Water Reuse Webinar

North Central Texas Council of Governments
Environment and Development Department

August 22, 2017

North Central Texas
Council of Governments
Environment & Development

Please welcome our first speaker:

Glenn Clingenpeel

Trinity River Authority

Trinity River Authority of Texas

Enriching the Trinity basin as a resource for Texans

Reuse, Water Supply and Environmental Flows in the Trinity River Basin

NCTCOG Webinar August 22, 1017

Wastewater Treatment ▪ Water Treatment ▪ Water Storage ▪ Lake Livingston ▪ Recreation

Outline

Glenn Clingenpeel

Overview of Trinity River Basin
- Basin and Hydrology
- Water Supplies

History of Reuse in the Region
- Historical Perspective

Types of Potable Reuse
- Indirect Potable Reuse
- Direct Potable Reuse

Concerns over impacts to instream flows

Outline

Webster Mangham

Trinity River Flows - Historical Perspective
- Trinity River Flows
- WWTP Discharges
- Past, Present, and Future Flows

Environmental Flows
- SB2 and SB3
- TRA Environmental Flow Studies
- Preliminary Results

Next Steps

Trinity River Authority of Texas

Enriching the Trinity basin as a resource for Texans

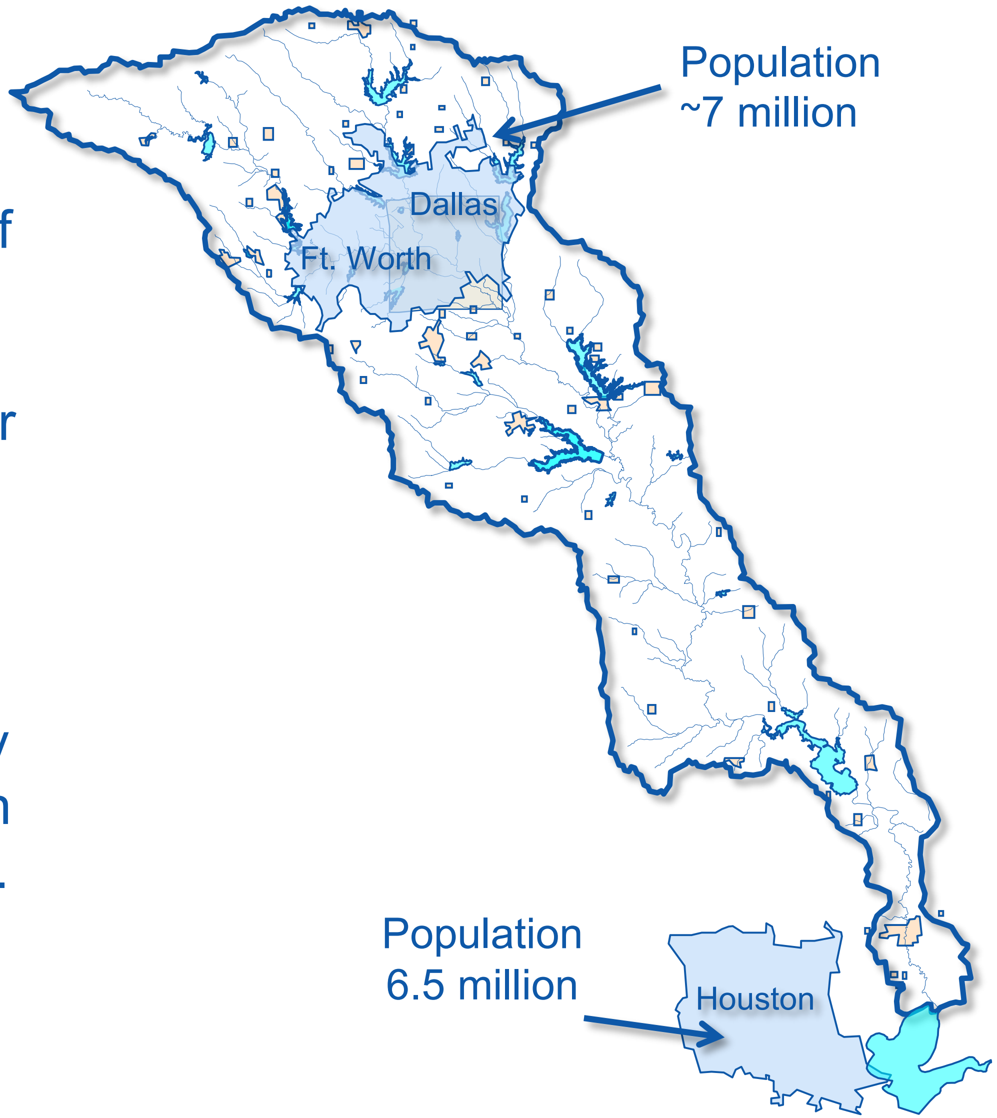
Reuse and Water Supply

Glenn Clingenpeel

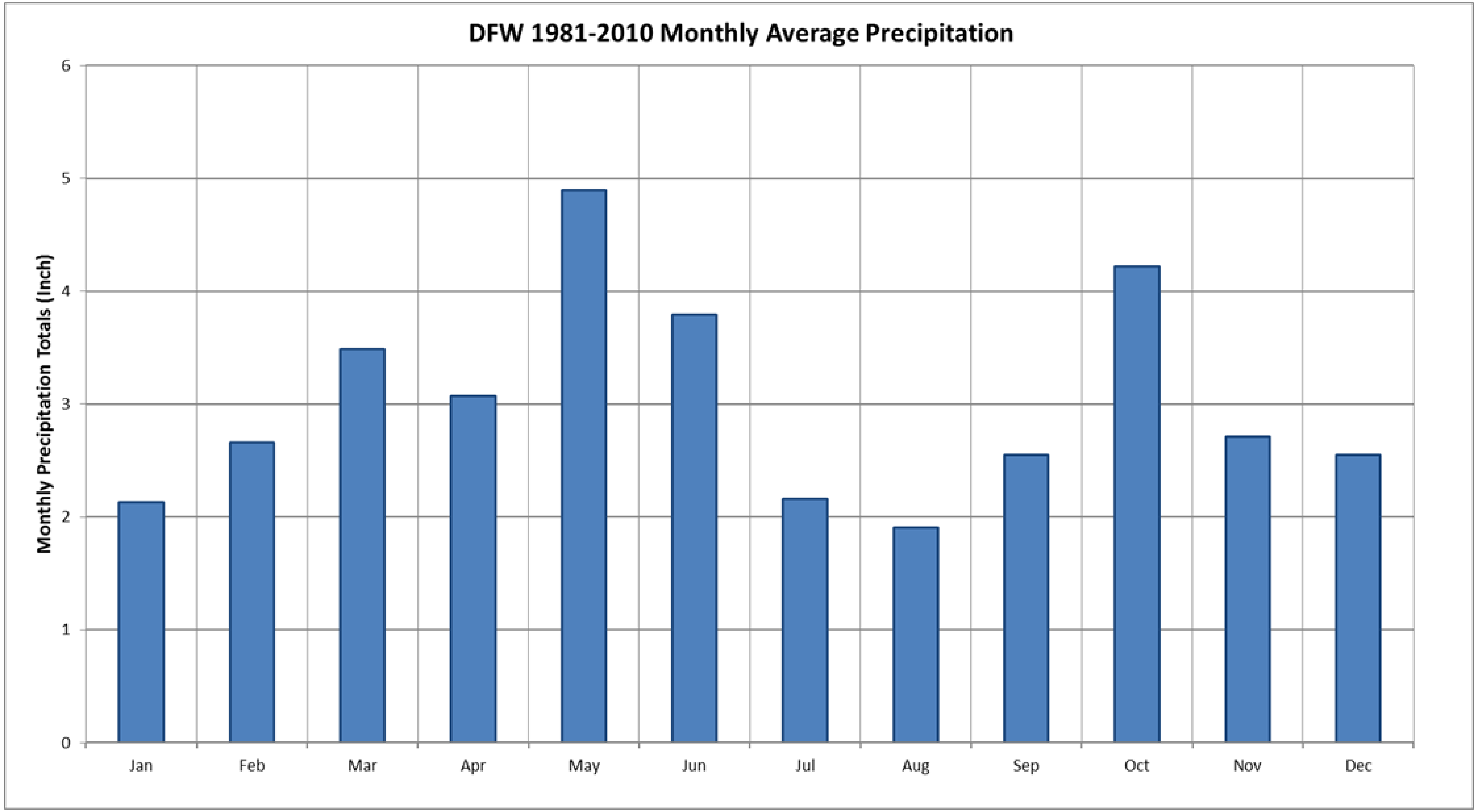
Wastewater Treatment ▪ Water Treatment ▪ Water Storage ▪ Lake Livingston ▪ Recreation

Trinity River Basin

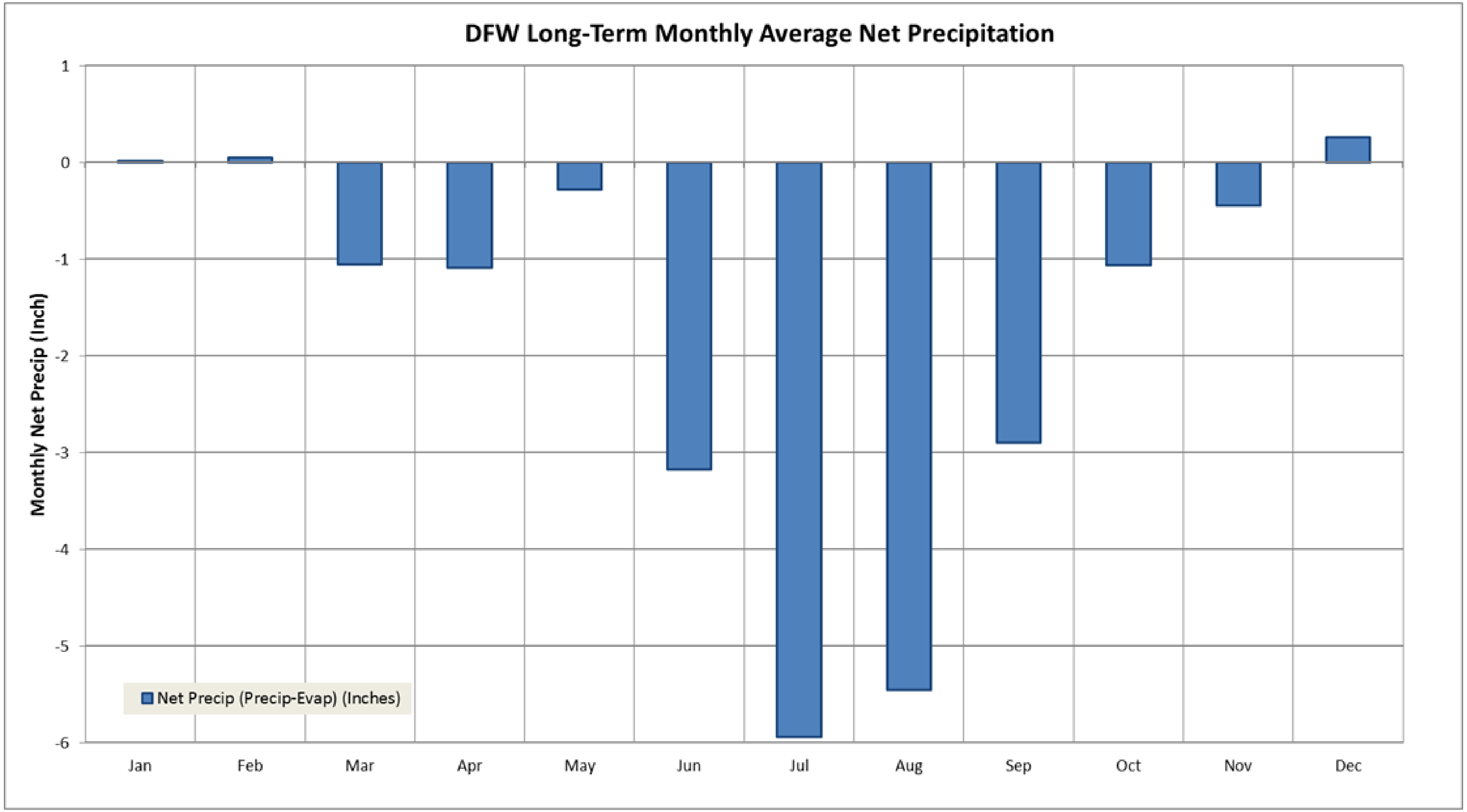
- Approximately half of Texas' population depends on the Trinity River basin for at least part of its water supply.
- Since 1911, more than 32 water-supply reservoirs have been built within the basin.



