Delta Risk Management Strategy Risk Analysis Overview

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Presented to

Delta Levees & Habitat Committee

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DRMS Project

- Two phases:
  - Risk Analysis
  - Evaluate Risk Management Strategies

DRMS & AB 1200

AB 1200 (CWC 139.2) Sets the General Framework for both DRSM & DVP

- DWR Shall Evaluate Potential Impacts on 50, 100, 200 year projections on possible impacts to Delta from:
  - Subsidence
  - Earthquakes
  - Floods
  - Climate Change &
  - Combination of above

DRMS & AB1200 (cont.)

- DWR/DFG to Determine Principal Options for Delta & comparatively rate for their ability to:
  - Prevent Disruption of Water Supplies
  - Improve the Quality of Water Supplies
  - Reduce Salts, Maintain Water Quality
  - Preserve, Protect, Improve Delta Levees
  - Protect Water Rights/Environments of River Systems
  - Protect Infrastructure within Delta
- DRMS Report Due – January 2008 (DVP)

DRMS Approach (DWR & SC)

Other Guiding Concepts

- Protect & Enhance Ecosystem
- Assist in Preserving Delta Lands
- Assess Economic Impacts
- Consider “Public Safety”
- Risk Based Evaluation

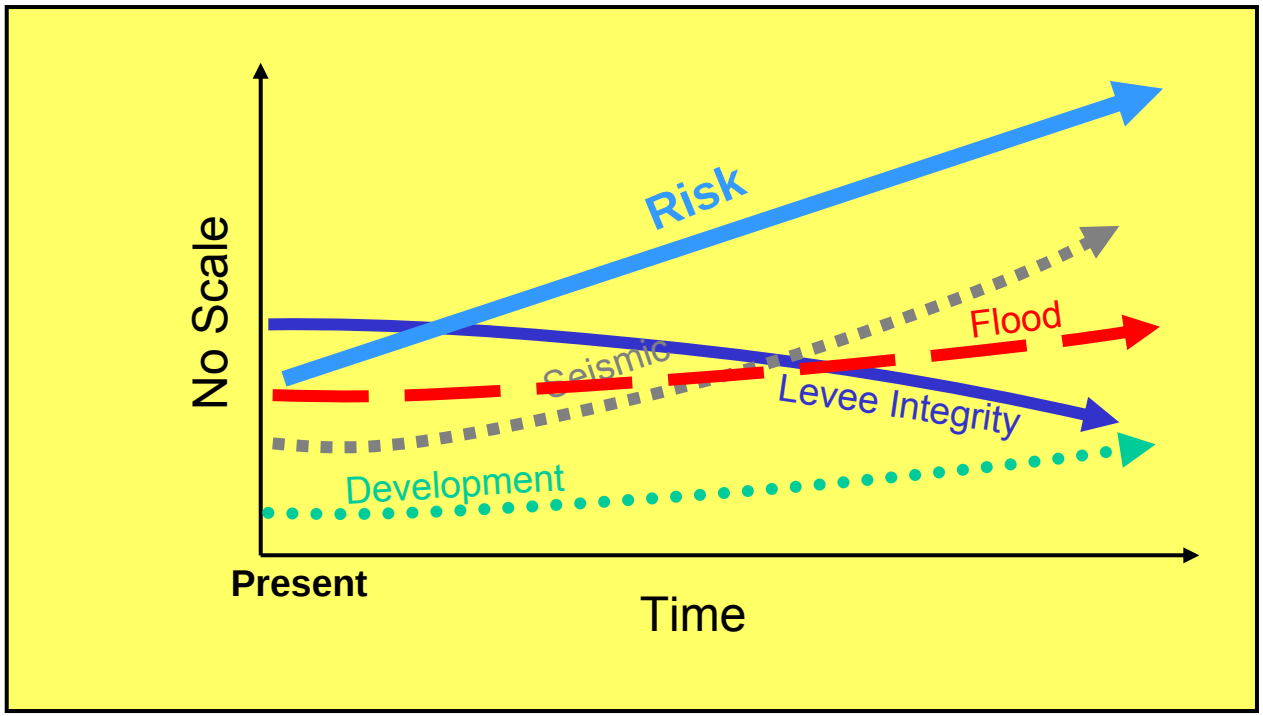
DRMS Risk Analysis

- What can happen?
- How likely are these events to occur?
- How (un)certain are we of the results?

DRMS Risk Analysis

- Risk Analysis for the Delta
  - Multi-hazards, time varying in their frequency and severity
  - Deteriorating system
  - Evaluation for future time periods: 50, 100 and 200 years
  - Complex and not-well understood eco-system
  - Analysis of levee performance, economic, & environmental consequences
- Evaluation of risk management strategies for the Delta

