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P L A N N I N G

Comparison of Risk Assessment Tools

for the Water Sector

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AWWA Management Standards

- “G Standards”
- AWWA management standards “describe consensus requirements for utility management practices”
- Their use is “voluntary,” not a regulatory requirement
- “Intended to serve the water sector and improve overall operations and service”
- Establishes “formal management and operations guidelines”

Risk Assessments are Standard Practice in the Water Sector

- AWWA G430-14 Security Practices for Operation and Management
 - 4.4.1 The utility shall perform a risk assessment...
 - 4.4.2 The utility shall review and update its risk assessment as new hazards and threats emerge...
 - 4.4.3 The [review] schedule shall not exceed five years...
- AWWA G440-11 Emergency Preparedness Practices
 - Same as above
- Both standards “define the minimum emergency preparedness requirements for water, wastewater, or reuse facilities to respond to emergencies and restore normal operations, minimizing the disruption of critical services while sustaining public health, protecting property, and maintaining consumer confidence.”

HOW DID WE GET HERE?

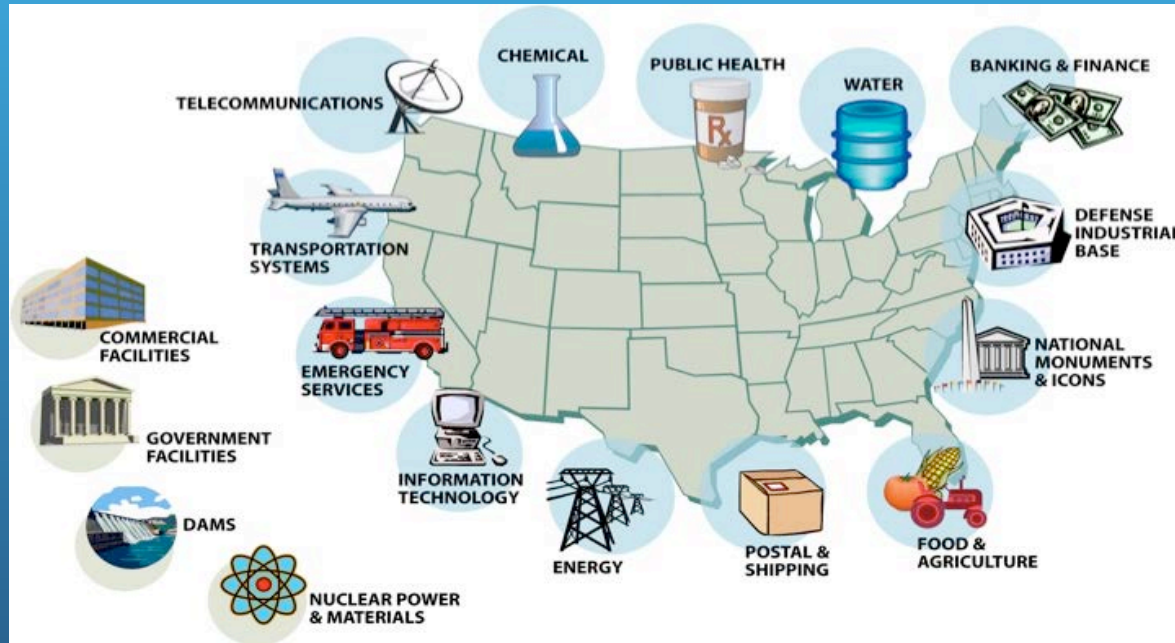
Public Health Security and Bioterrorism Preparedness and Response Act of 2002

- All water utilities servicing more than 3,300 people required to:
 - Perform Vulnerability Assessments (VA)
 - Update Emergency Response Plans to include the results of the VA



By December 2003...

- Homeland Security Presidential Directive (HSPD)-7*:
 - Identifies 18 critical infrastructure and key resources (CIKR) sectors
 - Assigned EPA as the Sector-Specific Agency for the water and wastewater sector



*Homeland Security Presidential Directive 7 (HSPD-7) from 2006 to 2009 and the Presidential Policy Directive 21 (PPD-21) after 2009

Since 2003, a Lot Has Changed



Since 2003, a Lot Has Changed

CLIMATE CHANGE EFF

IMPAIRMENTS

Source Water

- Regional drought
- Intake elevations
- Water quality issues
- Evaporation
- Groundwater depletion
- Seawater intrusion

