Developing a Method for Measuring the Climate Resilience of Water Policy Subsystems

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OVERVIEW

I. Climate Change Policy Challenges

II. Existing Methods

III. Research for Improving Methods for Evaluating Community Policy Resilience

Climate Change Challenges For Policy Communities

- ***Modeling Information:*** Problematic for Decision-making
- ***New Uncertainties:*** Non-stationarity, Cascades of Uncertainty, Tipping Points, Projections
- ***New Challenges:*** Improving Robustness and Resilience of Local Policy Systems
- ***Methods:*** Need for Innovation

NETWORKED APPROACH

- ***Impacts:*** Highly Localized And Regional
- ***Governance Structures:*** Most Already Exist
- ***Pros:***
  - ✓ Flexible Policy Structures
  - ✓ Inclusion of More Diverse Organizational Entities
  - ✓ Coordination and Cooperation Across Jurisdictions, Sectors, Spatial Units, and Resources

WHAT IS MEANT BY GOVERNANCE?

Governance can be defined as "…institutionalized modes of social coordination to produce and implement collectively binding rules, or to provide collective goods through both structural ("institutionalized") and process dimensions ("modes of social coordination")".

- Risse, 2011, ***Governance without a State.***

MANAGING CLIMATE RISK AND UNCERTAINTY
Two Emergent Approaches

Robustness ***vs.*** ***Resilience***

Robust System:

- ✓ Ranges of Future Conditions
- ✓ Not Always Optimal Under a Smaller Range of Conditions

Resilient System:

- ✓ Respond to Disturbances
- ✓ Resist Damage
- ✓ Adapt Rapidly to New Conditions

CRITIQUES OF ROBUSTNESS APPROACH

- ***Decision Analysis:*** Risk-reduction and "No Regrets"
- ***Potential For:*** Demand Hardening and Maladaptation
- ***Does Not Account For:***
  - ✓Inherent Uncertainty of Complex Systems
  - ✓Surprises
- ***Methods Subject to Bias:***
  - ✓Expert Judgment

CRITIQUES OF RESILIENCE THEORY

- ***Resilience to Exogenous Shock:***
  - ⬆ Resilience to One ⬇ Resilience to Another
- ***Current Literature:***
  - ⬆ Metaphors ⬇ Empirical Measurement
- ***Intellectual Roots:*** Ecological Theory
  - Policy Systems ✖ Ecological Systems
- ***Policy Sciences:*** Current Understanding Not Much Explicitly Utilized
- ***Heavy Reliance:*** Single Case Studies and Ad Hoc Analysis
- ***BUT…***
  - Improvements Over Business-as-usual…

APPLYING THE CONCEPTS

Goals of this project are to capture inherent potential of the policy system to avoid, or recover from, a negative impact to the system without reducing, or even improving, the delivery of public good/service

Develops an empirical measure of the resilience of a policy system

METHODS

Level of Measurement:

Resilience of a policy system at a community level, focused on specific policy system

Theory:

- ✓ Institutional analysis
- ✓ Network theory with focus on decision nodes

APPLICATION OF THE APPROACH

- ***Case Studies:***

  Comparative Analysis of Two Community Water Delivery Systems

  - ✓ Truckee Meadows
  - ✓ Las Vegas

APPLICATION OF THE APPROACH

- ***Data:*** Based on Interviews with Water Managers at Multiple Levels Responsible for

  - ✓ Allocation
  - ✓ Use
  - ✓ Access
  - ✓ Management
  - ✓ Inputs

  } Contribute to Overall Water System

APPLICATION OF THE APPROACH

- ***Assessment method:***
  - ✓ Queries Individual Responses to a Variety of Self-assessment Climate Risk Scenarios:
    - Flood
    - Seasonal Variability in Snowpack
    - Reduced Snowpack
    - Supply Interruption
    - Long-term Drought
  - ✓ Identifies Problems within the Entire Production System and at Each Decision Node

MEASURING RESILIENCE

***Characteristics of a Resilient System as Applied to Policy Sub-systems*:**

1) **Multiple Feedback Loops**
2) **Diversity**
3) **Redundancy and Modularity**
4) **Degree of Social Capital**
5) **Responsive to Change**

MEASURING RESILIENCE

1.) MULTIPLE FEEDBACK LOOPS

- Awareness of Climate Impacts at Multiple Levels
- Anticipatory Planning
- Awareness and Perception of Changes
- Lateral and Horizontal Information Flows

