Water Reuse Webinar
North Central Texas Council of Governments
Environment and Development Department
August 22, 2017
Please welcome our first speaker:

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

NCTCOG Webinar August 22, 2017
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
Reuse and Water Supply

Glenn Clingenpeel
• 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

DFW 1981-2010 Monthly Average Precipitation

- Jan: 1.8
- Feb: 2.6
- Mar: 3.3
- Apr: 3.0
- May: 5.1
- Jun: 4.2
- Jul: 1.7
- Aug: 1.5
- Sep: 2.9
- Oct: 5.5
- Nov: 2.8
- Dec: 2.3

Monthly Precipitation Totals (in.)
Net Precipitation in North Texas

DFW Long-Term Monthly Average Net Precipitation
Precipitation and Evaporation in North Texas

DFW Long-Term Monthly Average Precipitation & Evaporation

- Precip (Inches)
Conventional water supplies in North Texas are from increasingly distant sources.
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”
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

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
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

- Non-potable Reuse (NPR)
- Passive potable Reuse (PPR)
- Engineered potable Reuse (EPR)
- Direct potable Reuse (DPR)
- De facto potable Reuse (dfPR)
Began out of necessity in West Texas during drought of 2010-2014
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
State-wide Direct Potable projected to increase from 33,000 AF/yr in 2020 to 87,000 AF/yr in 2070.
Please welcome our second speaker:

Webster Mangham
Trinity River Authority
Reuse and Return Flows

Webster Mangham
Outline

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
D/FW Population and Base Flows

![Graph showing population and base flows from 1900 to 2000.](chart)
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

![Graph showing the percent of Texas listed in drought from 2010 to 2015. The graph includes four categories: Mild, Med, Severe, and None. The severity percentages fluctuate over time, with a notable decrease in the severity from 2014 onwards.](image-url)
Water Availability Models Percent Exceedance Curves, Trinity at Rosser

Legend
- Trinity Water Rights
- Trinity Rivers
- Trinity Lakes
Water Availability Models Percent Exceedance Curves, Trinity at Rosser
Water Availability Models Percent Exceedance Curves, Trinity at Romayor
Water Availability Models Percent Exceedance Curves, Trinity at Galveston Bay
Environmental Flows

• SB2 (2001) – **Texas Instream Flows Program**
  – \textit{TIFP} = TCEQ, TWDB, & TPWD
  – Goal: Identify flow regimes that support a \textit{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

Discharge, cubic feet per second

200000
100000
10000
1000
300


Longitudinal Above Livingston 290 miles
Longitudinal Below Livingston 120 miles
E. Flows Phase I Site Install Follow-up Monitoring
E. Flows Phase II Site Install Follow-up Monitoring

