutdown. The Hatch Nuclear Power Plant sits on a 2,244-acre site which has two General Electric boiling water reactors with a total capacity of 1,848 megawatts located in Baxley, Georgia. In 2008, it underwent an emergency shutdown because of a software update that was made on the plant's network server. The network was in two-way communication with the plant's SCADA network and the update synchronized information on both systems. Reset after a reboot, the SCADA safety systems detected a lack of data and signaled that the water level in the cooling systems for the nuclear fuel rods had dropped, which caused an automatic shutdown. Engineers were aware of the two-way communication link, but they did not know that the update would synchronize data between the two networks. There was no danger to the public, but the power company lost millions of dollars in revenue and had to incur the substantial expense of getting the plant back. Because of this problem, the engineers chose to sever all physical connections between the SCADA and business networks.

February 2015- Data Breach affects 3.7 million Anthem Blue Cross Blue Shield members in GA. More than 3.7 million members of Blue Cross Blue Shield of Georgia may have had personal information exposed during the data breach of 2015. Anthem said hackers evaded several security layers to reach a database containing information on about 80 million people, including current and former policyholders in Georgia. Compromised information included names, Social Security numbers, and health identification numbers, dates of birth, addresses, telephone numbers, email addresses, employment information and income data

Georgia Department of Agriculture (GADOA) 2016. Ransomware breach demanding funds. Georgia's number one economic resource is agriculture. GADOA is responsible for food safety inspections, Farm (poultry, produce) support, Federal food stamp program (SNAP/TANF), federal WIC program (woman infant and children), and licensing and regulation of businesses with food (restaurants, grocery stores, etc).

September 2017- Equifax Data Breach impacts 145.5 million consumers. Equifax data was breached by hackers which potentially compromised sensitive information for 145.5 million American consumers, including Social Security numbers and driver's license numbers. The attack on the company represents one of the largest risks to personally sensitive information in recent years. Equifax, based in Atlanta, is a particularly tempting target for hackers. If identity thieves wanted to hit one place to grab all the data needed to do the most damage, they would go straight to one of the three major credit reporting agencies.

5.8.4 Impact on Public: Cyber infrastructure failure impacts such as hacking can not only impact government processes, but the private sector and citizens as a whole.

5.8.5 Impacts to Public Health: Data breaches to hospital networks could result in the compromising of Personally Identifiable Information and Patient Care Records. A potential ransomware attack could lead to lack of access to healthcare records preventing medical staff to provide necessary care for patient based on patient's medical history.

5.8.6 Impact on Responders: Cyber security breaches can compromise communications systems (cell phones, networks servers, Wi-Fi, etc.) This failure would impact the responders' ability to communicate their status or communicate through their command systems to needed response actions.

5.8.7 Continuity of Operations: GEMA/HS maintains a Continuity of Operations Plan (COOP). In the event of Cyber Attack on Critical Infrastructure that affects the state's operations, the Agency will enact the COOP appropriately to the situation. To date, there have been few or no major incidents that have shut down state, county, or municipal governmental operations. While expectation is minimal, this threat may impact GEMA/HS ability to implement their COOP based on the hazard's potential to cause power outages and transportation difficulties. If activation of alternate facilities was is, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.

5.8.8 Delivery of Services: Delivery of services will be disrupted due to the disruption of web based services and applications utilized by state agencies and private entities. A breach to GEMA/HS' server for example can greatly impact Webeoc and the SOC operations as a whole during a natural or man -made disaster.

5.8.9 Property, Facilities, and Infrastructure: Industrial Command Systems linked to SCADA networks if compromised can lead to Waste, Water, Nuclear Energy, Traffic control malfunctions throughout local cities and counties in the State.

5.8.10 Impact on Environment: N/A

5.8.11 Impact on State Economy: Georgia was ranked #2 in Fraud (ID Theft, Financial Fraud crimes) in 2014. There were 13,402 reports of identity theft, or 134.1 complaints per 100,000 Georgians, last year. More than half of all identity theft complaints were classified as government documents or benefits fraud, a higher percentage than in any other state except Florida. Aggressive debt collection and predatory lending accounted for many other complaints. Student loan debt in the State is the second highest nationwide, at $32,283 on average as of the beginning of this year.

GA FINTECH (Finance & Technology Industries)

Georgia has evolved to become the epicenter of a growing segment of the FinTech - 70% of U.S. financial transactions passing through Georgia. Georgia Finance & technology companies generate annual revenue of more than $72 billion, placing the state 3rd in the nation, behind only New York and California. Also, Georgia has the 3rd largest sea port in the nation.

Approximately 100 Fin-Tech companies are headquartered or have significant presence in Georgia with six of the ten largest U.S. payment processing firms based in the State of Georgia. These companies and others process over 118 billion transactions per year representing over $2 trillion of purchase volume each year, supporting nearly 4 million merchants. A cyber security attack in either industry would have Statewide, Nationwide and Global consequences.

5.8.12 Public Confidence in the State's Governance: A well-coordinated cyber-attack could impact all 16 sectors of critical infrastructure regulated and administered by Georgia. Direct, immediate, and effective actions must be taken in order to maintain public confidence. Response activities must include all levels of government in collaboration with the private sector.

5.9 Active Shooter

5.9.1 Hazard Description: Active killer or active shooter names the perpetrator of a type of mass murder marked by rapidity, scale, randomness, and often suicide.

The United States Department of Homeland Security defines the active shooter as "an individual actively engaged in killing or attempting to kill people in a confined and populated area; in most cases, active shooters use firearms and there is no pattern or method to their selection of victims." Most incidents occur at locations in which the killers find little impediment in pressing their attack. Locations are generally described as soft targets, that is, they carry limited security measures to protect members of the public. In most instances, shooters commit suicide, are shot by police, or surrender when confrontation with responding law enforcement becomes unavoidable. According to various sources 46 percent of active shooter incidents are ended by the application of force by police or security, 40 percent end in the shooter's suicide, 14 percent of the time the shooter surrenders and, in less than 1 percent of cases, the violence ends with the attacker fleeing.

Georgia has several large venue event centers and hosts SEAR 1 and SEAR 2 events annually. Crowds for events regularly exceed 250,000 people.

