Gulf Coast Water Authority

Drought Contingency Plan Update
US BoR WaterSMART Grant
Drought Task Force Meeting #4

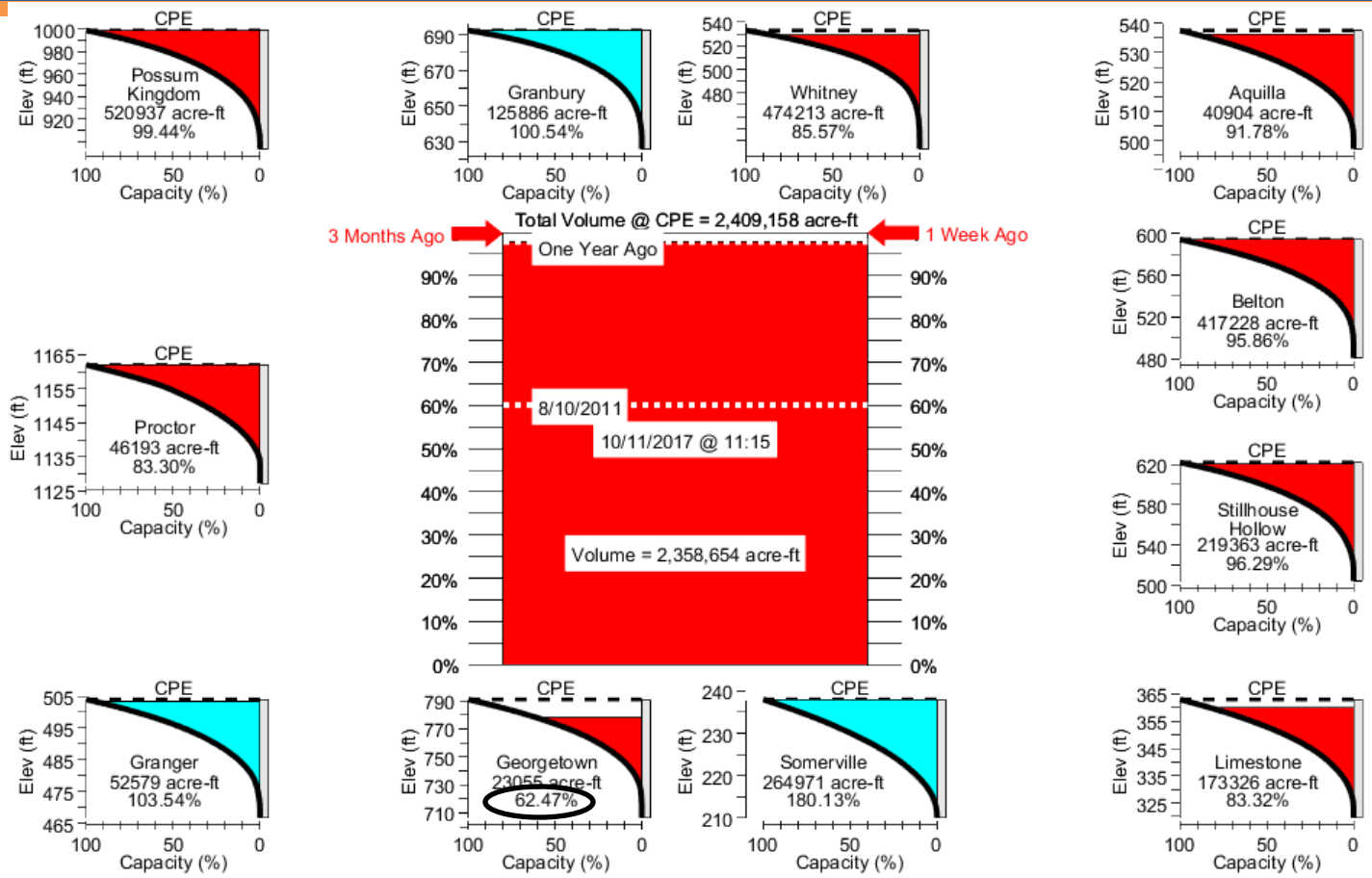
10/17/2017

LREWater, LLC
a Leonard Rice Engineers Company

LRPR
LAURA RAUN PUBLIC RELATIONS
SIMPLICITY WORKS

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Current Conditions in the Lower Brazos Basin



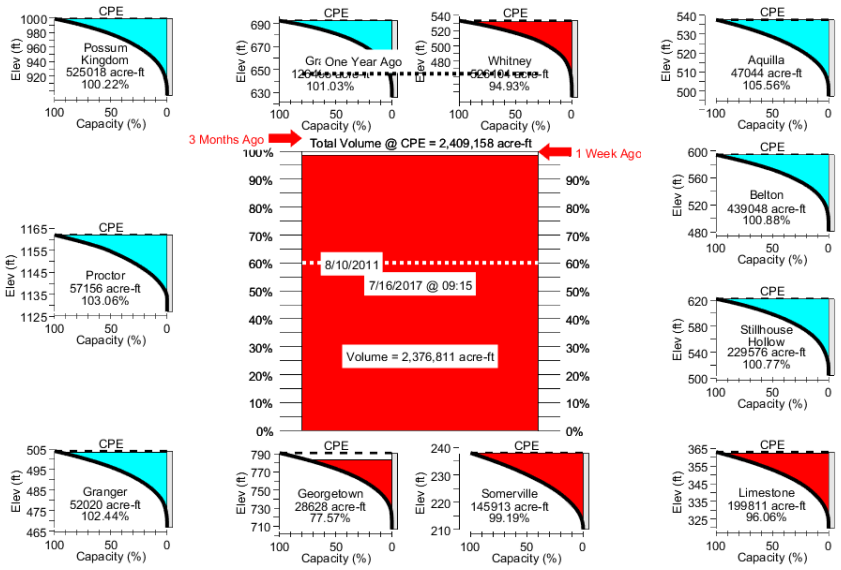
Streamflow Records (cfs):

		Current Flow	10/10/2017 Average Flow
Whitney	=	49	3470
Bryan	=	637	691 ??
Hempstead	=	3380	3470
San Felipe	=	3930	4010
Richmond	=	3880	4060
Rosharon	=	6330	6400

**All Demands Met w/
Q = 700-1000 cfs

Current Conditions in the Lower Brazos Basin

7/17/17

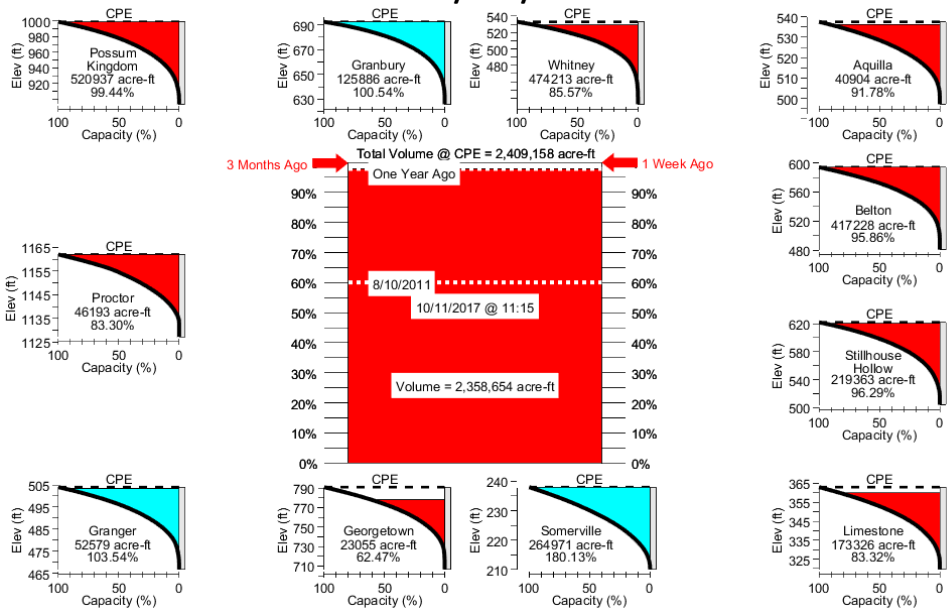


Streamflow Records (cfs):

		Current Flow	7/15/2017 Average Flow
Whitney	=	87	3120
Bryan	=	2070	2250
Hempstead	=	3220	3120
San Felipe	=	3040	3020
Richmond	=	2700	2740
Rosharon	=	3330	3010

**All Demands Met w/
Q = 700-1000 cfs

10/17/17



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Impact of Harvey

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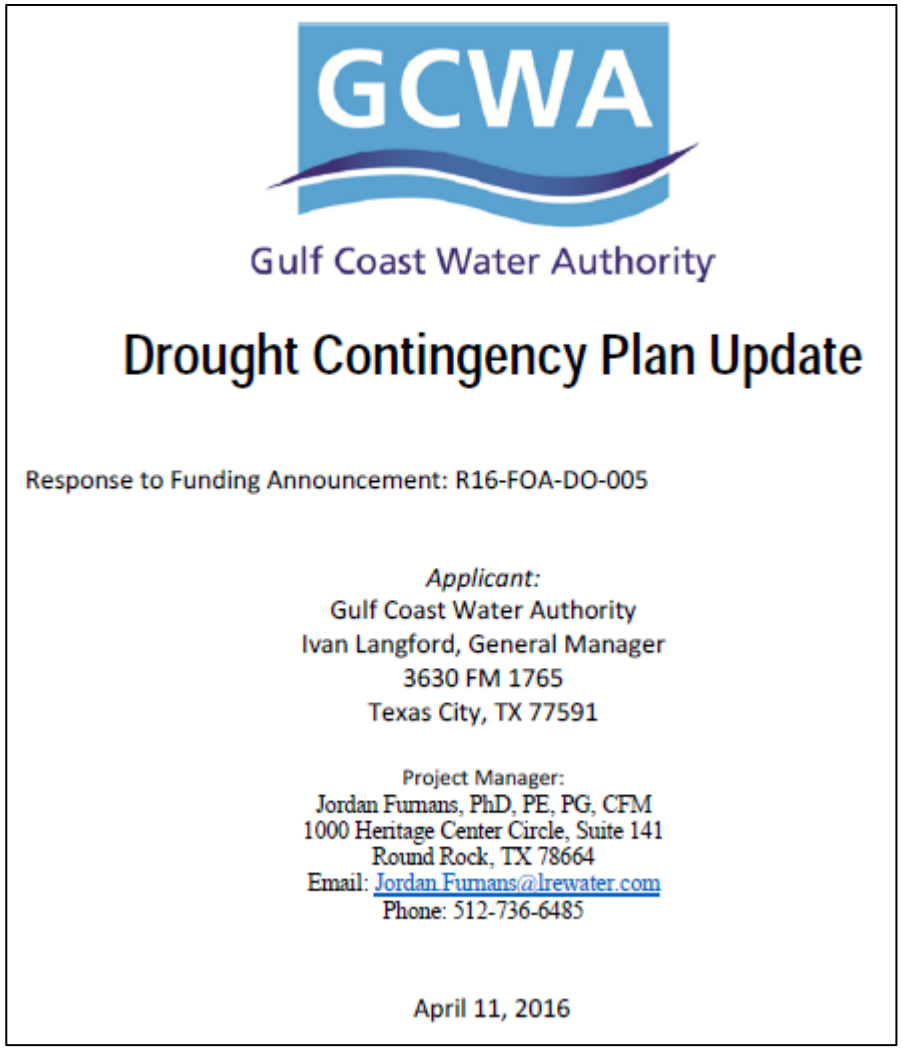
US BoR WaterSMART Program