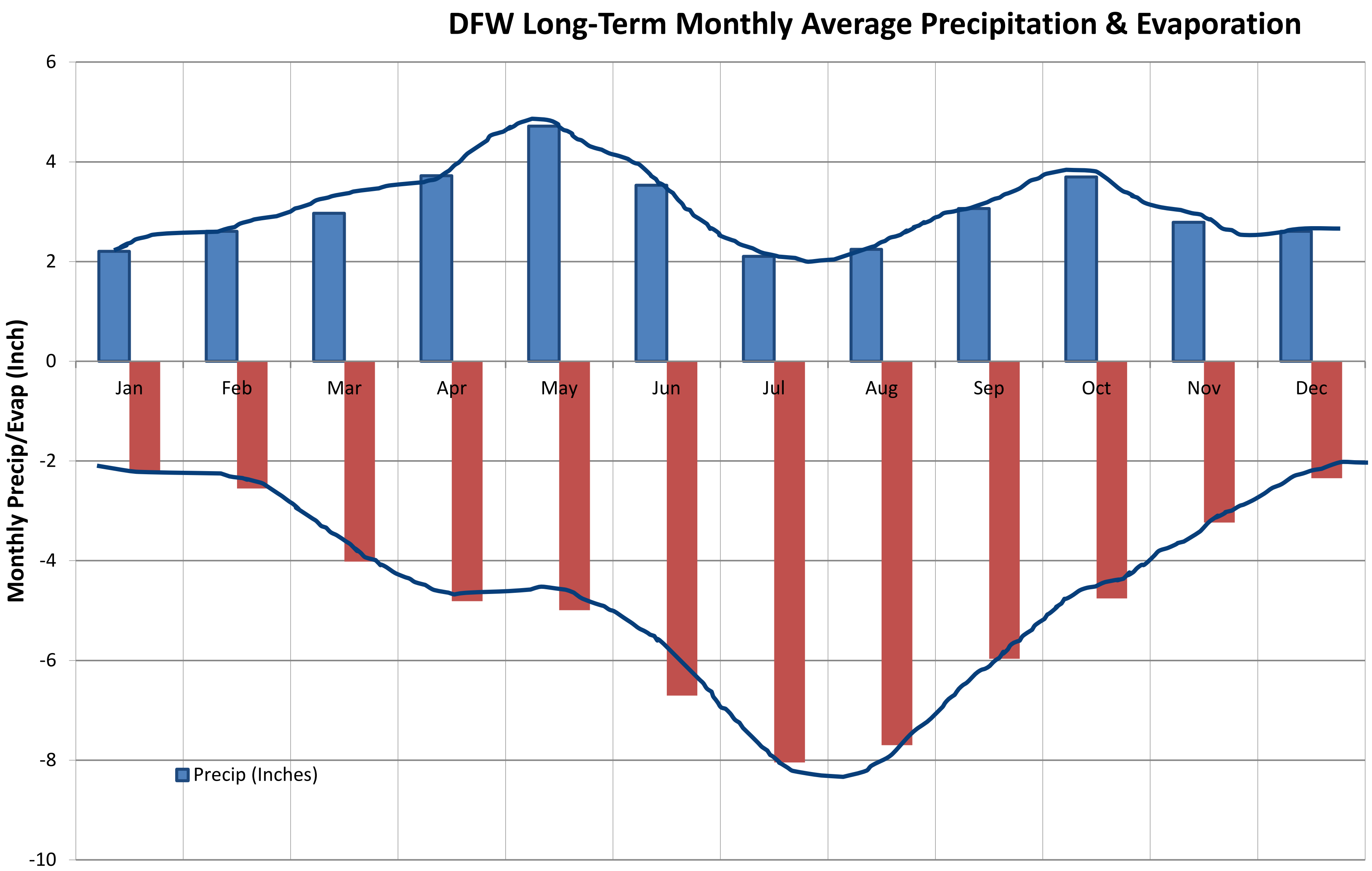
Precipitation in North Texas



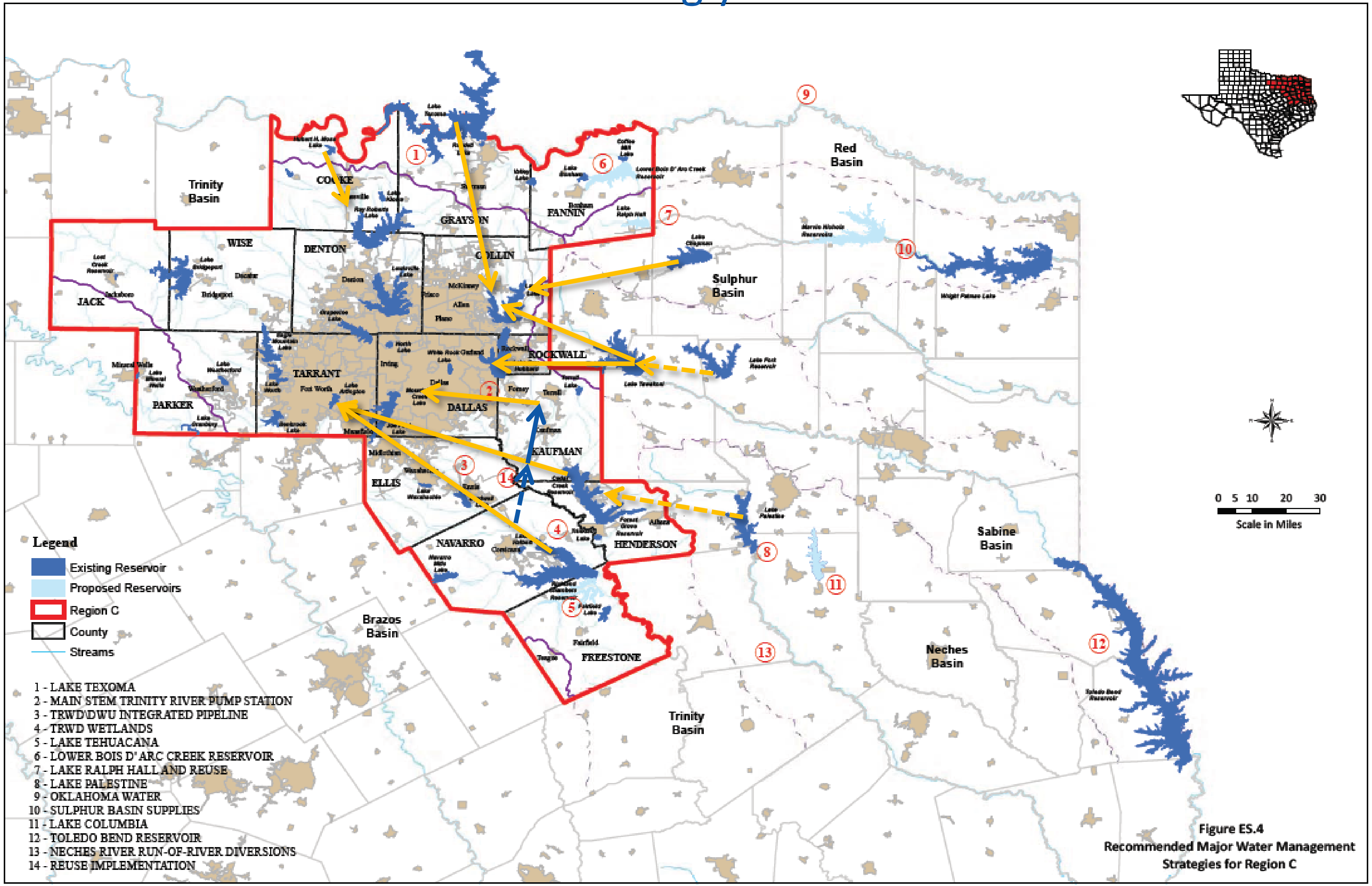
Net Precipitation in North Texas



Precipitation and Evaporation in North Texas

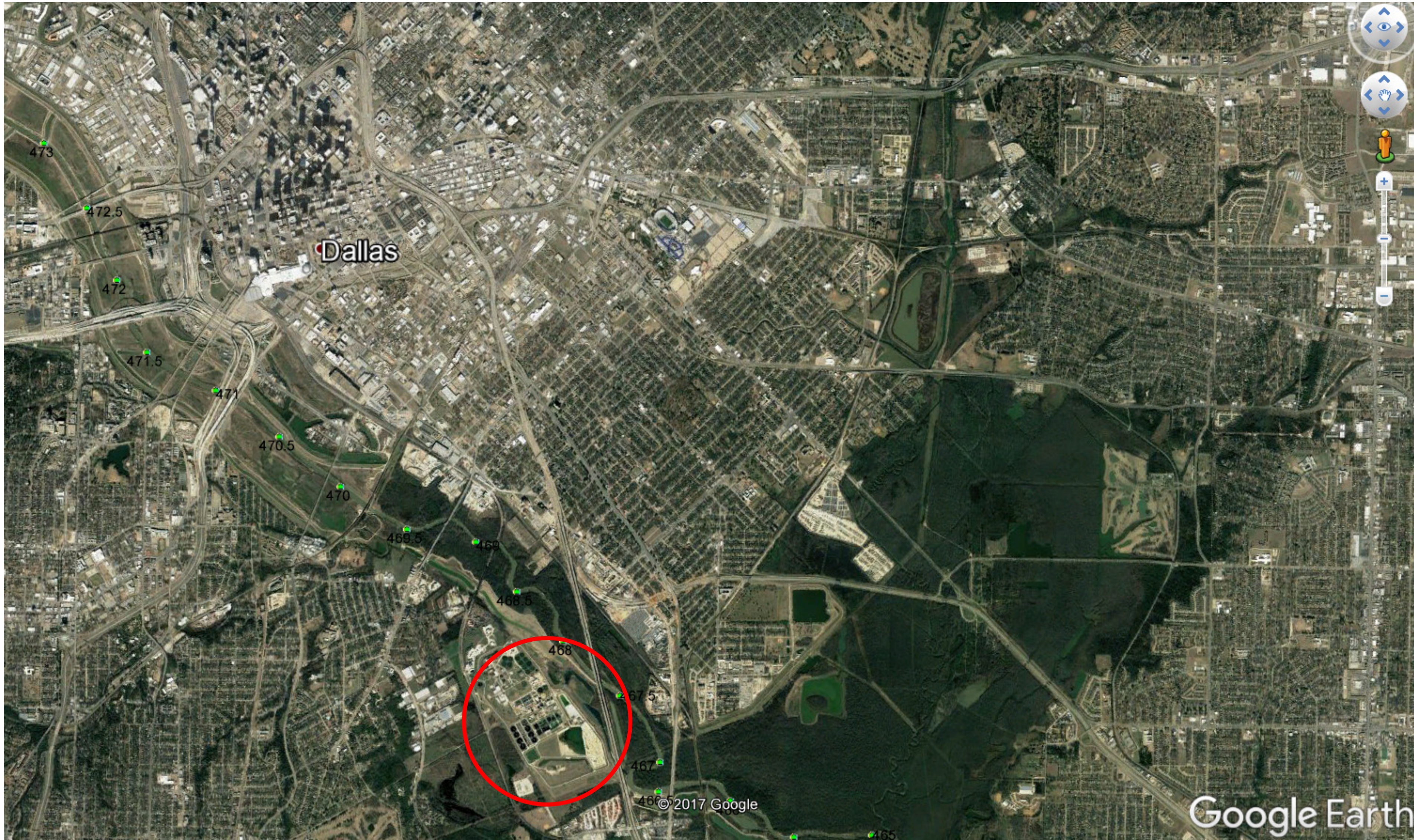


Conventional water supplies in North Texas are from increasingly distant sources



2016 Region C Water Plan

Return Flows Happen Where You Need Them

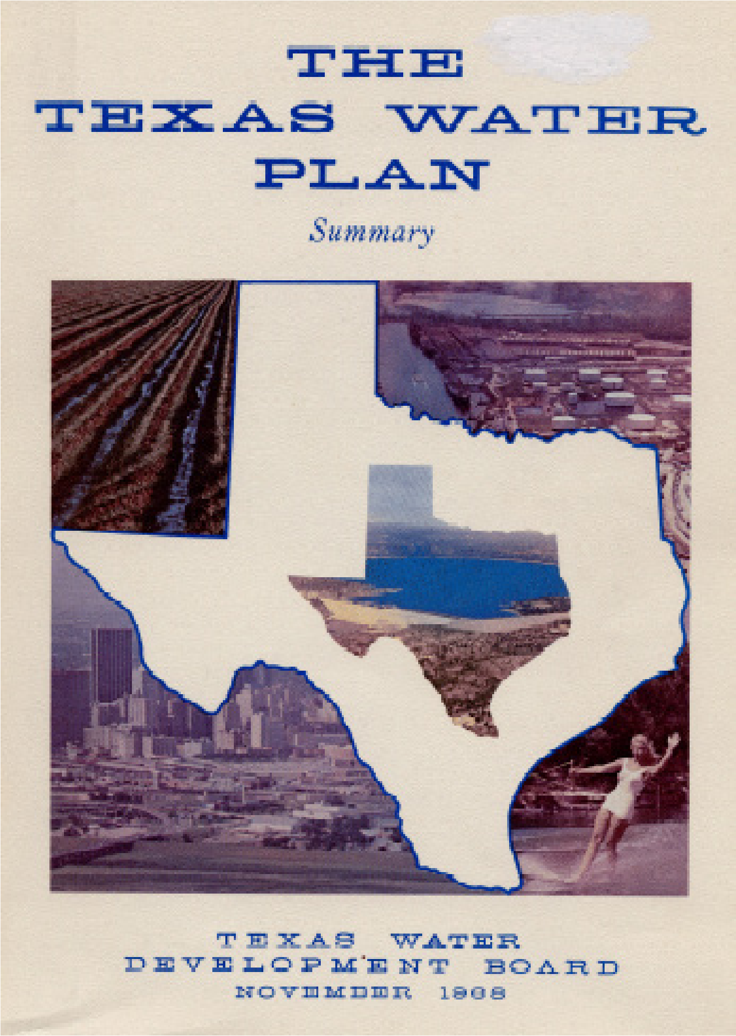


History of Reuse in Texas

1800's *De facto* reuse in San Antonio through acequías - irrigation canals

First record of legal entitlement to reuse in Texas dates to 1901 – San Antonio Irrigation Company given rights to "sewage"

1968 Water Plan Recognized Importance of Reclaimed Water

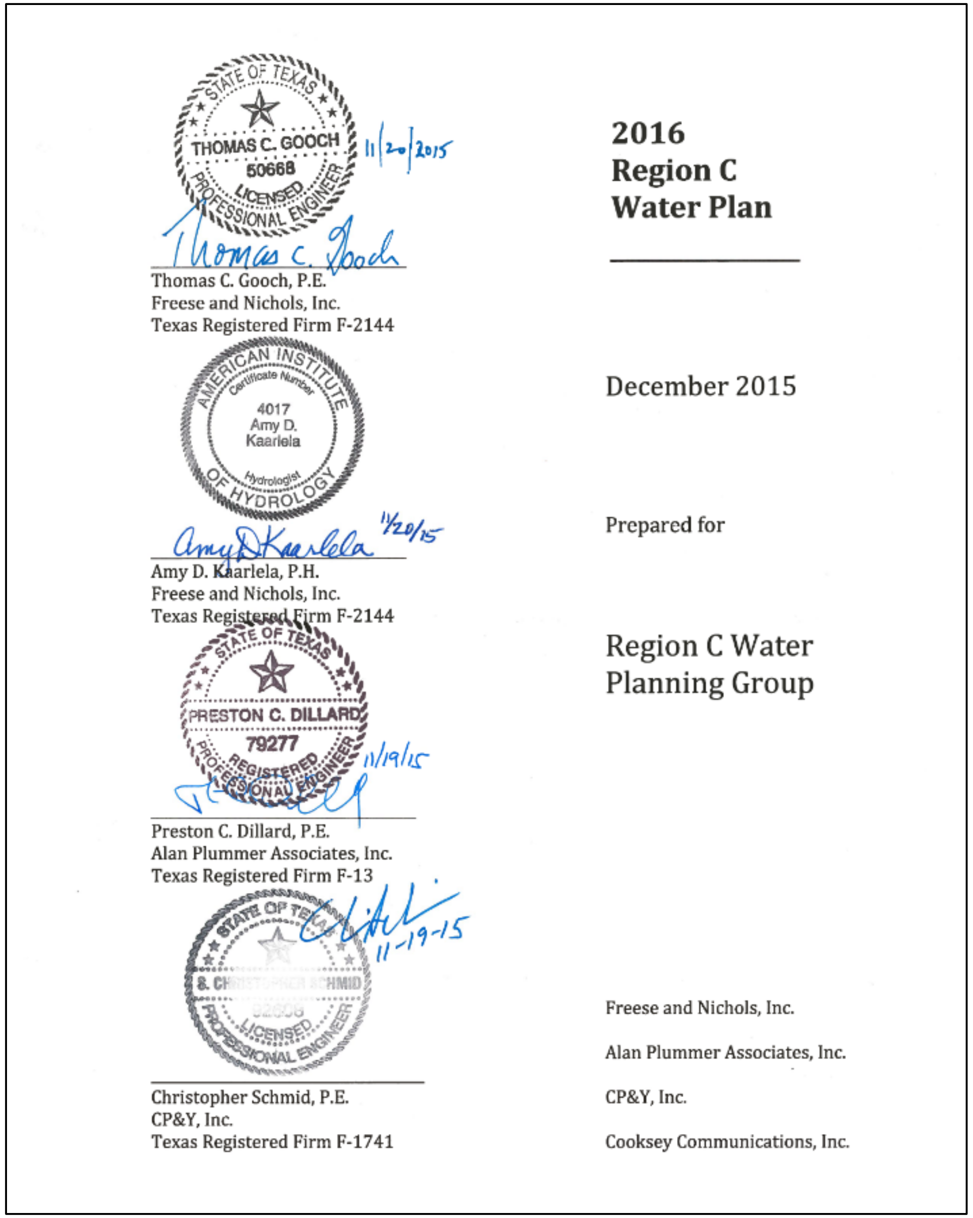


Return flows are…"an essential and valuable water resource that should be managed and administered conjunctively with other water resources"

First Major Urban Indirect Non-potable Water Plan Project

In 1997 TRA obtained a Water quality permit from the TCEQ to discharge reclaimed wastewater into the lakes at Las Colinas

2016 Region C Plan



2016
Region C
Water Plan

December 2015

Prepared for

Region C Water
Planning Group

Thomas C. Gooch, P.E.
Freese and Nichols, Inc.
Texas Registered Firm F-2144

Amy D. Kaarlela, P.H.
Freese and Nichols, Inc.
Texas Registered Firm F-2144

Preston C. Dillard, P.E.
Alan Plummer Associates, Inc.
Texas Registered Firm F-13

Christopher Schmid, P.E.
CP&Y, Inc.
Texas Registered Firm F-1741

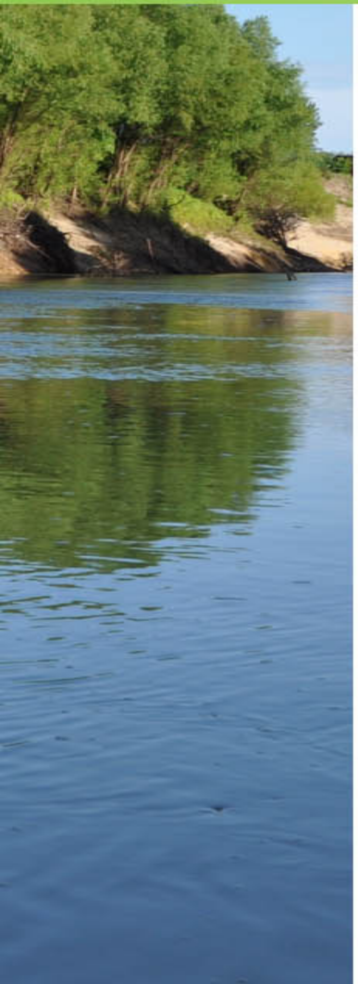
Freese and Nichols, Inc.

Alan Plummer Associates, Inc.

CP&Y, Inc.

Cooksey Communications, Inc.