5.9.2 Previous Major Occurrences: There have been 75 mass shootings in the United States since Sandy Hook Elementary, where a gunman in 2012 killed 20 first-graders, six faculty members and himself. In those 75 shootings, at least 235 people died, As of December 2017, Georgia led the nation in school shootings, but not all of those involved injuries.

Active shooter incidents in Georgia for 2016:

- Four people injured in Roswell on March 6, 2016 – An early morning argument at a Roswell hookah bar ended with a Gwinnett County man shooting into a car full of people and wounding four.
- Five people injured in northwest Atlanta on March 15, 2016 – Police suspect the five people injured in a shooting near a well-known nightclub in northwest Atlanta were innocent bystanders.

- Six people killed in Columbia County on April 22, 2016 – A 50-year-old man suspected of fatally shooting five people in two separate incidents in Appling was found dead in his home. The cause of death was an apparent gunshot wound.
- Five people killed in Moultrie on May 15, 2016 – Five people found dead in a South Georgia house fire were shot, and the blaze was set intentionally as a cover-up.
- One killed, three injured in Jackson on May 21, 2016.
- Four killed in Henry County on October 27, 2016 – Four people were fatally shot in the head in a McDonough home.

5.9.3 Impact on Public: Active shooters pose a direct threat to people and would cause considerable injury and death. An active shooter attack could kill and injure hundreds, which would overwhelm Level I Trauma Centers and local hospitals. Businesses, schools, and locations near the attack would be disrupted.

5.9.4 Impacts to Public Health: An active shooter attack will have varying effects on the population including injury, death, and significant psychological impacts. These impacts may be immediate or long-term depending on where the active shooter attack occurs.

5.9.5 Impact on Responders: An active shooter attack can create a dangerous environment and significant challenge for first responders. First responders may have to manage the evacuation of people from the area impacted, as well as direct traffic, close down roads, operate shelters, and take care of the injured. First responders may also become the direct target of the active shooter themselves either immediately or as a secondary attack during response activities. Based on the type of attack Personal Protective Equipment may be required to protect the first responder. Equipment may also be damaged or destroyed due to the impact of the attack, which may lead to a decrease in response capabilities.

5.9.6 Continuity of Operations: GEMA/HS maintains a Continuity of Operations Plan (COOP). In the event of active shooter attack that affects the state's operations, the Agency will enact the COOP appropriately to the situation. To date, there have been few or no major incidents that have shut down state, county, or municipal governmental operations. While expectation is minimal, this threat may impact GEMA/HS ability to implement their COOP based on the hazard's potential to cause power outages and transportation difficulties. If activation of alternate facilities was is, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.

5.9.7 Delivery of Services: The ability to deliver services can be impacted locally, regionally, or statewide depending on the characteristics of an active shooter attack. To reduce the public's potential exposure to the effects of an attack, roadway and bridge closures may be required, as well as transit service disruptions. Businesses and places of commerce may completely shut down due to an active shooter attack, which leads to the disruption of goods and services.

5.9.8 Property, Facilities, and Infrastructure: Transportation, governmental operations, and infrastructure facilities may be disrupted during a large scale active shooter attack, both directly and indirectly. Roads and bridges may be heavily impacted by an active shooter attack, especially if explosive devices are utilized in the active shooter attack. An active shooter attack and the response and recovery from those attacks can impact access to homes and critical entities such as hospitals, schools, and supermarkets, as well as other critical facilities. Safe access to homes, vehicles, structures, and resources may adversely affect response activities. If power loss occurs as part of or following an active shooter attack, it may lead to disruption of critical infrastructure and technology.

5.9.9 Impact on Environment: An active shooter attack involving bombings and arson pose considerable negative impacts to the environment in the form of smoke and destruction of vegetation.

5.9.10 Impact on State Economy: An active shooter attack poses a fiscal impact on the local and state governments. Local, county, and state resources may be required during an active shooter therefore reducing their availability for future events. Private businesses may not be able to maintain operations during or after an incident if they are impacted, which would impact the economy.

5.9.11 Public Confidence in the State's Governance: If government employees or facilities are targeted directly by an active shooter, it will have a significant impact on the state's ability to govern. The public's confidence in the state's governance is affected by immediate local and state response through direct and effective actions. Efficiency in response and recovery operations is critical in keeping public confidence high.

5.10 Radiological Release (Technical, Hostile)

5.10.1 Hazard Description: The State of Georgia has six counties within the 10-mile Emergency Planning Zone (EPZ) and 76 counties within the 50-mile Ingestion Pathway Zone (IPZ) of nuclear power plants located within Georgia and adjacent states. Although the risk frequency is low, potential consequences are high.

Within the 10-mile EPZ the primary hazard is direct radiological contamination due to the release of radiological material from the nuclear power plant and the resulting fallout from the plume as it is driven by local weather conditions. It is expected that a high percentage of the radiological material will be deposited on the ground prior to reaching the 10-mile EPZ limit.

Potential impacts within the 50-mile IPZ are primarily focused on the impact to soil and water as it relates to crops, livestock, and poultry. The primary focus is to identify potential contamination and prevent the introduction of contaminated foodstuffs into the food chain.

Georgia's agricultural industry plays a major role in the State's economy, contributing billions of dollars annually. Georgia, ranked first in the nation's production of broilers

(young chickens weighing less than two and a half pounds), blueberries, peanuts, and pecans.

An actual radiation impact, or perceived impact, to Georgia crops, livestock, poultry, and food industry could be overwhelming.

5.10.2 Previous Major Occurrences: The Three Mile Island Unit 2 (TMI-2) reactor, near Middletown, PA., partially melted down on March 28, 1979. This was the most serious accident in U.S. commercial nuclear power plant operating history. Although its small radioactive releases had no detectable health effects on plant workers or the public, its aftermath brought about sweeping changes involving emergency response planning, reactor operator training, human factors engineering, radiation protection, and many other areas of nuclear power plant operations. It also caused the Nuclear Regulatory Commission (NRC) to tighten and heighten its regulatory oversight. All of these changes significantly enhanced U.S. reactor safety.

In addition to the enhanced NRC oversight, the Federal Government created a new program called Radiological Emergency Preparedness (REP). As outlined in federal guidance documents, the mission of REP is to adequately protect the public health and safety by providing reasonable assurance that appropriate protective measures can be implemented offsite in the event of a radiological emergency.