- Proposal Submitted 4/11/16
- Notice of Award 6/23/2016
- Contract Initiated 10/2016

- Financial Part:
  - 2 Year Contract (Oct '16-Oct '18)
  - 50-50 Cost Share with GCWA

- Purpose:
  - Pro-Active Drought Management
  - Build Long-Term Drought Resiliency
  - Study potential mitigation strategies

- Potential Benefits for future Title 16 Funds
  - Strategy Implementation



GCWA

Gulf Coast Water Authority

Drought Contingency Plan Update

Response to Funding Announcement: R16-FOA-DO-005

Applicant:
Gulf Coast Water Authority
Ivan Langford, General Manager
3630 FM 1765
Texas City, TX 77591

Project Manager:
Jordan Furnans, PhD, PE, PG, CFM
1000 Heritage Center Circle, Suite 141
Round Rock, TX 78664
Email: Jordan.Furnans@lrewater.com
Phone: 512-736-6485

April 11, 2016

GCWA's Drought Contingency Planning Goal

- Ensure GCWA Customers have water needed during future droughts

**Curtailment Rules will be Included in DCP Update **

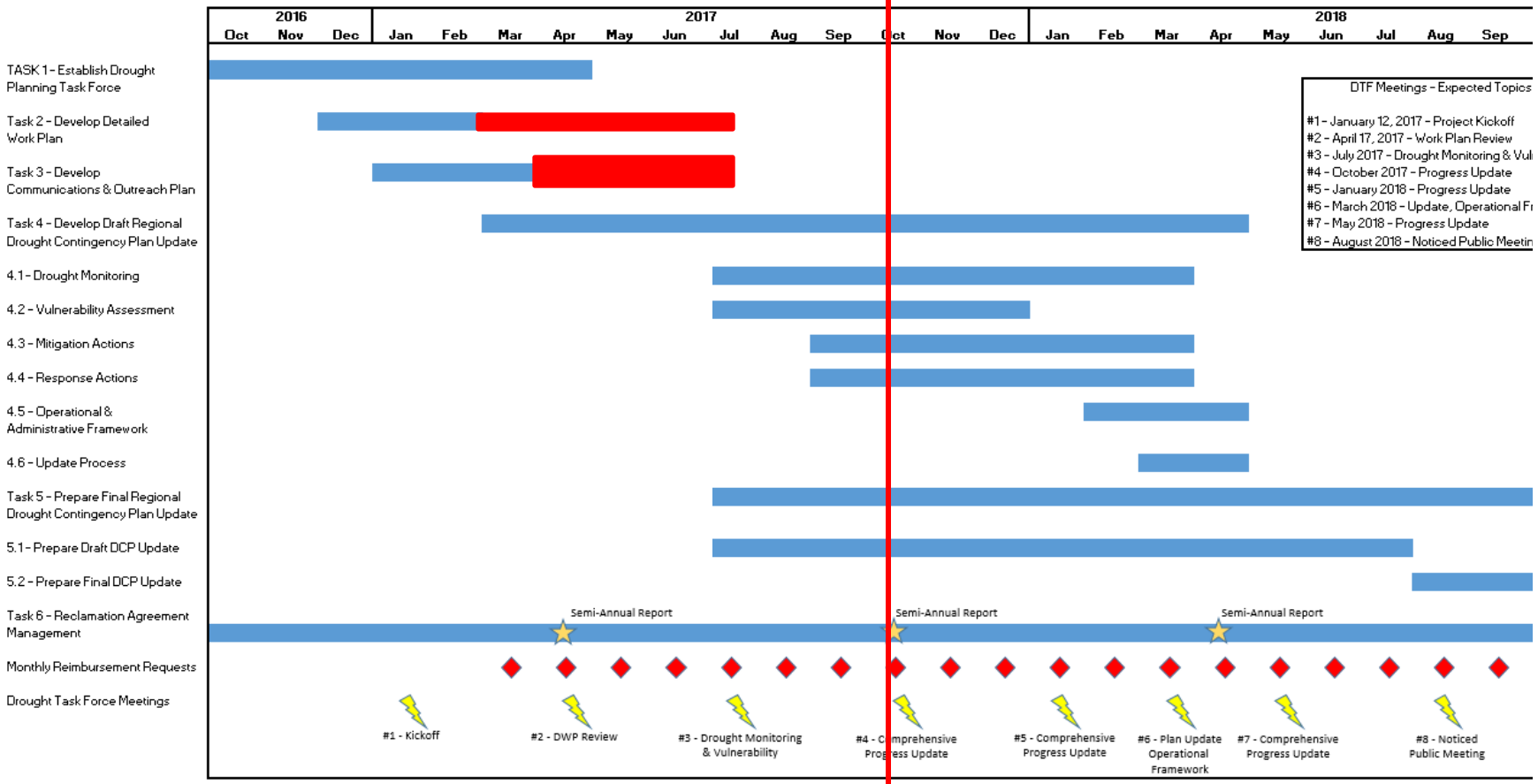
- Not: Curtailment
- Not: Rationing
- Not: Relying only on Watermaster

- Is: Maintaining Customer's Expectations
- Is: Smart Planning to maintain & grow Texas economy

Today's Agenda

- Welcome & Purpose of DCP Update Process
  - Gather Comments, incorporate
- Update on Climate Change Analysis
- Dashboard & Predictions & Usage Database
- Curtailment Rules Discussion
- Set Next Meeting
  - Tuesday, January 16, 2018?

Project Status & Website



Project Status & Website

http://gcwa.lrewater.com/

To Add:
Comment Submission Function

Link from GCWA Website

Paleo-Climate Analysis & Streamflow

GBRA – Published Study in 2011

Texas Water Resources Institute
Texas Water Journal
Volume 2, Number 1, Pages 54–96, December 2011

Extended Chronology of Drought in South Central, Southeastern and West Texas

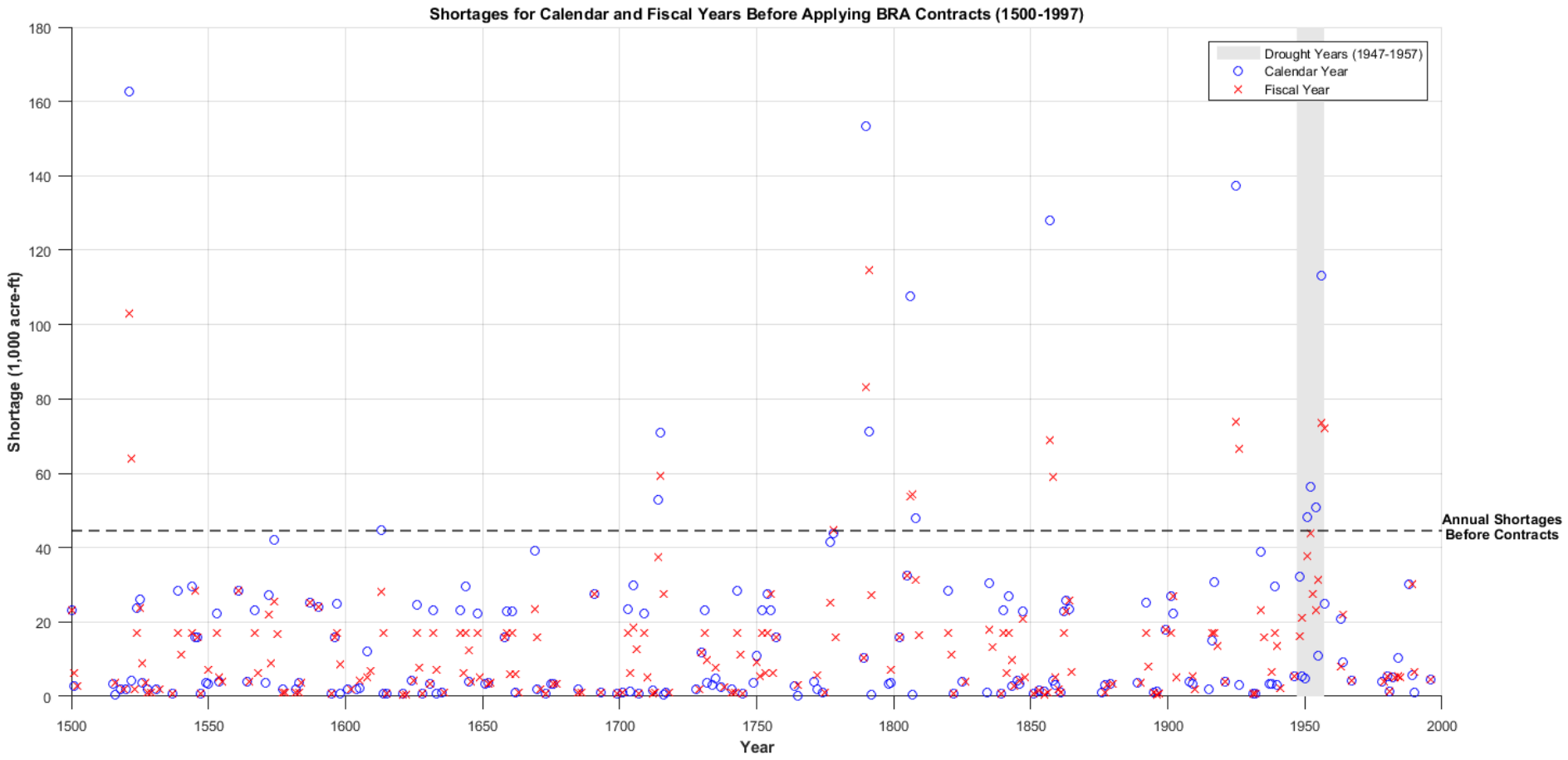
Malcolm K. Cleaveland[1], Todd H. Votteler[2], Daniel K. Stahle[1], Richard C. Casteel[3], Jay L. Banner[3]

**Used Bald Cypress Rings
Recreated Palmer Drought Severity Indices (PDSI)
1500-2008, LRE Extended Data through 2017

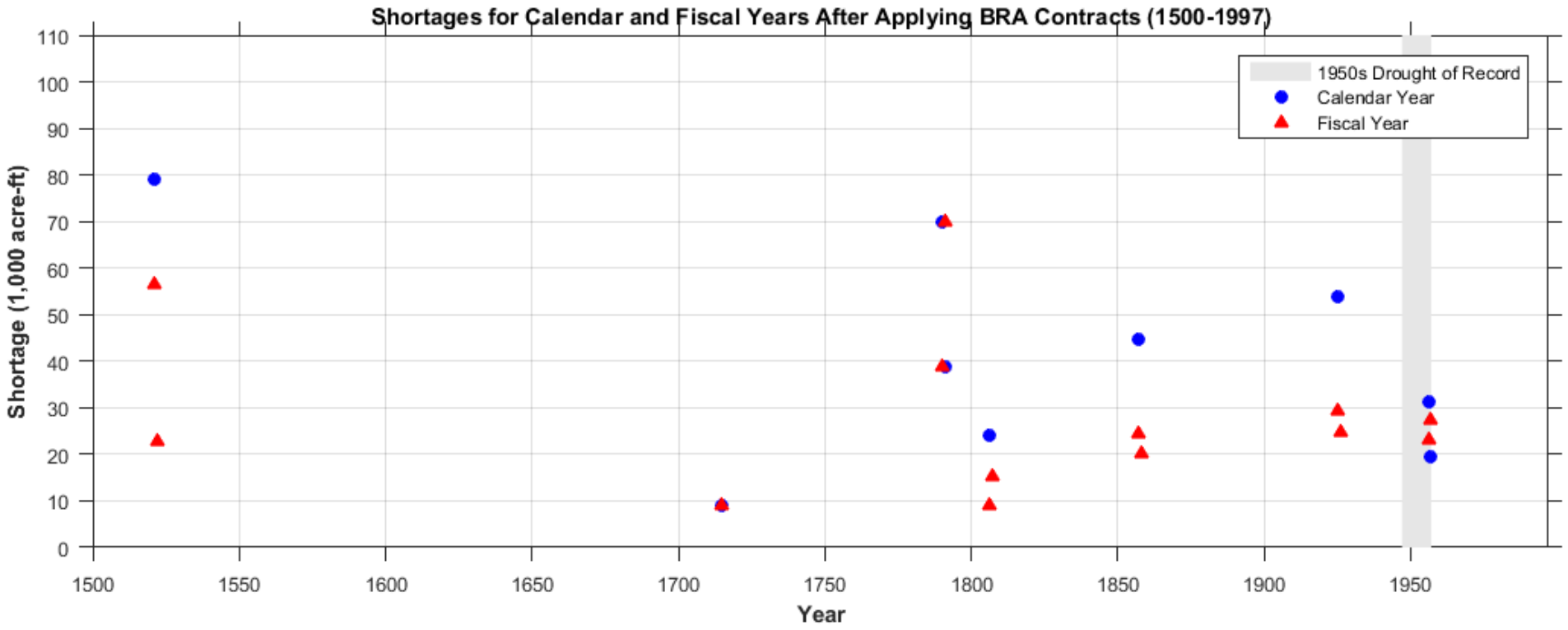
LRE Modified WAM to Assess GCWA Water Availability