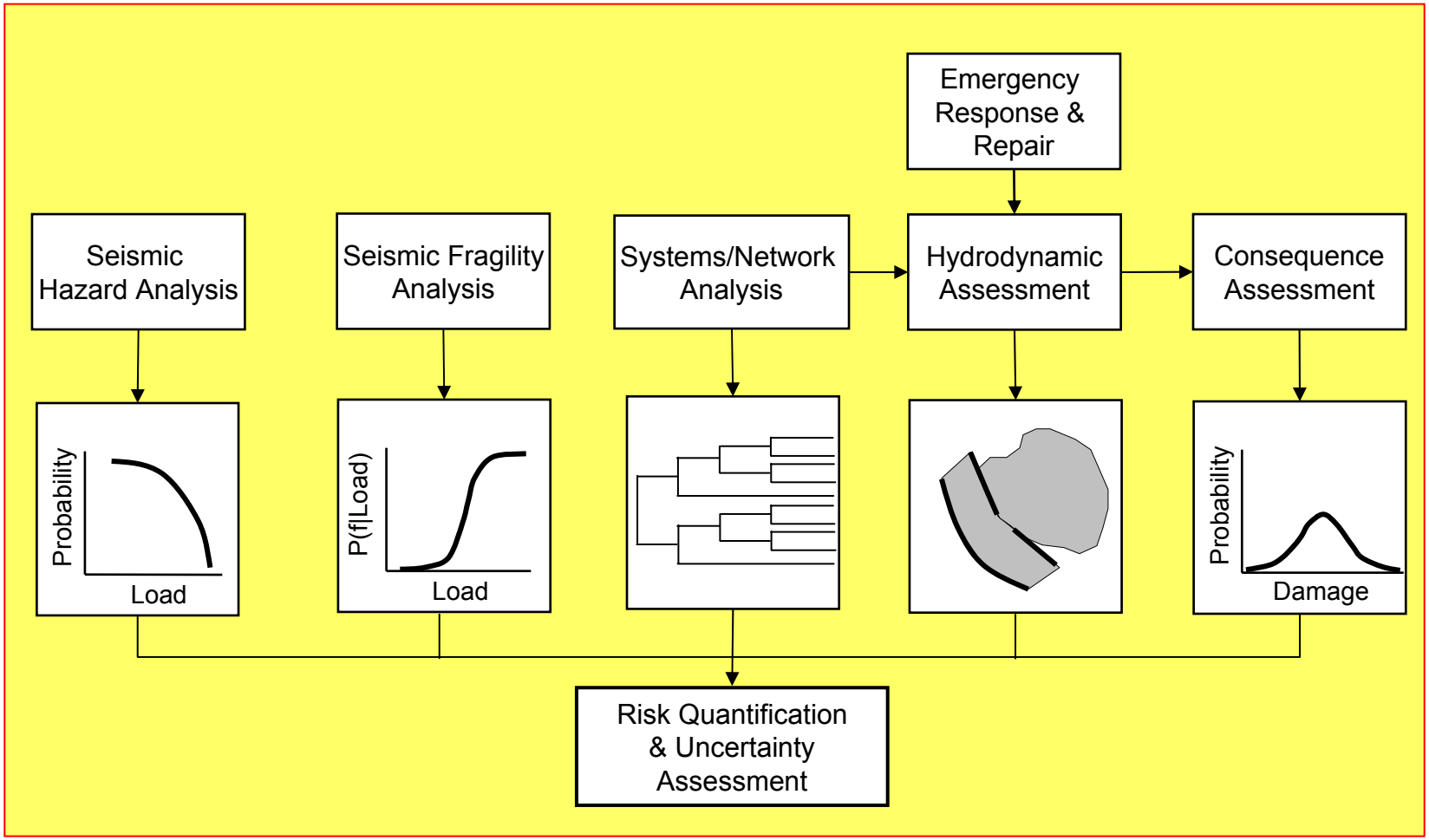
Risk Picture



Business-as-Usual

- Initial (baseline) analysis to be performed using a business-as-usual philosophy.
- Interpretation – evaluate risks presently and into the future assuming we maintain our attention to levee maintenance, etc. at the same rates over the course of the study period (200 years)
- Similarly for emergency response – implement DWR current policy; no extraordinary measures

