

# **Water Availability Modeling**

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# Prior Appropriation Doctrine

- Introduced in Texas in the late 1800s to encourage irrigation in the arid portions of the state
- Provides an opportunity to obtain a legally recognized right to use water and certainty as to the amount of the recognized right.
- Priority date determined by date application is accepted for filing
- “First in Time, First in Right”



# Water Availability Models

- Before 1970s
  - Various methods used
  - Early rights (granted before the 1950s) did not consider the drought of record
- During Adjudication
  - Determinations based on historical use
- Post 1970
  - Legacy Models
    - Return flows included in some basins
    - Not completed for all basins



# Senate Bill 1

- In response to drought conditions in the 1990s, the Texas Legislature implemented Regional Water Planning in 1997
- This legislation also included funding for the creation of new Water Availability Models for 22 of the 23 river basins in the state. (Funding for the additional basin, the Rio Grande, was authorized in 2001)



# So, what is a WAM?

**A Water Availability Model is a computer simulation used to predict the amount of water that would be available in a river or stream under a specified set of conditions**

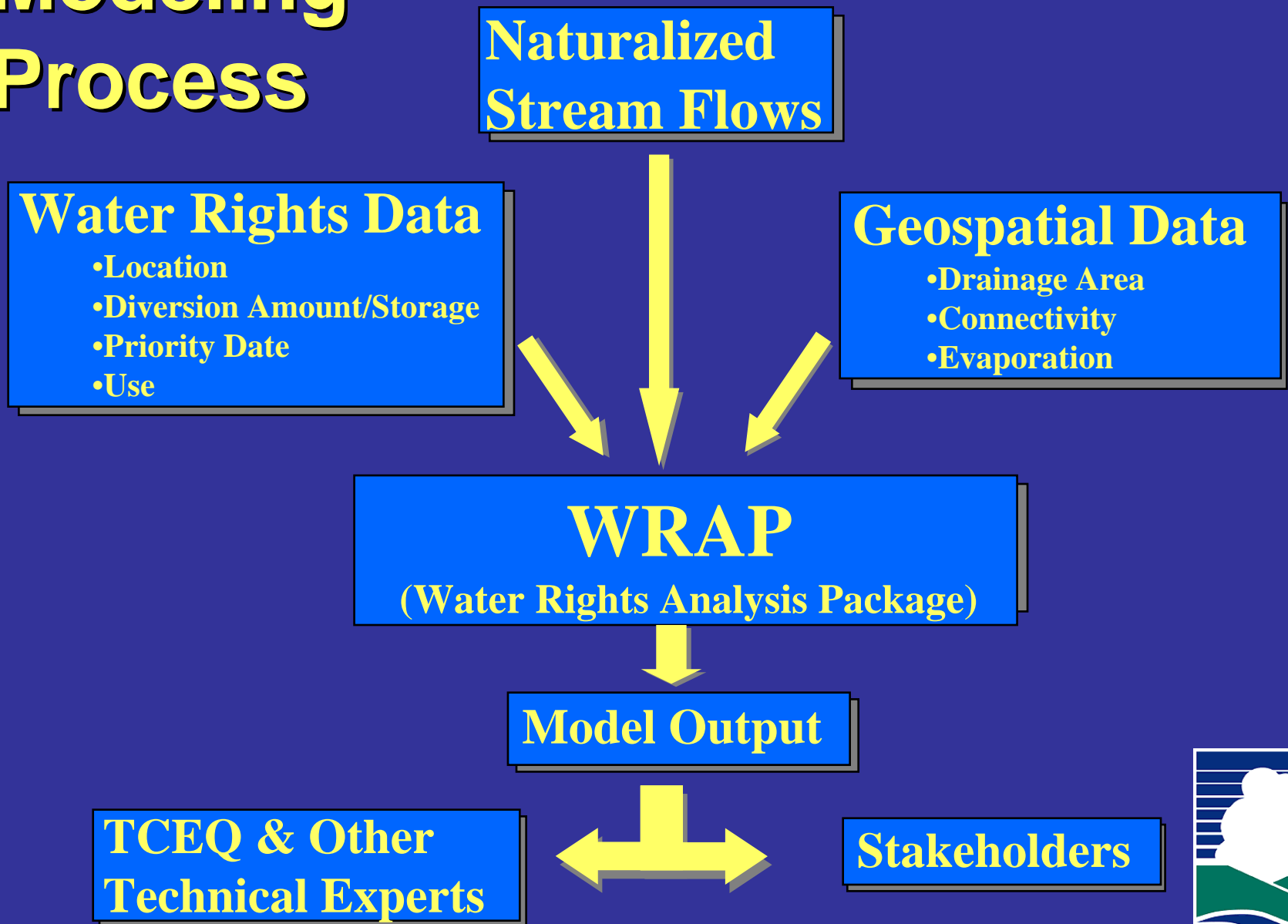


# What can a WAM do?

- It is based on historic hydrology and allocates water in accordance with the prior appropriation doctrine
- It is not a picture of what happened in 1945, or 1972
- It does not differentiate water quality
- It may not model all components of a water right (special conditions)



# Modeling Process



# Naturalized Streamflow

- The amount of water in the stream that would be there if not for the influence of man's activities