The Fukushima Daiichi nuclear disaster was an energy accident at the Fukushima Daiichi Nuclear Power Plant in Ōkuma, Fukushima Japan, initiated primarily by the tsunami following the Tōhoku earthquake on 11 March 2011. Immediately after the earthquake, the active reactors automatically shut down their sustained fission reactions. However, the tsunami disabled the emergency generators that would have provided power to control and operate the pumps necessary to cool the reactors. The insufficient cooling led to three nuclear meltdowns, hydrogen-air explosions, and the release of radioactive material in Units 1, 2, and 3 from 12 March to 15 March. Loss of cooling also caused the pool for storing spent fuel from Reactor 4 to overheat on 15 March due to the decay heat from the fuel rods.

5.10.3 Impact on Public: The State of Georgia has a footprint in three 10-mile Emergency Planning Zones surrounding the following nuclear power plants; Plant Hatch, located in Appling County; Plant Vogtle, located in Burke County; and Plant Farley, located on the west bank of the Chattahoochee River in Houston County, Alabama. The total at risk populations within the 10-mile Emergency Planning Zones are approximately; Plant Hatch, 8,900, Plant Vogtle, 3000, and Plant Farley, 1400. Both Appling and Toombs Counties each have one school within the 10-mile EPZ.

In addition, there are 70 more counties in Georgia within the 50-mile Ingestion Pathway Zones of nuclear power plants in South Carolina and Tennessee.

5.10.4 Impacts to Public Health: Based on all available information the State of Georgia Radiological Emergency Coordinator will provide state and local decision makers with Protective Action Recommendations in regards to minimizing the potential impact to the public. The recommendations may be to evacuate individuals within the potentially affected areas, advise individuals within the impacted areas to

shelter in place, or in the event of a hostile type action at the nuclear plant for those individuals to go inside and stay inside.

The State of Georgia highly recommends evacuation from areas of potential plume impact. Plans and procedures are in place to activate evacuee reception centers outside of the 10-mile EPZ where individuals can be screened for radiological contamination and decontaminated as necessary. Congregate shelters will be located nearby to provide temporary accommodations for those individuals who may be unable to return to their residence due to radiological contamination.

The impact to public health, to include psychological public health, will vary depending on the size, strength, movement, and impact of the radiological release. Radiological health effects, both acute (short term) and chronic (long term), will be based on an individual's proximity to the radiological material, time of exposure, and strength of the specific isotype. Protective Action Guidelines are available to identify levels of contamination and an appropriate response.

5.10.5 Impact on Responders: As with any emergency event, emergency responders will be called upon to carry out operations in support of the overall response. The type of response assignment will be based upon the responder's primary area of expertise, i.e., law enforcement, fire suppression, emergency medical services, etc. A response to a radiological emergency may place emergency response personnel in a unique situation where they must adhere to and be mindful of radiological exposure and contamination as they conduct response activities. State and local first responders within Georgia have been provided training in radiological emergency response and radiation exposure and contamination protocols.

5.10.6 Continuity of Operations: GEMA/HS maintains a Continuity of Operations Plan (COOP). In the event of radiological emergency at a nuclear power facility that affects the state's operations, the Agency will enact the COOP appropriately to the situation. To date, there have been few or no major incidents that have shut down state, county, or municipal governmental operations. While expectation is minimal, this threat may impact GEMA/HS ability to implement their COOP based on the hazard's potential to cause power outages and transportation difficulties. If activation of alternate facilities was is, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.

5.10.7 Delivery of Services:

Based on the locations of the nuclear power plants affecting the State of Georgia, the impact on the delivery of goods and services may possibly include national, state, regional, and local areas. Regional and local delivery of goods and services may be impacted by the closure of roads and bridges as a result of locations contaminated with radiological material. The statewide, and possibly national delivery of services may be impacted by railroads in South Georgia which serve a major terminal in Waycross. Additionally, a number of poultry and food processing centers in Georgia may be closed or products embargoed to protect the food chain from being potentially contaminated.

5.10.8 Property, Facilities, and Infrastructure: The impact to property, facilities, and infrastructure may be directly attributed to contamination of radiological material or the loss may be attributed to the lack of access to these areas for the near or long term. Based upon field monitoring information and protective action guidelines, some areas may be successfully decontaminated and available for return to limited or full service. Others with more extensive contamination, or the inability to be successfully decontaminated to an acceptable level, may need to be destroyed or placed on restricted access rendering them unusable for an identified or indefinite period of time.

5.10.9 Impact on Environment: Radiation is naturally occurring. Radiation comes to us from both natural and manmade sources. Limiting radiation exposure and contamination to acceptable protective action guideline levels allows the environment to provide critical resources such as safe water, air, and soil to support and sustain an ecological balance. This balance is crucial to sustaining agricultural and zoological interests. A radiological impact to the environment can be both near and long term depending on identified contamination levels. Radiological contamination provides for adverse effects on individuals, agriculture interests, poultry and livestock.

5.10.10 Impact on State Economy: Agriculture in the State of Georgia is a multi-billion dollar industry with over 9 million acres devoted to farming. Much of this area in located within a 50 mile ingestion pathway of nuclear power plants in Georgia and adjacent states. Not only will a nuclear power plant emergency cost the State and local governments during the initial response, but it will also impact local and regional businesses if they are unable to maintain operations or sell their products for a unspecified period of time.

5.10.11 Public Confidence in the State's Governance: During the Three Mile Island emergency event in March 1979, the public lost confidence in state and local government's ability to control and effectively respond to the event due to their lack of preparedness and ineffective information sharing and dissemination with the public. Following the events at Three Mile Island the Radiological Emergency Preparedness program was created to unsure that plans and procedures are in place to effectively respond and communicate information and protective actions with local residents and business near the facility. A nuclear power plant emergency will be live breaking news across all forms of media around the world. Confidence in state and local government will be based upon their ability to effectively and efficiently respond to a nuclear power plant emergency.

5.11 Hazardous Material Release (Transpiration / Storage Spills & Leaks)

5.11.1 Hazard Description: A hazardous material is any item or agent (biological, chemical, radiological, and/or physical), which has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors. Hazardous materials are routinely stored and transported throughout Georgia. Georgia's industrial capacity and network of highways, pipelines, waterways and railways result in vulnerabilities to hazardous material releases. Storage sites as well as hazardous materials in transit could be impacted by accidental, criminal or

terrorist events. Many sites that utilize or store hazardous materials are located in coastal counties where they are could be exposed to tropical cyclone winds and rains.