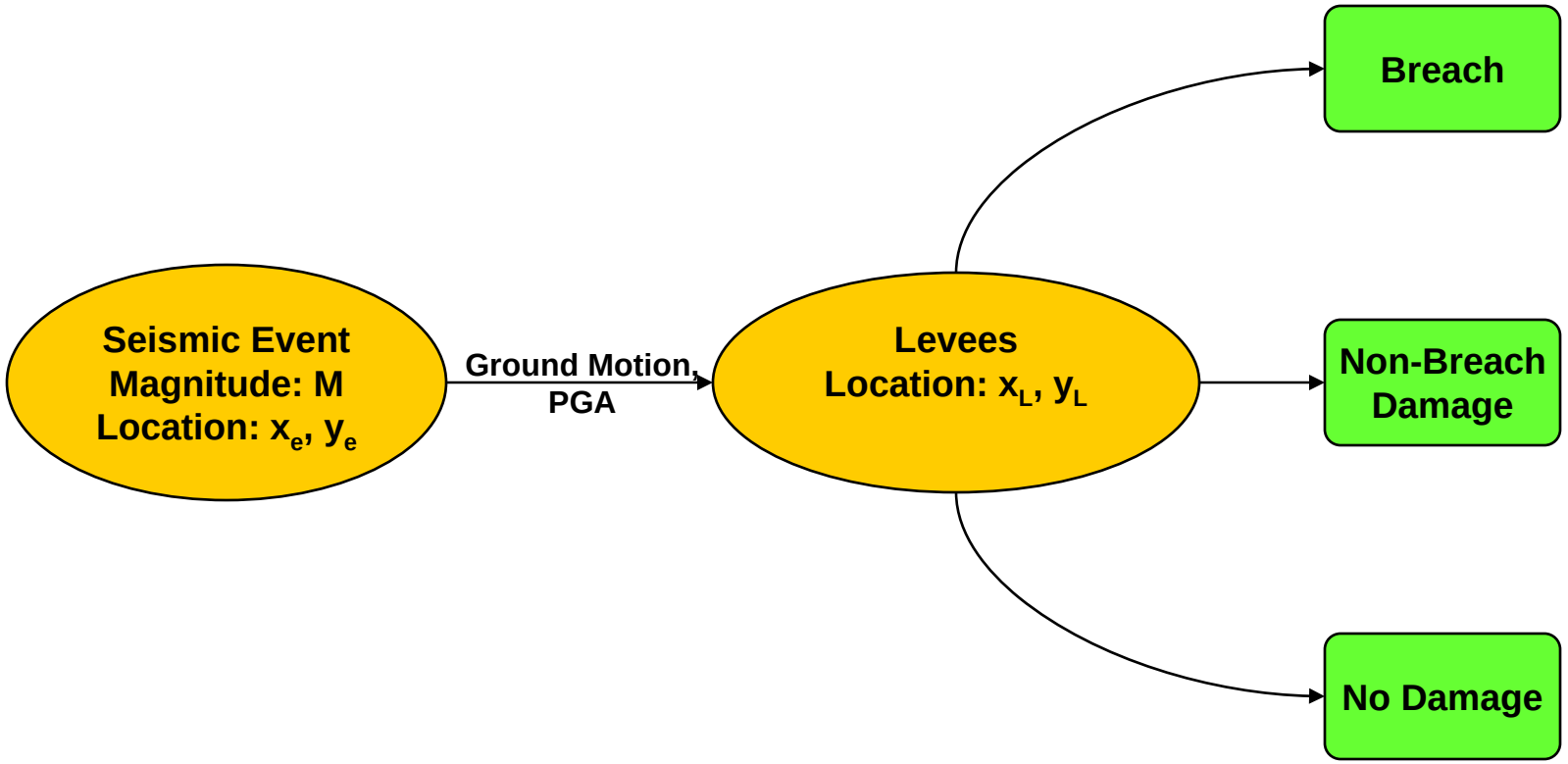
Risk Analysis Model Overview - Seismic



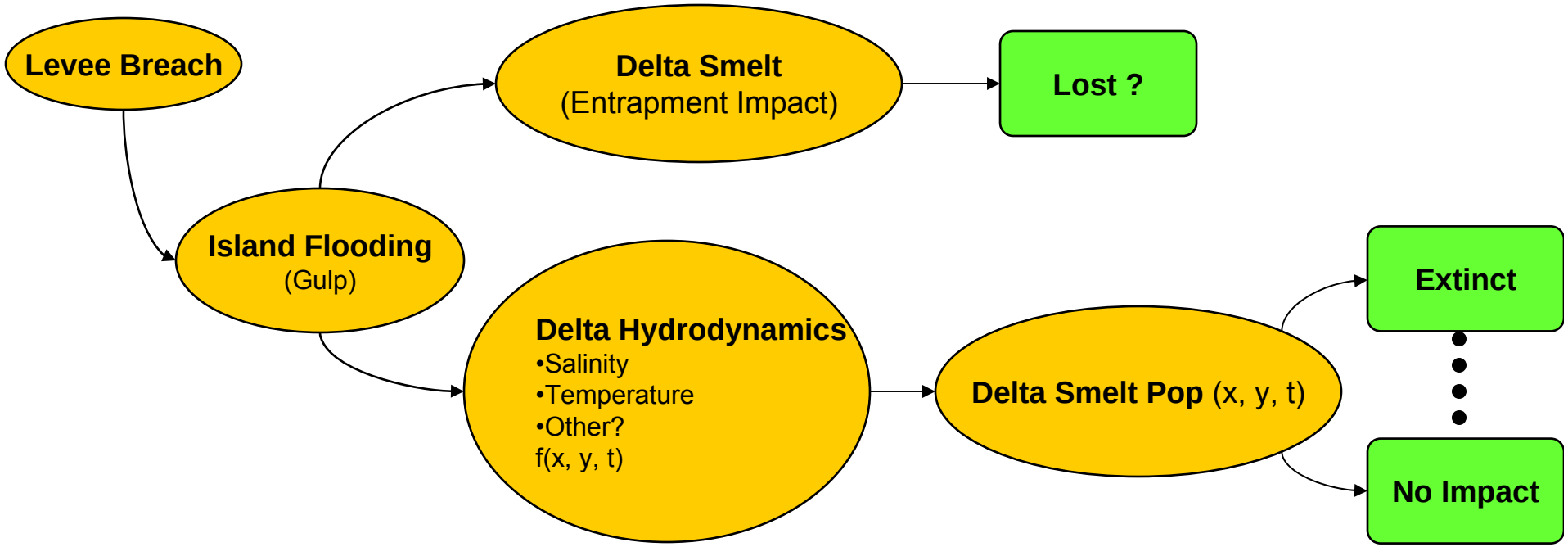
Risk Analysis Overview

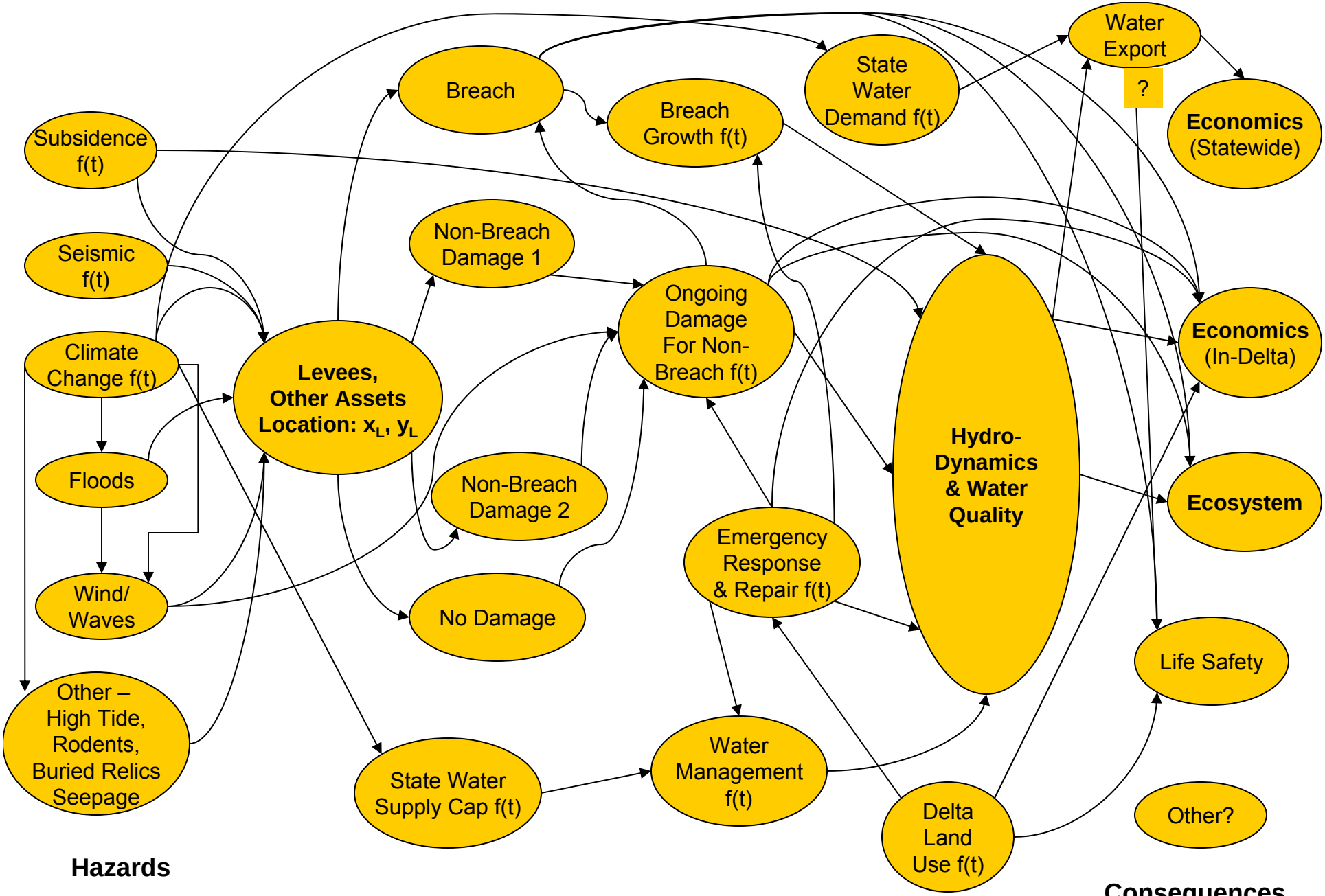
- Basic elements are easily defined
- Increasing complexity moving left to right
  - Building the individual (probabilistic) elements
  - Defining the interface requirements

Earthquake Influence Diagram



Ecosystem (Delta Smelt) Influence Diagram





Overall Influence Diagram ?

Logic Model

- Use logic model approach
- Model:
  - Hazard
  - Year (hydrologic year) type
  - Time of year
  - Levee system performance (which islands flood)
  - Water operations immediately post-event
  - Ongoing damage (island interiors)
  - Emergency response-repair (schedule, timing of repairs)

Logic Model

- Defines:
  - The set of scenarios that can occur
  - The state of the Delta following the event, including intervention/emergency response and repair and continuing damage
  - Conditional probability of each sequence
  - Frequency of occurrence

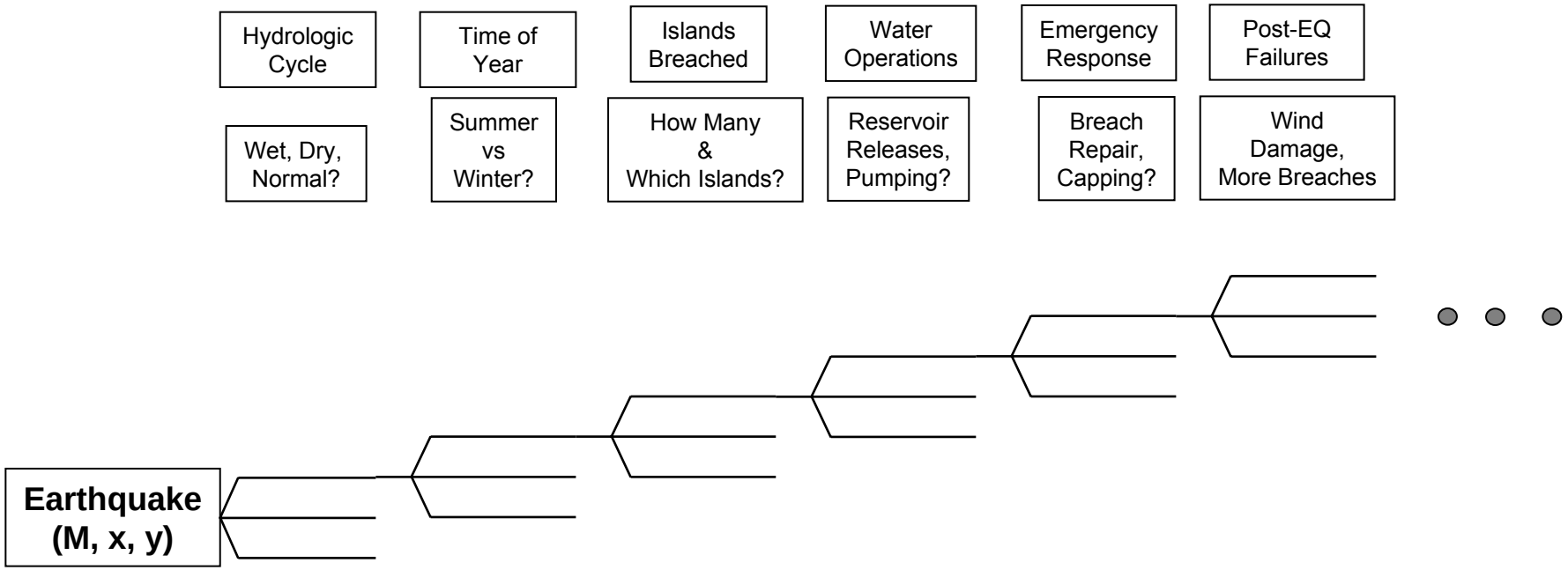
Risk Model (Module) Development

- Each element of the analysis can be considered a module (figuratively & literally in the sense of a code to do the computations)
- Modules must be developed based on certain ‘inputs’ and they must generate certain outputs

