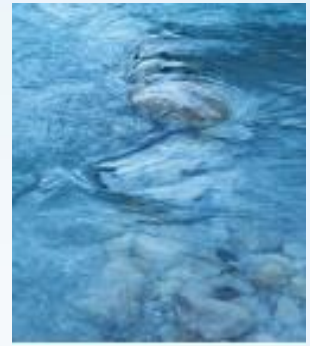


Managing Weather Risk: Creating Financial Stability

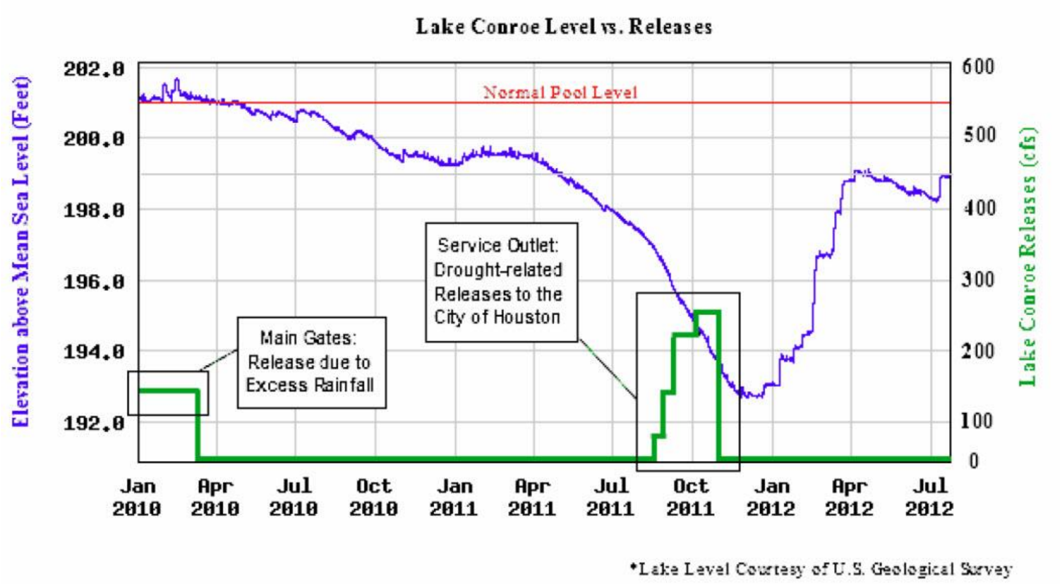
FINANCING SUSTAINABLE WATER
Rates. Revenue. Resources.

Alliance for Water Efficiency

Aiwex

Summary

- Brief History of the Weather Risk Management Market
- Hypothetical Case Studies



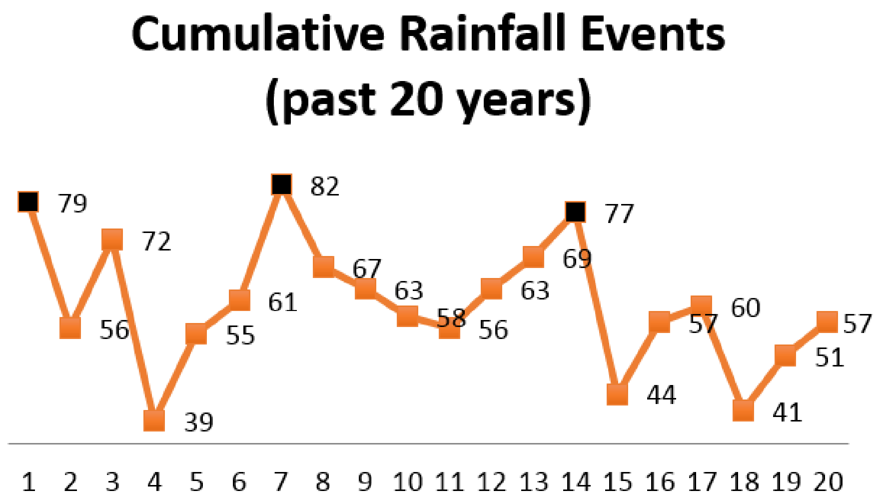
Brief History of the Market

- Physical Solutions
- Indirect Solutions -- Insurance and Forward Contracts
- OTC Derivatives -- Energy Merchants
- Futures -- Chicago Mercantile Exchange
- Hedge Funds, Reinsurance, End Users, and Banks
- Notable Transactions for Municipalities