2016 Region C Plan identifies 283,893 AF of reuse available in 2020



Urban Counties are Expected to Grow Significantly

- The population of Region C is projected to more than double over the next 50 years, from nearly

7 million in 2014 to *more than 14.3 million by 2070*

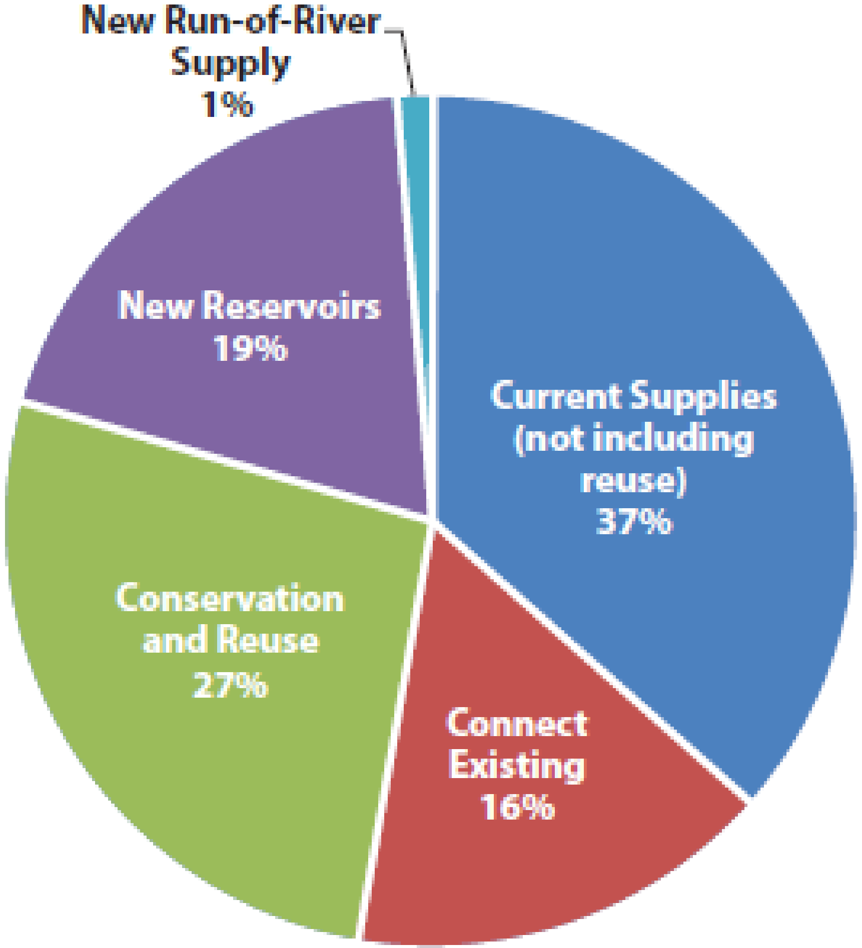
- Will Drive Water Demands Higher

Regional Water Supplies

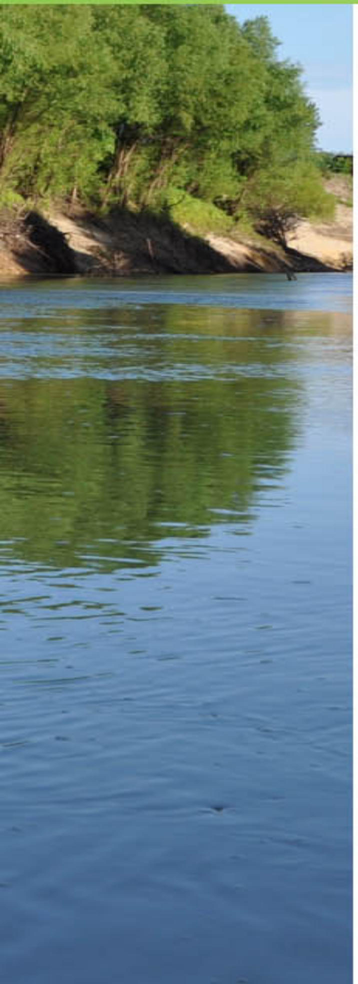
Region C (D/FW area) shows significant shortages in 2070

	Region C
Current Supply:	1,631,341 AF/yr
Projected Demand:	2,939,880 AF/yr
Projected Deficit:	(1,308,539) AF/yr
	4,263,351,000 gallons/yr

Water Supply Strategies



Key Points – Indirect Reuse



- Water Right Application (non-reuse)
  - Based on WAM Model Run 3 – Does not consider return flows
  - Reuse subject to 100% direct reuse prior to discharge

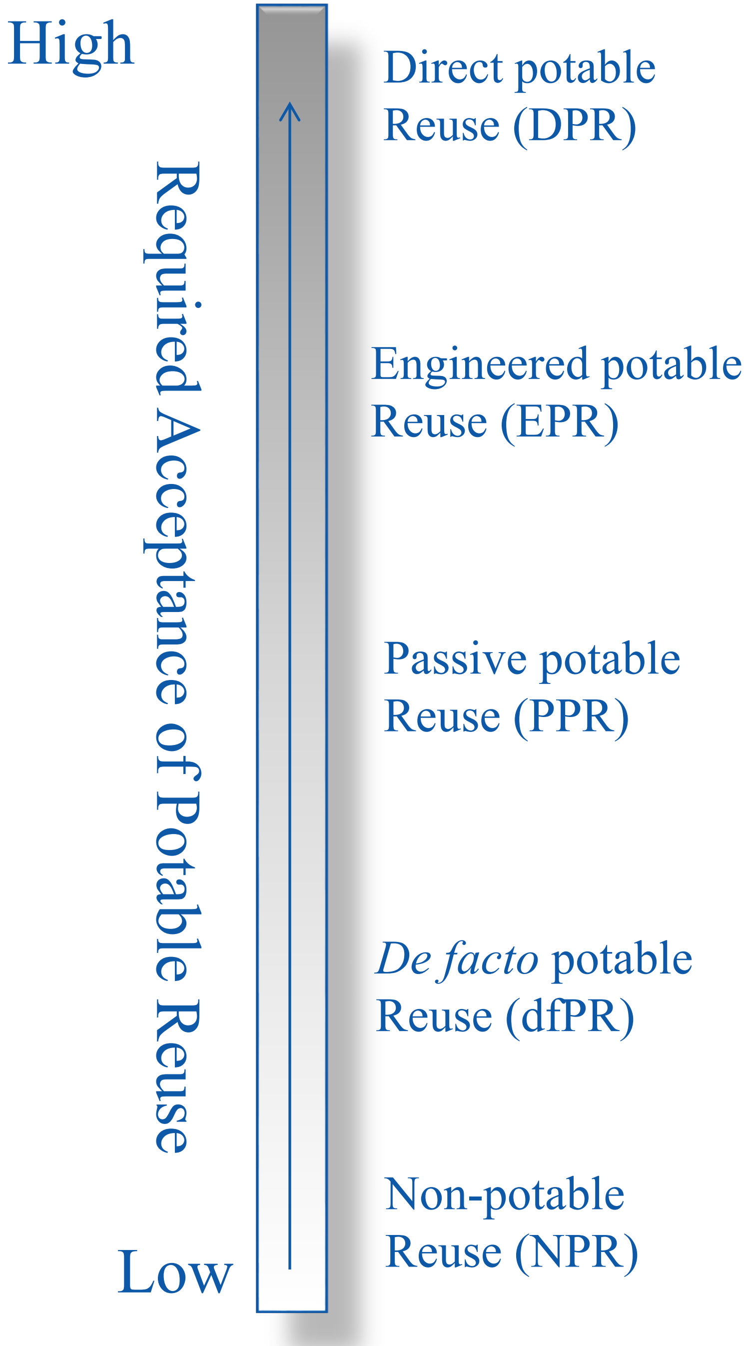
- Under a reuse permit, *only water put in can be taken out*

Key Points – Indirect Reuse

- Indirect reuse limited in practice to number of times it can be used - WQ Issues
- In Region C (upstream) major future water demand is municipal;
  - Not 100% consumptive
  - Remainder discharged and allowed to flow downstream

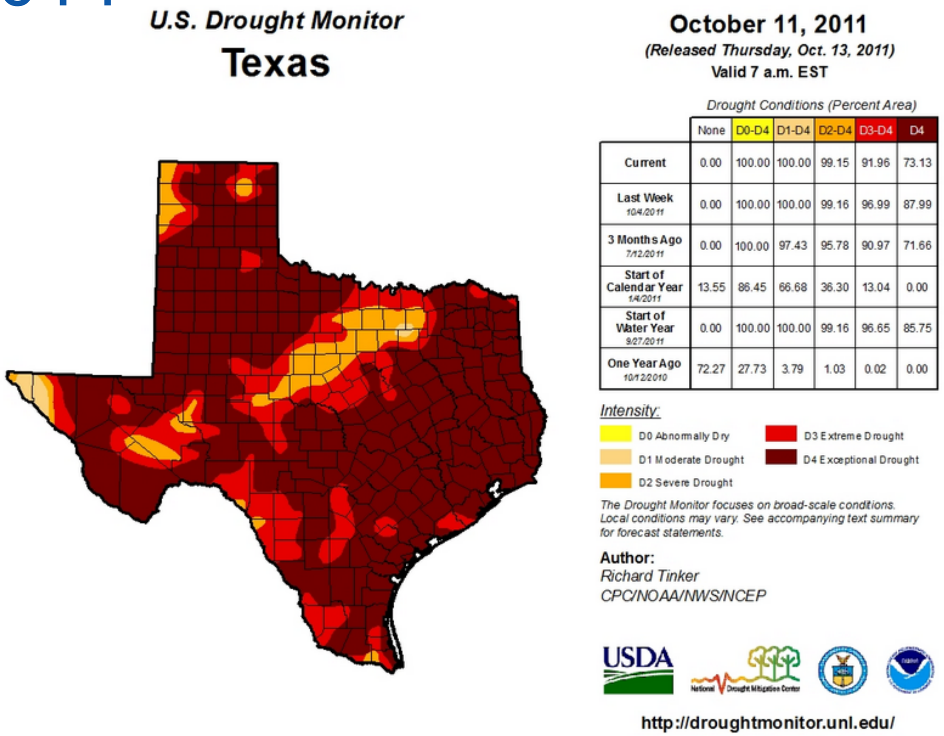
Direct Potable Reuse

Continuum of Reuse Projects and Need for Public Acceptance



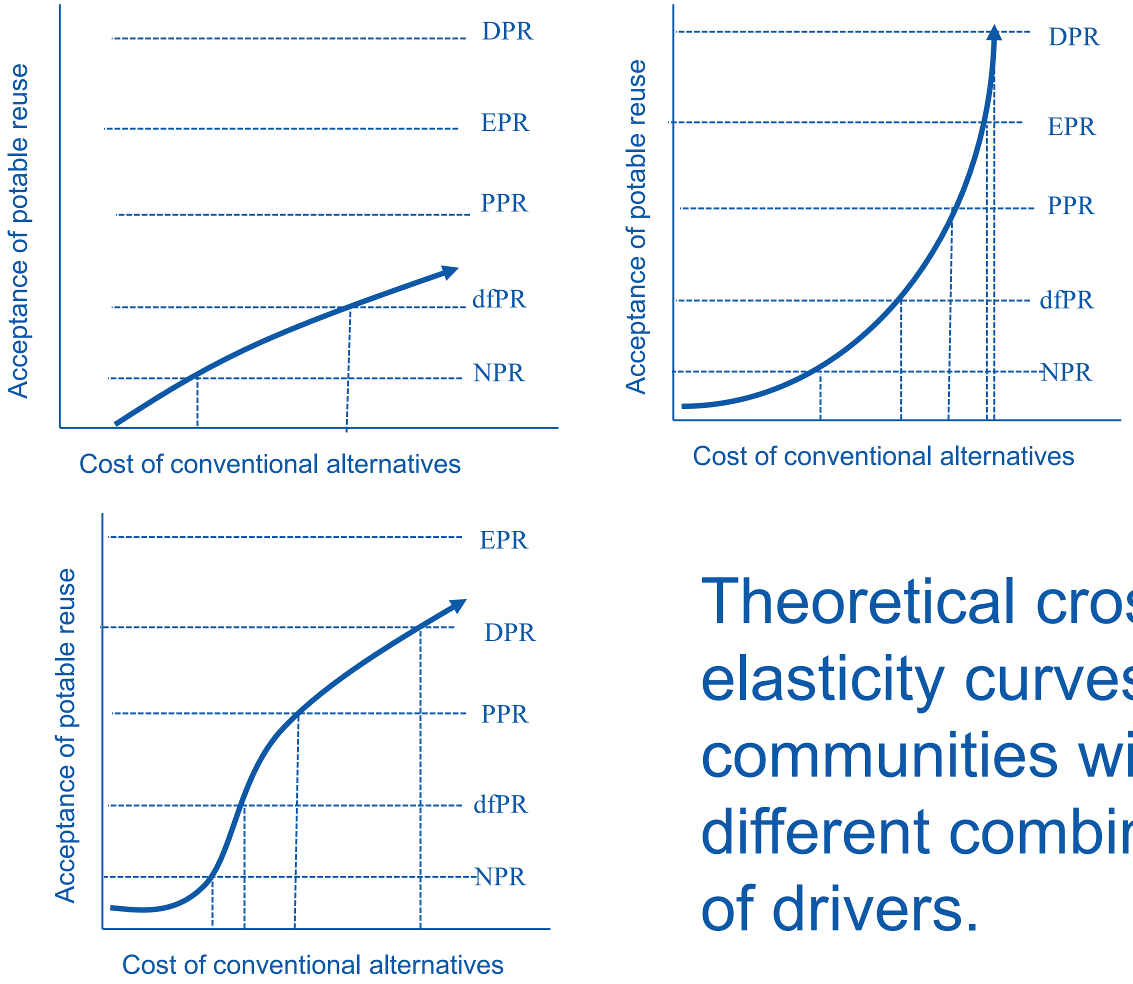
Direct Potable Reuse

Began out of necessity in West Texas during drought of 2010-2014



	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	100.00	99.15	91.96	73.13
Last Week 10/4/2011	0.00	100.00	100.00	99.16	96.99	87.99
3 Months Ago 7/12/2011	0.00	100.00	97.43	95.78	90.97	71.66
Start of Calendar Year 1/4/2011	13.55	86.45	66.68	36.30	13.04	0.00
Start of Water Year 9/27/2011	0.00	100.00	100.00	99.16	96.65	85.75
One Year Ago 10/12/2010	72.27	27.73	3.79	1.03	0.02	0.00

DPR As A Substitute Commodity



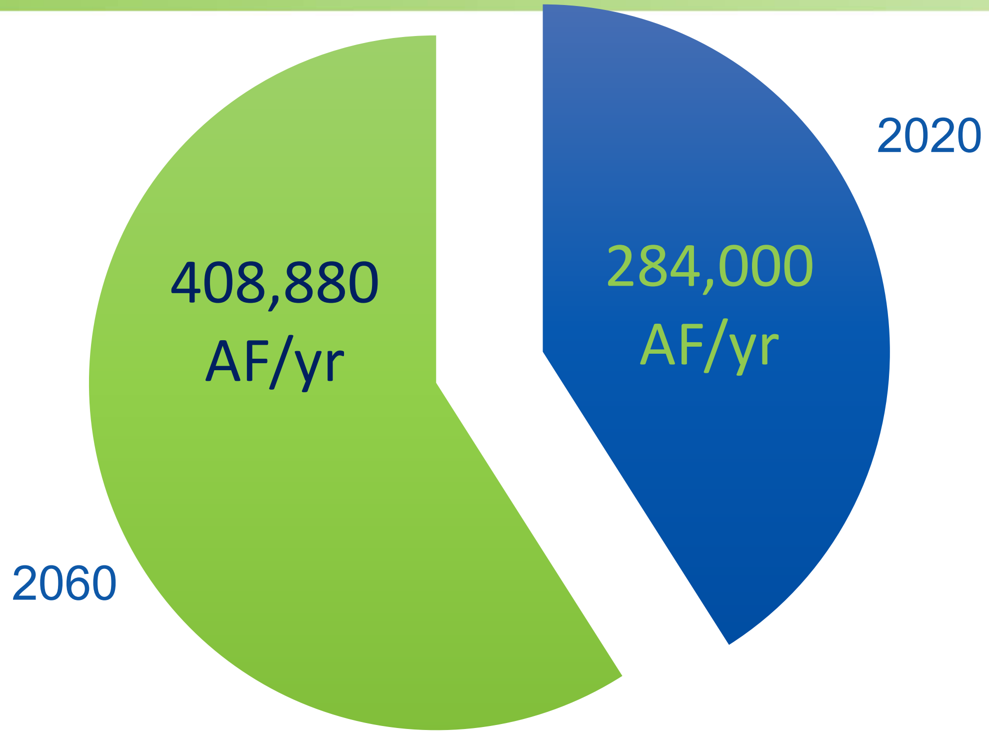
Theoretical cross elasticity curves for communities with different combinations of drivers.