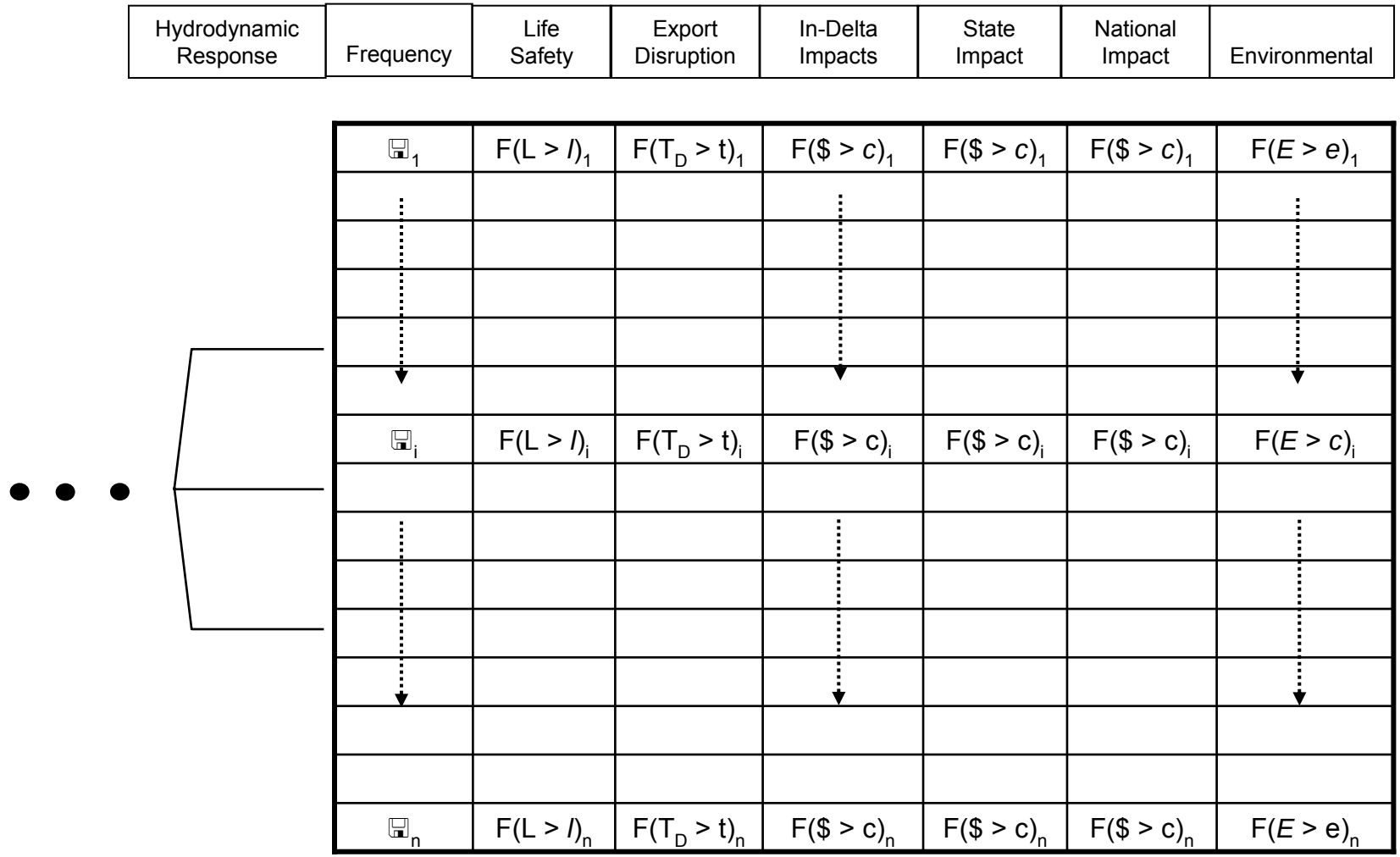
Risk Model (Module) Development

- Three parts:
  - Engineering/scientific evaluation
  - Probabilistic model (including the model of uncertainties)
  - Identifying/defining the interface requirements between elements of model (iterative)