Water Treatment

- Sedimentation
- Additional treatment requirements
- Siting elevations
- Water quality issues
- Infrastructure flooding

Wastewater

- Siting elevations
- Outfall elevations
- SSO and CSO frequency
- Temp-dependent processes
- Receiving water quality
- Infrastructure flooding

Ecosystem

Agriculture

Stormwater

CLIMATE CHANGE EFF

- Increase
- Drought
- Floods
- More Frequent Storm Events
- Rising Sea Levels



STOP WORKPLACE VIOLENCE

ACTIVE SHOOTER

HOW TO RESPOND

GUIDANCE ON HOW TO RESPOND TO AN ACTIVE SHOOTER SITUATION AND REACT WHEN LAW ENFORCEMENT RESPONDS



Common risk management framework for all critical sectors

PPD-21 set forth a comprehensive risk management framework and clearly defines critical infrastructure protection roles and responsibilities.



National Infrastructure Protection Plan

Partnering to enhance protection and resiliency

Managing Risk is a Utility Responsibility

(supported by public partnership)

PPD-21 states, “Critical infrastructure owners and operators are uniquely positioned to manage risks ... and to determine effective strategies to make them more secure and resilient.”



Utility risk assessments are one of the main topics of this plan:

“Utilities risk assessments prioritize security and emergency preparedness improvements by incorporating prevention, detection, response, and recovery concepts into their overall risk management strategy.”