Direct Potable Reuse

- Only makes sense in a limited number of cases
- Probably does not make sense in North Texas
  - Numerous reservoirs in which to divert and store return flows
  - High-quality surface water
- Could be used as an emergency supply
  - maintaining the infrastructure is prohibitively expensive

Potable Reuse - Future

Region C Reuse - Future



State-wide Direct Potable projected to increase from 33,000 AF/yr in 2020 to 87,000 AF/yr in 2070

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Reuse and Return Flows

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Wastewater Treatment ▪ Water Treatment ▪ Water Storage ▪ Lake Livingston ▪ Recreation

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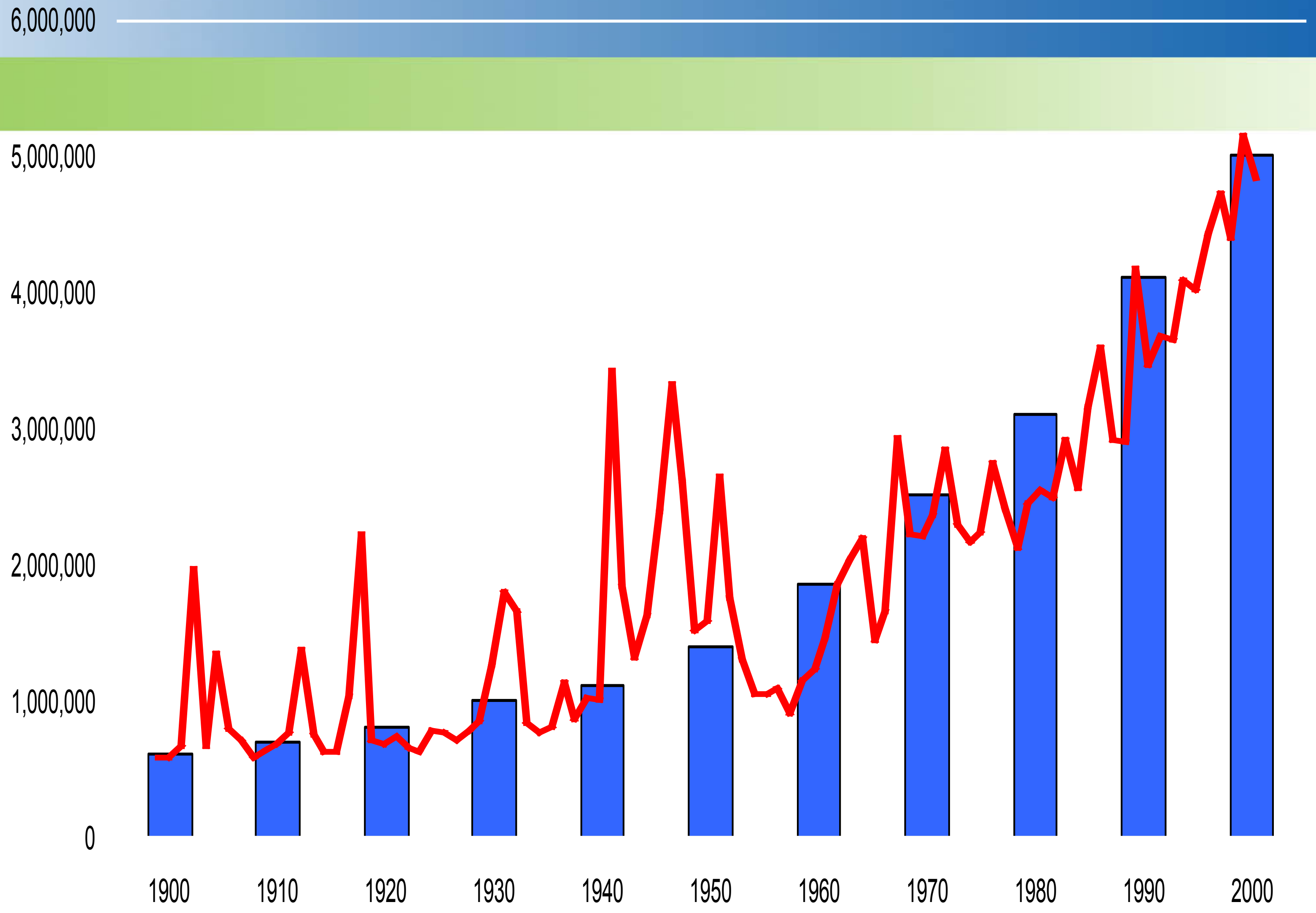
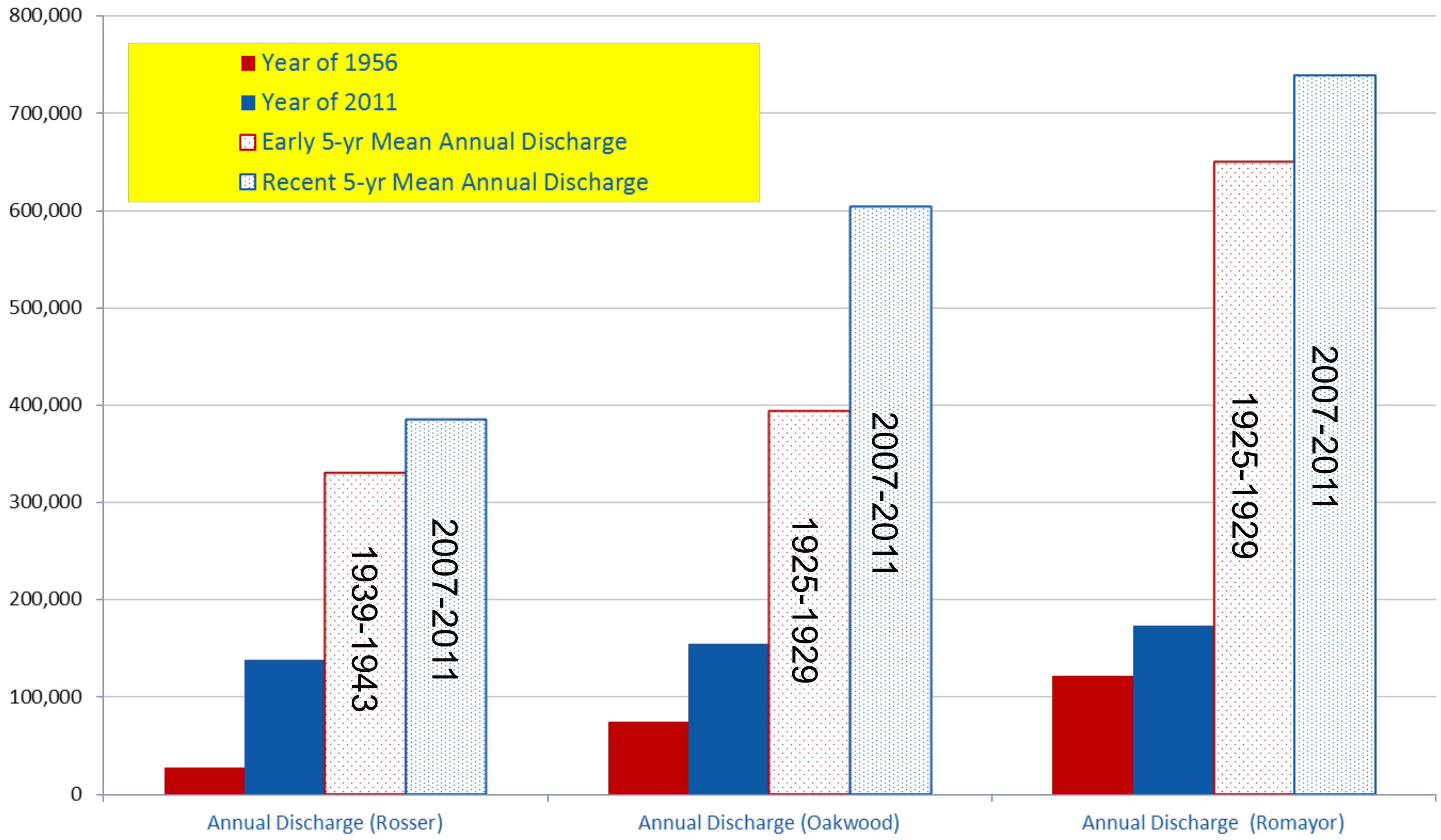
Next Steps