A release of a hazardous material could result in injury, long term health problems, loss of life and damage to property and the environment. The consequences of a hazardous material release will vary greatly depending on the location, time, quantity and material released.

5.11.2 Previous Major Occurrences: Based on available data, there were over 900 reports of oil and hazmat releases reported to GA EPD in 2017. Some of the major occurrences:

- Benzyl Chloride releases in Fulton and Clayton Counties
- Sulfuric acid spill in Fulton County
- Multiple tanker roll overs throughout GA releasing thousands of gallons of gasoline and diesel fuel
- Multiple train derailments resulting in the release of thousands of gallons of oil and diesel fuel
- 1,200 gallons of gasoline spilled into Lake Thurmond Reservoir
- Mercury spill in Whitfield County
- Multiple sunken vessels along Georgia's coast

5.11.3 Impact on Public: Cities within Georgia with dense populations, particularly along major travel routes, are the most vulnerable (with an emphasis on any particularly vulnerable groups, such as infants and young children in day-care centers, children in schools, the elderly in residential facilities, hospital patients, etc.).

5.11.4 Impacts to Public Health: Varying chemicals will have different effects on the population as well as environmental effects which will dilute or increase the chemical releases potency. Protective measures will need to be taken particularly for those of the most vulnerable communities.

5.11.5 Impact on Responders: Varying chemical incidents can create a dangerous environment and significant challenge for first responders. First responders may have to manage the evacuation of people from the area impacted by a chemical incident, as well as direct traffic, close roads, operate shelters, and take care of the injured and sick. First responders must control their own exposure to the chemical incident and ensure the correct PPE is utilized. Equipment may also be damaged or destroyed due to the impact of the chemical incident, which may lead to a decrease in response capabilities.

5.11.6 Continuity of Operations: GEMA/HS maintains a Continuity of Operations Plan (COOP). In the event of Hazardous Material Spill/Release that affects the state's operations, the Agency will enact the COOP appropriately to the situation. To date, there have been few or no major incidents that have shut down state, county, or

municipal governmental operations. While expectation is minimal, this threat may impact GEMA/HS ability to implement their COOP based on the hazard's potential to cause power outages and transportation difficulties. If activation of alternate facilities was is, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.

5.11.7 Delivery of Services: The ability to deliver services can be impacted locally, regionally, or statewide depending on the characteristics of the chemical incident. To reduce the public's potential exposure to dangerous chemicals, roadway and bridge closures may be required, as well as transit service disruptions. Businesses and places of commerce may completely shut down due to chemical incidents, which leads to the disruption of goods and services.

5.11.8 Property, Facilities, and Infrastructure: Transportation, governmental operations, and infrastructure facilities may be disrupted during a significant chemical incident. Roads and bridges can be completely obstructed by chemical releases and required cleanup. Chemical incidents can impact access to homes and critical entities such as hospitals, schools, and supermarkets, as well as other critical facilities. Safe access to homes, vehicles, structures, and resources may adversely affect response activities. Power loss can lead to disruption of critical infrastructure and technology.

5.11.9 Impact on Environment: Agriculture crops and livestock are extremely susceptible to the adverse effects of chemicals and the potential of a spill or contamination of a large area of land. Chemical incidents may impact the environment directly by causing pollution, damaging sewer and wastewater treatment plants; or disturbing or killing wildlife and adversely affecting nature preserves.

5.11.10 Impact on State Economy: Severe chemical incidents pose a fiscal impact on the local and state governments. Local, county, and state resources may be required during a large chemical incident therefore reducing their availability for future events. Additionally, private businesses may not be able to maintain operations during or after an incident if they are impacted, which would impact the economy.

5.11.11 Public Confidence in the State's Governance: The public's confidence in the state's governance is affected by immediate local and state response through direct and effective actions. Efficiency in response and recovery operations is critical in keeping public confidence high**.**

5.12 Dam Failure

5.12.1 Hazard Description: A dam is a constructed barrier across flowing water that obstructs, directs, or slows the velocity of the water, creating a reservoir, lake, or impoundment. The structure's purpose is to retain water for a variety of purposes such as generating power, providing water for irrigation or water supply, or controlling flooding.

The threat of dam failures is triggered by carelessness of design, construction, and maintenance. The integrity of older dams, often affected by weathering, mechanical changes, and the influence of chemical agents, is deteriorating. Not only is dam failure risk increasing (with aging infrastructure) but the population vulnerable to this hazard is also increasing due to downstream development.

Dam failures are generally grouped into three classifications: hydraulic, seepage, and structural. The three types of failure sometimes compound upon one another to create complex and interrelated hazard events.

Hydraulic failures are a result of the uncontrolled flow of water over and around the dam structure as well as the erosive action on the dam and its foundation. The uncontrolled flow causing the failure is often classified as wave action, toe erosion, or gullying. Earthen dams are particularly susceptible to hydraulic failure because earthen materials erode at relatively slow velocities. This type of failure constitutes approximately 40% of all dam failures.

While all dams exhibit some seepage, the velocity and amount of water are controlled to prevent failure. Seepage occurs through the structure and its foundation and erodes the structure from within. Seepage accounts for approximately 4% of all dam failures.

Structural failure involves the rupture of the dam or the foundation by water movement, earthquake, or sabotage. Large earthen dams and dams constructed with weak materials (such as silt) are especially susceptible to structural failure. This type of failure accounts for approximately 30% of all dam failures

5.12.2 Previous Major Occurrences: Kelly Barnes Dam, Toccoa, Georgia. The original structure consisted of a rock crib dam built in 1899 in order to create a small reservoir for a hydroelectric plant. The Toccoa Falls Bible Institute built an earthen dam over the original rock crib dam in 1937 in order to develop a more stable electric power source. The dam structure was raised several times, reaching 42 feet above the rock foundation by 1957, when power production was halted and the reservoir was solely utilized for recreation. At around 1:30 am on Sunday, November 6, 1977, the Kelly Barnes Dam failed. This collapse resulted in a flash flood that swept downstream causing 39 fatalities and caused $2.3 million in property damage. The sole cause of the failure is undetermined but the probable causes include a local slide on the steep downstream slope probably associated with piping (form of seepage) and a localized breach in the crest followed by progressive erosion, saturation of the downstream embankment, and the subsequent total collapse of the structure.