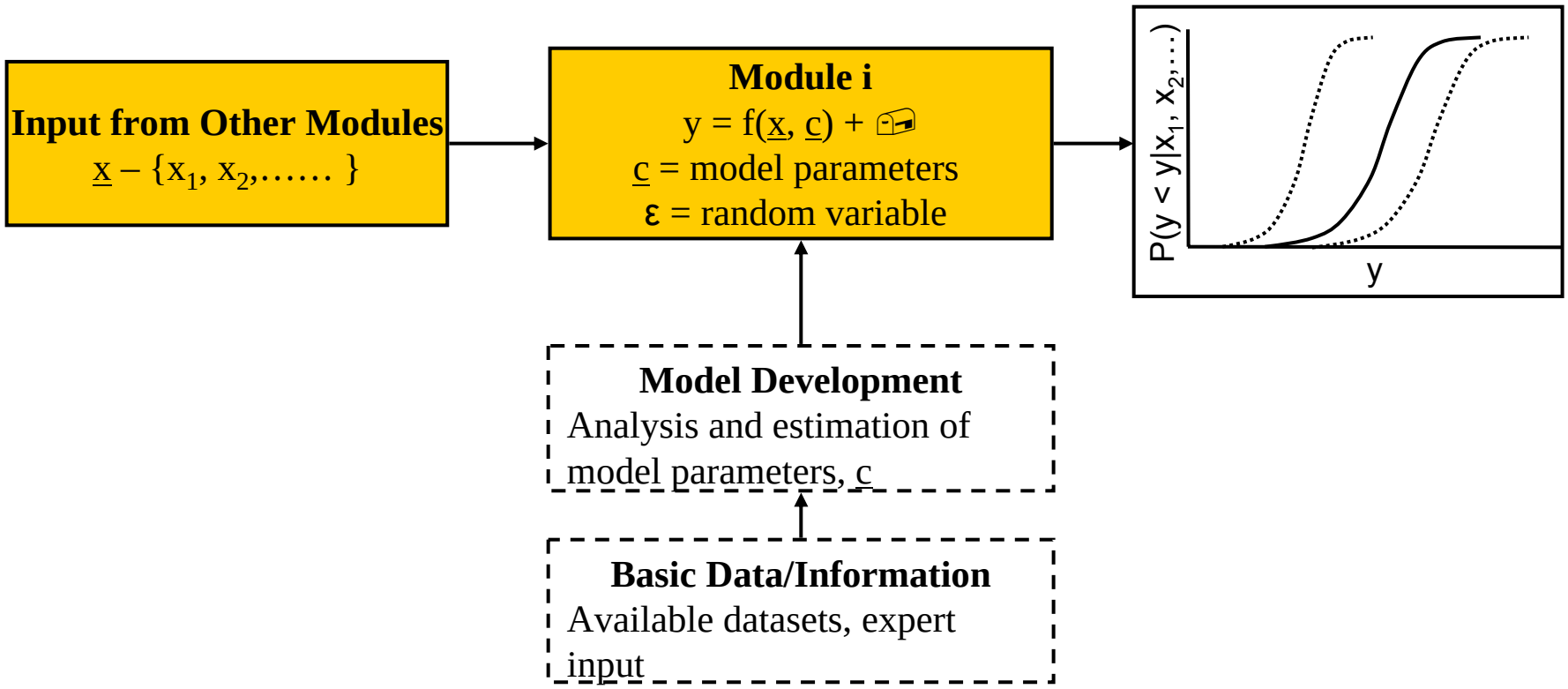
When the Earthquake Occurs



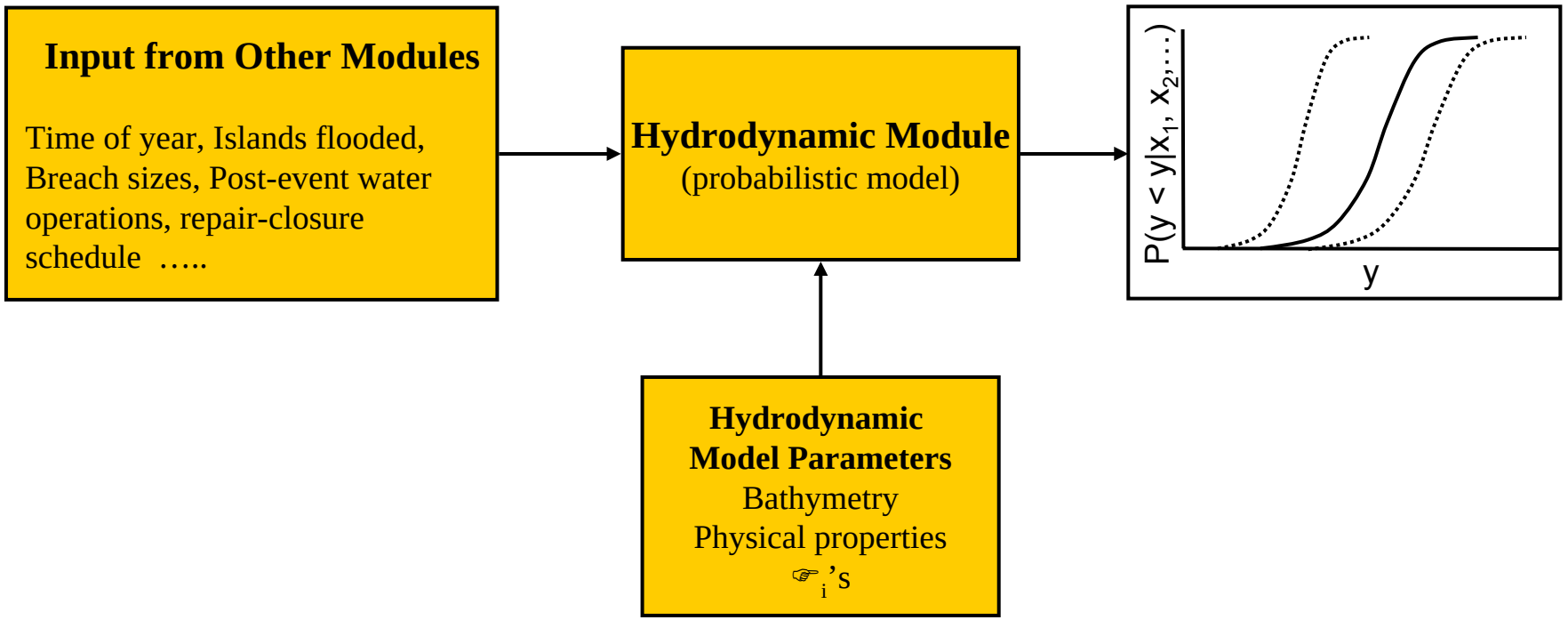
When the Earthquake Occurs



Risk Model (Module) Development



Consider the Hydrodynamic Model



Risk Model Features

- Must consider the range of sequences of events that can occur
- Sequences are defined by:
  - Time of year, type of year
  - Islands flooded (& number of breaches)
  - Water operations immediately following the event and during repairs
  - Repair strategy and schedule
- Analysis/module products must meet needs (input requirements) of other parts of the analysis (e.g., economic analysis, environmental analysis)

DRMS Risk Model
Uncertainty Approach

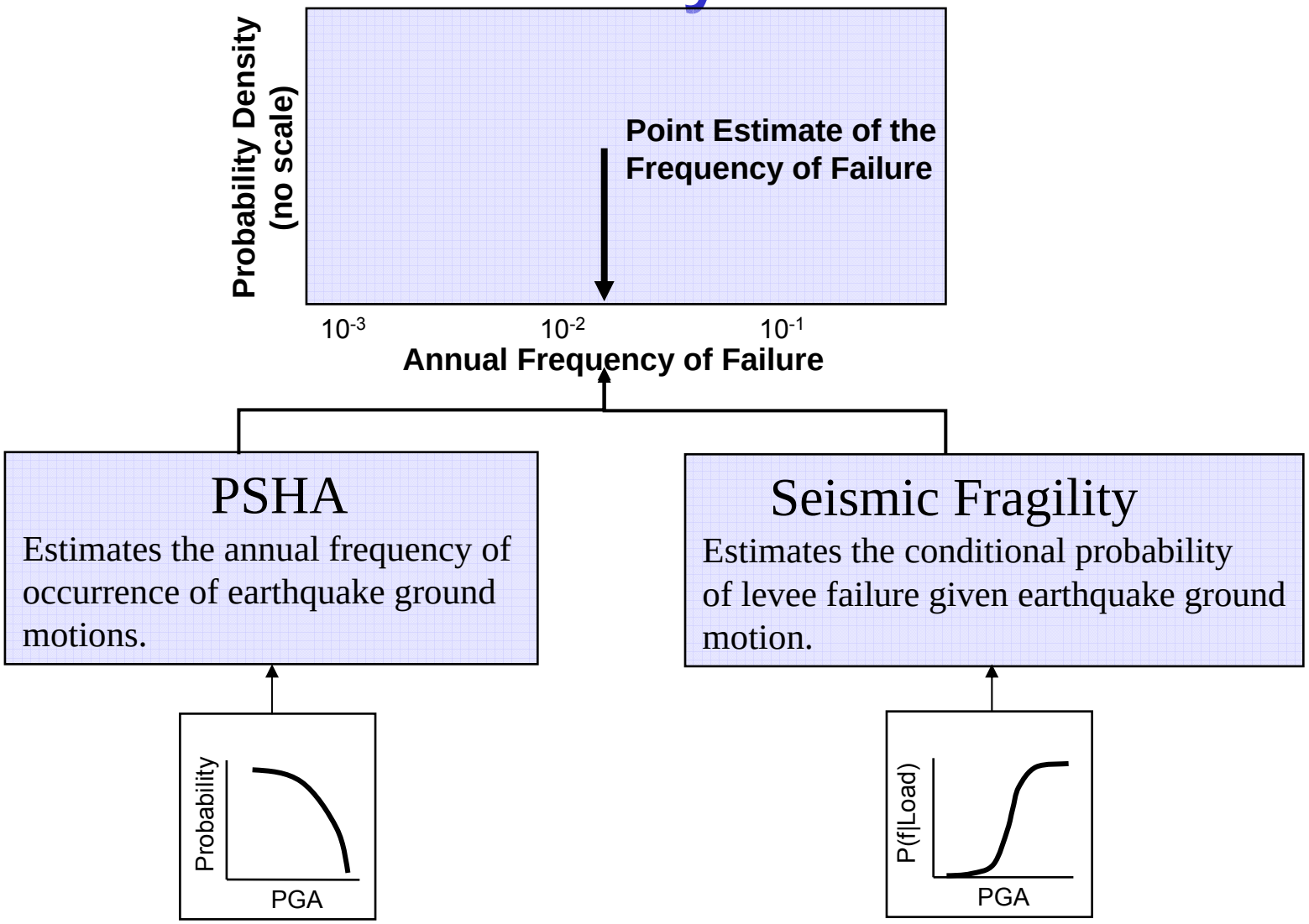
Estimate risks to the Delta and the State that is based on the distribution of inputs of the informed technical community.