Mid Trinity, 1899

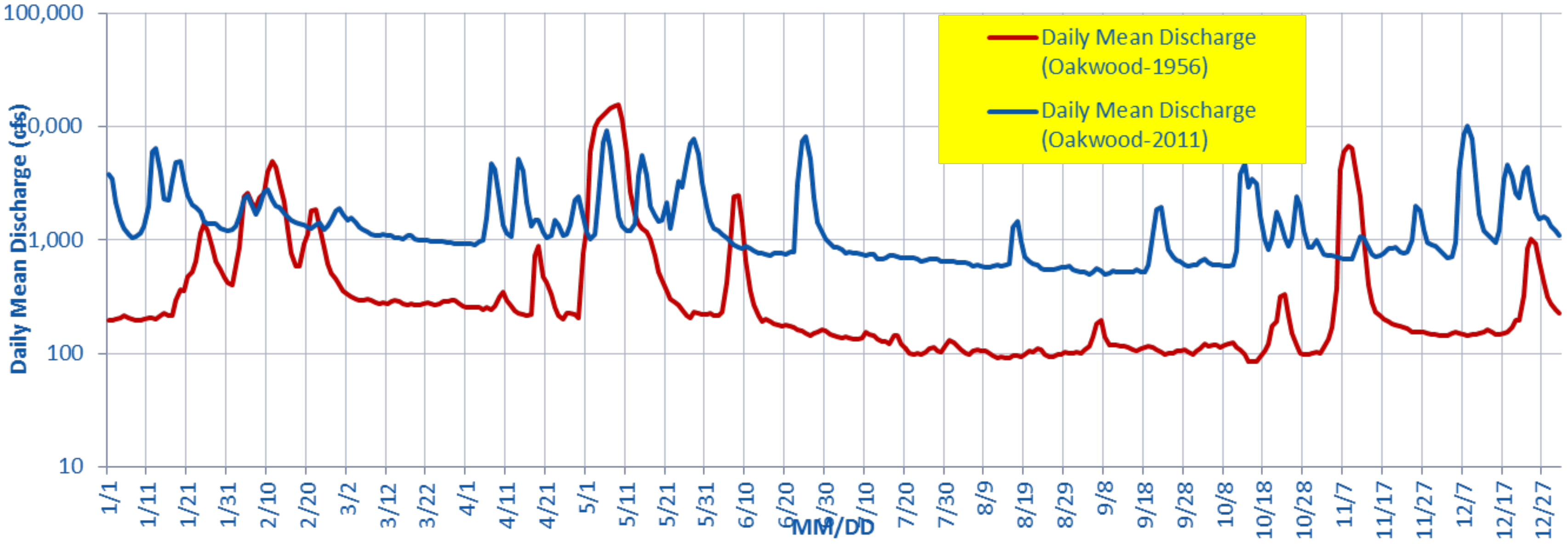
D/FW Population and Base Flows

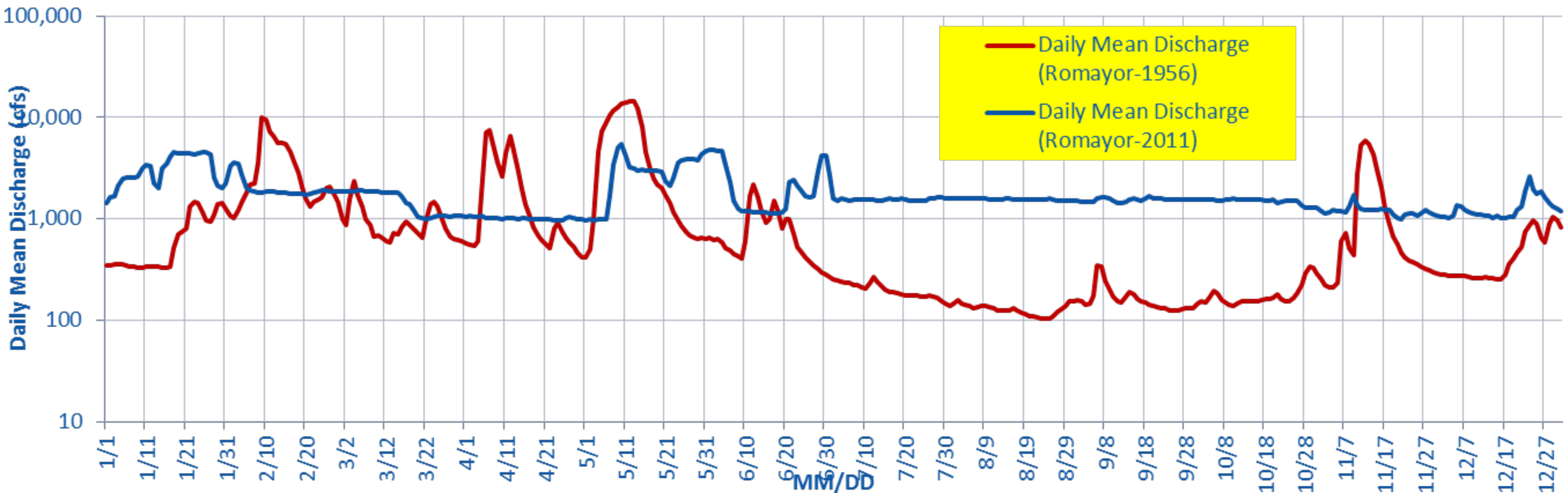


Cumulative Discharge (ac-ft) at USGS Gages Along Trinity

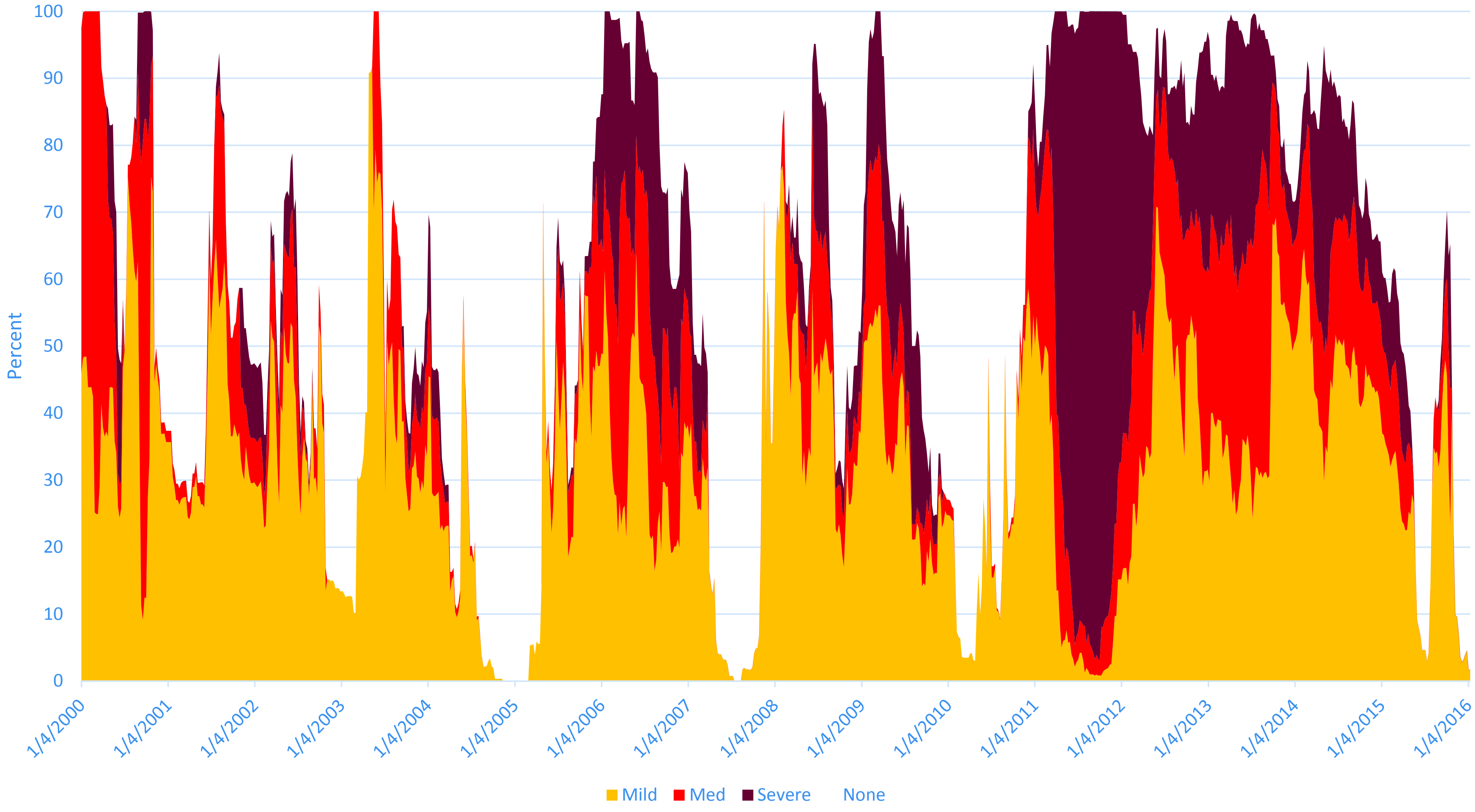


Comparison of USGS Measured Flows Between 1956 and 2011 at Mid and Lower Trinity

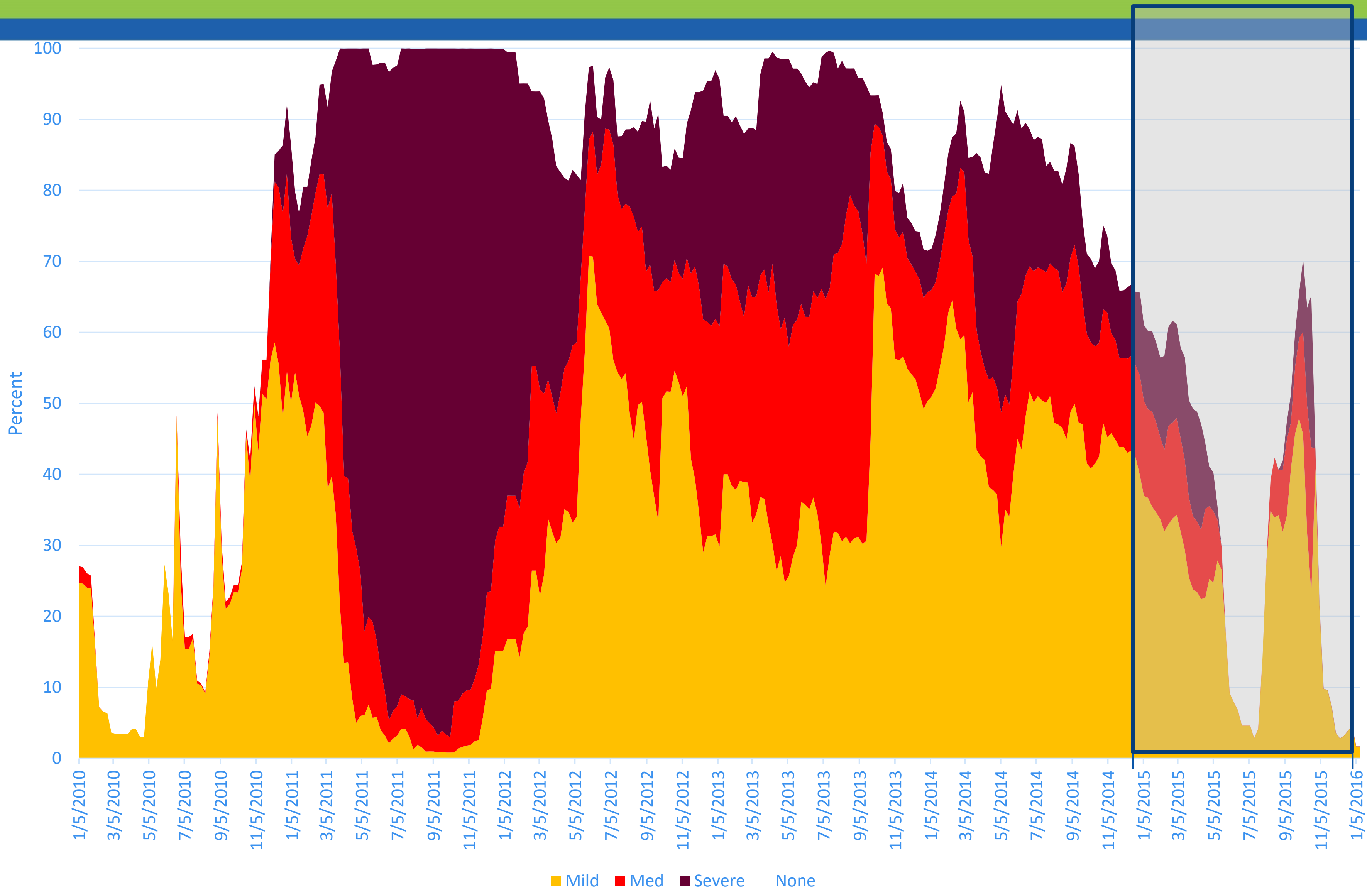




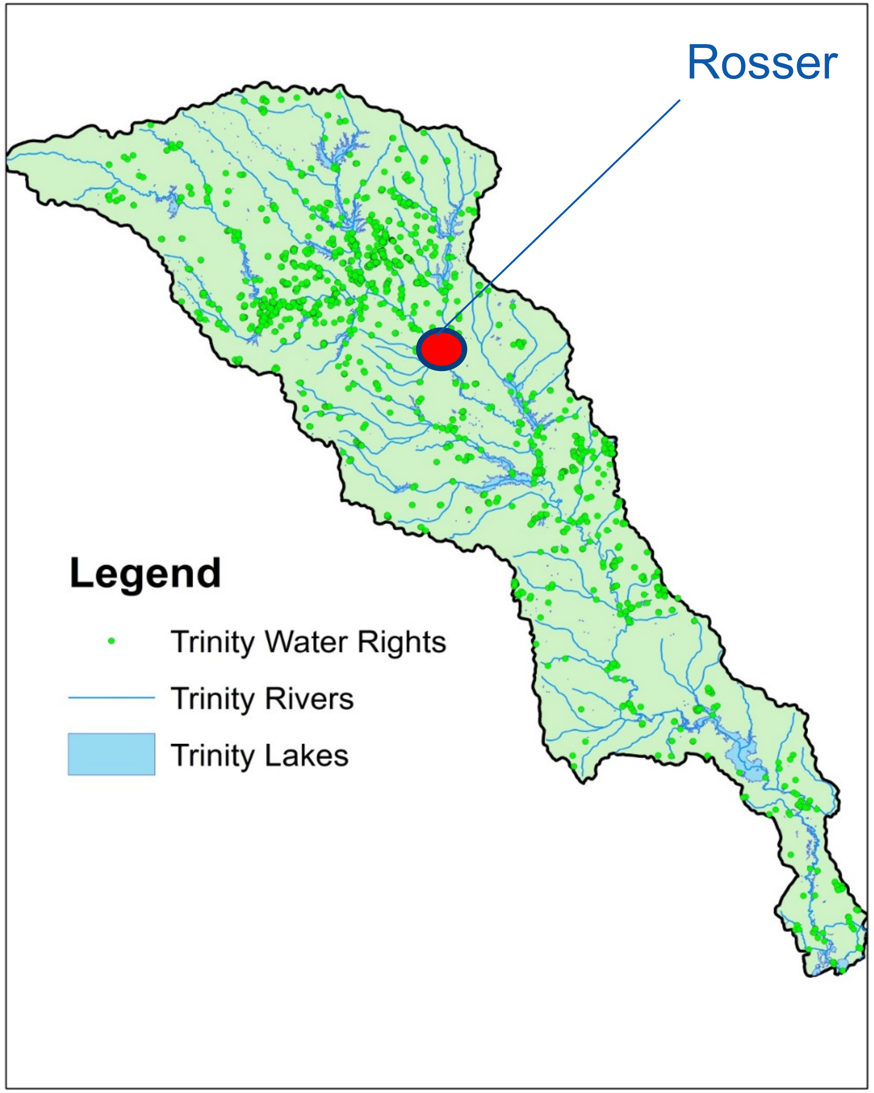
Percent of Texas Listed in Drought



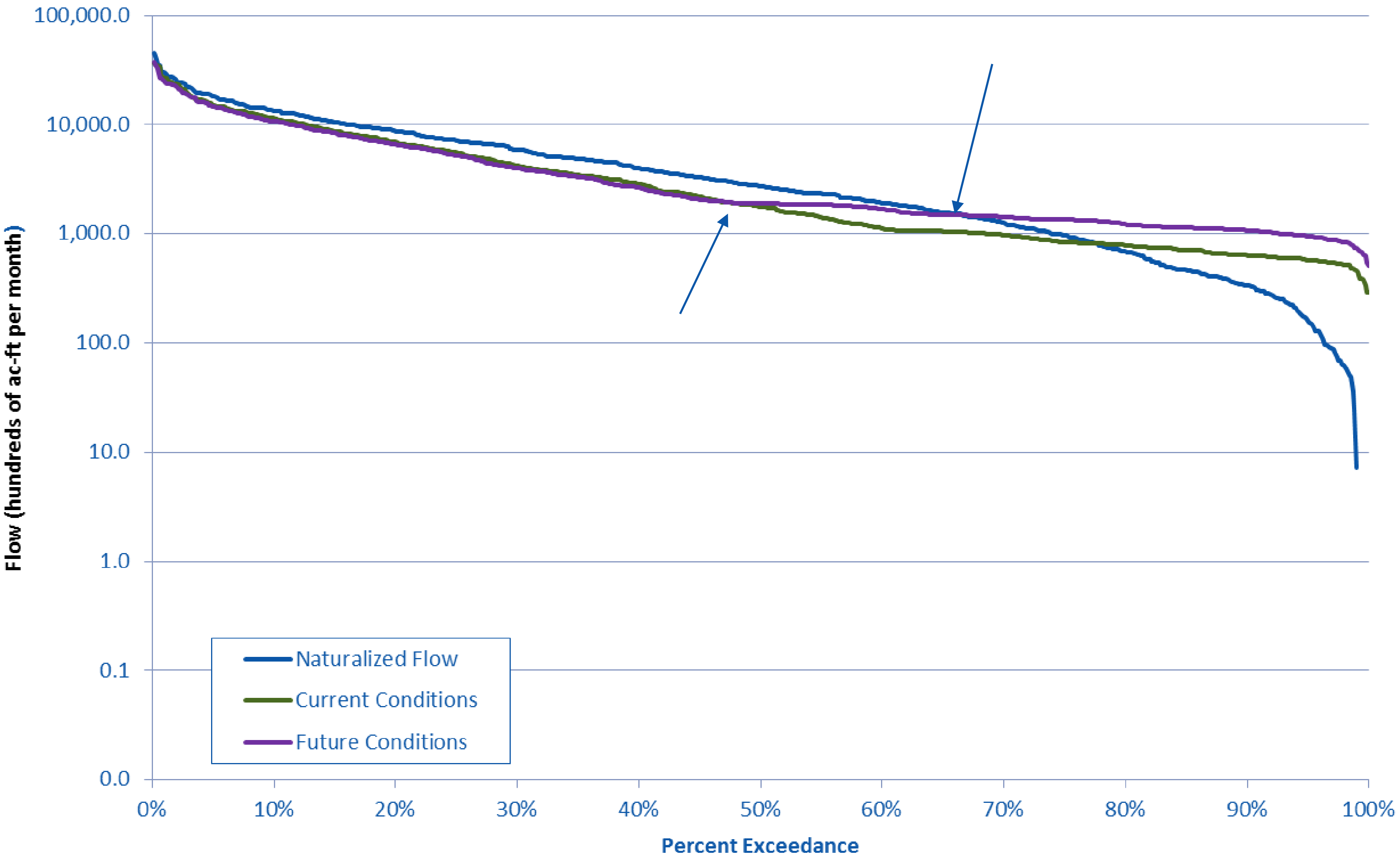
Percent of Texas Listed in Drought