MEASURING RESILIENCE

2.) DIVERSITY

- Polycentricism
- Diversity in Policy Networks:
  - ✓ Organizations
  - ✓ Users
- Ability to Jump Hierarchical Levels

MEASURING RESILIENCE

3.) REDUNDANCY AND MODULARITY

- Shared Responsibilities
- Diffuse Expertise
- Functional Redundancies

MEASURING RESILIENCE

4.) DEGREE OF SOCIAL CAPITAL

- Levels of Trust
- Degree of Coordination
- Structure of Policy Network

MEASURING RESILIENCE

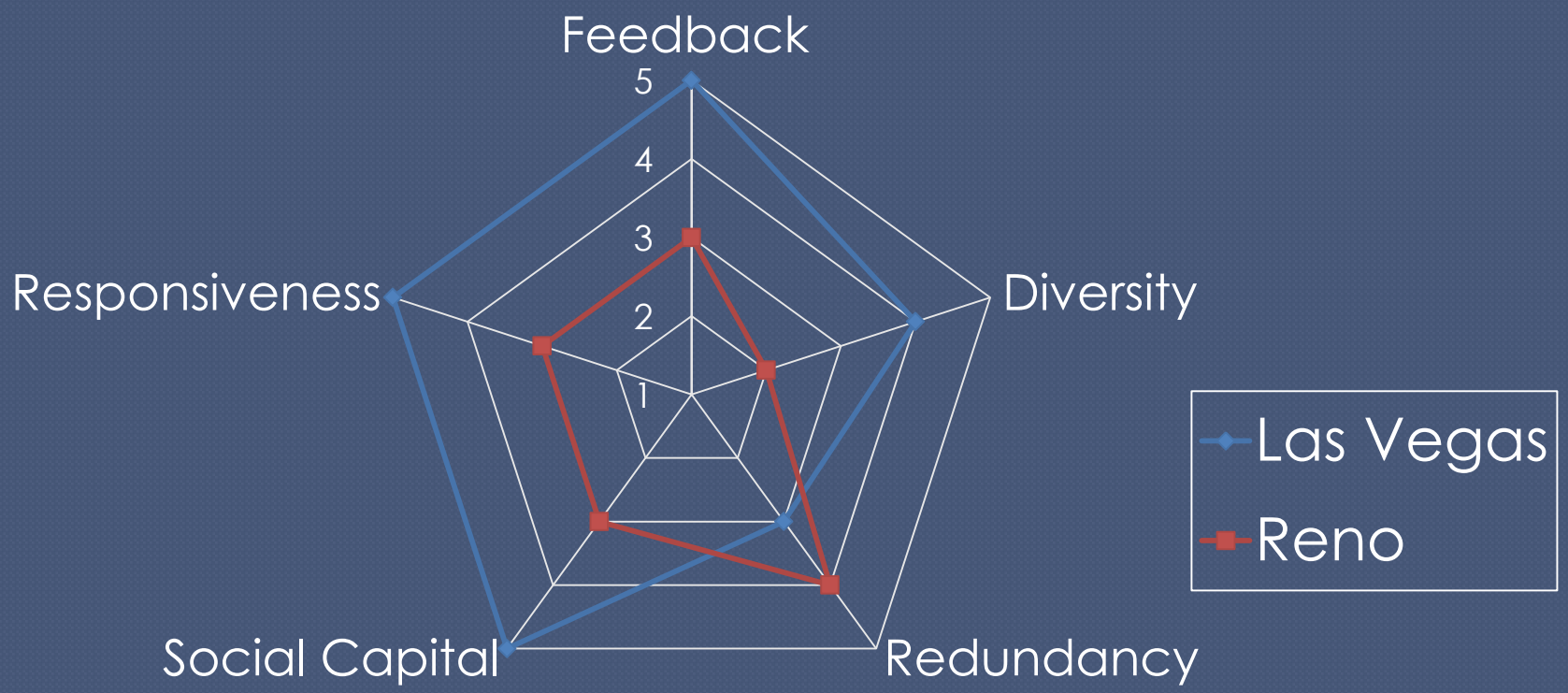
5.) RESPONSIVE TO CHANGE

- Innovation
- Access to Policy Diffusion
- Experimentation
- History of Response to Change
  - ✓ Gradual
  - ✓ Sudden
- Evidence of Organizational and Policy Learning

