Hawaiʻi State Energy Office Distribution and Integrated Resource Planning - Integrating Resiliency

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Risk Assessment Methodology

Exposure × Sensitivity × Consequence = Risk

Exposure

- Specific to location
- Probability of occurrence on an annual basis, assigned to buckets
- Informed by historic climate data (NOAA, NWS, etc.) in collaboration with the State Hazard Mitigation Plan and probabilistic models

Sensitivity

- Specific to asset type
- Can be interpreted as the expected outage duration from exposure to a given threat, bucketed 1–3
- Informed by subject matter experts

Consequence

- Specific to asset
- Primary consequence represented as lost energy supply from asset outage
- Secondary consequence represented by cost to society of lost supply– our focus with the CLKC dependency analysis
- Informed by analysis of asset and interdependency relation

Community Lifeline and Key Customers (CLKC) include Emergency operation centers, fire stations, police stations, shelters, hospitals and other medical centers, communication assets, water and wastewater systems, etc.

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Hazards Studied in Assessment

Quantitative Risk Assessment

- Coastal Flooding/Erosion
- Tsunami
- High Winds
- Earthquake
- Inland and Coastal Flooding (100- and 500-Year Floodplains
- Landslide and Rockfall
- Wildfire

Qualitative Risk Assessment

- Cyberattack
- Fuel Disruption
- Human Error or Accident
- Equipment Malfunction
- Pandemic

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Sensitivity

- Sensitivity scores, assessment of the likelihood and extent of damage and duration of infrastructure outage, were assigned into buckets of 1 through 3 based on subject matter expertise, including a utility and oil sector SMEs.
- A matrix of energy asset types vs. each natural hazard was created.

	Coastal Flooding and Erosion	High Winds	Flooding (inland and storm surge)	Tsunami	Earthquake	Landslide and Rockfall	Wildfire
Solar	2	1	2	3	2	2	2
Wind	2	3	2	2	2	2	1
Batteries	2	1	2	3	3	3	2
All Other Generation	2	1	2	3	3	3	2
Substations	2	1	2	3	3	3	2
Transmission Lines (overhead)	2	3	1	2	3	3	3
Transmission Lines (under)	2	1	1	1	2	2	1
Refinery	2	2	3	3	3	2	3
Liquid Pipelines	2	1	1	1	3	2	1
Ports	2	2	2	2	3	2	2
Terminals	2	2	3	3	2	2	3
Gas Production Facilities	2	2	3	3	3	2	3
Gas Pipelines	2	1	1	1	2	2	1

Consequence

- This risk assessment has a particular focus on exploring the relationships between CEI and community lifeline key customers (CLKC). Therefore, the dependency of CLKC on the CEI is an important factor in consequence scoring, especially for the electric system.
- Consequence was then scored on a scale of 1 to 6 with the following approach:

Table 2: Consequence Scoring Table

Consequence Score	Substations and Transmission Lines		Other Infrastructure Types
	Voltage	CLKC Weighted Dependency	Priority Score
6	138kV	≥20*	High
5	138kV	0-20	
4	138kV	0	Medium
3	69kV or below	≥20	
2	69kV or below	0-20	Low
1	69kV or below	0	