- Original WAM – 1940-1997
- Modified WAM – 1500-1997

Paleo-Climate Analysis & Streamflow – WAM Analysis



Paleo-Climate Analysis & Streamflow – WAM Analysis



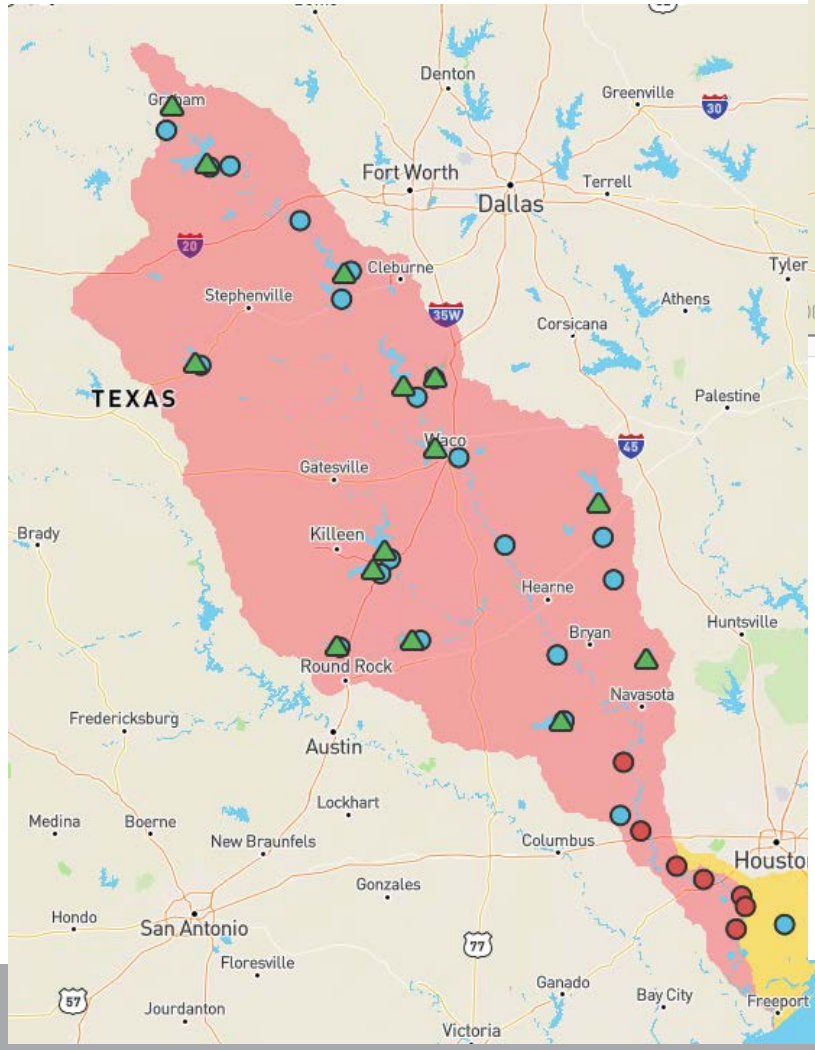
Max Shortage after using BRA Contracts: 79,000 acre-ft

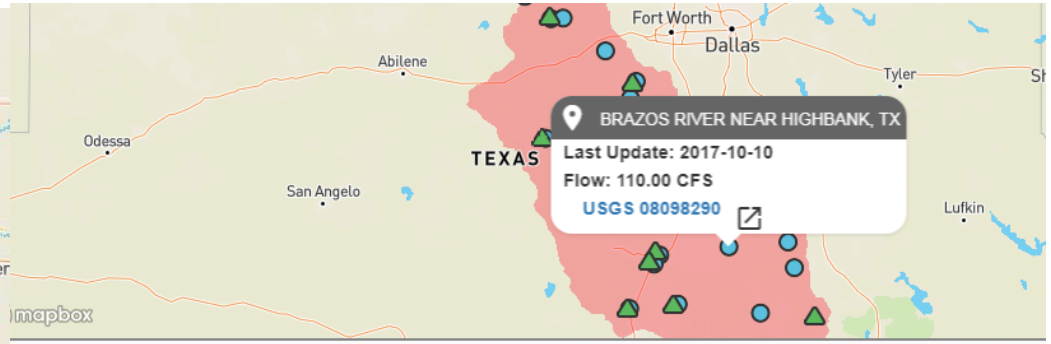
Take Away Messages:

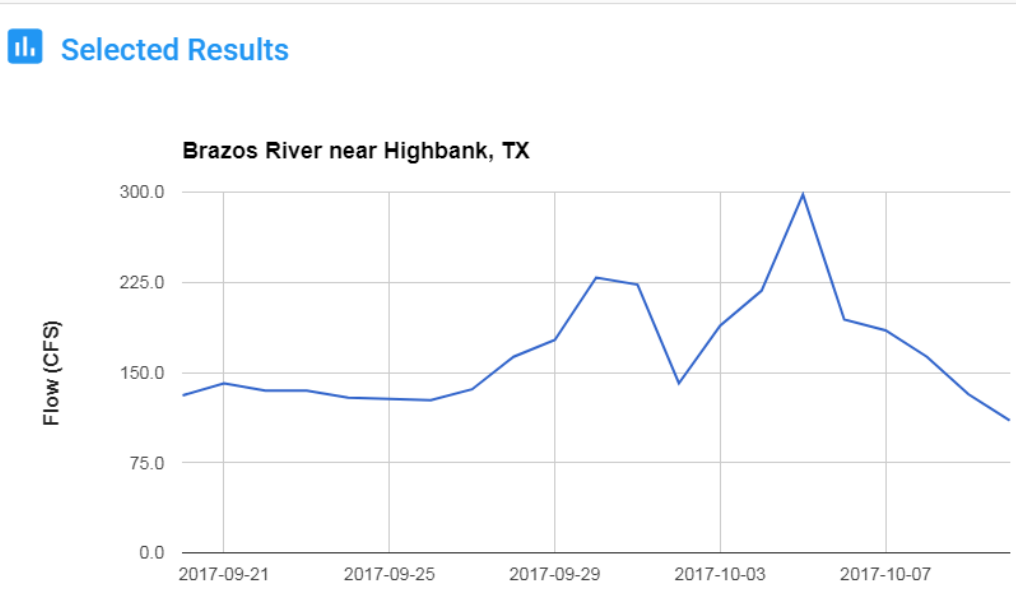
1) Worse droughts than 1950's have occurred
2) Not highly confident in quantitative results

Dashboard Creation Update

http://5.152.179.69/home







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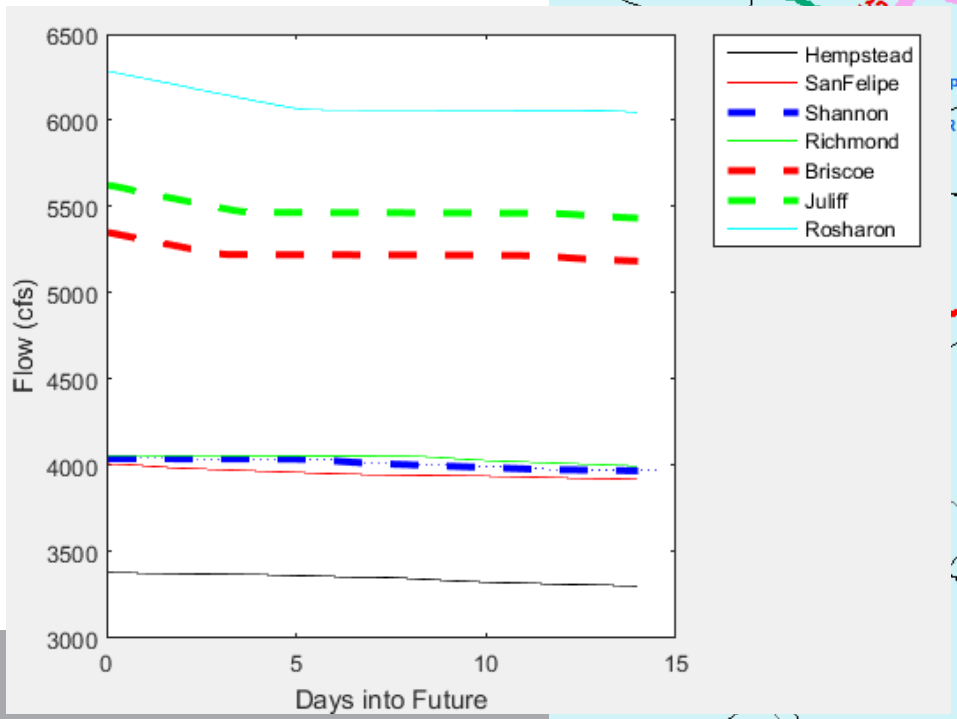
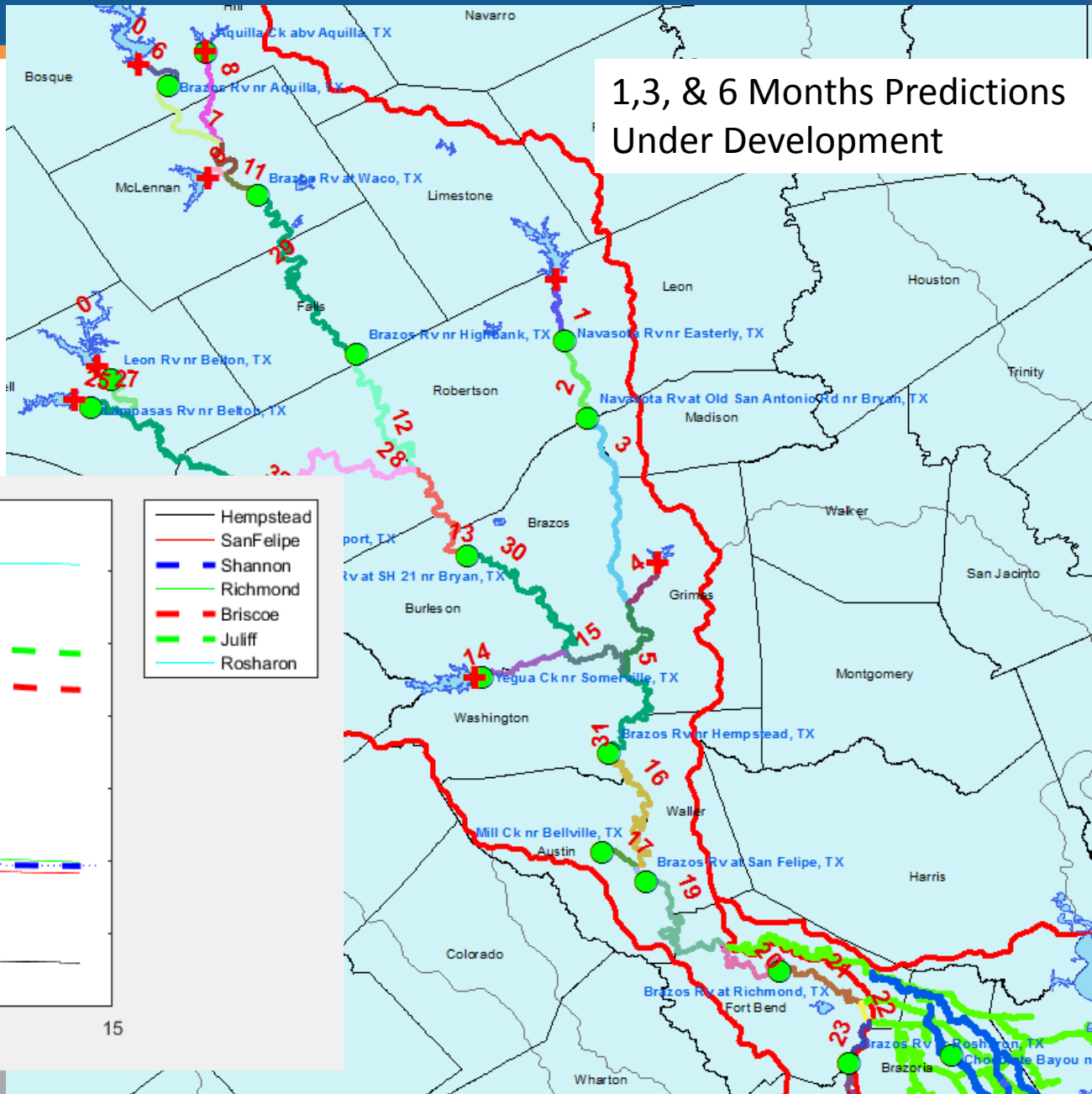
Dashboard Predictions

