BRA Exhibit No. 7 BRA's System Operation Water Rights Permit Application

Exhibit 7 Sub-Numbers		Name of Document	Testifying Witness
A		Application for Permit to Appropriate Public Water, filed June 25, 2004 with attachments	Forté
A	1	Supplemental Information for Brazos River Authority's Application for a System Operation Permit	Gooch
A	2	Attachment 1: Brazos River Authority Enabling Legislation	Forté
A	3	Attachment 2: System Operations Order, as amended	Forté
A	4	Attachment 3: Report in Support of System Operation Permit, June 14, 2004	Gooch
A	5	Attachment 4: Brazos River Authority Water Conservation Plan, June 2, 2004	Brunett
A	6	Attachment 5: Resolution Approved by the Board of Directors of BRA authorizing General Manager/CEO Phil Ford to sign and file application on behalf of BRA	Forté
B		October 8, 2004 Response to TCEQ's staff's Request for Additional Information with attachments	Gooch
B	1	Attachment 1: CD-ROM (containing electronic copies of Table D-3 and Table D-4 from Appendix D to Report in Support of System Operation Permit and GIS coverage of discharge points)	Gooch
B	2	Attachment 2: Latitude and Longitude of Brazos River Basin Wastewater Discharges	Gooch
B	3	Attachment 3: TWDB Population and Water Demand Data for Authority	Gooch
B	4	Attachment 4: Historic Authority Water Use Data	Brunett
C		Original WRAP Modeling used in the Application, December 2004	Gooch
D		First Update of System Operation Modeling, December 2005	Gooch
E		BRA February 17, 2005 Revised Water Conservation Plan, transmitted February 21, 2005	Brunett
F		BRA March 14, 2005 Drought Contingency Plan, transmitted March 24, 2005	Brunett
G		WRAP Modeling using Dual Simulation, 2007	Gooch
H		Memo on Development of Daily Flow Data, August 26, 2008	Gooch

Exhibit 7 Sub-Numbers		Name of Document	Testifying Witness
I		BRA February 5, 2009 Comments on December 1, 2008 Draft Permit	Gooch
I	1	Draft A proposed revisions of Draft Permit (using the "State Water" approach to appropriation of return flows)	Gooch
I	2	Draft B proposed revisions of Draft Permit (using the "Bed and Banks" approach to appropriation of return flows)	Gooch
I	3	February 5, 2009 Memorandum regarding TCEQ Modeling of Allens Creek Reservoir	Gooch
J		August 6, 2009 Comments of BRA and Texas Parks and Wildlife Department on December 1, 2008 Draft Permit	Gooch
J	1	Red-lined draft of proposed revision of the December 1, 2008 Draft Permit ("BRA / TPWD Draft Permit")	Gooch
J	2	Clean Copy of proposed revised BRA / TPWD Draft Permit	Gooch
K		Revised Allens Creek Modeling, transmitted August 6, 2009	Gooch
L		BRA's May 20, 2010 Comment Letter on February 11, 2010 Draft Permit	Gooch
L	1	Red-lined draft of proposed revision of February 11, 2010 Draft Permit	Gooch
M		BRA's December 22, 2009 Letter to the TCEQ Amending Application to address settlements with the Cities of Bryan and College Station	Forté

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
APPLICATION FOR PERMIT TO APPROPRIATE PUBLIC WATER
(SECTION 11.121 **OR** 11.143, TEXAS WATER CODE)
TAC CHAPTERS 30, 50, 281, 287, 288, 295, 297 AND 299
Water Quantity Division, Permitting MC-160
***P.O. Box 13087**
Austin, Texas 78711-3087
Telephone (512) 239-4730, FAX (512) 239-4770

If including a check, mail directly to P.O. Box 13088; ZIP 78711-3088

1. **Name:** BRAZOS RIVER AUTHORITY
   P.O. Box 7555
   Waco, Texas 76714-7555

   A. **Customer Reference Number (if issued):** CN
   Note: If you do not have a Customer Reference Number, complete Section II of the Core Data Form (TNRCC-10400) and submit it with this application.

   B. Lienholder Information (provide this information on the holder of any liens on any land to which the water right would be appurtenant):
   _____
   _____

2. **Dam (structure), Reservoir and Watercourse Data:**
   A. Type of Storage Reservoir (indicate by checking( ) all applicable)

   ( ) On-Channel ( ) Off-Channel ( ) Existing Structure ( ) Proposed Structure ( ) Exempt Structure*

*(TWC Section 11.143 for uses of water for other than domestic or livestock use from an existing reservoir, with a capacity of 200 acre-feet or less.)*Please complete Paragraph 6 below if proceeding under TWC 11.143.

   Date of Construction _____.

   B. Location of Structure No. _____.
   1) Watercourse: _____
   _____
   _____
   _____

   2) Location from County Seat: _____ miles in a _____ direction from _____, _____ County, Texas.

   3) Location from nearby town (if other than County Seat): _____ miles in a _____ direction from _____, a nearby town shown on county highway map.

   4) The dam will be/is located in the _____ Original Survey No. _____, Abstract No. _____ in _____ County, Texas.

   5) Station _____ on the centerline of the dam is _____° _____ (bearing), _____ feet (distance) from the _____ corner of _____ Original Survey No. _____, Abstract No._____, in _____ County, Texas, also being at Latitude _____ _°N, Longitude _____°W.

   C. Reservoir:
   1) Acre-feet of water impounded by structure at normal maximum operating level: _____.

   2) Surface area in acres of reservoir at normal maximum operating level: _____

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D. 1) If this is a U.S. Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service (SCS)) floodwater-retarding structure, provide the Site No. _____ and watershed project name .

2) Do you request authorization to close the "ports" or "windows" in the service spillway?

☐ Yes ☐ No

E. The drainage area above the dam and/or diversion point is _____ acres or _____ square miles.

3. **Appropriation Request (total amount of water needed , including maximum projected uses and accounting for evaporative losses for off-channel storage, if applicable).**

A. Appropriated water will be used as follows:

	Purpose*	Place of Use	Acre-feet per year
1)			
2)	(SEE ATTACHED SUPPLEMENTAL INFORMATION)		
3)			

*If irrigation use, list crops(s) to be irrigated:

_____
_____
_____

B. Lands to be irrigated (if applicable):

1) Applicant proposes to irrigate a total of _____ acres in any one year. This acreage is all of or part of a larger tract(s) which is described in a supplement attached to this application and contains a total of acres in _____ County, Texas. A copy of the deed(s) describing the overall tract(s) with the recording information from the county deed records is attached.

2) Location of land to be irrigated:
In the _____ Original Survey No. _____, Abstract No. _____.

C. Diversion Point No. _____.

1) Watercourse:_____
_____
_____
_____.

2) Location of point of diversion at Latitude _____°N, Longitude _____°W, also, bearing _____°___, _____feet (distance) from the _____ corner of the _____ Original Survey No. _____, Abstract No. _____, _____ County, Texas.

3) Location from County Seat: _____ miles in a _____ direction from _____ _____, _____ County, Texas. Location from nearby town (if other than County Seat): _____ miles in a _____ direction from _____, a nearby town shown on county highway map.

4) The diversion will be (check all appropriate boxes and if applicable, indicate whether existing or proposed):

	Directly from stream	Existing	Proposed
	From an on-channel reservoir		
	From stream to an off-channel reservoir		
	From a stream to an on-channel reservoir		
	From an off-channel reservoir		
	Other method (explain fully, use additional sheets if necessary)		

5) Rate of Diversion (Check ( ) applicable provision):

___1. Diversion Facility:

A.____ Maximum gpm (gallons per minute)

1) _____ Number of pumps
2) _____ Type of pump
3) _____ gpm, Pump capacity of each pump
4) Portable pump _____ Yes or _____ No.

___2. If by gravity:

A.____ Headgate _____ Diversion Dam _____ Maximum gpm

B.____ Other method (explain fully - use additional sheets if necessary)

_____

_____

D. Return Water or Return Flow (location and quantity information):

Water which is diverted but not consumed as a result of the above stated use, will be returned to _____, tributary of _____, tributary of _____ _____, _____ Basin, at a point which is at Latitude _____ ___°N, Longitude _____°W, also, bearing _____° _____ (direction), _____ feet (distance) from the _____corner of the _____ Original Survey No. ___, Abstract No. _____, in _____ County, Texas. Estimated **annual** amount of return flow to said stream will be _____acre-feet.

E. Surplus Water:

Water which is diverted but not used beneficially will be returned to _____, tributary of _____ Basin at a point which is at Latitude _____°N, Longitude _____°W, also, bearing _____° _____ (direction), _____feet (distance) from the _____ corner of the _____ Original Survey No. _____, Abstract No. _____, in _____ County, Texas.

4. **General Information:**

A. The proposed ____ or existing _____ works will be (are) located on the land of _____ _____, whose mailing address is _____ _____.

B. If an application for the appropriation is granted, either in whole or in part, construction works will begin within _____ such permit is issued. The proposed work will be completed within_____ of the date the permit is issued.

C. A Water Conservation Plan is attached? ___X___ Yes _____No

D. _____Interbasin transfer is not requested. (SEE ATTACHED SUPPLEMENTAL INFORMATION)

_____Applicant requests authorization to transfer _____ acre-feet of water per annum from the _____ Basin to the _____ Basin of which _____ acefet

will be used for _____ purposes and _____ acre-feet of water will be used for _____ purposes.

E. Is this project located within 200 river miles of the coast? Yes __X__ No _____ Unknown

5. **Maps, plats, plans, and drawings accompany this application as required by applicable TAC Sections.** ____ Yes ____ No. Attach additional sheets for multiple dams and reservoirs, diversion points, etc.

6. _____The dam(s) and reservoir(s) shown on the attached application was (were) constructed for domestic and livestock purposes and I/we elect to seek a permit under Section 11.143 of the Texas Water Code.

7. Provide information describing how this application addresses a water supply need in a manner that is consistent with the state water plan or the applicable approved regional water plan for any area in which the proposed appropriation is located or, in the alternative, describe conditions that warrant a waiver of this requirement.

(SEE ATTACHED SUPPLEMENTAL INFORMATION)

Witness by my hand in Waco, Texas, this the 14 day of June, 2004.

Phil Ford, General Manager/CEO
Name (Printed)

Name (Printed)

SWORN TO AND SUBSCRIBED before me this 14 day of June, 2004.

NOTARY PUBLIC STATE OF TEXAS
JENNIFER WHITE
Notary Public
STATE OF TEXAS
My Commission
Expires 05/21/2005

Notary Public for the State of Texas

SUPPLEMENTAL INFORMATION
FOR BRAZOS RIVER AUTHORITY'S
APPLICATION FOR A SYSTEM OPERATION PERMIT

I.

INTRODUCTION

The Brazos River Authority (the "Authority") is a conservation and reclamation district created by the Texas Legislature in 1929 for the purpose of developing and managing the water resources of the entire Brazos River Basin.[1]

The Texas Legislature has granted the Authority broad powers to control, store, preserve and distribute for all useful purposes the storm waters and floodwaters of the Brazos River and its tributary streams.[2]

The Authority may provide, through all practical and legal means, for the control and the coordination of the regulation of the waters of the watershed of the Brazos River and its tributary streams as a unit.[3]

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[1] The Authority's enabling statute was recently amended and codified in the 2003 Regular Legislative Session (S.B. No. 1935). The Authority's enabling act is now located in the Texas Water Code, Title 6, Surface Water Authorities, Subtitle B, Local Law Surface Water Authorities, Chapter 221. A copy of Chapter 221 is attached hereto and incorporated herein as Attachment No. 1.

[2] *See* Texas Water Code §§ 221.001; 221.004.

[3] *See* Texas Water Code § 221.004(b).

The Authority may provide for the development of groundwater and may make groundwater available for general use, including domestic, municipal, irrigation, commercial and industrial purposes.[4]

In the prosecution of the purposes for which the Authority has been created for the storing, controlling, conserving and distributing for useful purposes of the storm waters, floodwaters and unappropriated flow waters of the Brazos River Basin and developed groundwater from the Brazos River Basin for the use of its customers, the Authority is statutorily authorized to use the bed and banks of the Brazos River and its tributary streams for any and all purposes necessary to the accomplishment of the plans of the Authority.[5]

In carrying out its authority and responsibilities under its enabling act, the Authority holds Texas water rights for the four (4) reservoirs that it owns and operates for water supply – Possum Kingdom Lake, Lake Granbury, Lake Limestone and Lake Alan Henry. Additionally, the Authority, along with the Texas Water Development Board and the City of Houston, are the holders of the water right permit for the proposed Allens Creek Reservoir. The Authority has also contracted with the U.S. Army Corps of Engineers ("Corps") for storage space in nine (9) multi-purpose Federal Reservoirs – Lakes Whitney, Waco,[6] Belton, Proctor, Somerville,

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[4] *See* Texas Water Code § 221.004(l). However, the Authority may not transport or assist in the transport of groundwater pumped in the basin outside the Brazos River Basin. (§ 221.004(o)).

[5] *See* Texas Water Code § 221.017.

[6] Although the Authority has contracted with the U.S. Army Corps of Engineers for storage space in Lake Waco, the Authority has transferred all of its water rights to use water out of Lake Waco to the City of Waco. Therefore,

Stillhouse Hollow, Granger, Georgetown and Aquilla. The Authority also holds Texas water rights in each of these federal reservoirs with the exception of Lake Waco. These lakes, owned and operated by the Corps, provide flood control in the Brazos River Basin, as well as being sources for water supply.

A map of the Brazos River Basin showing the location of the above-mentioned lakes is attached hereto and incorporated herein as Figure 1.1 in Attachment No. 3, the Report in Support of System Operation Permit Application prepared by Freese and Nichols, Inc., and Espey Consultants, Inc.

II.

THE AUTHORITY'S WATER RIGHTS

A. Certificates of Adjudication and Permits.

The following Certificates of Adjudication and Permits are owned by the Authority.

1. Certificate No. 12-5155 (Possum Kingdom Lake)
2. Certificate No. 12-5156 (Lake Granbury)
3. Certificate No. 12-5157 (Lake Whitney)
4. Certificate No. 12-5158 (Lake Aquilla)
5. Certificate No. 12-5159 (Lake Proctor)
6. Certificate No. 12-5160 (Lake Belton)
7. Certificate No. 12-5161 (Lake Stillhouse Hollow)

Lake Waco is not included as part of the Authority's system of reservoirs for purposes of this application.

8. Certificate No. 12-5162 (Lake Georgetown)

9. Certificate No. 12-5163 (Lake Granger)

10. Certificate No. 12-5164 (Lake Somerville)

11. Certificate No. 12-5165 (Lake Limestone)

12. Certificate No. 12-5166 (Excess Flows Permit)[7]

13. Certificate No. 12-5167 (Interbasin Transfer Authorization)[8]

14. Permit No. 4146 (Lake Alan Henry)

15. Permit No. 2925A (proposed Allens Creek Reservoir)

A table summarizing the Authority's water rights is attached hereto and incorporated herein as Table 2.1 in Attachment No. 3.

B. <u>System Operation Order.</u>

On July 23, 1964, the Commission issued an Order authorizing the Authority to manage and operate its tributary reservoirs as elements of a system, coordinating releases from the tributary reservoirs with releases from the Authority's main stem reservoirs to minimize waste, and to conserve water in reservoirs in which the supply is short by making releases from tributary reservoirs in which the supply is more abundant.

Reservoirs included in the initial 1964 System Operation Order are Proctor, Belton, Stillhouse Hollow, Somerville and Granbury. In 1968, the Commission amended the System Operation

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[7] All diversions under Certificate No. 12-5166 are charged to the Authority's reservoirs in priority order starting with the most senior water right.

[8] All diversions under Certificate No. 12-5167 are water supplied by releases from the Authority's reservoirs. Certificate No. 12-5167 does not authorize an additional appropriation of state water.

Order by adding Lakes Granger and Georgetown. In 1977, the Commission further amended the System Operation Order by adding Lakes Limestone and Aquilla. The last amendment to the System Operation Order was approved in 1983 when Lake Whitney was added. Possum Kingdom Lake was incorporated into the System Operation Order when the water rights for Possum Kingdom Lake were adjudicated and the certificate issued. A copy of the System Operation Order, as amended, is attached hereto and incorporated herein as Attachment No. 2.

Provisions of the System Operation Order, as amended, have been incorporated into the Authority's individual water rights, described in Part II.A. above.

C. The Authority's System.

For purposes of this application, the "Authority's System" includes water rights granted under the above-referenced Certificates of Adjudication and permits, the Authority's enabling legislation, the System Operation Order, as amended, as well as groundwater, reservoirs, pipelines and other infrastructure owned or operated now or in the future by the Authority.[9]

[9] Documents relating to the Authority's bonded indebtedness define the Authority's system to mean the Authority's water supply system and including the Authority's facilities, infrastructure and properties, rights and privileges granted to the Authority by the State of Texas, an agency of appropriate jurisdiction, and the beds and banks of the Brazos River and its tributaries insofar as they are related to making water available from the Authority, together with all future extensions, improvements, enlargements, and additions to and replacements of the Authority's system, and all replacements thereof whether from surface water supplies, groundwater, or a combination thereof, unless specifically excluded from the Authority's system by resolution of the Authority's Board. Use of the term Authority's System in this application does not in any way, and it is not intended in any way, to amend the term as it is defined in the bonded indebtedness documents.

III.

SUMMARY OF APPLICATION

In this application for a "System Operation Permit" the Authority requests Commission approval and authorization for the following:

1. A new appropriation of state water for multiple uses, including domestic, municipal, agricultural, industrial, mining, and other beneficial uses on a firm or interruptible basis in the Brazos River Basin and interbasin transfer authorization pursuant to Texas Water Code § 11.085(v)(3)&(4) to transfer and use on a firm and interruptible basis such water in the San Jacinto–Brazos Coastal Basin and the Brazos-Colorado Coastal Basin and to transfer such water to any county or municipality or the municipality's retail service area that is partially within the Brazos River Basin for use on a firm and interruptible basis in that part of the county or municipality and the municipality's retail service area not within the Brazos River Basin.
2. Inclusion, as part of the appropriation described above, of an appropriation of current and future return flows (treated sewage effluent and brine bypass/return) to the extent that such return flows continue to be discharged or returned into the bed and banks of the Brazos River, its tributaries, and Authority reservoirs.
3. Authorization for operational flexibility to (i) use any source of water available to the Authority to satisfy the diversion requirements of senior water rights to the same extent that those water rights would have been

satisfied by passing inflows through the Authority's reservoirs on a priority basis, and (ii) release, pump and transport water from any of the Authority's reservoirs for subsequent storage, diversion and use throughout the Authority's service area.

4. Recognition that the System Operation Permit will prevail over inconsistent provisions in the Authority's existing Water Rights.

5. Authorization to use the bed and banks of the Brazos River, its tributaries and the Authority's reservoirs for the storage, conveyance and subsequent diversion of water appropriated by this application and from other sources.

IV.

SUPPLEMENTAL INFORMATION IN SUPPORT OF APPLICATION

A. New Appropriation of State Water and Exempt Interbasin Transfer Authorization.

The Authority's System Operation Order provides that the Authority's reservoirs can be operated as a system, and acknowledges the increased efficiency and increased water supply that is possible through system operation. The System Operation Order, however, does not appropriate the additional yield made available through system operation. By this application, the Authority seeks to appropriate this additional yield to meet future needs in the Brazos River Basin and such areas as are authorized under Texas Water Code § 11.085(v)(3)&(4). The additional water is a supply that can only be made available by the Authority through the system operation of its water rights. The requested appropriation is consistent with the Authority's authorizing legislation and the State's policy of optimal development of our limited water resources. It

represents a major additional water supply that can be developed without the adverse impacts that are possible from new reservoir construction.

In this application, the Authority is requesting the issuance of a new permit to appropriate state water in the amount of 421,449 acre-feet per annum for multiple uses, including domestic, municipal, agricultural, industrial, mining and other beneficial uses on a firm basis in the Brazos River Basin.[10] The Authority requests authorization to use up to 90,000 acre-feet of water per annum of its firm supply to produce, along with other unappropriated flows, an interruptible water supply of 670,000 acre-foot per annum and further requests the appropriation of that interruptible water supply. The Authority further requests that this new appropriation be authorized for transfer and use pursuant to Texas Water Code § 11.085(v)(3)&(4) in the San Jacinto-Brazos Coastal Basin and the Brazos-Colorado Coastal Basin, and for transfer in any county or municipality or the municipality's retail service area that is partially within the Brazos River Basin for use in that part of the county or municipality and in the municipality's retail service area not within the Brazos River Basin.

Based on the new water availability model for the Brazos River Basin ("Brazos WAM"), up to 421,449 acre-feet per annum of unappropriated water can be made available as a result of the efficiencies achieved through operation of the Authority's individual water rights as a system.

[10] The requested appropriation of 421,449 acre-feet of water per annum includes all available return flows at projected 2060 levels.

As discussed under Part IV.B. below, this 421,449 acre-feet per annum of unappropriated water can also be utilized to produce a supply of 331,449 acre-feet per annum as firm supply and 670,000 acre-feet per annum as interruptible supply.

Based upon the Commission's Water Availability Model for the Brazos River Basin, modified to reflect system operation and divided into three (3) subbasins, the maximum amount of available unappropriated water in each subbasin was determined as follows:

- Upper Subbasin: 150,538 acre-feet per annum firm.
- Central Subbasin: 144,306 acre-feet per annum firm.
- Lower Subbasin: 421,449 acre-feet per annum firm.

Control points defining each subbasin were chosen for their geographic distribution and period of historical flow records. The control points are:

- Brazos River @ the USGS gage No. 08091000 near Glen Rose, Texas, as the lower limit of the Upper Subbasin .
- Brazos River @ the USGS gage No. 08098290 near Highbank, Texas, as the lower limit of the Central Subbasin.
- Brazos River @ the Gulf of Mexico, as the lower limit of the Lower Subbasin.

The maximum supply of unappropriated water, 421,449 acre-feet per annum, is available if the entire amount is diverted at the lower limit of the Lower Subbasin. To the extent water is diverted upstream, the remaining unappropriated water downstream is reduced, but not on a 1:1 basis. The diversion must be modeled to determine the amount of unappropriated water

remaining, which will itself vary depending upon the location of its diversion and use. The Authority anticipates development of a Water Management Plan after appropriate public input and subject to periodic review and approval by the Commission to address utilization of the system operation appropriation at locations other than the three (3) control points identified in this application.[11]

SYSTEM OPERATION WITHOUT ALLENS CREEK RESERVOIR

Because Allens Creek Reservoir is not yet constructed and may not be constructed in the immediate future, the Authority has developed water availability scenarios for its system operation without Allens Creek Reservoir, either as a part of its system operation or as an existing water right that must be satisfied. This scenario results in alternative amounts of water available for appropriation, described in Attachment No. 3. Until Allens Creek Reservoir is constructed, the Authority requests that the System Operation Permit include a special condition which authorizes the Authority to appropriate state water in the amount of 425,099 acre-feet per annum for multiple uses, including domestic, municipal, agricultural, industrial, mining and other beneficial uses on a firm and interruptible basis in the Brazos River Basin, the San Jacinto-Brazos Coastal Basin and the Brazos-Colorado Coastal Basin (pursuant to Texas Water Code § 11.085(v)(3)) and in any county or municipality or the municipality's retail service area that is partially within the Brazos River Basin for use in that part of the county or municipality and municipality's retail service area not within the Brazos River Basin (pursuant to Texas Water

[11] As discussed further in Attachment No. 3, the Water Management Plan could also address instream and environmental flows, exercise of the operational flexibility to meet the needs of senior water rights from Authority sources of supply on a non-priority basis, and accounting for transfers of water among the Authority's System reservoirs.

Code § 11.085(v)(4)). Likewise, the amount of water authorized for the Authority to use from each subbasin prior to construction of the Allens Creek Reservoir is as follows:

- Upper Subbasin: 150,538 acre-feet per annum firm.
- Central Subbasin: 175,306 acre-feet per annum firm.
- Lower Subbasin: 425,099 acre-feet per annum firm.

B. <u>Use of State Water on a Firm or Interruptible Basis.</u>

The Authority is requesting authorization to use the new appropriation of state water on a firm or interruptible basis. By devoting a portion of the firm water supply of the new appropriation towards development of a larger, interruptible water supply, the Authority can greatly enhance the overall water supply capabilities of the system. By using up to 90,000 acre-feet of water per annum of its firm supply on an interruptible basis, the additional firm yield associated with system operation is reduced from 421,449 acre-feet per annum to 331,449 acre-feet per annum and an additional interruptible supply of up to 670,000 acre-feet per annum (75% of the water is available 75% of the time) is produced. As discussed above, the Brazos River Basin was divided into three (3) subbasins. The amount of unappropriated water on a firm and interruptible basis for each such subbasin was determined as follows:

- Upper Subbasin: 60,538 acre-feet per annum firm and 157,000 acre-feet per annum interruptible.
- Central Subbasin: 54,306 acre-feet per annum firm and 303,000 acre-feet per annum interruptible.

- Lower Subbasin: 331,449 acre-feet per annum firm and 670,000 acre-feet per annum interruptible.

Without the inclusion of the Allens Creek Reservoir as part of the system, the above stated amounts for each subbasin are modified as follows:

- Upper Subbasin: 60,538 acre-feet per annum firm and 190,000 acre-feet per annum interruptible.
- Central Subbasin: 85,306 acre-feet per annum firm and 284,000 acre-feet per annum interruptible.
- Lower Subbasin: 335,099 acre-feet per annum firm and 869,000 acre-feet per annum interruptible.

Such an appropriation for multiple beneficial uses on an interruptible basis is authorized under commission rules upon two grounds.

First, under 30 TAC § 297.42(d), a system operation in conjunction with other water rights is a type of project that is not required to be based upon the continuous availability of historic normal stream flow. The required availability of unappropriated water for a system operation project may be determined on a case-by-case basis based upon whether the proposed project can be viable for the intended purposes and the water will be beneficially used without waste.

Second, under 30 TAC § 297.42(c), to the extent that the Authority or the end user is able to supplement the requested interruptible amount with current or future sources of surface or

groundwater, such requested interruptible amount may be used on a firm yield basis for multiple uses, including domestic, municipal, agricultural, industrial, mining and other beneficial uses.

C. Authorization to Appropriate Current and Future Return Flows.

To the extent they may be available in the future, the Authority requests authorization to appropriate the current and future return flows (treated sewage effluent and brine bypass/return) being discharged into the bed and banks of the Brazos River, its tributaries, and Authority reservoirs pursuant to 30 TAC § 297.42(g).[12] If this authorization is granted, the Authority's right to use such water would have a 2004 priority date. Because such water would become appropriated water (no longer excluded from water availability computations), virtually all existing water rights in the Brazos River Basin would, according to their respective senior priorities, be able to use such water prior to any use by the Authority under the System Operation Permit. As a result, the reliability of virtually all existing senior water rights will improve.

D. Operational Flexibility.

The Authority is requesting the operational flexibility to (i) use any source of water available to the Authority to satisfy the diversion requirements of senior water rights to the same extent that those water rights would have been satisfied by passing inflows through the Authority's reservoirs on a priority basis and (ii) release, pump and transport water from any of the

[12] 30 TAC § 297.42(g) provides that in order to make the optimum beneficial use of available water, a water right may be granted upon the availability of return flows or discharges. However, a water right granted upon return flows or discharges that may cease in the future because of a new or increased direct reuse or that may cease for other lawful reasons will be granted with the express provision that the water available for the water right is dependent upon potentially interruptible return flows or discharges.

Authority's reservoirs for subsequent storage, diversion and use throughout the Authority's service area.

By satisfying downstream senior water rights from Authority sources on a non-priority basis, it is possible to make more water available in portions of the Brazos River Basin than would otherwise have been available if such downstream senior water demands had been met under strict application of the prior appropriations doctrine. For example, if a senior water right on the main stem of the Brazos River downstream of the confluence of the Little River would, under a strict application of the prior appropriation doctrine, be entitled to have water passed through the Authority's reservoirs in the Little River watershed during times of shortage, the Authority, by satisfying the demand of that downstream senior right from another source, e.g., Somerville Reservoir, can effectively make more water available from the Authority's reservoirs in the Little River watershed. This is because the yields of such reservoirs are increased by not having to meet the pass through obligation or priority call of the downstream senior water right. This operational flexibility will allow the Authority to make additional water available in areas within the Brazos River Basin having higher demand than otherwise would have been available from its local water sources and reduces the immediate necessity of constructing pipelines to deliver water to high demand areas. The Authority is also requesting the operational flexibility to release, pump and transport water from any of the Authority's reservoirs for subsequent storage, diversion and use throughout the Authority's service area. An example of this operational flexibility is when the Authority releases for hydroelectric generation purposes water from one of its reservoirs and subsequently stores that water in a downstream reservoir.

For these reasons, the Authority requests that the System Operation Permit authorize the Authority the operational flexibility as discussed above.

E. Recognition that the System Operation Permit will Prevail Over Inconsistent Provisions in the Authority's Existing Water Rights.

Provisions of the System Operation Permit may be inconsistent with some of the provisions of the prior System Operation Order that are incorporated into the Authority's existing water rights as special conditions or general limitations. These special conditions or general limitations relate to the use of water for multiple purposes, the percentage of reservoir storage allowed to be used in system operations and identification of sources of water supply. Each of these special conditions or general limitations is inconsistent with the system operation of the Authority's System. In order to allow the Authority to maximize its ability to operate the water resources under its control as a system, which in turn will result in the greater efficiency of the beneficial use of state water, the Authority requests that the System Operation Permit contain a provision stating that it prevails over prior inconsistent special conditions or general limitations concerning system operation contained in the Authority's existing water rights. The Commission's review and approval of the Authority's Water Management Plan will actually provide the same safeguards intended by the above-mentioned special conditions and general limitations, while allowing the Authority greater operational flexibility.

F. Bed and Banks Authorization.

In order to utilize its existing water rights, the appropriation requested by this application and other potential sources of supply as a system, the Authority requests authorization to use the bed and banks of the Brazos River, its tributaries and the Authority's reservoirs for the conveyance, storage, and subsequent diversion of (i) water that the Authority seeks to appropriate under this application; (ii) waters that are being conveyed via pipelines and subsequently discharged into the Brazos River, its tributaries or stored in the Authority's reservoirs; (iii) surface water and groundwater imported from areas located outside of the Brazos River Basin for subsequent use; (iv) in-basin surface water and groundwater subject to the Authority's control; and (v) waters developed from future Authority projects. As provided in Texas Water Code § 11.042(c), such authorization would allow the Authority to divert only the amount of water put into a watercourse, stream or reservoir, less carriage losses and subject to any special conditions that may address the impact of the discharge, conveyance, and diversion on existing permits, certified filings, or certificates of adjudication, instream uses, and freshwater inflows to bays and estuaries. Specific discharge and diversion points, as well as procedures to account for losses, could be addressed as part of the Authority's Water Management Plan.

V.

CONSISTENCY WITH STATE AND REGIONAL WATER PLANS

In compliance with 30 TAC § 295.16, the Authority submits the information in Section 5 of Attachment 3 to demonstrate that the proposed uses of water requested in this application are consistent with the State and Regional Water Plans.

VI.

THE AUTHORITY'S WATER CONSERVATION PLAN AND DROUGHT CONTINGENCY PLAN

In compliance with 30 TAC § 295.9, the Authority's existing Water Conservation Plan and proposed Drought Contingency Plan are attached hereto and incorporated herein as Attachment No. 4.

VII.

ENVIRONMENTAL FLOWS CONSIDERATIONS

A detailed discussion of environmental flows considerations is set forth in Section 4 of Attachment No. 3.

VIII.

CONSISTENCY WITH TEXAS COASTAL MANAGEMENT PROGRAM

A detailed discussion of the consistency of the proposed System Operation Permit with the Texas Coastal Management Program is set forth in Section 4 of Attachment No. 3.

IX.

GENERAL PROVISIONS

A. Fees.

In compliance with 30 TAC § 295.131-.140, the Authority encloses a check payable to the Commission in the amount of $55,000.00 to cover the filing, recording, notice and one-time use fees.

B. Authorization to File and Sign Application.

In compliance with 30 TAC § 295.14, the Authority attaches hereto and incorporates herein as Attachment No. 5, a Resolution approved by the Board of Directors of the Authority authorizing General Manager/CEO Phil Ford or his designee to sign and file this application on behalf of the Authority.

SUBTITLE B. LOCAL LAW SERVICE WATER AUTHORITIES

CHAPTER 221. BRAZOS RIVER AUTHORITY

Section

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221.019. Limited Liability for Aquatic Herbicide Application.

§ 221.001. Creation

(a) A conservation and reclamation district to be known as the "Brazos River Authority" is created. The authority is a river authority, a governmental agency, a municipality, and a body politic and corporate.

(b) The authority is created under and is essential to accomplish the purposes of Section 59, Article XVI, Texas Constitution.

(c) The authority may exercise the powers expressly granted by Section 59, Article XVI, Texas Constitution, to districts created to conserve, control, and utilize to beneficial service the storm waters and floodwaters of the rivers and streams of the state, as well as those powers that may be contemplated and implied by the purposes of that provision of the constitution and that are conferred by general law and the provisions of this chapter. In addition, the authority may discover, develop, and produce groundwater in the Brazos River basin for the use of its customers.

(d) The authority may exercise all the rights and powers of an independent governmental agency, a municipality, and a body politic and corporate to formulate plans deemed essential to its operation and for its administration in the control, storing, preservation, and distribution for all useful purposes of the storm waters and floodwaters of the Brazos River and its tributary streams.

(e) The authority may exercise the same authority and power of control and regulation over the storm waters and floodwaters of the Brazos River and its tributaries as may be exercised by the state, subject to the provisions of the constitution and the acts of the legislature.

Added by Acts 2003, 78th Leg., ch. 996, § 1, eff. Sept. 1, 2003.

§ 221.002. Definitions

In this chapter:

(1) "Authority" means the Brazos River Authority.

(2) "Board" means the board of directors of the authority.

(3) "Director" means a member of the board.

Added by Acts 2003, 78th Leg., ch. 996, § 1, eff. Sept. 1, 2003.

§ 221.003. Territory

The territory of the authority comprises the watershed of the Brazos River, as determined by rule of the Texas Water Development Board, except the portions lying within Freestone, Leon, and Madison counties.

Added by Acts 2003, 78th Leg., ch. 996, § 1, eff. Sept. 1, 2003.

§ 221.004. Powers

(a) The authority may exercise, in addition to all the general powers vested by the constitution and statutes in a governmental agency and body politic and corporate for the greatest practicable measure of conservation and beneficial utilization of storm waters, floodwaters, and unappropriated flow waters, the powers of control and employment of the floodwaters, storm waters, unappropriated flow waters, and groundwater of the authority in the manner and for the purposes provided by this section.

(b) The authority may provide, through all practical and legal means, for the control and the coordination of the regulation of the waters of the watershed of the Brazos River and its tributary streams as a unit.

(c) The authority may provide, by adequate organization and administration, for the preservation of the equitable rights of the people of the different sections of the watershed area in the beneficial use of storm waters, floodwaters, and unappropriated flow waters of the Brazos River and its tributary streams.

(d) The authority may provide for storing, controlling, and conserving storm waters, floodwaters, and unappropriated flow waters of the Brazos River and its tributaries, preventing the escape of those waters without the maximum of public service, preventing the devastation of lands by recurrent overflows, and protecting life and property in the watershed area from uncontrolled floodwaters.

(e) The authority may provide for the conservation of waters essential for the domestic uses of the people of the watershed of the Brazos River and its tributaries, including all necessary water supplies for municipalities.

(f) The authority may provide for the irrigation of lands in the watershed of the Brazos River and its tributary streams where irrigation is required for agricultural purposes, or may be considered helpful to more profitable agricultural production, and provide for the equitable distribution of storm waters, floodwaters, and unappropriated flow waters to the regional potential requirements for all uses. Plans and works provided by the authority, and works provided under the authorization of the authority, should give primary consideration to the necessary and potential needs for water by or within the areas constituting the watershed of the Brazos River and its tributary streams.

(g) The authority may provide for the better encouragement and development of drainage systems and provisions for drainage of lands in the valleys of the Brazos River and its tributary streams needing drainage for profitable agricultural production and drainage for other lands in the watershed area of the authority requiring drainage for the most advantageous use.

(h) The authority may provide for the conservation of all soils against destructive erosion and for the prevention of increased flood danger caused by destructive soil erosion.

(i) The authority may provide for controlling and making available for employment floodwaters, storm waters, and unappropriated flow waters in the development of commercial and industrial enterprises in all sections of the watershed area of the authority.

(j) The authority may provide for the control, storage, and employment of floodwaters, storm waters, and unappropriated flow waters in the development and distribution of hydroelectric power, where this use may be economically coordinated with other and superior uses and subordinated to the uses declared by law to be superior.

(k) The authority may provide for each purpose for which floodwaters, storm waters, and unappropriated flow waters, when controlled and conserved, may be used in the performance of a useful service as contemplated and authorized by the provisions of the constitution and the public policy it declares.

(*l*) The authority may provide for the development of groundwater and may make groundwater available for use for domestic, municipal, irrigation, commercial, and industrial purposes.

(m) This chapter does not confer on the authority any power under Chapter 36 to regulate the groundwater of other landowners.

(n) When producing groundwater, the authority is subject to all laws, regulations, and rules relating to groundwater, including the rules of a groundwater conservation district and the Central Carrizo–Wilcox Coordinating Council.

(*o*) The authority may not transport or assist in the transport of groundwater pumped in the basin outside the Brazos River basin.

Added by Acts 2003, 78th Leg., ch. 996, § 1, eff. Sept. 1, 2003.

Historical and Statutory Notes

Section 2(c) of Acts 2003, 78th Leg., ch. 996 provides:

"(c) This Act does not:

"(1) limit the powers granted to the Brazos River Authority or the Lower Colorado River Authority by any other law; or

"(2) impliedly repeal any laws granting powers to the Brazos River Authority or the Lower Colorado River Authority."

§ 221.005. Limitation of Authority; State Supervision

The powers and duties granted to the authority by this chapter are subject to all legislative declarations of public policy in the maximum utilization of the

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storm waters, floodwaters, and unappropriated flow waters of the Brazos River watershed and developed groundwater of the Brazos River basin for the purposes for which the authority is created, as expressed and indicated in this chapter, and subject to the continuing rights of supervision by the state.

Added by Acts 2003, 78th Leg., ch. 996, § 1, eff. Sept. 1, 2003.

§ 221.006. Dams and Reservoirs; Water Supply Contracts

(a) The authority may construct, acquire, equip, acquire storage rights at, and operate dams and reservoirs that, in the opinion of the board, are useful in carrying out the powers conferred on the authority by this chapter, regardless of whether a dam is designed to serve a single purpose or multiple purposes.

(b) The authority may provide water supply lines and water purification and pumping facilities.

(c) The authority may execute contracts with municipalities in the state substantially in the manner prescribed by Section 402.020, Local Government Code, for districts organized or created under Section 59, Article XVI, Texas Constitution, and may execute water supply contracts with other users of water.

Added by Acts 2003, 78th Leg., ch. 996, § 1, eff. Sept. 1, 2003.

§ 221.007. Priority of Rights

This chapter does not change any existing priority of right under the laws of this state to the use of waters of this state, including any rights of municipalities that maintain and use storage structures in the bed of the Brazos River or its tributaries.

Added by Acts 2003, 78th Leg., ch. 996, § 1, eff. Sept. 1, 2003.

§ 221.008. Bond Provisions

(a) Bonds may be:

(1) sold for cash, at public or private sale, and at the price the board determines;

(2) issued on the terms the board determines in exchange for property of any kind, real, personal, or mixed, or any interest in property, that the board determines necessary or convenient for any corporate purpose; or

(3) issued to refund bonds issued at any time under authority of this chapter.

(b) Bonds must be authorized by resolution of the board.

(c) A resolution authorizing bonds may contain provisions that are part of the contract between the authority and the purchasers and subsequent holders of the bonds:

(1) reserving the right to redeem the bonds at the time, in the amount, and at the price provided;

(2) providing for the setting aside of sinking funds or reserve funds and the regulation and disposition of those funds;

(3) pledging, to secure the payment of the principal of and interest on the bonds and the sinking fund or reserve fund payments agreed to be made with respect to the bonds, all or any part of the gross or net revenues subsequently received by the authority with respect to the property, real, personal, or mixed, to be acquired or constructed with the bonds or with proceeds of the bonds, or all or any part of the gross or net revenues subsequently received by the authority from any source;

(4) prescribing the purposes to which the bonds or any bonds later issued, or the proceeds of the bonds, may be applied;

(5) agreeing to set and collect rates and charges sufficient to produce revenues that are adequate to pay the items specified in any resolution or resolutions authorizing any bonds, and prescribing the use and disposition of all revenues;

(6) prescribing limitations on the issuance of additional bonds and on all agreements that may be made with the purchasers and successive holders of the bonds;

(7) relating to the construction, extension, improvement, operation, maintenance, depreciation, replacement, and repair of the properties of the authority and the carrying of insurance on all or any part of the property covering loss or damage or loss of use and occupancy resulting from specified risks;

(8) establishing the procedure, if any, by which, if the authority so desires, the terms of any contract with the bondholders may be amended or abrogated, the amount of bonds the holders of which must consent to such amendment or abrogation, and the manner in which the consent is evidenced;

(9) providing for the execution and delivery by the authority to a bank or trust company authorized by law to accept trusts, or to the United States or any office or agency of the United States, of indentures or agreements authorized to be made with or for the benefit of the bondholders and any other provisions contained in the indentures or agreements; and

(10) making other provisions, not inconsistent with this chapter, that the board approves.

Added by Acts 2003, 78th Leg., ch. 996, § 1, eff. Sept. 1, 2003.

§ 221.009. Board of Directors; Bonds; Quorum; Officers

(a) The board consists of 21 members. Members of the board and their successors serve staggered terms of six years and until their successors are designated and have qualified. The terms of seven members of the board expire on February 1 of each odd-numbered year.

(b) The governor shall appoint the directors at large with the advice and consent of the senate. Within 60 days after appointment, each director shall

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take and subscribe an oath of office similar to the oaths administered to county commissioners and shall execute bond in the amount of $5,000, payable to the authority. The premium on the bond shall be paid by the authority. The bond, after being recorded in the official bond records of the county in which the authority maintains its office, shall be deposited with a depository selected and approved for the deposit of the funds of the authority.

(c) A vacancy occurring on the board shall be filled by appointment of the governor with the advice and consent of the senate.

(d) Eleven members of the board constitute a quorum to transact business.

(e) The governor shall designate a director as the presiding officer of the board to serve in that capacity at the pleasure of the governor. The board shall elect from among its members an assistant presiding officer and a secretary. The board shall appoint a treasurer. The treasurer shall furnish a bond in an amount equal to 75 percent of the amount of money estimated to be on hand during the year, not to exceed $100,000.

Added by Acts 2003, 78th Leg., ch. 996, § 1, eff. Sept. 1, 2003.

Historical and Statutory Notes

Section 3 of Acts 2003, 78th Leg., ch. 996 provides:

"As soon as practicable on or after the effective date [Sept. 1, 2003] of this Act, the governor shall designate from the members of each board the presiding officers of the Brazos River Authority and the Lower Colorado River Authority. The governor may designate as the presiding officer of a board the person serving in that capacity immediately before the effective date of this Act. A person serving as the presiding officer of a board immediately before the effective date of this Act shall continue to serve in that capacity until the person's successor has been designated."

§ 221.010. Creation of Master District; Water Control and Improvement District

A master district is created having all the powers, duties, and functions, and subject to applicable and practicable procedures for those districts, to accomplish the purposes of this chapter, as provided by Chapter 49 and the provisions of this code applicable to water control and improvement districts.

Added by Acts 2003, 78th Leg., ch. 996, § 1, eff. Sept. 1, 2003.

§ 221.011. Bond Election Required

The authority may not issue bonds or incur any form of continuing obligation or indebtedness payable from ad valorem taxes for purposes of effecting improvements comprehended in the plan of organization and administration of the authority, or incur any indebtedness in the form of a continuing charge on lands or other physical properties within the authority, unless the proposition has been submitted to the qualified voters of the authority, or in appropriate cases the qualified voters of a defined area within the authority, and is approved by a majority of the electors voting on the proposition.

Added by Acts 2003, 78th Leg., ch. 996, § 1, eff. Sept. 1, 2003.

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§ 221.012. Additional Powers and Duties

(a) The authority is a district and a river authority as defined by Chapter 30. All the provisions of Chapter 30 are applicable to the authority.

(b) As used in this section:

(1) "Person" means any individual, partnership, corporation, public utility, or other private entity or any public agency.

(2) "Public agency" means an authority, district, municipality or other political subdivision, joint board, or other public agency created and operating under the laws of this state and any entity created to operate or act on behalf of a public agency.

(c) The authority and all persons may enter into contracts with each other, in any manner and on terms to which the parties agree, with respect to any power, function, facility, or service that the authority is authorized by law to provide or finance. Public agencies may use and pledge any available revenues for and in the payment of amounts due under a contract as an additional source of payment of the contract and may covenant with respect to available revenues to assure the availability of the revenues when required. In this subsection, "revenues" does not mean or include revenues from ad valorem taxes levied and collected by a public agency or the proceeds from the sale or refunding of bonds of a public agency that are to be wholly or partially paid from ad valorem taxes levied and collected by the public agency unless the use or pledge of the tax revenues or bond proceeds is approved by the qualified voters of the public agency at an election called for the purpose of levying taxes or issuing or refunding bonds, or both, for the purpose of using or pledging their revenues or proceeds under contracts entered into under this subsection.

(d) A public agency may set, charge, and collect fees, rates, charges, rentals, and other amounts for a service or facility provided by a utility operated by the public agency, or provided under or in connection with a contract with the authority, from the inhabitants of the authority or from any users or beneficiaries of the utility, service, or facility, including:

(1) water charges;

(2) sewage charges;

(3) solid waste disposal system fees and charges, including garbage collection or handling fees; and

(4) other fees or charges.

(e) A public agency may use and pledge the fees, rates, charges, rentals, and other amounts authorized by Subsection (c) to make payments to the authority required under a contract with the authority and may covenant to do so in amounts sufficient to make all or any part of the payments to the authority when due. If the parties agree in the contract, the payments shall constitute an expense of operation of any facility or utility operated by the public agency.

(f) The authority, acting through the board, may carry out any activities and acquire, purchase, construct, own, operate, maintain, repair, improve, or extend and may lease or sell, on terms and conditions, including rentals or sale

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prices, on which the parties agree, all works, improvements, facilities, plants, buildings, structures, equipment, and appliances, and all real and personal property, or any interest in real or personal property, related to the works, improvements, facilities, plants, buildings, structures, equipment, and appliances, that are incident to or necessary in carrying out or performing any power or function of the authority under this section.

(g) The authority may issue bonds with respect to the acquisition, purchase, construction, maintenance, repair, improvement, and extension of works, improvements, facilities, plants, buildings, structures, appliances, and property for the purpose of exercising any of its powers and functions under this section in the manner provided by this chapter or any other applicable law.

(h) The authority may issue revenue bonds to pay for the costs of feasibility studies for proposed projects of the authority, including engineering, planning and design, and environmental studies. The authority may include in any revenue bond issue the funds to operate and maintain, for a period not to exceed two years after completion, the facilities acquired or constructed through the revenue bond issue.

(i) If bonds issued by the authority recite that they are secured by a pledge of payments under a contract, a copy of the contract and the proceedings relating to the contract may be submitted to the attorney general along with the bonds. If the attorney general finds that the bonds have been authorized and the contract has been made and entered into in accordance with law, the attorney general shall approve the bonds and the contract, and after the approval, the bonds and the contract are incontestable in any court or other forum for any reason and are valid and binding in accordance with their terms and provisions for all purposes.

(j) The provisions of Chapters 618, 1201, 1204, 1207, and 1371, Government Code, are applicable to bonds issued by the authority.

(k) This section is wholly sufficient authority for the issuance of bonds, the execution of contracts, and the performance of other acts and procedures authorized by this section by the authority and all persons, including public agencies, without reference to any other provision of law or any restriction or limitation contained in those provisions, except as specifically provided by this section. To the extent of any conflict or inconsistency between this section and any other law, including any charter of a home-rule municipality, this section shall prevail and control. The authority and all persons, including public agencies, may use any law not in conflict with this section to the extent convenient or necessary to carry out any power or authority, expressed or implied, granted by this section.

Added by Acts 2003, 78th Leg., ch. 996, § 1, eff. Sept. 1, 2003.

§ 221.013. Disposition of Property

(a) Nothing in this chapter shall be construed as authorizing the authority, and it is not authorized, to mortgage or otherwise encumber any of its property of any kind, real, personal, or mixed, or any interest in property, or to acquire

any property or interest subject to a mortgage or conditional sale; provided, however, that this section shall not be construed as preventing the pledging of the revenues of the authority as provided by this chapter.

(b) Nothing in this chapter shall be construed as authorizing the sale, release, or other disposition of property of any kind, real, personal, or mixed, or any interest in property, by the authority or through any court proceedings or otherwise; provided, however, that the authority may sell for cash any property or interest if the board by affirmative vote of 11 of its members determines that the property or interest is not necessary to the business of the authority and approves the terms of the sale. Except by sale as expressly authorized by this section, authority property or interest may not come into the ownership or control, directly or indirectly, of any person, firm, or corporation other than a public authority created under the laws of the state.

(c) All authority property is exempt from forced sale, and nothing in this chapter authorizes the sale of any of the property of the authority under a judgment rendered in a suit, and a sale of that kind is prohibited.

(d) Notwithstanding any restrictions or provisions in this section or in this chapter, the authority, acting by a majority vote of the board, may construct or purchase, from any person, firm, or corporation (referred to in this subsection as "customer") with which the authority has contracted to sell hydroelectric power, transmission lines and other property used or to be used by the customer for the transmission of or in connection with power purchased or to be purchased from the authority. The authority may lease all or any portion of that property to the customer for all or a portion of the time during the term of the hydroelectric power purchase contract. The lease may contain provisions that are valid and enforceable giving the lessee the right to purchase from the authority all or any portion of the property at or within the time specified in the lease and for a price and on terms and conditions specified in the lease; provided, however, that the price may not be less than the depreciated value, determined in the manner prescribed in the lease, plus one percent of the original cost of the property.

Added by Acts 2003, 78th Leg., ch. 996, § 1, eff. Sept. 1, 2003.

§ 221.014. Acquisition of Property; Eminent Domain

(a) The authority may acquire by purchase, lease, or gift or in any other manner and may maintain, use, and operate property of any kind, real, personal, or mixed, or any interest in property, within or outside the boundaries of the authority, necessary or convenient to the exercise of the powers, rights, privileges, and functions conferred on the authority by this chapter.

(b) The authority may acquire, by purchase, condemnation, or otherwise, any property the board determines necessary to make effectual and practicable the construction and operation of all works, improvements, and services that are planned ultimately to be provided by the authority to accomplish any of the purposes for which the authority was created. The acquisition or condemnation may be either of the fee simple title or of a lesser title or an easement only,

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within the discretion of the board; provided, however, that a person may not be deprived of any defense available under the general law of eminent domain; and provided, further, that the authority may not acquire or operate a steam generating plant for the production and sale of electric energy and, except for the purpose of acquiring the necessary area below or above the anticipated high-water line of a reservoir, may not condemn any property of a rural electrification cooperative or other corporations engaged in the generation or sale of electric energy to the public.

(c) The authority may exercise the power of eminent domain for the purpose of acquiring by condemnation property of any kind, real, personal, or mixed, or any interest in property, within or outside the boundaries of the authority, other than property or an interest in property outside the boundaries of the authority owned by any body politic, that is necessary or convenient to the exercise of the powers, rights, privileges, and functions conferred on the authority by this chapter, in the manner provided by general law with respect to condemnation or, at the option of the authority, in the manner provided by statutes relative to condemnation by districts organized under general law under Section 59, Article XVI, Texas Constitution.

(d) In condemnation proceedings being prosecuted by the authority, the authority is not required to give bond for appeal or bond for cost.

(e) The authority may overflow and inundate any public lands and public property and may require the relocation of roads and highways in the manner and to the extent permitted to districts organized under general law under Section 59, Article XVI, Texas Constitution.

(f) If the authority, in the exercise of the power of eminent domain or power of relocation or any other power granted under this chapter, makes necessary the relocation, raising, rerouting, changing the grade, or altering the construction of any highway, railroad, electric transmission line, or pipeline, all necessary relocation, raising, rerouting, changing of grade, or alteration of construction shall be accomplished at the sole expense of the authority.

Added by Acts 2003, 78th Leg., ch. 996, § 1, eff. Sept. 1, 2003.

§ 221.015. Contracts, Grants, and Loans

(a) The board may negotiate and contract with the federal government or with any of its agencies for grants, loans, and advancements from the United States for the furtherance of any purpose set forth in this chapter.

(b) The authority may receive and accept grants, loans, or allotments from the United States and others for furtherance of any of the purposes set forth in this chapter.

(c) An opinion from the attorney general as to whether a grant, loan, or allotment has been received by the authority from the United States or others shall be authority for the action of any person charged with any duty contingent on such grant, loan, or allotment.

Acts 2003, 78th Leg., ch. 996, § 1, eff. Sept. 1, 2003.

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§ 221.016. Rules

The board may make all necessary rules for the government and control of the authority not inconsistent with the constitution and laws of the state.

Added by Acts 2003, 78th Leg., ch. 996, § 1, eff. Sept. 1, 2003.

§ 221.017. Use of Brazos River and Tributaries

In the prosecution of the plans for which the authority has been created for the storing, controlling, conserving, and distributing for useful purposes of the storm waters, floodwaters, and unappropriated flow waters of the Brazos River watershed and developed groundwater from the Brazos River basin for the use of its customers, the authority may use the bed and banks of the Brazos River and its tributary streams for any and all purposes necessary to the accomplishment of the plans of the authority.

Added by Acts 2003, 78th Leg., ch. 996, § 1, eff. Sept. 1, 2003.

§ 221.018. Default Procedures

(a) A resolution authorizing the issuance of bonds and any indenture or agreement entered into under the resolution may include provisions regarding a default on the:

(1) payment of the interest on any bonds as the interest becomes due and payable;

(2) payment of the principal of any bonds as they become due and payable, whether at maturity, by call for redemption, or otherwise; or

(3) performance of an agreement made with the purchasers or successive holders of any bonds.

(b) If a default described by Subsection (a) has occurred and has continued for a period, if any, prescribed by the resolution authorizing the issuance of the bonds, the trustee under an indenture entered into with respect to the bonds authorized by the resolution, or, if there is no indenture, a trustee appointed in the manner provided in the resolution by the holders of 25 percent in aggregate principal amount of the bonds authorized by the resolution and then outstanding may, and on the written request of the holders of 25 percent in aggregate principal amount of the bonds authorized by the resolution and then outstanding shall, in the trustee's own name but for the equal and proportionate benefit of the holders of all the bonds, and with or without having possession of the bonds:

(1) by mandamus or other suit, action, or proceeding at law or in equity, enforce all rights of the bondholders;

(2) bring suit on the bonds or the appurtenant coupons;

(3) by action or suit in equity, require the board to act as if it were the trustee of an express trust for the bondholders;

(4) by action or suit in equity, enjoin any acts or things that may be unlawful or in violation of the rights of the bondholders; or

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(5) after such notice to the board as the resolution may provide, declare the principal of all of the bonds due and payable, and if all defaults have been made good, then with the written consent of the holders of 25 percent in aggregate principal amount of the bonds then outstanding, annul the declaration and its consequences; provided, however, that the holders of more than a majority in principal amount of the bonds authorized by the resolution and then outstanding shall, by written instrument delivered to the trustee, have the right to direct and control any and all actions taken or to be taken by the trustee under this section.

(c) A resolution, indenture, or agreement relating to bonds may provide that in a suit, action, or proceeding under this section, the trustee, whether or not all of the bonds have been declared due and payable and with or without possession of any of the bonds, is entitled as of right to the appointment of a receiver who may enter and take possession of all or part of the properties of the authority, operate and maintain the properties, and set, collect, and receive rates and charges sufficient to provide revenues adequate to pay the items specified in the resolution authorizing bonds and the costs and disbursements of the suit, action, or proceeding and apply that revenue in conformity with this chapter and the resolution authorizing the bonds.

(d) In a suit, action, or proceeding by a trustee or receiver, if any, under this section, counsel fees and expenses of the trustee and of the receiver, if any, constitute taxable disbursements, and all costs and disbursements allowed by the court shall be a first charge on any revenue pledged to secure the payment of the bonds.

(e) Subject to the provisions of the constitution, the courts of McLennan County have jurisdiction of a suit, action, or proceeding under this section by a trustee on behalf of the bondholders and of all proceedings involved in the suit, action, or proceeding.

(f) In addition to the powers specifically provided by this section, the trustee has all powers necessary or appropriate for the exercise of the powers specifically provided or incident to the general representation of the bondholders in the enforcement of their rights.

Added by Acts 2003, 78th Leg., ch. 996, § 1, eff. Sept. 1, 2003.

§ 221.019. Limited Liability for Aquatic Herbicide Application

(a) In this section, "commercially licensed aquatic herbicide applicator" means a person who holds a commercial applicator license issued by the Department of Agriculture under Chapter 76, Agriculture Code, that authorizes the application of aquatic herbicides.

(b) Except as provided by Chapter 12, Parks and Wildlife Code, an authority employee holding a noncommercial aquatic herbicide applicator license or a commercially licensed aquatic herbicide applicator working under contract with the authority is not liable for damages in excess of $2 million for personal injury, property damage, or death resulting from the application by the applicator of aquatic herbicide in compliance with applicable law and the terms of the license or permit.

Added by Acts 2003, 78th Leg., ch. 996, § 1, eff. Sept. 1, 2003.

BRA-CA-000034

TEXAS WATER COMMISSION

AN ORDER authorizing system operation of certain reservoirs in the Brazos River Basin.

BE IT ORDERED BY THE TEXAS WATER COMMISSION:

Section 1. The Commission has this day granted to Brazos River Authority Permits numbered 2107, 2108, 2109, 2110 and 2111, to impound and divert water respectively from the Proctor Reservoir on the Leon River, the Belton Reservoir on the Leon River, the Stillhouse Hollow Reservoir on the Lampasas River, the Somerville Reservoir on Yegua Creek and the DeCordova Bend Reservoir on the main stem of the Brazos River. Brazos River Authority is the holder of Permit No. 1262, authorizing it to impound and divert water from the Possum Kingdom Reservoir on the main stem of the Brazos River. In this order DeCordova Bend and Possum Kingdom are sometimes called main stem reservoirs; Belton, Stillhouse Hollow, Proctor and Somerville are sometimes called tributary reservoirs.

Section 2. Brazos River Authority proposes and has requested permission of the Commission to operate the four tributary reservoirs as elements of a system under which releases from tributary reservoirs could be coordinated with releases from main stem reservoirs to achieve most effective conservation and beneficial use of available stored waters.

Section 3. The Commission recognizes that, when reservoirs are suitably located with regard to each other and with regard to water users, operation of such reservoirs as elements of a system, rather than as individual reservoirs, offers opportunities for more effective conservation and beneficial utilization of the available water resources. The Commission recognizes also that the effectiveness of system operation of reservoirs depends on the ability to

make releases of water from those reservoirs in the system in which supply is relatively abundant in order to reduce the need for releases from reservoirs where the supply is short.

Section 4. The Commission, by this order, grants to the Brazos River Authority permission to manage and operate the tributary reservoirs as elements of a system, coordinating releases from the tributary reservoirs with releases from the main stem reservoirs to minimize waste, and to conserve water in reservoirs in which the supply is short by making releases from tributary reservoirs in which the supply is more abundant. Pursuant to such operation, Brazos River Authority is authorized to make diversions from tributary reservoirs in excess of the acre-foot quantity limitations set out in the individual permits upon the amounts of water which may be diverted for municipal, industrial and irrigation purposes respectively, so long as the total amount of water released from all such tributary reservoirs in any year for each purpose does not exceed the cumulative authorized total for such purpose.

Section 5. To assure that the system operation authorized by this order will not impair the ability of each tributary reservoir to supply water for local needs within its tributary watershed, such tributary reservoir shall be excluded from system operation during any period of time in which Authority's permitted storage space in any such reservoir is less than 30 percent full. In such event, no releases shall be made from such reservoir except for local needs so long as other needs can be met from other reservoirs.

Section 6. This order is subject to all lawful vested rights of others entitled to waters of the Brazos River Basin.

Section 7. This order is subject to revocation or modification by the Commission with or without hearing on the Commission's own motion, upon application by the Brazos River Authority, or upon

application by any party whose interests or rights are affected by this order or by the system operation authorized hereunder.

This order shall be in full force and effect from the 23rd day of July, 1964, the date of its passage, and it is so ordered.

TEXAS WATER COMMISSION

Joe D. Carter, Chairman

O. F. Dant, Commissioner

H. A. Beckwith, Commissioner

ATTEST:

Sara Holder, Asst. Secretary

TEXAS WATER RIGHTS COMMISSION

AN ORDER amending the System Operation of certain reservoirs in the Brazos River Basin dated July 23, 1964.

BE IT ORDERED BY THE TEXAS WATER RIGHTS COMMISSION:

The System Operation Order to the Brazos River Authority entered on July 23, 1964, is amended by adding the reservoirs to be constructed under Permits Nos. 2366 and 2367.

All other of the terms and conditions of the System Operation Order for the Brazos River Authority shall remain the same.

Executed and entered this the 23rd day of July, 1968.

TEXAS WATER RIGHTS COMMISSION

Joe D. Carter

Joe D. Carter, Chairman

D. E. Dent, Commissioner

W. E. Berger

W. E. Berger, Commissioner

ATTEST:

Audrey Strandtman

Audrey Strandtman, Secretary

TEXAS WATER RIGHTS COMMISSION

AN ORDER amending the System Operation of certain reservoirs in the Brazos River Basin

BE IT ORDERED BY THE TEXAS WATER RIGHTS COMMISSION:

The System Operation Order to the Brazos River Authority entered on July 23, 1964, as amended July 23, 1968, is further amended by adding the reservoirs to be constructed under Permits Nos. 2950 and 3403.

All other of the terms and conditions of the System Operation Order, as amended, for the Brazos River Authority shall remain the same.

Executed and entered of record, this the 1st day of February, 1977.

TEXAS WATER RIGHTS COMMISSION

/s/ Joe D. Carter
Joe D. Carter, Chairman

ATTEST:

/s/ Joe R. Carroll
Joe R. Carroll, Commissioner

/s/ Dorsey B. Hardeman
Dorsey B. Hardeman, Commissioner

/s/ Mary Ann Hefner
Mary Ann Hefner, Secretary

TEXAS DEPARTMENT OF WATER RESOURCES

TEXAS WATER COMMISSION

AN ORDER amending the System Operation of certain reservoirs in the Brazos River Basin

BE IT ORDERED BY THE TEXAS WATER COMMISSION:

The System Operation Order to the Brazos River Authority entered on July 23, 1964, as amended, is further amended by adding the use of water under Permit No. 3940.

All other of the terms and conditions of the System Operation Order, as amended, for the Brazos River Authority shall remain the same.

Executed and entered of record, this the 31st day of January, 1983.

TEXAS WATER COMMISSION

/s/ Lee B. M. Biggart
Lee B. M. Biggart, Chairman

/s/ Felix McDonald
Felix McDonald, Commissioner

/s/ John D. Stover
John D. Stover, Commissioner

ATTEST:

/s/ Mary Ann Hefner
Mary Ann Hefner, Chief Clerk

Report in Support of System Operation Permit Application

June 14, 2004

Prepared for:

Brazos River Authority

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Report in Support of System Operation Permit Application for Brazos River Authority

June 14, 2004

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Executive Summary

The Brazos River Authority (Authority) was created by the Texas Legislature in 1929 to develop and manage the water resources of the Brazos River Basin, the largest river basin in Texas. The Authority owns and operates four reservoirs (Possum Kingdom Lake, Lake Limestone, Lake Granbury and Lake Alan Henry) and has water rights in eight federal reservoirs (Lake Belton, Lake Stillhouse Hollow, Lake Proctor, Lake Whitney, Aquilla Lake, Lake Georgetown, Lake Granger and Lake Somerville). The Authority also has a share in the proposed Allens Creek Reservoir in Austin County. Altogether, the Authority has total authorized diversions of 796,551[1] acre-feet per year and total authorized storage of 2,484,419 acre-feet, which are about 34% of the total diversions and 60% of the total storage in the basin, respectively. In addition to the above priority rights, the Authority has a permit to divert, on a non-priority basis, up to 650,000 acre-feet per year of the unregulated, unappropriated flows of the Brazos River in Austin and Fort Bend Counties. Water diverted under this permit is assigned to an Authority reservoir for accounting purposes, although it is not actually released or diverted from a reservoir.

According to the 2002 State Water Plan, demands from Authority water resources will be approximately 882,000 acre-feet by 2050. Demands from the Authority's system will exceed the Authority's existing water rights between 2020 and 2030. With this application, the Authority is seeking additional appropriations to meet future water demands and operational flexibility to address its statutory mandate to manage water resources throughout the Brazos River Basin. Major items sought in this application include:

- A new appropriation of 421,449 acre-feet per year of state water for multiple uses, including domestic, municipal, agricultural, industrial, mining, and other beneficial uses on a firm basis, as well as the authorization to dedicate up to 90,000 acre-feet per year of this firm supply to develop up to 670,000 acre-feet per year of interruptible supply.
- Interbasin transfer authorization to transfer water to counties and municipalities partially in the basin and to adjacent coastal basins pursuant to Texas Water Code § 11.085 (v) (3) and (4).

[1] Authorized diversions include 35,000 acre-feet per year from Lake Alan Henry and 99,650 acre-feet per year from Allens Creek Reservoir. Lake Alan Henry is not part of the existing System Operation Order and the supply has been fully contracted to the City of Lubbock. The permit for Allens Creek Reservoir is jointly owned by the Authority, the Texas Water Development Board, and the City of Houston. Allens Creek Reservoir has not been built.

- Inclusion, as part of the appropriation described above, of an appropriation of current and future return flows to the extent that such return flows continue to be discharged or returned into the bed and banks of the Brazos River, its tributaries, and Authority reservoirs.
- Authorization for operational flexibility to (i) use any source of water available to the Authority to satisfy the diversion requirements of senior water rights to the same extent that those water rights would have been satisfied by passing inflows through the Authority's reservoir on a priority basis, and (ii) release, pump, and transport water from any of the Authority's reservoirs for subsequent storage, diversion, and use throughout the Authority's service area.
- Recognition that the System Operation Permit will prevail over inconsistent provisions in the Authority's existing water rights.
- Authorization to use the bed and banks of the Brazos River, its tributaries and Authority reservoirs for the storage, conveyance and subsequent diversion of water appropriated by this application and from other sources.

The Authority already has authorization by the Texas Commission on Environmental Quality (TCEQ) through the System Operation Order[2] to operate its reservoirs as a system. However, the System Operation Order does not appropriate the additional yield made available through system operation and contains several limitations that may prevent the Authority from efficiently operating its system.

Many factors need to be taken into account when managing a system as large and complex as the Authority's system. Once the System Operation Permit is approved, the Authority will develop a Water Management Plan. It is anticipated that the Water Management Plan will be regularly updated and submitted to the TCEQ for review and approval. This Water Management Plan will provide the same safeguards intended by special provisions and general limitations in existing Authority water rights, including some provisions of the System Operation Order, and will provide greater flexibility.

The authorizations sought in the System Operation Application are based on hydrologic analyses of the Brazos River Basin using the TCEQ Water Availability Model of the Brazos River Basin and San Jacinto-Brazos Coastal Basin (Brazos WAM). For the system operation analyses, the Brazos WAM was modified to incorporate system operation. Estimated 2060 return flows were incorporated into the model to evaluate the impact on

[2] Texas Water Commission: An Order Authorizing System Operation of Certain Reservoirs in the Brazos River Basin, July 23, 1964, amended 1968, 1977 and 1983.

potential yield. In the model, all water rights in the basin have access to return flows. Water rights with the most senior priority dates have first access to return flows. The System Operation Permit has the most junior priority date of any current water right in the basin, and therefore is limited to return flows remaining after exercise of all other water rights in the model.

Most alternatives for development of significant new water supplies in the Brazos River Basin involve construction of a considerable amount of new infrastructure. Achieving an equivalent amount of water supply would require construction of a large reservoir or extensive groundwater development, either of which may have significant environmental impacts and require a large capital investment. The System Operation Permit will require no infrastructure to make new yield available and minimal investment on the part of the Authority. Therefore, the System Operation Permit represents the most cost-effective and environmentally sensitive alternative for development of new water supplies in the Brazos River Basin.

The Authority is in the unique position of being able to develop this significant new supply through system operation. The additional yield that the Authority seeks to develop with the System Operation Permit depends on the efficient joint management of unappropriated flows in the river and reservoir storage. The Authority has far more reservoir storage available to contribute to system operation than any other water right holder in the basin. Therefore, the vast majority of the additional supplies sought in the System Operation Permit can only be developed and made available by the Authority through the full use of the Authority's reservoir system.

System operation is included in the 2001 Brazos G regional water plan as a strategy for the Authority. The System Operation Permit is consistent with existing regional plans as a large part of the future water supply needs in the Brazos River Basin and adjacent areas are projected to be supplied by the Authority. The System Operation Permit is an alternative to new Authority-sponsored water supply projects designed to meet those needs.

The Authority has prepared amendments incorporating the System Operation Permit for the existing Region G and Region H plans. The Authority will be working with Regions

B, C, G, H, and O in the current round of regional planning to have water from the System Operation Permit considered in future regional plans.

1 Background and Purpose of the System Operation Permit

1.1 Key Points

The Brazos River Authority (Authority) was created by the Texas Legislature in 1929 to develop and manage the water resources of the Brazos River Basin, the largest river basin in Texas.

The Authority owns and operates four reservoirs (Possum Kingdom Lake, Lake Limestone, Lake Granbury and Lake Alan Henry) and has water rights in eight federal reservoirs (Lake Belton, Lake Stillhouse Hollow, Lake Proctor, Lake Whitney, Aquilla Lake, Lake Georgetown, Lake Granger and Lake Somerville). In addition, the Authority has a share in the proposed Allens Creek Reservoir. Altogether, the Authority has total authorized priority diversions of 796,551 acre-feet per year.

According to the 2002 State Water Plan, demands from Authority sources will exceed the existing supply between 2020 and 2030.

The System Operation Permit will allow the Authority to develop a major new supply of water without construction of new reservoirs.

1.2 History and Purpose of the Brazos River Authority

The Brazos River Basin is the largest of the fifteen major river basins in Texas. With a contributing drainage area of 36,028 square miles, the basin includes about one-sixth of the state[3]. The water resources of the Brazos River Basin are vital to the future development of a large part of Texas. The Texas Legislature has given the Brazos River Authority (Authority) broad authority to manage the water resources of the basin. The Authority is the major water rights holder in the basin as well. In seeking appropriation of additional state water, reuse, and greater flexibility in administering its existing water rights, the Authority is seeking to use its unique position and legislative mandate to efficiently manage the water resources of this basin for the benefit of both water users and the environment. This report serves as a background for that application.

Figure 1.1 is a general map of the Brazos River Basin, showing the location of the reservoirs for which the Authority holds Texas water rights.

[3] Townsend, George E., *Planning Report 30.1 Drainage Area Compilation*, U.S. Study Commission – Texas, November 1960.

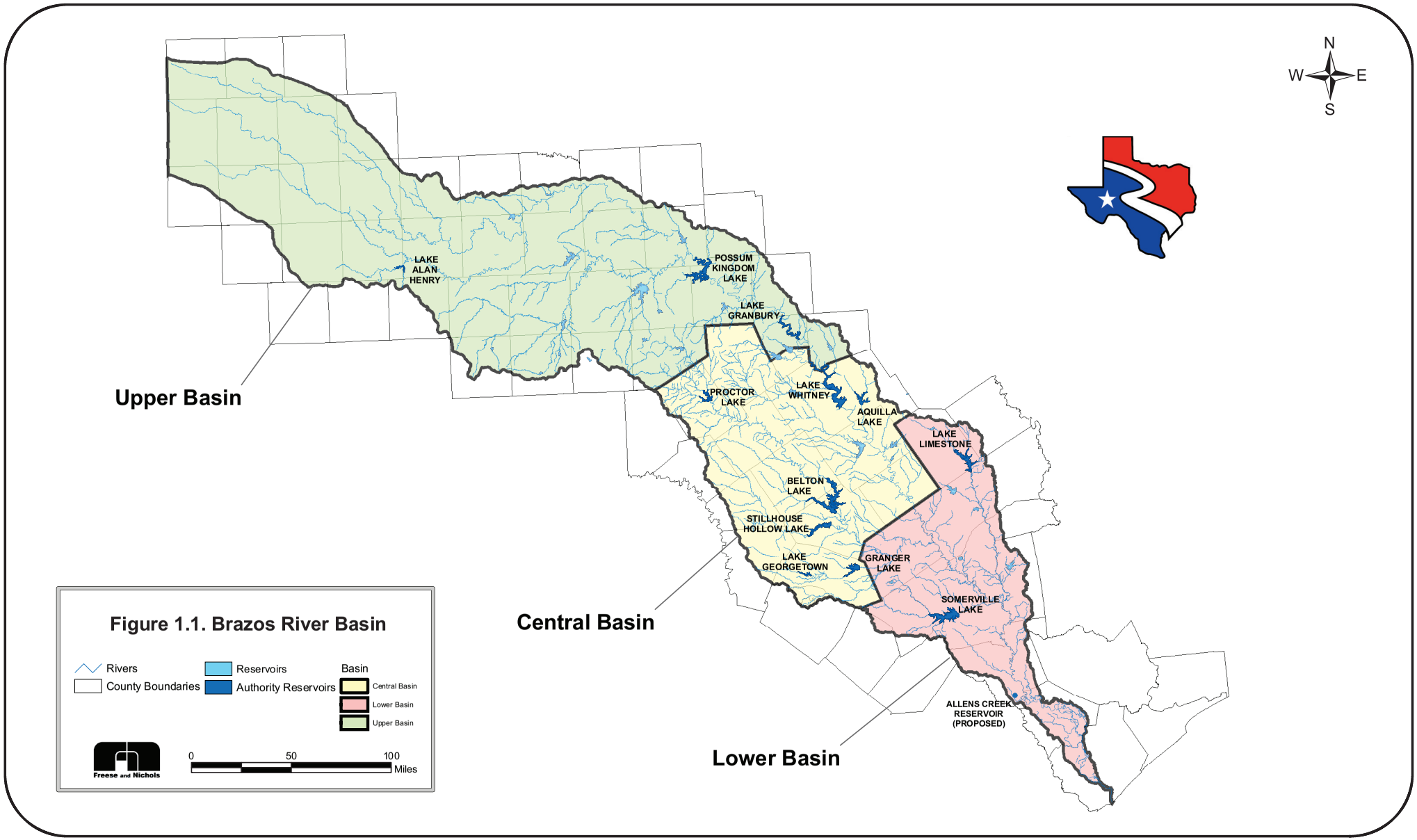


Figure 1.1. Brazos River Basin

BRA-CA-000050

In 1929 the Texas Legislature formed the Brazos River Conservation and Reclamation District, the first agency in the nation specifically created for the purpose of developing and managing the water resources of an entire river basin[4]. A partnership between the District and the Federal Government helped the District complete its first reservoir, Possum Kingdom Lake, for water supply and hydropower generation in 1941.

In 1953 the District obtained legislation changing its name to the Brazos River Authority. The legislation also provided the Authority with powers to issue bonds for irrigation and municipal water supply reservoirs in addition to flood control dams. Since then, the Authority completed Lake Granbury in 1969 and Lake Limestone in 1979, and constructed Lake Alan Henry in cooperation with the City of Lubbock in 1992.

As the U.S. Army Corps of Engineers (Corps) began to take the lead in flood control in the State, the Authority focused more on water supply for the basin. The Authority contracted with the Corps for conservation storage space in nine Corps reservoirs throughout the Brazos River Basin. Eight of these nine federal reservoirs (Lake Waco is not included) and the four reservoirs owned and operated entirely by the Authority are integrated into the Authority's basin-wide system of reservoirs.

Since 1971 the Authority has provided wastewater treatment services. Currently, the Authority owns or operates the Sugar Land Regional Sewerage System in Fort Bend County, the Temple-Belton Regional Sewerage System in Bell County, the Clute-Richwood Wastewater Facility in Brazoria County, and the Lee County Fresh Water Supply District #1 plant in Lee County. In 1995 the Authority entered into the Brazos-Colorado Water Alliance with the Lower Colorado River Authority (LCRA) to provide physical infrastructure and management services for a burgeoning population in Williamson County. The Alliance now provides wastewater services through the Brushy Creek Regional Wastewater System and the City of Hutto Wastewater Plant and surface water treatment for the city of Leander. The Authority has provided drinking water from the Lake Granbury Surface Water and Treatment System (SWATS) since 1989 and the Lee County Fresh Water District #1 system since 2002.

During the 1990s the Authority entered into an agreement with five entities in Williamson County to construct the 28-mile Williamson County Raw Water Pipeline to

[4] "Who is the Brazos River Authority?" *The Brazos Basin*, Volume 1, Summer 2003.

move water from Lake Stillhouse Hollow to Lake Georgetown. In 2002, the Authority took advantage of changes in the petrochemical industry by acquiring a 77-mile water distribution system previously used to supply oil field flooding operations. This system, known as the West Central Brazos Water Distribution System, is expected to begin supplementing existing municipal supplies in Throckmorton and Shackelford Counties by 2005.

The Authority conducts studies to anticipate the need for and reduce the time required to develop future supplies or treatment systems. Projects such as the proposed Allens Creek Reservoir in Austin County and the Gulf Coast Desalination plant near Freeport are just two of the additional projects planned by the Authority to help provide for the future of the Brazos River Basin. The Authority also actively participates in ongoing regional water planning processes for Region O (High Plains), Region H (Houston area), and Region G (Central Texas).

Today, headquartered in Waco, the Authority functions under the direction of a general manager/CEO and a 21-member Board of Directors. The Authority currently has employees in a wide variety of fields, including engineers, hydrologists, biologists, economists, and legal experts. Together, these employees represent a significant pool of expertise available to manage the water resources of the Brazos River Basin.

The Brazos River Basin exhibits a wide variety of climatic, topographic and geographic conditions, ranging from the arid conditions of the upper basin to semi-tropical conditions in the lower basin. Reflecting the variety of water needs in the Brazos River Basin, the Authority is divided into three operating divisions – Upper, Central, and Lower. The boundaries of these operating divisions are shown in Figure 1.1.

Although the Authority is a governmental agency, it operates without benefit of appropriations from the State or Federal government, nor does it have taxing authority. Except for occasional government grants to pay for specific projects, the Authority is entirely self-supporting.

1.3 Description of the Existing Brazos River Authority System

The Authority holds water rights in eight reservoirs operated by the Corps of Engineers and four existing reservoirs that it owns and operates (Possum Kingdom,

Granbury, Limestone, and Alan Henry). The eight Corps of Engineers reservoirs are Lakes Aquilla, Belton, Georgetown, Granger, Proctor, Somerville, Stillhouse Hollow, and Whitney. Table 1.1 is a list of the reservoirs in the Authority system.

The Authority holds water rights for the proposed Allens Creek Reservoir jointly with the City of Houston and the Texas Water Development Board. The Authority also holds separate water rights allowing non-priority use of excess flow in the Brazos River Basin and interbasin transfers to the San Jacinto-Brazos coastal basin. Specifics of current Authority water rights are discussed in more detail in Chapter 2 of this report.

Table 1.1
Reservoirs in the Brazos River Authority System

Reservoir	County	Owner	Year Completed	Conservation Storage (Ac-Ft)	Permitted Diversion (Ac-Ft/Yr)
Alan Henry	Garza and Kent	Lubbock & Authority	1992	115,937	35,000
Possum Kingdom	Palo Pinto	Authority	1941	724,739	230,750
Granbury	Hood	Authority	1969	155,000	64,712
Whitney	Hill & Bosque	Corps	1951	50,000[c]	18,336
Aquilla	Hill	Corps	1983	52,400	13,896
Proctor	Comanche	Corps	1963	59,400	19,658
Belton	Bell	Corps	1954	457,600	112,257[b]
Stillhouse Hollow	Bell	Corps	1968	235,700	67,768
Georgetown	Williamson	Corps	1980	37,100	13,610
Granger	Williamson	Corps	1980	65,500	19,840
Somerville	Burleson & Washington	Corps	1967	160,110	48,000
Limestone	Leon, Limestone & Robertson	Authority	1970	225,400	65,074
Allens Creek	Austin	Authority, Houston & TWDB	N/A[a]	145,533	99,650

a Allens Creek Reservoir has been permitted but has not been built.

b 12,000 ac-ft/yr for the U.S. Department of the Army and 100,257 ac-ft/yr for the Authority

c Total conservation storage of Lake Whitney is 642,179 acre-feet. The Authority has contracted only 50,000 acre-feet of storage with the Corps of Engineers, and the Authority's water right for the reservoir authorizes storage of 50,000 acre-feet between the elevations 520 feet and 533 feet (the power pool of the reservoir).

1.4 Purpose of the Proposed System Operation Permit

According to the 2002 State Water Plan, demands from Authority sources will exceed the existing supply between 2020 and 2030. With this application, the Authority is seeking additional appropriations to meet future demands and operational flexibility to address its legislated mandate to manage water resources throughout the Brazos River Basin.

The System Operation Permit represents a major new supply of water without construction of new reservoirs. It is fully consistent with the Authority's legislative mandate to manage the water resources of the Brazos River Basin. Chapter 2 of the report gives additional detail on what is being sought in the System Operation Permit.

1.5 Water Conservation to Ensure Beneficial Use of Water

The Authority is actively involved in efforts to encourage and increase water conservation in the Brazos River Basin. Copies of the current Authority Water Conservation Plan and the draft Drought Contingency Plan currently under development may be found in Attachment No. 4 of the *Supplemental Information for Brazos River Authority's Application for a System Operation Permit*[5]. Water conservation plans are required in all water supply contracts with the Authority. In addition, the Authority will provide technical expertise in water conservation to assist its customers in implementing water conservation strategies.

The Authority's Water Conservation and Drought Contingency Plans are likely to undergo revisions when rules for House Bills 2660 and 2663 are available. Draft rules for implementing this legislation have been published and made available for public comments. The comment period closed on May 24, 2004. It is also quite likely that the proposed Authority Water Management Plan will substantially alter the structure and methods used in the current policies, requiring revisions as well.

1.6 Concluding Remarks and Description of Report

The Authority has a long history and wide range of experience in managing water resources in the Brazos River Basin. The Authority controls most of the raw water supply infrastructure in the basin as well. The System Operation Permit is consistent with the

[5] Bickerstaff, Heath, Smiley, Pollan, Kever & McDaniel, L.L.P.: *Supplemental Information for Brazos River Authority's Application for a System Operation Permit*, prepared for the Brazos River Authority, June 18, 2004.

legislative mandate of the Brazos River Authority to develop, manage and conserve the water resources of the Brazos River Basin[6].

The remainder of this report contains supplemental technical information supporting the application. Chapter 2 describes the proposed System Operation Permit in detail. Chapter 3 summarizes the hydrologic analyses conducted to support the application. Chapter 4 contains information regarding environmental and cultural aspects of the application. Chapter 5 describes the relationship of the application to the existing regional water plans.

[6] Texas Water Code, Title 6, Surface Water Authorities, Subtitle B, Local Law Surface Water Authorities, Chapter 221.

2 Description of the Application

2.1 Key Points

The Authority holds 15 water rights in the Brazos River Basin, 13 of which are associated with reservoirs. These permits authorize total priority diversions of 796,551 acre-feet per year and a combined impoundment of 2,484,419 acre-feet, about 34% of the total authorized diversions and 60% of the storage in the Brazos River Basin.

The existing Authority System Operation Order and Excess Flows permit allow the Authority to operate most of their water supply sources as a system within certain restrictions. However, these water rights do not appropriate the additional supplies generated from this type of operation.

The application includes the following:

- A new appropriation of 421,449 acre-feet per year of state water for multiple uses, including domestic, municipal, agricultural, mining, industrial, and other beneficial uses on a firm basis, as well as the authorization to dedicate up to 90,000 acre-feet per year of this firm supply to develop up to 670,000 acre-feet per year of interruptible supply.
- Interbasin transfer authorization to transfer water to counties and municipalities partially in the basin and to adjacent coastal basins pursuant to Texas Water Code § 11.085 (v) (3) and (4).
- Inclusion, as part of the appropriation described above, of an appropriation of current and future return flows to the extent that such return flows continue to be discharged or returned into the bed and banks of the Brazos River, its tributaries, and Authority reservoirs.
- Authorization for operational flexibility to (i) use any source of water available to the Authority to satisfy the diversion requirements of senior water rights to the same extent that those water rights would have been satisfied by passing inflows though the Authority's reservoirs on a priority basis, and (ii) release, pump, and transport water from any of the Authority's reservoirs for subsequent storage, diversion, and use throughout the Authority's service area.
- Recognition that the System Operation Permit will prevail over inconsistent provisions in the Authority's existing water rights.
- Authorization to use the bed and banks of the Brazos River, its tributaries and Authority reservoirs for the storage, conveyance and subsequent diversion of water appropriated by this application and from other sources.

The Authority is seeking authorization to fulfill its legislative mandate to efficiently manage the limited water resources of the Brazos River Basin. Many factors need to be taken into account when managing these resources. To address these issues the Authority will develop a Water Management Plan. It is anticipated that the Water Management Plan will be updated regularly, and submitted to the TCEQ for review and approval.

2.2 Description of Existing Brazos River Authority Water Rights

The Authority holds 15 water rights in the Brazos River Basin, 13 of which are associated with reservoirs. These permits authorize total priority diversions of 796,551 acre-feet per year, which is about 34% of the total diversions in the Brazos River Basin, and impoundment of 2,484,491 acre-feet, which is 60% of the storage in the basin. In addition to the authorized diversions, the Lake Alan Henry permit allows 21,000 acre-feet of reuse for agricultural purposes of return flows from water diverted from the reservoir. The major provisions of these water rights are summarized in Table 2.1. Figure 2.1 shows the location of Authority water rights in the basin.

Figures 2.2 and 2.3 compare the priority dates of authorized diversions and storage of Authority rights to the other rights in the Brazos River Basin. The oldest rights in the Brazos River Basin date to the 1880s. The oldest significant diversions are associated with water rights owned by the City of Waco in 1914 and the City of Temple in 1915. The Authority's most senior priority date, April 6, 1938, is associated with Possum Kingdom Lake. The most junior Authority right, September 1, 1999, is associated with Allens Creek Reservoir, which is not yet built. Most of the permits have a priority date in the 1960s.

Lake Alan Henry, Possum Kingdom Lake, Lake Granbury and Lake Limestone are owned and operated by the Authority. The proposed Allens Creek Reservoir will be owned by the Authority, the Texas Water Development Board, and the City of Houston. The remaining Authority reservoirs are owned by the U.S. Army Corps of Engineers. Of these Corps reservoirs, the Authority is the sole water right holder with the exception of Lake Belton, in which the water rights are shared with the Fort Hood Army Base. The two remaining permits are associated with use of excess flows in the Brazos River Basin and interbasin transfer of water released from Authority reservoirs.

Table 2.1
Summary of Brazos River Authority Water Rights

Water Right	Reservoir or Source	Storage (Ac-Ft)	County	Stand-alone Reservoir Permit (Priority Authorization)			Maximum Authorized Diversion under the System Operation Order		
				Priority	Amount (Ac-Ft/Yr)	Max Rate (cfs)	Priority	Amount	Use
P 4146	Alan Henry	115,937	Lubbock, Lynn, Garza & Kent	10/5/1981	35,000	69.6 cfs			Mun
				10/5/1981	Reuse of 21,000 of the 35,000 diverted for municipal use	Unspecified			Reuse (Irr)
CA 5155	Possum Kingdom	724,739	Palo Pinto	4/6/1938 [a]	230,750 [a]	Unspecified	None	175,000 [a]	Mun
								250,000	Irr
								250,000	Ind
								49,800	Min
				None		Unspecified	--	--	Hydro
CA 5156	Granbury	155,000	Hood	2/13/1964 [b]	64,712 [b]	Unspecified	None	40,000 [b]	Mun
								14,500	Irr
								45,000	Ind
								500	Min
CA 5157	Whitney	50,000 [e]	Hill and Bosque	8/30/1982	18,336	5,000 cfs	None	25,000	Mun
							None	25,000	Ind
CA 5158	Aquilla	52,400	Hill	10/25/1976	13,896	2,100 cfs through dam	None	17,000	Mun
						90 cfs from reservoir	None	18,200	Ind
							None	200	Min
CA 5159	Proctor	59,400	Comanche	12/16/1963.	19,658	Unspecified	None	18,000	Mun
								17,800	Ind
								18,000	Irr
								200	Min
CA 5160	Belton	457,600	Bell	12/16/1963	100,257	Unspecified	None	95,000	Mun
								150,000	Ind
								149,500	Irr
								500	Min
CA 5161	Stillhouse Hollow	235,700	Bell	12/16/1963	67,768	Unspecified	None	74,000	Mun
								74,000	Ind
								73,700	Irr
								300	Min
CA 5162	Georgetown	37,100	Williamson	2/12/1968	13,610	Unspecified	None	16,500	Mun
								16,400	Ind
								4,100	Irr
								100	Min
CA 5163	Granger	65,500	Williamson	2/15/1968	19,840	Unspecified	None	30,000	Mun
								29,800	Ind
								5,500	Irr
								200	Min

Table 2.1 (continued)

Water Right	Reservoir or Source	Storage (Ac-Ft)	County	Stand-alone Reservoir Permit (Priority Authorization)			Maximum Authorized Diversion under the System Operation Order [a]		
				Priority	Amount (Ac-Ft/Yr)	Max Rate (cfs)	Priority	Amount	Use
CA 5164	Somerville	160,110	Burleson and Washington	12/16/1963	48,000	Unspecified	None	49,500	Mun
								50,000	Ind
								50,000	Irr
								500	Min
CA 5165	Limestone	225,400	Leon, Limestone and Robertson	5/6/1974 for 217,494 ac-ft 9/4/1979 for 7,906 ac-ft.	65,074	Unspecified	None	69,500	Mun
								77,500	Ind
								70,000	Irr
								500	Min
P 2925	Allens Creek	145,533	Austin	9/1/1999	202,000 from Brazos, 99,650 from reservoir [d]	2,200 from Brazos, 300 cfs from reservoir			Mun, Ind, Irr,
Total from reservoirs		***2,484,419***			***796,551***				
CA 5166	Excess flows	--	Austin, Brazoria, Fort Bend, Galveston and Harris	None [c]	100,000	3,200 cfs combined rate at four diversion points			Mun
					450,000				Ind
					100,000				Irr
CA 5167	Interbasin transfer of system releases [a]	--	Fort Bend	None	30,000	Two diversion points: 440 cfs at Churchill Fulcher Grant, and 467 cfs at Thomas Barnett Grant			Mun
					170,000				Ind

CA Certificate of Adjudication number
P Permit number

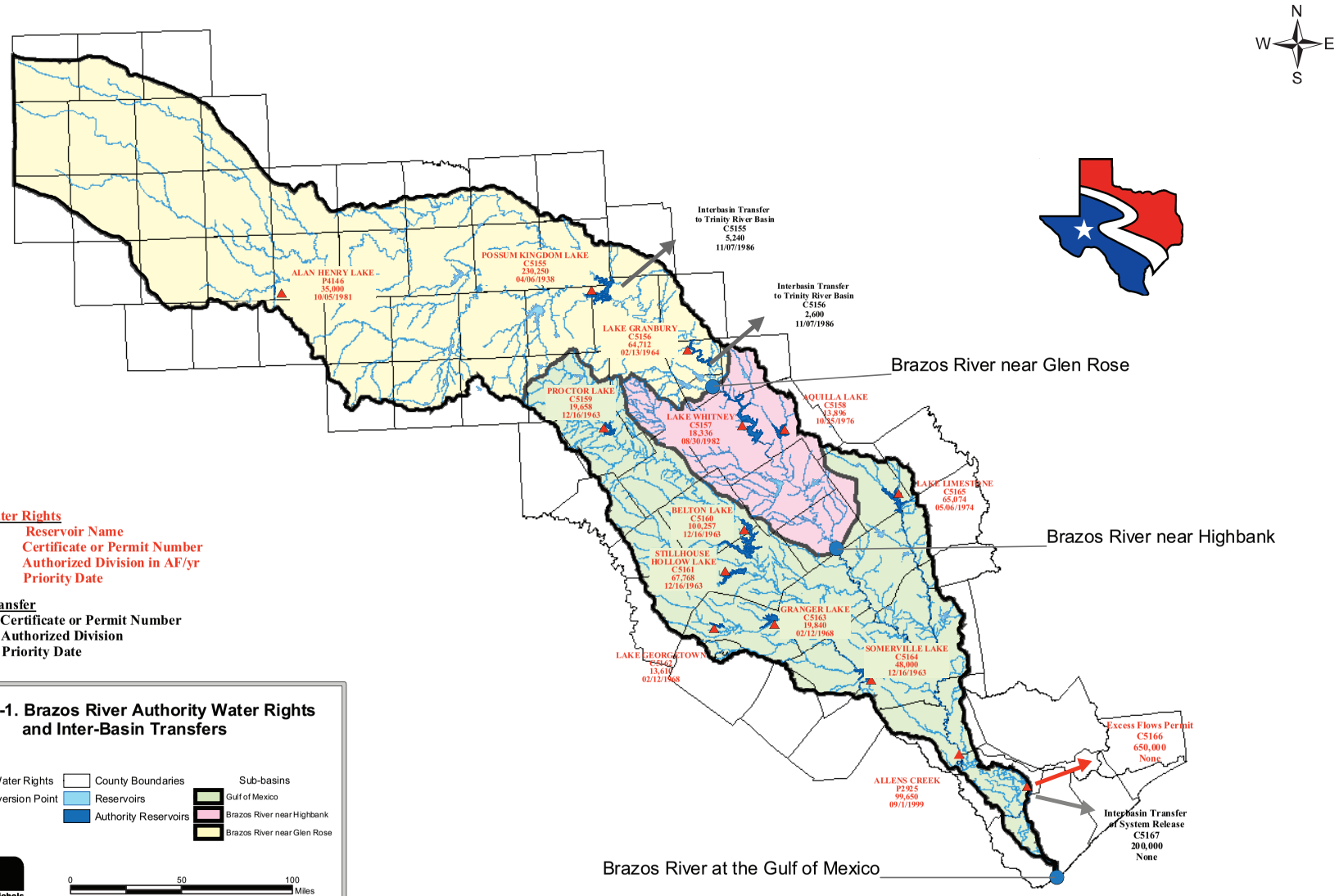
a CA 5155 authorizes transfer to the Trinity Basin of up to 5,240 acre-feet of the municipal diversions with a priority date of 11/7/1986.

b CA 5156 authorizes transfer to the Trinity Basin of up to 20,000 acre-feet of the municipal diversions with a priority date of 11/7/1986.

c Charged to Authority reservoirs in priority order.

d The water right for Allens Creek Reservoir is jointly owned by the City of Houston, the Brazos River Authority, and the Texas Water Development Board.

e Storage in Lake Whitney is between elevations 520 and 533 feet mean-sea-level.



Authority Water Rights

Proctor Lake	Reservoir Name
C5759	Certificate or Permit Number
19,658	Authorized Division in AF/yr
12/16/1963	Priority Date

Interbasin Transfer

C5156	Certificate or Permit Number
2,600	Authorized Division
11/7/1986	Priority Date

Figure 2-1. Brazos River Authority Water Rights and Inter-Basin Transfers

Authority Water Rights
Primary Diversion Point
Rivers
County Boundaries
Reservoirs
Authority Reservoirs
Sub-basins
Gulf of Mexico
Brazos River near Highbank
Brazos River near Glen Rose

Freese and Nichols

0 50 100 Miles

Figure 2.2
Comparison of Total Authorized Diversions in the Brazos River Basin to Authorized Authority Diversions by Priority Date

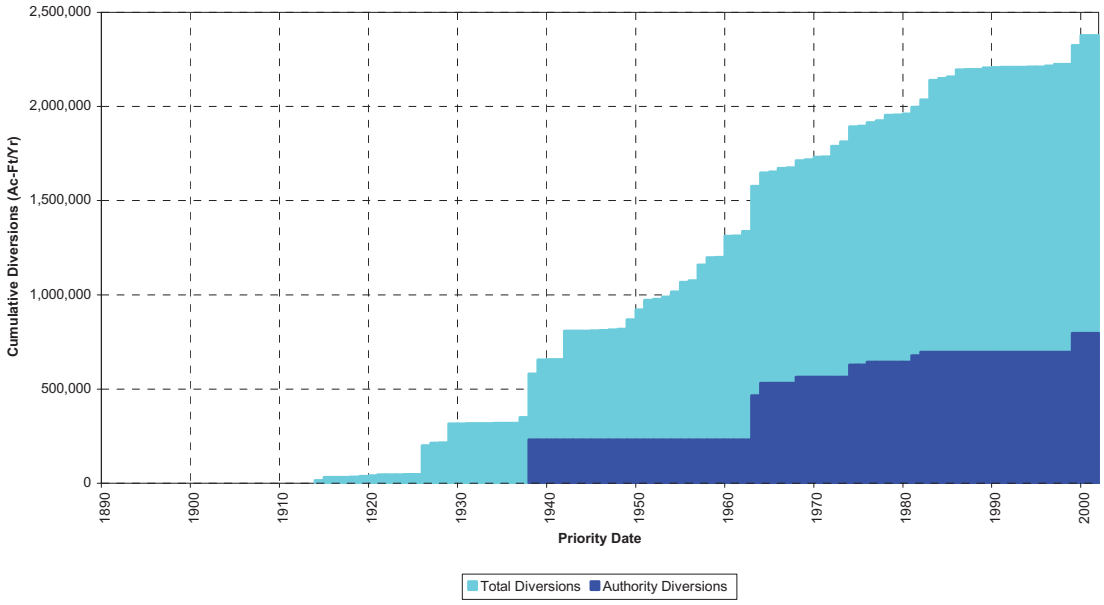
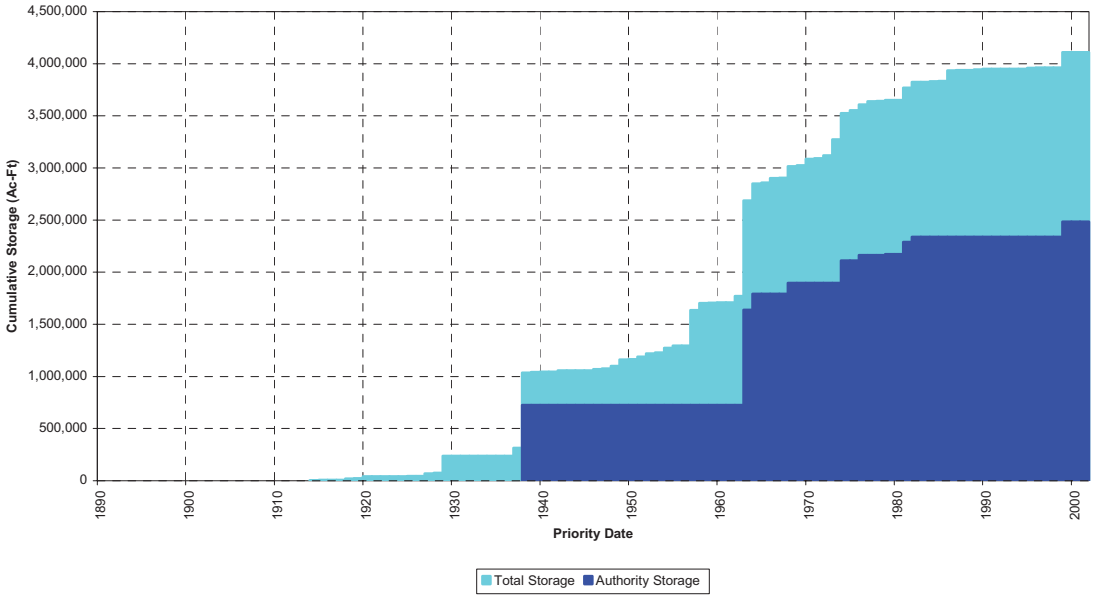


Figure 2.3
Comparison of Total Authorized Storage in the Brazos River Basin to Authorized Authority Storage by Priority Date



A key feature of many of the Authority's water rights is the System Operation Order[7] which allows coordinated operation of all the Authority's reservoirs except Lake Alan Henry and Allens Creek Reservoir. The System Operation Order allows the Authority to:

- Use the bed and banks of the Brazos River to deliver water to downstream customers.
- Release or divert water on a non-priority basis from any system reservoir in excess of its priority diversion up to a specified limit in each reservoir.
- Make use of unappropriated flows in the lower basin, again on a non-priority basis.

The System Operation Order has several restrictions, including:

- Total diversions are limited to the total priority authorization of the system reservoirs, currently 661,901 acre-feet per year[8].
- Each reservoir has a specified annual limit for the amount of water available for overdraft, identified by type of use (municipal, agricultural, etc.).
- If a reservoir is less than 30% capacity and other system reservoirs are more than 30% capacity, that reservoir may not be used for system operation until all reservoirs are below 30% capacity.

Non-priority use of unappropriated flows is authorized by Certificate of Adjudication 5166, known as the 'Excess Flows' permit. This water right allows the Authority to divert, on a non-priority basis, up to 650,000 acre-feet per year of the unregulated, unappropriated flows in Austin and Fort Bend Counties. Any water diverted under this water right must be assigned to the Authority reservoir covered by the System Operation Order which has the most senior priority date. Water is not actually diverted or released from the reservoir; it is only assigned to that reservoir for accounting purposes. Although this right allows the Authority to make use of unregulated flows, it does not allow any supply benefit for the Authority system by having access to such flows.

2.3 Additional Rights Sought in Current Application

The existing System Operation Order allows the Authority some flexibility in the operation of its reservoir system, and the excess flows permit allows access to unappropriated flows in the lower portion of the basin without actually releasing water from Authority reservoirs. However, the existing water rights do not allow the Authority to take full advantage of the potential operational efficiencies and additional yield available from system

[7] Texas Water Commission: An Order Authorizing System Operation of Certain Reservoirs in the Brazos River Basin, July 23, 1964, amended 1968, 1977 and 1983.
[8] The System Operation Order does not include Lake Alan Henry or Allens Creek Reservoir.

operation. These two goals, additional yield from the system and more efficient operation, can be met without new infrastructure and with negligible impact on other water rights holders in the Brazos River Basin. Finally, the additional appropriations sought by the Authority can only be developed and made available by the Authority through the full use of the Authority reservoir system.

Specifically, in the application for a System Operation Permit the Authority is seeking the following:

- A new appropriation of 421,449 acre-feet per year of state water for multiple uses, including domestic, municipal, agricultural, mining, industrial, and other beneficial uses on a firm basis, as well as the authorization to dedicate up to 90,000 acre-feet per year of this firm supply to develop up to 670,000 acre-feet per year of interruptible supply.
- Interbasin transfer authorization to transfer water to counties and municipalities partially in the basin and to adjacent coastal basins pursuant to Texas Water Code § 11.085 (v) (3) and (4).
- Inclusion, as part of the appropriation described above, of an appropriation of current and future return flows to the extent that such return flows continue to be discharged or returned into the bed and banks of the Brazos River, its tributaries, and Authority reservoirs.
- Authorization for operational flexibility to (i) use any source of water available to the Authority to satisfy the diversion requirements of senior water rights to the same extent that those water rights would have been satisfied by passing inflows though the Authority's reservoirs on a priority basis, and (ii) release, pump, and transport water from any of the Authority's reservoirs for subsequent storage, diversion, and use throughout the Authority's service area.
- Recognition that the System Operation Permit will prevail over inconsistent provisions in the Authority's existing water rights.
- Authorization to use the bed and banks of the Brazos River, its tributaries and Authority reservoirs for the storage, conveyance and subsequent diversion of water appropriated by this application and from other sources.

Each of these subjects is discussed in more detail in the following sections.

2.3.1 New Appropriation of State Water

For the purposes of this report, water availability was evaluated at the three points listed in Table 2.2 and shown in Figure 2.1.

Table 2.2
System Yield Evaluation Locations

Location	WAM Control Point	USGS Gauge Number
Brazos River near Glen Rose	BRGR30	08091000
Brazos River near Highbank	BRHB42	08098290
Brazos River at the Gulf of Mexico	BRGM73	none

The hydrologic evaluations used as the basis for this application were performed using the TCEQ's water availability model for the Brazos River Basin (Brazos WAM), modified to perform system operation. The modeling approach and basis for the appropriation are discussed in more detail in Chapter 3. Table 2.3 summarizes the additional water appropriation requested at the three analysis points.

Table 2.3
Additional Appropriations
Available through System Operation by Subbasin
(Values in Acre-Feet per Year)

Scenario	Subbasin	Additional Firm Supply from System Operation without Interruptible Supplies	Additional Supply from System Operation with Interruptible Supplies [b]		
			Firm Supply	Interruptible Supply	Total Supply
Without Allens Creek Reservoir [a]	Glen Rose	150,538	60,538	190,000	250,538
	Highbank	175,306	85,306	284,000	369,306
	Gulf of Mexico	425,099	335,099	869,000	1,024,099
With Allens Creek Reservoir [a]	Glen Rose	150,538	60,538	157,000	217,538
	Highbank	144,306	54,306	303,000	357,306
	Gulf of Mexico	421,449	331,449	670,000	1,001,499

a With 2060 return flow conditions and Lyons bypass criteria
b Interruptible supply meets the 75/75 criteria.

Allens Creek Reservoir is a project located in the lower Brazos River Basin that will be part of the Authority system. The project has been permitted but has not yet been constructed. According to the 2001 Region H regional water plan, this reservoir will be built

between 2010 and 2020[9]. The entries under "Without Allens Creek Reservoir" in Table 2.3 show the amount of water requested for authorization in the System Operation Permit until such time as Allens Creek Reservoir is built and operating.

Once Allens Creek Reservoir is constructed it will be a key part of the Authority system. The reservoir's location in the lower portion of the basin makes it able to capture and store unappropriated flows and gives the Authority added operational flexibility. The Authority plans to partner with the City of Houston to use the entire storage and diversions from the reservoir as part of the system.

Table 2.3 shows the requested appropriation for both firm and interruptible water. Firm water can be reliably supplied from a reservoir through a repeat of the most hydrologically severe drought in the historical record. Interruptible water may be curtailed during extended dry periods. The Authority is requesting authorization to dedicate up to 90,000 acre-feet per year of the firm yield of system operation to generate interruptible supply. By devoting a portion of the system's firm water supply towards development of a larger, interruptible water supply, the Authority can greatly enhance the overall water supply capabilities of the system.

Interruptible water is normally used for irrigated agriculture or other purposes that do not require a reliable source of water. However, under some circumstances interruptible water is appropriate for use for municipal or industrial supplies. Interruptible water may be appropriate for municipal and industrial purposes if another surface water source or groundwater source is available to replace the interruptible supplies when they are curtailed.

2.3.2 Authorization to Appropriate Current and Future Return Flows

The yields shown in Table 2.3 include the authorization for a new appropriation of current and existing return flows discharged or returned into the bed and banks of the Brazos River, its tributaries and the Authority's reservoirs. Return flows represent a significant potential water supply in the Brazos River Basin. The Authority's right to use such water would have a 2004 priority date, the same date as the rest of the System Operation Permit. As a result, other existing water rights holders would continue to be able to access these

[9] Brown & Root/Turner Collie & Braden: *Task 5 Report: Identification, Evaluation, and Selection of Water Management Strategies*, prepared for the Region H Water Planning Group, February 2001.

return flows as part of their water supply, improving the reliability of these rights. The System Operation Permit would not prevent direct reuse of effluent by others[10].

2.3.3 Operational Flexibility

Texas water law is based on the prior appropriations doctrine, often summarized as 'first in time first in right.' Each water right is given a priority date which governs the order in which water is allocated during times of shortage. For older rights, the priority date is based on the first beneficial use of the water. For newer rights, the priority is based upon the date in which the application was declared administratively complete by the TCEQ. A right with an older priority date is referred to as a 'senior right', while a right with a more recent priority date is called a 'junior right'. The Authority's water rights have priority dates ranging from April 6, 1938, for Possum Kingdom Lake to September 1, 1999, for Allens Creek Reservoir.

Strictly following the prior appropriation doctrine, a priority call by a senior water right can only be met from a junior water right. However, from an overall system viewpoint, this may not be the most efficient way to manage the Authority's water resources. The Authority is requesting the operational flexibility to allow the Authority to pass through or release water from any part of the Authority system to satisfy downstream senior demands to the extent that they would have been satisfied by a priority call on a junior Authority water right, regardless of the priority of the rights or source of water used by the Authority to satisfy the downstream senior demand. This flexibility will allow the Authority to efficiently manage its supplies by using more plentiful supplies to satisfy downstream water rights while conserving less plentiful supplies.

The Little River watershed is a good example of how this might benefit the Authority's customers. This watershed includes the Temple-Belton area and Williamson County, which is the location of many of the Authority's customers and a high growth area. The reservoirs that supply this area (Lakes Proctor, Belton, Stillhouse Hollow, Georgetown and Granger) all have priority dates in the 1960s. It would be desirable to maximize the yield of these reservoirs. If the Authority is granted this operational flexibility, a senior demand on

[10] Texas Administrative Code Title 30 Chapter 297 Subchapter E Rule §297.42(g), available on line at http://www.sos.state.tx.us/tac/index.shtml.

the main stem of the Brazos River could be met from passage of inflows or releases from storage from other reservoirs in the Authority system rather than from releases of inflows from Little River watershed reservoirs. This would reserve water for future use within the Little River watershed.

The Authority is also seeking the right to move water from storage in its reservoirs to storage in other reservoirs or for use in the Authority's service area. For example, this would allow the Authority to meet needs from a nearby reservoir and refill storage in that reservoir with water diverted or released from other Authority projects. This sort of flexibility is needed to optimize system operation.

2.3.4 System Operation Inconsistencies in the Authority's Existing Water Rights

There are several provisions based on the System Operation Order in the Authority's existing water rights that are inconsistent with the proposed System Operation Permit. The provisions relate to the use of water for multiple purposes, the percentage of reservoir storage allowed to be used in system operations and identification of sources of water supply. These provisions prevent the Authority from making optimal use of its water resources. The application includes a request for language specifying that provisions in the System Operation Permit prevail over inconsistent provisions in the Authority's existing water rights. The proposed Water Management Plan described in section 2.4, which will be updated regularly and approved by the TCEQ, will provide the same safeguards intended by such provisions in existing Authority water rights.

2.3.5 Bed and Banks Authorization

The Authority provides water to a variety of customers located throughout the Brazos River Basin. A large portion of this water is delivered via the bed and banks of the Brazos River and its tributaries. The use of the bed and banks is authorized in all of the Authority's existing water rights, the System Operation Order, and the Authority's enabling legislation. This application for a System Operation Permit requests bed and banks authorization to transport the additional water appropriated under the System Operation Permit, as well as water from other sources. Specifically, the Authority requests authorization to use the bed

and banks of the Brazos River and its tributaries and Authority reservoirs for the conveyance, storage, and subsequent diversion of:

- Water that the Authority seeks to appropriate under the System Operation Permit
- Waters that are being conveyed via pipelines or other water transmission systems and subsequently discharged into the Brazos River and its tributaries or stored in the Authority's reservoirs
- Surface water and groundwater imported from areas located outside of the Brazos River Basin for subsequent use
- In-basin surface water and groundwater subject to the Authority's control
- Water developed from new Authority projects

In all cases, the Authority would be allowed to divert only the amount of water put into a watercourse or stream less allowances for losses, if any.

2.3.6 Interbasin Transfer Authorization

Under Texas water law, a transfer of water from one river basin to another river basin requires authorization by the state. Interbasin transfer authorization requires basin-wide notice and additional analyses regarding the basin of origin and the receiving basin. Also, a water right authorizing interbasin transfer is junior in priority to all other water rights granted before the time the application for the interbasin transfer is accepted for filing.

Texas water law recognizes exemptions from most of the above mentioned requirements for the transfer of water to adjacent coastal basins or to counties or municipalities or municipality's retail service areas that are partially within the basin of origin for use in that part of the county, or municipality or municipality's retail service area not within the basin of origin[11]. In this application, the Authority requests interbasin transfer authorization under these exemptions for use of water in the San Jacinto-Brazos Coastal Basin and the Brazos-Colorado Coastal Basin, and for use outside the Brazos River Basin to any county, municipality or the retail service area of a municipality that is partially within the Brazos River Basin.

[11] Texas Water Code § 11.085(v)(3)&(4), available on line at http://www.capitol.state.tx.us/statutes/statutes.html.

2.4 Implementation of the System Operation Permit – Water Management Plan

In this application for a System Operation Permit, the Authority is seeking authorization to fulfill its legislative mandate to manage the water resources of the Brazos River Basin. The application is more than just a request for additional water supply. Meeting the future water needs of the State of Texas requires balancing between managing water supplies and protecting cultural and natural resources. For any other entity to develop a significant surface water supply project in the Brazos River Basin would require the construction of a new reservoir, which is expensive and can have adverse environmental and cultural impacts. The System Operation Permit requires no additional infrastructure to generate a new supply of water. The additional reliable supply made available by system operation can only be created by use of the Authority's reservoir storage. The System Operation Permit will give the Authority the ability to manage its resources efficiently, consistent with the Authority's legislative directive to manage the water of the Brazos River Basin. The System Operation Permit is also consistent with the State's policy of optimal development of our limited water resources.

The analysis used to determine the yield of the three subbasins assumes that the same amount of water is taken every year at the most downstream point in the subbasin, which tends to maximize the potential yield of the water supply. Reality is more complex. Authority customers are not located at these three diversion points, and demands are not constant year after year. Some Authority customers take their water directly lakeside. Others take their water from the Brazos River, relying on releases from upstream reservoirs during low-flow periods. Some customers may be supplied by multiple sources in the Authority system, while others can only be supplied by one or two sources. Some customers have large contracts for which they are only currently using a small amount, reserving supplies for the future. Other customers may need to increase their contract amounts as their demand grows. Some customers only buy supplemental water for use during dry conditions, while other customers get their water solely from the Authority. Overall, the interaction of these water supply factors, along with environmental and cultural impacts, must be taken into account when managing the system.

In order to address the issues associated with the implementation of the System Operation Permit, the Authority will undertake development of a Water Management Plan for the Authority system. Because the Water Management Plan will potentially be of interest to other water users in the basin, as well as the general public, the Authority plans to solicit public input in the development and periodic revision of the plan. The Water Management Plan will be submitted to the TCEQ for review and approval and will be updated on a regular basis. The Water Management Plan will allow the Authority to optimize its system operation and use the rights and flexibility granted by the System Operation Permit. The Water Management Plan will also give TCEQ an on-going review of Authority operations to assure that the flexibility granted in the System Operation Permit is used wisely and that other water rights and the environment are fully protected. The Water Management Plan would address issues such as:

- Given the location and type of current Authority contractual commitments, how much water can be supplied through operation of the Authority system?
- Where can additional water supplies be delivered?
- How should diversions under the System Operation Permit and the Authority's existing water rights be accounted for and reported to TCEQ?
- Has new information been developed on channel losses in the Brazos River and its tributaries? If so, how should the revised information be incorporated in the operation of the system?
- Has new information been developed on environmental flow needs in the Brazos River and its tributaries? If so, how should the revised information be incorporated in the operation of the system?
- How can the Authority's system be operated to maintain and improve water quality in the Brazos River Basin and the quality of water delivered to customers?
- How does the current water supply available from the Authority's system compare with current contractual commitments and projected demands? What additional water supplies are needed? Where and how might such water supplies be developed?
- How can the Authority's system best be operated on a real-time basis to maximize available supplies, protect environmental values, and ensure reliability?
- How can the Authority's system be managed to minimize salt water intrusion in the lower basin during low-flow periods?

3 Hydrologic Analyses of the Brazos River Authority System

3.1 Key Points

The authorizations sought in the application for a System Operation Permit are based on hydrologic analyses of the Brazos River Basin using the TCEQ Water Availability Model of the Brazos River Basin and San Jacinto-Brazos Coastal Basin (Brazos WAM). The Brazos WAM Run 3 is used as the base case when evaluating the impacts of system operation. Run 3 assumes that all water rights divert and impound at their full authorized amounts and full reuse (no return flows).

For the system operation analyses, the Brazos WAM was modified to incorporate system operation of Authority reservoirs. System yields were calculated at three control points: the Brazos River near Glen Rose, the Brazos River near Highbank, and the Gulf of Mexico. Several modeling scenarios were developed where the Authority's yield was maximized at one of the above locations. For the Glen Rose and Highbank scenarios, any additional yield was taken at the Gulf of Mexico diversion point.

The original Brazos WAM Run 3 does not include return flows. Estimated 2060 return flows were incorporated into the model to evaluate the impact on potential yield. These return flows were allocated to each water right by priority date.

The modeling of the Authority's water rights was designed to prevent negative impacts on other water rights when implementing system operation. Most water rights are either unaffected or positively impacted by system operation. For those few that are negatively impacted the change is negligible, a change in reliability of 1% or less. Other water rights are more reliable because releases and increased spills from Authority reservoirs as a result of system operation are available to meet instream flow requirements.

Table 3.1 summarizes the results of the system operation studies at the Gulf of Mexico.

Table 3.1
Summary of System Operation Studies at the Gulf of Mexico
(Values in Acre-Feet per Year)

Description	Increased Firm Yield	Interruptible Supply	Increase above Current Rights
Firm Supply Only	421,449	-	421,449
Firm & Interruptible Supply	331,449	670,000	1,001,499

3.2 Description of the System Operation Model

The authorizations sought in the application for a System Operation Permit are based on hydrologic analyses of the Brazos River Basin using the TCEQ Water Availability Model of the Brazos River Basin and San Jacinto-Brazos Coastal Basin (Brazos WAM). The Brazos WAM was developed as a result of Senate Bill One, the landmark water legislation passed by the 75th Legislature in response to the drought of 1996. Senate Bill One required development of water availability models for every river basin in Texas. The water availability modeling program was administered by the predecessor agency of the Texas Commission on Environmental Quality (TCEQ). The models themselves were developed by contractors. The Brazos WAM was developed by HDR Engineering, Inc., in conjunction with Freese and Nichols, Inc., Crespo Consultants and Densmore-Dufrain Consultants. The Brazos WAM was completed in December 2001[12]. The WAM program uses the Water Rights Analysis Package (WRAP), a computer model developed by Texas A&M University under the direction of Dr. Ralph Wurbs to analyze water availability under the prior appropriations doctrine which underlies Texas water law.

The Brazos WAM is a highly complex model incorporating over 1,200 water rights in the Brazos River Basin and the San Jacinto-Brazos Coastal Basin. Most of the provisions of each water right are incorporated into the model, including the priority date, diversion amount, storage and instream flow requirements. Water rights are spatially related to a series of control points that define the stream network of the basin. Hydrologic data used in the model includes naturalized stream flows and evaporation rates covering the period from 1940 to 1997. All of these data are utilized by the WRAP model to assess water availability for each water right in the basin.

Since completion of the initial Brazos WAM, the model has gone through several updates. New water rights have been added and errors in the initial setup have been corrected. New versions of the WRAP model have also been made available. Updates to the model are periodically posted by TCEQ on their website[13]. The Brazos WAM model used in

[12] HDR Engineering, Inc.: *Water Availability in the Brazos River Basin and the San Jacinto-Brazos Coastal Basin,* prepared for the Texas Natural Resource Conservation Commission, December 2001.

[13] Files for each basin may be found online at http://www.tnrcc.state.tx.us/permitting/waterperm/wrpa/wam.html. The WRAP model can be found at http://ceprofs.tamu.edu/rwurbs/wrap.htm.

this report was obtained from TCEQ on March 25, 2004. All analyses were performed with the February 2004 version of WRAP.

3.2.1 Base Model

For the purposes of this report, the March 2004 TCEQ WAM Run 3 served as the base model. In the base model, all Authority water rights are modeled as lakeside diversions. The Excess Flows permit and downstream releases for customers are not included in the base model.

3.2.2 System Model

Although some reservoirs have significant lakeside diversions, many of the Authority's customers are actually located downstream of reservoirs and receive their water via the bed and banks of the Brazos River and its tributaries. Many of these customers can be supplied from multiple reservoirs. During times of high flows, the Authority is currently allowed to supply some of these customers using unappropriated flows as authorized in its Excess Flows permit. These diversions are assigned to Authority reservoirs for accounting purposes even though water is not actually released from the reservoir. During lower flow times water must actually be released from an Authority reservoir to meet demands. This type of operation was taken into account when developing the system model.

To simulate the potential yield of all the Authority reservoirs acting together as a system another version of the Brazos WAM was developed, referred to here as the *system model*. The system model was developed by Freese and Nichols, Inc. in consultation with Espey Consultants, Inc. and Dr. Ralph Wurbs. It incorporates several modifications to the base model, described in detail in Appendix C. The most significant modification groups all of the Authority's diversions together at common locations. Three control points shown in Figure 3.1 and listed in Table 3.2 were chosen for the common locations.

Several modeling scenarios were developed where the Authority's total yield was maximized at one of the above locations, with all Authority reservoirs above that location contributing to the yield. For the Glen Rose and Highbank scenarios, any remaining yield was taken at the Gulf of Mexico diversion point, with the Authority reservoirs below the upstream control point contributing to the total yield at the Gulf of Mexico.

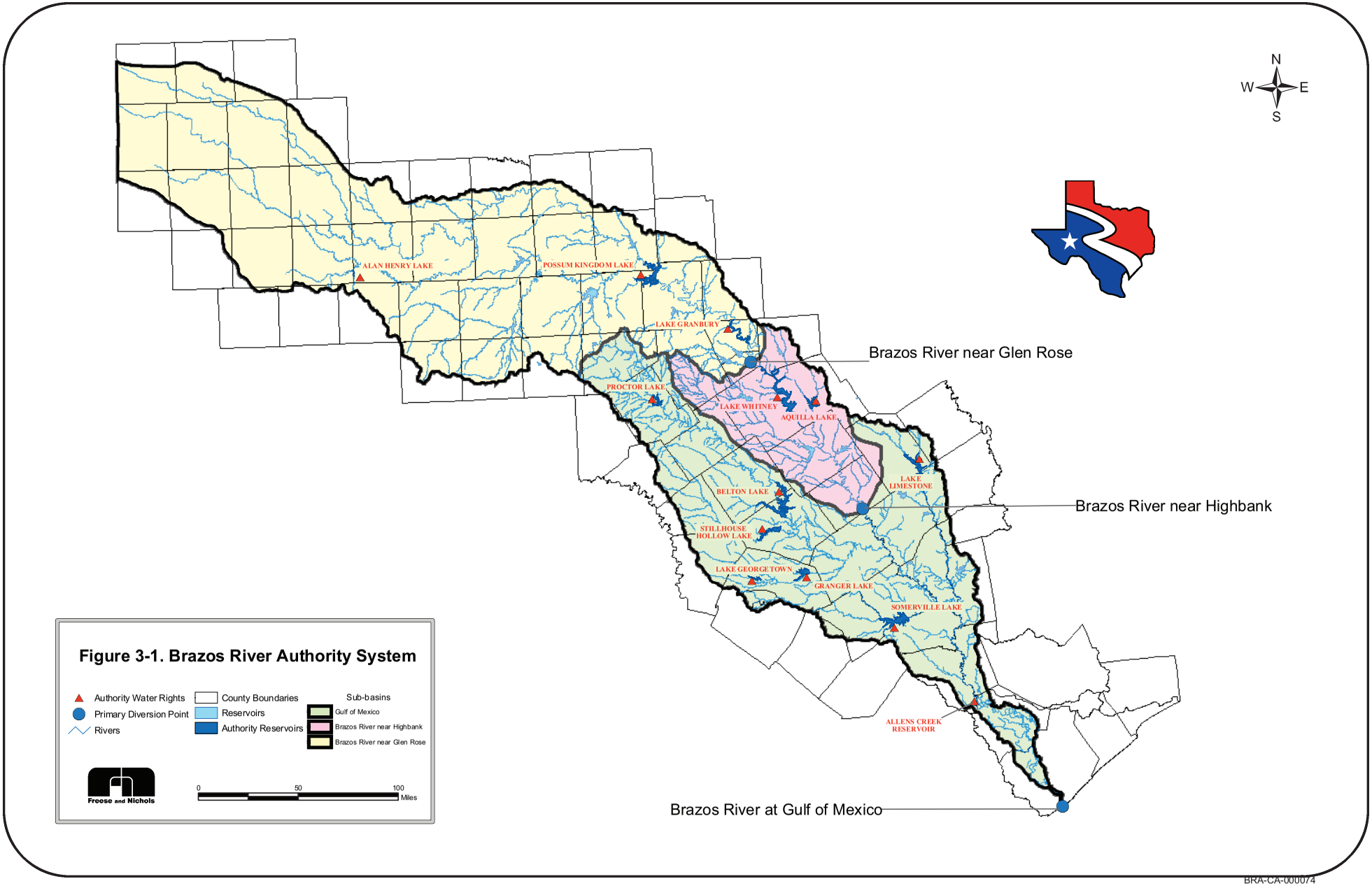


Figure 3-1. Brazos River Authority System

Table 3.2
System Yield Evaluation Locations

Location	WAM Control Point	USGS Gauge Number	Contributing Drainage Area (square miles)		Average Unit Flow (acre-feet/square mile/month)	
			Incremental	Total	Historical	Naturalized
Brazos River near Glen Rose	BRGR30	08091000	16,252	16,252[14]	5.0	5.7
Brazos River near Highbank	BRHB42	08098290	4,618	20,870	8.1	9.3
Brazos River at the Gulf of Mexico	BRGM73	none	15,158	36,028[15]	n/a	14.1

The Glen Rose control point has the largest incremental contributing drainage area but the smallest flow per square mile, reflecting the lower rainfall in this portion of the basin. This subbasin also has substantial channel losses in several reaches. Authority reservoirs in this subbasin include Lake Alan Henry[16], Possum Kingdom Lake and Lake Granbury. The Highbank control point has the smallest incremental drainage area but has substantially higher unit flow than the Glen Rose control point. Authority reservoirs in the Highbank subbasin include Lake Whitney and Aquilla Lake. The Gulf of Mexico subbasin has an incremental drainage area similar to the Glen Rose subbasin, but more than twice the unit runoff, reflecting the general increase in precipitation from west to east in the State of Texas. The majority of the Authority's reservoirs are located in this subbasin, including Lake Proctor, Lake Belton, Stillhouse Hollow Lake, Lake Georgetown, Lake Granger, Lake Limestone, Somerville Lake and the proposed Allens Creek Reservoir.

The Authority's water rights are modeled as a system based on meeting four goals:

- System operation should not impair the access of existing water rights to water that would have been available to those rights without system operation.
- The priority date and authorized storage and diversion of Authority water rights are respected.
- All existing Authority priority water rights are used to meet system diversions at the closest downstream system yield evaluation point.

[14] U.S. Geological Survey: *Water Resources Data Texas,* published annually.
[15] Texas Natural Resource Conservation Commission: Brazos and San Jacinto-Brazos Water Availability Model, available online at http://www.tnrcc.state.tx.us/permitting/waterperm/wrpa/wam.html.
[16] Lake Alan Henry is not used for system operation because of its location in the upper basin and substantial losses between the reservoir and Possum Kingdom Lake.

- Additional yield above existing Authority authorizations is junior in priority to all other water rights in the basin.

These goals were addressed using some of the new features of the WRAP model. In the system model, Authority reservoirs cannot deplete more water under their priority date than they do under the base run. This technique prevents system operation from having a significant impact on existing water rights. System operation diversions only have access to water that belongs to the Authority under current permits, plus any remaining unappropriated flow after all existing rights have diverted. Appendix C contains more details on the specific techniques used in the system model.

All system operation runs apply instream flow criteria using the Lyons method before diverting. Instream flow criteria are discussed in Section 4.3.

3.2.3 Use of Return Flows

The TCEQ uses the Full Authorization Run (WAM Run 3) to evaluate new perpetual water rights[17]. WAM Run 3 assumes that all water rights operate at their full permitted diversion and authorized storage capacity, with no return flows (except those specified in a water right). Therefore under current TCEQ procedures return flows are not considered when evaluating new appropriations. WAM Run 3 is equivalent to the base model.

As part of the application for a System Operation Permit, the Authority is seeking a new appropriation of all current and future return flows (treated sewage effluent and brine bypass/return) being discharged into the bed and banks of the Brazos River, its tributaries, and Authority reservoirs that are not appropriated by existing water rights. This appropriation will be conditioned on the continued discharge of the return flows and would be granted with the condition that this appropriation would not prevent any discharger from directly reusing their effluent, now or in the future[18]. The new appropriation would have a 2004 priority date. The 2004 priority date assures that all other current water rights would be able to divert and use return flows, distributed in priority order, before the System Operation Permit would be allowed to divert and use return flows.

[17] Texas Commission on Environmental Quality: *Water Availability Models*, available on line at www.tnrcc.state.tx.us/permitting/waterperm/wrpa/wam.html#used, downloaded February 27, 2004.
[18] 30 TAC §297.42(g)

In order to evaluate the impact of return flows on potential yield it is necessary to add return flows to the base model. Therefore, the modeling team developed current and 2060 return flows for all major dischargers in the Brazos River Basin. A summary of these return flows is given in Table 3.3. A discussion of the methodology used to generate these return flows is given in Appendix D. The return flows were modeled in the system operation as 'constant inflows', which are added to the naturalized flows at each return location at the beginning of each month. Using this method, return flows are available to all water rights in priority order, increasing the reliability for most rights in the Brazos River Basin when compared to the base run.

Table 3.3
Summary of Projected Current and 2060 Return Flows in the Brazos River Basin
(Values in Acre-Feet per Year)

Location	Current Surface Water Returns	Current Ground-water Returns	Total Current Returns	Projected 2060 Surface Water Returns	Projected 2060 Ground-water Returns	Projected 2060 Total Returns
Above the Brazos River near Glen Rose	16,789	366	17,155	25,446	366	25,812
Below Glen Rose and above Brazos River near Highbank	23,937	5,601	29,538	34,606	5,850	40,456
Below Highbank and above Gulf of Mexico	47,067	43,425	90,492	141,990	51,909	193,899
Total	*87,793*	*49,392*	*137,185*	*202,042*	*58,125*	*260,167*

Figure 3.2 shows the location and relative volume of major return flows in the Brazos River Basin under 2060 conditions. Most of the return flows in the Brazos River Basin originate in the I-35 corridor between Waco and Georgetown, the Bryan-College Station area, or in the lower basin. Currently, about 28% of these return flows originate from Authority-owned raw water sources, increasing to 43% by 2060. About 13% of these return flows currently come from Authority-owned or operated wastewater treatment facilities discharging into the Brazos River Basin. Not all of the water discharged from Authority wastewater treatment facilities originates from an Authority-owned source.

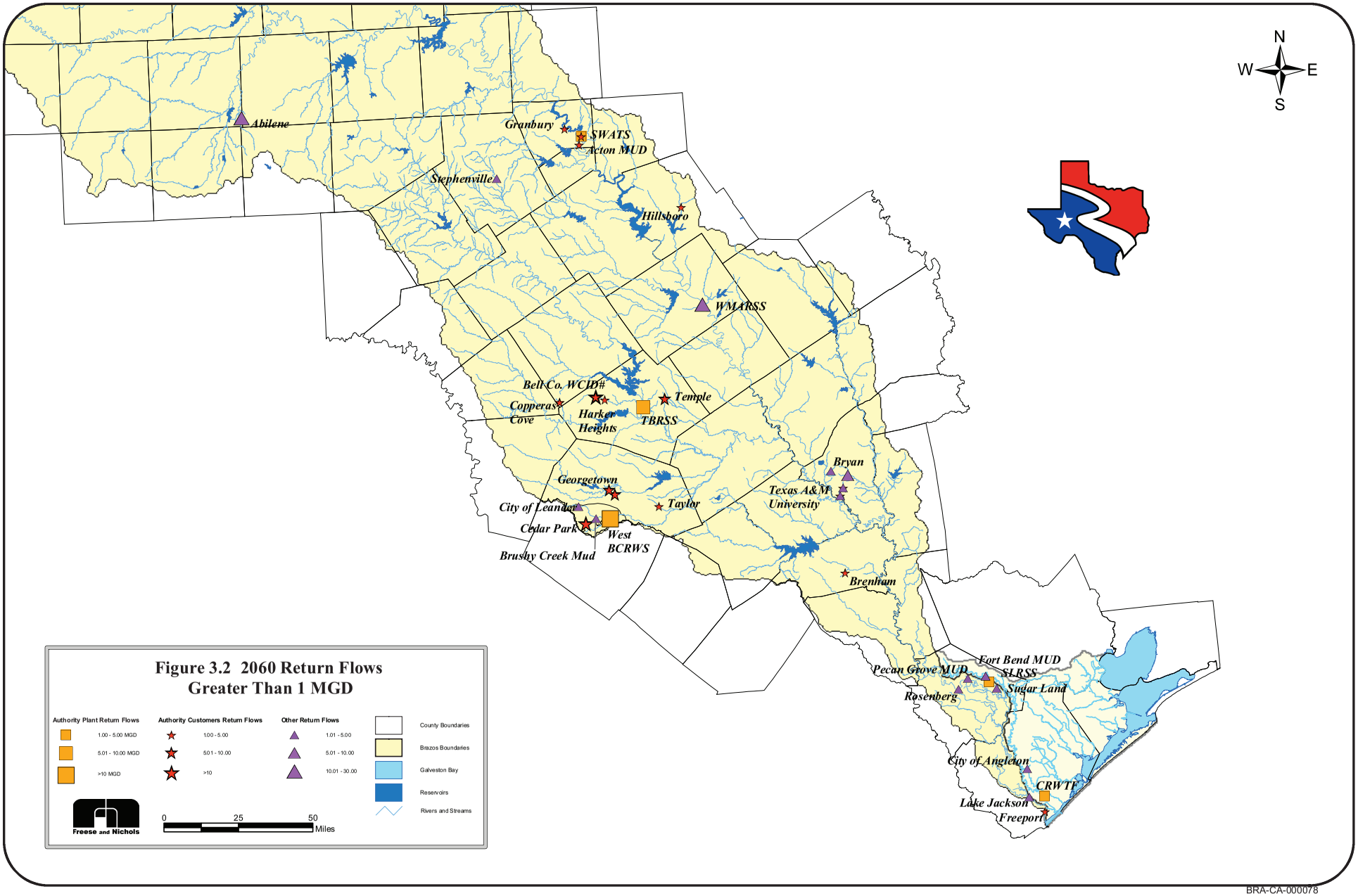


Figure 3.2 2060 Return Flows Greater Than 1 MGD

3.3 Additional Supply from System Operation

The system operation model was used to evaluate two scenarios:

- System operation to provide additional firm yield
- System operation dedicating a portion of system yield to provide interruptible supplies

Each scenario was evaluated maximizing yield at either the Glen Rose gauge, the Highbank gauge or at the Gulf of Mexico. The results of these runs are summarized in Table 3.4.

Diversions at the Glen Rose and Highbank locations were restricted by instream flow criteria based on the Lyons method. Instream flow criteria are discussed in more detail in Section 4.3.

If a portion of the Authority's yield is dedicated to creating interruptible supplies, the potential water supplies from the system can be increased substantially. The interruptible supplies were evaluated using the "75-75 rule", which is the method primarily used by TCEQ when evaluating interruptible supplies. The 75-75 rule is met if at least 75% of the maximum annual interruptible supply is available at least 75% of the years. More information regarding the modeling of interruptible supplies may be found in Appendix C.

Table 3.4
Summary of System Operation Yield Runs
(Values in Acre-Feet)

Description	Diversion Locations	Additional Firm Yield at Diversion Location	Additional (Reduced) Firm Yield at Gulf	Interruptible Supply at Diversion	Total Additional Yield
System operation	GR	150,538	(2,089)	-	148,449
	HB	144,306	1,143	-	145,449
	GM	421,449	-	-	421,449
System operation with interruptible supplies	GR	60,538	(2,089)	157,000	215,449
	HB	54,306	(1,143)	303,000	358,449
	GM	330,449	-	670,000	1,001,449

GR Yield maximized at the Brazos River near Glen Rose. Remaining yield is taken at the Gulf of Mexico.
HB Yield maximized at the Brazos River near Highbank. Remaining yield is taken at the Gulf of Mexico.
GM All yield taken at the Gulf of Mexico.

3.4 Interaction of Bed and Banks Delivery and Instream Flow Requirements

The Authority has customers located throughout the Brazos River Basin. The largest demand centers are located on the I-35 corridor between the cities of Waco and Round Rock and in the lower basin in Fort Bend and Brazoria Counties. Some of these customers take water directly from a reservoir, while others take water from the Brazos River or one of its tributaries. Many of these riverside customers depend on periodic reservoir releases to back up their own run-of-the-river or reservoir rights, while others depend on regular downstream releases. The use of the bed and banks of the Brazos River and its tributaries is crucial to Authority operations, and new water appropriated and made available through system operation will need bed-and-banks authorization to be incorporated in the Authority system.

The base WAM model has all Authority water rights modeled as lakeside diversions, while the system operation model assumes that all diversions occur from three points on the river. In actual operation, the Authority system will be a combination of lakeside and river diversions. This has implications for water rights in the Brazos River Basin with instream flow requirements.

Instream flow requirements are special conditions included in water rights that prevent a water right from diverting when streamflow is below a specific amount, or from diverting an amount that would cause streamflow to fall below a specific amount. Following TCEQ guidance, most of these instream flow requirements apply to all water rights junior to the water right with the instream flow requirement, even if that junior water right has no instream flow requirements of its own. This prevents a junior water right in the model from making diversions when a senior water right cannot divert. The additional flow in the river derived from releases or spills due to system operation from Authority reservoirs can be used to meet the instream flow requirements for many rights, potentially increasing the reliability of those rights.

Sixty-one rights with instream flow requirements are referred to as 'Hale clause' rights. The Hale clause is a special condition that specifies instream flow requirements are exclusive of releases from upstream Authority reservoirs. Previous versions of WRAP could

not correctly model Hale clause rights, but the February 2004 version used for this analysis incorporates logic to model these rights correctly.

3.5 Impacts on Existing Water Rights

As mentioned in Section 3.2, the system operation model uses special techniques to minimize impacts on existing water rights. Additional demand on reservoirs can result in impacts on other water rights, even if the additional diversions from the reservoir are junior to all other water rights. (This can happen because the additional diversions made at a junior priority create more empty storage space in the reservoir, and the empty storage space is refilled in subsequent months at the priority associated with storage under the reservoir's senior water right.) In order to minimize this type of occurrence a special modeling technique was derived to prevent Authority water rights from depleting more water at their original priority date than they would in the base model. (In water availability modeling, depletions are the total amount of flow used by a water right, including diversions and impoundment.) Depletions made by each Authority system right were extracted from the base run. These depletions were used to generate a time series of monthly target diversions in the system model, with a unique value for each time step in the model. These target diversions were substituted for Authority water rights in the system model. Rather than filling storage or meeting demands, the depletions from the target diversions were placed into 'dummy' control points, reserving them for diversion and storage by the system operation water rights. This assures that the Authority does not deplete more flow in system operation than would be depleted with full use of existing water rights at their current priority unless there is unappropriated flow available. Because the Authority's existing rights do not deplete more water than they would have without system operation, other water rights are not significantly affected by system operation. This technique is described in more detail in Appendix C.

The system modeling technique utilized to evaluate the system operations application was successful. Table 3.5 compares the reliability of water rights under system operation with the base run. The reliability of most water rights was not impacted by incorporating system operation. Other water rights are more reliable with system operation, largely because releases and more frequent spills from Authority reservoirs meet instream flow

requirements more frequently than in the base model (see Section 3.4). A few water rights, less than 0.5% of the rights in the basin, had minor negative impacts on reliability. Of the seven rights with impacts greater than 1%, most are very small rights experiencing a loss of a few acre-feet per year. The negative impacts generally occur when a senior water right subject to an instream flow requirement was able to deplete more flows than in the base runs, impacting junior water rights. Other negative impacts appear to be cumulative rounding errors. Given the complexity of the interactions of water rights and the accuracy of the model, these negative impacts are not significant.

