Identifying the Problem

- Over-draft of the Mississippi River Alluvial Aquifer (MRVA) at an approximate rate of 400,000 acre-feet per year.

- Declining in groundwater levels throughout the MS Delta as a result of overdraft of the MRVA

*Mark Stiles (YMD)
**Identifying the Problem**

- **Loss of base flows** in streams caused by declining groundwater levels and reduced irrigation runoff.

- **Degradation of water quality and aquatic habitat** as a result of inadequate flows.

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![Diagram of gaining and losing flows](image)

**Sunflower River (Low-Flow Conditions)**
Agriculture, Irrigation, and the MS Delta

- The agricultural industry is an integral part of the MS Delta’s economy and is dependent on a reliable water source to meet irrigation needs.

- Irrigation is proven to increase crop productivity and increase crop stability.

- Declining water levels lead to increased pumping costs and potential loss of a reliable supply.

- Loss of a reliable irrigation supply will lead to a loss of crop productivity and a decrease in economic stability for the MS Delta.
Courses of Action

1. **No Action:**
   - Continued overdraft of the MRVA leading to declining water levels, degradation of aquatic habitat, and eventual loss of a reliable supply
   - Potential Regulation

2. **Conservation:**
   - Reducing the amount of groundwater used for irrigation by maximizing water use efficiency (reduces irrigation runoff and contributes to loss of stream base-flows)

3. **New Water Supplies:**
   - Reducing or eliminating groundwater use by developing alternative sources of water (Ex. Well Fields, Inter-basin Transfer)
Proposed Action: Pecan Bayou Pilot Watershed

• **Implement a Pilot Conservation Watershed**
  - Effectively integrate the two available tools for reducing groundwater use (Conservation and New Water Supplies) to maximize the efficiency and benefits of the system and ultimately reduce overdraft of the MRVA

• **Actively manage the watershed**
  - Daily monitoring of the watershed to provide adequate supply of irrigation water to meet the crop needs as well as maintain in-stream aquatic needs.
• Using an existing regional groundwater flow model, conservation scenarios were developed for the alluvial aquifer underlying the Delta region in northwestern Mississippi to assess where the implementation of water-use conservation efforts would have the greatest effect on future water availability—either uniformly throughout the Delta, or focused on a cone of depression in the alluvial aquifer underlying the central part of the Delta.

• Overall, the results indicate that focusing conservation efforts within the area of the cone of depression, rather than distributing conservation efforts uniformly across the Delta, results in greater improvements in the amount of storage within the alluvial aquifer.
Pecan Bayou Pilot-Watershed

- Additional support/benefits via the proposed Quiver-Tallahatchie Inter-basin Transfer

- In the final stages of a feasibility study with the USACE to re-lift surface water from the Tallahatchie River and import it into the Quiver River via existing channels.

- **Additional Surface Water Potential:**
  300-500 cubic feet per second (cfs)
Quiver-Tallahatchie Transfer:

Supplemental Water:

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Flow (cfs)</th>
<th>Duration (days)</th>
<th>Volume (acre-feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquatic Restoration</td>
<td>100</td>
<td>365</td>
<td>72,397</td>
</tr>
<tr>
<td>Agricultural Water Supply</td>
<td>400</td>
<td>100</td>
<td>79,339</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td><strong>500</strong></td>
<td></td>
<td><strong>151,736</strong></td>
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</tbody>
</table>
## Project Watershed: Calculated aquifer overdraft

<table>
<thead>
<tr>
<th></th>
<th>Acres</th>
<th>Volume Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impacted Acres</td>
<td>134,000</td>
<td></td>
</tr>
<tr>
<td>Calculated Overdraft</td>
<td>34,100</td>
<td>-3,000 ac-ft/yr</td>
</tr>
<tr>
<td>Supplemental Water Water</td>
<td>40,000</td>
<td>-8,500 ac-ft/yr</td>
</tr>
</tbody>
</table>

*Based on YMD water level survey data*
Pecan Bayou Pilot Watershed:

**Effectively utilizing imported surface water**

- Ensure surface water is easily accessible and reliable through channel design and layout
- Utilize permitting process to encourage surface water use over groundwater use
- Engage landowners and encourage implementation of applicable conservation practices to improve water use efficiency
Pecan Bayou Pilot Watershed:

- Make surface water easily accessible and reliable through channel design
- 25 cfs (<1100 gpm) pumping plant on Quiver River
- Distribution Channels (Existing and Improved Channels)
- Weirs and WCS for water retention
- Lateral Ditches for distribution and runoff collection
Pecan Bayou Pilot Watershed:
Lateral Ditch Design

- Aerial of Surface Water Reservoirs and Tail-water Recovery Ditch (Pennington 2012)
- Aerial of Surface Water Irrigation from Tail-Water Ditch (Pennington 2012)
Pecan Bayou: Lateral Ditch Schematic
48" Culvert to be placed under Adair Road
Pecan Bayou Pilot Watershed

Projected Benefits

• Decrease groundwater use and improve sustainability of the MRVA by provide surface water irrigation opportunities for approximately 4000-5000 acres of cropland

• Channel distribution system will provide multiple benefits: distribution, storage, runoff collection, improved drainage, sediment and nutrient reduction.