Water Sector-Specific Plan

An Annex to the National Infrastructure Protection Plan

2010



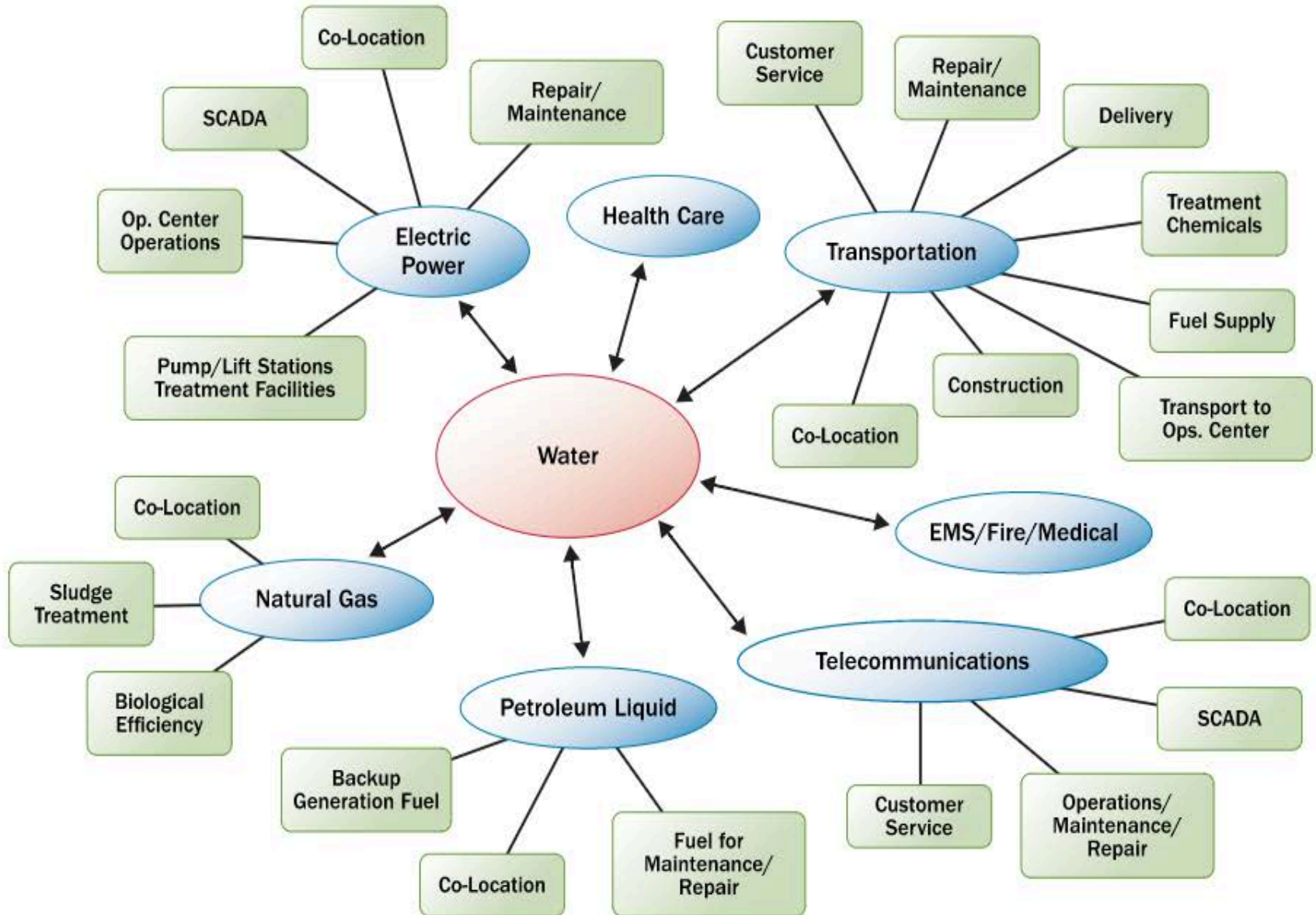
Homeland
Security



United States
Environmental
Protection Agency

(from Water Sector Specific Plan)

Figure 3-2: Interdependencies with the Water Sector



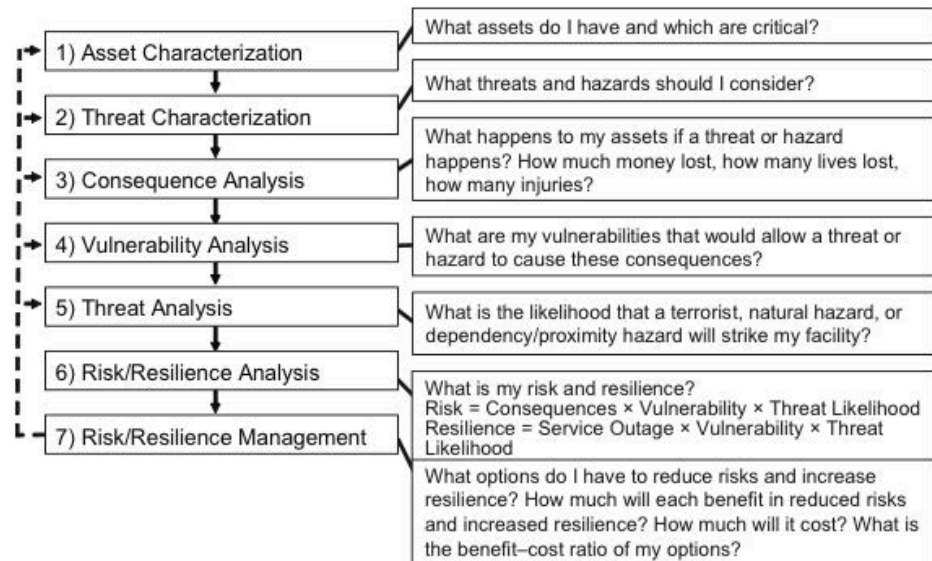
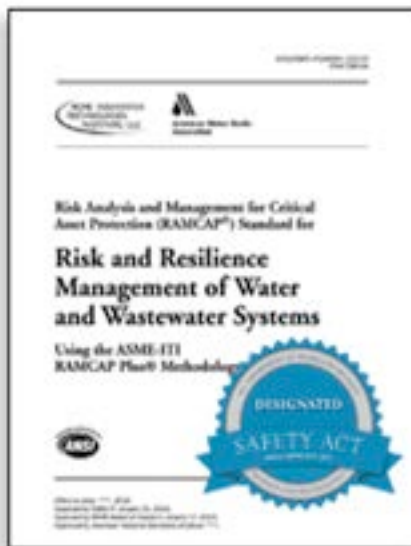
What is RAMCAP?