METHODS

- Content Analysis: Multi-level Interview Data
- Attribute: Scored on a 1-5 Scale
- Cross-validation of the Score
- Weighted Aggregate Across Individual Characteristics
- Weighted Aggregate Across Spatial Influence of Each Organization

RESULTING RESILIENCE INDEX



Contrasting The Two Systems: Truckee Meadows Urban Water System

- Water-related Focusing Events: Lacking
- Climate Impacts: High Degree of Uncertainty due to Heterogeneity of Topography
- Medium Capacity
- Supply Focused

LAS VEGAS URBAN WATER SYSTEM

- Clear Information Signals
- Clear Articulation of Policy Responses
- Clear Understanding of Relevant Decision Space
- High Capacity

CONCLUSIONS

- ***Method Development***

  Empirical Tool for Evaluating Community-level Resilience of Specific Policy Sub-system to Range of Climate Scenarios

- ***Network Approach***

  Allows for Full Range of Formal and Informal Activities that Contribute to Production of Public Goods

CONCLUSIONS

- ***Focus***

  On Combination of Institutional Constraints ***and*** Organizational Interactions

- ***Application***

  Can Diagnose those Aspects that Lead to Reduced System Resilience

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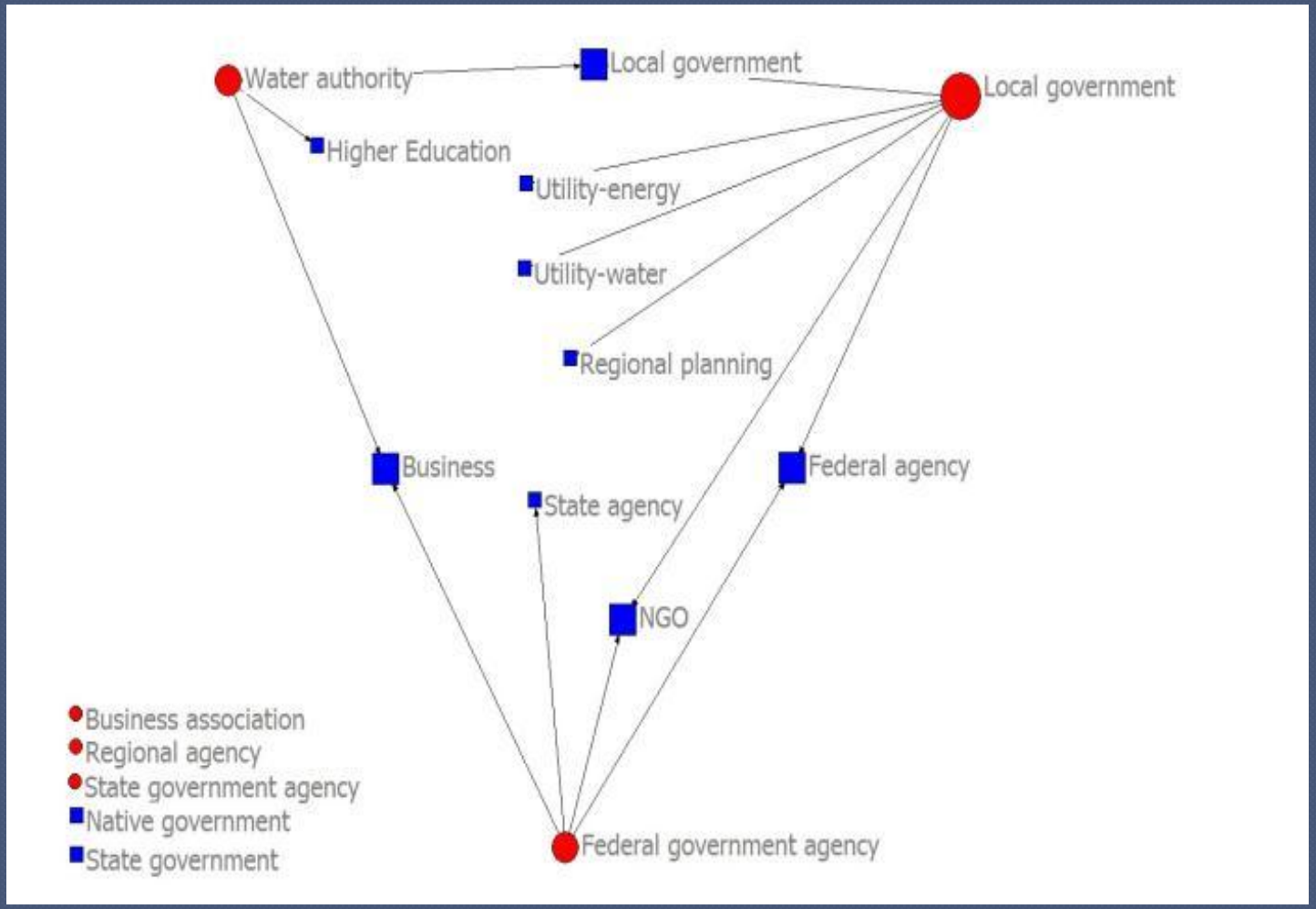
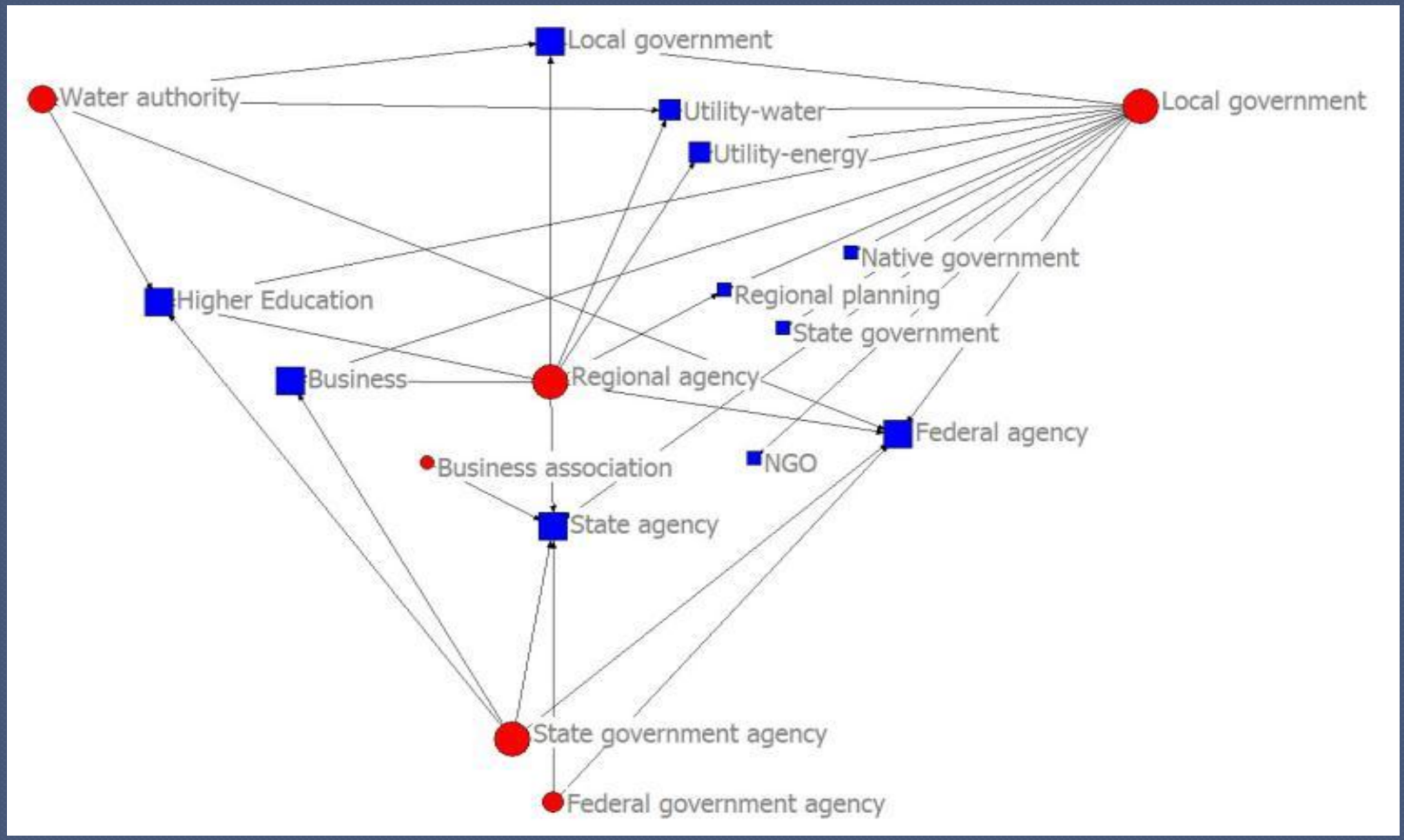
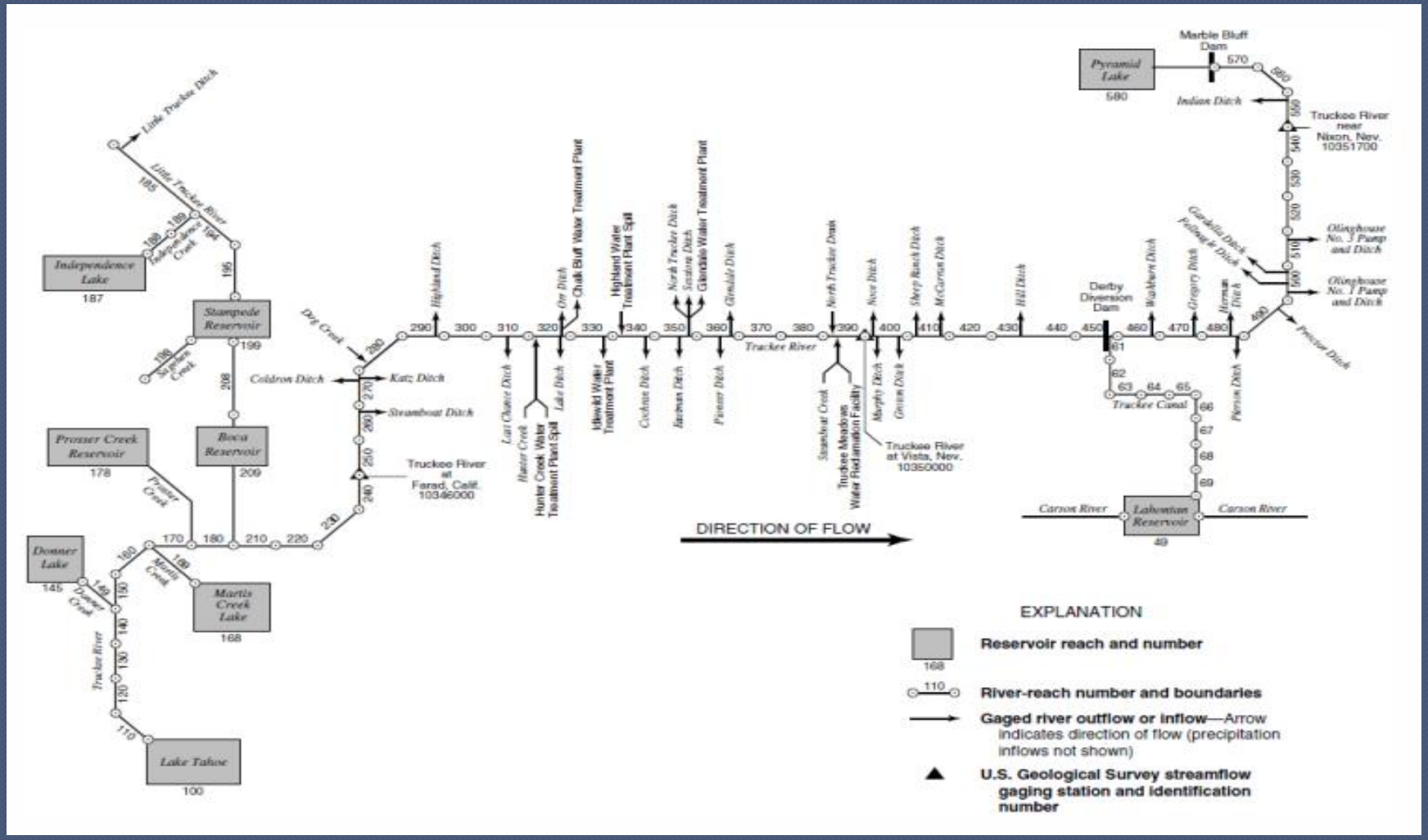
EXISTING NEVADA WATER NETWORKS



ORGANIZATIONS IDENTIFIED AS IMPORTANT



RENO/SPARKS WATER SYSTEM



LAS VEGAS WATER SYSTEM