USGS Gauges
Streamflow
Reservoir Levels

Routing Downstream
Muskingam-Based

1,3, & 6 Months Predictions
Under Development





Curtailment Modeling – GCWA Daily Hydro (V7)

- Daily Water Availability Model
  - Developed for GCWA in 2011
    - Continuous refinements
  - Simulates through 2017
    - Uses Gauged Streamflow @ Hempstead
    - Models 2011 – "Worst Single Year on Record"
- Models Contractual GCWA Demands
  - Can Model Current/Future Usage
- Applies Prior-Appropriation Doctrine
- Includes GCWA, NRG, Dow, Brazosport WA

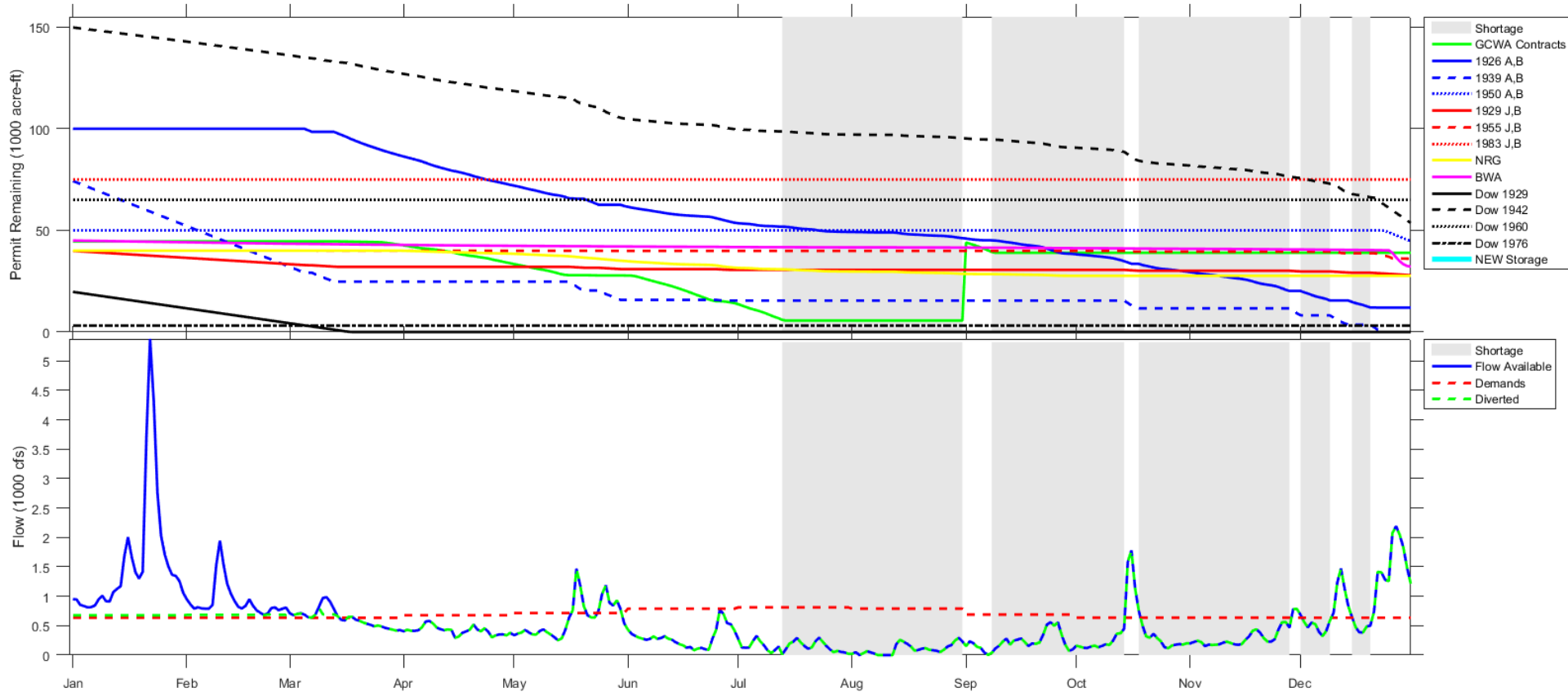
Use Daily-Hydro (V7) to model impact of proposed/potential Curtailment rules

Curtailment Modeling – GCWA Daily Hydro (V7)

- Water Allocation Methods:
  - Strict Priority – Senior First
    - With Monthly Limits – is in Texas WAM
  - Senior First during drought, otherwise junior first
  - §297.58(b) – Senior first within individual water rights
    - GCWA can use 1939-***5171*** before using 1926-***5168***
    - GCWA cannot use 1950-***5171*** before exhausting 1939-***5171***
    - ***Watermaster can accept or deny GCWA usage requests***
  - Pro-Rata Allocation among GCWA, Dow, NRG, BWA
    - At all times, or
    - Only during shortage, otherwise use §297.58(b)

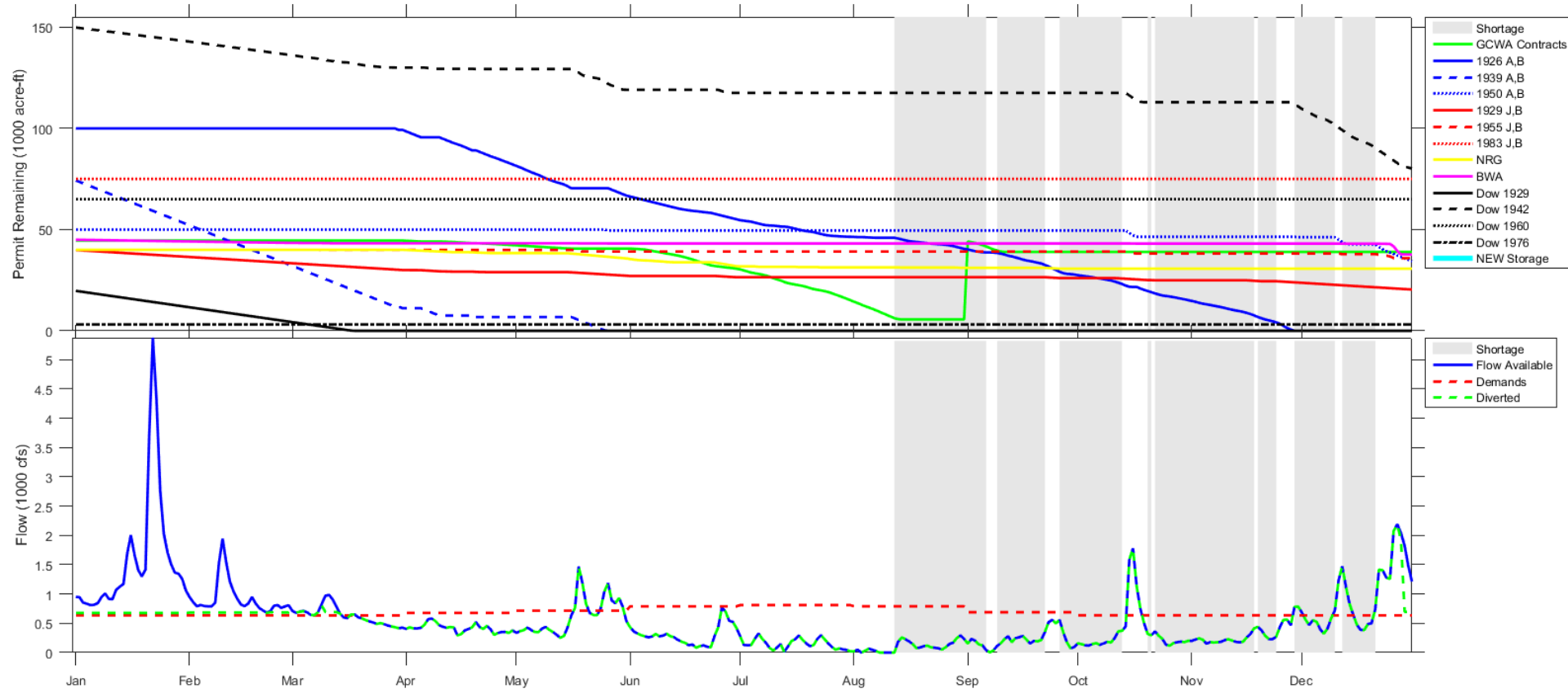
Different Methods yield different GCWA Shortages