Implementing this type of operation will require a water accounting procedure that will track diversion and storage of Authority rights under existing water rights and the System Operation Permit. These accounting procedures will be developed as part of the Water Management Plan and will be approved by TCEQ.

Table 3.5
Summary of Impacts of System Operation on the Volume Reliability of Existing Water Rights

	Impact on average diversion as a percentage of permitted amount							
	Total	**Less than 1%**	**1% to 2%**	**2% to 3%**	**3% to 4%**	**4% to 5%**	**5% to 6%**	**More than 6%**
Yield at Gulf of Mexico								
Water rights less reliable	81	74	6	1	0	0	0	0
Water rights more reliable	341	161	41	24	12	12	6	85
Water rights with no change	1,080							
Total	1,502							
Yield at Highbank								
Water rights less reliable	98	91	6	1	0	0	0	0
Water rights more reliable	333	153	43	23	15	10	6	83
Water rights with no change	1,071							
Total	1,502							
Yield at Glen Rose								
Water rights less reliable	99	92	6	1	0	0	0	0
Water rights more reliable	332	151	44	21	17	10	6	83
Water rights with no change	1,071							
Total	1,502							

NOTE: Values assuming 2060 return flow conditions

4 Environmental Analysis of the System Operation Permit

4.1 Key Points

Alternatives to the System Operation Permit include no action, Little River Reservoir, Millican Reservoir, Carrizo-Wilcox aquifer development, out-of-basin water, reallocation of Corps reservoirs, and reservoirs such as South Bend, Turkey Peak and others. With the exception of reallocation, all of these alternatives involve construction of a considerable amount of new infrastructure to make additional water available.

Achieving an equivalent amount of surface water supplies would require construction of a large reservoir or extensive groundwater development, either of which may have significant impacts. Other than delivery facilities to customers, the System Operation Permit will require no infrastructure to make new yield available. **The System Operation Permit represents the most cost-effective and environmentally sensitive alternative for development of new water supplies in the Brazos River Basin.**

At this time site-specific instream flow studies are not completed for the Brazos River or its tributaries, although several studies are proposed in the near future. The Authority is committed to protecting instream uses through dedication of a portion of the appropriation through system operation for environmental needs. For this report, instream flow criteria using the Lyons method were developed and applied to system operation diversions. The modeling runs show no impact at the diversion point when implementing system operation, and improved streamflow conditions at other locations.

The System Operation Permit is not expected to significantly impact the groundwater resources of the Brazos River Basin. Conjunctive use of water generated by the System Operation Permit with groundwater may prove to be an efficient way to manage both resources.

The Brazos River has a very small estuary system. The overall impact on the productivity and ecological health of the Brazos River Estuary is expected to be minimal.

System operation on a firm yield basis actually improves lake levels by leaving more water in storage in the Authority system much of the time when compared to the base Brazos WAM. However, during extended dry periods there is less storage in the system.

The System Operation Permit is expected to have minimal impact on water quality, archeological resources, wetlands, flooding terrestrial vegetation, or endangered and threatened species. As releases from reservoirs increase over time, instream aquatic habitats may actually improve.

The System Operation Permit is consistent with the Coastal Management Program.

4.2 Alternatives to the Permit

Many water supply projects have been studied in the Brazos River Basin that could be considered as alternatives to the System Operation Permit. The latest review of potential water supply projects was performed for the first round of Senate Bill One sponsored regional water planning. For the most part, the alternatives presented in this section are from the plans for Brazos G and Region H. A summary of the alternatives is presented in Table 4.1.

With the exception of reallocation of Corps reservoirs, all of these alternatives involve construction of a considerable amount of new infrastructure to make additional water available. Achieving a significant new water supply requires construction of a large reservoir or extensive groundwater development, either of which may have environmental impacts. Other than delivery facilities to new customers, the System Operation Permit will require no infrastructure to make new yield available. The System Operation Permit represents the most cost-effective and environmentally sensitive alternative for development of new water supplies in the Brazos River Basin.

One of the key features of the System Operation Permit is the flexibility that the permit will give the Authority in carrying out its legislative mandate to develop, manage and conserve the water resources of the Brazos River Basin. The current System Operation Order and the Excess Flows permits already grant a degree of flexibility. However, some of the accounting requirements and constraints imposed by the current System Operation Order and the Authority's water rights prevent the Authority from making the most efficient use of its system. The System Operation Order does not appropriate the additional water made available through system operation as well. The System Operation Permit is needed to assure that the water made available by system operation is available as a reliable water supply for future development in the Brazos River Basin.

The System Operation Permit, along with the proposed Water Management Plan, will provide a flexible method for efficiently managing the resources in the basin under current and future conditions. The Water Management Plan would be submitted for approval by TCEQ and updated periodically to reflect changing conditions.

Table 4.1
Potential Alternatives to the System Operation Permit

Alternative	Yield (ac-ft/yr)	Estimated Cost	Comments
Little River Reservoir - small version	56,000	$ 172,852,000	Alternative to larger version of reservoir
Little River Reservoir - large version	129,000	$ 361,065,000	Recommended in both Brazos G and Region H plans
Millican Reservoir - Panther Creek Site	235,200	$ 1,237,318,000	Potential value for flood reduction
Millican Reservoir - Bundic Site	73,800	$ 552,370,000	Recommended for Authority in Region G plan
Carrizo-Wilcox - Brazos County, uniform delivery	8,354	$ 10,695,000	7.45 mgd uniform delivery
Carrizo-Wilcox - Brazos County, peak delivery	8,354	$ 16,753,000	14.9 mgd peak delivery
Carrizo-Wilcox - Williamson County, uniform delivery	36,514	$ 130,219,000	32.6 mgd uniform delivery, well fields are in Lee & Burleson Counties
Carrizo-Wilcox - Williamson County, peak delivery	36,514	$ 189,341,000	65.2 mgd peak delivery, well fields are in Lee & Burleson Counties
Out-of-Basin water	Unknown	Unknown	Groundwater or surface water imported into the Brazos River Basin
Reallocation of Corps Reservoirs	Unknown	Unknown	Reallocation of hydropower, dead storage or flood storage to conservation storage

Note: Yields and costs are from the 2001 Brazos G and Region H plans.

4.2.1 No Action

The 2002 State Water Plan identified as much as 1,488,686 acre-feet of water supply needs in the Brazos River Basin and adjacent areas that cannot be met with existing water supplies and infrastructure. Although some of these needs can be met by improvements to existing infrastructure or connections to existing supplies, a significant portion of these needs can only be met through development of new water supplies. New supplies, such as the supplies from the System Operation Permit, are necessary to prevent potential shortages of water in the Brazos River Basin and ensure the economic viability of the region.

4.2.2 Carrizo-Wilcox Aquifer

The Carrizo-Wilcox aquifer is a prolific fresh-water source underlying Brazos, Burleson, Falls, Grimes, Lee, Limestone, Milam and Robertson Counties. According to the Brazos G plan, almost 268,000 acre-feet of water per year are available from the aquifer. In 1999 the water use from the aquifer was approximately 90,500 acre-feet per year. Over 40,000 acre-feet per year were used for municipal purposes, mostly in the Bryan-College Station area. Significant amounts of water from this source are used for manufacturing, irrigation and steam-electric power generation[19]. The quality of water in the aquifer is generally adequate for municipal purposes, with some locations requiring additional treatment because of iron, hydrogen sulfide and methane concentrations that exceed standards.

The Brazos G plan includes further development of the Carrizo-Wilcox aquifer to meet future demands in Brazos and Williamson Counties. The total cost of development of these projects ranges between $141 million and $206 million.

4.2.3 Little River Reservoir

The Little River Reservoir was a recommended strategy in both the 2001 Brazos G plan and the Region H plan[20]. The Little River site is located in Milam County near the City of Cameron, just upstream of the confluence with the Brazos River. The Region G plan evaluated two alternatives for the reservoir. The smaller version has a storage volume of

[19] Texas Water Development Board: Historical Groundwater Pumpage Data, December 2003.
[20] Brown & Root/Turner, Collie and Braden Joint Venture: *Task 5 Report Identification, Evaluation, and Selection of Water Management Strategies*, prepared for the Region H Water Planning Group, January 2001.

about 180,000 acre-feet and a yield of 56,000 acre-feet per year. The larger version, which was recommended in the regional plans, has a storage volume of 930,000 acre-feet and a yield of 129,000 acre-feet per year. The two projects were estimated to cost approximately $173 million and $361 million, respectively. Most of the water would be used to supply Region H, with approximately 30,000 acre-feet per year remaining in Brazos G.

The regional plans report potential environmental impacts on instream flows in the Little River, fish and wildlife impacts, including possible low impacts on one federally listed bird species (Interior least tern) and one endangered amphibian species (Houston toad), and cultural impacts near the City of Cameron. Implementing the reservoir would require a coalition of potential water users in the Williamson County and Houston metropolitan areas. The Authority is listed as the most likely primary sponsor of this project.

4.2.4 Millican Reservoir

The Millican Reservoir refers to several alternative reservoir sites located on the Navasota River. Since the mid 1940s, the U.S. Army Corps of Engineers has studied various alternatives for the Millican Reservoir for the purposes of flood control, water supply, hydropower generation and recreation. The latest studies, conducted in the 1980s, recommended two sites for the dam: Bundic and Panther Creek.

The Brazos G plan recommended the upstream Bundic Site as a water management strategy for the Authority. The Bundic site is located between SH 21 and US 79, about 19 miles northeast of the City of Bryan. This site was chosen over the downstream Panther Creek site because it had fewer environmental impacts and was more economical. The proposed reservoir would have 228,000 acre-feet of capacity, with a conservation pool area of 15,400 acres. The Bundic Site would supply 73,800 acre-feet per year of water. Project cost is estimated to be $552.4 million (1999 dollars). Environmental impacts are moderate to high. According to the Corps study, this reservoir would be constructed for water supply and recreation purposes.

Recent studies by the Corps of Engineers have indicated that the Panther Creek Dam Site remains a suggested alternative for area stakeholders because of the potential for flood

damage reduction associated with the project[21]. The Panther Creek Site is located on the Navasota River in the Brazos River Basin east of Bryan-College Station in Brazos, Grimes, Robertson and Leon Counties. The Panther Creek Site project could supply 235,200 acre-feet per year of water. Project cost is estimated to be $1,237.3 million (1999 dollars), and 47,550 acres of land will be impacted by this project. Impacts are high due to the inundation of the Yegua Lignite, Kurten oil and gas field, and wetland areas.

4.2.5 Out-of Basin Water

Currently the most significant interbasin transfers of surface water into the Brazos River Basin occur in Williamson County, where water is imported from the Highland Lakes system in the Colorado River Basin, and in Taylor County, where water is imported for the City of Abilene from Lake Ivie, also in the Colorado River Basin. Other interbasin transfers include Oak Creek Reservoir to the City of Sweetwater and Lake J. B. Thomas to the City of Snyder from the Colorado River Basin. Although it is likely that supplies from these sources will increase over time, it is unlikely that new interbasin transfers could replace more than a small part of the supplies available from the System Operation Permit.

Significant quantities of out-of-basin groundwater could become a viable alternative to water generated from the System Operation Permit. However, transporting the water to potential customers would require a significant amount of infrastructure. An efficient use of out-of-basin water may be conjunctive use with interruptible supplies generated by the System Operation Permit.

4.2.6 Reallocation of Corps Reservoirs

There are nine Federal reservoirs in the Brazos River Basin operated by the Corps of Engineers: Lake Whitney, Lake Aquilla, Lake Waco, Lake Proctor, Lake Belton, Lake Stillhouse Hollow, Lake Georgetown, Lake Granger and Lake Somerville. The Authority has water rights in every reservoir except Lake Waco. Currently, the Authority is working with the Corps to evaluate the possibility of converting existing hydropower storage, flood storage and sediment storage to water supply use. Because these reservoirs are Federal projects, reallocation of the reservoirs may require a complete Environmental Assessment

[21] Freese and Nichols, Inc.: *Texas Water Allocation Assessment Report,* prepared for the U.S. Army Corps of Engineers Fort Worth District, March 2002.

following the requirements of the National Environmental Policy Act of 1969. If reallocation is shown to have significant environmental impacts, a detailed Environmental Impact Statement will be required. In some cases, reallocation may require Federal legislative action.

It is unlikely that reallocation by itself would produce enough yield to replace the System Operation Permit. However, even with the System Operation Permit in place, reallocation is a viable strategy that the Authority may elect to pursue at some future date. The additional storage could be an enhancement to system operation.

4.2.7 Other Reservoir Sites

Several other large reservoir sites were evaluated as part of the Brazos G plan, including the Paluxy Reservoir, Lake Bosque, South Bend Reservoir, Breckenridge Reservoir and Double Mountain Fork sites. Several smaller on-channel and off-channel reservoirs were evaluated in the plan as well. Others, such as the Turkey Peak Reservoir and Cedar Ridge sites, have been evaluated in other recent studies[22]. These reservoir sites are not viable alternatives to the System Operation Permit because they produce much less water than the System Operation Permit and the supply would be used solely to meet local needs.

4.3 Instream Uses

As the largest river basin in Texas, the Brazos River and its tributaries represent a significant portion of the environmental resources of the state. Also, with the basin's location close to most of the major population centers in the state, the basin contains significant recreational resources as well. The main stem segments from Morris Sheppard Dam to US 180 and from De Cordova Bend to Lake Whitney are popular with canoeists. Reservoirs located near urban areas, such as Lakes Belton, Stillhouse Hollow, Granger, Georgetown, Whitney and Somerville, are particularly valuable as recreational resources. Cultural resources are represented by Dinosaur Valley State Park near Glen Rose and historical areas at Washington-on-the-Brazos and Stephen F. Austin State Parks, just to name a few. The Authority is committed to protecting these resources.

[22] Freese and Nichols, Inc.: *Draft West Central Brazos River Basin Regional Water Treatment and Distribution Facility Plan,* prepared for the Brazos River Authority et al., February 2004.

At this time no site-specific instream flow studies have been completed for the Brazos River or its tributaries, although several studies are proposed in the near future. For the purposes of this report, instream flow criteria were developed using the Lyons method at the Glen Rose and Highbank yield analysis points, as well as at the Brazos River at Richmond gauge. The Lyons method is the default method used by TCEQ when evaluating water rights when no site-specific information is available. The Lyons method sets minimum stream flow bypass levels at 40% of the historical median daily flow for the months of October through February and 60% of the median daily flows for March through September. Diversions may not cause flow in the stream to fall below these levels.

Table 4.2 shows the monthly Lyons bypass criteria for the Glen Rose and Highbank primary diversion points, and for the Brazos River at Richmond USGS stream gauge.

Table 4.2
Instream Flow Criteria Using the Lyons Method
(Values in Acre-Feet per Month)

Month	Glen Rose	Highbank	Richmond
January	6,272	28,530	85,837
February	4,976	27,102	121,960
March	9,223	42,058	199,589
April	11,211	46,235	184,046
May	24,866	76,737	333,509
June	30,597	66,050	232,602
July	16,712	37,630	82,086
August	15,347	31,617	58,844
September	12,674	25,706	65,514
October	6,788	17,217	46,417
November	5,141	18,696	53,197
December	4,993	24,546	75,999

Many water rights include restrictions specifying a minimum flow that must be left in a stream before a water right can divert. In older water rights, these instream flow requirements are designed to protect senior water rights. Newer water rights may include instream flow requirements for environmental protection. Because diversions under system operation are considered the most junior water rights in the basin, these instream flow requirements apply to system operation diversions as well.

Figures 4.1, 4.2 and 4.3 compare the frequency of meeting Lyons bypass goals at the Glen Rose, Highbank and Richmond gauges. The red bars in each chart shows the percentage of months with flows greater than criteria from the base run (Brazos WAM Run 3), which has all Authority diversions lakeside and no return flows. The magenta line with a square marker shows the same information for the base run incorporating 2060 return flows. The dark blue line with the triangle marker shows the percentage of months meeting criteria for the system operation run maximizing the supply at the Glen Rose gauge. The light blue line with the diamond marker and the green line with the circle marker show the same information for the yield runs maximizing the supplies at the Highbank Gauge and Gulf of Mexico, respectively. (Although the Richmond Gauge is not a yield location, it is included because of the number of existing instream flow requirements that are based on that particular gauge.) These graphs represent flows measured just downstream of the diversion point.

Figure 4.1
Frequency of Meeting or Exceeding Lyons Bypass Criteria at the Glen Rose Gauge

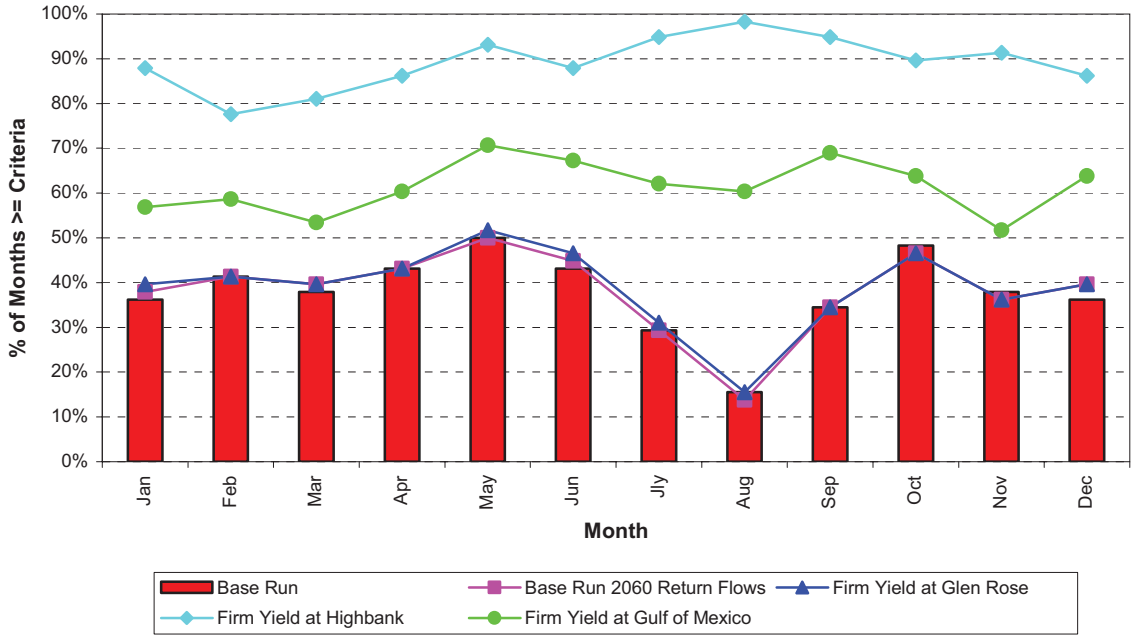


Figure 4.2
Frequency of Meeting or Exceeding Lyons Bypass Criteria at Highbank Gauge

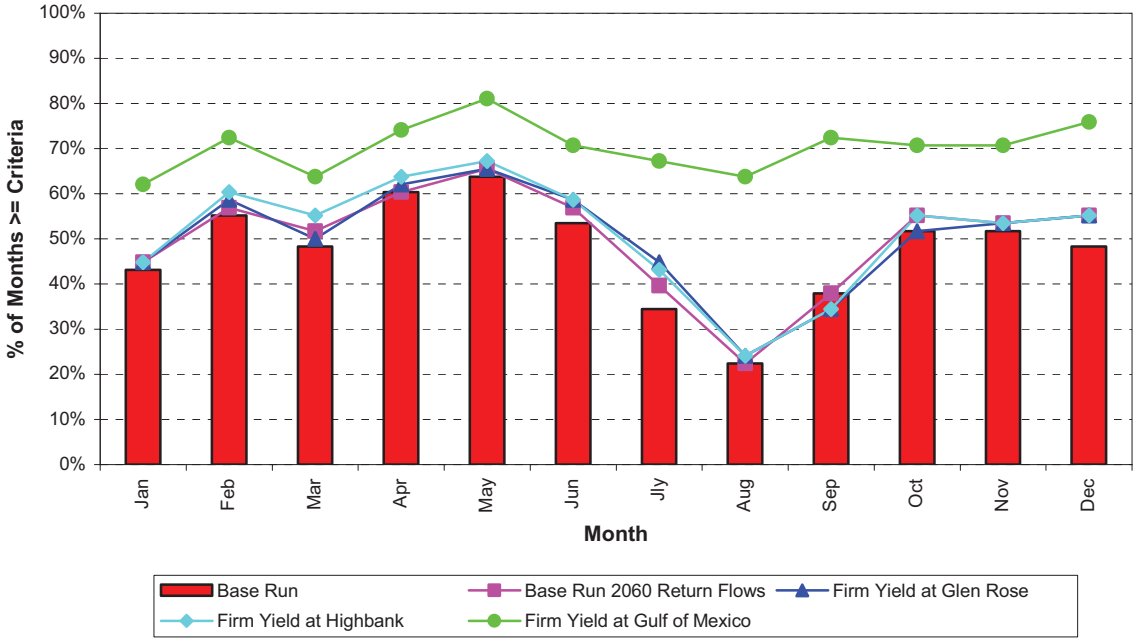
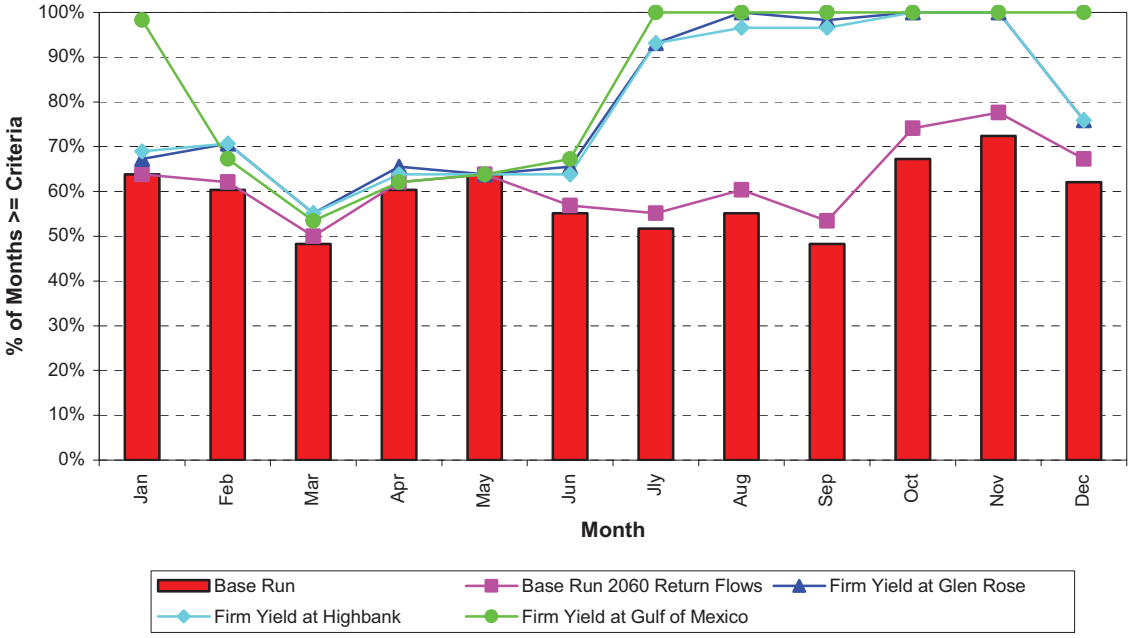


Figure 4.3
Frequency of Meeting or Exceeding Lyons Bypass Criteria at the Richmond Gauge

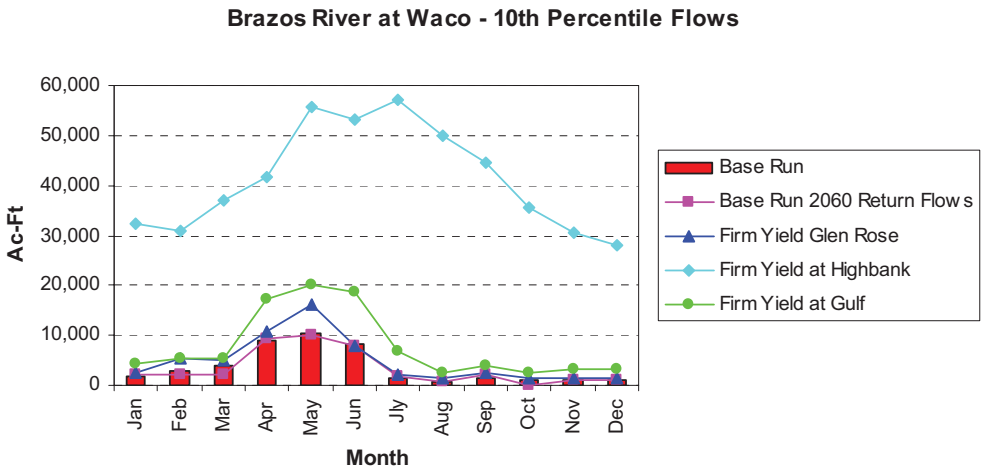


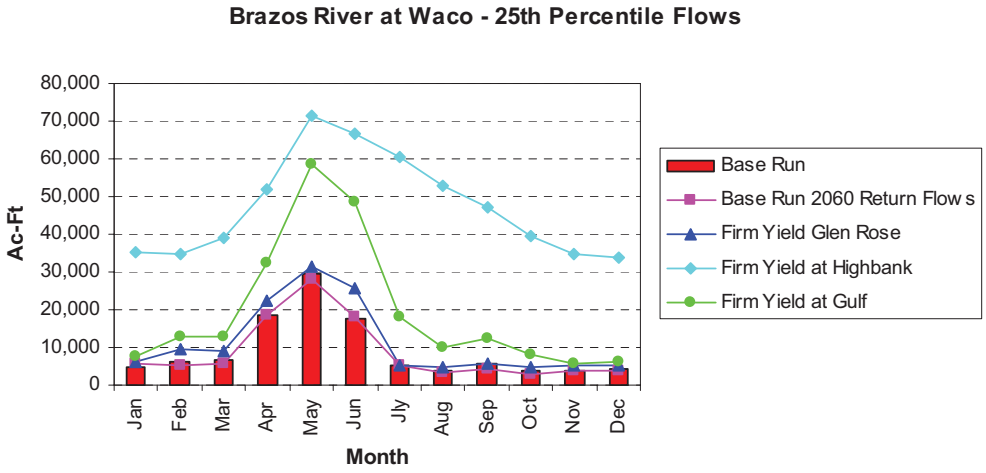
Examining these graphs, we can make the following observations:

- Return flows do not significantly increase the frequency of meeting instream criteria at the Glen Rose and Highbank gauges. At the Richmond Gauge, the presence of return flows causes a modest increase in the frequency of meeting instream flow requirements in the latter half of the year.
- When yield is taken at the Glen Rose Gauge, the frequency of meeting instream flow requirements is about the same with and without system operation. If yield is taken downstream, the frequency of meeting instream flow requirements is greater than in the base runs.
- At the Highbank Gauge, the frequency of meeting instream flow requirements is about the same as the base runs when taking yield at either Glen Rose or Highbank. When yield is taken downstream at the Gulf of Mexico, the frequency of meeting instream flow requirements is higher.
- At the Richmond Gauge the frequency of meeting instream flow criteria with system operation is much improved over the base runs. In the months of July through November, the instream flow criteria are exceeded almost all of the time with system operation.

The above graphs show that there are minimal impacts on instream flows at the diversion points. To further illustrate the instream benefits of system operation, Figures 4.4, 4.5 and 4.6 illustrate low flow statistics (flows below the median) for the base and firm yield runs at other locations in the basin. The 10th percentile flows represent extreme low flow conditions, while the 25th percentile flows represent moderate low flow conditions. Figure 4.4 shows low flow statistics at the Brazos River at Waco Gauge, which is located between the Glen Rose and Highbank yield points. Figure 4.5 shows the same data for the Little River at Cameron Gauge, which is located on a major tributary of the Brazos River downstream of five of the Authority's reservoirs (Lake Proctor, Lake Belton, Lake Stillhouse Hollow, Lake Georgetown and Lake Granger). Figure 4.6 shows low flow statistics at the Brazos River at Richmond Gauge, which is a key flow indicator gauge for the lower Brazos Basin. The color convention used in these graphs is the same as in Figures 4.1, 4.2 and 4.3. More information on flow statistics may be found in Appendix F.

Figure 4.4
Low Flow Statistics at the Brazos River at Waco Gauge





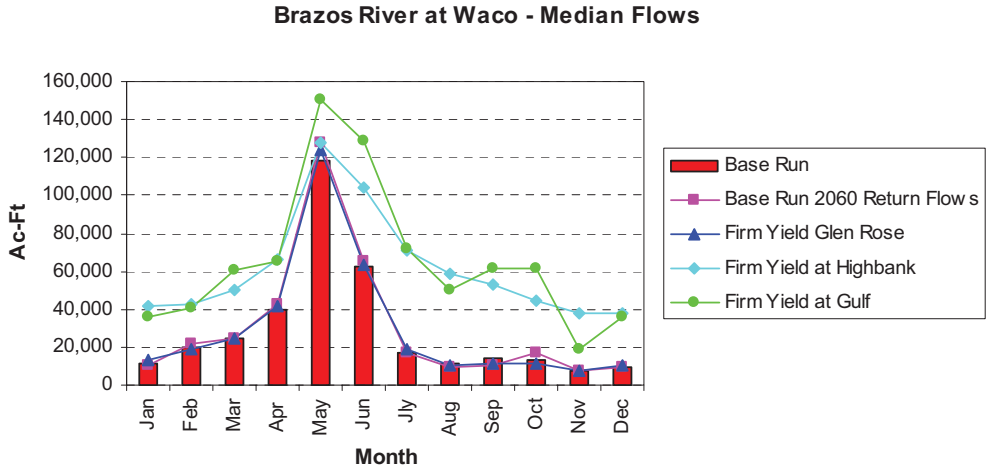
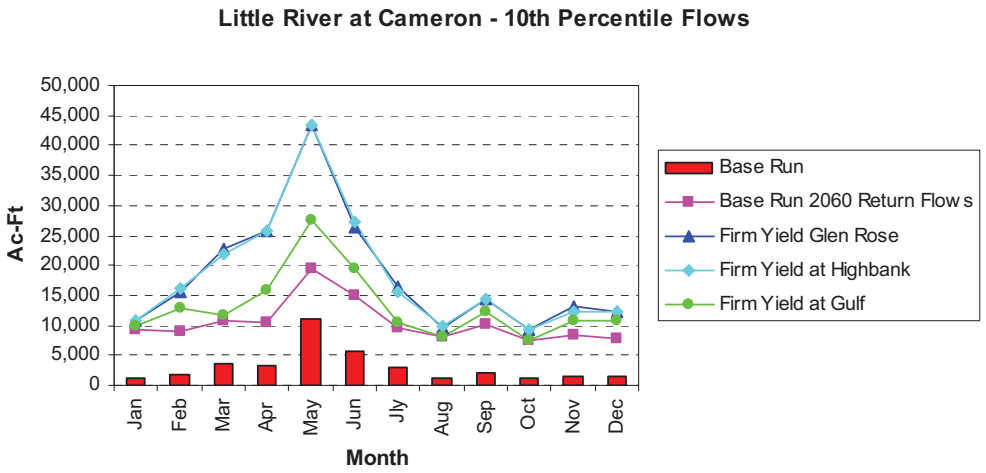
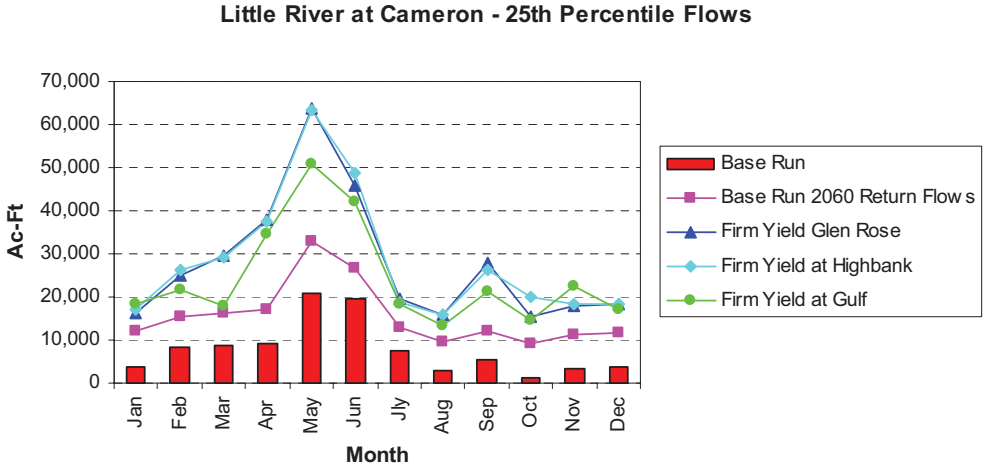


Figure 4.5
Low Flow Statistics at the Little River at Cameron Gauge





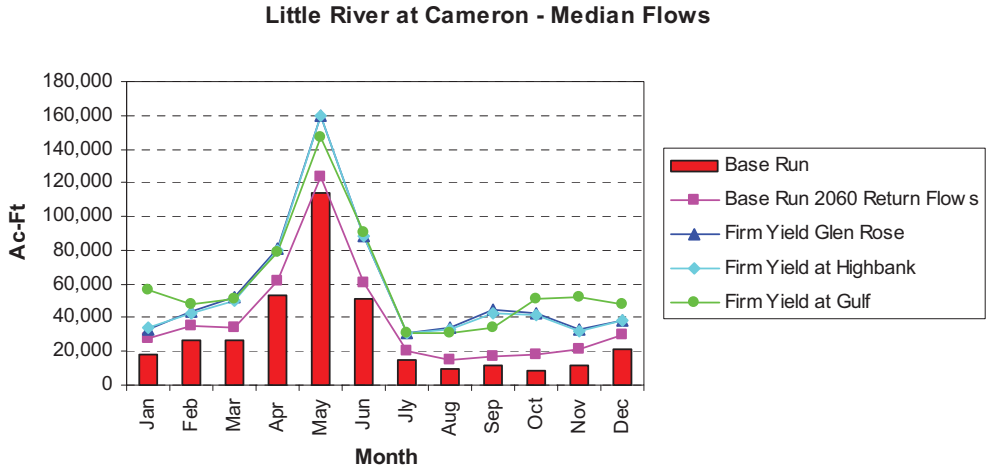
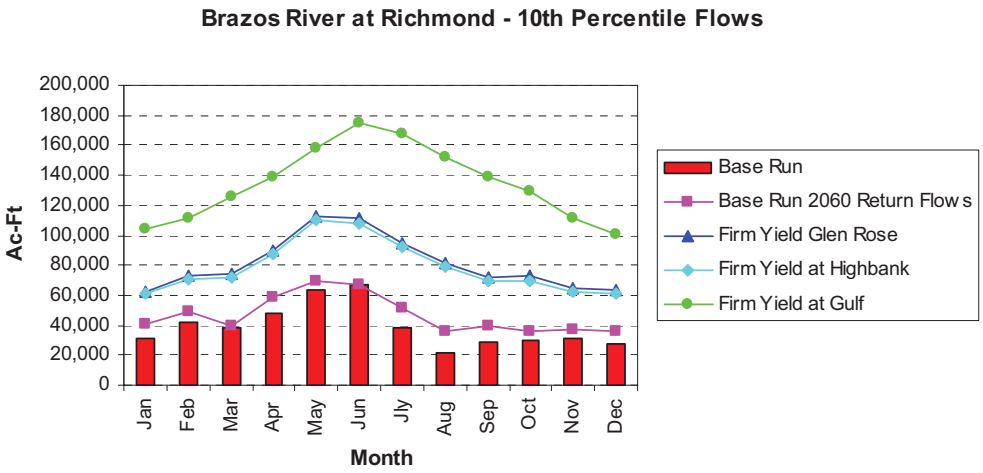
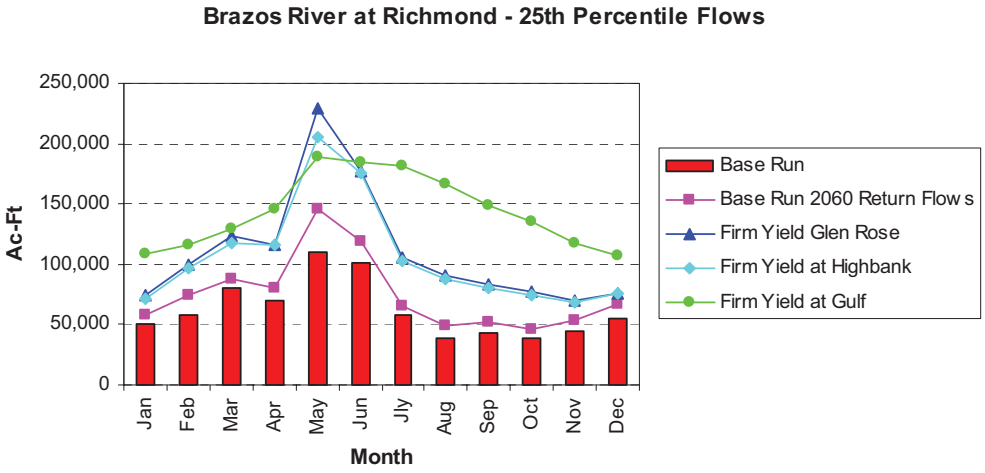
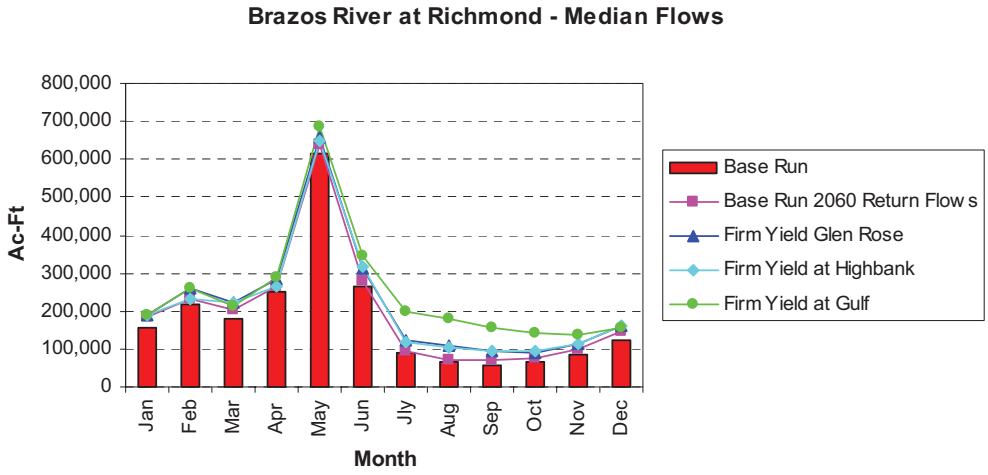


Figure 4.6
Low Flow Statistics at the Brazos River at Richmond Gauge







These graphs illustrate several flow trends when comparing system operation with the base runs:

- The inclusion of return flows causes a significant increase in low flows at the Cameron Gauge. Return flows in the base run makes almost no difference in low flows at the Waco Gauge and causes only minor increases at the Richmond Gauge.
- In almost every case low flows are higher with system operation.
  - The least improvement is shown in the Glen Rose runs at the Waco Gauge (Figure 4.4). Low flows are slightly higher from March through June and about the same the rest of the year.
  - In contrast, looking at the Highbank run at the Waco Gauge, the minimum flow for the 10th percentile with return flows is 115 acre-feet, while the minimum 10th percentile flow in the Highbank run is over 28,000 acre-feet, a substantial increase.

These graphs support the following conclusions:

- The System Operation Permit will not adversely impact instream flows.
- Downstream reservoir releases and more frequent spills made under the System Operation Permit will actually improve instream flow conditions in many locations.

4.4 Water Quality

The draft 2004 Texas 303(d) list identifies several segments of the Brazos River Basin with water quality concerns[23]. Most of these segments are tributaries of the Brazos River and are listed for high bacteria levels. A few reservoirs are noted for dissolved oxygen concerns. Several segments in the upper basin are impacted by high chloride and dissolved solids. The System Operation Permit will have minimal or no impact on most of the impaired segments on the 303(d) list because these segments are part of tributaries of the Brazos River and are not below Authority reservoirs. For those segments directly

[23] Texas Commission on Environmental Quality: Draft 2004 303(d) List, available on line at http://www.tnrcc.state.tx.us/water/quality/305_303.html

downstream of an Authority reservoir, more frequent releases from the reservoir during dry periods as a result of system operation may improve water quality. As demand increases in the lower basin and deliveries using the bed and banks of the Brazos River occur more frequently, water quality during low flow times may improve in other impacted areas, such as the Brazos River above the Navasota River.

In addition to the segments listed on the 303(d) list, Possum Kingdom Lake, Lake Granbury and Lake Whitney have relatively high concentrations of chlorides and dissolved solids. These reservoirs meet stream standards, but in most cases use of these reservoirs for drinking water purposes requires advanced treatment. The increased operational flexibility sought in the System Operation Permit will allow the Authority to balance water quality problems for customers receiving water from multiple sources. The impact of water quality on Authority operations will be addressed in the Water Management Plan.

4.5 Groundwater

The additional yield made available through the System Operation Permit is not expected to have an impact on groundwater resources in the Brazos River Basin. This water may serve as a substitute for further development of groundwater in some parts of the basin, potentially reducing aquifer declines and subsidence.

It is likely that some of the interruptible supply may be used conjunctively with groundwater resources in various parts of the basin. This may prove to be an efficient way to use these resources.

4.6 Bays and Estuaries

The Brazos River Estuary is very small, with an open water area of about 2 square miles and about 31 square miles of adjacent wetlands. There is no bay system at the mouth of the river like other major rivers in Texas. The mouth of the river has been relocated to a new channel, and the old channel now serves as the harbor for the City of Freeport. The

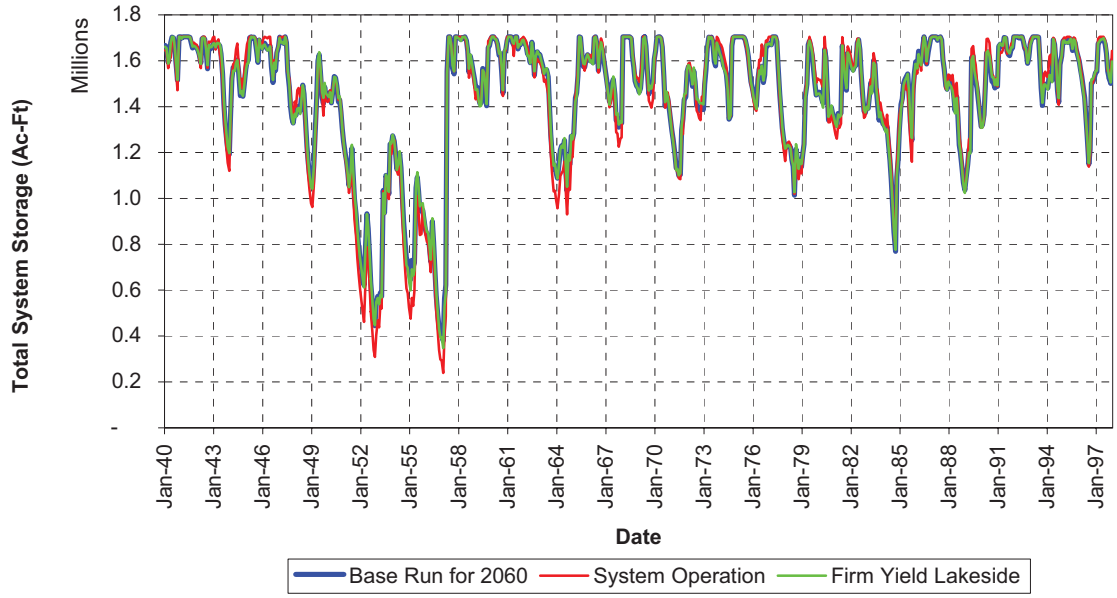
Brazos River Estuary is not an important recreational destination or a significant commercial fishery. Commercial fishing in the Brazos River Estuary is limited primarily to crabbing[24].

An increase in the water volume pumped under the System Operation Permit may reduce water levels downstream, causing some reduction in water entering the Brazos River Estuary or coastal wetlands adjacent to the Brazos River. The overall impact on the productivity and ecological health of Brazos River Estuary is expected to be minimal.

4.7 Other Issues

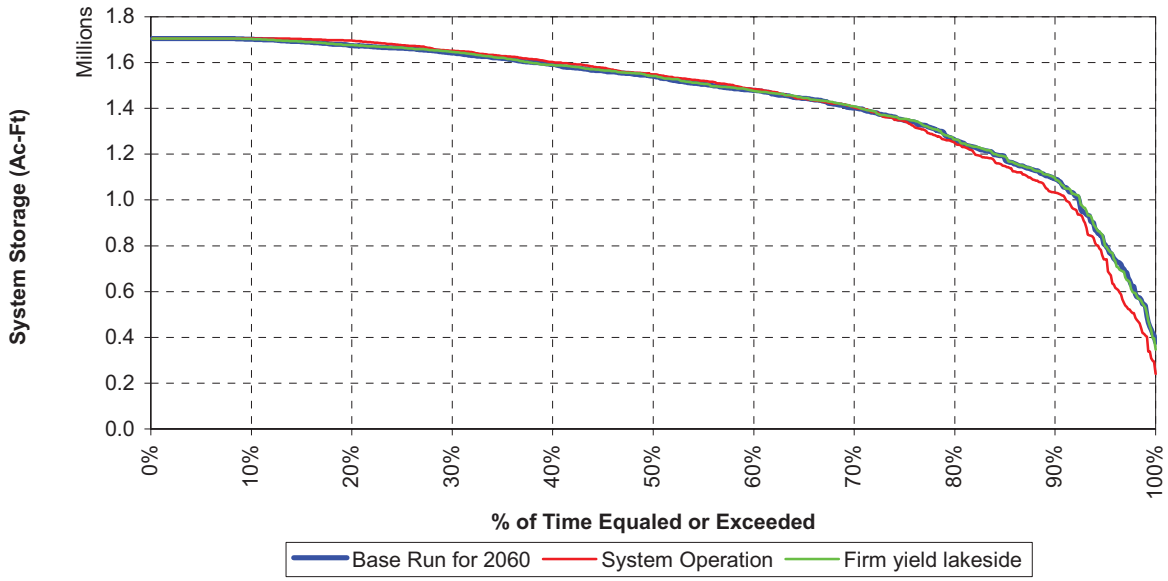
Figures 4.7 and 4.8 compare the total Authority system storage in the base run, with all reservoirs operating on a firm yield basis and with system operation, all under estimated 2060 conditions. These figures show that under maximum use conditions the storage in Authority reservoirs will be the same or slightly higher most of the time with system operation. There are small impacts of system operation during extremely dry periods, with reservoir storage somewhat lower.

Figure 4.7
Comparison of Total System Storage
with and without the System Operation Permit – 2060 Conditions



[24] Freese and Nichols, Inc. and Brown and Root, Inc.: *Report on Allens Creek Reservoir Supporting an Application to Amend Permit 2925,* prepared for the Brazos River Authority, City of Houston and the Texas Water Development Board, May 2000.

Figure 4.8
Comparison of Range of Storage Values
with and without the System Operation Permit – 2060 Conditions



Reservoir elevation will be a key consideration in developing the Water Management Plan, which will balance recreational needs, instream flow needs and current system demands.

The System Operation Permit is expected to have minimal impact on archeological resources, wetlands, flooding, terrestrial vegetation, or endangered and threatened species. Over time as releases from reservoirs increase to meet downstream needs with system operation water aquatic habitats may actually improve.

4.8 Consistency with the Texas Coastal Management Program

The regulations concerning compliance with the Texas Coastal Management Program (CMP) are found in Title 31, Part 16, Chapter 501 through Chapter 506 of the Texas Administrative Code and Section 33 of the Texas Natural Resources Code. The purpose of the CMP is to make more effective and efficient use of public funds and to more effectively and efficiently manage coastal natural resource areas (CNRAs) and the activities that may affect them. The program is based on goals and policies that guide the use and development of CNRAs, preserve and protect CNRAs, and improve government processes. The Coastal

Coordination Council (Council) has adopted rules promulgating these goals and policies. Agency actions that impact CNRAs must comply with these goals and policies. Certain activities undertaken by state agencies must be referred to the Council for a consistency review to assess whether the action is consistent with the goals and policies of the CMP.

The goals of the CMP are[25]:

(1) to protect, preserve, restore, and enhance the diversity, quality, quantity, functions, and values of CNRAs;

(2) to ensure sound management of all coastal resources by allowing for compatible economic development and multiple human uses of the coastal zone;

(3) to minimize loss of human life and property due to the impairment and loss of protective features of CNRAs;

(4) to ensure and enhance planned public access to and enjoyment of the coastal zone in a manner that is compatible with private property rights and other uses of the coastal zone;

(5) to balance the benefits from economic development and multiple human uses of the coastal zone, the benefits from protecting, preserving, restoring, and enhancing CNRAs, the benefits from minimizing loss of human life and property, and the benefits from public access to and enjoyment of the coastal zone;

(6) to coordinate agency and subdivision decision-making affecting CNRAs by establishing clear, objective policies for the management of CNRAs;

(7) to make agency and subdivision decision-making affecting CNRAs efficient by identifying and addressing duplication and conflicts among local, state, and federal regulatory and other programs for the management of CNRAs;

(8) to make agency and subdivision decision-making affecting CNRAs more effective by employing the most comprehensive, accurate, and reliable information and scientific data available and by developing, distributing for public comment, and maintaining a coordinated, publicly accessible geographic information system of maps of the coastal zone and CNRAs at the earliest possible date.

(9) to make coastal management processes visible, coherent, accessible, and accountable to the people of Texas by providing for public participation in the ongoing development and implementation of the Texas CMP; and

(10) to educate the public about the principal coastal problems of state concern and technology available for the protection and improved management of CNRAs.

Under § 505.11, actions by the TCEQ that are subject to consistency review include a new or amended appropriation of water exceeding 5,000 or more acre-feet within the program boundary or exceeding 10,000 or more acre-feet outside the program boundary but

[25] 31 Texas Administrative Code §501.12. Available online at http://www.sos.state.tx.us/tac/

within 200 river miles of the coast. The proposed System Operation Permit meets both criteria and so is subject to consistency review under the CMP.

Additionally, subsection (f) of § 33.2053 of the Texas Natural Resources Code states that the TCEQ shall comply with Sections 33.205(a) and (b) when issuing or approving a new permit or an amendment for an annual appropriation of 5,000 or more acre-feet of water within the program boundary; or 10,000 or more acre-feet of water outside the program boundary but within 200 river miles of the coast. The proposed System Operation Permit meets both criteria. For these reasons, the proposed System Operation Permit is subject to consistency review by the Council as stated in subsection (f).

31 TAC §501.14(r) offers policy guidance to TCEQ for appropriations of water in CNRAs. Factors to be taken into account include beneficial inflows to affected bay and estuary systems, instream uses, water quality, and fish and wildlife habitats.

4.8.1 Beneficial Inflows to the Brazos River Estuary

Unlike most Texas estuaries, the Brazos River Estuary lacks a large bay behind a barrier island system. The Brazos River empties directly into the Gulf of Mexico and has a very small estuary. The estuary has an open water area of about 2 square miles and has about 31 square miles of adjacent wetlands. The river has been diverted to a new channel approximately 6 miles south of the original mouth. The old channel now serves as the harbor at Freeport. Commercial fishing in the Brazos River Estuary is limited primarily to crabbing.

The Gulf Intracoastal Waterway intersects the Brazos River Estuary just upstream of the mouth of the river. Fresh water flows from the river are controlled by floodgates, which are normally closed unless boat traffic is crossing the river. These gates reduce the amount of fresh water entering the fisheries associated with the waterway[26].

It is unlikely that diversion amounts in the Brazos River Estuary will ever match those shown in the system operation runs. As such, these scenarios are a poor indicator of the impact on the estuary. Control of salt water intrusion during extended periods of low flow will be a key issue that will be addressed in the proposed Water Management Plan.

[26] Freese and Nichols, Inc. and Brown and Root, Inc.: *Report on Allens Creek Reservoir Supporting an Application to Amend Permit 2925,* prepared for the Brazos River Authority, City of Houston and the Texas Water Development Board, May 2000.

Because the System Operation Permit does not require construction of a new reservoir or significant development of groundwater resources, it is a low impact alternative to meeting the future water requirements of the State of Texas. The reliable water authorized in the System Operation Permit can only be made available through use of the Authority system. If the System Operation Permit is not granted, other potentially higher impact alternatives may be needed to meet future water demands.

4.8.2 Instream Uses, Water Quality and Habitat

In the modeling supporting this application, diversions upstream of the Gulf of Mexico are subject to instream flow requirements using the Lyons Method (see section 4.3). Until site-specific studies have been completed on the Brazos River system, this method will be used for protection of instream uses, water quality and wildlife habitat. Site specific requirements may be applicable when the proposed studies in the Brazos River Basin have been completed. It is likely that over time, as releases increase from upstream reservoirs for water used under the System Operation Permit, some habitats may actually improve.

The proposed System Operation Permit will not directly harm the functions and values of CNRAs as habitat for terrestrial and aquatic wildlife. An increase in the water volume pumped may reduce water levels downstream, causing some reduction in water entering coastal estuaries and bays or coastal wetlands adjacent to the Brazos River. Total river diversions under the proposed System Operation Permit represent only a small percent of the total inflows into the Brazos River Estuary under high flow conditions. For this reason, impacts to the aquatic life should be minimal. The effects of the proposed System Operation Permit on habitat values for terrestrial wildlife within the CNRAs should be minimal.

The System Operation Permit is not expected to significantly impact water quality of coastal waters. Most of the flow in the Brazos River goes directly into the Gulf of Mexico. Any alteration in water quality in the Gulf of Mexico is likely to be localized and within range of historical conditions.

4.8.3 Other Requirements of 31 TAC §501.14(r)

This System Operation Permit will be subject to review by the Texas Parks and Wildlife Department (TPWD). TCEQ will consider all information, evidence or testimony presented by the TPWD.

There is no new reservoir construction associated with the System Operation Permit. Therefore, 31 TAC §501.14(r) (J), which requires that five percent of the yield of a new reservoir constructed with state participation that is located less than 200 miles from the coast be dedicated to TPWD, does not apply.

The Authority has a Water Conservation Plan, which may be found in the Application documents.

5 Consistency with the State and Regional Water Plans

5.1 Key Points

Expected demands from the Authority will exceed supplies between 2020 and 2030. By 2050, the shortage is expected to be over 155,000 acre-feet per year. The regional water plans include several options for the Authority to meet this demand, including construction of the Little River and Millican Reservoirs.

The System Operation Permit may be considered consistent with the existing regional plans because much of the future increases in demand in the Brazos River Basin and adjacent areas are expected to be supplied by the Authority using the Brazos River and its tributaries as a source of supply. The System Operation Permit is an alternative to new Authority-sponsored water supply projects.

System Operation is included in the 2001 Brazos G regional water plan as a strategy for the Authority.

The Authority has prepared amendments to the existing Region G and Region H plans. The Authority will be working with Regions B, C, G, H, and O in the current round of regional planning to have water from the System Operation Permit considered in future regional plans.

There are several other strategies included in the regional plans for which system operation may be considered as an alternative in the current round of regional planning. These strategies may be found in Table 5.4.

5.2 Introduction

TAC 30 §295.16 states that an application for a new water right:

Shall contain information describing how it addresses a water supply need in a manner that is consistent with the state water plan or the applicable approved regional water plan for any area in which the proposed appropriation is located or, in the alternative, describe conditions that warrant a waiver of this requirement.

System operation is mentioned as a major water provider strategy in the Brazos G plan. However, no supply or cost is listed in the plan and no water from system operation is allocated to meet needs in the region. As a result, system operation is not mentioned in the list of strategies for Region G in the 2002 state water plan[27].

The System Operation Permit may be considered consistent with the existing regional plans because much of the future increases in demand in the Brazos River Basin and adjacent areas are expected to be supplied by the Authority using the Brazos River and its tributaries

[27] Texas Water Development Board: *Water for Texas – 2002,* January 2002.

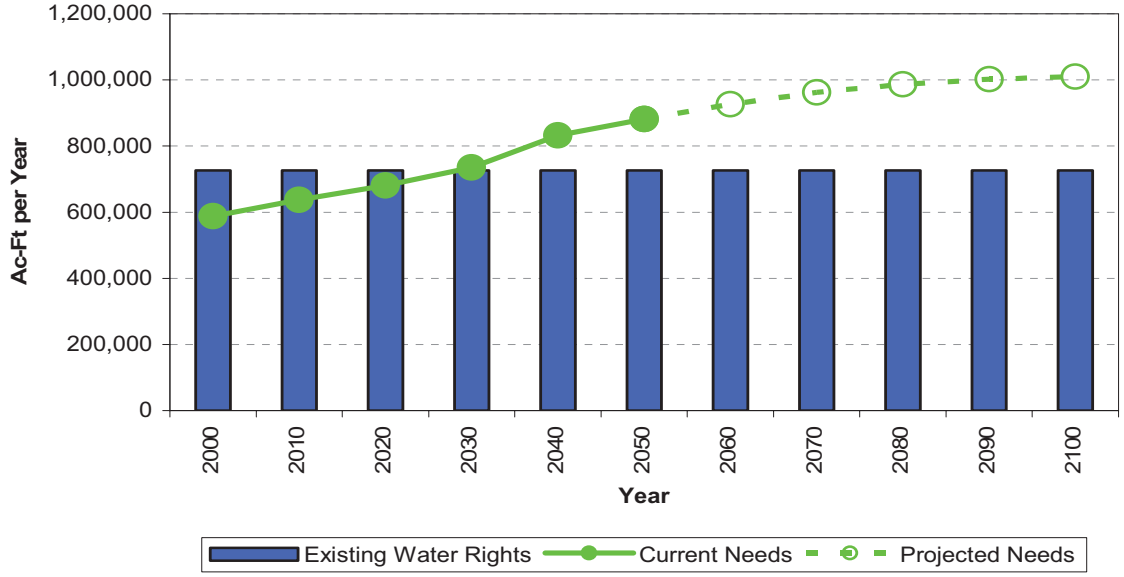
as a source of supply. The System Operation Permit is an alternative to new Authority-sponsored water supply projects.

The Authority has contacted the Brazos G and Region H Water Planning Groups to coordinate inclusion of the System Operation Permit in the 2005 regional water plans. In addition, the Authority has prepared an amendment to the Brazos G and Region H plans to include System Operation as a major water provider strategy.

5.3 Need for Additional Water

Currently the Authority has water rights for existing reservoirs totaling 696,901 acre-feet per year (excluding Allens Creek Reservoir, which has not yet been built). Figure 5.1 compares the projected demands from the Authority system from the 2002 State Water Plan, extended through the year 2100, to water rights for existing reservoirs. Demands from Authority sources will exceed the existing supply between 2020 and 2030. Table 5.1 summarizes the water needed from the Authority system from the 2002 State Water Plan[28].

Figure 5.1
Comparison of Brazos River Authority Demand Projections to Current Supply



[28] Texas Water Development Board: Attachment B Tables 5 and 12 for Regions G, H and O, available on line at http://www.twdb.state.tx.us/rwp/

Table 5.1
Summary of Water Needed from Brazos River Authority Sources from the 2002 State Water Plan[28]
(Values in Acre-Feet per Year)

Source	Supply 2000	Supply 2010	Supply 2020	Supply 2030	Supply 2040	Supply 2050
Region G	*419,665*	*462,196*	*492,689*	*497,387*	*505,195*	*509,486*
Region H	*168,238*	*175,163*	*188,326*	*238,206*	*297,616*	*342,727*
Region O	0	0	0	0	29,900	29,900
Authority Total from All Plans	*587,903*	*637,359*	*681,015*	*735,593*	*832,711*	*882,112*
Amount Above (Below) Water Rights for Existing Reservoirs *	*(108,998)*	*(59,542)*	*(15,886)*	*38,692*	*135,810*	*185,211*

* The total water rights for existing reservoirs are 696,901 acre-feet per year. Because Allens Creek has not yet been constructed it is not included in the total. Including all of the supply from Allens Creek results in a supply of 796,551 acre-feet per year.

Additional water from system operation could be used for other purposes as well. The 2002 State Water Plan identified as much as 1,388,686 acre-feet of water supply needs that cannot be met from existing supplies and infrastructure in the counties that are completely or partially within the Brazos River Basin. In other counties that are near but not included in the Brazos River Basin, there are 1,392,989 acre-feet per year of potential water supply needs. Although most of these needs were met by water management strategies in the regional plans (including water from the Authority system), water from this application may be a viable, cost-effective and environmentally friendly alternative to many of these strategies. More detailed information on potential needs may be found in Appendix B.

5.4 Water Management Strategies from the 2001 Regional Water Plans

The regional water plans recommend many water management strategies to meet potential shortages. Some of these strategies use water from the existing Authority system, some use water from new projects that are associated with the Authority, and others use water from other sources. This section describes recommended water management strategies from the regional water plans associated with the Authority and other water management strategies for which water from the System Operation Permit would be a viable alternative.

5.4.1 New Supplies from the Brazos River Authority System

The regional water plans identified over 340,000 acre-feet per year of new supplies from the Authority System. Table 5.2 summarizes the total amount of water needed from current and proposed Authority sources. These numbers show that the amount of water needed from Authority sources would exceed the current permitted supply by the year 2030. By 2050, supply needed from the Authority System would exceed current water rights by 155,317 acre-feet per year.

Table 5.2
Summary of Water Needed from Brazos River Authority Sources from the 2002 State Water Plan[29]

	2000	2010	2020	2030	2040	2050
Region G						
Possum Kingdom Lake	123,267	122,292	127,292	127,292	128,412	128,412
Lake Granbury	49,865	62,845	62,845	62,874	67,195	67,091
Lake Whitney	85	631	631	631	631	631
Lake Aquilla	9,138	9,138	8,365	7,304	6,242	5,114
Lake Proctor	16,517	18,159	18,159	18,159	18,159	18,159
Lake Belton	98,252	98,455	98,455	96,855	96,852	96,607
Lake Stillhouse Hollow	48,698	53,943	55,543	55,543	55,543	55,543
Lake Georgetown	3,570	7,342	21,251	21,292	21,319	21,333
Lake Granger	11,478	11,548	16,548	16,548	18,798	18,796
Lake Somerville	4,624	4,619	4,619	4,619	4,619	4,619
Lake Limestone	46,837	46,836	46,836	46,836	46,836	46,836
Little River Reservoir	0	0	0	0	0	5,000
Authority System (no source specified)	7,334	26,388	32,145	39,434	40,589	41,345
Total	*419,665*	*462,196*	*492,689*	*497,387*	*505,195*	*509,486*
Region H						
Authority System	168,238	175,163	177,545	202,278	202,635	210,620
Little River Reservoir	0	0	0	9,953	66,929	102,355
Allens Creek Reservoir	0	0	10,781	25,975	28,052	29,752
Total	*168,238*	*175,163*	*188,326*	*238,206*	*297,616*	*342,727*
Region O						
Lake Alan Henry	0	0	0	0	29,900	29,900
Authority Total from All Plans	*587,903*	*637,359*	*681,015*	*735,593*	*832,711*	*882,112*
Water Rights for Existing Reservoirs [a]	*696,901*	*696,901*	*696,901*	*696,901*	*696,901*	*696,901*
Amount Above (Below) Water Rights for Existing Reservoirs	*(108,998)*	*(59,542)*	*(15,886)*	*38,269*	*135,810*	*185,211*

a Water rights associated with existing reservoirs. Including all of the supply from Allens Creek results in a supply of 796,551 acre-feet per year.

[29] Texas Water Development Board: Attachment B Tables 5 and 12 for Regions G, H and O, available on line at http://www.twdb.state.tx.us/rwp/

Table 5.3 contains supplies from new sources in the Authority System. Lake Alan Henry is already built but is not currently used as supply, so it is considered a new source in the regional water plans. Allens Creek Reservoir, which will provide water for both the City of Houston and the Authority, is permitted but not built. The supply and the costs for Allens Creek Reservoir shown in Table 5.2 are for 30% of the reservoir. The regional plans allocate the remainder of the cost and supply of the reservoir to the City of Houston. The Little River and Millican Reservoirs are new projects recommended in the Brazos G and Region H plans. At this time there is no sponsor actively pursuing either project, although the regional water plans assumed that the Authority was the primary sponsor. No supplies from the Millican Reservoir were assigned to meet needs in the Brazos River Basin, so this project is not included in the list of recommended strategies in the State Water Plan.

Table 5.2 shows that projected water needs exceed the supply available from the current Authority System. The new sources described in Table 5.3 provide enough water to prevent a shortage from the system. The System Operation Permit is an economical and environmentally sensitive way to develop additional water supplies to meet these projected needs.

5.4.2 Other Water Management Strategies

There are several water management strategies from the regional water plans for which water from the System Operation Permit would be a viable alternative. These strategies are listed in Table 5.4, and these strategies fall in five general categories:

- Development of groundwater supplies to meet demands in Williamson County.
- Expanded supplies from reservoirs in the upper Brazos River Basin. Recent severe drought conditions indicate that these reservoirs may not have sufficient reliable supplies on their own to meet the projected demands.
- Additional interbasin transfers from the Colorado River and Trinity River Basins for use in Williamson and Parker Counties.
- New sources of supply, including the Little River Reservoir mentioned above. Water from the System Operation Permit could be a viable alternative to these projects because of the low start-up cost associated with developing the supply.
- Advanced municipal conservation and irrigation conservation in Region H. It is possible that the advanced conservation proposed for several small entities in Fort Bend County may not result in sufficient reliable supply. It is also possible that water saved through irrigation conservation would not result in additional water being made available for other uses.

Table 5.3
New Supplies in the Brazos River Authority System
from the 2001 Regional Water Plans

Region	Strategy	Capital Cost	2000	2010	2020	2030	2040	2050	Comments
O	Lake Alan Henry to Lubbock	$123,963,000	0	0	0	0	29,900	29,900	
G	System Operation								No cost or supply included
G	Carrizo-Wilcox Aquifer Development	$380,000,000	0	65,000	65,000	65,000	65,000	65,000	
G	Millican Reservoir - Bundic Dam Site	$552,370,000	0	0	0	73,800	73,800	73,800	Not assigned to meet specific needs
G & H	Little River Reservoir	$361,000,000	0	0	129,000	129,000	129,000	129,000	
G	LCRA imports	$88,614,000	0	25,000	25,000	25,000	25,000	25,000	
G	Conjunctive Use of Brazos River Alluvium	$9,843,000	0	0	0	0	3,220	3,220	Not assigned to meet specific needs
G	South Bend Reservoir	$205,000,000	0	0	0	0	106,700	106,700	Not assigned to meet specific needs
H	Allens Creek Reservoir	$47,190,000	0	0	29,900	29,900	29,900	29,900	
	Total	*$1,767,980,000*	*0*	*90,000*	*248,900*	*322,700*	*462,520*	*462,520*	
	Total Less Alan Henry & Allens Creek	*$1,596,827,000*	*0*	*90,000*	*219,000*	*292,800*	*402,720*	*402,720*	

Table 5.4
Water Management Strategies from the 2001 Regional Water Plans
Potentially Replaced by System Operation Permit Water

Region	Description	Source Specified in Plan	Interbasin Transfer Required	Year 2000 Supply	Year 2010 Supply	Year 2020 Supply	Year 2030 Supply	Year 2040 Supply	Year 2050 Supply
G	Williamson County Carrizo-Wilcox Development	Carrizo-Wilcox Aquifer	No	0	12,850	12,850	14,357	14,357	19,357
G	Additional supply from Hubbard Creek	Hubbard Creek Reservoir	No	179	1,489	1,489	1,489	1,489	1,489
G	Throckmorton & Young County Other from Graham	Lake Graham	No	300	600	600	600	600	600
G	Additional supply from Oak Creek Reservoir for Nolan County Other	Oak Creek Reservoir (Region F)	No	663	724	787	852	920	990
G	LCRA to Williamson County	LCRA System	No	0	0	12,000	12,000	12,000	12,000
G	Additional water for Steam-Electric in Milam County	Carrizo-Wilcox Aquifer	No	0	0	0	0	2,000	2,000
G	Additional Carrizo-Wilcox Development for Bryan-College Station	Carrizo-Wilcox Aquifer	No	0	7,000	7,000	14,000	14,000	14,000
H	Advanced Municipal conservation in Brazoria, Ft Bend and Waller Counties	Conservation	No	0	458	2,163	2,929	3,271	3,953
H	Advanced Irrigation conservation in Brazoria and Ft Bend Counties	Conservation	No	0	827	10,870	11,029	11,204	11,422
C	TRWD additional supplies to Parker County	TRWD System	Yes	0	5,247	6,621	12,765	12,175	14,550

Appendix A
List of References

Appendix A
List of References

Brown & Root/Turner Collie & Braden: *Task 5 Report: Identification, Evaluation, and Selection of Water Management Strategies*, prepared for the Region H Water Planning Group, January 2001.

Bickerstaff, Heath, Smiley, Pollan, Kever & McDaniel, L.L.P.: *Supplemental Information for Brazos River Authority's Application for a System Operation Permit*, prepared for the Brazos River Authority, June 18, 2004.

Freese and Nichols, Inc.: *Draft West Central Brazos River Basin Regional Water Treatment and Distribution Facility Plan*, prepared for the Brazos River Authority et al., February 2004.

Freese and Nichols, Inc., and Brown and Root, Inc.: *Report on Allens Creek Reservoir Supporting an Application to Amend Permit 2925*, prepared for the Brazos River Authority, City of Houston and the Texas Water Development Board, May 2000.

Freese and Nichols, Inc.: *Texas Water Allocation Assessment Report*, prepared for the U.S. Army Corps of Engineers Fort Worth District, March 2002.

HDR Engineering et. al.: *Brazos G Regional Water Planning Area Regional Water Plan*, prepared for the Brazos G Regional Water Planning Group, January 2001.

HDR Engineering, Inc.: *Water Availability in the Brazos River Basin and the San Jacinto Brazos Coastal Basin*, prepared for the Texas Natural Resource Conservation Commission, December 2001.

Texas Administrative Code, available on line at http://www.sos.state.tx.us/tac/index.shtml.

Texas Commission on Environmental Quality: Brazos and San-Jacinto Brazos Water Availability Model, available on line at http://www.tnrcc.state.tx.us/permitting/waterperm/wrpa/wam.html.

Texas Commission on Environmental Quality: Draft 2004 303(d) List, available on line at http://www.tnrcc.state.tx.us/water/quality/305_303.html

Texas Water Code, available on line at http://www.capitol.state.tx.us/statutes/statutes.html.

Texas Water Commission: An Order Authorizing System Operation of Certain Reservoirs in the Brazos Basin, July 23, 1964, amended 1968, 1977 and 1983.

Texas Water Development Board: Attachment B Tables 5 and 12 for Regions G, H and O, available on line at http://www.twdb.state.tx.us/rwp/

Texas Water Development Board: Exhibit B: Guidelines for Regional Water Plan Development, July 2002.

Texas Water Development Board: Historical Groundwater Pumpage Data, December 2003.

Texas Water Development Board: *Water for Texas – 2002*, January 2002.

Townsend, George E.: *Planning Report 30.1 Drainage Area Compilation*, U.S. Study Commission – Texas, November 1960.

U.S. Geological Survey: *Water Resources Data Texas*, published annually.

"Who is the Brazos River Authority?" *The Brazos Basin*, Volume 1, Summer 2003.

Appendix B
Potential Needs from Regional Water Plans

Appendix B
Potential Needs from Regional Water Plans

All of the data in this section are from the tabular data submissions from the regional water plans for Regions B, C, F, Brazos G, H, K, the South Central Texas Planning Region (Region L) and Llano Estacado Planning Region (Region O). Although the second round of regional water planning is well underway at the time of this report, data from the current round are not final. At this time the governing information on water supply planning is from the 2001 Regional Water Plans.

Water Needed from the Current Authority System

Table B-1 summarizes the water needed from the current Authority system[1] according to the Brazos G, Region H and Region C plans. The regional water plans treated the Authority system somewhat differently. Brazos G and Region C show a specific source for their current supplies, while Region H chose to group all Authority sources together as the Authority/COE System. According to these plans, there are 547,993 acre-feet of water allocated from the Authority system. The supply allocated from the regional plans is less than the current estimated contractual commitments from Authority of 657,650 acre-feet per year. At least part of this discrepancy may be explained by infrastructure constraints; some entities may have contractual supplies that cannot currently be delivered using existing infrastructure.

Note that some of the supplies in Table B-1 are reduced over time due to sediment accumulation in the reservoirs.

[1] Water allocated from the current Authority system is the amount of water contracted to end-users from the Authority system, taking into account limitations in infrastructure or other factors that may reduce supplies below the current contract level. For example, Lake Alan Henry is a part of the Authority system, but there is currently no infrastructure available to get the water to end-users. Therefore, Lake Alan Henry is not considered part of the current system.

Table B-1
Water Needed from the Current Brazos River Authority System from the 2001 Regional Water Plans

Source	Total Year 2000 Supply	Total Year 2010 Supply	Total Year 2020 Supply	Total Year 2030 Supply	Total Year 2040 Supply	Total Year 2050 Supply
Possum Kingdom Reservoir	123,302	122,327	122,327	122,327	122,327	122,327
Lake Granbury	49,865	49,695	49,695	49,695	49,695	49,591
Lake Whitney	85	80	80	80	80	80
Lake Aquilla	9,138	9,138	8,365	7,304	6,242	5,114
Lake Proctor	16,517	15,445	15,445	15,445	15,445	15,445
Lake Belton	97,302	97,047	97,065	95,442	95,423	95,147
Lake Stillhouse Hollow	48,570	48,215	48,215	48,215	48,215	48,215
Lake Georgetown	3,570	342	427	468	495	509
Lake Granger	11,478	11,478	11,478	11,478	11,478	11,476
Lake Somervell	4,624	4,619	4,619	4,619	4,619	4,619
Lake Limestone	46,837	46,836	46,836	46,836	46,836	46,836
Authority System (no source specified)	136,706	136,706	136,706	136,706	136,706	136,706
Total	*547,993*	*541,928*	*541,258*	*538,614*	*537,561*	*536,065*
Current Authority Water Rights [a]	*661,901*	*661,901*	*661,901*	*661,901*	*661,901*	*661,901*
Uncommitted or Unavailable Supply	*113,908*	*119,973*	*120,643*	*123,287*	*124,340*	*125,836*

a Does not include Lake Alan Henry

Potential Shortages in the Brazos River Basin and Adjacent Regions

Brazos River Basin and Adjacent Coastal Basins

In the regional water planning process, currently allocated supplies were compared to demand projections to determine potential water supply shortages. Table B-2 summarizes the potential shortages by demand category for counties partially or entirely within the Brazos River Basin and adjacent Coastal Basins. Currently, irrigation has the most significant potential for water supply shortages, accounting for about 86 percent of the total. About 220,000 acre-feet of these irrigation shortages are located in the lower Brazos River Basin and adjacent coastal basins, an area which uses a significant amount of surface water originating from the Authority system and other Brazos River Basin water sources. The majority of the other potential irrigation shortages are located in areas that primarily use groundwater supplies. Potential municipal shortages

increase rapidly over time, outstripping potential irrigation shortages by 2050. Potential manufacturing and steam-electric shortages increase at a rapid rate as well. Irrigation shortages decline over time, primarily due to increased conservation.

Table B-2
Potential Water Supply Shortages by Category in the Brazos River Basin and Adjacent Coastal Basins

Demand Category	Potential Shortage					
	2000	2010	2020	2030	2040	2050
Municipal	37,896	119,556	303,140	397,340	477,221	565,615
Irrigation	419,129	427,187	409,231	402,455	395,325	392,383
Livestock	10	10	10	10	10	10
Manufacturing	27,311	69,941	105,785	147,383	227,992	307,696
Mining	4,895	4,856	5,234	5,688	6,217	7,655
Steam-Electric	30	36,441	47,401	52,548	60,094	65,207
Total	*489,271*	*657,991*	*870,802*	*1,005,424*	*1,166,859*	*1,338,567*

Table B-3 shows the total potential water supply shortages on a county-by-county basis for counties wholly or partially within the Brazos River Basin or the adjacent coastal basins. Irrigation shortages that are only included if they are in the Brazos River Basin or adjacent coastal basin. Other categories may be outside of these basins if they are in a county partially within the basin. Shortages broken down by category may be found in Tables B-4 through B-9.

Figure B-1 shows the spatial distribution of these shortages in 2010, and Figure B-2 shows the same information for 2050. The largest potential shortages are located in the lower Brazos River Basin and adjacent coastal basins, where shortages of municipal, manufacturing and irrigation supplies are expected by 2050 without additional water supply development. Other areas of concentrated shortage are along the I-35 corridor from Waco to Austin and in the counties on the edge of the Dallas-Fort Worth Metroplex. These shortages are primarily municipal.

The data in Tables B-2 through B-9 have been adjusted to remove artificial shortages caused by the expiration of contracts during the planning period. Contracts were assumed to be renewed at the same level as when they expired.

Table B-3
Potential Water Supply Shortages from 2001 Regional Water Plans for Counties Partially or Entirely within the Brazos River Basin and Adjacent Coastal Basins [a]

Region	County Name	Potential Shortage					
		2000	2010	2020	2030	2040	2050
B	Archer	0	0	0	0	0	0
B	Baylor	0	0	0	0	0	0
B	King	0	0	0	0	0	0
B	Young	0	0	0	0	0	0
C	Freestone	267	9,070	11,088	11,158	15,377	15,408
C	Jack	0	0	0	0	0	0
C	Parker	4,623	14,181	17,720	27,378	32,999	36,609
F	Borden	3,813	3,808	3,802	3,795	3,795	3,804
F	Brown	138	325	5,035	5,720	5,659	5,582
F	Mitchell	30	457	1,364	2,439	3,721	5,263
F	Scurry	15	13	10	10	10	10
G	Bell	7,012	19,066	21,187	22,894	23,890	24,311
G	Bosque	1,782	7,465	7,617	7,768	7,948	8,339
G	Brazos	0	169	3,819	6,381	11,083	15,401
G	Burleson	0	0	0	0	0	0
G	Callahan	189	183	164	149	122	118
G	Comanche	13,938	14,493	13,981	13,475	12,973	12,477
G	Coryell	3,353	3,167	3,012	5,449	7,467	10,132
G	Eastland	7,202	7,172	7,145	7,121	7,096	7,068
G	Erath	598	930	1,237	1,538	1,750	1,899
G	Falls	0	0	0	0	0	0
G	Fisher	0	0	0	0	0	0
G	Grimes	0	3,279	3,279	3,279	3,279	3,279
G	Hamilton	0	0	0	0	0	0
G	Haskell	45	933	1,674	1,731	1,788	1,859
G	Hill	21	37	47	56	70	84
G	Hood	0	1,025	2,508	2,944	3,408	3,910
G	Johnson	7,585	8,575	9,287	11,249	14,032	17,962
G	Jones	1,043	1,192	4,994	5,011	5,057	5,114
G	Kent	0	0	0	0	0	0
G	Knox	4,484	3,691	2,936	2,199	1,480	779
G	Lampasas	180	214	426	802	1,257	1,814
G	Lee	109	183	253	337	426	542
G	Limestone	1,020	1,202	1,357	1,533	1,718	1,933
G	McLennan	8,485	9,116	9,593	10,747	11,319	12,077
G	Milam	0	0	3,498	3,498	3,498	7,028
G	Nolan	769	748	777	852	891	924
G	Palo Pinto	47	67	76	86	101	118
G	Robertson	0	0	0	67	165	290
G	Shackelford	582	550	533	512	502	507
G	Somervell	306	539	764	1,034	1,349	1,720
G	Stephens	360	353	347	342	335	329
G	Stonewall	0	0	0	0	0	0
G	Taylor	1,958	2,086	2,280	5,049	7,897	9,922
G	Throckmorton	266	251	229	208	191	183
G	Washington	0	0	0	0	0	0
G	Williamson	2,180	9,632	26,613	38,191	48,688	59,657
G	Young	471	478	483	488	508	534
H	Austin	0	0	0	0	0	0
H	Brazoria	30,781	67,639	72,558	85,290	111,108	141,412

Table B-3 (continued)

Region	County Name	Potential Shortage					
		2000	2010	2020	2030	2040	2050
H	Fort Bend	16,277	24,007	38,759	62,275	89,569	118,906
H	Galveston	1,550	3,425	5,297	11,504	21,332	31,675
H	Harris	8,709	88,589	234,045	283,392	347,385	391,779
H	Leon	0	0	0	0	0	0
H	Madison	0	0	0	0	0	0
H	Waller	1,515	2,736	5,643	9,756	11,713	14,309
K	Bastrop	0	0	0	0	1	11
K	Burnet	0	0	0	0	0	0
K	Colorado	30,494	28,335	26,431	24,592	22,811	21,082
K	Fayette	0	0	0	0	0	0
K	Matagorda	82,262	76,587	73,529	70,584	67,763	65,039
K	Mills	117	101	88	89	85	88
K	Travis	291	793	1,476	2,358	2,916	26,552
K	Wharton	74,714	69,911	66,108	62,441	58,905	55,495
K	Williamson	0	0	0	0	0	391
O	Bailey	7,278	6,463	5,350	4,014	2,431	925
O	Castro	39,262	39,143	38,621	37,593	36,449	35,108
O	Cochran	13,181	12,046	10,948	9,868	8,836	7,856
O	Crosby	179	107	48	0	0	0
O	Dawson	0	0	0	0	0	0
O	Dickens	0	0	0	0	0	0
O	Floyd	23,567	23,949	24,088	23,855	23,576	23,200
O	Garza	570	90	0	0	0	0
O	Hale	0	0	2,052	5,941	8,666	11,831
O	Hockley	4,272	258	711	716	708	710
O	Lamb	0	0	918	1,371	1,368	1,381
O	Lubbock	0	0	1,358	1,504	1,549	1,623
O	Lynn	0	0	0	46	43	42
O	Parmer	34,176	42,245	49,404	56,597	62,026	66,840
O	Swisher	45,350	45,145	42,544	44,533	44,228	43,921
O	Terry	1,855	1,772	1,690	1,615	1,542	1,406
	Total	489,271	657,991	870,802	1,005,424	1,166,859	1,338,567

a Does not include irrigation shortages outside of the Brazos River Basin and adjacent coastal basins.

Table B-4
Potential Municipal Shortages from 2001 Regional Water Plans for Counties Partially or Entirely within the Brazos River Basin and Adjacent Coastal Basins

Region	County Name	Potential Shortage					
		2000	2010	2020	2030	2040	2050
B	Archer	0	0	0	0	0	0
B	Baylor	0	0	0	0	0	0
B	King	0	0	0	0	0	0
C	Freestone	267	274	292	362	389	420
C	Jack	0	0	0	0	0	0
C	Parker	3,063	6,596	9,782	15,068	18,290	21,474
F	Borden	0	0	0	0	0	0
F	Brown	138	325	5,035	5,719	5,658	5,581
F	Mitchell	0	0	0	0	0	0
F	Scurry	5	3	0	0	0	0
G	Bell	3,277	3,531	3,972	4,379	4,615	4,716
G	Bosque	1,349	1,309	1,321	1,328	1,362	1,601
G	Brazos	0	169	3,819	6,381	11,083	15,401
G	Burleson	0	0	0	0	0	0
G	Callahan	189	183	164	149	122	118
G	Comanche	0	0	0	0	0	0
G	Coryell	3,344	3,156	2,999	5,434	7,451	10,115
G	Eastland	316	268	225	185	149	119
G	Erath	598	930	1,237	1,538	1,750	1,899
G	Falls	0	0	0	0	0	0
G	Fisher	0	0	0	0	0	0
G	Grimes	0	0	0	0	0	0
G	Hamilton	0	0	0	0	0	0
G	Haskell	45	0	23	22	21	34
G	Hill	0	0	0	0	0	0
G	Hood	0	1,025	2,508	2,944	3,408	3,910
G	Johnson	6,679	7,591	8,133	9,881	12,420	16,078
G	Jones	712	839	801	807	824	854
G	Kent	0	0	0	0	0	0
G	Knox	19	0	0	0	0	0
G	Lampasas	89	116	322	694	1,139	1,686
G	Lee	109	183	253	337	426	542
G	Limestone	569	655	702	756	807	874
G	McLennan	4,664	4,765	4,691	5,292	5,197	5,138
G	Milam	0	0	0	0	0	30
G	Nolan	161	155	139	155	126	89
G	Palo Pinto	0	0	0	0	0	0
G	Robertson	0	0	0	67	165	290
G	Shackelford	0	0	0	0	0	0
G	Somervell	256	526	764	1,034	1,349	1,714
G	Stephens	0	0	0	0	0	0
G	Stonewall	0	0	0	0	0	0
G	Taylor	402	409	462	3,090	5,750	7,576
G	Throckmorton	266	251	229	208	191	183

Table B-4 (continued)

Region	County Name	Potential Shortage					
		2000	2010	2020	2030	2040	2050
G	Washington	0	0	0	0	0	0
G	Williamson	713	8,179	25,127	36,648	47,086	57,994
G	Young	0	0	0	0	0	0
H	Austin	0	0	0	0	0	0
H	Brazoria	0	1,414	2,997	6,047	10,037	14,942
H	Fort Bend	0	5,822	18,825	40,902	65,606	92,036
H	Galveston	1,550	3,425	5,297	7,880	9,119	10,859
H	Harris	8,709	66,120	193,922	223,317	243,527	244,439
H	Leon	0	0	0	0	0	0
H	Madison	0	0	0	0	0	0
H	Waller	0	102	2,526	6,006	7,136	8,669
K	Bastrop	0	0	0	0	1	11
K	Burnet	0	0	0	0	0	0
K	Colorado	0	0	0	0	0	0
K	Fayette	0	0	0	0	0	0
K	Matagorda	0	0	0	0	0	0
K	Mills	117	101	88	89	85	88
K	Travis	291	793	1,476	2,358	2,916	26,552
K	Wharton	0	0	0	0	0	0
K	Williamson	0	0	0	0	0	391
O	Bailey	0	0	0	0	0	0
O	Castro	0	0	0	1,250	1,555	1,580
O	Cochran	0	0	673	750	738	727
O	Crosby	0	0	0	0	0	0
O	Dawson	0	0	0	0	0	0
O	Dickens	0	0	0	0	0	0
O	Floyd	0	0	0	190	157	140
O	Garza	0	0	0	0	0	0
O	Hale	0	0	403	406	797	789
O	Hockley	0	258	711	716	708	710
O	Lamb	0	0	918	1,371	1,368	1,381
O	Lubbock	0	0	1,358	1,504	1,549	1,623
O	Lynn	0	0	0	46	43	42
O	Parmer	0	0	874	1,965	2,040	2,140
O	Swisher	0	84	72	65	61	59
O	Terry	0	0	0	0	0	0
	Total	*37,896*	*119,556*	*303,140*	*397,340*	*477,221*	*565,615*

Table B-5
Potential Irrigation Shortages from 2001 Regional Water Plans for Counties Partially or Entirely within the Brazos River Basin and Adjacent Coastal Basins

Region	County Name	Potential Shortage					
		2000	2010	2020	2030	2040	2050
B	Archer	0	0	0	0	0	0
B	Baylor	0	0	0	0	0	0
B	King	0	0	0	0	0	0
C	Freestone	0	0	0	0	0	0
C	Jack	0	0	0	0	0	0
C	Parker	0	0	0	0	0	0
F	Borden	3,813	3,808	3,802	3,795	3,790	3,784
F	Brown	0	0	0	0	0	0
F	Mitchell	0	0	0	0	0	0
F	Scurry	0	0	0	0	0	0
G	Bell	0	0	0	0	0	0
G	Bosque	0	0	0	0	0	0
G	Brazos	0	0	0	0	0	0
G	Burleson	0	0	0	0	0	0
G	Callahan	0	0	0	0	0	0
G	Comanche	13,938	14,493	13,981	13,475	12,973	12,477
G	Coryell	0	0	0	0	0	0
G	Eastland	6,886	6,904	6,920	6,936	6,947	6,949
G	Erath	0	0	0	0	0	0
G	Falls	0	0	0	0	0	0
G	Fisher	0	0	0	0	0	0
G	Grimes	0	0	0	0	0	0
G	Hamilton	0	0	0	0	0	0
G	Haskell	0	0	0	0	0	0
G	Hill	0	0	0	0	0	0
G	Hood	0	0	0	0	0	0
G	Johnson	0	0	0	0	0	0
G	Jones	0	0	0	0	0	0
G	Kent	0	0	0	0	0	0
G	Knox	4,465	3,691	2,936	2,199	1,480	779
G	Lampasas	0	0	0	0	0	0
G	Lee	0	0	0	0	0	0
G	Limestone	0	0	0	0	0	0
G	McLennan	0	0	0	0	0	0
G	Milam	0	0	0	0	0	0
G	Nolan	0	0	0	0	0	0
G	Palo Pinto	0	0	0	0	0	0
G	Robertson	0	0	0	0	0	0
G	Shackelford	199	192	185	179	173	167
G	Somervell	0	0	0	0	0	0
G	Stephens	360	353	347	341	334	328
G	Stonewall	0	0	0	0	0	0
G	Taylor	0	0	0	0	0	0

Table B-5 (continued)

Region	County Name	Potential Shortage					
		2000	2010	2020	2030	2040	2050
G	Throckmorton	0	0	0	0	0	0
G	Washington	0	0	0	0	0	0
G	Williamson	0	0	0	0	0	0
G	Young	313	296	280	265	250	235
H	Austin	0	0	0	0	0	0
H	Brazoria	30,479	49,107	38,872	34,508	32,815	34,125
H	Fort Bend	0	0	0	0	101	632
H	Galveston	0	0	0	0	0	0
H	Harris	0	0	0	0	0	0
H	Leon	0	0	0	0	0	0
H	Madison	0	0	0	0	0	0
H	Waller	1,515	2,634	3,117	3,750	4,577	5,640
K	Bastrop	0	0	0	0	0	0
K	Burnet	0	0	0	0	0	0
K	Colorado	30,494	28,335	26,431	24,592	22,811	21,082
K	Fayette	0	0	0	0	0	0
K	Matagorda	82,262	76,587	73,529	70,584	67,763	65,038
K	Mills	0	0	0	0	0	0
K	Travis	0	0	0	0	0	0
K	Wharton	74,714	69,911	66,108	62,441	58,905	55,495
K	Williamson	0	0	0	0	0	0
O	Bailey	7,278	6,463	5,350	4,014	2,431	925
O	Castro	39,262	39,143	38,621	36,343	34,894	33,528
O	Cochran	13,181	12,046	10,275	9,118	8,098	7,129
O	Crosby	179	107	48	0	0	0
O	Dawson	0	0	0	0	0	0
O	Dickens	0	0	0	0	0	0
O	Floyd	23,567	23,949	24,088	23,665	23,419	23,060
O	Garza	570	90	0	0	0	0
O	Hale	0	0	1,649	5,535	7,869	11,042
O	Hockley	4,272	0	0	0	0	0
O	Lamb	0	0	0	0	0	0
O	Lubbock	0	0	0	0	0	0
O	Lynn	0	0	0	0	0	0
O	Parmer	34,176	42,245	48,530	54,632	59,986	64,700
O	Swisher	45,350	45,061	42,472	44,468	44,167	43,862
O	Terry	1,855	1,772	1,690	1,615	1,542	1,406
	Total	419,129	427,187	409,231	402,455	395,325	392,383

Table B-6
Potential Livestock Shortages from 2001 Regional Water Plans for Counties Partially or Entirely within the Brazos River Basin and Adjacent Coastal Basins

Region	County Name	Potential Shortage					
		2000	2010	2020	2030	2040	2050
B	Archer	0	0	0	0	0	0
B	Baylor	0	0	0	0	0	0
B	King	0	0	0	0	0	0
C	Freestone	0	0	0	0	0	0
C	Jack	0	0	0	0	0	0
C	Parker	0	0	0	0	0	0
F	Borden	0	0	0	0	0	0
F	Brown	0	0	0	0	0	0
F	Mitchell	0	0	0	0	0	0
F	Scurry	10	10	10	10	10	10
G	Bell	0	0	0	0	0	0
G	Bosque	0	0	0	0	0	0
G	Brazos	0	0	0	0	0	0
G	Burleson	0	0	0	0	0	0
G	Callahan	0	0	0	0	0	0
G	Comanche	0	0	0	0	0	0
G	Coryell	0	0	0	0	0	0
G	Eastland	0	0	0	0	0	0
G	Erath	0	0	0	0	0	0
G	Falls	0	0	0	0	0	0
G	Fisher	0	0	0	0	0	0
G	Grimes	0	0	0	0	0	0
G	Hamilton	0	0	0	0	0	0
G	Haskell	0	0	0	0	0	0
G	Hill	0	0	0	0	0	0
G	Hood	0	0	0	0	0	0
G	Johnson	0	0	0	0	0	0
G	Jones	0	0	0	0	0	0
G	Kent	0	0	0	0	0	0
G	Knox	0	0	0	0	0	0
G	Lampasas	0	0	0	0	0	0
G	Lee	0	0	0	0	0	0
G	Limestone	0	0	0	0	0	0
G	McLennan	0	0	0	0	0	0
G	Milam	0	0	0	0	0	0
G	Nolan	0	0	0	0	0	0
G	Palo Pinto	0	0	0	0	0	0
G	Robertson	0	0	0	0	0	0
G	Shackelford	0	0	0	0	0	0
G	Somervell	0	0	0	0	0	0
G	Stephens	0	0	0	0	0	0
G	Stonewall	0	0	0	0	0	0
G	Taylor	0	0	0	0	0	0

Table B-6 (continued)

Region	County Name	Potential Shortage					
		2000	2010	2020	2030	2040	2050
G	Throckmorton	0	0	0	0	0	0
G	Washington	0	0	0	0	0	0
G	Williamson	0	0	0	0	0	0
G	Young	0	0	0	0	0	0
H	Austin	0	0	0	0	0	0
H	Brazoria	0	0	0	0	0	0
H	Fort Bend	0	0	0	0	0	0
H	Galveston	0	0	0	0	0	0
H	Harris	0	0	0	0	0	0
H	Leon	0	0	0	0	0	0
H	Madison	0	0	0	0	0	0
H	Waller	0	0	0	0	0	0
K	Bastrop	0	0	0	0	0	0
K	Burnet	0	0	0	0	0	0
K	Colorado	0	0	0	0	0	0
K	Fayette	0	0	0	0	0	0
K	Matagorda	0	0	0	0	0	0
K	Mills	0	0	0	0	0	0
K	Travis	0	0	0	0	0	0
K	Wharton	0	0	0	0	0	0
K	Williamson	0	0	0	0	0	0
O	Bailey	0	0	0	0	0	0
O	Castro	0	0	0	0	0	0
O	Cochran	0	0	0	0	0	0
O	Crosby	0	0	0	0	0	0
O	Dawson	0	0	0	0	0	0
O	Dickens	0	0	0	0	0	0
O	Floyd	0	0	0	0	0	0
O	Garza	0	0	0	0	0	0
O	Hale	0	0	0	0	0	0
O	Hockley	0	0	0	0	0	0
O	Lamb	0	0	0	0	0	0
O	Lubbock	0	0	0	0	0	0
O	Lynn	0	0	0	0	0	0
O	Parmer	0	0	0	0	0	0
O	Swisher	0	0	0	0	0	0
O	Terry	0	0	0	0	0	0
	Total	*10*	*10*	*10*	*10*	*10*	*10*

Table B-7
Potential Manufacturing Shortages from 2001 Regional Water Plans for Counties Partially or Entirely within the Brazos River Basin and Adjacent Coastal Basins

Region	County Name	Potential Shortage					
		2000	2010	2020	2030	2040	2050
B	Archer	0	0	0	0	0	0
B	Baylor	0	0	0	0	0	0
B	King	0	0	0	0	0	0
C	Freestone	0	0	0	0	0	0
C	Jack	0	0	0	0	0	0
C	Parker	21	51	104	165	227	277
F	Borden	0	0	0	0	5	20
F	Brown	0	0	0	0	0	0
F	Mitchell	0	0	0	0	0	0
F	Scurry	0	0	0	0	0	0
G	Bell	3,735	4,335	6,015	7,315	8,075	8,395
G	Bosque	424	514	607	704	803	903
G	Brazos	0	0	0	0	0	0
G	Burleson	0	0	0	0	0	0
G	Callahan	0	0	0	0	0	0
G	Comanche	0	0	0	0	0	0
G	Coryell	9	11	13	15	16	17
G	Eastland	0	0	0	0	0	0
G	Erath	0	0	0	0	0	0
G	Falls	0	0	0	0	0	0
G	Fisher	0	0	0	0	0	0
G	Grimes	0	0	0	0	0	0
G	Hamilton	0	0	0	0	0	0
G	Haskell	0	0	0	0	0	0
G	Hill	21	37	47	56	70	84
G	Hood	0	0	0	0	0	0
G	Johnson	640	844	1,069	1,309	1,570	1,839
G	Jones	331	353	369	380	409	436
G	Kent	0	0	0	0	0	0
G	Knox	0	0	0	0	0	0
G	Lampasas	91	98	104	108	118	128
G	Lee	0	0	0	0	0	0
G	Limestone	451	547	655	777	911	1059
G	McLennan	3,071	3,518	3,950	4,384	4,932	5,617
G	Milam	0	0	0	0	0	0
G	Nolan	508	569	632	697	765	835
G	Palo Pinto	47	67	76	86	101	118
G	Robertson	0	0	0	0	0	0
G	Shackelford	0	0	0	0	0	0
G	Somervell	0	0	0	0	0	0
G	Stephens	0	0	0	1	1	1
G	Stonewall	0	0	0	0	0	0

Table B-7 (continued)

Region	County Name	Potential Shortage					
		2000	2010	2020	2030	2040	2050
G	Taylor	1,527	1,673	1,814	1,953	2,139	2,327
G	Throckmorton	0	0	0	0	0	0
G	Washington	0	0	0	0	0	0
G	Williamson	0	22	0	0	0	0
G	Young	158	182	203	223	258	299
H	Austin	0	0	0	0	0	0
H	Brazoria	0	16,853	30,454	44,521	68,042	91,332
H	Fort Bend	16,277	18,185	19,934	21,373	23,862	26,238
H	Galveston	0	0	0	3,625	12,214	20,816
H	Harris	0	22,082	39,739	59,692	103,475	146,956
H	Leon	0	0	0	0	0	0
H	Madison	0	0	0	0	0	0
H	Waller	0	0	0	0	0	0
K	Bastrop	0	0	0	0	0	0
K	Burnet	0	0	0	0	0	0
K	Colorado	0	0	0	0	0	0
K	Fayette	0	0	0	0	0	0
K	Matagorda	0	0	0	0	0	0
K	Mills	0	0	0	0	0	0
K	Travis	0	0	0	0	0	0
K	Wharton	0	0	0	0	0	0
K	Williamson	0	0	0	0	0	0
O	Bailey	0	0	0	0	0	0
O	Castro	0	0	0	0	0	0
O	Cochran	0	0	0	0	0	0
O	Crosby	0	0	0	0	0	0
O	Dawson	0	0	0	0	0	0
O	Dickens	0	0	0	0	0	0
O	Floyd	0	0	0	0	0	0
O	Garza	0	0	0	0	0	0
O	Hale	0	0	0	0	0	0
O	Hockley	0	0	0	0	0	0
O	Lamb	0	0	0	0	0	0
O	Lubbock	0	0	0	0	0	0
O	Lynn	0	0	0	0	0	0
O	Parmer	0	0	0	0	0	0
O	Swisher	0	0	0	0	0	0
O	Terry	0	0	0	0	0	0
	Total	*27,311*	*69,941*	*105,785*	*147,383*	*227,992*	*307,696*

Table B-8
Potential Mining Shortages from 2001 Regional Water Plans for Counties Partially or Entirely within the BrazosRiver Basin and Adjacent Coastal Basins

Region	County Name	Potential Shortage					
		2000	2010	2020	2030	2040	2050
B	Archer	0	0	0	0	0	0
B	Baylor	0	0	0	0	0	0
B	King	0	0	0	0	0	0
C	Freestone	0	0	0	0	0	0
C	Jack	0	0	0	0	0	0
C	Parker	1,539	1,738	2,025	2,322	2,645	3,008
F	Borden	0	0	0	0	0	0
F	Brown	0	0	0	1	1	1
F	Mitchell	0	0	0	0	0	0
F	Scurry	0	0	0	0	0	0
G	Bell	0	0	0	0	0	0
G	Bosque	9	42	89	136	183	235
G	Brazos	0	0	0	0	0	0
G	Burleson	0	0	0	0	0	0
G	Callahan	0	0	0	0	0	0
G	Comanche	0	0	0	0	0	0
G	Coryell	0	0	0	0	0	0
G	Eastland	0	0	0	0	0	0
G	Erath	0	0	0	0	0	0
G	Falls	0	0	0	0	0	0
G	Fisher	0	0	0	0	0	0
G	Grimes	0	0	0	0	0	0
G	Hamilton	0	0	0	0	0	0
G	Haskell	0	0	0	0	0	0
G	Hill	0	0	0	0	0	0
G	Hood	0	0	0	0	0	0
G	Johnson	266	140	85	59	42	45
G	Jones	0	0	0	0	0	0
G	Kent	0	0	0	0	0	0
G	Knox	0	0	0	0	0	0
G	Lampasas	0	0	0	0	0	0
G	Lee	0	0	0	0	0	0
G	Limestone	0	0	0	0	0	0
G	McLennan	750	833	952	1,071	1,190	1,322
G	Milam	0	0	0	0	0	0
G	Nolan	100	24	6	0	0	0
G	Palo Pinto	0	0	0	0	0	0
G	Robertson	0	0	0	0	0	0
G	Shackelford	383	358	348	333	329	340
G	Somervell	50	13	0	0	0	6
G	Stephens	0	0	0	0	0	0
G	Stonewall	0	0	0	0	0	0
G	Taylor	29	4	4	6	8	19

Table B-8 (cont.)

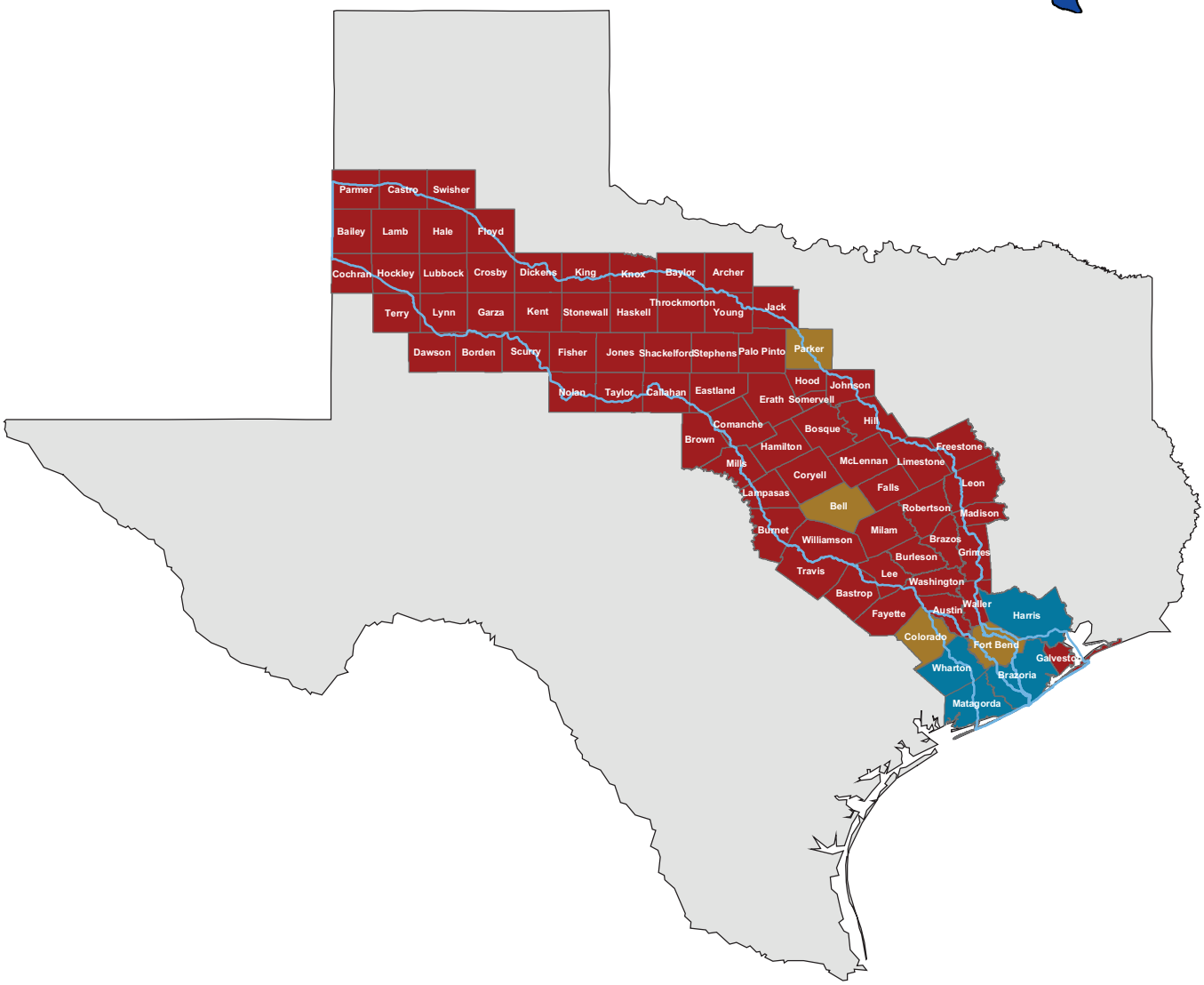
Region	County Name	Potential Shortage					
		2000	2010	2020	2030	2040	2050
G	Throckmorton	0	0	0	0	0	0
G	Washington	0	0	0	0	0	0
G	Williamson	1,467	1,431	1,486	1,543	1,602	1,663
G	Young	0	0	0	0	0	0
H	Austin	0	0	0	0	0	0
H	Brazoria	302	266	234	213	213	1,012
H	Fort Bend	0	0	0	0	0	0
H	Galveston	0	0	0	0	0	0
H	Harris	0	7	5	4	4	4
H	Leon	0	0	0	0	0	0
H	Madison	0	0	0	0	0	0
H	Waller	0	0	0	0	0	0
K	Bastrop	0	0	0	0	0	0
K	Burnet	0	0	0	0	0	0
K	Colorado	0	0	0	0	0	0
K	Fayette	0	0	0	0	0	0
K	Matagorda	0	0	0	0	0	0
K	Mills	0	0	0	0	0	0
K	Travis	0	0	0	0	0	0
K	Wharton	0	0	0	0	0	0
K	Williamson	0	0	0	0	0	0
O	Bailey	0	0	0	0	0	0
O	Castro	0	0	0	0	0	0
O	Cochran	0	0	0	0	0	0
O	Crosby	0	0	0	0	0	0
O	Dawson	0	0	0	0	0	0
O	Dickens	0	0	0	0	0	0
O	Floyd	0	0	0	0	0	0
O	Garza	0	0	0	0	0	0
O	Hale	0	0	0	0	0	0
O	Hockley	0	0	0	0	0	0
O	Lamb	0	0	0	0	0	0
O	Lubbock	0	0	0	0	0	0
O	Lynn	0	0	0	0	0	0
O	Parmer	0	0	0	0	0	0
O	Swisher	0	0	0	0	0	0
O	Terry	0	0	0	0	0	0
	Total	4,895	4,856	5,234	5,688	6,217	7,655

Table B-9
Potential Steam-Electric Shortages from 2001 Regional Water Plansfor Counties Partially or Entirely within the Brazos River Basin and Adjacent Coastal Basins

Region	County Name	Potential Shortage					
		2000	2010	2020	2030	2040	2050
B	Archer	0	0	0	0	0	0
B	Baylor	0	0	0	0	0	0
B	King	0	0	0	0	0	0
C	Freestone	0	8,796	10,796	10,796	14,988	14,988
C	Jack	0	0	0	0	0	0
C	Parker	0	5,796	5,809	9,823	11,837	11,850
F	Borden	0	0	0	0	0	0
F	Brown	0	0	0	0	0	0
F	Mitchell	30	457	1,364	2,439	3,721	5,263
F	Scurry	0	0	0	0	0	0
G	Bell	0	11,200	11,200	11,200	11,200	11,200
G	Bosque	0	5,600	5,600	5,600	5,600	5,600
G	Brazos	0	0	0	0	0	0
G	Burleson	0	0	0	0	0	0
G	Callahan	0	0	0	0	0	0
G	Comanche	0	0	0	0	0	0
G	Coryell	0	0	0	0	0	0
G	Eastland	0	0	0	0	0	0
G	Erath	0	0	0	0	0	0
G	Falls	0	0	0	0	0	0
G	Fisher	0	0	0	0	0	0
G	Grimes	0	3,279	3,279	3,279	3,279	3,279
G	Hamilton	0	0	0	0	0	0
G	Haskell	0	933	1,651	1,709	1,767	1,825
G	Hill	0	0	0	0	0	0
G	Hood	0	0	0	0	0	0
G	Johnson	0	0	0	0	0	0
G	Jones	0	0	3,824	3,824	3,824	3,824
G	Kent	0	0	0	0	0	0
G	Knox	0	0	0	0	0	0
G	Lampasas	0	0	0	0	0	0
G	Lee	0	0	0	0	0	0
G	Limestone	0	0	0	0	0	0
G	McLennan	0	0	0	0	0	0
G	Milam	0	0	3,498	3,498	3,498	6,998
G	Nolan	0	0	0	0	0	0
G	Palo Pinto	0	0	0	0	0	0
G	Robertson	0	0	0	0	0	0
G	Shackelford	0	0	0	0	0	0
G	Somervell	0	0	0	0	0	0
G	Stephens	0	0	0	0	0	0
G	Stonewall	0	0	0	0	0	0
G	Taylor	0	0	0	0	0	0

Table B-9 (continued)

Region	County Name	Potential Shortage					
		2000	2010	2020	2030	2040	2050
G	Throckmorton	0	0	0	0	0	0
G	Washington	0	0	0	0	0	0
G	Williamson	0	0	0	0	0	0
G	Young	0	0	0	0	0	0
H	Austin						
H	Brazoria						
H	Fort Bend	0	0	0	0	0	0
H	Galveston	0	0	0	0	0	0
H	Harris	0	380	380	380	380	380
H	Leon						
H	Madison						
H	Waller						
K	Bastrop	0	0	0	0	0	0
K	Burnet	0	0	0	0	0	0
K	Colorado	0	0	0	0	0	0
K	Fayette	0	0	0	0	0	0
K	Matagorda	0	0	0	0	0	0
K	Mills	0	0	0	0	0	0
K	Travis	0	0	0	0	0	0
K	Wharton	0	0	0	0	0	0
K	Williamson	0	0	0	0	0	0
O	Bailey	0	0	0	0	0	0
O	Castro	0	0	0	0	0	0
O	Cochran	0	0	0	0	0	0
O	Crosby	0	0	0	0	0	0
O	Dawson	0	0	0	0	0	0
O	Dickens	0	0	0	0	0	0
O	Floyd	0	0	0	0	0	0
O	Garza	0	0	0	0	0	0
O	Hale	0	0	0	0	0	0
O	Hockley	0	0	0	0	0	0
O	Lamb	0	0	0	0	0	0
O	Lubbock	0	0	0	0	0	0
O	Lynn	0	0	0	0	0	0
O	Parmer	0	0	0	0	0	0
O	Swisher	0	0	0	0	0	0
O	Terry	0	0	0	0	0	0
	Total	30	36,441	47,401	52,548	60,094	65,207



Legend

Potential Shortages Year 2010 (Acre Feet per Year)

- 0 - 10,000
- 10,001 - 35,000
- 35,001 - 65,000
- 65,001 - 140,000
- 140,001 - 400,000
- Basin Boundaries

0 50 100 200 Miles

Freese and Nichols
4055 International Plaza, Suite 200
Fort Worth, TX 76109 - 4895
Phone - (817) 735 - 7300

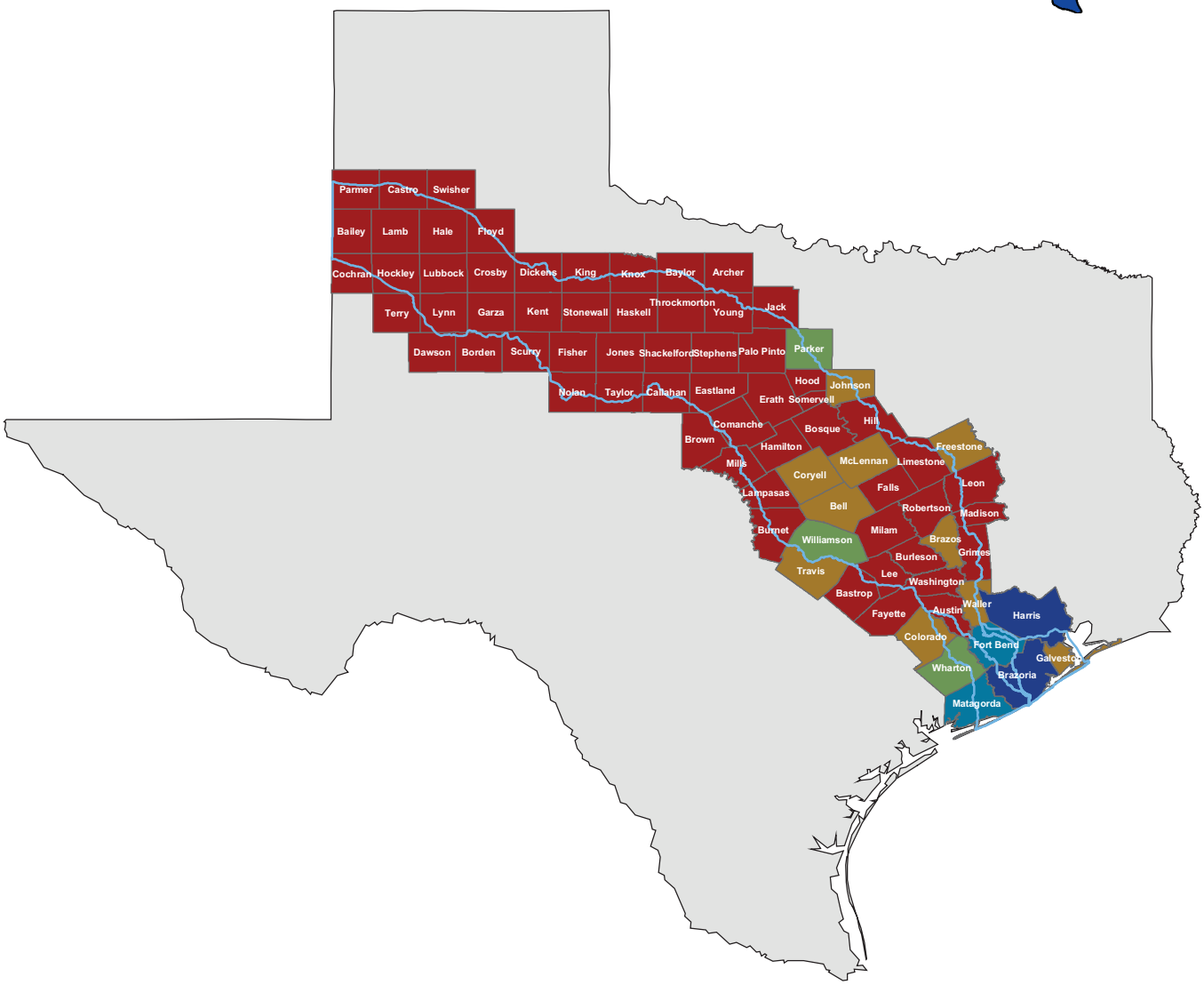
N W E S

Brazos River Authority
System Operation Permit

Water Shortages in Counties All or Partially Within Brazos River and Adjacent Coastal Basins

FN JOB NO	BRA03108
FILE	H:/BRA_water_shortages_B-1.mxd
DATE	April 15, 2004
SCALE	1:8,200,000
DESIGNED	JSA
DRAFTED	REC

FIGURE B-1



Legend

Potential Shortages Year 2050 (Acre Feet per Year)

- 0 - 10,000
- 10,001 - 35,000
- 35,001 - 65,000
- 65,001 - 140,000
- 140,001 - 400,000
- Basin Boundaries

0 50 100 200 Miles

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N W E S

Brazos River Authority
System Operation Permit

Water Shortages in Counties All or Partially Within Brazos River and Adjacent Coastal Basins

FN JOB NO	BRA03108
FILE	H:/BRA_water_shortages_B-2.mxd
DATE	April 15, 2004
SCALE	1:8,200,000
DESIGNED	JSA
DRAFTED	REC

FIGURE B-2

Appendix C
Modeling Approach

Appendix C
Modeling Approach

The system operation model is based on an updated version of the Brazos WAM received from TCEQ on March 25, 2004. In order to minimize the impact of system operation on other water rights, the system operation model uses a special modeling technique that prevents any Authority water right from depleting more water at its original priority date than it would have in the base run. Depletions for system operation are only made after every other water right in the basin has diverted and filled storage.

The reason for the special modeling technique is best illustrated by an example. Assume a particular water right has a constant demand of 1,000 acre-feet per month, a 1950 priority, and a large amount of storage. In a particular month there is only 500 acre-feet of available flow to meet that demand, so the remaining 500 acre-feet must be met from storage. In the next month there is 2,000 acre-feet of available flow, which is enough water to meet the 1,000 acre-feet of diversion and refill the 500 acre-feet of storage emptied the previous month at the 1950 priority, but not enough to satisfy all junior water rights. Now assume that an additional demand of 250 acre-feet per month with a priority date junior to all other water rights is added at the same location. In the first month, the water right depletes the same 500 acre-feet of flow but now uses 750 acre-feet from storage. The next month the reservoir refills at its 1950 priority, now depleting 1,750 acre-feet instead of 1,500 acre-feet at the 1950 priority. This leaves only 250 acre-feet for junior water rights rather than 500 acre-feet, causing increased shortages.

The base model scenario used to generate depletions for modeling with return flows also includes return flows. This gives Authority water rights access to return flows in priority order, the same as other existing water rights. More information on return flows may be found in Appendix D.

The base model also uses the 'second pass' option for all instream flow requirements and excludes releases from instream flow calculations for Hale Clause rights.

System operation at the Gulf of Mexico and at Glen Rose and Highbank has somewhat different logic, as does system operation when generating firm or interruptible yield. Each of these situations is discussed separately below.

System Operation for Firm Yield

System Operation at the Gulf of Mexico

System operation at the Gulf of Mexico is implemented using the following steps:

1. Water right records for Authority water rights are removed from the model. A new set of water right records is added for each Authority diversion, reservoir and system diversion point.
2. Month-by-month depletions by Authority water rights are extracted from the base model and entered as TS (Target Series) records in the system model. These TS records are used in the system operation model as a substitute for the annual diversion amount usually entered into a water right record. Depletions include water used to meet demands and refill storage.
3. The TS records are associated with water rights that make depletions at the same priority dates as the Authority's water rights. Therefore, each Authority water right depletes no more at its priority date than in the base run. Rather than being used to meet diversion targets and refill storage, these depletions are stored in 'dummy' control points for later use in system operation.
4. All other water rights divert in priority order.
5. Once all other rights have diverted, Authority reservoirs are refilled with Authority water reserved in the dummy control points.
6. Any remaining water in the dummy control points is returned to the river at the original point of diversion.
7. Empty storage in Authority reservoirs is refilled with unappropriated flows.
8. System operation water is diverted at the Gulf of Mexico control point using unappropriated flows backed up by storage in all Authority reservoirs (except Lake Alan Henry, which is not included in system operation).
9. Authority reservoirs are refilled with any remaining unappropriated flows.

System Operation at Highbank and Glen Rose

For system operation at one of the upstream diversion points (Highbank or Glen Rose), steps 1 through 4 are identical. The actual system operation follows somewhat different logic in order to maximize diversions at the primary diversion point. For these runs, the Highbank or Glen Rose control point is referred to as the primary diversion point. The Gulf of Mexico is the secondary diversion point.

1. Water right records for Authority water rights are removed from the model. A new set of water right records is added for each Authority diversion, reservoir and system diversion point.

2. Month-by-month depletions by Authority water rights are extracted from the base model and entered as TS (Target Series) records in the system model. These TS records are used in the system operation model as a substitute for the annual diversion amount usually entered into a water right record. Depletions include water used to meet demands and refill storage.
3. The TS records are associated with water rights that make depletions at the same priority dates as the Authority's water rights. Therefore, each Authority water right depletes no more at its priority date than in the base run. Rather than being used to meet diversion targets and refill storage, these depletions are stored in 'dummy' control points for later use in system operation.
4. All other water rights divert in priority order.
5. Authority water is returned from dummy control points located downstream of the primary diversion point (either Highbank or Glen Rose). This helps meet downstream in-stream flow requirements and helps maximize yield at the primary diversion point.
6. Authority reservoirs upstream of the primary diversion point are refilled with Authority water from the dummy control points and any remaining unappropriated flows.
7. System operation water is diverted at the primary diversion point using unappropriated flows backed up by storage in all Authority reservoirs upstream of the primary diversion point.
8. Authority reservoirs upstream of the primary diversion point are filled with any remaining water in the dummy control points.
9. Any water remaining in the dummy control points is returned to the river.
10. Authority reservoirs downstream of the primary diversion point are refilled with unappropriated flows (including any flows returned from the upstream dummy control points).
11. System operation water is diverted at the secondary diversion point (Gulf of Mexico) using unappropriated flows backed up by storage inall Authority reservoirs below the primary diversion point.
12. All Authority reservoirs are refilled with any remaining unappropriated flows.

Special Considerations

Allens Creek Reservoir, Lake Whitney ,Lake Belton and Lake Alan Henry were given special consideration in the system modeling.

Allens Creek Reservoir was not modeled in system operation using the TS cards. Allens Creek Reservoir is an off-channel reservoir with a maximum annual diversion of 202,000 acre-feet per year from the Brazos River to fill the reservoir. The water right cards in the base run for Allens Creek Reservoir were retained to prevent too much water from

being diverted from the Brazos River. Allens Creek Reservoir is one of the most junior water rights in the basin with a priority date of September 1, 1999. Therefore, there is little impact on other water rights using this technique.

In Lake Whitney, the Authority is authorized to impound 50,000 acre-feet in the hydropower pool of the reservoir. The hydropower pool is between elevations 520 feet (387,024 acre-feet of storage) and 533 feet (642,179 acre-feet of storage). In the Brazos WAM, it is assumed that the storage between 387,024 acre-feet and 437,024 acre-feet is filled at the 1982 priority. The remaining storage up to 642,179 acre-feet is filled on a non-priority basis. The system model treats the reservoir in a similar fashion. The reservoir is refilled only to 437,024 acre-feet with reserved Authority water from the dummy control point. The final refilling of the reservoirs, which is the last step in the process, refills storage to 642,179 acre-feet.

Lake Belton is given a reserve content of 5,000 acre-feet to prevent shortages for Fort Hood's water right CA 5160.

Lake Alan Henry is not considered part of the system in the system model. This reservoir is located far upstream from the other reservoirs and there are considerable losses between the reservoir and Possum Kingdom Lake.

System Operation for Interruptible Yield

There are insufficient unappropriated flows to develop interruptible yield without impacting the yield of the Authority system. Therefore, a portion of the yield of the Authority system has been set aside to generate interruptible yield using the '75-75' criterion. The 75-75 criterion requires that 75% of the diversion be available in 75% of the years in the simulation.

The Authority elected to dedicate up to 90,000 acre-feet per year of the yield of the system at the Gulf of Mexico to generate interruptible supplies. The same technique used to determine firm system yields was used in determining interruptible supplies to minimize impact on other water rights.

Interruptible yield was determined using the following steps:

1. The firm yield at the primary diversion point is set to the firm yield less 90,000 acre-feet per year.
2. Another set of water right cards is added for the interruptible diversion. This water right ceases diverting when storage in the Authority system falls below a specified level.
3. The level at which interruptible diversions are curtailed and the amount of interruptible diversion is determined iteratively until all storage in the system is utilized and the interruptible diversion matches the 75-75 criterion.
4. Demand at the secondary control point (if used) is set to the firm yield at that point.

Appendix D
Return Flows

Appendix D
Return Flows

There are three potential approaches for modeling return flows using the WRAP model:

- A percentage of a diversion returned at the same priority date as the diversion,
- A percentage of a diversion returned at the beginning of the next month in the simulation, or
- A constant inflow at the beginning of each month in the simulation.

These options are discussed in detail below.

On average only about 40% of the water treated for municipal use is actually consumed, with the remainder discharged as 'return flow'. The actual percentage varies seasonally and geographically. For example, the percentage of water returned is typically lower during summer because of landscape irrigation. On the other hand, the percentage of water returned tends to be higher in the eastern areas of the state because less water is used for landscape irrigation and there is higher inflow and infiltration (water that unintentionally enters the wastewater stream) due to greater rainfall. In the Brazos WAM, a series of monthly factors was developed and used to calculate returns associated with a particular diversion.

When using the percentage method, returns are based on water availability. If a diversion experiences a shortage, there is a corresponding decrease in returns associated with that diversion. This method is most appropriate for reliable water rights that are associated with a single return flow location.

In the WRAP model, return flows can be either returned at the same priority date as the diversion or returned at the beginning of the next month. If water is returned at the same priority date as the diversion, return flows are not available for appropriation by water rights senior to the diversion that created the return flow. This tends to increase the reliability of water rights junior to the diversion. This approach also tends to increase unappropriated flow because it denies senior water rights access to return flows. Returning flows at the same priority date is probably the least realistic method of modeling return flows.

If water is returned the next month, return flows are available to all downstream water rights in priority order. This tends to assign most of the benefit of return flows to senior water rights. On the other hand, giving all water rights access to return flows tends to decrease the amount of unappropriated flow in the system. The Brazos WAM assumed that return flows

occurred in the next month. This approach is consistent with the assumption that return flows become unappropriated water once they mingle with the waters of the state.

Another way to model return flows in WRAP is to enter them as monthly 'constant inflows', entered on CI cards. These flows are added to the naturalized flows at the beginning of each month. Returns modeled in this manner are not associated with a particular diversion and will not be impacted by water availability. If a water right experiences a shortage, the associated return flows will not be diminished. The advantages of this technique are:

- It is more realistic in cases where an unreliable supply is backed up by groundwater or other surface supplies.
- It is easier to change return flow levels to match estimated returns at a particular demand scenario (say 2060 demands).
- It is easier to model return flows associated with multiple water rights, water rights associated with multiple return flows, and other complex situations.

The disadvantages of this technique are:

- Return flows are not directly associated with a particular water right.
- It is different than the approach used in the Brazos WAM.

For this study, the constant inflow technique was selected because it is easier to implement return flow scenarios and model the complex return flows from Lakes Belton and Stillhouse Hollow.

Development of Return Flow Data

Return flows were developed for current and 2060 conditions. Current return flows were based upon the minimum annual return flows between 1998 and 2002 whenever data are available. With a few exceptions, when recent data were not available or incomplete, we used the minimum returns between 1993 and 2002. Because finalized 2060 water use projections are not available at this time, annual 2060 return flows were developed from per capita return flow data multiplied by 2060 population projections developed for the 2006 Regional Water Plans by the Texas Water Development Board.

Returns from groundwater and surface water sources are entered separately to be consistent with the TCEQ WAM program. In cases where a specific discharge includes both groundwater and surface water sources, an estimate was made of the amount of returns from

groundwater. If more recent data (after 1997) were not available we retained the groundwater return flows used in the Brazos WAM as current condition return flows, unless errors were identified in the original calculations. (Note that groundwater return flows were developed based on the minimum monthly returns between 1988 and 1997 rather than minimum annual returns.) If more recent data were available, current groundwater return flows were adjusted if flows have increased by more than 100 acre-feet per year since the development of the Brazos WAM. Table D-1 is a summary of the changes made to current groundwater dischargers.

The 2002 Region G and Region H water plans were reviewed for the 2060 projections and several groundwater only return flows were identified for users that will be developing surface water sources. Table D-2 is a summary of these changes. No surface dischargers who will be developing groundwater sources were identified in the regional plans.

The annual return flows need to be distributed for each month for entry into the WRAP model. For surface water returns, annual return flows were multiplied by monthly distribution factors for return flows developed for the Brazos WAM to generate monthly constant inflow factors. However, new return factors for large and small communities that receive water from Lakes Belton and Stillhouse Hollow were developed for this project. Groundwater returns were distributed based on monthly data developed for the Brazos WAM. In some cases, these patterns were adjusted to prevent zero returns. For some smaller dischargers that use both groundwater and surface water, the amount of surface water returned was adjusted to prevent negative discharges of surface water.

According to Special Condition B of CA 2938, the City of Temple must return water to the City's sewage treatment plant. For the 2060 projections, we assumed that 55% of the 15,804 acre-feet per year of water diverted under Temple's own water is returned to the City's treatment plant. The remaining water is assumed to be from an Authority contract and is returned to Authority's Temple-Belton Regional Sewerage System.

It was assumed that the SWATS plant would have a capacity of 25 mgd in 2060. Annual returns were assumed to be 20% of the average water use from the plant of 10 mgd (2.5 peaking factor).

Table D-1
Proposed Changes to Current Groundwater Return Flows
(Values in Acre-Feet per Year)

Facility	County	Permit Number	Brazos WAM Ground-water Return Flows	Proposed Ground-water Return Flows	Remarks
Brushy Creek MUD	Williamson	11865.001	232	335	
Authority/LCRA BCRWSS West	Williamson	10264.001	783	1,657	East facility no longer in operation. Returns moved to BCRWSS West
Authority/LCRA BCRWSS East	Williamson	10264.002	874	0	
City of Holland	Bell	10897.001	0	14	Correction to Brazos WAM
City of Troy	Bell	11263.001	0	17	Correction to Brazos WAM
City of Navasota	Grimes	10231.001	583	762	
City of College Station	Brazos	10024.006	5,694	6,108	Increase of returns due to growth
City of Bryan	Brazos	10426.001	4,052	4,998	Increase of returns due to growth
City of Bryan	Brazos	10426.002	1,607	1,866	
City of Bryan	Brazos	10426.003	307	391	
Texas A&M University	Brazos	10968.003	1,415	1,946	Increase of returns due to growth
Texas A&M University	Brazos	2585.001	230	1,176	
City of Richmond	Fort Bend	10258.001	679	652	Decrease in recent years
City of Richmond	Fort Bend	10258.003	1,269	800	Decrease in recent years
City of Rosenberg	Fort Bend	10607.003	928	1,362	Increase of returns due to growth
City of Rosenberg	Fort Bend	10607.002	1,089	1,453	
Authority SLRSS	Fort Bend	11317.001	3,218	4,135	Increase of returns due to growth
City of Sugarland	Fort Bend	12833.002	2,194	4,349	Increase of returns due to growth
City of Sugarland	Fort Bend	12833.003	6,158	0	Correction to Brazos WAM. Same facility as SLRSS
Texas Dept. of Criminal Justice – Central	Fort Bend	10986.001	129	230	Increase in recent years
Fort Bend MUD 106	Fort Bend	13355.001	117	539	Increase of returns due to growth
Fort Bend MUD 112	Fort Bend	13628.001	14	844	Increase of returns due to growth
Plantation MUD	Fort Bend	11971.001	206	310	Increase of returns due to growth
Texas Dept. of Criminal Justice - Jester I	Fort Bend	11475.001	120	221	Increase in recent years
City of Lake Jackson	Brazoria	10047.001	327	471	Increase of returns due to growth
City of West Columbia	Brazoria	10312.001	711	1,143	Increase of returns due to growth
Authority CRWTF	Brazoria	10044.001	0	48	Correction to Brazos WAM
City of Angleton	Brazoria	10548.001	0	42	Correction to Brazos WAM
Fort Bend MUD 041	Fort Bend	12475.001	28	175	Increase of returns due to growth

Table D-2
New Surface Water Return Flows in 2060
(Values in Acre-Feet per Year)

Facility	County	Permit Number	Description
City of Godley	Johnson	10542.001	Water from SWATS facility
City of Glen Rose	Somervell	10177.001	Development of off-channel reservoir
City of Meridian	Bosque	10113.002	Development of off-channel reservoir
City of Stephenville	Erath	10290.001	Water from Lake Proctor
City of Valley Mills	Bosque	10307.001	
City of West	McLennan	10544.001	Water from Waco
City of Florence	Williamson	10944.001	
Brushy Creek MUD	Williamson	11865.001	
City of Richmond	Fort Bend	10258.001	Surface water from Authority
City of Richmond	Fort Bend	10258.003	
City of Rosenberg	Fort Bend	10607.003	Surface water from Authority
City of Rosenberg	Fort Bend	10607.002	
Brookshire MWD	Waller	10001.001	Surface water from Authority
City of Hempstead	Waller	10948.001	
Authority SLRSS	Fort Bend	11317.001	Surface water from Gulf Coast Water Authority
City of Sugar Land	Fort Bend	12833.002	
Plantation MUD	Fort Bend	11971.001	Assumed to be similar to Sugar Land
Fort Bend MUD 106	Fort Bend	13355.001	Assumed to be similar to Sugar Land
Pecan Grove MUD	Fort Bend	11655.001	Assumed to be similar to Richmond/Rosenberg
Fort Bend MUD 025	Fort Bend	12003.001	Assumed to be similar to Sugar Land
Fort Bend MUD 041	Fort Bend	12475.001	Assumed to be similar to Sugar Land

Adjustments were made to return flows to account for known direct reuse projects. Currently, the City of Cleburne is able to reuse up to 2 mgd of its return flows. For 2060 projections, it was assumed that the City would increase direct reuse, returning about 1,000 acre-feet of water. The Authority provided information on future reuse levels in Williamson County. It was assumed that 27,642 acre-feet per year of direct reuse will occur from the Brushy Creek Regional Wastewater System. A total of 3,171 acre-feet of direct reuse was assumed for the Cities of Georgetown, Cedar Park, and Leander and the Brushy Creek MUD and Blockhouse MUD. The reuse was divided among the plants based on their discharge.

In most cases, return flows above Possum Kingdom Lake were ignored. The majority of these return flows are small, and it is reasonable to assume that a significant level of reuse will occur in the upper basin. Much of these return flows would be lost before reaching Possum Kingdom Lake as well. Return flows for Abilene, Breckenridge and Graham were included in the Attachments because of the volume of return flow or their proximity to Possum Kingdom Lake.

A detailed list of return flow locations and a comparison of current and 2060 return flows may be found in Table D-3. Table D-4 contains historical data and calculations of current return flows. Table D-5 contains historical and projected population data used to calculate 2060 return flows. Table D-6 contains the actual monthly data used for input into the WRAP model for both current and 2060 conditions.