Other dam failures have occurred in Georgia with some related to the spring of 1990 flooding and the July 1994 flooding associated with Tropical Storm Alberto. However, these dam failures were not documented as having a significant contribution to already flooded conditions.

5.12.3 Impact on Public: Dam failures impact those living near the incident area by resulting in flooding, power outages, property damage, and injury or death.

Evacuations of the incident zone may require the victims to be sheltered. Roadways may be inaccessible to the public, inhibiting their ability to receive help.

5.12.4 Impacts to Public Health: Fast-moving water and debris-filled water are very dangerous to the public and can result in injury or death. Standing water poses health risks to the public because it can contain or foster diseases.

5.12.5 Impact on Responders: A dam failure may cause inaccessibility of transportation routes or damage to resources. Flooding from a dam failure puts responders in dangerous situations including performing swift high-water rescues, facilitating evacuations, and controlling traffic.

5.12.6 Continuity of Operations: GEMA/HS maintains a Continuity of Operations Plan (COOP). In the event of dam failure that affects the state's operations, the Agency will enact the COOP appropriately to the situation. To date, there have been few or no major incidents that have shut down state, county, or municipal governmental operations. While expectation is minimal, this threat may impact GEMA/HS ability to implement their COOP based on the hazard's potential to cause power outages and transportation difficulties. If activation of alternate facilities was is, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.

5.12.7 Delivery of Services: Delivery of services may be disrupted due to transportation issues or access to goods. Public transportation may also be affected preventing victims from getting goods and services they need. Loss of power and communication could directly or indirectly affect all levels of response to the incident area.

5.12.8 Property, Facilities, and Infrastructure: Flooding from dam failures will damage or destroy all property, facilities, or infrastructure in its path. Roads, bridges, and other critical facilities may be directly or indirectly impacted from the rush of water and debris. Water and wastewater plants may become overwhelmed causing sanitation issues. Homes and businesses may be damaged or destroyed if near the incident.

5.12.9 Impact on Environment: Environmental impacts of a dam failure include flooding, moving debris, disturbance of pollutants, and overloading of water and wastewater treatment plants. Ecosystems could be heavily affected causing death or migration of wildlife.

5.12.10 Impact on State Economy: The fiscal impacts on the state economy will be due to a disruption in transportation routes inhibiting citizens' ability to travel to and from work and businesses. The utilization of resources at all levels of government will also add stress to the state's economy.

5.12.11 Public Confidence in the State's Governance: Governmental response must be immediate and effective to maintain public confidence. If the state is disorganized in its response operations or takes too long to begin recovery operations, the public may lose confidence in the government's ability to manage the event.

5.13 Infrastructure Failure

5.13.1 Hazard Description: Infrastructure in the United States is becoming more prone to failure as the average age of structures increases. Infrastructure is owned and managed by both the public and private sector, and includes a number of structures that improve living conditions and commerce, including schools, hospitals, roads, bridges, dams, sewers, and energy systems. Between 2000 and 2009, the average age of government and privately-owned structures (excluding housing) increased by about one year. For government structures, the trend was even more pronounced over the long term—United States structures' average age rose from 18 years in 1970 to 25 in 2009, indicating that structures are being replaced at a slower rate. Bridges are generally designed to last 50 years, and the average bridge in the United States is 43 years old. Georgia has almost 800 structurally deficient bridges and over 2,000 functionally obsolete bridges.

Metro Atlanta's current system of multiple transit providers is inefficient, as well as time-consuming and confusing to the users. Metropolitan Atlanta Rapid Transit Authority is the largest transit agency in the country that does not receive state funding support for operations. Collaboration between governments is needed to establish a truly regional, accessible transit system in Georgia. Although traffic fatalities have been significantly reduced in the last five years, Georgia's traffic fatality rate is still well above the national average. Metro Atlanta is congested during peak commute hours.

Georgia has 191 wastewater plants with capacities over 1 million gallons per day. Tightening water quality standards such as instream nutrient level limits will likely require utilities to implement additional treatment processes and technologies. Reducing and eliminating sewer overflows must receive the focused attention of utilities. Also, improving maintenance programs with techniques such as expanded asset management is critical. These challenges underscore the need for workforce development to recruit qualified staff and keep up with advancing technologies.

5.13.2 Previous Major Occurrences: March 30, 2017 – A bridge collapsed on Interstate 85 in Atlanta, Georgia, after a massive fire. After the collapse of the 100-foot-long section, I-85 was closed to traffic over approximately two miles (between its split with I-75 and the interchange with State Route 400). Three sections of northbound I-85 and three sections of southbound I-85 were replaced by May 13, 2017.

April 21, 2017 – An internet outage today disrupted Georgia Milestones testing across the state. As a result, some districts including Gwinnett and Clayton had to delay testing. A Department of Education spokesman reported "PeachNet (state internet provider) went down for a little while this morning. We had 124 districts testing. According to IT for GaDOE, 22 districts remained out as of late this morning. Some delayed testing today."

December 17, 2017 – A major power outage halted air traffic at Hartsfield-Jackson Atlanta International Airport for 11 hours, grounding all of the hub's outgoing flights

and halting incoming traffic for tens of thousands of travelers hoping to land at the world's busiest airport. The outage, reported after a fire ravaged an underground power substation, forced travelers out of the darkened terminal and into an icy rain for hours, witnesses reported. It stranded others on Atlanta's tarmac as they waited to get off of incoming flights.

5.13.3 Impact on Public: Critical infrastructure failures impact those living within the hazard area and surrounding areas and can lead to heavy flooding, power loss, property damage, injury, and even death. Extensive flooding and damage may lead to the evacuation and displacement of those individuals in the impact zone. Roadways may be obstructed or inaccessible to the public, challenging transport and resource acquirement activities.

5.13.4 Impacts to Public Health: A failure of critical infrastructure, regardless of which piece of the infrastructure failed, would have a direct impact on public health. Power outages, transit failures, access to clean water would all be critical infrastructure failures which would create severe and immediate public health impacts.