- Risk Analysis and Management for Critical Asset Protection (RAMCAP®) Standard
- “ANSI/ASME-ITI/AWWA J100-10”



By 2010, the VA process was retooled to respond to the needs of the nation to protect the water and wastewater infrastructure

~~Vulnerability Assessment~~ → Risk Assessment



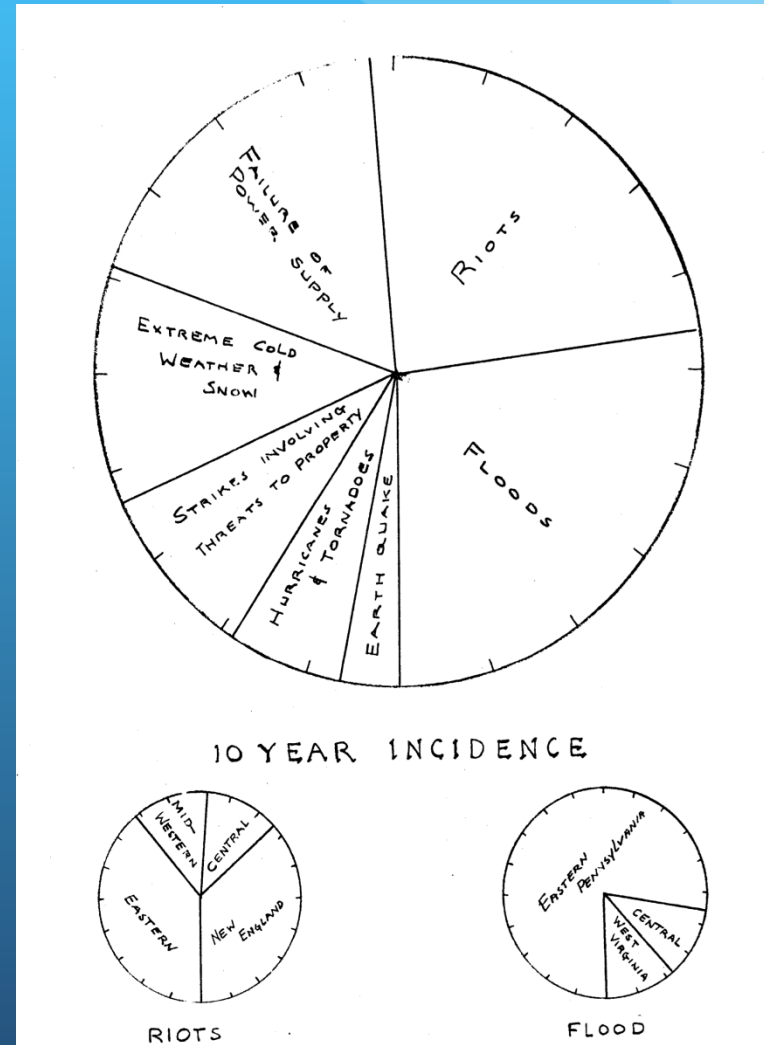
Risk Analysis

- RAMCAP® is a process for analyzing and managing the risks associated with malevolent attacks and naturally occurring hazards against critical infrastructure

$$\begin{aligned} & \text{CONSEQUENCE} \times \\ & \text{THREAT LIKELIHOOD} \times \\ & \text{VULNERABILITY} = \\ & \text{RISK} \end{aligned}$$

Page from a 1973 Risk Assessment Report for a Water System in Pennsylvania

Risk assessments in the water sector were performed long before 2001. They are useful for planning.



Benefits of Performing a Risk Assessment

- Standard practice across critical key infrastructure sectors
- Provide insights about water and wastewater system vulnerabilities, consequences and risks as support for internal decisions.
- Lower risks, increase resilience to attacks and natural hazards.
- Improve reliability of service.
- Improve ability to communicate risk.
- Assist in rate and fee setting to pay for reliability.
- May reduce insurance costs and/or improve credit ratings, etc.

Threats and Hazards in RAMCAP

- Specific reference threat scenarios are included in the Standard
 - **Natural events**
 - Flood, hurricane, tornado, wildfire, ice storm, earthquake
 - **Man-made events**
 - Contamination of product, process sabotage, diversion or theft, boat as weapon, plane as weapon, vehicle as weapon, assault teams
 - **Dependency and proximity hazards**
 - Other utilities, service interruptions of key suppliers, proximity to others' assets that carry significant risk)

RAMCAP Risk Assessment Tools



- Owned by AEM Corporation
- Buy annual license
- Web-based
- More user-friendly
- 1-hour of free technical support
- Been available for 2 years
- Been consistent with RAMCAP since its inception
- Good for any-size system



- Owned by EPA
- Free
- Not web-based
- Online tutorial videos
- Used more often than PARRE
- No technical support
- Latest version (6.02) is consistent with RAMCAP
- Good for small and some medium-sized systems

Getting the Tools



PARRE™

About ▾ Products & Services ▾ Resources ▾



PARRE PROFESSIONAL
by AEM Corporation

Qty: 1 ▾

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The Program to Assist Risk & Resilience Examination (PARRE) is an interactive application designed to assist owner/operator assessment teams in conducting a probability-based risk & resilience assessment of their critical assets.