Types of Uncertainty

Epistemic Uncertainty - Uncertainty that is due to incomplete knowledge and/or data about the state of nature (the natural processes that we are modeling). In principle, epistemic uncertainty can be reduced with improved knowledge and/or the collection of additional information.

Aleatory Uncertainty - Uncertainty that is inherent to the unpredictable nature of future events (e.g., failure of structures under given load conditions). Given a model, one cannot reduce the aleatory uncertainty by collection of additional information.

Uncertainty Illustration



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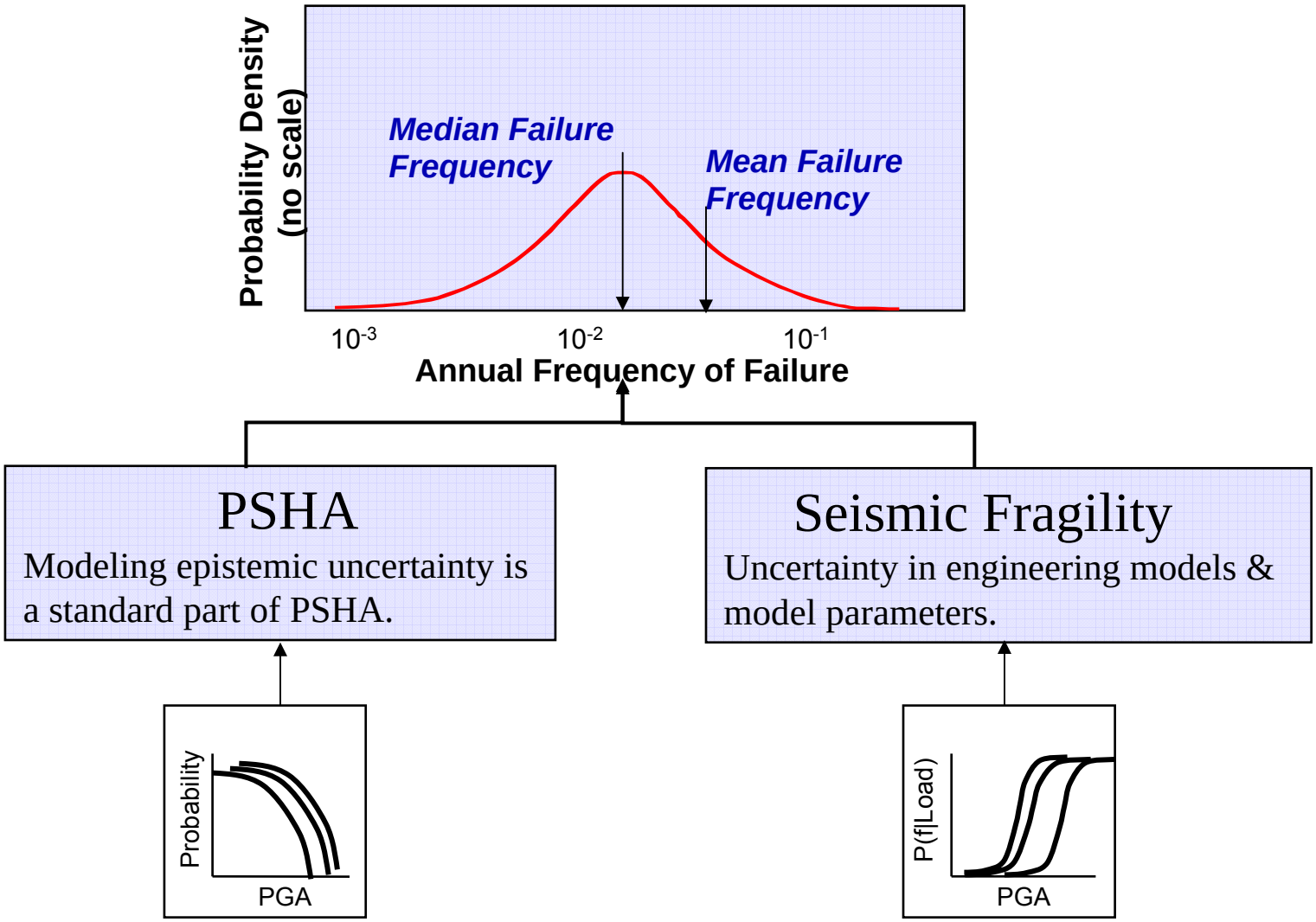
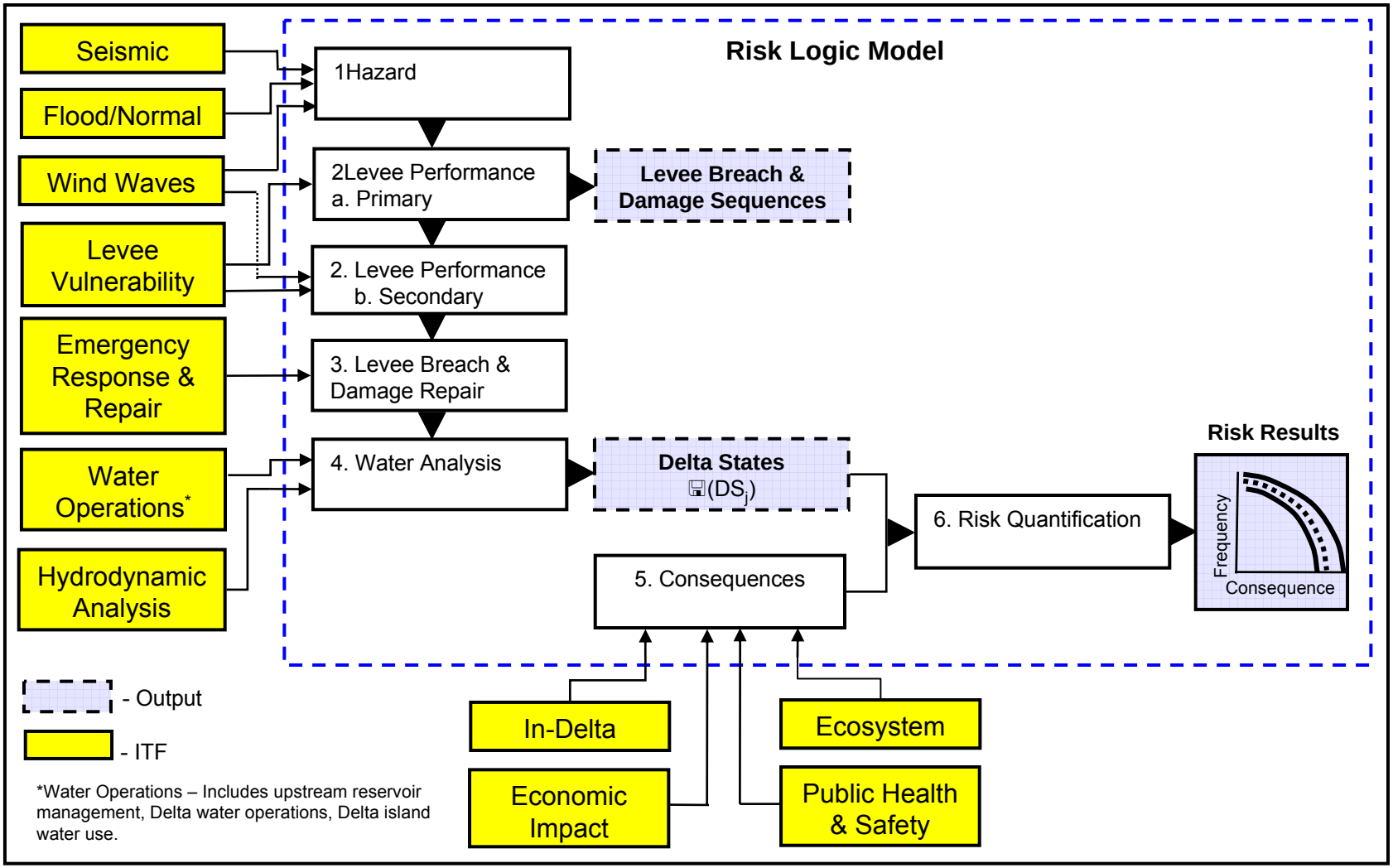