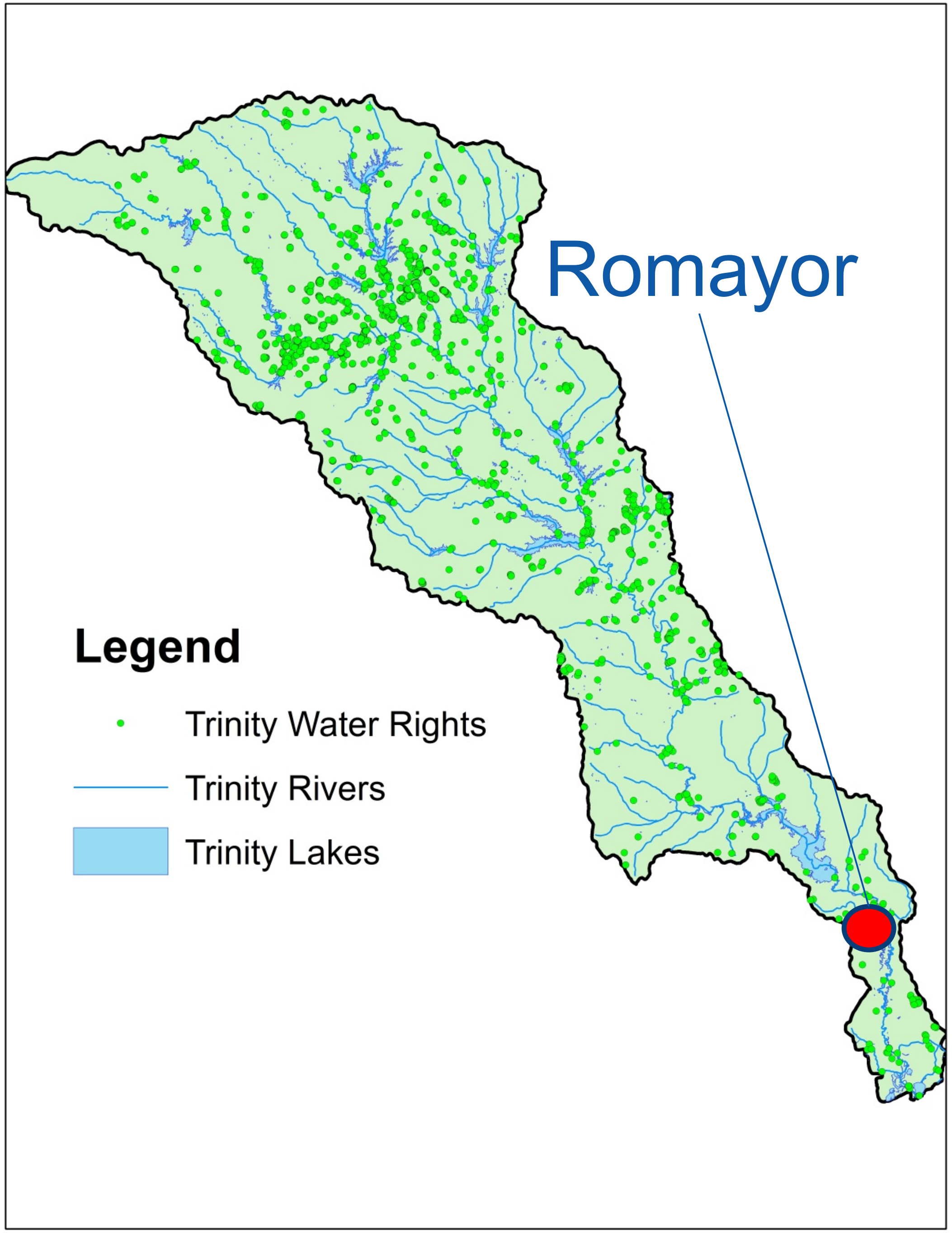


Water Availability Models Percent Exceedance Curves, Trinity at Rosser

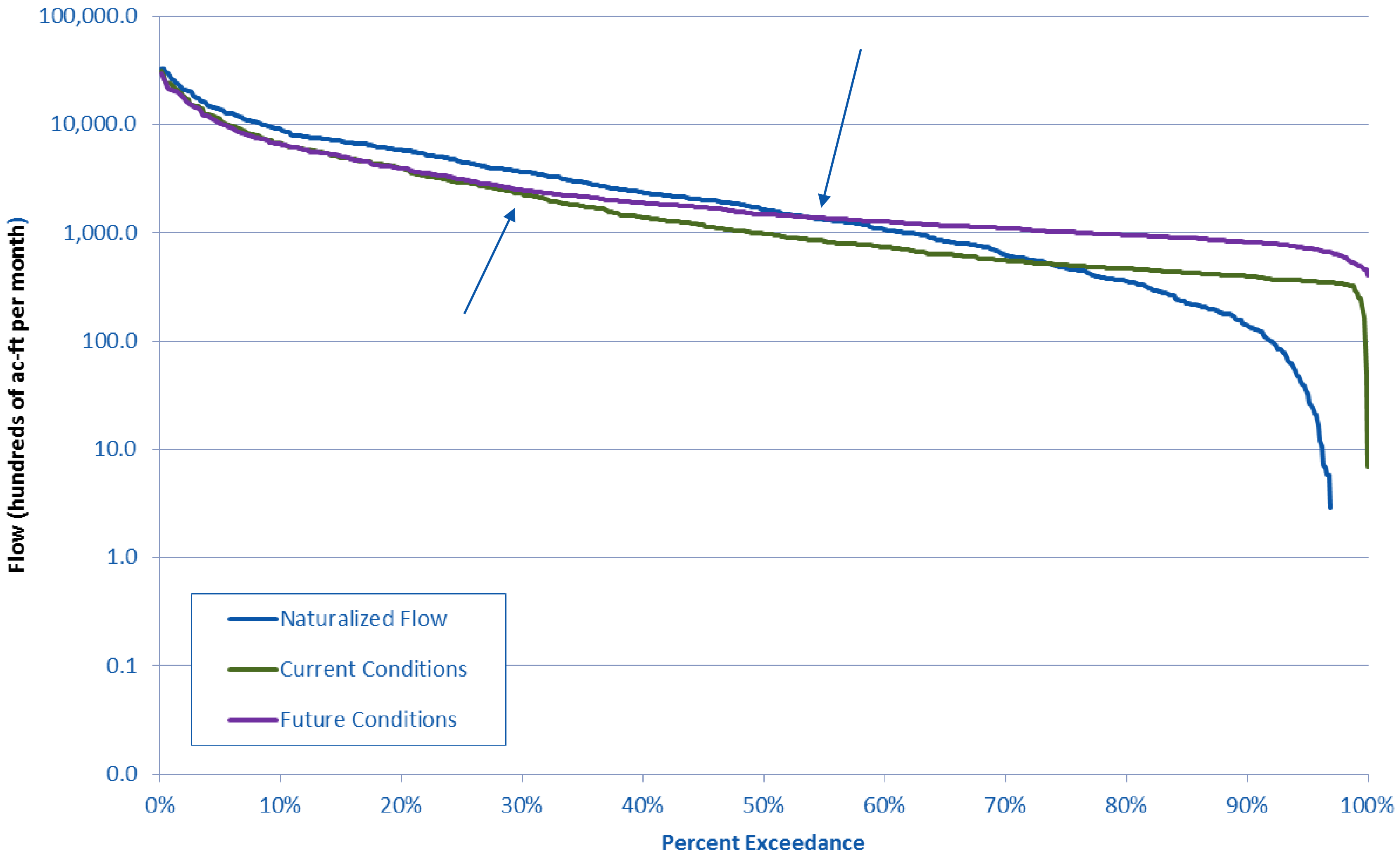


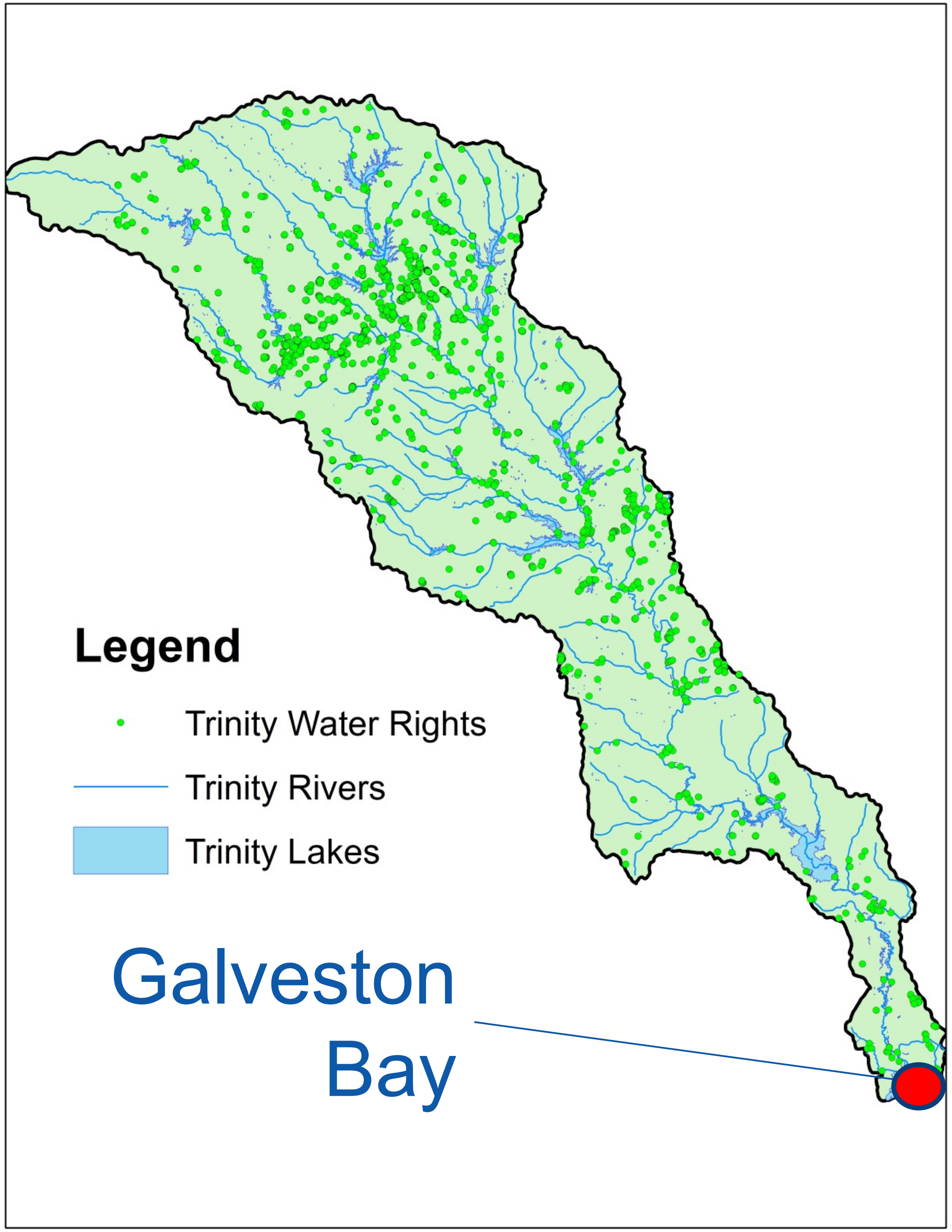
Water Availability Models Percent Exceedance Curves, Trinity at Rosser



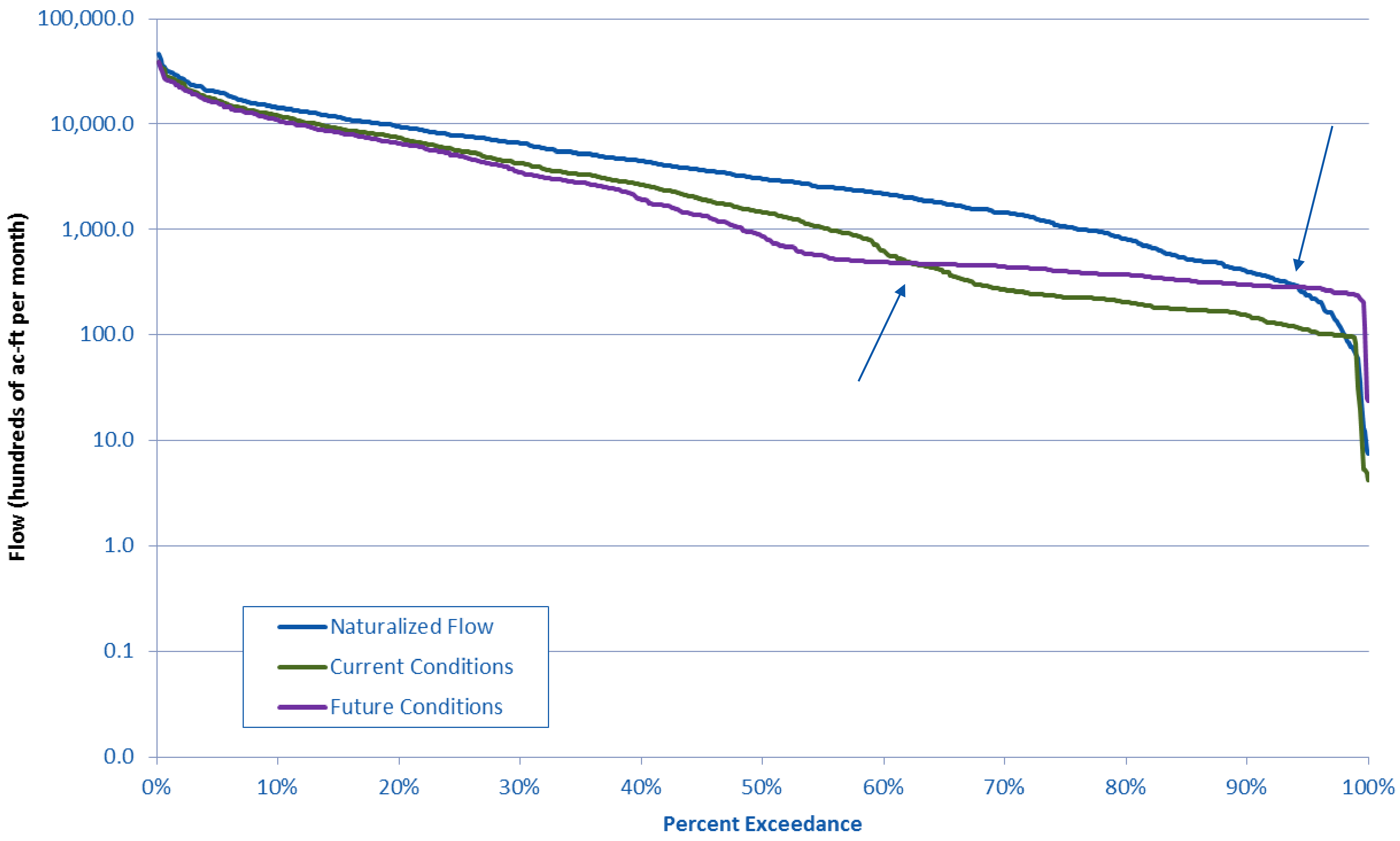

Romayor
Legend
Trinity Water Rights
Trinity Rivers
Trinity Lakes

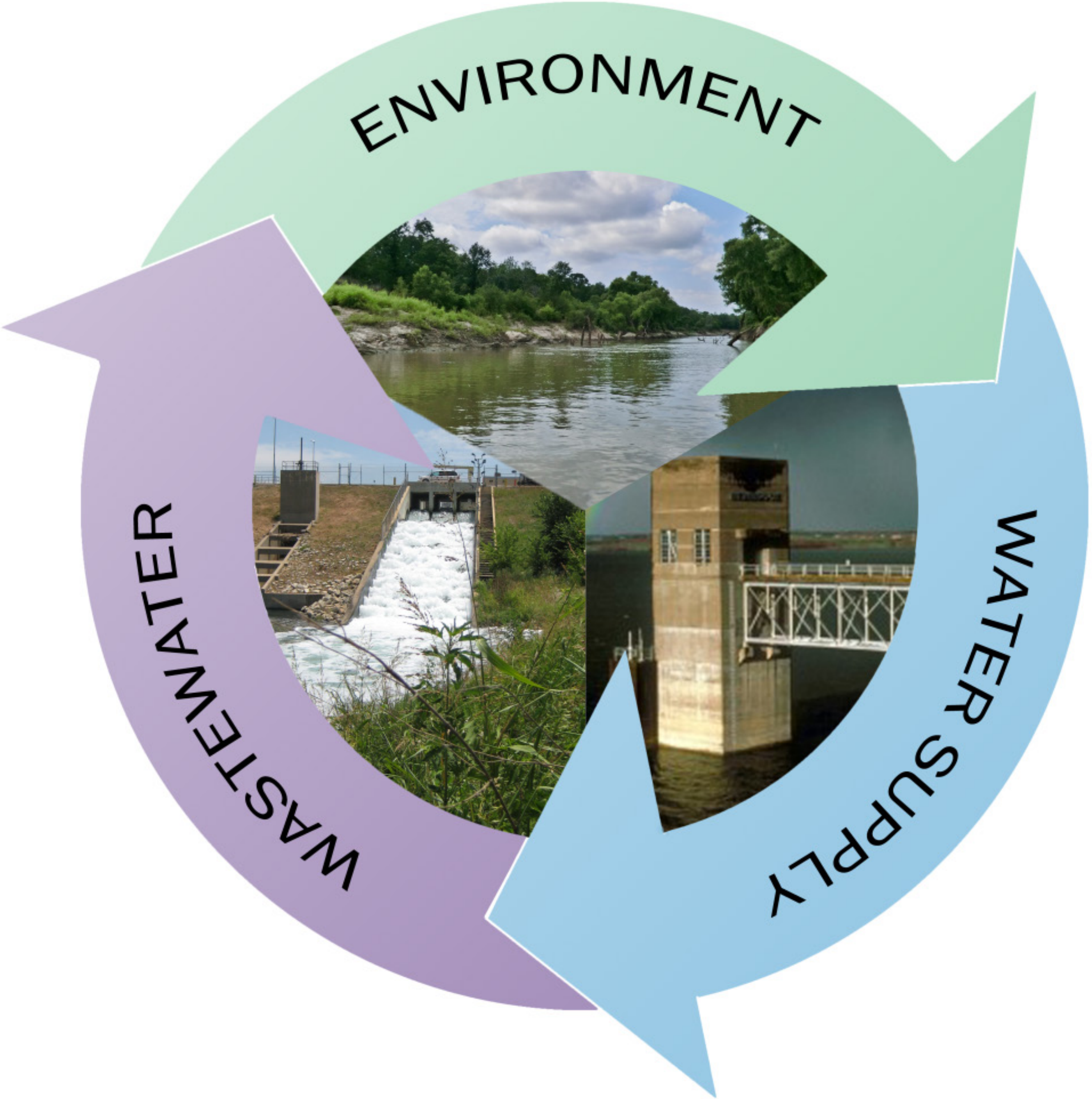
Water Availability Models Percent Exceedance Curves, Trinity at Romayor