LT Site Install
LT Site Install
<table>
<thead>
<tr>
<th>Season</th>
<th>Subsistence cfs</th>
<th>Base cfs</th>
<th>Pulse cfs</th>
<th>Season</th>
<th>Subsistence cfs</th>
<th>Base cfs</th>
<th>Pulse cfs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
<td>19 cfs</td>
<td>45 cfs</td>
<td></td>
<td>Winter</td>
<td>26 cfs</td>
<td>50 cfs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trigger 300 cfs</td>
<td>Volume 3,500 af</td>
<td>Duration 4 days</td>
<td>Trigger 700 cfs</td>
<td>Volume 3,500 af</td>
<td>Days 3 days</td>
<td></td>
</tr>
<tr>
<td>Spring</td>
<td>25 cfs</td>
<td>45 cfs</td>
<td></td>
<td>Spring</td>
<td>37 cfs</td>
<td>70 cfs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trigger 1,200 cfs</td>
<td>Volume 8,000 af</td>
<td>Days 8 days</td>
<td>Trigger 4,000 cfs</td>
<td>Volume 40,000 af</td>
<td>Days 9 days</td>
<td></td>
</tr>
<tr>
<td>Summer</td>
<td>23 cfs</td>
<td>35 cfs</td>
<td></td>
<td>Summer</td>
<td>22 cfs</td>
<td>40 cfs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trigger 300 cfs</td>
<td>Volume 1,800 af</td>
<td>Days 3 days</td>
<td>Trigger 1,000 cfs</td>
<td>Volume 8,500 af</td>
<td>Days 5 days</td>
<td></td>
</tr>
<tr>
<td>Fall</td>
<td>21 cfs</td>
<td>35 cfs</td>
<td></td>
<td>Fall</td>
<td>15 cfs</td>
<td>50 cfs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trigger 300 cfs</td>
<td>Volume 1,800 af</td>
<td>Days 3 days</td>
<td>Trigger 1,000 cfs</td>
<td>Volume 8,500 af</td>
<td>Days 5 days</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Season</th>
<th>Subsistence cfs</th>
<th>Base cfs</th>
<th>Pulse cfs</th>
<th>Season</th>
<th>Subsistence cfs</th>
<th>Base cfs</th>
<th>Pulse cfs</th>
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<tbody>
<tr>
<td>Winter</td>
<td>120 cfs</td>
<td>340 cfs</td>
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<td>Winter</td>
<td>495 cfs</td>
<td>875 cfs</td>
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<tr>
<td></td>
<td>Trigger 3,000 cfs</td>
<td>Volume 18,000 af</td>
<td>Days 5 days</td>
<td>Trigger 8,000 cfs</td>
<td>Volume 80,000 af</td>
<td>Days 7 days</td>
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</tr>
<tr>
<td>Spring</td>
<td>160 cfs</td>
<td>450 cfs</td>
<td></td>
<td>Spring</td>
<td>700 cfs</td>
<td>1150 cfs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trigger 7,000 cfs</td>
<td>Volume 130,000 af</td>
<td>Days 11 days</td>
<td>Trigger 10,000 cfs</td>
<td>Volume 150,000 af</td>
<td>Days 9 days</td>
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</tr>
<tr>
<td>Summer</td>
<td>75 cfs</td>
<td>250 cfs</td>
<td></td>
<td>Summer</td>
<td>200 cfs</td>
<td>575 cfs</td>
<td></td>
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<tr>
<td></td>
<td>Trigger 2,500 cfs</td>
<td>Volume 23,000 af</td>
<td>Days 5 days</td>
<td>Trigger 4,000 cfs</td>
<td>Volume 60,000 af</td>
<td>Days 5 days</td>
<td></td>
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<tr>
<td>Fall</td>
<td>100 cfs</td>
<td>260 cfs</td>
<td></td>
<td>Fall</td>
<td>230 cfs</td>
<td>625 cfs</td>
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<tr>
<td></td>
<td>Trigger 2,500 cfs</td>
<td>Volume 23,000 af</td>
<td>Days 5 days</td>
<td>Trigger 4,000 cfs</td>
<td>Volume 60,000 af</td>
<td>Days 5 days</td>
<td></td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Site</th>
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<tbody>
<tr>
<td>Grand Prairie</td>
</tr>
<tr>
<td>Dallas</td>
</tr>
<tr>
<td>Oakwood</td>
</tr>
<tr>
<td>Romayor</td>
</tr>
<tr>
<td>Clay</td>
</tr>
<tr>
<td>Montague</td>
</tr>
<tr>
<td>Grayson</td>
</tr>
<tr>
<td>Cooke</td>
</tr>
<tr>
<td>Fannin</td>
</tr>
<tr>
<td>Archer</td>
</tr>
<tr>
<td>Jack</td>
</tr>
<tr>
<td>Hunt</td>
</tr>
<tr>
<td>Wise</td>
</tr>
<tr>
<td>Denton</td>
</tr>
<tr>
<td>Collin</td>
</tr>
<tr>
<td>Young</td>
</tr>
<tr>
<td>Rockwall</td>
</tr>
<tr>
<td>Dallas</td>
</tr>
<tr>
<td>Tarrant</td>
</tr>
<tr>
<td>Parker</td>
</tr>
<tr>
<td>Van Zandt</td>
</tr>
<tr>
<td>Kaufman</td>
</tr>
<tr>
<td>Ellis</td>
</tr>
<tr>
<td>Johnson</td>
</tr>
<tr>
<td>Hood</td>
</tr>
<tr>
<td>Henderson</td>
</tr>
<tr>
<td>Navarro</td>
</tr>
<tr>
<td>Hill</td>
</tr>
<tr>
<td>Anderson</td>
</tr>
<tr>
<td>Freestone</td>
</tr>
<tr>
<td>Limestone</td>
</tr>
<tr>
<td>Leon</td>
</tr>
<tr>
<td>Houston</td>
</tr>
<tr>
<td>Trinity</td>
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<tr>
<td>Polk</td>
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<td>Madison</td>
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<tr>
<td>Walker</td>
</tr>
<tr>
<td>San Jacinto</td>
</tr>
<tr>
<td>Grimes</td>
</tr>
<tr>
<td>Hardin</td>
</tr>
<tr>
<td>Liberty</td>
</tr>
<tr>
<td>Chambers</td>
</tr>
</tbody>
</table>
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
~80,000 cfs at Oakwood Gage
## Field Work

### Linear Survey

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**Oakwood – May 2016, 12,350 cfs, 33 mi**

<table>
<thead>
<tr>
<th>SB3 Pulse</th>
<th>Winter</th>
<th>Spring</th>
<th>Summer</th>
<th>Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oakwood</td>
<td>3k</td>
<td>7k</td>
<td>2.5k</td>
<td>2.5k</td>
</tr>
</tbody>
</table>
Field Work

Linear Survey
Analysis

Automated Game Cameras
Analysis

Riparian – 5,000 cfs
Modeling
Analysis
Sediment

Table 1. Shear stress causing incipient motion

<table>
<thead>
<tr>
<th>Sediment</th>
<th>D (in)</th>
<th>T (lb/ft)</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohesive compacted clay</td>
<td>0.003</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>Fine sand</td>
<td>0.005</td>
<td>0.003</td>
<td></td>
</tr>
<tr>
<td>Coarse sand</td>
<td>0.02</td>
<td>0.004</td>
<td></td>
</tr>
<tr>
<td>Fine gravel</td>
<td>0.15</td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td>Medium gravel</td>
<td>0.5</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>Coarse gravel</td>
<td>0.6</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>Very coarse gravel</td>
<td>1.3</td>
<td>0.56</td>
<td></td>
</tr>
<tr>
<td>Small cobble</td>
<td>2.5</td>
<td>0.91</td>
<td></td>
</tr>
<tr>
<td>Large cobble</td>
<td>5.1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Validation

Inundation at 6,200 cfs
Inundation at 21,000 cfs

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

16,500 cfs
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

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