Table D-3
Comparison of Current to 2060 Return Flows

Name	County	Permit Number	NPDES Number	Permitted Discharge (mgd)	Return Control Point	Primary Control Point	Current BRA Source	Percent of SW from BRA	Future BRA Source	Percent of SW from BRA	Current Surface Water Returns (ac-ft/yr)	Current Ground-water Returns (ac-ft/yr)	Total Current Returns (ac-ft/yr)	2060 Surface Water Returns (ac-ft/yr)	2060 Ground-water Returns (ac-ft/yr)	Total 2060 Returns (ac-ft/yr)	Surface Water Increase (Decrease)	Ground-water Increase (Decrease)	Total Increase (Decrease)	Current Returns from BRA Sources	2060 Returns from BRA Sources	Comments
City of Abilene	Jones	10334.004		22.0	103341	CFFG18			Possum Kingdom	10%	12,739	0	12,739	14,460	0	14,460	1,721	0	1,721	0	1,446	
City of Breckenridge	Stephens	10040.001	TX0023213	0.95	100401	CFEL22			Possum Kingdom	10%	498	0	498	484	0	484	(14)	0	(14)	0	48	2060 population less than 2000
City of Graham	Young	10487.001	TX0024635	2.1	104871	SHGR26			Possum Kingdom	10%	1,088	0	1,088	1,067	0	1,067	(21)	0	(21)	0	107	2060 population less than 2000
Double Diamond	Palo Pinto	2789.001	TX0099015	???	027891	BRPP27	Possum Kingdom	100%	Possum Kingdom	100%	30	0	30	30	0	30	0	0	0	30	30	
City of Ranger	Palo Pinto	11557.001	TX0071064	0.43	401401	PPSA28					213	0	213	131	0	131	(82)	0	(82)	0	0	2060 population less than 2000
City of Mineral Wells	Parker	10585.004		1.26	105851	BRDE29					413	0	413	520	0	520	107	0	107	0	0	
City of Mineral Wells	Palo Pinto	10585.001	TX0047414	2.35	105852	BRDE29					713	0	713	971	0	971	258	0	258	0	0	
City of Granbury	Hood	10178.002	TX0105210	2	101782	BRGR30	Granbury System	100%	Granbury System	100%	650	170	820	1,966	170	2,136	1,316	0	1,316	650	1,966	
Authority SWATS	**Hood**	**2889.000**	**TX0102598**	**0.39**	**515651**	**BRGR30**	**Granbury System**	**100%**	**Granbury System**	**100%**	**419**	**0**	**419**	**2,242**	**0**	**2,242**	**1,823**	**0**	**1,823**	**419**	**2,242**	
Acton MUD	Hood	11208.001	TX0105163	0.37	515651	BRGR30	Granbury System	100%	Granbury System	100%	15	110	125	1,726	110	1,836	1,711	0	1,711	15	1,726	Return flow low for current population. Data sparse. Assuming all of Acton MUD population will be connected by 2060 with a standard per capita rate.
Acton MUD	Hood	11415.001	TX0105155	0.39	407601	BRGR30	Granbury System	100%	Granbury System	100%	11	86	97	1,849	86	1,935	1,838	0	1,838	11	1,849	
City of Cleburne	Johnson	10006.001	TX0047155	6.25	100061	NRBL32	Lake Aquilla	10%	Aquilla, Whitney System	50%	374	0	374	1,000	0	1,000	626	0	626	37	500	
City of Godley	Johnson	10542.001	TX0104558	0.12	410501	NRBL32			Granbury System	100%	0	34	34	35	296	331	35	262	297	0	35	
City of Glen Rose	Somervell	10177.001	TX0033316	0.6	409631	BRAQ33					0	177	177	107	136	243	107	(41)	66	0	0	
City of Whitney	Hill	11408.002	TX0106551	0.4	515731	BRAQ33					0	116	116	0	246	246	0	130	130	0	0	Has a BRA contract, but assuming all groundwater use in future
City of Itasca	Hill	10423.001	TX0023892	0.378	106301	AQAQ34					0	104	104	0	147	147	0	43	43	0	0	
City of Hillsboro	Hill	10630.001	TX0023108	1.36	106301	AQAQ34	Lake Aquilla	100%	Lake Aquilla	100%	1,012	0	1,012	1,372	0	1,372	360	0	360	1,012	1,372	
City of Stephenville	Erath	10290.001	TX0024228	3	102902	NBHI35			Lake Proctor	100%	0	1,313	1,313	1,493	1,118	2,611	1,493	(195)	1,298	0	1,493	
City of Hico	Hamilton	10188.001	TX0026590	0.2	NBHI35	NBHI35					0	56	56	0	93	93	0	37	37	0	0	
City of Meridian	Bosque	10113.002	TX0053678	0.45	228202	NBCL37					0	93	93	205	88	293	205	(5)	200	0	0	
City of Clifton	Bosque	10043.001	TX0033936	0.65	555151	NBCL37					49	121	170	178	59	237	129	(62)	67	0	0	
City of McGregor	McLennan	10219.002	TX0023914	0.99	102191	BOWA40					562	63	625	582	63	645	20	0	20	0	0	
City of Valley Mills	Bosque	10307.001	TX0075647	0.36	W12252	BOWA40					0	15	15	25	19	44	25	4	29	0	0	
City of Marlin	Falls	10110.002	TX0021725	2	101102	BRHB42	Whitney system	16%	Whitney system	25%	713	0	713	884	0	884	171	0	171	114	221	Both BRA contract and own water right
City of Waco WMRSS	McLennan	11071.001	TX0026506	37.8	110711	BRHB42					21,227	3,348	24,575	28,433	3,348	31,781	7,206	0	7,206	0	0	Control transferred to City of Waco
City of Lorena	McLennan	12195.001	TX0083399	0.3	435201	BRHB42					0	61	61	0	204	204	0	143	143	0	0	
City of West	McLennan	10544.001	TX0020451	0.45	CON070	BRHB42					0	100	100	292	33	325	292	(67)	225	0	0	
City of Eastland	Eastland	10637.001	TX0024007	0.9	106371	LEDL43					433	0	433	381	0	381	(52)	0	(52)	0	0	2060 population less than 2000
City of DeLeon	Comanche	10078.001	TX0054844	0.3	CON054	LEHS45	Lake Proctor	100%	Lake Proctor	100%	138	0	138	141	0	141	3	0	3	138	141	
City of Dublin	Erath	10405.001	TX0054348	0.45	284602	LEHM46	Lake Proctor	100%	Lake Proctor	100%	218	0	218	433	0	433	215	0	215	218	433	
City of Comanche	Comanche	10719.001	TX0022730	0.73	363701	LEHM46	Lake Proctor	100%	Lake Proctor	100%	357	0	357	369	0	369	12	0	12	357	369	
City of Hamilton	Hamilton	10492.002	TX0026867	0.44	CON086	LEGT47	Lake Proctor	100%	Lake Proctor	100%	340	0	340	343	0	343	3	0	3	340	343	
City of Copperas Cove	Coryell	10045.005	TX0069841	3.05	100455	LEBE49	Lake Belton	100%	Lake Belton	100%	1,592	0	1,592	2,725	0	2,725	1,133	0	1,133	1,592	2,725	
City of Gatesville	Coryell	10176.001	TX0024953	1	101761	LEBE49	Lake Belton	100%	Lake Belton	100%	320	0	320	0	0	0	(320)	0	(320)	320	0	Assuming that this plant is inactive
City of Gatesville	Coryell	10176.002	TX0111791	2.2	101761	LEBE49	Lake Belton	100%	Lake Belton	100%	1,352	0	1,352	4,029	0	4,029	2,677	0	2,677	1,352	4,029	
City of Copperas Cove	Coryell	10045.004	TX0069850	0.8	022336	LEBE49	Lake Belton	100%	Lake Belton	100%	245	0	245	715	0	715	470	0	470	245	715	
City of Moody	McLennan	10225.001	TX0024066	0.2	CON090	LEBE49	Lake Belton	100%	Lake Belton	100%	105	0	105	162	0	162	57	0	57	105	162	
City of Lampassas	Lampassas	10205.002		1.5	102051	LAKE50	Lake Stillhouse Hollow	100%	Lake Stillhouse Hollow	100%	195	0	195	273	0	273	78	0	78	195	273	Assuming no supplies from Sulphur Cr
City of Copperas Cove	Coryell	10045.003	TX0067873	2	100451	LAYO51	Lake Belton	100%	Lake Belton	100%	527	0	527	1,786	0	1,786	1,259	0	1,259	527	1,786	
City of Harker Heights	Bell	10155.001	TX0024473	3	101551	LRLR53	Lake Belton	100%	Lake Belton	100%	1,287	0	1,287	3,544	0	3,544	2,257	0	2,257	1,287	3,544	
Bell County WCID#1	Bell	10351.001	TX0002470	0.9	103511	LEBE49	Lake Belton	100%	Lake Belton	100%	0	0	0	0	0	0	0	0	0	0	0	
Bell County WCID#1	Bell	10351.003	TX0102938	6	103512	LRLR53	Lake Belton	100%	Lake Belton	100%	3,668	0	3,668	7,601	0	7,601	3,933	0	3,933	3,668	7,601	
Bell County WCID#1	Bell	10351.002	TX0024597	15	103513	LRLR53	Lake Belton	100%	Lake Belton	100%	8,819	0	8,819	19,001	0	19,001	10,182	0	10,182	8,819	19,001	
Authority TBRSS	**Bell**	**11318.001**	**TX0058378**	**10**	**113181**	**LRLR53**	**Lake Belton**	**100%**	**Lake Belton**	**100%**	**5,959**	**0**	**5,959**	**7,704**	**0**	**7,704**	**1,745**	**0**	**1,745**	**5,959**	**7,704**	
Bell County WCID#2	Bell	11090.001	TX0020249	??	LRLR53	LRLR53	Lake Belton	100%	Lake Belton	100%	47	69	116	164	69	233	117	0	117	47	164	
Bell County WCID#2	Bell	11091.001	TX0020257	??	LRLR53	LRLR53	Lake Belton	100%	Lake Belton	100%	0	0	0	0	0	0	0	0	0	0	0	
City of Florence	Williamson	10944.001	TX0078247	0.25	W12431	LRLR53	Lake Stillhouse Hollow	100%	Lake Stillhouse Hollow	100%	0	45	45	78	117	195	78	72	150	0	78	
Bell County WCID#3	Bell	10797.001	TX0069191	0.25		LRLR53	Lake Belton	100%	Lake Belton	100%	98	0	98	133	0	133	35	0	35	98	133	
City of Georgetown	Williamson	10489.002	TX0022667	2.5	104893	GAGE56	Georgetown/Still-house System	100%	Georgetown/Still-house System	100%	894	978	1,872	6,075	267	6,342	5,181	(711)	4,470	894	6,075	Assuming 459 AF of direct reuse at each plant in 2060
City of Georgetown	Williamson	10489.003	TX0101281	2.5	104892	GALA57	Georgetown/Still-house System	100%	Georgetown/Still-house System	100%	188	415	603	6,523	267	6,790	6,335	(148)	6,187	188	6,523	

Table D-3 (Cont.)

Name	County	Permit Number	NPDES Number	Permitted Discharge (mgd)	Return Control Point	Primary Control Point	Current BRA Source	Percent of SW from BRA	Future BRA Source	Percent of SW from BRA	Current Surface Water Returns (ac-ft/yr)	Current Ground-water Returns (ac-ft/yr)	Total Current Returns (ac-ft/yr)	2060 Surface Water Returns (ac-ft/yr)	2060 Ground-water Returns (ac-ft/yr)	Total 2060 Returns (ac-ft/yr)	Surface Water Increase (Decrease)	Ground-water Increase (Decrease)	Total Increase (Decrease)	Current Returns from BRA Sources	2060 Returns from BRA Sources	Comments
City of Cameron	Milam	10004.001	TX0053651	0.96	100041	LRCA58					617	0	617	588	0	588	(29)	0	(29)	0	0	Population constant through 2060. City has own water right and a BRA contract. Assuming all returns from their own water right.
Authority/LCRA BCRWSS West	**Williamson**	**10264.001**	**TX0075167**	**3**	**102641**	**LRCA58**	**Georgetown/Still-house System**	**100%**	**Georgetown/Still-house System**	**100%**	**6,273**	**1,657**	**7,930**	**13,208**	**534**	**13,742**	**6,935**	**(1,123)**	**5,812**	**6,273**	**13,208**	Assuming 27,642 AF of reuse in 2060
Authority/LCRA BCRWSS East	**Williamson**	**10264.002**	**TX0101940**	**11.8**	**102642**	**LRCA58**	**Georgetown/Still-house System**	**100%**	**Georgetown/Still-house System**	**100%**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	Plant no longer in operation
City of Taylor	Williamson	10299.001	TX0020443	4	102991	LRCA58	Granger system	100%	Granger system	100%	1,613	0	1,613	3,367	0	3,367	1,754	0	1,754	1,613	3,367	
Anderson Mill MUD	Williamson	11459.001	TX0034207	1.3	114591	LRCA58					788	0	788	788	0	788	0	0	0	0	0	Imports
City of Cedar Park	Williamson	12308.001	TX0085740	2.5	123081	LRCA58					1,696	0	1,696	23,584	0	23,584	21,888	0	21,888	0	0	Assuming 1,535 AF of reuse by 2060. Population in 2060 expected to be almost 15 times current. Imports from LCRA.
City of Leander	Williamson	12644.001	TX0092151	2.25	126441	LRCA58					425	118	543	3,229	118	3,347	2,804	0	2,804	0	0	Assuming 245 AF of reuse by 2060. Population expected to by 6.5 times current. Imports from LCRA.
City of Bartlett	Bell	10880.001	TX0027006	0.325	372751	LRCA58					0	77	77	0	154	154	0	77	77	0	0	
Brushy Creek MUD	Williamson	11865.001	TX0072788	0.45	W12441	LRCA58			Georgetown/Still-house System	100%	0	335	335	2,259	189	2,448	2,259	(146)	2,113	0	2,259	Assuming 209 AF direct reuse in 2060
Block House MUD	Williamson	13031.001	TX0101397	0.5	W12441	LRCA58					243	0	243	2,879	0	2,879	2,636	0	2,636	0	0	Assuming 246 AF direct reuse. Imports SW
City of Holland	Bell	10897.001	TX0046612	0.2	372751	LRCA58	Lake Stillhouse Hollow	100%	Lake Stillhouse Hollow	100%	43	14	57	35	14	49	(8)	0	(8)	43	35	
City of Hearne	Robertson	10046.002	TX0025879	1.9	100462	BRBR59					0	509	509	0	570	570	0	61	61	0	0	
City of Calvert	Robertson	10095.001	TX0054020	0.25	100462	BRBR59					0	107	107	0	114	114	0	7	7	0	0	
City of Temple	Bell	10470.002	TX0047651	7.5	104702	BRBR59					2,304	0	2,304	8,692	0	8,692	6,388	0	6,388	0	0	Assuming all of 15,804 AF of Temple water right returned here. Rest to TBRSS
City of Rosebud	Falls	10731.001	TX0023981	0.25	CON117	BRBR59	Lake Stillhouse Hollow	100%	Lake Stillhouse Hollow	100%	90	0	90	84	0	84	(6)	0	(6)	90	84	Population constant through 2060
City of Troy	Bell	11263.001	TX0058084	0.309	CON109	BRBR59			Lake Belton	0%	104	17	121	80	17	97	(24)	0	(24)	0	0	Purchases SW from Temple
City of Lexington	Lee	10016.001	TX0054429	0.2	MYDB60	MYDB60					0	52	52	0	136	136	0	84	84	0	0	
Aluminum Corp. of America	Lee	395.000	TX0000876		003956	EYDB61					0	0	0	0	0	0	0	0	0	0	0	
City of Rockdale	Milam	10658.001	TX0027197	0.75	CON224	EYDB61					0	242	242	0	342	342	0	100	100	0	0	
City of Giddings	Lee	10456.001	TX0020516	0.7	CON125	YCSO62					0	210	210	0	526	526	0	316	316	0	0	
City of Caldwell	Burleson	10813.001	TX0023175	0.711	DCLY63	DCLY63					0	384	384	0	589	589	0	205	205	0	0	
Tx Dept MHMR	Limestone	10717.001	TX0030775	0.45	528801	NAGR64					63	149	212	63	149	212	0	0	0	0	0	
City of Teague	Freestone	10300.001	TX0034509	0.21	CON250	BGFR65					0	52	52	0	239	239	0	187	187	0	0	
City of Mexia	Limestone	10222.001	TX0052990	0.85	CON131	NAEA66					58	449	507	58	587	645	0	138	138	0	0	
City of Groesbeck	Limestone	10182.001	TX0054445	0.709	W12531	NAEA66					304	0	304	569	0	569	265	0	265	0	0	
City of College Station	Brazos	10024.006	TX0047163	9.50	100241	BRHE68					0	6,108	6,108	0	12,186	12,186	0	6,078	6,078	0	0	
City of Navasota	Grimes	10231.001	TX0071790	1.8	102311	BRHE68					0	762	762	0	917	917	0	155	155	0	0	
City of Brenham	Washington	10388.001	TX0025470	2.55	103881	BRHE68	Lake Somerville	100%	Lake Somerville	100%	1,809	0	1,809	2,300	0	2,300	491	0	491	1,809	2,300	
City of Bryan	Brazos	10426.001	TX0022616	8	104261	BRHE68					0	4,998	4,998	0	8,354	8,354	0	3,356	3,356	0	0	
City of Bryan	Brazos	10426.002	TX0025071	4	104262	BRHE68					0	1,866	1,866	0	4,177	4,177	0	2,311	2,311	0	0	
Texas A&M University	Brazos	10968.003	TX0108146	4	109681	BRHE68					0	1,946	1,946	0	1,946	1,946	0	0	0	0	0	
City of Somerville	Burleson	10371.001	TX0055492	0.3	516451	BRHE68					0	53	53	0	239	239	0	186	186	0	0	
City of Bryan	Brazos	10426.003	TX0062472	0.75	526851	BRHE68					0	391	391	0	783	783	0	392	392	0	0	
Texas A&M University	Brazos	2585.001	TX00090883	1.99	025851	BRHE68					0	1,176	1,176	0	1,176	1,176	0	0	0	0	0	
Texas Dept Of Criminal Justice	Grimes	13743.001	TX0089010	0.32	CON148	BRHE68					0	212	212	0	212	212	0	0	0	0	0	
Texas Dept Of Criminal Justice	Grimes	12458.002	TX0089028	0.25	CON149	BRHE68					0	62	62	0	62	62	0	0	0	0	0	
City of Bellville	Austin	10385.002	TX0020621	0.95	103851	MCBL69					0	388	388	0	646	646	0	258	258	0	0	
City of Richmond	Fort Bend	10258.001	TX0025526	1	102581	BRRI70			BRA system	100%	0	652	652	423	354	777	423	(298)	125	0	423	
City of Sealy	Austin	10276.001	TX0025054	0.975	102761	BRRI70					0	416	416	0	751	751	0	335	335	0	0	
City of Rosenberg	Fort Bend	10607.003	TX0098914	2	106073	BRRI70			BRA system	100%	0	1,362	1,362	1,260	1,250	2,510	1,260	(112)	1,148	0	1,260	

Table D-3 (Cont.)

Name	County	Permit Number	NPDES Number	Permitted Discharge (mgd)	Return Control Point	Primary Control Point	Current BRA Source	Percent of SW from BRA	Future BRA Source	Percent of SW from BRA	Current Surface Water Returns (ac-ft/yr)	Current Ground-water Returns (ac-ft/yr)	Total Current Returns (ac-ft/yr)	2060 Surface Water Returns (ac-ft/yr)	2060 Ground-water Returns (ac-ft/yr)	Total 2060 Returns (ac-ft/yr)	Surface Water Increase (Decrease)	Ground-water Increase (Decrease)	Total Increase (Decrease)	Current Returns from BRA Sources	2060 Returns from BRA Sources	Comments
Praire View A&M Universtiy	Waller	11275.002	TX0111201	2	112751	BRRI70					0	575	575	0	575	575	0	0	0	0	0	
Brookshire MWD	Waller	10001.001	TX0025046	0.65	516604	BRRI70			BRA system	100%	0	265	265	460	502	962	460	237	697	0	460	
Frito-Lay Inc.	Fort Bend	2443.001	TX0085782	1.09	024431	BRRI70					0	121	121	0	121	121	0	0	0	0	0	
Fort Bend Co. MUD 081	Fort Bend	13051.002	TX0106046	0.65	BRRI70	BRRI70					0	12	12	0	702	702	0	690	690	0	0	
City of Hempstead	Waller	10948.001	TX0023809	0.6	CON150	BRRI70			BRA system	100%	0	258	258	295	1,040	1,335	295	782	1,077	0	295	
City of Wallis	Austin	10765.001	TX0025968	0.498	CON153	BRRI70					0	85	85	0	173	173	0	88	88	0	0	
City of Rosenberg	Fort Bend	10607.002	TX0024490	3	106072	BGNE71			BRA system	100%	0	1,453	1,453	1,889	1,875	3,764	1,889	422	2,311	0	1,889	
City of Richmond	Fort Bend	10258.003	TX0025534	3.0	102582	BRRO72			BRA system	100%	0	800	800	1,269	1,063	2,332	1,269	263	1,532	0	1,269	
Authority SLRSS	**Fort Bend**	**11317.001**	**TX0058114**	**6**	**113171**	**BRRO72**			BRA system	100%	**0**	**4,135**	**4,135**	**2,490**	**1,547**	**4,037**	**2,490**	**(2,588)**	**(98)**	**0**	**2,490**	
Pecan Grove MUD	Fort Bend	11655.001	TX0056421	1.39	116551	BRRO72			BRA system	100%	0	1,172	1,172	815	695	1,510	815	(477)	338	0	815	
City of Sugarland	Fort Bend	12833.002	TX0096881	10	128331	BRRO72			BRA system	100%	0	4,349	4,349	2,297	1,426	3,723	2,297	(2,923)	(626)	0	2,297	
Texas Dept. of Criminal Justice - Central	Fort Bend	10986.001	TX0031551	0.45	128332	BRRO72					0	230	230	0	230	230	0	0	0	0	0	
Texas Dept. of Criminal Justice - Jester III	Fort Bend	11475.003	TX0089036	0.32	128332	BRRO72					0	170	170	0	170	170	0	0	0	0	0	
City of Sugarland	Fort Bend	12833.003	TX0096881	9.0	128332	BRRO72					0	0	0	0	0	0	0	0	0	0	0	Same as SLRSS
Plantation MUD	Fort Bend	11971.001	TX0076554	0.44	133551	BRRO72			BRA system	100%	0	310	310	248	165	413	248	(145)	103	0	248	
Fort Bend MUD 106	Fort Bend	13355.001	TX0101915	1.35	133551	BRRO72			BRA system	100%	0	539	539	335	223	558	335	(316)	19	0	335	
Fort Bend MUD 112	Fort Bend	13628.001	TX0111872	2.5	136281	BRRO72					0	844	844	0	844	844	0	0	0	0	0	
Texas Dept. of Criminal Justice - Jester I	Fort Bend	11475.001	TX0031674	0.31	517033	BRRO72					0	221	221	0	221	221	0	0	0	0	0	
City of Lake Jackson	Brazoria	10047.001	TX0025798	4	100471	BRGM73			BRA system	50%	2,336	471	2,807	2,726	1,468	4,194	390	997	1,387	0	1,363	SW from Brazosport WA
City of West Columbia	Brazoria	10312.001	TX0026182	1.6	103121	BRGM73					0	1,143	1,143	0	818	818	0	(325)	(325)	0	0	2060 population less than 2000
City of Freeport	Brazoria	10882.001	TX0033332	2.25	108821	BRGM73			BRA system	50%	1,522	0	1,522	3,520	0	3,520	1,998	0	1,998	0	1,760	SW from Dow Chemical. Assume same future BRA use as Brazosport.
Authority CRWTF	**Brazoria**	**10044.001**	**TX0034436**		**100441**	**SJGMC4**			BRA system	50%	**2,328**	**48**	**2,376**	**2,114**	**691**	**2,805**	**(214)**	**643**	**429**	**0**	**1,057**	SW from Brazosport WA
City of Angleton	Brazoria	10548.001	TX0056316	3.6	105481	SJGMC4			BRA system	50%	2,350	42	2,392	2,032	564	2,596	(318)	522	204	0	1,016	SW from Brazosport WA
Fort Bend MUD 025	Fort Bend	12003.001	TX0077178	0.8	517034	SJGMC4			BRA system	100%	0	135	135	2,702	1,801	4,503	2,702	1,666	4,368	0	2,702	
Fort Bend MUD 041	Fort Bend	12475.001	TX0089249	0.86	517034	SJGMC4			BRA system	100%	0	175	175	1,542	1,028	2,570	1,542	853	2,395	0	1,542	
Total											*92,470*	*49,792*	*142,262*	*210,432*	*62,209*	*272,642*	*117,962*	*12,418*	*130,379*	*38,463*	*117,309*	
Authority only Total											***14,978***	***5,840***	***20,818***	***27,758***	***2,772***	***30,530***	***12,780***	***-3,068***	***9,712***	***12,650***	***26,701***	

Table D-4
Detailed Current Conditions Return Flow Data
Values in Acre-Feet per Year

Name	County	Permit Number	Permitted Discharge (mgd)	Return Control Point	Primary Other Point	Historical Return Flow Data (Ac-Ft/Yr) 1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	93-97 Min	98-02 Min	88-97 Min	93-02 Min	Current Return SW or SW + GW	BWAM CI Ground-water Return Flow	Revised CI Ground water Returns	CI Surface Water Returns	% Groundwater	Comments
City of Abilene	Jones	10334.004	22.0	103341	CFFG18	11,260	11,318	13,285	13,198	16,057	12,991	12,739	13,294	13,279	14,735						12,739		11,260	12,739	12,739	0	0	12,739	0%	
City of Breckenridge	Stephens	10040.001	0.95	100401	CFEL22	620	644	748	728	758	634	758	543	498	536						498		498	498	498	0	0	498	0%	
City of Graham	Young	10487.001	2.1	104871	SHGR26	1,449	1,382	1,291	1,266	1,238	1,112	1,109	1,110	1,088	1,113						1,088		1,088	1,088	1,088	0	0	1,088	0%	
Double Diamond	Palo Pinto	2789.001	???	027891	BRPP27	188	388		22	617	617	404	30	75	240						30		22	30	30	0	0	30	0%	
City of Ranger	Palo Pinto	11557.001	0.43	401401	PPSA28	266	453	160	295	393	284	314	321	342	213						213		160	213	213	0	0	213	0%	
City of Mineral Wells	Parker	10585.004	1.26	105851	BRDE29	468	463	459	455	451	443	437	430	423	413						413		413	413	413	0	0	413	0%	
City of Mineral Wells	Palo Pinto	10585.001	2.35	105852	BRDE29	1,277	1,328	1,387	897	1,045	967	932	761	713	785						713		713	713	713	0	0	713	0%	
City of Granbury	Hood	10178.002	2	101782	BRGR30	774	802	814	840	849	837	762	770	771	875	831	820	836		923	762	820	762	762	820	170	170	650	21%	As of '97 using about 40% groundwater. No data for groundwater use since then.
Authority SWATS	**Hood**	**2889.000**	**0.39**	**515651**	**BRGR30**			**150**	**326**	**434**	**533**	**469**	**479**	**534**	**520**	**419**	**825**	**863**	**813**	**314**	**469**	**314**	**150**	**314**	**314**	**0**	**0**	**314**	**0%**	
Acton MUD	Hood	11208.001	0.37	515651	BRGR30	270	296	196	179	230	138	200	125	154	240					317	125	317	125	125	125	110	110	15	88%	
Acton MUD	Hood	11415.001	0.39	407601	BRGR30	172	189	163	171	245	97	131	118	108	147					287	97	287	97	97	97	86	86	11	89%	
City of Cleburne	Johnson	10006.001	6.25	100061	NRBL32	2,714	3,245	3,070	4,048	4,068	3,438	3,297	3,711	2,616	4,033						2,616	0	2,616	2,616	2,616	0	0	1,000	0%	Assuming a significant level of reuse, with only 1,000 af returning
City of Godley	Johnson	10542.001	0.12	410501	NRBL32	85	51	76	63	67	102	105	102	70	93						70		51		0	34	34	0	100%	Too small to adjust
City of Glen Rose	Somervell	10177.001	0.6	409631	BRAQ33	209	310	258	224	266	221	233	210	227	266						210		209		0	177	177	0	100%	Assuming no surface water use under current conditions
City of Whitney	Hill	11408.002	0.4	515731	BRAQ33	378	380	384	387	241	239	284	365	170	264						170		170		0	116	116	0	100%	
City of Itasca	Hill	10423.001	0.378	106301	AQAQ34																				0	104	104	0	100%	No data at all
City of Hillsboro	Hill	10630.001	1.36	106301	AQAQ34	1,056	1,015	1,126	1,071	1,194	1,221	1,132	1,316	1,012	1,358						1,012	0	1,012	1,012	1,012	0	0	1,012	0%	
City of Stephenville	Erath	10290.001	3	102902	NBHI35	1,500	1,602	1,932	2,014	2,102	2,059	1,842	1,722	1,720	1,937						1,720	0	1,500	1,720	0	1,313	1,313	0	100%	
City of Hico	Hamilton	11188.001	0.2	NBHI35	NBHI35	71	83	79	108	169	88	94	93	54	117						54		54		0	56	56	0	100%	
City of Meridian	Bosque	10113.002	0.45	228202	NBCL37	201	158	351	238	339	227	215	294	311	372						215		158		0	93	93	0	100%	
City of Clifton	Bosque	10043.001	0.65	555151	NBCL37	141	194	151	166	161	177	170	187	231	178						170		141		170	121	121	49	71%	Assuming increase over historical minimum groundwater return is surface water
City of McGregor	McLennan	10219.002	0.99	102191	BOWA40	349	641	739	986	939	863	625	797	734	827					654	625	654	349	625	625		63	562	10%	Assume 10% groundwater returns
City of Valley Mills	Bosque	10307.001	0.36	W12252	BOWA40	103	102	145	155	70	38	48	52	78	128						38		38		0	15	15	0	100%	Too small to adjust
City of Marlin	Falls	10110.002	2	101102	BRHB42	1,277	1,328	1,387	897	1,045	967	932	761	713	785						713		713		713	0	0	713	0%	
City of Waco WMRSS	McLennan	11071.001	37.8	110711	BRHB42	20,114	22,563	22,717	24,030	28,186	23,102	24,007	23,415	22,730	28,400	27,742	24,575	26,704	30,862	28,624	22,730	24,575	20,114	22,730	24,575	3,348	3,348	21,227	15%	
City of Lorena	McLennan	12195.001	0.3	435201	BRHB42	66	161	87	128	124	88	101	119	116	131			117	144	112	88	112	66	88	0	61	61	0	100%	
City of West	McLennan	10544.001	0.45	CON070	BRHB42	228	267	267	292	240	155	192	198	335	400					283	155	283	155	155	0	100	100	0	100%	Too small to adjust
City of Eastland	Eastland	10637.001	0.9	106371	LEDL43	345	416	454	430	474	575	489	531	433	546						433		345		433	0	0	433	0%	
City of DeLeon	Comanche	10078.001	0.3	CON054	LEHM45	133	138	135	130	141	138	171	228	211	242						138		130		138	0	0	138	0%	
City of Dublin	Erath	10405.001	0.45	284602	LEHM46	171	218	205	197	202	286	328	266	218	436						218		171		218	0	0	218	0%	
City of Comanche	Comanche	10719.001	0.73	363701	LEHM46	462	386	153	330	428	392	404	398	357	395						357		153		357	0	0	357	0%	
City of Hamilton	Hamilton	10492.002	0.44	CON086	LEGT47	324	353	355	372	432	365	340	366	387	523	338					340		324		340	0	0	340	0%	
City of Copperas Cove	Coryell	10045.005	3.05	100455	LEBE49	863	1,018	897	1,117	1,829	1,849	1,891	1,714	1,728	2,212	2,382	1,906			1,592	1,714	1,592	863	1,592	1,592	0	0	1,592	0%	
City of Gatesville	Coryell	10176.001	1	101761	LEBE49	1,002	1,053	1,096	1,119	586	426	441	347	320	387						320		320		320	0	0	320	0%	Inactivated?
City of Gatesville	Coryell	10176.002	2.2	101761	LEBE49	1,184	1,205	1,230	1,256	1,074	933	1,103	1,276	1,007	1,134	1,633	1,508	1,353	1,412	1,352	933	1,352	933	933	1,352	0	0	1,352	0%	
City of Copperas Cove	Coryell	10045.004	0.8	022336	LEBE49	671	831	757	871	591	528	343	509	361	391	330	245				343	245	343	245	245	0	0	245	0%	
City of Moody	McLennan	10225.001	0.2	CON090	LEBE49	144	167	70	130	208	125	119	134	95	162				153	105	95	105	70	95	105	0	0	105	<1%	Small GW use
City of Lampassas	Lampassas	10205.002	1.5	102051	LAKE50	389	360	277	235	327	244	227	235	195	207						195		195		195	0	0	195	0%	
City of Copperas Cove	Coryell	10045.003	2	100451	LAYO51	507	523	521	595	713	625	580	600	526	661	809	558	547	605	527	526	527	507	526	527	0	0	527	0%	
City of Harker Heights	Bell	10155.001	3	101551	LRLR53	930	1,130	1,170	1,776	2,528	1,882	1,560	1,553	1,419	1,907	2,196	1,287	1,547	2,184	1,730	1,419	1,287	930	1,287	1,287	0	0	1,287	0%	
Bell County WCID#1	Bell	10351.001	0.9	103511	LEBE49											399	375	363	438	625		363		363	0	0	0	0	0%	Process water, once trhough with no losses
Bell County WCID#1	Bell	10351.003	6	103512	LRLR53		2,587	2,725	3,575	3,691	3,261	3,250	3,269	3,802	4,385	4,847	4,042	4,495	3,893	3,668	3,250	3,668	2,587	3,250	3,668	0	0	3,668	0%	
Bell County WCID#1	Bell	10351.002	15	103513	LRLR53	12,217	13,163	9,909	10,360	11,863	11,048	10,382	10,591	8,872	10,887	11,808	8,918	8,820	8,819	9,960	8,872	8,819	8,872	8,819	8,819	0	0	8,819	0%	
Authority TBRSS	**Bell**	**11318.001**	**10**	**113181**	**LRLR53**	**2,839**	**3,176**	**4,673**	**6,224**	**7,222**	**6,491**	**5,565**	**5,373**	**5,365**	**7,804**	**7,506**	**5,959**	**6,719**	**7,970**	**6,742**	**5,365**	**5,959**	**2,839**	**5,365**	**5,959**	**0**	**0**	**5,959**	**0%**	
Bell County WCID#2	Bell	11090.001	??	LRLR53	LRLR53											66	63	59		62		59		59	116	69	69	47	60%	
Bell County WCID#2	Bell	11091.001	??	LRLR53	LRLR53											60	57		60	60		57		57				0		Combined w Academy
City of Florence	Williamson	10944.001	0.25	W12431	LRLR53	57	68	60	110	127	91	73	105	77	167	231	107	113	134	167	73	107	57	73		45	45	0	100%	Too small to adjust
Bell County WCID#3	Bell	10797.001	0.25	LRLR53	LRLR53	177	168	153	198	351	301	212	190	120	217	195	116	98	192	106	120	98	120	98	98	0	0	98	0%	
City of Georgetown	Williamson	10489.002	2.5	104893	GAGE56	1,651	1,744	1,863	2,017	2,243	2,143	1,590	1,561	1,586	2,114	2,256	2,054	2,089	2,170	1,872	1,561	1,872	1,561	1,561	1,872	978	978	894	63%	May want to alter distribution of GW CI cards
City of Georgetown	Williamson	10489.003	2.5	104892	GALA57	1,113	1,170	1,235	1,305	1,383	1,457	669	525	554	818	818	603	747	1,088	766	525	603	525	525	603	415	415	188	79%	
City of Cameron	Milam	10004.001	0.96	100041	LRCA58	672	653	634	753	783	795	753	757	617	738						617		617		617	0	0	617	0%	
Authority/LCRA BCRWSS West	**Williamson**	**10264.001**	**3**	**102641**	**LRCA58**	**1,956**	**2,199**	**2,398**	**2,974**	**3,230**	**3,087**	**3,334**	**3,437**	**3,257**	**5,868**	**7,930**	**8,523**	**9,634**	**11,161**	**11,437**	**3,087**	**7,930**	**1,956**	**3,087**	**7,930**	**783**	**1,657**	**6,273**	**54%**	**Assuming no reuse in current conditions**
Authority/LCRA BCRWSS East	**Williamson**	**10264.002**	**11.8**	**102642**	**LRCA58**	**1,417**	**1,873**	**2,179**	**2,508**	**2,644**	**2,766**	**3,108**	**3,462**	**3,659**	**3,133**	**948**	**152**	**0**	**0**	**0**	**2,766**	**0**	**1,417**	**0**	**0**	**874**	**0**	**0**			**No longer in operation**
City of Taylor	Williamson	10299.001	4	102991	LRCA58	1,416	1,439	1,462	2,158	3,549	2,164	1,697	1,920	1,567	1,949	2,232	1,613	1,880	2,400	2,109	1,567	1,613	1,416	1,567	1,613	0	0	1,613	0%	
Anderson Mill MUD	Williamson	11459.001	1.3	114591	LRCA58	1,255	1,197	1,156	1,277	1,213	1,007	975	998	1,034	1,003	852	788				975	788	975	788	788	915	0	788	0%	All surface imports.
City of Cedar Park	Williamson	12308.001	2.5	123081	LRCA58	387	528	840	1,338	1,378	1,339	1,088	1,351	1,570	1,702	1,696	2,124		3,038	2,647	1,088	1,696	387	1,088	1,696	385	0	1,696	0%	All surface imports.
City of Leander	Williamson	12644.001	2.25	126441	LRCA58	121	136	192	293	397	356	342	458	517	556	555	543	731			342	543	121	342	543	118	118	425	22%	
City of Bartlett	Bell	10880.001	0.325	372751	LRCA58	223	226	224	238	178	192	87	149	243	293	227	209				87	209	87	87	0	77	77	0	100%	Too small to adjust
Brushy Creek MUD	Williamson	11865.001	0.45	W12441	LRCA58	340	306	264	307	366	436	445	420	335	400	367	355	389	339	362	335	339	264	335	0	232	232	0	100%	Too small to adjust
Block House MUD	Williamson	13031.001	0.5	W12441	LRCA58	104	132	149	171	209	233	156	187	156	165	254	243	303	352	354	156	243	104	156	243	88	0	243	0%	Assuming all imported surface water
City of Holland	Bell	10897.001	0.2	372751	LRCA58	75	80	69	117	144	120	60	57	59	87	85		77	74		57	74	57	57	57	0	14	43	25%	
City of Hearne	Robertson	10046.002	1.9	100462	BRBR59	633	874	818	835	988	898	864	785	711	620	712					620		620		0	509	509	0	100%	
City of Calvert	Robertson	10095.001	0.25	100462	BRBR59	145	137	98	96	142	147	119	125	124	124	176					119		96	119	0	107	107	0	100%	
City of Temple	Bell	10470.002	7.5	104702	BRBR59	2,093	2,504	2,854	3,468	3,710	3,321	2,747	2,681	2,597	4,004	3,569	2,304	2,617	3,502	2,659	2,597	2,304	2,093	2,304	2,304	0	0	2,304	0%	
City of Rosebud	Falls	10731.001	0.25	CON117	BRBR59	110	134	126	165	159	121	90	123	206	228						90		90		90	0	0	90	0%	
City of Troy	Bell	11263.001	0.309	CON109	BRBR59	191	188	191	210	294	174	122	118	132	139	152	137	158	160	121	118	121	118	118	121	0	17	104	14%	
City of Lexington	Lee	10016.001	0.2	MYDB60	MYDB60	85	82	62	72	154	133	119	133	88	108						88		62		0	52	52	0	100%	
Aluminum Corp. of America	Lee	395.000		003956	EYDB61																0	0	0	0	0	0	0	0		
City of Rockdale	Milam	10658.001	0.75	CON224	EYDB61	268	366	300	427	389	495	555	586	538	586						495		268		0	242	242	0	100%	
City of Giddings	Lee	10456.001	0.7	CON125	YCSO62	270	256	234	297	302	276	280	308	286	323	412					276		234	276	0	210	210	0	100%	
City of Caldwell	Burleson	10813.001	0.711	DCLY63	DCLY63	427	492	511	569	577	596	509	553	523	549	559					509		427	509	0	384	384	0	100%	
Tx Dept MHMR	Limestone	10717.001	0.45	528801	NAGR64	322	228	242	215	205	212	225	231	217	284						212		205		212	149	149	63	70%	May want to redistribute groundwater with City of Mexia
City of Teague	Freestone	10300.001	0.21	CON250	BGFR65	167	156	157	177	110	78	64	58	53	78						53		53		0	52	52	0	100%	Both groundwater & surface water imports. Assume all groundwater for simplification.
City of Mexia	Limestone	10222.001	0.85	CON131	NAEA66	368	650	805	1,007	839	729	507	624	581	795						507		368		507	449	449	58	89%	May want to redistribute groundwater with TxMHMR
City of Groesbeck	Limestone	10182.001	0.709	W12531	NAEA66	177	170	207	208	240	395	403	304	388	482						304		170		304	0	0	304	0%	
City of College Station	Brazos	10024.006	9.50	100241	BRHE68	5,975	6,185	6,415	6,650	6,908	6,963	6,258	6,055	5,784	6,426	6,619	6,108	6,148	7,035	7,257	5,784	6,108	5,784	5,784	0	5,694	6,108	0	100%	
City of Navasota	Grimes	10231.001	1.8	102311	BRHE68	614	731	850	1,132	1,037	902	762	907	774	930				905	855	762		614	762	0	583	583	0	100%	
City of Brenham	Washington	10388.001	2.55	103881	BRHE68	1,769	1,729	1,684	1,835	2,069	1,880	1,871	1,904	1,852	1,973	2,080	1,809				1,852	1,809	1,684	1,809	1,809	0	0	1,809	0%	
City of Bryan	Brazos	10426.001	8	104261	BRHE68	4,495	4,961	4,644	4,783	4,897	5,384	5,205	5,180	5,144	5,300	5,207	4,998	5,202	5,361	5,226	5,144	4,998	4,495	4,998	0	4,052	4,998	0	100%	
City of Bryan	Brazos	10426.002	4	104262	BRHE68	2,088	2,388	2,408	2,561	2,273	2,015	2,037	2,082	1,888	1,976	2,210	1,866			2,578	1,888	1,866	1,888	1,866	0	1,607	1,866	0	100%	

Table D-4 (Continued)

Name	County	Permit Number	Permitted Discharge (mgd)	Return Control Point	Primary Control Point	Historical Return Flow Data (Ac-Ft/Yr)															93-97 Min	98-02 Min	88-97 Min	93-02 Min	Current Return SW or SW + GW	BWAM CI Ground-water Return Flow	Revised CI Ground water Returns	CI Surface Water Returns	% Groundw ater	Comments
						1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002										
Texas A&M University	Brazos	10968.003	4	109681	BRHE68	1,581	1,600	1,766	1,765	1,832	2,060	1,789	1,905	1,876	1,680	1,946	1,953		2,076	1,988	1,680	1,946	1,581	1,680	0	1,415	1,946	0	100%	
City of Somerville	Burleson	10371.001	0.3	516451	BRHE68	94	113	168	177	243	260	275	219	191	299						191		94		0	53	53	0	100%	
City of Bryan	Brazos	10426.003	0.75	526851	BRHE68	307	435	378	497	477	452	450	391	446	462						391		307		0	307	307	0	100%	
Texas A&M University	Brazos	2585.001	1.99	025851	BRHE68	233	471	963	1,077	1,170	1,416	1,251	1,734	1,401	1,394			1,567		1,176	1,251	1,176	233	1,176	0	230	1,176	0	100%	
Texas Dept Of Criminal Justice	Grimes	13743.001	0.32	CON148	BRHE68	225	224	224	224	225	224	224	226	275	239	278	309				224	278	224	224	0	212	212	0	100%	
Texas Dept Of Criminal Justice	Grimes	12458.002	0.25	CON149	BRHE68	190	85	100	166	153	163	176	177	203	190	213	205				163	205	85	163	0	62	62	0	100%	
City of Bellville	Austin	10385.002	0.95	103851	MCBL69	450	405	455	490	558	518	531	525	475	482	552	513				475	513	405	475	0	388	388	0	100%	
City of Richmond	Fort Bend	10258.001	1	102581	BRRI70	787	790	779	796	783	786	715	1063	1526	780	710	668	657	670	652	715	652	715	652	0	679	679	0	100%	
City of Sealy	Austin	10276.001	0.975	102761	BRRI70	456	452	450	594	610	604	554	685	606	678	714					554	714	450	554	0	416	416	0	100%	
City of Rosenberg	Fort Bend	10607.003	2	106073	BRRI70	1,033	1,384	1,458	1,723	1,544	1,479	1,462	1,460	1,407	1,742	1,638	1,364	1,362	1,437	1,556	1,407	1,362	1,033	1,362	0	928	1,362	0	100%	
Praire View A&M University	Waller	11275.002	2	112751	BRRI70							260	702	725							260		260		0	575	575	0	100%	
Brookshire MWD	Waller	10001.001	0.65	516604	BRRI70	277	352	370	447	446	469	469	488	442	542	528					442		277	442	0	265	265	0	100%	Too small to adjust
Frito-Lay Inc.	Fort Bend	2443.001	1.09	024431	BRRI70	315	412	529	692	392	373	342	330	371	375	442	375	376	562	377	330	375	315	330	0	121	121	0	100%	Too small to adjust
Fort Bend Co. MUD 081	Fort Bend	13051.002	0.65	BRRI70	BRRI70	13	32	64	74	73	91	68	67	70	89	86	84	112	104	97	67	84	13	67	0	12	12	0	100%	Too small to adjust
City of Hempstead	Waller	10948.001	0.6	CON150	BRRI70	299	425	346	528	599	521	491	483	483	520	559					483		299	483	0	258	258	0	100%	Too small to adjust
City of Wallis	Austin	10765.001	0.498	CON153	BRRI70	100	129	110	167	170	152	111	123	194	141	124					111		100	111	0	85	85	0	100%	
City of Rosenberg	Fort Bend	10607.002	3	106072	BGNE71	1,141	1,318	1,264	1,473	1,435	1,502	1,566	1,669	1,497	2,047	1,908	1,535	1,453	1,616	1,766	1,497	1,453	1,141	1,453	0	1,089	1,453	0	100%	
City of Richmond	Fort Bend	10258.003	3.0	102582	BRRO72	1,356	1,399	1,426	1,375	1,399	1,430	1,506	1,410	1,416	1,360	800	863				1,360	800	1,356	800	0	1,269	1,269	0	100%	
Authority SLRSS	**Fort Bend**	**11317.001**	**6**	**113171**	**BRRO72**	**3,967**	**4,400**	**4,591**	**4,279**	**3,940**	**3,713**	**3,562**	**3,578**	**3,792**	**4,551**	**4,387**	**4,135**	**4,311**	**5,149**	**4,780**	**3,562**	**4,135**	**3,562**	**3,562**	**0**	**3,218**	**4,135**	**0**	**100%**	
Pecan Grove MUD	Fort Bend	11655.001	1.39	116551	BRRO72	833	748	807	1,010	1,128	1,213	1,063	1,143	1,188	1,164	1,247	1,172	1,221	1,271	1,242	1,063	1,172	748	1,063	0	671	1,172	0	100%	
City of Sugarland	Fort Bend	12833.002	10	128331	BRRO72	2,225	2,413	2,605	3,389	3,863	3,653	3,322	3,519	4,260	3,952	4,877	4,349	4,981	5,229	5,592	3,322	4,349	2,225	3,322	0	2,194	4,349	0	100%	
Texas Dept. of Criminal Justice - Central	Fort Bend	10986.001	0.45	128332	BRRO72	206	152	149	179	273	268	231	239	187	248	230	285	287	365	309	187	230	149	187	0	129	129	0	100%	
Texas Dept. of Criminal Justice - Jester III	Fort Bend	11475.003	0.32	128332	BRRO72	160	129	140	176	239	198	230	217	238	227	330	275			274	198	274	129	198	0	170	170	0	100%	
City of Sugarland	Fort Bend	12833.003	9.0	128332	BRRO72																				0	6,158	0	0		Same as SLRSS
Plantation MUD	Fort Bend	11971.001	0.44	133551	BRRO72	211	283	265	326	329	257	280	275	277	277	365	319	310	376	493	257	310	211	257	0	206	206	0	100%	
Fort Bend MUD 106	Fort Bend	13355.001	1.35	133551	BRRO72					132	156	217	276	340	351	539	578	560	723	861	156	539	132	156	0	117	539	0	100%	
Fort Bend MUD 112	Fort Bend	13628.001	2.5	136281	BRRO72			13	109	204	299	367	482	525	557	844	936				299	844	13	299	0	14	844	0	100%	
Texas Dept. of Criminal Justice - Jester I	Fort Bend	11475.001	0.31	517033	BRRO72	300	279	235	182	195	236	241	228	221	230	257	251	221	259	308	221	221	182	221	0	120	120	0	100%	
City of Lake Jackson	Brazoria	10047.001	4	100471	BRGM73	2,181	2,294	2,161	2,629	2,985	2,906	2,807	2,945	2,885	3,399						2,807		2,161		2,807	327	471	2,336	17%	% groundwater still a little bit low. Should be around 30-40%
City of West Columbia	Brazoria	10312.001	1.6	103121	BRGM73	921	933	980	1,980	2,631	1,662	1,507	1,557	1,143	1,888						1,143		921		0	711	1,143	0	100%	Also serves Columbia Lakes subdivision
City of Freeport	Brazoria	10882.001	2.25	108821	BRGM73	1,575	1,483	1,544	2,007	1,926	2,060	1,798	1,834	1,522	1,612						1,522		1,483		1,522	0	0	1,522	0%	
Authority CRWTF	**Brazoria**	**10044.001**		**100441**	**SJGMC4**	**1,800**	**1,722**	**1,837**	**3,060**	**3,292**	**3,311**	**2,745**	**2,766**	**1,881**	**3,127**	**2,969**	**3,355**	**2,376**	**3,092**	**3,146**	**1,881**	**2,376**	**1,722**	**1,881**	**2,376**	**0**	**48**	**2,328**	**2%**	**% groundwater low, should be about 10-20%**
City of Angleton	Brazoria	10548.001	3.6	105481	SJGMC4	2,671	2,636	2,638	2,670	2,639	2,576	2,392	2,563	3,103	2,445						2,392		2,392		2,392	0	42	2,350	2%	% groundwater low, should be about 10%
Fort Bend MUD 025	Fort Bend	12003.001	0.8	517034	SJGMC4	145	147	156	176	220	200	206	203	240		411				502	200	411	145	200	0	135	135	0	100%	Too small to adjust
Fort Bend MUD 041	Fort Bend	12475.001	0.86	517034	SJGMC4	31	37	37	66	102	119	129	161	175	183	198	175	237	277	298	119	175	31	119	0	28	28	0	100%	Too small to adjust
Totals						*126,651*	*139,911*	*142,533*	*158,869*	*175,523*	*159,331*	*151,383*	*154,683*	*149,213*	*174,746*										*102,932*	*47,535*	*49,469*	*92,991*		
Authority Only Totals						***32,093***	***35,933***	***38,545***	***43,401***	***48,948***	***43,002***	***42,790***	***42,510***	***41,219***	***53,402***										***41,153***	***8,223***	***9,188***	***36,100***		

Table D-5
2060 Return Flow Projections
Values in Acre-Feet per Year

Name	County	Permit Number	Return Control Point	Primary Control Point	2000 RF	2000 Population	2000 Annual Per Capita RF (AF/person)	TWDB Population Data 1990	1991	1992	1993	1994	1995	1996	1997	Annual Per Capita Return (AF/Person) 1990	1991	1992	1993	1994	1995	1996	1997	Average 90-97	Minimum 90-97	Assumed Per Capita	2060 Population	2060 Estimated RF	Current % Groundwater	Assumed 2060 % Groundwater	2060 Groundwater CI	2060 Surface CI	Comments
City of Abilene	Jones	10334.004	103341	CFFG18		115,930		106,654	107,707	108,831	110,661	111,437	115,293	116,474	117,077	0.125	0.123	0.148	0.117	0.114	0.115	0.114	0.126	0.123	0.114	0.114	126,835	14,460	0%	0%	0	14,460	
City of Breckenridge	Stephens	10040.001	100401	CFEL22		5,868		5,665	5,679	5,634	5,515	5,608	5,605	5,808	5,805	0.132	0.128	0.134	0.115	0.135	0.097	0.086	0.092	0.115	0.086	0.086	5,654	484	0%	0%	0	484	
City of Graham	Young	10487.001	104871	SHGR26		8,716		8,986	9,268	9,091	9,014	8,806	8,933	8,857	8,882	0.144	0.137	0.136	0.123	0.126	0.124	0.123	0.125	0.130	0.123	0.123	8,690	1,067	0%	0%	0	1,067	
Double Diamond	Palo Pinto	2789.001	027891	BRPP27																								30	0%	0%	0	30	No information. Set same as current
City of Ranger	Palo Pinto	11557.001	401401	PPSA28		2,584		2,803	2,759	2,778	2,822	2,815	2,887	2,902	2,798	0.057	0.107	0.142	0.101	0.111	0.111	0.118	0.076	0.103	0.057	0.057	2,292	131	0%	0%	0	131	
City of Mineral Wells	Parker	10585.004	105851	BRDE29		16,946		14,870	15,478	15,104	15,256	14,838	14,784	15,160	15,294	0.124	0.087	0.099	0.092	0.092	0.081	0.075	0.078	0.091	0.075	0.075	19,901	520	0%	0%	0	520	
City of Mineral Wells	Palo Pinto	10585.001	105852	BRDE29																								971	0%	0%	0	971	
City of Granbury	Hood	10178.002	101782	BRGR30	836	5,718	0.146	4,045	4,223	4,316	4,458	4,630	4,854	5,195	5,571	0.201	0.199	0.197	0.188	0.165	0.159	0.148	0.157	0.177	0.148	0.148	14,388	2,136	21%	8%	170	1,966	Keep groundwater at current levels
BRA SWATS	Hood	02889.000	515651	BRGR30	863																							2,242	0%	0%	0	2,242	Returns from 25 mgd, 2.5 peak factor, 20% return
Acton MUD	Hood	11208.001	515651	BRGR30																						0.11	34,285	1,836	88%	6%	110	1,726	Keep groundwater at current levels
Acton MUD	Hood	11415.001	407601	BRGR30																								1,935	89%	4%	86	1,849	Keep groundwater at current levels
City of Cleburne	Johnson	10006.001	100061	NRBL32		26,005		22,205	22,766	22,677	22,801	23,147	23,179	23,593	24,082	0.138	0.178	0.179	0.151	0.142	0.160	0.111	0.167	0.153	0.111	0.111	52,812	5,855	0%	0%	0	1,000	Reuse
City of Godley	Johnson	10542.001	410501	NRBL32		879		569	584	580	582	594		612	631	0.134	0.108	0.116	0.175	0.177		0.114	0.147	0.139	0.108	0.108	3,065	331	100%	89%	296	35	Assume 55% return from 63 AF from SWATS
City of Glen Rose	Somervell	10177.001	409631	BRAQ33		2,122		1,949	1,802	1,952	2,027	2,061	2,142	2,212	2,243	0.132	0.124	0.136	0.109	0.113	0.098	0.103	0.119	0.117	0.098	0.098	2,481	243	100%	56%	136	107	Assume 44% of return from reservoir (see Region G)
City of Whitney	Hill	11408.002	515731	BRAQ33		1,833		1,626	1,677	1,653	1,656	1,653	1,672	1,681	1,639	0.236	0.231	0.146	0.144	0.172	0.218	0.101	0.161	0.176	0.101	0.101	2,432	246	100%	100%	246	0	Region G plan does not recommend development of surface water
City of Itasca	Hill	10423.001	106301	AQAQ34		1,503		1,523	1,572	1,553	1,569	1,578	1,608	1,617	1,616	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			0.1	1,466	147	100%	100%	147	0	
City of Hillsboro	Hill	10630.001	106301	AQAQ34		8,232		7,072	7,355	7,270	7,423	7,423	7,661	7,722	7,776	0.159	0.146	0.164	0.165	0.152	0.172	0.131	0.175	0.158	0.131	0.131	10,467	1,372	0%	0%	0	1,372	
City of Stephenville	Erath	10290.001	102902	NBHI35		14,921		13,502	13,941	13,962	14,436	14,473	15,403	15,456	15,579	0.143	0.145	0.151	0.143	0.127	0.112	0.111	0.124	0.132	0.111	0.111	23,462	2,611	100%	43%	1,118	1,493	Assume 55% of 2,714 AF from Proctor
City of Hico	Hamilton	10188.001	NBHI35	NBHI35		1,341		1,342	1,394	1,448	1,440	1,432	1,486	1,498	1,478	0.059	0.077	0.117	0.061	0.066	0.063	0.036	0.079	0.070	0.036	0.070	1,341	93	100%	100%	93	0	Minimum per capita much lower than other years. Using average.
City of Meridian	Bosque	10113.002	228202	NBCL37		1,491		1,390	1,436	1,405	1,395	1,412	1,437	1,459	1,428	0.253	0.166	0.241	0.163	0.152	0.205	0.213	0.261	0.207	0.152	0.152	1,921	293	100%	30%	88	205	Assume 30% from groundwater (see Region G)
City of Clifton	Bosque	10043.001	555151	NBCL37		3,542		3,195	3,360	3,356	3,399	3,473	3,577	3,621	3,591	0.047	0.049	0.048	0.052	0.049	0.052	0.064	0.050	0.051	0.047	0.047	5,016	237	71%	25%	59	178	Assume 25% from groundwater (see Region G).
City of McGregor	McLennan	10219.002	102191	BOWA40		4,727		4,683	4,754	4,792	4,792	4,745	4,804	4,837	4,821	0.158	0.207	0.196	0.180	0.132	0.166	0.152	0.172	0.170	0.132	0.132	4,896	645	10%	10%	63	582	Keep groundwater at current levels
City of Valley Mills	Bosque	10307.001	W12252	BOWA40		1,123		1,095	1,126	1,109	1,105	1,122	1,145	1,153	1,127	0.132	0.138	0.063	0.034	0.043	0.045	0.068	0.114	0.080	0.034	0.034	1,267	44	100%	43%	19	25	Assume 43% from groundwater (see Region G)
City of Marlin	Falls	10110.002	101102	BRHB42		6,628		6,386	6,483	6,701	6,780	6,605	6,411	6,587	6,633	0.217	0.138	0.156	0.143	0.141	0.119	0.108	0.118	0.143	0.108	0.108	8,173	884	0%	0%	0	884	
BRA WMRSS	McLennan	11071.001	110711	BRHB42	26,704	113,726	0.235	103,590	105,636	106,589	107,191	107,617	108,192	109,225	109,822	0.219	0.227	0.264	0.216	0.223	0.216	0.208	0.259	0.229	0.208	0.208	152,715	31,781	15%	11%	3,348	28,433	Keep groundwater at current levels
City of Lorena	McLennan	12195.001	435201	BRHB42	117	1,433	0.082	1,158	1,244	1,266	1,342	1,322	1,453	1,582	1,627	0.075	0.103	0.098	0.066	0.076	0.082	0.073	0.081	0.082	0.066	0.082	2,491	204	100%	100%	204	0	Minimum per capita lower than other years. Using average.
City of West	McLennan	10544.001	CON070	BRHB42		2,692		2,515	2,582	2,603	2,719	2,739	2,800	2,783	2,824	0.106	0.113	0.092	0.057	0.070	0.071	0.120	0.142	0.096	0.057	0.096	3,372	325	100%	10%	33	292	Assume 10% from groundwater (see Region G). Minimum per capita low. Using average
City of Eastland	Eastland	10637.001	106371	LEDL43		3,769		3,690	3,705	3,731	3,641	3,681	3,759	3,795	3,712	0.123	0.116	0.127	0.158	0.133	0.141	0.114	0.147	0.132	0.114	0.114	3,342	381	0%	0%	0	381	
City of De Leon	Comanche	10078.001	CON054	LEHS45		2,433		2,190	2,247	2,283	2,292	2,242	2,305	2,338	2,358	0.062	0.058	0.062	0.060	0.076	0.099	0.090	0.103	0.076	0.058	0.058	2,436	141	0%	0%	0	141	
City of Dublin	Erath	10405.001	284602	LEHM46		3,754		3,190	3,225	3,185	3,298	3,408	3,559	3,600	3,634	0.064	0.061	0.063	0.087	0.096	0.075	0.061	0.120	0.078	0.061	0.061	7,149	433	0%	0%	0	433	
City of Comanche	Comanche	10719.001	363701	LEHM46		4,482		4,087	4,194	4,272	4,343	4,254	4,397	4,464	4,605	0.037	0.079	0.100	0.090	0.095	0.090	0.080	0.086	0.082	0.037	0.082	4,488	369	0%	0%	0	369	Minimum per capita much lower than other years. Using average.
City of Hamilton	Hamilton	10492.002	CON086	LEGT47		2,977		2,937	2,995	3,053	3,011	2,893	2,960	2,983	2,991	0.121	0.124	0.141	0.121	0.117	0.124	0.130	0.175	0.132	0.117	0.117	2,918	343	0%	0%	0	343	
City of Copperas Cove	Coryell	10045.005	100455	LEBE49		29,592		24,079	23,008	24,102	24,848	28,038	28,415	29,123	30,021	0.090	0.112	0.130	0.121	0.100	0.099	0.090	0.109	0.106	0.090	0.090	58,205	2,725	0%	0%	0	2,725	
City of Gatesville	Coryell	10176.001	101761	LEBE49		15,591																							0%				
City of Gatesville	Coryell	10176.002	101761	LEBE49	1,353	15,591		11,492	11,061	11,197	11,874	12,140	11,901	12,245	12,303	0.202	0.215	0.148	0.114	0.127	0.136	0.108	0.124	0.147	0.108	0.108	37,177	4,029	0%	0%	0	4,029	I believe only one operating
City of Copperas Cove	Coryell	10045.004	022336	LEBE49																								715	0%	0%	0	715	
City of Moody	McLennan	10225.001	CON090	LEBE49		1,400		1,329	1,261	1,353	1,363	1,350	1,364	1,379	1,393	0.053	0.103	0.154	0.092	0.088	0.098	0.069	0.116	0.097	0.053	0.097	1,672	162	<1%	0%	0	162	Minimum per capita lower than other years. Using average.
City of Lampasas	Lampasas	10205.002	102051	LAKE50		6,786		6,382	6,352	6,491	6,617	6,972	7,394	7,709	7,723	0.043	0.037	0.050	0.037	0.033	0.032	0.025	0.027	0.036	0.025	0.036	7,680	273	0%	0%	0	273	Minimum per capita low. Using average.
City of Copperas Cove	Coryell	10045.003	100451	LAYO51	547																							1,786	0%	0%	0	1,786	
City of Harker Heights	Bell	10155.001	101551	LRLR53	1,547	17,308	0.089	12,841	12,320	13,605	14,440	15,000	15,270	16,745	17,091	0.091	0.144	0.186	0.130	0.104	0.102	0.085	0.112	0.119	0.085	0.085	41,818	3,544	0%	0%	0	3,544	
Bell County WCID#1	Bell	10351.001	103511	LEBE49	363																								0%				Once through
Bell County WCID#1	Bell	10351.003	103512	LRLR53	4,495	86,911	0.153	63,535	61,094	66,188	71,031	77,260	78,616	80,962	83,278	0.199	0.228	0.235	0.201	0.176	0.176	0.157	0.183	0.195	0.157	0.157	169,937	7,601	0%	0%	0	7,601	
Bell County WCID#1	Bell	10351.002	103513	LRLR53	8,820																							19,001	0%	0%	0	19,001	
BRA TBRSS	Bell	11318.001	113181	LRLR53	6,719	14,623	0.135	12,476	11,888	12,580	12,900	12,940	13,382	13,826	15,076	0.128	0.174	0.185	0.163	0.134	0.128	0.125	0.179	0.152	0.125	0.125	26,116	7,704	0%	0%	0	7,704	Assuming Temple plant returns all of its water right, rest to TBRSS. Population data for Belton
Bell County WCID#2	Bell	11090.001	LRLR53	LRLR53	59	1,645	0.036	1,390	1,346	1,451	1,515	1,468	1,599	1,650	1,669											0.11	2,116	233	60%	30%	69	164	Keep groundwater at current levels
Bell County WCID#2	Bell	11091.001	LRLR53	LRLR53																													
City of Florence	Williamson	10944.001	W12431	LRLR53	113	1,054	0.107	829	811	876	921	1,036		1,126	1,154	0.072	0.136	0.145	0.099	0.070		0.068	0.145	0.105	0.068	0.068	2,850	195	100%	60%	117	78	Assume 60% groundwater (see Region G)
Bell County WCID#3	Bell	10797.001		LRLR53	98	2,150	0.045	1,834	1,777	1,935	2,026	2,126	2,350	2,461	2,565	0.083	0.111	0.181	0.149	0.100	0.081	0.049	0.085	0.105	0.049	0.049	2,732	133	0%	0%	0	133	
City of Georgetown	Williamson	10489.002	104893	GAGE56	2,089	28,339	0.100	14,842	15,118	15,825	16,752	17,585	19,706	21,445	24,860	0.209	0.220	0.229	0.215	0.128	0.106	0.100	0.118	0.166	0.100	0.100	136,082	6,342	63%	4%	267	6,075	Assume 58% of 921 AF groundwater supply (see Region G). Assuming 459 AF direct reuse
City of Georgetown	Williamson	10489.003	104892	GALA57	747																							6,790	79%	4%	267	6,523	Assuming 459 AF direct reuse
City of Cameron	Milam	10004.001	100041	LRCA58		5,634		5,580	5,591	5,826	5,865	5,789	5,720	5,909	6,051	0.114	0.135	0.134	0.135	0.130	0.132	0.104	0.122	0.126	0.104	0.104	5,634	588	0%	0%	0	588	
BRA/LCRA BCRWSS West	Williamson	10264.001	102641	LRCA58	9,634	61,136	0.158	30,963	34,170	34,940	36,924	40,751	45,806	48,961	51,848	0.148	0.160	0.168	0.159	0.158	0.151	0.141	0.174	0.157	0.141	0.141	292,970	13,742	54%	4%	534	13,208	Assume 58% of 921 AF groundwater supply (see Region G). Assuming 27,642 AF of direct reuse
BRA/LCRA BCRWSS East	Williamson	10264.002	102642	LRCA58																									0%				
City of Taylor	Williamson	10299.001	102991	LRCA58	1,880	13,575	0.139	11,472	11,904	11,839	11,971	12,434	13,053	14,130	14,379	0.127	0.181	0.300	0.181	0.136	0.147	0.111	0.136	0.165	0.111	0.111	30,363	3,367	0%	0%	0	3,367	
Anderson Mill MUD	Williamson	11459.001	114591	LRCA58		8,953																					????.	788	0%	0%	0	788	No information. Set same as current
City of Cedar Park	Williamson	12308.001	123081	LRCA58		26,049		5,161	5,389	5,388	6,360	6,643	9,762	10,847	12,666	0.163	0.248	0.256	0.211	0.164	0.138	0.145	0.134	0.182	0.134	0.134	187,931	23,584	0%	0%	0	23,584	Assuming 1,535 AF direct reuse
City of Leander	Williamson	12644.001	126441	LRCA58	731	7,596	0.096	3,398	3,560	3,453	3,634	4,342	5,187	5,738	6,303	0.057	0.082	0.115	0.098	0.079	0.088	0.090	0.088	0.087	0.057	0.087	41,107	3,347	22%	4%	118	3,229	Keep groundwater at current levels. Assuming 245 AF direct reuse. Minimum per capita low. Using average.
City of Bartlett	Bell	10880.001	372751	LRCA58		1,675		1,439	1,370	1,478	1,509	1,529	1,602	1,679	1,689	0.156	0.174	0.121	0.127	0.057	0.093	0.144	0.174	0.131	0.057	0.131	1,181	154	100%	100%	154	0	Minimum per capita lower than other years. Using average.
Brushy Creek MUD	Williamson	11865.001	W12441	LRCA58	389	15,371	0.025																			0.11	23,823	2,448	100%	8%	189	2,259	Assume 58% of 325 AF groundwater supply (see Region G). Assuming 209 AF direct reuse
Block House MUD	Williamson	13031.001	W12441	LRCA58	303																					0.11	28,018	2,879	0%	0%	0	2,879	Assuming 246 AF direct reuse

Table D-5 (Continued)

Name	County	Permit Number	Return Control Point	Primary Control Point	2000 RF	2000 Population	2000 Annual Per Capita RF (AF/person)	TWDB Population Data 1990	1991	1992	1993	1994	1995	1996	1997	Annual Per Capita Return (AF/Person) 1990	1991	1992	1993	1994	1995	1996	1997	Average 90-97	Minimum 90-97	Assumed Per Capita	2060 Population	2060 Estimated RF	Current % Groundwater	Assumed 2060 % Groundwater	2060 Groundwater CI	2060 Surface CI	Comments
City of Holland	Bell	10897.001	372751	LRCA58	77	1,102	0.070	1,118	1,076	1,151	1,197	1,212	1,295	1,316	1,328	0.062	0.109	0.125	0.100	0.050	0.044	0.045	0.066	0.075	0.044	0.044	1,102	49	25%	29%	14	35	Keep groundwater at current levels
City of Hearne	Robertson	10046.002	100462	BRBR59		4,690		5,132	5,163	5,257	5,355	5,110	4,923	5,079	5,099	0.159	0.162	0.188	0.168	0.169	0.159	0.140	0.122	0.158	0.122	0.122	4,690	570	100%	100%	570	0	
City of Calvert	Robertson	10095.001	100462	BRBR59		1,426		1,536	1,561	1,580	1,573	1,496	1,493	1,481	1,493	0.064	0.061	0.090	0.093	0.080	0.084	0.084	0.083	0.080	0.061	0.080	1,426	114	100%	100%	114	0	Minimum per capita low. Using average.
City of Temple	Bell	10470.002	104702	BRBR59	2,617	54,514		46,109	43,787	46,413	47,251	49,079	49,489	50,097	51,005											0.125	105,519	8,692	0%	0%	0	8,692	Temple water right states that all returns must go to Temple plant. Assuming 55% of 15,804 to Temple, with rest to TBRSS
City of Rosebud	Falls	10731.001	CON117	BRBR59		1,493		1,638	1,660	1,652	1,637	1,600	1,584	1,589	1,545	0.077	0.100	0.096	0.074	0.056	0.077	0.130	0.148	0.095	0.056	0.056	1,493	84	0%	0%	0	84	
City of Troy	Bell	11263.001	CON109	BRBR59	158	1,378	0.115	1,395	1,353	1,467	1,540	1,574	1,670	1,697	1,540	0.137	0.155	0.200	0.113	0.078	0.071	0.078	0.090	0.115	0.071	0.071	1,378	97	14%	18%	17	80	Keep groundwater at current levels
City of Lexington	Lee	10016.001	MYDB60	MYDB60		1,178		953	948	984	991	1,011	1,025	1,067	1,079	0.065	0.076	0.157	0.134	0.118	0.130	0.082	0.100	0.108	0.065	0.065	2,084	136	100%	100%	136	0	
Aluminum Corp. of America	Lee	395.005	003956	EYDB61																									0%				
City of Rockdale	Milam	10658.001	CON224	EYDB61		5,439		5,235	5,314	5,396	5,503	5,457	5,353	5,594	5,637	0.057	0.080	0.072	0.090	0.102	0.109	0.096	0.104	0.089	0.057	0.057	5,966	342	100%	100%	342	0	
City of Giddings	Lee	10456.001	CON125	YCSC62		5,105		4,093	4,117	4,186	4,223	4,298	4,355	4,523	4,636	0.057	0.072	0.072	0.065	0.065	0.071	0.063	0.070	0.067	0.057	0.057	9,180	526	100%	100%	526	0	
City of Caldwell	Burleson	10813.001	DCLY63	DCLY63		3,449		3,181	3,273	3,361	3,527	3,634	3,812	3,788	3,809	0.161	0.174	0.172	0.169	0.140	0.145	0.138	0.144	0.155	0.138	0.138	4,266	589	100%	100%	589	0	
Tx Dept MHMR	Limestone	10717.001	528801	NAGR64																								212	70%	70%	149	63	No information. Keep at current levels
City of Teague	Freestone	10300.001	CON250	BGFR65		4,557		3,268	3,355	3,410	3,457	3,426	3,480	3,678	3,680	0.048	0.053	0.032	0.023	0.019	0.017	0.014	0.021	0.028	0.014	0.028	8,424	239	100%	100%	239	0	Goundwater and imports. Keep assuming as groundwater. Minimum per capita low. Using average.
City of Mexia	Limestone	10222.001	CON131	NAEA66		6,563		6,933	7,161	7,071	7,056	6,916	6,916	6,835	6,897	0.116	0.141	0.119	0.103	0.073	0.090	0.085	0.115	0.105	0.073	0.073	8,800	645	89%	91%	587	58	Keep surface water at current levels
City of Groesbeck	Limestone	10182.001	W12531	NAEA66		4,291		3,185	3,318	3,545	3,500	3,454	3,515	3,614	3,747	0.065	0.063	0.068	0.113	0.117	0.086	0.107	0.129	0.093	0.063	0.063	9,068	569	0%	0%	0	569	
City of College Station	Brazos	10024.006	100241	BRHE68	6,148	67,890	0.091	52,456	54,894	56,671	60,012	58,982	61,814	62,644	63,628	0.122	0.121	0.122	0.116	0.106	0.098	0.092	0.101	0.110	0.092	0.092	131,981	12,186	100%	100%	12,186	0	
City of Navasota	Grimes	10231.001	102311	BRHE68		6,789		6,296	6,444	6,573	6,659	6,813	6,859	6,973	7,010	0.135	0.176	0.158	0.135	0.112	0.132	0.111	0.133	0.136	0.111	0.111	8,262	917	100%	100%	917	0	
City of Brenham	Washingto	10388.001	103881	BRHE68		13,507		11,952	12,445	12,616	12,950	12,966	13,560	13,564	13,726	0.141	0.147	0.164	0.145	0.144	0.140	0.137	0.144	0.145	0.137	0.137	16,844	2,300	0%	0%	0	2,300	
City of Bryan	Brazos	10426.001	104261	BRHE68	5,202	65,660	0.079	55,002	56,822	57,151	59,473	61,210	60,637	61,715	62,338	0.135	0.138	0.134	0.132	0.126	0.126	0.121	0.124	0.130	0.121	0.121	109,881	8,354	100%	100%	8,354	0	
City of Bryan	Brazos	10426.002	104262	BRHE68																								4,177	100%	100%	4,177	0	
Texas A&M University	Brazos	10968.003	109681	BRHE68																								1,946	100%	100%	1,946	0	Set same as current
City of Somerville	Burleson	10371.001	516451	BRHE68		1,704		1,542	1,556	1,555	1,592	1,611	1,641	1,653	1,657	0.109	0.114	0.156	0.163	0.171	0.133	0.116	0.180	0.143	0.109	0.109	2,197	239	100%	100%	239	0	
City of Bryan	Brazos	10426.003	526851	BRHE68																								783	100%	100%	783	0	
Texas A&M University	Brazos	2585.001	025851	BRHE68	1,567																							1,176	100%	100%	1,176	0	Set same as current
Texas Dept Of Criminal Justice	Grimes	13743.001	CON148	BRHE68																								212	100%	100%	212	0	Set same as current
Texas Dept Of Criminal Justice	Grimes	12458.002	CON149	BRHE68																								62	100%	100%	62	0	Set same as current
City of Bellville	Austin	10385.002	103851	MCBL69		3,794		3,378	3,427	3,449	3,484	3,659	3,726	3,799	3,734	0.135	0.143	0.162	0.149	0.145	0.141	0.125	0.129	0.141	0.125	0.125	5,164	646	100%	100%	646	0	
City of Richmond	Fort Bend	10258.001	102581	BRRI70	657	11,081	0.059	9,801	10,449	10,846	10,984	11,790	11,809	12,747	13,841	0.225	0.208	0.201	0.202	0.188	0.209	0.231	0.155	0.202	0.155	0.155	20,110	777	100%	46%	354	423	Assume 46% groundwater (see Region H)
City of Sealy	Austin	10276.001	102761	BRRI70		5,248		4,541	4,623	4,697	4,795	5,085	5,219	5,419	5,558	0.099	0.128	0.130	0.126	0.109	0.131	0.112	0.122	0.120	0.099	0.099	7,574	751	100%	100%	751	0	
City of Rosenberg	Fort Bend	10607.003	106073	BRRI70	1,362	24,043	0.117	20,183	21,577	22,345	23,275	24,210	25,857	26,654	28,589	0.135	0.148	0.133	0.128	0.125	0.121	0.109	0.133	0.129	0.109	0.109	57,587	2,510	100%	50%	1,250	1,260	Assume 50% groundwater (see Region H)
Praire View A&M Universtiy	Waller	11275.002	112751	BRRI70																								575	100%	100%	575	0	Set same as current
Brookshire MWD	Waller	10001.001	516604	BRRI70		3,450		2,922	3,140	3,158	3,305	3,377	3,511	3,510	3,811	0.127	0.142	0.141	0.142	0.139	0.139	0.126	0.142	0.137	0.126	0.126	7,642	962	100%	52%	502	460	Assume 52% groundwater (see Region H)
Frito-Lay Inc.	Fort Bend	2443.001	024431	BRRI70	376																							121	100%	100%	121	0	Set same as current
Fort Bend Co. MUD 081	Fort Bend	13051.002	BRRI70	BRRI70	112																					0.1	7,019	702	100%	100%	702	0	Assume staying all groundwater
City of Hempstead	Waller	10948.001	CON150	BRRI70		4,691		3,551	3,514	3,657	3,763	3,828	3,909	4,007	4,112	0.097	0.150	0.164	0.138	0.128	0.124	0.121	0.126	0.131	0.097	0.097	13,703	1,335	100%	78%	1,040	295	Assume 78% groundwater (see Region H)
City of Wallis	Austin	10765.001	CON153	BRRI70		1,172		1,001	1,036	1,070	1,098	1,111	1,128	1,286	1,300	0.110	0.161	0.159	0.138	0.100	0.109	0.151	0.108	0.130	0.100	0.100	1,735	173	100%	100%	173	0	
City of Rosenberg	Fort Bend	10607.002	106072	BGNE71	1,453																							3,764	100%	50%	1,875	1,889	Assume 50% groundwater (see Region H)
City of Richmond	Fort Bend	10258.003	102582	BRRO72																								2,332	100%	46%	1,063	1,269	Assume 46% groundwater (see Region H)
BRA SLRSS	Fort Bend	11317.001	113171	BRRO72	4,311																							4,037	100%	38%	1,547	2,490	Assume 38% groundwater (see Region H)
Pecan Grove MUD	Fort Bend	11655.001	116551	BRRO72	1,221																					0.1	15,099	1,510	100%	46%	695	815	Assume same amount of surface water as Richmond
City of Sugar Land	Fort Bend	12833.002	128331	BRRO72	4,981	63,328	0.147	24,529	27,020	36,708	38,925	41,589	43,182	52,967	79,433	0.293	0.284	0.213	0.189	0.166	0.164	0.152	0.107	0.196	0.107	0.107	72,500	3,723	100%	38%	1,426	2,297	Assume 38% groundwater (see Region H)
Texas Dept. of Criminal Justice - Central	Fort Bend	10986.001	128332	BRRO72	287																							230	100%	100%	230	0	Set same as current
Texas Dept. of Criminal Justice - Jester III	Fort Bend	11475.003	128332	BRRO72																								170	100%	100%	170	0	Set same as current
City of Sugar Land	Fort Bend	12833.003	128332	BRRO72																									0%				
Plantation MUD	Fort Bend	11971.001	133551	BRRO72	310																					0.1	4,130	413	100%	40%	165	248	Assume same as Sugar Land (40% groundwater)
Fort Bend MUD 106	Fort Bend	13355.001	133551	BRRO72	560																					0.17	3,285	558	100%	40%	223	335	Assume same as Sugar Land (40% groundwater)
Fort Bend MUD 112	Fort Bend	13628.001	136281	BRRO72																								844	100%	100%	844	0	No information. Set same as current
Texas Dept. of Criminal Justice - Jester I	Fort Bend	11475.001	517033	BRRO72	221																							221	100%	100%	221	0	Set same as current
City of Lake Jackson	Brazoria	10047.001	100471	BRGM73		26,386		22,776	23,412	23,814	24,355	24,308	24,642	25,330	25,948	0.095	0.112	0.125	0.119	0.115	0.120	0.114	0.131	0.116	0.095	0.095	44,205	4,194	17%	35%	1,468	2,726	Assume 35% groundwater (see Region H)
City of West Columbia	Brazoria	10312.001	103121	BRGM73		4,255		4,372	4,564	4,713	4,872	4,913	4,999	5,142	5,214	0.224	0.434	0.558	0.341	0.307	0.311	0.222	0.362	0.345	0.222	0.222	3,678	818	100%	100%	818	0	
City of Freeport	Brazoria	10882.001	108821	BRGM73		12,708		11,389	11,899	12,270	12,646	12,793	13,041	13,428	13,632	0.136	0.169	0.157	0.163	0.141	0.141	0.113	0.118	0.142	0.113	0.113	31,059	3,520	0%	0%	0	3,520	
BRA CRWTF	Brazoria	10044.001	100441	SJGMC4	2,376	10,424	0.177	8,910	9,116	9,776	9,743	9,672	9,672	10,160	10,190	0.158	0.257	0.261	0.263	0.218	0.221	0.144	0.238	0.220	0.144	0.144	15,141	2,805	2%	25%	691	2,114	Assume 25% groundwater (see Region H)
						3,012		2,732	2,795	2,822	2,847	2,899	2,842	2,938	2,948											0.144	4,392						
City of Angleton	Brazoria	10548.001	105481	SJGMC4		18,130		17,140	17,825	18,328	18,763	18,925	19,281	19,902	21,671	0.154	0.150	0.144	0.137	0.126	0.133	0.156	0.113	0.139	0.113	0.113	23,010	2,596	2%	22%	564	2,032	Assume 22% groundwater (see Region H)
Fort Bend MUD 025	Fort Bend	12003.001	517034	SJGMC4																						0.1	45,032	4,503	100%	40%	1,801	2,702	Assume same as Sugar Land (40% groundwater)
Fort Bend MUD 041	Fort Bend	12475.001	517034	SJGMC4	237																					0.1	25,701	2,570	100%	40%	1,028	1,542	Assume same as Sugar Land (40% groundwater)
Totals																												*277,497*			*62,209*	*210,432*	

Table D-6a
Surface Water Returns - Current Conditions
Values in Acre-Feet

CP	Jan Return	Feb Return	Mar Return	Apr Return	May Return	Jun Return	Jly Return	Aug Return	Sep Return	Oct Return	Nov Return	Dec Return	Total	Name
103341	1,197	1,147	1,025	933	1,063	1,025	932	891	1,071	1,067	1,212	1,176	12,739	City of Abilene
100401	41	43	49	41	49	48	40	38	37	37	38	37	498	City of Breckenridge
104871	95	90	95	90	106	90	87	77	89	83	94	92	1,088	City of Graham
027891	1	1	2	2	4	5	6	3	2	2	1	1	30	Double Diamond
401401	22	20	20	16	18	16	14	15	16	20	17	19	213	City of Ranger
105851	32	36	39	35	41	36	33	36	30	30	31	34	413	City of Mineral Wells
105852	55	62	68	61	71	63	57	63	51	52	53	57	713	City of Mineral Wells
101782	41	53	60	49	53	48	58	62	60	62	53	51	650	City of Granbury
515651	35	28	25	30	33	36	41	41	37	41	35	37	419	BRA SWATS
515651	0	0	1	3	1	3	4	2	1	0	0	0	15	Acton MUD
407601	0	0	1	3	1	1	2	1	1	1	0	0	11	Acton MUD
100061	25	27	28	31	35	34	36	39	35	32	26	26	374	City of Cleburne
410501	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Godley
409631	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Glen Rose
515731	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Whitney
106301	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Itasca
106301	80	72	74	78	93	94	96	95	91	86	73	80	1,012	City of Hillsboro
102902	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Stephenville
NBHI35	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Hico
228202	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Meridian
555151	0	1	6	4	12	1	1	11	2	1	5	5	49	City of Clifton
102191	49	47	53	49	57	47	42	42	41	43	43	49	562	City of McGregor
W12252	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Valley Mills
101102	24	29	36	34	118	123	89	102	88	28	23	19	713	City of Marlin
110711	1,662	1,660	1,772	1,714	1,776	1,844	1,818	1,868	1,885	1,807	1,732	1,689	21,227	BRA WMRSS
435201	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Lorena
CON070	0	0	0	0	0	0	0	0	0	0	0	0	0	City of West
106371	27	27	28	31	37	43	54	52	42	34	29	29	433	City of Eastland
CON054	12	12	13	12	13	11	10	11	11	11	11	11	138	City of De Leon
284602	18	20	20	19	21	17	16	17	17	17	17	19	218	City of Dublin
363701	30	32	33	31	34	29	26	28	28	28	28	30	357	City of Comanche
CON086	29	31	31	30	32	27	25	27	26	27	26	29	340	City of Hamilton
100455	130	127	146	139	156	140	128	126	123	122	120	135	1,592	City of Copperas Cove
101761	28	27	30	28	32	27	24	24	24	25	24	27	320	City of Gatesville
101761	117	113	127	118	136	112	102	101	100	104	103	119	1,352	City of Gatesville
022336	20	20	22	21	24	21	20	19	19	19	18	22	245	City of Copperas Cove
CON090	9	9	10	9	11	9	8	8	8	8	8	8	105	City of Moody
102051	17	16	18	17	20	16	15	15	14	15	15	17	195	City of Lampasas
100451	43	42	48	46	52	46	42	42	41	40	40	45	527	City of Copperas Cove
101551	111	107	121	113	129	107	97	96	95	99	98	114	1,287	City of Harker Heights
103511	0	0	0	0	0	0	0	0	0	0	0	0	0	Bell County WCID#1
103512	300	292	336	320	359	322	295	290	284	280	277	313	3,668	Bell County WCID#1
103513	721	703	809	769	862	773	708	697	682	673	665	757	8,819	Bell County WCID#1

Table D-6a (Continued)

CP	Jan Return	Feb Return	Mar Return	Apr Return	May Return	Jun Return	Jly Return	Aug Return	Sep Return	Oct Return	Nov Return	Dec Return	Total	Name
113181	487	475	547	520	583	522	478	471	461	455	449	511	5,959	BRA TBRSS
LRLR53	3	8	4	4	6	4	3	4	4	3	3	1	47	Bell County WCID#2
LRLR53	0	0	0	0	0	0	0	0	0	0	0	0	0	Bell County WCID#2
W12431	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Florence
LRLR53	8	8	9	9	10	8	7	7	7	8	7	10	98	Bell County WCID#3
104893	64	78	62	58	80	102	63	67	86	79	85	70	894	City of Georgetown
104892	13	18	11	10	17	25	12	14	19	17	19	13	188	City of Georgetown
100041	50	53	54	53	60	60	42	40	44	52	54	55	617	City of Cameron
102641	476	543	530	498	550	672	479	453	561	496	525	490	6,273	BRA/LCRA BCRWSS West
102642	0	0	0	0	0	0	0	0	0	0	0	0	0	BRA/LCRA BCRWSS East
102991	111	117	124	118	132	147	154	157	152	140	135	126	1,613	City of Taylor
114591	60	61	62	60	67	78	60	61	73	69	70	67	788	Anderson Mill MUD
123081	129	131	133	130	145	168	130	132	157	148	152	141	1,696	City of Cedar Park
126441	31	35	36	33	37	45	32	31	38	35	37	35	425	City of Leander
372751	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Bartlett
W12441	0	0	0	0	0	0	0	0	0	0	0	0	0	Brushy Creek MUD
W12441	19	19	19	19	21	24	19	19	22	21	22	19	243	Block House MUD
372751	4	4	4	4	5	4	3	3	3	3	3	3	43	City of Holland
100462	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Hearne
100462	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Calvert
104702	188	184	211	201	225	202	185	182	178	176	174	198	2,304	City of Temple
CON117	8	8	8	8	9	7	7	7	7	7	7	7	90	City of Rosebud
CON109	9	9	9	10	10	9	8	8	8	8	8	8	104	City of Troy
MYDB60	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Lexington
003956	0	0	0	0	0	0	0	0	0	0	0	0	0	Aluminum Corp. of America
CON224	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Rockdale
CON125	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Giddings
DCLY63	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Caldwell
528801	0	7	3	4	5	12	7	4	9	6	4	2	63	Tx Dept MHMR
CON250	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Teague
CON131	0	4	0	0	4	21	10	2	13	4	0	0	58	City of Mexia
W12531	21	22	24	24	29	32	28	26	25	25	22	26	304	City of Groesbeck
100241	0	0	0	0	0	0	0	0	0	0	0	0	0	City of College Station
102311	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Navasota
103881	131	134	142	142	161	181	160	162	164	158	143	131	1,809	City of Brenham
104261	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Bryan
104262	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Bryan
109681	0	0	0	0	0	0	0	0	0	0	0	0	0	Texas A&M University
516451	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Somerville
526851	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Bryan
025851	0	0	0	0	0	0	0	0	0	0	0	0	0	Texas A&M University
CON148	0	0	0	0	0	0	0	0	0	0	0	0	0	Texas Dept Of Criminal Justice
CON149	0	0	0	0	0	0	0	0	0	0	0	0	0	Texas Dept Of Criminal Justice
103851	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Bellville
102581	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Richmond
102761	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Sealy

Table D-6a (Continued)

CP	Jan Return	Feb Return	Mar Return	Apr Return	May Return	Jun Return	Jly Return	Aug Return	Sep Return	Oct Return	Nov Return	Dec Return	Total	Name
106073	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Rosenberg
112751	0	0	0	0	0	0	0	0	0	0	0	0	0	Praire View A&M Universtiy
516604	0	0	0	0	0	0	0	0	0	0	0	0	0	Brookshire MWD
024431	0	0	0	0	0	0	0	0	0	0	0	0	0	Frito-Lay Inc.
BRRI70	0	0	0	0	0	0	0	0	0	0	0	0	0	Fort Bend Co. MUD 081
CON150	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Hempstead
CON153	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Wallis
106072	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Rosenberg
102582	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Richmond
113171	0	0	0	0	0	0	0	0	0	0	0	0	0	BRA SLRSS
116551	0	0	0	0	0	0	0	0	0	0	0	0	0	Pecan Grove MUD
128331	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Sugarland
128332	0	0	0	0	0	0	0	0	0	0	0	0	0	Texas Dept. of Criminal Justice - Central
128332	0	0	0	0	0	0	0	0	0	0	0	0	0	Texas Dept. of Criminal Justice - Jester III
128332	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Sugarland
133551	0	0	0	0	0	0	0	0	0	0	0	0	0	Plantation MUD
133551	0	0	0	0	0	0	0	0	0	0	0	0	0	Fort Bend MUD 106
136281	0	0	0	0	0	0	0	0	0	0	0	0	0	Fort Bend MUD 112
517033	0	0	0	0	0	0	0	0	0	0	0	0	0	Texas Dept. of Criminal Justice - Jester I
100471	149	199	201	205	183	186	243	222	215	177	192	164	2,336	City of Lake Jackson
103121	0	0	0	0	0	0	0	0	0	0	0	0	0	City of West Columbia
108821	107	113	122	134	130	137	151	143	143	129	115	98	1,522	City of Freeport
100441	164	172	186	206	200	210	230	219	218	197	175	151	2,328	BRA CRWTF
105481	166	174	188	207	201	211	233	221	221	198	178	152	2,350	City of Angleton
517034	0	0	0	0	0	0	0	0	0	0	0	0	0	Fort Bend MUD 025
517034	0	0	0	0	0	0	0	0	0	0	0	0	0	Fort Bend MUD 041

Table D-6b
Groundwater Returns - Current Conditions
Values in Acre-Feet

CP	Jan Return	Feb Return	Mar Return	Apr Return	May Return	Jun Return	Jly Return	Aug Return	Sep Return	Oct Return	Nov Return	Dec Return	Total	Name
103341	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Abilene
100401	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Breckenridge
104871	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Graham
027891	0	0	0	0	0	0	0	0	0	0	0	0	0	Double Diamond
401401	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Ranger
105851	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Mineral Wells
105852	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Mineral Wells
101782	11	9	10	14	14	19	25	21	13	14	10	10	170	City of Granbury
515651	0	0	0	0	0	0	0	0	0	0	0	0	0	BRA SWATS
515651	10	13	6	6	10	8	7	10	8	9	12	11	110	Acton MUD
407601	7	11	4	4	8	7	6	8	6	7	9	9	86	Acton MUD
100061	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Cleburne
410501	4	3	3	4	2	4	1	3	2	1	3	4	34	City of Godley
409631	11	10	14	14	17	17	17	17	16	18	15	11	177	City of Glen Rose
515731	5	14	14	13	9	6	10	10	10	10	12	3	116	City of Whitney
106301	10	9	9	8	10	7	7	9	7	9	10	9	104	City of Itasca
106301	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Hillsboro
102902	113	112	115	126	126	127	110	83	72	116	109	104	1313	City of Stephenville
NBHI35	5	4	5	5	3	5	4	5	5	5	5	5	56	City of Hico
228202	10	10	9	11	11	2	7	4	5	6	7	11	93	City of Meridian
555151	16	12	10	11	5	13	12	2	11	12	8	9	121	City of Clifton
102191	5	5	6	6	6	5	5	5	5	5	5	5	63	City of McGregor
W12252	1	2	2	0	0	2	2	0	4	0	2	0	15	City of Valley Mills
101102	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Marlin
110711	291	273	271	292	287	237	272	278	275	308	257	307	3348	BRA WMRSS
435201	5	6	7	5	5	5	4	4	5	5	5	5	61	City of Lorena
CON070	8	10	18	10	7	6	4	4	5	7	13	8	100	City of West
106371	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Eastland
CON054	0	0	0	0	0	0	0	0	0	0	0	0	0	City of De Leon
284602	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Dublin
363701	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Comanche
CON086	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Hamilton
100455	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Copperas Cove
101761	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Gatesville
101761	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Gatesville
022336	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Copperas Cove
CON090	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Moody
102051	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Lampasas
100451	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Copperas Cove
101551	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Harker Heights
103511	0	0	0	0	0	0	0	0	0	0	0	0	0	Bell County WCID#1

Table D-6b (Continued)

CP	Jan Return	Feb Return	Mar Return	Apr Return	May Return	Jun Return	Jly Return	Aug Return	Sep Return	Oct Return	Nov Return	Dec Return	Total	Name
103512	0	0	0	0	0	0	0	0	0	0	0	0	0	Bell County WCID#1
103513	0	0	0	0	0	0	0	0	0	0	0	0	0	Bell County WCID#1
113181	0	0	0	0	0	0	0	0	0	0	0	0	0	BRA TBRSS
LRLR53	7	2	7	6	6	6	6	5	5	6	6	7	69	Bell County WCID#2
LRLR53	0	0	0	0	0	0	0	0	0	0	0	0	0	Bell County WCID#2
W12431	3	3	5	4	6	3	4	3	4	3	3	4	45	City of Florence
LRLR53	0	0	0	0	0	0	0	0	0	0	0	0	0	Bell County WCID#3
104893	79	67	85	85	80	84	80	78	87	84	82	87	978	City of Georgetown
104892	33	29	36	36	34	35	34	33	37	36	35	37	415	City of Georgetown
100041	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Cameron
102641	129	70	93	108	127	114	127	163	171	195	184	176	1657	BRA/LCRA BCRWSS West
102642	0	0	0	0	0	0	0	0	0	0	0	0	0	BRA/LCRA BCRWSS East
102991	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Taylor
114591	0	0	0	0	0	0	0	0	0	0	0	0	0	Anderson Mill MUD
123081	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Cedar Park
126441	10	7	7	8	9	9	10	11	12	12	12	11	118	City of Leander
372751	8	9	10	2	8	6	1	3	3	7	10	10	77	City of Bartlett
W12441	38	32	22	22	26	27	32	32	4	32	33	36	336	Brushy Creek MUD
W12441	0	0	0	0	0	0	0	0	0	0	0	0	0	Block House MUD
372751	1	1	1	1	1	1	1	1	1	1	1	3	14	City of Holland
100462	5	27	58	52	56	49	53	57	57	33	33	29	509	City of Hearne
100462	10	9	10	9	10	10	10	0	10	10	9	10	107	City of Calvert
104702	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Temple
CON117	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Rosebud
CON109	1	1	2	1	2	1	1	1	1	1	1	4	17	City of Troy
MYDB60	4	4	5	6	6	0	6	6	0	5	5	5	52	City of Lexington
003956	0	0	0	0	0	0	0	0	0	0	0	0	0	Aluminum Corp. of America
CON224	18	15	16	16	20	19	18	19	24	25	20	32	242	City of Rockdale
CON125	15	16	17	17	24	17	19	14	18	19	16	18	210	City of Giddings
DCLY63	20	19	21	23	42	39	38	37	37	38	33	37	384	City of Caldwell
528801	14	8	13	13	14	13	12	14	10	12	12	14	149	Tx Dept MHMR
CON250	6	5	0	0	6	5	5	5	4	6	5	5	52	City of Teague
CON131	42	23	39	40	42	39	36	42	32	36	37	41	449	City of Mexia
W12531	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Groesbeck
100241	485	505	521	537	502	474	496	525	542	537	510	474	6108	City of College Station
102311	64	58	65	60	59	44	72	75	68	67	64	67	762	City of Navasota
103881	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Brenham
104261	463	421	384	342	474	459	447	451	423	347	340	447	4998	City of Bryan
104262	163	109	131	109	161	171	164	163	178	186	179	152	1866	City of Bryan
109681	129	129	154	166	172	175	184	177	175	180	158	147	1946	Texas A&M University
516451	3	3	3	15	14	1	4	1	3	3	3	0	53	City of Somerville
526851	32	31	31	32	31	28	33	34	36	34	34	36	391	City of Bryan
025851	92	72	5	61	72	102	112	112	112	184	133	119	1176	Texas A&M University
CON148	19	17	19	18	18	16	16	17	18	17	18	19	212	Texas Dept Of Criminal Justice
CON149	6	3	3	12	4	5	5	5	4	5	5	5	62	Texas Dept Of Criminal Justice
103851	36	34	33	32	36	31	33	36	30	31	27	29	388	City of Bellville

Table D-6b (Continued)

CP	Jan Return	Feb Return	Mar Return	Apr Return	May Return	Jun Return	Jly Return	Aug Return	Sep Return	Oct Return	Nov Return	Dec Return	Total	Name
102581	54	53	54	53	60	54	55	57	52	54	52	57	652	City of Richmond
102761	36	34	38	36	35	32	34	33	31	32	33	42	416	City of Sealy
106073	15	66	88	98	153	172	145	150	138	112	107	118	1362	City of Rosenberg
112751	55	62	51	50	53	26	25	32	67	62	55	37	575	Praire View A&M Universtiy
516604	21	21	21	20	24	22	24	23	25	20	22	22	265	Brookshire MWD
024431	35	9	22	17	12	5	5	4	0	10	1	1	121	Frito-Lay Inc.
BRRI70	0	0	0	0	0	3	2	1	2	2	1	1	12	Fort Bend Co. MUD 081
CON150	16	1	17	13	18	23	29	27	28	29	29	28	258	City of Hempstead
CON153	8	7	7	7	8	6	7	7	6	7	7	8	85	City of Wallis
106072	141	109	136	128	120	119	120	119	119	111	109	122	1453	City of Rosenberg
102582	66	49	63	61	71	68	78	78	67	70	63	65	800	City of Richmond
113171	370	294	326	348	385	360	339	342	308	330	337	396	4135	BRA SLRSS
116551	86	84	86	98	115	110	110	103	105	98	82	95	1172	Pecan Grove MUD
128331	331	295	327	327	367	373	404	426	408	383	343	365	4349	City of Sugarland
128332	20	16	20	25	25	12	21	16	16	20	21	18	230	Texas Dept. of Criminal Justice - Central
128332	13	12	14	14	14	14	15	15	17	14	14	14	170	Texas Dept. of Criminal Justice - Jester III
128332	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Sugarland
133551	32	24	26	27	26	23	26	27	24	26	26	26	310	Plantation MUD
133551	18	18	46	32	46	51	60	60	55	74	41	38	539	Fort Bend MUD 106
136281	60	60	60	60	60	60	121	121	60	60	60	62	844	Fort Bend MUD 112
517033	18	17	18	18	18	18	18	18	20	18	18	18	221	Texas Dept. of Criminal Justice - Jester I
100471	49	9	23	43	58	66	35	42	49	60	20	17	471	City of Lake Jackson
103121	124	119	111	106	98	82	93	79	84	79	84	84	1143	City of West Columbia
108821	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Freeport
100441	3	4	4	4	4	4	5	5	5	4	4	2	48	BRA CRWTF
105481	3	3	3	4	4	4	4	4	4	4	3	2	42	City of Angleton
517034	12	10	10	11	11	11	12	11	12	12	12	11	135	Fort Bend MUD 025
517034	6	6	6	6	13	19	25	31	25	19	13	6	175	Fort Bend MUD 041

Table D-6c
Surface Water Returns - 2060 Conditions
Values in Acre-Feet

CP	Jan Return	Feb Return	Mar Return	Apr Return	May Return	Jun Return	Jly Return	Aug Return	Sep Return	Oct Return	Nov Return	Dec Return	Total	Name
103341	1,359	1,302	1,163	1,059	1,207	1,163	1,058	1,011	1,216	1,211	1,376	1,335	14,460	City of Abilene
100401	40	42	48	40	48	47	39	37	36	36	37	34	484	City of Breckenridge
104871	93	88	93	88	104	88	85	76	87	81	92	92	1,067	City of Graham
027891	1	1	2	2	4	5	6	3	2	2	1	1	30	Double Diamond
401401	14	12	12	10	11	10	9	9	10	12	10	12	131	City of Ranger
105851	40	45	49	44	52	45	42	45	38	38	39	43	520	City of Mineral Wells
105852	75	84	93	83	97	86	78	86	69	71	72	77	971	City of Mineral Wells
101782	125	149	168	151	161	161	199	199	175	182	151	145	1,966	City of Granbury
515651	187	150	134	161	177	193	219	219	198	219	187	198	2,242	BRA SWATS
515651	138	180	97	124	152	152	152	166	124	124	166	151	1,726	Acton MUD
407601	133	210	95	133	172	152	152	172	133	152	172	173	1,849	Acton MUD
100061	67	72	75	83	94	91	96	104	94	86	70	68	1,000	City of Cleburne
410501	4	3	3	4	2	4	1	3	2	1	3	5	35	City of Godley
409631	7	6	8	8	10	10	10	10	10	11	9	8	107	City of Glen Rose
515731	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Whitney
106301	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Itasca
106301	108	98	100	106	126	127	130	129	123	117	99	109	1,372	City of Hillsboro
102902	128	127	131	143	143	144	125	94	82	132	124	120	1,493	City of Stephenville
NBHI35	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Hico
228202	22	22	20	24	24	4	15	9	11	13	15	26	205	City of Meridian
555151	17	14	17	16	18	15	14	14	14	14	14	11	178	City of Clifton
102191	50	48	55	51	59	48	44	44	43	45	45	50	582	City of McGregor
W12252	1	2	2	1	2	3	2	2	3	3	2	2	25	City of Valley Mills
101102	30	36	45	42	146	152	110	126	109	35	29	24	884	City of Marlin
110711	2,260	2,236	2,364	2,321	2,387	2,408	2,418	2,483	2,499	2,447	2,301	2,309	28,433	BRA WMRSS
435201	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Lorena
CON070	23	29	53	29	20	18	12	12	15	20	38	23	292	City of West
106371	24	24	25	27	33	38	48	46	37	30	26	23	381	City of Eastland
CON054	12	12	13	12	13	11	10	11	11	11	11	14	141	City of De Leon
284602	36	40	40	38	42	34	32	34	34	34	34	35	433	City of Dublin
363701	31	33	34	32	35	30	27	29	29	29	29	31	369	City of Comanche
CON086	29	31	31	30	32	27	25	27	26	27	26	32	343	City of Hamilton
100455	223	217	250	238	267	240	219	216	211	209	205	230	2,725	City of Copperas Cove
101761	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Gatesville
101761	349	337	378	352	405	334	304	301	298	310	307	354	4,029	City of Gatesville
022336	58	58	64	61	70	61	58	55	55	55	53	67	715	City of Copperas Cove
CON090	14	14	15	14	17	14	12	12	12	12	12	14	162	City of Moody
102051	24	22	25	24	28	22	21	21	20	21	21	24	273	City of Lampasas
100451	146	142	163	156	176	156	142	142	139	136	136	152	1,786	City of Copperas Cove
101551	306	295	333	311	355	295	267	264	262	273	270	313	3,544	City of Harker Heights
103511	0	0	0	0	0	0	0	0	0	0	0	0	0	Bell County WCID#1
103512	622	605	696	663	744	667	611	601	589	580	574	649	7,601	Bell County WCID#1
103513	1,553	1,515	1,743	1,657	1,857	1,665	1,525	1,502	1,469	1,450	1,433	1,632	19,001	Bell County WCID#1

Table D-6c (Continued)

CP	Jan Return	Feb Return	Mar Return	Apr Return	May Return	Jun Return	Jly Return	Aug Return	Sep Return	Oct Return	Nov Return	Dec Return	Total	Name
113181	630	614	707	672	754	675	618	609	596	588	580	661	7,704	BRA TBRSS
LRLR53	14	14	16	14	17	14	13	13	13	13	13	10	164	Bell County WCID#2
LRLR53	0	0	0	0	0	0	0	0	0	0	0	0	0	Bell County WCID#2
W12431	5	5	9	7	10	5	7	5	7	5	5	8	78	City of Florence
LRLR53	11	11	12	12	14	11	10	10	10	11	10	11	133	Bell County WCID#3
104893	464	471	477	464	519	604	464	471	561	529	542	509	6,075	City of Georgetown
104892	498	508	508	498	552	649	498	508	606	573	584	541	6,523	City of Georgetown
100041	48	51	51	51	57	57	40	38	42	50	51	52	588	City of Cameron
102641	1,008	1,021	1,038	1,009	1,128	1,309	1,009	1,026	1,219	1,151	1,181	1,109	13,208	BRA/LCRA BCRWSS West
102642	0	0	0	0	0	0	0	0	0	0	0	0	0	BRA/LCRA BCRWSS East
102991	232	244	259	246	276	307	321	328	317	292	282	263	3,367	City of Taylor
114591	60	61	62	60	67	78	60	61	73	69	70	67	788	Anderson Mill MUD
123081	1,794	1,822	1,849	1,808	2,016	2,336	1,808	1,836	2,183	2,058	2,114	1,960	23,584	City of Cedar Park
126441	244	250	256	244	274	321	250	250	297	279	291	273	3,229	City of Leander
372751	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Bartlett
W12441	255	215	148	148	175	182	215	215	27	215	222	242	2,259	Brushy Creek MUD
W12441	225	225	225	225	249	284	225	225	261	249	261	225	2,879	Block House MUD
372751	3	3	3	3	4	3	2	2	2	2	2	6	35	City of Holland
100462	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Hearne
100462	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Calvert
104702	709	694	796	758	849	762	698	687	672	664	656	747	8,692	City of Temple
CON117	7	7	7	7	8	7	7	7	7	7	7	6	84	City of Rosebud
CON109	7	7	7	7	8	7	6	6	6	6	6	7	80	City of Troy
MYDB60	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Lexington
003956	0	0	0	0	0	0	0	0	0	0	0	0	0	Aluminum Corp. of America
CON224	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Rockdale
CON125	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Giddings
DCLY63	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Caldwell
528801	4	4	5	5	6	7	6	5	6	5	5	5	63	Tx Dept MHMR
CON250	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Teague
CON131	5	3	4	5	5	7	5	5	5	5	4	5	58	City of Mexia
W12531	39	41	45	45	54	60	52	49	47	47	41	49	569	City of Groesbeck
100241	0	0	0	0	0	0	0	0	0	0	0	0	0	City of College Station
102311	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Navasota
103881	167	170	181	181	205	230	203	206	209	201	182	165	2,300	City of Brenham
104261	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Bryan
104262	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Bryan
109681	0	0	0	0	0	0	0	0	0	0	0	0	0	Texas A&M University
516451	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Somerville
526851	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Bryan
025851	0	0	0	0	0	0	0	0	0	0	0	0	0	Texas A&M University
CON148	0	0	0	0	0	0	0	0	0	0	0	0	0	Texas Dept Of Criminal Justice
CON149	0	0	0	0	0	0	0	0	0	0	0	0	0	Texas Dept Of Criminal Justice
103851	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Bellville

Table D-6c (Continued)

CP	Jan Return	Feb Return	Mar Return	Apr Return	May Return	Jun Return	Jly Return	Aug Return	Sep Return	Oct Return	Nov Return	Dec Return	Total	Name
102581	35	34	35	34	39	35	36	37	34	35	34	35	423	City of Richmond
102761	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Sealy
106073	14	61	81	91	142	159	134	139	128	104	99	108	1,260	City of Rosenberg
112751	0	0	0	0	0	0	0	0	0	0	0	0	0	Praire View A&M Universtiy
516604	36	36	36	35	42	38	42	40	43	35	38	39	460	Brookshire MWD
024431	0	0	0	0	0	0	0	0	0	0	0	0	0	Frito-Lay Inc.
BRRI70	0	0	0	0	0	0	0	0	0	0	0	0	0	Fort Bend Co. MUD 081
CON150	18	1	19	15	21	26	33	31	32	33	33	33	295	City of Hempstead
CON153	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Wallis
106072	183	142	177	166	156	155	156	155	155	144	142	158	1,889	City of Rosenberg
102582	104	78	100	97	113	108	124	124	107	111	100	103	1,269	City of Richmond
113171	223	177	196	210	232	217	204	206	185	199	203	238	2,490	BRA SLRSS
116551	60	58	60	68	80	76	76	72	73	68	57	67	815	Pecan Grove MUD
128331	175	156	173	173	194	197	213	225	215	202	181	193	2,297	City of Sugarland
128332	0	0	0	0	0	0	0	0	0	0	0	0	0	Texas Dept. of Criminal Justice - Central
128332	0	0	0	0	0	0	0	0	0	0	0	0	0	Texas Dept. of Criminal Justice - Jester III
128332	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Sugarland
133551	25	19	20	22	20	18	20	22	19	20	20	23	248	Plantation MUD
133551	11	11	29	20	29	32	37	37	34	46	25	24	335	Fort Bend MUD 106
136281	0	0	0	0	0	0	0	0	0	0	0	0	0	Fort Bend MUD 112
517033	0	0	0	0	0	0	0	0	0	0	0	0	0	Texas Dept. of Criminal Justice - Jester I
100471	192	202	218	241	234	245	270	256	256	230	206	176	2,726	City of Lake Jackson
103121	0	0	0	0	0	0	0	0	0	0	0	0	0	City of West Columbia
108821	247	261	282	310	301	317	349	331	331	298	266	227	3,520	City of Freeport
100441	149	157	169	187	182	190	209	199	198	179	159	136	2,114	BRA CRWTF
105481	144	150	162	179	174	183	201	191	191	172	154	131	2,032	City of Angleton
517034	240	200	200	220	220	220	240	220	240	240	240	222	2,702	Fort Bend MUD 025
517034	55	55	55	55	110	165	220	275	220	165	110	57	1,542	Fort Bend MUD 041

Table D-6d
Groundwater Returns - 2060 Conditions
Values in Acre-Feet

CP	Jan Return	Feb Return	Mar Return	Apr Return	May Return	Jun Return	Jly Return	Aug Return	Sep Return	Oct Return	Nov Return	Dec Return	Total	Name
103341	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Abilene
100401	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Breckenridge
104871	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Graham
027891	0	0	0	0	0	0	0	0	0	0	0	0	0	Double Diamond
401401	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Ranger
105851	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Mineral Wells
105852	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Mineral Wells
101782	11	13	15	13	14	14	17	17	15	16	13	12	170	City of Granbury
515651	0	0	0	0	0	0	0	0	0	0	0	0	0	BRA SWATS
515651	9	11	6	8	10	10	10	11	8	8	11	8	110	Acton MUD
407601	6	10	4	6	8	7	7	8	6	7	8	9	86	Acton MUD
100061	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Cleburne
410501	35	26	26	35	17	35	9	26	17	9	26	35	296	City of Godley
409631	8	8	11	11	13	13	13	13	12	14	12	8	136	City of Glen Rose
515731	11	30	30	28	19	13	21	21	21	21	25	6	246	City of Whitney
106301	14	13	13	11	14	10	10	13	10	13	14	12	147	City of Itasca
106301	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Hillsboro
102902	96	95	98	107	107	108	94	71	61	99	93	89	1,118	City of Stephenville
NBHI35	8	7	8	8	5	8	7	8	8	8	8	10	93	City of Hico
228202	9	9	9	10	10	2	7	4	5	6	7	10	88	City of Meridian
555151	6	5	6	5	6	5	5	5	5	5	5	1	59	City of Clifton
102191	5	5	6	6	6	5	5	5	5	5	5	5	63	City of McGregor
W12252	1	2	2	1	2	2	2	1	3	2	2	-1	19	City of Valley Mills
101102	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Marlin
110711	266	263	278	273	281	284	285	292	294	288	271	273	3,348	BRA WMRSS
435201	17	20	23	17	17	17	13	13	17	17	17	16	204	City of Lorena
CON070	3	3	6	3	2	2	1	1	2	2	4	4	33	City of West
106371	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Eastland
CON054	0	0	0	0	0	0	0	0	0	0	0	0	0	City of De Leon
284602	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Dublin
363701	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Comanche
CON086	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Hamilton
100455	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Copperas Cove
101761	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Gatesville
101761	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Gatesville
022336	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Copperas Cove
CON090	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Moody
102051	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Lampasas
100451	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Copperas Cove
101551	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Harker Heights
103511	0	0	0	0	0	0	0	0	0	0	0	0	0	Bell County WCID#1
103512	0	0	0	0	0	0	0	0	0	0	0	0	0	Bell County WCID#1

Table D-6d (Continued)

CP	Jan Return	Feb Return	Mar Return	Apr Return	May Return	Jun Return	Jly Return	Aug Return	Sep Return	Oct Return	Nov Return	Dec Return	Total	Name
103513	0	0	0	0	0	0	0	0	0	0	0	0	0	Bell County WCID#1
113181	0	0	0	0	0	0	0	0	0	0	0	0	0	BRA TBRSS
LRLR53	6	6	7	6	7	6	5	5	5	5	5	6	69	Bell County WCID#2
LRLR53	0	0	0	0	0	0	0	0	0	0	0	0	0	Bell County WCID#2
W12431	8	8	13	10	16	8	10	8	10	8	8	10	117	City of Florence
LRLR53	0	0	0	0	0	0	0	0	0	0	0	0	0	Bell County WCID#3
104893	20	21	21	20	23	27	20	21	25	23	24	22	267	City of Georgetown
104892	20	21	21	20	23	27	20	21	25	23	24	22	267	City of Georgetown
100041	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Cameron
102641	41	41	42	41	46	53	41	41	49	47	48	44	534	BRA/LCRA BCRWSS West
102642	0	0	0	0	0	0	0	0	0	0	0	0	0	BRA/LCRA BCRWSS East
102991	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Taylor
114591	0	0	0	0	0	0	0	0	0	0	0	0	0	Anderson Mill MUD
123081	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Cedar Park
126441	9	9	9	9	10	12	9	9	11	10	11	10	118	City of Leander
372751	16	18	20	4	16	12	2	6	6	14	20	20	154	City of Bartlett
W12441	21	18	12	12	15	15	18	18	2	18	19	21	189	Brushy Creek MUD
W12441	0	0	0	0	0	0	0	0	0	0	0	0	0	Block House MUD
372751	1	1	1	1	1	1	1	1	1	1	1	3	14	City of Holland
100462	6	30	65	58	63	55	59	64	64	37	37	32	570	City of Hearne
100462	10	9	9	9	10	10	10	8	10	10	9	10	114	City of Calvert
104702	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Temple
CON117	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Rosebud
CON109	1	1	2	2	2	1	1	1	1	1	1	3	17	City of Troy
MYDB60	12	12	11	12	12	10	11	11	9	12	11	13	136	City of Lexington
003956	0	0	0	0	0	0	0	0	0	0	0	0	0	Aluminum Corp. of America
CON224	25	21	23	23	28	27	25	27	34	35	28	46	342	City of Rockdale
CON125	38	40	43	43	60	43	48	35	45	48	40	43	526	City of Giddings
DCLY63	31	29	32	35	64	60	58	57	57	58	51	57	589	City of Caldwell
528801	10	11	11	12	13	18	13	13	13	13	11	11	149	Tx Dept MHMR
CON250	21	23	24	28	22	19	12	16	16	19	18	21	239	City of Teague
CON131	49	31	45	46	53	69	53	51	52	46	43	49	587	City of Mexia
W12531	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Groesbeck
100241	968	1,008	1,039	1,071	1,002	946	990	1,047	1,081	1,071	1,017	946	12,186	City of College Station
102311	77	69	79	72	71	53	87	90	82	80	77	80	917	City of Navasota
103881	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Brenham
104261	774	704	642	572	792	767	747	754	707	580	568	747	8,354	City of Bryan
104262	365	244	293	244	360	383	367	365	398	416	401	341	4,177	City of Bryan
109681	129	129	154	166	172	175	184	177	175	180	158	147	1,946	Texas A&M University
516451	22	19	21	19	19	18	18	19	23	19	21	21	239	City of Somerville
526851	64	61	61	64	61	56	66	69	71	69	69	72	783	City of Bryan
025851	92	72	5	61	72	102	112	112	112	184	133	119	1,176	Texas A&M University
CON148	19	17	19	18	18	16	16	17	18	17	18	19	212	Texas Dept Of Criminal Justice
CON149	6	3	3	12	4	5	5	5	4	5	5	5	62	Texas Dept Of Criminal Justice
103851	60	57	55	53	60	52	55	60	50	52	45	47	646	City of Bellville
102581	29	29	29	29	32	29	30	31	28	29	28	31	354	City of Richmond

Table D-6d (Continued)

CP	Jan Return	Feb Return	Mar Return	Apr Return	May Return	Jun Return	Jly Return	Aug Return	Sep Return	Oct Return	Nov Return	Dec Return	Total	Name
102761	65	61	69	65	63	58	61	60	56	58	60	75	751	City of Sealy
106073	14	61	81	90	140	158	133	138	127	103	98	107	1,250	City of Rosenberg
112751	55	62	51	50	53	26	25	32	67	62	55	37	575	Praire View A&M Universtiy
516604	40	40	40	38	45	42	45	44	47	38	42	41	502	Brookshire MWD
024431	15	11	11	9	9	11	5	8	9	10	10	13	121	Frito-Lay Inc.
BRRI70	51	49	48	54	61	56	72	72	66	62	57	54	702	Fort Bend Co. MUD 081
CON150	64	4	69	52	73	93	117	109	113	117	117	112	1,040	City of Hempstead
CON153	16	14	14	14	16	12	14	14	12	14	14	19	173	City of Wallis
106072	182	141	175	165	155	154	155	154	154	143	141	156	1,875	City of Rosenberg
102582	87	65	84	81	95	90	104	104	90	93	84	86	1,063	City of Richmond
113171	138	110	122	130	144	135	127	128	115	123	126	149	1,547	BRA SLRSS
116551	51	50	51	58	68	65	65	61	62	58	49	57	695	Pecan Grove MUD
128331	109	97	107	107	120	122	132	140	134	126	112	120	1,426	City of Sugarland
128332	20	16	20	25	25	13	21	16	16	20	21	17	230	Texas Dept. of Criminal Justice - Central
128332	13	12	14	14	14	14	15	15	17	14	14	14	170	Texas Dept. of Criminal Justice - Jester III
128332	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Sugarland
133551	17	13	14	14	14	12	14	14	13	14	14	12	165	Plantation MUD
133551	7	7	19	13	19	21	25	25	23	31	17	16	223	Fort Bend MUD 106
136281	60	60	60	60	60	60	121	121	60	60	60	62	844	Fort Bend MUD 112
517033	18	17	18	18	18	18	18	18	20	18	18	22	221	Texas Dept. of Criminal Justice - Jester I
100471	104	109	117	130	126	132	145	138	138	124	111	94	1,468	City of Lake Jackson
103121	89	85	79	76	70	59	67	57	60	57	60	59	818	City of West Columbia
108821	0	0	0	0	0	0	0	0	0	0	0	0	0	City of Freeport
100441	49	51	55	61	59	62	68	65	65	58	52	46	691	BRA CRWTF
105481	40	42	45	50	48	51	56	53	53	48	43	35	564	City of Angleton
517034	160	133	133	147	147	147	160	147	160	160	160	147	1,801	Fort Bend MUD 025
517034	37	37	37	37	73	110	147	184	147	110	73	36	1,028	Fort Bend MUD 041