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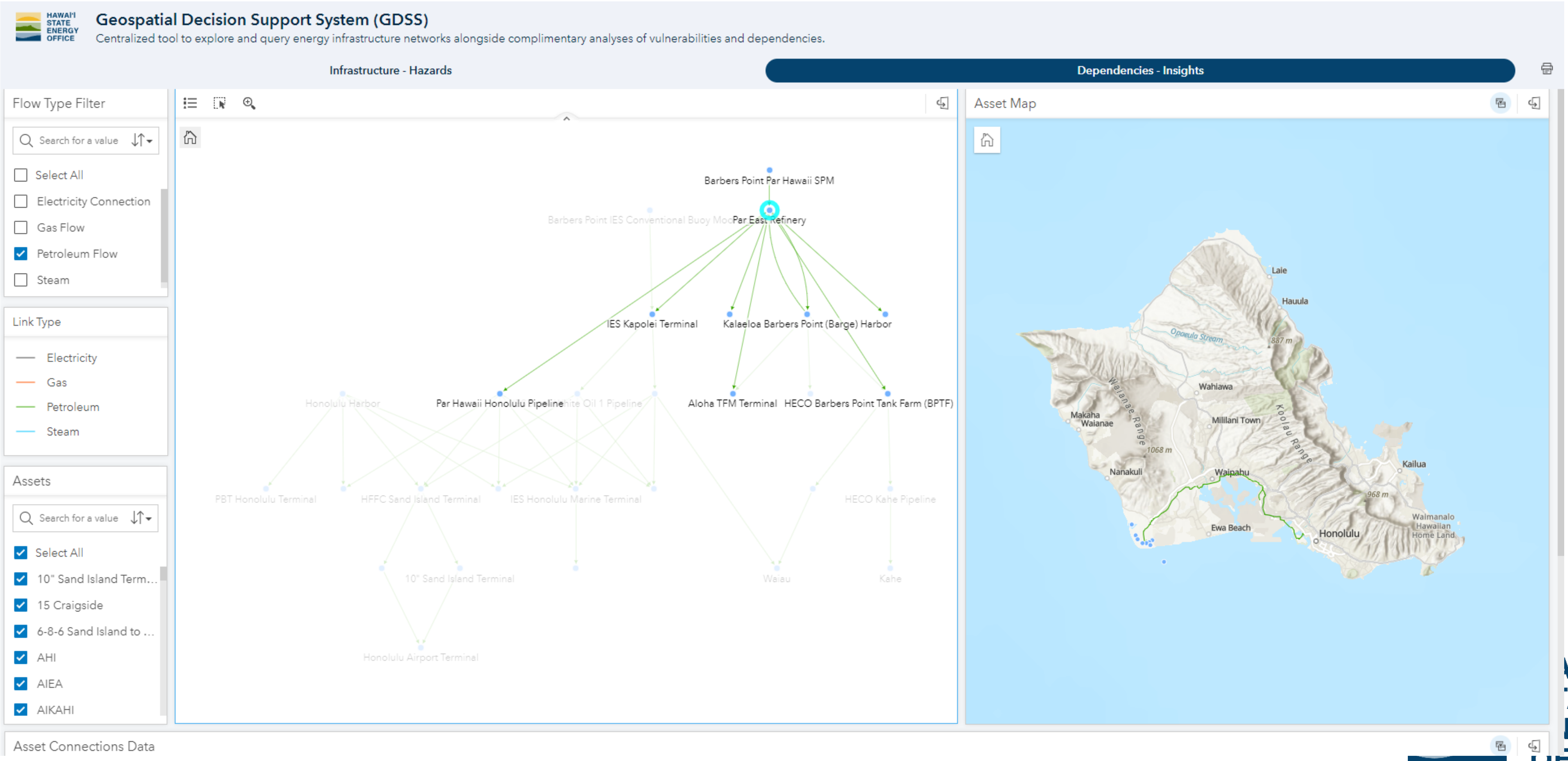
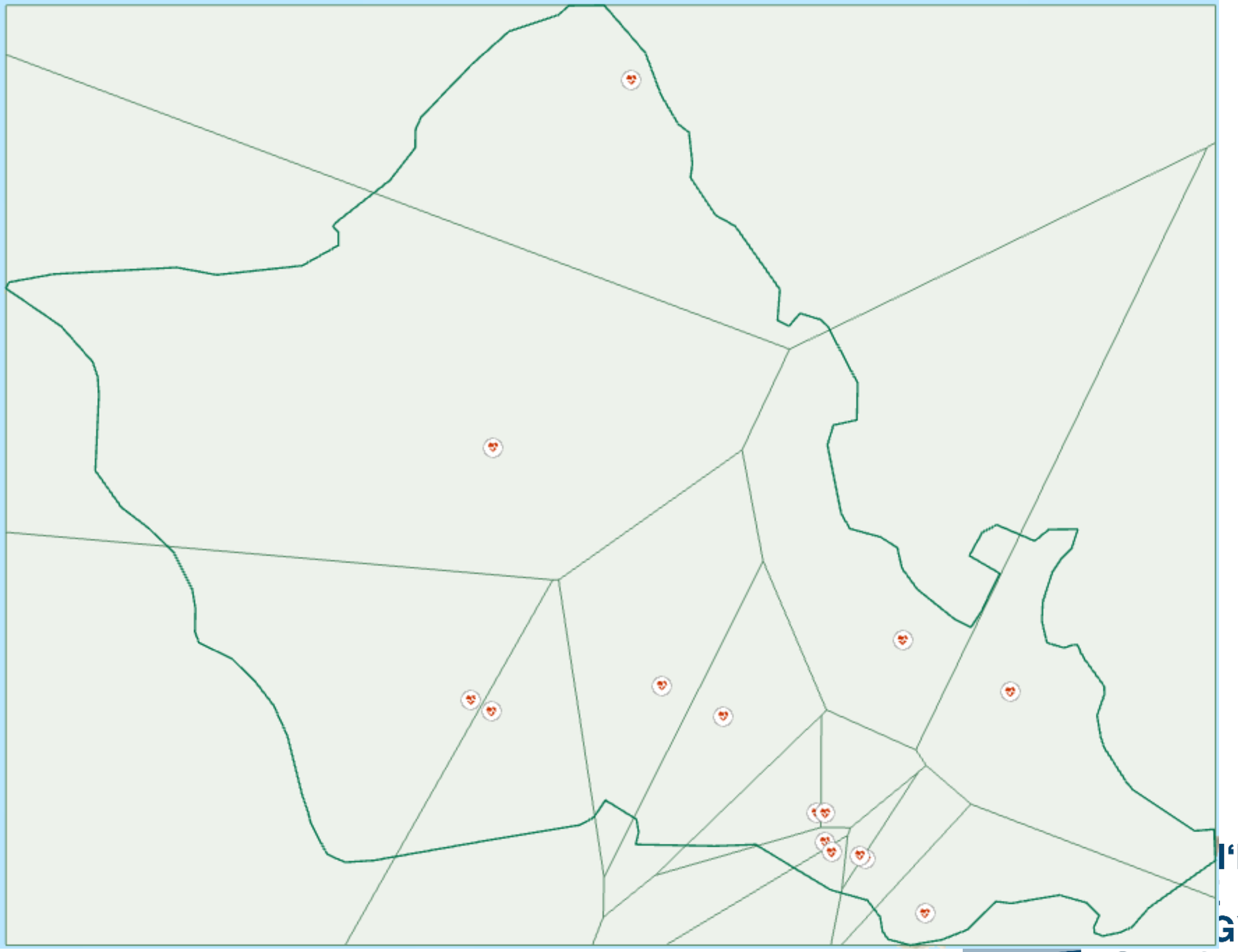
Critical Energy Infrastructure Interdependencies



CLKC Prioritization

ArcGIS tools were used to assign many of the CLKC assets (hospitals, police, fire) a Thiessen polygon area that represents the most likely service territory of each CLKC. This was based on proximity of each census tract to the associated CLKC point vs. to any other CLKC point.

These layers were then intersected with population and disadvantage community datasets to estimate the population and disadvantaged community served by the CLKC.



Aloha

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