- Naturalized streamflow cannot be directly measured, yet it is the baseline condition for water availability accounting.
- For most Texas river systems, the naturalized flows encompass at least a fifty-year period of record that includes the drought of the 1950s.
- The period of record also includes major floods and less severe droughts, thereby representing an approximation of historic hydrologic variability.





# Full Authorization Simulation

- Used to evaluate applications for perpetual water rights and some amendments
- As-built area-capacity information for reservoirs
- No return flows
- All water rights utilize their maximum authorized amounts



# Current Conditions Simulation

- Used to evaluate applications for term water rights and some amendments
- Uses self-reported water use data for diversion amounts, uses the maximum reported value for the ten year period preceding the model construction
- Year 2000 area-capacity information for reservoirs (to account for sedimentation)
- Includes return flows



# Water Availability Model Output

- Unappropriated flows
- Reliability of water rights
- Reservoir/system operations – end of month storage
- Naturalized & Regulated flows
- Instream flow frequency



# Water Availability in General

- WAMs include water rights management strategies, environmental flow requirements and interstate compact requirements.
- The WAM uses prior appropriation accounting to determine how much water a water right can impound or divert. Water availability is calculated by taking the amount of flow in the stream and subtracting the amount of flow appropriated to other water rights.
- The amount of water available for appropriation is limited by the amount of the instream flow requirement