Appendix E
System Operation Model Setups

Appendix E
System Operation Model Setups

System Yield at the Gulf of Mexico

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** BRA System Operation Modeling starts here
** TS used to represent the depletions for current BRA water right under the TCEQ Brazos WAM Run 3.
** TS with all 2060 return flows
**------Possum Kingdom
WR515531       0        19380406       1     1.0  5155DP                C5155_TS   C5155 5155001
TS      19401940    8863   10360     654   16202   67673   30014   43979   38650   35174    2445   41073   15924   311010
TS      19411941    9950   18613   20475   17235   22403   31096   39731   33466   32372   17418   23837   17758   284353
TS      19421942   18097   13077   14313   27077   28940   34546   15546   22890   68563   17424   24248   15394   300116
TS      19431943   16764   10168   25559   30878   16805   42869   14445    1225    2039    2966    1273     676   165666
TS      19441944    4303   12919   45050   23225   50575   49567   30222   16327   24759   52134   12571   11885   333535
TS      19451945   11282   12957  115437   58200   26897   38661   37892   10087    6531   82555    6801    1291   408591
TS      19461946   19329   15246    8135    8083   27433   43830   27725   58200   80981   27705   18633   16788   352089
TS      19471947   14082    6749   11971    9044   53766   37914    8654    2440   13272   30267    9874   37469   235501
TS      19481948    4132    5769   24226    8062   30609  125659   61022    7811    7459   15529   11007    3217   304502
TS      19491949    2527   13081   11536   14406  151237   32717   14691   15520   82164   21296    9562    3428   372165
10665.8
TS      19501950    3421    8187    2733   56928   58071   33669   31316   39058   26791   19775    1219    2196   283364
TS      19511951    3213    4763    2157    2318  105760   63085   23280   25177   21596     248     847     435   252879
TS      19521952     959     515    1226    6922   16176   13656    8279       0    4985    3035    4605    2824    63182
TS      19531953    1493    1124    7023    3303   76307     328  261348   85840    5708  179192   20200   10717   652581
TS      19541954    3865    5631    1823   72797   20295   35739   11451   13550     869     368   17753     561   184701
TS      19551955    2027    5957   17162   15016  183035   30258   39964   23247   39161   29140   15893    7934   408794
TS      19561956   15508    4452     423    2112   39320   13615       0      73    1877    5360   13349   20943   117031
TS      19571957     582  215737    9006   40762   13435   33226   35856   13036   17955   55137   13145   15594   463469
TS      19581958    9858    7677   29379   19158   25148   31467   39546    7523   51658    9821    2852     129   234215
TS      19591959    2391    1820    2656     592   43130  117540   31835   14193    5932   59372    3924   19831   303215
TS      19601960   23797   15819    8947   21636    6291   13026   84433    9725     361   70197   22058   13231   289520
TS      19611961   10244   14274   18873   11010   28039   34025   29957   24226   35792   12384   24939   11195   254957
TS      19621962    5645    3064    4951    6713    2364  103117   30669   14930   35973   20371   16205   15901   259903
TS      19631963    5894    6256    7981   52670   20651   28541    2212       0    8211   11689   42587    4400   191093
TS      19641964    7809   45284    7624    4160   12601   33525    2952   14968   43034    5190   64452    2619   244216
TS      19651965    5656    5433    3099   44533  150244   32908    6456   32250   37504   53163    8665    3732   383642
TS      19661966     622    5137    8638   74450   29714   23879    3947   58105   36019   23788    7314    3217   274828
TS      19671967    4005    6205    8405   54958   23986   74266   36435   16082   45278    6997     428    3066   280110
TS      19681968   55883   14943   18006   22288   21674   30547   33402   10247     474     397     278    5422   213560
TS      19691969    4446   11693   79444   67604   33355   31796    1495     817   92379   19227   20021   13561   375838
TS      19701970   16782   12936   18071   19229   27903   16370     184     348     464     491     555     408   113739
TS      19711971    1513    2898    2784    2955   15190   75656    8258  272002   23831   17531   15540   16743   454901
TS      19721972    5519   11669    7307   15277   66445   18615    9200   76929   26980   17368   20113   18351   293772
TS      19731973   10918   14675   19973   17972   19196   37834   29118    9327   20292   25509    3112     517   208442
TS      19741974    5556    5440    4137   29558   11498   33381    1926   14076  181778   17119   20519   15308   340295
TS      19751975   15484   15425   20653   22371   15741   34043   33749   35520   27946    5053    3008    3042   232034
TS      19761976    7808    8437    5168   17779   35949    6168   21318   22130   69328   91451   26404    9537   321476
TS      19771977   12268   12720   30006   20344   23069   33647    8542     272    6557     407     108    1641   149580
TS      19781978     755    3449    8460   26141   14833   15536    1100  280138   19580   16077    7343    4394   397805
TS      19791979    7218    8862   47302   18911   43119   30105   31187   24335    4504    2201     488    4661   222893
TS      19801980    3142    7471    4355    6133  159828   34572    6186    1007  104852   28832   18368   15754   390501
TS      19811981   16483   13128   20560   23162   24867   26099   11025   12755    6381   87168   19727   11250   272606
TS      19821982    7894   11782   15989    9524   51859   30508   39223   13962    3131    3713    1680    7248   196511
TS      19831983     910   17402   16315    9729   89458   39323    9360     556     396   95642   25982    1359   306434
TS      19841984   15755   10351    7128    3808     548     414     196    3161    1561   86798   46484   73575   249779
TS      19851985   82294   48518   15335   22466   25639   27695   25213   12806     908   83676   13583    5238   363372
TS      19861986    8436    7391   10080   15038   24414   72099   41274   19146   40983   20505   16082   13341   288788
TS      19871987   14341   11523   20834   27153   15101   27618   38931    9744   15622    1130    3247   30327   215569
TS      19881988   13948    9325    8173    7441    8087   17517   27788     976   57388    6717    2448    5712   165520
TS      19891989    3620   20227   13983    6469  202815   46450    7759   32082   53790    8459    3239    4493   403385
TS      19901990   12907   21900   57912   15240   25706   35337   17090   46152   30036   20819   19253    7706   310058
TS      19911991   19976   17748   18266   10915   46757   31694   40637   33695   25935   21533   21144   10163   298463
TS      19921992   14374   11867   21412   23663   18440   25100   35911   33422   24965    4486   16295   23904   253839
TS      19931993   19061   19499   18953   22488   25872   30658    9891   11073   13174   35379    4664    9890   220602
TS      19941994    6164    9042   10702    5815  146843   21437   17792     237   19064   75279   39250   12513   364139
TS      19951995    7403    3423   19921   12318   37328   37209   18676   44797   23217   10324    3024    2880   220520
TS      19961996    3596    7787    6935   15620    7339   14626    6487   42175  165007   22812    9837   16711   318931
TS      19971997   11365   15277   20445   17314   21305   21953   38319   18886    2598    2562     570   14511   185106
**
**
**------Granbury
WR515631       0        19640213       1     1.0  5156DP                C5156_TS   C5156 5156001
TS      19401940    1264    1270    2420   11578   11240    8801   13176   13689   12131    3673    7940    3293    90476
TS      19411941    4537    2616    5340    5239   10074    9567   12966   10905   11016    7043    7228    4584    91114
TS      19421942    5021    4385    3172    8071    7918   10234    5664       0   28325    6060    7084    4414    90347
TS      19431943    1936    7606    6438    7800    6696   10510       0       0       0    2383     966    2908    47242
TS      19441944    5342   25891   26498    6660    7442    8106    7955       0   26138    5298    5824    4497   129650
TS      19451945   12661    2131    3661    5196    9638    8289   12988    1895    4377   25117    3323    4697    93973
TS      19461946    7034    4054    5279    6953    5381   10905    1426       0   35308    9112    4359    4811    94621
TS      19471947    3921    5705    5022    5478    8715   10647       0    1402       0    8668    3955   30207    83720
TS      19481948   16043    3191    6082    1024   14364   10375   13220       0       0      67    1052     828    66244
TS      19491949     704   20522   34122    5193    6321    9958   10335       0       0   31743    7626    3815   130338
TS      19501950    4097    3720    5171    8079    7335   10116   11443   13393    8499    9972    4680    2356    88860
TS      19511951       0    6573    4408     281   12326   20819       0       0       0       0       0    3228    47635
TS      19521952       0    3018    1496    7528   38790       0       0       0       0       0    7903    2808    61542
TS      19531953    2418     575    1973    3335   21564       0    7324       0       0   30673    6534      53    74449
TS      19541954       0     763       0    9092  101571   12540       0       0       0     551    2393     918   127828
TS      19551955       0    2562    2175    1539   63489   17347    4073       0   28511    9817    4082     483   134078
TS      19561956    1674    1093    5032       0   29021       0       0       0       0       0       0   23262    60083
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TS      19571957       0    8938    8915   38566    9170   10853   13357     570   10027   14995    3181    4637  123208
TS      19581958    3336    3892    4153    4562    7876   10510   12801   11191    6363    1101    3770    6511   76065
TS      19591959     667    4440    1364    3504    4191   17698   19543    7663       0   16766    5540    3399   84775
TS      19601960    2962    4289    5761    6608    8219    2726   19822    3662       0   23204    6203    1759   85214
TS      19611961    2038    3450    5517    3261    3062   16410   10981    6955    6206   13340    4306    3896   79419
TS      19621962     895    1371    1868   11721    2392   19556   11086   12035    7467    6203    4699    4296   83590
TS      19631963    4151    1282    8312    8035    6948   10993       0       0       0       0    4172    1809   45703
TS      19641964    1066   10555    6439    8874    4183    2646       0       0   28562    2094   54647    4553  123619
TS      19651965    3194    2677    5409    6852    4395    8717     829    5792   14046    8592    1948    5898   68346
TS      19661966     405    9401    5185   14982    8147    8944       0    6202   23632    7599    3671    1710   89878
TS      19671967    3925    2871    2179    5262    3872   28598   11777       0    7805    6198     912    6118   79517
TS      19681968   13681    3782    4294    5850    6510    8581   11502   11749    5469    2150    2836    4006   80407
TS      19691969    2018    8554   10908    5671    7180   11151    5793   16445    9267    4859    5440    3060   90345
TS      19701970    3742    2371    3741    5645    7231    2147       0       0   13869    5000    4129    3209   51084
TS      19711971    3404    3037    2353    3237    8110       0    5758       0   64559   11149    5656    3184  110448
TS      19721972    3885    5303    3968    4165    8892    2970       0   27755   16745    5133    4908    4618   88342
TS      19731973    2454    3795    5451    4954    8213    7435   10070   12875    3562    6802    5457    5436   76503
TS      19741974    3704    2711    3085    4772       0     827       0    9606   12684   33320    6203    4004   80916
TS      19751975    3956    4338    5407    6253    4647   10926   10996   11705    8691       0       0       0   66918
TS      19761976    2805    2696    2553   17826   18800   10130    9372    1846    2711   18116    5260    4259   96373
TS      19771977    2957    4631    4588    4852    6925    9638    2585       0       0     776    3659    3112   43723
TS      19781978    2326    4223    4381   24844       0    3311       0   28678       0    4734    1949    1924   76369
TS      19791979    3545    2382   37836   23626    7540   10081     818    1762    1387    7938      65    5826  102805
TS      19801980    3401    8579    2119    4210       0    8069       0       0       0   78215       0    9385  113979
TS      19811981    1729    2480    8873    6525    6825    7225       0    3628       0   30271    6191    5303   79048
TS      19821982    3830    4146    5510    6560    5514    8480   13123       0       0       0     815    1936   49915
TS      19831983       0    5261   15700    5909   31890    6644       0       0       0    1229       0       0   66634
TS      19841984   13472    2788    6943       0       0       0       0       0       0   33070   23900   34704  114877
TS      19851985   17253     233    7945    6745    8164    9751   10501       0       0   28624    4628    1656   95499
TS      19861986       0   11025    3753    3199   11862    7547   13825       0   18729    5023    4207    2691   81861
TS      19871987    3847    2599    6513    8810    4487    8413   12828    1762     971       0    3624    3320   57174
TS      19881988    6377    1908    2915    1455       0   23683       0       0       0       0       0    2954   39290
TS      19891989    4433   21252   28101   16308   25327    8434    3296   15303   11223    4455    3217     239  141588
TS      19901990    8115    9885    3799    4699    8777   12025    2374       0   27754    5567    3857    5052   91904
TS      19911991    2621    4498    2776    9857    6485   10347    5593   16299    7293    6022    6421    3253   81464
TS      19921992    2584    4594    6461    6416    4664    7240   12176    6790   12688    4700    6749    2818   77882
TS      19931993    2958    2961    4886    5982    7983    9313       0       0       0   41255    5139    4073   84550
TS      19941994    3803    3688    4598    2168   10002   11363       0       0    8549   29321    2981    3896   80368
TS      19951995    3625    1704    5713    5278    3593    8751       0   20543    7184    6101    5474    4370   72337
TS      19961996    1220    6658    2659    5901       0       0       0   46333    7982    6394    1934    4479   83560
TS      19971997    4941    2677    7230    6108    7567    7724   13131   10936       0    2706    4541    9881   77442
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**
**------Whitney
WR515731       0        19820830       1     1.0  5157DP                C5157_TS   C5157 5157001
TS      19401940       0     571       0     271    4740    3216   10895   12764       0     485   -4779    -201   27963
TS      19411941    2751     159    3055    2072    4694    1962   11359   10349   10892     705    5805    1620   55424
TS      19421942    3938    3417    3224   -5367    3788    8054       0       0    4314    2813    4777    1599   30557
TS      19431943    3551    5545    2428    6329    2307    8321       0       0       0     713       0    -169   29027
TS      19441944   -1561   -1743    2666    4021   -1474   11591       0       0   11421    6759     283      68   32031
TS      19451945    1514    -784   -1298    3272    8162    5330    8575       0       0    4512    5090    2594   36967
TS      19461946    -448    1628    2724    4455    -881    9837       0       0    7279    8315     -67    3008   35848
TS      19471947     450    4742    1885    2174    4946    9199       0       0       0       0    2186    -691   24891
TS      19481948    1100    -172    3823       0    3953       0   11280       0       0       0       0       0   19985
TS      19491949   -3057    -757    2237    1614     987    5231       0       0       0    1610    6792    2013   16670
TS      19501950     961   -2128    6887    2693    3216    7394    8235   14897    6619    9362       0       0   58135
TS      19511951       0     824    2346       0       0    5382       0       0       0       0       0    1359    9910
TS      19521952       0       0       0   -4697     370       0       0       0       0       0   -2194   -2814   -9335
TS      19531953    4590    2135    1361    1443    2147       0       0       0       0       0       0       0   11676
TS      19541954       0       0       0       0   37880       0       0       0       0       0    3284       0   41164
TS      19551955       0    3221    1734    7444   54519    8164       0       0   16462   19026       0       0  110570
TS      19561956       0    2256       0       0    7780       0       0       0       0       0       0    1692   11728
TS      19571957       0       0    2291   -8860    8648   13186   15697       0       0   -4323   -3116    3401   26924
TS      19581958    1715     206    2522    2556     617    8081   13760       0    4773    1333    2890    1080   39533
TS      19591959     926   -1051    7924    4578    1022    -871    7907       0       0   -2188    3834     816   22895
TS      19601960     303    2314    4180    6203    8319     318    9604       0       0    1982    4300   -6647   30876
TS      19611961   -4129    1052    5507    8566    5523   -6990    9871   10574    7495    4686   -1772     463   40847
TS      19621962    1929    3370    5096    3487    1880   -2811   13999   15165    2747    5945     889    1534   53229
TS      19631963    2337    4136    4070    5225    2829   10057       0       0       0       0     741     -19   29377
TS      19641964   -1772    1683     681       0       0    6391       0       0    4632       0   -3565    2836   10885
TS      19651965     358    -389    4363    6937   -7487   10814       0       0       0     419     775     170   15959
TS      19661966    1118   -1278    4919   -2252    4189    9283       0    5196   -1738    7248    4081    2588   33355
TS      19671967    2818      15    2008    4641    5512    9565    6664       0   -5402    -900    2325     194   27439
TS      19681968   -4657    1926    1252    1496     518    4893   11141       0       0    5938     983    2696   26185
TS      19691969    3992     502    1041    2012     846   14536       0       0       0    2033    2148    -124   26985
TS      19701970    2017   -1741    3484    6062    4581    9658       0       0       0    -681    4330    2033   29745
TS      19711971       0    3131       0       0       0       0       0    1282       0   -5269    5054    1971    6169
TS      19721972    2389    5009    8623       0    2949       0       0       0    5733    1950    -258    2225   28619
TS      19731973       5    1032    4061    -650    5417    3930    1841   11520     -67   -5545    3799    4878   30220
TS      19741974    1196    4623    6939       0    6857       0       0    -832    1198   -1717    2553    1753   22570
TS      19751975    2124    1101    3400    1381   -4246   10130    6609       0    4198       0       0       0   24697
TS      19761976    2127    5473    3405   -3386    1554    4832    1036       0    1552   -1152    3377    1293   20111
TS      19771977     705    3334    1070    2523    4240   10545       0       0       0       0     521       0   22938
TS      19781978     803   -2143    4179       0       0       0       0       0       0       0   -1971       0     868
TS      19791979     484     273    -989    5182   -1105    9362    7665       0       0    4298       0    -297   24874
TS      19801980    -177    2347    1231    3759    2496       0       0       0       0    5961       0       5   15623
TS      19811981       0     804     -11    3861       0   -6041    9025       0       0   -7856    4274    3635    7691
TS      19821982    2204    2659    1654    3728    -659    3850   11966       0       0       0    -803    -500   24099
TS      19831983       0    -803    1544       0     819       0       0       0       0       0     -13       0    1548
TS      19841984       0       0    2295       0       0       0       0       0       0   -7694    1366   -4233   -8267
TS      19851985    1581     717    1226    6378    5608    6460       0       0       0    -818    2344   -2646   20849
TS      19861986       0    1888    5173       0    1032     434       0       0    3876   -1534    1356   -1007   11218
TS      19871987    1735     132    3590    8992     173    -496   11453       0       0       0   -3033    -955   21592
TS      19881988    3651     761    3230       0       0     857       0       0    -398       0       0     529    8628
TS      19891989    -838   -1653    3186    7297    4293    3675   10031    4071       0    2043       0    2900   35005
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TS      19901990   -1161   -1917   -3338    3197    9950   12986       0       0    4993    3991    -367     564   28899
TS      19911991   -1696    1751    7303    3765    3476    5965       0    1693    4041    2545    4839   -3180   30501
TS      19921992      40    1101    5765    7669    3628    9323   14723       0       0    1254   -2159    -805   40540
TS      19931993   -1083      88    2271    3878    5774    7819       0       0       0   -5052    1535    2235   17466
TS      19941994    1838    -114    3268       0   -4146   10476       0       0       0     778    -704   -2588    8809
TS      19951995    1375    2421     561   -2360    3044    8720    9815    6538    4917    1959       0    2508   39498
TS      19961996       0    4359    3473       0       0       0       0    6901    3105    4314   -1535     941   21559
TS      19971997    -368   -4476    -367   -2120    6408    4023   13510       0       0       0       0   -5472   11137
**
**------Aquilla
WR515831       0        19761025       1     1.0  5158DP                C5158_TS   C5158 5158001
TS      19401940      91     132      82    4659     972    2343    3197     111       0      99    8878     954   21519
TS      19411941    1305     983    1245    1570    1898    1571    3253    2423     142    4351     684    1403   20826
TS      19421942     945     714    1063    3902    1675    2218    1508       0    6975    1578    1714    1119   23409
TS      19431943    1450    1006    1954    2064    1557    1223       0       0       0     600      83     260   10195
TS      19441944    2170    8924    4640    2458    1302    3047     176       0     103     213     367    7878   31277
TS      19451945    6361     801     736    1403    2312    1941    3090     333       0     248    1242     186   18651
TS      19461946    3769    6462    1358    1679     863    2663       0       0     346     103    1617    5593   24453
TS      19471947    6807    1614    1139    1368    1616    2508       0     111       0       0      83    1150   16394
TS      19481948     645    1066    1061    1605   14557    1537    5346       0       0       0       0      90   25907
TS      19491949    2853    2547    2196    6728    3629    2117     474       0       0      99      83      90   20817
TS      19501950      91    7748     570    8010    2115     154     892     111    2265      99      83      90   22230
TS      19511951       0      91      82    1586       0   21243       0       0       0       0       0      90   23092
TS      19521952       0     637     303   18750    2811     338       0       0       0       0    4514   14015   41367
TS      19531953    1229     437    2043    1278    1355       0       0       0       0     503       0     152    6996
TS      19541954     128      29       0       0    5008     107       0       0       0       0    1170       0    6442
TS      19551955       0    1094    1256     684    7107    2835       0       0     103      99      83      90   13352
TS      19561956      91      84      82       0   10139       0       0       0       0       0       0     199   10596
TS      19571957       0       0     431   48637     550    2225     255     111       0    9109     409    1294   63021
TS      19581958     946     803    1201    1068    2561     311    2400    1116    2227      99      92     114   12937
TS      19591959     114    3368     572    4919    5125    1664    1452       0       0    6455     687    1396   25751
TS      19601960     911    1014    1481    1829    2253    2370     253       0       0     783      83    9515   20491
TS      19611961     931    1137    1452    1964    1210    2385    2678     286     730    1685    5185    1017   20660
TS      19621962     966    1325     962    1884    2530    1859     446     125    2970    6227     310     865   20469
TS      19631963     623     329     277     904    1263     107       0       0       0       0      83      90    3677
TS      19641964     197     139    1156     366     109     107       0       0    4070       0   10743     138   17025
TS      19651965    2713   12334     989     589   10172     920     109     111       0     142    1435     318   29832
TS      19661966     243     969     696   13549    1821     605       0    1688     510      99      83      90   20353
TS      19671967      91      83     170    5473    3104    3160    1491       0     612   15428    1179     766   31557
TS      19681968     203     966    1223    1305    2456    1742     576     111     189    1081    2047    3340   15237
TS      19691969     341    2742    4380    1064    1933     471     109     111     110     187      83     752   12283
TS      19701970     259    8212    6703    1272    1537     242       0       0     196   11469     479     244   30611
TS      19711971     178     894     142     155   10442       0       0     610       0   10312    1394     615   24742
TS      19721972     938    1603    2040    1114    2944     184       0       0     657    4497    1750     351   16077
TS      19731973    6835     926    1299    1264    1924    1799    2565     365    4395     768    1402    1264   24806
TS      19741974     879    1592     802     411    2100       0       0    4224    6939    1117     917    1000   19982
TS      19751975    1204    1022    1367    1562    1354    2292     318     127     129      99      83     122    9679
TS      19761976     120     130     687   15326    1107    2269    2662     219     920    2301     384    3738   29861
TS      19771977     778    1327    1340    1874    1902     790       0       0       0      99      83      90    8284
TS      19781978      91    1068     835     927       0     107       0       0       0       0      83     116    3228
TS      19791979     344    1220   14526    7127   13361    2587    1272     636     103     125       0     537   41836
TS      19801980    4411    2056    1096    6127    1451     135       0       0       0     123       0     857   16256
TS      19811981     217     166    1996     566    2599   17865    1296       0       0    1005     238     212   26160
TS      19821982     159    1046    1641     450   10719    1997     790       0       0      99      83     399   17383
TS      19831983     259    6966    6446     398     961     779       0     799       0     177     541      90   17415
TS      19841984     265     275    6663     358       0       0       0       0       0   13180    1749   11298   33789
TS      19851985    1298     688    1220    1522     313     367       0       0       0    6985     197    7401   19991
TS      19861986     563    1707     811     553    2834    1615       0       0    1922    6234    1502     513   18254
TS      19871987    1167     627    1558    1993    1296    1839     608     276    2507       0    4615    4478   20962
TS      19881988    1472    1187    1453    1506       0    2145       0       0       0       0       0     302    8065
TS      19891989    1782    8408    7063    1916     883    1474    2904     823     103      99      83      90   25629
TS      19901990    7032    3619     680    1340    1233     107     109       0     103      99     270      90   14682
TS      19911991    2234    2004     603    5457    7282     107     252    8078     459    2886    1375     602   31339
TS      19921992     888    1087    1546      87    2773    1803     109    2748     103      99    1677    6534   19456
TS      19931993     687     895    1035    1247    1809    1989     705       0       0   11098      83    1158   20705
TS      19941994    1056    2067    1432    1209    1365    2647       0       0       0    5592    5005     768   21141
TS      19951995    1074     910    1035    1612    1950    2398    2736    2313    1419    3135      83      90   18757
TS      19961996       0     655     340    1787       0       0       0    2796    1875    1093    9866    4528   22941
TS      19971997    1193     441    1557     972     859    1963     299     581       0    4049     350    7090   19351
**
**------Proctor
WR515931       0        19631216       1     1.0  5159DP                C5159_TS   C5159 5159001
TS      19401940       0     209       0    4775    2101    3254    2308    2314       0       0   13425    1142   29529
TS      19411941    1215     829    1264    1225    2537    3292    4528    5700    3141    1300    1759    1137   27927
TS      19421942    1240    1308    1294    1626    2625    3961    2664     552   10655    1494    1983     929   30329
TS      19431943    1229    1444    1185    2313    2516    1989       0       0    1069    2806      54     524   15129
TS      19441944    7402    8874    3517    2227    2805    1806    8494       0    3172    1507    1155    1536   42496
TS      19451945    3136    4367    1500    1949    3294    4193    4892     192     262    4887     716     884   30271
TS      19461946    5041    4143    1662    1816    2655    3805      82       0   12643     709    4270    1009   37833
TS      19471947    1114    1360    1214    1595    2088    1370       0       0       0       0     107    4259   13108
TS      19481948    1263    2507    1234     605    5354    2869    3517       0       0       0       0       0   17349
TS      19491949       0    1620    9836   16488    6836    3971     415       0       0    2800     509      66   42541
TS      19501950     142    2781       0    6003   12415    4027    4816       0     198       0       0       0   30383
TS      19511951       0       0       0       0    4060   12947       0       0       0       0       0       0   17007
TS      19521952       0       0       0    1159   31290     404       0       0       0       0    1550     566   34969
TS      19531953     133      80     255    3095    9057       0    3365       0       0    8711     998     357   26050
TS      19541954     167       0       0    1928    1259       0       0       0       0       0    2515       0    5869
TS      19551955       0     958       0    6943   40855    4164       0       0    2614     632       0       0   56166
TS      19561956       0     208       0       0   21118       0       0       0       0       0      65    3213   24604
TS      19571957       0      10     153   22047    1453    3464     618       0       0   13742     623    1075   43186
TS      19581958     583     847     855    1089    2078    1828       0       0       0       0       0       0    7279
TS      19591959     120     408       0     455       0   11634   13328      49       0   14623    1273     779   42670
TS      19601960     544     970    1223    1620    2675     620       0       0       0    1989      27     591   10259
TS      19611961   17003     997    1397    1960    2065    2437    4694     218       0    1405     695     999   33869
TS      19621962     808     830     796    1203     137    3074       0     378   20106    1728    1080     950   31090
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TS      19631963     936     985     967     766    2358    4027       0       0       0       0    6741       0   16780
TS      19641964    2615    5317    2153    5973     495      76       0       0   21232    1192    1297    1370   41719
TS      19651965     498     374    1774    2365     -86    4394    2582       0     224    2845    1764     672   17407
TS      19661966     692    1555    1164   10055    7335    4873       0    1119    7574     386     453     281   35486
TS      19671967     748     323    1868    2619   11789    7479     873       0    3621       0     520     508   30349
TS      19681968   11074     718     825    2039    1363    4719    4493     733       0       0     415     648   27026
TS      19691969    1184    1005   11314    5647    2467    3339       0       0       0    4258     875    9216   39303
TS      19701970    5142     107     895    1551    1719    5076       0       0    2728    1448       0     921   19585
TS      19711971     808     685       0     770    7400       0    1081   12433    3893   10558    1032    6738   45397
TS      19721972    1587    1758    1493    3699    2496       0       0       0       0     452       0     348   11832
TS      19731973    1393    1828    1873   19872    1964    3751    6231       0       0   10749    1104     627   49391
TS      19741974     616    1120    1697    1021       0       0       0    4083   10601   10152    4117     746   34153
TS      19751975    1421     814    2087    1408    1248    2718    2872    1286       0       0       0      11   13866
TS      19761976       0     587     561    8312    4207     291    1672    1024    1272    2930     524     540   21918
TS      19771977     316    1100   26775     127    3089    1350     852       0       0       0       0       0   33609
TS      19781978       0      10     645       0       0       0       0       0       0       0       0       0     654
TS      19791979     980     327   10794    2805   20834    1213     269    3467       0       0       0     117   40807
TS      19801980     149     290     234     643   14553     702       0       0       0       0       0       0   16572
TS      19811981       0     395     863     268     359    6435       0       0      31   24207    1097       0   33655
TS      19821982     286     671    1255     577   18407   19675    6865       0       0       0       0       0   47736
TS      19831983       0     197    2302     562     979       0       0       0       0       0       0       0    4040
TS      19841984       3       0    4761       0       0    2123       0       0       0   21832    3561    9754   42033
TS      19851985   20912    1022    1329    2456    2523    3465       0       0       0    1586     620     184   34097
TS      19861986     124    4185     743     884   17364    1250    5655       0    5500    1167     475     398   37743
TS      19871987    1059    -386    1582       5    2702    3145    6936       0     292       0       8      11   15354
TS      19881988    1426    2395       9     739       0   18621       0       0       0       0       0       0   23190
TS      19891989     315    2850    1497    2095   20148    2974    5089    6929       0       0       0       0   41897
TS      19901990    2367      10    8415    2060    3854    5325    5231    5366    2462    2679     753       0   38522
TS      19911991    1531    1484    2452    1569    1730    4867       0   10687    1939     273    1748    -199   28080
TS      19921992     742     578    2221    2331    1857    3307    5753    5343    3432    3141     -94     587   29199
TS      19931993     280     313    1333    2156    2619    3299       0       0       0   16304    1370     973   28646
TS      19941994     885     632    1805    1884   -1018    5439    4546       0       0    8740     163     130   23207
TS      19951995     923    1108     805    1415     919    3458    5773    4280    2132    3163     261    2315   26551
TS      19961996    1067    1571       0    4093       0       0       0   14176    2669     105     -12    1637   25305
TS      19971997    1610    -226    1525    1643    2207    2056    6607    4834       0       0    1597    2793   24645
**
**------Belton
WR516031       0        19631216       1     1.0  5160DP                C5160_TS   C5160 5160001
TS      19401940       0       5       0   22269     594   26703   16296    -314       0    1251   49014    8057  123874
TS      19411941    7923    7155    8168    7467   11339   10860   16320   16866   13992    8949    9235    7900  126174
TS      19421942    7216    5789    3782   15334   11200   13747   12868   19296   11873    9644    9487    7739  127976
TS      19431943    7854    8853    8091   10572    9852    1254       0       0    1732    1228    -173    1586   50849
TS      19441944   39846   55799    8000   10132   11377   14806    6889       0    2484    3878    4297   28812  186318
TS      19451945   35492    6581    7997    9804   12871   12063   15849     335    4463   34959   10548    8036  158998
TS      19461946    6183    7367    9341    8468    9530   13190    2038       0   11244    2025   18492   24395  112272
TS      19471947   21651    8217    8068    8352   10146    4733       0       0       0       0      -6    2122   63283
TS      19481948    -137   15540    7205    3129   20893    2491    7114       0       0       0       0       0   56235
TS      19491949    -115    -119   52945   67937   59529   42027    3152       0       0    -195    -169    -139  224852
TS      19501950    -141    6950    -131    4888   27405   14919   11671       0   25358       0       0       0   90918
TS      19511951       0       0       0    -161    8173   12510       0       0       0       0       0       0   20522
TS      19521952       0       0       0   22855   36731    3747       0       0       0       0    2770   14876   80979
TS      19531953    3078    -122   13813    4256  146584       0     906       0     -87   10947    1345    -137  180583
TS      19541954     -58       0       0    -178     695       0       0       0       0       0    -162       0     297
TS      19551955       0    5382    -173   12818   44207   24278       0       0   10844    2778       0       0  100134
TS      19561956       0    -134       0       0  104058       0       0       0       0       0    1345     478  105747
TS      19571957       0      18   16360  298275  109427   14426   19562    2108    -174   30632    5444    8696  504775
TS      19581958    7000    3177    9035    5328   11877   13582    -353       0       0       0       0       0   49646
TS      19591959    -141    1170     -51    -128    -192   35438   11305    5625       0  120888    7904    6045  187862
TS      19601960    6563    7350    8274   10335    9479    -246     -30       0       0   49897    7308   24786  123715
TS      19611961    6346    6670    9354   11583   10941   11830   13937    9470    6032   21338    7205    7542  122247
TS      19621962    7164    7450    5649    8406    4398    9072       0    -341   36042   16135    2065    8286  104327
TS      19631963    1755    1369    2464    -159   33353   11867    -333       0       0       0    -121       0   50195
TS      19641964    1594    4604   13625   41408   13034   80895       0       0   46898   10840    7078    7649  227626
TS      19651965    4828    5595    8313    9901    2647   13367   19388   17879   11504    6366    9498    5261  114547
TS      19661966    6497    5647    9620    6979   11038   13037    -323   33156   10476    6352    1420     126  104025
TS      19671967     987    -159     293    6745    6963   11437    6470       0     667       0    1171     -79   34494
TS      19681968  116338    6475    7272    8870    4386    9820   13227    -313    -217       0    -134    1739  167461
TS      19691969     917    3320    6862   70167   11149    4215       0     -98       0    4563    9862   20860  131818
TS      19701970   25972   33577    7493    9257    8767   14079       0       0   25991    2702    -184     -51  127601
TS      19711971     461    -155    -131     864    4312       0  103590    9476    -214   31821    6946    5637  162605
TS      19721972    7175    8476    8155    1934   16730    -116    -255       0       0    4715    2382     859   50055
TS      19731973   13467   16568   36338   31358   11118   10281   14042       0       0   34336    8821    1840  178168
TS      19741974    4922    4577    3452    1080    1403       0       0   20024   70895    7534    7171    7359  128416
TS      19751975    7640    6984    9019   10500    4259   10026   11433     753       0       0       0    -110   60503
TS      19761976    -166    -131    1230   18515   20604   18977   61698    -311    2750   14476    7369   20457  165466
TS      19771977    6365    6151    9016    6948    9982   14134     898       0       0       0       0       0   53494
TS      19781978       0    1896    2313    -184    -199    -140       0       0       0       0     611       0    4297
TS      19791979   14223   17104   57442   35566   94145   25235   13401    3241       0       0       0     748  261104
TS      19801980    2009    5459    5022    7765   65658    6395       0       0       0       0       0    -139   92170
TS      19811981       0    -116    8778    6332    1610  116843    -321       0    1630    3453     343       0  138552
TS      19821982    -148    1546   14361   12881   49825   29871    9069       0       0       0       0       0  117406
TS      19831983       0   10819   27966    3981   17727    -152       0       0       0       0       0       0   60341
TS      19841984    -145       0    6133       0       0    -187       0       0       0   15823    2338   14262   38225
TS      19851985   17943   19493   44584   18007   17941   24226       0       0       0   51499    7856   49198  250747
TS      19861986    7287   58549    6780     845   43603    9750   19391    1949   17546    6738    7067    4191  183696
TS      19871987    7605    5218    8662   11112    9132    7164   17761     612    2257       0     427    3909   73857
TS      19881988     722    2075    2619    -193       0   57965       0       0       0       0       0       0   63188
TS      19891989    6547   16812   27853   13952   86698    9214   11007    2068       0    -119       0       0  174032
TS      19901990    -142     817   28452   63527   10503   17225   13691   12088    2784    1992    2283       0  153219
TS      19911991   16765   13001    4339   10452   16476   11686    -297    6198    8661   34470    8734     804  131289
TS      19921992    5396    5688    7986   10664    4619   11844   17063   13286   12665    3011    8035   11262  111518
TS      19931993    5808    6701    7848    8896   10355   11347    -342       0       0   13874   10168    2248   76904
TS      19941994    2213   23714   10325    3203   50724   13580   11620       0    -231    6473   20671   29243  171535
TS      19951995    6323    6121    6807    8254    7222   11403   12747   16597   10821   12223    -152    1201   99564
TS      19961996     750    1534    -138     324       0    -230       0   27344   71631   18219    8978    6909  135320
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TS      19971997    6881    5669    8359    6798    9363    9433   17312    7098       0    -168    2077   42405  115227
**
**------StillHouse Hollow
WR516131       0        19631216       1     1.0  5161DP                C5161_TS   C5161 5161001
TS      19401940    1156    2791    1386    8853    5811   13168   10175    2470    1168    3757   25009    5484   81227
TS      19411941    5462    4980    5175    5201    6900    7784    9849   10617    3140   10792    3961    3733   77593
TS      19421942    2941    2460    2417   18454    6819    9784    9128    2812   15275    6306    6320    5215   87928
TS      19431943    5238    4809    6298    6510    5653    1720       0       0       0    2407    1502    1954   36091
TS      19441944   22305   35725    5279    6478    7325   10602   11318       0    8183    5647    7619   15170  135650
TS      19451945    5126    4939    5577    5446    8277    8801    9924    7384   11941    7384    6639    5431   86867
TS      19461946    4371    4952    5659    5347    5638    9238    2431       0    3807    2756    3942    8590   56731
TS      19471947   29133    5476    5212    5446    6472    4688       0    2068       0    1060    1456    1753   62763
TS      19481948    1512   13655    2846    6254    9971     819    5258       0       0     609     880    1449   43253
TS      19491949    1153    1067   24789   38818    7897   12713    1882       0       0     651     948    1281   91199
TS      19501950     968    4664    1351    4631    6363    4229     846      12    6631     623     684     763   31765
TS      19511951       0     809     810     756    5608    3447       0       0       0     237       0     702   12369
TS      19521952       0     589    1261   19779   39082    5257       0       0       0       0    1302   16962   84233
TS      19531953    4057    2465    5762    8556   84804       0    1696       0    3733    4206    1084    1304  117666
TS      19541954    1257     841       0    1259    5505     149       0       0       0    1579   19211     723   30523
TS      19551955    2640    6499    2411    3982   56837   24199   10032       0    4776     610     560     804  113349
TS      19561956     765    1293     511     345   31436       0       0       0       0       0    5453    4408   44211
TS      19571957       0    1429   12333  166498   27754    8225    3392    1132    1869   26648    4400    5484  259163
TS      19581958    4497    4049    5600    5448    6700    8705    3983    2215    2238    1933    1674    1669   48710
TS      19591959    1505    1792    1585    2525    1420   26491    3151    7691       0   46523    5704    4637  103023
TS      19601960    4930    4860    5414    5865    7258    3613    4980    3329       0   28714    5440    3998   78400
TS      19611961    4734    4846    6134    6811    7191    6409    8018    6329    4810   10835    6657    4730   77504
TS      19621962    4480    4045    5325    5859    6107    9863    2191     506   10566   20173    2594    5245   76954
TS      19631963    2746    2037    1776    1460    3240    1138       0       0       0    2334    3451    1042   19223
TS      19641964    1466    5224    9855    9810    6911    7227       0       0   16924    2837    8948    3667   72867
TS      19651965    8203   48835   25148   10178    2928   10080    8519    3235   10555   10035    9732    3451  150898
TS      19661966    4053    3797    6209    4307    6700    9917       0   20305    6869    7337    4532    3804   77830
TS      19671967    3147    2568    2457    2791    2226     649     290       0     558    1057    1339    1088   18170
TS      19681968   73014    4329    4075    5350    4087    8038    9314    3759    3779    1746    1771    2167  121427
TS      19691969    2548    3540    7072   28375    7523    6376    1644    2782    1328   14335    8937   19431  103888
TS      19701970    8117    3549    4288    6729    6117   11072       0       0   25478    5073    2611    2720   75753
TS      19711971    2388    2575    4506    2035    2384       0   22179    7720    1511   15717    7442   26390   94845
TS      19721972    5000    5920    6284    5125    9579    5808       0    2676     137    3418    3236    2874   50055
TS      19731973   10075   16565   18498    5440    7902    8377    8602     995     655   20022    6562    6052  109743
TS      19741974    4414    5532    5191    3678   11707    4162       0   22700    7016    5804    4104    4119   78426
TS      19751975    4603    4491    5100    6070    3178    7985   10414    8370    2362    1939    1614    1808   57934
TS      19761976    2137    2374    2840   19014   16098    7932    8333    5664    5682    8754    5271    5138   89235
TS      19771977    4239    4233    6242    7000    6148    8979    4072       0    1901     570    1014     888   45286
TS      19781978     921    2901    2608    2253     996    4436       0    1098       0      83    1263     815   17374
TS      19791979    6934   13447   31250   22543   46096   13186    7837    8084    1018    1104     492    2122  154112
TS      19801980    2144    3007    3107    4984   33197    9475       0       0       0     141     650    1384   58089
TS      19811981     797    1176    6583    7148    9831   54687   11981    4567    9452    8966    6275    3250  124714
TS      19821982    2847    3065    7889    7758    6433    9101    5049       0       0     152     318     899   43510
TS      19831983    1723   10222   25200    9484   23628   10474       0     672      75     354     199     226   82256
TS      19841984    1605    1392    2488    1348       0     579       0       0       0    7740    1457    4432   21041
TS      19851985    8137   11173   33101   19323   17247   23694    1608       0       0   30285    4886   20748  170202
TS      19861986    8746    6601    7237    3894    6305    5327    5190       0   12055   13230    3974    4488   77047
TS      19871987    6714    3811    6060    7196    4435    1538   11301    5403    8132    2436    3504    5301   65830
TS      19881988    5085    4930    5382    3668       0    7353       0       0       0       0       0     814   27231
TS      19891989    2439    3371    5966    5194   25372   12504    2111     128      73    1795     655     643   60250
TS      19901990    2379    2304   16484   85689   11665   10665    9975    6095    5128    4059    5032    2237  161714
TS      19911991   12849    5146    6241    5995    2664    7000    5372    6954    6971   16481    7853   -7968   75557
TS      19921992    3502   -7362    5066    7653    8291    7349   10280    5594   14059    4896    6528    5511   71367
TS      19931993    4030    5455    3761    4847    6577    9350    9810       0       0    9974    5499    3105   62407
TS      19941994    3022   12311    8390    4219   21449    9984       0       0    2715    7343    8935   18094   96460
TS      19951995   15514    4657    4657    8597    7923    9191    7576   16073    8299    9078    1326    2182   95071
TS      19961996    1818    2826    1732    3153       0       0       0   14628   24468    7049   13221   20892   89786
TS      19971997    5640   -6656   -1196    4362    7351    1225   12386    8967       0    2938    4362   20276   59656
**
**------Georgetown
WR516231       0        19680212       1     1.0  5162DP                C5162_TS   C5162 5162001
TS      19401940     155    1311     460    1997    1415    1366    2113    1337     619    1677    2994    1087   16531
TS      19411941    1091     960     957    1019    1308    1504    1930    1551     902    2746     945    1038   15949
TS      19421942     886     741     601    2279    1197    1865    1041       0    4363    1261    1261    1042   16537
TS      19431943    1047    1159    1082    1338    1304     416       0       0       0     343     208     105    7001
TS      19441944    4782    7062    1025    1336    1090    2067    1752       0    3161     687    2539    1359   26857
TS      19451945     940     914    1013    1003    1647    1802    2053    1610     552    1545    2412    1411   16902
TS      19461946     933     949    1088    1039    1163    1878     847       0    4327    2192     972    1063   16450
TS      19471947     874    1140    1049    1106    1320    1509       0     675       0     332     361     416    8781
TS      19481948     395     502     460    6384    6664     429     570       0       0       0       0     185   15590
TS      19491949     234     377       0    7466    1912    2572     856       0       0     231     155     345   14148
TS      19501950     306    1306     616    1373    2584    1659     403     136     373     157     142     151    9205
TS      19511951       0     191     285     375       0     218       0       0       0       0       0     123    1192
TS      19521952       0     316     557    4895    8043    1332       0       0       0       0      97    6207   21447
TS      19531953    1791    1667    1732    7782    7940       0       0       0    1998    8991    1467    1322   34692
TS      19541954     888     608       0       0     337      35       0       0       0       0      63      71    2002
TS      19551955     178     608     625     193    5221    2782       0       0       0      19      35      41    9702
TS      19561956      83      89      71       0       0       0       0       0       0       0       0    1301    1544
TS      19571957       0      10    1023   37797    1107    1745    2126     754       0    3763     892    1118   50336
TS      19581958     918     825    1097    1116    1303    1694    1306     807    2891    1310    1146    1016   15429
TS      19591959     998     737    1293     942    1297    1593    1045    2130       0    3094    1139     992   15260
TS      19601960     968     966    1084    1163    1484     954    1088       0       0    5904    1062     776   15450
TS      19611961     908     929    1225    1353    1467    1262    1552    1867    1512    1353    1013     981   15423
TS      19621962     969    1081    1226    1011    1498    1555    1512     290     805    1060     621     726   12353
TS      19631963     642     641     723     609     502     237       0       0       0       0     476     354    4183
TS      19641964     620    1483    2514    1941    1414     856       0       0    2149     891    3198    1806   16874
TS      19651965    3896   13491    1158    1145    1002    1853    2211    1039    2601    1307     976     815   31491
TS      19661966     896     784    1183     868    1161    1798       0    1049    2689    1418    1060    1011   13916
TS      19671967     811     656     496     856    2777     503     189       0     506     886    1222    1179   10081
TS      19681968    9160     971    1122    1074    1080    1597    1897     595    1365     291     386    1062   20601
TS      19691969     695    1448    3962    1063    1328    1922     644    3350    1626     936    1015    1256   19244
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TS      19701970     931     762    1119    1230    1077    2058       0       0     310     256     197     181    8121
TS      19711971     181     177     176     106      96       0    3326     346       0    2039    1404    2821   10671
TS      19721972    1543    1015     648     258    1146    1797       0       0      63     855    1803     954   10082
TS      19731973    2334    5583    9104    5582    1501    1522    1858    1013     938    2359    1235    1192   34221
TS      19741974     826    1173    1185    1182    1475       0       0    5403    1518    1390    1054     984   16190
TS      19751975    1036    1069    1220    1074     914    1695    1936    1789    1012     598     522     500   13365
TS      19761976     387     325     421    5562    1181    1760    1661    2032    1187    1066    1315     918   17813
TS      19771977     890    1010    1157    1091    1400    1866       0       0       0      65     247     119    7846
TS      19781978     158     432     368     324       0     184       0       0       0       0     189     126    1780
TS      19791979    2278    9038   13653    1818    1118    1854    1685    1256     356     145     202     279   33681
TS      19801980     226     461      82    1538    7865    2049       0       0       0      43     193     668   13125
TS      19811981     609     981    2553    4144    4744    1689    2057       0    3583    1022    1187    1154   23723
TS      19821982    1057     983    1062     781     929    1316    1469       0       0       0       0     183    7781
TS      19831983    1156    7122     693    1369     861    1648       0     790       0      42       0       0   13680
TS      19841984     405     232     351     239       0       0       0       0       0    5510     962    4337   12035
TS      19851985    7437    4779    1037     892    1109    1390     338       0       0    2737    2574    2259   24552
TS      19861986    1058     678    1303    1295     883    1572       0       0     469    4114    2451     511   14334
TS      19871987    1047     685    1114    1389     652    1297    1999    1062     582      75     316    1015   11233
TS      19881988     993     620     650     477       0    2596       0       0       0       0       0      72    5408
TS      19891989     325     592    2656    1634   13451    1830     288       0       0       0       0       0   20777
TS      19901990     149     159     536     595    2043     209       0       0       0       0     191      83    3964
TS      19911991    4096    3992    2774    4298    8264    1800    2097     142    2832    1237    1378     300   33211
TS      19921992     668     792     964    1256     719    1484    1956    1041     383      96     188    1083   10631
TS      19931993    1344    3301     769    1039     935    1381    2337       0       0       6     132     294   11537
TS      19941994     334     727    1176     889    2417     924       0       0       0    2352    1068    3574   13459
TS      19951995    4076    2140    3805     821     893    1849     737       0     226       0      35      58   14641
TS      19961996      59     183      72     302       0       0       0     539    3366    3139    1217    7003   15881
TS      19971997    6852    1184    1113     258    1048    1446    2193     863       0       0     322    5106   20386
**
**------Granger
WR516331       0        19680212       1     1.0  5163DP                C5163_TS   C5163 5163001
TS      19401940    1331    1090    2020    1824    2560    1971    4463    3824      72    1584    6364    1434   28535
TS      19411941    1871    1576    1617    1825    2474    2331    3712    2890    3150    3610    2099    1444   28600
TS      19421942    1943    2132    2330     516    1974    3510    3130       0    7300    1921    1928    1324   28007
TS      19431943    1641    2304    1866    2833    2070    2112       0       0       0    1880    1616    1311   17633
TS      19441944   11512    3764    1631    2698    1313    4488    4691       0    8123    2637     893     797   42548
TS      19451945    1271    1322    1402    1510    3422    3307    4322    3475       0    4527    3595    1368   29519
TS      19461946     723    1348    1528    1862    1428    3753    2702       0    9038    2633     533    1631   27181
TS      19471947    1109    2276    1620    1981    2121    4300       0    2366       0     768    1955    1995   20489
TS      19481948    1861    1409    2021   13408    2722    2141    2088       0       0       0       0    1489   27140
TS      19491949    1507    1839       0   17407    5122    3224    2721       0       0    1627    1499    1841   36787
TS      19501950    1663    3881    2363    3997    6746    3407    1717    1172    1987    1473    1471    1412   31288
TS      19511951       0    1428    1636    1799       0    1675       0       0       0       0       0    1352    7889
TS      19521952       0    1701    2232   11749   18767    4129       0       0       0       0    1316   13273   53168
TS      19531953    4933    4676    4820    5877    2203       0       0       0     376   18518    2036     929   44368
TS      19541954    1538    2344       0       0    1810    1274       0       0       0       0    1089    1237    9292
TS      19551955    1379    2347    2383    1401   12557    7320       0       0       0    1168    1235    1173   30963
TS      19561956    1174    1205    1164       0       0       0       0       0       0       0       0    3944    7486
TS      19571957       0       0    3261   45413    1740    3428    5098    2541       0    4315     683    1738   68217
TS      19581958    1325    1229    2173    1940    2586    3392    3713    2658    3147    1463    1657    1359   26643
TS      19591959    1599     650    2866    1283    2276    3073    3136    3563       0    4370    1672    1238   25724
TS      19601960    1432    1539    2140    2178    3142    3130    3231       0       0    7414    1159     275   25640
TS      19611961    1049    1427    2451    2964    3173    1615    2643    4248    1803    2128    1013    1103   25617
TS      19621962    1249    2105    2664    1807    3333    2641    4166    1515    2938    3460    2528    2377   30782
TS      19631963    1619    1553    2597    2315    2170    1630       0       0       0       0    2209    1861   15954
TS      19641964    2353    4272    6539    5239    4180    3083       0       0    5896    3087    8198    3607   46456
TS      19651965     864     705    2206    2337     879    3902    5139    3958    3222    1819     871     522   26422
TS      19661966    1086     846    2467    1554    2140    3916       0    5113    5877    2606    2439    1431   29475
TS      19671967    2012    1913    2460    2586    2138    2412    1103       0    9143    4195    1401    1121   30482
TS      19681968     449    1692    2025    1895    1215    2172    3962    4522    1979    2716     730    1408   24764
TS      19691969    1740    1012    1521    1553    2418    4252    4381    4473    2932    1514    1604     687   28086
TS      19701970    1289     889    1852    2284    1781    4516       0       0    7683    4393    2965    1993   29645
TS      19711971    2221    2051    2740    2385    2799       0    1799    3754       0    2079    9193    1428   30449
TS      19721972    1210    2192    3022    2881    1987    3721       0       0    1685    9970    1298    1458   29424
TS      19731973     507    1226    1616    1657    3155    2359    3914    3546    2609     279    2008    1888   24763
TS      19741974     654    2442    2475    2872    2417       0       0   10448    1337     914    1070    1264   25893
TS      19751975    1682    1631    2396    1762     683    3070    3905    3521    2703    2387    2337    1253   27330
TS      19761976    1993    2328    1895     436    2000    3237    2733    4435    1971     809    1355     786   23978
TS      19771977    1175    1858    2186     967    2797    3999       0       0       0    2130    2528    2196   19835
TS      19781978    2213    4384    3453    3674       0    2386       0       0       0       0    2776    3128   22013
TS      19791979   11658    8229    1517    2020    1189    4091    2895    3733    2846    2896    1885     802   43759
TS      19801980    1071    1665    1882    2461    1509    4418       0       0       0    1988    2505    3209   20708
TS      19811981    2878    4102    5480    1735    1132      57    3834       0    6483     783    1966    1993   30445
TS      19821982    1830    1876    1766    1584    1425    1956    4368       0       0    1232    2264    2819   21119
TS      19831983    3667    4457     865    3309     819    2381       0    3761       0    1316    2678    2123   25376
TS      19841984    3091    2162    3068    1506       0       0       0       0       0   22949    1502    -110   34168
TS      19851985    1767    1821    1842    2563    2501    2866     903       0       0    9212    4394    1419   29288
TS      19861986    1725    2065    3052    2936     907    2872       0       0    4118    6633    1506     332   26146
TS      19871987    1813    1235    2411    3297     536    2050    3769    5016    3234    2972     662    1177   28172
TS      19881988    1967    2040    2200    2940       0    5754       0       0       0       0       0    1432   16334
TS      19891989    2407    2113    3892    3020   14408    2357    2121     899    1165    1547    1491    1240   36659
TS      19901990    1888    2278    7716    3902    2350    2356    1046       0    1164    1125    1694    1336   26855
TS      19911991   10093    1383    2541    2476    1767    2549    3781    2556    2769    2400    1860   -2166   32008
TS      19921992     943     970    1787    2406    1347    2721    4073    3924    3354    3081    1331     630   26567
TS      19931993     899    1708    1840    2204     935    1653    5327       0       0    1738    2737    3092   22134
TS      19941994    3057    2636    2934    1831    2829    2095       0       0       0   11254    2897      75   29608
TS      19951995    1550    1738    1526    2310    1298    3208    3560    2704    1822    1651    1931    2384   25681
TS      19961996    2053    2588    1371    1894       0       0       0    1518   20870    2389     866    1216   34764
TS      19971997    1616     658    2086    2366    1611    2621    4669    4701       0    4793    2326     544   27990
**
**------Somerville
WR516431       0        19631216       1     1.0  5164DP                C5164_TS   C5164 5164001
TS      19401940     108    3838      98    2140   11279    4812   15267     147     370     903   18803    1137   58902
TS      19411941    3036    2074    2300    2159    5685    6329   12210    1323     292    1208    8654    1486   46755
TS      19421942     928     928     851   19656    2466    1999    3326       0    3205     515    2911    3225   40009
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TS      19431943    9912    1207    8698    1690    6762    3875     176      75     784     797     127     811   34914
TS      19441944   40703   17755    1705    3217    3162    4143     691       0   10627     104   28645    -448  110303
TS      19451945    2828    2137    1872    4131    5969    8668    1945   16928    7406    2211    1667    3726   59487
TS      19461946      22    1787    2061    3941    1549    6781     522       0    3322    4266   23070    2071   49392
TS      19471947     296    2637    4426    4929    4315    1728    1994   28175     538      98      78    1761   50974
TS      19481948     400    6859    1139     378    5589     327     876       0      87      94      78     101   15927
TS      19491949    1126   26507   16872   28946    8265    5120     317       0       0   31137     677    4840  123806
TS      19501950    2181    1610    2839    4087    5693    8148    2172      72   12592     146      78     101   39718
TS      19511951       0     244    4599    2691     675    1704       0       0     180       0       0     101   10193
TS      19521952       0     926     535    5480   17468    1985       0       0       0       0    3034   18216   47644
TS      19531953   16120    4308    1894    6315   69449     232    6117     633    3877   18550    7391   11119  146003
TS      19541954    2393    1268       0    1000    6683     614       0       0       0     250     206     279   12692
TS      19551955     334   17183     328    3955     366    4666     428       0     520     613     299     183   28875
TS      19561956     372   12938    3385    3745    2120       0       0       0       0       0       0     717   23276
TS      19571957       0     359   13643  133269   23722    8786     794     527   15408   12479     -14    2169  211142
TS      19581958    1484    3202    4701    4551    7448     971   13258     365   19096    1571    2230    1268   60144
TS      19591959    3077     243    4633    3479    4634    1586     370     152     212    3007   13465   19171   54029
TS      19601960    1654    1963    4817    3838    8856    5814    4429    1764     624   17742     790    -621   51668
TS      19611961    1780    1202    4751    4377    7901    8788    9151    1092   13459    2552    1955    1335   58344
TS      19621962    1692    4589    5082    3939    7048    8918    9558     583   12079   14254    1859     884   70486
TS      19631963    2459    3250    3957    8840    1694     673     728       0       0       0     421    1476   23497
TS      19641964    1063    3694   13467    2989    2983    2466       0       0    2139    4321    1996    3562   38681
TS      19651965    4955   72693    4563    3704    5949   10966     841    1117     268    1752   28637   -1412  134033
TS      19661966    1273    2133    6461    3762    6135    1162    1010     795    8941    2049     984     586   35293
TS      19671967    1779    1123    1121    3354    6778    3611     496       0    3737    1147    3501     287   26934
TS      19681968   75094    3187    4180    3361    2376    -360   10562    5146    8780    3037     -94    1060  116328
TS      19691969    3239    2483    3486     125    6209    2102      66      60     868      89    2026   12485   33238
TS      19701970    8138   26009    2979    5075    5415   12743     467       0      78    1392      65     301   62662
TS      19711971     587    1227    1133    1227      79      66      71     613      81     900      74   14727   20782
TS      19721972      62    2040    1412    1344   21749   13222       0     896      76     836      69      93   41798
TS      19731973   35464   28672   39224    7354    7850    4880    3730      60    1954   14195    3234    1836  148452
TS      19741974    -417    5874    4723    3396    7672   14009       0    5066   15808     946     -35    2329   59369
TS      19751975    2450    3710    5527    4000    2748    8785   10851    6258    3387     777     667    2789   51948
TS      19761976    3181    3240    8405   10004    6061    7755    5972     236    2671   14459    4247    1155   67386
TS      19771977    1857    3682    5141    3267    5485    4583      60     206     898      76     692    1432   27378
TS      19781978    6380   13996    8853    3563    9169   19871    3135    1956    5714      83   10019    5953   88692
TS      19791979   21155    2986    4049    4281    5019   10992   10357      57      59     303      51    3534   62842
TS      19801980   17037    2842    2205    6545    4097    3616    1190       0      84      84      71      95   37866
TS      19811981    1531     835    2347    1874    7561   53211   12320      61     318   15063    1926     494   97539
TS      19821982    1102    2019    2944    8822    4918    7150      67      58       0     821      65    5762   33727
TS      19831983   18689   14532    2538    3173    6488   10490    1098    5554    2976     427      66      87   66116
TS      19841984    3131    2057    6221    6294    3520    1315       0       0       0   37675   20545    6065   86823
TS      19851985    2308    1857    2939    5288    6442    4759    2129       0     513   16425   21575    2347   66583
TS      19861986    3018    3147     716    1861   12517    4462   13390    2171    4142    7017    3822    -383   55881
TS      19871987    2502    1017    5533    4081    8401    7372   13572    6728     769      94     442    2237   52747
TS      19881988    1520    1384    3698    2654    2438    5444    1101      42       0       0       0      95   18375
TS      19891989   10085    1726   13224    3710   15931    7959     645     476      75      87      75      91   54083
TS      19901990     958    2672    1029   21940   10246      60     402     160      76      94      69      98   37802
TS      19911991  100559    3628    4281    3069    4769    7058    1323     274    1029    2049    2312   26599  156948
TS      19921992     407    1468    4539    5072    2363    7768    7337    3292    3073    2199    7504   12801   57823
TS      19931993      55    2976    4311    4844    3702    4859    6221    3761    2803    6963    3355    2855   46704
TS      19941994    1941    5531    6024    2366    7900    2708    2762    5189     991   25381    3132   -1578   62346
TS      19951995    3329    3985    3628    5083    3610   11268    3274    6325    3890    1417    5133    2281   53224
TS      19961996    1232    1587    1542    1992       0       0       0    2422    5499    2496    1855    1319   19944
TS      19971997    1740   20623   12924    8889    5797    6760    8595    8059    7487    2680    3083    4586   91224
**
**------Limestone
WR516531       0        19740506       1     1.0  5165DP                C5165_TS   C5165 5165001
TS      19401940     224     911     239    4927   19924    5359   11400     217     220     208   32165    2291   78083
TS      19411941    5511    4578    5786    5234    7171    7967    8939    1282     538     283     515     858   48661
TS      19421942     443     741     557   40326   20113    9682     343       0   12009     875    7255   18132  110475
TS      19431943    6770     733    5530    5308    4421    6900     322     135     126    1860     484     551   33140
TS      19441944   39068   31140    5444    3866    8533   12018     302      90     536     153    9745   38830  149723
TS      19451945    5107    3210    3641    5981    8074    8905    7482   11682   12206    4865    3046    8399   82600
TS      19461946    2150    4246    4419    6523    4759   11558     865       0    1510     443   42019    5020   83512
TS      19471947    3451    3498    8594    6309    6233   11959     456     643     294       2     245    1617   43299
TS      19481948    3332   17978    8943    8641   21557     524    1305     169     178       1       0     504   63130
TS      19491949   15262    4542   29796    8956    1436    6190     965       4       0   29777     521    1145   98594
TS      19501950   20547   47234    1855   12742    5273    6605    1043     233     202     185     314     244   96476
TS      19511951       8     424     835     676       0    1591       0       0    1971       0       0     378    5883
TS      19521952       0    3773    4844   12239   30083     663       0       0       3       0    1806   11531   64942
TS      19531953   16319    1523   51253    2916  124193     439     435     345     397    1807    3050   54705  257382
TS      19541954    5860     814       0       0   18271     273       0       0       0       0     632     888   26738
TS      19551955    1016    7004    4801   16745    6515    3025     454       0     166     263     126     187   40301
TS      19561956     390    3734     321       0   14045       0       0       0       0       0       0     185   18675
TS      19571957       0       0   15677   95256  111328    9804     251     174     228   36763     878    2840  273197
TS      19581958    4928    4418    3589    4599   12786    7454     495      48   30578    6825     600    1367   77687
TS      19591959     952   14736    3353   10368    6440    9853    4557     832    1009    8070   16949    8959   86077
TS      19601960    3764    4221    7052    4614   11897    7518    1025     496     306    7171   16012   17570   81647
TS      19611961    4459    5302    6548    3606    1221   22478   10568     660   13524    1369    3582   11733   85051
TS      19621962    2618    5564    3422    5963   12334    8280    1057     171     238     576     880     742   41845
TS      19631963     397    1150     908     755     930     229     121       0       0       0     133     247    4871
TS      19641964    1415    1063    2896    2176     633     154       0       0    1685     171    1259     256   11709
TS      19651965   18319   27611   23178   62013   96500   12347     467     120     319     189    1704    2083  244848
TS      19661966    1488   11984    6230   40499    8438     659     121   19895   23238     992     387     775  114707
TS      19671967     622     444     952    5457    6273    3663     191       2    2171    1110   13706   23174   57764
TS      19681968   49877    5180    7149    6265    6424    7783    7645     236     526     256    2690   14126  108157
TS      19691969    6926   20730    5638    7532    6636     473     178     986     119    1072    3830   43479   97598
TS      19701970   12260    3665    6139    5865    1241     421     121       4    2226   11075     532     420   43969
TS      19711971     425    4573     807     516    1047     154       0     813     547    1692   10517   62009   83100
TS      19721972   26996    6883     691     372     194     969       0     350     119    4707    7543   11357   60180
TS      19731973   53809   12234   29347    5213    9331    8453    3673     310    2328   24720    5902    4904  160223
TS      19741974    2660    7811    8570    9105    9072     502       0    1463   37860    3830    3932    3666   88470
TS      19751975    5057    5480    6271    5174    5986   10731    8273     759     656    3345    1012    1098   53843
TS      19761976     760    1273    8231   47141    7463   11385    9897     448    1964   20651    4283    4229  117725
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TS      19771977    3886    7473    6831    6351    9616    4194     276     120    1018     175     379     546   40866
TS      19781978    2104   11263   20213    1448    1447     597       0       0    1450       0    8077    2612   49210
TS      19791979   21499   23073   66090    7308    2507   14114    6389    4862    4560    1150      49   17693  169295
TS      19801980    8827    6296    6281    8413    6756    1264     544       3     348      41     454     441   39666
TS      19811981    1169    3496    3205    3452    9831   84322    7334      11     126   26838    1743     477  142003
TS      19821982    2152    2835   16178    9424    6920       0     147      98       0      68    2920   34285   75026
TS      19831983    5087   24172    6321    2921   13691    2666    1209   11281     123     700    1009     474   69655
TS      19841984    2213    5050   20068    2006     183    2042       0       0       0   58920   15662   22443  128588
TS      19851985    4593    4285    6213    2756    4201      87     125       0     307    8412   54491    4459   89930
TS      19861986    2363   10480    3737   12496    6413    8159     501     125     115    4962   25330    9898   84580
TS      19871987    5416    3630    8688    2850    7727   14779    1071      95     476     455    1993   25254   72432
TS      19881988    4077   12445   16731    2650    2899    1282     322     719       0       0       0    2397   43522
TS      19891989     857    4163    3578    2819   89507    8303    4489     228     233     830     351     212  115571
TS      19901990    4288   11090   39956    6356    9555    4349     586     949    3788    3259   13388    6422  103987
TS      19911991   26485    5424    8080    6226    7576    7505    1585    3229    4229    5742    7028   30589  113698
TS      19921992    4590    5574    7064    4250    9917   10386       0     156       0      23    1206   22438   65602
TS      19931993   17112   13061    7019    6936    7701    8488    1634     855     577    9565     491    1683   75120
TS      19941994    1282   50230    6865    5009   10366   11859     477    2230       0    6861    5726   31762  132667
TS      19951995    6605    5022    5832    6849    8073    2111    2216   30115    5022      28      99    1202   73175
TS      19961996    1072    1629    1334    1243       0       0       0       0      33       0     715    3351    9377
TS      19971997    6298  104971    6731    6094    8438    9283     953    1542       0     131     915   27574  172930
**
**------Allens Creek
** Dummy WS Card added to locate Allens Creek at COntrol point 292531
WR292531       0        19990901       1     1.0  2925DP                C2925_TS   C2925 2925001
TS      19401940       0      82       0     656       0       0    4981       0       0       0       0   14479   20198
TS      19411941    9638    7462    8885   10070   12450   11586       0       0    9059    6045   10459    2465   88120
TS      19421942    1714    1454    1564       0   12893   11285   11400       0    1649    1278    2291       0   45528
TS      19431943    4540     947    1782    2074       0    3107    5644    3389       0     597    1059    2792   25931
TS      19441944    5183    3026    7963    7166    2496    8948    1138       0       0       0       0    3230   39149
TS      19451945    1496    5053       0       0    3206       0    2534   10953    5858      38     978    6081   36195
TS      19461946       0    2939    8253    4916    4494    8804    7083       0    1222    1787    5349    1210   46057
TS      19471947    1703    2844       0     472     737    2768    1058      70    3959       0    1904    5809   21322
TS      19481948    1120    1055    9402     899     499     327    1984       0       0       0       0       0   15287
TS      19491949       0       0    1765       0    6432       0    4298       0       0       0    3336    4139   19970
TS      19501950    5556       0    3805       0    3309   10077       0       0       0    1739       0       0   24487
TS      19511951       0       0       0     884       0       0       0       0       0       0       0       0     884
TS      19521952       0       0    1119    6782     901    3973       0       0       0       0       0    2245   15019
TS      19531953    1688     102     378       0    4683    2597       0       0    3881       0    5838    4345   23513
TS      19541954    3443       0       0       0       0    2205       0       0       0       0       0       0    5648
TS      19551955       0    1913       0       0       0    2097       0       0       0     900       0       0    4910
TS      19561956       0       0       0       0       0       0       0       0       0       0       0       0       0
TS      19571957       0       0    5246       0   17382   16272   16716    5048    1642   13743    7507    6899   90455
TS      19581958    6379       0   10239       0       0    5122    3975       0     482    6491    1681     945   35314
TS      19591959       0    2225    4734    7542   10422    3967    2346    2553       0       0    8251    3352   45392
TS      19601960    5228    5983    4869     880    9779    8922    8491    2380       0       0    8192    5480   60203
TS      19611961    8321    8853    8129    6587    3264    6383   12917    7993    7580    6129    7199    5051   88405
TS      19621962    2515    3668    2236     359    3284     472    3416     614       0    4019       0     911   21494
TS      19631963    6121       0    2411       0       0       0       0       0       0       0       0    1082    9614
TS      19641964       0    2674    2247       0    2744       0       0       0       0    1881    1575    1934   13054
TS      19651965       0       0    4750     444    5719   15498    3838    4138    2290    1952    5836    1121   45586
TS      19661966    1133    1065    2682       0   13930    5576    2685    3012       0    4515       0       0   34597
TS      19671967       0       0       0     290     249    2068       0       0    1652       0     468       0    4727
TS      19681968    4794    6320       0       0   10207    8896    3643    2581    1830    3138       0    4673   46081
TS      19691969    2043    5158    3330    5922   10649    3910    2026       0    1529     441     239       0   35246
TS      19701970      49       0    7713    4654    1999    4775    1579       0     156    7476    2423       0   30824
TS      19711971       0       0       0       0     122       0       0    1467    2879       0    4030    4841   13340
TS      19721972    6097    5834    3983       0   11437    3342       0       0    1122       0    4801    1650   38265
TS      19731973       0    4911     978    8573   12927    7492    7642    3912    2489    7019   10003    7841   73789
TS      19741974    5036    9532    3910    1294    5109       0       0       0    5702    9628    7245    7793   55249
TS      19751975    5011    8747    7573    5619    1233   10426    9138    4815    2368    1075     945    2187   59137
TS      19761976    1595    2230    1313       0    4924    5281    4091    3484    1915       0    4165    4361   33358
TS      19771977    7141    6069    2383       0    8166    9715    4251       0    2276       0     195     801   40996
TS      19781978    5179    7076    2720       0       0    2811       0       0    3699       0    1987    4324   27796
TS      19791979    5730    6754    4938    9523    5584   15268       0    8133    8501    2507    1270    2336   70543
TS      19801980    6111    6970       0    5616    6263    7075       0       0       0    1613       0       0   33647
TS      19811981       0     588    1055     456    2209    7488   13986    4061    5760       0    9030    2773   47405
TS      19821982     610    1108       0    1931    1641    6942   10812    2238       0       0    6205    4168   35654
TS      19831983    3099    6406    6912    6353    3552    7169    2735    3982    4298       0       0    2780   47287
TS      19841984       0    1786    2152       0    1425     677       0       0       0       0    8753     193   14985
TS      19851985    3944     342    7747    5057    1876    3816    2388       0       0     314    6264    9050   40798
TS      19861986    5299    1717    4594    2225    5066    9151    4666    3218    1810    3892    3980    5348   50965
TS      19871987    7966    2807   11494   11354    6000   12701   13756    6494    2166    1955    2695    2852   82239
TS      19881988    5212    1993    1018    2002     247    3066       0       0       0       0       0       0   13538
TS      19891989     302    4007       0    5357    1618   10496    9068    5632    1032       0       0       0   37510
TS      19901990    1469    2307     847       0       0    1151    1733       0     902       0     903       0    9310
TS      19911991    5433    7162    3476    7840    8785    7217    3659    1724    1912     843     644   -3815   44879
TS      19921992    8460       0   10679   10055       0    2114    4410    6824    3123     722    1665    3304   51356
TS      19931993    5427    5293    2080    7904    9639    9941    8304     890     731    1622    2216    1940   55985
TS      19941994    1809    2651    3855     520    4918    5943    2735       0    2138   13751    5905    4658   48881
TS      19951995    8925    5647    7260    6073    6046    9550    2865    3874    1620    2275    2286    3306   59725
TS      19961996    3528    2248       0       0       0       0       0       0    5242    4721    1875       0   17614
TS      19971997    2438       0    8536    5594    3154    2724    6967    3317    3097    6870    1578    6439   50713
WSALLENS       0
**
**------Allens Creek from the Brazos. (This diversion allows to refiil A Creek with Brazos River water.
** Diversion subject to IF requirement, and annual limit of 202,000 af/y.
WR292504       0    MUN419990901   1   1                              C2925_2   C2925 2925001
WSALLENS  145533
SO        130680  202000
**
** ------------- BEGIN OF SYSTEM OPERATION ---------
** Refill reservoirs with BRA water.
WR515531      0.        21111111                                  C5155_RF1_2  SYSTEM
WSPOSDOM 724739.                            0
```

```
SO                        5155DP
WR515631      0.        21111111                                  C5156_RF1_2  SYSTEM
WSGRNBRY 155000.                              0
SO                        5156DP
WR515731      0.        21111111                                  C5157_RF1_2  SYSTEM
WSWHITNY 437024.                         387024.
SO                        5157DP
WR515831     0.0        21111111                                  C5158_RF1_2  SYSTEM
WSAQUILA  52400.                              0
SO                        5158DP
WR515931      0.        21111111                                  C5159_RF1_2  SYSTEM
WSPRCTOR  59400.                              0
SO                        5159DP
WR516031     0.0        21111111                                  C5160_RF1_2  SYSTEM
WSBELTON 457600.                           1200
SO                        5160DP
WR516131      0.        21111111                                  C5161_RF1_2  SYSTEM
WSSTLHSE 235700.                              0
SO                        5161DP
WR516231      0.        21111111                                  C5162_RF1_2  SYSTEM
WSGRGTWN  37100.                              0
SO                        5162DP
WR516331      0.        21111111                                  C5163_RF1_2  SYSTEM
WSGRNGER  65500.                              0
SO                        5163DP
WR516431     0.0        21111111                                  C5164_RF1_2  SYSTEM
WSSMRVLE 160110.                              0
SO                        5164DP
WR516531     0.0        21111111                                  C5165_RF1_2  SYSTEM
WSLMSTNE 225400.                              0
SO                        5165DP
WR292531     0.0        21111111                                 ALLENS_RF1_2  SYSTEM
WSALLENS 145533.                              0
SO                        2925DP
**
** Return flow from dummy control points.
WR5155DP 999999.        22222222          1.0000  515531           C5155_DPRETQ  SYSTEM
WR5156DP 999999.        22222222          1.0000  515631           C5156_DPRETQ  SYSTEM
WR5157DP 999999.        22222222          1.0000  515731           C5157_DPRETQ  SYSTEM
WR5158DP 999999.        22222222          1.0000  515831           C5158_DPRETQ  SYSTEM
WR5159DP 999999.        22222222          1.0000  515931           C5159_DPRETQ  SYSTEM
WR5160DP 999999.        22222222          1.0000  516031           C5160_DPRETQ  SYSTEM
WR5161DP 999999.        22222222          1.0000  516131           C5161_DPRETQ  SYSTEM
WR5162DP 999999.        22222222          1.0000  516231           C5162_DPRETQ  SYSTEM
WR5163DP 999999.        22222222          1.0000  516331           C5163_DPRETQ  SYSTEM
WR5164DP 999999.        22222222          1.0000  516431           C5164_DPRETQ  SYSTEM
WR5165DP 999999.        22222222          1.0000  516531           C5165_DPRETQ  SYSTEM
WR2925DP 999999.        22222222          1.0000  292531          ALLENS_DPRETQ  SYSTEM
**
**  Lyons Method at Richmond
**
IFBRRI701539598.  IFBRRI33333333   1   2                IF_BRRI
**
**
** Refill reservoirs with QUNAP.
WR515531      0.        33333333                                  C5155_RF2_4  SYSTEM
WSPOSDOM 724739.                              0
WR515631      0.        33333333                                  C5156_RF2_4  SYSTEM
WSGRNBRY 155000.
WR515731      0.        33333333                                  C5157_RF2_4  SYSTEM
WSWHITNY 437024.                         387024.
WR515831      0.        33333333                                  C5158_RF2_4  SYSTEM
WSAQUILA  52400.                              0
WR515931      0.        33333333                                  C5159_RF2_4  SYSTEM
WSPRCTOR  59400.                              0
WR516031      0.        33333333                                  C5160_RF2_4  SYSTEM
WSBELTON 457600.                           1200
WR516131      0.        33333333                                  C5161_RF2_4  SYSTEM
WSSTLHSE 235700.                              0
WR516231      0.        33333333                                  C5162_RF2_4  SYSTEM
WSGRGTWN  37100.                              0
WR516331      0.        33333333                                  C5163_RF2_4  SYSTEM
WSGRNGER  65500.                              0
WR516431      0.        33333333                                  C5164_RF2_4  SYSTEM
WSSMRVLE 160110.                              0
WR516531      0.        33333333                                  C5165_RF2_4  SYSTEM
WSLMSTNE 225400.                              0
WR292531      0.        33333333                                 ALLENS_RF2_4  SYSTEM
WSALLENS 145533.
**
** System diversion at the Gulf.
WRBRGM73 1183000    MUN444444444   2                             SYSTEM_BRGM  SYSTEM
WSPOSDOM 724739.                              0
OR515531 217422.       1
WSGRNBRY 155000.                              0
OR515631  46500.       1
WSGRNGER  65500.                              0
OR516331  19650.       1
WSGRGTWN  37100.                              0
OR516231  11130.       1
WSSTLHSE 235700.                              0
OR516131  70710.       1
WSBELTON 457600.                           1200
OR516031 137280.       1
WSAQUILA  52400.                              0
```

```
OR515831  15720.       1
WSPRCTOR  59400.                              0
OR515931  17820.       1
WSWHITNY 437024.                         387024.
OR515731 387024.       0
WSALLENS 145533.                              0
OR292531  43660.       1
WSLMSTNE 217494.                              0
OR516531  65248.       1
WSSMRVLE 160110.                              0
OR516431  48033.       1
** Final refill of reservoirs. (Just to make sure we get all water)
WR515531      0.        99999998                                    C5155_RF3_9  SYSTEM
WSPOSDOM 724739.                              0
WR515631      0.        99999998                                    C5156_RF3_9  SYSTEM
WSGRNBRY 155000.
** Whitney fills the entire conservation pool here.
WR515731      0.        99999998                                    C5157_RF2_9  SYSTEM
WSWHITNY 642179.                         387024.
**
WR515831      0.        99999998                                    C5158_RF2_9  SYSTEM
WSAQUILA  52400.                              0
WR515931      0.        99999998                                    C5159_RF2_9  SYSTEM
WSPRCTOR  59400.                              0
WR516031      0.        99999998                                    C5160_RF2_9  SYSTEM
WSBELTON 457600.                           1200
WR516131      0.        99999998                                    C5161_RF2_9  SYSTEM
WSSTLHSE 235700.                              0
WR516231      0.        99999998                                    C5162_RF2_9  SYSTEM
WSGRGTWN  37100.                              0
WR516331      0.        99999998                                    C5163_RF2_9  SYSTEM
WSGRNGER  65500.                              0
WR516431      0.        99999998                                    C5164_RF2_9  SYSTEM
WSSMRVLE 160110.                              0
WR516531      0.        99999998                                    C5165_RF2_9  SYSTEM
WSLMSTNE 225400.                              0
WR292531      0.        99999998                                   ALLENS_RF2_9  SYSTEM
WSALLENS 145533.
**
** End of System Operation Modeling
```

System Yield at Glen Rose

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** BRA System Operation NModeling starts here
** TS used to represent the depletions for current BRA water right under the TCEQ Brazos WAM RUn 3.
** TS with all 2060 return flows
**------Possum Kingdom
WR515531       0        19380406       1     1.0  5155DP                C5155_TS   C5155 5155001
TS      19401940    8863   10360     654   16202   67673   30014   43979   38650   35174    2445   41073   15924   311010
TS      19411941    9950   18613   20475   17235   22403   31096   39731   33466   32372   17418   23837   17758   284353
TS      19421942   18097   13077   14313   27077   28940   34546   15546   22890   68563   17424   24248   15394   300116
TS      19431943   16764   10168   25559   30878   16805   42869   14445    1225    2039    2966    1273     676   165666
TS      19441944    4303   12919   45050   23225   50575   49567   30222   16327   24759   52134   12571   11885   333535
TS      19451945   11282   12957  115437   58200   26897   38661   37892   10087    6531   82555    6801    1291   408591
TS      19461946   19329   15246    8135    8083   27433   43830   27725   58200   80981   27705   18633   16788   352089
TS      19471947   14082    6749   11971    9044   53766   37914    8654    2440   13272   30267    9874   37469   235501
TS      19481948    4132    5769   24226    8062   30609  125659   61022    7811    7459   15529   11007    3217   304502
TS      19491949    2527   13081   11536   14406  151237   32717   14691   15520   82164   21296    9562    3428   372165
10665.8
TS      19501950    3421    8187    2733   56928   58071   33669   31316   39058   26791   19775    1219    2196   283364
TS      19511951    3213    4763    2157    2318  105760   63085   23280   25177   21596     248     847     435   252879
TS      19521952     959     515    1226    6922   16176   13656    8279       0    4985    3035    4605    2824    63182
TS      19531953    1493    1124    7023    3303   76307     328  261348   85840    5708  179192   20200   10717   652581
TS      19541954    3865    5631    1823   72797   20295   35739   11451   13550     869     368   17753     561   184701
TS      19551955    2027    5957   17162   15016  183035   30258   39964   23247   39161   29140   15893    7934   408794
TS      19561956   15508    4452     423    2112   39320   13615       0      73    1877    5360   13349   20943   117031
TS      19571957     582  215737    9006   40762   13435   33226   35856   13036   17955   55137   13145   15594   463469
TS      19581958    9858    7677   29379   19158   25148   31467   39546    7523   51658    9821    2852     129   234215
TS      19591959    2391    1820    2656     592   43130  117540   31835   14193    5932   59372    3924   19831   303215
TS      19601960   23797   15819    8947   21636    6291   13026   84433    9725     361   70197   22058   13231   289520
TS      19611961   10244   14274   18873   11010   28039   34025   29957   24226   35792   12384   24939   11195   254957
TS      19621962    5645    3064    4951    6713    2364  103117   30669   14930   35973   20371   16205   15901   259903
TS      19631963    5894    6256    7981   52670   20651   28541    2212       0    8211   11689   42587    4400   191093
TS      19641964    7809   45284    7624    4160   12601   33525    2952   14968   43034    5190   64452    2619   244216
TS      19651965    5656    5433    3099   44533  150244   32908    6456   32250   37504   53163    8665    3732   383642
TS      19661966     622    5137    8638   74450   29714   23879    3947   58105   36019   23788    7314    3217   274828
TS      19671967    4005    6205    8405   54958   23986   74266   36435   16082   45278    6997     428    3066   280110
TS      19681968   55883   14943   18006   22288   21674   30547   33402   10247     474     397     278    5422   213560
TS      19691969    4446   11693   79444   67604   33355   31796    1495     817   92379   19227   20021   13561   375838
TS      19701970   16782   12936   18071   19229   27903   16370     184     348     464     491     555     408   113739
TS      19711971    1513    2898    2784    2955   15190   75656    8258  272002   23831   17531   15540   16743   454901
TS      19721972    5519   11669    7307   15277   66445   18615    9200   76929   26980   17368   20113   18351   293772
TS      19731973   10918   14675   19973   17972   19196   37834   29118    9327   20292   25509    3112     517   208442
TS      19741974    5556    5440    4137   29558   11498   33381    1926   14076  181778   17119   20519   15308   340295
TS      19751975   15484   15425   20653   22371   15741   34043   33749   35520   27946    5053    3008    3042   232034
TS      19761976    7808    8437    5168   17779   35949    6168   21318   22130   69328   91451   26404    9537   321476
TS      19771977   12268   12720   30006   20344   23069   33647    8542     272    6557     407     108    1641   149580
TS      19781978     755    3449    8460   26141   14833   15536    1100  280138   19580   16077    7343    4394   397805
TS      19791979    7218    8862   47302   18911   43119   30105   31187   24335    4504    2201     488    4661   222893
TS      19801980    3142    7471    4355    6133  159828   34572    6186    1007  104852   28832   18368   15754   390501
TS      19811981   16483   13128   20560   23162   24867   26099   11025   12755    6381   87168   19727   11250   272606
TS      19821982    7894   11782   15989    9524   51859   30508   39223   13962    3131    3713    1680    7248   196511
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TS      19831983     910   17402   16315    9729   89458   39323    9360     556     396   95642   25982    1359   306434
TS      19841984   15755   10351    7128    3808     548     414     196    3161    1561   86798   46484   73575   249779
TS      19851985   82294   48518   15335   22466   25639   27695   25213   12806     908   83676   13583    5238   363372
TS      19861986    8436    7391   10080   15038   24414   72099   41274   19146   40983   20505   16082   13341   288788
TS      19871987   14341   11523   20834   27153   15101   27618   38931    9744   15622    1130    3247   30327   215569
TS      19881988   13948    9325    8173    7441    8087   17517   27788     976   57388    6717    2448    5712   165520
TS      19891989    3620   20227   13983    6469  202815   46450    7759   32082   53790    8459    3239    4493   403385
TS      19901990   12907   21900   57912   15240   25706   35337   17090   46152   30036   20819   19253    7706   310058
TS      19911991   19976   17748   18266   10915   46757   31694   40637   33695   25935   21533   21144   10163   298463
TS      19921992   14374   11867   21412   23663   18440   25100   35911   33422   24965    4486   16295   23904   253839
TS      19931993   19061   19499   18953   22488   25872   30658    9891   11073   13174   35379    4664    9890   220602
TS      19941994    6164    9042   10702    5815  146843   21437   17792     237   19064   75279   39250   12513   364139
TS      19951995    7403    3423   19921   12318   37328   37209   18676   44797   23217   10324    3024    2880   220520
TS      19961996    3596    7787    6935   15620    7339   14626    6487   42175  165007   22812    9837   16711   318931
TS      19971997   11365   15277   20445   17314   21305   21953   38319   18886    2598    2562     570   14511   185106
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**
**------Granbury
WR515631       0        19640213       1     1.0  5156DP                C5156_TS   C5156 5156001
TS      19401940    1264    1270    2420   11578   11240    8801   13176   13689   12131    3673    7940    3293    90476
TS      19411941    4537    2616    5340    5239   10074    9567   12966   10905   11016    7043    7228    4584    91114
TS      19421942    5021    4385    3172    8071    7918   10234    5664       0   28325    6060    7084    4414    90347
TS      19431943    1936    7606    6438    7800    6696   10510       0       0       0    2383     966    2908    47242
TS      19441944    5342   25891   26498    6660    7442    8106    7955       0   26138    5298    5824    4497   129650
TS      19451945   12661    2131    3661    5196    9638    8289   12988    1895    4377   25117    3323    4697    93973
TS      19461946    7034    4054    5279    6953    5381   10905    1426       0   35308    9112    4359    4811    94621
TS      19471947    3921    5705    5022    5478    8715   10647       0    1402       0    8668    3955   30207    83720
TS      19481948   16043    3191    6082    1024   14364   10375   13220       0       0      67    1052     828    66244
TS      19491949     704   20522   34122    5193    6321    9958   10335       0       0   31743    7626    3815   130338
TS      19501950    4097    3720    5171    8079    7335   10116   11443   13393    8499    9972    4680    2356    88860
TS      19511951       0    6573    4408     281   12326   20819       0       0       0       0       0    3228    47635
TS      19521952       0    3018    1496    7528   38790       0       0       0       0       0    7903    2808    61542
TS      19531953    2418     575    1973    3335   21564       0    7324       0       0   30673    6534      53    74449
TS      19541954       0     763       0    9092  101571   12540       0       0       0     551    2393     918   127828
TS      19551955       0    2562    2175    1539   63489   17347    4073       0   28511    9817    4082     483   134078
TS      19561956    1674    1093    5032       0   29021       0       0       0       0       0       0   23262    60083
TS      19571957       0    8938    8915   38566    9170   10853   13357     570   10027   14995    3181    4637   123208
TS      19581958    3336    3892    4153    4562    7876   10510   12801   11191    6363    1101    3770    6511    76065
TS      19591959     667    4440    1364    3504    4191   17698   19543    7663       0   16766    5540    3399    84775
TS      19601960    2962    4289    5761    6608    8219    2726   19822    3662       0   23204    6203    1759    85214
TS      19611961    2038    3450    5517    3261    3062   16410   10981    6955    6206   13340    4306    3896    79419
TS      19621962     895    1371    1868   11721    2392   19556   11086   12035    7467    6203    4699    4296    83590
TS      19631963    4151    1282    8312    8035    6948   10993       0       0       0       0    4172    1809    45703
TS      19641964    1066   10555    6439    8874    4183    2646       0       0   28562    2094   54647    4553   123619
TS      19651965    3194    2677    5409    6852    4395    8717     829    5792   14046    8592    1948    5898    68346
TS      19661966     405    9401    5185   14982    8147    8944       0    6202   23632    7599    3671    1710    89878
TS      19671967    3925    2871    2179    5262    3872   28598   11777       0    7805    6198     912    6118    79517
TS      19681968   13681    3782    4294    5850    6510    8581   11502   11749    5469    2150    2836    4006    80407
TS      19691969    2018    8554   10908    5671    7180   11151    5793   16445    9267    4859    5440    3060    90345
TS      19701970    3742    2371    3741    5645    7231    2147       0       0   13869    5000    4129    3209    51084
TS      19711971    3404    3037    2353    3237    8110       0    5758       0   64559   11149    5656    3184   110448
TS      19721972    3885    5303    3968    4165    8892    2970       0   27755   16745    5133    4908    4618    88342
TS      19731973    2454    3795    5451    4954    8213    7435   10070   12875    3562    6802    5457    5436    76503
TS      19741974    3704    2711    3085    4772       0     827       0    9606   12684   33320    6203    4004    80916
TS      19751975    3956    4338    5407    6253    4647   10926   10996   11705    8691       0       0       0    66918
TS      19761976    2805    2696    2553   17826   18800   10130    9372    1846    2711   18116    5260    4259    96373
TS      19771977    2957    4631    4588    4852    6925    9638    2585       0       0     776    3659    3112    43723
TS      19781978    2326    4223    4381   24844       0    3311       0   28678       0    4734    1949    1924    76369
TS      19791979    3545    2382   37836   23626    7540   10081     818    1762    1387    7938      65    5826   102805
TS      19801980    3401    8579    2119    4210       0    8069       0       0       0   78215       0    9385   113979
TS      19811981    1729    2480    8873    6525    6825    7225       0    3628       0   30271    6191    5303    79048
TS      19821982    3830    4146    5510    6560    5514    8480   13123       0       0       0     815    1936    49915
TS      19831983       0    5261   15700    5909   31890    6644       0       0       0    1229       0       0    66634
TS      19841984   13472    2788    6943       0       0       0       0       0       0   33070   23900   34704   114877
TS      19851985   17253     233    7945    6745    8164    9751   10501       0       0   28624    4628    1656    95499
TS      19861986       0   11025    3753    3199   11862    7547   13825       0   18729    5023    4207    2691    81861
TS      19871987    3847    2599    6513    8810    4487    8413   12828    1762     971       0    3624    3320    57174
TS      19881988    6377    1908    2915    1455       0   23683       0       0       0       0       0    2954    39290
TS      19891989    4433   21252   28101   16308   25327    8434    3296   15303   11223    4455    3217     239   141588
TS      19901990    8115    9885    3799    4699    8777   12025    2374       0   27754    5567    3857    5052    91904
TS      19911991    2621    4498    2776    9857    6485   10347    5593   16299    7293    6022    6421    3253    81464
TS      19921992    2584    4594    6461    6416    4664    7240   12176    6790   12688    4700    6749    2818    77882
TS      19931993    2958    2961    4886    5982    7983    9313       0       0       0   41255    5139    4073    84550
TS      19941994    3803    3688    4598    2168   10002   11363       0       0    8549   29321    2981    3896    80368
TS      19951995    3625    1704    5713    5278    3593    8751       0   20543    7184    6101    5474    4370    72337
TS      19961996    1220    6658    2659    5901       0       0       0   46333    7982    6394    1934    4479    83560
TS      19971997    4941    2677    7230    6108    7567    7724   13131   10936       0    2706    4541    9881    77442
**
**
**------Whitney
WR515731       0        19820830       1     1.0  5157DP                C5157_TS   C5157 5157001
TS      19401940       0     571       0     271    4740    3216   10895   12764       0     485   -4779    -201    27963
TS      19411941    2751     159    3055    2072    4694    1962   11359   10349   10892     705    5805    1620    55424
TS      19421942    3938    3417    3224   -5367    3788    8054       0       0    4314    2813    4777    1599    30557
TS      19431943    3551    5545    2428    6329    2307    8321       0       0       0     713       0    -169    29027
TS      19441944   -1561   -1743    2666    4021   -1474   11591       0       0   11421    6759     283      68    32031
TS      19451945    1514    -784   -1298    3272    8162    5330    8575       0       0    4512    5090    2594    36967
TS      19461946    -448    1628    2724    4455    -881    9837       0       0    7279    8315     -67    3008    35848
TS      19471947     450    4742    1885    2174    4946    9199       0       0       0       0    2186    -691    24891
TS      19481948    1100    -172    3823       0    3953       0   11280       0       0       0       0       0    19985
TS      19491949   -3057    -757    2237    1614     987    5231       0       0       0    1610    6792    2013    16670
TS      19501950     961   -2128    6887    2693    3216    7394    8235   14897    6619    9362       0       0    58135
TS      19511951       0     824    2346       0       0    5382       0       0       0       0       0    1359     9910
TS      19521952       0       0       0   -4697     370       0       0       0       0       0   -2194   -2814    -9335
TS      19531953    4590    2135    1361    1443    2147       0       0       0       0       0       0       0    11676
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TS      19541954       0       0       0       0   37880       0       0       0       0       0    3284       0   41164
TS      19551955       0    3221    1734    7444   54519    8164       0       0   16462   19026       0       0  110570
TS      19561956       0    2256       0       0    7780       0       0       0       0       0       0    1692   11728
TS      19571957       0       0    2291   -8860    8648   13186   15697       0       0   -4323   -3116    3401   26924
TS      19581958    1715     206    2522    2556     617    8081   13760       0    4773    1333    2890    1080   39533
TS      19591959     926   -1051    7924    4578    1022    -871    7907       0       0   -2188    3834     816   22895
TS      19601960     303    2314    4180    6203    8319     318    9604       0       0    1982    4300   -6647   30876
TS      19611961   -4129    1052    5507    8566    5523   -6990    9871   10574    7495    4686   -1772     463   40847
TS      19621962    1929    3370    5096    3487    1880   -2811   13999   15165    2747    5945     889    1534   53229
TS      19631963    2337    4136    4070    5225    2829   10057       0       0       0       0     741     -19   29377
TS      19641964   -1772    1683     681       0       0    6391       0       0    4632       0   -3565    2836   10885
TS      19651965     358    -389    4363    6937   -7487   10814       0       0       0     419     775     170   15959
TS      19661966    1118   -1278    4919   -2252    4189    9283       0    5196   -1738    7248    4081    2588   33355
TS      19671967    2818      15    2008    4641    5512    9565    6664       0   -5402    -900    2325     194   27439
TS      19681968   -4657    1926    1252    1496     518    4893   11141       0       0    5938     983    2696   26185
TS      19691969    3992     502    1041    2012     846   14536       0       0       0    2033    2148    -124   26985
TS      19701970    2017   -1741    3484    6062    4581    9658       0       0       0    -681    4330    2033   29745
TS      19711971       0    3131       0       0       0       0       0    1282       0   -5269    5054    1971    6169
TS      19721972    2389    5009    8623       0    2949       0       0       0    5733    1950    -258    2225   28619
TS      19731973       5    1032    4061    -650    5417    3930    1841   11520     -67   -5545    3799    4878   30220
TS      19741974    1196    4623    6939       0    6857       0       0    -832    1198   -1717    2553    1753   22570
TS      19751975    2124    1101    3400    1381   -4246   10130    6609       0    4198       0       0       0   24697
TS      19761976    2127    5473    3405   -3386    1554    4832    1036       0    1552   -1152    3377    1293   20111
TS      19771977     705    3334    1070    2523    4240   10545       0       0       0       0     521       0   22938
TS      19781978     803   -2143    4179       0       0       0       0       0       0       0   -1971       0     868
TS      19791979     484     273    -989    5182   -1105    9362    7665       0       0    4298       0    -297   24874
TS      19801980    -177    2347    1231    3759    2496       0       0       0       0    5961       0       5   15623
TS      19811981       0     804     -11    3861       0   -6041    9025       0       0   -7856    4274    3635    7691
TS      19821982    2204    2659    1654    3728    -659    3850   11966       0       0       0    -803    -500   24099
TS      19831983       0    -803    1544       0     819       0       0       0       0       0     -13       0    1548
TS      19841984       0       0    2295       0       0       0       0       0       0   -7694    1366   -4233   -8267
TS      19851985    1581     717    1226    6378    5608    6460       0       0       0    -818    2344   -2646   20849
TS      19861986       0    1888    5173       0    1032     434       0       0    3876   -1534    1356   -1007   11218
TS      19871987    1735     132    3590    8992     173    -496   11453       0       0       0   -3033    -955   21592
TS      19881988    3651     761    3230       0       0     857       0       0    -398       0       0     529    8628
TS      19891989    -838   -1653    3186    7297    4293    3675   10031    4071       0    2043       0    2900   35005
TS      19901990   -1161   -1917   -3338    3197    9950   12986       0       0    4993    3991    -367     564   28899
TS      19911991   -1696    1751    7303    3765    3476    5965       0    1693    4041    2545    4839   -3180   30501
TS      19921992      40    1101    5765    7669    3628    9323   14723       0       0    1254   -2159    -805   40540
TS      19931993   -1083      88    2271    3878    5774    7819       0       0       0   -5052    1535    2235   17466
TS      19941994    1838    -114    3268       0   -4146   10476       0       0       0     778    -704   -2588    8809
TS      19951995    1375    2421     561   -2360    3044    8720    9815    6538    4917    1959       0    2508   39498
TS      19961996       0    4359    3473       0       0       0       0    6901    3105    4314   -1535     941   21559
TS      19971997    -368   -4476    -367   -2120    6408    4023   13510       0       0       0       0   -5472   11137
**
**------Aquilla
WR515831       0        19761025       1     1.0  5158DP                C5158_TS   C5158 5158001
TS      19401940      91     132      82    4659     972    2343    3197     111       0      99    8878     954   21519
TS      19411941    1305     983    1245    1570    1898    1571    3253    2423     142    4351     684    1403   20826
TS      19421942     945     714    1063    3902    1675    2218    1508       0    6975    1578    1714    1119   23409
TS      19431943    1450    1006    1954    2064    1557    1223       0       0       0     600      83     260   10195
TS      19441944    2170    8924    4640    2458    1302    3047     176       0     103     213     367    7878   31277
TS      19451945    6361     801     736    1403    2312    1941    3090     333       0     248    1242     186   18651
TS      19461946    3769    6462    1358    1679     863    2663       0       0     346     103    1617    5593   24453
TS      19471947    6807    1614    1139    1368    1616    2508       0     111       0       0      83    1150   16394
TS      19481948     645    1066    1061    1605   14557    1537    5346       0       0       0       0      90   25907
TS      19491949    2853    2547    2196    6728    3629    2117     474       0       0      99      83      90   20817
TS      19501950      91    7748     570    8010    2115     154     892     111    2265      99      83      90   22230
TS      19511951       0      91      82    1586       0   21243       0       0       0       0       0      90   23092
TS      19521952       0     637     303   18750    2811     338       0       0       0       0    4514   14015   41367
TS      19531953    1229     437    2043    1278    1355       0       0       0       0     503       0     152    6996
TS      19541954     128      29       0       0    5008     107       0       0       0       0    1170       0    6442
TS      19551955       0    1094    1256     684    7107    2835       0       0     103      99      83      90   13352
TS      19561956      91      84      82       0   10139       0       0       0       0       0       0     199   10596
TS      19571957       0       0     431   48637     550    2225     255     111       0    9109     409    1294   63021
TS      19581958     946     803    1201    1068    2561     311    2400    1116    2227      99      92     114   12937
TS      19591959     114    3368     572    4919    5125    1664    1452       0       0    6455     687    1396   25751
TS      19601960     911    1014    1481    1829    2253    2370     253       0       0     783      83    9515   20491
TS      19611961     931    1137    1452    1964    1210    2385    2678     286     730    1685    5185    1017   20660
TS      19621962     966    1325     962    1884    2530    1859     446     125    2970    6227     310     865   20469
TS      19631963     623     329     277     904    1263     107       0       0       0       0      83      90    3677
TS      19641964     197     139    1156     366     109     107       0       0    4070       0   10743     138   17025
TS      19651965    2713   12334     989     589   10172     920     109     111       0     142    1435     318   29832
TS      19661966     243     969     696   13549    1821     605       0    1688     510      99      83      90   20353
TS      19671967      91      83     170    5473    3104    3160    1491       0     612   15428    1179     766   31557
TS      19681968     203     966    1223    1305    2456    1742     576     111     189    1081    2047    3340   15237
TS      19691969     341    2742    4380    1064    1933     471     109     111     110     187      83     752   12283
TS      19701970     259    8212    6703    1272    1537     242       0       0     196   11469     479     244   30611
TS      19711971     178     894     142     155   10442       0       0     610       0   10312    1394     615   24742
TS      19721972     938    1603    2040    1114    2944     184       0       0     657    4497    1750     351   16077
TS      19731973    6835     926    1299    1264    1924    1799    2565     365    4395     768    1402    1264   24806
TS      19741974     879    1592     802     411    2100       0       0    4224    6939    1117     917    1000   19982
TS      19751975    1204    1022    1367    1562    1354    2292     318     127     129      99      83     122    9679
TS      19761976     120     130     687   15326    1107    2269    2662     219     920    2301     384    3738   29861
TS      19771977     778    1327    1340    1874    1902     790       0       0       0      99      83      90    8284
TS      19781978      91    1068     835     927       0     107       0       0       0       0      83     116    3228
TS      19791979     344    1220   14526    7127   13361    2587    1272     636     103     125       0     537   41836
TS      19801980    4411    2056    1096    6127    1451     135       0       0       0     123       0     857   16256
TS      19811981     217     166    1996     566    2599   17865    1296       0       0    1005     238     212   26160
TS      19821982     159    1046    1641     450   10719    1997     790       0       0      99      83     399   17383
TS      19831983     259    6966    6446     398     961     779       0     799       0     177     541      90   17415
TS      19841984     265     275    6663     358       0       0       0       0       0   13180    1749   11298   33789
TS      19851985    1298     688    1220    1522     313     367       0       0       0    6985     197    7401   19991
TS      19861986     563    1707     811     553    2834    1615       0       0    1922    6234    1502     513   18254
TS      19871987    1167     627    1558    1993    1296    1839     608     276    2507       0    4615    4478   20962
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TS      19881988    1472    1187    1453    1506       0    2145       0       0       0       0       0     302    8065
TS      19891989    1782    8408    7063    1916     883    1474    2904     823     103      99      83      90   25629
TS      19901990    7032    3619     680    1340    1233     107     109       0     103      99     270      90   14682
TS      19911991    2234    2004     603    5457    7282     107     252    8078     459    2886    1375     602   31339
TS      19921992     888    1087    1546      87    2773    1803     109    2748     103      99    1677    6534   19456
TS      19931993     687     895    1035    1247    1809    1989     705       0       0   11098      83    1158   20705
TS      19941994    1056    2067    1432    1209    1365    2647       0       0       0    5592    5005     768   21141
TS      19951995    1074     910    1035    1612    1950    2398    2736    2313    1419    3135      83      90   18757
TS      19961996       0     655     340    1787       0       0       0    2796    1875    1093    9866    4528   22941
TS      19971997    1193     441    1557     972     859    1963     299     581       0    4049     350    7090   19351
**
**------Proctor
WR515931       0        19631216       1     1.0  5159DP                C5159_TS   C5159 5159001
TS      19401940       0     209       0    4775    2101    3254    2308    2314       0       0   13425    1142   29529
TS      19411941    1215     829    1264    1225    2537    3292    4528    5700    3141    1300    1759    1137   27927
TS      19421942    1240    1308    1294    1626    2625    3961    2664     552   10655    1494    1983     929   30329
TS      19431943    1229    1444    1185    2313    2516    1989       0       0    1069    2806      54     524   15129
TS      19441944    7402    8874    3517    2227    2805    1806    8494       0    3172    1507    1155    1536   42496
TS      19451945    3136    4367    1500    1949    3294    4193    4892     192     262    4887     716     884   30271
TS      19461946    5041    4143    1662    1816    2655    3805      82       0   12643     709    4270    1009   37833
TS      19471947    1114    1360    1214    1595    2088    1370       0       0       0       0     107    4259   13108
TS      19481948    1263    2507    1234     605    5354    2869    3517       0       0       0       0       0   17349
TS      19491949       0    1620    9836   16488    6836    3971     415       0       0    2800     509      66   42541
TS      19501950     142    2781       0    6003   12415    4027    4816       0     198       0       0       0   30383
TS      19511951       0       0       0       0    4060   12947       0       0       0       0       0       0   17007
TS      19521952       0       0       0    1159   31290     404       0       0       0       0    1550     566   34969
TS      19531953     133      80     255    3095    9057       0    3365       0       0    8711     998     357   26050
TS      19541954     167       0       0    1928    1259       0       0       0       0       0    2515       0    5869
TS      19551955       0     958       0    6943   40855    4164       0       0    2614     632       0       0   56166
TS      19561956       0     208       0       0   21118       0       0       0       0       0      65    3213   24604
TS      19571957       0      10     153   22047    1453    3464     618       0       0   13742     623    1075   43186
TS      19581958     583     847     855    1089    2078    1828       0       0       0       0       0       0    7279
TS      19591959     120     408       0     455       0   11634   13328      49       0   14623    1273     779   42670
TS      19601960     544     970    1223    1620    2675     620       0       0       0    1989      27     591   10259
TS      19611961   17003     997    1397    1960    2065    2437    4694     218       0    1405     695     999   33869
TS      19621962     808     830     796    1203     137    3074       0     378   20106    1728    1080     950   31090
TS      19631963     936     985     967     766    2358    4027       0       0       0       0    6741       0   16780
TS      19641964    2615    5317    2153    5973     495      76       0       0   21232    1192    1297    1370   41719
TS      19651965     498     374    1774    2365     -86    4394    2582       0     224    2845    1764     672   17407
TS      19661966     692    1555    1164   10055    7335    4873       0    1119    7574     386     453     281   35486
TS      19671967     748     323    1868    2619   11789    7479     873       0    3621       0     520     508   30349
TS      19681968   11074     718     825    2039    1363    4719    4493     733       0       0     415     648   27026
TS      19691969    1184    1005   11314    5647    2467    3339       0       0       0    4258     875    9216   39303
TS      19701970    5142     107     895    1551    1719    5076       0       0    2728    1448       0     921   19585
TS      19711971     808     685       0     770    7400       0    1081   12433    3893   10558    1032    6738   45397
TS      19721972    1587    1758    1493    3699    2496       0       0       0       0     452       0     348   11832
TS      19731973    1393    1828    1873   19872    1964    3751    6231       0       0   10749    1104     627   49391
TS      19741974     616    1120    1697    1021       0       0       0    4083   10601   10152    4117     746   34153
TS      19751975    1421     814    2087    1408    1248    2718    2872    1286       0       0       0      11   13866
TS      19761976       0     587     561    8312    4207     291    1672    1024    1272    2930     524     540   21918
TS      19771977     316    1100   26775     127    3089    1350     852       0       0       0       0       0   33609
TS      19781978       0      10     645       0       0       0       0       0       0       0       0       0     654
TS      19791979     980     327   10794    2805   20834    1213     269    3467       0       0       0     117   40807
TS      19801980     149     290     234     643   14553     702       0       0       0       0       0       0   16572
TS      19811981       0     395     863     268     359    6435       0       0      31   24207    1097       0   33655
TS      19821982     286     671    1255     577   18407   19675    6865       0       0       0       0       0   47736
TS      19831983       0     197    2302     562     979       0       0       0       0       0       0       0    4040
TS      19841984       3       0    4761       0       0    2123       0       0       0   21832    3561    9754   42033
TS      19851985   20912    1022    1329    2456    2523    3465       0       0       0    1586     620     184   34097
TS      19861986     124    4185     743     884   17364    1250    5655       0    5500    1167     475     398   37743
TS      19871987    1059    -386    1582       5    2702    3145    6936       0     292       0       8      11   15354
TS      19881988    1426    2395       9     739       0   18621       0       0       0       0       0       0   23190
TS      19891989     315    2850    1497    2095   20148    2974    5089    6929       0       0       0       0   41897
TS      19901990    2367      10    8415    2060    3854    5325    5231    5366    2462    2679     753       0   38522
TS      19911991    1531    1484    2452    1569    1730    4867       0   10687    1939     273    1748    -199   28080
TS      19921992     742     578    2221    2331    1857    3307    5753    5343    3432    3141     -94     587   29199
TS      19931993     280     313    1333    2156    2619    3299       0       0       0   16304    1370     973   28646
TS      19941994     885     632    1805    1884   -1018    5439    4546       0       0    8740     163     130   23207
TS      19951995     923    1108     805    1415     919    3458    5773    4280    2132    3163     261    2315   26551
TS      19961996    1067    1571       0    4093       0       0       0   14176    2669     105     -12    1637   25305
TS      19971997    1610    -226    1525    1643    2207    2056    6607    4834       0       0    1597    2793   24645
**
**------Belton
WR516031       0        19631216       1     1.0  5160DP                C5160_TS   C5160 5160001
TS      19401940       0       5       0   22269     594   26703   16296    -314       0    1251   49014    8057  123874
TS      19411941    7923    7155    8168    7467   11339   10860   16320   16866   13992    8949    9235    7900  126174
TS      19421942    7216    5789    3782   15334   11200   13747   12868   19296   11873    9644    9487    7739  127976
TS      19431943    7854    8853    8091   10572    9852    1254       0       0    1732    1228    -173    1586   50849
TS      19441944   39846   55799    8000   10132   11377   14806    6889       0    2484    3878    4297   28812  186318
TS      19451945   35492    6581    7997    9804   12871   12063   15849     335    4463   34959   10548    8036  158998
TS      19461946    6183    7367    9341    8468    9530   13190    2038       0   11244    2025   18492   24395  112272
TS      19471947   21651    8217    8068    8352   10146    4733       0       0       0       0      -6    2122   63283
TS      19481948    -137   15540    7205    3129   20893    2491    7114       0       0       0       0       0   56235
TS      19491949    -115    -119   52945   67937   59529   42027    3152       0       0    -195    -169    -139  224852
TS      19501950    -141    6950    -131    4888   27405   14919   11671       0   25358       0       0       0   90918
TS      19511951       0       0       0    -161    8173   12510       0       0       0       0       0       0   20522
TS      19521952       0       0       0   22855   36731    3747       0       0       0       0    2770   14876   80979
TS      19531953    3078    -122   13813    4256  146584       0     906       0     -87   10947    1345    -137  180583
TS      19541954     -58       0       0    -178     695       0       0       0       0       0    -162       0     297
TS      19551955       0    5382    -173   12818   44207   24278       0       0   10844    2778       0       0  100134
TS      19561956       0    -134       0       0  104058       0       0       0       0       0    1345     478  105747
TS      19571957       0      18   16360  298275  109427   14426   19562    2108    -174   30632    5444    8696  504775
TS      19581958    7000    3177    9035    5328   11877   13582    -353       0       0       0       0       0   49646
TS      19591959    -141    1170     -51    -128    -192   35438   11305    5625       0  120888    7904    6045  187862
TS      19601960    6563    7350    8274   10335    9479    -246     -30       0       0   49897    7308   24786  123715
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TS      19611961    6346    6670    9354   11583   10941   11830   13937    9470    6032   21338    7205    7542  122247
TS      19621962    7164    7450    5649    8406    4398    9072       0    -341   36042   16135    2065    8286  104327
TS      19631963    1755    1369    2464    -159   33353   11867    -333       0       0       0    -121       0   50195
TS      19641964    1594    4604   13625   41408   13034   80895       0       0   46898   10840    7078    7649  227626
TS      19651965    4828    5595    8313    9901    2647   13367   19388   17879   11504    6366    9498    5261  114547
TS      19661966    6497    5647    9620    6979   11038   13037    -323   33156   10476    6352    1420     126  104025
TS      19671967     987    -159     293    6745    6963   11437    6470       0     667       0    1171     -79   34494
TS      19681968  116338    6475    7272    8870    4386    9820   13227    -313    -217       0    -134    1739  167461
TS      19691969     917    3320    6862   70167   11149    4215       0     -98       0    4563    9862   20860  131818
TS      19701970   25972   33577    7493    9257    8767   14079       0       0   25991    2702    -184     -51  127601
TS      19711971     461    -155    -131     864    4312       0  103590    9476    -214   31821    6946    5637  162605
TS      19721972    7175    8476    8155    1934   16730    -116    -255       0       0    4715    2382     859   50055
TS      19731973   13467   16568   36338   31358   11118   10281   14042       0       0   34336    8821    1840  178168
TS      19741974    4922    4577    3452    1080    1403       0       0   20024   70895    7534    7171    7359  128416
TS      19751975    7640    6984    9019   10500    4259   10026   11433     753       0       0       0    -110   60503
TS      19761976    -166    -131    1230   18515   20604   18977   61698    -311    2750   14476    7369   20457  165466
TS      19771977    6365    6151    9016    6948    9982   14134     898       0       0       0       0       0   53494
TS      19781978       0    1896    2313    -184    -199    -140       0       0       0       0     611       0    4297
TS      19791979   14223   17104   57442   35566   94145   25235   13401    3241       0       0       0     748  261104
TS      19801980    2009    5459    5022    7765   65658    6395       0       0       0       0       0    -139   92170
TS      19811981       0    -116    8778    6332    1610  116843    -321       0    1630    3453     343       0  138552
TS      19821982    -148    1546   14361   12881   49825   29871    9069       0       0       0       0       0  117406
TS      19831983       0   10819   27966    3981   17727    -152       0       0       0       0       0       0   60341
TS      19841984    -145       0    6133       0       0    -187       0       0       0   15823    2338   14262   38225
TS      19851985   17943   19493   44584   18007   17941   24226       0       0       0   51499    7856   49198  250747
TS      19861986    7287   58549    6780     845   43603    9750   19391    1949   17546    6738    7067    4191  183696
TS      19871987    7605    5218    8662   11112    9132    7164   17761     612    2257       0     427    3909   73857
TS      19881988     722    2075    2619    -193       0   57965       0       0       0       0       0       0   63188
TS      19891989    6547   16812   27853   13952   86698    9214   11007    2068       0    -119       0       0  174032
TS      19901990    -142     817   28452   63527   10503   17225   13691   12088    2784    1992    2283       0  153219
TS      19911991   16765   13001    4339   10452   16476   11686    -297    6198    8661   34470    8734     804  131289
TS      19921992    5396    5688    7986   10664    4619   11844   17063   13286   12665    3011    8035   11262  111518
TS      19931993    5808    6701    7848    8896   10355   11347    -342       0       0   13874   10168    2248   76904
TS      19941994    2213   23714   10325    3203   50724   13580   11620       0    -231    6473   20671   29243  171535
TS      19951995    6323    6121    6807    8254    7222   11403   12747   16597   10821   12223    -152    1201   99564
TS      19961996     750    1534    -138     324       0    -230       0   27344   71631   18219    8978    6909  135320
TS      19971997    6881    5669    8359    6798    9363    9433   17312    7098       0    -168    2077   42405  115227
**
**------StillHouse Hollow
WR516131        0        19631216       1     1.0  5161DP                C5161_TS    C5161 5161001
TS      19401940    1156    2791    1386    8853    5811   13168   10175    2470    1168    3757   25009    5484   81227
TS      19411941    5462    4980    5175    5201    6900    7784    9849   10617    3140   10792    3961    3733   77593
TS      19421942    2941    2460    2417   18454    6819    9784    9128    2812   15275    6306    6320    5215   87928
TS      19431943    5238    4809    6298    6510    5653    1720       0       0       0    2407    1502    1954   36091
TS      19441944   22305   35725    5279    6478    7325   10602   11318       0    8183    5647    7619   15170  135650
TS      19451945    5126    4939    5577    5446    8277    8801    9924    7384   11941    7384    6639    5431   86867
TS      19461946    4371    4952    5659    5347    5638    9238    2431       0    3807    2756    3942    8590   56731
TS      19471947   29133    5476    5212    5446    6472    4688       0    2068       0    1060    1456    1753   62763
TS      19481948    1512   13655    2846    6254    9971     819    5258       0       0     609     880    1449   43253
TS      19491949    1153    1067   24789   38818    7897   12713    1882       0       0     651     948    1281   91199
TS      19501950     968    4664    1351    4631    6363    4229     846      12    6631     623     684     763   31765
TS      19511951       0     809     810     756    5608    3447       0       0       0     237       0     702   12369
TS      19521952       0     589    1261   19779   39082    5257       0       0       0       0    1302   16962   84233
TS      19531953    4057    2465    5762    8556   84804       0    1696       0    3733    4206    1084    1304  117666
TS      19541954    1257     841       0    1259    5505     149       0       0       0    1579   19211     723   30523
TS      19551955    2640    6499    2411    3982   56837   24199   10032       0    4776     610     560     804  113349
TS      19561956     765    1293     511     345   31436       0       0       0       0       0    5453    4408   44211
TS      19571957       0    1429   12333  166498   27754    8225    3392    1132    1869   26648    4400    5484  259163
TS      19581958    4497    4049    5600    5448    6700    8705    3983    2215    2238    1933    1674    1669   48710
TS      19591959    1505    1792    1585    2525    1420   26491    3151    7691       0   46523    5704    4637  103023
TS      19601960    4930    4860    5414    5865    7258    3613    4980    3329       0   28714    5440    3998   78400
TS      19611961    4734    4846    6134    6811    7191    6409    8018    6329    4810   10835    6657    4730   77504
TS      19621962    4480    4045    5325    5859    6107    9863    2191     506   10566   20173    2594    5245   76954
TS      19631963    2746    2037    1776    1460    3240    1138       0       0       0    2334    3451    1042   19223
TS      19641964    1466    5224    9855    9810    6911    7227       0       0   16924    2837    8948    3667   72867
TS      19651965    8203   48835   25148   10178    2928   10080    8519    3235   10555   10035    9732    3451  150898
TS      19661966    4053    3797    6209    4307    6700    9917       0   20305    6869    7337    4532    3804   77830
TS      19671967    3147    2568    2457    2791    2226     649     290       0     558    1057    1339    1088   18170
TS      19681968   73014    4329    4075    5350    4087    8038    9314    3759    3779    1746    1771    2167  121427
TS      19691969    2548    3540    7072   28375    7523    6376    1644    2782    1328   14335    8937   19431  103888
TS      19701970    8117    3549    4288    6729    6117   11072       0       0   25478    5073    2611    2720   75753
TS      19711971    2388    2575    4506    2035    2384       0   22179    7720    1511   15717    7442   26390   94845
TS      19721972    5000    5920    6284    5125    9579    5808       0    2676     137    3418    3236    2874   50055
TS      19731973   10075   16565   18498    5440    7902    8377    8602     995     655   20022    6562    6052  109743
TS      19741974    4414    5532    5191    3678   11707    4162       0   22700    7016    5804    4104    4119   78426
TS      19751975    4603    4491    5100    6070    3178    7985   10414    8370    2362    1939    1614    1808   57934
TS      19761976    2137    2374    2840   19014   16098    7932    8333    5664    5682    8754    5271    5138   89235
TS      19771977    4239    4233    6242    7000    6148    8979    4072       0    1901     570    1014     888   45286
TS      19781978     921    2901    2608    2253     996    4436       0    1098       0      83    1263     815   17374
TS      19791979    6934   13447   31250   22543   46096   13186    7837    8084    1018    1104     492    2122  154112
TS      19801980    2144    3007    3107    4984   33197    9475       0       0       0     141     650    1384   58089
TS      19811981     797    1176    6583    7148    9831   54687   11981    4567    9452    8966    6275    3250  124714
TS      19821982    2847    3065    7889    7758    6433    9101    5049       0       0     152     318     899   43510
TS      19831983    1723   10222   25200    9484   23628   10474       0     672      75     354     199     226   82256
TS      19841984    1605    1392    2488    1348       0     579       0       0       0    7740    1457    4432   21041
TS      19851985    8137   11173   33101   19323   17247   23694    1608       0       0   30285    4886   20748  170202
TS      19861986    8746    6601    7237    3894    6305    5327    5190       0   12055   13230    3974    4488   77047
TS      19871987    6714    3811    6060    7196    4435    1538   11301    5403    8132    2436    3504    5301   65830
TS      19881988    5085    4930    5382    3668       0    7353       0       0       0       0       0     814   27231
TS      19891989    2439    3371    5966    5194   25372   12504    2111     128      73    1795     655     643   60250
TS      19901990    2379    2304   16484   85689   11665   10665    9975    6095    5128    4059    5032    2237  161714
TS      19911991   12849    5146    6241    5995    2664    7000    5372    6954    6971   16481    7853   -7968   75557
TS      19921992    3502   -7362    5066    7653    8291    7349   10280    5594   14059    4896    6528    5511   71367
TS      19931993    4030    5455    3761    4847    6577    9350    9810       0       0    9974    5499    3105   62407
TS      19941994    3022   12311    8390    4219   21449    9984       0       0    2715    7343    8935   18094   96460
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TS      19951995   15514    4657    4657    8597    7923    9191    7576   16073    8299    9078    1326    2182   95071
TS      19961996    1818    2826    1732    3153       0       0       0   14628   24468    7049   13221   20892   89786
TS      19971997    5640   -6656   -1196    4362    7351    1225   12386    8967       0    2938    4362   20276   59656
**
**------Georgetown
WR516231       0        19680212       1     1.0  5162DP               C5162_TS   C5162 5162001
TS      19401940     155    1311     460    1997    1415    1366    2113    1337     619    1677    2994    1087   16531
TS      19411941    1091     960     957    1019    1308    1504    1930    1551     902    2746     945    1038   15949
TS      19421942     886     741     601    2279    1197    1865    1041       0    4363    1261    1261    1042   16537
TS      19431943    1047    1159    1082    1338    1304     416       0       0       0     343     208     105    7001
TS      19441944    4782    7062    1025    1336    1090    2067    1752       0    3161     687    2539    1359   26857
TS      19451945     940     914    1013    1003    1647    1802    2053    1610     552    1545    2412    1411   16902
TS      19461946     933     949    1088    1039    1163    1878     847       0    4327    2192     972    1063   16450
TS      19471947     874    1140    1049    1106    1320    1509       0     675       0     332     361     416    8781
TS      19481948     395     502     460    6384    6664     429     570       0       0       0       0     185   15590
TS      19491949     234     377       0    7466    1912    2572     856       0       0     231     155     345   14148
TS      19501950     306    1306     616    1373    2584    1659     403     136     373     157     142     151    9205
TS      19511951       0     191     285     375       0     218       0       0       0       0       0     123    1192
TS      19521952       0     316     557    4895    8043    1332       0       0       0       0      97    6207   21447
TS      19531953    1791    1667    1732    7782    7940       0       0       0    1998    8991    1467    1322   34692
TS      19541954     888     608       0       0     337      35       0       0       0       0      63      71    2002
TS      19551955     178     608     625     193    5221    2782       0       0       0      19      35      41    9702
TS      19561956      83      89      71       0       0       0       0       0       0       0       0    1301    1544
TS      19571957       0      10    1023   37797    1107    1745    2126     754       0    3763     892    1118   50336
TS      19581958     918     825    1097    1116    1303    1694    1306     807    2891    1310    1146    1016   15429
TS      19591959     998     737    1293     942    1297    1593    1045    2130       0    3094    1139     992   15260
TS      19601960     968     966    1084    1163    1484     954    1088       0       0    5904    1062     776   15450
TS      19611961     908     929    1225    1353    1467    1262    1552    1867    1512    1353    1013     981   15423
TS      19621962     969    1081    1226    1011    1498    1555    1512     290     805    1060     621     726   12353
TS      19631963     642     641     723     609     502     237       0       0       0       0     476     354    4183
TS      19641964     620    1483    2514    1941    1414     856       0       0    2149     891    3198    1806   16874
TS      19651965    3896   13491    1158    1145    1002    1853    2211    1039    2601    1307     976     815   31491
TS      19661966     896     784    1183     868    1161    1798       0    1049    2689    1418    1060    1011   13916
TS      19671967     811     656     496     856    2777     503     189       0     506     886    1222    1179   10081
TS      19681968    9160     971    1122    1074    1080    1597    1897     595    1365     291     386    1062   20601
TS      19691969     695    1448    3962    1063    1328    1922     644    3350    1626     936    1015    1256   19244
TS      19701970     931     762    1119    1230    1077    2058       0       0     310     256     197     181    8121
TS      19711971     181     177     176     106      96       0    3326     346       0    2039    1404    2821   10671
TS      19721972    1543    1015     648     258    1146    1797       0       0      63     855    1803     954   10082
TS      19731973    2334    5583    9104    5582    1501    1522    1858    1013     938    2359    1235    1192   34221
TS      19741974     826    1173    1185    1182    1475       0       0    5403    1518    1390    1054     984   16190
TS      19751975    1036    1069    1220    1074     914    1695    1936    1789    1012     598     522     500   13365
TS      19761976     387     325     421    5562    1181    1760    1661    2032    1187    1066    1315     918   17813
TS      19771977     890    1010    1157    1091    1400    1866       0       0       0      65     247     119    7846
TS      19781978     158     432     368     324       0     184       0       0       0       0     189     126    1780
TS      19791979    2278    9038   13653    1818    1118    1854    1685    1256     356     145     202     279   33681
TS      19801980     226     461      82    1538    7865    2049       0       0       0      43     193     668   13125
TS      19811981     609     981    2553    4144    4744    1689    2057       0    3583    1022    1187    1154   23723
TS      19821982    1057     983    1062     781     929    1316    1469       0       0       0       0     183    7781
TS      19831983    1156    7122     693    1369     861    1648       0     790       0      42       0       0   13680
TS      19841984     405     232     351     239       0       0       0       0       0    5510     962    4337   12035
TS      19851985    7437    4779    1037     892    1109    1390     338       0       0    2737    2574    2259   24552
TS      19861986    1058     678    1303    1295     883    1572       0       0     469    4114    2451     511   14334
TS      19871987    1047     685    1114    1389     652    1297    1999    1062     582      75     316    1015   11233
TS      19881988     993     620     650     477       0    2596       0       0       0       0       0      72    5408
TS      19891989     325     592    2656    1634   13451    1830     288       0       0       0       0       0   20777
TS      19901990     149     159     536     595    2043     209       0       0       0       0     191      83    3964
TS      19911991    4096    3992    2774    4298    8264    1800    2097     142    2832    1237    1378     300   33211
TS      19921992     668     792     964    1256     719    1484    1956    1041     383      96     188    1083   10631
TS      19931993    1344    3301     769    1039     935    1381    2337       0       0       6     132     294   11537
TS      19941994     334     727    1176     889    2417     924       0       0       0    2352    1068    3574   13459
TS      19951995    4076    2140    3805     821     893    1849     737       0     226       0      35      58   14641
TS      19961996      59     183      72     302       0       0       0     539    3366    3139    1217    7003   15881
TS      19971997    6852    1184    1113     258    1048    1446    2193     863       0       0     322    5106   20386
**
**------Granger
WR516331       0        19680212       1     1.0  5163DP               C5163_TS   C5163 5163001
TS      19401940    1331    1090    2020    1824    2560    1971    4463    3824      72    1584    6364    1434   28535
TS      19411941    1871    1576    1617    1825    2474    2331    3712    2890    3150    3610    2099    1444   28600
TS      19421942    1943    2132    2330     516    1974    3510    3130       0    7300    1921    1928    1324   28007
TS      19431943    1641    2304    1866    2833    2070    2112       0       0       0    1880    1616    1311   17633
TS      19441944   11512    3764    1631    2698    1313    4488    4691       0    8123    2637     893     797   42548
TS      19451945    1271    1322    1402    1510    3422    3307    4322    3475       0    4527    3595    1368   29519
TS      19461946     723    1348    1528    1862    1428    3753    2702       0    9038    2633     533    1631   27181
TS      19471947    1109    2276    1620    1981    2121    4300       0    2366       0     768    1955    1995   20489
TS      19481948    1861    1409    2021   13408    2722    2141    2088       0       0       0       0    1489   27140
TS      19491949    1507    1839       0   17407    5122    3224    2721       0       0    1627    1499    1841   36787
TS      19501950    1663    3881    2363    3997    6746    3407    1717    1172    1987    1473    1471    1412   31288
TS      19511951       0    1428    1636    1799       0    1675       0       0       0       0       0    1352    7889
TS      19521952       0    1701    2232   11749   18767    4129       0       0       0       0    1316   13273   53168
TS      19531953    4933    4676    4820    5877    2203       0       0       0     376   18518    2036     929   44368
TS      19541954    1538    2344       0       0    1810    1274       0       0       0       0    1089    1237    9292
TS      19551955    1379    2347    2383    1401   12557    7320       0       0       0    1168    1235    1173   30963
TS      19561956    1174    1205    1164       0       0       0       0       0       0       0       0    3944    7486
TS      19571957       0       0    3261   45413    1740    3428    5098    2541       0    4315     683    1738   68217
TS      19581958    1325    1229    2173    1940    2586    3392    3713    2658    3147    1463    1657    1359   26643
TS      19591959    1599     650    2866    1283    2276    3073    3136    3563       0    4370    1672    1238   25724
TS      19601960    1432    1539    2140    2178    3142    3130    3231       0       0    7414    1159     275   25640
TS      19611961    1049    1427    2451    2964    3173    1615    2643    4248    1803    2128    1013    1103   25617
TS      19621962    1249    2105    2664    1807    3333    2641    4166    1515    2938    3460    2528    2377   30782
TS      19631963    1619    1553    2597    2315    2170    1630       0       0       0       0    2209    1861   15954
TS      19641964    2353    4272    6539    5239    4180    3083       0       0    5896    3087    8198    3607   46456
TS      19651965     864     705    2206    2337     879    3902    5139    3958    3222    1819     871     522   26422
TS      19661966    1086     846    2467    1554    2140    3916       0    5113    5877    2606    2439    1431   29475
TS      19671967    2012    1913    2460    2586    2138    2412    1103       0    9143    4195    1401    1121   30482
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TS      19681968     449    1692    2025    1895    1215    2172    3962    4522    1979    2716     730    1408   24764
TS      19691969    1740    1012    1521    1553    2418    4252    4381    4473    2932    1514    1604     687   28086
TS      19701970    1289     889    1852    2284    1781    4516       0       0    7683    4393    2965    1993   29645
TS      19711971    2221    2051    2740    2385    2799       0    1799    3754       0    2079    9193    1428   30449
TS      19721972    1210    2192    3022    2881    1987    3721       0       0    1685    9970    1298    1458   29424
TS      19731973     507    1226    1616    1657    3155    2359    3914    3546    2609     279    2008    1888   24763
TS      19741974     654    2442    2475    2872    2417       0       0   10448    1337     914    1070    1264   25893
TS      19751975    1682    1631    2396    1762     683    3070    3905    3521    2703    2387    2337    1253   27330
TS      19761976    1993    2328    1895     436    2000    3237    2733    4435    1971     809    1355     786   23978
TS      19771977    1175    1858    2186     967    2797    3999       0       0       0    2130    2528    2196   19835
TS      19781978    2213    4384    3453    3674       0    2386       0       0       0       0    2776    3128   22013
TS      19791979   11658    8229    1517    2020    1189    4091    2895    3733    2846    2896    1885     802   43759
TS      19801980    1071    1665    1882    2461    1509    4418       0       0       0    1988    2505    3209   20708
TS      19811981    2878    4102    5480    1735    1132      57    3834       0    6483     783    1966    1993   30445
TS      19821982    1830    1876    1766    1584    1425    1956    4368       0       0    1232    2264    2819   21119
TS      19831983    3667    4457     865    3309     819    2381       0    3761       0    1316    2678    2123   25376
TS      19841984    3091    2162    3068    1506       0       0       0       0       0   22949    1502    -110   34168
TS      19851985    1767    1821    1842    2563    2501    2866     903       0       0    9212    4394    1419   29288
TS      19861986    1725    2065    3052    2936     907    2872       0       0    4118    6633    1506     332   26146
TS      19871987    1813    1235    2411    3297     536    2050    3769    5016    3234    2972     662    1177   28172
TS      19881988    1967    2040    2200    2940       0    5754       0       0       0       0       0    1432   16334
TS      19891989    2407    2113    3892    3020   14408    2357    2121     899    1165    1547    1491    1240   36659
TS      19901990    1888    2278    7716    3902    2350    2356    1046       0    1164    1125    1694    1336   26855
TS      19911991   10093    1383    2541    2476    1767    2549    3781    2556    2769    2400    1860   -2166   32008
TS      19921992     943     970    1787    2406    1347    2721    4073    3924    3354    3081    1331     630   26567
TS      19931993     899    1708    1840    2204     935    1653    5327       0       0    1738    2737    3092   22134
TS      19941994    3057    2636    2934    1831    2829    2095       0       0       0   11254    2897      75   29608
TS      19951995    1550    1738    1526    2310    1298    3208    3560    2704    1822    1651    1931    2384   25681
TS      19961996    2053    2588    1371    1894       0       0       0    1518   20870    2389     866    1216   34764
TS      19971997    1616     658    2086    2366    1611    2621    4669    4701       0    4793    2326     544   27990
**
**------Somerville
WR516431        0        19631216       1     1.0  5164DP                C5164_TS   C5164 5164001
TS      19401940     108    3838      98    2140   11279    4812   15267     147     370     903   18803    1137   58902
TS      19411941    3036    2074    2300    2159    5685    6329   12210    1323     292    1208    8654    1486   46755
TS      19421942     928     928     851   19656    2466    1999    3326       0    3205     515    2911    3225   40009
TS      19431943    9912    1207    8698    1690    6762    3875     176      75     784     797     127     811   34914
TS      19441944   40703   17755    1705    3217    3162    4143     691       0   10627     104   28645    -448  110303
TS      19451945    2828    2137    1872    4131    5969    8668    1945   16928    7406    2211    1667    3726   59487
TS      19461946      22    1787    2061    3941    1549    6781     522       0    3322    4266   23070    2071   49392
TS      19471947     296    2637    4426    4929    4315    1728    1994   28175     538      98      78    1761   50974
TS      19481948     400    6859    1139     378    5589     327     876       0      87      94      78     101   15927
TS      19491949    1126   26507   16872   28946    8265    5120     317       0       0   31137     677    4840  123806
TS      19501950    2181    1610    2839    4087    5693    8148    2172      72   12592     146      78     101   39718
TS      19511951       0     244    4599    2691     675    1704       0       0     180       0       0     101   10193
TS      19521952       0     926     535    5480   17468    1985       0       0       0       0    3034   18216   47644
TS      19531953   16120    4308    1894    6315   69449     232    6117     633    3877   18550    7391   11119  146003
TS      19541954    2393    1268       0    1000    6683     614       0       0       0     250     206     279   12692
TS      19551955     334   17183     328    3955     366    4666     428       0     520     613     299     183   28875
TS      19561956     372   12938    3385    3745    2120       0       0       0       0       0       0     717   23276
TS      19571957       0     359   13643  133269   23722    8786     794     527   15408   12479     -14    2169  211142
TS      19581958    1484    3202    4701    4551    7448     971   13258     365   19096    1571    2230    1268   60144
TS      19591959    3077     243    4633    3479    4634    1586     370     152     212    3007   13465   19171   54029
TS      19601960    1654    1963    4817    3838    8856    5814    4429    1764     624   17742     790    -621   51668
TS      19611961    1780    1202    4751    4377    7901    8788    9151    1092   13459    2552    1955    1335   58344
TS      19621962    1692    4589    5082    3939    7048    8918    9558     583   12079   14254    1859     884   70486
TS      19631963    2459    3250    3957    8840    1694     673     728       0       0       0     421    1476   23497
TS      19641964    1063    3694   13467    2989    2983    2466       0       0    2139    4321    1996    3562   38681
TS      19651965    4955   72693    4563    3704    5949   10966     841    1117     268    1752   28637   -1412  134033
TS      19661966    1273    2133    6461    3762    6135    1162    1010     795    8941    2049     984     586   35293
TS      19671967    1779    1123    1121    3354    6778    3611     496       0    3737    1147    3501     287   26934
TS      19681968   75094    3187    4180    3361    2376    -360   10562    5146    8780    3037     -94    1060  116328
TS      19691969    3239    2483    3486     125    6209    2102      66      60     868      89    2026   12485   33238
TS      19701970    8138   26009    2979    5075    5415   12743     467       0      78    1392      65     301   62662
TS      19711971     587    1227    1133    1227      79      66      71     613      81     900      74   14727   20782
TS      19721972      62    2040    1412    1344   21749   13222       0     896      76     836      69      93   41798
TS      19731973   35464   28672   39224    7354    7850    4880    3730      60    1954   14195    3234    1836  148452
TS      19741974    -417    5874    4723    3396    7672   14009       0    5066   15808     946     -35    2329   59369
TS      19751975    2450    3710    5527    4000    2748    8785   10851    6258    3387     777     667    2789   51948
TS      19761976    3181    3240    8405   10004    6061    7755    5972     236    2671   14459    4247    1155   67386
TS      19771977    1857    3682    5141    3267    5485    4583      60     206     898      76     692    1432   27378
TS      19781978    6380   13996    8853    3563    9169   19871    3135    1956    5714      83   10019    5953   88692
TS      19791979   21155    2986    4049    4281    5019   10992   10357      57      59     303      51    3534   62842
TS      19801980   17037    2842    2205    6545    4097    3616    1190       0      84      84      71      95   37866
TS      19811981    1531     835    2347    1874    7561   53211   12320      61     318   15063    1926     494   97539
TS      19821982    1102    2019    2944    8822    4918    7150      67      58       0     821      65    5762   33727
TS      19831983   18689   14532    2538    3173    6488   10490    1098    5554    2976     427      66      87   66116
TS      19841984    3131    2057    6221    6294    3520    1315       0       0       0   37675   20545    6065   86823
TS      19851985    2308    1857    2939    5288    6442    4759    2129       0     513   16425   21575    2347   66583
TS      19861986    3018    3147     716    1861   12517    4462   13390    2171    4142    7017    3822    -383   55881
TS      19871987    2502    1017    5533    4081    8401    7372   13572    6728     769      94     442    2237   52747
TS      19881988    1520    1384    3698    2654    2438    5444    1101      42       0       0       0      95   18375
TS      19891989   10085    1726   13224    3710   15931    7959     645     476      75      87      75      91   54083
TS      19901990     958    2672    1029   21940   10246      60     402     160      76      94      69      98   37802
TS      19911991  100559    3628    4281    3069    4769    7058    1323     274    1029    2049    2312   26599  156948
TS      19921992     407    1468    4539    5072    2363    7768    7337    3292    3073    2199    7504   12801   57823
TS      19931993      55    2976    4311    4844    3702    4859    6221    3761    2803    6963    3355    2855   46704
TS      19941994    1941    5531    6024    2366    7900    2708    2762    5189     991   25381    3132   -1578   62346
TS      19951995    3329    3985    3628    5083    3610   11268    3274    6325    3890    1417    5133    2281   53224
TS      19961996    1232    1587    1542    1992       0       0       0    2422    5499    2496    1855    1319   19944
TS      19971997    1740   20623   12924    8889    5797    6760    8595    8059    7487    2680    3083    4586   91224
**
**------Limestone
WR516531        0        19740506       1     1.0  5165DP                C5165_TS   C5165 5165001
TS      19401940     224     911     239    4927   19924    5359   11400     217     220     208   32165    2291   78083
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TS      19411941    5511    4578    5786    5234    7171    7967    8939    1282     538     283     515     858   48661
TS      19421942     443     741     557   40326   20113    9682     343       0   12009     875    7255   18132  110475
TS      19431943    6770     733    5530    5308    4421    6900     322     135     126    1860     484     551   33140
TS      19441944   39068   31140    5444    3866    8533   12018     302      90     536     153    9745   38830  149723
TS      19451945    5107    3210    3641    5981    8074    8905    7482   11682   12206    4865    3046    8399   82600
TS      19461946    2150    4246    4419    6523    4759   11558     865       0    1510     443   42019    5020   83512
TS      19471947    3451    3498    8594    6309    6233   11959     456     643     294       2     245    1617   43299
TS      19481948    3332   17978    8943    8641   21557     524    1305     169     178       1       0     504   63130
TS      19491949   15262    4542   29796    8956    1436    6190     965       4       0   29777     521    1145   98594
TS      19501950   20547   47234    1855   12742    5273    6605    1043     233     202     185     314     244   96476
TS      19511951       8     424     835     676       0    1591       0       0    1971       0       0     378    5883
TS      19521952       0    3773    4844   12239   30083     663       0       0       3       0    1806   11531   64942
TS      19531953   16319    1523   51253    2916  124193     439     435     345     397    1807    3050   54705  257382
TS      19541954    5860     814       0       0   18271     273       0       0       0       0     632     888   26738
TS      19551955    1016    7004    4801   16745    6515    3025     454       0     166     263     126     187   40301
TS      19561956     390    3734     321       0   14045       0       0       0       0       0       0     185   18675
TS      19571957       0       0   15677   95256  111328    9804     251     174     228   36763     878    2840  273197
TS      19581958    4928    4418    3589    4599   12786    7454     495      48   30578    6825     600    1367   77687
TS      19591959     952   14736    3353   10368    6440    9853    4557     832    1009    8070   16949    8959   86077
TS      19601960    3764    4221    7052    4614   11897    7518    1025     496     306    7171   16012   17570   81647
TS      19611961    4459    5302    6548    3606    1221   22478   10568     660   13524    1369    3582   11733   85051
TS      19621962    2618    5564    3422    5963   12334    8280    1057     171     238     576     880     742   41845
TS      19631963     397    1150     908     755     930     229     121       0       0       0     133     247    4871
TS      19641964    1415    1063    2896    2176     633     154       0       0    1685     171    1259     256   11709
TS      19651965   18319   27611   23178   62013   96500   12347     467     120     319     189    1704    2083  244848
TS      19661966    1488   11984    6230   40499    8438     659     121   19895   23238     992     387     775  114707
TS      19671967     622     444     952    5457    6273    3663     191       2    2171    1110   13706   23174   57764
TS      19681968   49877    5180    7149    6265    6424    7783    7645     236     526     256    2690   14126  108157
TS      19691969    6926   20730    5638    7532    6636     473     178     986     119    1072    3830   43479   97598
TS      19701970   12260    3665    6139    5865    1241     421     121       4    2226   11075     532     420   43969
TS      19711971     425    4573     807     516    1047     154       0     813     547    1692   10517   62009   83100
TS      19721972   26996    6883     691     372     194     969       0     350     119    4707    7543   11357   60180
TS      19731973   53809   12234   29347    5213    9331    8453    3673     310    2328   24720    5902    4904  160223
TS      19741974    2660    7811    8570    9105    9072     502       0    1463   37860    3830    3932    3666   88470
TS      19751975    5057    5480    6271    5174    5986   10731    8273     759     656    3345    1012    1098   53843
TS      19761976     760    1273    8231   47141    7463   11385    9897     448    1964   20651    4283    4229  117725
TS      19771977    3886    7473    6831    6351    9616    4194     276     120    1018     175     379     546   40866
TS      19781978    2104   11263   20213    1448    1447     597       0       0    1450       0    8077    2612   49210
TS      19791979   21499   23073   66090    7308    2507   14114    6389    4862    4560    1150      49   17693  169295
TS      19801980    8827    6296    6281    8413    6756    1264     544       3     348      41     454     441   39666
TS      19811981    1169    3496    3205    3452    9831   84322    7334      11     126   26838    1743     477  142003
TS      19821982    2152    2835   16178    9424    6920       0     147      98       0      68    2920   34285   75026
TS      19831983    5087   24172    6321    2921   13691    2666    1209   11281     123     700    1009     474   69655
TS      19841984    2213    5050   20068    2006     183    2042       0       0       0   58920   15662   22443  128588
TS      19851985    4593    4285    6213    2756    4201      87     125       0     307    8412   54491    4459   89930
TS      19861986    2363   10480    3737   12496    6413    8159     501     125     115    4962   25330    9898   84580
TS      19871987    5416    3630    8688    2850    7727   14779    1071      95     476     455    1993   25254   72432
TS      19881988    4077   12445   16731    2650    2899    1282     322     719       0       0       0    2397   43522
TS      19891989     857    4163    3578    2819   89507    8303    4489     228     233     830     351     212  115571
TS      19901990    4288   11090   39956    6356    9555    4349     586     949    3788    3259   13388    6422  103987
TS      19911991   26485    5424    8080    6226    7576    7505    1585    3229    4229    5742    7028   30589  113698
TS      19921992    4590    5574    7064    4250    9917   10386       0     156       0      23    1206   22438   65602
TS      19931993   17112   13061    7019    6936    7701    8488    1634     855     577    9565     491    1683   75120
TS      19941994    1282   50230    6865    5009   10366   11859     477    2230       0    6861    5726   31762  132667
TS      19951995    6605    5022    5832    6849    8073    2111    2216   30115    5022      28      99    1202   73175
TS      19961996    1072    1629    1334    1243       0       0       0       0      33       0     715    3351    9377
TS      19971997    6298  104971    6731    6094    8438    9283     953    1542       0     131     915   27574  172930
**
**------Allens Creek
** Dummy WS Card added to locate Allens Creek at COntrol point 292531
WR292531        0        19990901       1     1.0  2925DP                C2925_TS   C2925 2925001
TS      19401940       0      82       0     656       0       0    4981       0       0       0       0   14479   20198
TS      19411941    9638    7462    8885   10070   12450   11586       0       0    9059    6045   10459    2465   88120
TS      19421942    1714    1454    1564       0   12893   11285   11400       0    1649    1278    2291       0   45528
TS      19431943    4540     947    1782    2074       0    3107    5644    3389       0     597    1059    2792   25931
TS      19441944    5183    3026    7963    7166    2496    8948    1138       0       0       0       0    3230   39149
TS      19451945    1496    5053       0       0    3206       0    2534   10953    5858      38     978    6081   36195
TS      19461946       0    2939    8253    4916    4494    8804    7083       0    1222    1787    5349    1210   46057
TS      19471947    1703    2844       0     472     737    2768    1058      70    3959       0    1904    5809   21322
TS      19481948    1120    1055    9402     899     499     327    1984       0       0       0       0       0   15287
TS      19491949       0       0    1765       0    6432       0    4298       0       0       0    3336    4139   19970
TS      19501950    5556       0    3805       0    3309   10077       0       0       0    1739       0       0   24487
TS      19511951       0       0       0     884       0       0       0       0       0       0       0       0     884
TS      19521952       0       0    1119    6782     901    3973       0       0       0       0       0    2245   15019
TS      19531953    1688     102     378       0    4683    2597       0       0    3881       0    5838    4345   23513
TS      19541954    3443       0       0       0       0    2205       0       0       0       0       0       0    5648
TS      19551955       0    1913       0       0       0    2097       0       0       0     900       0       0    4910
TS      19561956       0       0       0       0       0       0       0       0       0       0       0       0       0
TS      19571957       0       0    5246       0   17382   16272   16716    5048    1642   13743    7507    6899   90455
TS      19581958    6379       0   10239       0       0    5122    3975       0     482    6491    1681     945   35314
TS      19591959       0    2225    4734    7542   10422    3967    2346    2553       0       0    8251    3352   45392
TS      19601960    5228    5983    4869     880    9779    8922    8491    2380       0       0    8192    5480   60203
TS      19611961    8321    8853    8129    6587    3264    6383   12917    7993    7580    6129    7199    5051   88405
TS      19621962    2515    3668    2236     359    3284     472    3416     614       0    4019       0     911   21494
TS      19631963    6121       0    2411       0       0       0       0       0       0       0       0    1082    9614
TS      19641964       0    2674    2247       0    2744       0       0       0       0    1881    1575    1934   13054
TS      19651965       0       0    4750     444    5719   15498    3838    4138    2290    1952    5836    1121   45586
TS      19661966    1133    1065    2682       0   13930    5576    2685    3012       0    4515       0       0   34597
TS      19671967       0       0       0     290     249    2068       0       0    1652       0     468       0    4727
TS      19681968    4794    6320       0       0   10207    8896    3643    2581    1830    3138       0    4673   46081
TS      19691969    2043    5158    3330    5922   10649    3910    2026       0    1529     441     239       0   35246
TS      19701970      49       0    7713    4654    1999    4775    1579       0     156    7476    2423       0   30824
TS      19711971       0       0       0       0     122       0       0    1467    2879       0    4030    4841   13340
TS      19721972    6097    5834    3983       0   11437    3342       0       0    1122       0    4801    1650   38265
TS      19731973       0    4911     978    8573   12927    7492    7642    3912    2489    7019   10003    7841   73789
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TS      19741974    5036    9532    3910    1294    5109       0       0       0    5702    9628    7245    7793   55249
TS      19751975    5011    8747    7573    5619    1233   10426    9138    4815    2368    1075     945    2187   59137
TS      19761976    1595    2230    1313       0    4924    5281    4091    3484    1915       0    4165    4361   33358
TS      19771977    7141    6069    2383       0    8166    9715    4251       0    2276       0     195     801   40996
TS      19781978    5179    7076    2720       0       0    2811       0       0    3699       0    1987    4324   27796
TS      19791979    5730    6754    4938    9523    5584   15268       0    8133    8501    2507    1270    2336   70543
TS      19801980    6111    6970       0    5616    6263    7075       0       0       0    1613       0       0   33647
TS      19811981       0     588    1055     456    2209    7488   13986    4061    5760       0    9030    2773   47405
TS      19821982     610    1108       0    1931    1641    6942   10812    2238       0       0    6205    4168   35654
TS      19831983    3099    6406    6912    6353    3552    7169    2735    3982    4298       0       0    2780   47287
TS      19841984       0    1786    2152       0    1425     677       0       0       0       0    8753     193   14985
TS      19851985    3944     342    7747    5057    1876    3816    2388       0       0     314    6264    9050   40798
TS      19861986    5299    1717    4594    2225    5066    9151    4666    3218    1810    3892    3980    5348   50965
TS      19871987    7966    2807   11494   11354    6000   12701   13756    6494    2166    1955    2695    2852   82239
TS      19881988    5212    1993    1018    2002     247    3066       0       0       0       0       0       0   13538
TS      19891989     302    4007       0    5357    1618   10496    9068    5632    1032       0       0       0   37510
TS      19901990    1469    2307     847       0       0    1151    1733       0     902       0     903       0    9310
TS      19911991    5433    7162    3476    7840    8785    7217    3659    1724    1912     843     644   -3815   44879
TS      19921992    8460       0   10679   10055       0    2114    4410    6824    3123     722    1665    3304   51356
TS      19931993    5427    5293    2080    7904    9639    9941    8304     890     731    1622    2216    1940   55985
TS      19941994    1809    2651    3855     520    4918    5943    2735       0    2138   13751    5905    4658   48881
TS      19951995    8925    5647    7260    6073    6046    9550    2865    3874    1620    2275    2286    3306   59725
TS      19961996    3528    2248       0       0       0       0       0       0    5242    4721    1875       0   17614
TS      19971997    2438       0    8536    5594    3154    2724    6967    3317    3097    6870    1578    6439   50713
WSALLENS       0
**
**------Allens Creek from the Brazos. (This diversion allows to refiil A Creek with Brazos River water.
** Diversion subject to IF requirement, and annual limit of 202,000 af/y.
WR292504       0    MUN419990901   1   1                                C2925_2   C2925 2925001
WSALLENS  145533
SO        130680  202000
**
** ------------- BEGIN OF SYSTEM OPERATION ---------
** Return flow from d/s reservoirs. This helps to meet IFs and increase the diversion at Glen Rose
WR5157DP 999999.        21111111          1.0000  515731            C5157_DPRETQ  SYSTEM
WR5158DP 999999.        21111111          1.0000  515831            C5158_DPRETQ  SYSTEM
WR5159DP 999999.        21111111          1.0000  515931            C5159_DPRETQ  SYSTEM
WR5160DP 999999.        21111111          1.0000  516031            C5160_DPRETQ  SYSTEM
WR5161DP 999999.        21111111          1.0000  516131            C5161_DPRETQ  SYSTEM
WR5162DP 999999.        21111111          1.0000  516231            C5162_DPRETQ  SYSTEM
WR5163DP 999999.        21111111          1.0000  516331            C5163_DPRETQ  SYSTEM
WR5164DP 999999.        21111111          1.0000  516431            C5164_DPRETQ  SYSTEM
WR5165DP 999999.        21111111          1.0000  516531            C5165_DPRETQ  SYSTEM
WR2925DP 999999.        21111111          1.0000  292531           ALLENS_DPRETQ  SYSTEM
** Refill U/S reservoirs with BRA water.
WR515531      0.        22222222                                     C5155_RF1_2  SYSTEM
WSPOSDOM 724739.                                0
SO                        5155DP
WR515631      0.        22222222                                     C5156_RF1_2  SYSTEM
WSGRNBRY 155000.                                0
SO                        5156DP
**
**  Lyons Method at Glen Rose.
**
IFBRGR30 148800.  IFBRGR22222222   1   2                 IF_BRGR
**
**
** Refill U/S reservoirs with Q unap
WR515531      0.        22222222                                     C5155_RF1_2  SYSTEM
WSPOSDOM 724739.                                0
WR515631      0.        22222222                                     C5156_RF1_2  SYSTEM
WSGRNBRY 155000.
**-------------
** System Diversions at Glen Rose.
WRBRGR30 446000.    MUN133333333   2                               SYSTEM_BRGR  SYSTEM
WSPOSDOM 724739.                                0
OR       217422.       1
WSGRNBRY 155000.                                0
OR        46500.       1
**-------------
** Refill u/s reservoir with BRA water after system diversion at Glen Rose
WR515531      0.        44444444                                     C5155_RF2_4  SYSTEM
WSPOSDOM 724739.                                0
SO                        5155DP
WR515631      0.        44444444                                     C5156_RF2_4  SYSTEM
WSGRNBRY 155000.                                0
SO                        5156DP
**-------------
** We're done with u/s reservoirs. Then, return all dummy water.
WR5155DP 999999.        55555555          1.0000  515531            C5155_DPRETQ  SYSTEM
WR5156DP 999999.        55555555          1.0000  515631            C5156_DPRETQ  SYSTEM
**
**  Lyons Method at Richmond.
**
IFBRRI701539598.  IFBRRI66666666   1   2                 IF_BRRI
**
** ------------
** Refill d/s reservoirs with QUNAP
WR515731      0.        66666666                                     C5157_RF1_6  SYSTEM
WSWHITNY 437024.                        387024.
WR515831      0.        66666666                                     C5158_RF1_6  SYSTEM
WSAQUILA  52400.                                0
WR515931      0.        66666666                                     C5159_RF1_6  SYSTEM
WSPRCTOR  59400.                                0
WR516031      0.        66666666                                     C5160_RF1_6  SYSTEM
```

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WSBELTON 457600.                          1200
WR516131      0.        66666666                                  C5161_RF1_6  SYSTEM
WSSTLHSE 235700.                             0
WR516231      0.        66666666                                  C5162_RF1_6  SYSTEM
WSGRGTWN  37100.                             0
WR516331      0.        66666666                                  C5163_RF1_6  SYSTEM
WSGRNGER  65500.                             0
WR516431      0.        66666666                                  C5164_RF1_6  SYSTEM
WSSMRVLE 160110.                             0
WR516531      0.        66666666                                  C5165_RF1_6  SYSTEM
WSLMSTNE 225400.                             0
WR292531      0.        66666666                                 ALLENS_RF1_6  SYSTEM
WSALLENS 145533.                             0
** System diversion at the Gulf. (Pick up remaining yield with d/s reservoirs)
WRBRGM73 464000.    MUN477777777   2                              SYSTEM_BRGM  SYSTEM
WSGRNGER  65500.                             0
OR516331  19650.       1
WSGRGTWN  37100.                             0
OR516231  11130.       1
WSSTLHSE 235700.                             0
OR516131  70710.       1
WSBELTON 457600.                          1200
OR516031 137280.       1
WSAQUILA  52400.                             0
OR515831  15720.       1
WSPRCTOR  59400.                             0
OR515931  17820.       1
WSWHITNY 437024.                       387024.
OR515731 387024.       0
WSALLENS 145533.                             0
OR292531  43660.       1
WSLMSTNE 217494.                             0
OR516531  65248.       1
WSSMRVLE 160110.                             0
OR516431  48033.       1
**--------------
** Final refill of all reservoirs. (Just to make sure we get all water)
WR515531      0.        99999998                                  C5155_RF3_9  SYSTEM
WSPOSDOM 724739.                             0
WR515631      0.        99999998                                  C5156_RF3_9  SYSTEM
WSGRNBRY 155000.
WR515731      0.        99999998                                  C5157_RF2_9  SYSTEM
WSWHITNY 642179.                       387024.
WR515831      0.        99999998                                  C5158_RF2_9  SYSTEM
WSAQUILA  52400.                             0
WR515931      0.        99999998                                  C5159_RF2_9  SYSTEM
WSPRCTOR  59400.                             0
WR516031      0.        99999998                                  C5160_RF2_9  SYSTEM
WSBELTON 457600.                          1200
WR516131      0.        99999998                                  C5161_RF2_9  SYSTEM
WSSTLHSE 235700.                             0
WR516231      0.        99999998                                  C5162_RF2_9  SYSTEM
WSGRGTWN  37100.                             0
WR516331      0.        99999998                                  C5163_RF2_9  SYSTEM
WSGRNGER  65500.                             0
WR516431      0.        99999998                                  C5164_RF2_9  SYSTEM
WSSMRVLE 160110.                             0
WR516531      0.        99999998                                  C5165_RF2_9  SYSTEM
WSLMSTNE 225400.                             0
WR292531      0.        99999998                                 ALLENS_RF2_9  SYSTEM
WSALLENS 145533.
**
** End of System Operation Modeling
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Interruptible Yield at the Gulf of Mexico