Risk Modules

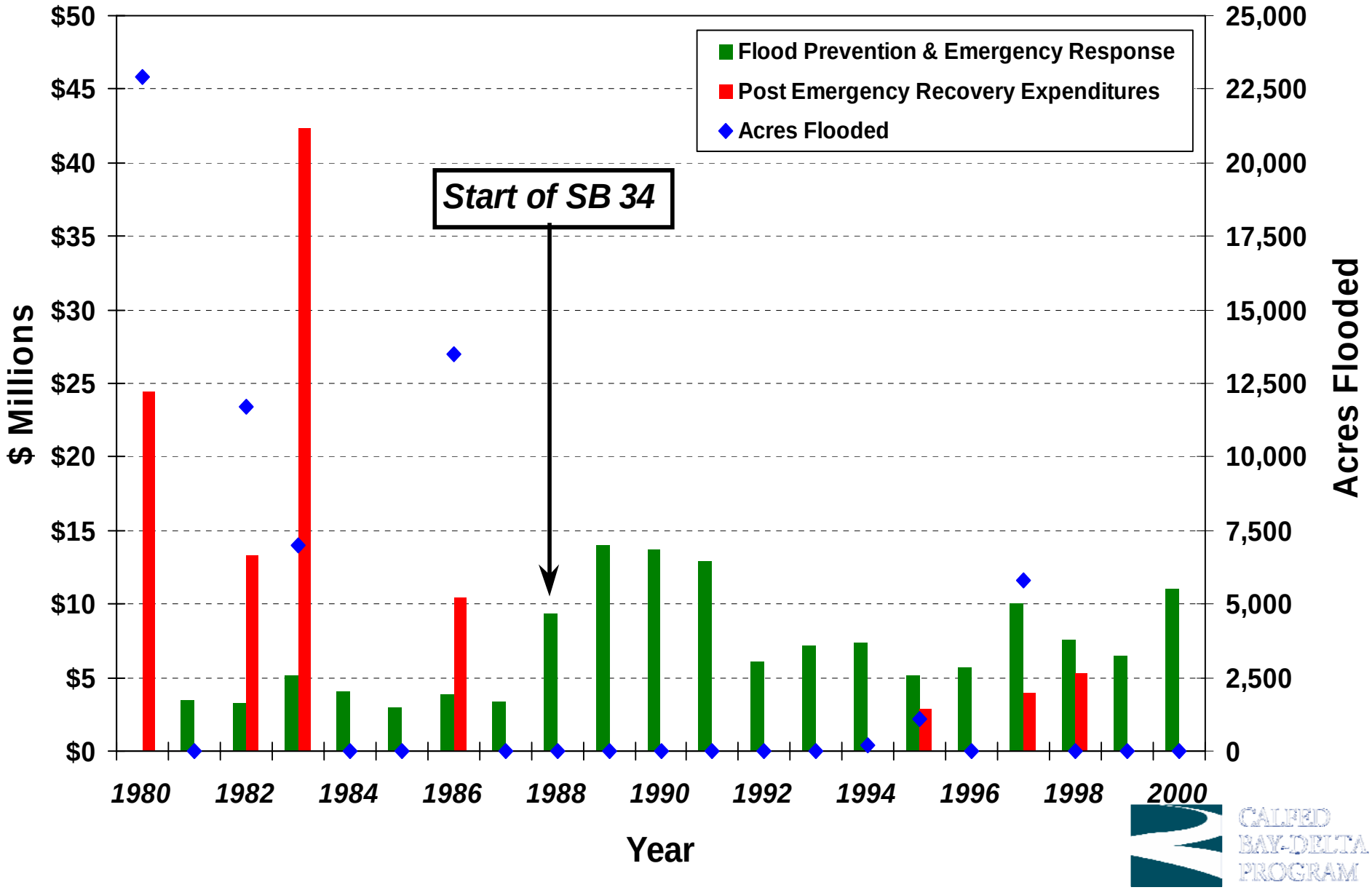


Levees & Habitat Committee Input

What Does Business As Usual Mean, Relative to Levees Program Trends Over the Next 50, 100, to 200 Years?