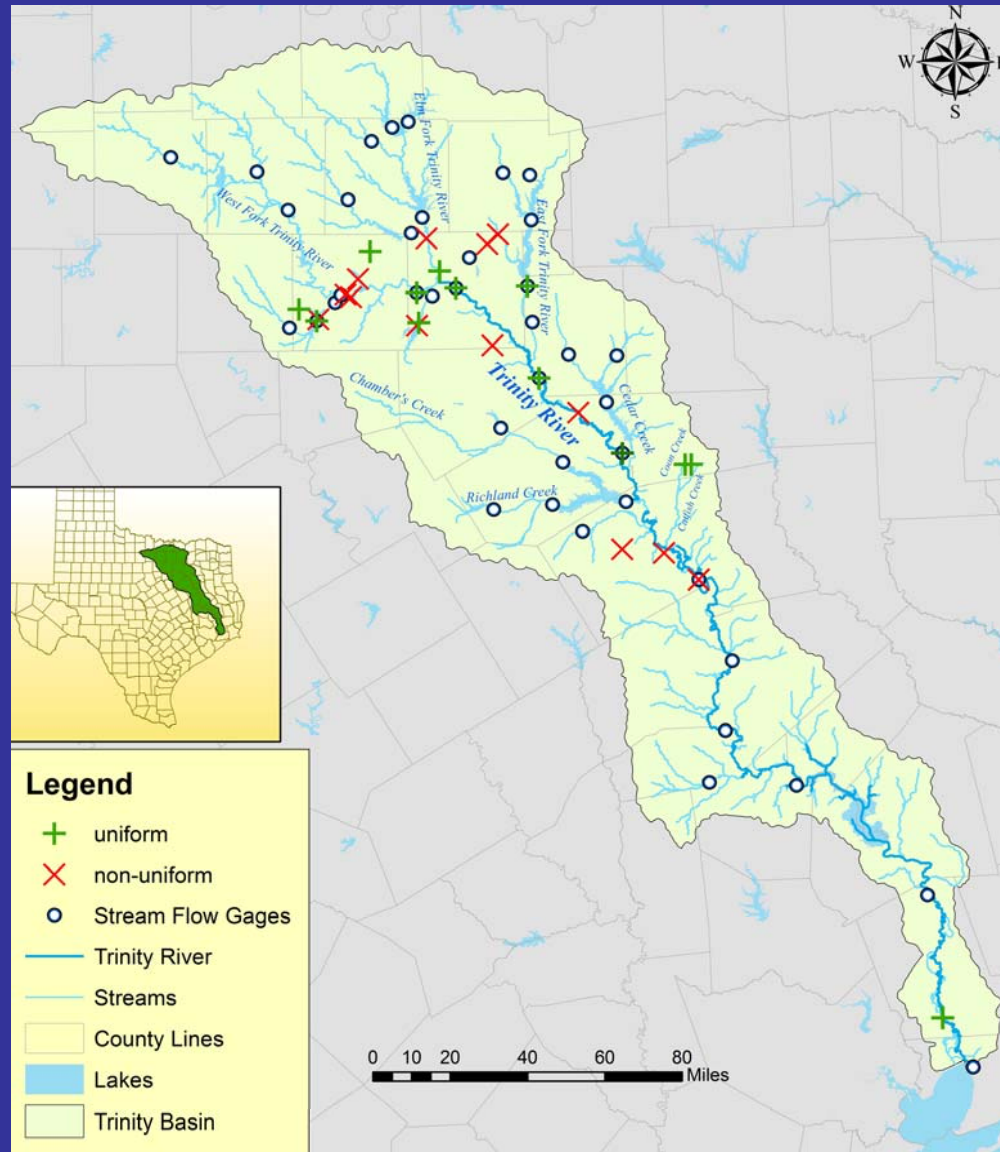


# WAM and Instream Flow Requirements

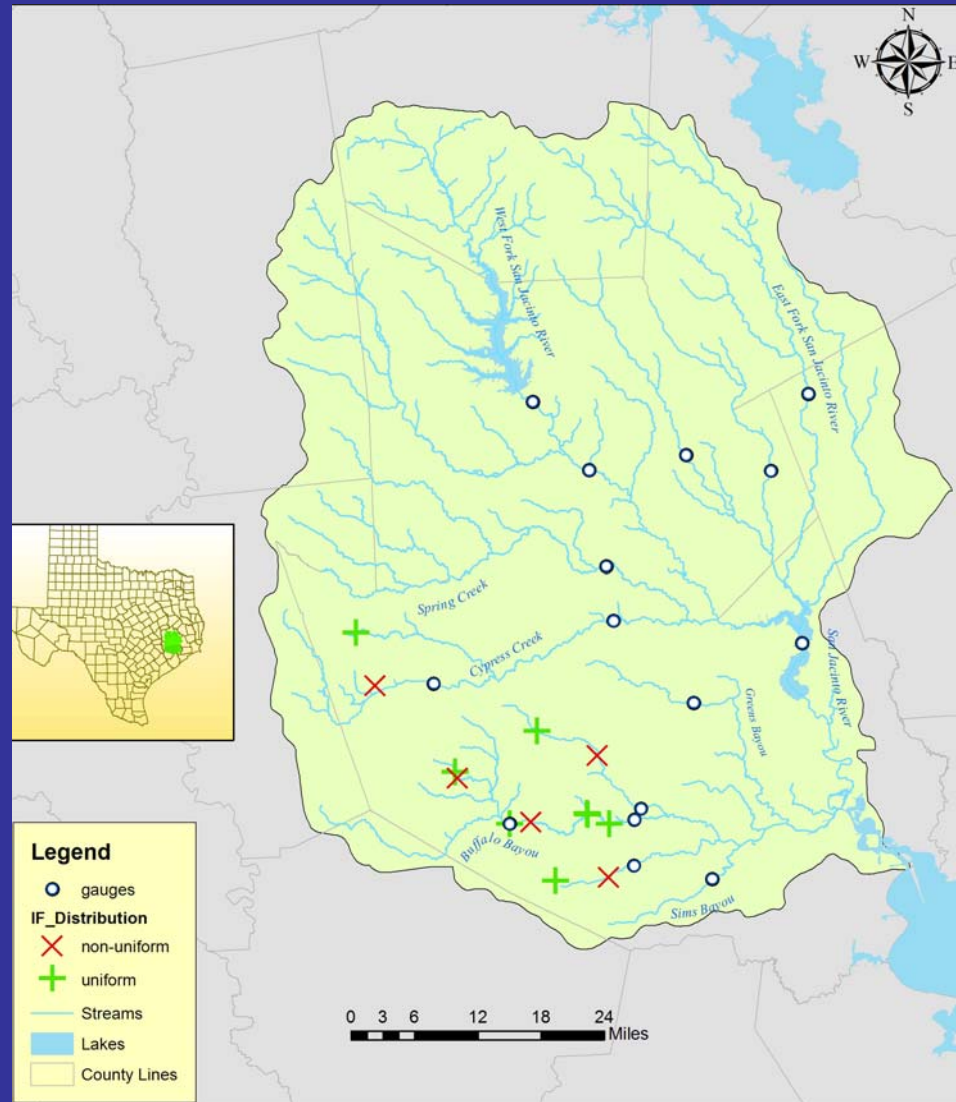
- Lyons' Method requirements are easily incorporated into the WAMs by converting the monthly requirement in cfs to acre-feet
- Transforming a new generation of permit requirements into monthly values in acre-feet
  - Pulse flows are computed outside the WAM and a conservative approximation is included
  - Varying streamflow requirement that depends on whether the season is classified as wet, average, dry
- New capabilities required for Texas Water Availability Models
  - Project completed May 2007



# Instream Flow Requirements Included in the Trinity WAM



# Instream Flow Requirements Included in the San Jacinto WAM



# Water Availability Determinations

- For new permits, the amount of flow appropriated to others is the full amount of the paper water right. Any remaining water is available to others. Term permits are based on appropriated but unused water
- Reuse permits
  - Surface Water
  - Groundwater
- Other types of permits
  - Conjunctive use of surface water and groundwater
  - Scalping





# Water Availability Maps

## The maps do not show:

- the quantity of streamflow present at any given location (i.e. gageflow)
- the quantity of water available for appropriation at any give location

## The maps do show:

- where no water is available for appropriation
- how often *some* water is available for appropriation