Conduct a Drinking Water or Wastewater Assessment

Vulnerability Self-Assessment Tool (VSAT) 6.0

Drinking water and wastewater utilities of all sizes can use VSAT to enhance their risk assessment and resiliency. Utilities can:

- Identify the highest risks to mission-critical operations
- Find the most cost-effective measures to reduce those risks

VSAT Version 6.0 complies with the water sector risk assessment standard under the Department of Homeland Security's Support Anti-Terrorism by Enhancing Water Sector Resiliency (SAFETY) Act program. EPA strongly encourages drinking water and wastewater utilities to use VSAT 6.0 to conduct or update an all-hazards risk assessment.

Download VSAT 6.0

VSAT 6.0 Training V

Home Screens

PARRE™

File View Administration Resources Process Steps Help

VSAT Home Tools

Home

VSAT is a risk assessment application for water, wastewater, and combined utilities of all sizes. It allows utilities to develop a risk assessment by guiding them through a series of

Setup
VSAT captures a variety of information about your utility including size and location. You can also specify other data used during analysis.

Assets
VSAT provides a standardized list of assets. You can modify the asset inventory to reflect your specific facility (wastewater, water, or water-wastewater).

Countermeasures
VSAT provides a template of commonly used countermeasures and users can develop new countermeasures and assign to assets. Assign countermeasures to the assets they protect. During analysis, they are evaluated for the protection they provide.

Threats
The water sector has defined a common framework to assess terrorist and natural hazard risk to utility systems. Select the threats that apply and define facility-specific threats.

Baseline
After establishing the asset risk level associated with currently in place.

Improvement
After conducting a baseline ways to lower the risk as

Cost/Risk
Use the Cost/Risk module that conform to existing

Results & Reports
Generate reports of the threats, countermeasures

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Threat/Asset Identification

Asset Characterization

Threat Characterization

Asset/Threat Characterization

Data Documentation

Direct Threats

Consequence Analysis

Vulnerability Analysis

Threat Analysis

Indirect Threats

Natural Threat Analysis

Dependency Threat Analysis

Data Analysis

Risk/Resilience Analysis

Risk/Resilience Management

Reports

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Additional Features of PARRE

- Two levels of prioritization and screening to refine scope of assessment
 - One at asset level and one at asset-threat pair level
- Vulnerability Analysis of Malevolent Threats has 4 built-in methods to choose:
 1. Direct expert elicitation
 2. Path analysis
 3. Vulnerability logic diagram
 4. Event tree
- Threat Analysis of Malevolent Threats has 3 built-in methods to choose:
 1. Conditional probability
 2. Best estimate
 3. Proxy indicator

Additional Features of PARRE

- Natural Threat Analysis has built-in calculators for hurricane, earthquake, tornado, floods, and ice storms to evaluate natural threats or you can manually input values

Edit/Calculate Hurricane Threat

Asset ID

Threat N(H)

Fatalities 0

Serious Injuries 0

Duration (days) 0

Severity (MGD) 0

Economic Impact 0

Manually enter risk totals.