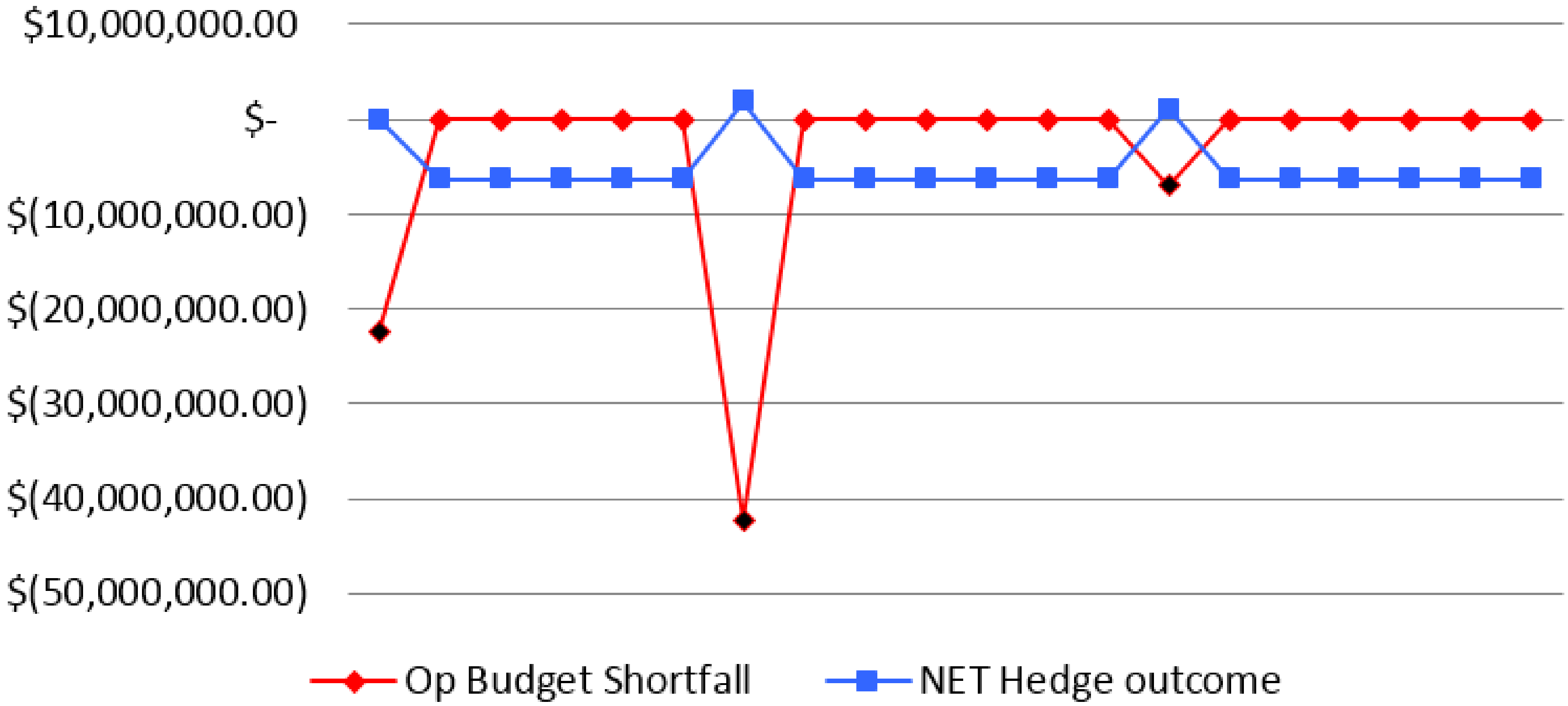
Case Study #1

- Utility A gains majority of its revenues during the summer
  - Summer sales critical to recover costs
  - Higher than normal rainfall reduces revenues
- Historical data shows that high Cumulative Rainfall Events correlates well with lost revenues
- Rainfall Events are defined as:
  - 0 - 1” / week = 3 events
  - 1.01 - 2” / week = 7 events
  - 2(+)” / week = 9 events

- **SOLUTION:** Utility A buys a Cumulative Rainfall Event CALL OPTION for **~ $6MM annual premium** which pays **$7.2MM per Rainfall Event above a strike of 75 Events**