5.13.5 Impact on Responders: Infrastructure failure would have a direct and immediate impact on first responder's ability to respond effectively. Critical infrastructure failure may cause inaccessibility of roadways for first responders as well as damage of materials and resources. Communications system failure would impact the responders' ability to communicate their status or communicate through their command system to identify areas that require response.

5.13.6 Continuity of Operations: GEMA/HS maintains a Continuity of Operations Plan (COOP). In the event of Infrastructure failure that affects the state's operations, the Agency will enact the COOP appropriately to the situation. To date, there have been few or no major incidents that have shut down state, county, or municipal governmental operations. While expectation is minimal, this threat may impact GEMA/HS ability to implement their COOP based on the hazard's potential to cause power outages and transportation difficulties. If activation of alternate facilities was is, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.

5.13.7 Delivery of Services: Delivery of services will be disrupted due to critical infrastructure failure. Transit systems may face closures due to public safety concerns due to inability to operate transportation vehicles such as trains and buses. The ability to deliver food, drinking-water, and services will be impacted locally, regionally, and statewide due to problems with accessibility and transport abilities. Communications, transportation, and governmental services operations would be impacted due to power failure and accessibility challenges.

5.13.8 Property, Facilities, and Infrastructure: Roads and bridges may be impacted and water and sewer systems may be damaged, leading to the issue of sanitation and waste collection. Property of homes and businesses may be completely destroyed if situated close to the failure point.

5.13.9 Impact on Environment: The impacts on the environment of critical infrastructure would vary based on the event and impact. Failure of waste water plants would result in spreading pollution and hazardous materials throughout the environment including large bodies of water. Ecosystems and natural habitats may be destroyed, causing migration.

5.13.10 Impact on State Economy: Critical infrastructure failure would have a direct and considerable fiscal impact on the State government, even after some of the costs have been paid through federal disaster declarations, if the failure was caused by another hazard. Additionally, infrastructure failure in every sector has the potential to impact the ability of businesses to operate. If the private sector is not able to maintain operability, there would be continued revenue loss until operability is restored.

5.13.11 Public Confidence in the State's Governance: Critical infrastructure failure would have a direct and immediate impact on the state's ability to provide governance, maintain order, and ensure the continuity of public services. If there were delays in restoring infrastructure, and any services contingent on this infrastructure, the public would become increasingly distrustful of the government's ability to restore services and ensure public safety and wellbeing. Direct, immediate, and effective actions must be taken in order to maintain public confidence. Response activities must include all levels of government.

6.0 OVERALL HAZARDS RESULTS AND SUMMARY

The preceding hazard sections discussed the probability, impacts, vulnerabilities, and risk for each of the natural, human-caused, and technological hazards determined to have a significant impact on the population, facilities, and infrastructure in the State of Georgia. This final sub-section to the HIRA provides an overall assessment and summary of the individual hazard analyses.

6.1 Composite Hazard Priorities

Hazard: Severe Weather

Risk Assessment: Frequency: 6 X Consequence: 6 = 36 Extreme

Associated Hazards:

- Thunderstorms;
- High Winds;
- Lightning;
- Hail;
- Tornado *(Most Significant Hazard in Georgia*)

Table 12 for Severe Weather

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho-social Impact	Sub-variable Total
6	**2**	**2**	**2**	**1**	**1**	**14**

Hazard: Infrastructure Failure

Risk Assessment: Frequency: 6 X 6 Consequence: 36 Extreme

Associated Hazards:

- Communications
- Transportation
- Energy
- Public Works

Table 12 for Infrastructure Failure

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho-social Impact	Sub-variable Total
10	**2**	**3**	**1**	**2**	**2**	**20**

Hazard: Cyber Attack

Risk Assessment: Frequency: 6 X 6 Consequence: = 36 Extreme

Associated Hazards:

- Hacking/Phishing
- Infrastructure Disruptions
- Ransomware/Malware Attacks
- Network Intrusion/Disruptions
- Transpiration Intrusion/Disruptions

Table 12 for Cyber Attack

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho-social Impact	Sub-variable Total
10	**0**	**3**	**0**	**2**	**2**	**17**

Hazard: Hazardous Material Spill/Release

Risk Assessment: Frequency: 6 X 6 Consequence: = 36 Extreme

Associated Hazards:

- Injury
- loss of life
- property and environmental damage

Table 12 for Hazardous Material Spill/Release

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho-social Impact	Sub-variable Total
5	**2**	**2**	**3**	**1**	**1**	**14**

Hazard: Inland Flooding

Risk Assessment: Frequency: 6 X Consequence: 5 = 30 Extreme

Associated Hazards:

- River Flooding;
- Flash Flooding;
- Urban Flooding.

Table 12 for inland Flooding

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho-social Impact	Sub-variable Total
2	**2**	**3**	**2**	**1**	**1**	**11**

Hazard: Tropical Cyclone

Risk Assessment: Frequency: 5 X Consequence: 6 = 30 Extreme

Associated Hazards:

- Storm Surge;
- High Winds;
- Heavy Rainfall;
- Tornado.

Table 12 for Tropical Cyclone

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho-social Impact	Sub-variable Total
10	**3**	**3**	**3**	**2**	**2**	**23**

Hazard: Active Shooters

Risk Assessment: Frequency: 5 X Consequence: 6 = 30 Extreme

Associated Hazards:

- Explosives/Improvised Explosive Devices
- Vehicle Ramming
- Sniper Attack
- Hostage Taking

Table 12 for Active Shooter

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho-social Impact	Sub-variable Total
8	**2**	**1**	**1**	**1**	**2**	**15**

Hazard: Winter Weather

Risk Assessment: Frequency: 4 X Consequence: 4 = 16 High

Associated Hazards:

- Snow;
- Ice;
- Freezing Rain;
- Sleet;
- Blizzard;
- Extreme Cold.

Table 12 for Winter Weather

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho-social Impact	Sub-variable Total
4	**1**	**2**	**1**	**1**	**0**	**9**

Hazard: Infectious Diseases

Risk Assessment: Frequency: 6 X Consequence: 1 = 6 Low

Associated Hazards:

- Food borne diseases;
- Agricultural disease outbreaks;
- Novel disease outbreaks.