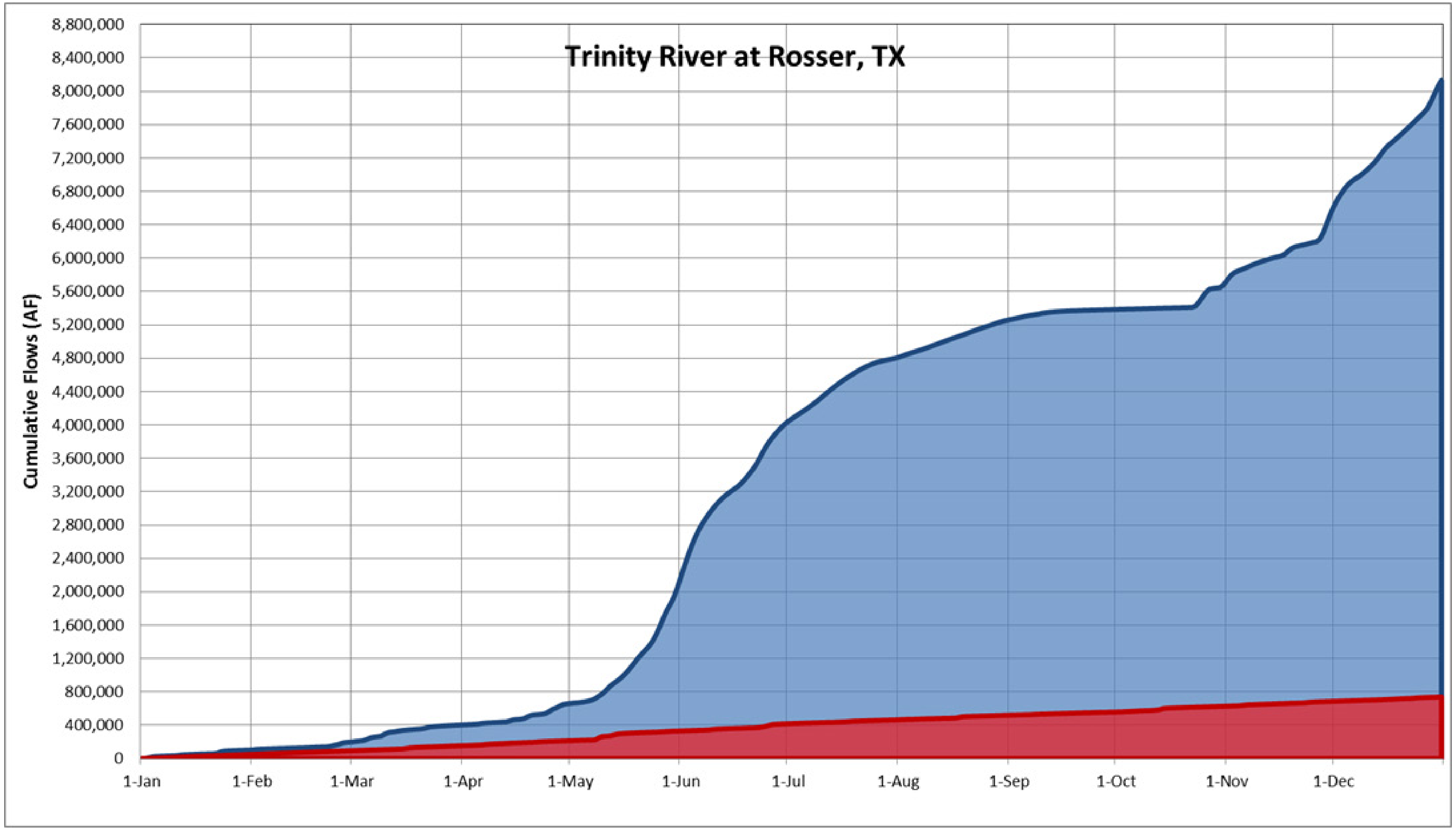

Legend
Trinity Water Rights
Trinity Rivers
Trinity Lakes
Galveston Bay

Water Availability Models Percent Exceedance Curves, Trinity at Galveston Bay




ENVIRONMENT
WATER SUPPLY
WASTEWATER

2015 Cumulative Flow in Trinity River South of Dallas



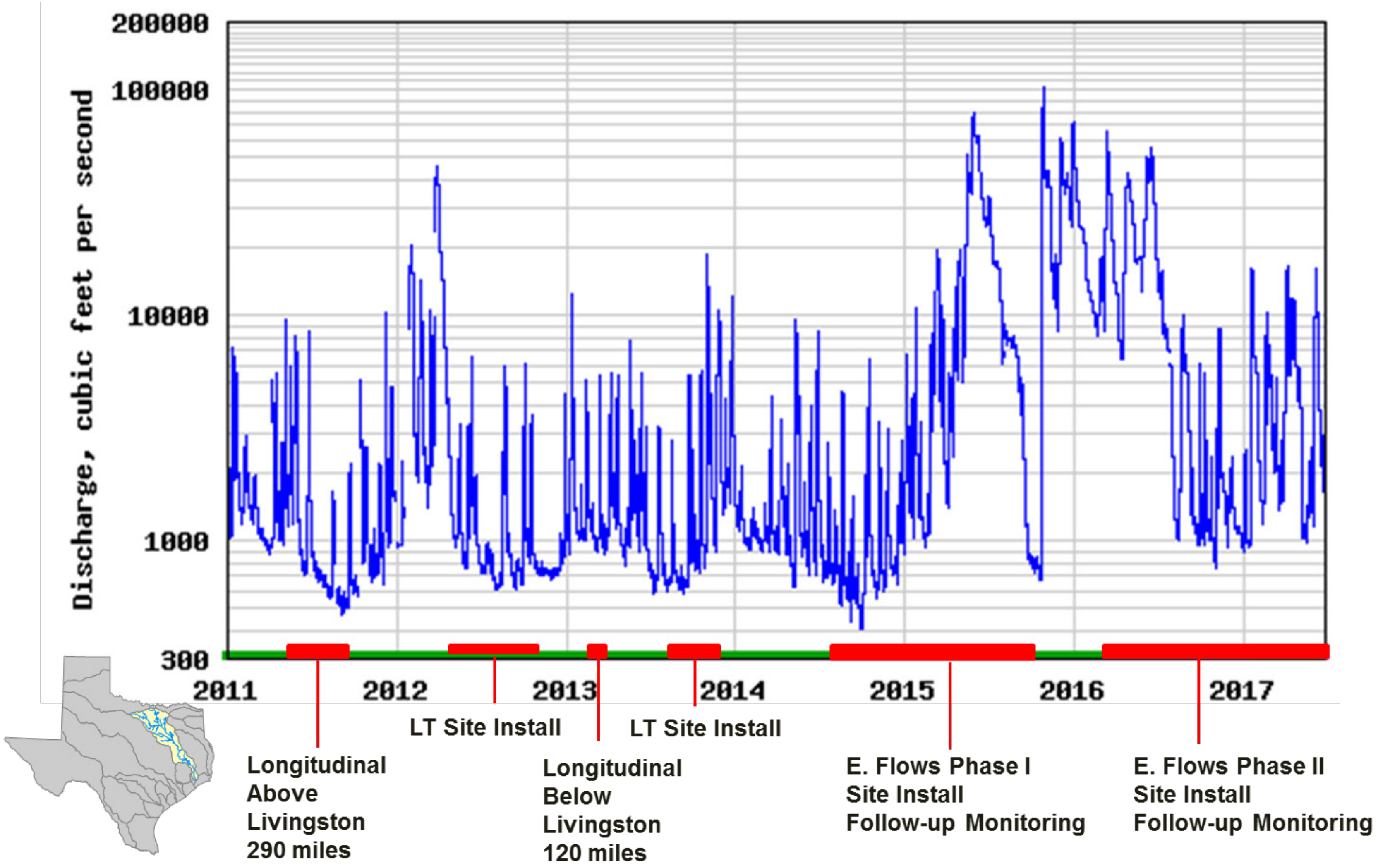
Environmental Flows

- SB2 (2001) – **T**exas **I**nstream **F**lows **P**rogram
  - *TIFP* = TCEQ, TWDB, & TPWD
  - Goal: Identify flow regimes that support a *sound ecological environment.*
- SB3 (2007) – Environmental Flows Process
  - Best Available Science
  - Establish Environmental Flow Standards
  - Adaptive Management

TRA Environmental Flow Studies

- 2010 – Baseline Longitudinal (225 mi.)
- 2011 – Longitudinal Study FW to Lake Livingston (290 mi.)
- 2012 – Baseline Biological (TPWD & TRA)
- 2012 – **SB3** Flow Standards Approved
- 2012 – Upper Trinity Biological
- 2013 – Longitudinal Study Lake Livingston to the Bay (118 mi.)
- 2013 – Long-term Sites (2012-Ongoing)
- 2014 – **SB2** Texas Instream Flow Program
- 2015-Present – E Flow Validation Studies

TR is Very Dynamic



Evaluation of SB3 Flow Standards

	8049500 Grand Prairie		Pulse cfs	
Season	Subsistence cfs	Base cfs		
Winter	19 cfs	45 cfs	Trigger	300 cfs
			Volume	3,500 af
			Duration	4 days
Spring	25 cfs	45 cfs	Trigger	1,200 cfs
			Volume	8,000 af
			Days	8 days
Summer	23 cfs	35 cfs	Trigger	300 cfs
			Volume	1,800 af
			Days	3 days
Fall	21 cfs	35 cfs	Trigger	300 cfs
			Volume	1,800 af
			Days	3 days

	8049500 Dallas		Pulse cfs	
Season	Subsistence cfs	Base cfs		
Winter	26 cfs	50 cfs	Trigger	700 cfs
			Volume	3,500 af
			Days	3 days
Spring	37 cfs	70 cfs	Trigger	4,000 cfs
			Volume	40,000 af
			Days	9 days
Summer	22 cfs	40 cfs	Trigger	1,000 cfs
			Volume	8,500 af
			Days	5 days
Fall	15 cfs	50 cfs	Trigger	1,000 cfs
			Volume	8,500 af
			Days	5 days

	8065000 Oakwood		Pulse cfs	
Season	Subsistence cfs	Base cfs		
Winter	120 cfs	340 cfs	Trigger	3,000 cfs
			Volume	18,000 af
			Days	5 days
Spring	160 cfs	450 cfs	Trigger	7,000 cfs
			Volume	130,000 af
			Days	11 days
Summer	75 cfs	250 cfs	Trigger	2,500 cfs
			Volume	23,000 af
			Days	5 days
Fall	100 cfs	260 cfs	Trigger	2,500 cfs
			Volume	23,000 af
			Days	5 days

	8066500 Romayor		Pulse cfs	
Season	Subsistence cfs	Base cfs		
Winter	495 cfs	875 cfs	Trigger	8,000 cfs
			Volume	80,000 af
			Days	7 days
Spring	700 cfs	1150 cfs	Trigger	10,000 cfs
			Volume	150,000 a
			Days	9 days
Summer	200 cfs	575 cfs	Trigger	4,000 cfs
			Volume	60,000 af
			Days	5 days
Fall	230 cfs	625 cfs	Trigger	4,000 cfs
			Volume	60,000 af
			Days	5 days

Evaluation of SB3 Flow Standards

Goal:

Use data to assess the instream physical and ecological functions of the SB3 Flow Standards.

Tasks:

1. Reconnaissance
2. Study Design/Site Selection
3. Field Work
4. Data Processing
5. Data Analysis
6. Reporting
7. Data Archiving
8. Information Dissemination

Long-term Monitoring Sites

Field Work

Hardened Benchmarks

Field Work

Sediment Collection

Field Work

Survey Grade GPS

Field Work

Laser Scanning and Total Station

Field Work

Bathymetry

Field Work

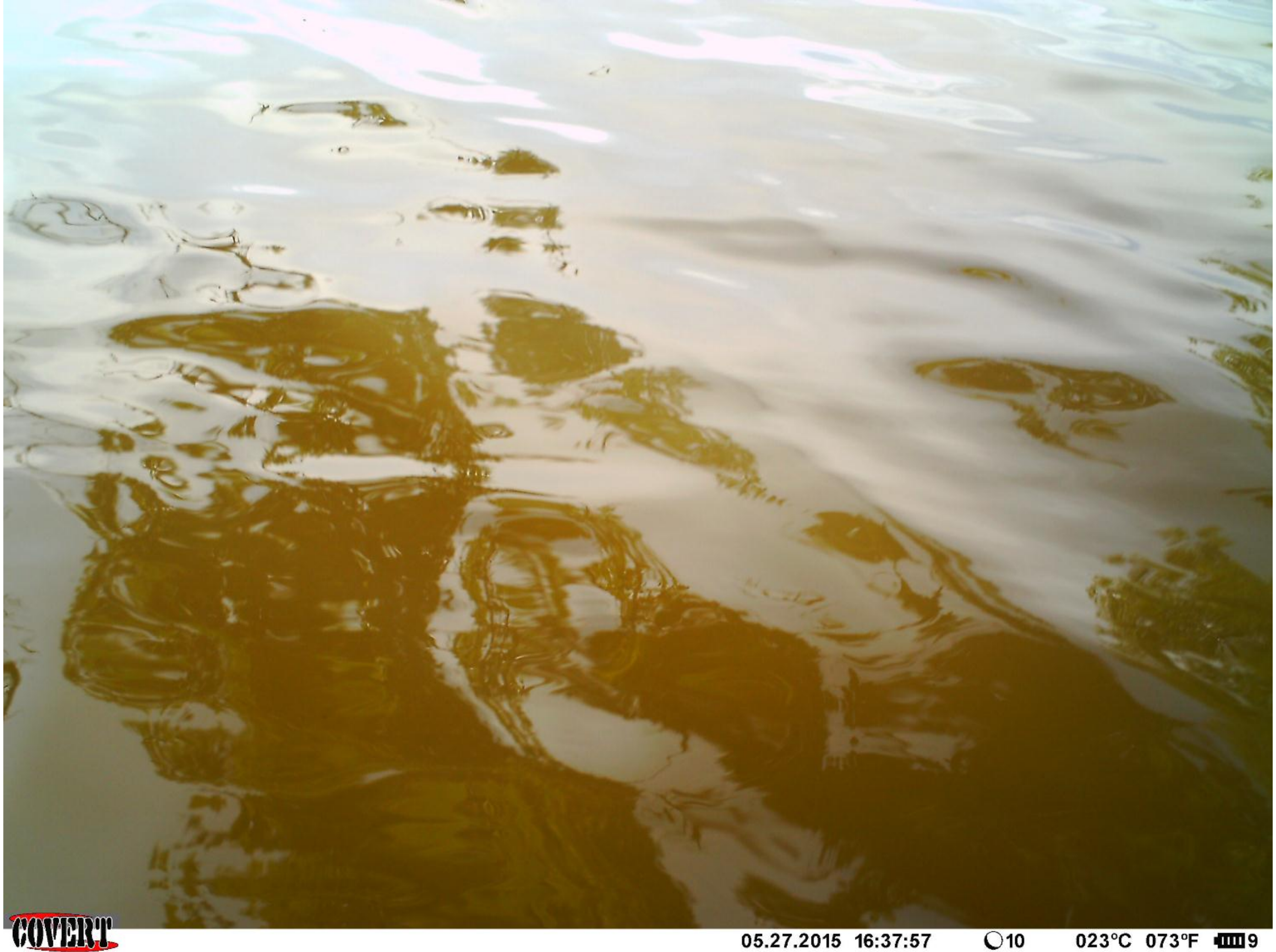
Riparian

Field Work

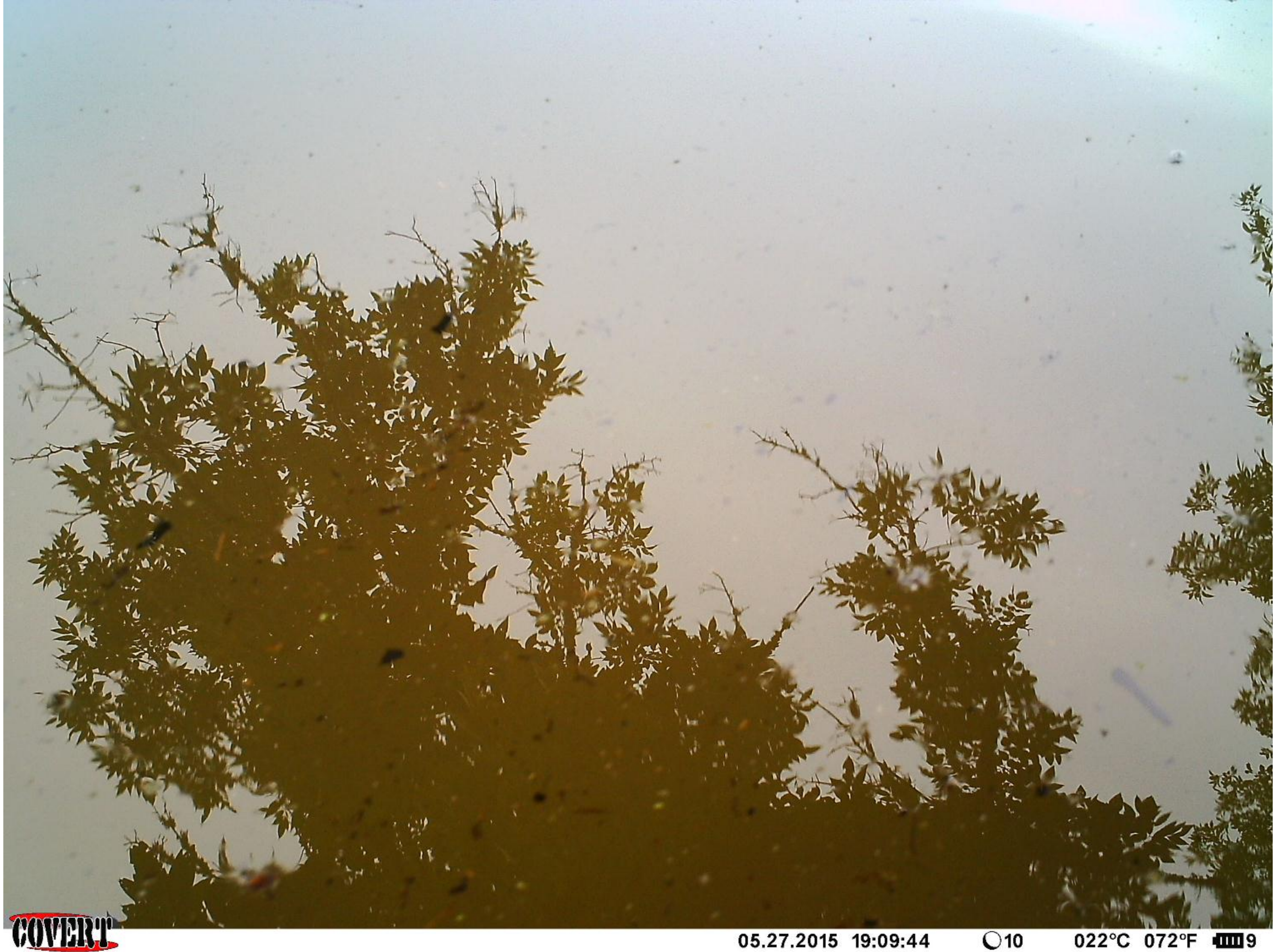
Automated Game Cameras

Field Work

Automated Game Cameras


COVERT
05.27.2015 16:37:57
10
023°C 073°F
9


COVERT
05.27.2015 17:38:40
10
025°C 077°F
9


COVERT
05.27.2015 19:09:44
10
022°C 072°F
9


COVERT
05.28.2015 06:30:52
11
017°C 063°F
9

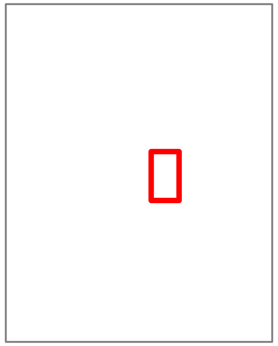

COVERT
05.28.2015 16:07:30
11
019°C 066°F
9

~80,000 cfs at Oakwood Gage

Field Work

Linear Survey

Oakwood – May 2016,**12,350 cfs**, 33 mi				
SB3 Pulse	**Winter**	**Spring**	**Summer**	**Fall**
Oakwood	3k	**7k**	2.5k	2.5k