• Potential capacity to meet the calculated water demand and offset the overdraft of the MRVA within the project footprint by providing enough storage capacity through channel design and construction.
## Pecan Bayou: Conservation

### Implementation and Promotion of Approved NRCS Practices

<table>
<thead>
<tr>
<th>Code</th>
<th>Practice</th>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>449</td>
<td>Irrigation Water Management</td>
<td>Intermediate</td>
<td>PHAUCET</td>
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<tr>
<td></td>
<td></td>
<td>Advanced</td>
<td>Irrigation Scheduling</td>
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<tr>
<td>443</td>
<td>Surface and Subsurface Irrigation</td>
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<td>SURGE</td>
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<tr>
<td>587</td>
<td>Structure for Water Control</td>
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<td>Weirs</td>
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<tr>
<td>410</td>
<td>Grade Stabilization Structure</td>
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<tr>
<td>533</td>
<td>Pumping Plant</td>
<td></td>
<td>Surface Water Relifts/Stream Gages for Management</td>
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<tr>
<td>607</td>
<td>Surface Drainage</td>
<td></td>
<td>Channel Excavation/Improvements</td>
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<tr>
<td>430</td>
<td>Irrigation Water Conveyance</td>
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<td>Underground Pipe</td>
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<tr>
<td>449</td>
<td>Sprinkler Irrigation</td>
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<td>Pivot Irrigation and Efficiency</td>
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<tr>
<td>447</td>
<td>Irrigation System, Tailwater Recovery</td>
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<td>Tailwater Recovery/Lateral Ditches</td>
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<td>356</td>
<td>Dike</td>
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<td>Pipes and Pads</td>
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<tr>
<td>578</td>
<td>Structure for Water Control</td>
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<td></td>
</tr>
<tr>
<td>606</td>
<td>Constructed Wetlands</td>
<td></td>
<td>Utilize abandoned fish ponds to East of Channel</td>
</tr>
<tr>
<td>340B</td>
<td>Cover Crops</td>
<td></td>
<td>Promote use for soil health within Demo area</td>
</tr>
<tr>
<td>328</td>
<td>Crop Rotation</td>
<td></td>
<td>Promote use for soil health within Demo area</td>
</tr>
<tr>
<td>329</td>
<td>Conservation Tillage</td>
<td></td>
<td>Promote use for soil health within Demo area</td>
</tr>
</tbody>
</table>
Pecan Bayou: An Actively Managed System

- YMD will manage pumping schedule and provide adequate surface water based on monthly crop water use needs

**Dave Kelly: YMD**

- The YMD began measuring crop irrigation use in 1995, resulting in one of the most comprehensive datasets on crop irrigation in the Mid-South.
- The *Power Conversion Coefficient* method used by the YMD was developed by engineers with the U.S. Geological Survey and provides unbiased measurements of season-long irrigation use.
- The dataset allows Delta-wide estimations of irrigation demand, energy costs associated with irrigation and will serve as a benchmark to which future advances in irrigation efficiency can be compared.
- 12-year averages (acre-feet/acre): Soybean: $0.9 \pm 0.3$, Corn: $1.0 \pm 0.3$, Rice: $3.1 \pm 0.3$, Cotton: $0.6 \pm 0.2$
**Pecan Bayou:** An Actively Managed System

**Real-Time Stream Gages:**

- Daily monitor in-stream conditions to balance in-stream aquatic habitat requirements versus irrigation needs to provide a reliable water supply.

- Stream gages can also be used to compare inputs (imported water) versus outputs (flow over weir) to monitor system performance and operation.
Pecan Bayou Pilot Watershed:

**Evaluating Impacts and Monitoring Performance**

- **Semiannual Water Level Survey:** Monitor and track groundwater levels and aquifer changes to evaluate the project’s impact on the MRVA

- **Flowmeters:** Flowmeters will be used within the system to monitor surface water use

- **Stream Gages:** Installed at key locations in the system to monitor and regulate the system

- **Conservation Practice Tracking:** Document and track conservation practices implemented within the project footprint in an effort to determine the effects of conservation on performance.
Conclusions

- **Utilize a proactive strategy** that effectively addresses the issues of Mississippi River Valley Alluvial Aquifer overdraft and declining in-stream base-flows by implementing a pilot conservation-watershed that incorporates both conservation and new water supplies.

- **Actively manage the watershed** through daily monitoring to balance the in-stream needs with irrigation needs in order to provide a reliable supply of surface water to meet the crop water demand and provide sufficient aquatic habitat.

- **Monitor and evaluate** the system performance to provide data for an adaptive management plan.

- **Provide a blueprint** for managing our vital natural resources that can be applied to other areas within the watershed and throughout the MS Delta.
Comments and Questions