Financial Impact 100,000,000

Vulnerability 1

Threat Likelihood 0.0167

Calculator

Operational Loss (\$) 100,000,000

Replacement Cost (\$) 0

Damage Factor 0.5

Design Speed 100

Hurricane Profile

Financial Total (\$) 100,000,000

Total Risk (\$) 1,670,000

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Baseline Results for Both

Asset	Threat	Number of Fatalities	Number of Injuries	Fatalities (\$)	Injuries (\$)	Utility Financial Impact	Regional Economic Impact
Treatment Facility	S(PI) - Process Sabotage-Physical Insider	50	2000	\$390,000,000	\$156,000,000	\$100,000,000	\$1,000,000,000
Treatment Facility	AT1 - Assault Team 1	50	2000	\$390,000,000	\$156,000,000	\$100,000,000	\$1,000,000,000
Treatment Facility	V1 - Car Bomb	50	2000	\$390,000,000	\$156,000,000	\$10,000,000	\$100,000,000
----- Lake	C(C) – Contamination	50	2000	\$390,000,000	\$156,000,000	\$11,000,000	\$110,000,000
----- Street Offices	Active Shooter	8	20	\$62,400,000	\$1,560,000	\$1,000,000	\$10,000,000
Treatment Facility	Active Shooter	4	10	\$31,200,000	\$780,000	\$1,000,000	\$10,000,000
-----Storage	C(C) – Contamination	4	8	\$31,200,000	\$624,000	\$2,000,000	\$20,000,000
----- Street Offices	H1 - Category 1	2	2	\$15,600,000	\$156,000	\$10,000,000	\$0
Transmission Mains	F2 - 500-year flood	2	2	\$15,600,000	\$156,000	\$5,000,000	\$2,000,000
Distribution Mains	F2 - 500-year flood	2	2	\$15,600,000	\$156,000	\$500,000	\$100,000
-----Storage	T1 - Fujita 1	2	4	\$15,600,000	\$312,000	\$2,000,000	\$0
-----Storage	C(C) – Contamination	2	4	\$15,600,000	\$312,000	\$4,000,000	\$40,000,000
----- Storage	C(C) – Contamination	2	4	\$15,600,000	\$312,000	\$3,000,000	\$30,000,000
-----Storage	C(C) – Contamination	2	4	\$15,600,000	\$312,000	\$2,000,000	\$20,000,000
-----Storage	C(C) – Contamination	2	4	\$15,600,000	\$312,000	\$2,000,000	\$20,000,000
----- Storage	C(C) – Contamination	2	4	\$15,600,000	\$312,000	\$5,000,000	\$50,000,000
Continued...							

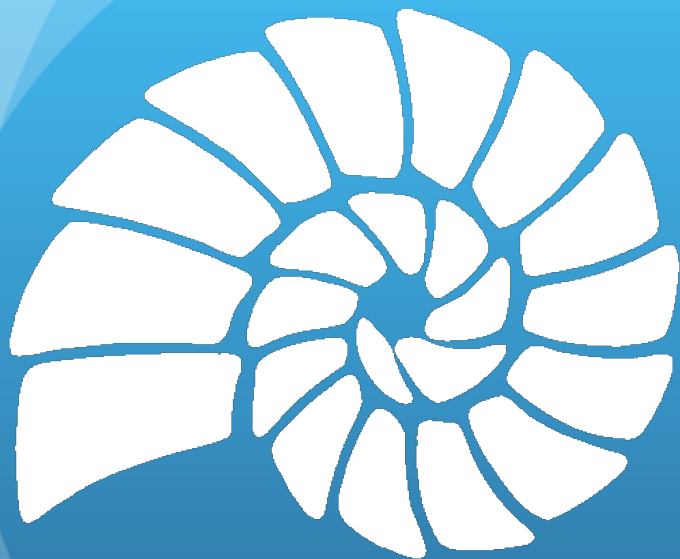
Baseline Results for Both

Asset	Threat	Likelihood of Damage	Likelihood of Threat	Total Monetized Risk
Treatment Facility	S(PI) - Process Sabotage-Physical Insider	0.3	0.0001	\$49,380
Treatment Facility	AT1 - Assault Team 1	0.3	0.000000001	\$0
Treatment Facility	V1 - Car Bomb	0.3	0.000000001	\$0
----- Lake	C(C) – Contamination	0.15	1E-10	\$0
----- Street Offices	Active Shooter	0.03	0.0001	\$225
Treatment Facility	Active Shooter	0.3	0.00001	\$129
-----Storage	C(C) – Contamination	0.05	1E-10	\$0
----- Street Offices	H1 - Category 1	0.03	0.0233	\$18,003
Transmission Mains	F2 - 500-year flood	0.25	0.002	\$11,378
Distribution Mains	F2 - 500-year flood	0.25	0.002	\$8,178
-----Storage	T1 - Fujita 1	0.2	0.0001412	\$506
-----Storage	C(C) – Contamination	0.1	1E-10	\$0
----- Storage	C(C) – Contamination	0.1	1E-10	\$0
-----Storage	C(C) – Contamination	0.1	1E-10	\$0
-----Storage	C(C) – Contamination	0.1	1E-10	\$0
----- Storage	C(C) – Contamination	0.05	1E-10	\$0
Continued...				

RAMCAP Risk Assessment Report

- Top threats
- Asset-threat pair risks prioritized
- Risk reduction options prioritized
- And more...





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