Table 12 for Infectious Diseases

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho-social Impact	Sub-variable Total
3	**0**	**0**	**0**	**1**	**1**	**5**

Hazard: Dam Failure

Risk Assessment: Frequency: 2 X Consequence: 3 = 6 Low

Associated Hazards:

- Downstream Flooding;
- Erosion;
- Property Damage;
- Environmental Damage;
- Transportation Disruption;
- Infrastructure Disruption.

Table 12 for Dam Failure

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho-social Impact	Sub-variable Total
2	**1**	**1**	**2**	**1**	**1**	**8**

Hazard: Geologic Hazards

Risk Assessment: Frequency: 2 X Consequence: 2 = 4 Very Low

Associated Hazards:

- Earthquake;
- Sinkhole;
- Landslide.

Table 12 for Geologic Hazards

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho-social Impact	Sub-variable Total
0	**1**	**1**	**2**	**1**	**0**	**5**

Hazard: Drought/Wildfire

Risk Assessment: Frequency: 1 X Consequence: 2 = 3 Very Low

Associated Hazards:

- Extreme Heat;
- Wildfires;
- Smoke;
- Water Shortage.

Table 12 for Drought/Wildfire

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho-social Impact	Sub-variable Total
0	**1**	**1**	**2**	**1**	**1**	**6**

Hazard: Radiological Release

Risk Assessment: Frequency: 1 X Consequence: 3 = 3 Very Low

Associated Hazards:

- Radiological contamination impact areas:
- Individuals (Physical and Psychological Health)
- Property (Private / Commercial / Governmental)
- Environment (Air / Land / Water)
- Infrastructure (Private / Commercial / Governmental)
- Agriculture
- Zoological
    - Economy (Restricted Use Space / Consumer Confidence)

Table 12 for Radiological Release

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho-social Impact	Sub-variable Total
2	**1**	**1**	**3**	**1**	**1**	**9**

7.0 PLAN MAINTENANCE

GEMA/HS is the responsible agency for publishing the Plans Standardization and Maintenance Policy. The Deputy Director of Emergency Management will oversee the update and maintain this policy as required. Appropriate officials in state agencies should recommend changes at any time and provide information periodically as to changes of personnel and available resources. All changes will be referred to the GEMA/HS Planning Section Manager.

The Plans Standardization and Maintenance Policy will be revised on a regular basis in accordance with this policy.

8.0 Annexes

Annex A Acronyms

CA- Consequence Analysis

COOP- Continuity of Operations Plan

DDOS- Distributed Denial of Service

DMA- Disaster Mitigation Act

EMAP- Emergency Management Accreditation Program

EMS- Emergency Medical Services

EPZ- Emergency Planning Zone

GADOA- Georgia Department of Agriculture

GEMA/HS- Georgia Emergency Management and Homeland Security Agency

GIS- Geographic Information System

GTA- Georgia Technology Authority

HIRA- Hazard Identification and Risk Assessment

HMS- Hazard Mitigation Strategy

IPZ- Ingestion Pathway Zone

NCADAC- National Climate Assessment and Development Advisory Committee

NCIE- National Center for Environmental Information

NCR- Nuclear Regulatory Commission

NWS- National Weather Service

REP- Radiological Emergency Preparedness

SCADS- Supervisory Control and Data Acquisition

SME- Subject-Matter Experts

THIRA- Threat and Hazard Identification and Risk Assessment

TMI-2-Three Mile Island Unit

Hazard Profile / Consequence Analysis Instructions

1. **Hazard Identification** - In this step identify the hazards that have the largest and probable impact. This requires a review of all hazards and their causes to determine whether they may be a threat. This may require the consultation of the scientific community, historical records government agencies and other stakeholders. List the identified hazards in table 1 below by natural, human-caused, or technological hazards. Use table two to explain how and why the hazard was identified.
2. **Hazard Profile:** - In this step the level of risk for each hazard is examined using a risk assessment. This may involve speaking with hazard experts, researching past occurrences and possible scenarios. The likelihood of the hazard occurring and the potential impacts of the hazard on people, property, the environment, business and finance and critical infrastructure should be examined. The desired outcome of the risk assessment is the ranking of the hazards.
3. **Consequence Analysis** - The information collected in the hazard profile step will be analyzed in this step. This highlights the hazards that should be considered a current priority for your emergency management program.
4. **Monitor and Review** - It is important to remember that a HIRA is an ongoing process and hazards and their associated risks must be monitored and reviewed.

Table 1 Hazard Identification and Hazard Grouping

Natural Hazards	Human Caused Hazards	Technological Hazards

Table 2 Hazzard Identification Process

Hazard of Concern	How and Why hazard was Identified

Hazard Profile Steps:

1. **Hazard:** *List a hazard from table 1 above.*
2. **Associated Hazards:** *List any associated hazards for the main hazard.*
3. **Risk Assessment:** *Frequency (Table 3) * Consequence (Table 13) = level of risk in table 14*

   a. **Obtain Frequency:** *Use Table 3 below to record the frequency of the hazards and add to Hazard Profile and Consequence Analysis Worksheet in Annex C.*

Table 3 Likelihood of hazard occurrence

Frequency	Category	Percent Chance	Description
1	Rare	Less than a 1% chance of occurrence in any year.	Hazards with return periods >100 years.
2	Very Unlikely	Between a 1- 2% chance of occurrence in any year.	Occurs every 50 – 99 years and includes hazards that have not occurred but are reported to be more likely to occur in the near future.
3	Unlikely	Between a 3 – 10% chance of occurrence in any year.	Occurs every 20 – 49 years
4	Probable	Between an 11 – 50% chance of occurrence in any year.	Occurs every 5 – 19 years
5	Likely	Between a 51 – 99% chance of occurrence in any year.	Occurs >4 years.
6	Almost Certain	100% chance of occurrence in any year.	The hazard occurs annually.

   b. **Consequence:** Consequence is divided into six categories based on recommended practices. Use Table 4 – 11 below to record the frequency of the hazards that could affect your community. **Note:** The social impacts sub variable is further divided into the fatality rate, injury rate and evacuation rate.

Social Impacts - The direct negative consequences of a hazard on the physical health of people. Social Impacts include fatalities, injuries, and evacuation.