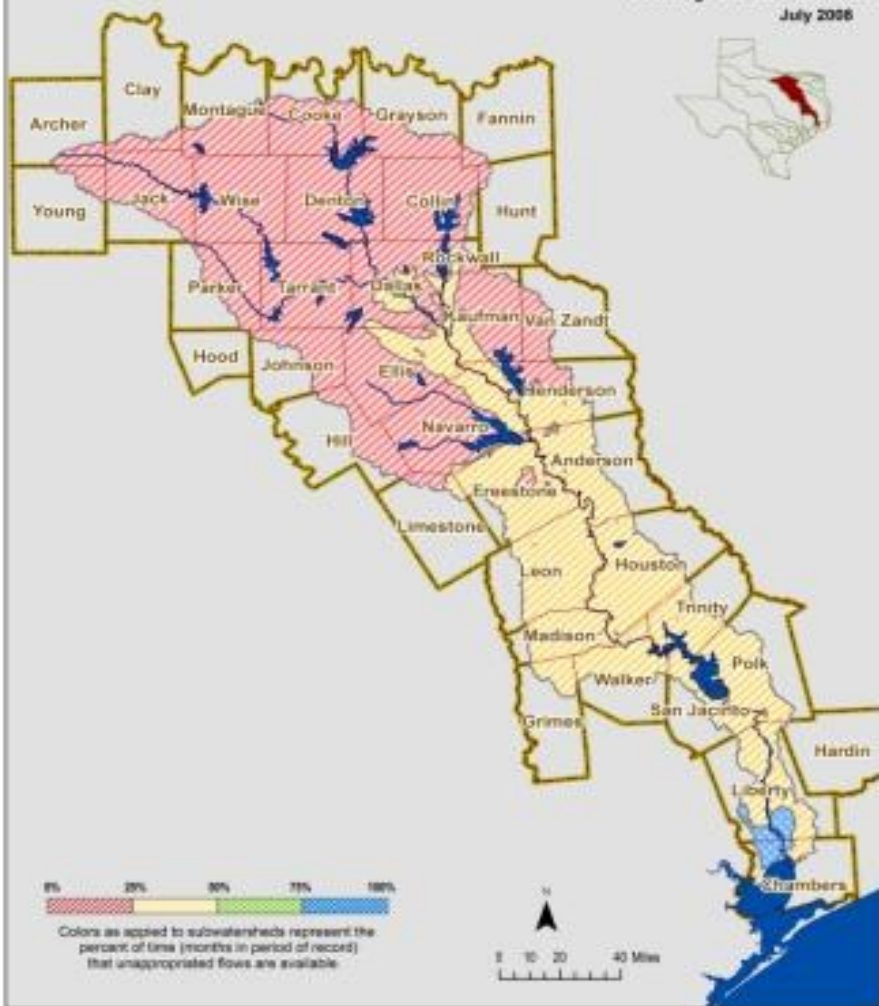


# General Water Availability Maps for the Trinity Basin

Water Availability for NEW PERPETUAL RIGHTS

Trinity River Basin

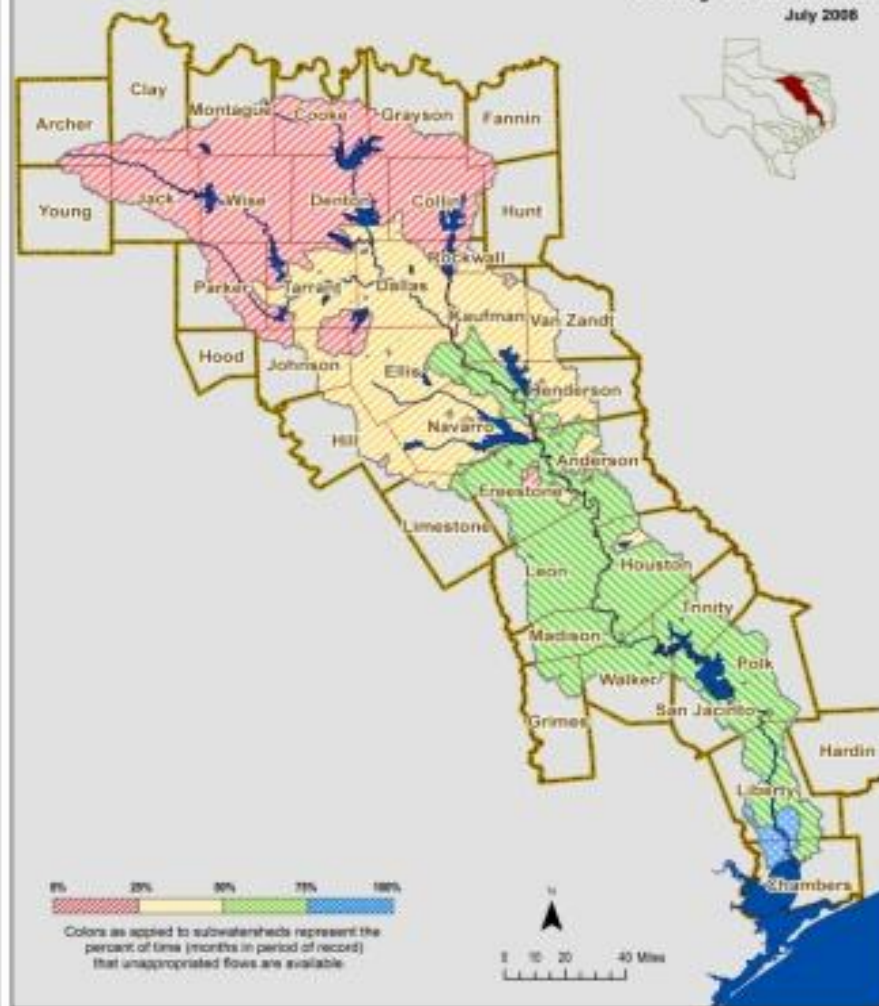
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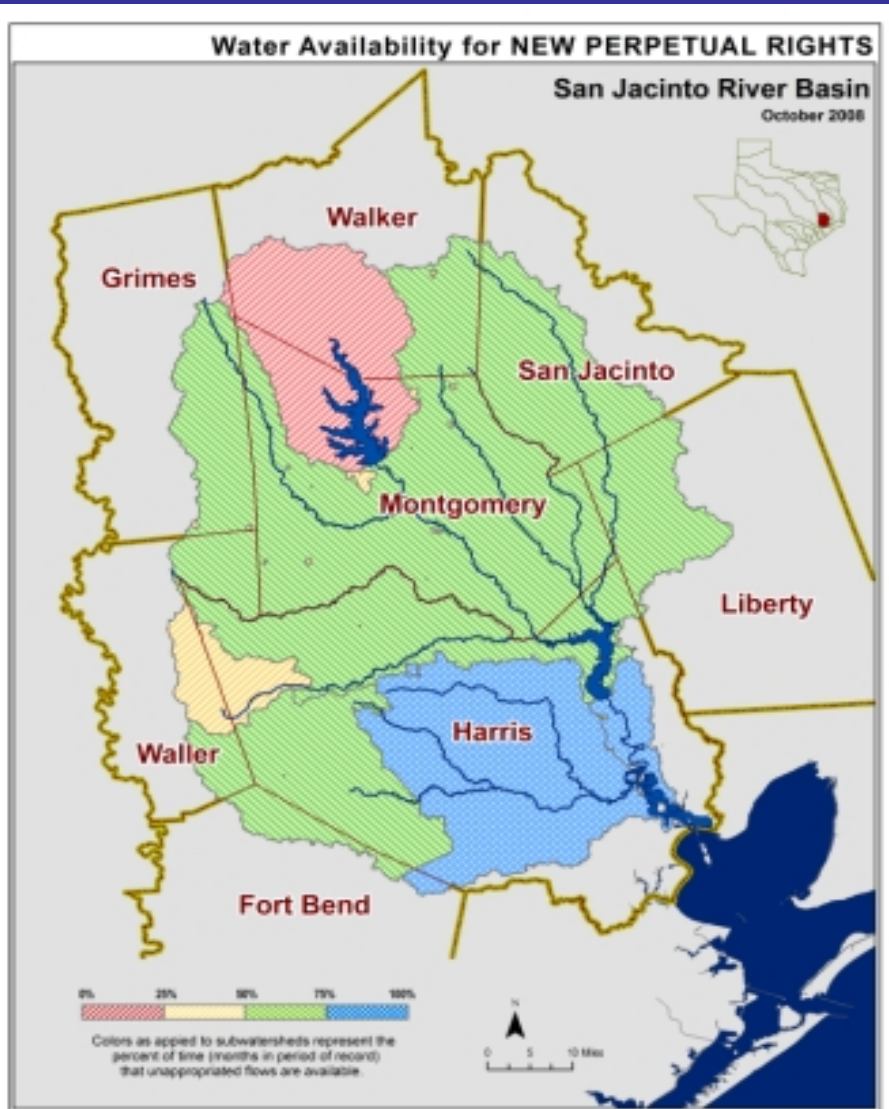
Water Availability for NEW TERM RIGHTS

Trinity River Basin

July 2006



# General Water Availability Maps for the San Jacinto Basin



# Water Availability Modeling on the Web

- Available at  
[http://www.tceq.state.tx.us/permitting/water\\_supply/water\\_rights/wam.html](http://www.tceq.state.tx.us/permitting/water_supply/water_rights/wam.html)
- Water Availability Maps by River Basin
- Link to WRAP programs and Manuals
- GIS data available
- Input Files by River Basin



# Questions?

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