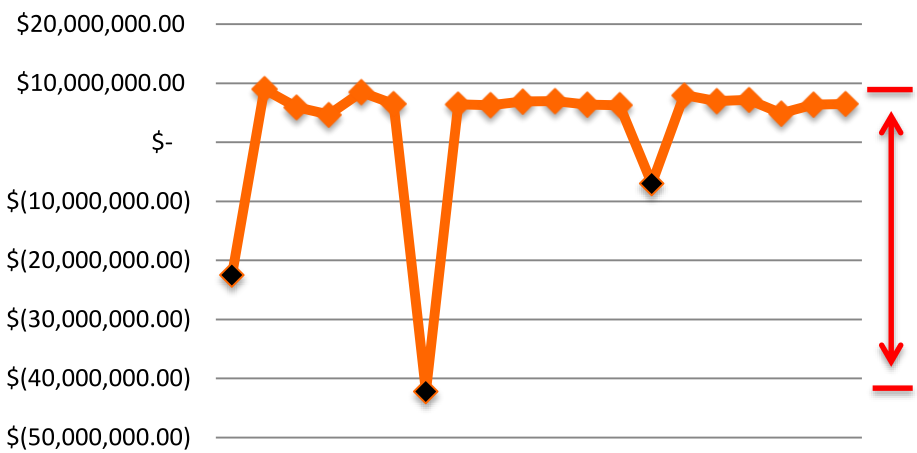


Hedge Results



Case Study #1

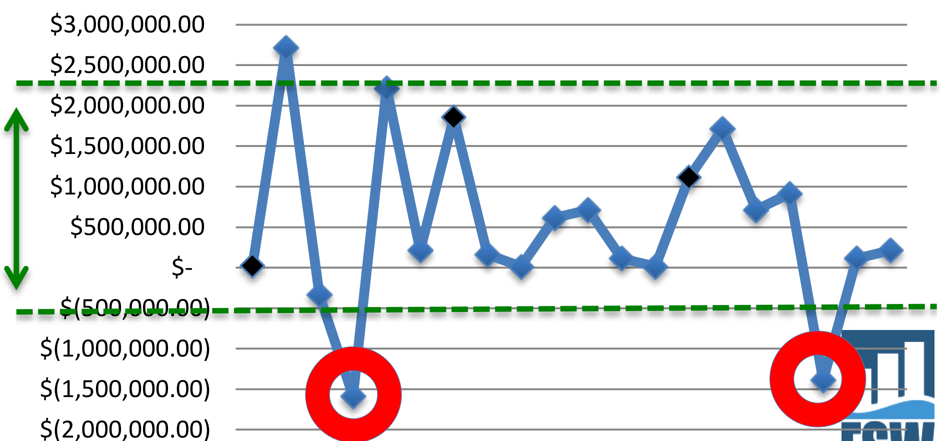
Net Income BEFORE Hedge



FINANCIAL UNCERTAINTY REDUCED!

What may be worth additional exploration is muting the low Cumulative Rainfall Events in Years 4 and 18; when high import costs during high demand may be driving a negative result

Net Income AFTER Hedge



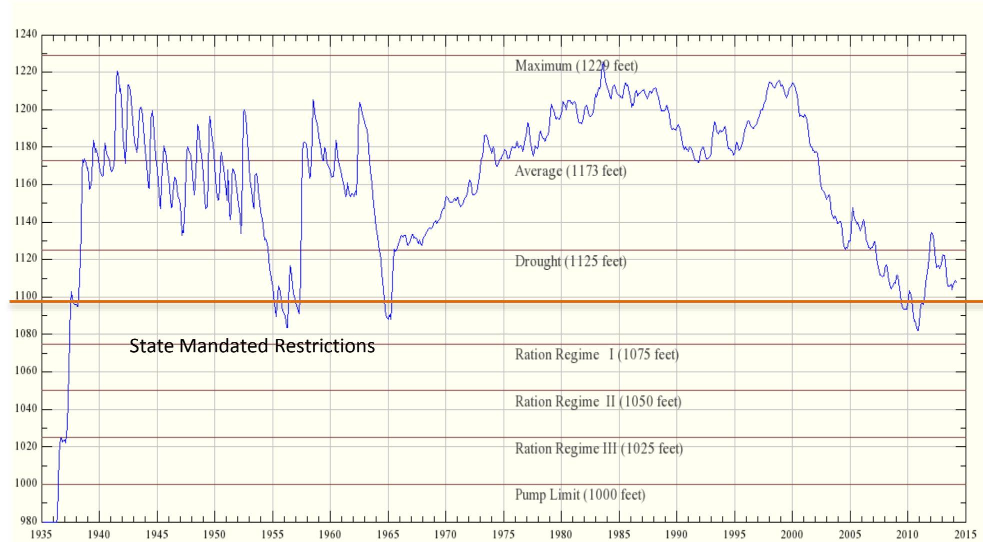
KEY TAKE AWAY:

Extreme volatility in Net Income from high Cumulative Rainfall Events can be muted

Case Study #2

SCENARIO:

- Utility B experiences lost sales when drought restrictions are enacted due to low precipitation
- Water usage curtailed at 91.7% of normal lake levels per state regulation
    - Cost of implementing drought restrictions = $500k
    - Lost sales = $6.884MM
    - Avoided Supply Costs = $3.065MM
    - Lost revenue to hedge = $4.318MM



Source: http://www.arachnoid.com/NaturalResources/

SOLUTION:

- **Utility B buys DIGITAL PUT OPTION on lake level that pays $4.318MM below 1095**

HEDGE PROVIDER's PERSPECTIVE:

Historical Frequency of Loss: 6x since 1940

- Average Loss from selling Hedge to Utility: $350k
- Std Deviation of Loss: $1.2MM

Premium: ~$500k

Corollaries to Case Study #2

- Drought conditions frequently require costly replacement water to be delivered
- **SOLUTION:** Put option on lake water levels, lake inflows, rainfall, or aquifer levels
- Drought conditions are more damaging with persistence
- **SOLUTION:** Multi-year put option that pays only when weather is persistent across 2 or more years

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Download White Paper on this subject at

www.FinancingSustainableWater.org

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