Curtailment Modeling – Sample 2011 Results



Using Pro-Rata Allocation – Total Shortage: **68,088** acre-ft

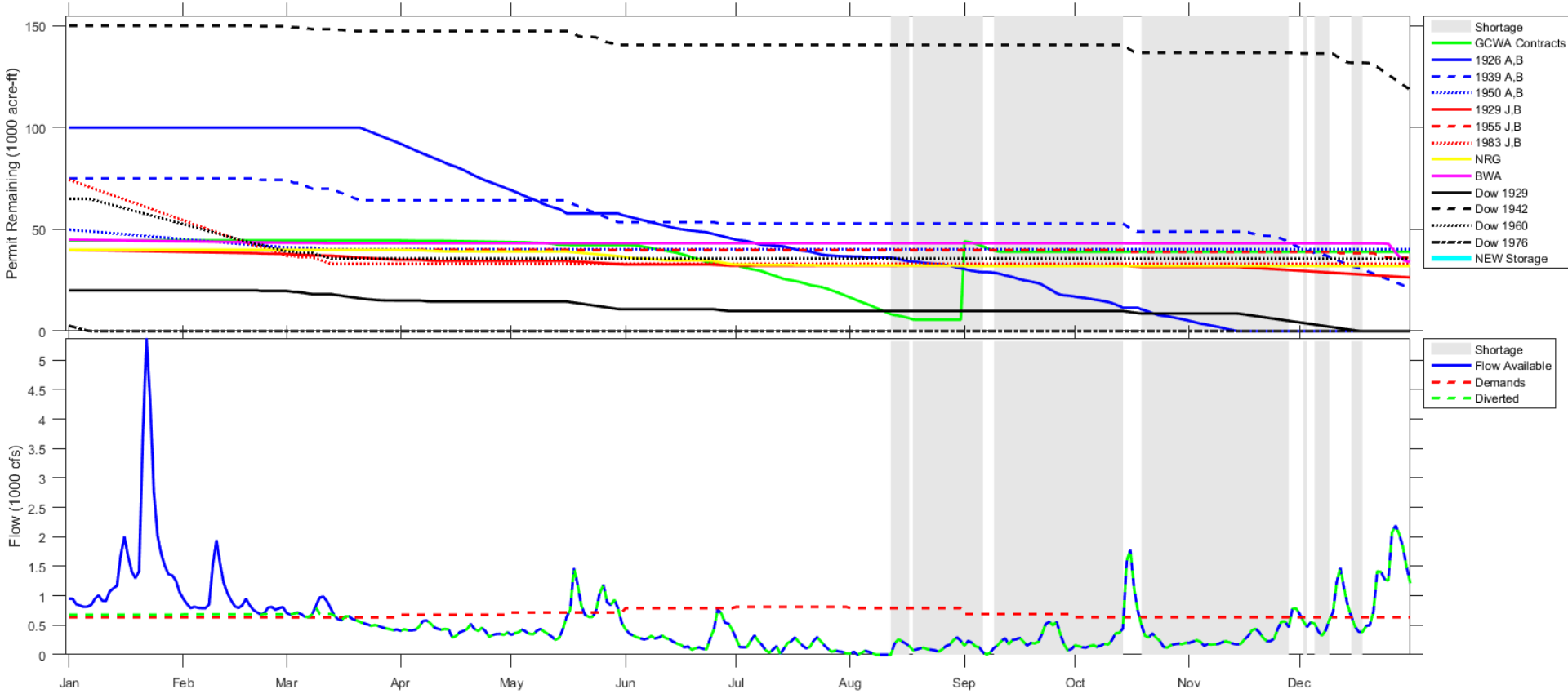
Curtailment Modeling – Sample 2011 Results



Using §297.58(b) Allocation – Total Shortage: **40,432** acre-ft

**Following Watermaster's Choices (6/2015-Present)

Curtailment Modeling – Sample 2011 Results



Using §297.58(b) Allocation – Total Shortage: **32,127** acre-ft

**w/Choices favorable to GCWA – using junior rights when flows are high

Curtailment Modeling – Sample 2011 Results

Summary – No Curtailment

Pro-Rata Allocation	Watermaster Rules	§297.58(b)
68,088 acre-ft	40,432 acre-ft	32,137 acre-ft

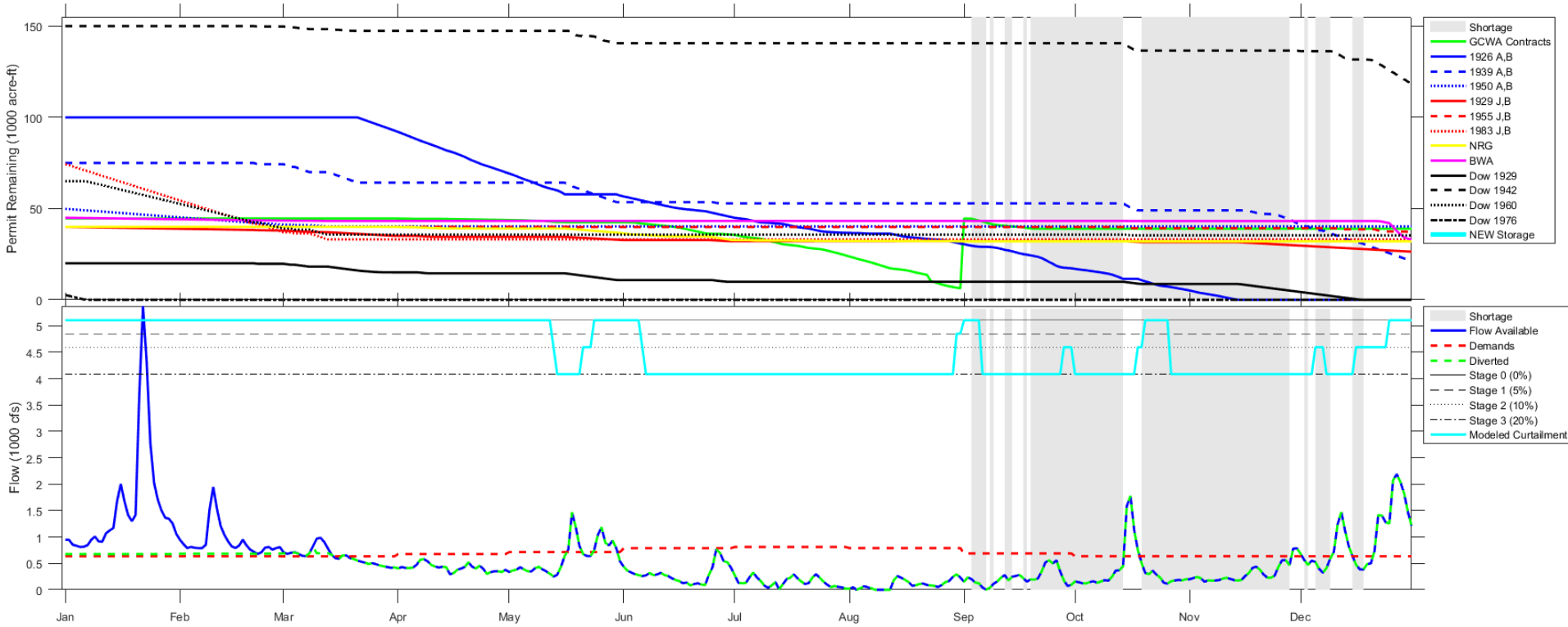
Demands = Full Contract Amounts
Up to 24% Canal Losses

Added to Daily-Hydro (V7)

GCWA's Current DCP Curtailment Rules (2012):

Stage	Curtailment	Days to Start	Days to End
0	0%	NA	NA
1	5%	3	7
2	10%	3	7
3	20%	3	7

Curtailment Modeling – Sample 2011 Results



Using §297.58(b) Allocation with DCP Curtailment – Total Shortage: **16,125** acre-ft

Curtailment Modeling – Sample 2011 Results

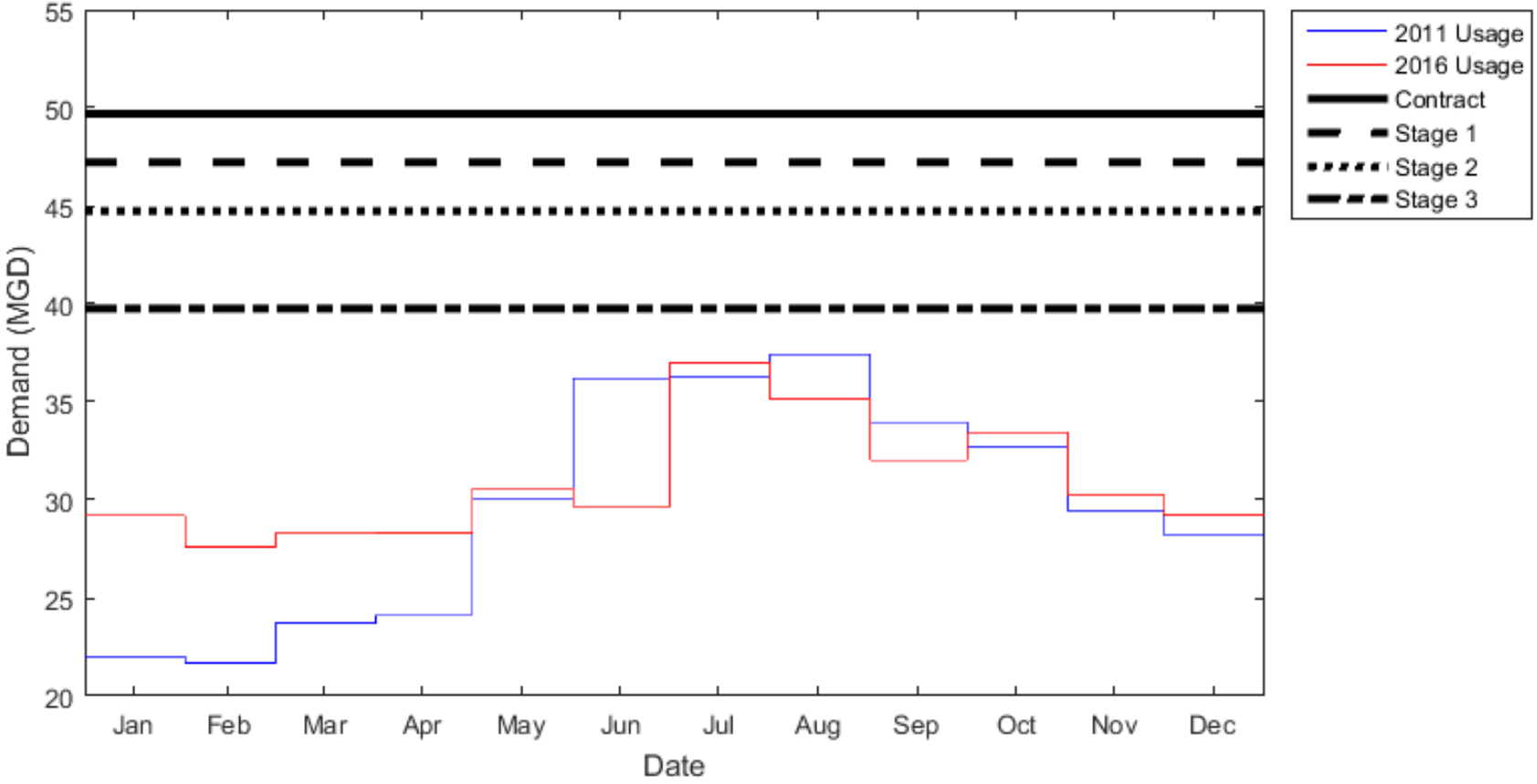
Summary – 2012 Curtailment Rules

	Pro-Rata Allocation	Watermaster Rules	§297.58(b)
No Curtailment	68,088 acre-ft	40,432 acre-ft	32,137 acre-ft
2012 Curtailment	39,889 acre-ft	20,954 acre-ft	16,125 acre-ft

How do Firm & Curtailed Demands compare with recent historical usage?