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** BRA System Operation NModeling starts here
** TS used to represent the depletions for current BRA water right under the TCEQ Brazos WAM RUn 3.
** TS with all 2060 return flows
**------Possum Kingdom
WR515531       0        19380406       1     1.0  5155DP                C5155_TS   C5155 5155001
TS      19401940    8863   10360     654   16202   67673   30014   43979   38650   35174    2445   41073   15924   311010
TS      19411941    9950   18613   20475   17235   22403   31096   39731   33466   32372   17418   23837   17758   284353
TS      19421942   18097   13077   14313   27077   28940   34546   15546   22890   68563   17424   24248   15394   300116
TS      19431943   16764   10168   25559   30878   16805   42869   14445    1225    2039    2966    1273     676   165666
TS      19441944    4303   12919   45050   23225   50575   49567   30222   16327   24759   52134   12571   11885   333535
TS      19451945   11282   12957  115437   58200   26897   38661   37892   10087    6531   82555    6801    1291   408591
TS      19461946   19329   15246    8135    8083   27433   43830   27725   58200   80981   27705   18633   16788   352089
TS      19471947   14082    6749   11971    9044   53766   37914    8654    2440   13272   30267    9874   37469   235501
TS      19481948    4132    5769   24226    8062   30609  125659   61022    7811    7459   15529   11007    3217   304502
TS      19491949    2527   13081   11536   14406  151237   32717   14691   15520   82164   21296    9562    3428   372165
10665.8
TS      19501950    3421    8187    2733   56928   58071   33669   31316   39058   26791   19775    1219    2196   283364
TS      19511951    3213    4763    2157    2318  105760   63085   23280   25177   21596     248     847     435   252879
TS      19521952     959     515    1226    6922   16176   13656    8279       0    4985    3035    4605    2824    63182
TS      19531953    1493    1124    7023    3303   76307     328  261348   85840    5708  179192   20200   10717   652581
TS      19541954    3865    5631    1823   72797   20295   35739   11451   13550     869     368   17753     561   184701
TS      19551955    2027    5957   17162   15016  183035   30258   39964   23247   39161   29140   15893    7934   408794
TS      19561956   15508    4452     423    2112   39320   13615       0      73    1877    5360   13349   20943   117031
TS      19571957     582  215737    9006   40762   13435   33226   35856   13036   17955   55137   13145   15594   463469
TS      19581958    9858    7677   29379   19158   25148   31467   39546    7523   51658    9821    2852     129   234215
TS      19591959    2391    1820    2656     592   43130  117540   31835   14193    5932   59372    3924   19831   303215
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TS      19601960   23797   15819    8947   21636    6291   13026   84433    9725     361   70197   22058   13231   289520
TS      19611961   10244   14274   18873   11010   28039   34025   29957   24226   35792   12384   24939   11195   254957
TS      19621962    5645    3064    4951    6713    2364  103117   30669   14930   35973   20371   16205   15901   259903
TS      19631963    5894    6256    7981   52670   20651   28541    2212       0    8211   11689   42587    4400   191093
TS      19641964    7809   45284    7624    4160   12601   33525    2952   14968   43034    5190   64452    2619   244216
TS      19651965    5656    5433    3099   44533  150244   32908    6456   32250   37504   53163    8665    3732   383642
TS      19661966     622    5137    8638   74450   29714   23879    3947   58105   36019   23788    7314    3217   274828
TS      19671967    4005    6205    8405   54958   23986   74266   36435   16082   45278    6997     428    3066   280110
TS      19681968   55883   14943   18006   22288   21674   30547   33402   10247     474     397     278    5422   213560
TS      19691969    4446   11693   79444   67604   33355   31796    1495     817   92379   19227   20021   13561   375838
TS      19701970   16782   12936   18071   19229   27903   16370     184     348     464     491     555     408   113739
TS      19711971    1513    2898    2784    2955   15190   75656    8258  272002   23831   17531   15540   16743   454901
TS      19721972    5519   11669    7307   15277   66445   18615    9200   76929   26980   17368   20113   18351   293772
TS      19731973   10918   14675   19973   17972   19196   37834   29118    9327   20292   25509    3112     517   208442
TS      19741974    5556    5440    4137   29558   11498   33381    1926   14076  181778   17119   20519   15308   340295
TS      19751975   15484   15425   20653   22371   15741   34043   33749   35520   27946    5053    3008    3042   232034
TS      19761976    7808    8437    5168   17779   35949    6168   21318   22130   69328   91451   26404    9537   321476
TS      19771977   12268   12720   30006   20344   23069   33647    8542     272    6557     407     108    1641   149580
TS      19781978     755    3449    8460   26141   14833   15536    1100  280138   19580   16077    7343    4394   397805
TS      19791979    7218    8862   47302   18911   43119   30105   31187   24335    4504    2201     488    4661   222893
TS      19801980    3142    7471    4355    6133  159828   34572    6186    1007  104852   28832   18368   15754   390501
TS      19811981   16483   13128   20560   23162   24867   26099   11025   12755    6381   87168   19727   11250   272606
TS      19821982    7894   11782   15989    9524   51859   30508   39223   13962    3131    3713    1680    7248   196511
TS      19831983     910   17402   16315    9729   89458   39323    9360     556     396   95642   25982    1359   306434
TS      19841984   15755   10351    7128    3808     548     414     196    3161    1561   86798   46484   73575   249779
TS      19851985   82294   48518   15335   22466   25639   27695   25213   12806     908   83676   13583    5238   363372
TS      19861986    8436    7391   10080   15038   24414   72099   41274   19146   40983   20505   16082   13341   288788
TS      19871987   14341   11523   20834   27153   15101   27618   38931    9744   15622    1130    3247   30327   215569
TS      19881988   13948    9325    8173    7441    8087   17517   27788     976   57388    6717    2448    5712   165520
TS      19891989    3620   20227   13983    6469  202815   46450    7759   32082   53790    8459    3239    4493   403385
TS      19901990   12907   21900   57912   15240   25706   35337   17090   46152   30036   20819   19253    7706   310058
TS      19911991   19976   17748   18266   10915   46757   31694   40637   33695   25935   21533   21144   10163   298463
TS      19921992   14374   11867   21412   23663   18440   25100   35911   33422   24965    4486   16295   23904   253839
TS      19931993   19061   19499   18953   22488   25872   30658    9891   11073   13174   35379    4664    9890   220602
TS      19941994    6164    9042   10702    5815  146843   21437   17792     237   19064   75279   39250   12513   364139
TS      19951995    7403    3423   19921   12318   37328   37209   18676   44797   23217   10324    3024    2880   220520
TS      19961996    3596    7787    6935   15620    7339   14626    6487   42175  165007   22812    9837   16711   318931
TS      19971997   11365   15277   20445   17314   21305   21953   38319   18886    2598    2562     570   14511   185106
**
**
**------Granbury
WR515631       0        19640213       1     1.0  5156DP                C5156_TS   C5156 5156001
TS      19401940    1264    1270    2420   11578   11240    8801   13176   13689   12131    3673    7940    3293    90476
TS      19411941    4537    2616    5340    5239   10074    9567   12966   10905   11016    7043    7228    4584    91114
TS      19421942    5021    4385    3172    8071    7918   10234    5664       0   28325    6060    7084    4414    90347
TS      19431943    1936    7606    6438    7800    6696   10510       0       0       0    2383     966    2908    47242
TS      19441944    5342   25891   26498    6660    7442    8106    7955       0   26138    5298    5824    4497   129650
TS      19451945   12661    2131    3661    5196    9638    8289   12988    1895    4377   25117    3323    4697    93973
TS      19461946    7034    4054    5279    6953    5381   10905    1426       0   35308    9112    4359    4811    94621
TS      19471947    3921    5705    5022    5478    8715   10647       0    1402       0    8668    3955   30207    83720
TS      19481948   16043    3191    6082    1024   14364   10375   13220       0       0      67    1052     828    66244
TS      19491949     704   20522   34122    5193    6321    9958   10335       0       0   31743    7626    3815   130338
TS      19501950    4097    3720    5171    8079    7335   10116   11443   13393    8499    9972    4680    2356    88860
TS      19511951       0    6573    4408     281   12326   20819       0       0       0       0       0    3228    47635
TS      19521952       0    3018    1496    7528   38790       0       0       0       0       0    7903    2808    61542
TS      19531953    2418     575    1973    3335   21564       0    7324       0       0   30673    6534      53    74449
TS      19541954       0     763       0    9092  101571   12540       0       0       0     551    2393     918   127828
TS      19551955       0    2562    2175    1539   63489   17347    4073       0   28511    9817    4082     483   134078
TS      19561956    1674    1093    5032       0   29021       0       0       0       0       0       0   23262    60083
TS      19571957       0    8938    8915   38566    9170   10853   13357     570   10027   14995    3181    4637   123208
TS      19581958    3336    3892    4153    4562    7876   10510   12801   11191    6363    1101    3770    6511    76065
TS      19591959     667    4440    1364    3504    4191   17698   19543    7663       0   16766    5540    3399    84775
TS      19601960    2962    4289    5761    6608    8219    2726   19822    3662       0   23204    6203    1759    85214
TS      19611961    2038    3450    5517    3261    3062   16410   10981    6955    6206   13340    4306    3896    79419
TS      19621962     895    1371    1868   11721    2392   19556   11086   12035    7467    6203    4699    4296    83590
TS      19631963    4151    1282    8312    8035    6948   10993       0       0       0       0    4172    1809    45703
TS      19641964    1066   10555    6439    8874    4183    2646       0       0   28562    2094   54647    4553   123619
TS      19651965    3194    2677    5409    6852    4395    8717     829    5792   14046    8592    1948    5898    68346
TS      19661966     405    9401    5185   14982    8147    8944       0    6202   23632    7599    3671    1710    89878
TS      19671967    3925    2871    2179    5262    3872   28598   11777       0    7805    6198     912    6118    79517
TS      19681968   13681    3782    4294    5850    6510    8581   11502   11749    5469    2150    2836    4006    80407
TS      19691969    2018    8554   10908    5671    7180   11151    5793   16445    9267    4859    5440    3060    90345
TS      19701970    3742    2371    3741    5645    7231    2147       0       0   13869    5000    4129    3209    51084
TS      19711971    3404    3037    2353    3237    8110       0    5758       0   64559   11149    5656    3184   110448
TS      19721972    3885    5303    3968    4165    8892    2970       0   27755   16745    5133    4908    4618    88342
TS      19731973    2454    3795    5451    4954    8213    7435   10070   12875    3562    6802    5457    5436    76503
TS      19741974    3704    2711    3085    4772       0     827       0    9606   12684   33320    6203    4004    80916
TS      19751975    3956    4338    5407    6253    4647   10926   10996   11705    8691       0       0       0    66918
TS      19761976    2805    2696    2553   17826   18800   10130    9372    1846    2711   18116    5260    4259    96373
TS      19771977    2957    4631    4588    4852    6925    9638    2585       0       0     776    3659    3112    43723
TS      19781978    2326    4223    4381   24844       0    3311       0   28678       0    4734    1949    1924    76369
TS      19791979    3545    2382   37836   23626    7540   10081     818    1762    1387    7938      65    5826   102805
TS      19801980    3401    8579    2119    4210       0    8069       0       0       0   78215       0    9385   113979
TS      19811981    1729    2480    8873    6525    6825    7225       0    3628       0   30271    6191    5303    79048
TS      19821982    3830    4146    5510    6560    5514    8480   13123       0       0       0     815    1936    49915
TS      19831983       0    5261   15700    5909   31890    6644       0       0       0    1229       0       0    66634
TS      19841984   13472    2788    6943       0       0       0       0       0       0   33070   23900   34704   114877
TS      19851985   17253     233    7945    6745    8164    9751   10501       0       0   28624    4628    1656    95499
TS      19861986       0   11025    3753    3199   11862    7547   13825       0   18729    5023    4207    2691    81861
TS      19871987    3847    2599    6513    8810    4487    8413   12828    1762     971       0    3624    3320    57174
TS      19881988    6377    1908    2915    1455       0   23683       0       0       0       0       0    2954    39290
TS      19891989    4433   21252   28101   16308   25327    8434    3296   15303   11223    4455    3217     239   141588
TS      19901990    8115    9885    3799    4699    8777   12025    2374       0   27754    5567    3857    5052    91904
TS      19911991    2621    4498    2776    9857    6485   10347    5593   16299    7293    6022    6421    3253    81464
TS      19921992    2584    4594    6461    6416    4664    7240   12176    6790   12688    4700    6749    2818    77882
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TS      19931993    2958    2961    4886    5982    7983    9313       0       0       0   41255    5139    4073   84550
TS      19941994    3803    3688    4598    2168   10002   11363       0       0    8549   29321    2981    3896   80368
TS      19951995    3625    1704    5713    5278    3593    8751       0   20543    7184    6101    5474    4370   72337
TS      19961996    1220    6658    2659    5901       0       0       0   46333    7982    6394    1934    4479   83560
TS      19971997    4941    2677    7230    6108    7567    7724   13131   10936       0    2706    4541    9881   77442
**
**
**------Whitney
WR515731       0        19820830       1     1.0  5157DP                C5157_TS   C5157 5157001
TS      19401940       0     571       0     271    4740    3216   10895   12764       0     485   -4779    -201   27963
TS      19411941    2751     159    3055    2072    4694    1962   11359   10349   10892     705    5805    1620   55424
TS      19421942    3938    3417    3224   -5367    3788    8054       0       0    4314    2813    4777    1599   30557
TS      19431943    3551    5545    2428    6329    2307    8321       0       0       0     713       0    -169   29027
TS      19441944   -1561   -1743    2666    4021   -1474   11591       0       0   11421    6759     283      68   32031
TS      19451945    1514    -784   -1298    3272    8162    5330    8575       0       0    4512    5090    2594   36967
TS      19461946    -448    1628    2724    4455    -881    9837       0       0    7279    8315     -67    3008   35848
TS      19471947     450    4742    1885    2174    4946    9199       0       0       0       0    2186    -691   24891
TS      19481948    1100    -172    3823       0    3953       0   11280       0       0       0       0       0   19985
TS      19491949   -3057    -757    2237    1614     987    5231       0       0       0    1610    6792    2013   16670
TS      19501950     961   -2128    6887    2693    3216    7394    8235   14897    6619    9362       0       0   58135
TS      19511951       0     824    2346       0       0    5382       0       0       0       0       0    1359    9910
TS      19521952       0       0       0   -4697     370       0       0       0       0       0   -2194   -2814   -9335
TS      19531953    4590    2135    1361    1443    2147       0       0       0       0       0       0       0   11676
TS      19541954       0       0       0       0   37880       0       0       0       0       0    3284       0   41164
TS      19551955       0    3221    1734    7444   54519    8164       0       0   16462   19026       0       0  110570
TS      19561956       0    2256       0       0    7780       0       0       0       0       0       0    1692   11728
TS      19571957       0       0    2291   -8860    8648   13186   15697       0       0   -4323   -3116    3401   26924
TS      19581958    1715     206    2522    2556     617    8081   13760       0    4773    1333    2890    1080   39533
TS      19591959     926   -1051    7924    4578    1022    -871    7907       0       0   -2188    3834     816   22895
TS      19601960     303    2314    4180    6203    8319     318    9604       0       0    1982    4300   -6647   30876
TS      19611961   -4129    1052    5507    8566    5523   -6990    9871   10574    7495    4686   -1772     463   40847
TS      19621962    1929    3370    5096    3487    1880   -2811   13999   15165    2747    5945     889    1534   53229
TS      19631963    2337    4136    4070    5225    2829   10057       0       0       0       0     741     -19   29377
TS      19641964   -1772    1683     681       0       0    6391       0       0    4632       0   -3565    2836   10885
TS      19651965     358    -389    4363    6937   -7487   10814       0       0       0     419     775     170   15959
TS      19661966    1118   -1278    4919   -2252    4189    9283       0    5196   -1738    7248    4081    2588   33355
TS      19671967    2818      15    2008    4641    5512    9565    6664       0   -5402    -900    2325     194   27439
TS      19681968   -4657    1926    1252    1496     518    4893   11141       0       0    5938     983    2696   26185
TS      19691969    3992     502    1041    2012     846   14536       0       0       0    2033    2148    -124   26985
TS      19701970    2017   -1741    3484    6062    4581    9658       0       0       0    -681    4330    2033   29745
TS      19711971       0    3131       0       0       0       0       0    1282       0   -5269    5054    1971    6169
TS      19721972    2389    5009    8623       0    2949       0       0       0    5733    1950    -258    2225   28619
TS      19731973       5    1032    4061    -650    5417    3930    1841   11520     -67   -5545    3799    4878   30220
TS      19741974    1196    4623    6939       0    6857       0       0    -832    1198   -1717    2553    1753   22570
TS      19751975    2124    1101    3400    1381   -4246   10130    6609       0    4198       0       0       0   24697
TS      19761976    2127    5473    3405   -3386    1554    4832    1036       0    1552   -1152    3377    1293   20111
TS      19771977     705    3334    1070    2523    4240   10545       0       0       0       0     521       0   22938
TS      19781978     803   -2143    4179       0       0       0       0       0       0       0   -1971       0     868
TS      19791979     484     273    -989    5182   -1105    9362    7665       0       0    4298       0    -297   24874
TS      19801980    -177    2347    1231    3759    2496       0       0       0       0    5961       0       5   15623
TS      19811981       0     804     -11    3861       0   -6041    9025       0       0   -7856    4274    3635    7691
TS      19821982    2204    2659    1654    3728    -659    3850   11966       0       0       0    -803    -500   24099
TS      19831983       0    -803    1544       0     819       0       0       0       0       0     -13       0    1548
TS      19841984       0       0    2295       0       0       0       0       0       0   -7694    1366   -4233   -8267
TS      19851985    1581     717    1226    6378    5608    6460       0       0       0    -818    2344   -2646   20849
TS      19861986       0    1888    5173       0    1032     434       0       0    3876   -1534    1356   -1007   11218
TS      19871987    1735     132    3590    8992     173    -496   11453       0       0       0   -3033    -955   21592
TS      19881988    3651     761    3230       0       0     857       0       0    -398       0       0     529    8628
TS      19891989    -838   -1653    3186    7297    4293    3675   10031    4071       0    2043       0    2900   35005
TS      19901990   -1161   -1917   -3338    3197    9950   12986       0       0    4993    3991    -367     564   28899
TS      19911991   -1696    1751    7303    3765    3476    5965       0    1693    4041    2545    4839   -3180   30501
TS      19921992      40    1101    5765    7669    3628    9323   14723       0       0    1254   -2159    -805   40540
TS      19931993   -1083      88    2271    3878    5774    7819       0       0       0   -5052    1535    2235   17466
TS      19941994    1838    -114    3268       0   -4146   10476       0       0       0     778    -704   -2588    8809
TS      19951995    1375    2421     561   -2360    3044    8720    9815    6538    4917    1959       0    2508   39498
TS      19961996       0    4359    3473       0       0       0       0    6901    3105    4314   -1535     941   21559
TS      19971997    -368   -4476    -367   -2120    6408    4023   13510       0       0       0       0   -5472   11137
**
**------Aquilla
WR515831       0        19761025       1     1.0  5158DP                C5158_TS   C5158 5158001
TS      19401940      91     132      82    4659     972    2343    3197     111       0      99    8878     954   21519
TS      19411941    1305     983    1245    1570    1898    1571    3253    2423     142    4351     684    1403   20826
TS      19421942     945     714    1063    3902    1675    2218    1508       0    6975    1578    1714    1119   23409
TS      19431943    1450    1006    1954    2064    1557    1223       0       0       0     600      83     260   10195
TS      19441944    2170    8924    4640    2458    1302    3047     176       0     103     213     367    7878   31277
TS      19451945    6361     801     736    1403    2312    1941    3090     333       0     248    1242     186   18651
TS      19461946    3769    6462    1358    1679     863    2663       0       0     346     103    1617    5593   24453
TS      19471947    6807    1614    1139    1368    1616    2508       0     111       0       0      83    1150   16394
TS      19481948     645    1066    1061    1605   14557    1537    5346       0       0       0       0      90   25907
TS      19491949    2853    2547    2196    6728    3629    2117     474       0       0      99      83      90   20817
TS      19501950      91    7748     570    8010    2115     154     892     111    2265      99      83      90   22230
TS      19511951       0      91      82    1586       0   21243       0       0       0       0       0      90   23092
TS      19521952       0     637     303   18750    2811     338       0       0       0       0    4514   14015   41367
TS      19531953    1229     437    2043    1278    1355       0       0       0       0     503       0     152    6996
TS      19541954     128      29       0       0    5008     107       0       0       0       0    1170       0    6442
TS      19551955       0    1094    1256     684    7107    2835       0       0     103      99      83      90   13352
TS      19561956      91      84      82       0   10139       0       0       0       0       0       0     199   10596
TS      19571957       0       0     431   48637     550    2225     255     111       0    9109     409    1294   63021
TS      19581958     946     803    1201    1068    2561     311    2400    1116    2227      99      92     114   12937
TS      19591959     114    3368     572    4919    5125    1664    1452       0       0    6455     687    1396   25751
TS      19601960     911    1014    1481    1829    2253    2370     253       0       0     783      83    9515   20491
TS      19611961     931    1137    1452    1964    1210    2385    2678     286     730    1685    5185    1017   20660
TS      19621962     966    1325     962    1884    2530    1859     446     125    2970    6227     310     865   20469
TS      19631963     623     329     277     904    1263     107       0       0       0       0      83      90    3677
TS      19641964     197     139    1156     366     109     107       0       0    4070       0   10743     138   17025
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TS      19651965    2713   12334     989     589   10172     920     109     111       0     142    1435     318   29832
TS      19661966     243     969     696   13549    1821     605       0    1688     510      99      83      90   20353
TS      19671967      91      83     170    5473    3104    3160    1491       0     612   15428    1179     766   31557
TS      19681968     203     966    1223    1305    2456    1742     576     111     189    1081    2047    3340   15237
TS      19691969     341    2742    4380    1064    1933     471     109     111     110     187      83     752   12283
TS      19701970     259    8212    6703    1272    1537     242       0       0     196   11469     479     244   30611
TS      19711971     178     894     142     155   10442       0       0     610       0   10312    1394     615   24742
TS      19721972     938    1603    2040    1114    2944     184       0       0     657    4497    1750     351   16077
TS      19731973    6835     926    1299    1264    1924    1799    2565     365    4395     768    1402    1264   24806
TS      19741974     879    1592     802     411    2100       0       0    4224    6939    1117     917    1000   19982
TS      19751975    1204    1022    1367    1562    1354    2292     318     127     129      99      83     122    9679
TS      19761976     120     130     687   15326    1107    2269    2662     219     920    2301     384    3738   29861
TS      19771977     778    1327    1340    1874    1902     790       0       0       0      99      83      90    8284
TS      19781978      91    1068     835     927       0     107       0       0       0       0      83     116    3228
TS      19791979     344    1220   14526    7127   13361    2587    1272     636     103     125       0     537   41836
TS      19801980    4411    2056    1096    6127    1451     135       0       0       0     123       0     857   16256
TS      19811981     217     166    1996     566    2599   17865    1296       0       0    1005     238     212   26160
TS      19821982     159    1046    1641     450   10719    1997     790       0       0      99      83     399   17383
TS      19831983     259    6966    6446     398     961     779       0     799       0     177     541      90   17415
TS      19841984     265     275    6663     358       0       0       0       0       0   13180    1749   11298   33789
TS      19851985    1298     688    1220    1522     313     367       0       0       0    6985     197    7401   19991
TS      19861986     563    1707     811     553    2834    1615       0       0    1922    6234    1502     513   18254
TS      19871987    1167     627    1558    1993    1296    1839     608     276    2507       0    4615    4478   20962
TS      19881988    1472    1187    1453    1506       0    2145       0       0       0       0       0     302    8065
TS      19891989    1782    8408    7063    1916     883    1474    2904     823     103      99      83      90   25629
TS      19901990    7032    3619     680    1340    1233     107     109       0     103      99     270      90   14682
TS      19911991    2234    2004     603    5457    7282     107     252    8078     459    2886    1375     602   31339
TS      19921992     888    1087    1546      87    2773    1803     109    2748     103      99    1677    6534   19456
TS      19931993     687     895    1035    1247    1809    1989     705       0       0   11098      83    1158   20705
TS      19941994    1056    2067    1432    1209    1365    2647       0       0       0    5592    5005     768   21141
TS      19951995    1074     910    1035    1612    1950    2398    2736    2313    1419    3135      83      90   18757
TS      19961996       0     655     340    1787       0       0       0    2796    1875    1093    9866    4528   22941
TS      19971997    1193     441    1557     972     859    1963     299     581       0    4049     350    7090   19351
**
**------Proctor
WR515931       0        19631216       1     1.0  5159DP                C5159_TS   C5159 5159001
TS      19401940       0     209       0    4775    2101    3254    2308    2314       0       0   13425    1142   29529
TS      19411941    1215     829    1264    1225    2537    3292    4528    5700    3141    1300    1759    1137   27927
TS      19421942    1240    1308    1294    1626    2625    3961    2664     552   10655    1494    1983     929   30329
TS      19431943    1229    1444    1185    2313    2516    1989       0       0    1069    2806      54     524   15129
TS      19441944    7402    8874    3517    2227    2805    1806    8494       0    3172    1507    1155    1536   42496
TS      19451945    3136    4367    1500    1949    3294    4193    4892     192     262    4887     716     884   30271
TS      19461946    5041    4143    1662    1816    2655    3805      82       0   12643     709    4270    1009   37833
TS      19471947    1114    1360    1214    1595    2088    1370       0       0       0       0     107    4259   13108
TS      19481948    1263    2507    1234     605    5354    2869    3517       0       0       0       0       0   17349
TS      19491949       0    1620    9836   16488    6836    3971     415       0       0    2800     509      66   42541
TS      19501950     142    2781       0    6003   12415    4027    4816       0     198       0       0       0   30383
TS      19511951       0       0       0       0    4060   12947       0       0       0       0       0       0   17007
TS      19521952       0       0       0    1159   31290     404       0       0       0       0    1550     566   34969
TS      19531953     133      80     255    3095    9057       0    3365       0       0    8711     998     357   26050
TS      19541954     167       0       0    1928    1259       0       0       0       0       0    2515       0    5869
TS      19551955       0     958       0    6943   40855    4164       0       0    2614     632       0       0   56166
TS      19561956       0     208       0       0   21118       0       0       0       0       0      65    3213   24604
TS      19571957       0      10     153   22047    1453    3464     618       0       0   13742     623    1075   43186
TS      19581958     583     847     855    1089    2078    1828       0       0       0       0       0       0    7279
TS      19591959     120     408       0     455       0   11634   13328      49       0   14623    1273     779   42670
TS      19601960     544     970    1223    1620    2675     620       0       0       0    1989      27     591   10259
TS      19611961   17003     997    1397    1960    2065    2437    4694     218       0    1405     695     999   33869
TS      19621962     808     830     796    1203     137    3074       0     378   20106    1728    1080     950   31090
TS      19631963     936     985     967     766    2358    4027       0       0       0       0    6741       0   16780
TS      19641964    2615    5317    2153    5973     495      76       0       0   21232    1192    1297    1370   41719
TS      19651965     498     374    1774    2365     -86    4394    2582       0     224    2845    1764     672   17407
TS      19661966     692    1555    1164   10055    7335    4873       0    1119    7574     386     453     281   35486
TS      19671967     748     323    1868    2619   11789    7479     873       0    3621       0     520     508   30349
TS      19681968   11074     718     825    2039    1363    4719    4493     733       0       0     415     648   27026
TS      19691969    1184    1005   11314    5647    2467    3339       0       0       0    4258     875    9216   39303
TS      19701970    5142     107     895    1551    1719    5076       0       0    2728    1448       0     921   19585
TS      19711971     808     685       0     770    7400       0    1081   12433    3893   10558    1032    6738   45397
TS      19721972    1587    1758    1493    3699    2496       0       0       0       0     452       0     348   11832
TS      19731973    1393    1828    1873   19872    1964    3751    6231       0       0   10749    1104     627   49391
TS      19741974     616    1120    1697    1021       0       0       0    4083   10601   10152    4117     746   34153
TS      19751975    1421     814    2087    1408    1248    2718    2872    1286       0       0       0      11   13866
TS      19761976       0     587     561    8312    4207     291    1672    1024    1272    2930     524     540   21918
TS      19771977     316    1100   26775     127    3089    1350     852       0       0       0       0       0   33609
TS      19781978       0      10     645       0       0       0       0       0       0       0       0       0     654
TS      19791979     980     327   10794    2805   20834    1213     269    3467       0       0       0     117   40807
TS      19801980     149     290     234     643   14553     702       0       0       0       0       0       0   16572
TS      19811981       0     395     863     268     359    6435       0       0      31   24207    1097       0   33655
TS      19821982     286     671    1255     577   18407   19675    6865       0       0       0       0       0   47736
TS      19831983       0     197    2302     562     979       0       0       0       0       0       0       0    4040
TS      19841984       3       0    4761       0       0    2123       0       0       0   21832    3561    9754   42033
TS      19851985   20912    1022    1329    2456    2523    3465       0       0       0    1586     620     184   34097
TS      19861986     124    4185     743     884   17364    1250    5655       0    5500    1167     475     398   37743
TS      19871987    1059    -386    1582       5    2702    3145    6936       0     292       0       8      11   15354
TS      19881988    1426    2395       9     739       0   18621       0       0       0       0       0       0   23190
TS      19891989     315    2850    1497    2095   20148    2974    5089    6929       0       0       0       0   41897
TS      19901990    2367      10    8415    2060    3854    5325    5231    5366    2462    2679     753       0   38522
TS      19911991    1531    1484    2452    1569    1730    4867       0   10687    1939     273    1748    -199   28080
TS      19921992     742     578    2221    2331    1857    3307    5753    5343    3432    3141     -94     587   29199
TS      19931993     280     313    1333    2156    2619    3299       0       0       0   16304    1370     973   28646
TS      19941994     885     632    1805    1884   -1018    5439    4546       0       0    8740     163     130   23207
TS      19951995     923    1108     805    1415     919    3458    5773    4280    2132    3163     261    2315   26551
TS      19961996    1067    1571       0    4093       0       0       0   14176    2669     105     -12    1637   25305
TS      19971997    1610    -226    1525    1643    2207    2056    6607    4834       0       0    1597    2793   24645
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**------Belton
WR516031       0        19631216       1     1.0  5160DP                C5160_TS   C5160 5160001
TS      19401940       0       5       0   22269     594   26703   16296    -314       0    1251   49014    8057  123874
TS      19411941    7923    7155    8168    7467   11339   10860   16320   16866   13992    8949    9235    7900  126174
TS      19421942    7216    5789    3782   15334   11200   13747   12868   19296   11873    9644    9487    7739  127976
TS      19431943    7854    8853    8091   10572    9852    1254       0       0    1732    1228    -173    1586   50849
TS      19441944   39846   55799    8000   10132   11377   14806    6889       0    2484    3878    4297   28812  186318
TS      19451945   35492    6581    7997    9804   12871   12063   15849     335    4463   34959   10548    8036  158998
TS      19461946    6183    7367    9341    8468    9530   13190    2038       0   11244    2025   18492   24395  112272
TS      19471947   21651    8217    8068    8352   10146    4733       0       0       0       0      -6    2122   63283
TS      19481948    -137   15540    7205    3129   20893    2491    7114       0       0       0       0       0   56235
TS      19491949    -115    -119   52945   67937   59529   42027    3152       0       0    -195    -169    -139  224852
TS      19501950    -141    6950    -131    4888   27405   14919   11671       0   25358       0       0       0   90918
TS      19511951       0       0       0    -161    8173   12510       0       0       0       0       0       0   20522
TS      19521952       0       0       0   22855   36731    3747       0       0       0       0    2770   14876   80979
TS      19531953    3078    -122   13813    4256  146584       0     906       0     -87   10947    1345    -137  180583
TS      19541954     -58       0       0    -178     695       0       0       0       0       0    -162       0     297
TS      19551955       0    5382    -173   12818   44207   24278       0       0   10844    2778       0       0  100134
TS      19561956       0    -134       0       0  104058       0       0       0       0       0    1345     478  105747
TS      19571957       0      18   16360  298275  109427   14426   19562    2108    -174   30632    5444    8696  504775
TS      19581958    7000    3177    9035    5328   11877   13582    -353       0       0       0       0       0   49646
TS      19591959    -141    1170     -51    -128    -192   35438   11305    5625       0  120888    7904    6045  187862
TS      19601960    6563    7350    8274   10335    9479    -246     -30       0       0   49897    7308   24786  123715
TS      19611961    6346    6670    9354   11583   10941   11830   13937    9470    6032   21338    7205    7542  122247
TS      19621962    7164    7450    5649    8406    4398    9072       0    -341   36042   16135    2065    8286  104327
TS      19631963    1755    1369    2464    -159   33353   11867    -333       0       0       0    -121       0   50195
TS      19641964    1594    4604   13625   41408   13034   80895       0       0   46898   10840    7078    7649  227626
TS      19651965    4828    5595    8313    9901    2647   13367   19388   17879   11504    6366    9498    5261  114547
TS      19661966    6497    5647    9620    6979   11038   13037    -323   33156   10476    6352    1420     126  104025
TS      19671967     987    -159     293    6745    6963   11437    6470       0     667       0    1171     -79   34494
TS      19681968  116338    6475    7272    8870    4386    9820   13227    -313    -217       0    -134    1739  167461
TS      19691969     917    3320    6862   70167   11149    4215       0     -98       0    4563    9862   20860  131818
TS      19701970   25972   33577    7493    9257    8767   14079       0       0   25991    2702    -184     -51  127601
TS      19711971     461    -155    -131     864    4312       0  103590    9476    -214   31821    6946    5637  162605
TS      19721972    7175    8476    8155    1934   16730    -116    -255       0       0    4715    2382     859   50055
TS      19731973   13467   16568   36338   31358   11118   10281   14042       0       0   34336    8821    1840  178168
TS      19741974    4922    4577    3452    1080    1403       0       0   20024   70895    7534    7171    7359  128416
TS      19751975    7640    6984    9019   10500    4259   10026   11433     753       0       0       0    -110   60503
TS      19761976    -166    -131    1230   18515   20604   18977   61698    -311    2750   14476    7369   20457  165466
TS      19771977    6365    6151    9016    6948    9982   14134     898       0       0       0       0       0   53494
TS      19781978       0    1896    2313    -184    -199    -140       0       0       0       0     611       0    4297
TS      19791979   14223   17104   57442   35566   94145   25235   13401    3241       0       0       0     748  261104
TS      19801980    2009    5459    5022    7765   65658    6395       0       0       0       0       0    -139   92170
TS      19811981       0    -116    8778    6332    1610  116843    -321       0    1630    3453     343       0  138552
TS      19821982    -148    1546   14361   12881   49825   29871    9069       0       0       0       0       0  117406
TS      19831983       0   10819   27966    3981   17727    -152       0       0       0       0       0       0   60341
TS      19841984    -145       0    6133       0       0    -187       0       0       0   15823    2338   14262   38225
TS      19851985   17943   19493   44584   18007   17941   24226       0       0       0   51499    7856   49198  250747
TS      19861986    7287   58549    6780     845   43603    9750   19391    1949   17546    6738    7067    4191  183696
TS      19871987    7605    5218    8662   11112    9132    7164   17761     612    2257       0     427    3909   73857
TS      19881988     722    2075    2619    -193       0   57965       0       0       0       0       0       0   63188
TS      19891989    6547   16812   27853   13952   86698    9214   11007    2068       0    -119       0       0  174032
TS      19901990    -142     817   28452   63527   10503   17225   13691   12088    2784    1992    2283       0  153219
TS      19911991   16765   13001    4339   10452   16476   11686    -297    6198    8661   34470    8734     804  131289
TS      19921992    5396    5688    7986   10664    4619   11844   17063   13286   12665    3011    8035   11262  111518
TS      19931993    5808    6701    7848    8896   10355   11347    -342       0       0   13874   10168    2248   76904
TS      19941994    2213   23714   10325    3203   50724   13580   11620       0    -231    6473   20671   29243  171535
TS      19951995    6323    6121    6807    8254    7222   11403   12747   16597   10821   12223    -152    1201   99564
TS      19961996     750    1534    -138     324       0    -230       0   27344   71631   18219    8978    6909  135320
TS      19971997    6881    5669    8359    6798    9363    9433   17312    7098       0    -168    2077   42405  115227
**
**------StillHouse Hollow
WR516131       0        19631216       1     1.0  5161DP                C5161_TS   C5161 5161001
TS      19401940    1156    2791    1386    8853    5811   13168   10175    2470    1168    3757   25009    5484   81227
TS      19411941    5462    4980    5175    5201    6900    7784    9849   10617    3140   10792    3961    3733   77593
TS      19421942    2941    2460    2417   18454    6819    9784    9128    2812   15275    6306    6320    5215   87928
TS      19431943    5238    4809    6298    6510    5653    1720       0       0       0    2407    1502    1954   36091
TS      19441944   22305   35725    5279    6478    7325   10602   11318       0    8183    5647    7619   15170  135650
TS      19451945    5126    4939    5577    5446    8277    8801    9924    7384   11941    7384    6639    5431   86867
TS      19461946    4371    4952    5659    5347    5638    9238    2431       0    3807    2756    3942    8590   56731
TS      19471947   29133    5476    5212    5446    6472    4688       0    2068       0    1060    1456    1753   62763
TS      19481948    1512   13655    2846    6254    9971     819    5258       0       0     609     880    1449   43253
TS      19491949    1153    1067   24789   38818    7897   12713    1882       0       0     651     948    1281   91199
TS      19501950     968    4664    1351    4631    6363    4229     846      12    6631     623     684     763   31765
TS      19511951       0     809     810     756    5608    3447       0       0       0     237       0     702   12369
TS      19521952       0     589    1261   19779   39082    5257       0       0       0       0    1302   16962   84233
TS      19531953    4057    2465    5762    8556   84804       0    1696       0    3733    4206    1084    1304  117666
TS      19541954    1257     841       0    1259    5505     149       0       0       0    1579   19211     723   30523
TS      19551955    2640    6499    2411    3982   56837   24199   10032       0    4776     610     560     804  113349
TS      19561956     765    1293     511     345   31436       0       0       0       0       0    5453    4408   44211
TS      19571957       0    1429   12333  166498   27754    8225    3392    1132    1869   26648    4400    5484  259163
TS      19581958    4497    4049    5600    5448    6700    8705    3983    2215    2238    1933    1674    1669   48710
TS      19591959    1505    1792    1585    2525    1420   26491    3151    7691       0   46523    5704    4637  103023
TS      19601960    4930    4860    5414    5865    7258    3613    4980    3329       0   28714    5440    3998   78400
TS      19611961    4734    4846    6134    6811    7191    6409    8018    6329    4810   10835    6657    4730   77504
TS      19621962    4480    4045    5325    5859    6107    9863    2191     506   10566   20173    2594    5245   76954
TS      19631963    2746    2037    1776    1460    3240    1138       0       0       0    2334    3451    1042   19223
TS      19641964    1466    5224    9855    9810    6911    7227       0       0   16924    2837    8948    3667   72867
TS      19651965    8203   48835   25148   10178    2928   10080    8519    3235   10555   10035    9732    3451  150898
TS      19661966    4053    3797    6209    4307    6700    9917       0   20305    6869    7337    4532    3804   77830
TS      19671967    3147    2568    2457    2791    2226     649     290       0     558    1057    1339    1088   18170
TS      19681968   73014    4329    4075    5350    4087    8038    9314    3759    3779    1746    1771    2167  121427
TS      19691969    2548    3540    7072   28375    7523    6376    1644    2782    1328   14335    8937   19431  103888
TS      19701970    8117    3549    4288    6729    6117   11072       0       0   25478    5073    2611    2720   75753
TS      19711971    2388    2575    4506    2035    2384       0   22179    7720    1511   15717    7442   26390   94845
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TS      19721972    5000    5920    6284    5125    9579    5808       0    2676     137    3418    3236    2874   50055
TS      19731973   10075   16565   18498    5440    7902    8377    8602     995     655   20022    6562    6052  109743
TS      19741974    4414    5532    5191    3678   11707    4162       0   22700    7016    5804    4104    4119   78426
TS      19751975    4603    4491    5100    6070    3178    7985   10414    8370    2362    1939    1614    1808   57934
TS      19761976    2137    2374    2840   19014   16098    7932    8333    5664    5682    8754    5271    5138   89235
TS      19771977    4239    4233    6242    7000    6148    8979    4072       0    1901     570    1014     888   45286
TS      19781978     921    2901    2608    2253     996    4436       0    1098       0      83    1263     815   17374
TS      19791979    6934   13447   31250   22543   46096   13186    7837    8084    1018    1104     492    2122  154112
TS      19801980    2144    3007    3107    4984   33197    9475       0       0       0     141     650    1384   58089
TS      19811981     797    1176    6583    7148    9831   54687   11981    4567    9452    8966    6275    3250  124714
TS      19821982    2847    3065    7889    7758    6433    9101    5049       0       0     152     318     899   43510
TS      19831983    1723   10222   25200    9484   23628   10474       0     672      75     354     199     226   82256
TS      19841984    1605    1392    2488    1348       0     579       0       0       0    7740    1457    4432   21041
TS      19851985    8137   11173   33101   19323   17247   23694    1608       0       0   30285    4886   20748  170202
TS      19861986    8746    6601    7237    3894    6305    5327    5190       0   12055   13230    3974    4488   77047
TS      19871987    6714    3811    6060    7196    4435    1538   11301    5403    8132    2436    3504    5301   65830
TS      19881988    5085    4930    5382    3668       0    7353       0       0       0       0       0     814   27231
TS      19891989    2439    3371    5966    5194   25372   12504    2111     128      73    1795     655     643   60250
TS      19901990    2379    2304   16484   85689   11665   10665    9975    6095    5128    4059    5032    2237  161714
TS      19911991   12849    5146    6241    5995    2664    7000    5372    6954    6971   16481    7853   -7968   75557
TS      19921992    3502   -7362    5066    7653    8291    7349   10280    5594   14059    4896    6528    5511   71367
TS      19931993    4030    5455    3761    4847    6577    9350    9810       0       0    9974    5499    3105   62407
TS      19941994    3022   12311    8390    4219   21449    9984       0       0    2715    7343    8935   18094   96460
TS      19951995   15514    4657    4657    8597    7923    9191    7576   16073    8299    9078    1326    2182   95071
TS      19961996    1818    2826    1732    3153       0       0       0   14628   24468    7049   13221   20892   89786
TS      19971997    5640   -6656   -1196    4362    7351    1225   12386    8967       0    2938    4362   20276   59656
**
**------Georgetown
WR516231       0        19680212       1     1.0  5162DP                C5162_TS   C5162 5162001
TS      19401940     155    1311     460    1997    1415    1366    2113    1337     619    1677    2994    1087   16531
TS      19411941    1091     960     957    1019    1308    1504    1930    1551     902    2746     945    1038   15949
TS      19421942     886     741     601    2279    1197    1865    1041       0    4363    1261    1261    1042   16537
TS      19431943    1047    1159    1082    1338    1304     416       0       0       0     343     208     105    7001
TS      19441944    4782    7062    1025    1336    1090    2067    1752       0    3161     687    2539    1359   26857
TS      19451945     940     914    1013    1003    1647    1802    2053    1610     552    1545    2412    1411   16902
TS      19461946     933     949    1088    1039    1163    1878     847       0    4327    2192     972    1063   16450
TS      19471947     874    1140    1049    1106    1320    1509       0     675       0     332     361     416    8781
TS      19481948     395     502     460    6384    6664     429     570       0       0       0       0     185   15590
TS      19491949     234     377       0    7466    1912    2572     856       0       0     231     155     345   14148
TS      19501950     306    1306     616    1373    2584    1659     403     136     373     157     142     151    9205
TS      19511951       0     191     285     375       0     218       0       0       0       0       0     123    1192
TS      19521952       0     316     557    4895    8043    1332       0       0       0       0      97    6207   21447
TS      19531953    1791    1667    1732    7782    7940       0       0       0    1998    8991    1467    1322   34692
TS      19541954     888     608       0       0     337      35       0       0       0       0      63      71    2002
TS      19551955     178     608     625     193    5221    2782       0       0       0      19      35      41    9702
TS      19561956      83      89      71       0       0       0       0       0       0       0       0    1301    1544
TS      19571957       0      10    1023   37797    1107    1745    2126     754       0    3763     892    1118   50336
TS      19581958     918     825    1097    1116    1303    1694    1306     807    2891    1310    1146    1016   15429
TS      19591959     998     737    1293     942    1297    1593    1045    2130       0    3094    1139     992   15260
TS      19601960     968     966    1084    1163    1484     954    1088       0       0    5904    1062     776   15450
TS      19611961     908     929    1225    1353    1467    1262    1552    1867    1512    1353    1013     981   15423
TS      19621962     969    1081    1226    1011    1498    1555    1512     290     805    1060     621     726   12353
TS      19631963     642     641     723     609     502     237       0       0       0       0     476     354    4183
TS      19641964     620    1483    2514    1941    1414     856       0       0    2149     891    3198    1806   16874
TS      19651965    3896   13491    1158    1145    1002    1853    2211    1039    2601    1307     976     815   31491
TS      19661966     896     784    1183     868    1161    1798       0    1049    2689    1418    1060    1011   13916
TS      19671967     811     656     496     856    2777     503     189       0     506     886    1222    1179   10081
TS      19681968    9160     971    1122    1074    1080    1597    1897     595    1365     291     386    1062   20601
TS      19691969     695    1448    3962    1063    1328    1922     644    3350    1626     936    1015    1256   19244
TS      19701970     931     762    1119    1230    1077    2058       0       0     310     256     197     181    8121
TS      19711971     181     177     176     106      96       0    3326     346       0    2039    1404    2821   10671
TS      19721972    1543    1015     648     258    1146    1797       0       0      63     855    1803     954   10082
TS      19731973    2334    5583    9104    5582    1501    1522    1858    1013     938    2359    1235    1192   34221
TS      19741974     826    1173    1185    1182    1475       0       0    5403    1518    1390    1054     984   16190
TS      19751975    1036    1069    1220    1074     914    1695    1936    1789    1012     598     522     500   13365
TS      19761976     387     325     421    5562    1181    1760    1661    2032    1187    1066    1315     918   17813
TS      19771977     890    1010    1157    1091    1400    1866       0       0       0      65     247     119    7846
TS      19781978     158     432     368     324       0     184       0       0       0       0     189     126    1780
TS      19791979    2278    9038   13653    1818    1118    1854    1685    1256     356     145     202     279   33681
TS      19801980     226     461      82    1538    7865    2049       0       0       0      43     193     668   13125
TS      19811981     609     981    2553    4144    4744    1689    2057       0    3583    1022    1187    1154   23723
TS      19821982    1057     983    1062     781     929    1316    1469       0       0       0       0     183    7781
TS      19831983    1156    7122     693    1369     861    1648       0     790       0      42       0       0   13680
TS      19841984     405     232     351     239       0       0       0       0       0    5510     962    4337   12035
TS      19851985    7437    4779    1037     892    1109    1390     338       0       0    2737    2574    2259   24552
TS      19861986    1058     678    1303    1295     883    1572       0       0     469    4114    2451     511   14334
TS      19871987    1047     685    1114    1389     652    1297    1999    1062     582      75     316    1015   11233
TS      19881988     993     620     650     477       0    2596       0       0       0       0       0      72    5408
TS      19891989     325     592    2656    1634   13451    1830     288       0       0       0       0       0   20777
TS      19901990     149     159     536     595    2043     209       0       0       0       0     191      83    3964
TS      19911991    4096    3992    2774    4298    8264    1800    2097     142    2832    1237    1378     300   33211
TS      19921992     668     792     964    1256     719    1484    1956    1041     383      96     188    1083   10631
TS      19931993    1344    3301     769    1039     935    1381    2337       0       0       6     132     294   11537
TS      19941994     334     727    1176     889    2417     924       0       0       0    2352    1068    3574   13459
TS      19951995    4076    2140    3805     821     893    1849     737       0     226       0      35      58   14641
TS      19961996      59     183      72     302       0       0       0     539    3366    3139    1217    7003   15881
TS      19971997    6852    1184    1113     258    1048    1446    2193     863       0       0     322    5106   20386
**
**------Granger
WR516331       0        19680212       1     1.0  5163DP                C5163_TS   C5163 5163001
TS      19401940    1331    1090    2020    1824    2560    1971    4463    3824      72    1584    6364    1434   28535
TS      19411941    1871    1576    1617    1825    2474    2331    3712    2890    3150    3610    2099    1444   28600
TS      19421942    1943    2132    2330     516    1974    3510    3130       0    7300    1921    1928    1324   28007
TS      19431943    1641    2304    1866    2833    2070    2112       0       0       0    1880    1616    1311   17633
TS      19441944   11512    3764    1631    2698    1313    4488    4691       0    8123    2637     893     797   42548
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TS      19451945    1271    1322    1402    1510    3422    3307    4322    3475       0    4527    3595    1368   29519
TS      19461946     723    1348    1528    1862    1428    3753    2702       0    9038    2633     533    1631   27181
TS      19471947    1109    2276    1620    1981    2121    4300       0    2366       0     768    1955    1995   20489
TS      19481948    1861    1409    2021   13408    2722    2141    2088       0       0       0       0    1489   27140
TS      19491949    1507    1839       0   17407    5122    3224    2721       0       0    1627    1499    1841   36787
TS      19501950    1663    3881    2363    3997    6746    3407    1717    1172    1987    1473    1471    1412   31288
TS      19511951       0    1428    1636    1799       0    1675       0       0       0       0       0    1352    7889
TS      19521952       0    1701    2232   11749   18767    4129       0       0       0       0    1316   13273   53168
TS      19531953    4933    4676    4820    5877    2203       0       0       0     376   18518    2036     929   44368
TS      19541954    1538    2344       0       0    1810    1274       0       0       0       0    1089    1237    9292
TS      19551955    1379    2347    2383    1401   12557    7320       0       0       0    1168    1235    1173   30963
TS      19561956    1174    1205    1164       0       0       0       0       0       0       0       0    3944    7486
TS      19571957       0       0    3261   45413    1740    3428    5098    2541       0    4315     683    1738   68217
TS      19581958    1325    1229    2173    1940    2586    3392    3713    2658    3147    1463    1657    1359   26643
TS      19591959    1599     650    2866    1283    2276    3073    3136    3563       0    4370    1672    1238   25724
TS      19601960    1432    1539    2140    2178    3142    3130    3231       0       0    7414    1159     275   25640
TS      19611961    1049    1427    2451    2964    3173    1615    2643    4248    1803    2128    1013    1103   25617
TS      19621962    1249    2105    2664    1807    3333    2641    4166    1515    2938    3460    2528    2377   30782
TS      19631963    1619    1553    2597    2315    2170    1630       0       0       0       0    2209    1861   15954
TS      19641964    2353    4272    6539    5239    4180    3083       0       0    5896    3087    8198    3607   46456
TS      19651965     864     705    2206    2337     879    3902    5139    3958    3222    1819     871     522   26422
TS      19661966    1086     846    2467    1554    2140    3916       0    5113    5877    2606    2439    1431   29475
TS      19671967    2012    1913    2460    2586    2138    2412    1103       0    9143    4195    1401    1121   30482
TS      19681968     449    1692    2025    1895    1215    2172    3962    4522    1979    2716     730    1408   24764
TS      19691969    1740    1012    1521    1553    2418    4252    4381    4473    2932    1514    1604     687   28086
TS      19701970    1289     889    1852    2284    1781    4516       0       0    7683    4393    2965    1993   29645
TS      19711971    2221    2051    2740    2385    2799       0    1799    3754       0    2079    9193    1428   30449
TS      19721972    1210    2192    3022    2881    1987    3721       0       0    1685    9970    1298    1458   29424
TS      19731973     507    1226    1616    1657    3155    2359    3914    3546    2609     279    2008    1888   24763
TS      19741974     654    2442    2475    2872    2417       0       0   10448    1337     914    1070    1264   25893
TS      19751975    1682    1631    2396    1762     683    3070    3905    3521    2703    2387    2337    1253   27330
TS      19761976    1993    2328    1895     436    2000    3237    2733    4435    1971     809    1355     786   23978
TS      19771977    1175    1858    2186     967    2797    3999       0       0       0    2130    2528    2196   19835
TS      19781978    2213    4384    3453    3674       0    2386       0       0       0       0    2776    3128   22013
TS      19791979   11658    8229    1517    2020    1189    4091    2895    3733    2846    2896    1885     802   43759
TS      19801980    1071    1665    1882    2461    1509    4418       0       0       0    1988    2505    3209   20708
TS      19811981    2878    4102    5480    1735    1132      57    3834       0    6483     783    1966    1993   30445
TS      19821982    1830    1876    1766    1584    1425    1956    4368       0       0    1232    2264    2819   21119
TS      19831983    3667    4457     865    3309     819    2381       0    3761       0    1316    2678    2123   25376
TS      19841984    3091    2162    3068    1506       0       0       0       0       0   22949    1502    -110   34168
TS      19851985    1767    1821    1842    2563    2501    2866     903       0       0    9212    4394    1419   29288
TS      19861986    1725    2065    3052    2936     907    2872       0       0    4118    6633    1506     332   26146
TS      19871987    1813    1235    2411    3297     536    2050    3769    5016    3234    2972     662    1177   28172
TS      19881988    1967    2040    2200    2940       0    5754       0       0       0       0       0    1432   16334
TS      19891989    2407    2113    3892    3020   14408    2357    2121     899    1165    1547    1491    1240   36659
TS      19901990    1888    2278    7716    3902    2350    2356    1046       0    1164    1125    1694    1336   26855
TS      19911991   10093    1383    2541    2476    1767    2549    3781    2556    2769    2400    1860   -2166   32008
TS      19921992     943     970    1787    2406    1347    2721    4073    3924    3354    3081    1331     630   26567
TS      19931993     899    1708    1840    2204     935    1653    5327       0       0    1738    2737    3092   22134
TS      19941994    3057    2636    2934    1831    2829    2095       0       0       0   11254    2897      75   29608
TS      19951995    1550    1738    1526    2310    1298    3208    3560    2704    1822    1651    1931    2384   25681
TS      19961996    2053    2588    1371    1894       0       0       0    1518   20870    2389     866    1216   34764
TS      19971997    1616     658    2086    2366    1611    2621    4669    4701       0    4793    2326     544   27990
**
**------Somerville
WR516431       0        19631216       1     1.0  5164DP                C5164_TS   C5164 5164001
TS      19401940     108    3838      98    2140   11279    4812   15267     147     370     903   18803    1137   58902
TS      19411941    3036    2074    2300    2159    5685    6329   12210    1323     292    1208    8654    1486   46755
TS      19421942     928     928     851   19656    2466    1999    3326       0    3205     515    2911    3225   40009
TS      19431943    9912    1207    8698    1690    6762    3875     176      75     784     797     127     811   34914
TS      19441944   40703   17755    1705    3217    3162    4143     691       0   10627     104   28645    -448  110303
TS      19451945    2828    2137    1872    4131    5969    8668    1945   16928    7406    2211    1667    3726   59487
TS      19461946      22    1787    2061    3941    1549    6781     522       0    3322    4266   23070    2071   49392
TS      19471947     296    2637    4426    4929    4315    1728    1994   28175     538      98      78    1761   50974
TS      19481948     400    6859    1139     378    5589     327     876       0      87      94      78     101   15927
TS      19491949    1126   26507   16872   28946    8265    5120     317       0       0   31137     677    4840  123806
TS      19501950    2181    1610    2839    4087    5693    8148    2172      72   12592     146      78     101   39718
TS      19511951       0     244    4599    2691     675    1704       0       0     180       0       0     101   10193
TS      19521952       0     926     535    5480   17468    1985       0       0       0       0    3034   18216   47644
TS      19531953   16120    4308    1894    6315   69449     232    6117     633    3877   18550    7391   11119  146003
TS      19541954    2393    1268       0    1000    6683     614       0       0       0     250     206     279   12692
TS      19551955     334   17183     328    3955     366    4666     428       0     520     613     299     183   28875
TS      19561956     372   12938    3385    3745    2120       0       0       0       0       0       0     717   23276
TS      19571957       0     359   13643  133269   23722    8786     794     527   15408   12479     -14    2169  211142
TS      19581958    1484    3202    4701    4551    7448     971   13258     365   19096    1571    2230    1268   60144
TS      19591959    3077     243    4633    3479    4634    1586     370     152     212    3007   13465   19171   54029
TS      19601960    1654    1963    4817    3838    8856    5814    4429    1764     624   17742     790    -621   51668
TS      19611961    1780    1202    4751    4377    7901    8788    9151    1092   13459    2552    1955    1335   58344
TS      19621962    1692    4589    5082    3939    7048    8918    9558     583   12079   14254    1859     884   70486
TS      19631963    2459    3250    3957    8840    1694     673     728       0       0       0     421    1476   23497
TS      19641964    1063    3694   13467    2989    2983    2466       0       0    2139    4321    1996    3562   38681
TS      19651965    4955   72693    4563    3704    5949   10966     841    1117     268    1752   28637   -1412  134033
TS      19661966    1273    2133    6461    3762    6135    1162    1010     795    8941    2049     984     586   35293
TS      19671967    1779    1123    1121    3354    6778    3611     496       0    3737    1147    3501     287   26934
TS      19681968   75094    3187    4180    3361    2376    -360   10562    5146    8780    3037     -94    1060  116328
TS      19691969    3239    2483    3486     125    6209    2102      66      60     868      89    2026   12485   33238
TS      19701970    8138   26009    2979    5075    5415   12743     467       0      78    1392      65     301   62662
TS      19711971     587    1227    1133    1227      79      66      71     613      81     900      74   14727   20782
TS      19721972      62    2040    1412    1344   21749   13222       0     896      76     836      69      93   41798
TS      19731973   35464   28672   39224    7354    7850    4880    3730      60    1954   14195    3234    1836  148452
TS      19741974    -417    5874    4723    3396    7672   14009       0    5066   15808     946     -35    2329   59369
TS      19751975    2450    3710    5527    4000    2748    8785   10851    6258    3387     777     667    2789   51948
TS      19761976    3181    3240    8405   10004    6061    7755    5972     236    2671   14459    4247    1155   67386
TS      19771977    1857    3682    5141    3267    5485    4583      60     206     898      76     692    1432   27378
TS      19781978    6380   13996    8853    3563    9169   19871    3135    1956    5714      83   10019    5953   88692
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TS      19791979   21155    2986    4049    4281    5019   10992   10357      57      59     303      51    3534   62842
TS      19801980   17037    2842    2205    6545    4097    3616    1190       0      84      84      71      95   37866
TS      19811981    1531     835    2347    1874    7561   53211   12320      61     318   15063    1926     494   97539
TS      19821982    1102    2019    2944    8822    4918    7150      67      58       0     821      65    5762   33727
TS      19831983   18689   14532    2538    3173    6488   10490    1098    5554    2976     427      66      87   66116
TS      19841984    3131    2057    6221    6294    3520    1315       0       0       0   37675   20545    6065   86823
TS      19851985    2308    1857    2939    5288    6442    4759    2129       0     513   16425   21575    2347   66583
TS      19861986    3018    3147     716    1861   12517    4462   13390    2171    4142    7017    3822    -383   55881
TS      19871987    2502    1017    5533    4081    8401    7372   13572    6728     769      94     442    2237   52747
TS      19881988    1520    1384    3698    2654    2438    5444    1101      42       0       0       0      95   18375
TS      19891989   10085    1726   13224    3710   15931    7959     645     476      75      87      75      91   54083
TS      19901990     958    2672    1029   21940   10246      60     402     160      76      94      69      98   37802
TS      19911991  100559    3628    4281    3069    4769    7058    1323     274    1029    2049    2312   26599  156948
TS      19921992     407    1468    4539    5072    2363    7768    7337    3292    3073    2199    7504   12801   57823
TS      19931993      55    2976    4311    4844    3702    4859    6221    3761    2803    6963    3355    2855   46704
TS      19941994    1941    5531    6024    2366    7900    2708    2762    5189     991   25381    3132   -1578   62346
TS      19951995    3329    3985    3628    5083    3610   11268    3274    6325    3890    1417    5133    2281   53224
TS      19961996    1232    1587    1542    1992       0       0       0    2422    5499    2496    1855    1319   19944
TS      19971997    1740   20623   12924    8889    5797    6760    8595    8059    7487    2680    3083    4586   91224
**
**------Limestone
WR516531       0        19740506       1     1.0  5165DP                C5165_TS   C5165 5165001
TS      19401940     224     911     239    4927   19924    5359   11400     217     220     208   32165    2291   78083
TS      19411941    5511    4578    5786    5234    7171    7967    8939    1282     538     283     515     858   48661
TS      19421942     443     741     557   40326   20113    9682     343       0   12009     875    7255   18132  110475
TS      19431943    6770     733    5530    5308    4421    6900     322     135     126    1860     484     551   33140
TS      19441944   39068   31140    5444    3866    8533   12018     302      90     536     153    9745   38830  149723
TS      19451945    5107    3210    3641    5981    8074    8905    7482   11682   12206    4865    3046    8399   82600
TS      19461946    2150    4246    4419    6523    4759   11558     865       0    1510     443   42019    5020   83512
TS      19471947    3451    3498    8594    6309    6233   11959     456     643     294       2     245    1617   43299
TS      19481948    3332   17978    8943    8641   21557     524    1305     169     178       1       0     504   63130
TS      19491949   15262    4542   29796    8956    1436    6190     965       4       0   29777     521    1145   98594
TS      19501950   20547   47234    1855   12742    5273    6605    1043     233     202     185     314     244   96476
TS      19511951       8     424     835     676       0    1591       0       0    1971       0       0     378    5883
TS      19521952       0    3773    4844   12239   30083     663       0       0       3       0    1806   11531   64942
TS      19531953   16319    1523   51253    2916  124193     439     435     345     397    1807    3050   54705  257382
TS      19541954    5860     814       0       0   18271     273       0       0       0       0     632     888   26738
TS      19551955    1016    7004    4801   16745    6515    3025     454       0     166     263     126     187   40301
TS      19561956     390    3734     321       0   14045       0       0       0       0       0       0     185   18675
TS      19571957       0       0   15677   95256  111328    9804     251     174     228   36763     878    2840  273197
TS      19581958    4928    4418    3589    4599   12786    7454     495      48   30578    6825     600    1367   77687
TS      19591959     952   14736    3353   10368    6440    9853    4557     832    1009    8070   16949    8959   86077
TS      19601960    3764    4221    7052    4614   11897    7518    1025     496     306    7171   16012   17570   81647
TS      19611961    4459    5302    6548    3606    1221   22478   10568     660   13524    1369    3582   11733   85051
TS      19621962    2618    5564    3422    5963   12334    8280    1057     171     238     576     880     742   41845
TS      19631963     397    1150     908     755     930     229     121       0       0       0     133     247    4871
TS      19641964    1415    1063    2896    2176     633     154       0       0    1685     171    1259     256   11709
TS      19651965   18319   27611   23178   62013   96500   12347     467     120     319     189    1704    2083  244848
TS      19661966    1488   11984    6230   40499    8438     659     121   19895   23238     992     387     775  114707
TS      19671967     622     444     952    5457    6273    3663     191       2    2171    1110   13706   23174   57764
TS      19681968   49877    5180    7149    6265    6424    7783    7645     236     526     256    2690   14126  108157
TS      19691969    6926   20730    5638    7532    6636     473     178     986     119    1072    3830   43479   97598
TS      19701970   12260    3665    6139    5865    1241     421     121       4    2226   11075     532     420   43969
TS      19711971     425    4573     807     516    1047     154       0     813     547    1692   10517   62009   83100
TS      19721972   26996    6883     691     372     194     969       0     350     119    4707    7543   11357   60180
TS      19731973   53809   12234   29347    5213    9331    8453    3673     310    2328   24720    5902    4904  160223
TS      19741974    2660    7811    8570    9105    9072     502       0    1463   37860    3830    3932    3666   88470
TS      19751975    5057    5480    6271    5174    5986   10731    8273     759     656    3345    1012    1098   53843
TS      19761976     760    1273    8231   47141    7463   11385    9897     448    1964   20651    4283    4229  117725
TS      19771977    3886    7473    6831    6351    9616    4194     276     120    1018     175     379     546   40866
TS      19781978    2104   11263   20213    1448    1447     597       0       0    1450       0    8077    2612   49210
TS      19791979   21499   23073   66090    7308    2507   14114    6389    4862    4560    1150      49   17693  169295
TS      19801980    8827    6296    6281    8413    6756    1264     544       3     348      41     454     441   39666
TS      19811981    1169    3496    3205    3452    9831   84322    7334      11     126   26838    1743     477  142003
TS      19821982    2152    2835   16178    9424    6920       0     147      98       0      68    2920   34285   75026
TS      19831983    5087   24172    6321    2921   13691    2666    1209   11281     123     700    1009     474   69655
TS      19841984    2213    5050   20068    2006     183    2042       0       0       0   58920   15662   22443  128588
TS      19851985    4593    4285    6213    2756    4201      87     125       0     307    8412   54491    4459   89930
TS      19861986    2363   10480    3737   12496    6413    8159     501     125     115    4962   25330    9898   84580
TS      19871987    5416    3630    8688    2850    7727   14779    1071      95     476     455    1993   25254   72432
TS      19881988    4077   12445   16731    2650    2899    1282     322     719       0       0       0    2397   43522
TS      19891989     857    4163    3578    2819   89507    8303    4489     228     233     830     351     212  115571
TS      19901990    4288   11090   39956    6356    9555    4349     586     949    3788    3259   13388    6422  103987
TS      19911991   26485    5424    8080    6226    7576    7505    1585    3229    4229    5742    7028   30589  113698
TS      19921992    4590    5574    7064    4250    9917   10386       0     156       0      23    1206   22438   65602
TS      19931993   17112   13061    7019    6936    7701    8488    1634     855     577    9565     491    1683   75120
TS      19941994    1282   50230    6865    5009   10366   11859     477    2230       0    6861    5726   31762  132667
TS      19951995    6605    5022    5832    6849    8073    2111    2216   30115    5022      28      99    1202   73175
TS      19961996    1072    1629    1334    1243       0       0       0       0      33       0     715    3351    9377
TS      19971997    6298  104971    6731    6094    8438    9283     953    1542       0     131     915   27574  172930
**
**------Allens Creek
** Dummy WS Card added to locate Allens Creek at COntrol point 292531
WR292531       0        19990901       1     1.0  2925DP                C2925_TS   C2925 2925001
TS      19401940       0      82       0     656       0       0    4981       0       0       0       0   14479   20198
TS      19411941    9638    7462    8885   10070   12450   11586       0       0    9059    6045   10459    2465   88120
TS      19421942    1714    1454    1564       0   12893   11285   11400       0    1649    1278    2291       0   45528
TS      19431943    4540     947    1782    2074       0    3107    5644    3389       0     597    1059    2792   25931
TS      19441944    5183    3026    7963    7166    2496    8948    1138       0       0       0       0    3230   39149
TS      19451945    1496    5053       0       0    3206       0    2534   10953    5858      38     978    6081   36195
TS      19461946       0    2939    8253    4916    4494    8804    7083       0    1222    1787    5349    1210   46057
TS      19471947    1703    2844       0     472     737    2768    1058      70    3959       0    1904    5809   21322
TS      19481948    1120    1055    9402     899     499     327    1984       0       0       0       0       0   15287
TS      19491949       0       0    1765       0    6432       0    4298       0       0       0    3336    4139   19970
TS      19501950    5556       0    3805       0    3309   10077       0       0       0    1739       0       0   24487
```

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TS      19511951       0       0       0     884       0       0       0       0       0       0       0       0     884
TS      19521952       0       0    1119    6782     901    3973       0       0       0       0       0    2245   15019
TS      19531953    1688     102     378       0    4683    2597       0       0    3881       0    5838    4345   23513
TS      19541954    3443       0       0       0       0    2205       0       0       0       0       0       0    5648
TS      19551955       0    1913       0       0       0    2097       0       0       0     900       0       0    4910
TS      19561956       0       0       0       0       0       0       0       0       0       0       0       0       0
TS      19571957       0       0    5246       0   17382   16272   16716    5048    1642   13743    7507    6899   90455
TS      19581958    6379       0   10239       0       0    5122    3975       0     482    6491    1681     945   35314
TS      19591959       0    2225    4734    7542   10422    3967    2346    2553       0       0    8251    3352   45392
TS      19601960    5228    5983    4869     880    9779    8922    8491    2380       0       0    8192    5480   60203
TS      19611961    8321    8853    8129    6587    3264    6383   12917    7993    7580    6129    7199    5051   88405
TS      19621962    2515    3668    2236     359    3284     472    3416     614       0    4019       0     911   21494
TS      19631963    6121       0    2411       0       0       0       0       0       0       0       0    1082    9614
TS      19641964       0    2674    2247       0    2744       0       0       0       0    1881    1575    1934   13054
TS      19651965       0       0    4750     444    5719   15498    3838    4138    2290    1952    5836    1121   45586
TS      19661966    1133    1065    2682       0   13930    5576    2685    3012       0    4515       0       0   34597
TS      19671967       0       0       0     290     249    2068       0       0    1652       0     468       0    4727
TS      19681968    4794    6320       0       0   10207    8896    3643    2581    1830    3138       0    4673   46081
TS      19691969    2043    5158    3330    5922   10649    3910    2026       0    1529     441     239       0   35246
TS      19701970      49       0    7713    4654    1999    4775    1579       0     156    7476    2423       0   30824
TS      19711971       0       0       0       0     122       0       0    1467    2879       0    4030    4841   13340
TS      19721972    6097    5834    3983       0   11437    3342       0       0    1122       0    4801    1650   38265
TS      19731973       0    4911     978    8573   12927    7492    7642    3912    2489    7019   10003    7841   73789
TS      19741974    5036    9532    3910    1294    5109       0       0       0    5702    9628    7245    7793   55249
TS      19751975    5011    8747    7573    5619    1233   10426    9138    4815    2368    1075     945    2187   59137
TS      19761976    1595    2230    1313       0    4924    5281    4091    3484    1915       0    4165    4361   33358
TS      19771977    7141    6069    2383       0    8166    9715    4251       0    2276       0     195     801   40996
TS      19781978    5179    7076    2720       0       0    2811       0       0    3699       0    1987    4324   27796
TS      19791979    5730    6754    4938    9523    5584   15268       0    8133    8501    2507    1270    2336   70543
TS      19801980    6111    6970       0    5616    6263    7075       0       0       0    1613       0       0   33647
TS      19811981       0     588    1055     456    2209    7488   13986    4061    5760       0    9030    2773   47405
TS      19821982     610    1108       0    1931    1641    6942   10812    2238       0       0    6205    4168   35654
TS      19831983    3099    6406    6912    6353    3552    7169    2735    3982    4298       0       0    2780   47287
TS      19841984       0    1786    2152       0    1425     677       0       0       0       0    8753     193   14985
TS      19851985    3944     342    7747    5057    1876    3816    2388       0       0     314    6264    9050   40798
TS      19861986    5299    1717    4594    2225    5066    9151    4666    3218    1810    3892    3980    5348   50965
TS      19871987    7966    2807   11494   11354    6000   12701   13756    6494    2166    1955    2695    2852   82239
TS      19881988    5212    1993    1018    2002     247    3066       0       0       0       0       0       0   13538
TS      19891989     302    4007       0    5357    1618   10496    9068    5632    1032       0       0       0   37510
TS      19901990    1469    2307     847       0       0    1151    1733       0     902       0     903       0    9310
TS      19911991    5433    7162    3476    7840    8785    7217    3659    1724    1912     843     644   -3815   44879
TS      19921992    8460       0   10679   10055       0    2114    4410    6824    3123     722    1665    3304   51356
TS      19931993    5427    5293    2080    7904    9639    9941    8304     890     731    1622    2216    1940   55985
TS      19941994    1809    2651    3855     520    4918    5943    2735       0    2138   13751    5905    4658   48881
TS      19951995    8925    5647    7260    6073    6046    9550    2865    3874    1620    2275    2286    3306   59725
TS      19961996    3528    2248       0       0       0       0       0       0    5242    4721    1875       0   17614
TS      19971997    2438       0    8536    5594    3154    2724    6967    3317    3097    6870    1578    6439   50713
WSALLENS       0
**
**------Allens Creek from the Brazos. (This diversion allows to refiil A Creek with Brazos River water.
** Diversion subject to IF requirement, and annual limit of 202,000 af/y.
WR292504       0    MUN419990901   1   1                                C2925_2   C2925 2925001
WSALLENS  145533
SO        130680  202000
**
** ------------- BEGIN OF SYSTEM OPERATION ---------
** Refill reservoirs with BRA water.
WR515531      0.        21111111                                  C5155_RF1_2  SYSTEM
WSPOSDOM 724739.                                0
SO                        5155DP
WR515631      0.        21111111                                  C5156_RF1_2  SYSTEM
WSGRNBRY 155000.                                0
SO                        5156DP
WR515731      0.        21111111                                  C5157_RF1_2  SYSTEM
WSWHITNY 437024.                         387024.
SO                        5157DP
WR515831     0.0        21111111                                  C5158_RF1_2  SYSTEM
WSAQUILA  52400.                                0
SO                        5158DP
WR515931      0.        21111111                                  C5159_RF1_2  SYSTEM
WSPRCTOR  59400.                                0
SO                        5159DP
WR516031     0.0        21111111                                  C5160_RF1_2  SYSTEM
WSBELTON 457600.                             1200
SO                        5160DP
WR516131      0.        21111111                                  C5161_RF1_2  SYSTEM
WSSTLHSE 235700.                                0
SO                        5161DP
WR516231      0.        21111111                                  C5162_RF1_2  SYSTEM
WSGRGTWN  37100.                                0
SO                        5162DP
WR516331      0.        21111111                                  C5163_RF1_2  SYSTEM
WSGRNGER  65500.                                0
SO                        5163DP
WR516431     0.0        21111111                                  C5164_RF1_2  SYSTEM
WSSMRVLE 160110.                                0
SO                        5164DP
WR516531     0.0        21111111                                  C5165_RF1_2  SYSTEM
WSLMSTNE 225400.                                0
SO                        5165DP
WR292531     0.0        21111111                                 ALLENS_RF1_2  SYSTEM
WSALLENS 145533.                                0
SO                        2925DP
**
** Return flow from dummy control points.
```

```
WR5155DP 999999.        22222222          1.0000  515531            C5155_DPRETQ  SYSTEM
WR5156DP 999999.        22222222          1.0000  515631            C5156_DPRETQ  SYSTEM
WR5157DP 999999.        22222222          1.0000  515731            C5157_DPRETQ  SYSTEM
WR5158DP 999999.        22222222          1.0000  515831            C5158_DPRETQ  SYSTEM
WR5159DP 999999.        22222222          1.0000  515931            C5159_DPRETQ  SYSTEM
WR5160DP 999999.        22222222          1.0000  516031            C5160_DPRETQ  SYSTEM
WR5161DP 999999.        22222222          1.0000  516131            C5161_DPRETQ  SYSTEM
WR5162DP 999999.        22222222          1.0000  516231            C5162_DPRETQ  SYSTEM
WR5163DP 999999.        22222222          1.0000  516331            C5163_DPRETQ  SYSTEM
WR5164DP 999999.        22222222          1.0000  516431            C5164_DPRETQ  SYSTEM
WR5165DP 999999.        22222222          1.0000  516531            C5165_DPRETQ  SYSTEM
WR2925DP 999999.        22222222          1.0000  292531           ALLENS_DPRETQ  SYSTEM
**
**  Lyons Method at Richmond
**
IFBRRI701539598.  IFBRRI33333333   1   2                IF_BRRI
**
**
** Refill reservoirs with QUNAP.
WR515531      0.        33333333                                     C5155_RF2_4  SYSTEM
WSPOSDOM 724739.                              0
WR515631      0.        33333333                                     C5156_RF2_4  SYSTEM
WSGRNBRY 155000.
WR515731      0.        33333333                                     C5157_RF2_4  SYSTEM
WSWHITNY 437024.                         387024.
WR515831      0.        33333333                                     C5158_RF2_4  SYSTEM
WSAQUILA  52400.                              0
WR515931      0.        33333333                                     C5159_RF2_4  SYSTEM
WSPRCTOR  59400.                              0
WR516031      0.        33333333                                     C5160_RF2_4  SYSTEM
WSBELTON 457600.                           1200
WR516131      0.        33333333                                     C5161_RF2_4  SYSTEM
WSSTLHSE 235700.                              0
WR516231      0.        33333333                                     C5162_RF2_4  SYSTEM
WSGRGTWN  37100.                              0
WR516331      0.        33333333                                     C5163_RF2_4  SYSTEM
WSGRNGER  65500.                              0
WR516431      0.        33333333                                     C5164_RF2_4  SYSTEM
WSSMRVLE 160110.                              0
WR516531      0.        33333333                                     C5165_RF2_4  SYSTEM
WSLMSTNE 225400.                              0
WR292531      0.        33333333                                    ALLENS_RF2_4  SYSTEM
WSALLENS 145533.
**
** System diversion at the Gulf.
WRBRGM731093000.    MUN444444444   2                               SYSTEM_BRGM  SYSTEM
WSPOSDOM 724739.                              0
OR515531 217422.       1
WSGRNBRY 155000.                              0
OR515631  46500.       1
WSGRNGER  65500.                              0
OR516331  19650.       1
WSGRGTWN  37100.                              0
OR516231  11130.       1
WSSTLHSE 235700.                              0
OR516131  70710.       1
WSBELTON 457600.                           1200
OR516031 137280.       1
WSAQUILA  52400.                              0
OR515831  15720.       1
WSPRCTOR  59400.                              0
OR515931  17820.       1
WSWHITNY 437024.                         387024.
OR515731 387024.       0
WSALLENS 145533.                              0
OR292531  43660.       1
WSLMSTNE 217494.                              0
OR516531  65248.       1
WSSMRVLE 160110.                              0
OR516431  48033.       1
** Interruptible Supply at Gulf of Mexico
WRBRGM73 670000.    MUN455555555   2                          SYSTEM_BRGM_7575  SYSTEM
WSPOSDOM 724739.                         0565296.
OR515531 645018.       1
WSGRNBRY 155000.                         0120900.
OR515631 137950.       1
WSGRNGER 065500.                         0051090.
OR516331 058295.       1
WSGRGTWN 037100.                         0028938.
OR516231 033019.       1
WSSTLHSE 235700.                         0183846.
OR516131 209773.       1
WSBELTON 457600.                         0356928.
OR516031 407264.       1
WSAQUILA 052400.                         0040872.
OR515831 046636.       1
WSPRCTOR 059400.                         0046332.
OR515931 052866.       1
WSWHITNY 437024.                         0426024.
OR515731 431524.       0
WSALLENS 145533.                         0113516.
OR292531 129524.       1
WSLMSTNE 217494.                         0175812.
OR516531 196653.       1
WSSMRVLE 160110.                         0124886.
```

```
OR516431 142498.       1
**
** Final refill of reservoirs. (Just to make sure we get all water)
WR515531      0.        99999998                                    C5155_RF3_9  SYSTEM
WSPOSDOM 724739.                              0
WR515631      0.        99999998                                    C5156_RF3_9  SYSTEM
WSGRNBRY 155000.
** Whitney fills the entire conservation pool here.
WR515731      0.        99999998                                    C5157_RF2_9  SYSTEM
WSWHITNY 642179.                        387024.
**
WR515831      0.        99999998                                    C5158_RF2_9  SYSTEM
WSAQUILA  52400.                              0
WR515931      0.        99999998                                    C5159_RF2_9  SYSTEM
WSPRCTOR  59400.                              0
WR516031      0.        99999998                                    C5160_RF2_9  SYSTEM
WSBELTON 457600.                           1200
WR516131      0.        99999998                                    C5161_RF2_9  SYSTEM
WSSTLHSE 235700.                              0
WR516231      0.        99999998                                    C5162_RF2_9  SYSTEM
WSGRGTWN  37100.                              0
WR516331      0.        99999998                                    C5163_RF2_9  SYSTEM
WSGRNGER  65500.                              0
WR516431      0.        99999998                                    C5164_RF2_9  SYSTEM
WSSMRVLE 160110.                              0
WR516531      0.        99999998                                    C5165_RF2_9  SYSTEM
WSLMSTNE 225400.                              0
WR292531      0.        99999998                                   ALLENS_RF2_9  SYSTEM
WSALLENS 145533.
**
** End of System Operation Modeling
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Interruptible Yield at Glen Rose

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** BRA System Operation NModeling starts here
** TS used to represent the depletions for current BRA water right under the TCEQ Brazos WAM RUn 3.
** TS with all 2060 return flows
**------Possum Kingdom
WR515531       0        19380406       1     1.0  5155DP               C5155_TS   C5155 5155001
TS      19401940    8863   10360     654   16202   67673   30014   43979   38650   35174    2445   41073   15924   311010
TS      19411941    9950   18613   20475   17235   22403   31096   39731   33466   32372   17418   23837   17758   284353
TS      19421942   18097   13077   14313   27077   28940   34546   15546   22890   68563   17424   24248   15394   300116
TS      19431943   16764   10168   25559   30878   16805   42869   14445    1225    2039    2966    1273     676   165666
TS      19441944    4303   12919   45050   23225   50575   49567   30222   16327   24759   52134   12571   11885   333535
TS      19451945   11282   12957  115437   58200   26897   38661   37892   10087    6531   82555    6801    1291   408591
TS      19461946   19329   15246    8135    8083   27433   43830   27725   58200   80981   27705   18633   16788   352089
TS      19471947   14082    6749   11971    9044   53766   37914    8654    2440   13272   30267    9874   37469   235501
TS      19481948    4132    5769   24226    8062   30609  125659   61022    7811    7459   15529   11007    3217   304502
TS      19491949    2527   13081   11536   14406  151237   32717   14691   15520   82164   21296    9562    3428   372165
10665.8
TS      19501950    3421    8187    2733   56928   58071   33669   31316   39058   26791   19775    1219    2196   283364
TS      19511951    3213    4763    2157    2318  105760   63085   23280   25177   21596     248     847     435   252879
TS      19521952     959     515    1226    6922   16176   13656    8279       0    4985    3035    4605    2824    63182
TS      19531953    1493    1124    7023    3303   76307     328  261348   85840    5708  179192   20200   10717   652581
TS      19541954    3865    5631    1823   72797   20295   35739   11451   13550     869     368   17753     561   184701
TS      19551955    2027    5957   17162   15016  183035   30258   39964   23247   39161   29140   15893    7934   408794
TS      19561956   15508    4452     423    2112   39320   13615       0      73    1877    5360   13349   20943   117031
TS      19571957     582  215737    9006   40762   13435   33226   35856   13036   17955   55137   13145   15594   463469
TS      19581958    9858    7677   29379   19158   25148   31467   39546    7523   51658    9821    2852     129   234215
TS      19591959    2391    1820    2656     592   43130  117540   31835   14193    5932   59372    3924   19831   303215
TS      19601960   23797   15819    8947   21636    6291   13026   84433    9725     361   70197   22058   13231   289520
TS      19611961   10244   14274   18873   11010   28039   34025   29957   24226   35792   12384   24939   11195   254957
TS      19621962    5645    3064    4951    6713    2364  103117   30669   14930   35973   20371   16205   15901   259903
TS      19631963    5894    6256    7981   52670   20651   28541    2212       0    8211   11689   42587    4400   191093
TS      19641964    7809   45284    7624    4160   12601   33525    2952   14968   43034    5190   64452    2619   244216
TS      19651965    5656    5433    3099   44533  150244   32908    6456   32250   37504   53163    8665    3732   383642
TS      19661966     622    5137    8638   74450   29714   23879    3947   58105   36019   23788    7314    3217   274828
TS      19671967    4005    6205    8405   54958   23986   74266   36435   16082   45278    6997     428    3066   280110
TS      19681968   55883   14943   18006   22288   21674   30547   33402   10247     474     397     278    5422   213560
TS      19691969    4446   11693   79444   67604   33355   31796    1495     817   92379   19227   20021   13561   375838
TS      19701970   16782   12936   18071   19229   27903   16370     184     348     464     491     555     408   113739
TS      19711971    1513    2898    2784    2955   15190   75656    8258  272002   23831   17531   15540   16743   454901
TS      19721972    5519   11669    7307   15277   66445   18615    9200   76929   26980   17368   20113   18351   293772
TS      19731973   10918   14675   19973   17972   19196   37834   29118    9327   20292   25509    3112     517   208442
TS      19741974    5556    5440    4137   29558   11498   33381    1926   14076  181778   17119   20519   15308   340295
TS      19751975   15484   15425   20653   22371   15741   34043   33749   35520   27946    5053    3008    3042   232034
TS      19761976    7808    8437    5168   17779   35949    6168   21318   22130   69328   91451   26404    9537   321476
TS      19771977   12268   12720   30006   20344   23069   33647    8542     272    6557     407     108    1641   149580
TS      19781978     755    3449    8460   26141   14833   15536    1100  280138   19580   16077    7343    4394   397805
TS      19791979    7218    8862   47302   18911   43119   30105   31187   24335    4504    2201     488    4661   222893
TS      19801980    3142    7471    4355    6133  159828   34572    6186    1007  104852   28832   18368   15754   390501
TS      19811981   16483   13128   20560   23162   24867   26099   11025   12755    6381   87168   19727   11250   272606
TS      19821982    7894   11782   15989    9524   51859   30508   39223   13962    3131    3713    1680    7248   196511
TS      19831983     910   17402   16315    9729   89458   39323    9360     556     396   95642   25982    1359   306434
TS      19841984   15755   10351    7128    3808     548     414     196    3161    1561   86798   46484   73575   249779
TS      19851985   82294   48518   15335   22466   25639   27695   25213   12806     908   83676   13583    5238   363372
TS      19861986    8436    7391   10080   15038   24414   72099   41274   19146   40983   20505   16082   13341   288788
TS      19871987   14341   11523   20834   27153   15101   27618   38931    9744   15622    1130    3247   30327   215569
TS      19881988   13948    9325    8173    7441    8087   17517   27788     976   57388    6717    2448    5712   165520
TS      19891989    3620   20227   13983    6469  202815   46450    7759   32082   53790    8459    3239    4493   403385
TS      19901990   12907   21900   57912   15240   25706   35337   17090   46152   30036   20819   19253    7706   310058
TS      19911991   19976   17748   18266   10915   46757   31694   40637   33695   25935   21533   21144   10163   298463
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TS      19921992   14374   11867   21412   23663   18440   25100   35911   33422   24965    4486   16295   23904   253839
TS      19931993   19061   19499   18953   22488   25872   30658    9891   11073   13174   35379    4664    9890   220602
TS      19941994    6164    9042   10702    5815  146843   21437   17792     237   19064   75279   39250   12513   364139
TS      19951995    7403    3423   19921   12318   37328   37209   18676   44797   23217   10324    3024    2880   220520
TS      19961996    3596    7787    6935   15620    7339   14626    6487   42175  165007   22812    9837   16711   318931
TS      19971997   11365   15277   20445   17314   21305   21953   38319   18886    2598    2562     570   14511   185106
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**
**------Granbury
WR515631       0        19640213       1     1.0  5156DP                C5156_TS   C5156 5156001
TS      19401940    1264    1270    2420   11578   11240    8801   13176   13689   12131    3673    7940    3293    90476
TS      19411941    4537    2616    5340    5239   10074    9567   12966   10905   11016    7043    7228    4584    91114
TS      19421942    5021    4385    3172    8071    7918   10234    5664       0   28325    6060    7084    4414    90347
TS      19431943    1936    7606    6438    7800    6696   10510       0       0       0    2383     966    2908    47242
TS      19441944    5342   25891   26498    6660    7442    8106    7955       0   26138    5298    5824    4497   129650
TS      19451945   12661    2131    3661    5196    9638    8289   12988    1895    4377   25117    3323    4697    93973
TS      19461946    7034    4054    5279    6953    5381   10905    1426       0   35308    9112    4359    4811    94621
TS      19471947    3921    5705    5022    5478    8715   10647       0    1402       0    8668    3955   30207    83720
TS      19481948   16043    3191    6082    1024   14364   10375   13220       0       0      67    1052     828    66244
TS      19491949     704   20522   34122    5193    6321    9958   10335       0       0   31743    7626    3815   130338
TS      19501950    4097    3720    5171    8079    7335   10116   11443   13393    8499    9972    4680    2356    88860
TS      19511951       0    6573    4408     281   12326   20819       0       0       0       0       0    3228    47635
TS      19521952       0    3018    1496    7528   38790       0       0       0       0       0    7903    2808    61542
TS      19531953    2418     575    1973    3335   21564       0    7324       0       0   30673    6534      53    74449
TS      19541954       0     763       0    9092  101571   12540       0       0       0     551    2393     918   127828
TS      19551955       0    2562    2175    1539   63489   17347    4073       0   28511    9817    4082     483   134078
TS      19561956    1674    1093    5032       0   29021       0       0       0       0       0       0   23262    60083
TS      19571957       0    8938    8915   38566    9170   10853   13357     570   10027   14995    3181    4637   123208
TS      19581958    3336    3892    4153    4562    7876   10510   12801   11191    6363    1101    3770    6511    76065
TS      19591959     667    4440    1364    3504    4191   17698   19543    7663       0   16766    5540    3399    84775
TS      19601960    2962    4289    5761    6608    8219    2726   19822    3662       0   23204    6203    1759    85214
TS      19611961    2038    3450    5517    3261    3062   16410   10981    6955    6206   13340    4306    3896    79419
TS      19621962     895    1371    1868   11721    2392   19556   11086   12035    7467    6203    4699    4296    83590
TS      19631963    4151    1282    8312    8035    6948   10993       0       0       0       0    4172    1809    45703
TS      19641964    1066   10555    6439    8874    4183    2646       0       0   28562    2094   54647    4553   123619
TS      19651965    3194    2677    5409    6852    4395    8717     829    5792   14046    8592    1948    5898    68346
TS      19661966     405    9401    5185   14982    8147    8944       0    6202   23632    7599    3671    1710    89878
TS      19671967    3925    2871    2179    5262    3872   28598   11777       0    7805    6198     912    6118    79517
TS      19681968   13681    3782    4294    5850    6510    8581   11502   11749    5469    2150    2836    4006    80407
TS      19691969    2018    8554   10908    5671    7180   11151    5793   16445    9267    4859    5440    3060    90345
TS      19701970    3742    2371    3741    5645    7231    2147       0       0   13869    5000    4129    3209    51084
TS      19711971    3404    3037    2353    3237    8110       0    5758       0   64559   11149    5656    3184   110448
TS      19721972    3885    5303    3968    4165    8892    2970       0   27755   16745    5133    4908    4618    88342
TS      19731973    2454    3795    5451    4954    8213    7435   10070   12875    3562    6802    5457    5436    76503
TS      19741974    3704    2711    3085    4772       0     827       0    9606   12684   33320    6203    4004    80916
TS      19751975    3956    4338    5407    6253    4647   10926   10996   11705    8691       0       0       0    66918
TS      19761976    2805    2696    2553   17826   18800   10130    9372    1846    2711   18116    5260    4259    96373
TS      19771977    2957    4631    4588    4852    6925    9638    2585       0       0     776    3659    3112    43723
TS      19781978    2326    4223    4381   24844       0    3311       0   28678       0    4734    1949    1924    76369
TS      19791979    3545    2382   37836   23626    7540   10081     818    1762    1387    7938      65    5826   102805
TS      19801980    3401    8579    2119    4210       0    8069       0       0       0   78215       0    9385   113979
TS      19811981    1729    2480    8873    6525    6825    7225       0    3628       0   30271    6191    5303    79048
TS      19821982    3830    4146    5510    6560    5514    8480   13123       0       0       0     815    1936    49915
TS      19831983       0    5261   15700    5909   31890    6644       0       0       0    1229       0       0    66634
TS      19841984   13472    2788    6943       0       0       0       0       0       0   33070   23900   34704   114877
TS      19851985   17253     233    7945    6745    8164    9751   10501       0       0   28624    4628    1656    95499
TS      19861986       0   11025    3753    3199   11862    7547   13825       0   18729    5023    4207    2691    81861
TS      19871987    3847    2599    6513    8810    4487    8413   12828    1762     971       0    3624    3320    57174
TS      19881988    6377    1908    2915    1455       0   23683       0       0       0       0       0    2954    39290
TS      19891989    4433   21252   28101   16308   25327    8434    3296   15303   11223    4455    3217     239   141588
TS      19901990    8115    9885    3799    4699    8777   12025    2374       0   27754    5567    3857    5052    91904
TS      19911991    2621    4498    2776    9857    6485   10347    5593   16299    7293    6022    6421    3253    81464
TS      19921992    2584    4594    6461    6416    4664    7240   12176    6790   12688    4700    6749    2818    77882
TS      19931993    2958    2961    4886    5982    7983    9313       0       0       0   41255    5139    4073    84550
TS      19941994    3803    3688    4598    2168   10002   11363       0       0    8549   29321    2981    3896    80368
TS      19951995    3625    1704    5713    5278    3593    8751       0   20543    7184    6101    5474    4370    72337
TS      19961996    1220    6658    2659    5901       0       0       0   46333    7982    6394    1934    4479    83560
TS      19971997    4941    2677    7230    6108    7567    7724   13131   10936       0    2706    4541    9881    77442
**
**
**------Whitney
WR515731       0        19820830       1     1.0  5157DP                C5157_TS   C5157 5157001
TS      19401940       0     571       0     271    4740    3216   10895   12764       0     485   -4779    -201    27963
TS      19411941    2751     159    3055    2072    4694    1962   11359   10349   10892     705    5805    1620    55424
TS      19421942    3938    3417    3224   -5367    3788    8054       0       0    4314    2813    4777    1599    30557
TS      19431943    3551    5545    2428    6329    2307    8321       0       0       0     713       0    -169    29027
TS      19441944   -1561   -1743    2666    4021   -1474   11591       0       0   11421    6759     283      68    32031
TS      19451945    1514    -784   -1298    3272    8162    5330    8575       0       0    4512    5090    2594    36967
TS      19461946    -448    1628    2724    4455    -881    9837       0       0    7279    8315     -67    3008    35848
TS      19471947     450    4742    1885    2174    4946    9199       0       0       0       0    2186    -691    24891
TS      19481948    1100    -172    3823       0    3953       0   11280       0       0       0       0       0    19985
TS      19491949   -3057    -757    2237    1614     987    5231       0       0       0    1610    6792    2013    16670
TS      19501950     961   -2128    6887    2693    3216    7394    8235   14897    6619    9362       0       0    58135
TS      19511951       0     824    2346       0       0    5382       0       0       0       0       0    1359     9910
TS      19521952       0       0       0   -4697     370       0       0       0       0       0   -2194   -2814    -9335
TS      19531953    4590    2135    1361    1443    2147       0       0       0       0       0       0       0    11676
TS      19541954       0       0       0       0   37880       0       0       0       0       0    3284       0    41164
TS      19551955       0    3221    1734    7444   54519    8164       0       0   16462   19026       0       0   110570
TS      19561956       0    2256       0       0    7780       0       0       0       0       0       0    1692    11728
TS      19571957       0       0    2291   -8860    8648   13186   15697       0       0   -4323   -3116    3401    26924
TS      19581958    1715     206    2522    2556     617    8081   13760       0    4773    1333    2890    1080    39533
TS      19591959     926   -1051    7924    4578    1022    -871    7907       0       0   -2188    3834     816    22895
TS      19601960     303    2314    4180    6203    8319     318    9604       0       0    1982    4300   -6647    30876
TS      19611961   -4129    1052    5507    8566    5523   -6990    9871   10574    7495    4686   -1772     463    40847
TS      19621962    1929    3370    5096    3487    1880   -2811   13999   15165    2747    5945     889    1534    53229
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TS      19631963    2337    4136    4070    5225    2829   10057       0       0       0       0     741     -19   29377
TS      19641964   -1772    1683     681       0       0    6391       0       0    4632       0   -3565    2836   10885
TS      19651965     358    -389    4363    6937   -7487   10814       0       0       0     419     775     170   15959
TS      19661966    1118   -1278    4919   -2252    4189    9283       0    5196   -1738    7248    4081    2588   33355
TS      19671967    2818      15    2008    4641    5512    9565    6664       0   -5402    -900    2325     194   27439
TS      19681968   -4657    1926    1252    1496     518    4893   11141       0       0    5938     983    2696   26185
TS      19691969    3992     502    1041    2012     846   14536       0       0       0    2033    2148    -124   26985
TS      19701970    2017   -1741    3484    6062    4581    9658       0       0       0    -681    4330    2033   29745
TS      19711971       0    3131       0       0       0       0       0    1282       0   -5269    5054    1971    6169
TS      19721972    2389    5009    8623       0    2949       0       0       0    5733    1950    -258    2225   28619
TS      19731973       5    1032    4061    -650    5417    3930    1841   11520     -67   -5545    3799    4878   30220
TS      19741974    1196    4623    6939       0    6857       0       0    -832    1198   -1717    2553    1753   22570
TS      19751975    2124    1101    3400    1381   -4246   10130    6609       0    4198       0       0       0   24697
TS      19761976    2127    5473    3405   -3386    1554    4832    1036       0    1552   -1152    3377    1293   20111
TS      19771977     705    3334    1070    2523    4240   10545       0       0       0       0     521       0   22938
TS      19781978     803   -2143    4179       0       0       0       0       0       0       0   -1971       0     868
TS      19791979     484     273    -989    5182   -1105    9362    7665       0       0    4298       0    -297   24874
TS      19801980    -177    2347    1231    3759    2496       0       0       0       0    5961       0       5   15623
TS      19811981       0     804     -11    3861       0   -6041    9025       0       0   -7856    4274    3635    7691
TS      19821982    2204    2659    1654    3728    -659    3850   11966       0       0       0    -803    -500   24099
TS      19831983       0    -803    1544       0     819       0       0       0       0       0     -13       0    1548
TS      19841984       0       0    2295       0       0       0       0       0       0   -7694    1366   -4233   -8267
TS      19851985    1581     717    1226    6378    5608    6460       0       0       0    -818    2344   -2646   20849
TS      19861986       0    1888    5173       0    1032     434       0       0    3876   -1534    1356   -1007   11218
TS      19871987    1735     132    3590    8992     173    -496   11453       0       0       0   -3033    -955   21592
TS      19881988    3651     761    3230       0       0     857       0       0    -398       0       0     529    8628
TS      19891989    -838   -1653    3186    7297    4293    3675   10031    4071       0    2043       0    2900   35005
TS      19901990   -1161   -1917   -3338    3197    9950   12986       0       0    4993    3991    -367     564   28899
TS      19911991   -1696    1751    7303    3765    3476    5965       0    1693    4041    2545    4839   -3180   30501
TS      19921992      40    1101    5765    7669    3628    9323   14723       0       0    1254   -2159    -805   40540
TS      19931993   -1083      88    2271    3878    5774    7819       0       0       0   -5052    1535    2235   17466
TS      19941994    1838    -114    3268       0   -4146   10476       0       0       0     778    -704   -2588    8809
TS      19951995    1375    2421     561   -2360    3044    8720    9815    6538    4917    1959       0    2508   39498
TS      19961996       0    4359    3473       0       0       0       0    6901    3105    4314   -1535     941   21559
TS      19971997    -368   -4476    -367   -2120    6408    4023   13510       0       0       0       0   -5472   11137
**
**------Aquilla
WR515831       0        19761025       1     1.0  5158DP                C5158_TS   C5158 5158001
TS      19401940      91     132      82    4659     972    2343    3197     111       0      99    8878     954   21519
TS      19411941    1305     983    1245    1570    1898    1571    3253    2423     142    4351     684    1403   20826
TS      19421942     945     714    1063    3902    1675    2218    1508       0    6975    1578    1714    1119   23409
TS      19431943    1450    1006    1954    2064    1557    1223       0       0       0     600      83     260   10195
TS      19441944    2170    8924    4640    2458    1302    3047     176       0     103     213     367    7878   31277
TS      19451945    6361     801     736    1403    2312    1941    3090     333       0     248    1242     186   18651
TS      19461946    3769    6462    1358    1679     863    2663       0       0     346     103    1617    5593   24453
TS      19471947    6807    1614    1139    1368    1616    2508       0     111       0       0      83    1150   16394
TS      19481948     645    1066    1061    1605   14557    1537    5346       0       0       0       0      90   25907
TS      19491949    2853    2547    2196    6728    3629    2117     474       0       0      99      83      90   20817
TS      19501950      91    7748     570    8010    2115     154     892     111    2265      99      83      90   22230
TS      19511951       0      91      82    1586       0   21243       0       0       0       0       0      90   23092
TS      19521952       0     637     303   18750    2811     338       0       0       0       0    4514   14015   41367
TS      19531953    1229     437    2043    1278    1355       0       0       0       0     503       0     152    6996
TS      19541954     128      29       0       0    5008     107       0       0       0       0    1170       0    6442
TS      19551955       0    1094    1256     684    7107    2835       0       0     103      99      83      90   13352
TS      19561956      91      84      82       0   10139       0       0       0       0       0       0     199   10596
TS      19571957       0       0     431   48637     550    2225     255     111       0    9109     409    1294   63021
TS      19581958     946     803    1201    1068    2561     311    2400    1116    2227      99      92     114   12937
TS      19591959     114    3368     572    4919    5125    1664    1452       0       0    6455     687    1396   25751
TS      19601960     911    1014    1481    1829    2253    2370     253       0       0     783      83    9515   20491
TS      19611961     931    1137    1452    1964    1210    2385    2678     286     730    1685    5185    1017   20660
TS      19621962     966    1325     962    1884    2530    1859     446     125    2970    6227     310     865   20469
TS      19631963     623     329     277     904    1263     107       0       0       0       0      83      90    3677
TS      19641964     197     139    1156     366     109     107       0       0    4070       0   10743     138   17025
TS      19651965    2713   12334     989     589   10172     920     109     111       0     142    1435     318   29832
TS      19661966     243     969     696   13549    1821     605       0    1688     510      99      83      90   20353
TS      19671967      91      83     170    5473    3104    3160    1491       0     612   15428    1179     766   31557
TS      19681968     203     966    1223    1305    2456    1742     576     111     189    1081    2047    3340   15237
TS      19691969     341    2742    4380    1064    1933     471     109     111     110     187      83     752   12283
TS      19701970     259    8212    6703    1272    1537     242       0       0     196   11469     479     244   30611
TS      19711971     178     894     142     155   10442       0       0     610       0   10312    1394     615   24742
TS      19721972     938    1603    2040    1114    2944     184       0       0     657    4497    1750     351   16077
TS      19731973    6835     926    1299    1264    1924    1799    2565     365    4395     768    1402    1264   24806
TS      19741974     879    1592     802     411    2100       0       0    4224    6939    1117     917    1000   19982
TS      19751975    1204    1022    1367    1562    1354    2292     318     127     129      99      83     122    9679
TS      19761976     120     130     687   15326    1107    2269    2662     219     920    2301     384    3738   29861
TS      19771977     778    1327    1340    1874    1902     790       0       0       0      99      83      90    8284
TS      19781978      91    1068     835     927       0     107       0       0       0       0      83     116    3228
TS      19791979     344    1220   14526    7127   13361    2587    1272     636     103     125       0     537   41836
TS      19801980    4411    2056    1096    6127    1451     135       0       0       0     123       0     857   16256
TS      19811981     217     166    1996     566    2599   17865    1296       0       0    1005     238     212   26160
TS      19821982     159    1046    1641     450   10719    1997     790       0       0      99      83     399   17383
TS      19831983     259    6966    6446     398     961     779       0     799       0     177     541      90   17415
TS      19841984     265     275    6663     358       0       0       0       0       0   13180    1749   11298   33789
TS      19851985    1298     688    1220    1522     313     367       0       0       0    6985     197    7401   19991
TS      19861986     563    1707     811     553    2834    1615       0       0    1922    6234    1502     513   18254
TS      19871987    1167     627    1558    1993    1296    1839     608     276    2507       0    4615    4478   20962
TS      19881988    1472    1187    1453    1506       0    2145       0       0       0       0       0     302    8065
TS      19891989    1782    8408    7063    1916     883    1474    2904     823     103      99      83      90   25629
TS      19901990    7032    3619     680    1340    1233     107     109       0     103      99     270      90   14682
TS      19911991    2234    2004     603    5457    7282     107     252    8078     459    2886    1375     602   31339
TS      19921992     888    1087    1546      87    2773    1803     109    2748     103      99    1677    6534   19456
TS      19931993     687     895    1035    1247    1809    1989     705       0       0   11098      83    1158   20705
TS      19941994    1056    2067    1432    1209    1365    2647       0       0       0    5592    5005     768   21141
TS      19951995    1074     910    1035    1612    1950    2398    2736    2313    1419    3135      83      90   18757
TS      19961996       0     655     340    1787       0       0       0    2796    1875    1093    9866    4528   22941
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TS      19971997    1193     441    1557     972     859    1963     299     581       0    4049     350    7090   19351
**
**------Proctor
WR515931       0        19631216       1     1.0  5159DP                C5159_TS   C5159 5159001
TS      19401940       0     209       0    4775    2101    3254    2308    2314       0       0   13425    1142   29529
TS      19411941    1215     829    1264    1225    2537    3292    4528    5700    3141    1300    1759    1137   27927
TS      19421942    1240    1308    1294    1626    2625    3961    2664     552   10655    1494    1983     929   30329
TS      19431943    1229    1444    1185    2313    2516    1989       0       0    1069    2806      54     524   15129
TS      19441944    7402    8874    3517    2227    2805    1806    8494       0    3172    1507    1155    1536   42496
TS      19451945    3136    4367    1500    1949    3294    4193    4892     192     262    4887     716     884   30271
TS      19461946    5041    4143    1662    1816    2655    3805      82       0   12643     709    4270    1009   37833
TS      19471947    1114    1360    1214    1595    2088    1370       0       0       0       0     107    4259   13108
TS      19481948    1263    2507    1234     605    5354    2869    3517       0       0       0       0       0   17349
TS      19491949       0    1620    9836   16488    6836    3971     415       0       0    2800     509      66   42541
TS      19501950     142    2781       0    6003   12415    4027    4816       0     198       0       0       0   30383
TS      19511951       0       0       0       0    4060   12947       0       0       0       0       0       0   17007
TS      19521952       0       0       0    1159   31290     404       0       0       0       0    1550     566   34969
TS      19531953     133      80     255    3095    9057       0    3365       0       0    8711     998     357   26050
TS      19541954     167       0       0    1928    1259       0       0       0       0       0    2515       0    5869
TS      19551955       0     958       0    6943   40855    4164       0       0    2614     632       0       0   56166
TS      19561956       0     208       0       0   21118       0       0       0       0       0      65    3213   24604
TS      19571957       0      10     153   22047    1453    3464     618       0       0   13742     623    1075   43186
TS      19581958     583     847     855    1089    2078    1828       0       0       0       0       0       0    7279
TS      19591959     120     408       0     455       0   11634   13328      49       0   14623    1273     779   42670
TS      19601960     544     970    1223    1620    2675     620       0       0       0    1989      27     591   10259
TS      19611961   17003     997    1397    1960    2065    2437    4694     218       0    1405     695     999   33869
TS      19621962     808     830     796    1203     137    3074       0     378   20106    1728    1080     950   31090
TS      19631963     936     985     967     766    2358    4027       0       0       0       0    6741       0   16780
TS      19641964    2615    5317    2153    5973     495      76       0       0   21232    1192    1297    1370   41719
TS      19651965     498     374    1774    2365     -86    4394    2582       0     224    2845    1764     672   17407
TS      19661966     692    1555    1164   10055    7335    4873       0    1119    7574     386     453     281   35486
TS      19671967     748     323    1868    2619   11789    7479     873       0    3621       0     520     508   30349
TS      19681968   11074     718     825    2039    1363    4719    4493     733       0       0     415     648   27026
TS      19691969    1184    1005   11314    5647    2467    3339       0       0       0    4258     875    9216   39303
TS      19701970    5142     107     895    1551    1719    5076       0       0    2728    1448       0     921   19585
TS      19711971     808     685       0     770    7400       0    1081   12433    3893   10558    1032    6738   45397
TS      19721972    1587    1758    1493    3699    2496       0       0       0       0     452       0     348   11832
TS      19731973    1393    1828    1873   19872    1964    3751    6231       0       0   10749    1104     627   49391
TS      19741974     616    1120    1697    1021       0       0       0    4083   10601   10152    4117     746   34153
TS      19751975    1421     814    2087    1408    1248    2718    2872    1286       0       0       0      11   13866
TS      19761976       0     587     561    8312    4207     291    1672    1024    1272    2930     524     540   21918
TS      19771977     316    1100   26775     127    3089    1350     852       0       0       0       0       0   33609
TS      19781978       0      10     645       0       0       0       0       0       0       0       0       0     654
TS      19791979     980     327   10794    2805   20834    1213     269    3467       0       0       0     117   40807
TS      19801980     149     290     234     643   14553     702       0       0       0       0       0       0   16572
TS      19811981       0     395     863     268     359    6435       0       0      31   24207    1097       0   33655
TS      19821982     286     671    1255     577   18407   19675    6865       0       0       0       0       0   47736
TS      19831983       0     197    2302     562     979       0       0       0       0       0       0       0    4040
TS      19841984       3       0    4761       0       0    2123       0       0       0   21832    3561    9754   42033
TS      19851985   20912    1022    1329    2456    2523    3465       0       0       0    1586     620     184   34097
TS      19861986     124    4185     743     884   17364    1250    5655       0    5500    1167     475     398   37743
TS      19871987    1059    -386    1582       5    2702    3145    6936       0     292       0       8      11   15354
TS      19881988    1426    2395       9     739       0   18621       0       0       0       0       0       0   23190
TS      19891989     315    2850    1497    2095   20148    2974    5089    6929       0       0       0       0   41897
TS      19901990    2367      10    8415    2060    3854    5325    5231    5366    2462    2679     753       0   38522
TS      19911991    1531    1484    2452    1569    1730    4867       0   10687    1939     273    1748    -199   28080
TS      19921992     742     578    2221    2331    1857    3307    5753    5343    3432    3141     -94     587   29199
TS      19931993     280     313    1333    2156    2619    3299       0       0       0   16304    1370     973   28646
TS      19941994     885     632    1805    1884   -1018    5439    4546       0       0    8740     163     130   23207
TS      19951995     923    1108     805    1415     919    3458    5773    4280    2132    3163     261    2315   26551
TS      19961996    1067    1571       0    4093       0       0       0   14176    2669     105     -12    1637   25305
TS      19971997    1610    -226    1525    1643    2207    2056    6607    4834       0       0    1597    2793   24645
**
**------Belton
WR516031       0        19631216       1     1.0  5160DP                C5160_TS   C5160 5160001
TS      19401940       0       5       0   22269     594   26703   16296    -314       0    1251   49014    8057  123874
TS      19411941    7923    7155    8168    7467   11339   10860   16320   16866   13992    8949    9235    7900  126174
TS      19421942    7216    5789    3782   15334   11200   13747   12868   19296   11873    9644    9487    7739  127976
TS      19431943    7854    8853    8091   10572    9852    1254       0       0    1732    1228    -173    1586   50849
TS      19441944   39846   55799    8000   10132   11377   14806    6889       0    2484    3878    4297   28812  186318
TS      19451945   35492    6581    7997    9804   12871   12063   15849     335    4463   34959   10548    8036  158998
TS      19461946    6183    7367    9341    8468    9530   13190    2038       0   11244    2025   18492   24395  112272
TS      19471947   21651    8217    8068    8352   10146    4733       0       0       0       0      -6    2122   63283
TS      19481948    -137   15540    7205    3129   20893    2491    7114       0       0       0       0       0   56235
TS      19491949    -115    -119   52945   67937   59529   42027    3152       0       0    -195    -169    -139  224852
TS      19501950    -141    6950    -131    4888   27405   14919   11671       0   25358       0       0       0   90918
TS      19511951       0       0       0    -161    8173   12510       0       0       0       0       0       0   20522
TS      19521952       0       0       0   22855   36731    3747       0       0       0       0    2770   14876   80979
TS      19531953    3078    -122   13813    4256  146584       0     906       0     -87   10947    1345    -137  180583
TS      19541954     -58       0       0    -178     695       0       0       0       0       0    -162       0     297
TS      19551955       0    5382    -173   12818   44207   24278       0       0   10844    2778       0       0  100134
TS      19561956       0    -134       0       0  104058       0       0       0       0       0    1345     478  105747
TS      19571957       0      18   16360  298275  109427   14426   19562    2108    -174   30632    5444    8696  504775
TS      19581958    7000    3177    9035    5328   11877   13582    -353       0       0       0       0       0   49646
TS      19591959    -141    1170     -51    -128    -192   35438   11305    5625       0  120888    7904    6045  187862
TS      19601960    6563    7350    8274   10335    9479    -246     -30       0       0   49897    7308   24786  123715
TS      19611961    6346    6670    9354   11583   10941   11830   13937    9470    6032   21338    7205    7542  122247
TS      19621962    7164    7450    5649    8406    4398    9072       0    -341   36042   16135    2065    8286  104327
TS      19631963    1755    1369    2464    -159   33353   11867    -333       0       0       0    -121       0   50195
TS      19641964    1594    4604   13625   41408   13034   80895       0       0   46898   10840    7078    7649  227626
TS      19651965    4828    5595    8313    9901    2647   13367   19388   17879   11504    6366    9498    5261  114547
TS      19661966    6497    5647    9620    6979   11038   13037    -323   33156   10476    6352    1420     126  104025
TS      19671967     987    -159     293    6745    6963   11437    6470       0     667       0    1171     -79   34494
TS      19681968  116338    6475    7272    8870    4386    9820   13227    -313    -217       0    -134    1739  167461
TS      19691969     917    3320    6862   70167   11149    4215       0     -98       0    4563    9862   20860  131818
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TS      19701970   25972   33577    7493    9257    8767   14079       0       0   25991    2702    -184     -51  127601
TS      19711971     461    -155    -131     864    4312       0  103590    9476    -214   31821    6946    5637  162605
TS      19721972    7175    8476    8155    1934   16730    -116    -255       0       0    4715    2382     859   50055
TS      19731973   13467   16568   36338   31358   11118   10281   14042       0       0   34336    8821    1840  178168
TS      19741974    4922    4577    3452    1080    1403       0       0   20024   70895    7534    7171    7359  128416
TS      19751975    7640    6984    9019   10500    4259   10026   11433     753       0       0       0    -110   60503
TS      19761976    -166    -131    1230   18515   20604   18977   61698    -311    2750   14476    7369   20457  165466
TS      19771977    6365    6151    9016    6948    9982   14134     898       0       0       0       0       0   53494
TS      19781978       0    1896    2313    -184    -199    -140       0       0       0       0     611       0    4297
TS      19791979   14223   17104   57442   35566   94145   25235   13401    3241       0       0       0     748  261104
TS      19801980    2009    5459    5022    7765   65658    6395       0       0       0       0       0    -139   92170
TS      19811981       0    -116    8778    6332    1610  116843    -321       0    1630    3453     343       0  138552
TS      19821982    -148    1546   14361   12881   49825   29871    9069       0       0       0       0       0  117406
TS      19831983       0   10819   27966    3981   17727    -152       0       0       0       0       0       0   60341
TS      19841984    -145       0    6133       0       0    -187       0       0       0   15823    2338   14262   38225
TS      19851985   17943   19493   44584   18007   17941   24226       0       0       0   51499    7856   49198  250747
TS      19861986    7287   58549    6780     845   43603    9750   19391    1949   17546    6738    7067    4191  183696
TS      19871987    7605    5218    8662   11112    9132    7164   17761     612    2257       0     427    3909   73857
TS      19881988     722    2075    2619    -193       0   57965       0       0       0       0       0       0   63188
TS      19891989    6547   16812   27853   13952   86698    9214   11007    2068       0    -119       0       0  174032
TS      19901990    -142     817   28452   63527   10503   17225   13691   12088    2784    1992    2283       0  153219
TS      19911991   16765   13001    4339   10452   16476   11686    -297    6198    8661   34470    8734     804  131289
TS      19921992    5396    5688    7986   10664    4619   11844   17063   13286   12665    3011    8035   11262  111518
TS      19931993    5808    6701    7848    8896   10355   11347    -342       0       0   13874   10168    2248   76904
TS      19941994    2213   23714   10325    3203   50724   13580   11620       0    -231    6473   20671   29243  171535
TS      19951995    6323    6121    6807    8254    7222   11403   12747   16597   10821   12223    -152    1201   99564
TS      19961996     750    1534    -138     324       0    -230       0   27344   71631   18219    8978    6909  135320
TS      19971997    6881    5669    8359    6798    9363    9433   17312    7098       0    -168    2077   42405  115227
**
**------StillHouse Hollow
WR516131       0        19631216       1     1.0  5161DP                C5161_TS   C5161 5161001
TS      19401940    1156    2791    1386    8853    5811   13168   10175    2470    1168    3757   25009    5484   81227
TS      19411941    5462    4980    5175    5201    6900    7784    9849   10617    3140   10792    3961    3733   77593
TS      19421942    2941    2460    2417   18454    6819    9784    9128    2812   15275    6306    6320    5215   87928
TS      19431943    5238    4809    6298    6510    5653    1720       0       0       0    2407    1502    1954   36091
TS      19441944   22305   35725    5279    6478    7325   10602   11318       0    8183    5647    7619   15170  135650
TS      19451945    5126    4939    5577    5446    8277    8801    9924    7384   11941    7384    6639    5431   86867
TS      19461946    4371    4952    5659    5347    5638    9238    2431       0    3807    2756    3942    8590   56731
TS      19471947   29133    5476    5212    5446    6472    4688       0    2068       0    1060    1456    1753   62763
TS      19481948    1512   13655    2846    6254    9971     819    5258       0       0     609     880    1449   43253
TS      19491949    1153    1067   24789   38818    7897   12713    1882       0       0     651     948    1281   91199
TS      19501950     968    4664    1351    4631    6363    4229     846      12    6631     623     684     763   31765
TS      19511951       0     809     810     756    5608    3447       0       0       0     237       0     702   12369
TS      19521952       0     589    1261   19779   39082    5257       0       0       0       0    1302   16962   84233
TS      19531953    4057    2465    5762    8556   84804       0    1696       0    3733    4206    1084    1304  117666
TS      19541954    1257     841       0    1259    5505     149       0       0       0    1579   19211     723   30523
TS      19551955    2640    6499    2411    3982   56837   24199   10032       0    4776     610     560     804  113349
TS      19561956     765    1293     511     345   31436       0       0       0       0       0    5453    4408   44211
TS      19571957       0    1429   12333  166498   27754    8225    3392    1132    1869   26648    4400    5484  259163
TS      19581958    4497    4049    5600    5448    6700    8705    3983    2215    2238    1933    1674    1669   48710
TS      19591959    1505    1792    1585    2525    1420   26491    3151    7691       0   46523    5704    4637  103023
TS      19601960    4930    4860    5414    5865    7258    3613    4980    3329       0   28714    5440    3998   78400
TS      19611961    4734    4846    6134    6811    7191    6409    8018    6329    4810   10835    6657    4730   77504
TS      19621962    4480    4045    5325    5859    6107    9863    2191     506   10566   20173    2594    5245   76954
TS      19631963    2746    2037    1776    1460    3240    1138       0       0       0    2334    3451    1042   19223
TS      19641964    1466    5224    9855    9810    6911    7227       0       0   16924    2837    8948    3667   72867
TS      19651965    8203   48835   25148   10178    2928   10080    8519    3235   10555   10035    9732    3451  150898
TS      19661966    4053    3797    6209    4307    6700    9917       0   20305    6869    7337    4532    3804   77830
TS      19671967    3147    2568    2457    2791    2226     649     290       0     558    1057    1339    1088   18170
TS      19681968   73014    4329    4075    5350    4087    8038    9314    3759    3779    1746    1771    2167  121427
TS      19691969    2548    3540    7072   28375    7523    6376    1644    2782    1328   14335    8937   19431  103888
TS      19701970    8117    3549    4288    6729    6117   11072       0       0   25478    5073    2611    2720   75753
TS      19711971    2388    2575    4506    2035    2384       0   22179    7720    1511   15717    7442   26390   94845
TS      19721972    5000    5920    6284    5125    9579    5808       0    2676     137    3418    3236    2874   50055
TS      19731973   10075   16565   18498    5440    7902    8377    8602     995     655   20022    6562    6052  109743
TS      19741974    4414    5532    5191    3678   11707    4162       0   22700    7016    5804    4104    4119   78426
TS      19751975    4603    4491    5100    6070    3178    7985   10414    8370    2362    1939    1614    1808   57934
TS      19761976    2137    2374    2840   19014   16098    7932    8333    5664    5682    8754    5271    5138   89235
TS      19771977    4239    4233    6242    7000    6148    8979    4072       0    1901     570    1014     888   45286
TS      19781978     921    2901    2608    2253     996    4436       0    1098       0      83    1263     815   17374
TS      19791979    6934   13447   31250   22543   46096   13186    7837    8084    1018    1104     492    2122  154112
TS      19801980    2144    3007    3107    4984   33197    9475       0       0       0     141     650    1384   58089
TS      19811981     797    1176    6583    7148    9831   54687   11981    4567    9452    8966    6275    3250  124714
TS      19821982    2847    3065    7889    7758    6433    9101    5049       0       0     152     318     899   43510
TS      19831983    1723   10222   25200    9484   23628   10474       0     672      75     354     199     226   82256
TS      19841984    1605    1392    2488    1348       0     579       0       0       0    7740    1457    4432   21041
TS      19851985    8137   11173   33101   19323   17247   23694    1608       0       0   30285    4886   20748  170202
TS      19861986    8746    6601    7237    3894    6305    5327    5190       0   12055   13230    3974    4488   77047
TS      19871987    6714    3811    6060    7196    4435    1538   11301    5403    8132    2436    3504    5301   65830
TS      19881988    5085    4930    5382    3668       0    7353       0       0       0       0       0     814   27231
TS      19891989    2439    3371    5966    5194   25372   12504    2111     128      73    1795     655     643   60250
TS      19901990    2379    2304   16484   85689   11665   10665    9975    6095    5128    4059    5032    2237  161714
TS      19911991   12849    5146    6241    5995    2664    7000    5372    6954    6971   16481    7853   -7968   75557
TS      19921992    3502   -7362    5066    7653    8291    7349   10280    5594   14059    4896    6528    5511   71367
TS      19931993    4030    5455    3761    4847    6577    9350    9810       0       0    9974    5499    3105   62407
TS      19941994    3022   12311    8390    4219   21449    9984       0       0    2715    7343    8935   18094   96460
TS      19951995   15514    4657    4657    8597    7923    9191    7576   16073    8299    9078    1326    2182   95071
TS      19961996    1818    2826    1732    3153       0       0       0   14628   24468    7049   13221   20892   89786
TS      19971997    5640   -6656   -1196    4362    7351    1225   12386    8967       0    2938    4362   20276   59656
**
**------Georgetown
WR516231       0        19680212       1     1.0  5162DP                C5162_TS   C5162 5162001
TS      19401940     155    1311     460    1997    1415    1366    2113    1337     619    1677    2994    1087   16531
TS      19411941    1091     960     957    1019    1308    1504    1930    1551     902    2746     945    1038   15949
TS      19421942     886     741     601    2279    1197    1865    1041       0    4363    1261    1261    1042   16537
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TS      19431943    1047    1159    1082    1338    1304     416       0       0       0     343     208     105    7001
TS      19441944    4782    7062    1025    1336    1090    2067    1752       0    3161     687    2539    1359   26857
TS      19451945     940     914    1013    1003    1647    1802    2053    1610     552    1545    2412    1411   16902
TS      19461946     933     949    1088    1039    1163    1878     847       0    4327    2192     972    1063   16450
TS      19471947     874    1140    1049    1106    1320    1509       0     675       0     332     361     416    8781
TS      19481948     395     502     460    6384    6664     429     570       0       0       0       0     185   15590
TS      19491949     234     377       0    7466    1912    2572     856       0       0     231     155     345   14148
TS      19501950     306    1306     616    1373    2584    1659     403     136     373     157     142     151    9205
TS      19511951       0     191     285     375       0     218       0       0       0       0       0     123    1192
TS      19521952       0     316     557    4895    8043    1332       0       0       0       0      97    6207   21447
TS      19531953    1791    1667    1732    7782    7940       0       0       0    1998    8991    1467    1322   34692
TS      19541954     888     608       0       0     337      35       0       0       0       0      63      71    2002
TS      19551955     178     608     625     193    5221    2782       0       0       0      19      35      41    9702
TS      19561956      83      89      71       0       0       0       0       0       0       0       0    1301    1544
TS      19571957       0      10    1023   37797    1107    1745    2126     754       0    3763     892    1118   50336
TS      19581958     918     825    1097    1116    1303    1694    1306     807    2891    1310    1146    1016   15429
TS      19591959     998     737    1293     942    1297    1593    1045    2130       0    3094    1139     992   15260
TS      19601960     968     966    1084    1163    1484     954    1088       0       0    5904    1062     776   15450
TS      19611961     908     929    1225    1353    1467    1262    1552    1867    1512    1353    1013     981   15423
TS      19621962     969    1081    1226    1011    1498    1555    1512     290     805    1060     621     726   12353
TS      19631963     642     641     723     609     502     237       0       0       0       0     476     354    4183
TS      19641964     620    1483    2514    1941    1414     856       0       0    2149     891    3198    1806   16874
TS      19651965    3896   13491    1158    1145    1002    1853    2211    1039    2601    1307     976     815   31491
TS      19661966     896     784    1183     868    1161    1798       0    1049    2689    1418    1060    1011   13916
TS      19671967     811     656     496     856    2777     503     189       0     506     886    1222    1179   10081
TS      19681968    9160     971    1122    1074    1080    1597    1897     595    1365     291     386    1062   20601
TS      19691969     695    1448    3962    1063    1328    1922     644    3350    1626     936    1015    1256   19244
TS      19701970     931     762    1119    1230    1077    2058       0       0     310     256     197     181    8121
TS      19711971     181     177     176     106      96       0    3326     346       0    2039    1404    2821   10671
TS      19721972    1543    1015     648     258    1146    1797       0       0      63     855    1803     954   10082
TS      19731973    2334    5583    9104    5582    1501    1522    1858    1013     938    2359    1235    1192   34221
TS      19741974     826    1173    1185    1182    1475       0       0    5403    1518    1390    1054     984   16190
TS      19751975    1036    1069    1220    1074     914    1695    1936    1789    1012     598     522     500   13365
TS      19761976     387     325     421    5562    1181    1760    1661    2032    1187    1066    1315     918   17813
TS      19771977     890    1010    1157    1091    1400    1866       0       0       0      65     247     119    7846
TS      19781978     158     432     368     324       0     184       0       0       0       0     189     126    1780
TS      19791979    2278    9038   13653    1818    1118    1854    1685    1256     356     145     202     279   33681
TS      19801980     226     461      82    1538    7865    2049       0       0       0      43     193     668   13125
TS      19811981     609     981    2553    4144    4744    1689    2057       0    3583    1022    1187    1154   23723
TS      19821982    1057     983    1062     781     929    1316    1469       0       0       0       0     183    7781
TS      19831983    1156    7122     693    1369     861    1648       0     790       0      42       0       0   13680
TS      19841984     405     232     351     239       0       0       0       0       0    5510     962    4337   12035
TS      19851985    7437    4779    1037     892    1109    1390     338       0       0    2737    2574    2259   24552
TS      19861986    1058     678    1303    1295     883    1572       0       0     469    4114    2451     511   14334
TS      19871987    1047     685    1114    1389     652    1297    1999    1062     582      75     316    1015   11233
TS      19881988     993     620     650     477       0    2596       0       0       0       0       0      72    5408
TS      19891989     325     592    2656    1634   13451    1830     288       0       0       0       0       0   20777
TS      19901990     149     159     536     595    2043     209       0       0       0       0     191      83    3964
TS      19911991    4096    3992    2774    4298    8264    1800    2097     142    2832    1237    1378     300   33211
TS      19921992     668     792     964    1256     719    1484    1956    1041     383      96     188    1083   10631
TS      19931993    1344    3301     769    1039     935    1381    2337       0       0       6     132     294   11537
TS      19941994     334     727    1176     889    2417     924       0       0       0    2352    1068    3574   13459
TS      19951995    4076    2140    3805     821     893    1849     737       0     226       0      35      58   14641
TS      19961996      59     183      72     302       0       0       0     539    3366    3139    1217    7003   15881
TS      19971997    6852    1184    1113     258    1048    1446    2193     863       0       0     322    5106   20386
**
**------Granger
WR516331       0        19680212       1     1.0  5163DP                C5163_TS   C5163 5163001
TS      19401940    1331    1090    2020    1824    2560    1971    4463    3824      72    1584    6364    1434   28535
TS      19411941    1871    1576    1617    1825    2474    2331    3712    2890    3150    3610    2099    1444   28600
TS      19421942    1943    2132    2330     516    1974    3510    3130       0    7300    1921    1928    1324   28007
TS      19431943    1641    2304    1866    2833    2070    2112       0       0       0    1880    1616    1311   17633
TS      19441944   11512    3764    1631    2698    1313    4488    4691       0    8123    2637     893     797   42548
TS      19451945    1271    1322    1402    1510    3422    3307    4322    3475       0    4527    3595    1368   29519
TS      19461946     723    1348    1528    1862    1428    3753    2702       0    9038    2633     533    1631   27181
TS      19471947    1109    2276    1620    1981    2121    4300       0    2366       0     768    1955    1995   20489
TS      19481948    1861    1409    2021   13408    2722    2141    2088       0       0       0       0    1489   27140
TS      19491949    1507    1839       0   17407    5122    3224    2721       0       0    1627    1499    1841   36787
TS      19501950    1663    3881    2363    3997    6746    3407    1717    1172    1987    1473    1471    1412   31288
TS      19511951       0    1428    1636    1799       0    1675       0       0       0       0       0    1352    7889
TS      19521952       0    1701    2232   11749   18767    4129       0       0       0       0    1316   13273   53168
TS      19531953    4933    4676    4820    5877    2203       0       0       0     376   18518    2036     929   44368
TS      19541954    1538    2344       0       0    1810    1274       0       0       0       0    1089    1237    9292
TS      19551955    1379    2347    2383    1401   12557    7320       0       0       0    1168    1235    1173   30963
TS      19561956    1174    1205    1164       0       0       0       0       0       0       0       0    3944    7486
TS      19571957       0       0    3261   45413    1740    3428    5098    2541       0    4315     683    1738   68217
TS      19581958    1325    1229    2173    1940    2586    3392    3713    2658    3147    1463    1657    1359   26643
TS      19591959    1599     650    2866    1283    2276    3073    3136    3563       0    4370    1672    1238   25724
TS      19601960    1432    1539    2140    2178    3142    3130    3231       0       0    7414    1159     275   25640
TS      19611961    1049    1427    2451    2964    3173    1615    2643    4248    1803    2128    1013    1103   25617
TS      19621962    1249    2105    2664    1807    3333    2641    4166    1515    2938    3460    2528    2377   30782
TS      19631963    1619    1553    2597    2315    2170    1630       0       0       0       0    2209    1861   15954
TS      19641964    2353    4272    6539    5239    4180    3083       0       0    5896    3087    8198    3607   46456
TS      19651965     864     705    2206    2337     879    3902    5139    3958    3222    1819     871     522   26422
TS      19661966    1086     846    2467    1554    2140    3916       0    5113    5877    2606    2439    1431   29475
TS      19671967    2012    1913    2460    2586    2138    2412    1103       0    9143    4195    1401    1121   30482
TS      19681968     449    1692    2025    1895    1215    2172    3962    4522    1979    2716     730    1408   24764
TS      19691969    1740    1012    1521    1553    2418    4252    4381    4473    2932    1514    1604     687   28086
TS      19701970    1289     889    1852    2284    1781    4516       0       0    7683    4393    2965    1993   29645
TS      19711971    2221    2051    2740    2385    2799       0    1799    3754       0    2079    9193    1428   30449
TS      19721972    1210    2192    3022    2881    1987    3721       0       0    1685    9970    1298    1458   29424
TS      19731973     507    1226    1616    1657    3155    2359    3914    3546    2609     279    2008    1888   24763
TS      19741974     654    2442    2475    2872    2417       0       0   10448    1337     914    1070    1264   25893
TS      19751975    1682    1631    2396    1762     683    3070    3905    3521    2703    2387    2337    1253   27330
TS      19761976    1993    2328    1895     436    2000    3237    2733    4435    1971     809    1355     786   23978
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TS      19771977    1175    1858    2186     967    2797    3999       0       0       0    2130    2528    2196   19835
TS      19781978    2213    4384    3453    3674       0    2386       0       0       0       0    2776    3128   22013
TS      19791979   11658    8229    1517    2020    1189    4091    2895    3733    2846    2896    1885     802   43759
TS      19801980    1071    1665    1882    2461    1509    4418       0       0       0    1988    2505    3209   20708
TS      19811981    2878    4102    5480    1735    1132      57    3834       0    6483     783    1966    1993   30445
TS      19821982    1830    1876    1766    1584    1425    1956    4368       0       0    1232    2264    2819   21119
TS      19831983    3667    4457     865    3309     819    2381       0    3761       0    1316    2678    2123   25376
TS      19841984    3091    2162    3068    1506       0       0       0       0       0   22949    1502    -110   34168
TS      19851985    1767    1821    1842    2563    2501    2866     903       0       0    9212    4394    1419   29288
TS      19861986    1725    2065    3052    2936     907    2872       0       0    4118    6633    1506     332   26146
TS      19871987    1813    1235    2411    3297     536    2050    3769    5016    3234    2972     662    1177   28172
TS      19881988    1967    2040    2200    2940       0    5754       0       0       0       0       0    1432   16334
TS      19891989    2407    2113    3892    3020   14408    2357    2121     899    1165    1547    1491    1240   36659
TS      19901990    1888    2278    7716    3902    2350    2356    1046       0    1164    1125    1694    1336   26855
TS      19911991   10093    1383    2541    2476    1767    2549    3781    2556    2769    2400    1860   -2166   32008
TS      19921992     943     970    1787    2406    1347    2721    4073    3924    3354    3081    1331     630   26567
TS      19931993     899    1708    1840    2204     935    1653    5327       0       0    1738    2737    3092   22134
TS      19941994    3057    2636    2934    1831    2829    2095       0       0       0   11254    2897      75   29608
TS      19951995    1550    1738    1526    2310    1298    3208    3560    2704    1822    1651    1931    2384   25681
TS      19961996    2053    2588    1371    1894       0       0       0    1518   20870    2389     866    1216   34764
TS      19971997    1616     658    2086    2366    1611    2621    4669    4701       0    4793    2326     544   27990
**
**------Somerville
WR516431       0        19631216       1     1.0  5164DP                C5164_TS   C5164 5164001
TS      19401940     108    3838      98    2140   11279    4812   15267     147     370     903   18803    1137   58902
TS      19411941    3036    2074    2300    2159    5685    6329   12210    1323     292    1208    8654    1486   46755
TS      19421942     928     928     851   19656    2466    1999    3326       0    3205     515    2911    3225   40009
TS      19431943    9912    1207    8698    1690    6762    3875     176      75     784     797     127     811   34914
TS      19441944   40703   17755    1705    3217    3162    4143     691       0   10627     104   28645    -448  110303
TS      19451945    2828    2137    1872    4131    5969    8668    1945   16928    7406    2211    1667    3726   59487
TS      19461946      22    1787    2061    3941    1549    6781     522       0    3322    4266   23070    2071   49392
TS      19471947     296    2637    4426    4929    4315    1728    1994   28175     538      98      78    1761   50974
TS      19481948     400    6859    1139     378    5589     327     876       0      87      94      78     101   15927
TS      19491949    1126   26507   16872   28946    8265    5120     317       0       0   31137     677    4840  123806
TS      19501950    2181    1610    2839    4087    5693    8148    2172      72   12592     146      78     101   39718
TS      19511951       0     244    4599    2691     675    1704       0       0     180       0       0     101   10193
TS      19521952       0     926     535    5480   17468    1985       0       0       0       0    3034   18216   47644
TS      19531953   16120    4308    1894    6315   69449     232    6117     633    3877   18550    7391   11119  146003
TS      19541954    2393    1268       0    1000    6683     614       0       0       0     250     206     279   12692
TS      19551955     334   17183     328    3955     366    4666     428       0     520     613     299     183   28875
TS      19561956     372   12938    3385    3745    2120       0       0       0       0       0       0     717   23276
TS      19571957       0     359   13643  133269   23722    8786     794     527   15408   12479     -14    2169  211142
TS      19581958    1484    3202    4701    4551    7448     971   13258     365   19096    1571    2230    1268   60144
TS      19591959    3077     243    4633    3479    4634    1586     370     152     212    3007   13465   19171   54029
TS      19601960    1654    1963    4817    3838    8856    5814    4429    1764     624   17742     790    -621   51668
TS      19611961    1780    1202    4751    4377    7901    8788    9151    1092   13459    2552    1955    1335   58344
TS      19621962    1692    4589    5082    3939    7048    8918    9558     583   12079   14254    1859     884   70486
TS      19631963    2459    3250    3957    8840    1694     673     728       0       0       0     421    1476   23497
TS      19641964    1063    3694   13467    2989    2983    2466       0       0    2139    4321    1996    3562   38681
TS      19651965    4955   72693    4563    3704    5949   10966     841    1117     268    1752   28637   -1412  134033
TS      19661966    1273    2133    6461    3762    6135    1162    1010     795    8941    2049     984     586   35293
TS      19671967    1779    1123    1121    3354    6778    3611     496       0    3737    1147    3501     287   26934
TS      19681968   75094    3187    4180    3361    2376    -360   10562    5146    8780    3037     -94    1060  116328
TS      19691969    3239    2483    3486     125    6209    2102      66      60     868      89    2026   12485   33238
TS      19701970    8138   26009    2979    5075    5415   12743     467       0      78    1392      65     301   62662
TS      19711971     587    1227    1133    1227      79      66      71     613      81     900      74   14727   20782
TS      19721972      62    2040    1412    1344   21749   13222       0     896      76     836      69      93   41798
TS      19731973   35464   28672   39224    7354    7850    4880    3730      60    1954   14195    3234    1836  148452
TS      19741974    -417    5874    4723    3396    7672   14009       0    5066   15808     946     -35    2329   59369
TS      19751975    2450    3710    5527    4000    2748    8785   10851    6258    3387     777     667    2789   51948
TS      19761976    3181    3240    8405   10004    6061    7755    5972     236    2671   14459    4247    1155   67386
TS      19771977    1857    3682    5141    3267    5485    4583      60     206     898      76     692    1432   27378
TS      19781978    6380   13996    8853    3563    9169   19871    3135    1956    5714      83   10019    5953   88692
TS      19791979   21155    2986    4049    4281    5019   10992   10357      57      59     303      51    3534   62842
TS      19801980   17037    2842    2205    6545    4097    3616    1190       0      84      84      71      95   37866
TS      19811981    1531     835    2347    1874    7561   53211   12320      61     318   15063    1926     494   97539
TS      19821982    1102    2019    2944    8822    4918    7150      67      58       0     821      65    5762   33727
TS      19831983   18689   14532    2538    3173    6488   10490    1098    5554    2976     427      66      87   66116
TS      19841984    3131    2057    6221    6294    3520    1315       0       0       0   37675   20545    6065   86823
TS      19851985    2308    1857    2939    5288    6442    4759    2129       0     513   16425   21575    2347   66583
TS      19861986    3018    3147     716    1861   12517    4462   13390    2171    4142    7017    3822    -383   55881
TS      19871987    2502    1017    5533    4081    8401    7372   13572    6728     769      94     442    2237   52747
TS      19881988    1520    1384    3698    2654    2438    5444    1101      42       0       0       0      95   18375
TS      19891989   10085    1726   13224    3710   15931    7959     645     476      75      87      75      91   54083
TS      19901990     958    2672    1029   21940   10246      60     402     160      76      94      69      98   37802
TS      19911991  100559    3628    4281    3069    4769    7058    1323     274    1029    2049    2312   26599  156948
TS      19921992     407    1468    4539    5072    2363    7768    7337    3292    3073    2199    7504   12801   57823
TS      19931993      55    2976    4311    4844    3702    4859    6221    3761    2803    6963    3355    2855   46704
TS      19941994    1941    5531    6024    2366    7900    2708    2762    5189     991   25381    3132   -1578   62346
TS      19951995    3329    3985    3628    5083    3610   11268    3274    6325    3890    1417    5133    2281   53224
TS      19961996    1232    1587    1542    1992       0       0       0    2422    5499    2496    1855    1319   19944
TS      19971997    1740   20623   12924    8889    5797    6760    8595    8059    7487    2680    3083    4586   91224
**
**------Limestone
WR516531       0        19740506       1     1.0  5165DP                C5165_TS   C5165 5165001
TS      19401940     224     911     239    4927   19924    5359   11400     217     220     208   32165    2291   78083
TS      19411941    5511    4578    5786    5234    7171    7967    8939    1282     538     283     515     858   48661
TS      19421942     443     741     557   40326   20113    9682     343       0   12009     875    7255   18132  110475
TS      19431943    6770     733    5530    5308    4421    6900     322     135     126    1860     484     551   33140
TS      19441944   39068   31140    5444    3866    8533   12018     302      90     536     153    9745   38830  149723
TS      19451945    5107    3210    3641    5981    8074    8905    7482   11682   12206    4865    3046    8399   82600
TS      19461946    2150    4246    4419    6523    4759   11558     865       0    1510     443   42019    5020   83512
TS      19471947    3451    3498    8594    6309    6233   11959     456     643     294       2     245    1617   43299
TS      19481948    3332   17978    8943    8641   21557     524    1305     169     178       1       0     504   63130
TS      19491949   15262    4542   29796    8956    1436    6190     965       4       0   29777     521    1145   98594
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TS      19501950   20547   47234    1855   12742    5273    6605    1043     233     202     185     314     244   96476
TS      19511951       8     424     835     676       0    1591       0       0    1971       0       0     378    5883
TS      19521952       0    3773    4844   12239   30083     663       0       0       3       0    1806   11531   64942
TS      19531953   16319    1523   51253    2916  124193     439     435     345     397    1807    3050   54705  257382
TS      19541954    5860     814       0       0   18271     273       0       0       0       0     632     888   26738
TS      19551955    1016    7004    4801   16745    6515    3025     454       0     166     263     126     187   40301
TS      19561956     390    3734     321       0   14045       0       0       0       0       0       0     185   18675
TS      19571957       0       0   15677   95256  111328    9804     251     174     228   36763     878    2840  273197
TS      19581958    4928    4418    3589    4599   12786    7454     495      48   30578    6825     600    1367   77687
TS      19591959     952   14736    3353   10368    6440    9853    4557     832    1009    8070   16949    8959   86077
TS      19601960    3764    4221    7052    4614   11897    7518    1025     496     306    7171   16012   17570   81647
TS      19611961    4459    5302    6548    3606    1221   22478   10568     660   13524    1369    3582   11733   85051
TS      19621962    2618    5564    3422    5963   12334    8280    1057     171     238     576     880     742   41845
TS      19631963     397    1150     908     755     930     229     121       0       0       0     133     247    4871
TS      19641964    1415    1063    2896    2176     633     154       0       0    1685     171    1259     256   11709
TS      19651965   18319   27611   23178   62013   96500   12347     467     120     319     189    1704    2083  244848
TS      19661966    1488   11984    6230   40499    8438     659     121   19895   23238     992     387     775  114707
TS      19671967     622     444     952    5457    6273    3663     191       2    2171    1110   13706   23174   57764
TS      19681968   49877    5180    7149    6265    6424    7783    7645     236     526     256    2690   14126  108157
TS      19691969    6926   20730    5638    7532    6636     473     178     986     119    1072    3830   43479   97598
TS      19701970   12260    3665    6139    5865    1241     421     121       4    2226   11075     532     420   43969
TS      19711971     425    4573     807     516    1047     154       0     813     547    1692   10517   62009   83100
TS      19721972   26996    6883     691     372     194     969       0     350     119    4707    7543   11357   60180
TS      19731973   53809   12234   29347    5213    9331    8453    3673     310    2328   24720    5902    4904  160223
TS      19741974    2660    7811    8570    9105    9072     502       0    1463   37860    3830    3932    3666   88470
TS      19751975    5057    5480    6271    5174    5986   10731    8273     759     656    3345    1012    1098   53843
TS      19761976     760    1273    8231   47141    7463   11385    9897     448    1964   20651    4283    4229  117725
TS      19771977    3886    7473    6831    6351    9616    4194     276     120    1018     175     379     546   40866
TS      19781978    2104   11263   20213    1448    1447     597       0       0    1450       0    8077    2612   49210
TS      19791979   21499   23073   66090    7308    2507   14114    6389    4862    4560    1150      49   17693  169295
TS      19801980    8827    6296    6281    8413    6756    1264     544       3     348      41     454     441   39666
TS      19811981    1169    3496    3205    3452    9831   84322    7334      11     126   26838    1743     477  142003
TS      19821982    2152    2835   16178    9424    6920       0     147      98       0      68    2920   34285   75026
TS      19831983    5087   24172    6321    2921   13691    2666    1209   11281     123     700    1009     474   69655
TS      19841984    2213    5050   20068    2006     183    2042       0       0       0   58920   15662   22443  128588
TS      19851985    4593    4285    6213    2756    4201      87     125       0     307    8412   54491    4459   89930
TS      19861986    2363   10480    3737   12496    6413    8159     501     125     115    4962   25330    9898   84580
TS      19871987    5416    3630    8688    2850    7727   14779    1071      95     476     455    1993   25254   72432
TS      19881988    4077   12445   16731    2650    2899    1282     322     719       0       0       0    2397   43522
TS      19891989     857    4163    3578    2819   89507    8303    4489     228     233     830     351     212  115571
TS      19901990    4288   11090   39956    6356    9555    4349     586     949    3788    3259   13388    6422  103987
TS      19911991   26485    5424    8080    6226    7576    7505    1585    3229    4229    5742    7028   30589  113698
TS      19921992    4590    5574    7064    4250    9917   10386       0     156       0      23    1206   22438   65602
TS      19931993   17112   13061    7019    6936    7701    8488    1634     855     577    9565     491    1683   75120
TS      19941994    1282   50230    6865    5009   10366   11859     477    2230       0    6861    5726   31762  132667
TS      19951995    6605    5022    5832    6849    8073    2111    2216   30115    5022      28      99    1202   73175
TS      19961996    1072    1629    1334    1243       0       0       0       0      33       0     715    3351    9377
TS      19971997    6298  104971    6731    6094    8438    9283     953    1542       0     131     915   27574  172930
**
**------Allens Creek
** Dummy WS Card added to locate Allens Creek at COntrol point 292531
WR292531       0        19990901       1     1.0  2925DP                C2925_TS   C2925 2925001
TS      19401940       0      82       0     656       0       0    4981       0       0       0       0   14479   20198
TS      19411941    9638    7462    8885   10070   12450   11586       0       0    9059    6045   10459    2465   88120
TS      19421942    1714    1454    1564       0   12893   11285   11400       0    1649    1278    2291       0   45528
TS      19431943    4540     947    1782    2074       0    3107    5644    3389       0     597    1059    2792   25931
TS      19441944    5183    3026    7963    7166    2496    8948    1138       0       0       0       0    3230   39149
TS      19451945    1496    5053       0       0    3206       0    2534   10953    5858      38     978    6081   36195
TS      19461946       0    2939    8253    4916    4494    8804    7083       0    1222    1787    5349    1210   46057
TS      19471947    1703    2844       0     472     737    2768    1058      70    3959       0    1904    5809   21322
TS      19481948    1120    1055    9402     899     499     327    1984       0       0       0       0       0   15287
TS      19491949       0       0    1765       0    6432       0    4298       0       0       0    3336    4139   19970
TS      19501950    5556       0    3805       0    3309   10077       0       0       0    1739       0       0   24487
TS      19511951       0       0       0     884       0       0       0       0       0       0       0       0     884
TS      19521952       0       0    1119    6782     901    3973       0       0       0       0       0    2245   15019
TS      19531953    1688     102     378       0    4683    2597       0       0    3881       0    5838    4345   23513
TS      19541954    3443       0       0       0       0    2205       0       0       0       0       0       0    5648
TS      19551955       0    1913       0       0       0    2097       0       0       0     900       0       0    4910
TS      19561956       0       0       0       0       0       0       0       0       0       0       0       0       0
TS      19571957       0       0    5246       0   17382   16272   16716    5048    1642   13743    7507    6899   90455
TS      19581958    6379       0   10239       0       0    5122    3975       0     482    6491    1681     945   35314
TS      19591959       0    2225    4734    7542   10422    3967    2346    2553       0       0    8251    3352   45392
TS      19601960    5228    5983    4869     880    9779    8922    8491    2380       0       0    8192    5480   60203
TS      19611961    8321    8853    8129    6587    3264    6383   12917    7993    7580    6129    7199    5051   88405
TS      19621962    2515    3668    2236     359    3284     472    3416     614       0    4019       0     911   21494
TS      19631963    6121       0    2411       0       0       0       0       0       0       0       0    1082    9614
TS      19641964       0    2674    2247       0    2744       0       0       0       0    1881    1575    1934   13054
TS      19651965       0       0    4750     444    5719   15498    3838    4138    2290    1952    5836    1121   45586
TS      19661966    1133    1065    2682       0   13930    5576    2685    3012       0    4515       0       0   34597
TS      19671967       0       0       0     290     249    2068       0       0    1652       0     468       0    4727
TS      19681968    4794    6320       0       0   10207    8896    3643    2581    1830    3138       0    4673   46081
TS      19691969    2043    5158    3330    5922   10649    3910    2026       0    1529     441     239       0   35246
TS      19701970      49       0    7713    4654    1999    4775    1579       0     156    7476    2423       0   30824
TS      19711971       0       0       0       0     122       0       0    1467    2879       0    4030    4841   13340
TS      19721972    6097    5834    3983       0   11437    3342       0       0    1122       0    4801    1650   38265
TS      19731973       0    4911     978    8573   12927    7492    7642    3912    2489    7019   10003    7841   73789
TS      19741974    5036    9532    3910    1294    5109       0       0       0    5702    9628    7245    7793   55249
TS      19751975    5011    8747    7573    5619    1233   10426    9138    4815    2368    1075     945    2187   59137
TS      19761976    1595    2230    1313       0    4924    5281    4091    3484    1915       0    4165    4361   33358
TS      19771977    7141    6069    2383       0    8166    9715    4251       0    2276       0     195     801   40996
TS      19781978    5179    7076    2720       0       0    2811       0       0    3699       0    1987    4324   27796
TS      19791979    5730    6754    4938    9523    5584   15268       0    8133    8501    2507    1270    2336   70543
TS      19801980    6111    6970       0    5616    6263    7075       0       0       0    1613       0       0   33647
TS      19811981       0     588    1055     456    2209    7488   13986    4061    5760       0    9030    2773   47405
TS      19821982     610    1108       0    1931    1641    6942   10812    2238       0       0    6205    4168   35654
```