Table 4 Fatalities

Consequence	Category	Description
0	None	Not likely to result in fatalities within the community.
1	Minor	Could result in fewer than five fatalities within the community.
2	Moderate	Could result in 5 – 10 Fatalities within the community.
3	Severe	Could result in 10-50 fatalities within the community.
4	Catastrophic	Could result in 50+ fatalities within the community.

Table 5 Injuries

Consequence	Category	Description
0	None	Not likely to result in injuries within the community.
1	Minor	Could injure fewer than 25 people within community.
2	Moderate	Could injure 25 – 100 people within the community.
3	Severe	Could injure +100 people within the community.

Table 6 Evacuation

Consequence	Category	Description
0	None	Not likely to result in an evacuation shelter-in-place orders, or people stranded.
1	Minor	Could result in fewer than 100 people being evacuated, sheltered-in-place or stranded.
2	Moderate	Could result in 100 - 500 people being evacuated, sheltered-in-place or stranded.
3	Severe	Could result in more than 500 people being evacuated, sheltered-in-place or stranded.

Property Damage - The direct negative consequences of a hazard on buildings, structures and other forms of property, such as crops.

Table 7 Property Damage

Consequence	Category	Description
0	None	Not likely to result in property damage within the community.
1	Minor	Could cause minor and mostly cosmetic damage.
2	Moderate	Localized severe damage (a few buildings destroyed).
3	Severe	Widespread severe damage (many buildings destroyed).

Critical Infrastructure Service Disruptions/Impact - The negative consequences of a hazard on the interdependent, interactive, interconnected networks of institutions,

services, systems and processes that meet vital human needs, sustain the economy, protect public safety and security, and maintain continuity of and confidence in government.

Table 8 Critical Infrastructure Service Impact (CI)

Consequence	Category	Description
0	None	Not likely to disrupt critical infrastructure services.
1	Minor	Could disrupt 1 critical infrastructure service.
2	Moderate	Could disrupt 2 – 3 critical infrastructure services.
3	Severe	Could disrupt more than 3 critical infrastructure services.

Environmental Damage - The negative consequences of a hazard on the environment, including the soil, water, air and/or plants and animals.

Table 9 Environmental Damage

Consequence	Category	Description
0	None	Not likely to result in environmental damage.
1	Minor	Could cause localized and reversible damage. Quick clean up possible.
2	Moderate	Could cause major but reversible damage. Full clean up difficult.
3	Severe	Could cause severe and irreversible environmental damage. Full clean up not possible.

Business/Financial Impact - The negative economic consequences of a hazard.

Table 10 Business/Financial Impact

Consequence	Category	Description
0	None	Not likely to disrupt business/financial activities.
1	Moderate	Could result in losses for a few businesses.
2	Severe	Could result in losses for an industry.

Psychosocial Impacts - The negative response of community or a subset of the community to a hazard caused by their perception of risk. This includes human responses such as self-evacuation, mass panic and other potential undesirable responses.

Table 11 Psychosocial Impact

Consequence	Category	Description
0	None	Not likely to result in significant psychosocial impacts.
1	Moderate	Significant psychosocial impacts including limited panic, hoarding, self-evacuation and long-term psychosocial impacts.
2	Severe	Widespread psychosocial impacts, e.g. mass panic, widespread hoarding and self-evacuation and long-term psychological impacts.

The total consequence value can be obtained by adding the values obtained from each of the sub variables.

Table 12 Total Consequence

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho -social Impact	Sub-variable Total

Once the consequence values have been added up, they are put into groups as shown in the table below.

Table 13

Sub Total Variable	Consequence	Description
1 - 4	1	Minor
5- 6	2	Slight
7- 8	3	Moderate
9 - 10	4	Severe
11 - 12	5	Very Severe
+13	6	Catastrophic

This gives equal weight to Consequence and Frequency.

Risk Amassment

Once you have completed the Frequency, Consequence Work Sheets, you can now begin to prioritize your hazards by using the HIRA equation:

Risk = Frequency * Consequence

Table 14

Level of Risk		Level of Risk	
< 5	Very Low	16- 20	High
6 -10	Low	21- 25	Very High
11- 15	Moderate	> 25	Extreme

Consequence Analysis steps:

1. **Hazard:** Retype hazard and add level of Risk.
4. **Hazard Description:** Type one to two paragraphs about the selected hazards including all associated hazards.
5. **Previous Major Occurrences:** Discuss only the last two or three times the selected hazard had a major impact on the State.
    a. Or if there are no major impacts of the selected hazard, list the last two or three times the hazard has occurred,
    b. Or if the selected hazard has not occurred, list worst case scenarios.
6. **Impact on Public:**
7. **Impacts to Public Health:**
8. **Impact on Responders:**
9. **Continuity of Operations:**
10. **Delivery of Services:**
11. **Property, Facilities, and Infrastructure:**
12. **Impact on Environment:**
13. **Impact on State Economy:**

Annex C Hazard Profile / Consequence Analysis Worksheet

Hazard Profile / Consequence Analysis Worksheet

Hazard Profile

1. **Hazard:** *List the hazard from table 1 from the Hazard Profile / Consequence Analysis Instructions*
2. **Associated Hazards:** *List any associated hazards for the main hazard.*
3. **Risk Assessment:** *Frequency (Table 2) * Consequence (Table 12) = level of risk table 13*
    a. **Frequency:** *Add a (1-6) from table 2 from the Hazard Profile / Consequence Analysis Instructions*
    b. **Consequence:** *Use the sub-variable total from table 11 to find consequence in table 12.*

Table 11: *Use tables 3-10 to fill in table 11.* **Note:** *Social impacts is tables 3-5 added together.*

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho -social Impact	Sub-variable Total
Add Tables 3-5	*Table 6*	*Table 7*	*Table 8*	*Table 9*	*Table 10*	Total of tables 3-10

Consequence Analysis

1. **Hazard:**
2. **Hazard Description:**
3. **Previous Major Occurrences:**
4. **Impact on Public:**
5. **Impacts to Public Health:**
6. **Impact on Responders:**
7. **Continuity of Operations:**
8. **Delivery of Services:**
9. **Property, Facilities, and Infrastructure:**
10. **Impact on Environment:**
11. **Impact on State Economy:**
12. **Public Confidence in the State's Governance:**