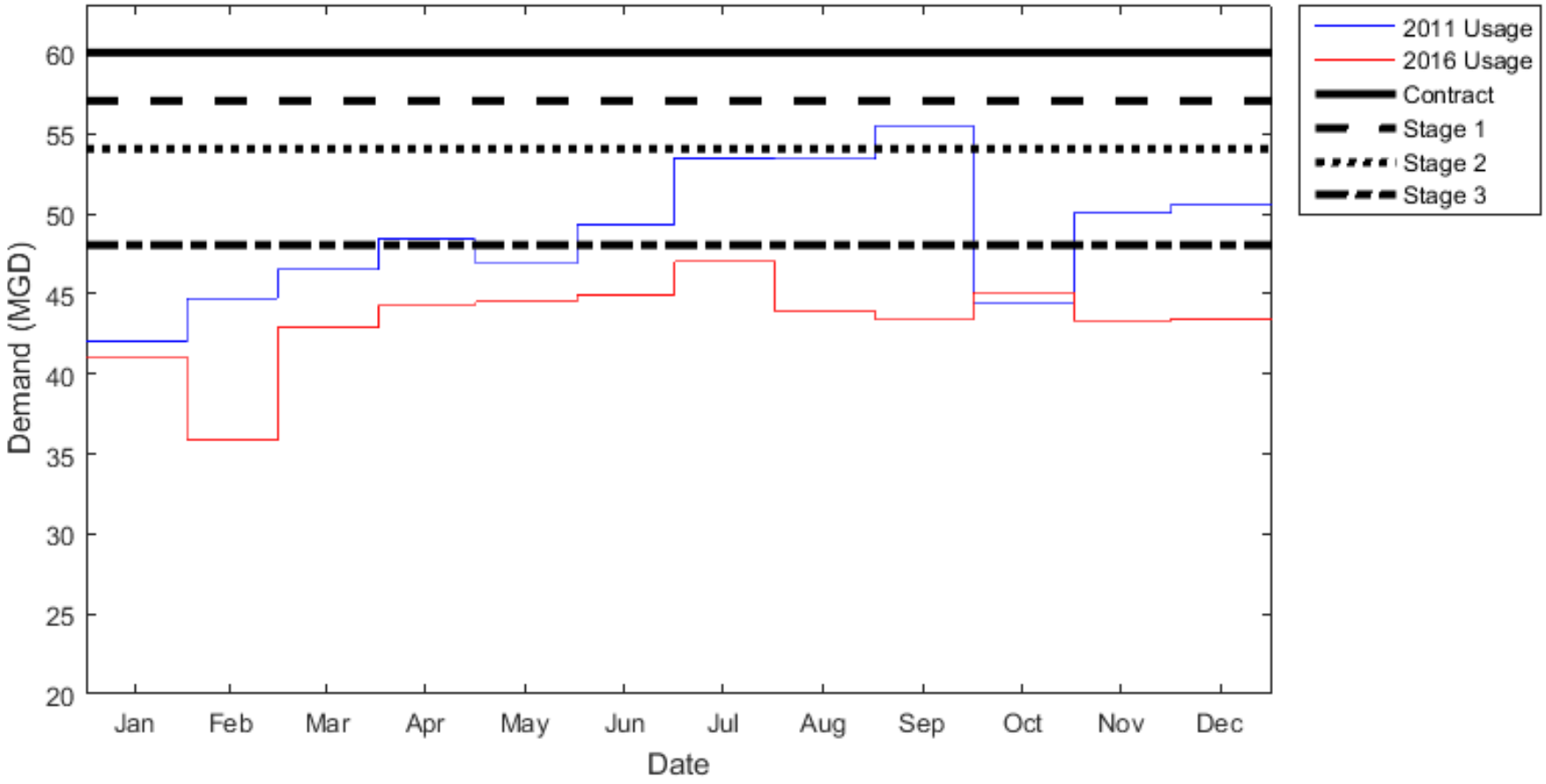
Curtailment Modeling – Sample 2011 Results

Thomas Mackey Water Plant – Delivered Water vs. Curtailments



Curtailment Modeling – Sample 2011 Results

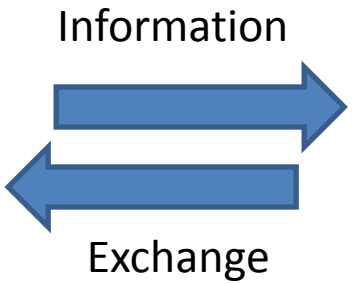
Industrial Pump Station – Delivered Water vs. Curtailments



Curtailment Ideas – What would you like to see?

Drought Task Force – Future Meeting

- Working Meetings = No lunch, but snacks likely → At GCWA facility or **online**
  - January 2017: Date & Time TBD
    - Project Updates – Dashboard, Water Loss, GW Assessment
    - Continued Discussion on Curtailment Rules/Triggers
  - Future meetings will be limited to 90 minutes
    - We do a "show & tell"
    - We listen to **YOU**
  - Task Force Roles:
    - Guide the engineering/planning process
    - Evaluate proposed solutions & provide feedback
    - Provide local knowledge & data to support project



January 16, 2018 – 2:00pm - WTP

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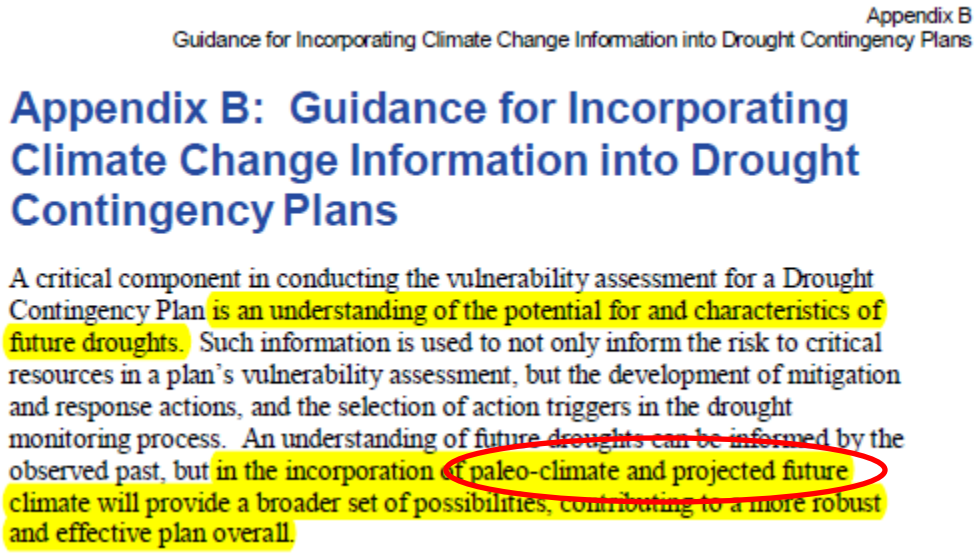
Jordan Furnans, PhD, PE, PG, CFM
Project Manager – GCWA US BoR DCP Update

512-736-6485
Jordan.Furnans@LREWater.com
1101 Satellite View #301 – Round Rock, TX 78665

Climate Change Analysis – US BoR Requirement

- TCEQ Planning Requirements – Only for the "Drought of Record"
- US BoR Requirement – more "all-encompassing"



Appendix B: Guidance for Incorporating Climate Change Information into Drought Contingency Plans

A critical component in conducting the vulnerability assessment for a Drought Contingency Plan is an understanding of the potential for and characteristics of future droughts. Such information is used to not only inform the risk to critical resources in a plan's vulnerability assessment, but the development of mitigation and response actions, and the selection of action triggers in the drought monitoring process. An understanding of future droughts can be informed by the observed past, but in the incorporation of paleo-climate and projected future climate will provide a broader set of possibilities, contributing to a more robust and effective plan overall.

- Paleo-Climate = Tree Ring Analysis
- Projected Future = Global Climate Modeling

Tree-Ring Analysis of Paleo-Climate & Streamflow

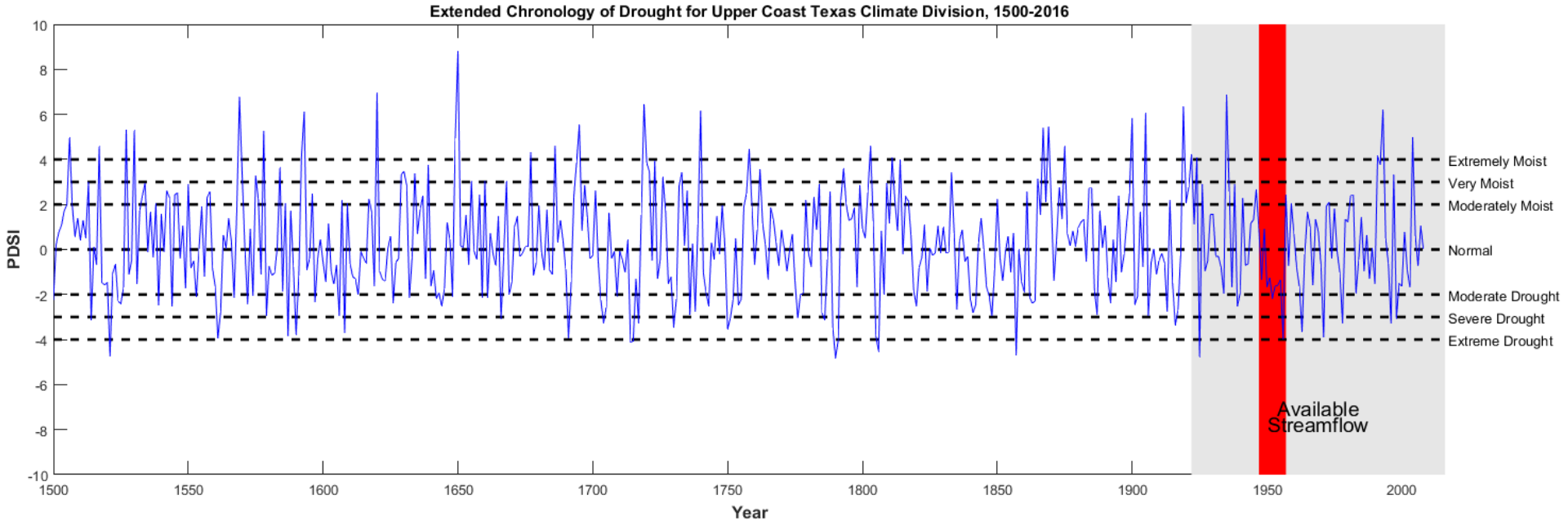
Common Analyses

Concept: Thickness of annual tree rings indicate drought conditions

"Ring-width and streamflow - an indirect but robust relationship" - http://www.treeflow.info/