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TS      19831983    3099    6406    6912    6353    3552    7169    2735    3982    4298       0       0    2780   47287
TS      19841984       0    1786    2152       0    1425     677       0       0       0       0    8753     193   14985
TS      19851985    3944     342    7747    5057    1876    3816    2388       0       0     314    6264    9050   40798
TS      19861986    5299    1717    4594    2225    5066    9151    4666    3218    1810    3892    3980    5348   50965
TS      19871987    7966    2807   11494   11354    6000   12701   13756    6494    2166    1955    2695    2852   82239
TS      19881988    5212    1993    1018    2002     247    3066       0       0       0       0       0       0   13538
TS      19891989     302    4007       0    5357    1618   10496    9068    5632    1032       0       0       0   37510
TS      19901990    1469    2307     847       0       0    1151    1733       0     902       0     903       0    9310
TS      19911991    5433    7162    3476    7840    8785    7217    3659    1724    1912     843     644   -3815   44879
TS      19921992    8460       0   10679   10055       0    2114    4410    6824    3123     722    1665    3304   51356
TS      19931993    5427    5293    2080    7904    9639    9941    8304     890     731    1622    2216    1940   55985
TS      19941994    1809    2651    3855     520    4918    5943    2735       0    2138   13751    5905    4658   48881
TS      19951995    8925    5647    7260    6073    6046    9550    2865    3874    1620    2275    2286    3306   59725
TS      19961996    3528    2248       0       0       0       0       0       0    5242    4721    1875       0   17614
TS      19971997    2438       0    8536    5594    3154    2724    6967    3317    3097    6870    1578    6439   50713
WSALLENS       0
**
**------Allens Creek from the Brazos. (This diversion allows to refiil A Creek with Brazos River water.
** Diversion subject to IF requirement, and annual limit of 202,000 af/y.
WR292504       0    MUN419990901   1   1                                C2925_2   C2925 2925001
WSALLENS  145533
SO        130680  202000
**
** ------------- BEGIN OF SYSTEM OPERATION ---------
** Return flow from d/s reservoirs. This helps to meet IFs and increase the diversion at Glen Rose
WR5157DP 999999.        21111111          1.0000  515731            C5157_DPRETQ  SYSTEM
WR5158DP 999999.        21111111          1.0000  515831            C5158_DPRETQ  SYSTEM
WR5159DP 999999.        21111111          1.0000  515931            C5159_DPRETQ  SYSTEM
WR5160DP 999999.        21111111          1.0000  516031            C5160_DPRETQ  SYSTEM
WR5161DP 999999.        21111111          1.0000  516131            C5161_DPRETQ  SYSTEM
WR5162DP 999999.        21111111          1.0000  516231            C5162_DPRETQ  SYSTEM
WR5163DP 999999.        21111111          1.0000  516331            C5163_DPRETQ  SYSTEM
WR5164DP 999999.        21111111          1.0000  516431            C5164_DPRETQ  SYSTEM
WR5165DP 999999.        21111111          1.0000  516531            C5165_DPRETQ  SYSTEM
WR2925DP 999999.        21111111          1.0000  292531           ALLENS_DPRETQ  SYSTEM
** Refill U/S reservoirs with BRA water.
WR515531      0.        22222222                                     C5155_RF1_2  SYSTEM
WSPOSDOM 724739.                                0
SO                        5155DP
WR515631      0.        22222222                                     C5156_RF1_2  SYSTEM
WSGRNBRY 155000.                                0
SO                        5156DP
**
**  Lyons Method at Glen Rose.
**
IFBRGR30 148800.  IFBRGR22222222   1   2                IF_BRGR
**
**
** Refill U/S reservoirs with Q unap
WR515531      0.        22222222                                     C5155_RF1_2  SYSTEM
WSPOSDOM 724739.                                0
WR515631      0.        22222222                                     C5156_RF1_2  SYSTEM
WSGRNBRY 155000.
**-------------
** System Diversion at Glen Rose.
WRBRGR30 356000.    MUN133333333   2                               SYSTEM_BRGR  SYSTEM
WSPOSDOM 724739.                                0
OR       217422.       1
WSGRNBRY 155000.                                0
OR        46500.       1
** Interruptible diversion at Glen Rose.
WRBRGR30 157000.    MUN188888888   2                          SYSTEM_BRGR_7575  SYSTEM
WSPOSDOM 724739.                        0326133.
OR515531 525436.       1
WSGRNBRY 155000.                        0069750.
OR515631 112375.       1
**-------------
** Refill u/s reservoir with BRA water after system diversion at Glen Rose
WR515531      0.        44444444                                     C5155_RF2_4  SYSTEM
WSPOSDOM 724739.                                0
SO                        5155DP
WR515631      0.        44444444                                     C5156_RF2_4  SYSTEM
WSGRNBRY 155000.                                0
SO                        5156DP
**-------------
** We're done with u/s reservoirs. Then, return all dummy water.
WR5155DP 999999.        55555555          1.0000  515531            C5155_DPRETQ  SYSTEM
WR5156DP 999999.        55555555          1.0000  515631            C5156_DPRETQ  SYSTEM
**
**  Lyons Method at Richmond.
**
IFBRRI701539598.  IFBRRI66666666   1   2                IF_BRRI
**
** ------------
** Refill d/s reservoirs with QUNAP
WR515731      0.        66666666                                     C5157_RF1_6  SYSTEM
WSWHITNY 437024.                        387024.
WR515831      0.        66666666                                     C5158_RF1_6  SYSTEM
WSAQUILA  52400.                                0
WR515931      0.        66666666                                     C5159_RF1_6  SYSTEM
WSPRCTOR  59400.                                0
WR516031      0.        66666666                                     C5160_RF1_6  SYSTEM
WSBELTON 457600.                           1200
WR516131      0.        66666666                                     C5161_RF1_6  SYSTEM
WSSTLHSE 235700.                                0
```

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WR516231      0.        66666666                                    C5162_RF1_6  SYSTEM
WSGRGTWN  37100.                              0
WR516331      0.        66666666                                    C5163_RF1_6  SYSTEM
WSGRNGER  65500.                              0
WR516431      0.        66666666                                    C5164_RF1_6  SYSTEM
WSSMRVLE 160110.                              0
WR516531      0.        66666666                                    C5165_RF1_6  SYSTEM
WSLMSTNE 225400.                              0
WR292531      0.        66666666                                   ALLENS_RF1_6  SYSTEM
WSALLENS 145533.                              0
** System diversion at the Gulf. (Pick up remaining yield with d/s reservoirs)
WRBRGM73 464000.    MUN477777777   2                               SYSTEM_BRGM  SYSTEM
WSGRNGER  65500.                              0
OR516331  19650.       1
WSGRGTWN  37100.                              0
OR516231  11130.       1
WSSTLHSE 235700.                              0
OR516131  70710.       1
WSBELTON 457600.                           1200
OR516031 137280.       1
WSAQUILA  52400.                              0
OR515831  15720.       1
WSPRCTOR  59400.                              0
OR515931  17820.       1
WSWHITNY 437024.                         387024.
OR515731 387024.       0
WSALLENS 145533.                              0
OR292531  43660.       1
WSLMSTNE 217494.                              0
OR516531  65248.       1
WSSMRVLE 160110.                              0
OR516431  48033.       1
**
** Backup the Gulf diversion with upstream reservoirs.
WRBRGM73            MUN477777777   2                            SYSTEM_BRGM_BK  SYSTEM
WSPOSDOM 724739.                              0
OR       217422.       1
WSGRNBRY 155000.                              0
OR        46500.       1
SO                               BACKUP
**--------------
** Final refill of all reservoirs. (Just to make sure we get all water)
WR515531      0.        99999998                                    C5155_RF3_9  SYSTEM
WSPOSDOM 724739.                              0
WR515631      0.        99999998                                    C5156_RF3_9  SYSTEM
WSGRNBRY 155000.
WR515731      0.        99999998                                    C5157_RF2_9  SYSTEM
WSWHITNY 642179.                         387024.
WR515831      0.        99999998                                    C5158_RF2_9  SYSTEM
WSAQUILA  52400.                              0
WR515931      0.        99999998                                    C5159_RF2_9  SYSTEM
WSPRCTOR  59400.                              0
WR516031      0.        99999998                                    C5160_RF2_9  SYSTEM
WSBELTON 457600.                           1200
WR516131      0.        99999998                                    C5161_RF2_9  SYSTEM
WSSTLHSE 235700.                              0
WR516231      0.        99999998                                    C5162_RF2_9  SYSTEM
WSGRGTWN  37100.                              0
WR516331      0.        99999998                                    C5163_RF2_9  SYSTEM
WSGRNGER  65500.                              0
WR516431      0.        99999998                                    C5164_RF2_9  SYSTEM
WSSMRVLE 160110.                              0
WR516531      0.        99999998                                    C5165_RF2_9  SYSTEM
WSLMSTNE 225400.                              0
WR292531      0.        99999998                                   ALLENS_RF2_9  SYSTEM
WSALLENS 145533.
**
** End of System Operation Modeling
```

Appendix F
Flow Statistics at Selected Stream Gauges

Table F-1

Brazos River at Waco

Monthly Regulated Flow Statistics

Values in Acre-Feet

Min

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	0	0	1,085	1,637	4,363	43	70	22	0	0	0	201
Base Run 2060 Return Flows	0	0	0	1,669	6,331	120	0	0	0	0	0	3
Firm Yield Glen Rose	0	36	1,173	3,620	6,330	119	0	0	0	0	0	3
Firm Yield at Highbank	8,720	12,485	30,627	29,159	50,279	43,383	54,936	35,097	37,507	18,151	14,542	5,080
Firm Yield at Gulf	0	3,920	1,853	6,364	6,330	119	2	0	84	0	0	922

10th Percentile

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	1,926	2,848	4,047	8,879	10,294	8,433	1,537	681	1,477	1,076	1,195	907
Base Run 2060 Return Flows	2,279	2,228	2,241	9,248	10,054	8,066	1,976	728	2,000	115	1,043	1,213
Firm Yield Glen Rose	2,613	5,338	5,047	10,706	16,256	7,982	2,069	1,596	2,506	1,361	1,400	1,370
Firm Yield at Highbank	32,196	30,957	37,061	41,536	55,836	53,034	57,005	49,919	44,435	35,679	30,597	28,182
Firm Yield at Gulf	4,156	5,360	5,472	17,322	20,129	18,530	6,652	2,533	3,836	2,637	3,073	3,221

25th Percentile

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	4,952	6,143	6,481	18,750	29,735	17,656	5,474	3,775	5,736	3,657	3,941	4,389
Base Run 2060 Return Flows	5,590	5,396	5,569	18,620	28,280	17,857	5,019	3,198	4,509	2,670	3,584	3,630
Firm Yield Glen Rose	6,001	9,408	9,121	22,569	31,594	25,837	5,377	4,614	5,915	4,656	5,005	5,107
Firm Yield at Highbank	35,133	34,853	39,077	51,842	71,569	66,812	60,313	52,673	47,338	39,399	34,660	34,009
Firm Yield at Gulf	7,623	12,664	12,741	32,315	58,661	48,410	18,183	10,104	12,504	8,200	5,951	6,149

Median

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	11,426	19,851	24,801	39,836	118,578	62,028	16,574	10,955	13,832	13,381	8,019	9,488
Base Run 2060 Return Flows	10,275	21,495	24,661	42,710	128,049	65,261	17,311	9,699	10,309	16,970	7,420	9,807
Firm Yield Glen Rose	12,807	19,254	24,710	41,569	124,205	63,771	19,107	10,786	10,916	10,942	7,319	10,034
Firm Yield at Highbank	41,891	42,973	50,586	66,590	128,033	104,421	71,164	58,473	53,165	44,594	38,303	38,108
Firm Yield at Gulf	35,549	40,272	60,875	64,915	150,142	129,204	71,820	49,740	61,833	61,290	19,260	36,185

75th Percentile

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	55,100	78,842	120,781	140,370	378,892	280,383	46,315	19,543	28,863	68,688	40,646	65,148
Base Run 2060 Return Flows	57,584	92,161	122,184	141,833	385,469	286,331	47,095	17,979	27,164	71,826	34,820	56,413
Firm Yield Glen Rose	48,160	84,758	101,690	132,554	355,886	262,356	51,675	19,905	22,688	36,536	32,608	62,587
Firm Yield at Highbank	54,750	93,852	134,560	164,338	427,238	286,007	87,640	68,227	66,204	83,513	53,991	70,179
Firm Yield at Gulf	80,166	104,498	154,985	164,338	464,878	324,596	135,178	142,510	125,411	116,244	86,275	86,271

90th Percentile

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	109,622	251,474	308,532	461,714	738,448	517,554	147,796	52,591	78,679	272,609	125,334	154,524
Base Run 2060 Return Flows	112,720	258,472	310,853	463,444	739,778	519,169	147,724	49,052	88,259	282,882	147,352	158,058
Firm Yield Glen Rose	104,923	203,164	278,819	434,584	685,543	497,946	126,060	61,596	73,084	154,390	110,030	159,040
Firm Yield at Highbank	120,674	230,785	331,736	467,977	737,388	541,314	182,039	93,226	119,633	276,231	155,343	159,816
Firm Yield at Gulf	121,461	225,083	334,333	465,993	767,603	551,379	185,655	175,429	141,695	328,103	167,043	173,615

Max

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	633,081	1,261,441	740,063	1,271,848	3,130,643	815,404	305,267	346,467	463,692	703,151	488,835	2,033,276
Base Run 2060 Return Flows	634,750	1,263,304	741,713	1,280,015	3,132,495	816,988	306,707	353,134	466,741	737,232	491,485	2,035,115
Firm Yield Glen Rose	622,836	1,253,107	731,111	1,229,752	2,767,767	805,831	295,146	258,812	412,617	648,840	411,388	2,024,172
Firm Yield at Highbank	651,458	1,280,862	761,902	1,246,187	2,841,444	849,198	345,019	372,904	471,888	683,100	512,163	2,053,662
Firm Yield at Gulf	651,458	1,280,862	761,902	1,231,558	2,683,759	849,198	345,019	410,396	527,645	765,973	512,163	2,053,662

Average

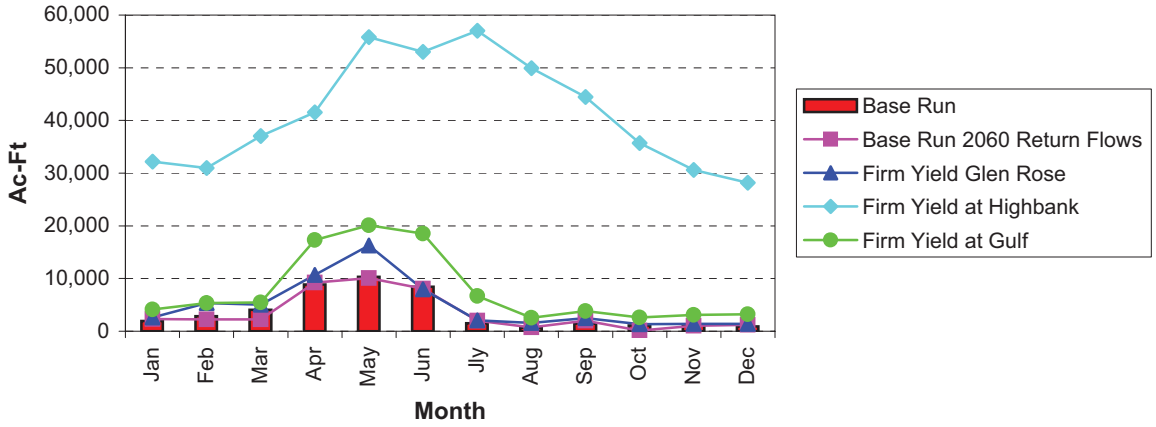
	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	54,622	98,855	105,378	156,210	312,870	173,813	48,049	25,983	40,547	85,147	46,075	78,139
Base Run 2060 Return Flows	55,899	99,820	107,864	158,166	317,933	176,382	47,576	24,719	40,578	86,563	46,686	80,370
Firm Yield Glen Rose	50,666	94,348	99,484	146,350	291,982	164,408	44,643	23,955	35,268	62,144	38,989	77,031
Firm Yield at Highbank	75,111	118,025	130,393	177,252	332,313	206,581	96,400	72,027	77,032	104,341	69,616	100,220
Firm Yield at Gulf	68,482	113,233	127,168	174,532	336,856	210,183	90,809	79,380	80,294	113,903	59,545	95,890

Standard Deviation

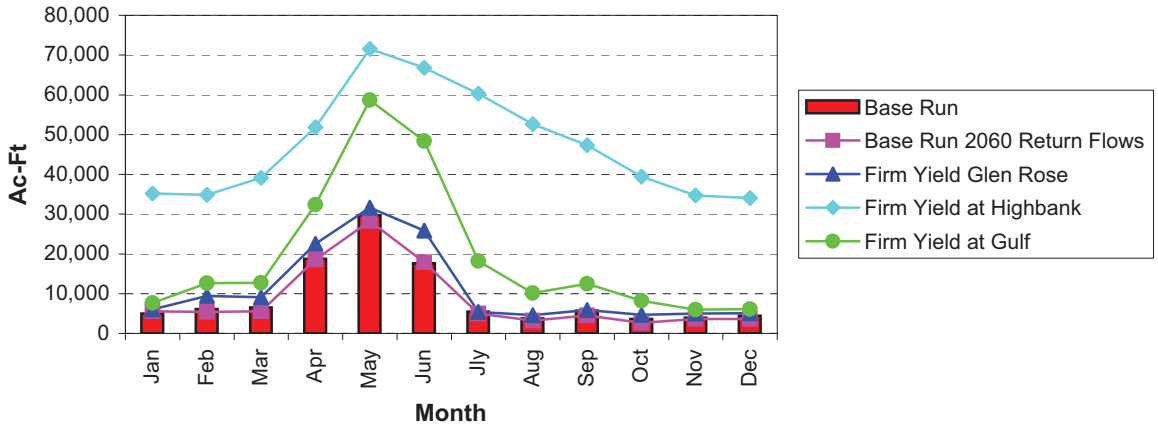
	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	114,879	220,354	173,836	265,972	504,917	220,499	74,480	53,528	86,627	165,296	86,246	270,698
Base Run 2060 Return Flows	116,868	221,172	174,397	268,375	506,071	222,354	75,189	54,097	87,125	169,566	88,560	272,112
Firm Yield Glen Rose	107,719	214,877	165,064	246,454	458,725	209,616	66,481	43,208	75,908	132,741	76,566	268,869
Firm Yield at Highbank	109,020	218,706	170,879	256,451	466,009	209,921	68,050	49,890	77,928	145,005	83,751	269,325
Firm Yield at Gulf	114,344	222,555	178,514	258,969	461,899	225,357	84,791	81,494	92,263	172,112	90,417	272,893

Table F-1a
Brazos River at Waco
Low Flow Statistics

Brazos River at Waco - 10th Percentile Regulated Flows



Brazos River at Waco - 25th Percentile Regulated Flows



Brazos River at Waco - Median Regulated Flows

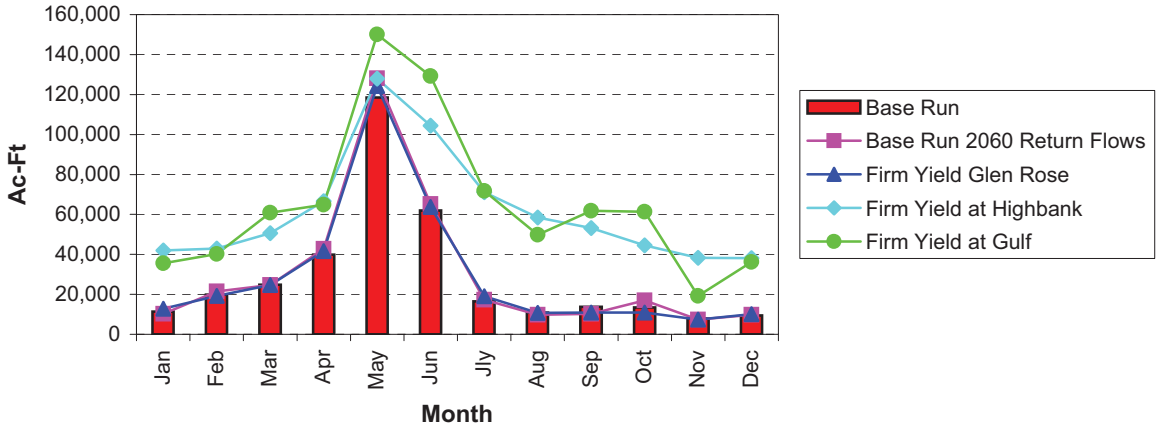
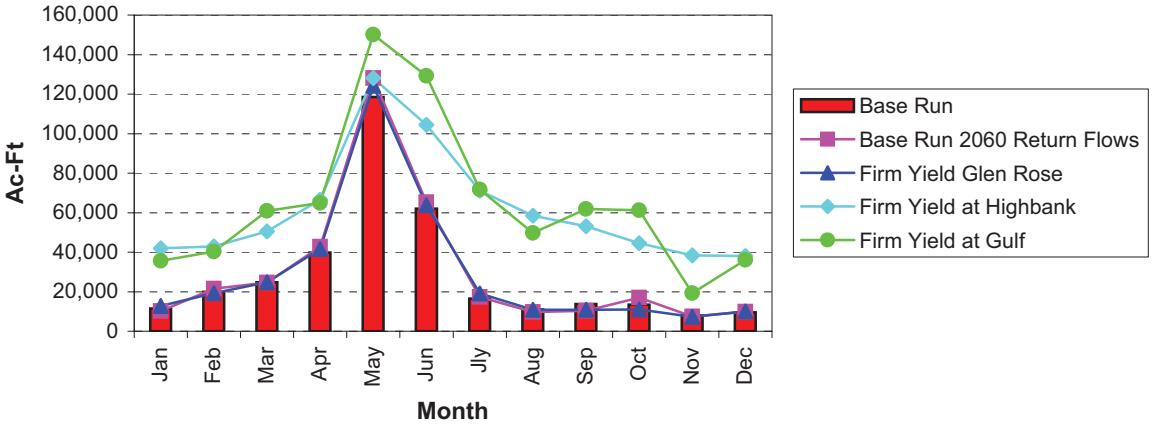
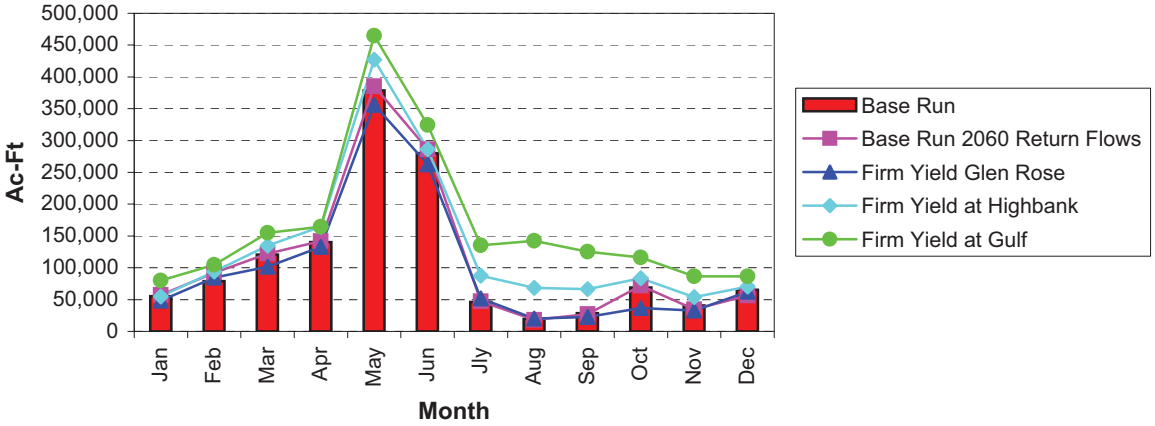


Figure F-1b
Brazos River at Waco
High Flow Statistics

Brazos River at Waco - Median Regulated Flows



Brazos River at Waco - 75th Percentile Regulated Flows



Brazos River at Waco - 90th Percentile Regulated Flows

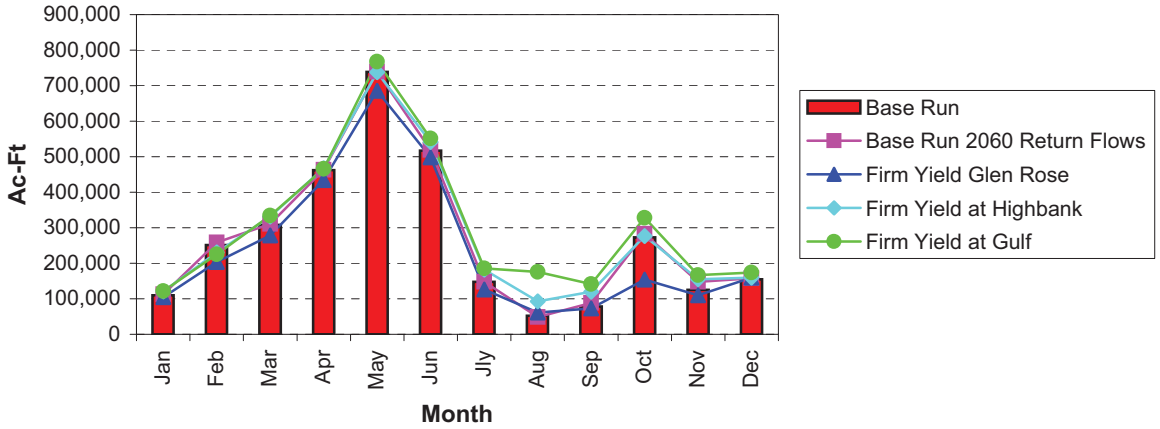


Figure F-2a: Regulated Flow at the Brazos River at Waco Gauge

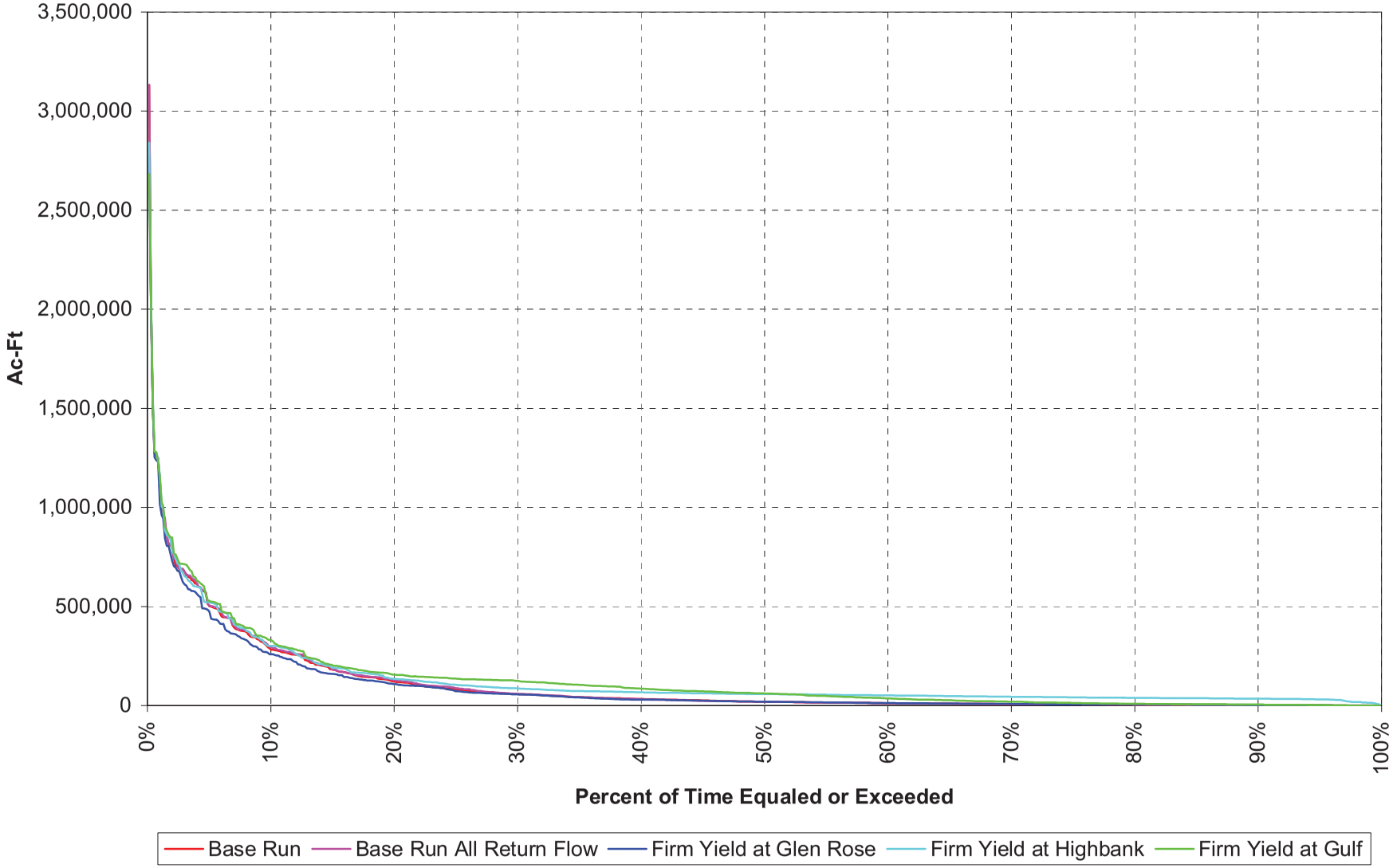


Figure F-2b: Regulated Flow at the Brazos River at Waco Gauge

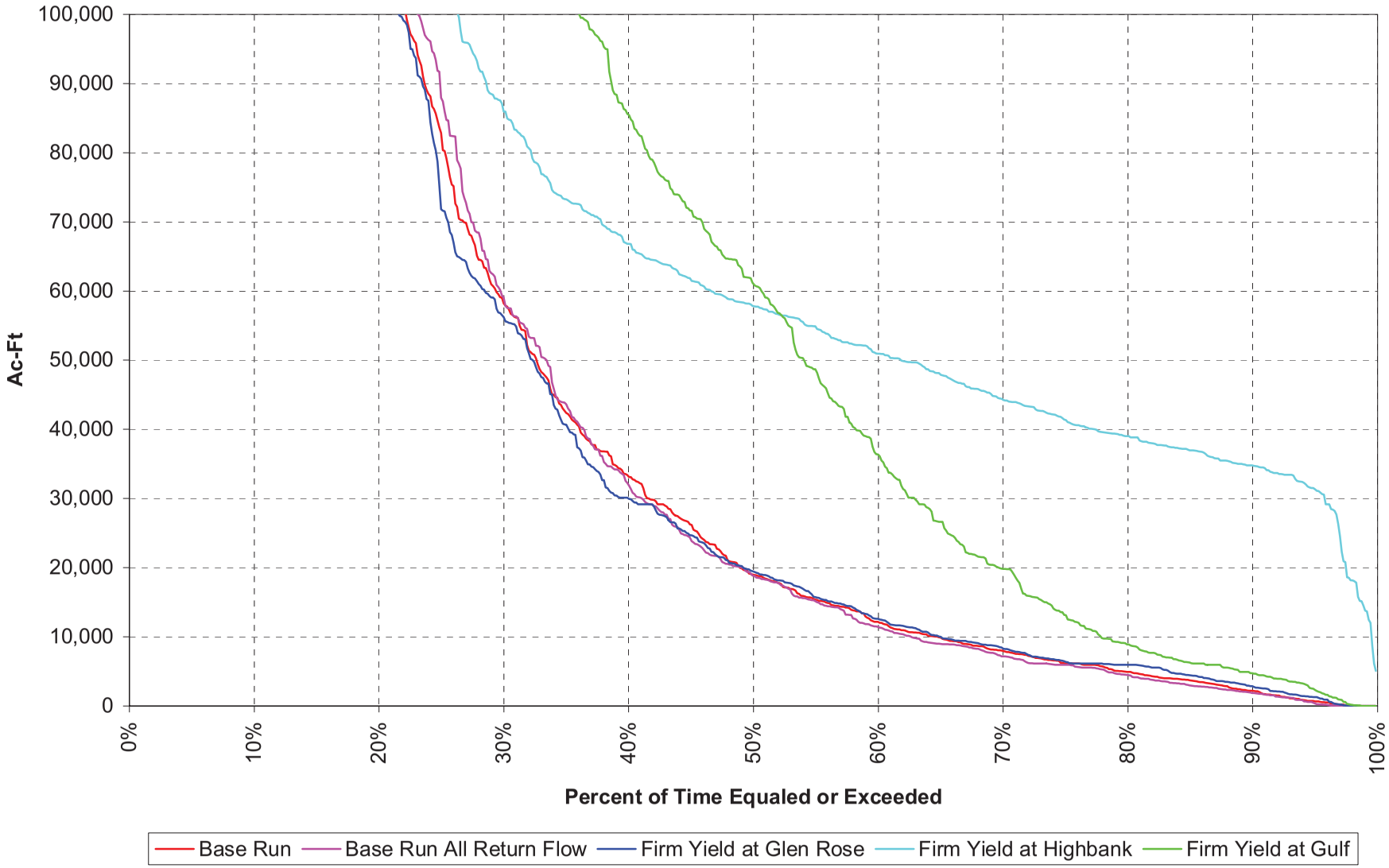


Figure F-2c: Regulated Flow at the Brazos River at Waco Gauge

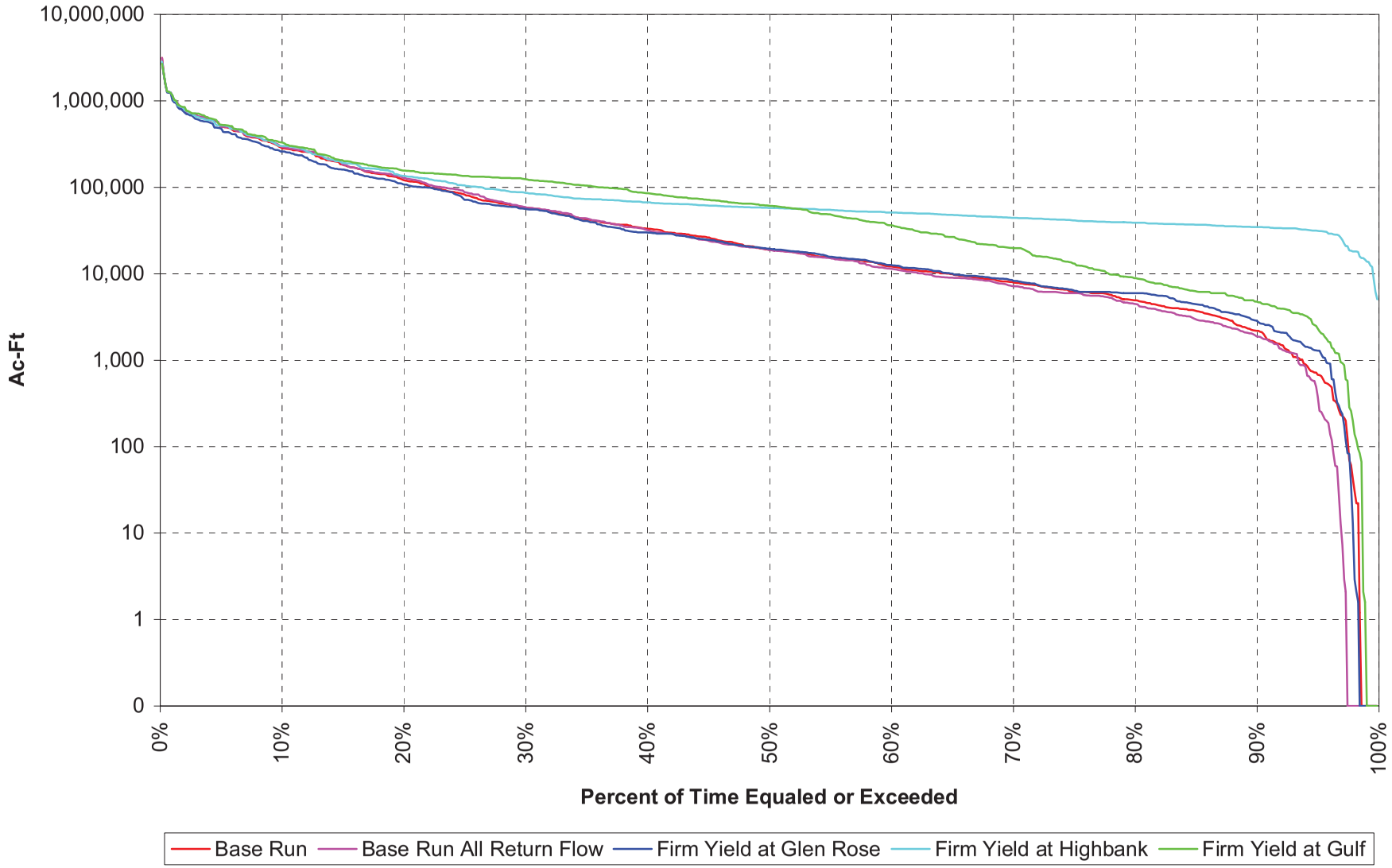


Table F-2
Little River at Cameron
Monthly Regulated Regulated Flow Statistics
Values in Acre-Feet

Min

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	1,211	1,101	509	580	0	425	0	6	0	0	558	1,026
Base Run 2060 Return Flows	6,738	4,192	1,230	6,933	1,230	3,273	4,788	1,335	8,291	1,230	2,483	1,230
Firm Yield Glen Rose	8,410	7,331	10,989	11,278	8,389	7,244	8,908	5,966	11,083	5,220	9,118	8,116
Firm Yield at Highbank	8,410	7,331	7,539	11,278	8,389	7,244	7,945	5,966	10,504	5,398	8,457	8,116
Firm Yield at Gulf	6,816	5,673	1,230	9,189	8,389	5,810	4,946	1,335	8,684	3,859	4,749	1,230

10th Percentile

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	1,254	1,818	3,690	3,255	10,977	5,613	2,878	1,150	2,125	1,224	1,379	1,467
Base Run 2060 Return Flows	9,302	9,021	10,653	10,440	19,543	14,895	9,553	8,054	10,160	7,449	8,505	7,704
Firm Yield Glen Rose	10,660	15,547	22,742	25,628	43,387	26,224	16,351	9,453	14,502	9,276	13,129	12,353
Firm Yield at Highbank	10,843	16,044	21,761	25,628	43,387	27,160	15,591	10,005	14,502	9,276	12,237	12,353
Firm Yield at Gulf	9,984	12,976	11,802	15,879	27,553	19,566	10,364	8,109	12,204	7,621	10,900	10,855

25th Percentile

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	3,955	8,218	8,820	9,364	20,772	19,526	7,615	2,743	5,447	1,230	3,486	3,910
Base Run 2060 Return Flows	11,909	15,226	16,113	17,114	32,952	26,770	13,045	9,578	11,952	9,008	11,432	11,482
Firm Yield Glen Rose	16,348	25,070	29,637	37,960	63,767	45,762	19,670	15,642	28,125	15,282	17,850	18,334
Firm Yield at Highbank	16,974	26,111	29,146	37,563	63,320	48,611	18,935	15,642	26,090	20,052	18,541	18,334
Firm Yield at Gulf	18,156	21,832	18,096	34,524	50,713	42,019	18,461	13,154	21,237	14,473	22,508	17,184

Median

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	18,284	26,491	26,165	53,069	114,164	51,251	14,490	9,874	11,913	8,576	11,699	20,890
Base Run 2060 Return Flows	27,401	34,683	34,147	61,954	123,729	61,220	19,918	14,848	17,303	18,216	21,579	29,983
Firm Yield Glen Rose	33,021	43,546	51,690	81,048	159,833	88,712	31,398	34,591	44,480	42,116	33,506	38,512
Firm Yield at Highbank	34,503	42,215	49,699	80,182	159,833	88,712	31,398	32,958	42,117	41,211	32,017	37,839
Firm Yield at Gulf	56,510	47,807	50,932	79,110	146,585	90,670	31,254	31,109	34,193	51,638	51,906	48,391

75th Percentile

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	74,397	150,061	148,088	162,109	248,233	171,423	29,643	19,169	23,729	37,501	46,185	93,940
Base Run 2060 Return Flows	82,604	162,557	156,953	171,094	258,496	181,721	37,227	23,197	31,375	47,471	54,516	109,252
Firm Yield Glen Rose	97,405	197,430	167,686	185,611	288,663	198,748	65,990	62,585	60,200	79,791	68,752	130,653
Firm Yield at Highbank	97,405	200,458	169,352	188,903	288,663	200,474	63,916	59,244	57,756	82,079	68,515	122,845
Firm Yield at Gulf	100,331	167,604	165,122	185,611	288,663	191,703	70,649	61,450	58,736	108,289	83,629	109,647

90th Percentile

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	233,714	313,086	298,420	347,288	520,682	342,055	131,554	27,539	55,083	139,602	117,469	151,619
Base Run 2060 Return Flows	248,071	334,851	307,818	356,366	530,776	359,588	140,258	32,081	65,806	150,704	126,320	164,531
Firm Yield Glen Rose	290,309	314,629	321,449	365,293	492,772	380,882	165,268	70,816	75,346	178,385	140,535	204,738
Firm Yield at Highbank	297,039	310,363	316,968	365,293	492,772	380,882	165,268	67,475	79,290	179,396	140,535	197,898
Firm Yield at Gulf	297,489	314,629	321,449	368,418	548,360	380,882	165,654	144,518	113,280	172,878	140,524	197,999

Max

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	560,154	1,399,450	668,948	702,773	1,301,707	747,347	357,395	76,040	285,057	538,249	395,953	1,319,395
Base Run 2060 Return Flows	569,012	1,408,254	678,304	711,758	1,314,708	757,687	366,066	84,124	316,138	568,695	416,932	1,334,450
Firm Yield Glen Rose	581,939	1,420,937	691,924	726,276	1,332,530	778,957	389,132	104,530	336,175	703,713	429,927	1,348,095
Firm Yield at Highbank	581,939	1,420,937	691,924	726,276	1,325,563	778,957	389,132	104,530	338,488	703,713	455,101	1,348,095
Firm Yield at Gulf	581,939	1,420,937	691,924	726,276	1,326,510	778,957	388,793	176,355	355,910	687,137	388,591	1,348,095

Average

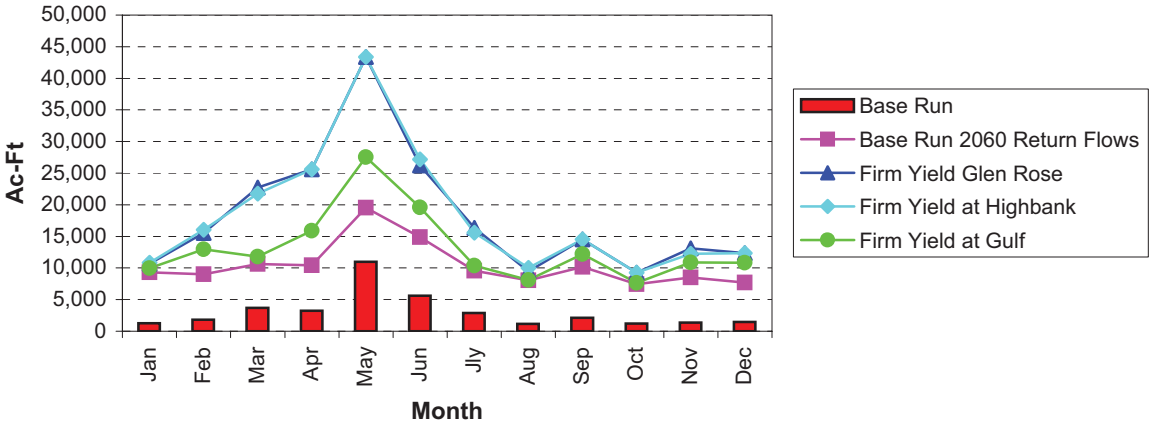
	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	77,104	121,119	104,061	119,849	194,844	122,081	41,193	13,485	24,911	49,025	44,555	86,764
Base Run 2060 Return Flows	86,482	130,315	112,271	129,082	207,225	131,915	47,693	19,394	33,176	58,101	53,590	96,037
Firm Yield Glen Rose	93,228	140,079	127,443	148,636	233,427	153,412	64,354	40,066	53,324	77,890	62,879	107,259
Firm Yield at Highbank	93,991	139,992	126,771	148,292	232,873	154,092	64,333	39,138	52,449	79,540	63,759	106,740
Firm Yield at Gulf	99,118	137,143	123,385	144,183	225,743	153,380	66,520	48,656	51,988	87,081	68,012	106,976

Standard Deviation

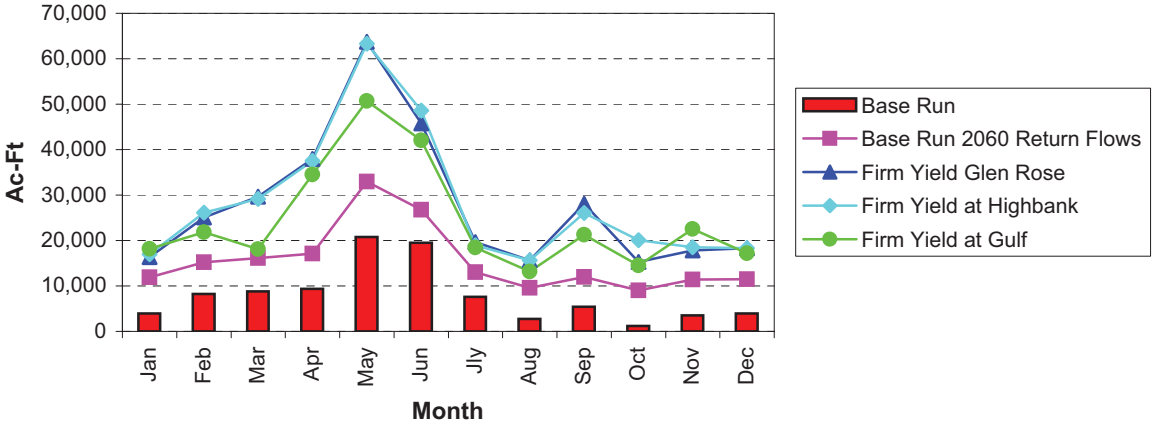
	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	128,352	225,767	149,200	162,869	257,731	165,154	68,544	15,508	44,982	102,468	78,141	197,137
Base Run 2060 Return Flows	129,986	226,370	150,004	164,038	261,053	167,036	69,583	15,274	49,138	105,631	79,466	198,371
Firm Yield Glen Rose	131,852	227,629	148,949	165,970	246,474	163,614	75,846	26,393	50,461	121,560	81,133	202,145
Firm Yield at Highbank	132,645	227,354	149,192	165,598	246,150	163,085	76,416	25,711	50,621	121,479	84,098	201,831
Firm Yield at Gulf	132,545	227,218	149,104	165,988	258,610	165,997	79,799	48,213	54,911	119,238	76,201	200,730

Figure F-3a
Little River at Cameron
Low-Flow Statistics

Little River at Cameron - 10th Percentile Regulated Flows



Little River at Cameron - 25th Percentile Regulated Flows



Little River at Cameron - Median Regulated Flows

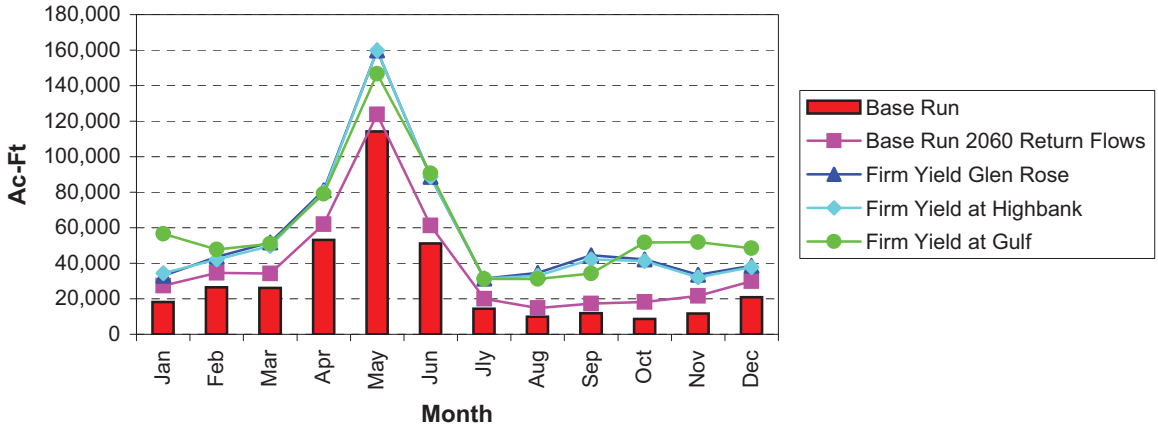
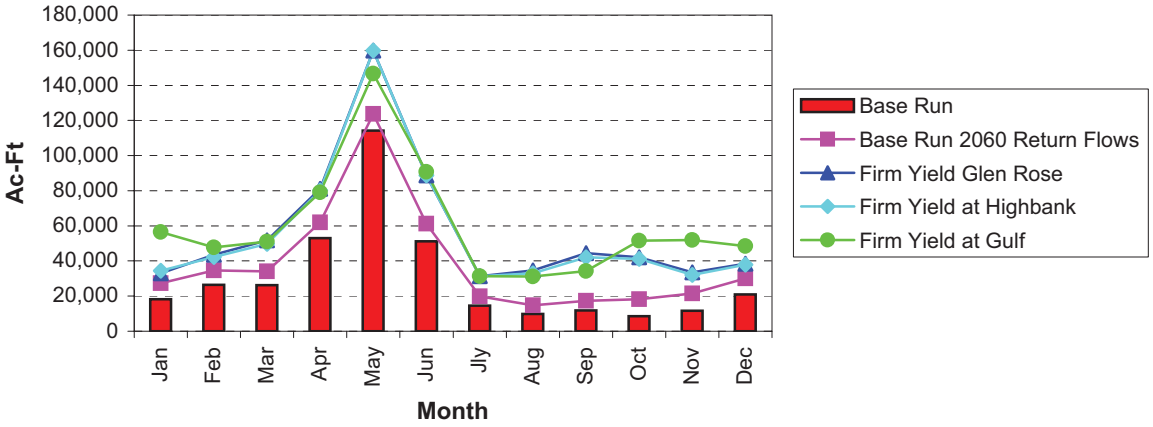
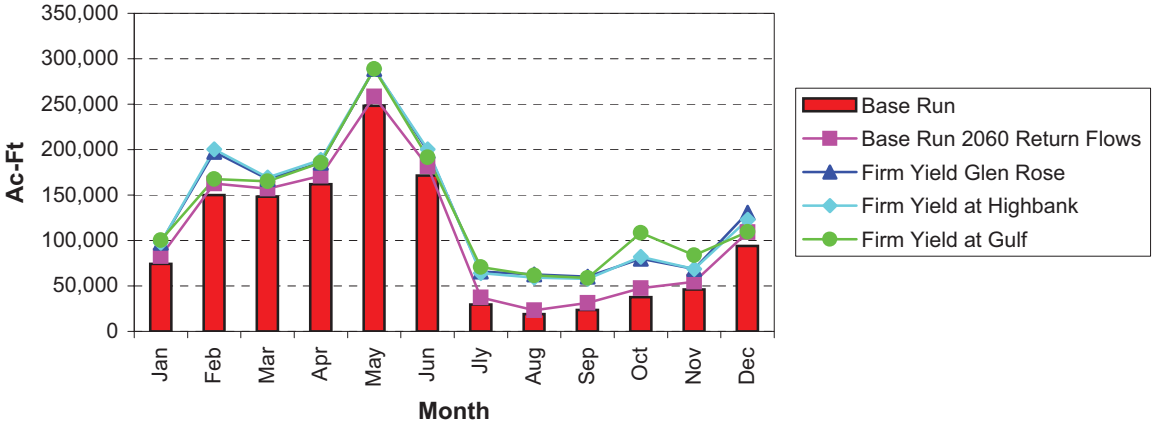


Figure F-3b
Little River at Cameron
High-Flow Statistics

Little River at Cameron - Median Regulated Flows



Little River at Cameron - 75th Percentile Regulated Flows



Little River at Cameron - 90th Percentile Regulated Flows

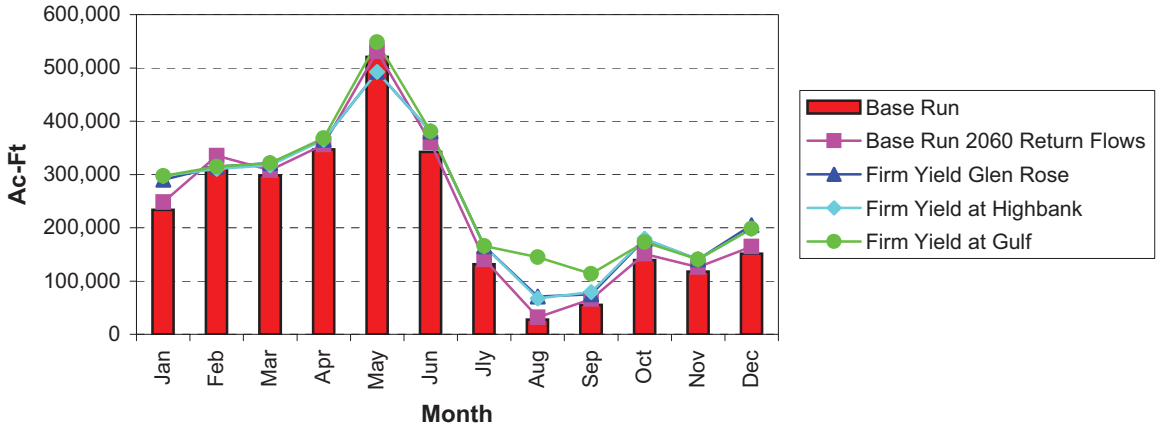


Figure F-4a: Regulated Flow at the Little River at Cameron Gauge

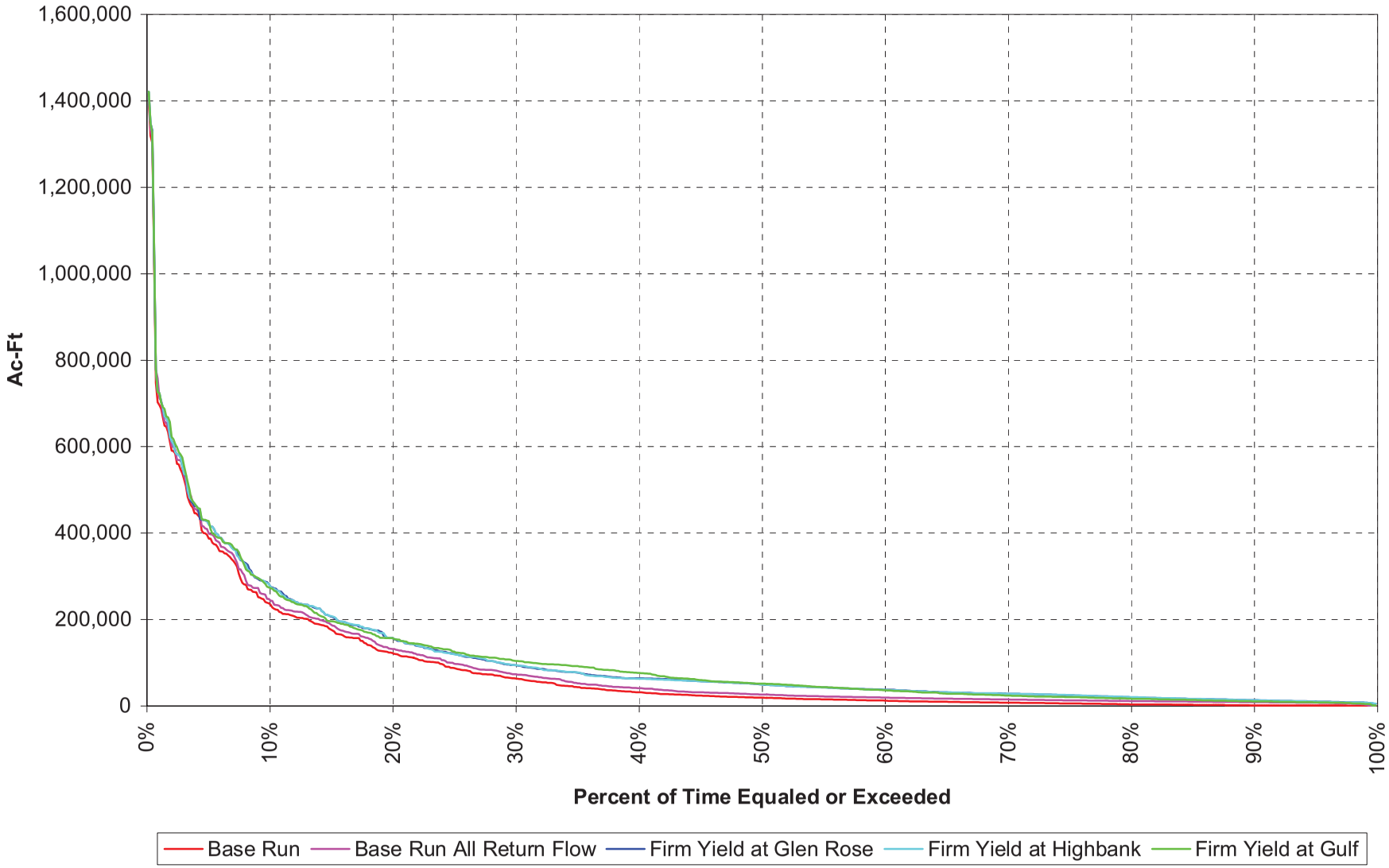


Figure F-4b: Regulated Flow at the Little River at Cameron Gauge

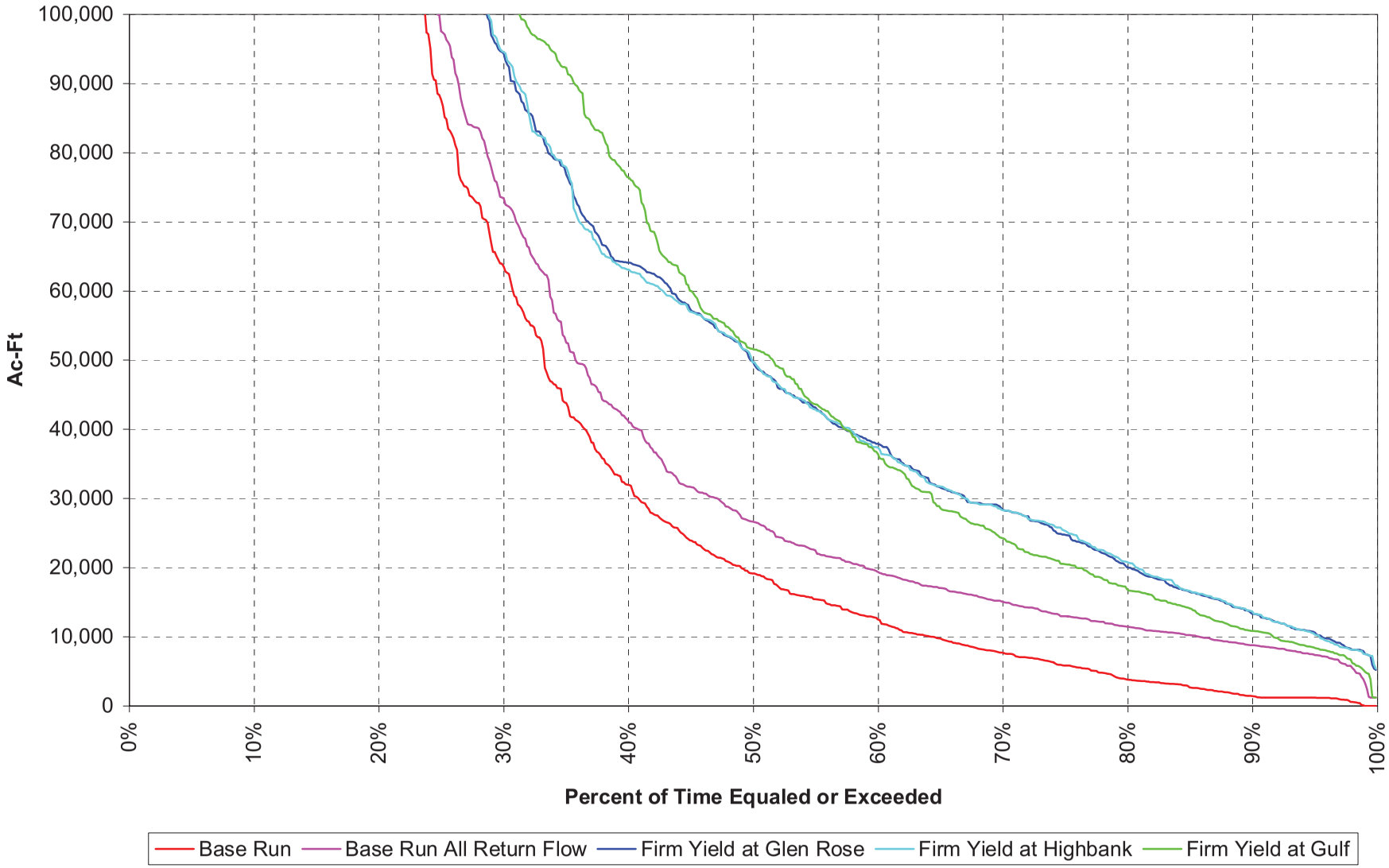


Figure F-4c: Regulated Flow at the Little River at Cameron Gauge

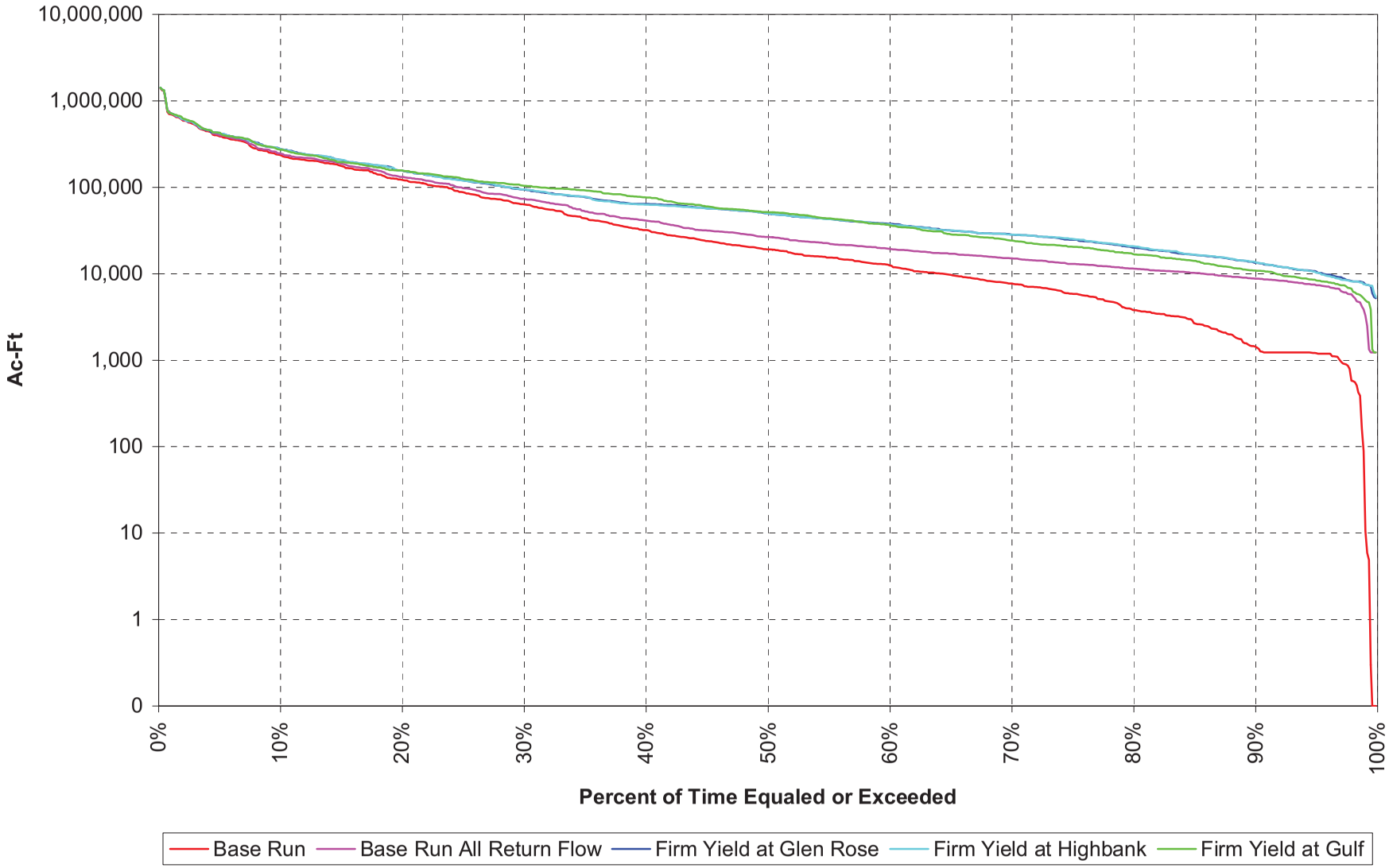


Table F-3
Navasota River near Bryan
Monthly Regulated Flow Statistics
Values in Acre-Feet

Min

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	120	674	0	683	473	0	0	0	0	0	0	0
Base Run 2060 Return Flows	120	674	0	658	473	152	0	0	0	0	0	0
Firm Yield Glen Rose	357	1,035	0	1,372	665	478	0	0	0	0	98	209
Firm Yield at Highbank	357	1,035	0	1,372	665	152	0	0	0	0	98	209
Firm Yield at Gulf	768	678	0	658	473	152	0	0	0	0	0	0

10th Percentile

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	1,369	2,464	1,971	2,463	2,755	743	123	0	21	1	322	737
Base Run 2060 Return Flows	1,374	2,136	1,574	2,548	2,750	743	149	12	32	28	258	605
Firm Yield Glen Rose	1,812	3,063	2,474	3,777	3,992	1,110	248	45	96	69	445	975
Firm Yield at Highbank	2,158	3,063	2,837	3,777	3,992	1,005	231	45	53	108	445	975
Firm Yield at Gulf	1,686	2,870	1,948	2,628	2,750	743	184	12	32	51	275	737

25th Percentile

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	3,233	4,109	4,567	4,049	5,557	1,329	241	59	132	120	770	1,344
Base Run 2060 Return Flows	3,190	3,580	4,567	3,876	4,954	1,373	323	149	161	162	719	1,322
Firm Yield Glen Rose	5,144	6,951	8,091	6,475	9,858	2,116	415	190	207	301	1,381	1,990
Firm Yield at Highbank	5,642	6,771	8,755	6,578	9,858	1,815	415	173	181	352	1,381	2,114
Firm Yield at Gulf	3,742	5,513	5,051	4,544	6,070	1,767	381	151	170	185	883	1,526

Median

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	9,609	17,169	12,206	9,213	19,614	4,721	840	384	710	711	3,284	6,193
Base Run 2060 Return Flows	9,609	17,465	12,678	9,161	19,763	4,721	840	449	603	716	3,284	5,293
Firm Yield Glen Rose	18,951	24,313	22,695	15,999	35,597	11,157	1,086	639	812	1,347	4,417	9,654
Firm Yield at Highbank	16,052	23,770	24,949	16,862	35,597	9,217	1,086	601	812	1,790	4,417	10,133
Firm Yield at Gulf	13,839	24,256	19,072	16,242	22,961	9,217	1,255	488	721	837	3,759	8,214

75th Percentile

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	33,858	43,798	68,611	43,212	101,623	42,809	3,282	1,346	2,337	7,185	8,913	35,453
Base Run 2060 Return Flows	33,858	43,546	68,742	43,270	101,929	42,986	3,321	1,512	2,152	7,185	8,878	37,052
Firm Yield Glen Rose	48,294	62,422	73,277	55,189	98,040	50,094	8,512	3,006	2,332	14,528	10,541	49,015
Firm Yield at Highbank	48,294	62,422	73,632	55,189	98,040	46,738	8,512	3,006	2,247	12,371	15,385	52,521
Firm Yield at Gulf	44,640	56,540	76,905	57,001	113,074	53,542	13,284	3,009	3,500	14,132	15,319	45,211

90th Percentile

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	89,818	129,350	110,371	141,237	153,224	72,027	12,353	3,016	13,160	39,656	56,624	123,674
Base Run 2060 Return Flows	90,484	129,548	112,915	141,377	153,375	72,778	11,029	5,738	13,160	38,452	56,887	123,846
Firm Yield Glen Rose	97,827	137,384	124,727	146,808	163,803	85,163	29,218	23,060	22,071	50,275	60,684	128,231
Firm Yield at Highbank	96,677	137,384	124,727	146,808	163,037	85,163	24,461	35,907	16,811	46,626	60,684	128,231
Firm Yield at Gulf	91,613	137,384	120,918	146,808	167,855	89,803	43,904	60,960	22,071	49,485	61,863	108,747

Max

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	236,553	248,772	169,283	207,934	364,833	170,514	39,651	49,055	99,246	177,127	228,673	344,256
Base Run 2060 Return Flows	236,683	248,883	169,414	208,074	365,122	170,692	39,651	49,656	101,168	177,656	228,800	346,884
Firm Yield Glen Rose	240,600	253,426	185,596	241,655	373,653	178,108	50,467	72,003	117,915	202,351	240,816	368,788
Firm Yield at Highbank	240,600	253,426	185,596	241,655	373,653	178,108	47,044	72,003	117,915	202,351	242,634	344,705
Firm Yield at Gulf	240,600	253,426	185,596	213,505	373,653	178,108	137,367	105,145	113,800	182,485	232,253	339,657

Average

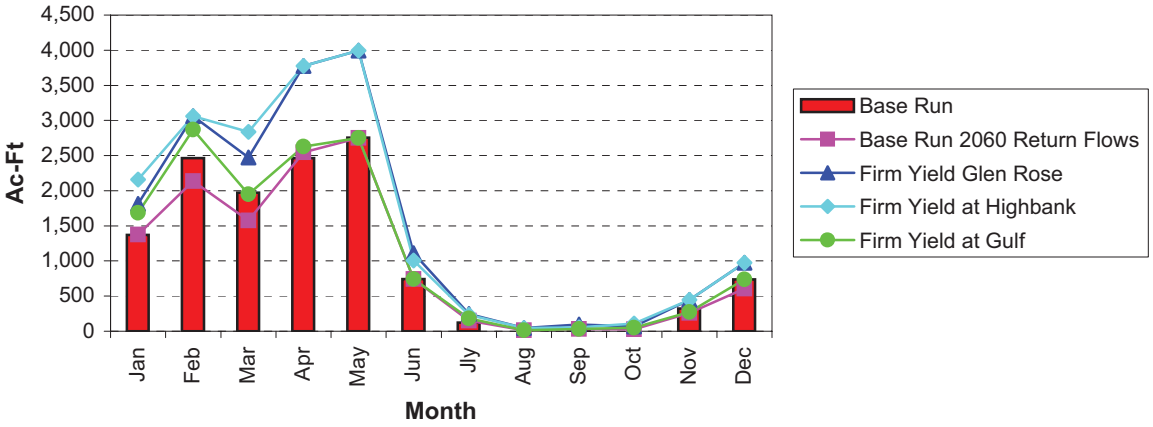
	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	31,342	40,469	37,013	38,208	61,160	26,503	4,371	2,734	5,904	13,986	17,772	35,395
Base Run 2060 Return Flows	31,510	40,636	37,186	38,111	61,732	26,609	4,369	2,926	5,629	13,897	17,779	35,562
Firm Yield Glen Rose	37,363	47,699	44,028	44,897	68,928	31,898	7,467	7,440	8,714	17,965	20,590	39,979
Firm Yield at Highbank	37,650	47,976	44,643	44,978	68,845	30,963	7,059	7,916	7,782	16,995	21,857	40,377
Firm Yield at Gulf	34,308	46,826	42,738	43,963	66,607	33,112	15,575	12,707	8,954	16,245	22,245	36,630

Standard Deviation

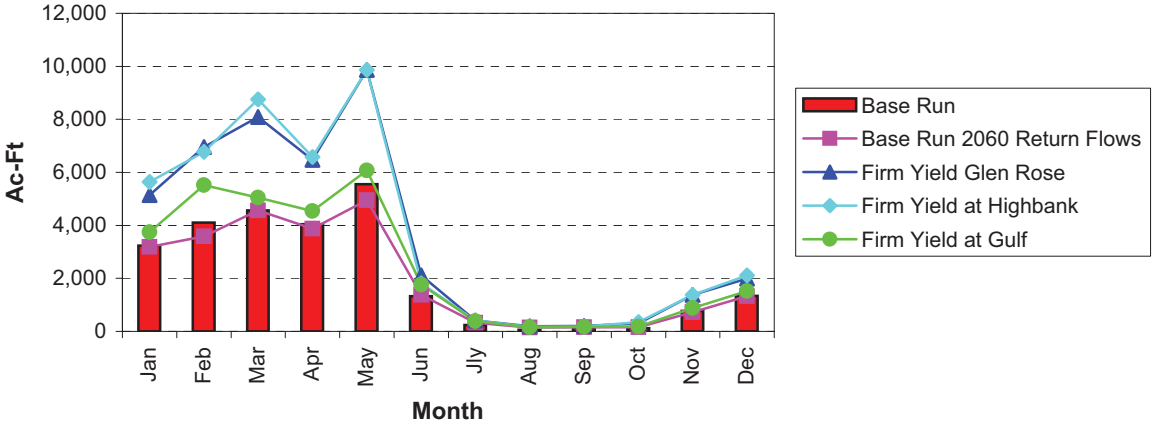
	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	48,932	52,636	46,265	57,286	74,150	40,961	8,461	7,810	16,856	35,089	44,337	65,035
Base Run 2060 Return Flows	49,331	52,973	46,946	57,411	74,865	41,171	8,440	7,886	16,373	35,204	44,543	65,504
Firm Yield Glen Rose	49,998	55,875	49,323	60,638	78,542	44,095	12,606	15,548	21,736	40,538	46,345	67,821
Firm Yield at Highbank	50,692	57,129	49,058	60,515	78,562	44,764	11,974	15,983	20,799	40,460	47,671	65,982
Firm Yield at Gulf	48,558	56,803	49,634	57,197	81,655	46,414	29,770	26,655	22,795	35,571	46,424	61,371

Figure F-5a
Navasota River near Bryan
Low-Flow Statistics

Navasota River near Bryan - 10th Percentile Regulated Flows



Navasota River near Bryan - 25th Percentile Regulated Flows



Navasota River near Bryan - Median Regulated Flows

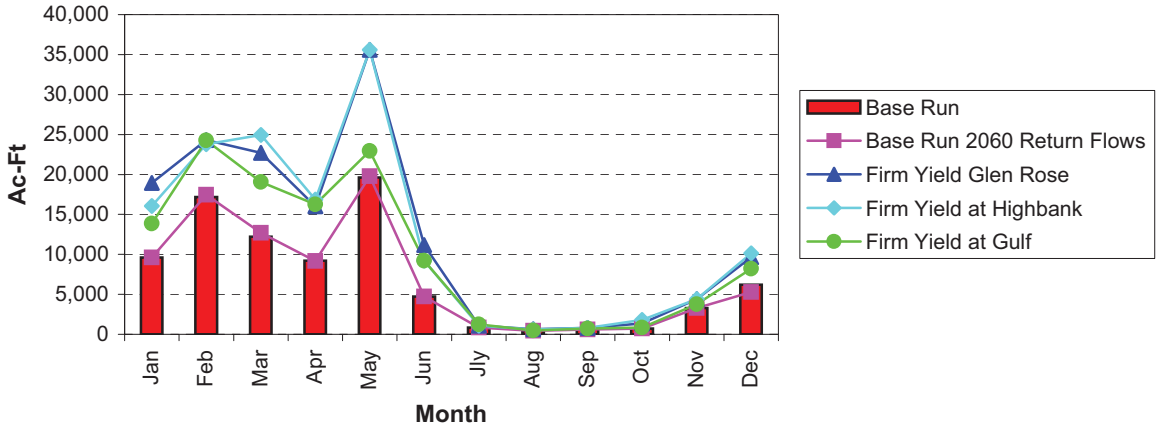
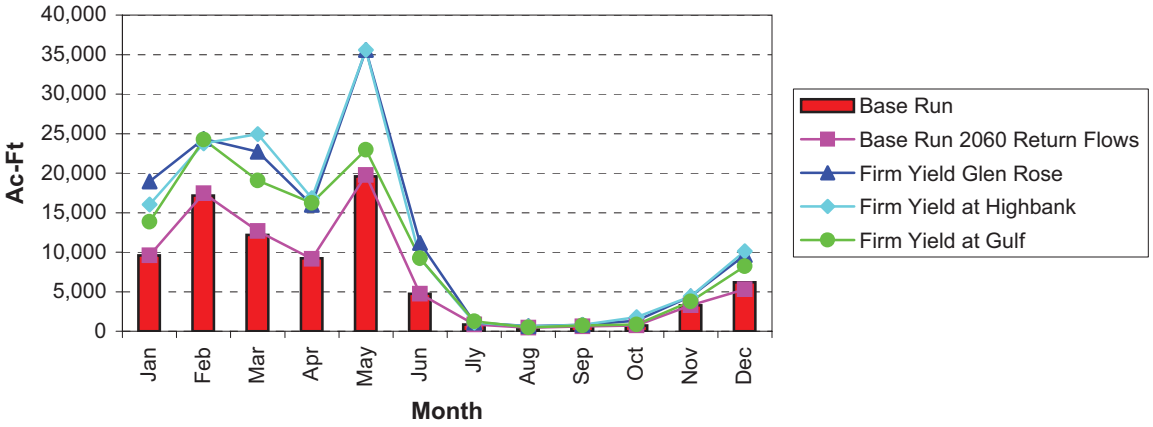
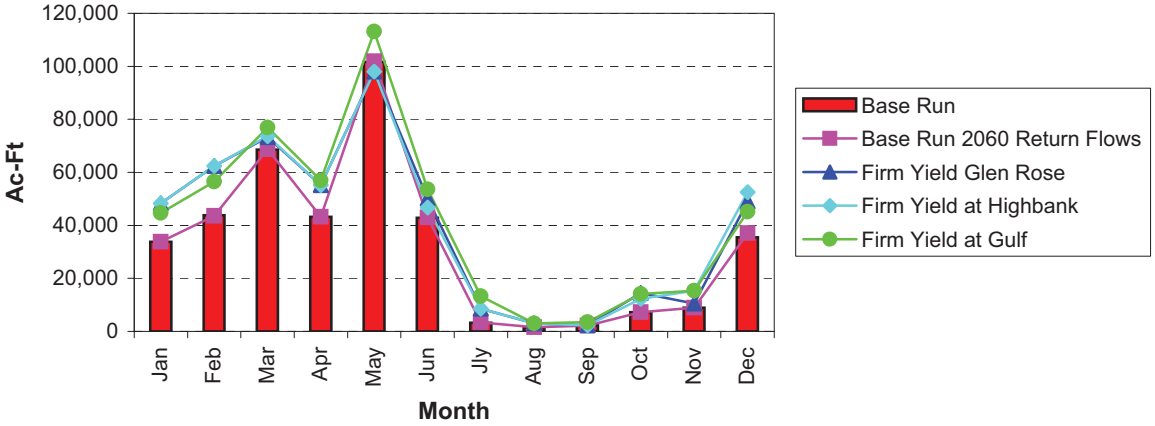


Figure F-5b
Navasota River near Bryan
High-Flow Statistics

Navasota River near Bryan - Median Regulated Flows



Navasota River near Bryan - 75th Percentile Regulated Flows



Navasota River near Bryan - 90th Percentile Regulated Flows

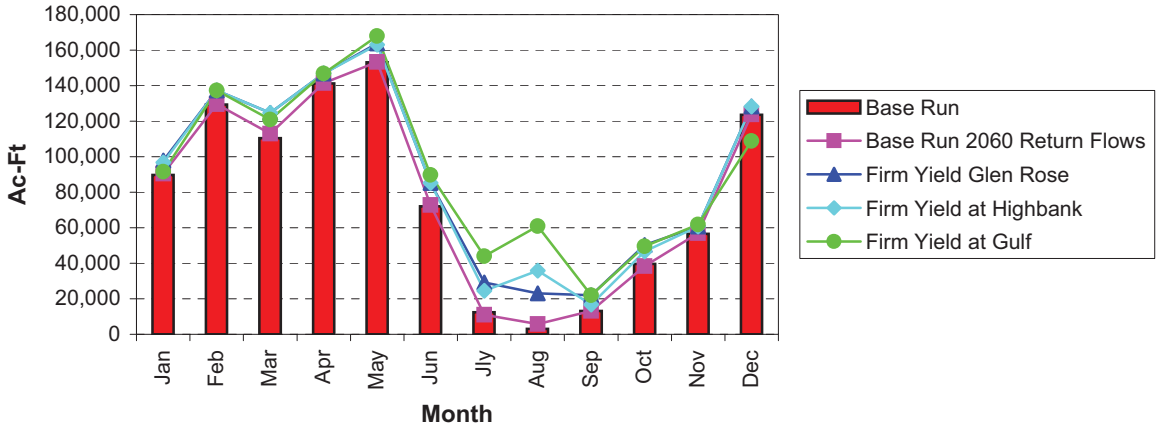


Figure F-6a: Regulated Flow at the Navasota River near Bryan Gauge

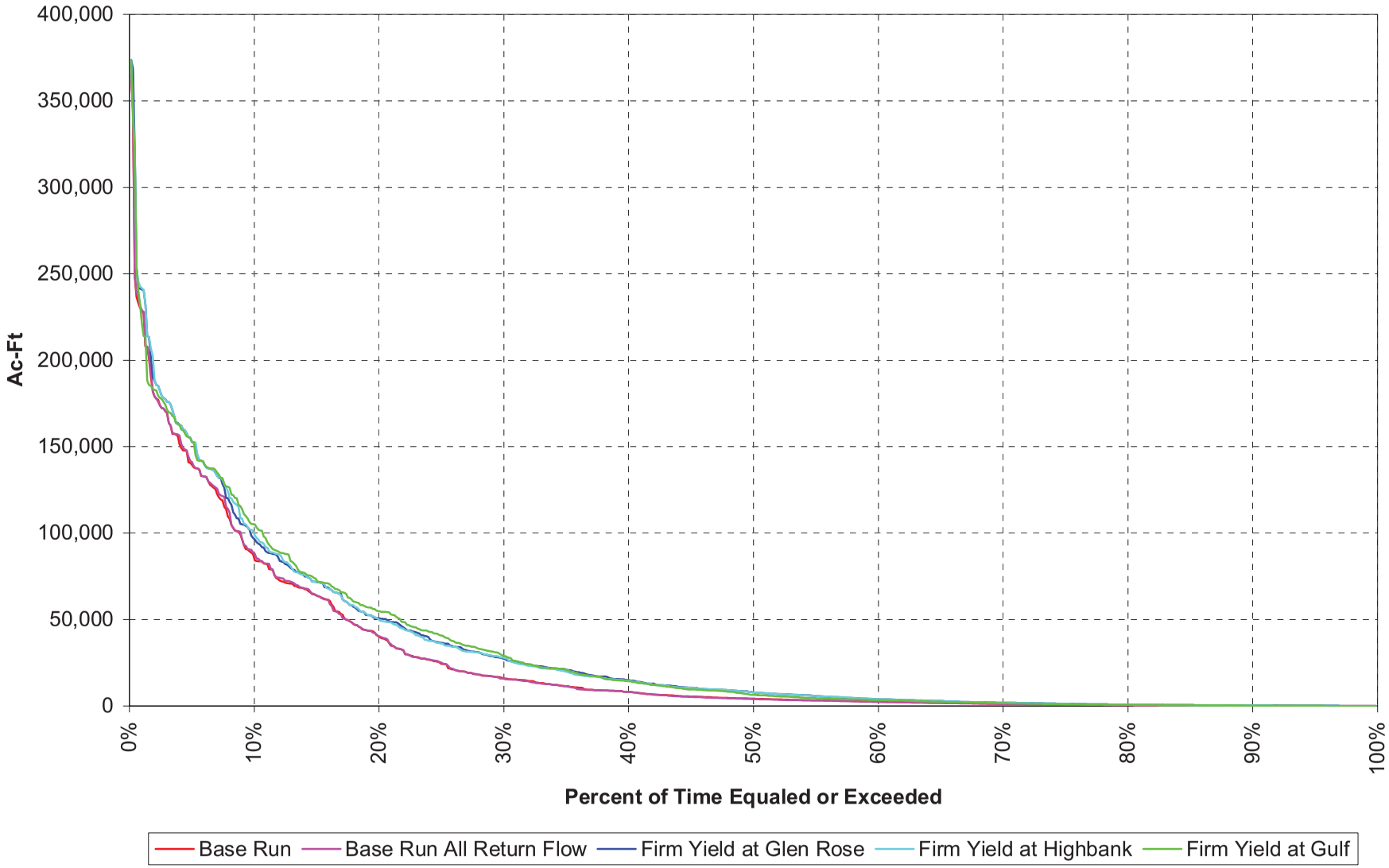


Figure F-6b: Regulated Flow at the Navasota River near Bryan Gauge

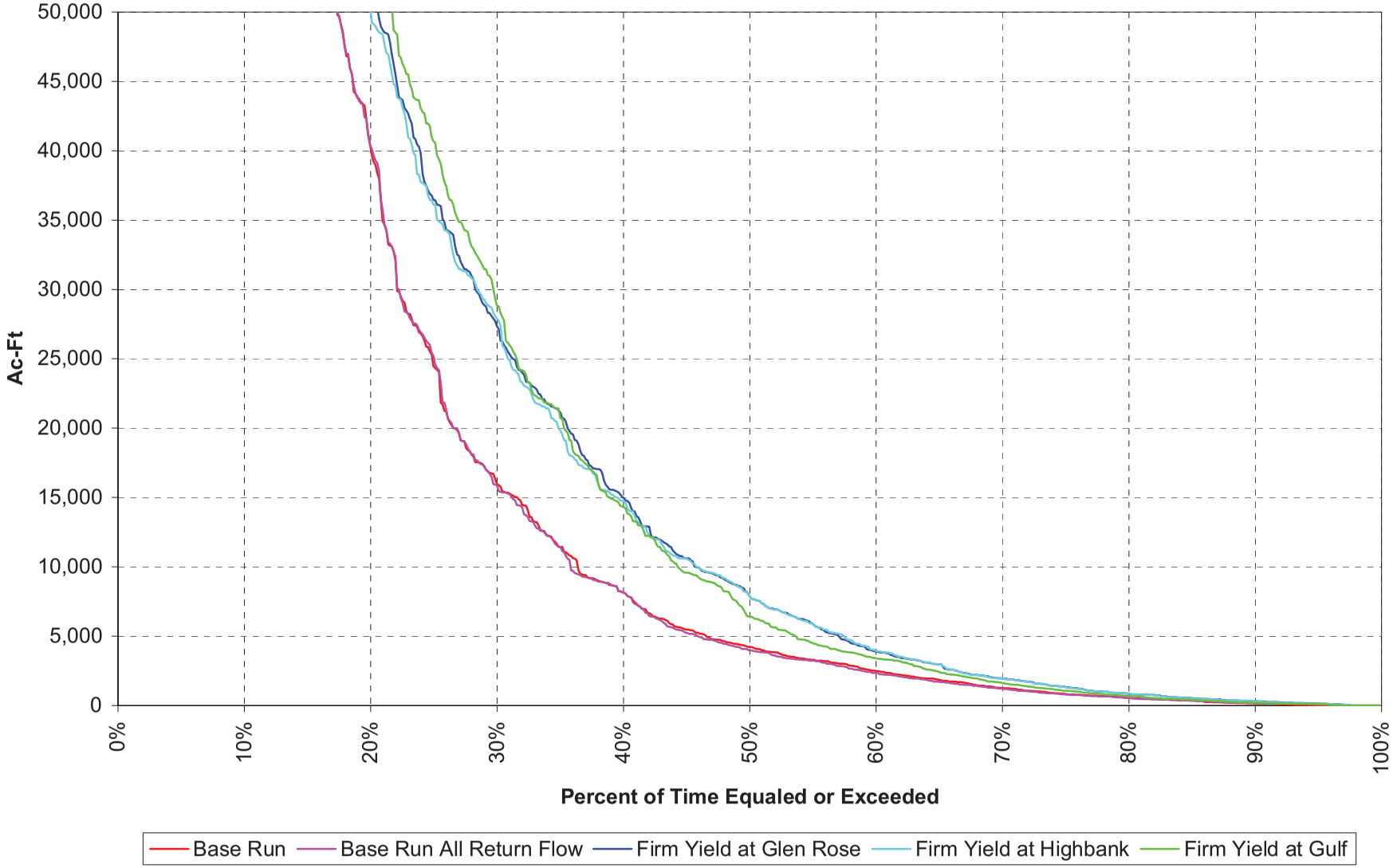


Figure F-6c: Regulated Flow at the Navasota River near Bryan Gauge

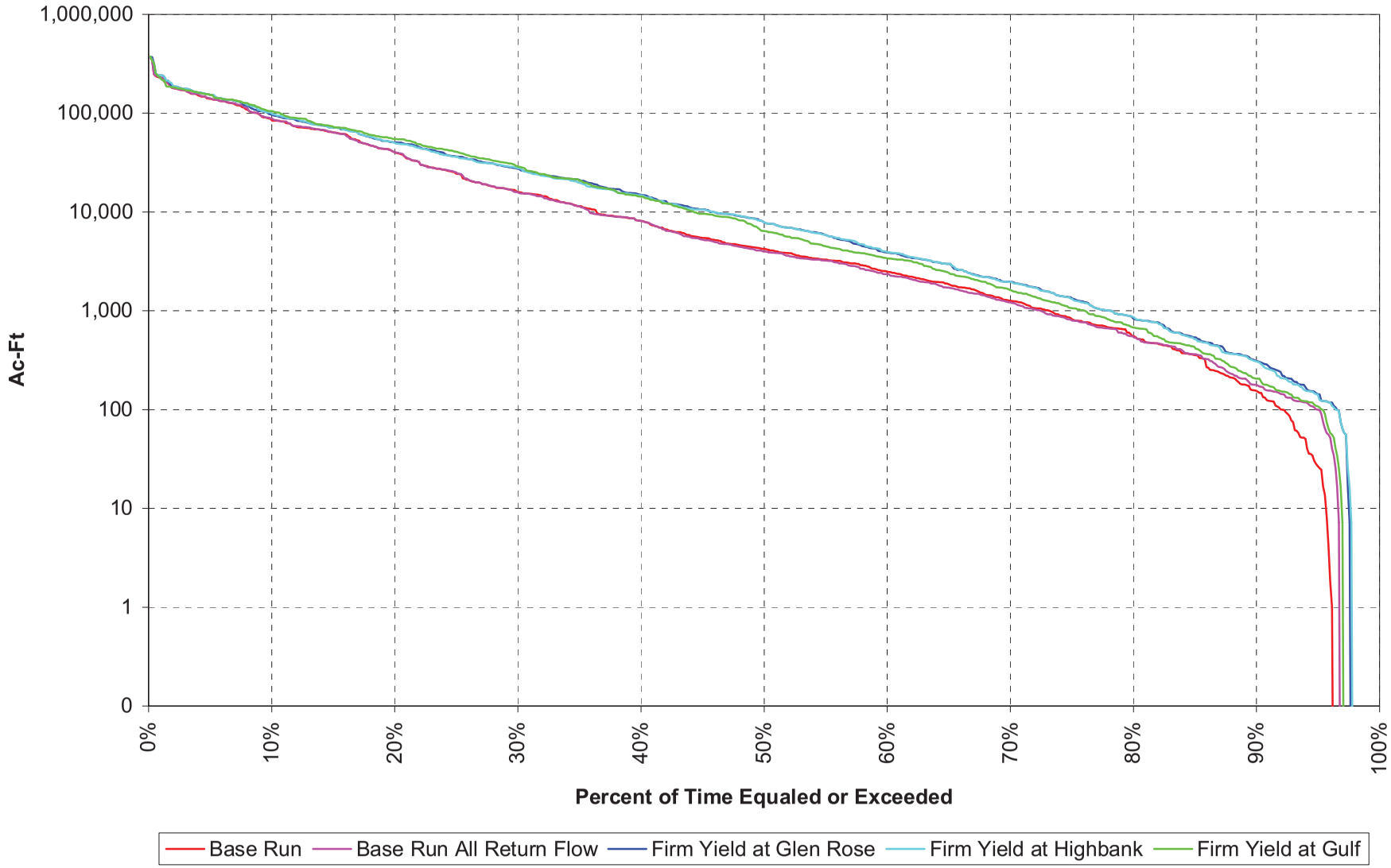


Table F-4
Brazos River at Richmond
Monthly Regulated Flow Statistics
Values in Acre-Feet

Min

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	6,985	21,593	21,434	30,045	30,752	21,939	266	271	12,641	9,492	16,719	20,179
Base Run 2060 Return Flows	21,749	23,592	33,630	38,753	47,752	39,290	11,594	11,111	26,282	23,912	27,174	30,880
Firm Yield Glen Rose	51,750	55,023	68,870	77,805	74,417	86,238	63,027	60,162	60,223	60,794	56,612	60,115
Firm Yield at Highbank	49,875	53,059	60,865	75,364	74,417	83,291	59,812	57,096	64,563	58,264	56,536	58,240
Firm Yield at Gulf	73,172	98,629	97,648	132,863	118,205	141,527	142,727	136,171	67,721	119,764	76,605	90,646

10th Percentile

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	30,867	41,515	38,124	47,981	63,114	67,241	37,997	21,003	28,677	29,757	30,903	27,837
Base Run 2060 Return Flows	40,907	48,780	40,083	58,762	69,482	67,241	51,189	36,119	39,307	35,978	36,569	35,797
Firm Yield Glen Rose	62,336	72,677	74,199	89,717	112,504	111,282	94,998	81,973	72,268	72,938	64,719	63,333
Firm Yield at Highbank	60,655	70,712	71,996	87,276	110,156	108,335	91,783	79,108	69,641	69,966	62,625	61,489
Firm Yield at Gulf	104,223	111,223	125,190	138,521	158,197	174,684	167,326	152,445	138,819	129,471	111,920	100,579

25th Percentile

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	49,930	57,864	80,074	70,192	109,535	100,994	58,091	39,047	43,005	38,106	45,120	55,340
Base Run 2060 Return Flows	57,921	73,769	87,423	81,033	145,313	118,826	65,738	49,382	52,587	45,400	53,555	67,143
Firm Yield Glen Rose	73,673	99,827	124,198	115,666	228,644	177,447	105,633	91,467	83,718	77,444	69,980	76,154
Firm Yield at Highbank	71,112	96,260	117,381	115,522	205,049	175,901	102,418	88,401	80,920	74,174	68,356	76,128
Firm Yield at Gulf	108,949	116,675	130,107	145,148	188,978	184,556	180,874	166,398	148,166	135,660	118,106	106,521

Median

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	157,017	216,692	178,384	249,272	614,991	263,044	88,209	64,041	58,817	68,240	87,317	123,711
Base Run 2060 Return Flows	183,501	232,660	201,459	266,285	641,097	279,382	92,713	69,035	68,703	73,983	101,475	146,875
Firm Yield Glen Rose	191,529	259,850	222,081	286,135	660,322	312,459	121,266	106,886	94,265	90,527	115,119	160,646
Firm Yield at Highbank	189,959	233,028	221,641	262,741	646,934	316,977	118,911	103,348	93,173	92,728	114,972	162,245
Firm Yield at Gulf	188,910	261,877	214,996	286,448	687,793	346,476	196,790	178,443	157,133	142,929	139,125	154,544

75th Percentile

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	481,473	587,805	684,497	776,417	1,153,711	883,071	254,173	90,033	129,726	247,798	288,258	445,695
Base Run 2060 Return Flows	496,956	603,991	702,217	799,524	1,182,212	902,294	266,600	94,744	146,545	279,398	307,644	459,770
Firm Yield Glen Rose	521,698	624,948	731,799	828,082	1,196,880	940,286	283,611	123,223	142,291	276,753	335,149	474,966
Firm Yield at Highbank	508,960	616,053	718,781	810,697	1,185,622	905,723	287,558	112,762	143,828	276,293	323,776	468,276
Firm Yield at Gulf	505,426	648,496	760,251	829,287	1,267,286	972,647	324,731	189,419	172,141	299,089	355,684	465,818

90th Percentile

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	955,823	905,006	1,149,948	1,188,988	1,925,590	1,626,907	428,062	182,083	247,129	650,520	575,814	874,954
Base Run 2060 Return Flows	990,937	924,870	1,167,212	1,217,049	1,953,086	1,648,468	443,122	194,621	253,496	673,691	602,694	901,843
Firm Yield Glen Rose	964,592	933,803	1,151,395	1,276,874	1,890,971	1,640,988	472,204	212,323	267,772	593,851	630,555	931,484
Firm Yield at Highbank	964,004	917,004	1,178,059	1,279,404	1,971,710	1,590,554	462,311	190,837	274,711	635,161	627,516	902,056
Firm Yield at Gulf	966,159	949,913	1,224,796	1,311,260	1,997,500	1,681,057	498,685	244,787	271,895	717,440	632,298	971,359

Max

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	2,657,898	4,120,830	2,510,198	2,380,314	5,465,099	2,730,569	1,110,504	542,041	1,004,375	1,466,652	1,802,194	3,536,928
Base Run 2060 Return Flows	2,674,067	4,139,134	2,527,037	2,405,548	5,570,503	2,750,880	1,127,023	562,588	1,048,720	1,500,712	1,819,929	3,562,057
Firm Yield Glen Rose	2,686,773	4,154,674	2,544,693	2,401,548	4,786,189	2,788,684	1,178,799	532,977	1,089,207	1,542,354	1,772,030	3,614,567
Firm Yield at Highbank	2,684,071	4,152,055	2,541,787	2,454,744	4,813,828	2,784,590	1,141,367	592,860	1,037,330	1,558,080	1,834,632	3,589,169
Firm Yield at Gulf	2,713,382	4,180,478	2,573,319	2,488,941	5,102,926	2,829,003	1,201,313	662,840	1,124,756	1,573,179	1,862,394	3,614,628

Average

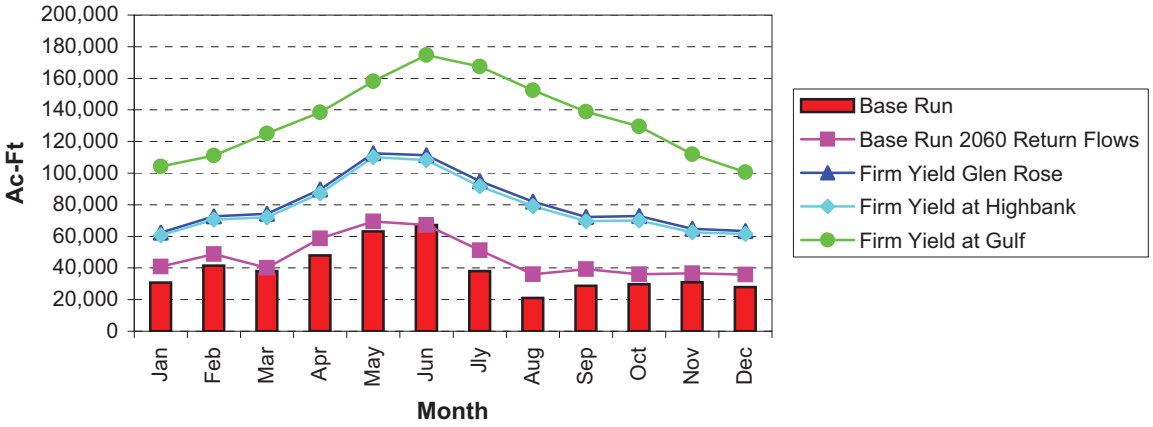
	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	372,785	445,959	443,265	475,509	854,142	576,080	197,320	86,771	123,528	229,513	234,980	389,829
Base Run 2060 Return Flows	389,438	460,711	459,506	492,398	878,716	593,303	207,564	95,904	136,100	246,893	249,774	407,057
Firm Yield Glen Rose	406,660	482,877	483,092	517,509	898,234	623,048	242,526	130,506	160,371	255,197	263,046	425,647
Firm Yield at Highbank	399,743	477,455	479,963	511,288	894,412	617,227	238,819	127,846	157,460	261,024	262,851	417,215
Firm Yield at Gulf	417,957	495,378	502,524	537,397	932,702	662,795	299,944	194,559	206,703	308,210	290,914	438,910

Standard Deviation

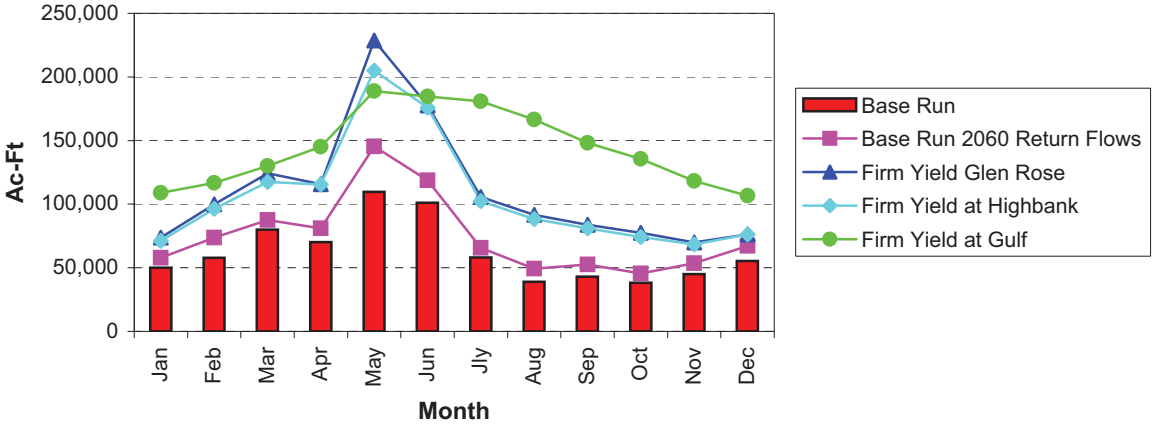
	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Base Run	510,735	644,849	529,662	545,123	965,375	616,674	238,384	89,391	171,933	347,751	329,806	654,538
Base Run 2060 Return Flows	514,726	647,587	532,233	549,122	975,409	621,161	241,529	91,934	177,336	354,644	334,858	657,618
Firm Yield Glen Rose	514,791	643,956	525,101	547,431	889,168	613,541	242,332	82,827	175,110	349,159	326,624	663,710
Firm Yield at Highbank	512,301	645,416	525,251	551,996	897,469	609,354	238,258	88,430	170,204	354,471	335,004	658,291
Firm Yield at Gulf	509,160	646,615	533,050	552,210	932,333	618,453	228,658	76,410	167,096	349,420	327,565	658,097

Figure F-7a
Brazos River at Richmond
Low-Flow Statistics

Brazos River at Richmond - 10th Percentile Regulated Flows



Brazos River at Richmond - 25th Percentile Regulated Flows



Brazos River at Richmond - Median Regulated Flows

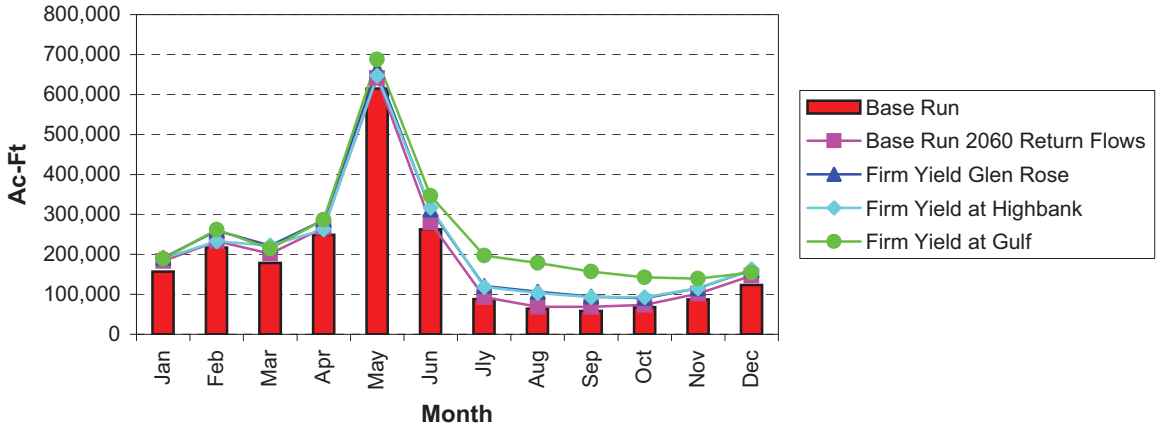
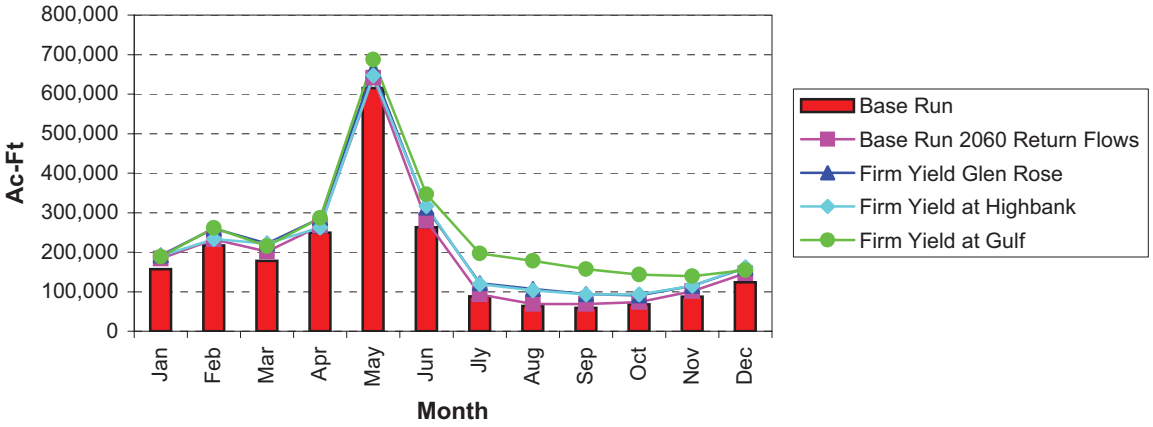
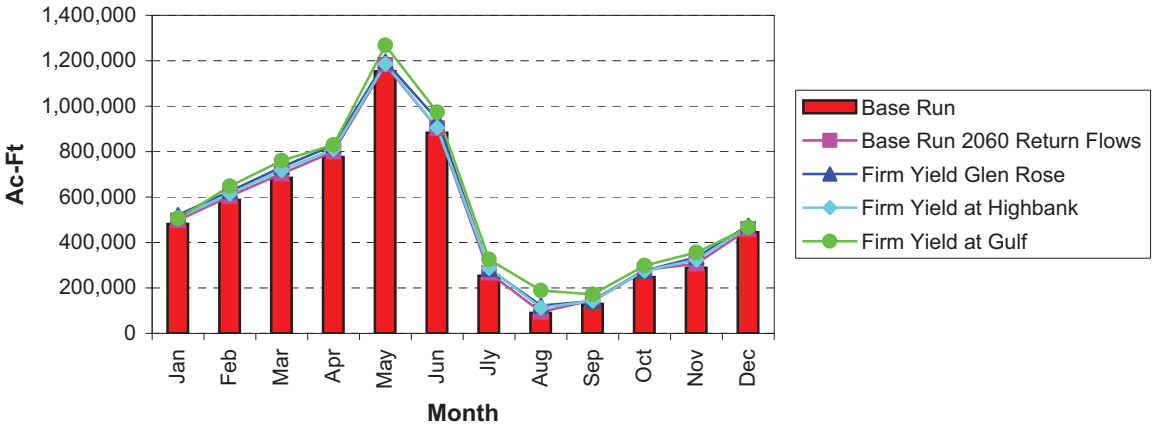


Figure F-7b
Brazos River at Richmond
High-Flow Statistics

Brazos River at Richmond - Median Regulated Flows



Brazos River at Richmond - 75th Percentile Regulated Flows



Brazos River at Richmond - 90th Percentile Regulated Flows

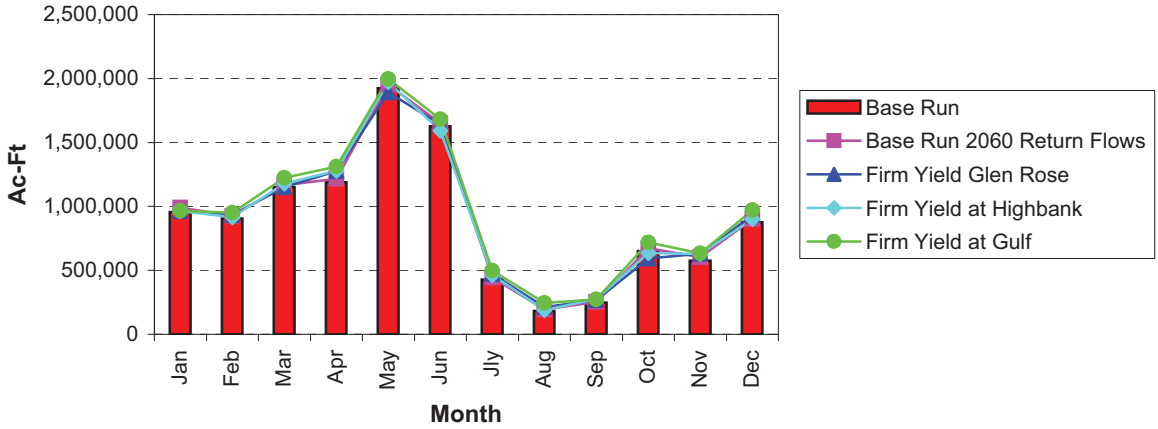


Figure F-8a: Regulated Flow at the Brazos River at Richmond Gauge

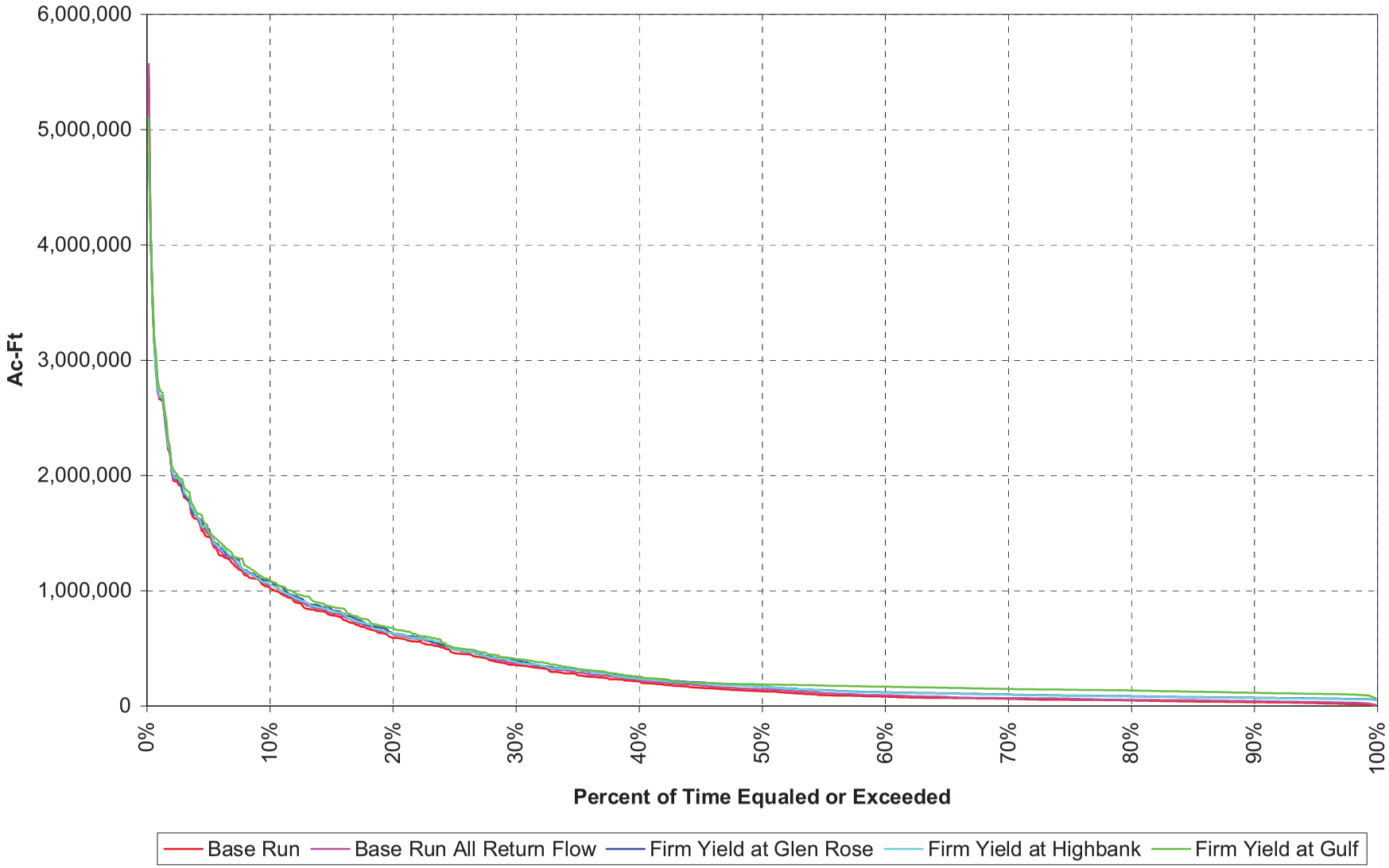


Figure F-8b: Regulated Flow at the Brazos River at Richmond Gauge

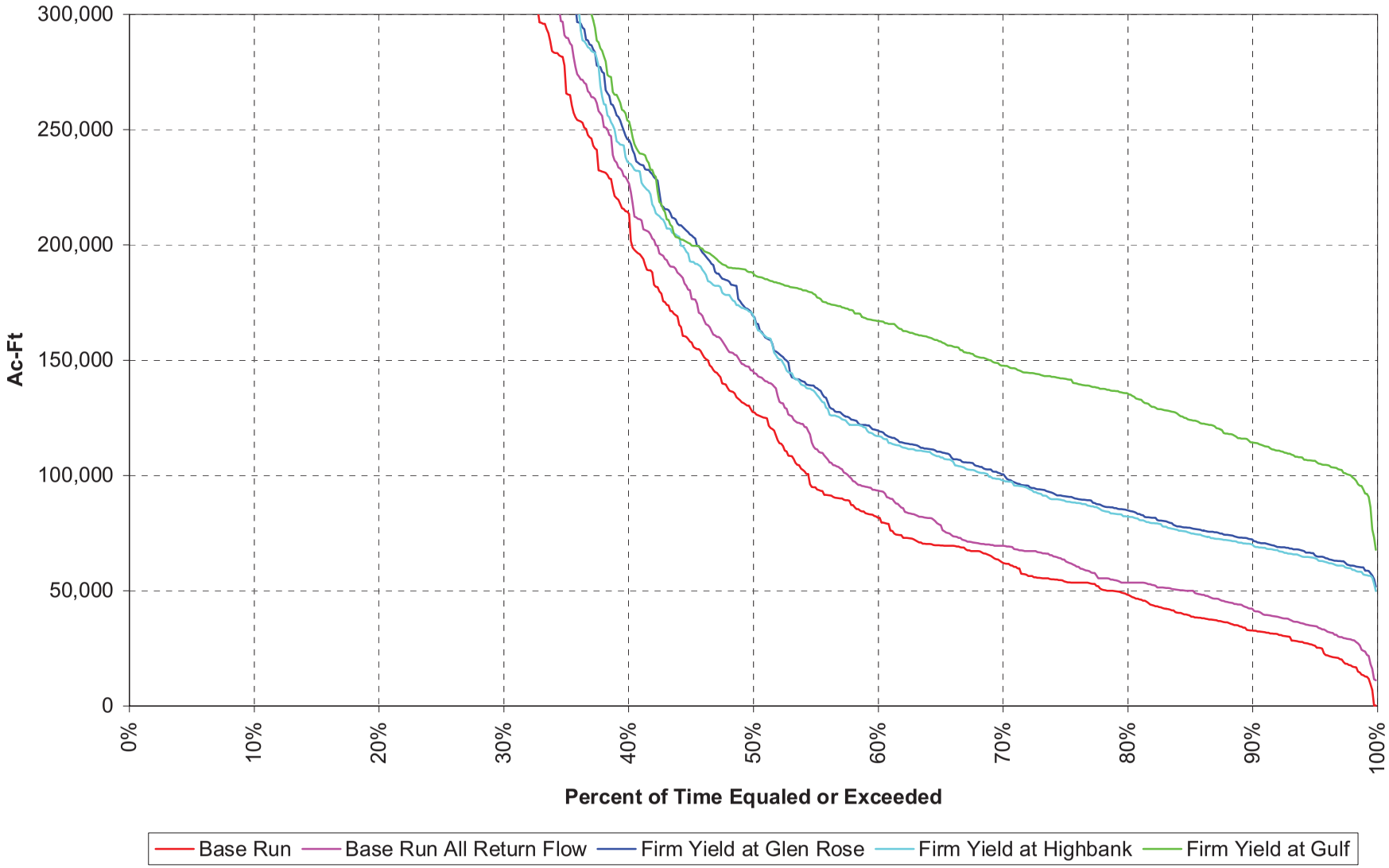
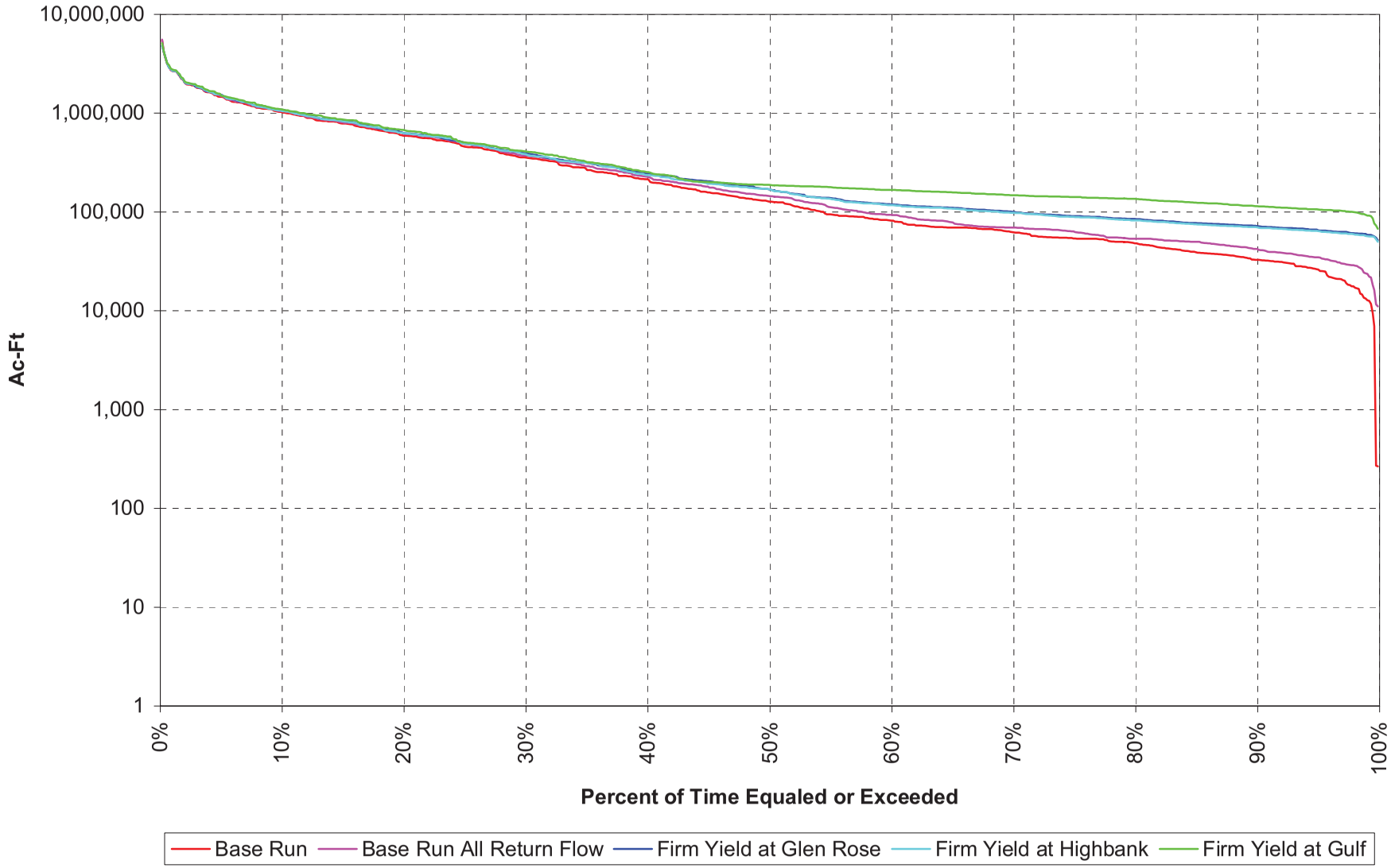


Figure F-8c: Regulated Flow at the Brazos River at Richmond Gauge



Water Conservation Plan

June 2, 2004

Prepared for:

Brazos River Authority

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BRA03108

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Appendix A Texas Commission on Environmental Quality Rules on Water Conservation Plans for Wholesale Water Providers

Appendix B Resolution Adopting Water Conservation Plan

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Brazos River Authority
Waco, Texas

Water Conservation Plan
June 2, 2004

1. Introduction

As a wholesale water supplier, the Brazos River Authority (Authority) adopts this Water Conservation Plan in conformance with the rules governing water conservation plans for wholesale water providers set forth by the Texas Commission on Environmental Quality (TCEQ) in *Texas Administrative Code* Title 30, Part 1, Rule §288.5, *Water Conservation Plans for Wholesale Water Suppliers*. Appendix A includes a copy of the TCEQ rules governing water conservation plans for wholesale water providers.

2. Minimum Requirements

Description of the Authority's Service Area

The Authority has statutory responsibility for conserving and developing the water resources of the Brazos River Basin in Texas and making them available for beneficial use. Figure 1 shows the Brazos River Basin in Texas, which includes all or part of 65 counties. The Brazos River Basin covers about 47,000 square miles, with 44,440 in Texas and slightly over 2,500 in New Mexico. The Authority's service area includes the Brazos River Basin in Texas, and the Authority also supplies water outside of the Brazos River Basin to the San Jacinto-Brazos Coastal Basin and a small part of the Trinity Basin (in Johnson County).

Population Data

Table 1 shows the projected population for the Brazos River Basin and the San Jacinto-Brazos and Brazos-Colorado Coastal Basins as approved by the Texas Water Development Board for the round of regional water planning and due to be completed by January of 2006. As of the year 2000, the population of the Brazos River Basin was 2.14 million, the population of the San Jacinto-Brazos Coastal Basin was 838,000 and the population of the Brazos-Colorado Coastal Basin was 81,000. The projected year 2060 population for the Brazos River Basin is 4.29 million, the projected year 2060 population for the San Jacinto-Brazos Coastal Basin is 1.73 million, and the projected 2060 population for the Brazos-Colorado Coastal Basin is 102,000.

BRA-CA-000233

Figure 1: Brazos River Basin Location Map

Table 1
Population Projections for the Brazos River Basin and the San Jacinto-Brazos and Brazos-Colorado Coastal Basins

Year	Projected Brazos River Basin Population	Projected San Jacinto-Brazos Population	Projected Brazos-Colorado Population
2000	2,142,862	838,435	80,994
2010	2,479,828	972,910	86,096
2020	2,835,278	1,110,665	91,478
2030	3,197,695	1,253,983	95,489
2040	3,544,891	1,391,394	98,388
2050	3,915,510	1,552,278	100,179
2060	4,285,525	1,727,265	101,642

Customer Data

As of April 1, 2004, the Authority has approximately 623,000 acre-feet per year of water committed under long-term contracts. Table 2 lists customers with contracts for 5,000 acre-feet per year or more. Table 3 lists projected population, municipal water use, and per capita municipal water use for the Authority's major municipal customers. These data were approved by the Texas Water Development Board for the round of regional water planning due to be completed by January of 2006.

Table 2
Brazos River Authority Contracts for
5,000 Acre-Feet per Year or More

Entity	**Contract Amount** (Acre-Feet per Year)
TXU	122,447
Reliant	97,000
Bell County WCID #1	49,509
City of Lubbock	35,000
Gulf Coast Water Authority	32,668
City of Temple	27,953
City of Round Rock	24,854
City of Georgetown	22,168
Dow Chemical	16,000
Johnson County Rural SUD	13,210
City of Granbury	11,300
AES Wolf Hollow, L.P.	10,000
City of Taylor	8,525
Acton MUD	7,800
Central Texas WSC	6,950
Texas A&M University	6,945
Kerr-McGee Oil & Gas	6,000
Aquilla Water Supply District	5,953
South Texas Water Company	5,625
City of Cleburne	5,300
Alcoa	5,000

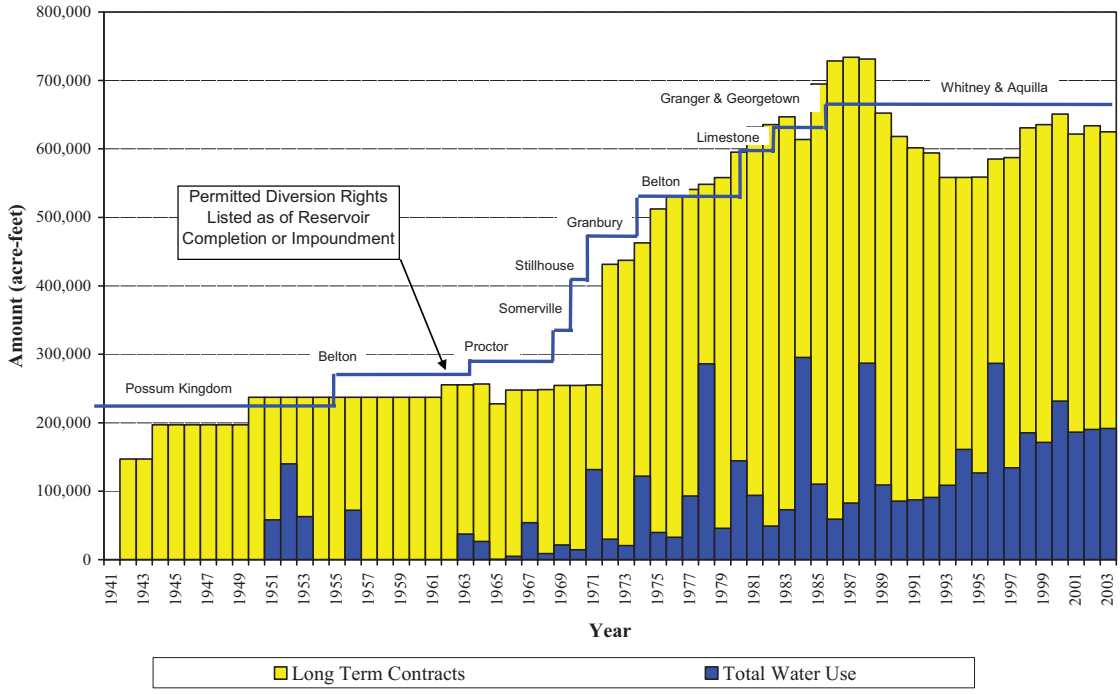
Water Use Data

Figure 2 shows the history of annual water use from Authority water rights and the Authority's total permitted diversions. The Authority's annual use has been increasing over the years, with high water use in dry years, including 1978, 1984, 1988, 1996, and 2000.

Table 3
Projected Population, Municipal Water Use, and Per Capita Water Use for Major Municipal Customers

Authority Customer	Region	Water User Group	County	Demand							Population							Per Capita						
				2000	2010	2020	2030	2040	2050	2060	2000	2010	2020	2030	2040	2050	2060	2000	2010	2020	2030	2040	2050	2060
Acton MUD	G	Acton MUD	Hood	2,026	2,425	2,912	3,363	3,851	4,464	5,204	12,222	15,036	18,435	21,599	24,913	29,088	33,909	148	144	141	139	138	137	137
Aquilla WSC	G	Files Valley WSC	Hill	338	338	341	344	347	354	365	1,605	1,633	1,672	1,717	1,761	1,808	1,861	188	185	182	179	176	175	175
Aquilla WSC	G	Hillsboro	Hill	1,706	1,728	1,768	1,815	1,859	1,928	2,017	8,232	8,477	8,820	9,208	9,595	10,008	10,467	185	182	179	176	173	172	172
Bell County WCID#1	G	439 WSC	Bell	591	727	822	901	953	981	1,010	5,274	6,765	7,802	8,740	9,345	9,735	10,018	100	96	94	92	91	90	90
Bell County WCID#1	G	Belton	Bell	2,195	2,568	2,902	3,208	3,364	3,499	3,540	14,623	17,633	20,399	22,914	24,617	25,815	26,116	134	130	127	125	122	121	121
Bell County WCID#1	G	Harker Heights	Bell	2,656	3,349	4,244	4,954	5,550	5,708	5,808	17,308	22,477	29,147	34,822	39,636	41,096	41,818	137	133	130	127	125	124	124
Bell County WCID#1	G	Killeen	Bell	11,682	18,031	23,507	25,837	27,827	29,735	31,789	86,911	104,528	117,239	130,315	142,772	156,151	169,937	120	154	179	177	174	170	167
Bell County WCID#1	G	Nolanville	Bell	265	274	281	286	285	287	291	2,150	2,333	2,460	2,575	2,649	2,697	2,732	110	105	102	99	96	95	95
Bell County WCID#1	G	Copperas Cove	Coryell	2,903	3,232	3,664	4,042	4,292	4,542	4,788	29,455	34,762	40,893	46,866	51,092	54,790	57,765	88	83	80	77	75	74	74
Bell County WCID#1	G	Fort Hood (CDP)	Coryell	7,251	7,196	7,140	7,085	7,030	6,993	6,993	16,429	16,429	16,429	16,429	16,429	16,429	16,429	394	391	388	385	382	380	380
Central Texas WSC	G	Bell-Milam Falls WSC	Bell	299	342	371	398	415	425	435	1,980	2,350	2,607	2,840	2,990	3,087	3,157	135	130	127	125	124	123	123
Central Texas WSC	G	Dog Ridge WSC	Bell	586	715	799	876	926	955	982	3,534	4,434	5,060	5,626	5,991	6,226	6,397	148	144	141	139	138	137	137
Central Texas WSC	G	East Bell County WSC	Bell	250	263	271	276	279	282	286	2,274	2,502	2,661	2,805	2,898	2,958	3,001	98	94	91	88	86	85	85
Central Texas WSC	G	Holland	Bell	130	125	121	117	114	111	111	1,102	1,102	1,102	1,102	1,102	1,102	1,102	105	101	98	95	92	90	90
Central Texas WSC	G	Rogers	Bell	199	195	191	188	184	181	181	1,117	1,117	1,117	1,117	1,117	1,117	1,117	159	156	153	150	147	145	145
Central Texas WSC	G	West Bell County WSC	Bell	678	660	642	623	605	599	599	5,456	5,456	5,456	5,456	5,456	5,456	5,456	111	108	105	102	99	98	98
Central Texas WSC	G	Lott	Falls	99	97	94	92	89	88	88	724	724	724	724	724	724	724	122	120	116	113	110	108	108
Central Texas WSC	G	Rosebud	Falls	177	171	166	161	156	152	152	1,493	1,493	1,493	1,493	1,493	1,493	1,493	106	102	99	96	93	91	91
Central Texas WSC	G	Kempner	Lampasas	238	300	366	411	446	467	482	1,004	1,286	1,584	1,800	1,960	2,065	2,131	212	208	206	204	203	202	202
Central Texas WSC	G	Kempner WSC	Lampasas	1,053	1,293	1,547	1,734	1,870	1,956	2,015	3,081	3,836	4,633	5,211	5,639	5,920	6,098	305	301	298	297	296	295	295
Central Texas WSC	G	Lampasas	Lampasas	1,224	1,570	1,583	1,579	1,563	1,563	1,548	6,786	7,010	7,246	7,417	7,544	7,627	7,680	161	200	195	190	185	183	180
Cleburne	G	Cleburne	Johnson	4,165	5,748	6,370	7,003	7,722	8,666	9,879	26,005	29,158	32,872	36,774	41,036	46,324	52,812	143	176	173	170	168	167	167
Georgetown	G	Georgetown	Williamson	6,127	8,610	11,619	15,141	19,003	23,293	27,895	28,339	40,888	55,770	73,463	92,702	113,633	136,082	193	188	186	184	183	183	183
Granbury	G	Granbury	Hood	2,005	2,369	2,811	3,213	3,651	4,201	4,851	5,718	6,843	8,202	9,467	10,792	12,461	14,388	313	309	306	303	302	301	301
Gulf Coast Water Authority	H	Missouri City	Fort Bend	198	315	390	466	545	603	733	1,025	1,659	2,088	2,499	2,917	3,206	3,880	172	169	167	166	167	168	169
Gulf Coast Water Authority	H	Missouri City	Fort Bend	7,353	11,664	14,464	17,280	20,186	22,351	27,175	37,999	61,510	77,411	92,650	108,116	118,851	143,849	173	169	167	166	167	168	169
Gulf Coast Water Authority	H	Stafford	Fort Bend	1,001	1,395	1,820	2,317	2,839	3,573	4,411	12,412	18,593	24,999	32,832	40,886	51,449	63,519	72	67	65	63	62	62	62
Gulf Coast Water Authority	H	Sugar Land	Fort Bend	6,356	7,112	7,047	6,981	6,948	6,948	6,948	25,677	29,396	29,396	29,396	29,396	29,396	29,396	221	216	214	212	211	211	211
Gulf Coast Water Authority	H	Sugar Land	Fort Bend	8,684	9,717	9,627	9,537	9,492	9,492	9,492	35,079	40,160	40,160	40,160	40,160	40,160	40,160	221	216	214	212	211	211	211
Gulf Coast Water Authority	H	Bacliff MUD	Galveston	526	552	572	569	560	557	562	7,014	7,816	8,509	8,919	9,085	9,209	9,289	67	63	60	57	55	54	54
Gulf Coast Water Authority	H	Bayou Vista	Galveston	396	429	458	471	475	478	482	1,644	1,816	1,964	2,052	2,088	2,114	2,131	215	211	208	205	203	202	202
Gulf Coast Water Authority	H	Clear Lake Shores	Galveston	273	282	287	289	287	287	289	1,205	1,263	1,313	1,343	1,355	1,364	1,370	202	199	195	192	189	188	188
Gulf Coast Water Authority	H	Galveston	Galveston	16,288	16,095	15,903	15,711	15,518	15,390	15,390	57,247	57,247	57,247	57,247	57,247	57,247	57,247	254	251	248	245	242	240	240
Gulf Coast Water Authority	H	Galveston County WCID #12	Galveston	231	267	296	312	316	320	324	1,386	1,641	1,861	1,992	2,045	2,084	2,110	149	145	142	140	138	137	137
Gulf Coast Water Authority	H	Hitchcock	Galveston	916	933	935	930	914	911	915	6,386	6,660	6,897	7,037	7,094	7,136	7,163	128	125	121	118	115	114	114
Gulf Coast Water Authority	H	Kemah	Galveston	227	278	322	348	356	360	366	2,330	2,985	3,550	3,885	4,021	4,122	4,188	87	83	81	80	79	78	78
Gulf Coast Water Authority	H	La Marque	Galveston	2,207	2,161	2,115	2,069	2,023	1,992	1,992	13,682	13,682	13,682	13,682	13,682	13,682	13,682	144	141	138	135	132	130	130
Gulf Coast Water Authority	H	League City	Galveston	6,597	7,477	8,253	8,674	8,751	8,840	8,947	45,306	53,403	60,392	64,532	66,207	67,454	68,265	130	125	122	120	118	117	117
Gulf Coast Water Authority	H	San Leon MUD	Galveston	585	632	670	680	676	677	684	6,000	6,795	7,481	7,887	8,051	8,173	8,253	87	83	80	77	75	74	74
Gulf Coast Water Authority	H	Santa Fe	Galveston	963	988	990	982	956	951	956	9,548	10,141	10,653	10,956	11,079	11,170	11,229	90	87	83	80	77	76	76
Gulf Coast Water Authority	H	Texas City	Galveston	6,604	6,476	6,383	6,269	6,138	6,051	6,056	41,521	41,891	42,211	42,400	42,477	42,534	42,571	142	138	135	132	129	127	127
Gulf Coast Water Authority	H	Tiki Island	Galveston	199	243	282	303	311	316	321	1,016	1,270	1,489	1,619	1,672	1,711	1,736	175	171	169	167	166	165	165
Gulf Coast Water Authority	H	Pearland	Harris	292	342	394	445	496	551	606	1,944	2,364	2,773	3,175	3,573	3,968	4,362	134	129	127	125	124	124	124
Johnson County Rural WSC	G	Johnson County Rural WSC	Hill	34	37	41	46	53	59	65	177	191	211	233	255	279	305	171	173	173	176	185	189	190
Johnson County Rural WSC	G	Johnson County Rural WSC	Johnson	1,660	2,200	2,885	3,647	4,555	5,709	6,943	8,666	11,484	14,803	18,290	22,099	26,825	32,623	171	171	174	178	184	190	190
Lubbock	O	Lubbock	Lubbock	40,461	41,765	42,580	42,652	42,033	42,349	41,915	199,564	210,658	218,471	222,680	223,370	226,395	224,074	181	177	174	171	168	167	167
Round Rock	G	Brushy Creek MUD	Williamson	1,902	2,643	3,596	3,869	3,869	3,869	3,869	11,322	16,270	22,138	23,823	23,823	23,823	23,823	150	145	145	145	145	145	145
Round Rock	G	Fern Bluff MUD	Williamson	745	1,339	2,049	2,882	3,805	4,810	5,888	5,319	9,801	15,117	21,437	28,309	35,785	43,803	125	122	121	120	120	120	120
Round Rock	G	Round Rock	Williamson	13,522	19,239	25,937	33,896	42,617	52,298	62,680	60,060	87,187	119,358	157,606	199,196	244,442	292,970	201	197	194	192	191	191	191
Taylor	G	Taylor	Williamson	2,281	2,522	2,839	3,208	3,622	4,093	4,625	13,575	15,530	17,849	20,606	23,604	26,865	30,363	150	145	142	139	137	136	136
Temple	G	Little River-Academy	Bell	260	275	285	292	294	297	301	1,645	1,793	1,896	1,989	2,049	2,088	2,116	141	137	134	131	128	127	127
Temple	G	Morgans Point Resort	Bell	348	414	455	493	518	532	546	2,989	3,698	4,191	4,637	4,924	5,109	5,243	104	100	97	95	94	93	93
Temple	G	Temple	Bell	13,678	15,373	17,343	19,466	21,194	23,109	24,939	54,514	62,382	71,350	80,830	89,247	97,774	105,519	224	220	217	215	212	211	211
Temple	G	Troy	Bell	191	185	181	176	171	168	168	1,378	1,378	1,378	1,378	1,378	1,378	1,378	124	120	117	114	111	109	109

Figure 2: Permitted Diversion Rights and Total Water Use



Water Supply System Data

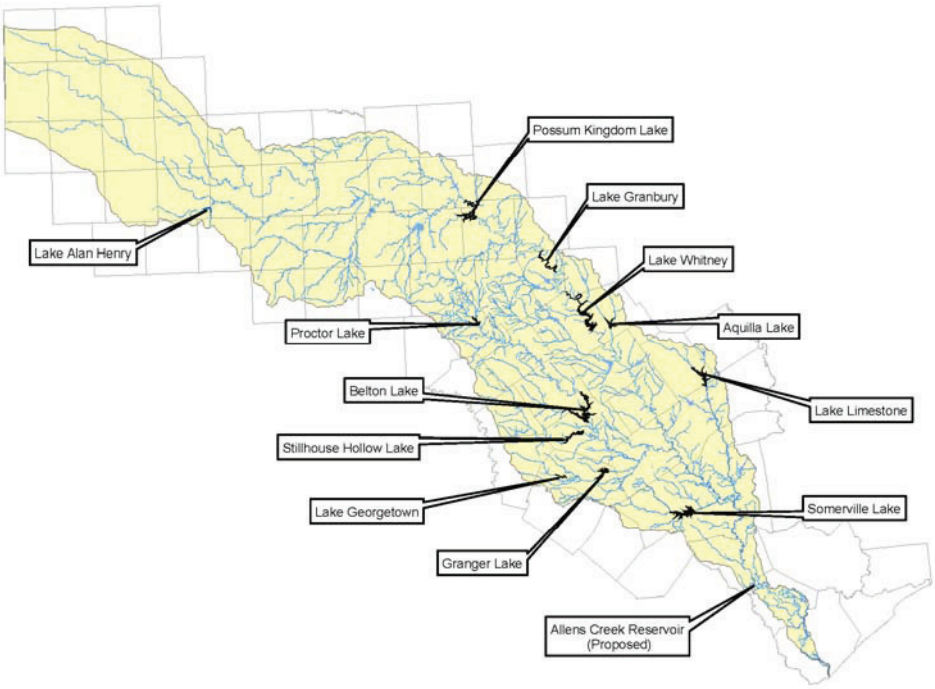
The Authority holds Texas water rights for four reservoirs that it owns and operates for water supply – Possum Kingdom Lake, Lake Granbury, Lake Limestone and Lake Alan Henry. The Authority holds Texas water rights and contracts with the U.S. Army Corps of Engineers for storage space in eight multi-purpose Federal reservoirs – Lakes Whitney, Belton, Proctor, Somerville, Stillhouse Hollow, Granger, Georgetown and Aquilla. Figure 3 shows the location of the twelve existing reservoirs for which the Authority has water rights.