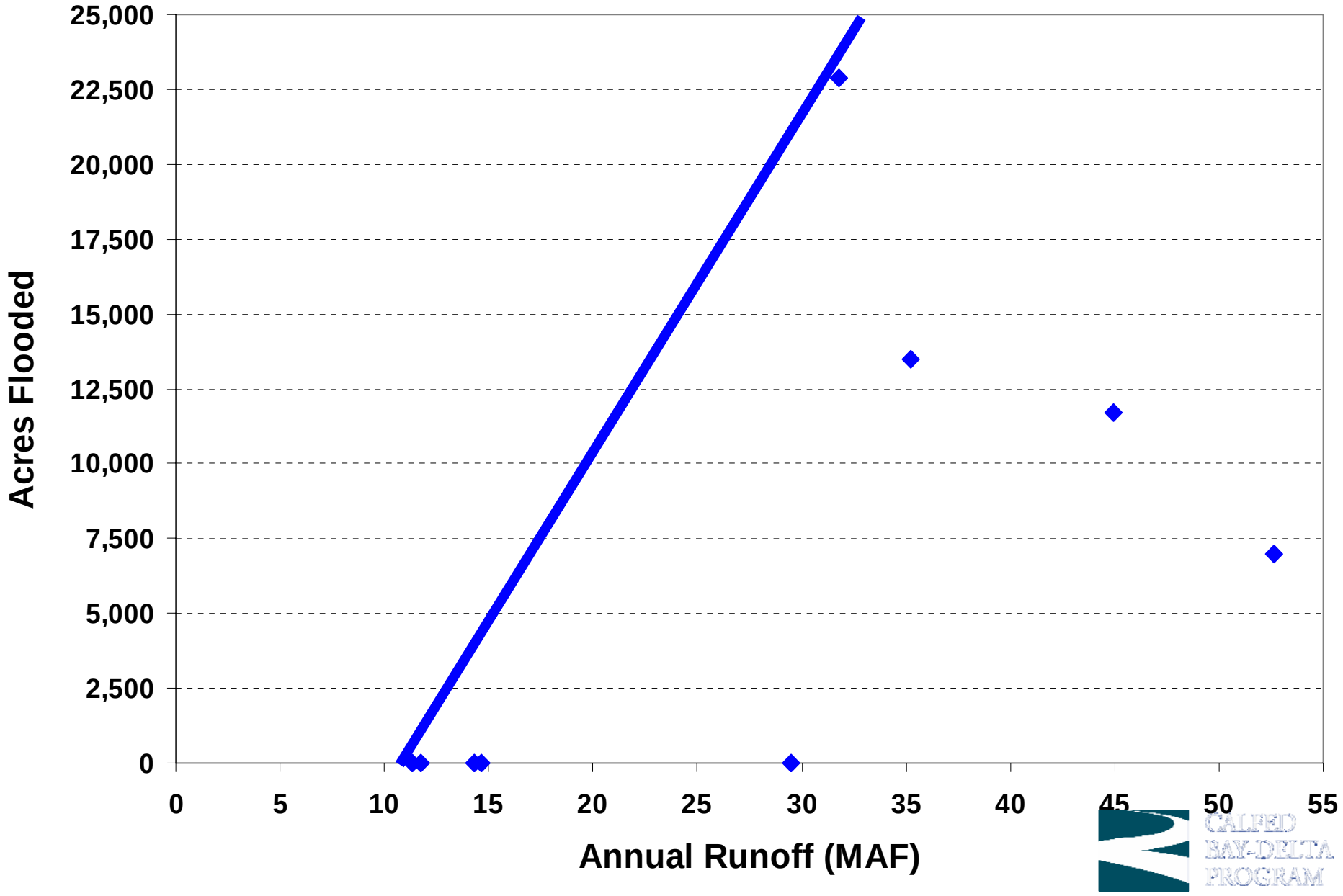
- Levee Program Funding (Do Bond Funds Count?)
- Levee Strength/Integrity (Assuming No Sea Level Rise)
- Habitat Quality/Viability
- Capability to Respond to Sea Level Rise with BAU Funding (state number of inches Delta-wide in 50 years)

DELTA LEVEE FLOOD PREVENTION COSTS, POST DISASTER ASSISTANCE COSTS, & ACRES FLOODED



CALFED BAY-DELTA PROGRAM

ACRES FLOODED VS. ANNUAL RUNOFF
1980 - 1988



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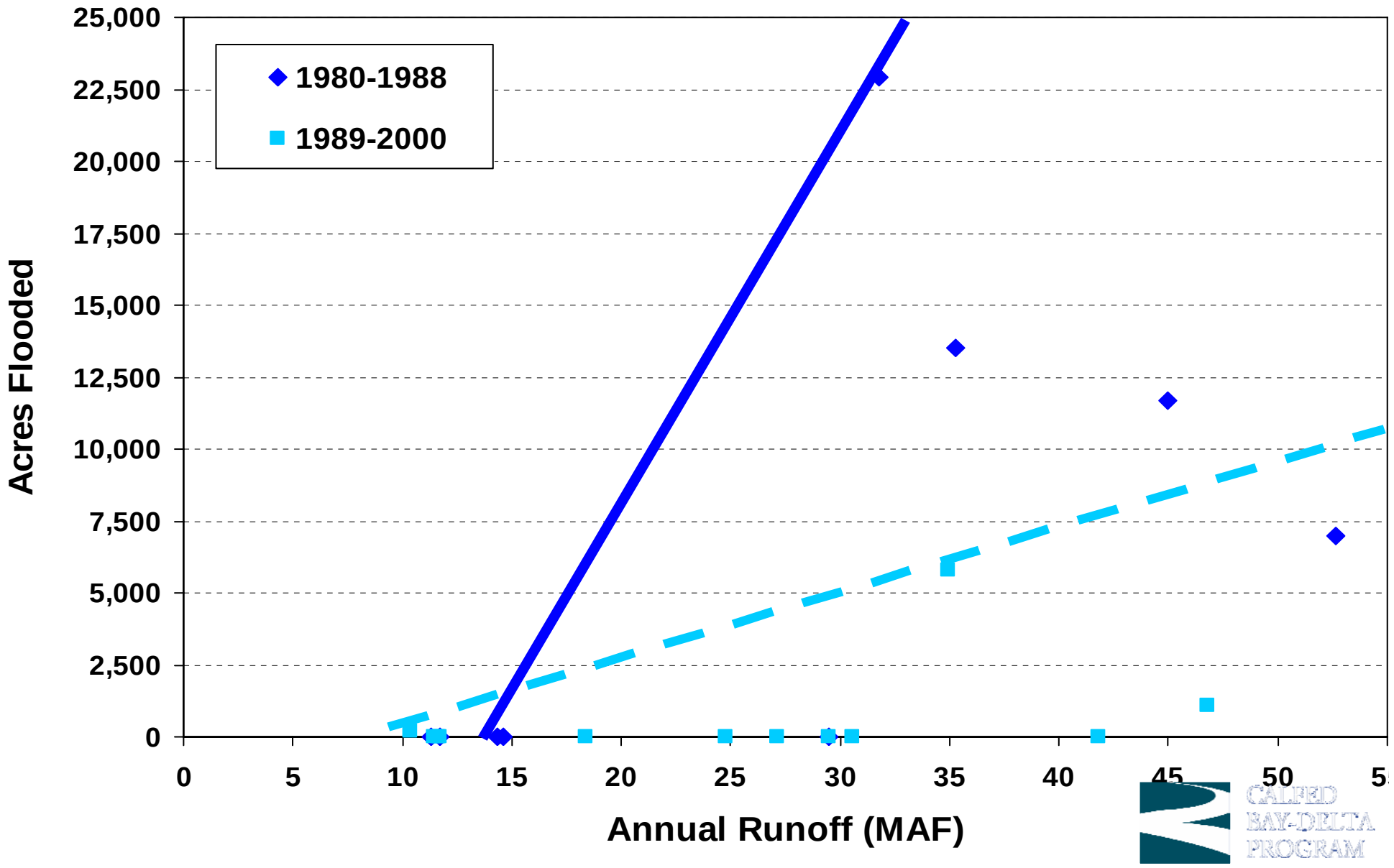

CALFED BAY-DELTA PROGRAM

DRMS Schedule

Deliverable	**Date**
• ITF Papers on DRMS web site	09/15/06
• Current-Use-Trends Report (DVP)	11/30/06
• Draft Phase 1 (Risk Analysis) Report	03/16/07
• Public Review Period Starts	04/15/07
• CALFED ISB Review	05-06/07
• Draft Final Report	08/03/07
• Public Review Period Starts	09/06/07
• DRMS Final Report	11/01/07

Questions or
Comments ??