No Data Yet for TX

Historical Droughts in the Lower Brazos

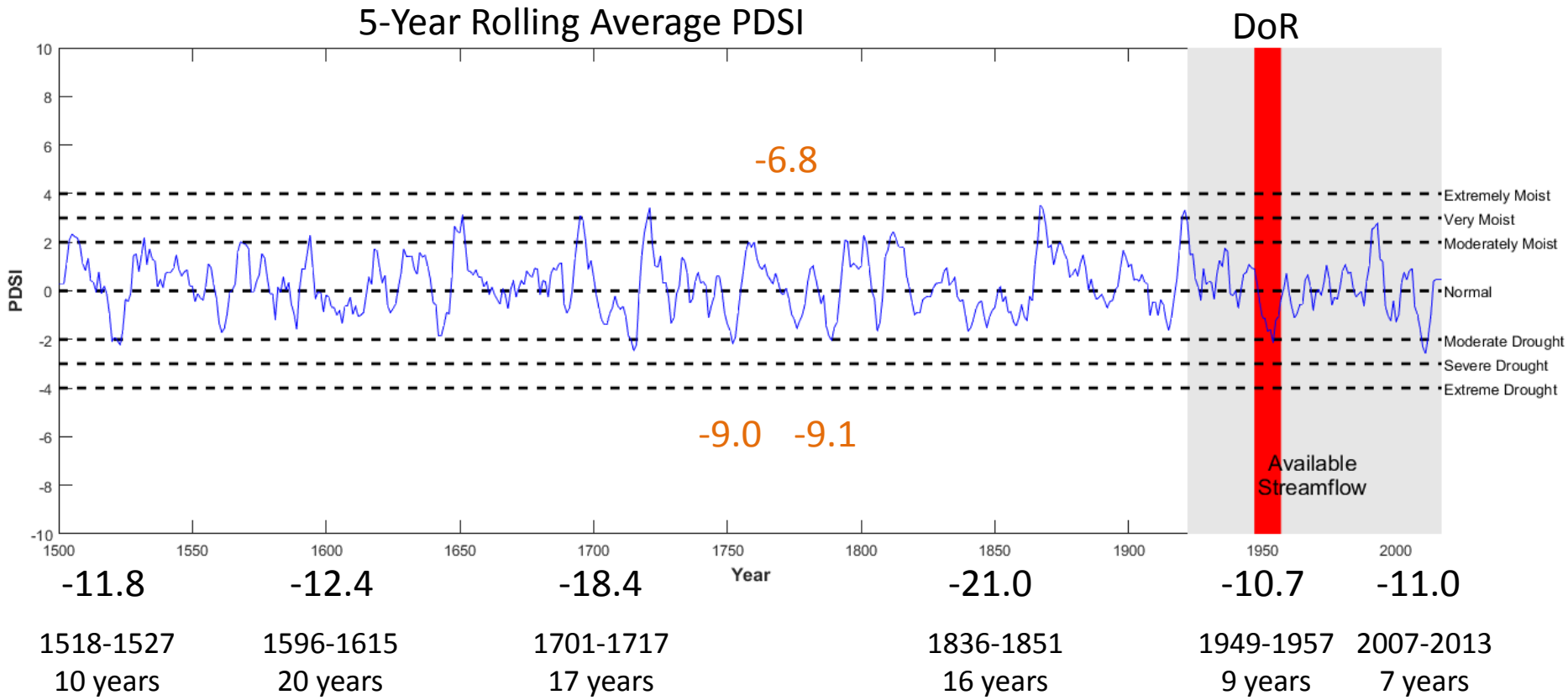


Large year-to-year variations

More extremely moist years than extreme drought years

Trends there – yet difficult to discern

Historical Droughts in the Lower Brazos

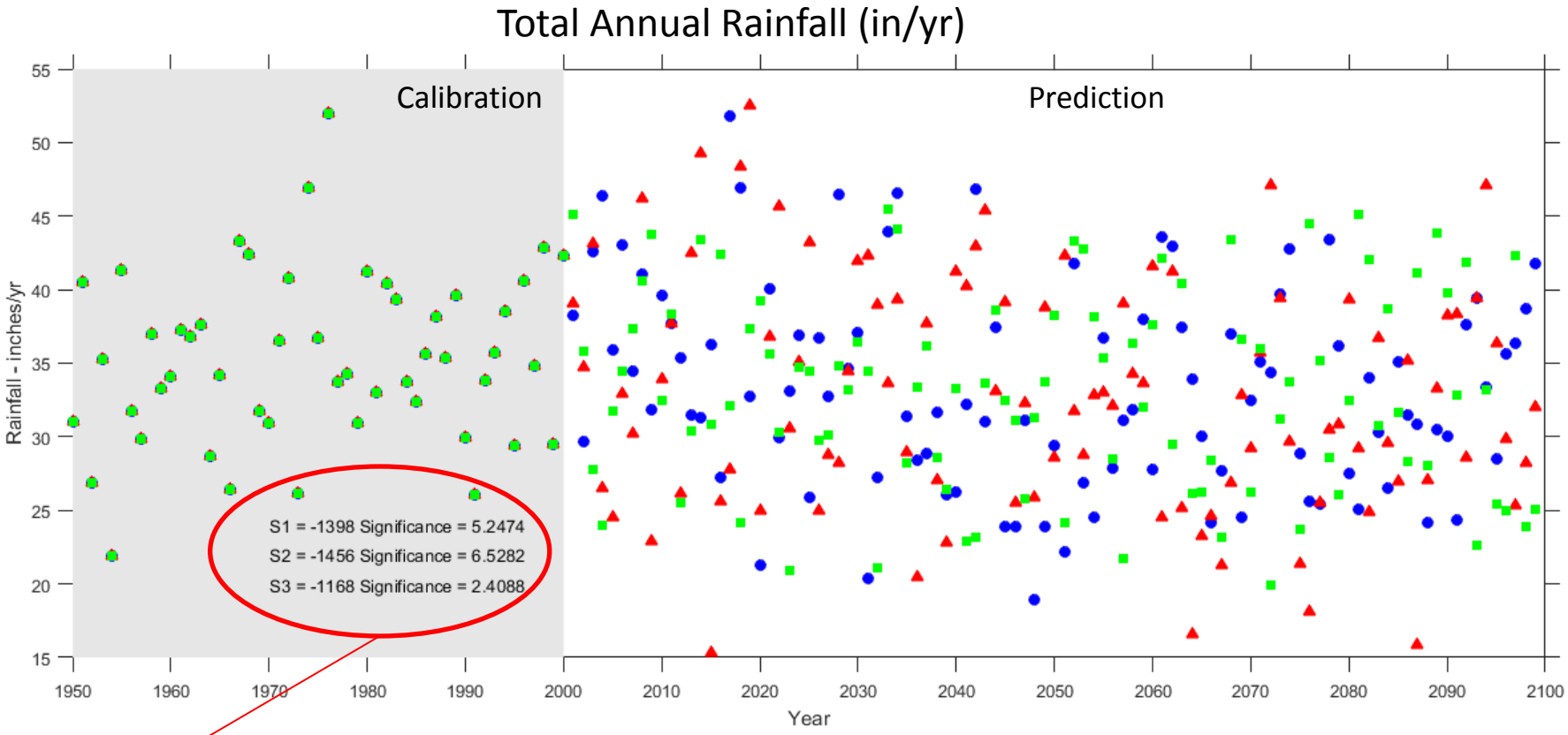


-11.8	-12.4	-18.4	-21.0	-10.7	-11.0
1518-1527 10 years	1596-1615 20 years	1701-1717 17 years	1836-1851 16 years	1949-1957 9 years	2007-2013 7 years

Conclusion – Droughts worse than the DoR occur 1x per 100 years

Future Droughts in the Brazos – Through 2099

Future Droughts – Implicit within Global Climate Model Results



Indicate Decreasing Rainfall With significance

Results shown for BC3 Model – On Lower Brazos Watershed

http://gdo-dcp.ucllnl.org/downscaled_cmip_projections/dcpInterface.html

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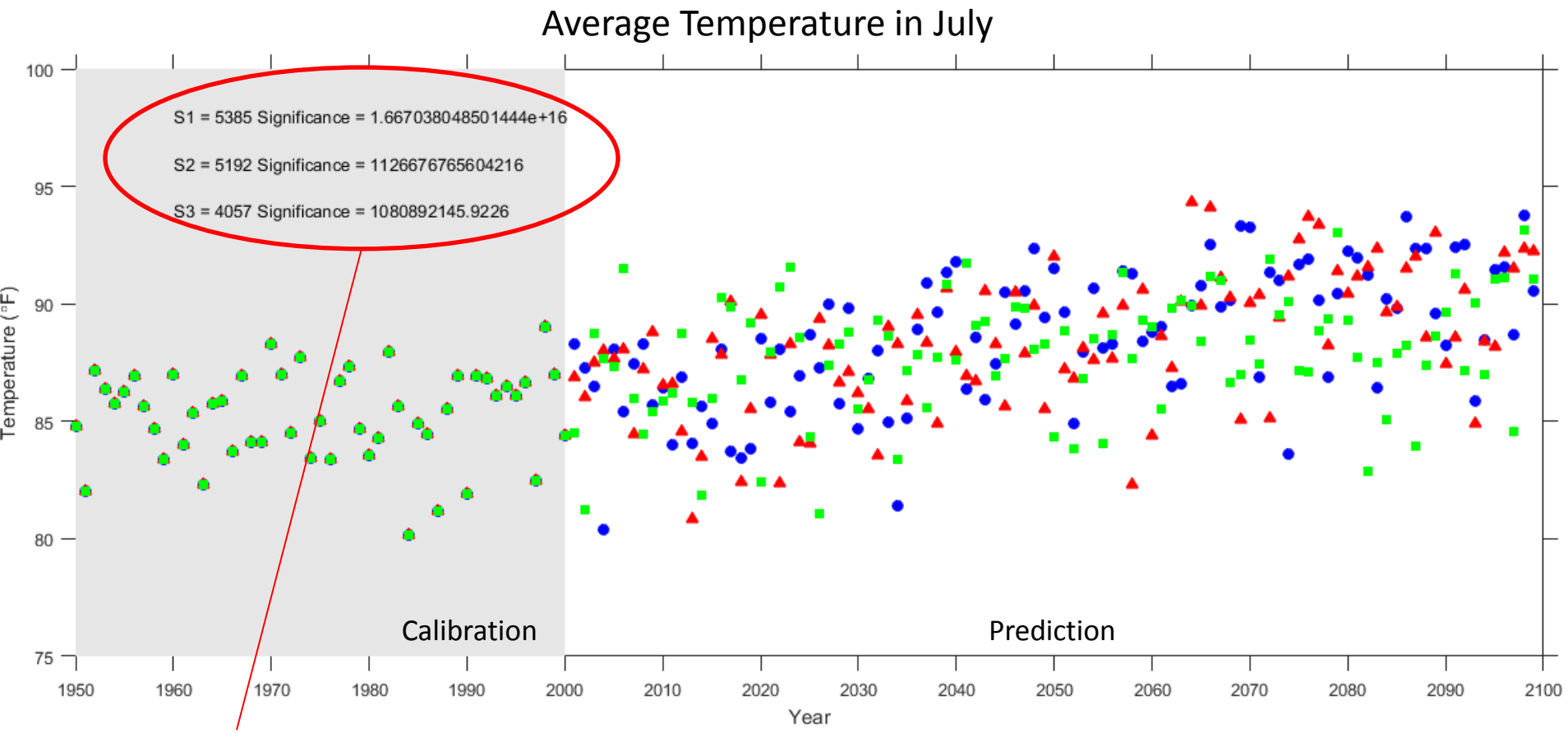
Future Droughts in the Brazos – Through 2099