The Authority makes water available on a wholesale basis from the twelve existing reservoirs in which it holds water rights to municipal, industrial and agricultural water customers. The Authority also holds a water right jointly with the City of Houston and the Texas Water Development Board for the proposed Allens Creek Reservoir. Altogether, the Authority has total authorized priority diversions of 796,551 acre-feet per year[1].

[1] Permitted diversions include 35,000 acre-feet per year from Lake Alan Henry and 99,650 acre-feet per year from Allens Creek Reservoir. Lake Alan Henry is not part of the existing System Operation Order and the supply has been fully contracted to the City of Lubbock.

In addition to its reservoirs, the Authority operates two pipeline delivery systems: the Williamson County Raw Water Line connecting Lake Stillhouse Hollow to Lake Georgetown, and the West Central Brazos Water Distribution System, a pipeline formerly used to deliver water from Lake Possum Kingdom for oilfield production. The Williamson County pipeline is expected to begin operation in 2004 and the West Central Brazos system is expected to begin delivery of water to municipal customers by 2006.

Figure 3: Brazos River Authority Reservoirs



The Authority currently owns and operates the Lake Granbury Surface Water and Treatment System (SWATS), which was the first advanced membrane treatment plant in Texas. The plant uses an electrodialysis reversal process and ultra filter/reverse osmosis to remove naturally occurring salt from raw water diverted from Lake Granbury. The SWATS plant provides water for the City of Granbury, the Acton Municipal Utility District, the Johnson County Fresh Water Supply District No. 1, the Johnson County Rural Special Utility District, and the City of Keene.

Wastewater Data

The Authority owns or operates six wastewater facilities – the Temple-Belton Regional Sewerage System, the Brushy Creek Regional Sewerage System, Clute-Richwood Wastewater Treatment Facility, Sugar Land Regional Sewerage System, City of Hutto

Wastewater Plant, and the Lee County Freshwater Supply District #1. Table 4 shows the return flows of treated effluent from these plants for 2000 through 2002.

Table 4
Return Flows from Brazos River Authority Wastewater Treatment Facilities
(Values in Acre-Feet per Year)

Brazos River Authority Wastewater Plant	2000	2001	2002	2003
Temple-Belton Regional Sewerage System	6,705	7,971	6,743	7,011
East Brushy Creek Regional Wastewater System	9,412	10,990	11,223	11,922
City of Hutto Wastewater Plant	142	264	255	282
Clute-Richwood Wastewater Treatment Facility	2,376	3,092	3,318	3,057
Lee County Fresh Water Supply District #1 (Dime Box)	-	-	6	5
Sugar Land Regional Sewerage System	4,311	5,149	4,780	4,370
Total	*22,946*	*27,466*	*26,325*	*26,647*

Specification of Conservation Goals

The Brazos River Basin is very large and has highly varied climatic conditions. The basin includes a multitude of water users, some of which purchase water from the Authority and some of which do not. The Authority provides assistance to its customers (industries, municipalities, and irrigators) in the development and implementation of conservation programs. The Authority adopts the following conservation goals:

- As existing water sale contracts come due for renewal, implement and maintain water rate structures that discourage wasteful use of water and produce enough revenue to meet bond obligations and other expenses of operation.
- To the maximum extent possible within regulatory, institutional, and physical constraints, optimize benefits from the Authority's reservoirs through system operation and coordinated use of excess unregulated flows.
- Implement a program of regular inspection, maintenance and repair of pipelines and pump stations in the Authority’s delivery system. Emphasize control of leaks and water losses.
- Continue to develop and improve the Authority’s existing water conservation education and information program.
- Pursue wastewater reuse by the Authority as opportunities arise.
- When authorized by the Authority's Board of Directors, cooperate with various local entities in planning, developing and operating regional water resource projects and pollution prevention and abatement programs.

- Implement the Environmental Leadership Policy of the Brazos River Authority to enhance and protect the water quality in the Brazos River Basin and adjacent coastal basins. Specific programs include but are not limited to the Clean Rivers Program and the Quality Water for the Brazos Community program.
- Continue to cooperate with federal and state agencies in monitoring, developing and disseminating water quantity and quality data.
- Develop and implement appropriate water conservation plans and programs to meet the needs of specific projects, areas or circumstances.
- As new contracts are entered into and contracts are renewed, require contract users to develop and implement conservation plans pursuant to TCEQ rules. Users that supply potable water to others will be encouraged to consider and implement the following conservation activities, as appropriate:
    - Set specific conservation goals including, where appropriate, target per capita water use, maximum acceptable unaccounted-for water, and a time frame for achieving these goals.
    - Establish conservation-oriented rate structures such as uniform or increasing block rates and or seasonal rates to inhibit the waste or inefficient use of water. Similar rate structures should also be applied to wastewater returned to the sewerage system for treatment.
    - Establish an aggressive program for calibrating water meters and for repairing or replacing those found to have an error of 5% or more. The program should focus initially on master meters and those of major users, then expand to include the meters of all users.
    - Establish and maintain an active leak detection and repair program to identify discrete sections of distribution systems with excessive water losses. Implement maintenance programs which will result in long-term solutions to repetitive line breaks or other events which result in the loss of water.
    - Establish a goal to reduce annual unaccounted water in distribution systems to no more than 12% within 5 years of the date of the water conservation plan and maintain unaccounted losses at no more than 12% for each year thereafter. (Water suppliers in rural areas with large distances between customers may set a goal higher than 12%, if appropriate.)
    - Publicize the financial benefits to the community of water conservation by avoiding the cost of expanding the water supply and wastewater treatment systems.
    - Encourage the use of landscaping that will minimize water requirements.
    - Publicize and encourage demand reduction practices, i.e., off-peak watering of lawns, etc.

Description of Practices Utilized to Measure and Account for Diversions

All diversions of water by the Authority's water customers (excepting those uses not exceeding five acre-feet of water per year) must be metered or otherwise measured with an error of less than plus or minus 5% and reported to the Authority in a timely manner.

Monitoring and Record Management Program

The Authority, in conjunction with the U.S. Geological Survey, operates numerous stream gauging stations throughout the basin which provide information on Authority reservoirs and stream flows, including releases from the reservoirs. The Authority has developed an integrated communication system for real-time monitoring that uses satellites, line-of-sight radio, microwave and dedicated telephone land lines to transmit radar images, river and reservoir conditions, and weather forecasts to Authority personnel.

The Authority monitors surface water rights in the basin and water supply releases to ensure that its water rights and releases for customers are protected. The Authority has developed a plan for cooperative water rights monitoring for the lower Brazos River Basin based on daily flows.

The Brazos River Authority preserves its records in accordance with its Records Retention Policy, which is modeled after the procedures used by the Texas State Library. This policy is consistent with the provisions of the Local Government Records Act (Texas Water Code § 49.065(c); Texas Local Government Code §§ 201.001-205.009).

Metering and Leak Detection and Repair

Currently the Authority uses the bed and banks of the Brazos River and its tributaries to deliver water the vast majority of its supplies to customers. The Authority currently has limited deliveries by pipeline in the West Central Brazos Pipeline. The Williamson County Raw Water Line is also part of the Authority system. Deliveries through both of these systems are expected to increase over time. The Authority will implement a program of regular inspection, maintenance and repair of pipelines and pump stations, focusing on the monitoring of unaccounted water and the detection and repair of leaks.

Conservation Requirements in Authority Contracts

The Authority includes the following clause addressing water conservation in every new and renewed contract:

> ***Conservation of Water.*** *It is the intent of the parties to this Agreement to provide to the maximum extent practicable for the conservation of water, and Purchaser agrees that it is a condition of this Agreement that Purchaser shall*

maintain and operate its facilities in a manner that will prevent the unnecessary waste of water. Purchaser agrees to implement a water conservation program in accordance with the BRA's Water Conservation Plan adopted by BRA's Board of Directors on April 26, 2004, and any subsequent amendments thereto and that the water diverted by Purchaser, pursuant to this Agreement, will be used in accordance with such Water Conservation Plan. Purchaser agrees that, in the event that Purchaser furnishes water or water services to a third party or successive parties, that, in turn, will furnish the water or water services to the ultimate consumer, the requirements of this Agreement relative to water conservation shall be met through contractual agreements between the Purchaser and the third party or successive parties, providing for the establishment and implementation of a water conservation program consistent with BRA's Water Conservation Plan. BRA, in accordance with applicable law, may from time to time adopt reasonable rules and regulations relating to water conservation. Purchaser agrees to amend its water conservation program, as necessary, to reflect BRA's Water Conservation Plan, as such plan may be amended from time to time.

Reservoir System Operation Plan

To the maximum extent possible within regulatory, institutional, and physical constraints, the Authority seeks to optimize water supply from its reservoirs and run-of-the-river supplies through coordinated system operation. In order to achieve the goal of optimal management of the water resources of the Brazos River Basin, the Authority may seek additional appropriations of state water and seek changes to its existing water rights to allow more efficient operation of its system.

The most productive conservation measure available to the Authority is the effective development and protection of water resources. The operation of the Authority system is currently governed by the System Operation Order, which has been incorporated into the water rights for Lake Possum Kingdom, Lake Granbury, Lake Whitney, Lake Aquilla, Lake Proctor, Lake Belton, Lake Stillhouse Hollow, Lake Georgetown, Lake Granger, Lake Limestone and Lake Somerville. (Lake Alan Henry and the proposed Allens Creek Reservoir are not included in the System Operation Order.) The total sum of the priority rights for the 11 reservoirs included in the System Operation Order is 661,901 acre-feet[2]. The System Operation Order allows diversion from any reservoir to exceed the priority right for that reservoir as long as:

- The sum of the annual diversions from the 11 reservoirs included in the System Operation Order does not exceed 661,901 acre-feet,
- The annual amount diverted from that reservoir does not exceed the sum of the amounts authorized for all purposes for the reservoir,

[2] The water rights for Lake Alan Henry and Allens Creek Reservoir, which are not included in the System Operation Order, allow diversion of 35,000 acre-feet per year and 99,650 acre-feet per year, respectively. Altogether, the Authority has permitted priority diversions of 796,551 acre-feet per year.

- The annual amount of water diverted or released from that reservoir for a particular purpose may exceed the authorization for that purpose under that reservoir's certificate of adjudication, but may not exceed the total authorized diversions for all purposes from that reservoir.

Diversion for system operation may not be made from a reservoir when the content of that reservoir is 30 percent or less of the conservation storage unless the content of all system reservoirs is 30 percent or less of the conservation storage.

The Authority also has the ability under Certificate of Adjudication 12-5166 to utilize unappropriated flows in the lower Brazos River Basin to meet customer demands on a non-priority basis, accounting for these diversions by assigning them to an Authority reservoir included in the System Operation Order. Any additional water that may become available through system operation is not recognized by these existing water rights.

Means for Implementation and Enforcement

This Water Conservation Plan and all plans developed hereunder are required to be followed by purchasers in all of the Authority's water availability agreements. Violation of the Plan is a violation of the agreement provision and will be treated as such.

A copy of the resolution by the Board of Directors of the Brazos River Authority adopting this Water Conservation Plan may be found in Appendix B.

Documentation of Coordination with Regional Water Plans

The Authority is providing a copy of this Plan to each of the Regional Water Planning Groups located within the Brazos River Basin (Region B, Region C, Region F, Brazos G, Region H, Lower Colorado (Region K) and Llano-Estacado (Region O)).

3. Additional Conservation Strategies

The Authority also adopts these additional conservation strategies:

- The Authority will encourage and assist customers in the development of conservation pollution prevention and abatement plans through participation in programs such as the Clean Rivers Program and the Quality Water for the Brazos Community program.

- The Authority will adopt any other water conservation practice, method, or technique which the Authority finds to be appropriate for achieving the stated goals of this water conservation plan.

APPENDIX A

Texas Commission on Environmental Quality Rules on Water Conservation Plans for Wholesale Water Suppliers

APPENDIX A

Texas Commission on Environmental Quality Rules on Water Conservation Plans for Wholesale Water Suppliers

Texas Administrative Code

TITLE 30	ENVIRONMENTAL QUALITY
PART 1	TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
CHAPTER 288	WATER CONSERVATION PLANS, DROUGHT CONTINGENCY PLANS, GUIDELINES AND REQUIREMENTS
SUBCHAPTER A	WATER CONSERVATION PLANS
RULE §288.1	**Definitions**

The following words and terms, when used in this chapter, shall have the following meanings, unless the context clearly indicates otherwise.

(1) Agricultural or Agriculture--means any of the following activities:

(A) cultivating the soil to produce crops for human food, animal feed, or planting seed or for the production of fibers;

(B) the practice of floriculture, viticulture, silviculture, and horticulture, including the cultivation of plants in containers or non-soil media by a nursery grower;

(C) raising, feeding, or keeping animals for breeding purposes or for the production of food or fiber, leather, pelts, or other tangible products having a commercial value;

(D) raising or keeping equine animals;

(E) wildlife management; and

(F) planting cover crops, including cover crops cultivated for transplantation, or leaving land idle for the purpose of participating in any governmental program or normal crop or livestock rotation procedure.

(2) Agricultural use--Any use or activity involving agriculture, including irrigation.

(3) Conservation--Those practices, techniques, and technologies that reduce the consumption of water, reduce the loss or waste of water, improve the efficiency in the use of water, or increase the recycling and reuse of water so that a water supply is made available for future or alternative uses.

(4) Drought contingency plan--A strategy or combination of strategies for temporary supply and demand management responses to temporary and potentially recurring water supply shortages and other water supply emergencies. A drought contingency plan may be a separate document identified as such or may be contained within another water management document(s).

(5) Industrial use--The use of water in processes designed to convert materials of a lower order of value into forms having greater usability and commercial value, commercial fish production, and the development of power by means other than hydroelectric, but does not include agricultural use.

(6) Irrigation--The agricultural use of water for the irrigation of crops, trees, and pastureland, including, but not limited to, golf courses and parks which do not receive water through a municipal distribution system.

(7) Irrigation water use efficiency--The percentage of that amount of irrigation water which is beneficially used by agriculture crops or other vegetation relative to the amount of water diverted from the source(s) of supply. Beneficial uses of water for irrigation purposes include, but are not limited to, evapotranspiration needs for vegetative maintenance and growth, salinity management, and leaching requirements associated with irrigation.

(8) Mining use--The use of water for mining processes including hydraulic use, drilling, washing sand and gravel, and oil field repressuring.

(9) Municipal per capita water use--The sum total of water diverted into a water supply system for residential, commercial, and public and institutional uses divided by actual population served.

(10) Municipal use--The use of potable water within or outside a municipality and its environs whether supplied by a person, privately owned utility, political subdivision, or other entity as well as the use of sewage effluent for certain purposes, including the use of treated water for domestic purposes, fighting fires, sprinkling streets, flushing sewers and drains, watering parks and parkways, and recreational purposes, including public and private swimming pools, the use of potable water in industrial and commercial enterprises supplied by a municipal distribution system without special construction to meet its demands, and for the watering of lawns and family gardens.

(11) Nursery grower--A person engaged in the practice of floriculture, viticulture, silviculture, and horticulture, including the cultivation of plants in containers or nonsoil media, who grows more than 50% of the products that the person either sells or leases, regardless of the variety sold, leased, or grown. For the purpose of this definition, grow means the actual cultivation or propagation of the product beyond the mere holding or maintaining of the item prior to sale or lease, and typically includes activities associated with the production or multiplying of stock such as the development of new plants from cuttings, grafts, plugs, or seedlings.

(12) Pollution--The alteration of the physical, thermal, chemical, or biological quality of, or the contamination of, any water in the state that renders the water harmful, detrimental, or injurious to humans, animal life, vegetation, or property, or to the public health, safety, or welfare, or impairs the usefulness or the public enjoyment of the water for any lawful or reasonable purpose.

(13) Public Water Supplier--An individual or entity that supplies water to the public for human consumption.

(14) Regional Water Planning Group--A group established by the Texas Water

Development Board to prepare a regional water plan under Texas Water Code, §16.053.

(15) Retail Public Water Supplier--An individual or entity that for compensation supplies water to the public for human consumption. The term does not include an individual or entity that supplies water to itself or its employees or tenants when that water is not resold to or used by others.

(16) Reuse--The authorized use for one or more beneficial purposes of use of water that remains unconsumed after the water is used for the original purpose of use and before that water is either disposed of or discharged or otherwise allowed to flow into a watercourse, lake, or other body of state-owned water.

(17) Water conservation plan--A strategy or combination of strategies for reducing the volume of water withdrawn from a water supply source, for reducing the loss or waste of water, for maintaining or improving the efficiency in the use of water, for increasing the recycling and reuse of water, and for preventing the pollution of water. A water conservation plan may be a separate document identified as such or may be contained within another water management document(s).

(18) Wholesale Public Water Supplier--An individual or entity that for compensation supplies water to another for resale to the public for human consumption. The term does not include an individual or entity that supplies water to itself or its employees or tenants as an incident of that employee service or tenancy when that water is not resold to or used by others, or an individual or entity that conveys water to another individual or entity, but does not own the right to the water which is conveyed, whether or not for a delivery fee.

Source Note: The provisions of this §288.1 adopted to be effective May 3, 1993, 18 TexReg 2558; amended to be effective February 21, 1999, 24 TexReg 949; amended to be effective April 27, 2000, 25 TexReg 3544; amended to be effective August 15, 2002, 27 TexReg 7146.

Texas Administrative Code

TITLE 30	ENVIRONMENTAL QUALITY
PART 1	TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
CHAPTER 288	WATER CONSERVATION PLANS, DROUGHT CONTINGENCY PLANS, GUIDELINES AND REQUIREMENTS
SUBCHAPTER A	WATER CONSERVATION PLANS
RULE §288.5	**Water Conservation Plans for Wholesale Water Suppliers**

A water conservation plan for a wholesale water supplier shall provide information, where applicable, in response to each of the following paragraphs.

(1) Minimum requirements. All water conservation plans for wholesale water suppliers shall include the following elements:

(A) a description of the wholesaler's service area, including population and customer data, water use data, water supply system data, and wastewater data;

(B) specification of conservation goals including, where appropriate, target per capita water use goals for the wholesaler's service area, maximum acceptable unaccounted-for water, the basis for the development of said goals, and a time frame for achieving those goals;

(C) a description as to which practice(s) and/or device(s) will be utilized to measure and account for the amount of water diverted from the source(s) of supply;

(D) a monitoring and record management program for determining water deliveries, sales, and losses;

(E) a program of metering and leak detection and repair for the wholesaler's water storage, delivery, and distribution system;

(F) a requirement in every water supply contract entered into or renewed after official adoption of the water conservation plan, and including any contract extension, that each successive wholesale customer develop and implement a water conservation plan or water conservation measures using the applicable elements of this chapter. If the customer intends to resell the water, then the contract between the initial supplier and customer must provide that the contract for the resale of the water must have water conservation requirements so that each successive customer in the resale of the water will be required to implement water conservation measures in accordance with applicable provisions of this chapter;

(G) a reservoir systems operations plan, if applicable, providing for the coordinated operation of reservoirs owned by the applicant within a common watershed or river basin. The reservoir systems operations plans shall include optimization of water supplies as one of the significant goals of the plan;

(H) a means for implementation and enforcement, which shall be evidenced by: a copy of the ordinance, rule, resolution, or tariff, indicating official adoption of the water conservation plan by the water supplier; and a description of the authority by which the water supplier will implement and enforce the conservation plan; and

(I) documentation of coordination with the Regional Water Planning Groups for the

service area of the wholesale water supplier in order to insure consistency with the appropriate approved regional water plans.

(2) Additional conservation strategies. Any combination of the following strategies shall be selected by the water wholesaler, in addition to the minimum requirements of paragraph (1) of this section, if they are necessary in order to achieve the stated water conservation goals of the plan. The commission may require by commission order that any of the following strategies be implemented by the water supplier if the commission determines that the strategies are necessary in order for the conservation plan to be achieved:

(A) conservation-oriented water rates and water rate structures such as uniform or increasing block rate schedules, and/or seasonal rates, but not flat rate or decreasing block rates;

(B) a program to assist customers in the development of conservation pollution prevention and abatement plans;

(C) a program for reuse and/or recycling of wastewater and/or greywater; and

(D) any other water conservation practice, method, or technique which the wholesaler shows to be appropriate for achieving the stated goal or goals of the water conservation plan.

Source Note: The provisions of this §288.5 adopted to be effective May 3, 1993, 18 TexReg 2558; amended to be effective February 21, 1999, 24 TexReg 949; amended to be effective April 27, 2000, 25 TexReg 3544.

APPENDIX B

Board Resolution Adopting Water Conservation Plan

Prepared by_____

Approved by_____

Brazos River Authority

Board of Directors
Agenda Item 15
Deliberate and Act On a Resolution Adopting a Water Conservation Plan for the Brazos River Authority and Authorizing Incorporation of Provisions into All Water Sales Contracts used by the Brazos River Authority.

ACTION:
The following resolution is presented for consideration by the Board of Directors for adoption:

> **BE IT RESOLVED** by the Board of Directors of the Brazos River Authority that a Water Conservation Plan, attached hereto as Exhibit, prepared in conformance with the requirements of the Texas Commission on Environmental Quality (TCEQ) is hereby adopted; and
>
> **BE IT FURTHER RESOLVED** by the Board of Directors of the Brazos River Authority that the General Manager/CEO is directed to incorporate provisions into all water sales contracts used by the Brazos River Authority to require purchasers of water from the Brazos River Authority to implement a Water Conservation Program in accordance with the adopted Brazos River Authority Water Conservation Plan.

SUMMARY:
As a wholesale water supplier, the Authority must have an adopted Water Conservation Plan to be in conformance with the rules set forth by the Texas Commission on Environmental Quality (TCEQ). Contained within the plan are details regarding Authority practices, including those which could be imposed on customers of the Authority, to deal with water conservation throughout the Basin. Provisions contained within the approved Brazos River Authority Water Conservation Plan should be incorporated into all water sales contracts used by the Authority.

FINANCIAL:
There are no direct financial implications to the Authority by adoption of this Water Conservation Plan.

STAFF VIEW:
Adoption of the plan by the Board of Directors will put the Authority in compliance with the rules of the Texas Commission on Environmental Quality and inclusion of the

provisions within the water sales contracts used by the Authority will ensure our ability to pass these requirements on to our customers.

Brazos River Authority

Board of Directors
Agenda Item 25B
Resolution Authorizing the General Manager/CEO to make Application to the Texas Commission on Environmental Quality

ACTION:

The following resolution is presented for consideration by the Board of Directors for adoption:

> **BE IT RESOLVED** by the Board of Directors of the Brazos River Authority that the General Manager/CEO is hereby authorized to sign and file an application with the Texas Commission on Environmental Quality and pursue favorable action on the application to the benefit of the Brazos River Basin and the State of Texas; and
>
> **BE IT FURTHER RESOLVED** by the Board of Directors of the Brazos River Authority that the General Manager/CEO is hereby authorized to take all actions as deemed necessary, including the retention of sufficient and appropriate consulting and legal support, to accomplish that activity.

SUMMARY:

Successful approval of this application will result in the creation of sources of surface water to meet the future needs of both the Basin and other regions that are dependent upon the Brazos River System as a water source.

FINANCIAL:

Funding for this project was initiated in FY 2003 and reaffirmed for FY 2004. Additional funding may be required in FY 2005, FY 2006, and FY 2007, depending on the duration of the project. The Filing Fee for the application is approximately $60,000, and is included in the FY 2004 Project Budget.

STAFF VIEW:

The successful completion of this project will prepare the Authority to address the current and future water resource needs of the Basin, and the State of Texas.

Bickerstaff, Heath, Smiley, Pollan, Kever & McDaniel, L.L.P.

816 Congress Avenue Suite 1700 Austin, Texas 78701 (512) 472-8021 Fax (512) 320-5638 www.bickerstaff.com

October 8, 2004

Via Hand Delivery

Mr. David Koinm
Project Manager
Water Rights Permitting Team
Texas Commission on Environmental Quality
Building F, 3rd Floor
12100 Park 35 Circle
Austin, Texas 78753

RE: Brazos River Authority Application No. 5851 to Appropriate State Water

Dear Mr. Koinm:

This letter is in response to your September 1, 2004 letter to Bruce Wasinger requesting information regarding the above-referenced application.

1. Information required by 30 TAC §297.50 and 288.5 concerning water conservation goals and water conservation plan requirements, including a description of the service area, water use data, water supply system data, system inventory and wastewater data. (RFI by Kristin Wang per July 12, 2004 interoffice memorandum.)

The information requested is contained in the 2004 Brazos River Authority *Water Conservation Plan*, included in the application as Attachment 4. The following information is provided to assist you in identifying the requested information in the *Water Conservation Plan*.

Requirements of 30 TAC §297.50

30 TAC §297.50 states that:

A water conservation plan submitted with an application requesting an appropriation for new or additional state water must include data and information which:

(1) supports the applicant's proposed use of water with consideration of the water conservation goals of the water conservation plan;

(2) evaluates conservation as an alternative to the proposed appropriation; and

(3) evaluates other feasible alternatives to new water development, including but not limited to, waste prevention, recycling and reuse, water transfer and marketing, reservoir system operations, and optimum water management practices and

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procedures. It shall be the burden of proof of the applicant to demonstrate that the requested amount of appropriation is necessary and reasonable for the proposed use.

Support of Applicant's Proposed Use of Water

Two of the water conservation goals found on page 7 of the *Water Conservation Plan* specifically support the application:

- *To the maximum extent possible within regulatory, institutional, and physical constraints, optimize benefits from the Authority's reservoirs through system operation and coordinated use of excess unregulated flows.*

- *Pursue wastewater reuse by the Authority as opportunities arise.*

These goals support the application in the following ways:

a) The appropriation of 421,449 acre-feet is the result of optimizing the benefits from the Authority's reservoirs through system operation and coordinated use of excess unregulated flows, as well as the appropriation of return flows.

b) The requested water right will remove some of the regulatory barriers to optimizing the benefits from the Authority's existing reservoir system.

Evaluation of Conservation as an Alternative to the Application

The proposed System Operation Permit is a water conservation strategy. 30 TAC §288.1 defines conservation as:

Those practices, techniques, and technologies that reduce the consumption of water, reduce the loss or waste of water, improve the efficiency in the use of water, or increase the recycling and reuse of water so that a water supply is made available for future or alternative uses.

The proposed System Operation Permit reduces the waste of water and improves the efficient use of water by efficiently coordinating reservoir operation with excess unregulated flows. The application includes recycling and reuse of water by the Authority. Finally, the appropriation of the water made available by implementing these practices makes the water available for future or alternative uses. The yield made available through system operation can only be achieved by use of the Authority's reservoir system, and without the appropriation the water would not be available for future or alternative use.

Feasible Alternatives and Proof of Need

The additional yield sought in the proposed System Operation Permit is made available by implementing most of the alternatives listed specifically in requirement 30 TAC §297.50 (3), namely waste prevention, recycling and reuse, reservoir system operation and optimum water management practices. The Authority is seeking appropriation of additional supply made available by implementing these alternatives. The additional yield can only be achieved through use of the Authority's reservoir system. Water transfer and marketing is not explicitly part of the application.

In addition to the information found in the *Water Conservation Plan*, a list of feasible alternatives to the proposed System Operation Permit may be found in the 2004 *Report in Support of System Operation Permit Application*, which is included in the application documents as Attachment 3. Alternatives are listed under the heading Alternatives to the Permit beginning on page 4-2. A summary of the alternatives may be found in Table 4.1 on page 4-3. Alternatives include the Little River Reservoir, the Millican Reservoir, groundwater development from the Carrizo-Wilcox, importation of out-of-basin water, and reallocation of Corps reservoirs.

Supplemental information that may be used as justification that the proposed System Operation Permit is necessary and reasonable for the proposed use may be found in the same report beginning on page 5-2 under the heading Need for Additional Water. This section summarizes information from the 2002 State Water Plan supporting the need for the proposed System Operation Permit. According to the plan, over 185,000 acre-feet of additional supply will be needed from the Authority system by 2050. More detailed information on needs may be found in Appendix B of the report.

Requirements of 30 TAC §288.5

Specific items requested include:

a) a description of the service area,
b) water use data,
c) water supply system data,
d) system inventory, and
e) wastewater data

The information requested is available in the *Water Conservation Plan* under the heading Description of the Authority's Service Area, in the *Report in Support of System Operation Permit Application*, and in the *Supplemental Information for Brazos River Authority's Application for a System Operation Permit*.

Description of Service Area

The Authority's service area includes the entire Texas portion of Brazos River Basin as well as the adjacent coastal basins. As stated on page 1 of the *Water Conservation Plan* "the Authority has statutory responsibility for conserving and developing the water resources of the Brazos River Basin in Texas and making them available for beneficial use." A map of the basin is included as Figure 1 of the *Water Conservation Plan.*

Supplemental information describing the Authority and its service may be found in Sections 1.1 and 1.2 of the *Report in Support of System Operation Permit Application* and in Section I of the *Supplemental Information for Brazos River Authority's Application for a System Operation Permit.*

Water Use Data

Historical water use data are summarized in Figure 2 on page 5 of the *Water Conservation Plan.*

Water Supply System Data and System Inventory

Water supply system data and a system inventory begins on page 5 of the *Water Conservation Plan* under the heading Water Supply System Data. Additional information regarding the history of the Authority and the current Authority system may be found in Sections 1.2 and 1.3 of the *Report in Support of System Operation Permit Application* and in Section II of the *Supplemental Information for Brazos River Authority's Application for a System Operation Permit.*

Wastewater Data

Information on wastewater data for Authority owned or operated facilities may be found in the *Water Conservation Plan* beginning on page 4 under the heading Wastewater Data. A summary of historical discharges from these plants may be found in Table 4 on page 7. Additional information regarding Authority and other wastewater discharges may be found in the *Report in Support of System Operation Permit Application.* Figure 3.2 on page 3-8 shows the location of major dischargers in the Brazos River Basin. Table 3.3 on page 3-7 summarizes current and projected wastewater discharges. Finally, detailed information for individual dischargers may be found in Appendix D of the above-mentioned report. Electronic copies of Tables D-3 and D-4 are included on the CD-ROM in Attachment 1 as part of this response.

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2. Identification of watercourses, quantity and diversion rates that will be used to convey in-basin surface and groundwater, water conveyed by pipeline and discharged into the Brazos River and its tributaries or stored in reservoirs, surface water and groundwater imported from areas located outside the Brazos River Basin, and water developed by future Authority projects.

Specific locations, quantities and diversion rates are unknown at this time. The State Water Plan shows that there will be significant unmet needs in the Brazos River Basin in the future. Information on needs from the State Water Plan is summarized in Chapter 5 of the *Report in Support of System Operation Permit Application.* Although the proposed System Operation Permit will provide a significant amount of water to meet these needs, it is likely that additional water supplies will need to be developed in the future, and some of these new supplies may be developed by the Authority. Much of the demand growth in the Brazos River Basin is in the I-35 corridor and transmission facilities will be required to meet these demands. Parts of these transmission facilities may include the bed and banks of the Brazos River and its tributaries. In anticipation of meeting these needs, the application seeks bed and banks authorization to convey water from existing Authority water rights, the proposed System Operation Permit and as yet unknown sources.

The following Certificates of Adjudication and Permits are owned by the Authority. Water from these sources may be used under the above bed-and-banks authorization.

1. Certificate No. 12-5155 (Possum Kingdom Lake)
2. Certificate No. 12-5156 (Lake Granbury)
3. Certificate No. 12-5157 (Lake Whitney)
4. Certificate No. 12-5158 (Lake Aquilla)
5. Certificate No. 12-5159 (Lake Proctor)
6. Certificate No. 12-5160 (Lake Belton)
7. Certificate No. 12-5161 (Lake Stillhouse Hollow)
8. Certificate No. 12-5162 (Lake Georgetown)
9. Certificate No. 12-5163 (Lake Granger)
10. Certificate No. 12-5164 (Lake Somerville)
11. Certificate No. 12-5165 (Lake Limestone)
12. Certificate No. 12-5166 (Excess Flows Permit)
13. Certificate No. 12-5167 (Interbasin Transfer Authorization)
14. Permit No. 4146 (Lake Alan Henry)
15. Permit No. 2925A (proposed Allens Creek Reservoir)

Specific discharge and diversion points, as well as procedures to account for losses, will be addressed as part of the Authority's Water Management Plan.

Potential diversion locations include the following:

- The perimeter of all existing and proposed Authority Reservoirs, including Lake Alan Henry, Possum Kingdom Lake, Lake Granbury, Lake Whitney, Lake Aquilla, Lake Proctor, Lake Belton, Lake Stillhouse Hollow, Lake Georgetown, Lake Granger, Lake Somerville, Lake Limestone and Allens Creek Reservoir

- The Double Mountain Fork of the Brazos River below Lake Alan Henry to its confluence with the Brazos River

- The main stem of the Brazos River from the junction of the Salt Fork and Double Mountain Fork to the Gulf of Mexico

- The Leon River from Lake Proctor to its the junction with the Little River

- The Lampasas River from Lake Stillhouse Hollow to its junction with the Little River

- The Little River from the junction of the Leon and Lampasas Rivers to its junction with the Brazos River

- Yegua Creek from Lake Somerville to its junction with the Brazos River

- The Navasota River from Lake Limestone to its junction with the Brazos River

- Allens Creek from Allens Creek Reservoir to the Brazos River

- Any other tributary of the Brazos River that may in the future be a recipient of water from this application or from groundwater or surface water under the Authority's control

3. Location of discharge facilities used in developing return flows

Attachment 2 contains a table of the latitude and longitude of the discharge points used to develop the return flows used in the modeling for the application. A GIS coverage including these points is included in the CD-ROM submitted with this document as Attachment 1.

Like specific discharge and diversion points discussed under item #2, we anticipate that the appropriation of water from current and future return flows would be accomplished by the approval of the System Operation Permit application, but accounting for water available from return flows on a daily or monthly basis would be pursuant to an accounting system approved as part of the Authority's Water Management Plan. In this regard, 30 TAC § 297.42(g) provides that a right based on return flows may be expressly conditioned on the availability of those return flows. The Authority requests that the permit contain a provision stating that the appropriation

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of wastewater return flows authorized is limited as follows: (a) wastewater return flows available for appropriation are interruptible by either direct reuse or indirect reuse by the discharger within its jurisdiction, extraterritorial jurisdiction or contiguous CCN; and (b) the Authority shall account for wastewater discharges on a monthly basis and determine, as provided in the Authority's approved Water Management Plan, the amount of wastewater return flows available for appropriation as part of its system operation.

4. Tables D-3 and D-4

An electronic version of Tables D-3 and D-4 from Appendix D of the *Report in Support of System Operation Permit Application* is included on the CD-ROM included as Attachment 1.

Kristin Wang in her July 12, 2004 Interoffice Memorandum requested the following information: an updated description of the Authority's service area, population and customer data, conservation goals, unaccounted-for water, a resolution adopting the Authority's water conservation plan and means for implementation and enforcement of the water conservation plan.

Updated Description of Service Area

The *Water Conservation Plan* was developed in 2004 and the data in these reports are up-to-date, including the description of the Authority's service area.

Current and Projected Population and Customer Data

Current and projected population and customer data may be found in Tables 1, 2 and 3 of the *Water Conservation Plan*. The projection data are from the current round of regional water planning and are the most up-to-date projections available. These projections include the years 2010, 2020, 2030, 2040, 2050 and 2060.

In addition to the above-mentioned data, we are also providing basin-wide population and water use data for the years 2001 and 2002 as Attachment 3 of this response. These data are the most recent available. Tabular data used to generate Figure 2 in the *Water Conservation Plan*, which represents historical water use by Authority customers, may be found in Attachment 4 of this response.

Conservation Goals

Ms. Wang requests the following information regarding conservation goals:

a) current per capita use for the Authority's service area
b) targeted per capita water use goals
c) unaccounted-for water

d) the basis for development of the above goals, and
e) a time frame for achieving those goals

Year 2000 per capita water use data is already included in the *Water Conservation Plan* in Table 3, as well as expected per capita water demand reduction over time. Recently, the Texas Water Development Board has released summaries of their 2001 water use surveys and a draft summary of their year 2002 water surveys. These data are the most recent available for per capita water use. A summary of these data for the Authority's customers are included in Attachment 3 of this response.

The *Water Conservation Plan* does not contain specific per capita water use goals. The plan was adopted prior to the effective date of TCEQ's current rules. Under the prior rules, specific per capita conservation goals were only required "where appropriate" and in the Authority's judgment adoption of per capita water use goals was inappropriate because the Authority serves only a small percent of the total demand in its service area and lacks authority to either contemporaneously collect data on per capita consumption or directly influence the per capita consumption within the vast majority of its service area. Nevertheless, we understand the view of TCEQ staff that under the current rules by May 1, 2005, the Authority must adopt specific quantifiable targets for water savings. The Authority plans to adopt such goals, as well as any other modifications needed to comply with the newly effective rules before that time.

The Authority will implement those practices which are appropriate for a wholesale water provider, such as use of conservation-based wholesale rate structures for renewing contracts, system operation, inspection and repair of Authority-owned delivery facilities, wastewater reuse, monitoring and other programs stated in the *Water Conservation Plan*. Unfortunately, it is difficult if not impossible to quantify the impacts of these conservation strategies on per capita water use at the retail level.

The Authority will continue to encourage its customers to adopt conservation strategies that will reduce per capita demand.

Unaccounted-For Water

Unaccounted-for water typically refers to municipal distribution systems. The Authority does not own or operate a municipal distribution system. However, the Authority does encourage its customers to reduce unaccounted-for water.

The Authority does proactively measure and account for diversions from its system. Methods used are described in three locations in the Water Conservation Plan:

- On page 8 under the headings Description of Practices Utilized to Measure and Account for Diversions, which states that meters must have 5% accuracy,

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- On page 9 under the heading Monitoring and Record Management Program, which describes the system of stream gauges that the Authority uses to track releases and flows within the Brazos River Basin, and

- On page 9 under the heading Metering and Leak Detection and Repair which describes the intent of a metering and leak detection program for pipeline deliveries through Authority raw water facilities. The delivery facilities described in this section either are not yet in use or have only been in use for a very short time, so the leak detection program has not yet been implemented.

Administrative Sufficiency of the 2004 Water Conservation Plan

Ms. Wang's July 12, 2004 interoffice memorandum states that the following is needed for administrative sufficiency of the Water Conservation Plan per 30 TAC §288.5:

> *A means for implementation and enforcement, which shall be evidenced by: a copy of the resolution indicating official adoption of the water conservation plan by the water supplier, and a description of the authority by which the water supplier will implement and enforce the conservation plan*

The resolution adopting the *Water Conservation Plan* may be found in Appendix B of the plan. As described on page 11 under the heading Means for Implementation and Enforcement, the authority by which the Water Conservation Plan will be enforced is through water availability agreements (i.e. contracts) with individual Authority customers.

We hope that this letter addresses the information requested. Please contact me if you need any further assistance.

Sincerely,

Douglas G. Caroom
Bruce Wasinger

Attorneys for Brazos River Authority

Attachments

CD SUBMITTED SEPARATELY

Attachment 2

Latitude and Longitude of Brazos Basin Wastewater Discharges

Table 2-1
Location of Selected Wastewater Discharges

Name	County	Permit Number	NPDES Number	Latitude N (DDMMSS)	Longitude W (DDMMSS)	Permitted Discharge (mgd)	Return Control Point	Primary Control Point
City of Abilene	Jones	10334.004		324742	994818	22.0	103341	CFFG18
City of Breckenridge	Stephens	10040.001	TX0023213	324620	985341	0.95	100401	CFEL22
City of Graham	Young	10487.001	TX0024635	330516	983533	2.1	104871	SHGR26
Double Diamond	Palo Pinto	2789.001	TX0099015	325119	982507	???	027891	BRPP27
City of Ranger	Palo Pinto	11557.001	TX0071064	322957	983925	0.43	401401	PPSA28
City of Mineral Wells	Parker	10585.004		324841	980253	1.26	105851	BRDE29
City of Mineral Wells	Palo Pinto	10585.001	TX0047414	324711	980805	2.35	105852	BRDE29
City of Granbury	Hood	10178.002	TX0105210	322506	974633	2	101782	BRGR30
Authority SWATS	**Hood**	**2889.001**	**TX0102598**	322501	974029	**0.39**	**515651**	**BRGR30**
Acton MUD	Hood	11208.001	TX0105163	322614	974143	0.37	515651	BRGR30
Acton MUD	Hood	11415.001	TX0105155	322133	974113	0.39	407601	BRGR30
City of Cleburne	Johnson	10006.001	TX0047155	321848	972342	6.25	100061	NRBL32
City of Godley	Johnson	10542.001	TX0104558	322633	973140	0.12	410501	NRBL32
City of Glen Rose	Somervell	10177.001	TX0033316	321450	974415	0.6	409631	BRAQ33
City of Whitney	Hill	11408.002	TX0106551	315659	972001	0.4	515731	BRAQ33
City of Itasca	Hill	10423.001	TX0023892	320843	970838	0.378	106301	AQAQ34
City of Hillsboro	Hill	10630.001	TX0023108	315954	970840	1.36	106301	AQAQ34
City of Stephenville	Erath	10290.001	TX0024228	321150	981059	3	102902	NBHI35
City of Hico	Hamilton	10188.001	TX0026590	315851	980132	0.2	NBHI35	NBHI35
City of Meridian	Bosque	10113.002	TX0053678	315505	973905	0.45	228202	NBCL37
City of Clifton	Bosque	10043.001	TX0033936	314652	973410	0.65	555151	NBCL37
City of McGregor	McLennan	10219.002	TX0023914	312454	972346	0.99	102191	BOWA40
City of Valley Mills	Bosque	10307.001	TX0075647	313956	972743	0.36	W12252	BOWA40
City of Marlin	Falls	10110.002	TX0021725	311533	965540	2	101102	BRHB42
City of Waco WMRSS	McLennan	11071.001	TX0026506	313111	970358	37.8	110711	BRHB42
City of Lorena	McLennan	12195.001	TX0083399	312225	971300	0.3	435201	BRHB42
City of West	McLennan	10544.001	TX0020451	314808	970447	0.45	CON070	BRHB42
City of Eastland	Eastland	10637.001	TX0024007	322314	984834	0.9	106371	LEDL43
City of DeLeon	Comanche	10078.001	TX0054844	320640	983126	0.3	CON054	LEHS45
City of Dublin	Erath	10405.001	TX0054348	320343	982013	0.45	284602	LEHM46
City of Comanche	Comanche	10719.001	TX0022730	315325	983536	0.73	363701	LEHM46
City of Hamilton	Hamilton	10492.002	TX0026867	314234	980650	0.44	CON086	LEGT47
City of Copperas Cove	Coryell	10045.005	TX0069841	310856	975428	3.05	100455	LEBE49
City of Gatesville	Coryell	10176.001	TX0024953	312534	974439	1	101761	LEBE49
City of Gatesville	Coryell	10176.002	TX0111791	312621	974459	2.2	101761	LEBE49
City of Copperas Cove	Coryell	10045.004	TX0069850	310747	975251	0.8	022336	LEBE49
City of Moody	McLennan	10225.001	TX0024066	311835	972148	0.2	CON090	LEBE49
City of Lampassas	Lampassas	10205.002		311122	981504	1.5	102051	LAKE50
City of Copperas Cove	Coryell	10045.003	TX0067873	310533	975426	2	100451	LAYO51
City of Harker Heights	Bell	10155.001	TX0024473	310532	973914	3	101551	LRLR53
Bell County WCID#1	Bell	10351.001	TX0002470	310731	973055	0.9	103511	LEBE49
Bell County WCID#1	Bell	10351.003	TX0102938	310631	974213	6	103512	LRLR53
Bell County WCID#1	Bell	10351.002	TX0024597	310627	974206	15	103513	LRLR53
Authority TBRSS	**Bell**	**11318.001**	**TX0058378**	310238	972623	**10**	**113181**	**LRLR53**
Bell County WCID#2	Bell	11090.001	TX0020249	305842	972037	??	LRLR53	LRLR53
Bell County WCID#2	Bell	11091.001	TX0020257	305905	972159	??	LRLR53	LRLR53
City of Florence	Williamson	10944.001	TX0078247	304947	974644	0.25	W12431	LRLR53
Bell County WCID#3	Bell	10797.001	TX0069191	314008	973614	0.25		LRLR53
City of Georgetown	Williamson	10489.002	TX0022667	303911	973941	2.5	104893	GAGE56
City of Georgetown	Williamson	10489.003	TX0101281	303753	973752	2.5	104892	GALA57
City of Cameron	Milam	10004.001	TX0053651	305041	965804	0.96	100041	LRCA58
Authority/LCRA BCRWSS West	**Williamson**	**10264.001**	**TX0075167**	303056	973953	**3**	**102641**	**LRCA58**
Authority/LCRA BCRWSS East	**Williamson**	**10264.002**	**TX0101940**	303135	973702	**11.8**	**102642**	**LRCA58**
City of Taylor	Williamson	10299.001	TX0020443	303327	972318	4	102991	LRCA58
Anderson Mill MUD	Williamson	11459.001	TX0034207	302751	974747	1.3	114591	LRCA58
City of Cedar Park	Williamson	12308.001	TX0085740	302945	974816	2.5	123081	LRCA58
City of Leander	Williamson	12644.001	TX0092151	303454	975022	2.25	126441	LRCA58
City of Bartlett	Bell	10880.001	TX0027006	304753	972448	0.325	372751	LRCA58
Brushy Creek MUD	Williamson	11865.001	TX0072788	303119	974408	0.45	W12441	LRCA58
Block House MUD	Williamson	13031.001	TX0101397	303318	974919	0.5	W12441	LRCA58

Table 2-1
Location of Selected Wastewater Discharges

Name	County	Permit Number	NPDES Number	Latitude N (DDMMSS)	Longitude W (DDMMSS)	Permitted Discharge (mgd)	Return Control Point	Primary Control Point
City of Holland	Bell	10897.001	TX0046612	305251	972345	0.2	372751	LRCA58
City of Hearne	Robertson	10046.002	TX0025879	305128	963606	1.9	100462	BRBR59
City of Calvert	Robertson	10095.001	TX0054020	305808	964100	0.25	100462	BRBR59
City of Temple	Bell	10470.002	TX0047651	310435	971852	7.5	104702	BRBR59
City of Rosebud	Falls	10731.001	TX0023981	310348	965928	0.25	CON117	BRBR59
City of Troy	Bell	11263.001	TX0058084	311259	971746	0.309	CON109	BRBR59
City of Lexington	Lee	10016.001	TX0054429	302430	970102	0.2	MYDB60	MYDB60
Aluminum Corp. of America	Milam	395.001	TX0000876	303513	970241		003956	EYDB61
City of Rockdale	Milam	10658.001	TX0027197	303823	965958	0.75	CON224	EYDB61
City of Giddings	Lee	10456.001	TX0020516	301129	965704	0.7	CON125	YCSO62
City of Caldwell	Burleson	10813.001	TX0023175	303147	964058	0.711	DCLY63	DCLY63
Tx Dept MHMR	Limestone	10717.001	TX0030775	314138	963203	0.45	528801	NAGR64
City of Teague	Freestone	10300.001	TX0034509	313724	961748	0.21	CON250	BGFR65
City of Mexia	Limestone	10222.001	TX0052990	313939	962844	0.85	CON131	NAEA66
City of Groesbeck	Limestone	10182.001	TX0054445	313141	963107	0.709	W12531	NAEA66
City of College Station	Brazos	10024.003	TX0047163	303346	961225	9.50	100241	BRHE68
City of Navasota	Grimes	10231.001	TX0071790	302301	960601	1.8	102311	BRHE68
City of Brenham	Washington	10388.001	TX0025470	301016	962239	2.55	103881	BRHE68
City of Bryan	Brazos	10426.001	TX0022616	303829	961920	8	104261	BRHE68
City of Bryan	Brazos	10426.002	TX0025071	304004	962452	4	104262	BRHE68
Texas A&M University	Brazos	10968.003	TX0108146	303247	962222	4	109681	BRHE68
City of Somerville	Burleson	10371.001	TX0055492	302106	963122	0.3	516451	BRHE68
City of Bryan	Brazos	10426.003	TX0062472	303714	962301	0.75	526851	BRHE68
Texas A&M University	Brazos	2585.001	TX00090883	303459	962113	1.99	025851	BRHE68
Texas Dept Of Criminal Justice	Grimes	13743.001	TX0089010	301911	960623	0.32	CON148	BRHE68
Texas Dept Of Criminal Justice	Grimes	12458.002	TX0089028	301527	960314	0.25	CON149	BRHE68
City of Bellville	Austin	10385.002	TX0020621	295631	961606	0.95	103851	MCBL69
City of Richmond	Fort Bend	10258.001	TX0025526	293506	954537	1	102581	BRRI70
City of Sealy	Austin	10276.001	TX0025054	294528	961000	0.975	102761	BRRI70
City of Rosenberg	Fort Bend	10607.003	TX0098914	293359	954755	2	106073	BRRI70
Praire View A&M Universtiy	Waller	11275.002	TX0111201	300557	955945	2	112751	BRRI70
Brookshire MWD	Waller	10001.001	TX0025046	294640	955609	0.65	516604	BRRI70
Frito-Lay Inc.	Fort Bend	2443.001	TX0085782	293539	955206	1.09	024431	BRRI70
Fort Bend Co. MUD 081	Fort Bend	13051.002	TX0106046	293920	955547	0.65	BRRI70	BRRI70
City of Hempstead	Waller	10948.001	TX0023809	300458	960544	0.6	CON150	BRRI70
City of Wallis	Austin	10765.001	TX0025968	293819	960433	0.498	CON153	BRRI70
City of Rosenberg	Fort Bend	10607.002	TX0024490	293126	954820	3	106072	BGNE71
City of Richmond	Fort Bend	10258.003	TX0025534	293406	954515	3.0	102582	BRRO72
Authority SLRSS	**Fort Bend**	**11317.001**	**TX0058114**	293533	953748	**6**	**113171**	**BRRO72**
Pecan Grove MUD	Fort Bend	11655.001	TX0056421	293658	954429	1.39	116551	BRRO72
City of Sugarland	Fort Bend	12833.002	TX0096881	293320	953535	10	128331	BRRO72
Texas Dept. of Criminal Justice - Central	Fort Bend	10986.001	TX0031551	293658	953923	0.45	128332	BRRO72
Texas Dept. of Criminal Justice - Jester III	Fort Bend	11475.003	TX0089036	293718	954216	0.32	128332	BRRO72
City of Sugarland	Fort Bend	12833.002	TX0096881	293320	953535	9.0	128332	BRRO72
Plantation MUD	Fort Bend	11971.001	TX0076554	293247	954112	0.44	133551	BRRO72
Fort Bend MUD 106	Fort Bend	13355.001	TX0101915	293248	954119	1.35	133551	BRRO72
Fort Bend MUD 112	Fort Bend	13628.001	TX0111872	293441	954145	2.5	136281	BRRO72
Texas Dept. of Criminal Justice - Jester I	Fort Bend	11475.001	TX0031674	293801	954231	0.31	517033	BRRO72
City of Lake Jackson	Brazoria	10047.001	TX0025798	290118	952735	4	100471	BRGM73
City of West Columbia	Brazoria	10312.001	TX0026182	290815	953731	1.6	103121	BRGM73
City of Freeport	Brazoria	10882.001	TX0033332	285642	952247	2.25	108821	BRGM73
Authority CRWTF	**Brazoria**	**10044.001**	**TX0034436**	290056	952322		**100441**	**SJGMC4**
City of Angleton	Brazoria	10548.001	TX0056316	290926	952731	3.6	105481	SJGMC4
Fort Bend MUD 025	Fort Bend	12003.001	TX0077178	293804	954025	0.8	517034	SJGMC4
Fort Bend MUD 041	Fort Bend	12475.001	TX0089249	293852	953955	0.86	517034	SJGMC4

Attachment 3

TWDB Population and Water Demand Data for Authority Customers

Table 3-1
2001 and 2002 Brazos Basin Population Calculations

Region	County	TWDB 2000 Brazos Basin Population	TWDB 2000 Total Population	% of Population in Brazos Basin	TSDC Jan 2002 Total Population	TSDC Jan 2003 Total Population	Estimated January 2002 Brazos Basin Population	Estimated January 2003 Brazos Basin Population
B	Archer	77	8,854	0.9%	9,085	8,816	79	77
H	Austin	20,164	23,590	85.5%	24,214	25,801	20,697	22,054
O	Bailey	6,594	6,594	100.0%	6,440	6,272	6,440	6,272
K	Bastrop	669	57,733	1.2%	63,657	64,207	738	744
B	Baylor	3,767	4,093	92.0%	4,085	4,029	3,760	3,708
G	Bell	237,974	237,974	100.0%	245,675	248,368	245,675	248,368
F	Borden	59	729	8.1%	642	709	52	57
G	Bosque	17,204	17,204	100.0%	17,683	17,632	17,683	17,632
H	Brazoria	11,486	241,767	4.8%	250,761	259,801	11,913	12,343
G	Brazos	152,415	152,415	100.0%	156,765	162,787	156,765	162,787
F	Brown	85	37,674	0.2%	38,122	38,872	86	88
G	Burleson	16,470	16,470	100.0%	16,712	17,412	16,712	17,412
K	Burnet	6,070	34,147	17.8%	36,032	36,583	6,405	6,503
G	Callahan	8,250	12,905	63.9%	13,083	12,830	8,364	8,202
O	Castro	6,813	8,285	82.2%	7,971	7,952	6,555	6,539
O	Cochran	3,212	3,730	86.1%	3,745	3,515	3,225	3,027
G	Comanche	13,897	14,026	99.1%	14,044	14,195	13,915	14,064
G	Coryell	74,978	74,978	100.0%	75,443	74,364	75,443	74,364
O	Crosby	7,066	7,072	99.9%	6,997	6,823	6,991	6,817
O	Dawson	256	14,985	1.7%	14,786	14,135	253	241
O	Dickens	2,490	2,762	90.2%	2,767	2,751	2,495	2,480
G	Eastland	18,059	18,297	98.7%	18,136	18,495	17,900	18,254
G	Erath	33,001	33,001	100.0%	33,046	33,196	33,046	33,196
G	Falls	18,576	18,576	100.0%	18,544	18,679	18,544	18,679
K	Fayette	0	21,804	0.0%	22,612	22,635	0	0
G	Fisher	4,344	4,344	100.0%	4,188	4,335	4,188	4,335
O	Floyd	7,023	7,771	90.4%	7,651	7,489	6,915	6,768
H	Fort Bend	126,321	354,452	35.6%	376,912	410,336	134,325	146,237
C	Freestone	3,145	17,867	17.6%	18,424	18,721	3,243	3,295
O	Garza	4,872	4,872	100.0%	5,008	5,240	5,008	5,240
G	Grimes	16,819	23,552	71.4%	24,402	24,881	17,426	17,768
O	Hale	36,602	36,602	100.0%	36,452	35,918	36,452	35,918
G	Hamilton	8,229	8,229	100.0%	8,290	8,294	8,290	8,294
G	Haskell	6,093	6,093	100.0%	6,051	5,891	6,051	5,891
G	Hill	27,040	32,321	83.7%	33,378	34,080	27,924	28,512
O	Hockley	20,923	22,716	92.1%	22,326	22,605	20,564	20,821
G	Hood	41,036	41,100	99.8%	42,786	44,543	42,719	44,474
C	Jack	1,868	8,763	21.3%	8,792	8,740	1,874	1,863
G	Johnson	47,298	126,811	37.3%	134,028	138,881	49,990	51,800
G	Jones	20,785	20,785	100.0%	20,767	20,317	20,767	20,317
G	Kent	859	859	100.0%	848	860	848	860
B	King	20	356	5.6%	336	337	19	19
G	Knox	4,064	4,253	95.6%	4,050	4,263	3,870	4,074
O	Lamb	14,709	14,709	100.0%	14,850	14,691	14,850	14,691
G	Lampasas	16,910	17,762	95.2%	18,584	19,192	17,693	18,271
G	Lee	11,457	15,657	73.2%	16,367	16,353	11,977	11,966
H	Leon	3,906	15,335	25.5%	15,527	16,008	3,955	4,077
G	Limestone	17,755	22,051	80.5%	22,427	22,702	18,058	18,279
O	Lubbock	242,628	242,628	100.0%	245,945	248,636	245,945	248,636
O	Lynn	6,502	6,550	99.3%	6,392	6,456	6,345	6,409

Table 3-1
2001 and 2002 Brazos Basin Population Calculations

Region	County	TWDB 2000 Brazos Basin Population	TWDB 2000 Total Population	% of Population in Brazos Basin	TSDC Jan 2002 Total Population	TSDC Jan 2003 Total Population	Estimated January 2002 Brazos Basin Population	Estimated January 2003 Brazos Basin Population
H	Madison	922	12,940	7.1%	13,073	12,919	931	921
G	Mclennan	213,517	213,517	100.0%	216,517	219,065	216,517	219,065
G	Milam	24,238	24,238	100.0%	25,050	24,966	25,050	24,966
K	Mills	1,369	5,151	26.6%	5,163	5,006	1,372	1,330
F	Mitchell	0	9,698	0.0%	9,760	9,907	0	0
G	Nolan	14,862	15,802	94.1%	15,491	15,530	14,570	14,606
G	Palo Pinto	27,026	27,026	100.0%	27,563	27,450	27,563	27,450
C	Parker	19,138	88,495	21.6%	93,778	98,843	20,281	21,376
O	Parmer	5,372	10,016	53.6%	9,720	9,805	5,213	5,259
G	Robertson	16,000	16,000	100.0%	16,005	16,326	16,005	16,326
F	Scurry	2,016	16,361	12.3%	15,982	15,892	1,969	1,958
G	Shackelford	3,302	3,302	100.0%	3,308	3,250	3,308	3,250
G	Somervell	6,809	6,809	100.0%	7,190	7,645	7,190	7,645
G	Stephens	9,674	9,674	100.0%	9,840	9,493	9,840	9,493
G	Stonewall	1,693	1,693	100.0%	1,714	1,498	1,714	1,498
O	Swisher	473	8,378	5.6%	8,435	7,924	476	447
G	Taylor	124,550	126,551	98.4%	126,692	125,752	124,689	123,764
O	Terry	93	12,761	0.7%	12,375	12,264	90	89
G	Throckmorton	1,850	1,850	100.0%	1,838	1,653	1,838	1,653
H	Waller	21,220	32,663	65.0%	33,514	35,854	21,773	23,293
G	Washington	30,363	30,373	100.0%	30,724	31,047	30,714	31,037
G	Williamson	211,474	249,967	84.6%	278,715	290,355	235,795	245,643
K	Williamson	38,493	249,967	15.4%	278,715	290,355	42,920	44,712
B	Young	3,948	17,943	22.0%	17,896	17,890	3,938	3,936
G	Young	13,620	17,943	75.9%	17,896	17,890	13,584	13,580
	Total	*2,142,862*	*3,335,221*		*3,472,782*	*3,569,207*	*2,210,372*	*2,256,020*

Table 3-2
2001 and 2002 San Jacinto-Brazos Population Calculations

Region	County	TWDB 2000 San Jacinto-Brazos Basin Population	TWDB 2000 Total Population	% of Population in San Jacinto-Brazos Basin	TSDC Jan 2002 Total Population	TSDC Jan 2003 Total Population	Estimated January 2002 San Jacinto-Brazos Basin Population	Estimated January 2003 San Jacinto-Brazos Population
H	Brazoria	205,361	241,767	84.9%	250,761	259,801	213,001	220,679
H	Fort Bend	135,245	354,452	38.2%	376,912	410,336	143,815	156,568
H	Galveston	246,305	250,158	98.5%	257,350	264,847	253,386	260,768
H	Harris	251,524	3,400,578	7.4%	3,487,195	3,582,772	257,931	265,000
	Total	*838,435*	*4,246,955*		*4,372,218*	*4,517,756*	*868,133*	*903,015*

Table 3-3
2001 and 2002 Brazos-Colorado Population Calculations

Region	County	TWDB 2000 Brazos-Colorado Basin Population	TWDB 2000 Total Population	% of Population in Brazos-Colorado	TSDC Jan 2002 Total Population	TSDC Jan 2003 Total Population	Estimated January 2002 Brazos-Colorado Basin Population	Estimated January 2003 Brazos-Colorado Population
H	Austin	3,233	23,590	13.7%	24,214	25,801	3,319	3,536
H	Brazoria	24,920	241,767	10.3%	250,761	259,801	25,847	26,779
H	Fort Bend	7,014	354,452	2.0%	376,912	410,336	7,458	8,120
K	Colorado	2,139	20,390	10.5%	20,745	21,073	2,176	2,211
K	Matagorda	26,276	37,957	69.2%	38,340	37,841	26,541	26,196
K	Wharton	17,412	41,188	42.3%	41,637	42,145	17,602	17,817
	Total	*80,994*	*719,344*		*752,609*	*796,997*	*82,943*	*84,659*

Table 3-4
TWDB Population, Water Use and Per Capita Water Use for Authority Customers

Authority Customer	Region	Water User Group	County	2000 Population	2001 Population	Draft 2002 Population	2000 Water Use (ac-ft)	2001 Water Use (ac-ft)	Draft 2002 Water Use (ac-ft)	2000 Per Capita (gpcd)	2001 Per Capita (gpcd)	Draft 2002 Per Capita (gpcd)
Acton MUD	G	Acton MUD	Hood	12,222	#N/A	#N/A	2,026	#N/A	#N/A	148	#N/A	#N/A
Aquilla WSC	G	Files Valley WSC	Hill	1,605	#N/A	#N/A	338	#N/A	#N/A	188	#N/A	#N/A
Aquilla WSC	G	Hillsboro	Hill	8,232	8,408	8,612	1,706	1,829	1,717	185	194	178
Bell County WCID#1	G	439 WSC	Bell	5,274	#N/A	#N/A	591	#N/A	#N/A	100	#N/A	#N/A
Bell County WCID#1	G	Belton	Bell	14,623	14,932	14,975	2,195	1,972	2,248	134	118	134
Bell County WCID#1	G	Harker Heights	Bell	17,308	17,715	18,186	2,656	2,584	3,035	137	130	149
Bell County WCID#1	G	Killeen	Bell	86,911	90,482	92,809	11,682	12,653	13,515	120	125	130
Bell County WCID#1	G	Nolanville	Bell	2,150	2,159	2,210	265	185	297	110	76	120
Bell County WCID#1	G	Copperas Cove	Coryell	29,455	29,867	29,896	2,903	2,112	3,617	88	63	108
Bell County WCID#1	G	Fort Hood (CDP)	Coryell	16,429	33,500	33,200	7,251	7,428	5,355	394	198	144
Central Texas WSC	G	Bell-Milam Falls WSC	Bell	1,980	#N/A	#N/A	299	#N/A	#N/A	135	#N/A	#N/A
Central Texas WSC	G	Dog Ridge WSC	Bell	3,534	#N/A	#N/A	586	#N/A	#N/A	148	#N/A	#N/A
Central Texas WSC	G	East Bell County WSC	Bell	2,274	#N/A	#N/A	250	#N/A	#N/A	98	#N/A	#N/A
Central Texas WSC	G	Holland	Bell	1,102	1,114	1,103	130	102	100	105	82	81
Central Texas WSC	G	Rogers	Bell	1,117	1,121	1,115	199	167	150	159	133	120
Central Texas WSC	G	West Bell County WSC	Bell	5,456	#N/A	#N/A	678	#N/A	#N/A	111	#N/A	#N/A
Central Texas WSC	G	Lott	Falls	724	721	715	99	93	90	122	115	112
Central Texas WSC	G	Rosebud	Falls	1,493	1,485	1,479	177	166	162	106	100	98
Central Texas WSC	G	Kempner	Lampasas	1,004	1,052	1,048	238	250	258	212	212	220
Central Texas WSC	G	Kempner WSC	Lampasas	3,081	#N/A	#N/A	1,053	#N/A	#N/A	305	#N/A	#N/A
Central Texas WSC	G	Lampasas	Lampasas	6,786	7,007	7,163	1,224	1,796	1,910	161	229	238
Cleburne	G	Cleburne	Johnson	26,005	26,963	27,851	4,165	5,031	5,366	143	167	172
Georgetown	G	Georgetown	Williamson	28,339	31,127	32,153	6,127	6,394	6,735	193	183	187
Granbury	G	Granbury	Hood	5,718	5,947	6,440	2,005	1,460	1,724	313	219	239
Gulf Coast Water Authority	H	Missouri City	Fort Bend	39,024	56,066	59,307	7,551	8,895	6,577	172	142	99
Gulf Coast Water Authority	H	Stafford	Fort Bend	12,412	16,508	17,804	1,001	1,115	1,177	72	60	59
Gulf Coast Water Authority	H	Sugar Land	Fort Bend	60,756	67,465	70,413	15,040	12,495	13,408	221	165	170
Gulf Coast Water Authority	H	Bacliff MUD	Galveston	7,014	#N/A	#N/A	526	#N/A	#N/A	67	#N/A	#N/A
Gulf Coast Water Authority	H	Bayou Vista	Galveston	1,644	1,646	1,684	396	419	324	215	227	172
Gulf Coast Water Authority	H	Clear Lake Shores	Galveston	1,205	1,223	1,230	273	299	338	202	218	245
Gulf Coast Water Authority	H	Galveston	Galveston	57,247	57,013	57,601	16,288	16,993	10,517	254	266	163
Gulf Coast Water Authority	H	Galveston County WCID #12	Galveston	1,386	#N/A	#N/A	231	#N/A	#N/A	149	#N/A	#N/A
Gulf Coast Water Authority	H	Hitchcock	Galveston	6,386	6,562	7,073	916	857	808	128	117	102
Gulf Coast Water Authority	H	Kemah	Galveston	2,330	2,398	2,417	227	249	279	87	93	103
Gulf Coast Water Authority	H	La Marque	Galveston	13,682	13,763	13,768	2,207	2,212	1,635	144	143	106
Gulf Coast Water Authority	H	League City	Galveston	45,306	47,788	50,883	6,597	5,901	5,814	130	110	102
Gulf Coast Water Authority	H	San Leon MUD	Galveston	6,000	#N/A	#N/A	585	#N/A	#N/A	87	#N/A	#N/A
Gulf Coast Water Authority	H	Santa Fe	Galveston	9,548	9,782	10,077	963	1,194	790	90	109	70
Gulf Coast Water Authority	H	Texas City	Galveston	41,521	42,286	42,317	6,604	5,950	5,830	142	126	123
Gulf Coast Water Authority	H	Tiki Island	Galveston	1,016	1,047	1,078	199	188	188	175	160	156

Table 3-4
TWDB Population, Water Use and Per Capita Water Use for Authority Customers

Authority Customer	Region	Water User Group	County	2000 Population	2001 Population	Draft 2002 Population	2000 Water Use (ac-ft)	2001 Water Use (ac-ft)	Draft 2002 Water Use (ac-ft)	2000 Per Capita (gpcd)	2001 Per Capita (gpcd)	Draft 2002 Per Capita (gpcd)
Gulf Coast Water Authority	H	Pearland	Harris	1,944	40,044	44,207	292	6,011	5,298	134	134	107
Johnson County Rural WSC	G	Johnson County Rural WSC	Hill	177	#N/A	#N/A	34	#N/A	#N/A	171	#N/A	#N/A
Johnson County Rural WSC	G	Johnson County Rural WSC	Johnson	8,666	#N/A	#N/A	1,660	#N/A	#N/A	171	#N/A	#N/A
Lubbock	O	Lubbock	Lubbock	199,564	201,179	203,157	40,461	41,477	40,507	181	184	178
Round Rock	G	Brushy Creek MUD	Williamson	11,322	#N/A	#N/A	1,902	#N/A	#N/A	150	#N/A	#N/A
Round Rock	G	Fern Bluff MUD	Williamson	5,319	#N/A	#N/A	745	#N/A	#N/A	125	#N/A	#N/A
Round Rock	G	Round Rock	Williamson	60,060	67,666	72,467	13,522	25,736	12,176	201	340	150
Taylor	G	Taylor	Williamson	13,575	14,176	14,439	2,281	2,382	2,394	150	150	148
Temple	G	Little River-Academy	Bell	1,645	1,731	1,658	260	243	371	141	125	200
Temple	G	Morgans Point Resort	Bell	2,989	3,169	3,253	348	309	361	104	87	99
Temple	G	Temple	Bell	54,514	55,128	55,567	13,678	12,635	11,951	224	205	192
Temple	G	Troy	Bell	1,378	1,380	1,374	191	211	212	124	136	138

Attachment 4

Historical Authority Water Use Data

Table 4-1
Historical Water Use from the Brazos River Authority System

Year	Total Use from Authority System (Ac-Ft)	Total Authority Contracts (Ac-Ft)		Year	Total Use from Authority System (Ac-Ft)	Total Authority Contracts (Ac-Ft)
1942	0	147,000		1973	20,546	437,232
1943	0	147,000		1974	121,826	462,645
1944	0	197,000		1975	39,782	512,493
1945	0	197,000		1976	32,838	537,380
1946	0	197,000		1977	93,150	540,780
1947	0	197,000		1978	286,118	548,530
1948	0	197,000		1979	45,822	558,030
1949	0	197,000		1980	144,522	595,490
1950	0	237,000		1981	93,874	631,546
1951	58,285	237,000		1982	49,136	635,619
1952	140,000	237,000		1983	73,034	646,900
1953	62,965	237,000		1984	295,376	613,785
1954	0	237,000		1985	110,305	695,004
1955	0	237,000		1986	59,174	728,669
1956	72,312	237,000		1987	82,557	733,760
1957	0	237,000		1988	286,945	731,293
1958	0	237,000		1989	109,399	652,354
1959	0	237,000		1990	85,652	617,967
1960	0	237,000		1991	87,271	601,621
1961	0	237,000		1992	90,984	594,186
1962	0	255,500		1993	108,776	558,415
1963	37,593	255,500		1994	160,825	558,550
1964	26,675	256,500		1995	126,566	558,822
1965	426	227,782		1996	286,776	585,250
1966	5,104	247,782		1997	134,152	587,403
1967	54,173	247,782		1998	185,536	630,857
1968	8,747	248,332		1999	171,270	635,381
1969	21,555	254,458		2000	231,613	650,870
1970	14,606	254,632		2001	186,317	621,602
1971	131,696	255,215		2002	190,292	633,856
1972	29,894	431,400		2003	191,614	624,758

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CD SUBMITTED SEPARATELY

Water Conservation Plan

February 17, 2005

Prepared for:

Brazos River Authority

THE SEAL THAT ORIGINALLY APPEARED ON THIS DOCUMENT WAS AUTHORIZED BY THOMAS C. GOOCH, P.E., TEXAS NO. 50668 ON FEBRUARY 18, 2005. ALTERATION OF A SEALED DOCUMENT WITHOUT PROPER NOTIFICATION OF THE RESPONSIBLE ENGINEER IS AN OFFENSE UNDER THE TEXAS ENGINEERING PRACTICE ACT.

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BRA03108

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Brazos River Authority
Waco, Texas

Water Conservation Plan
February 17, 2005

1. Introduction

As a wholesale water supplier, the Brazos River Authority (Authority) adopts this Water Conservation Plan in conformance with the rules governing water conservation plans for wholesale water providers set forth by the Texas Commission on Environmental Quality (TCEQ) in *Texas Administrative Code* Title 30, Part 1, Rule §288.5, *Water Conservation Plans for Wholesale Water Suppliers*. Appendix A includes a copy of the TCEQ rules governing water conservation plans for wholesale water providers.

2. Minimum Requirements

Description of the Authority's Service Area

The Authority has statutory responsibility for conserving and developing the water resources of the Brazos River Basin in Texas and making them available for beneficial use. Figure 1 shows the Brazos River Basin in Texas, which includes all or part of 65 counties. The Brazos River Basin covers about 47,000 square miles, with 44,440 in Texas and slightly over 2,500 in New Mexico. The Authority's service area includes the Brazos River Basin in Texas, and the Authority also supplies water outside of the Brazos River Basin to the San Jacinto-Brazos Coastal Basin and a small part of the Trinity Basin (in Johnson County).

Population Data

Table 1 shows the projected population for the Brazos River Basin and the San Jacinto-Brazos and Brazos-Colorado Coastal Basins as approved by the Texas Water Development Board for the round of regional water planning and due to be completed by January of 2006. As of the year 2000, the population of the Brazos River Basin was 2.14 million, the population of the San Jacinto-Brazos Coastal Basin was 838,000 and the population of the Brazos-Colorado Coastal Basin was 81,000. The projected year 2060 population for the Brazos River Basin is 4.29 million, the projected year 2060 population for the San Jacinto-Brazos Coastal Basin is 1.73 million, and the projected 2060 population for the Brazos-Colorado Coastal Basin is 102,000.

BRA-CA-000277

Figure 1: Brazos River Basin Location Map

Table 1
Population Projections for the Brazos River Basin and the San Jacinto-Brazos and Brazos-Colorado Coastal Basins

Year	Projected Brazos River Basin Population	Projected San Jacinto-Brazos Population	Projected Brazos-Colorado Population
2000	2,142,862	838,435	80,994
2010	2,479,828	972,910	86,096
2020	2,835,278	1,110,665	91,478
2030	3,197,695	1,253,983	95,489
2040	3,544,891	1,391,394	98,388
2050	3,915,510	1,552,278	100,179
2060	4,285,525	1,727,265	101,642

Customer Data

As of April 1, 2004, the Authority has approximately 623,000 acre-feet per year of water committed under long-term contracts. Table 2 lists customers with contracts for 5,000 acre-feet per year or more. Table 3 lists projected population, municipal water use, and per capita municipal water use for the Authority's major municipal customers. These data were approved by the Texas Water Development Board for the round of regional water planning due to be completed by January of 2006.

Table 2
Brazos River Authority Contracts for
5,000 Acre-Feet per Year or More

Entity	**Contract Amount** (Acre-Feet per Year)
TXU	122,447
Reliant	97,000
Bell County WCID #1	49,509
City of Lubbock	35,000
Gulf Coast Water Authority	32,668
City of Temple	27,953
City of Round Rock	24,854
City of Georgetown	22,168
Dow Chemical	16,000
Johnson County Rural SUD	13,210
City of Granbury	11,300
AES Wolf Hollow, L.P.	10,000
City of Taylor	8,525
Acton MUD	7,800
Central Texas WSC	6,950
Texas A&M University	6,945
Kerr-McGee Oil & Gas	6,000
Aquilla Water Supply District	5,953
South Texas Water Company	5,625
City of Cleburne	5,300
Alcoa	5,000

Water Use Data

Figure 2 shows the history of annual water use from Authority water rights and the Authority's total permitted diversions. The Authority's annual use has been increasing over the years, with high water use in dry years, including 1978, 1984, 1988, 1996, and 2000.

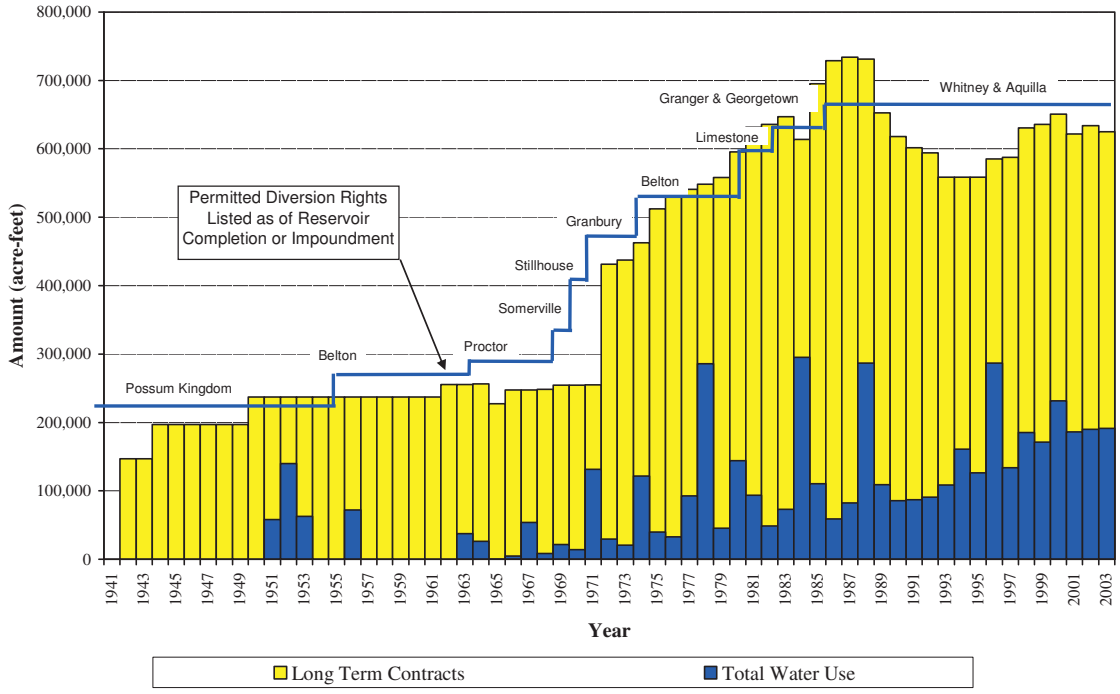
Table 3a
Projected Population and Municipal Water Use for Major Municipal Customers

Authority Customer	Region	Water User Group	County	Demand (Acre-Feet per Year)							Population						
				2000	2010	2020	2030	2040	2050	2060	2000	2010	2020	2030	2040	2050	2060
Acton MUD	G	Acton MUD	Hood	2,026	2,425	2,912	3,363	3,851	4,464	5,204	12,222	15,036	18,435	21,599	24,913	29,088	33,909
Aquilla WSC	G	Files Valley WSC	Hill	338	338	341	344	347	354	365	1,605	1,633	1,672	1,717	1,761	1,808	1,861
Aquilla WSC	G	Hillsboro	Hill	1,706	1,728	1,768	1,815	1,859	1,928	2,017	8,232	8,477	8,820	9,208	9,595	10,008	10,467
Bell County WCID#1	G	439 WSC	Bell	591	727	822	901	953	981	1,010	5,274	6,765	7,802	8,740	9,345	9,735	10,018
Bell County WCID#1	G	Belton	Bell	2,195	2,568	2,902	3,208	3,364	3,499	3,540	14,623	17,633	20,399	22,914	24,617	25,815	26,116
Bell County WCID#1	G	Harker Heights	Bell	2,656	3,349	4,244	4,954	5,550	5,708	5,808	17,308	22,477	29,147	34,822	39,636	41,096	41,818
Bell County WCID#1	G	Killeen	Bell	11,682	18,031	23,507	25,837	27,827	29,735	31,789	86,911	104,528	117,239	130,315	142,772	156,151	169,937
Bell County WCID#1	G	Nolanville	Bell	265	274	281	286	285	287	291	2,150	2,333	2,460	2,575	2,649	2,697	2,732
Bell County WCID#1	G	Copperas Cove	Coryell	2,903	3,232	3,664	4,042	4,292	4,542	4,788	29,455	34,762	40,893	46,866	51,092	54,790	57,765
Bell County WCID#1	G	Fort Hood (CDP)	Coryell	7,251	7,196	7,140	7,085	7,030	6,993	6,993	16,429	16,429	16,429	16,429	16,429	16,429	16,429
Central Texas WSC	G	Bell-Milam Falls WSC	Bell	299	342	371	398	415	425	435	1,980	2,350	2,607	2,840	2,990	3,087	3,157
Central Texas WSC	G	Dog Ridge WSC	Bell	586	715	799	876	926	955	982	3,534	4,434	5,060	5,626	5,991	6,226	6,397
Central Texas WSC	G	East Bell County WSC	Bell	250	263	271	276	279	282	286	2,274	2,502	2,661	2,805	2,898	2,958	3,001
Central Texas WSC	G	Holland	Bell	130	125	121	117	114	111	111	1,102	1,102	1,102	1,102	1,102	1,102	1,102
Central Texas WSC	G	Rogers	Bell	199	195	191	188	184	181	181	1,117	1,117	1,117	1,117	1,117	1,117	1,117
Central Texas WSC	G	West Bell County WSC	Bell	678	660	642	623	605	599	599	5,456	5,456	5,456	5,456	5,456	5,456	5,456
Central Texas WSC	G	Lott	Falls	99	97	94	92	89	88	88	724	724	724	724	724	724	724
Central Texas WSC	G	Rosebud	Falls	177	171	166	161	156	152	152	1,493	1,493	1,493	1,493	1,493	1,493	1,493
Central Texas WSC	G	Kempner	Lampasas	238	300	366	411	446	467	482	1,004	1,286	1,584	1,800	1,960	2,065	2,131
Central Texas WSC	G	Kempner WSC	Lampasas	1,053	1,293	1,547	1,734	1,870	1,956	2,015	3,081	3,836	4,633	5,211	5,639	5,920	6,098
Central Texas WSC	G	Lampasas	Lampasas	1,224	1,570	1,583	1,579	1,563	1,563	1,548	6,786	7,010	7,246	7,417	7,544	7,627	7,680
Cleburne	G	Cleburne	Johnson	4,165	5,748	6,370	7,003	7,722	8,666	9,879	26,005	29,158	32,872	36,774	41,036	46,324	52,812
Georgetown	G	Georgetown	Williamson	6,127	8,610	11,619	15,141	19,003	23,293	27,895	28,339	40,888	55,770	73,463	92,702	113,633	136,082
Granbury	G	Granbury	Hood	2,005	2,369	2,811	3,213	3,651	4,201	4,851	5,718	6,843	8,202	9,467	10,792	12,461	14,388
Gulf Coast Water Authority	H	Missouri City	Fort Bend	198	315	390	466	545	603	733	1,025	1,659	2,088	2,499	2,917	3,206	3,880
Gulf Coast Water Authority	H	Missouri City	Fort Bend	7,353	11,664	14,464	17,280	20,186	22,351	27,175	37,999	61,510	77,411	92,650	108,116	118,851	143,849
Gulf Coast Water Authority	H	Stafford	Fort Bend	1,001	1,395	1,820	2,317	2,839	3,573	4,411	12,412	18,593	24,999	32,832	40,886	51,449	63,519
Gulf Coast Water Authority	H	Sugar Land	Fort Bend	6,356	7,112	7,047	6,981	6,948	6,948	6,948	25,677	29,396	29,396	29,396	29,396	29,396	29,396
Gulf Coast Water Authority	H	Sugar Land	Fort Bend	8,684	9,717	9,627	9,537	9,492	9,492	9,492	35,079	40,160	40,160	40,160	40,160	40,160	40,160
Gulf Coast Water Authority	H	Bacliff MUD	Galveston	526	552	572	569	560	557	562	7,014	7,816	8,509	8,919	9,085	9,209	9,289
Gulf Coast Water Authority	H	Bayou Vista	Galveston	396	429	458	471	475	478	482	1,644	1,816	1,964	2,052	2,088	2,114	2,131
Gulf Coast Water Authority	H	Clear Lake Shores	Galveston	273	282	287	289	287	287	289	1,205	1,263	1,313	1,343	1,355	1,364	1,370
Gulf Coast Water Authority	H	Galveston	Galveston	16,288	16,095	15,903	15,711	15,518	15,390	15,390	57,247	57,247	57,247	57,247	57,247	57,247	57,247
Gulf Coast Water Authority	H	Galveston County WCID #12	Galveston	231	267	296	312	316	320	324	1,386	1,641	1,861	1,992	2,045	2,084	2,110
Gulf Coast Water Authority	H	Hitchcock	Galveston	916	933	935	930	914	911	915	6,386	6,660	6,897	7,037	7,094	7,136	7,163
Gulf Coast Water Authority	H	Kemah	Galveston	227	278	322	348	356	360	366	2,330	2,985	3,550	3,885	4,021	4,122	4,188
Gulf Coast Water Authority	H	La Marque	Galveston	2,207	2,161	2,115	2,069	2,023	1,992	1,992	13,682	13,682	13,682	13,682	13,682	13,682	13,682
Gulf Coast Water Authority	H	League City	Galveston	6,597	7,477	8,253	8,674	8,751	8,840	8,947	45,306	53,403	60,392	64,532	66,207	67,454	68,265
Gulf Coast Water Authority	H	San Leon MUD	Galveston	585	632	670	680	676	677	684	6,000	6,795	7,481	7,887	8,051	8,173	8,253
Gulf Coast Water Authority	H	Santa Fe	Galveston	963	988	990	982	956	951	956	9,548	10,141	10,653	10,956	11,079	11,170	11,229
Gulf Coast Water Authority	H	Texas City	Galveston	6,604	6,476	6,383	6,269	6,138	6,051	6,056	41,521	41,891	42,211	42,400	42,477	42,534	42,571
Gulf Coast Water Authority	H	Tiki Island	Galveston	199	243	282	303	311	316	321	1,016	1,270	1,489	1,619	1,672	1,711	1,736
Gulf Coast Water Authority	H	Pearland	Harris	292	342	394	445	496	551	606	1,944	2,364	2,773	3,175	3,573	3,968	4,362
Johnson County Rural WSC	G	Johnson County Rural WSC	Hill	34	37	41	46	53	59	65	177	191	211	233	255	279	305
Johnson County Rural WSC	G	Johnson County Rural WSC	Johnson	1,660	2,200	2,885	3,647	4,555	5,709	6,943	8,666	11,484	14,803	18,290	22,099	26,825	32,623
Lubbock	O	Lubbock	Lubbock	40,461	41,765	42,580	42,652	42,033	42,349	41,915	199,564	210,658	218,471	222,680	223,370	226,395	224,074
Round Rock	G	Brushy Creek MUD	Williamson	1,902	2,643	3,596	3,869	3,869	3,869	3,869	11,322	16,270	22,138	23,823	23,823	23,823	23,823
Round Rock	G	Fern Bluff MUD	Williamson	745	1,339	2,049	2,882	3,805	4,810	5,888	5,319	9,801	15,117	21,437	28,309	35,785	43,803
Round Rock	G	Round Rock	Williamson	13,522	19,239	25,937	33,896	42,617	52,298	62,680	60,060	87,187	119,358	157,606	199,196	244,442	292,970
Taylor	G	Taylor	Williamson	2,281	2,522	2,839	3,208	3,622	4,093	4,625	13,575	15,530	17,849	20,606	23,604	26,865	30,363
Temple	G	Little River-Academy	Bell	260	275	285	292	294	297	301	1,645	1,793	1,896	1,989	2,049	2,088	2,116
Temple	G	Morgans Point Resort	Bell	348	414	455	493	518	532	546	2,989	3,698	4,191	4,637	4,924	5,109	5,243
Temple	G	Temple	Bell	13,678	15,373	17,343	19,466	21,194	23,109	24,939	54,514	62,382	71,350	80,830	89,247	97,774	105,519
Temple	G	Troy	Bell	191	185	181	176	171	168	168	1,378	1,378	1,378	1,378	1,378	1,378	1,378

Table 3b
Projected Per Capita Water Use for Major Municipal Customers

Authority Customer	Region	Water User Group	County	Per Capita (Gallons per Capita per Day)						
				2000	2010	2020	2030	2040	2050	2060
Acton MUD	G	Acton MUD	Hood	148	144	141	139	138	137	137
Aquilla WSC	G	Files Valley WSC	Hill	188	185	182	179	176	175	175
Aquilla WSC	G	Hillsboro	Hill	185	182	179	176	173	172	172
Bell County WCID#1	G	439 WSC	Bell	100	96	94	92	91	90	90
Bell County WCID#1	G	Belton	Bell	134	130	127	125	122	121	121
Bell County WCID#1	G	Harker Heights	Bell	137	133	130	127	125	124	124
Bell County WCID#1	G	Killeen	Bell	120	154	179	177	174	170	167
Bell County WCID#1	G	Nolanville	Bell	110	105	102	99	96	95	95
Bell County WCID#1	G	Copperas Cove	Coryell	88	83	80	77	75	74	74
Bell County WCID#1	G	Fort Hood (CDP)	Coryell	394	391	388	385	382	380	380
Central Texas WSC	G	Bell-Milam Falls WSC	Bell	135	130	127	125	124	123	123
Central Texas WSC	G	Dog Ridge WSC	Bell	148	144	141	139	138	137	137
Central Texas WSC	G	East Bell County WSC	Bell	98	94	91	88	86	85	85
Central Texas WSC	G	Holland	Bell	105	101	98	95	92	90	90
Central Texas WSC	G	Rogers	Bell	159	156	153	150	147	145	145
Central Texas WSC	G	West Bell County WSC	Bell	111	108	105	102	99	98	98
Central Texas WSC	G	Lott	Falls	122	120	116	113	110	108	108
Central Texas WSC	G	Rosebud	Falls	106	102	99	96	93	91	91
Central Texas WSC	G	Kempner	Lampasas	212	208	206	204	203	202	202
Central Texas WSC	G	Kempner WSC	Lampasas	305	301	298	297	296	295	295
Central Texas WSC	G	Lampasas	Lampasas	161	200	195	190	185	183	180
Cleburne	G	Cleburne	Johnson	143	176	173	170	168	167	167
Georgetown	G	Georgetown	Williamson	193	188	186	184	183	183	183
Granbury	G	Granbury	Hood	313	309	306	303	302	301	301
Gulf Coast Water Authority	H	Missouri City	Fort Bend	172	169	167	166	167	168	169
Gulf Coast Water Authority	H	Missouri City	Fort Bend	173	169	167	166	167	168	169
Gulf Coast Water Authority	H	Stafford	Fort Bend	72	67	65	63	62	62	62
Gulf Coast Water Authority	H	Sugar Land	Fort Bend	221	216	214	212	211	211	211
Gulf Coast Water Authority	H	Sugar Land	Fort Bend	221	216	214	212	211	211	211
Gulf Coast Water Authority	H	Bacliff MUD	Galveston	67	63	60	57	55	54	54
Gulf Coast Water Authority	H	Bayou Vista	Galveston	215	211	208	205	203	202	202
Gulf Coast Water Authority	H	Clear Lake Shores	Galveston	202	199	195	192	189	188	188
Gulf Coast Water Authority	H	Galveston	Galveston	254	251	248	245	242	240	240
Gulf Coast Water Authority	H	Galveston County WCID #12	Galveston	149	145	142	140	138	137	137
Gulf Coast Water Authority	H	Hitchcock	Galveston	128	125	121	118	115	114	114
Gulf Coast Water Authority	H	Kemah	Galveston	87	83	81	80	79	78	78
Gulf Coast Water Authority	H	La Marque	Galveston	144	141	138	135	132	130	130
Gulf Coast Water Authority	H	League City	Galveston	130	125	122	120	118	117	117
Gulf Coast Water Authority	H	San Leon MUD	Galveston	87	83	80	77	75	74	74
Gulf Coast Water Authority	H	Santa Fe	Galveston	90	87	83	80	77	76	76
Gulf Coast Water Authority	H	Texas City	Galveston	142	138	135	132	129	127	127
Gulf Coast Water Authority	H	Tiki Island	Galveston	175	171	169	167	166	165	165
Gulf Coast Water Authority	H	Pearland	Harris	134	129	127	125	124	124	124
Johnson County Rural WSC	G	Johnson County Rural WSC	Hill	171	173	173	176	185	189	190
Johnson County Rural WSC	G	Johnson County Rural WSC	Johnson	171	171	174	178	184	190	190
Lubbock	O	Lubbock	Lubbock	181	177	174	171	168	167	167
Round Rock	G	Brushy Creek MUD	Williamson	150	145	145	145	145	145	145
Round Rock	G	Fern Bluff MUD	Williamson	125	122	121	120	120	120	120
Round Rock	G	Round Rock	Williamson	201	197	194	192	191	191	191
Taylor	G	Taylor	Williamson	150	145	142	139	137	136	136
Temple	G	Little River-Academy	Bell	141	137	134	131	128	127	127
Temple	G	Morgans Point Resort	Bell	104	100	97	95	94	93	93
Temple	G	Temple	Bell	224	220	217	215	212	211	211
Temple	G	Troy	Bell	124	120	117	114	111	109	109

Figure 2: Permitted Diversion Rights and Total Water Use



Water Supply System Data

The Authority holds Texas water rights for four reservoirs that it owns and operates for water supply – Possum Kingdom Lake, Lake Granbury, Lake Limestone and Lake Alan Henry. The Authority holds Texas water rights and contracts with the U.S. Army Corps of Engineers for storage space in eight multi-purpose Federal reservoirs – Lakes Whitney, Belton, Proctor, Somerville, Stillhouse Hollow, Granger, Georgetown and Aquilla. Figure 3 shows the location of the twelve existing reservoirs for which the Authority has water rights.

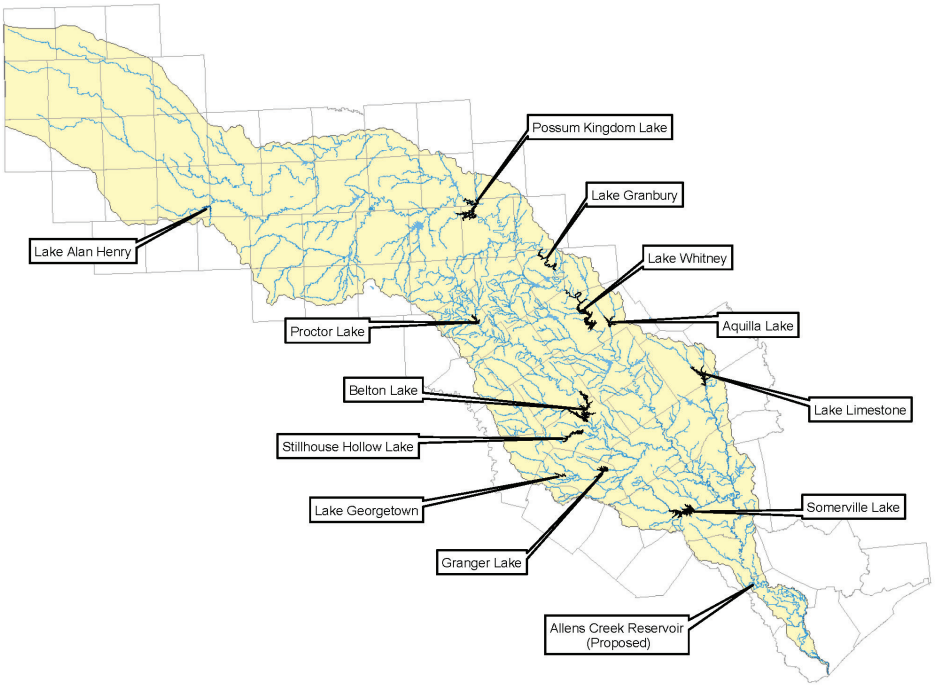
The Authority makes water available on a wholesale basis from the twelve existing reservoirs in which it holds water rights to municipal, industrial and agricultural water customers. The Authority also holds a water right jointly with the City of Houston and the Texas Water Development Board for the proposed Allens Creek Reservoir. Altogether, the Authority has total authorized priority diversions of 796,551 acre-feet per year[1].

In addition to its reservoirs, the Authority operates two pipeline delivery systems: the Williamson County Raw Water Line connecting Lake Stillhouse Hollow to Lake

[1] Permitted diversions include 35,000 acre-feet per year from Lake Alan Henry and 99,650 acre-feet per year from Allens Creek Reservoir. Lake Alan Henry is not part of the existing System Operation Order and the supply has been fully contracted to the City of Lubbock.

Georgetown, and the West Central Brazos Water Distribution System, a pipeline formerly used to deliver water from Lake Possum Kingdom for oilfield production. The Williamson County pipeline is expected to begin operation in 2004 and the West Central Brazos system is expected to begin delivery of water to municipal customers by 2006.

Figure 3: Brazos River Authority Reservoirs



The Authority currently owns and operates the Lake Granbury Surface Water and Treatment System (SWATS), which was the first advanced membrane treatment plant in Texas. The plant uses an electrodialysis reversal process and ultra filter/reverse osmosis to remove naturally occurring salt from raw water diverted from Lake Granbury. The SWATS plant provides water for the City of Granbury, the Acton Municipal Utility District, the Johnson County Fresh Water Supply District No. 1, the Johnson County Rural Special Utility District, and the City of Keene.

Wastewater Data

The Authority owns or operates six wastewater facilities – the Temple-Belton Regional Sewerage System, the Brushy Creek Regional Sewerage System, Clute-Richwood Wastewater Treatment Facility, Sugar Land Regional Sewerage System, City of Hutto Wastewater Plant, and the Lee County Freshwater Supply District #1. Table 4 shows the return flows of treated effluent from these plants for 2000 through 2002.

Table 4
Return Flows from Brazos River Authority Wastewater Treatment Facilities
(Values in Acre-Feet per Year)

Brazos River Authority Wastewater Plant	2000	2001	2002	2003
Temple-Belton Regional Sewerage System	6,705	7,971	6,743	7,011
East Brushy Creek Regional Wastewater System	9,412	10,990	11,223	11,922
City of Hutto Wastewater Plant	142	264	255	282
Clute-Richwood Wastewater Treatment Facility	2,376	3,092	3,318	3,057
Lee County Fresh Water Supply District #1 (Dime Box)	-	-	6	5
Sugar Land Regional Sewerage System	4,311	5,149	4,780	4,370
Total	*22,946*	*27,466*	*26,325*	*26,647*

Specification of Conservation Goals

The Brazos River Basin is very large and has highly varied climatic conditions. The basin includes a multitude of water users, some of which purchase water from the Authority and some of which do not. The Authority provides assistance to its customers (industries, municipalities, and irrigators) in the development and implementation of conservation programs. The Authority adopts the following conservation goals:

- As existing water sale contracts come due for renewal, implement and maintain water rate structures that discourage wasteful use of water and produce enough revenue to meet bond obligations and other expenses of operation.
- To the maximum extent possible within regulatory, institutional, and physical constraints, optimize benefits from the Authority's reservoirs through system operation and coordinated use of excess unregulated flows.
- Implement a program of regular inspection, maintenance and repair of pipelines and pump stations in the Authority's delivery system. Emphasize control of leaks and water losses.
- Continue to develop and improve the Authority's existing water conservation education and information program.
- Pursue wastewater reuse by the Authority as opportunities arise.
- When authorized by the Authority's Board of Directors, cooperate with various local entities in planning, developing and operating regional water resource projects and pollution prevention and abatement programs.
- Implement the Environmental Leadership Policy of the Brazos River Authority to enhance and protect the water quality in the Brazos River Basin and adjacent coastal basins. Specific programs include but are not limited to the Clean Rivers Program and the Quality Water for the Brazos Community program.

- Continue to cooperate with federal and state agencies in monitoring, developing and disseminating water quantity and quality data.
- Develop and implement appropriate water conservation plans and programs to meet the needs of specific projects, areas or circumstances.
- As new contracts are entered into and contracts are renewed, require contract users to develop and implement conservation plans pursuant to TCEQ rules. Users that supply potable water to others will be encouraged to consider and implement the following conservation activities, as appropriate:
    - Set specific conservation goals including, where appropriate, target per capita water use, maximum acceptable unaccounted-for water, and a time frame for achieving these goals. After May 1, 2005, specific, quantifiable 5-year and 10-year goals will be required.
    - Establish conservation-oriented rate structures such as uniform or increasing block rates and or seasonal rates to inhibit the waste or inefficient use of water. Similar rate structures should also be applied to wastewater returned to the sewerage system for treatment.
    - Establish an aggressive program for calibrating water meters and for repairing or replacing those found to have an error of 5% or more. The program should focus initially on master meters and those of major users, then expand to include the meters of all users.
    - Establish and maintain an active leak detection and repair program to identify discrete sections of distribution systems with excessive water losses. Implement maintenance programs which will result in long-term solutions to repetitive line breaks or other events which result in the loss of water.
    - Establish a goal to reduce annual unaccounted water in distribution systems to no more than 12% within 5 years of the date of the water conservation plan and maintain unaccounted losses at no more than 12% for each year thereafter. (Water suppliers in rural areas with large distances between customers may set a goal higher than 12%, if appropriate.)
    - Publicize the financial benefits to the community of water conservation by avoiding the cost of expanding the water supply and wastewater treatment systems.
    - Encourage the use of landscaping that will minimize water requirements.
    - Publicize and encourage demand reduction practices, i.e., off-peak watering of lawns, etc.

In accordance with TAC 30 §288.5, the Authority has set specific, quantified targets for water savings. These goals include target goals for municipal use in gallons per capita per day (gpcd) for the Authority's service area and maximum acceptable unaccounted-for water. The full text of §288.5 is in Appendix A.

The Authority has set per capita water use goals of 157 gpcd for the year 2010 and 153 gpcd for the year 2015 for its service area, which is the entire Brazos Basin. The basis for these goals are projected per capita water demands developed by the Texas Water Development Board for the 2006 State Water Plan and suggested municipal conservation savings developed by the Brazos G Regional Water Planning Group for use in the 2006 Brazos G regional water plan. More information regarding the basis for the goals may be found in Appendix B. The per capita water demands are the total projected municipal water use within the Brazos Basin divided by the population within the basin and do not represent per capita water demand for a specific entity.

The Authority has set a goal for its service area to reduce annual unaccounted water in distribution systems to no more than 12% for the year 2010 and maintain unaccounted losses at no more than 12% through the year 2020. Water suppliers in rural areas with large distances between customers may have more than 12% unaccounted for water, if appropriate.

As stated in TAC 30 §288.5, these goals are not enforceable. The goals contained in this plan are provided as guidance for retail water providers within the Brazos Basin. Current or future Authority water sales, contracts or other agreements will not depend upon adoption or achievement of these goals by Authority customers. The Authority will continue to encourage customers to adopt goals based on criteria specific to the customer's situation.

Description of Practices Utilized to Measure and Account for Diversions

All diversions of water by the Authority's water customers (excepting those uses not exceeding five acre-feet of water per year) must be metered or otherwise measured with an error of less than plus or minus 5% and reported to the Authority in a timely manner.

Monitoring and Record Management Program

The Authority, in conjunction with the U.S. Geological Survey, operates numerous stream gauging stations throughout the basin which provide information on Authority reservoirs and stream flows, including releases from the reservoirs. The Authority has developed an integrated communication system for real-time monitoring that uses satellites, line-of-sight radio, microwave and dedicated telephone land lines to transmit radar images, river and reservoir conditions, and weather forecasts to Authority personnel.

The Authority monitors surface water rights in the basin and water supply releases to ensure that its water rights and releases for customers are protected. The Authority has developed a plan for cooperative water rights monitoring for the lower Brazos River Basin based on daily flows.

BRA-CA-000286

The Brazos River Authority preserves its records in accordance with its Records Retention Policy, which is modeled after the procedures used by the Texas State Library. This policy is consistent with the provisions of the Local Government Records Act (Texas Water Code § 49.065(c); Texas Local Government Code §§ 201.001-205.009).

Metering and Leak Detection and Repair

Currently the Authority uses the bed and banks of the Brazos River and its tributaries to deliver water the vast majority of its supplies to customers. The Authority currently has limited deliveries by pipeline in the West Central Brazos Pipeline. The Williamson County Raw Water Line is also part of the Authority system. Deliveries through both of these systems are expected to increase over time. The Authority will implement a program of regular inspection, maintenance and repair of pipelines and pump stations, focusing on the monitoring of unaccounted water and the detection and repair of leaks.

Conservation Requirements in Authority Contracts

The Authority includes the following clause addressing water conservation in every new and renewed contract:

> ***Conservation of Water.*** *It is the intent of the parties to this Agreement to provide to the maximum extent practicable for the conservation of water, and Purchaser agrees that it is a condition of this Agreement that Purchaser shall maintain and operate its facilities in a manner that will prevent the unnecessary waste of water. Purchaser agrees to implement a water conservation program in accordance with the BRA's Water Conservation Plan adopted by BRA's Board of Directors on April 26, 2004, and any subsequent amendments thereto and that the water diverted by Purchaser, pursuant to this Agreement, will be used in accordance with such Water Conservation Plan. Purchaser agrees that, in the event that Purchaser furnishes water or water services to a third party or successive parties, that, in turn, will furnish the water or water services to the ultimate consumer, the requirements of this Agreement relative to water conservation shall be met through contractual agreements between the Purchaser and the third party or successive parties, providing for the establishment and implementation of a water conservation program consistent with BRA's Water Conservation Plan. BRA, in accordance with applicable law, may from time to time adopt reasonable rules and regulations relating to water conservation. Purchaser agrees to amend its water conservation program, as necessary, to reflect BRA's Water Conservation Plan, as such plan may be amended from time to time.*

Reservoir System Operation Plan

To the maximum extent possible within regulatory, institutional, and physical constraints, the Authority seeks to optimize water supply from its reservoirs and run-of-the-river

supplies through coordinated system operation. In order to achieve the goal of optimal management of the water resources of the Brazos River Basin, the Authority may seek additional appropriations of state water and seek changes to its existing water rights to allow more efficient operation of its system.

The most productive conservation measure available to the Authority is the effective development and protection of water resources. The operation of the Authority system is currently governed by the System Operation Order, which has been incorporated into the water rights for Lake Possum Kingdom, Lake Granbury, Lake Whitney, Lake Aquilla, Lake Proctor, Lake Belton, Lake Stillhouse Hollow, Lake Georgetown, Lake Granger, Lake Limestone and Lake Somerville. (Lake Alan Henry and the proposed Allens Creek Reservoir are not included in the System Operation Order.) The total sum of the priority rights for the 11 reservoirs included in the System Operation Order is 661,901 acre-feet[2]. The System Operation Order allows diversion from any reservoir to exceed the priority right for that reservoir as long as:

- The sum of the annual diversions from the 11 reservoirs included in the System Operation Order does not exceed 661,901 acre-feet,
- The annual amount diverted from that reservoir does not exceed the sum of the amounts authorized for all purposes for the reservoir,
- The annual amount of water diverted or released from that reservoir for a particular purpose may exceed the authorization for that purpose under that reservoir's certificate of adjudication, but may not exceed the total authorized diversions for all purposes from that reservoir.

Diversion for system operation may not be made from a reservoir when the content of that reservoir is 30 percent or less of the conservation storage unless the content of all system reservoirs is 30 percent or less of the conservation storage.

The Authority also has the ability under Certificate of Adjudication 12-5166 to utilize unappropriated flows in the lower Brazos River Basin to meet customer demands on a non-priority basis, accounting for these diversions by assigning them to an Authority reservoir included in the System Operation Order. Any additional water that may become available through system operation is not recognized by these existing water rights.

Means for Implementation and Enforcement

This Water Conservation Plan and all plans developed hereunder are required to be followed by purchasers in all of the Authority's water availability agreements. Violation of the Plan is a violation of the agreement provision and will be treated as such.

[2] The water rights for Lake Alan Henry and Allens Creek Reservoir, which are not included in the System Operation Order, allow diversion of 35,000 acre-feet per year and 99,650 acre-feet per year, respectively. Altogether, the Authority has permitted priority diversions of 796,551 acre-feet per year.

A copy of the resolution by the Board of Directors of the Brazos River Authority adopting this Water Conservation Plan may be found in Appendix C.

Documentation of Coordination with Regional Water Plans

The Authority is providing a copy of this Plan to each of the Regional Water Planning Groups located within the Brazos River Basin (Region B, Region C, Region F, Brazos G, Region H, Lower Colorado (Region K) and Llano-Estacado (Region O)).

Review and Update of Water Conservation Plan

The Authority will review and update this Water Conservation Plan, as appropriate, at least every 5 years, but not later than May 1, 2009. The update will include an assessment of water conservation goals and new or updated information.

3. Additional Conservation Strategies

The Authority also adopts these additional conservation strategies:

- The Authority will encourage and assist customers in the development of conservation pollution prevention and abatement plans through participation in programs such as the Clean Rivers Program and the Quality Water for the Brazos Community program.

- The Authority will adopt any other water conservation practice, method, or technique which the Authority finds to be appropriate for achieving the stated goals of this water conservation plan.

APPENDIX A

Texas Commission on Environmental Quality Rules on Water Conservation Plans for Wholesale Water Suppliers

APPENDIX A

Texas Commission on Environmental Quality Rules on Water Conservation Plans for Wholesale Water Suppliers

Texas Administrative Code

TITLE 30	ENVIRONMENTAL QUALITY
PART 1	TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
CHAPTER 288	WATER CONSERVATION PLANS, DROUGHT CONTINGENCY PLANS, GUIDELINES AND REQUIREMENTS
SUBCHAPTER A	WATER CONSERVATION PLANS
RULE §288.1	**Definitions**

The following words and terms, when used in this chapter, shall have the following meanings, unless the context clearly indicates otherwise.

(1) Agricultural or Agriculture--means any of the following activities:

(A) cultivating the soil to produce crops for human food, animal feed, or planting seed or for the production of fibers;

(B) the practice of floriculture, viticulture, silviculture, and horticulture, including the cultivation of plants in containers or non-soil media by a nursery grower;

(C) raising, feeding, or keeping animals for breeding purposes or for the production of food or fiber, leather, pelts, or other tangible products having a commercial value;

(D) raising or keeping equine animals;

(E) wildlife management; and

(F) planting cover crops, including cover crops cultivated for transplantation, or leaving land idle for the purpose of participating in any governmental program or normal crop or livestock rotation procedure.

(2) Agricultural use--Any use or activity involving agriculture, including irrigation.

(3) Conservation--Those practices, techniques, and technologies that reduce the consumption of water, reduce the loss or waste of water, improve the efficiency in the use of water, or increase the recycling and reuse of water so that a water supply is made available for future or alternative uses.

(4) Drought contingency plan--A strategy or combination of strategies for temporary supply and demand management responses to temporary and potentially recurring water supply shortages and other water supply emergencies. A drought contingency plan may be a separate document identified as such or may be contained within another water management document(s).

(5) Industrial use--The use of water in processes designed to convert materials of a lower order of value into forms having greater usability and commercial value, commercial fish production, and the development of power by means other than hydroelectric, but does not include agricultural use.

(6) Irrigation--The agricultural use of water for the irrigation of crops, trees, and pastureland, including, but not limited to, golf courses and parks which do not receive water through a municipal distribution system.

(7) Irrigation water use efficiency--The percentage of that amount of irrigation water which is beneficially used by agriculture crops or other vegetation relative to the amount of water diverted from the source(s) of supply. Beneficial uses of water for irrigation purposes include, but are not limited to, evapotranspiration needs for vegetative maintenance and growth, salinity management, and leaching requirements associated with irrigation.

(8) Mining use--The use of water for mining processes including hydraulic use, drilling, washing sand and gravel, and oil field repressuring.

(9) Municipal per capita water use--The sum total of water diverted into a water supply system for residential, commercial, and public and institutional uses divided by actual population served.

(10) Municipal use--The use of potable water within or outside a municipality and its environs whether supplied by a person, privately owned utility, political subdivision, or other entity as well as the use of sewage effluent for certain purposes, including the use of treated water for domestic purposes, fighting fires, sprinkling streets, flushing sewers and drains, watering parks and parkways, and recreational purposes, including public and private swimming pools, the use of potable water in industrial and commercial enterprises supplied by a municipal distribution system without special construction to meet its demands, and for the watering of lawns and family gardens.

(11) Nursery grower--A person engaged in the practice of floriculture, viticulture, silviculture, and horticulture, including the cultivation of plants in containers or nonsoil media, who grows more than 50% of the products that the person either sells or leases, regardless of the variety sold, leased, or grown. For the purpose of this definition, grow means the actual cultivation or propagation of the product beyond the mere holding or maintaining of the item prior to sale or lease, and typically includes activities associated with the production or multiplying of stock such as the development of new plants from cuttings, grafts, plugs, or seedlings.

(12) Pollution--The alteration of the physical, thermal, chemical, or biological quality of, or the contamination of, any water in the state that renders the water harmful, detrimental, or injurious to humans, animal life, vegetation, or property, or to the public health, safety, or welfare, or impairs the usefulness or the public enjoyment of the water for any lawful or reasonable purpose.

(13) Public Water Supplier--An individual or entity that supplies water to the public for human consumption.

(14) Regional Water Planning Group--A group established by the Texas Water

Development Board to prepare a regional water plan under Texas Water Code, §16.053.

(15) Retail Public Water Supplier--An individual or entity that for compensation supplies water to the public for human consumption. The term does not include an individual or entity that supplies water to itself or its employees or tenants when that water is not resold to or used by others.

(16) Reuse--The authorized use for one or more beneficial purposes of use of water that remains unconsumed after the water is used for the original purpose of use and before that water is either disposed of or discharged or otherwise allowed to flow into a watercourse, lake, or other body of state-owned water.

(17) Water conservation plan--A strategy or combination of strategies for reducing the volume of water withdrawn from a water supply source, for reducing the loss or waste of water, for maintaining or improving the efficiency in the use of water, for increasing the recycling and reuse of water, and for preventing the pollution of water. A water conservation plan may be a separate document identified as such or may be contained within another water management document(s).

(18) Wholesale Public Water Supplier--An individual or entity that for compensation supplies water to another for resale to the public for human consumption. The term does not include an individual or entity that supplies water to itself or its employees or tenants as an incident of that employee service or tenancy when that water is not resold to or used by others, or an individual or entity that conveys water to another individual or entity, but does not own the right to the water which is conveyed, whether or not for a delivery fee.

Source Note: The provisions of this §288.1 adopted to be effective May 3, 1993, 18 TexReg 2558; amended to be effective February 21, 1999, 24 TexReg 949; amended to be effective April 27, 2000, 25 TexReg 3544; amended to be effective August 15, 2002, 27 TexReg 7146.

Texas Administrative Code

TITLE 30	ENVIRONMENTAL QUALITY
PART 1	TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
CHAPTER 288	WATER CONSERVATION PLANS, DROUGHT CONTINGENCY PLANS, GUIDELINES AND REQUIREMENTS
SUBCHAPTER A	WATER CONSERVATION PLANS
RULE §288.5	**Water Conservation Plans for Wholesale Water Suppliers**

A water conservation plan for a wholesale water supplier must provide information in response to each of the following paragraphs. If the plan does not provide information for each requirement, the wholesale water supplier shall include in the plan an explanation of why the requirement is not applicable.

(1) Minimum requirements. All water conservation plans for wholesale water suppliers must include the following elements:

(A) a description of the wholesaler's service area, including population and customer data, water use data, water supply system data, and wastewater data;

(B) until May 1, 2005, specification of conservation goals including, where appropriate, target per capita water use goals for the wholesaler's service area, maximum acceptable unaccounted-for water, the basis for the development of these goals, and a time frame for achieving these goals;

(C) beginning May 1, 2005, specific, quantified five-year and ten-year targets for water savings including, where appropriate, target goals for municipal use in gallons per capita per day for the wholesaler's service area, maximum acceptable unaccounted-for water, and the basis for the development of these goals. The goals established by wholesale water suppliers under this subparagraph are not enforceable;

(D) a description as to which practice(s) and/or device(s) will be utilized to measure and account for the amount of water diverted from the source(s) of supply;

(E) a monitoring and record management program for determining water deliveries, sales, and losses;

(F) a program of metering and leak detection and repair for the wholesaler's water storage, delivery, and distribution system;

(G) a requirement in every water supply contract entered into or renewed after official adoption of the water conservation plan, and including any contract extension, that each successive wholesale customer develop and implement a water conservation plan or water

conservation measures using the applicable elements of this chapter. If the customer intends to resell the water, then the contract between the initial supplier and customer must provide that the contract for the resale of the water must have water conservation requirements so that each successive customer in the resale of the water will be required to implement water conservation measures in accordance with applicable provisions of this chapter;

(H) a reservoir systems operations plan, if applicable, providing for the coordinated operation of reservoirs owned by the applicant within a common watershed or river basin. The reservoir systems operations plans shall include optimization of water supplies as one of the significant goals of the plan;

(I) a means for implementation and enforcement, which shall be evidenced by a copy of the ordinance, rule, resolution, or tariff, indicating official adoption of the water conservation plan by the water supplier; and a description of the authority by which the water supplier will implement and enforce the conservation plan; and

(J) documentation of coordination with the regional water planning groups for the service area of the wholesale water supplier in order to ensure consistency with the appropriate approved regional water plans.

(2) Additional conservation strategies. Any combination of the following strategies shall be selected by the water wholesaler, in addition to the minimum requirements of paragraph (1) of this section, if they are necessary in order to achieve the stated water conservation goals of the plan. The commission may require by commission order that any of the following strategies be implemented by the water supplier if the commission determines that the strategies are necessary in order for the conservation plan to be achieved:

(A) conservation-oriented water rates and water rate structures such as uniform or increasing block rate schedules, and/or seasonal rates, but not flat rate or decreasing block rates;

(B) a program to assist agricultural customers in the development of conservation pollution prevention and abatement plans;

(C) a program for reuse and/or recycling of wastewater and/or graywater; and

(D) any other water conservation practice, method, or technique which the wholesaler shows to be appropriate for achieving the stated goal or goals of the water conservation plan.

(3) Review and update requirements. Beginning May 1, 2005, the wholesale water supplier shall review and update its water conservation plan, as appropriate, based on an assessment of previous five-year and ten-year targets and any other new or updated information. A wholesale water supplier shall review and update the next revision of its water conservation plan not later than May 1, 2009, and every five years after that date to coincide with the regional water planning group.

Source Note: The provisions of this §288.5 adopted to be effective May 3, 1993, 18 TexReg 2558; amended to be effective February 21, 1999, 24 TexReg 949; amended to be effective April 27, 2000, 25 TexReg 3544; amended to be effective October 7, 2004, 29 TexReg 9384

APPENDIX B

Per Capita Water Demand Projections

Table B-1
Texas Water Development Board Population and Water Demand Projections for the Brazos Basin

Region	County	Population			Demand (ac-ft)			Per Capita Water Use (gpcd)		
		2000	2010	2020	2000	2010	2020	2000	2010	2020
B	Archer	77	84	92	11	79	72	127	839	698
B	Baylor	3,767	3,543	3,415	710	812	740	168	204	193
B	King	20	22	24	11	7	8	491	284	297
B	Young	3,948	3,986	4,074	735	789	767	166	177	168
C	Freestone	3,145	3,468	3,785	338	404	478	96	104	113
C	Jack	1,868	1,917	1,977	230	269	270	110	125	122
C	Parker	19,138	23,300	25,291	2,513	3,279	3,467	117	126	122
F	Borden	59	64	66	13	14	14	197	195	189
F	Brown	85	89	92	12	12	12	126	120	116
F	Mitchell	0	0	0	0	0	0			
F	Scurry	2,016	2,103	2,186	312	316	318	138	134	130
G	Bell	237,974	279,313	315,766	45,030	55,113	64,401	169	176	182
G	Bosque	17,204	19,831	22,646	2,539	2,829	3,138	132	127	124
G	Brazos	152,415	178,187	205,099	30,317	34,992	39,587	177	175	172
G	Burleson	16,470	18,477	20,663	2,320	2,656	2,863	126	128	124
G	Callahan	8,250	8,207	8,292	989	955	936	107	104	101
G	Comanche	13,897	14,142	14,586	1,753	1,813	1,815	113	114	111
G	Coryell	74,978	87,707	102,414	16,581	18,390	20,528	197	187	179
G	Eastland	18,059	18,097	18,143	2,970	2,907	2,853	147	143	140
G	Erath	33,001	36,666	40,609	4,619	4,907	5,252	125	119	115
G	Falls	18,576	19,600	20,884	3,895	3,993	4,132	187	182	177
G	Fisher	4,344	4,264	4,259	689	656	641	142	137	134
G	Grimes	16,819	19,450	22,384	2,328	2,709	3,009	123	124	120
G	Hamilton	8,229	7,790	7,681	1,360	1,279	1,239	147	146	144
G	Haskell	6,093	5,860	5,741	936	883	844	137	134	131
G	Hill	27,040	27,854	28,992	3,924	3,943	3,995	129	126	123
G	Hood	41,036	49,131	58,273	7,784	9,123	10,652	169	166	163
G	Johnson	47,298	55,643	65,473	7,651	10,030	11,647	144	161	159

Table B-1 (cont.)

Region	County	Population			Demand (ac-ft)			Per Capita Water Use (gpcd)		
		2000	2010	2020	2000	2010	2020	2000	2010	2020
G	Jones	20,785	21,211	21,729	3,988	3,136	3,138	171	132	129
G	Kent	859	840	821	161	154	148	167	164	161
G	Knox	4,064	4,012	4,114	706	682	686	155	152	149
G	Lampasas	16,910	19,150	21,514	3,529	4,313	4,785	186	201	198
G	Lee	11,457	13,271	15,460	1,930	2,167	2,463	150	146	142
G	Limestone	17,755	19,116	20,852	2,493	2,633	2,830	125	123	121
G	McLennan	213,517	231,882	250,398	44,105	47,046	50,004	184	181	178
G	Milam	24,238	25,456	26,820	4,633	4,826	4,968	171	169	165
G	Nolan	14,862	15,565	16,155	3,320	3,422	3,481	199	196	192
G	Palo Pinto	27,026	28,895	31,147	4,756	4,926	5,187	157	152	149
G	Robertson	16,000	17,164	18,704	2,812	2,874	2,979	157	149	142
G	Shackelford	3,302	3,456	3,638	931	963	997	252	249	244
G	Somervell	6,809	7,542	8,393	1,013	1,071	1,145	133	127	122
G	Stephens	9,674	9,873	10,030	1,469	1,778	1,778	135	161	158
G	Stonewall	1,693	1,687	1,634	299	292	277	158	154	151
G	Taylor	124,550	134,214	140,390	39,219	23,539	24,148	281	156	153
G	Throckmorton	1,850	1,851	1,793	354	348	332	171	168	165
G	Washington	30,363	32,548	35,241	5,046	5,264	5,545	148	144	140
G	Williamson	211,474	304,154	416,122	39,993	57,688	78,184	169	169	168
G	Young	13,620	13,752	14,052	2,183	2,149	2,150	143	139	136
H	Austin	20,164	23,203	26,088	3,102	3,433	3,728	137	132	127
H	Brazoria	11,486	14,102	16,825	1,942	2,451	2,996	151	155	159
H	Fort Bend	126,321	167,064	209,292	25,188	31,762	38,443	178	170	164
H	Leon	3,906	4,317	4,730	451	486	518	103	100	98
H	Madison	922	994	1,066	102	106	110	99	95	92
H	Waller	21,220	26,272	32,256	3,293	3,812	4,425	138	129	122
K	Bastrop	669	1,018	1,455	96	142	201	128	124	123
K	Burnet	6,070	7,596	9,386	861	1,052	1,282	127	124	122
K	Fayette	0	0	0	0	0	0			
K	Mills	1,369	1,364	1,449	174	169	175	113	111	108
K	Williamson	38,493	48,657	60,711	6,949	8,841	11,095	161	162	163
O	Bailey	6,594	7,060	7,558	1,310	1,369	1,440	177	173	170

Table B-1 (cont.)

Region	County	Population			Demand (ac-ft)			Per Capita Water Use (gpcd)		
		2000	2010	2020	2000	2010	2020	2000	2010	2020
O	Castro	6,813	7,459	8,028	1,406	1,501	1,588	184	180	176
O	Cochran	3,212	3,519	3,736	671	718	751	186	182	179
O	Crosby	7,066	7,672	8,167	1,103	1,158	1,206	139	135	132
O	Dawson	256	265	273	35	35	35	122	118	114
O	Dickens	2,490	2,448	2,405	509	495	479	182	180	178
O	Floyd	7,023	7,386	7,754	1,078	1,105	1,125	137	133	129
O	Garza	4,872	5,072	5,265	777	787	798	142	138	135
O	Hale	36,602	39,456	42,103	6,370	6,677	6,982	155	151	148
O	Hockley	20,923	22,503	23,483	3,435	3,571	3,648	146	142	139
O	Lamb	14,709	15,515	16,500	3,349	3,467	3,624	203	199	196
O	Lubbock	242,628	259,231	270,924	46,409	48,539	49,849	171	167	164
O	Lynn	6,502	6,918	7,227	967	1,002	1,019	133	129	126
O	Parmer	5,372	5,707	6,062	966	1,006	1,044	160	157	154
O	Swisher	473	495	514	62	63	64	117	114	111
O	Terry	93	101	107	13	14	14	125	124	117
	Total	*2,142,862*	*2,479,828*	*2,835,278*	*414,128*	*456,191*	*515,542*	*172*	*164*	*162*

Table B-2
Brazos G Regional Water Planning Group
Recommended Conservation BMPs for Inclusion as Water Management Strategies for Municipal WUGs with Needs,
Beginning in Year 2020

Conservation BMP	Savings	Source
Advanced Conservation □ Toilet retrofit □ Showerheads and Aerators □ Irrigation Audit – High User	7 gpcd*	GDS Associates, savings are for existing connections only
Landscape irrigation	11 gpcd	Based upon 15% reduction referenced in draft Task Force report
Public Education Programs	3 gpcd	TCEQ
Total	**21 gpcd**	

*Note: This is an average for the WUGs analyzed, and represents 50% replacement of existing fixtures. In contrast, the TWDB maximum savings for a specific WUG in Region G (Brazos County-Other) is about 13 gpcd, representing 100% replacement of existing fixtures for a WUG projected to have declining population and, consequently, minimal new construction.

Source: HDR Engineering: *Memorandum: Municipal Water Conservation*, prepared for the Brazos G Regional Water Planning Group, September 14, 2004.

APPENDIX C

Board Resolution Adopting Water Conservation Plan

Brazos River Authority

RESOLUTION OF THE BOARD OF DIRECTORS OF THE BRAZOS RIVER AUTHORITY JANUARY 24TH, 2005

Revised Water Conservation Plan for the Brazos River Authority and Incorporation of Provisions into All Water Sales Contracts used by the Brazos River Authority AGENDA ITEM NO. 18

"BE IT RESOLVED by the Board of Directors of the Brazos River Authority that a Water Conservation Plan, as presented to Brazos River Authority by Freese and Nichols, Inc., dated December 8, 2004, prepared in conformance with the requirements of the Texas Commission on Environmental Quality (TCEQ) is hereby adopted; and

BE IT FURTHER RESOLVED by the Board of Directors of the Brazos River Authority that the General Manager/CEO is directed to incorporate provisions into all water sales contracts used by the Brazos River Authority to require purchasers of water from the Brazos River Authority to implement a Water Conservation Program in accordance with the adopted Brazos River Authority Water Conservation Plan."

The aforementioned resolution was approved by the Board of Directors of the Brazos River Authority on January 24, 2005, to certify which witness my hand and seal.

Joe B. Hinton
Chairman of the Board

SUBSCRIBED AND SWORN TO BEFORE ME on this the 10th day of February 2005, to certify which witness my hand and official seal.

Notary Public in and for the
State of Texas

Drought Contingency Plan

March 14, 2005

Prepared for:

Brazos River Authority

THE SEAL THAT ORIGINALLY APPEARED ON THIS DOCUMENT WAS AUTHORIZED BYTHOMAS C. GOOCH, P.E., TEXAS NO. 50668 ON MARCH 14, 2005. ALTERATION OF A SEALED DOCUMENT WITHOUT PROPER NOTIFICATION OF THE RESPONSIBLE ENGINEER IS AN OFFENSE UNDER THE TEXAS ENGINEERING PRACTICE ACT.

Thomas C. Gooch, P.E.

Jon S. Albright

Freese and Nichols, Inc.
4055 International Plaza
Suite 200
Fort Worth, TX 76109
817/735-7300

BRA03108

Brazos River Authority
Waco, Texas

Drought Contingency Plan
March 14, 2005

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Appendix A Texas Administrative Code, Section 288.22

Appendix B Letter to Customers

Appendix C Letter to Regional Water Planning Groups

Appendix D Texas Water Code, Section 11.039

Appendix E Board Resolution to Adopt the Drought Contingency Plan

Brazos River Authority
Waco, Texas

Drought Contingency Plan
March 14, 2005

1. Introduction

As a wholesale water supplier, the Brazos River Authority (Authority) adopts this Drought Contingency Plan (Plan) in conformance with the rules governing drought contingency plans for wholesale water providers set forth by the Texas Commission on Environmental Quality (TCEQ) in *Texas Administrative Code* Title 30, Part 1, Rule §288.22, *Drought Contingency Plans for Wholesale Water Suppliers*. Appendix A includes a copy of the TCEQ rules governing drought contingency plans for wholesale water providers.

2. Provisions to Actively Inform the Public and Provide Opportunity for Input

The Authority has taken the following steps to actively inform the public and affirmatively provide opportunity for user input in the preparation of the Plan and to inform wholesale customers about the Plan:

- Putting a draft of the Plan on the Authority's web site at www.brazos.org and inviting comments on the draft Plan.
- Sending a letter to all wholesale water customers discussing the draft Plan, mentioning where it could be found on the Authority's web site, offering copies to interested customers who did not wish to access the draft Plan on the web site, and soliciting comments from customers. (Appendix B includes a copy of the letter sent to wholesale customers.)
- Sending a draft of this Plan to all Regional Water Planning Groups located in its service area. (Appendix C)
- Providing written notice to the public concerning the draft Plan and the public meeting on the draft Plan and inviting their comments. (Written notice was provided by posting with the Secretary of State's office at the McLennan County Courthouse, and at the BRA central office.)
- Holding a public meeting on the draft Plan at the Authority's office in Waco at 9:00 a.m. Thursday, January 13, 2005.

3. Coordination with Regional Water Planning Groups

The Authority has statutory responsibility for conserving and developing the water resources of the Brazos River Basin in Texas and making them available for beneficial use. The Brazos River Basin covers about 47,000 square miles, with 44,440 in Texas (all or part of 65 counties) and slightly over 2,500 in New Mexico. The Authority's service area includes the Brazos River Basin in Texas, and the Authority also supplies water outside of the Brazos River Basin to the San Jacinto-Brazos Coastal Basin and a small part of the Trinity Basin (in Johnson County).

The Authority has provided a draft of this Plan to each of the Regional Water Planning Groups located within its service area (Region B, Region C, Region F, Brazos G, Region H, and Llano-Estacado (Region O)). Appendix C includes an example of the letter sent to the Regional Water Planning Groups asking that they review the draft Plan for consistency with their approved regional water plans.

4. Information to Be Monitored and Criteria for the Initiation and Termination of Drought Response Stages

The Authority's General Manager/CEO or his/her designee shall monitor water supply and demand conditions. The triggering criteria described below are based on hydrologic analyses and more than 50 years of reservoir operations experience.

Three levels of potential drought severity have been identified at which specific actions will be conducted, including the development of specific drought response plans tailored to conditions as they exist at that time.

Stage 1 – Drought Watch Condition

Requirements for initiation – The Authority's General Manager/CEO or his/her designee may initiate a drought watch condition in one or more of the following circumstances:

- For a reservoir when the content of that reservoir is at or below Stage 1 Storage Trigger for that reservoir found in Table 1 and reasonable estimates of current annual demands, coupled with inflows and evaporation representative of the drought-of-record, indicate that the content could be reduced to the Stage 2 Reservoir Storage Trigger or less during the next 12 months.
- For a reservoir, group of reservoirs, or the entire Authority system when the combined storage of the Authority system is below the Stage 1 System Storage Trigger found in Table 1 and reasonable estimates of current annual demands, coupled with inflows and evaporation representative of the drought-of-record, indicate that the combined system storage could be reduced to the Stage 2 System Storage Trigger or less during the next 12 months.

Table 1
Drought Stage Triggers

Reservoir	Reservoir Storage (Ac-Ft)				Water Surface Elevation (Feet)			
	Conservation Storage	Stage 1 - Drought Watch	Stage 2 - Drought Warning	Stage 3 - Drought Emergency	Top of Conservation Storage	Stage 1 - Drought Watch	Stage 2 - Drought Warning	Stage 3 - Drought Emergency
Possum Kingdom Lake	539,425	396,497	320,000	250,000	1,000.0	990.7	984.3	977.2
Lake Granbury	132,180	103,239	88,232	52,872	693.0	689.1	686.7	678.9
Lake Whitney	585,782	525,864	489,038	432,758	533.0	530.3	528.5	525.6
Lake Aquilla	45,319	33,797	28,155	17,878	537.5	533.4	531.0	525.7
Lake Proctor	54,762	32,955	22,525	13,187	1,162.0	1156.5	1152.4	1147.7
Lake Belton	431,597	320,099	217,388	114,737	594.0	584.1	572.7	556.1
Lake Stillhouse Hollow	224,247	161,530	91,417	42,276	622.0	610.9	593.5	574.1
Lake Georgetown	36,986	26,221	20,740	14,106	791.0	781.8	776.2	767.9
Lake Granger	52,525	39,183	30,035	22,959	504.0	500.4	497.4	494.6
Lake Somerville	154,260	110,010	83,769	66,164	238.0	233.7	230.6	228.3
Lake Limestone	211,008	143,689	107,248	62,941	363.0	357.2	353.3	347.3
Lake Alan Henry	115,689	32,188	20,342	13,322	353.3	340.2	336.7	333.9
Authority System	2,583,780	1,625,182	1,369,773	1,015,602				

Note: Drought stage triggers are based on statistical analyses of storage from year 2000 firm yield studies of each reservoir. Trigger levels 1, 2 and 3 correspond to reoccurrence frequencies of 20%, 10% and 5%, respectively for all reservoirs except Possum Kingdom Lake. For Possum Kingdom Lake levels trigger levels 1, 2 and 3 correspond to reoccurrence frequencies of 20%, 7.6% and 2.4%, respectively.