Field Work

Linear Survey

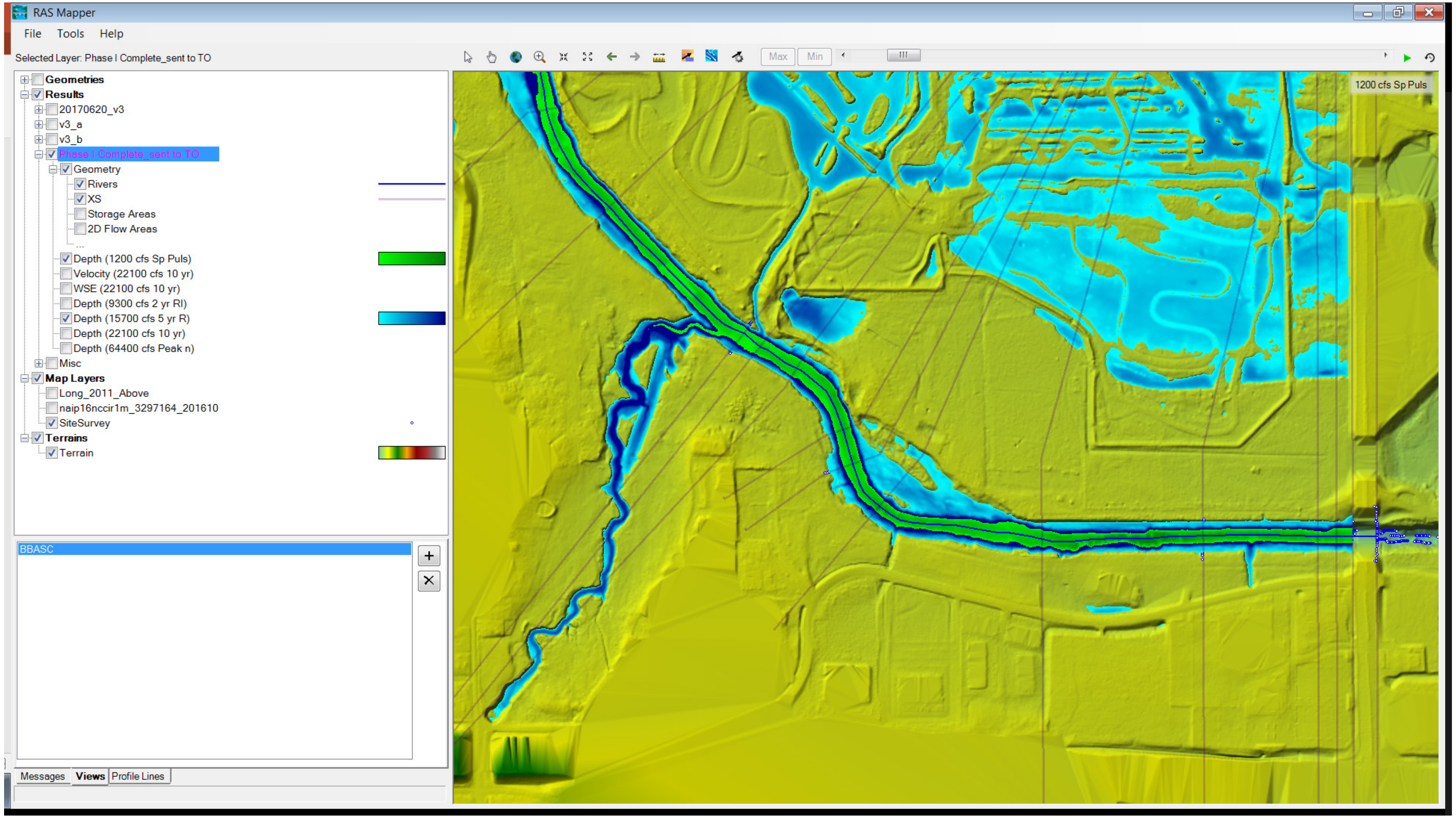
Analysis

Automated Game Cameras

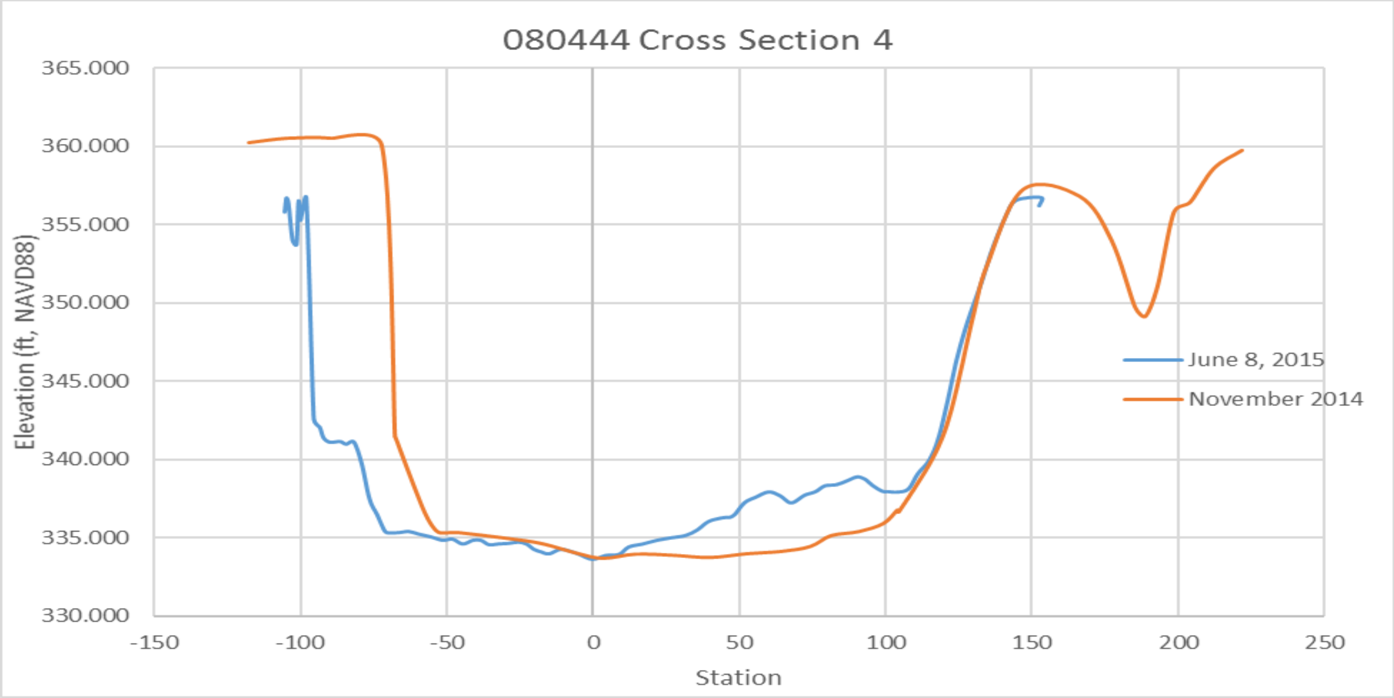
Analysis

Riparian – 5,000 cfs

Modeling


RAS Mapper
File Tools Help
Selected Layer: Phase I Complete_sent to TO
Max Min
1200 cfs Sp Puls
Geometries
Results
20170620_v3
v3_a
v3_b
Phase I Complete_sent to TO
Geometry
Rivers
XS
Storage Areas
2D Flow Areas
Depth (1200 cfs Sp Puls)
Velocity (22100 cfs 10 yr)
WSE (22100 cfs 10 yr)
Depth (9300 cfs 2 yr RI)
Depth (15700 cfs 5 yr R)
Depth (22100 cfs 10 yr)
Depth (64400 cfs Peak n)
Misc
Map Layers
Long_2011_Above
naip16nccir1m_3297164_201610
SiteSurvey
Terrains
Terrain
BBASC
Messages
Views
Profile Lines

Analysis


080444 Cross Section 4
Elevation (ft, NAVD88)
365.000
360.000
355.000
350.000
345.000
340.000
335.000
330.000
-150
-100
-50
0
50
100
150
200
250
Station
June 8, 2015
November 2014

Sediment

	Channel shear stress (lb/sf) and transportable grain size					
	XS5 - downstream		XS4 - riffle		XS2 - upstream	
Flow (cfs)	Shear stress	Grain size	Shear stress	Grain size	Shear stress	Grain size
526	0.030	Coarse sand	0.115	Fine grvl	0.003	Fine sand
700	0.042	Coarse sand	0.133	Med grvl	0.005	Fine sand
1000	0.069	Fine grvl	0.166	Med grvl	0.008	Coarse sand
1167	0.077	Fine grvl	0.183	Med grvl	0.011	Coarse sand
1411	0.078	Fine grvl	0.208	Med grvl	0.014	Coarse sand
1900	0.129	Med grvl	0.253	Coarse grvl	0.023	Coarse sand
2503	0.144	Med grvl	0.304	Coarse grvl*	0.035	Coarse sand
4000	0.198	Med grvl	0.408	Coarse grvl*	0.067	Fine grvl
4427	0.170	Med grvl	0.419	Coarse grvl*	0.077	Fine grvl
4540	0.213	Med grvl	0.439	Coarse grvl*	0.080	Fine grvl
6114	0.222	Med grvl	0.506	Coarse grvl*	0.118	Fine grvl
6470	0.229	Med grvl	0.521	Coarse grvl*	0.127	Med grvl
10042	0.170	Med grvl	0.473	Coarse grvl*	0.194	Med grvl

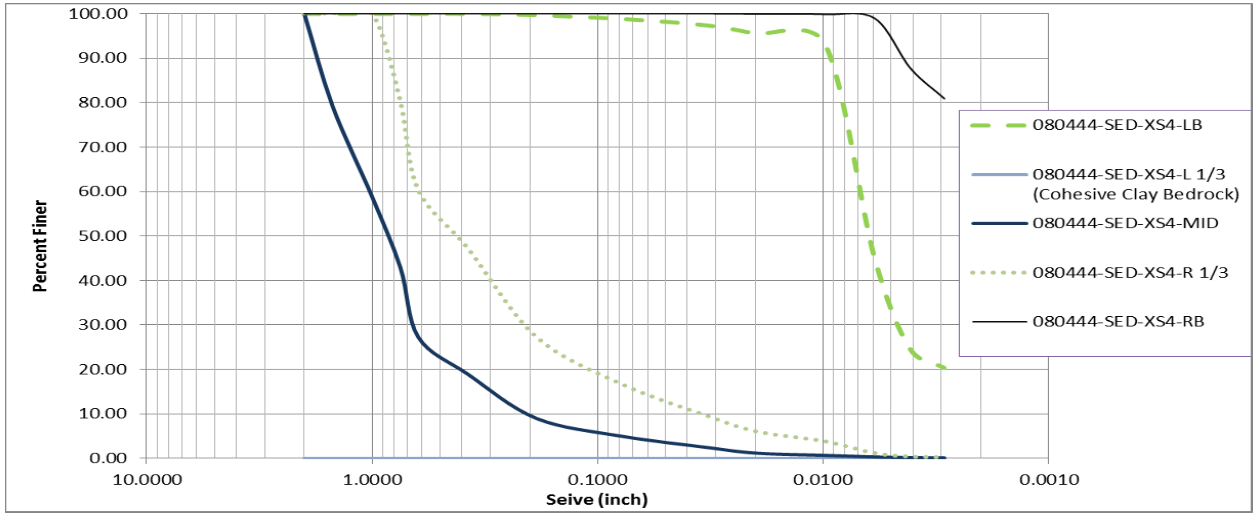
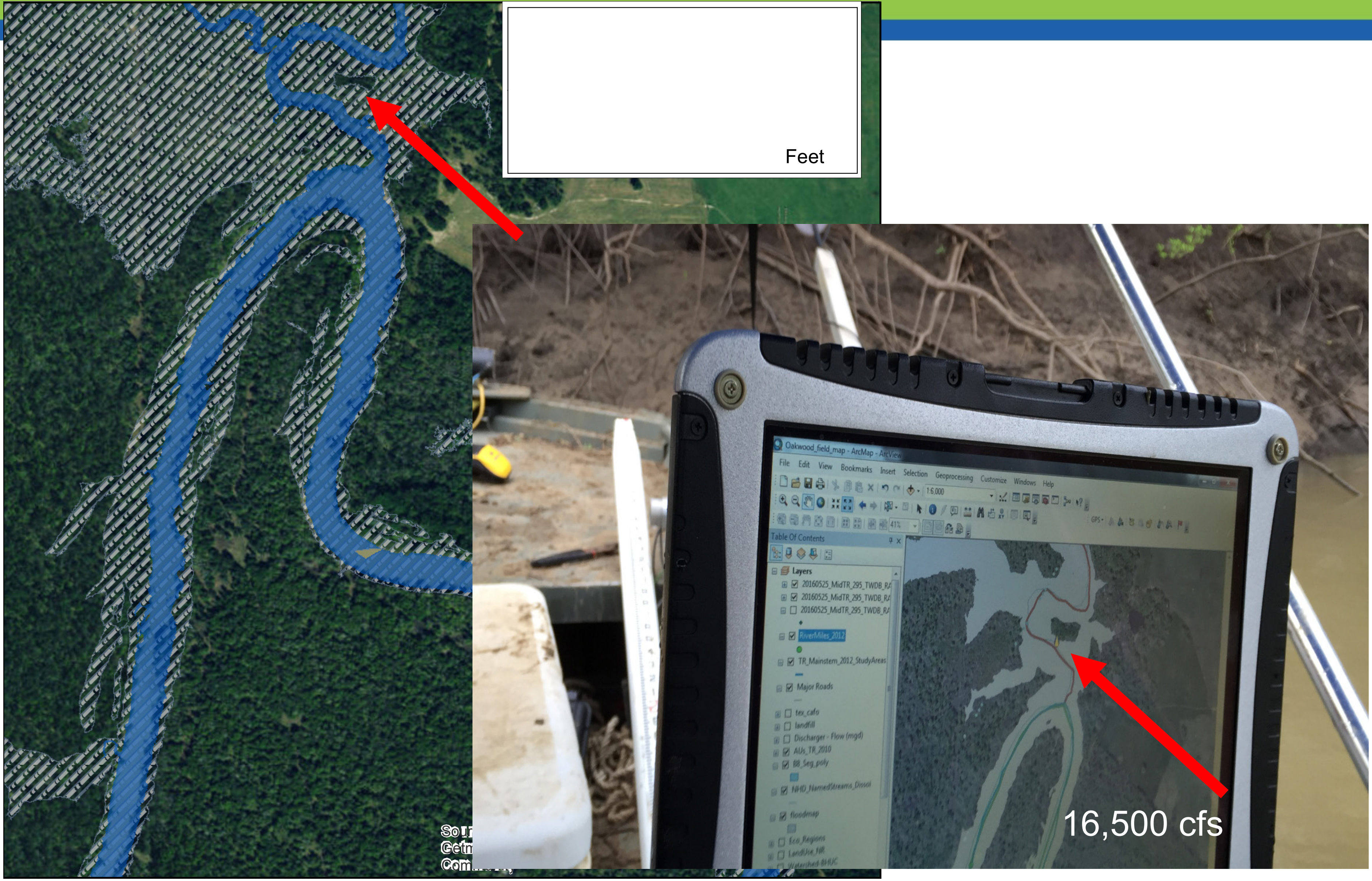


Table 1. Shear stress causing incipient motion

Shear stress (T) for transport of uniform sediments			
Sediment	D (in)	T (lb/sf)	Note
Cohesive compacted clay		***0.3***	*e=0.40*
Medium silt	0.001	0.001	
Fine sand	0.005	0.003	
Coarse sand	0.02	0.006	
Fine gravel	0.16	0.06	
Medium gravel	0.3	0.12	
Coarse gravel	0.6	0.25	
Very coarse gravel	1.3	0.54	
Small cobble	2.5	1.1	
Large cobble	5	2.3	

Validation



What have we learned?

- SB3 pulse flows are not inundating backwater habitat.
- Very, very hard to tie biological responses to a single variable (flow).
- Large pulses do the “work” in the channel.
- Extensive mussel beds
- Water Quality is generally very good
- Mesohabitat diversity *may* increase with decreased flow
- Sites are not aggrading or degrading
- Fish have not returned to a similar baseline since 2015-16 flooding
- Much more analysis underway

Next Steps

- Continue Long-term monitoring
- Aggregate SB2 and SB3 data
- Biological sampling
- Additional inundation modeling
- SB3 Adaptive Management recommendations for 2021

Questions?

Contact | Connect

Cassidy Campbell
Senior Environment & Development Planner
North Central Texas Council of Governments
ccampbell@nctcog.org
817.608.2368

Tamara Cook
Senior Program Manager
Environment and Development Department
North Central Texas Council of Governments
tcook@nctcog.org
817.695.9221

Edith Marvin
Director of Environment & Development
North Central Texas Council of Governments
emarvin@nctcog.org
817.695.9211

Facebook.com/nctcogenv

@nctcogenv

nctcogenv

youtube.com/user/nctcoged

EandD@nctcog.org

www nctcog.org/envir

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