Future Droughts – Implicit within Global Climate Model Results



Indicate Increasing Temperature With significance

Results shown for RGRD3 Model – On Lower Brazos Watershed

http://gdo-dcp.ucllnl.org/downscaled_cmip_projections/dcpInterface.html

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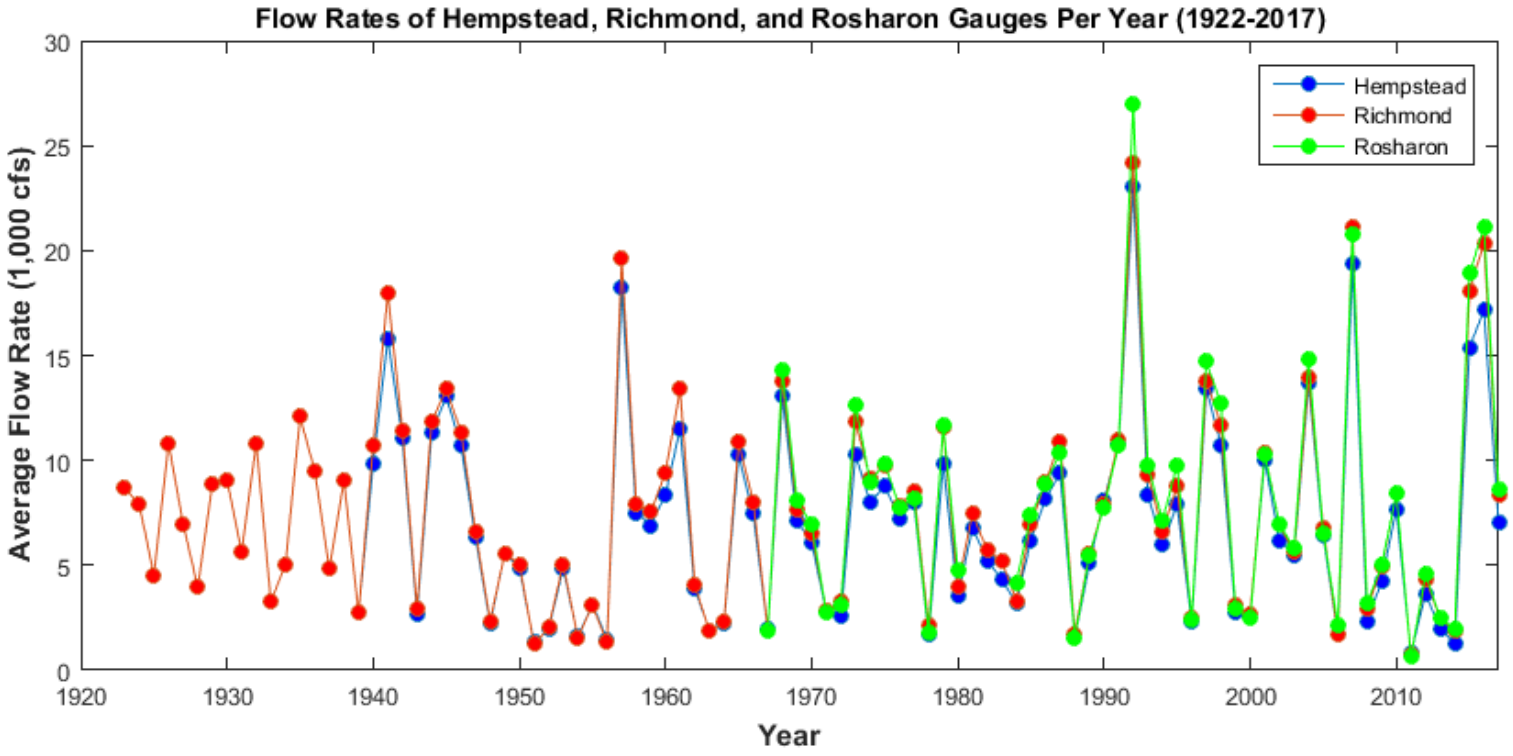
Combining Temperature & Rainfall Data

- VIC Watershed Modeling
  - Translates Temperature & Rainfall into Runoff
  - Compute Future Streamflow in the Lower Brazos
  - Model Future Water Availability/Reliability

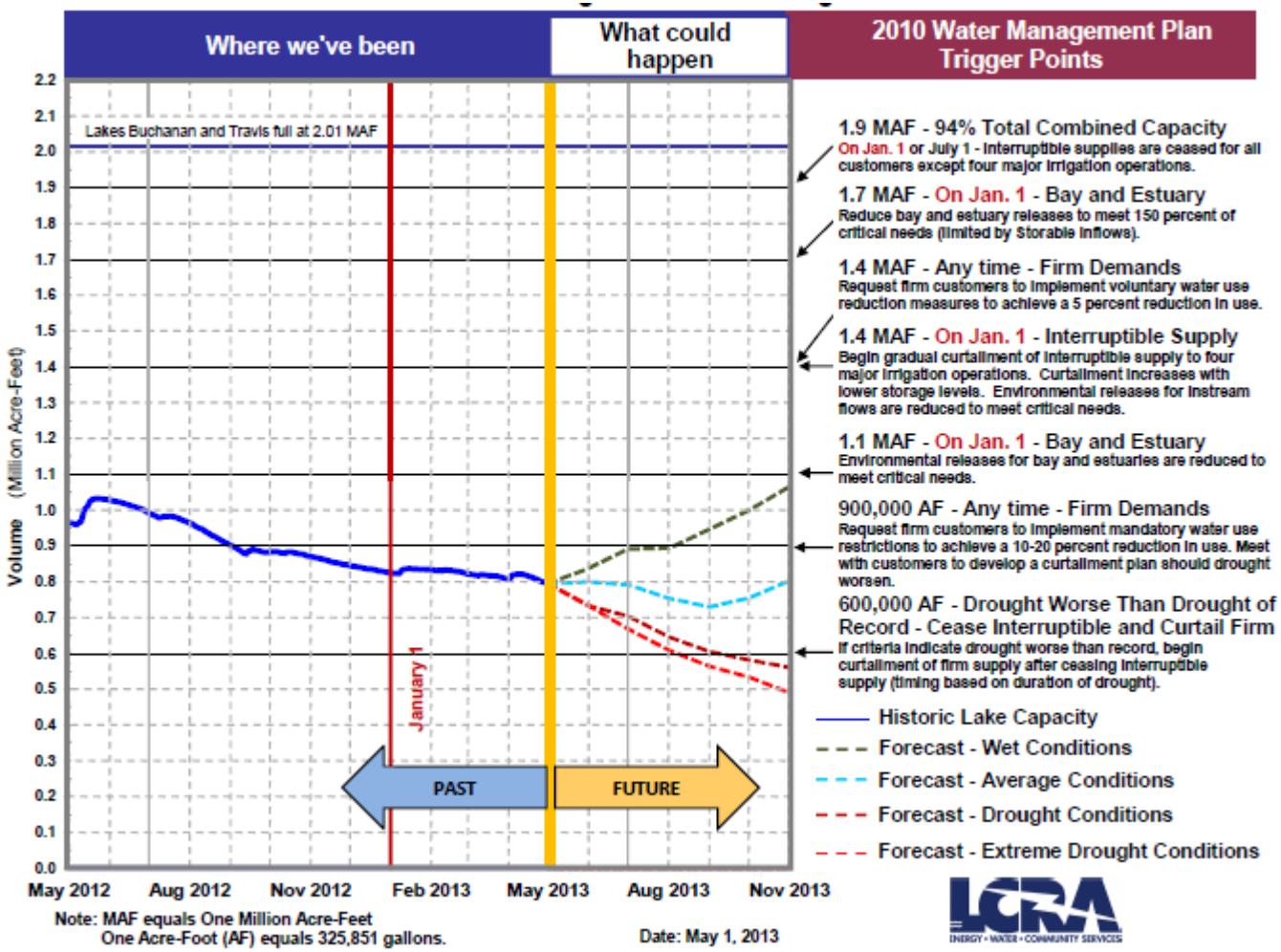
Outside of Project Scope

- Correlation Method with Measured Streamflow



Use Established & New Ideas

- LCRA "Look Ahead" Test



Apply to Brazos
Streamflow
Lake Storage

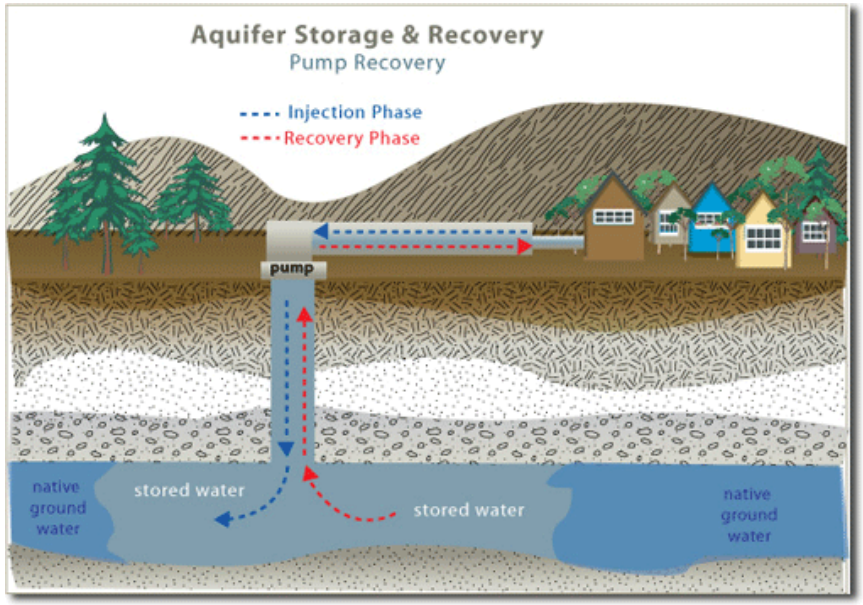
Water Usage Patterns
Smart Analysis

Conjunctive Use – SW & GW

- Idea = Use local groundwater when surface water is scarce
  - Use Existing or additional wells
  - Pumping subject to *subsidence district rules*
- Questions to answer:
  - How much pumping could be achieved?
  - Are existing wells operational?
  - Infrastructure Needs?
  - Permit Needs?
  - Other Needs?
  - Is ASR of benefit?

Potential Investigation of Upstream GW usage

Building on Ongoing & Completed GCWA Projects



Drought Task Force

- Drought Contingency Planning with US BoR
  - Large Stakeholder Component needed
  - Need to form a "Drought Task Force"
    - Will advise on project
    - Will "approve" project components
    - Comprised of GCWA customers, stakeholders, officials
  - Multiple Meetings – Quarterly (8 more)
  - Last Meeting – Public Meeting
  - Proposal Supporters:
    - San Leon MUD
    - Galveston County MUD #12
    - Bayview MUD
    - City of League City

Stakeholders Identified To Date

GCWA Drought Contingency Plan Update - Participants							
	Level			Primary Interest			
Entity	Commit	Interest	Expected	MUN	IND	IRR	ENV
San Leon MUD	X			X			
Galveston County Mud #12	X			X			
Bayview MUD	X			X			
City of League City	X			X			
City of Missouri City		X		X			
City of Sugarland		X		X			
Ascend Performance Materials		X			X		
Marathon Petroleum		X			X		
INEOS		X			X		
Dow Chemical		X			X		
NRG Energy		X			X		
Brazos River Authority			X	X	X	X	
Lower Brazos River Coalition		X		X	X	X	X
Harris-Galveston Subsidence District			X	X	X	X	
Texas Farm Bureau			X		X	X	
Texas Parks And Wildlife			X				X
Texas Water Development Board			X	X	X	X	X

GCWA Customer DCPs

From 1/12/2017 Meeting:

- "New GCWA DCP must be consistent with current customer DCPs"

What is good? Bad?

Customer DCP's I have (and will review)

- Bacliff MUD
- Bayview MUD
- City of Galveston
- City of Hitchcock
- City of La Marque
- City of League City
- City of Texas City
- GC FWD #6 (Tiki Island)
- GC Mud #12 (Bayou Vista)
- GC WCID #1 (Dickinson)
- GC WCID #8 (Santa Fe)
- GC WCID #12 (Kemah)
- San Leon MUD

From City of Galveston DCP:

Stress Public Education Need:

1) The water management condition is real
2) Reductions in water demand are necessary.
3) The adopted measures realistically correspond to the severity of the situation.
4) All Customers share the inconvenience during water shortages.
5) The City of Galveston is effectively managing the existing water supply.