Requirements for termination – The Authority's General Manager/CEO or his/her designee may terminate a drought watch condition when any of the circumstances listed as reasons for initiation have ceased to exist for a period of 30 consecutive days or other relevant factors determined by the Authority's General Manager/CEO or designee.

Stage 2 – Drought Warning Condition

Requirements for initiation – The Authority's General Manager/CEO or his/her designee may initiate a drought warning condition in one or more of the following circumstances:

- For a reservoir when the content of that reservoir is at or below the Stage 2 Storage Trigger for that reservoir found in Table 1 and reasonable estimates of current annual demands, coupled with inflows and evaporation representative of the drought-of-record, indicate that the content could be reduced to the Stage 3 Storage Trigger or less during the next 12 months.
- For a reservoir, group of reservoirs, or the entire Authority system when the combined storage of the Authority system is below the Stage 2 System Storage Trigger found in Table 1 and reasonable estimates of current annual demands, coupled with inflows and evaporation representative of the drought-of-record, indicate that the combined system storage could be reduced to the Stage 3 System Storage Trigger or less during the next 12 months.

Requirements for termination – The Authority's General Manager/CEO or his/her designee may terminate a drought warning condition when any of the circumstances listed as reasons for initiation have ceased to exist for a period of 30 consecutive days or other relevant factors determined by the Authority's General Manager/CEO or designee. Upon termination of a drought warning, a drought watch may become operative depending on conditions at the time.

Stage 3 – Drought Emergency Condition

Requirements for initiation – The Authority's General Manager/CEO or his/her designee may initiate a drought emergency condition in one or more of the following circumstances:

- For a reservoir when the content of that reservoir is at or below the Stage 3 Storage Trigger for that reservoir found in Table 1.
- For a reservoir, group of reservoirs, or the entire Authority system when the combined storage of the Authority system is below the Stage 3 System Storage Trigger found in Table 1

Requirements for termination – The Authority's General Manager/CEO or his/her designee may terminate a drought emergency condition when any of the circumstances listed as reasons for initiation have ceased to exist for a period of 30 consecutive days or other relevant factors determined by the Authority's General Manager/CEO or designee. Upon termination of a drought emergency, a drought warning or drought watch may become operative depending on conditions at the time.

5. Procedures to Be Followed for Initiation and Termination of Drought Response Stages

Initiation of a Drought Response Stage

The Authority's General Manager/CEO or his/her designee may order the implementation of a drought response stage when the trigger conditions for that stage are met. The following actions will be taken when a drought stage is initiated:

- The public will be notified through the appropriate media and the Authority web site.
- Wholesale customers will be notified by telephone with a follow-up letter or fax.
- Meetings will be held with customers as appropriate.
- If any mandatory provisions of the Plan are activated, the Authority will notify the Executive Director of the TCEQ within 5 business days.

The Authority's General Manager/CEO or his/her designee may decide not to order the implementation of a drought response stage even though the trigger criteria for the stage are met. Factors which could influence such a decision include, but are not limited to, the time of the year, weather conditions, the anticipation of replenished water supplies, or the anticipation that additional facilities will become available to meet needs. The reason for this decision should be documented.

Termination of a Drought Response Stage

The Authority's General Manager/CEO or his/her designee may order the termination of a drought response stage when the conditions for termination are met or at his/her discretion. The following actions will be taken when a drought stage is terminated:

- The public will be notified through local media and the Authority web site.
- Wholesale customers will be notified by telephone with a follow-up letter or fax.
- When any mandatory provisions of the Plan that have been activated are terminated, the Authority will notify the Executive Director of the TCEQ within 5 business days.

The Authority's General Manager/CEO or his/her designee may decide not to order the termination of a drought response stage even though the conditions for termination of the stage are met. Factors which could influence such a decision include, but are not limited to, the time of the year, weather conditions, or the anticipation of potential changed conditions that warrant the continuation of the drought stage. The reason for this decision should be documented.

BRA-CA-000309

6. Drought Response Stages, Measures to Be Implemented and Goals for Use Reduction

Stage 1 – Drought Watch Condition

Stage 1, drought watch condition, is intended to raise customer and public awareness of potential drought problems. There is no goal for reduction of water use. The Authority's General Manager/CEO or his/her designee can order the implementation of any of the actions listed below, as deemed necessary:

- Inform customers of the drought watch condition and request them to inform their customers, if any.
- Notify customers of actions being taken and urge activation by customers of appropriate water conservation measures.
- Meet with customers to discuss the current drought and possible measures to be taken if the drought intensifies. These measures may include:
    - Initiate Stage 1 or equivalent of customer drought contingency plans, if available
    - Intensify efforts on leak detection and repair
    - Reduce non-essential water use
    - Initiate voluntary landscape watering schedules
    - Implement other measures identified by the Authority and its customers
- Increase public education efforts on ways to reduce water use.
- Investigate alternative ways to supply needs that could be implemented if the drought intensifies.
- In cooperation with customers, initiate the preparation of a specific drought response plan tailored to conditions as they exist at the time.
- Implement appropriate provisions of the specific drought response plan.
- Consider activation of any additional water supply storage space that may be available but not yet activated in water supply reservoirs.
- Contact the TCEQ, United States Geological Survey (USGS), and Corps of Engineers. Inform them of the situation and request appropriate actions from each, such as closer monitoring to protect releases, more frequent gage inspections to reflect actual flow conditions more accurately, a greater effort to meet exact release requests, or activating water user conservation plans.
- Other actions as deemed appropriate for the given situation.

Stage 2 – Drought Warning Condition

The goal for water use reduction under Stage 2, drought warning, is a three percent reduction of the use that would have occurred in the absence of drought contingency

measures. If circumstances warrant, the Authority's General Manager/CEO or his designee may modify this goal. The Authority's General Manager/CEO or his/her designee can order the implementation of any of the actions listed below, as deemed necessary:

- Continue or initiate any actions available under Stage 1.
- Inform customers of the drought warning condition and request them to inform their customers, if any.
- Notify customers of actions being taken and urge activation by customers of appropriate water conservation measures.
- Meet with customers to discuss the current drought and possible measures to be taken. These measures may include:
    - Initiate Stage 2 or equivalent of customer drought contingency plans, if available
    - Encourage the public to wait until the current drought has passed before establishing new landscaping
    - Initiate mandatory landscape watering restrictions
    - Implement other measures identified by the Authority and its customers
- Require customers to initiate drought management efforts.
- Initiate engineering studies to evaluate alternative actions if conditions worsen.
- Further accelerate public education efforts on ways to reduce water use.
- In cooperation with Authority customers, update the specific drought response plan tailored to conditions as they exist at the time.
- Implement appropriate provisions of the specific drought response plan.

Stage 3 – Drought Emergency Condition

The goal for water use reduction under Stage 3, drought emergency, is a total reduction of seven percent in the use that would have occurred in the absence of any drought contingency measures. If circumstances warrant, the Authority's General Manager/CEO or his designee may modify this goal.

The Authority's General Manager/CEO or his designee can order the implementation of any of the actions listed below, as deemed necessary. Measures described as "requires notification to Executive Director of TCEQ" impose mandatory requirements on the Authority and customers. The Authority must notify the Executive Director of TCEQ within 5 business days if these measures are implemented.

- Continue or initiate any actions available under Stages 1 and 2.
- Inform customers of the drought emergency condition and request them to inform their customers, if any.

- Notify customers of actions being taken and urge activation by customers of appropriate water conservation measures.
- Meet with customers to discuss the current drought and measures to be taken. These measures may include:
    - Initiate the drought emergency provisions of customer drought contingency plans, if available
    - **Requires Notification to Executive Director of TCEQ** - Initiate mandatory water use restrictions such as prohibiting hosing of paved area, buildings or windows, prohibiting operation of ornamental fountains, prohibit washing or rinsing of vehicle by hose, and prohibiting water use in such a manner as to allow runoff or other waste
    - **Requires Notification to Executive Director of TCEQ** - Limit landscape watering at each service address to once every five days
    - **Requires Notification to Executive Director of TCEQ** - Prohibit draining and filling of existing swimming pools and filling of new swimming pools (Pools may add water to replace losses during normal use)
    - **Requires Notification to Executive Director of TCEQ** - Prohibit establishment of new landscaping
    - Initiate a surcharge by Authority customers for all water use
    - Implement other measures identified by the Authority and its customers
- Implement appropriate provisions of the specific drought response plan.
- Implement viable alternative water supply strategies. (This may require prior approval of the TCEQ.)
- **Requires Notification to Executive Director of TCEQ** – Institute a mandated reduction in deliveries to all customers. Such a reduction will be pursuant to Texas Water Code §11.039. (Texas Water Code §11.039 is included as Appendix D).

7. Required Provision on Distribution of Water in Case of Shortage in Authority Contracts

As required by 30 Texas Administrative Code §288.22(a)(7), the Authority shall include a provision in every water contract entered into or renewed after adoption of the Plan, including contract extensions, indicating that in case of a shortage of water resulting from drought the water will be divided in accordance with the provisions of Texas Water Code §11.039.

8. Procedures for Granting Variances

The Authority's General Manager/CEO or his/her designee may grant a temporary variance to the requirements of this Plan if it is determined that:

- Failure to grant such variance would cause an emergency condition adversely affecting the public health, welfare, or safety, or
- Compliance with this Plan cannot be technically accomplished during the duration of the water supply shortage or other condition for which the Plan is in effect, or
- Alternative methods can be implemented which will achieve the same level of reduction in water use.

Variances shall be granted or denied at the discretion of the Authority's General Manager/CEO or his/her designee. All petitions for variances should be in writing and should include the following information:

- Name and address of the petitioner(s)
- Purpose of water use
- Specific provisions from which relief is requested
- Detailed statement of the adverse effect of the provision from which relief is requested
- Description of the relief requested
- Period of time for which the variance is sought
- Alternative measures that will be taken to reduce water use
- Other pertinent information.

9. Procedures for Implementation and Enforcement

Appendix E is a copy of the Authority Board resolution approving this Plan. Compliance with this Plan, as amended from time to time, is a condition in the Authority's water supply agreements. Violation of the Plan is a violation of the water supply agreement provision and will be treated as such.

10. Review and Update

The Authority shall review this Plan at least every five years and shall update as appropriate based on new or updated information.

BRA-CA-000313

APPENDIX A

Texas Administrative Code, Section 288.22

APPENDIX A
Texas Commission on Environmental Quality Rules on Drought Contingency Plans for Wholesale Water Suppliers

TITLE 30	ENVIRONMENTAL QUALITY
PART 1	TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
CHAPTER 288	WATER CONSERVATION PLANS, DROUGHT CONTINGENCY PLANS, GUIDELINES AND REQUIREMENTS
SUBCHAPTER B	DROUGHT CONTINGENCY PLANS
RULE §288.22	**Drought Contingency Plans for Wholesale Water Suppliers**

(a) A drought contingency plan for a wholesale water supplier must include the following minimum elements.

(1) Preparation of the plan shall include provisions to actively inform the public and to affirmatively provide opportunity for user input in the preparation of the plan and for informing wholesale customers about the plan. Such acts may include, but are not limited to, having a public meeting at a time and location convenient to the public and providing written notice to the public concerning the proposed plan and meeting.

(2) The drought contingency plan must document coordination with the regional water planning groups for the service area of the wholesale public water supplier to ensure consistency with the appropriate approved regional water plans.

(3) The drought contingency plan must include a description of the information to be monitored by the water supplier and specific criteria for the initiation and termination of drought response stages, accompanied by an explanation of the rationale or basis for such triggering criteria.

(4) The drought contingency plan must include a minimum of three drought or emergency response stages providing for the implementation of measures in response to water supply conditions during a repeat of the drought-of-record.

(5) The drought contingency plan must include the procedures to be followed for the initiation or termination of drought response stages, including procedures for notification of wholesale customers regarding the initiation or termination of drought response stages.

(6) The drought contingency plan must include specific, quantified targets for water use reductions to be achieved during periods of water shortage and drought. The entity preparing the plan shall establish the targets. The goals established by the entity under this paragraph are not enforceable.

(7) The drought contingency plan must include the specific water supply or water demand management measures to be implemented during each stage of the plan including, but not limited to, the following:

(A) pro rata curtailment of water deliveries to or diversions by wholesale water customers as provided in Texas Water Code, §11.039; and

BRA-CA-000315

(B) utilization of alternative water sources with the prior approval of the executive director as appropriate (e.g., interconnection with another water system, temporary use of a non-municipal water supply, use of reclaimed water for non-potable purposes, etc.).

(8) The drought contingency plan must include a provision in every wholesale water contract entered into or renewed after adoption of the plan, including contract extensions, that in case of a shortage of water resulting from drought, the water to be distributed shall be divided in accordance with Texas Water Code, §11.039.

(9) The drought contingency plan must include procedures for granting variances to the plan.

(10) The drought contingency plan must include procedures for the enforcement of any mandatory water use restrictions including specification of penalties (e.g., liquidated damages, water rate surcharges, discontinuation of service) for violations of such restrictions.

(b) The wholesale public water supplier shall notify the executive director within five business days of the implementation of any mandatory provisions of the drought contingency plan.

(c) The wholesale public water supplier shall review and update, as appropriate, the drought contingency plan, at least every five years, based on new or updated information, such as adoption or revision of the regional water plan.

Source Note: The provisions of this §288.22 adopted to be effective February 21, 1999, 24 TexReg 949; amended to be effective April 27, 2000, 25 TexReg 3544; amended to be effective October 7, 2004, 29 TexReg 9384

APPENDIX B

Letter to Customers

APPENDIX B
Example Letter to Wholesale Water Customers

Date

[Customer]
[Address]

Dear [Customer]:

The Brazos River Authority has prepared a draft Drought Contingency Plan, which when adopted by the Board of Directors of the Brazos River Authority will be used by the Authority as a component of its Water Management and Drought Protection Plan. As a wholesale water customer of the Authority, we are seeking your input and comments on the draft Drought Contingency Plan. This plan is available for review on the Authority's web site at www.brazos.org. If you do not wish to access the plan over the internet, you may request a copy through our public relations office at (254) 761-3111.

Public comments regarding the Drought Contingency Plan may be made at the Public Meeting to be held by the Brazos River Authority Board of Directors Asset Management Committee, on Thursday, January 13, 2004 at 9:00 a.m. Written comments on the draft Drought Contingency Plan will be accepted through close of business on Thursday, January 20, 2005.

The Drought Contingency Plan will be presented to the entire Brazos River Authority Board of Directors for adoption at its Monday, January 26, 2004 meeting.

We appreciate your input and interest in the water resources in the Brazos River Basin.

Sincerely,

Phil Ford
General Manager/CEO
Brazos River Authority

APPENDIX C

Letter to Regional Water Planning Groups

APPENDIX C
Example Letter to Regional Water Planning Groups
[Planning Groups B, C, F, G, H, and O]

Date

[Chairman]
Chair, Region _ Water Planning Group
[Address]

Dear [Chairman]:

Enclosed please find a copy of the draft Drought Contingency Plan for the Brazos River Authority. I am submitting a copy of this plan to the Region __ Water Planning Group in accordance with the Texas Water Development Board and Texas Commission on Environmental Quality rules.

Please review the draft plan for consistency with the approved Regional Water Plan. Public comments regarding the Drought Contingency Plan may be made at the Public Meeting to be held by the Brazos River Authority Board of Directors Asset Management Committee, on Thursday, January 13, 2004 at 9:00 a.m. Written comments on the draft Drought Contingency Plan will be accepted through close of business on Thursday, January 20, 2005. Any comments or concerns may be addressed to Jim Forte, Planning and Development Manager.

The Drought Contingency Plan will be presented to the entire Brazos River Authority Board of Directors for adoption at its Monday, January 26, 2004 meeting. A final copy of the Drought Contingency Plan will be forwarded to the Region _ Water Planning Group after it is adopted by the Brazos River Authority Board.

Sincerely,

Phil Ford
General Manager/CEO
Brazos River Authority

APPENDIX D

Texas Water Code, Section 11.039

APPENDIX D

Texas Water Code Section 11.039

§ 11.039. Distribution of Water During Shortage

(a) If a shortage of water in a water supply not covered by a water conservation plan prepared in compliance with Texas Natural Resource Conservation Commission or Texas Water Development Board rules results from drought, accident, or other cause, the water to be distributed shall be divided among all customers pro rata, according to the amount each may be entitled to, so that preference is given to no one and everyone suffers alike.

(b) If a shortage of water in a water supply covered by a water conservation plan prepared in compliance with Texas Natural Resource Conservation Commission or Texas Water Development Board rules results from drought, accident, or other cause, the person, association of persons, or corporation owning or controlling the water shall divide the water to be distributed among all customers pro rata, according to:

(1) the amount of water to which each customer may be entitled; or

(2) the amount of water to which each customer may be entitled, less the amount of water the customer would have saved if the customer had operated its water system in compliance with the water conservation plan.

(c) Nothing in Subsection (a) or (b) precludes the person, association of persons, or corporation owning or controlling the water from supplying water to a person who has a prior vested right to the water under the laws of this state.

Amended by Acts 1977, 65th Leg., p. 2207, ch. 870, § 1, eff. Sept. 1, 1977.

Amended by Acts 2001, 77th Leg., ch. 1126, § 1, eff. June 15, 2001.

BRA-CA-000322

APPENDIX E

Board Resolution to Adopt the Drought Contingency Plan

APPENDIX E
Brazos River Authority
Board Resolution Adopting the Drought Contingency Plan

Brazos River Authority

RESOLUTION OF THE BOARD OF DIRECTORS OF THE BRAZOS RIVER AUTHORITY JANUARY 24TH, 2005

Drought Contingency Plan for the Brazos River Authority, Authorizing Submittal of the Drought Contingency Plan to the Texas Commission on Environmental Quality and the Texas Water Development Board for approval, and Authorizing Incorporation of Provisions into All Water Sales Contracts used by the Brazos River Authority

AGENDA ITEM NO. 17

"BE IT RESOLVED by the Board of Directors of the Brazos River Authority that a Drought Contingency Plan, as presented to Brazos River Authority by Freese and Nichols, Inc., dated December 8, 2004, prepared in conformance with the requirements of the Texas Commission on Environmental Quality (TCEQ) and the Texas Water Development Board (TWDB) is hereby adopted;

BE IT FURTHER RESOLVED by the Board of Directors of the Brazos River Authority that the General Manager/CEO is directed to submit the adopted Brazos River Authority Drought Contingency Plan to both TCEQ and TWDB for their approval; and

BE IT FURTHER RESOLVED by the Board of Directors of the Brazos River Authority that the General Manager/CEO is directed to incorporate provisions into all water sales contracts used by the Brazos River Authority to require purchasers of water from the

Brazos River Authority to implement water conservation and demand reduction measures in accordance with the adopted Brazos River Authority Drought Contingency Plan."

The aforementioned resolution was approved by the Board of Directors of the Brazos River Authority on January 24, 2005, to certify which witness my hand and seal.

Joe B. Hinton
Chairman of the Board

SUBSCRIBED AND SWORN TO BEFORE ME on this the 10th day of February, 2005, to certify which witness my hand and official seal.

Notary Public in and for the
State of Texas

CD SUBMITTED SEPARATELY

Freese and Nichols

MEMORANDUM

TO: Philip Price, P.E.

FROM: Jon S. Albright

SUBJECT: Development of Daily Flow for Brazos River Authority Diversion Rate Analysis

DATE: August 26, 2008

This memorandum describes the procedure used by Freese and Nichols, Inc. (FNI) to develop daily flows used for the Brazos River Authority (Authority) diversion rate analysis. These flows were extracted from the System Operation Model with diversions at Richmond. Instream flows were applied based on the base flow criteria found in the draft System Operation Permit. Pulse flow criteria were not modeled in the WAM.

FNI used monthly regulated flows just prior to system operation to develop daily flows. These regulated flows represent the flow that would be seen by the Authority at the time of diversion. The regulated flows include unused depletions at Authority reservoirs from the first pass through the simulation that has not been used to fill reservoirs in the second pass through the simulation. The regulated flows do not include releases from upstream reservoirs to meet System Operation diversions.

Regulated flows were chosen because these flows most closely mimic historical flows and instream flow criteria are based on regulated flows. Daily available water in excess of the instream flow criteria can then be calculated.

The regulated flows include both water reserved for downstream water rights and water reserved by instream flow criteria. At times the amount reserved for downstream water rights is less than the amount reserved by instream flows, and at other times it is more. In order to prevent impacts on downstream water rights, FNI divided the volume reserved for downstream water rights evenly throughout each month. If daily flows fell below this reserve flow on any day, then an adjustment was added to other days until the desired volume was achieved over the month. This flow reserve was compared to the instream flow criteria. If it is more than the criteria, then the flow reserved for downstream water rights controls available water.

As a further protection for downstream uses, diversions by BRA are limited by the monthly depletions made in the WAM simulation.

1. For the first step, FNI extracted the monthly regulated flows just prior to diversions under system operation. This information is not directly available from the model. To record the regulated flows, a dummy water right was added that diverted the regulated flow amount from a dummy control point (SR5155) with a large amount of flow. This water

Freese and Nichols, Inc. ◆ Engineers ◆ Environmental Scientists ◆ Architects
4055 International Plaza ◆ Suite 200 ◆ Fort Worth, Texas 76109-4895
(817) 735-7300 ◆ Metro (817) 429-1900 ◆ Fax (817) 735-7491

right is placed just before the System Operation diversion. Therefore it includes both unappropriated naturalized flow as well as flow that has been released from upstream control points that contain Authority water that had not been used to fill Authority reservoirs.

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CPSR5155     OUT                      2    NONE    NONE     -3.  0.0000

CISR5155 9999999 9999999 9999999 9999999 9999999 9999999
CI       9999999 9999999 9999999 9999999 9999999 9999999

WRSR5155                20041015   2                                    look SYSTEM4
TO     2                                  BRRI70
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2. FNI developed daily flows by multiplying the regulated flow by the historical percentage of monthly flow that occurred at the Richmond gauge. These percentages were developed in previous analyses performed with Texas Parks and Wildlife.
3. In order to determine the volume of flow reserved for downstream water rights, another WR record was added with no diversions, followed by an SO record with the IFNOTA flag. The difference between regulated flows and available flows for this record is the volume reserved in each month for downstream water rights.

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WRBRRI70                20041015   2                           4lookb4sydivASF    look
SO                                                                                   IFNOTA       2
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4. The volume of flow reserved for downstream water rights was divided evenly among the days of the month. If the daily flows fall below the daily reserved flow, then the amount reserved was adjusted upwards in other days of the month until the overall volume of water required by downstream water rights was achieved.
5. FNI provided the daily regulated flows, daily flows reserved for downstream water rights, and monthly depletions by the System Operation Permit to the Authority. The Authority subsequently determined how those streamflows might be diverted on a daily basis after meeting instream flow requirements. The monthly total of the daily diversions were limited to the monthly depletion made in the System Operation run.

Bickerstaff Heath Delgado Acosta LLP

816 Congress Avenue Suite 1700 Austin, Texas 78701 (512) 472-8021 Fax (512) 320-5638 www.bickerstaff.com

February 5, 2009

Ron Ellis, Project Manager
Mail Code 160
Water Rights Permitting and Availability Section
Water Supply Division
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087

RE: Brazos River Authority System Operation Permit; WRPERM 5851

Dear Mr. Ellis:

The Brazos River Authority (BRA) has reviewed the draft permit transmitted by your letter of December 1, 2008, as well as the technical memoranda accompanying that draft. We appreciate the effort and good work of the Executive Director's staff in getting us to this point. BRA offers the following comments for your consideration. BRA's suggestions are reflected in two redline revisions of the draft permit, included herewith, and explained below.

Use of Return Flows

BRA's application requested authorization to appropriate additional state water made available by return flows up to the projected levels of discharge in 2060. The application requested that return flows discharged into the Brazos River Basin, regardless of source, be treated as state water according to Texas Water Code § 11.046(c), i.e., once discharged, return flows are considered to be state water available for use and appropriation as is other state water. BRA's application also included groundwater based return flows because, pursuant to common law, following discharge into a watercourse groundwater based return flows also become state water. *City of San Marcos v. TCEQ,* 128 S.W.3d 264, 272 (Tex. App. – Austin 2004, pet. denied).[1]

Treating return flows in this fashion results in current and future return flows being available for satisfaction of both the unsatisfied demands of senior rights and of environmental flow requirements before they are available for storage or use by BRA. This is the method of handling return flows that was, we believe, favorably viewed by Commissioners during their 2005 work sessions, and the method that was supported by Texas Parks and Wildlife Department (TPWD) and several environmental organizations.

The draft permit and hydrology memo treat BRA's application as if it were an application to transport and reuse water pursuant to Texas Water Code § 11.042. Sources of return flow

[1] Pursuant to Texas Water Code § 11.042, such discharges may, with TCEQ authorization, be claimed by the discharger. BRA's proposed revision of the draft permit recognizes that BRA's use of groundwater based return flows is interruptible if such authorization is obtained.

derived from BRA-supplied water or discharged from BRA-owned wastewater treatment plants are identified and, subject to accounting requirements and other restrictions, BRA is authorized downstream use of these discharges. While this alternative "bed and banks" approach to handling return flows is authorized by statute, it is not what BRA requested.

Two revised drafts of the permit are provided: Draft-A, which handles return flows as state water, as authorized by Texas Water Code § 11.046, and as requested in the application; and Draft-B which reflects the "bed and banks" approach contained in the 12/01/08 draft permit. Other than the treatment of return flows, both revised drafts are the same.

BRA requests that the draft permit be modified to reflect the "state water" approach reflected in Draft-A.[2] The return flows utilized to develop the firm yield values presented in Draft-A are those described in BRA's application, and reflect utilization of environmental flow requirements from the 12/01/08 draft permit, subject to demands of senior water rights.

Environmental Flow Requirements

As you are aware, the environmental flow requirements contained in the 12/01/08 draft permit are the result of a collaborative effort between BRA, TPWD, and TCEQ staff. While not the product of site-specific environmental studies, they reflect the SB 3 approach of developing a flow regime reflecting different conditions on a seasonal basis. As such, the draft permit's environmental flow provisions are the most progressive, state of the art, environmental flow requirements that have been included in any TCEQ water rights permit, to our knowledge. By way of the permit's environmental flow requirements, BRA believes that environmental flows for the Brazos River Basin will be ensured for the future. Nevertheless, as the draft permit recognizes, the environmental flow requirements are interim, based on an analysis of historic flows rather than a direct analysis of the biological or environmental impacts of those flows. For this reason, specific Instream Flow Studies are contemplated, as well as ongoing adaptive management to enable us to take better scientific knowledge into account as it is developed.

The only substantive provision proposed by BRA regarding environmental flow requirements is found in section 6.E.15 and addresses diversion trigger levels. The 12/01/08 draft permit recognized that cumulative diversions at a rate less than 7,535 cfs above the Richmond gage did not significantly impact High Flow Pulses (HFP) under wet conditions, as the magnitude of the diversion relative to the quantities of water involved in the HFP is small. BRA performed an analysis of other HFP control points under dry, average and wet flow conditions and developed diversion rates for each season and control point that are comparable to the 7,535 cfs diversion rate at Richmond under wet conditions. BRA's memorandum of January 27, 2008 by Phil Price, documenting the computation of the values reflected in proposed special condition 6.E.15 is enclosed for your review. BRA believes that this proposed revision is particularly important because diversions at a relatively low rate, as compared to the HFP, may

[2] If the "state water" approach were determined to be unauthorized or legally unacceptable for some reason, BRA nevertheless desires to obtain authorization to use return flows and would alternatively accept the authorization under the "bed and banks" approach reflected in Draft-B.

have little impact on the number of qualifying HFPs, while limitation of diversions unnecessarily can have a substantial impact on the water supply available.

BRA's other specific proposed revisions to special provisions concerning environmental flows are explained as follows:

- E.1 – clarification that the interim requirements are based on hydrology and do not reflect results of biological studies.

- E.4 – clarification that the values presented are cumulative, e.g., 75% of flows do not qualify as "wet," but cumulatively 75% of the flows are within or less than the "wet" condition criteria.

- E.5 – clarification that storage and diversion is limited by HFP requirements at the next downstream control point, rather than at all downstream control points, e.g., limitation of storage and diversion at Possum Kingdom because HFP requirements are not satisfied at Richmond (approximately 15 days of flow time below Possum Kingdom) makes no sense if HFP requirements at Glen Rose (only 3 days downstream) are being satisfied.

- E.7 – clarification that BRA is not being affirmatively ordered to produce HFPs, but is restricted from storage or diversion in order to allow HFPs to occur.

- E.7 – Glen Rose winter, wet HFPs are deleted because the historic frequency of these pulses is less than 0.50 per year. Rounding up to require more pulses than have historically occurred is not justified.

- E.10 – clarification that BRA may obtain credit for pulses by utilizing its storage capacity in the manner described, but is not required to do so.

- E.14 – clarification that an overbanking flow may also (prior to the time that it overbanks) satisfy HFP requirements.

New Appropriation Volumes

Volumes of the new appropriation of firm water at Richmond and the Gulf of Mexico have been corrected to reflect that diversions from the Brazos River to Allens Creek Reservoir, under this permit are not subject to the diversion limitations contained in Permit No. 2925A. Under the authorization of Permit No. 2925A, diversions from the Brazos River to Allens Creek Reservoir are limited to 202,000 acre-feet per year (af/yr). However, under the System Operation Permit, BRA has requested (and the draft permit recognizes) the ability to divert additional water for purposes of system operation; quantities of water and diversion rates under this authorization are not limited so long as other special conditions are satisfied. Thus, diversions from the Brazos River into Allens Creek Reservoir under the authority of the System Operation Permit are not subject to the 202,000 af/yr limitation contained in the stand-alone

Allens Creek Permit, No. 2925A. Removing this limiting constraint from the TCEQ version of the WAM utilized to compute the available new appropriation results in the values reflected in paragraphs 1.A.1 and 1.A.2. Freese & Nichols' February 5, 2009 memorandum addressing this issue is also included for your reference.

The bases for BRA's other proposed revisions relative to the new appropriation are as follows:

- C.1.c – clarification that impoundment of HFP volumes is not mandatory.
- C.2. – clarification that adjustment of firm water available for delivery may also be made in the Water Management Plan (WMP).
- C.3 – clarification that the amount of firm water supply reduction required to produce non-firm water is variable, depending upon the amount and location of use and other factors.
- C.4&5 – values are adjusted to reflect updates in the Return Flows Available Table, discussed below.
- C.5-7 – clarification.
- C.9 – clarification that authorization may also be obtained through Commission approval of the WMP.

Reuse of Water

If the "bed and banks" approach to reuse is utilized, Draft-B contains additional corrections and revisions to the 12/01/08 draft permit, described as follows:

- Return Flows Available Table – the permitted discharge volumes for specific dischargers has been corrected; percent of groundwater and BRA surface water have been deleted (the mix will vary and need to be addressed in the reuse accounting plan); other proposed anticipated sources of return flow of BRA-supplied water have been identified (avoiding the necessity of future amendments or addition to the reuse accounting plan or WMP).
- Return Flow Discharge Table – comparable revisions have been carried through from the Return Flows Available Table.
- A.3 – clarification that imported/developed water is also included in the authorization.

- A.4 – inclusion of wastewater treatment plants operated by BRA and clarification that authorization may be obtained from the Commission via its approval of the WMP or an amendment of the permit.

- A.9,10&12 – substitution of reference to Return Flows Available Table since the specific amount has changed and could change further in the future.

Use of Bed and Banks

Several reaches of tributaries below existing System reservoirs were omitted from the 12/01/08 draft permit. These have been added to section B.2. Additionally, section B.4 is clarified to reflect that future authorizations may be obtained via Texas Water Code § 11.042 authorization or the WMP. Finally, the "daily" delivery requirement from section B.3's accounting delivery plan has been deleted. In BRA's system operation a delivery may require multiple days or weeks. Requiring the accounting plan to address daily deliveries is unrealistic, requiring a greater degree of precision than is achievable in the actual operation of the system.

Water Management Plan

Provisions in the 12/01/08 draft permit require contested case procedures for adoption of the WMP and subsequent major amendments, but do not provide guidelines to distinguish between major and minor amendments. BRA's proposed draft identifies several categories of changes that would be considered minor amendments, not requiring a contested case hearing. The provision contemplates that the WMP, as initially approved, would provide methodologies for use in adding diversion points, adjusting the remaining available supply (depending upon the point of delivery) and determining the water supply available from return flow sources as they may increase or decrease in the future. Subsequent modifications of the values based upon the approved methodologies should not constitute major amendments. Also, the 12/01/08 draft permit contemplates that some changes in the accounting/delivery plan will be approved by the Executive Director, without notice and hearing. Because the accounting/delivery plan may be included in the WMP, the proposed language clarifies that such changes are not major amendments.

BRA appreciates your consideration of these comments and is available to discuss them with you or other TCEQ staff at your convenience. Please do not hesitate to give me a call or contact me by email if you have questions or would like to discuss any of these issues.

Sincerely,

Doug Caroom

Douglas G. Caroom

DGC/mmr
Enclosures

DRAFT-A

WATER USE PERMIT

Permit No.	5851		TYPE §§ 11.121, 11.042 & 11.085
Owner:	Brazos River Authority	Address:	P.O. Box 7555 Waco, Texas 76714-7555
Filed:	October 15, 2004	Granted:	
Purpose:	Multiple-Use (Domestic, Municipal, Agricultural, Industrial, Mining, Recreation)	Counties:	Parmer, Castro, Swisher, Bailey, Lamb, Hale, Floyd, Cochran, Hockley, Archer, Lubbock, Crosby, Baylor, Dickens, King, Knox, Jack, Terry, Lynn, Mitchell, Chambers, Young, Garza, Throckmorton, Kent, Haskell, Stonewall, Parker, Palo Pinto, Dawson, Scurry, Borden, Fisher, Stephens, Jones, Shackelford, Johnson, Hood, Nolan, Erath, Eastland, Taylor, Callahan, Somervell, Hill, Comanche, Bosque, Brown, Freestone, Hamilton, McLennan, Limestone, Mills, Coryell, Leon, Falls, Lampasas, Robertson, Bell, Madison, Milam, Burnet, Brazos, Grimes, Williamson, Burleson, Travis, Lee, Washington, Bastrop, Waller, Harris, Austin, Colorado, Fort Bend, Galveston, Matagorda, Wharton, Fayette, and Brazoria
Watercourse:	Multiple Tributaries of the Brazos River and the Brazos River	Watershed:	Brazos River Basin; San Jacinto-Brazos Coastal Basin; and Brazos-Colorado Coastal Basin

WHEREAS, the Brazos River Authority, Applicant, owns the water rights and reservoirs authorized by Certificate of Adjudication (Certificate) No. 12-5155 (Possum Kingdom Lake), Certificate No. 12-5156 (Lake Granbury), Certificate No. 12-5165 (Lake Limestone), and Water

Use Permit 2925A (Allens Creek Reservoir in conjunction with the Texas Water Development Board and the City of Houston); and

WHEREAS, Applicant also owns the water rights and has contracts with the United States Army Corps of Engineers for storage authorized by Certificate No. 12-5157 (Lake Whitney), Certificate No. 12-5158 (Lake Aquilla), Certificate No. 12-5159 (Lake Proctor), Certificate No. 12-5160 (Lake Belton), Certificate No. 12-5161 (Lake Stillhouse Hollow), Certificate No. 12-5162 (Lake Georgetown), Certificate No. 12-5163 (Lake Granger), Certificate No. 12-5164 (Lake Somerville), and

WHEREAS, Applicant also owns the water rights authorized by Certificate Nos. 12-5166 and 12-5167, which authorize various uses of water within the Applicant's other certificates and permits; and

WHEREAS, Applicant is currently authorized, pursuant to a TCEQ order, to manage and operate its tributary reservoirs as elements of a system, coordinating releases and diversions from the tributary reservoirs with releases and diversions from the Applicant's main-stem reservoirs to minimize waste, and to conserve water in reservoirs in which the supply is short by making releases from tributary reservoirs in which the supply is more abundant; and

WHEREAS, Applicant has applied for a Water Use Permit to authorize:

- A new appropriation of state water in the amount of 421,449 acre-feet per year for multiple use purposes, including domestic, municipal, agricultural, industrial, mining, and other beneficial uses on a firm basis in the Brazos River Basin. The amount of this new appropriation of water includes the current and future return flows requested in this application. Applicant indicates that the entire amount of 421,449 acre-feet of water per year is available only if all of it is diverted at the mouth of the Brazos River, and can only be made available by the Applicant through the system operation of its water rights. To the extent water is diverted upstream, the remaining unappropriated water downstream is reduced and will itself vary depending upon the location of its diversion and use. Out of the 421,449 acre-feet per year of unappropriated water being requested, the maximum amount of unappropriated water that will be available if such water is diverted upstream at USGS gage No. 08091000 near Glen Rose, Texas is 150,538 acre-feet per year firm, and if such unappropriated water is diverted upstream at USGS gage No. 08098290 near Highbank, Texas, the maximum amount of unappropriated water that will be available at that location is 144,306 acre-feet per year firm.

- Diversion of the water authorized by this amendment, if granted, from: (i) the existing diversion points authorized by Applicant's existing water rights; (ii) the Brazos River at the USGS gage No. 08091000 near Glen Rose, Texas; (iii) the Brazos River at USGS gage No. 08098290 near Highbank, Texas; (iv) the Brazos River at the Gulf of Mexico; and (v) at such other diversion points that may be

identified and included in Applicant's proposed Water Management Plan which is subject to TCEQ's approval.

- Use of up to 90,000 acre-feet of water per year of its firm supply (part of the 421,449 acre-feet of firm water requested above) to produce, along with other unappropriated flows, an interruptible water supply of 670,000 acre-feet per year and the appropriation of that interruptible water supply. Applicant indicates that the entire amount of 1,001,449 acre-feet of water (331,449 acre-feet of firm water and 670,000 acre-feet of interruptible water) is available only if all of it is diverted at the mouth of the Brazos River, and can only be made available by the Applicant through the system operation of its water rights. To the extent water is diverted upstream, the remaining unappropriated water downstream is reduced and will itself vary depending on the location of its diversion and use. This new appropriation of water includes the current and future return flows requested in this application. Out of the 1,001,449 acre-feet of firm and interruptible water being requested, the maximum amount of firm and interruptible water that will be available if such water is diverted upstream at USGS Gage No. 08091000 near Glen Rose, Texas is 60,538 acre-feet of firm water per year and 157,000 acre-feet of interruptible water per year and if such water is diverted upstream at USGS Gage No. 08098290 near Highbank, Texas, the maximum amount of firm water is 54,306 acre-feet of water per year and 303,000 acre-feet of interruptible water per year.

- An exempt interbasin transfer authorization to transfer and use, on a firm and interruptible basis, such water in the adjoining San Jacinto-Brazos Coastal Basin and the Brazos-Colorado Coastal Basin, and to transfer such water to any county or municipality or the municipality's retail service area that is partially within the Brazos River Basin for use, on a firm and interruptible basis, in that part of the county or municipality and the municipality's retail service area not within the Brazos River Basin.

- An appropriation of current and future return flows (treated sewage effluent and brine bypass/return) to the extent that such return flows continue to be discharged or returned into the bed and banks of the Brazos River, its tributaries, and Applicant's reservoirs. Applicant indicates that such appropriation of return flows would be subject to interruption by direct use or indirect use within the discharging entity's city limits, extraterritorial jurisdiction, or contiguous water certificate of convenience and necessity boundary. Specified discharge points and amounts of water will be accounted for on a monthly basis as part of Applicant's Water Management Plan which is subject to TCEQ's approval.

- Operational flexibility to (1) use any source of water available to the Applicant to satisfy the diversion requirements of senior water rights to the same extent that those water rights would have been satisfied by passing inflows through the Applicant's reservoirs on a priority basis; and (2) release, pump and transport

water from any of the Applicant's reservoirs for subsequent storage, diversion and use throughout the Applicant's service area. (Applicant's "service area" includes all counties listed above.)

- Recognition that the System Operation Permit approved pursuant to this application will prevail over inconsistent provisions in the Applicant's existing water rights regarding system operation.

- Use of the bed and banks of the Brazos River, its tributaries and the Applicant's reservoirs for the conveyance, storage, and subsequent diversion of (i) water that the Applicant seeks to appropriate under this application; (ii) waters that are being conveyed via pipelines and subsequently discharged into the Brazos River, its tributaries or stored in the Applicant's reservoirs; (iii) surface water imported from areas located outside the Brazos River Basin for subsequent use; (iv) in-basin surface water and groundwater subject to the Applicant's control; (v) waters developed from future Applicant projects; and (vi) current and future reuse of surface and groundwater based effluent requested by this application. This bed and banks authorization is subject to Applicant, after identifying specific points of discharge and diversion and conveyance and other losses, obtaining future authorizations to satisfy the requirements of TWC § 11.042. Such points of discharge and diversion and conveyance and other losses may also be identified and included in Applicant's proposed Water Management Plan which is subject to TCEQ's approval.

WHEREAS, Applicant seeks authorization to divert and use treated effluent at multiple points in the Brazos River Basin; and

WHEREAS, until the construction of Allens Creek Reservoir is completed, Applicant requests that the System Operation Permit include special conditions which authorize:

- The Applicant to appropriate state water in the amount of 425,099 acre-feet per year for multiple use purposes, including domestic, municipal, agricultural, industrial, mining, and other beneficial uses on a firm basis in the Brazos River Basin. This amount includes the current and future return flows requested in this application. This amount is available if all of the water is diverted at the mouth of the Brazos River, and can only be made available by the Applicant through the system operation of its water rights. To the extent water is diverted upstream, the remaining unappropriated water downstream is reduced and will itself vary depending upon the location of its diversion and use. Out of the 425,099 acre-feet per year of unappropriated water being requested, the maximum amount of unappropriated water that will be available if such water is diverted upstream at USGS Gage 08091000 near Glen Rose, Texas is 150,538 acre-feet per year firm and if such unappropriated water is diverted upstream at USGS Gage 08098290 near Highbank, Texas the maximum amount of unappropriated water that will be available is, at that location, 175,306 acre-feet per year firm;

- The Applicant to use up to 90,000 acre-feet of water per year of its firm supply to produce, along with other unappropriated flows an interruptible water supply of 869,000 acre-feet per year. This amount includes the current and future return flows requested in this application. Applicant indicates that the entire amount of 1,204,099 acre-feet of water (335,099 acre-feet of firm water and 869,000 acre-feet of interruptible water) is only available if all of it is diverted at the mouth of the Brazos River, and can only be made available by the Applicant through the system operation of its water rights. To the extent water is diverted upstream, the remaining unappropriated water downstream is reduced and will itself vary depending upon the location of its diversion and use. Out of the 1,204,099 acre-feet of firm and interruptible water being requested, the maximum amount of firm and interruptible water that will be available if such water is diverted upstream at USGS Gage No. 08091000 near Glen Rose, Texas, will be 60,538 acre-feet of firm water per year and 190,000 acre-feet of interruptible water per year and if such water is diverted upstream at USGS Gage No. 08098290 near Highbank, Texas the maximum amount of firm water will be 85,306 acre-feet of water per year and 284,000 acre-feet of interruptible water per year; and

- Exempt interbasin transfer authorization to transfer and use, on a firm and interruptible basis, such water in the adjoining San Jacinto-Brazos Coastal Basin and the Brazos-Colorado Coastal Basin, and to transfer such water to any county or municipality or the municipality's retail service area that is partially within the Brazos River Basin for use, on a firm and interruptible basis, in that part of the county or municipality and the municipality's retail service area not within the Brazos River Basin.

WHEREAS, the Texas Commission on Environmental Quality (Commission) finds that jurisdiction over the application is established; and

WHEREAS, the Executive Director recommends that specific stream flow restrictions should be included in the permit to maintain the instream uses and water quality conditions of the Brazos River; and

WHEREAS, as additional factual and scientific information becomes available, it is anticipated that the interim special conditions in Paragraph 6.E. below are relative to environmental flows will be revised, through Commission approved revisions of the Water Management Plan, to better provide for the environmental instream flow needs of the Brazos River and its tributaries and to make the maximum amount of water available for beneficial uses that is consistent with those needs, and

WHEREAS, the Executive Director recommends that in order to protect senior and superior water rights owners, special conditions should be included in the permit; and

WHEREAS, to avoid ambiguities between this authorization and Applicant's previous authorizations, the Executive Director recommends that this System Operation Permit be subject to all provisions included in the Commission's July 23, 1964 Order, as amended, authorizing system operation of certain reservoirs in the Brazos River Basin and to all terms and conditions of Permittee's authorizations in Certificate Nos. 12-5155, 12-5156, 12-5165, 12-5157, 12-5160, 12-5159, 12-5164, 12-5161, 12-5163, 12-5162, 12-5158, 12-5166 and 12-5167 and Water Use Permit 2925A except to the extent specifically provided otherwise by this permit, or approved by the Commission in a Water Management Plan for the Brazos River Basin; and

WHEREAS, the Commission has complied with the requirements of the Texas Water Code and Rules of the Texas Commission on Environmental Quality in issuing this permit;

NOW, THEREFORE, Water Use Permit No. 5851, is issued to the Brazos River Authority, subject to the following terms and conditions:

1. USE

A. NEW APPROPRIATION

1) Permittee is authorized to impound, divert, and use not to exceed the following volumes of unappropriated water per year for multiple uses (domestic, municipal, agricultural, industrial, mining) within their service area subject to special conditions:

Recommended Amounts of New Appropriation

	Volume in acre-feet	
Location	**Firm Water**	**Non-firm Water**
Glen Rose	131,363	157,000
Highbank	144,306	303,000
Richmond	239,297~~188,095~~	670,000
Gulf of Mexico	243,146~~191,516~~	670,000

2) Until such time as the ports are closed on the dam impounding Allens Creek Reservoir, authorized by Permit 2925A, in lieu of 1.A.1 Permittee may impound, divert, and use not to exceed the following volumes of unappropriated water per year, subject to special conditions:

Recommended Amounts of New Appropriation without Allens Creek

	Volume in acre-feet without Allens Creek Reservoir	
Location	**Firm Water**	**Non-firm Water**
Glen Rose	131,363	190,000
Highbank	175,306	284,000
Richmond	235,377~~237,000~~	869,000
Gulf of Mexico	239,199~~241,765~~	869,000

B. Permittee is authorized to use the bed and banks of the Brazos River, its tributaries and Permittee's authorized reservoirs for the conveyance, storage, and subsequent diversion of the water authorized herein, subject to identification of specific losses and special conditions.

C. Permittee is hereby granted an exempt interbasin transfer authorization to transfer and use the water authorized herein in Permittee's service area in the adjoining San Jacinto-Brazos Coastal Basin and the Brazos-Colorado Coastal Basin and to transfer such water to any county or municipality or the municipality's retail service area that is partially within the Brazos River Basin for use on a firm and non-firm basis in that part of the county or municipality and the municipality's retail service area not within the Trinity, Red, Colorado, and San Jacinto River Basins.

D. RETURN FLOWS

1) Based upon anticipated discharges through 2060, Permittee is authorized to impound, divert and use return flows discharged into the Brazos River Basin, not to exceed the following additional volumes per year, attributable to return flows, for multiple uses (domestic, municipal, agriculture, industrial, mining) within their service area subject to special conditions:

Amount of Additional Appropriation from Return Flows,

Volume in acre-feet	
Location	**Firm Water**
Richmond	80,850
Gulf of Mexico	82,157

Amount of Additional Appropriation from Return Flows, without Allens Creek

Volume in acre-feet	
Location	**Firm Water**
Richmond	82,509
Gulf of Mexico	83,842

2) The priority date of diversion of return flows is October 15, 2004. The storage and diversion of return flows is subject to environmental flow requirements set out in Section 6.E.

3. DIVERSION

Permittee is authorized to divert and use the water authorized by this permit as follows:

A. POINTS

1) At the diversion points authorized by Permittee's existing water rights.

2) At United States Geological Survey (USGS) Gage No. 08091000 near Glen Rose at Latitude 31.2589°N, Longitude 97.7022°W in Somervell County.

3) At USGS Gage No. 08098290 near Highbank at Latitude 31.1339°N, Longitude 96.8247°W in Falls County.

4) At the mouth of the Brazos River at the Gulf of Mexico at Latitude 28.8783°N, Longitude 95.379111°W in Brazoria County.

5) At other such diversion points located in the reaches specified in USE Paragraph 1.B, above, or as may be identified and included in Permittee's Commission approved Water Management Plan, or as may be otherwise authorized in the future.

B. RATES

1) At the diversion rates authorized by the Certificates of Adjudication and Water Use Permit authorizing each of the reservoirs comprising the system operation as defined in this permit.

2) At unspecified rates at points within the reaches authorized in USE paragraph 1.B, or points identified in the Commission approved Water Management Plan, subject to Permittee's accounting/delivery plan.

4. PRIORITY

The priority date for the rights authorized by this permit is October 15, 2004.

5. CONSERVATION

Permittee shall implement water conservation plans that provide for the utilization of those reasonable practices, techniques, and technologies that will reduce on a per unit basis the consumption of water, prevent or reduce the loss or waste of water, improve the efficiency in the use of water, increase the recycling and reuse of water, and prevent the pollution of water, so that a water supply is made available for future or alternative uses. The practices, techniques, and technologies used shall be designed to achieve a level of efficiency of use that is equal to or greater than the level provided for in Permittee's most recent water conservation plans on file with the Commission as of the date of the

issuance of this permit. Such plans shall include a requirement that in every wholesale water supply contract entered into on or after the date of this permit, including any contract extension or renewal, that each successive wholesale customer develop and implement conservation measures meeting the requirements of this provision. If the customer intends to resell the water, then the contract for resale of the water must have water conservation requirements so that each successive wholesale customer in the resale of the water is required to implement water conservation measures meeting the requirements of this provision.

6. SPECIAL CONDITIONS

A. SPECIAL CONDITIONS RELATIVE TO ~~REUSE WATER~~USE OF RETURN FLOWS

1) Prior to the diversion of return flows authorized by this permit, Permittee must submit to and have approved by the Executive Director, a ~~reuse~~return flow accounting plan. The ~~reuse~~return flow accounting plan must be in electronic format and account, by source, for all return flows discharged ~~and subsequently diverted~~. The ~~reuse~~return flow accounting plan should include amounts discharged by outfall~~, amounts of return flows used by permits granted based on the presence of these return flows, and estimated travel times and conveyance losses from discharge point to diversion point(s). If the return flows will be stored in Permittee's reservoirs, the reuse accounting plan should include any evaporative losses associated with the storage~~ and computation of the amount of additional firm yield at the anticipated diversion location attributable to those return flows, taking into account environmental flow requirements and demands of senior water rights. Permittee's use of additional firm supply attributable to return flows is limited to the amount shown to be available, based upon amounts discharged, by the return flows accounting plan. Permittee shall maintain the approved ~~reuse~~return flow accounting plan in electronic format and make it available to the general public during normal business hours and to the Executive Director upon request. Modifications or changes to the ~~reuse~~return flow accounting plan must be approved by the Executive Director. The ~~reuse~~return flow accounting plan shall be included as part of Permittee's accounting/delivery plan.

2) Permittee's storage, diversion and use of surface water based return flows is subject to interruption by direct use or indirect use within the discharging entity's corporate limits, extraterritorial jurisdiction, or contiguous water certificate of convenience and necessity boundary, provided the discharging entity has applied for and been granted authorization to reuse the return flows.~~The right to divert discharged return flows from plants owned by the City of Granbury (TPDES Permit No. 10178002), Acton MUD (TPDES Permit Nos. 14211001 and 10178002), Bell County WCID #2 (TPDES Permit No. 11090001), City of Georgetown (TPDES Permit Nos. 10489002 and 10489003) and the~~

~~City of Holland (TPDES Permit No. 10897001) is limited to the amount of surface water based return flows discharged from those plants that originates from water rights owned by the Permittee. Permittee is not authorized to divert groundwater based return flows discharged from these plants, except as may be authorized by Special Condition 6.A.4. Permittee must include in the reuse accounting plan the total amount discharged from the plants and the percentage of that water that is divertable under this permit.~~

3) Permittee's storage, diversion and use of groundwater based return flows is subject to interruption by direct use or indirect provided the discharging entity has applied for and been granted authorization for reuse of groundwater based return flows.~~Permittee is authorized to divert historically discharged groundwater based return flows from the Brazos River Authority/LCRA BCRWSS West (TPDES Permit No. 10264001).~~

~~4) Future discharges of groundwater based return flows may be diverted if those return flows originate from groundwater owned by Permittee or are discharged from treatment plants owned by the Permittee. Prior to diversion, Permittee must apply for and be granted an amendment to this permit authorizing these diversions and shall submit for approval by the Executive Director a revised accounting/delivery plan addressing such new groundwater based discharges.~~

~~5) Permittee is authorized to divert only that water discharged by the City of Marlin (TPDES Permit No. 10110002) originating from water rights owned by the Permittee. Permittee shall calculate the divertable amount of the City's discharge and include this information in the reuse accounting plan.~~

~~6) Permittee shall only divert the actual annual amount of return flows discharged from the Bell County WCID #1 (TPDES Permit Nos. 10351001 and 10351002) and the City of Harker Heights (TPDES Permit No. 10155001) less up to 172 acre-feet as authorized by Permit 4218, 37 acre-feet as authorized by Permit 5088 and 60 acre-feet as authorized by Permit 5089 when the aforementioned permits are being used.~~

~~7) Diversions and storage of return flows shall not occur at rates or in amounts higher than the actual daily amount of return flows discharged into watercourses in the Brazos River Basin, after accounting for the calculated losses and travel time from the discharge point(s) to the diversion point(s) in accordance with the accounting/delivery plan.~~

8) Prior to diversion of the water authorized herein as additional firm supply attributable to return flows, if sufficiently accurate measuring devices are not available, Permittee shall install and maintain measuring device(s) capable of measuring within plus or minus 5% accuracy, at the discharge

point of each wastewater treatment plant (WWTP) to record the amount of return flows discharged into the Brazos River or its tributaries on a daily basis.

~~9) The priority date for diversion of up to 116,434 acre-feet (103.899 mgd) of return flows is October 15, 2004.~~

~~10) The priority date for diversion of future return flows in excess of 116,434 acre-feet (103.899 mgd) of discharged effluent is October 15, 2004 but is not subject to call by senior and superior permit holders in the basin and is not subject to instream flow limitations.~~

~~11) Prior to diversion of any return flows in excess of the TPDES Permit limits for each facility indicated in the table Return Flows Available to the BRA (Paragraph 1.D. RETURN FLOWS), Permittee must apply for and be granted the right to reuse those return flows. Permittee must amend the reuse accounting plan to include future return flows prior to diverting said return flows.~~

~~12) The diversion of up to 116,434 acre-feet (103.899 mgd) of water is dependant upon potentially interruptible return flows or discharges and is conditioned on the availability of those discharges. The right to divert the discharged return flows is subject to revocation if discharges become permanently unavailable for diversion and may be subject to reduction if the return flows are not available quantities and qualities sufficient to fully satisfy the permit. Should any discharges become permanently unavailable for diversion, Permittee shall immediately cease diversions of these return flows and reflect such reductions in the reuse accounting plan.~~
~~13) Permittee's diversion and use of return flows is subject to interruption by direct use or indirect use within the discharging entity's corporate limits, extraterritorial jurisdiction, or contiguous water certificate of convenience and necessity boundary, provided the discharging entity has applied for and been granted authorization to reuse the return flows.~~

B. SPECIAL CONDITIONS RELATIVE TO USE OF BED AND BANKS

1) The use of the bed and banks of Allens Creek below Allens Creek Reservoir is not authorized until Permittee applies for and is granted an amendment to Permit 2925A.

2) Permittee is authorized to use the following reaches, authorized in Permittee's certificates and amendments, for conveyance of water previously appropriated to Permittee and water authorized by this permit, downstream for diversion at Glen Rose, Highbank and the Gulf of Mexico

and any of Permittee's currently authorized diversion points within these reaches:

a) Brazos River from below Possum Kingdom Reservoir to the Gulf of Mexico

b) Leon River from Lake Proctor to the confluence with the Little River

c) Lampasas River from Lake Stillhouse Hollow to the confluence with the Little River

d) Little River from the confluence of Leon and Lampasas Rivers to the junction with the Brazos River

e) Yegua Creek from Lake Somerville to the confluence with the Brazos River

f) Navasota River from Lake Limestone to the confluence with the Brazos River

g) San Gabriel River from Lake Granger to the confluence with the Little River and downstream to its confluence with the Brazos River

h) North Fork San Gabriel River from Lake Georgetown to the confluence with the San Gabriel River, to its confluence with the Little River and downstream to its confluence with the Brazos River

i) Aquilla Creek from Lake Aquilla downstream to its confluence with the Brazos River

j) Allens Creek, following construction of Allens Creek Reservoir, downstream from Allens Creek Reservoir to its confluence with the Brazos River

3) Prior to use of the bed and banks identified in Special Condition 6.B.2 above, Permittee must submit to and have approved by the Executive Director, as part of its accounting/delivery plan, a procedure to estimate ~~daily~~ deliveries of water. This procedure should be in electronic format and detail by source, type and priority date, the amounts to be conveyed and delivered, losses associated with the conveyance, specific points of diversion, associated travel times, and times of commencement and termination of transit for conveyed waters. Documentation of actual

deliveries as well as the accounting/delivery plan shall be maintained by the Permittee in electronic format and made available to the general public during normal business hours and to the Executive Director upon request. Modifications or changes to the accounting/delivery plan must be approved by the Executive Director.

4) The use of the bed and banks of additional streams and tributaries in the Brazos River Basin for conveyance of water appropriated under this permit, or other sources available to the Permittee, is subject to Permittee, after identifying specific sources and types of water, specific points of discharge and diversion, and conveyance and other losses, obtaining future authorizations to satisfy the requirements of TWC § 11.042, which may be provided pursuant to a Commission approved Water Management Plan.

5) The use of additional points of diversion within the reaches specified in Special Condition 6.B.2 above is subject to Permittee, obtaining authorization to use those diversion points. The points of diversion may also be identified and included in Permittee's proposed Water Management Plan which is subject to Commission approval.

C. SPECIAL CONDITIONS RELATIVE TO NEW APPROPRIATION

1) Prior to diversion or storage of the additional water authorized by this permit, Permittee shall provide to and have approved by the Executive Director, a daily accounting/delivery plan that includes, at minimum, the following:

a. The accounting/delivery plan shall address reservoir storage and withdrawal plans for each system reservoir and account by priority date and amounts for any inflows, evaporation, water in storage and diversions from the reservoirs under all of Permittee's priority dates and authorizations including reuse of return flows.

b. A method to account for inflows to system reservoirs for purposes of compliance with special conditions requiring passage of pulse flows and estimation of those inflows.

c. An accounting for instream flow and pulse requirements to include total system storage, gage flows at the measurement points, high flow pulse volume impounded, if any, and the release schedule for the impounded high flow pulse, and timing, magnitude and duration of pulse flows.

d. The accounting/delivery plan must detail how measurements will be taken to determine if impoundment or diversions under either Permittee's senior or junior rights can be made.

e. The accounting/delivery plan must identify, account for and distinguish between firm and non-firm water supplied or delivered from Permittee's system of reservoirs. In addition, the accounting/delivery plan must specify diversion points for this water if those diversion points are not specifically identified in this permit. Any additional diversion points must be within the reaches where use of the bed and banks is authorized. Any diversion points outside those reaches will require an amendment to this permit.

f. Permittee shall maintain the approved daily accounting/delivery plan in electronic format and make it available to the general public during normal business hours and to the Executive Director upon request. Modifications or changes to the plan must be approved by the Executive Director.

2) If the total amounts of firm water indicated above are diverted at Glen Rose or Highbank, the additional amount of firm water available below those points is reduced accordingly. Permittee shall include the amount of that reduction in the accounting/delivery plan or Water Management Plan.

3) The full additional amount of non-firm water is only available when the amount of firm water is reduced by a maximum of 90,000 acre-feet per year at Glen Rose, Highbank, Richmond ~~and~~or the Gulf of Mexico. ~~If less than the full amount of non-firm water is used, the amount of the firm water reduction shall be adjusted proportionately.~~The amount of firm water needed to generate non-firm water will be evaluated in the Water Management Plan and may depend upon location and other factors.

~~4) The non-firm water authorized above includes 74,387 acre-feet of historically discharged return flows. A reduction in firm yield water is not required in order to divert these return flows.~~

~~5) The remaining 42,047 acre-feet of return flows out of the total amount of 116,434 acre-feet of return flows indicated in Paragraph 1.D. may be diverted by the Permittee so long as the total diversions under this permit for all of the authorizations do not exceed the amounts of firm water and non-firm water indicated in Paragraph 1.A.1, above unless Permittee applies for and is granted the authorization to divert additional amounts of water.~~

6) Permittee may not exercise a priority call on water rights in the Brazos River Basin with priority dates senior to October 15, 2004 for purposes of increasing storage in and/or diversion from Permittee's system reservoirs where drawdown of Permittee's system reservoirs is caused by delivery of water authorized by ~~compliance with the terms and conditions of~~ this permit.

7) The request for operational flexibility to use any source of water available to Permittee to satisfy the diversion requirements of senior water rights to the same extent that those water rights would have been satisfied by passing inflows through the Permittee's system reservoirs on a priority basis is granted, but limited as follows:

   a) To water previously stored in Permittee's reservoirs as documented in the accounting/delivery plan required in Special Condition 6.C.1 above.

   b) Use of this option shall not cause Permittee to be out of compliance with Special Condition 6.C.1 and Special Condition 6.C.6.

8) Permittee may divert water from storage in its permitted reservoirs and store that water in Permittee's other reservoirs for use within the Permittee's service area so long as all diversions and storage are included in and comply with the provisions of the accounting/delivery plan and of the accounting/delivery plan required by Special Condition 6.C.1 above.

9) The total amount of water diverted and released from Permittee's system reservoirs in any year for each authorized purpose of use may not exceed the cumulative authorized total for each purpose until Permittee applies for and is granted amendments to the underlying authorizations or obtains Commission authorization through approval of its Water Management Plan.

10) Permittee is required to comply with the existing System Operation Order and certificates of adjudication requiring Permittee to exclude tributary reservoirs from operation of the system during any period of time in which Permittee's permitted storage space in that reservoir is less than 30% full (until all system reservoirs are below 30% capacity, at which time the reservoir can resume system operation), until such time as Permittee submits, and the Commission approves, a Water Management Plan for the Brazos River Basin which details how such limitations will be altered. Any alterations to the limitations must be in compliance with the accounting provisions required in Special Condition 6.C.1 above.

11) Until such time as the ports are closed on the dam impounding Allens Creek Reservoir, authorized by Permit 2925, Permittee may impound and divert additional unappropriated water as specified in Paragraph 1.A.2 subject to Special Conditions 6.C.1 through 10 above.

D. WATER MANAGEMENT PLAN SPECIAL CONDITIONS

1) Permittee shall prepare and submit to the Commission, a Water Management Plan (WMP) which shall include such studies and other information as may be required by the Commission to demonstrate Permittee's compliance with and its ability to comply with all of the Special Conditions included in this permit.

2) The initial proceedings to consider the adoption of the WMP, and any major amendment thereof, shall be pursuant to contested case procedures. Provided that the approved WMP describes the methodology to be utilized, addition of diversion points within the authorization of this permit, modification of volumes of return flow to account for amendments or modifications of discharge permits or new discharge authorizations, modification of the accounting/delivery plan approved by the Executive Director, and comparable modifications are not major amendments of the WMP. Any proceeding to consider the adoption or major amendment of the WMP shall be preceded by notice and opportunity to request a hearing, in accordance with the Commission's regulations applicable to water rights permitting proceedings. The WMP shall provide an adaptive management strategy for instream flow requirements and water supply and thus may be amended from time to time upon the request of Permittee or on the Commission's own motion. The initial accounting/delivery plan shall be submitted as part of the WMP.

E. INTERIM SPECIAL CONDITIONS RELATIVE TO ENVIRONMENTAL FLOWS

1) Because the following interim conditions are preliminary and are based upon historic flow analyses, without direct relationships to the biological and environmental benefits intended to be protected, Permittee shall conduct Instream Flow Studies (Studies) on the Brazos River and on segments of major tributaries upstream of their confluence with the Brazos River consistent with and in cooperation with the Texas Instream Flow Program. Upon completion of the Studies, Permittee shall submit an application to amend the WMP to reflect the results of the Instream Flow Studies.

2) Seasons are defined as Spring (March–May), Summer (June-August), Fall (September-November), and Winter (December-February). The number of seasons and the months representing each season are subject to revision in the WMP.

3) Total storage in Permittee's system reservoirs is a trigger for determining instream flow requirements and is subject to revision in future Water Management Plans. 7Q2 flows are to be implemented when total storage in Permittee's system reservoirs is below 60% of total capacity. "Dry"

means times when the total storage in Permittee's system reservoirs is below 74%, but more than 60% of total capacity. "Average" means times when the total storage in Permittee's system reservoirs is at least 74%, but less than 96% of total capacity. "Wet" means times when the total storage in Permittee's system reservoirs is at least 96% of total capacity.

4) Storage triggers are to be recalculated every five years to ensure implementation of Subsistence, Dry, Average, and Wet provisions at frequencies of 2.5%, 25%, 50%, and 75%, respectively, on a cumulative basis.

5) Until such time as the Studies are completed, the interim instream flows in the following tables apply at the following USGS gauging stations. Measurement points for instream flows are subject to change in the WMP with approval of the Executive Director. The instream flow criteria in the following tables are applicable at all times. Depending upon the hydrologic condition (Subsistence, Dry, Average, or Wet), storage of water authorized by this permit in Permittee's system reservoirs ~~upstream from the following flow gauging stations~~ and the diversion and use of water pursuant to this permit ~~at locations upstream from the flow gauging locations~~ shall be authorized only when streamflows exceed the instantaneous flow values at the station downstream of such diversion or storage, as established in the following tables:

Instream Flow (cfs)	BRAZOS RIVER NEAR GLEN ROSE - USGS #08091000			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	15.3	15.3	15.3	15.3
Dry	39.0	45.0	33.3	62.0
Average	92.0	138.0	101.5	150.0
Wet	234.0	292.8	249.5	332.0

Instream Flow (cfs)	YEGUA CREEK NEAR SOMERVILLE – USGS #08110000			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	0.1	0.1	0.1	0.1
Dry	5.6	3.9	0.4	0.3
Average	14.0	12.0	2.5	1.8
Wet	34.0	31.0	8.9	9.6

Instream Flow (cfs)	NAVASOTA RIVER NEAR EASTERLY USGS #08110500			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	7.6	7.6	7.6	7.6
Dry	7.6	10.0	7.6	7.6
Average	15.0	24.0	7.6	7.6

Wet	34.0	43.0	7.6	7.6

Instream Flow (cfs)	LITTLE RIVER NEAR CAMERON – USGS #08106500			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	67.9	67.9	67.9	67.9
Dry	100.0	135.0	133.0	82.0
Average	200.0	365.0	260.5	152.0
Wet	475.0	730.0	500.0	342.0

Instream Flow (cfs)	BRAZOS RIVER NEAR HIGHBANK – USGS #08098290			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	167.1	167.1	167.1	167.1
Dry	167.1	167.1	167.1	167.1
Average	220.59	344.19	323.85	225.29
Wet	672.74	759.30	780.69	508.98

Instream Flow (cfs)	BRAZOS RIVER NEAR RICHMOND – USGS #08114000			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	743	743	743	743
Dry	885	1170	930	760
Average	1630	2030	1450	1150
Wet	2955	3670	2635	2038

6) A High Flow Pulse (HFP) is initiated when flows are greater than the 10th percentile and increase by more than 50% from the previous day, or when flows exceed the 75th percentile, regardless of the rate of change. A HFP is terminated when the flow drops below the 10th percentile or when the flow decreases from one day to the next by less than 5%, or when a succeeding pulse occurs. An entire HPFP is also reclassified as a small flood if the maximum rate exceeds the small flood threshold at the 1.5-year recurrence interval.

7) Pursuant to the provisions set forth below, Permittee shall meet a seasonal schedule of individual high flow pulses by refraining from storing or diverting water appropriated by this permit in order to provide qualifying HFPs as set forth below. Qualifying HFPs are defined as follows:

Pulse Flows (ac-ft)	BRAZOS RIVER NEAR GLEN ROSE - USGS #08091000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	2329.6	3208.3	2617.2	2211.6

Average	7325.0	14915.7	7265.5	7565.0
Wet	31220.8	36144.8	33064.5	28682.0

Peak Flows (cfs)	BRAZOS RIVER NEAR GLEN ROSE - USGS #08091000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	403	466	394	347
Average	1,120	2,070	1,320	1,040
Wet	~~4,945~~	5,265	4,370	3,525

Pulse Flow Schedule (days/# of events)	BRAZOS RIVER NEAR GLEN ROSE - USGS #08091000							
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq
Dry	6	2	4	3	4	2	4	2
Average	7	2	6	2	6	2	7	1
Wet	~~13~~	~~01~~	10	2	11	1	11	1

*Duration **Frequency

Pulse Flows (ac-ft)	YEGUA CREEK NEAR SOMERVILLE – USGS #08110000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	416.6	275.7	52.4	59.2
Average	1904.1	1225.8	239.2	372.9
Wet	8510.1	4331.3	845.2	3367.3

Peak Flows (cfs)	YEGUA CREEK NEAR SOMERVILLE – USGS #08110000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	69	51	13	10
Average	294	176	53	64
Wet	978	620	140	490

Pulse Flow Schedule (days/# of events)	YEGUA CREEK NEAR SOMERVILLE – USGS #08110000							
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq

Dry	5	2	5	2	4	2	5	1
Average	10	1	8	1	7	1	7	2
Wet	15	1	13	1	11	1	11	1

*Duration **Frequency

Pulse Flows (ac-ft)	NAVASOTA RIVER NEAR EASTERLY-USGS #08110500			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	439.3	748.3	195.9	77.1
Average	2142.1	2220.5	746.9	275.0
Wet	7927.9	8537.9	3399.7	2456.3

Peak Flows (cfs)	BRAZOS RIVER NEAR EASTERLY – USGS #08110500			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	76	124	33	11
Average	298	344	142	43
Wet	1,060	1,160	592	371

Pulse Flow Schedule (days/# of events)	NAVASOTA RIVER NEAR EASTERLY – USGS #08110500							
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq
Dry	5	2	5	3	5	2	4	2
Average	8	2	9	2	8	2	7	2
Wet	12	1	12	1	13	1	11	1

*Duration **Frequency

Pulse Flows (ac-ft)	LITTLE RIVER NEAR CAMERON – USGS #08106500			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	4194.4	5641.5	3563.3	3511.2
Average	9633.7	16251.6	9088.3	9183.5
Wet	29414.9	42034.7	25811.4	20494.2

Peak Flows (cfs)	LITTLE RIVER NEAR CAMERON – USGS #08106500			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	604	958	577	568
Average	1,600	2,545	1,875	1,630

Wet	5,190	6,405	3,665	3,723

Pulse Flow Schedule (days/# of events)	LITTLE RIVER NEAR CAMERON – USGS #08106500							
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq
Dry	5	1	4	2	4	2	4	2
Average	6	1	6	1	6	1	6	1
Wet	10	1	9	1	9	1	9	1

*Duration **Frequency

Pulse Flows (ac-ft)	BRAZOS RIVER AT HIGHBANK – USGS #08098290			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	5113.9	6040.7	4784.0	3652.4
Average	11647.1	14346.9	15135.1	11398.8
Wet	38514.1	38127.3	49810.6	39416.6

Peak Flows (cfs)	BRAZOS RIVER AT HIGHBANK – USGS #08098290			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	1471	1429	1116	714
Average	2576	2952	2566	2274
Wet	5225	6748	7703	5366

Pulse Flow Schedule (days/# of events)	BRAZOS RIVER AT HIGHBANK – USGS #08098290							
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq
Dry	3	1	3	3	3	3	3	2
Average	4	1	4	3	5	2	5	2
Wet	7	1	7	1	8	1	9	1

*Duration **Frequency

Pulse Flows (ac-ft)	BRAZOS RIVER NEAR RICHMOND – USGS #08114000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	36265.8	44667.8	38181.1	22457.9
Average	90287.6	101405.0	77176.9	56162.0

Wet	297550.4	270153.7	166115.7	146866.1

Peak Flows (cfs)	BRAZOS RIVER NEAR RICHMOND – USGS #08114000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	3,748	5,640	4,880	2,500
Average	9,670	10,200	8,830	7,730
Wet	19,500	19,150	15,300	13,175

Pulse Flow Schedule (days/# of events)	BRAZOS RIVER NEAR RICHMOND – USGS #08114000							
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq
Dry	5	1	5	1	4	1	4	1
Average	6	1	7	1	7	1	7	1
Wet	16	1	13	1	12	1	11	1

*Duration **Frequency

8) Except under Subsistence conditions, diversion or storage of water upstream from defined measurement points under the authority of this permit shall be authorized during a pulse when the volume, duration, and peak flow of the individual pulse exceeds the individual pulse criteria, or when the number of pulse events in that season exceeds the pulse frequency criteria. When a Qualifying HFP is passed or provided for at one of the six defined measurement points it may be used as credit for meeting one seasonal HFP frequency requirement.

9) For streamflow events that meet the requirements of Special Condition 6.E.5, Permittee may temporarily impound all flows in excess of the instream flow requirement. If the streamflow event provided a Qualifying HFP, flow may need to be passed downstream for environmental needs, subject to seasonal requirements in Special Condition 6.E.7 above. If it did not, then Permittee may retain the impounded water for water supply purposes. Once the required number of HFPs is met, Permittee may divert or impound all subsequent HFPs for use as water supply as long as instream flow requirements specified in Special Condition 6.E.5 are met.

10) For pulses that generate a volume in excess of 250% of the Qualifying HFP volume criterion, Permittee may~~must~~ provide two Qualifying HFPs with at least one week of instream flow, as required by Special Condition 6.E.5 above, between them. Similarly, for pulses in excess of 350% of the Qualifying HFP

volume criterion, Permittee may~~must~~ provide three Qualifying HFPs with at least one week of instream flow between each pair. A similarly scaled requirement holds for larger pulses.

11) For streamflow events that meet the requirements of Special Condition 6.E.6, but do not meet the minimum requirements of a Qualifying HFP, Permittee may impound flows in excess of instream flow requirements and shall record the impounded volume in their accounting/delivery plan. At such time as the cumulative volume of streamflow events exceeds the volume of a Qualifying HFP, Permittee may release such a pulse to the environment. Such a release will result in a credit for a Qualifying HFP.

12) If the streamflow event is designated a HFP but ultimately does not meet the minimum requirements of a Qualifying HFP, the volume passed shall be recorded in the accounting/delivery plan. At such time as the cumulative volume of such pulses exceeds the volume of a Qualifying HFP, Permittee will be credited with one Qualifying HFP (even if the duration, peak flow, etc. characteristics were not met).

13) For purposes of determining satisfaction of Qualifying HFP criteria, each season is accounted for independently. There is no carry-over from season to season, either in regard to exceeding or not meeting HFP requirements. In the event there are seasons where the requisite number or volume of HFPs do not occur naturally, the Permittee is not obligated to meet the seasonal HFP requirements. In the event that a pulse extends across seasonal boundaries, it will be accounted in the season in which it ends.

14) ~~All s~~Seasonal HFP requirements are to be met using streamflow events with peak flows less than the 1.5-year return interval~~.~~; however, ~~S~~streamflow events with both peak flows that exceed the 1.5-year return interval and satisfy the requirements of a qualifying HFP~~are~~ may be classified as both overbanking flows and an~~the water volume associated with these events shall not be used to meet~~ HFP ~~requirements~~.

15) Permittee may divert water ~~at or downstream of USGS Gage No. 08114000, Brazos River near Richmond,~~ upstream from the following gages without restriction during ~~wet~~the seasons and under the conditions described below ~~season pulses as defined in Special Conditions 6.E.7~~ when Permittee's cumulative upstream diversion rate is less than ~~7,535 cfs~~the rate set forth below~~:, if Permittee also meets the applicable instream flow requirement in Special Condition 6.E.5.~~

Min Rate (cfs)	BRAZOS RIVER NEAR RICHMOND – USGS #08114000			
	Revised Winter	Revised Spring	Revised Summer	Revised Fall
Dry	1,448	2,219	2,403	1,430

Average	3,737	4,013	4,349	4,421
Wet	7,535	7,535	7,535	7,535

Min Rate (cfs)	BRAZOS RIVER AT HIGHBANK – USGS #08098290			
	Winter	Spring	Summer	Fall
Dry	568	562	550	408
Average	995	1,162	1,264	1,301
Wet	2,019	2,655	3,794	3,069

Min Rate (cfs)	BRAZOS RIVER NEAR GLEN ROSE - USGS #08091000			
	Winter	Spring	Summer	Fall
Dry	156	183	194	198
Average	433	814	650	595
Wet	1,911	2,072	2,152	2,016

Min Rate (cfs)	LITTLE RIVER NEAR CAMERON – USGS #08106500			
	Winter	Spring	Summer	Fall
Dry	233	377	284	325
Average	618	1,001	923	932
Wet	2,005	2,520	1,805	2,129

Min Rate (cfs)	NAVASOTA RIVER NEAR EASTERLY-USGS #08110500			
	Winter	Spring	Summer	Fall
Dry	29	49	16	6
Average	115	135	70	25
Wet	410	456	292	212

Min Rate (cfs)	YEGUA CREEK NEAR SOMERVILLE – USGS #08110000			
	Winter	Spring	Summer	Fall
Dry	27	20	6	6
Average	114	69	26	37
Wet	378	244	69	280

Gage Name	Gage #	7Q2 Value (cfs)
Brazos River near Palo Pinto	08089000	30.3
Aquilla Creek above Aquilla	08093360	0.1
Brazos River near Aquilla	08093100	30.7
Leon River near Belton	08102500	4.7
Lampasas River near Belton	08104100	4.8
N Fork San Gabriel River near Georgetown	08104700	1.5

16) In San Gabriel River at Georgetown points and 08105700 requirements specified in Special Conditions 6.E.5

17) Permittee shall install and maintain a streamflow gage at Yegua Creek at Somerville.

18) The requirements of these Special Conditions apply only to diversion and storage under the authority of this permit and do not address or limit diversion and storage of water authorized by other water rights held by Permittee.

19) These special conditions are subject to adjustment by the Commission if the Commission determines, through an expedited public review process, that such adjustment is appropriate to achieve compliance with applicable environmental flow standards adopted pursuant to Texas Water Code § 11.1471. Any adjustment shall be made in accordance with the provisions of Texas Water Code § 11.147(e-1).

This permit is issued subject to all superior and senior water rights in the Brazos River Basin.

Permittee agrees to be bound by the terms, conditions and provisions contained herein and such agreement is a condition precedent to the granting of this permit.

All other matters requested in the application which are not specifically granted by this permit are denied.

This permit is issued subject to the Rules of the Texas Commission on Environmental Quality and to the right of continuing supervision of State water resources exercised by the Commission.

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For the Commission

DRAFT-B

WATER USE PERMIT

Permit No.	5851		TYPE §§ 11.121, 11.042 & 11.085
Owner:	Brazos River Authority	Address:	P.O. Box 7555 Waco, Texas 76714-7555
Filed:	October 15, 2004	Granted:	
Purpose:	Multiple-Use (Domestic, Municipal, Agricultural, Industrial, Mining, Recreation)	Counties:	Parmer, Castro, Swisher, Bailey, Lamb, Hale, Floyd, Cochran, Hockley, Archer, Lubbock, Crosby, Baylor, Dickens, King, Knox, Jack, Terry, Lynn, Mitchell, Chambers, Young, Garza, Throckmorton, Kent, Haskell, Stonewall, Parker, Palo Pinto, Dawson, Scurry, Borden, Fisher, Stephens, Jones, Shackelford, Johnson, Hood, Nolan, Erath, Eastland, Taylor, Callahan, Somervell, Hill, Comanche, Bosque, Brown, Freestone, Hamilton, McLennan, Limestone, Mills, Coryell, Leon, Falls, Lampasas, Robertson, Bell, Madison, Milam, Burnet, Brazos, Grimes, Williamson, Burleson, Travis, Lee, Washington, Bastrop, Waller, Harris, Austin, Colorado, Fort Bend, Galveston, Matagorda, Wharton, Fayette, and Brazoria
Watercourse:	Multiple Tributaries of the Brazos River and the Brazos River	Watershed:	Brazos River Basin; San Jacinto-Brazos Coastal Basin; and Brazos-Colorado Coastal Basin

WHEREAS, the Brazos River Authority, Applicant, owns the water rights and reservoirs authorized by Certificate of Adjudication (Certificate) No. 12-5155 (Possum Kingdom Lake), Certificate No. 12-5156 (Lake Granbury), Certificate No. 12-5165 (Lake Limestone), and Water Use Permit 2925A (Allens Creek Reservoir in conjunction with the Texas Water Development Board and the City of Houston); and

WHEREAS, Applicant also owns the water rights and has contracts with the United States Army Corps of Engineers for storage authorized by Certificate No. 12-5157 (Lake Whitney), Certificate No. 12-5158 (Lake Aquilla), Certificate No. 12-5159 (Lake Proctor), Certificate No. 12-5160 (Lake Belton), Certificate No. 12-5161 (Lake Stillhouse Hollow), Certificate No. 12-5162 (Lake Georgetown), Certificate No. 12-5163 (Lake Granger), Certificate No. 12-5164 (Lake Somerville), and

WHEREAS, Applicant also owns the water rights authorized by Certificate Nos. 12-5166 and 12-5167, which authorize various uses of water within the Applicant's other certificates and permits; and

WHEREAS, Applicant is currently authorized, pursuant to a TCEQ order, to manage and operate its tributary reservoirs as elements of a system, coordinating releases and diversions from the tributary reservoirs with releases and diversions from the Applicant's main-stem reservoirs to minimize waste, and to conserve water in reservoirs in which the supply is short by making releases from tributary reservoirs in which the supply is more abundant; and

WHEREAS, Applicant has applied for a Water Use Permit to authorize:

- A new appropriation of state water in the amount of 421,449 acre-feet per year for multiple use purposes, including domestic, municipal, agricultural, industrial, mining, and other beneficial uses on a firm basis in the Brazos River Basin. The amount of this new appropriation of water includes the current and future return flows requested in this application. Applicant indicates that the entire amount of 421,449 acre-feet of water per year is available only if all of it is diverted at the mouth of the Brazos River, and can only be made available by the Applicant through the system operation of its water rights. To the extent water is diverted upstream, the remaining unappropriated water downstream is reduced and will itself vary depending upon the location of its diversion and use. Out of the 421,449 acre-feet per year of unappropriated water being requested, the maximum amount of unappropriated water that will be available if such water is diverted upstream at USGS gage No. 08091000 near Glen Rose, Texas is 150,538 acre-feet per year firm, and if such unappropriated water is diverted upstream at USGS gage No. 08098290 near Highbank, Texas, the maximum amount of unappropriated water that will be available at that location is 144,306 acre-feet per year firm.

- Diversion of the water authorized by this amendment, if granted, from: (i) the existing diversion points authorized by Applicant's existing water rights; (ii) the Brazos River at the USGS gage No. 08091000 near Glen Rose, Texas; (iii) the Brazos River at USGS gage No. 08098290 near Highbank, Texas; (iv) the Brazos River at the Gulf of Mexico; and (v) at such other diversion points that may be identified and included in Applicant's proposed Water Management Plan which is subject to TCEQ's approval.

- Use of up to 90,000 acre-feet of water per year of its firm supply (part of the 421,449 acre-feet of firm water requested above) to produce, along with other unappropriated flows, an interruptible water supply of 670,000 acre-feet per year and the appropriation of that interruptible water supply. Applicant indicates that the entire amount of 1,001,449 acre-feet of water (331,449 acre-feet of firm water and 670,000 acre-feet of interruptible water) is available only if all of it is diverted at the mouth of the Brazos River, and can only be made available by the Applicant through the system operation of its water rights. To the extent water is diverted upstream, the remaining unappropriated water downstream is reduced and will itself vary depending on the location of its diversion and use. This new appropriation of water includes the current and future return flows requested in this application. Out of the 1,001,449 acre-feet of firm and interruptible water being requested, the maximum amount of firm and interruptible water that will be available if such water is diverted upstream at USGS Gage No. 08091000 near Glen Rose, Texas is 60,538 acre-feet of firm water per year and 157,000 acre-feet of interruptible water per year and if such water is diverted upstream at USGS Gage No. 08098290 near Highbank, Texas, the maximum amount of firm water is 54,306 acre-feet of water per year and 303,000 acre-feet of interruptible water per year.

- An exempt interbasin transfer authorization to transfer and use, on a firm and interruptible basis, such water in the adjoining San Jacinto-Brazos Coastal Basin and the Brazos-Colorado Coastal Basin, and to transfer such water to any county or municipality or the municipality's retail service area that is partially within the Brazos River Basin for use, on a firm and interruptible basis, in that part of the county or municipality and the municipality's retail service area not within the Brazos River Basin.

- An appropriation of current and future return flows (treated sewage effluent and brine bypass/return) to the extent that such return flows continue to be discharged or returned into the bed and banks of the Brazos River, its tributaries, and Applicant's reservoirs. Applicant indicates that such appropriation of return flows would be subject to interruption by direct use or indirect use within the discharging entity's city limits, extraterritorial jurisdiction, or contiguous water certificate of convenience and necessity boundary. Specified discharge points and amounts of water will be accounted for on a monthly basis as part of Applicant's Water Management Plan which is subject to TCEQ's approval.

- Operational flexibility to (1) use any source of water available to the Applicant to satisfy the diversion requirements of senior water rights to the same extent that those water rights would have been satisfied by passing inflows through the Applicant's reservoirs on a priority basis; and (2) release, pump and transport water from any of the Applicant's reservoirs for subsequent storage, diversion and

use throughout the Applicant's service area. (Applicant's "service area" includes all counties listed above.)

- Recognition that the System Operation Permit approved pursuant to this application will prevail over inconsistent provisions in the Applicant's existing water rights regarding system operation.

- Use of the bed and banks of the Brazos River, its tributaries and the Applicant's reservoirs for the conveyance, storage, and subsequent diversion of (i) water that the Applicant seeks to appropriate under this application; (ii) waters that are being conveyed via pipelines and subsequently discharged into the Brazos River, its tributaries or stored in the Applicant's reservoirs; (iii) surface water imported from areas located outside the Brazos River Basin for subsequent use; (iv) in-basin surface water and groundwater subject to the Applicant's control; (v) waters developed from future Applicant projects; and (vi) current and future reuse of surface and groundwater based effluent requested by this application. This bed and banks authorization is subject to Applicant, after identifying specific points of discharge and diversion and conveyance and other losses, obtaining future authorizations to satisfy the requirements of TWC § 11.042. Such points of discharge and diversion and conveyance and other losses may also be identified and included in Applicant's proposed Water Management Plan which is subject to TCEQ's approval.

WHEREAS, Applicant seeks authorization to divert and use treated effluent at multiple points in the Brazos River Basin; and

WHEREAS, until the construction of Allens Creek Reservoir is completed, Applicant requests that the System Operation Permit include special conditions which authorize:

- The Applicant to appropriate state water in the amount of 425,099 acre-feet per year for multiple use purposes, including domestic, municipal, agricultural, industrial, mining, and other beneficial uses on a firm basis in the Brazos River Basin. This amount includes the current and future return flows requested in this application. This amount is available if all of the water is diverted at the mouth of the Brazos River, and can only be made available by the Applicant through the system operation of its water rights. To the extent water is diverted upstream, the remaining unappropriated water downstream is reduced and will itself vary depending upon the location of its diversion and use. Out of the 425,099 acre-feet per year of unappropriated water being requested, the maximum amount of unappropriated water that will be available if such water is diverted upstream at USGS Gage 08091000 near Glen Rose, Texas is 150,538 acre-feet per year firm and if such unappropriated water is diverted upstream at USGS Gage 08098290 near Highbank, Texas the maximum amount of unappropriated water that will be available is, at that location, 175,306 acre-feet per year firm;

- The Applicant to use up to 90,000 acre-feet of water per year of its firm supply to produce, along with other unappropriated flows an interruptible water supply of 869,000 acre-feet per year. This amount includes the current and future return flows requested in this application. Applicant indicates that the entire amount of 1,204,099 acre-feet of water (335,099 acre-feet of firm water and 869,000 acre-feet of interruptible water) is only available if all of it is diverted at the mouth of the Brazos River, and can only be made available by the Applicant through the system operation of its water rights. To the extent water is diverted upstream, the remaining unappropriated water downstream is reduced and will itself vary depending upon the location of its diversion and use. Out of the 1,204,099 acre-feet of firm and interruptible water being requested, the maximum amount of firm and interruptible water that will be available if such water is diverted upstream at USGS Gage No. 08091000 near Glen Rose, Texas, will be 60,538 acre-feet of firm water per year and 190,000 acre-feet of interruptible water per year and if such water is diverted upstream at USGS Gage No. 08098290 near Highbank, Texas the maximum amount of firm water will be 85,306 acre-feet of water per year and 284,000 acre-feet of interruptible water per year; and

- Exempt interbasin transfer authorization to transfer and use, on a firm and interruptible basis, such water in the adjoining San Jacinto-Brazos Coastal Basin and the Brazos-Colorado Coastal Basin, and to transfer such water to any county or municipality or the municipality's retail service area that is partially within the Brazos River Basin for use, on a firm and interruptible basis, in that part of the county or municipality and the municipality's retail service area not within the Brazos River Basin.

WHEREAS, the Texas Commission on Environmental Quality (Commission) finds that jurisdiction over the application is established; and

WHEREAS, the Executive Director recommends that specific stream flow restrictions should be included in the permit to maintain the instream uses and water quality conditions of the Brazos River; and

WHEREAS, as additional factual and scientific information becomes available, it is anticipated that the interim special conditions in Paragraph 6.E. below are relative to environmental flows will be revised, through Commission approved revisions of the Water Management Plan, to better provide for the environmental instream flow needs of the Brazos River and its tributaries and to make the maximum amount of water available for beneficial uses that is consistent with those needs, and

WHEREAS, the Executive Director recommends that in order to protect senior and superior water rights owners, special conditions should be included in the permit; and

WHEREAS, to avoid ambiguities between this authorization and Applicant's previous authorizations, the Executive Director recommends that this System Operation Permit be subject

to all provisions included in the Commission's July 23, 1964 Order, as amended, authorizing system operation of certain reservoirs in the Brazos River Basin and to all terms and conditions of Permittee's authorizations in Certificate Nos. 12-5155, 12-5156, 12-5165, 12-5157, 12-5160, 12-5159, 12-5164, 12-5161, 12-5163, 12-5162, 12-5158, 12-5166 and 12-5167 and Water Use Permit 2925A except to the extent specifically provided otherwise by this permit, or approved by the Commission in a Water Management Plan for the Brazos River Basin; and

WHEREAS, the Commission has complied with the requirements of the Texas Water Code and Rules of the Texas Commission on Environmental Quality in issuing this permit;

NOW, THEREFORE, Water Use Permit No. 5851, is issued to the Brazos River Authority, subject to the following terms and conditions:

1. USE

A. NEW APPROPRIATION

1) Permittee is authorized to impound, divert, and use not to exceed the following volumes of unappropriated water per year for multiple uses (domestic, municipal, agricultural, industrial, mining) within their service area subject to special conditions:

Recommended Amounts of New Appropriation

	Volume in acre-feet	
Location	**Firm Water**	**Non-firm Water**
Glen Rose	131,363	157,000
Highbank	144,306	303,000
Richmond	239,297~~188,095~~	670,000
Gulf of Mexico	243,146~~191,516~~	670,000

2) Until such time as the ports are closed on the dam impounding Allens Creek Reservoir, authorized by Permit 2925A, in lieu of 1.A.1 Permittee may impound, divert, and use not to exceed the following volumes of unappropriated water per year, subject to special conditions:

Recommended Amounts of New Appropriation without Allens Creek

	Volume in acre-feet without Allens Creek Reservoir	
Location	**Firm Water**	**Non-firm Water**
Glen Rose	131,363	190,000
Highbank	175,306	284,000
Richmond	235,377~~237,000~~	869,000
Gulf of Mexico	239,199~~241,765~~	869,000

B. Permittee is authorized to use the bed and banks of the Brazos River, its

tributaries and Permittee's authorized reservoirs for the conveyance, storage, and subsequent diversion of the water authorized herein, subject to identification of specific losses and special conditions.

C. Permittee is hereby granted an exempt interbasin transfer authorization to transfer and use the water authorized herein in Permittee's service area in the adjoining San Jacinto-Brazos Coastal Basin and the Brazos-Colorado Coastal Basin and to transfer such water to any county or municipality or the municipality's retail service area that is partially within the Brazos River Basin for use on a firm and non-firm basis in that part of the county or municipality and the municipality's retail service area not within the Trinity, Red, Colorado, and San Jacinto River Basins.

D. RETURN FLOWS

Permittee is authorized to divert and use return flows discharged from the Permittee's facilities or originating from diversions pursuant to Permittee's water rights, as indicated in the table below, for multiple uses (domestic, municipal, agricultural, industrial, mining) within their service area, subject to special conditions to protect water rights granted based on the presence of those return flows as well as other senior water rights:

Return Flows Available to Permittee

Name	TPDES Permit #	Permitted Discharge (mgd)	Current or Proposed BRA Source	~~Percent of Surface Water from BRA~~	Current Surface Water Returns (ac-ft/yr)	~~Current Ground-Water Returns (ac-ft/yr)~~
Sportsmans World MUD WTP	02461000	0.10 ~~0.010~~	Possum Kingdom	~~100%~~	112 ~~11.2~~	~~0~~
Double Diamond	02789000	0.060	Possum Kingdom	~~100%~~	67	~~0~~
Authority SWATS	02889000	2.500	Granbury System	~~100%~~	730	~~0~~
City of Copperas Cove	10045003	2.500	Lake Belton	~~100%~~	923	~~0~~
City of Copperas Cove	10045004	2.500	Lake Belton	~~100%~~	1,375	~~0~~
City of Copperas Cove	10045005	4.000	Lake Belton	~~100%~~	1,600	~~0~~
City of DeLeon	10078001	0.300	Lake Proctor	~~100%~~	192	~~0~~
City of Marlin	10110002	2.000	Whitney System	~~16%~~	2,241 ~~159.4~~	~~0~~
City of Harker Heights	10155001	3.000	Lake Belton	~~100%~~	2,780	~~0~~
City of Gatesville	10176002	2.200	Lake Belton	~~100%~~	1,731	~~0~~
City of Gatesville	10176004	1.000	Lake Belton	~~100%~~	703	~~0~~
City of Granbury	10178002	2.000	Granbury System	~~100%~~	1313	~~0~~
City of Lampasas	10205002	1.500	Lake Stillhouse Hollow	~~100%~~	580	~~0~~
City of McGregor (South WWTP)	10219002	1.10 ~~0.990~~	Lake Belton	~~95%~~	1,233 ~~651.7~~	~~0~~

Name	TPDES Permit #	Permitted Discharge (mgd)	Current or Proposed BRA Source	~~Percent of Surface Water from BRA~~	Current Surface Water Returns (ac-ft/yr)	~~Current Ground-Water Returns (ac-ft/yr)~~
City of Moody	10225001	0.200	Lake Belton	~~100%~~	157	~~0~~
BRA/LCRA BCRWSS West	10264001	3.000	Georgetown/Still-house System	~~100%~~	2,402	~~1,657~~
BRA/LCRA BCRWSS East	10264002	21.500	Georgetown/Still-house System	~~100%~~	16,767	~~0~~
City of Taylor	10299001	4.000	Granger System	~~100%~~	2,220	~~0~~
Bell County WCID#1	10351001	0.900	Lake Belton	~~100%~~	983	~~0~~
Bell County WCID#1	10351002	18.000	Lake Belton	~~100%~~	14,123	~~0~~
Bell County WCID#1	10351003	6.000	Lake Belton	~~100%~~	5,389	~~0~~
City of Brenham	10388001	3.550	Lake Somerville	~~100%~~	2,485	~~0~~
City of Dublin	10405001	0.450	Lake Proctor	~~100%~~	325	~~0~~
City of Georgetown	10489002	2.500	Georgetown/Stillhouse System	~~100%~~	1,815	~~0~~
City of Georgetown	10489003	2.500	Georgetown/Stillhouse System	~~100%~~	1,423	~~0~~
City of Georgetown	10489005	1.500	Georgetown/Stillhouse System	~~100%~~	1,389	~~0~~
City of Hamilton	10492002	~~0.6200.440~~	Lake Proctor	~~100%~~	~~695392~~	~~0~~
City of Hillsboro	10630001	1.810	Lake Aquilla	~~100%~~	1,440	~~0~~
City of Rosebud	10731001	0.250	Lake Stillhouse Hollow	~~100%~~	194	~~0~~
Bell County WCID#3	10797001	0.675	Lake Belton	~~100%~~	360	~~0~~
City of Holland	10891001	0.200	Lake Stillhouse Hollow	~~100%~~	93	~~0~~
Bell County WCID#2	11090001	0.094	Lake Belton	~~100%~~	63	~~0~~
Bell County WCID#2	11091001	0.080	Lake Belton	~~100%~~	70	~~0~~
Authority TBRSS	11318001	10.000	Lake Belton	~~100%~~	8,523	~~0~~
Acton MUD	14211001	0.600	Granbury System	~~100%~~	366	~~0~~
Acton MUD	14212001	0.490	Granbury System	~~100%~~	268	~~0~~
City of Comanche	14445001	0.600	Lake Proctor	~~100%~~	324	~~0~~
City of Graham	10487001	2.1	Possum Kingdom		1,174	
AES Wolf Hollow	4288000	1.1	Lake Granbury		728	
City of Cleburne	10006001	7.5	Lake Aquilla		5,636	
City of Whitney	11408002	0.4	Lake Whitney		405	
Comanche Peak NPP	1854000	*	Lake Granbury		0	
Bosque County PP	4167000	1.8	Lake Whitney		831	
Liberty Hill Regional	14477001	0.4	Lake Georgetown		37	
City of Temple	10470002	7.5	Lake Belton		3,596	
City of Troy	11263001	0.309	Lake Belton (through Temple)		365	

* Dicharges to Lake Granbury (Outfall 005). The current TPDES permit has no maximum discharge for these returns.

2. DISCHARGE

The points of origin and rates for Permittee's return flows are itemized below:

Name	TPDES Permit #	Discharge (mgd)	Receiving Stream	North Latitude	West Longitude
Sportsmans World MUD WTP	2461000	0.1000.010	Bluff Creek	32.845111	-98.486972
Double Diamond	2789000	0.060	Unnamed Tributary to the Brazos River	32.8552778	98.4186111
BRA[1] SWAT[2]	2889000	2.500	Lake Granbury/Brazos River	32.4169445	97.6747223
City of Copperas Cove	10054003	2.500	Clear Creek	31.0925000	97.9072222
City of Copperas Cove	10054004	2.500	Unnamed tributary to Turkey Run	31.1297223	97.8808334
City of Copperas Cove	10045005	4.000	House Creek	31.1488889	97.9077778
City of DeLeon	10078001	0.300	Unnamed tributary to Leon River (Proctor Lake)	32.1111111	98.5238889
City of Marlin	10110002	2.000	Brazos River	31.2591667	96.9277778
City of Harker Heights	10155001	3.000	South Nolan Creek	31.0922222	97.6538889
City of Gatesville	10176002	2.200	Stillhouse Branch	31.4391666	97.7497222
City of Gatesville	10176004	1.000	Leon River	31.4261111	97.7441666
City of Granbury	10178002	2.000	Lake Granbury/Brazos River	32.4183334	97.7758334
City of Lampasas	10205002	1.500	Sulphur Creek	31.1893000	98.1540000
City of McGregor (South WWTP)	10219002	1.10.990	Unnamed tributary of South Bosque River	31.412416	97.395694
City of Moody	10225001	0.200	Unnamed tributary to Stampede Creek	31.3097222	97.3633333
BRA/LCRA[3] BCRWSS West[4]	10264001	3.000	Brushy Creek	30.5155556	97.6647222
BRA/LCRA[3] BCRWSS[4] East	10264002	21.500	Brushy Creek	30.5263889	97.6172223
City of Taylor	10299001	4.000	Mustang Creek	30.5575000	97.3883333
Bell County WCID[5]#1	10351001	0.900	Belton Lake	31.1252778	97.5152778
Bell County WCID[5]#1	10351002	18.000	South Nolan Creek	31.1075000	97.7016667
Bell County WCID[5]#1	10351003	6.000	South Nolan Creek	31.1086111	97.7036111
City of Brenham	10388001	3.550	Hog Branch	30.1711111	96.3775000
City of Dublin	10405001	0.450	Resley Creek	32.0619444	98.3369444

Name	TPDES Permit #	Discharge (mgd)	Receiving Stream	North Latitude	West Longitude
City of Georgetown	10489002	2.500	San Gabriel River	30.6530556	97.6613889
City of Georgetown	10489003	2.500	Unnamed tributary to Mankins Branch	30.6313889	97.6311111
City of Georgetown	10489005	1.500	Berry Creek	30.672944	97.609750
City of Hamilton	10492002	6200.440	Pecan Creek	31.7094444	98.1138889
City of Hillsboro	10630001	1.810	Hackberry Creek	31.9983333	97.1444444
City of Rosebud	10731001	0.250	Salt Creek	31.0633333	96.9911111
Bell County WCID[5]#3	10797001	0.675	South Nolan Creek	31.6688889	97.603889
City of Holland	10897001	0.200	Unnamed tributary to Darr Creek	30.8808334	97.3958333
Bell County WCID[5]#2	11090001	0.094	Boggy Creek	30.9783334	97.3436111
Bell County WCID[5]#2	11091001	0.080	Unnamed tributary to Boggy Creek	30.9847222	97.3663889
BRA TBRSS6	11318001	10.000	Nolan Creek	31.0438889	97.4397222
Acton MUD	14211001	0.600	McCarty Branch	32.4372222	97.6952777
Acton MUD[7]	14212001	0.490	Brazos River	32.3591667	97.6869444
City of Comanche	14445001	0.600	Indian Creek	31.8902777	98.5933333
City of Graham	10487001	2.1	Salt Creek	33.10	98.59
AES Wolf Hollow	4288000	1.1	Brazos River	32.33	97.73
City of Cleburne	10006001	7.5	Buffalo Creek	32.31	97.39
City of Whitney	11408002	0.4	Lake Whitney	31.95	97.34
Comanche Peak NPP[9]	1854000		Lake Granbury	32.30	97.79
Bosque County PP	4167000	1.8	Brazos River	31.85	97.35
Liberty Hill Regional	14477001	0.4	S. Fk. San Gabriel River	31.11	97.79
City of Temple	10470002	7.5	Big Elm Creek	31.08	97.32
City of Troy	11263001	0.309	Kings Branch	31.22	97.29

1 BRA - Brazos River Authority
2 SWATS – Surface Water and Treatment System (Lake Granbury)
3 LCRA – Lower Colorado River Authority
4 BCRWSS – Brushy Creek Regional Wastewater Sewage System
5 WCID – Water Control & Improvement District
6 SLRSS – Sugarland Regional Sewage System
7 TBRSS – Temple-Belton Regional Sewage System
8 MUD – Municipal Utility District
9 Discharges to Lake Granbury (Outfall 005). Current draftpermit has no maximum for these discharges

3. DIVERSION

Permittee is authorized to divert and use the water authorized by this permit as follows:

A. POINTS

1) At the diversion points authorized by Permittee's existing water rights.

2) At United States Geological Survey (USGS) Gage No. 08091000 near Glen Rose at Latitude 31.2589°N, Longitude 97.7022°W in Somervell County.

3) At USGS Gage No. 08098290 near Highbank at Latitude 31.1339°N, Longitude 96.8247°W in Falls County.

4) At the mouth of the Brazos River at the Gulf of Mexico at Latitude 28.8783°N, Longitude 95.379111°W in Brazoria County.

5) At other such diversion points located in the reaches specified in USE Paragraph 1.B, above, or as may be identified and included in Permittee's Commission approved Water Management Plan, or as may be otherwise authorized in the future.

B. RATES

1) At the diversion rates authorized by the Certificates of Adjudication and Water Use Permit authorizing each of the reservoirs comprising the system operation as defined in this permit.

2) At unspecified rates at points within the reaches authorized in USE paragraph 1.B, or points identified in the Commission approved Water Management Plan, subject to Permittee's accounting/delivery plan.

4. PRIORITY

The priority date for the rights authorized by this permit is October 15, 2004.

5. CONSERVATION

Permittee shall implement water conservation plans that provide for the utilization of those reasonable practices, techniques, and technologies that will reduce on a per unit basis the consumption of water, prevent or reduce the loss or waste of water, improve the efficiency in the use of water, increase the recycling and reuse of water, and prevent the pollution of water, so that a water supply is made available for future or alternative uses. The practices, techniques, and technologies used shall be designed to achieve a level of efficiency of use that is equal to or greater than the level provided for in Permittee's most recent water conservation plans on file with the Commission as of the date of the issuance of this permit. Such plans shall include a requirement that in every wholesale water supply contract entered into on or after the date of this permit, including any contract extension or renewal, that each successive wholesale customer develop and implement conservation measures meeting the requirements of this provision. If the

customer intends to resell the water, then the contract for resale of the water must have water conservation requirements so that each successive wholesale customer in the resale of the water is required to implement water conservation measures meeting the requirements of this provision.

6. SPECIAL CONDITIONS

A. SPECIAL CONDITIONS RELATIVE TO REUSE WATER

1) Prior to the diversion of return flows authorized by this permit, Permittee must submit to and have approved by the Executive Director, a reuse accounting plan. The reuse accounting plan must be in electronic format and account, by source, for all return flows discharged and subsequently diverted. The reuse accounting plan should include amounts discharged by outfall, amounts of return flows used by permits granted based on the presence of these return flows, and estimated travel times and conveyance losses from discharge point to diversion point(s). If the return flows will be stored in Permittee's reservoirs, the reuse accounting plan should include any evaporative losses associated with the storage. Permittee shall maintain the approved reuse accounting plan in electronic format and make it available to the general public during normal business hours and to the Executive Director upon request. Modifications or changes to the reuse accounting plan must be approved by the Executive Director. The reuse accounting plan shall be included as part of Permittee's accounting/delivery plan.

2) The right to divert discharged return flows from plants owned by the City of Granbury (TPDES Permit No. 10178002), Acton MUD (TPDES Permit Nos. 14211001 and 10178002), Bell County WCID #2 (TPDES Permit No. 11090001), City of Georgetown (TPDES Permit Nos. 10489002 and 10489003) and the City of Holland (TPDES Permit No. 10897001) is limited to the amount of surface water based return flows discharged from those plants that originates from water rights owned by the Permittee. Permittee is not authorized to divert groundwater based return flows discharged from these plants, except as may be authorized by Special Condition 6.A.4. Permittee must include in the reuse accounting plan the total amount discharged from the plants and the percentage of that water that is divertable under this permit.

3) Permittee is authorized to divert historically discharged groundwater based return flows and return flows based upon water imported from the Colorado River Basin from the Brazos River Authority/LCRA BCRWSS West (TPDES Permit No. 10264001).

4) Future discharges of groundwater based return flows may be diverted if those return flows originate from groundwater owned by Permittee or are discharged from treatment plants owned or operated by the Permittee.

Prior to diversion, Permittee must ~~apply for and be granted an amendment to this permit~~ receive authorizationing for these diversions pursuant to a Commission approved Water Management Plan or permit amendment and shall submit for approval by the Executive Director a revised accounting/delivery plan addressing such new groundwater based discharges.

5) Permittee is authorized to divert only that water discharged by the City of Marlin (TPDES Permit No. 10110002) originating from water rights owned by the Permittee. Permittee shall calculate the divertable amount of the City's discharge and include this information in the reuse accounting plan.

6) Permittee shall only divert the actual annual amount of return flows discharged from the Bell County WCID #1 (TPDES Permit Nos. 10351001 and 10351002) and the City of Harker Heights (TPDES Permit No. 10155001) less up to 172 acre-feet as authorized by Permit 4218, 37 acre-feet as authorized by Permit 5088 and 60 acre-feet as authorized by Permit 5089 when the aforementioned permits are being used.

7) Diversions and storage of return flows shall not occur at rates or in amounts higher than the actual daily amount of return flows discharged into watercourses in the Brazos River Basin, after accounting for the calculated losses and travel time from the discharge point(s) to the diversion point(s) in accordance with the accounting/delivery plan.

8) Prior to diversion of the water authorized herein, if sufficiently accurate measuring devices are not available, Permittee shall install and maintain measuring device(s) capable of measuring within plus or minus 5% accuracy, at the discharge point of each wastewater treatment plant (WWTP) to record the amount of return flows discharged into the Brazos River or its tributaries on a daily basis.

9) The priority date for diversion of currently discharged amounts (see Return Flows Available to Permittee table)~~up to 116,434 acre-feet (103.899 mgd)~~ of return flows is October 15, 2004.

10) The priority date for diversion of future return flows in excess of ~~116,434 acre-feet (103.899 mgd) of discharged effluent~~ currently discharged amounts (see Return Flows Available to Permittee table) is October 15, 2004 but is not subject to call by senior and superior permit holders in the basin and is not subject to instream flow limitations.

11) Prior to diversion of any return flows in excess of the TPDES Permit limits for each facility indicated in the table Return Flows Available to the BRA (Paragraph 1.D. RETURN FLOWS), Permittee must apply for and be recognized~~granted~~ the right to reuse those return flows pursuant to a

Commission approved Water Management Plan or permit amendment. Permittee must amend the reuse accounting plan to include future return flows prior to diverting said return flows.

12) The diversion of currently discharged amounts (see Return Flows Available to Permittee table)~~up to 116,434 acre-feet (103.899 mgd)~~ of water is dependant upon potentially interruptible return flows or discharges and is conditioned on the availability of those discharges. The right to divert the discharged return flows is subject to revocation if discharges become permanently unavailable for diversion and may be subject to reduction if the return flows are not available quantities and qualities sufficient to fully satisfy the permit. Should any discharges become permanently unavailable for diversion, Permittee shall immediately cease diversions of these return flows and reflect such reductions in the reuse accounting plan.

13) Permittee's diversion and use of return flows is subject to interruption by direct use or indirect use within the discharging entity's corporate limits, extraterritorial jurisdiction, or contiguous water certificate of convenience and necessity boundary, provided the discharging entity has applied for and been granted authorization to reuse the return flows.

B. SPECIAL CONDITIONS RELATIVE TO USE OF BED AND BANKS

1) The use of the bed and banks of Allens Creek below Allens Creek Reservoir is not authorized until Permittee applies for and is granted an amendment to Permit 2925A.

2) Permittee is authorized to use the following reaches, authorized in Permittee's certificates and amendments, for conveyance of water previously appropriated to Permittee and water authorized by this permit, downstream for diversion at Glen Rose, Highbank and the Gulf of Mexico and any of Permittee's currently authorized diversion points within these reaches:

a) Brazos River from below Possum Kingdom Reservoir to the Gulf of Mexico

b) Leon River from Lake Proctor to the confluence with the Little River

c) Lampasas River from Lake Stillhouse Hollow to the confluence with the Little River

d) Little River from the confluence of Leon and Lampasas Rivers to the junction with the Brazos River

e) Yegua Creek from Lake Somerville to the confluence with the Brazos River

f) Navasota River from Lake Limestone to the confluence with the Brazos River

g) San Gabriel River from Lake Granger to the confluence with the Little River and downstream to its confluence with the Brazos River

h) North Fork San Gabriel River from Lake Georgetown to the confluence with the San Gabriel River, to its confluence with the Little River and downstream to its confluence with the Brazos River

i) Aquilla Creek from Lake Aquilla downstream to its confluence with the Brazos River

j) Allens Creek, following construction of Allens Creek Reservoir, downstream from Allens Creek Reservoir to its confluence with the Brazos River

3) Prior to use of the bed and banks identified in Special Condition 6.B.2 above, Permittee must submit to and have approved by the Executive Director, as part of its accounting/delivery plan, a procedure to estimate ~~daily~~ deliveries of water. This procedure should be in electronic format and detail by source, type and priority date, the amounts to be conveyed and delivered, losses associated with the conveyance, specific points of diversion, associated travel times, and times of commencement and termination of transit for conveyed waters. Documentation of actual deliveries as well as the accounting/delivery plan shall be maintained by the Permittee in electronic format and made available to the general public during normal business hours and to the Executive Director upon request. Modifications or changes to the accounting/delivery plan must be approved by the Executive Director.

4) The use of the bed and banks of additional streams and tributaries in the Brazos River Basin for conveyance of water appropriated under this permit, or other sources available to the Permittee, is subject to Permittee, after identifying specific sources and types of water, specific points of discharge and diversion, and conveyance and other losses, obtaining future authorizations to satisfy the requirements of TWC § 11.042, which may be provided pursuant to a Commission approved Water Management Plan.

5) The use of additional points of diversion within the reaches specified in Special Condition 6.B.2 above is subject to Permittee, obtaining authorization to use those diversion points. The points of diversion may also be identified and included in Permittee's proposed Water Management Plan which is subject to Commission approval.

C. SPECIAL CONDITIONS RELATIVE TO NEW APPROPRIATION

1) Prior to diversion or storage of the additional water authorized by this permit, Permittee shall provide to and have approved by the Executive Director, a daily accounting/delivery plan that includes, at minimum, the following:

a. The accounting/delivery plan shall address reservoir storage and withdrawal plans for each system reservoir and account by priority date and amounts for any inflows, evaporation, water in storage and diversions from the reservoirs under all of Permittee's priority dates and authorizations including reuse.

b. A method to account for inflows to system reservoirs for purposes of compliance with special conditions requiring passage of pulse flows and estimation of those inflows.

c. An accounting for instream flow and pulse requirements to include total system storage, gage flows at the measurement points, high flow pulse volume impounded, if any, and the release schedule for the impounded high flow pulse, and timing, magnitude and duration of pulse flows.

d. The accounting/delivery plan must detail how measurements will be taken to determine if impoundment or diversions under either Permittee's senior or junior rights can be made.

e. The accounting/delivery plan must identify, account for and distinguish between firm and non-firm water supplied or delivered from Permittee's system of reservoirs. In addition, the accounting/delivery plan must specify diversion points for this water if those diversion points are not specifically identified in this permit. Any additional diversion points must be within the reaches where use of the bed and banks is authorized. Any diversion points outside those reaches will require an amendment to this permit.

f. Permittee shall maintain the approved daily accounting/delivery plan in electronic format and make it available to the general public during normal business hours and to the Executive Director upon request. Modifications or changes to the plan must be approved by the Executive Director.

2) If the total amounts of firm water indicated above are diverted at Glen Rose or Highbank, the additional amount of firm water available below those points is reduced accordingly. Permittee shall include the amount of that reduction in the accounting/delivery plan or Water Management Plan.

3) The full additional amount of non-firm water is only available when the amount of firm water is reduced by a maximum of 90,000 acre-feet per year at Glen Rose, Highbank, Richmond ~~and~~or the Gulf of Mexico. ~~If less than the full amount of non-firm water is used, the amount of the firm water reduction shall be adjusted proportionately.~~The amount of firm water actually needed to generate non-firm water will be evaluated in the Water Management Plan and may depend upon location and other factors.

4) The non-firm water authorized above includes 90,266~~74,387~~ acre-feet of historically discharged return flows. A reduction in firm yield water is not required in order to divert these return flows.

5) The remaining 50,300~~42,047~~ acre-feet of return flows out of the total amount of 140,526~~116,434~~ acre-feet of return flows indicated in Paragraph 1.D. may be diverted by the Permittee so long as the total diversions under this permit for all of the authorizations do not exceed the amounts of firm water and non-firm water indicated in Paragraph 1.A.1, above unless Permittee applies for and is granted the authorization to divert additional amounts of water. A reduction in firm yield water is not required in order to divert these return flows.

6) Permittee may not exercise a priority call on water rights in the Brazos River Basin with priority dates senior to October 15, 2004 for purposes of increasing storage in and/or diversion from Permittee's system reservoirs where drawdown of Permittee's system reservoirs is caused by delivery of water authorized by ~~compliance with the terms and conditions of~~ this permit.

7) The request for operational flexibility to use any source of water available to Permittee to satisfy the diversion requirements of senior water rights to the same extent that those water rights would have been satisfied by passing inflows through the Permittee's system reservoirs on a priority basis is granted, but limited as follows:

   a) To water previously stored in Permittee's reservoirs as documented in the accounting/delivery plan required in Special Condition 6.C.1 above.

   b) Use of this option shall not cause Permittee to be out of compliance with Special Condition 6.C.1 and Special Condition 6.C.6.

8) Permittee may divert water from storage in its permitted reservoirs and store that water in Permittee's other reservoirs for use within the Permittee's service area so long as all diversions and storage are included in and comply with the provisions of the accounting/delivery plan and of the accounting/delivery plan required by Special Condition 6.C.1 above.

9) The total amount of water diverted and released from Permittee's system reservoirs in any year for each authorized purpose of use may not exceed the cumulative authorized total for each purpose until Permittee applies for and is granted amendments to the underlying authorizations or obtains Commission authorization through approval of its Water Management Plan.

10) Permittee is required to comply with the existing System Operation Order and certificates of adjudication requiring Permittee to exclude tributary reservoirs from operation of the system during any period of time in which Permittee's permitted storage space in that reservoir is less than 30% full (until all system reservoirs are below 30% capacity, at which time the reservoir can resume system operation), until such time as Permittee submits, and the Commission approves, a Water Management Plan for the Brazos River Basin which details how such limitations will be altered. Any alterations to the limitations must be in compliance with the accounting provisions required in Special Condition 6.C.1 above.

11) Until such time as the ports are closed on the dam impounding Allens Creek Reservoir, authorized by Permit 2925, Permittee may impound and divert additional unappropriated water as specified in Paragraph 1.A.2 subject to Special Conditions 6.C.1 through 10 above.

D. WATER MANAGEMENT PLAN SPECIAL CONDITIONS

1) Permittee shall prepare and submit to the Commission, a Water Management Plan (WMP) which shall include such studies and other information as may be required by the Commission to demonstrate Permittee's compliance with and its ability to comply with all of the Special Conditions included in this permit.

2) The initial proceedings to consider the adoption of the WMP, and any major amendment thereof, shall be pursuant to contested case procedures. Provided that the approved WMP describes the methodology to be utilized, addition of diversion points within the authorization of this permit, modification of volumes of return flow to account for amendments or modifications of discharge permits or new discharge authorizations, modification of the accounting/delivery plan approved by the Executive Director, and comparable modifications are not major amendments of the

WMP. Any proceeding to consider the adoption or major amendment of the WMP shall be preceded by notice and opportunity to request a hearing, in accordance with the Commission's regulations applicable to water rights permitting proceedings. The WMP shall provide an adaptive management strategy for instream flow requirements and water supply and thus may be amended from time to time upon the request of Permittee or on the Commission's own motion. The initial accounting/delivery plan shall be submitted as part of the WMP.

E. INTERIM SPECIAL CONDITIONS RELATIVE TO ENVIRONMENTAL FLOWS

1) Because the following interim conditions are preliminary and are based upon historic flow analyses, without direct relationships to the biological and environmental benefits intended to be protected, Permittee shall conduct Instream Flow Studies (Studies) on the Brazos River and on segments of major tributaries upstream of their confluence with the Brazos River consistent with and in cooperation with the Texas Instream Flow Program. Upon completion of the Studies, Permittee shall submit an application to amend the WMP to reflect the results of the Instream Flow Studies.

2) Seasons are defined as Spring (March–May), Summer (June-August), Fall (September-November), and Winter (December-February). The number of seasons and the months representing each season are subject to revision in the WMP.

3) Total storage in Permittee's system reservoirs is a trigger for determining instream flow requirements and is subject to revision in future Water Management Plans. 7Q2 flows are to be implemented when total storage in Permittee's system reservoirs is below 60% of total capacity. "Dry" means times when the total storage in Permittee's system reservoirs is below 74%, but more than 60% of total capacity. "Average" means times when the total storage in Permittee's system reservoirs is at least 74%, but less than 96% of total capacity. "Wet" means times when the total storage in Permittee's system reservoirs is at least 96% of total capacity.

4) Storage triggers are to be recalculated every five years to ensure implementation of Subsistence, Dry, Average, and Wet provisions at frequencies of 2.5%, 25%, 50%, and 75%, respectively, on a cumulative basis.

5) Until such time as the Studies are completed, the interim instream flows in the following tables apply at the following USGS gauging stations. Measurement points for instream flows are subject to change in the WMP

with approval of the Executive Director. The instream flow criteria in the following tables are applicable at all times. Depending upon the hydrologic condition (Subsistence, Dry, Average, or Wet), storage of water authorized by this permit in Permittee's system reservoirs ~~upstream from the following flow gauging stations~~ and the diversion and use of water pursuant to this permit ~~at locations upstream from the flow gauging locations~~ shall be authorized only when streamflows exceed the instantaneous flow values at the station downstream of such diversion or storage, as established in the following tables:

Instream Flow (cfs)	BRAZOS RIVER NEAR GLEN ROSE - USGS #08091000			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	15.3	15.3	15.3	15.3
Dry	39.0	45.0	33.3	62.0
Average	92.0	138.0	101.5	150.0
Wet	234.0	292.8	249.5	332.0

Instream Flow (cfs)	YEGUA CREEK NEAR SOMERVILLE – USGS #08110000			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	0.1	0.1	0.1	0.1
Dry	5.6	3.9	0.4	0.3
Average	14.0	12.0	2.5	1.8
Wet	34.0	31.0	8.9	9.6

Instream Flow (cfs)	NAVASOTA RIVER NEAR EASTERLY USGS #08110500			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	7.6	7.6	7.6	7.6
Dry	7.6	10.0	7.6	7.6
Average	15.0	24.0	7.6	7.6
Wet	34.0	43.0	7.6	7.6

Instream Flow (cfs)	LITTLE RIVER NEAR CAMERON – USGS #08106500			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	67.9	67.9	67.9	67.9
Dry	100.0	135.0	133.0	82.0
Average	200.0	365.0	260.5	152.0
Wet	475.0	730.0	500.0	342.0

Instream Flow (cfs)	BRAZOS RIVER NEAR HIGHBANK – USGS #08098290

	Winter	Spring	Summer	Fall
Subsistence (7Q2)	167.1	167.1	167.1	167.1
Dry	167.1	167.1	167.1	167.1
Average	220.59	344.19	323.85	225.29
Wet	672.74	759.30	780.69	508.98

Instream Flow (cfs)	BRAZOS RIVER NEAR RICHMOND – USGS #08114000			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	743	743	743	743
Dry	885	1170	930	760
Average	1630	2030	1450	1150
Wet	2955	3670	2635	2038

6) A High Flow Pulse (HFP) is initiated when flows are greater than the 10th percentile and increase by more than 50% from the previous day, or when flows exceed the 75th percentile, regardless of the rate of change. A HFP is terminated when the flow drops below the 10th percentile or when the flow decreases from one day to the next by less than 5%, or when a succeeding pulse occurs. An entire HPF is also reclassified as a small flood if the maximum rate exceeds the small flood threshold at the 1.5-year recurrence interval.

7) Pursuant to the provisions set forth below, Permittee shall meet a seasonal schedule of individual high flow pulses by refraining from storing or diverting water appropriated by this permit in order to provide qualifying HFPs as set forth below. Qualifying HFPs are defined as follows:

Pulse Flows (ac-ft)	BRAZOS RIVER NEAR GLEN ROSE - USGS #08091000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	2329.6	3208.3	2617.2	2211.6
Average	7325.0	14915.7	7265.5	7565.0
Wet	31220.8	36144.8	33064.5	28682.0

Peak Flows (cfs)	BRAZOS RIVER NEAR GLEN ROSE - USGS #08091000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	403	466	394	347
Average	1,120	2,070	1,320	1,040
Wet	4,945	5,265	4,370	3,525

Pulse Flow Schedule	BRAZOS RIVER NEAR GLEN ROSE - USGS #08091000

(days/# of events)								
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq
Dry	6	2	4	3	4	2	4	2
Average	7	2	6	2	6	2	7	1
Wet	~~13~~	~~01~~	10	2	11	1	11	1

*Duration **Frequency

Pulse Flows (ac-ft)	YEGUA CREEK NEAR SOMERVILLE – USGS #08110000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	416.6	275.7	52.4	59.2
Average	1904.1	1225.8	239.2	372.9
Wet	8510.1	4331.3	845.2	3367.3

Peak Flows (cfs)	YEGUA CREEK NEAR SOMERVILLE – USGS #08110000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	69	51	13	10
Average	294	176	53	64
Wet	978	620	140	490

Pulse Flow Schedule (days/# of events)	YEGUA CREEK NEAR SOMERVILLE – USGS #08110000							
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq
Dry	5	2	5	2	4	2	5	1
Average	10	1	8	1	7	1	7	2
Wet	15	1	13	1	11	1	11	1

*Duration **Frequency

Pulse Flows (ac-ft)	NAVASOTA RIVER NEAR EASTERLY-USGS #08110500			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	439.3	748.3	195.9	77.1
Average	2142.1	2220.5	746.9	275.0
Wet	7927.9	8537.9	3399.7	2456.3

Peak Flows (cfs)	BRAZOS RIVER NEAR EASTERLY – USGS #08110500			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	76	124	33	11
Average	298	344	142	43
Wet	1,060	1,160	592	371

Pulse Flow Schedule (days/# of events)	NAVASOTA RIVER NEAR EASTERLY – USGS #08110500							
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq
Dry	5	2	5	3	5	2	4	2
Average	8	2	9	2	8	2	7	2
Wet	12	1	12	1	13	1	11	1

*Duration **Frequency

Pulse Flows (ac-ft)	LITTLE RIVER NEAR CAMERON – USGS #08106500			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	4194.4	5641.5	3563.3	3511.2
Average	9633.7	16251.6	9088.3	9183.5
Wet	29414.9	42034.7	25811.4	20494.2

Peak Flows (cfs)	LITTLE RIVER NEAR CAMERON – USGS #08106500			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	604	958	577	568
Average	1,600	2,545	1,875	1,630
Wet	5,190	6,405	3,665	3,723

Pulse Flow Schedule (days/# of events)	LITTLE RIVER NEAR CAMERON – USGS #08106500							
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq
Dry	5	1	4	2	4	2	4	2
Average	6	1	6	1	6	1	6	1
Wet	10	1	9	1	9	1	9	1

*Duration **Frequency

Pulse Flows (ac-ft)	BRAZOS RIVER AT HIGHBANK – USGS #08098290			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	5113.9	6040.7	4784.0	3652.4
Average	11647.1	14346.9	15135.1	11398.8
Wet	38514.1	38127.3	49810.6	39416.6

Peak Flows (cfs)	BRAZOS RIVER AT HIGHBANK – USGS #08098290			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	1471	1429	1116	714
Average	2576	2952	2566	2274
Wet	5225	6748	7703	5366

Pulse Flow Schedule (days/# of events)	BRAZOS RIVER AT HIGHBANK – USGS #08098290							
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq
Dry	3	1	3	3	3	3	3	2
Average	4	1	4	3	5	2	5	2
Wet	7	1	7	1	8	1	9	1

*Duration **Frequency

Pulse Flows (ac-ft)	BRAZOS RIVER NEAR RICHMOND – USGS #08114000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	36265.8	44667.8	38181.1	22457.9
Average	90287.6	101405.0	77176.9	56162.0
Wet	297550.4	270153.7	166115.7	146866.1

Peak Flows (cfs)	BRAZOS RIVER NEAR RICHMOND – USGS #08114000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	3,748	5,640	4,880	2,500
Average	9,670	10,200	8,830	7,730
Wet	19,500	19,150	15,300	13,175

Pulse Flow Schedule (days/# of	BRAZOS RIVER NEAR RICHMOND – USGS #08114000

events)								
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq
Dry	5	1	5	1	4	1	4	1
Average	6	1	7	1	7	1	7	1
Wet	16	1	13	1	12	1	11	1

*Duration **Frequency

8) Except under Subsistence conditions, diversion or storage of water upstream from defined measurement points under the authority of this permit shall be authorized during a pulse when the volume, duration, and peak flow of the individual pulse exceeds the individual pulse criteria, or when the number of pulse events in that season exceeds the pulse frequency criteria. When a Qualifying HFP is passed or provided for at one of the six defined measurement points it may be used as credit for meeting one seasonal HFP frequency requirement.

9) For streamflow events that meet the requirements of Special Condition 6.E.5, Permittee may temporarily impound all flows in excess of the instream flow requirement. If the streamflow event provided a Qualifying HFP, flow may need to be passed downstream for environmental needs, subject to seasonal requirements in Special Condition 6.E.7 above. If it did not, then Permittee may retain the impounded water for water supply purposes. Once the required number of HFPs is met, Permittee may divert or impound all subsequent HFPs for use as water supply as long as instream flow requirements specified in Special Condition 6.E.5 are met.

10) For pulses that generate a volume in excess of 250% of the Qualifying HFP volume criterion, Permittee may~~must~~ provide two Qualifying HFPs with at least one week of instream flow, as required by Special Condition 6.E.5 above, between them. Similarly, for pulses in excess of 350% of the Qualifying HFP volume criterion, Permittee may~~must~~ provide three Qualifying HFPs with at least one week of instream flow between each pair. A similarly scaled requirement holds for larger pulses.

11) For streamflow events that meet the requirements of Special Condition 6.E.6, but do not meet the minimum requirements of a Qualifying HFP, Permittee may impound flows in excess of instream flow requirements and shall record the impounded volume in their accounting/delivery plan. At such time as the cumulative volume of streamflow events exceeds the volume of a Qualifying HFP, Permittee may release such a pulse to the environment. Such a release will result in a credit for a Qualifying HFP.

12) If the streamflow event is designated a HFP but ultimately does not meet the minimum requirements of a Qualifying HFP, the volume passed shall be recorded in the accounting/delivery plan. At such time as the cumulative volume of such pulses exceeds the volume of a Qualifying HFP, Permittee will be credited with one Qualifying HFP (even if the duration, peak flow, etc. characteristics were not met).

13) For purposes of determining satisfaction of Qualifying HFP criteria, each season is accounted for independently. There is no carry-over from season to season, either in regard to exceeding or not meeting HFP requirements. In the event there are seasons where the requisite number or volume of HFPs do not occur naturally, the Permittee is not obligated to meet the seasonal HFP requirements. In the event that a pulse extends across seasonal boundaries, it will be accounted in the season in which it ends.

14) ~~All s~~Seasonal HFP requirements are to be met using streamflow events with peak flows less than the 1.5-year return interval~~.~~; however, ~~S~~streamflow events with both peak flows that exceed the 1.5-year return interval and satisfying the requirements of a qualifying HFP~~are~~ may be classified as both overbanking flows and an~~the water volume associated with these events shall not be used to meet~~ HFP ~~requirements~~.

15) Permittee may divert water ~~at or downstream of USGS Gage No. 08114000, Brazos River near Richmond,~~ upstream from the following gages without restriction during ~~wet~~the seasons and under the conditions set forth below ~~season pulses as defined in Special Conditions 6.E.7~~ when Permittee's cumulative upstream diversion rate is less than ~~7,535 cfs~~the rate set forth below:~~, if Permittee also meets the applicable instream flow requirement in Special Condition 6.E.5.~~

Min Rate (cfs)	BRAZOS RIVER NEAR RICHMOND – USGS #08114000			
	Revised Winter	Revised Spring	Revised Summer	Revised Fall
Dry	1,448	2,219	2,403	1,430
Average	3,737	4,013	4,349	4,421
Wet	7,535	7,535	7,535	7,535

Min Rate (cfs)	BRAZOS RIVER AT HIGHBANK – USGS #08098290			
	Winter	Spring	Summer	Fall
Dry	568	562	550	408
Average	995	1,162	1,264	1,301
Wet	2,019	2,655	3,794	3,069

Min Rate (cfs)	BRAZOS RIVER NEAR GLEN ROSE - USGS #08091000			
	Winter	Spring	Summer	Fall
Dry	156	183	194	198
Average	433	814	650	595
Wet	1,911	2,072	2,152	2,016

Min Rate (cfs)	LITTLE RIVER NEAR CAMERON – USGS #08106500			
	Winter	Spring	Summer	Fall
Dry	233	377	284	325
Average	618	1,001	923	932
Wet	2,005	2,520	1,805	2,129

Min Rate (cfs)	NAVASOTA RIVER NEAR EASTERLY-USGS #08110500			
	Winter	Spring	Summer	Fall
Dry	29	49	16	6
Average	115	135	70	25
Wet	410	456	292	212

Min Rate (cfs)	YEGUA CREEK NEAR SOMERVILLE – USGS #08110000			
	Winter	Spring	Summer	Fall
Dry	27	20	6	6
Average	114	69	26	37
Wet	378	244	69	280

16) In addition to the measurement points and requirements specified in Special Conditions 6.E.5 and 6.E.7 above, Permittee is prohibited from diverting and storing water authorized by this permit upstream of the following gages unless streamflow at the following gages meets or exceeds the 7Q2 value as follows:

Gage Name	Gage #	7Q2 Value (cfs)
Brazos River near Palo Pinto	08089000	30.3
Aquilla Creek above Aquilla	08093360	0.1
Brazos River near Aquilla	08093100	30.7
Leon River near Belton	08102500	4.7
Lampasas River near Belton	08104100	4.8
N Fork San Gabriel River near Georgetown	08104700	1.5
San Gabriel River at Laneport	08105700	3.6

17) Permittee shall install and maintain a streamflow gage at Yegua Creek at Somerville.

18) The requirements of these Special Conditions apply only to diversion and storage under the authority of this permit and do not address or limit diversion and storage of water authorized by other water rights held by Permittee.

19) These special conditions are subject to adjustment by the Commission if the Commission determines, through an expedited public review process, that such

adjustment is appropriate to achieve compliance with applicable environmental flow standards adopted pursuant to Texas Water Code § 11.1471. Any adjustment shall be made in accordance with the provisions of Texas Water Code § 11.147(e-1).

This permit is issued subject to all superior and senior water rights in the Brazos River Basin.

Permittee agrees to be bound by the terms, conditions and provisions contained herein and such agreement is a condition precedent to the granting of this permit.

All other matters requested in the application which are not specifically granted by this permit are denied.

This permit is issued subject to the Rules of the Texas Commission on Environmental Quality and to the right of continuing supervision of State water resources exercised by the Commission.

_____
For the Commission

ISSUED:

Freese and Nichols

MEMORANDUM

TO: File

FROM: Jon S. Albright

SUBJECT: TCEQ Modeling of Allens Creek Reservoir

DATE: February 5, 2009

1. The TCEQ modeling of the System Operation Permit does not allow Allens Creek Reservoir to fill from the Brazos River at the 2004 System Operation priority date. All previous analyses by FNI do allow filling of the reservoir at both the Allens Creek priority date and the System Operation Priority date. This change reduces System Operation yield at Richmond by 3,165 acre-feet per year if the 202,000 ac-ft annual diversion limit from the Brazos River in the Allens Creek permit is respected for all diversions (both under its existing water right and the System Operation Permit). If Allens Creek is allowed to divert without an annual limit from the Brazos River, System Operation yield could be increased approximately 48,000 ac-ft per year.

2. In the initial model submitted with the application, Allens Creek was not modeled using dual simulation for Brazos diversions because of the reservoir's relatively junior priority date. Kathy Alexander requested that we provide revised modeling of Allens Creek like the modeling of other reservoirs. We provided a version that treated diversions from the Brazos River using dual simulation. This model also allowed filling from the Brazos River at the System Operation priority date, which is consistent with the modeling of other BRA reservoirs and the permit application. We respected the 130,680 ac-ft monthly diversion limit from the Brazos River, but not the 202,000 ac-ft annual limit. With the suggested modeling and the original Lyons bypass, the annual limit was exceeded in two years of the simulation. We submitted this modeling to TCEQ stating that if they felt the annual limit needed to be respected we could make that modification. TCEQ never

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responded.

3. Applying the FNI method with dual simulation with the new instream flow requirements at Richmond results in exceeding the annual limit more frequently and in larger amounts than with the Lyons bypass. Therefore we revised the modeling so that it does not exceed the 202,000 ac-ft per year annual limit. This is the basis of the 3,165 ac-ft per year impact.

4. If more than 202,000 ac-ft per year could be diverted into Allens Creek, it could increase the yield from System Operation by about 48,000 ac-ft per year. If not pursued in the current System Operation Permit, BRA may want to consider permit amendments to allow this in the future. It is possible that both the Allens Creek permit and the System Operation permit would require amendments.

Bickerstaff Heath Delgado Acosta LLP

816 Congress Avenue Suite 1700 Austin, Texas 78701 (512) 472-8021 Fax (512) 320-5638 www.bickerstaff.com

August 6, 2009

Mr. Ron Ellis, Project Manager
Water Rights Permitting & Availability Section
Texas Commission on Environmental Quality, MC 160
P.O. Box 13087
Austin, Texas 78711-3087

RE: Brazos River Authority Application No. 5851 for System Operation Permit

Dear Ron:

Since issuance of the most recent draft of the System Operation Permit in December 2008, the Brazos River Authority (BRA) and the Texas Parks and Wildlife Department (TPWD) have consulted extensively with each other in an effort to arrive at proposed revisions of the draft permit that we could jointly recommend for the Executive Director's consideration. The enclosed draft is the product of those efforts. Both a clean and red-line version (compared to the December 2008 Draft) are enclosed. In addition to the enclosures, I would offer the following general comments:

1. *Use of Return Flows* – Both BRA and TPWD believe that it is preferable and appropriate to process the reuse portion of the application under Texas Water Code § 11.046(c) as a new appropriation. Reasons for this conclusion include the fact that this is what was requested in the application, and that this results in use of such return flows being subject to the permit's environmental flow requirements. Moreover, with the special conditions recommended, this allows use of surface water-based return flows, to the extent that they are available, while preserving direct and indirect reuse rights of the discharger. In the case of groundwater-based return flows, BRA does not propose to limit reuse to the service area of the discharger.

2. *Water Management Plan* – The draft permit's provisions regarding the Water Management Plan (WMP) were perhaps the subject of the most discussion between BRA and TPWD, and extensive additional language is proposed. One purpose of these revisions is to clarify what constitutes a "major amendment," which would require public hearings and possible contested case hearings, and what might be considered a "minor amendment" that could be approved by the Executive Director. Another major purpose of the proposed revisions is to address the initial adoption of the WMP, both in terms of timing and content. Some items for the initial WMP would be mandatory (e.g., development of the accounting/delivery plan), and others

would be issues for consideration (e.g., establishing diversion rate trigger levels below which HFP requirements would not apply).

3. *Environmental Flow Requirements* – BRA and TPWD are both pleased and a little cautious about breaking new ground by imposing the first SB 3 type environmental flows matrix provisions in this permit. These provisions have been the subject of extensive discussions between BRA and TPWD, as well as a topic of consideration by the Science Advisory Committee established by SB 3. As you can see, we have agreed that the provisions are only interim and subject to modification through adaptive management as better information becomes available, and also subject to Texas Water Code §11.147(e-1) limitations. TPWD is not comfortable that the 7Q2 flow restrictions in paragraph 5.E.15 provide sufficient protection, while BRA believes that the permit may already have more full matrix control points than it can reasonably manage. To address this issue, paragraph 5.E.16 has been included requiring monitoring studies for the 7Q2 control points and making the Little River watershed points a top study priority.

As is obvious from the enclosed draft, these comments simply address the major areas of discussion between BRA and TPWD. However, each of the specific comments reflected in the enclosed draft is significant and, on behalf of BRA and TPWD, I recommended all of them for your most serious consideration. We look forward to discussing these comments with you in more detail during our meeting August 11th, and will be available either before or after that meeting for this purpose.

Thank you for your attention to this matter.

Sincerely,

Douglas G. Caroom

DGC/mmr

Enclosures

cc: Carter Smith, TPWD
Colette Barron, TPWD
Phil Ford, BRA
Jim Forte, BRA
Todd Chenoweth, TCEQ
Kellye Rila, TCEQ

DRAFT-BRA/TPWD

WATER USE PERMIT

Permit No.	5851		TYPE §§ 11.121, 11.042 & 11.085
Owner:	Brazos River Authority	Address:	P.O. Box 7555 Waco, Texas 76714-7555
Filed:	October 15, 2004	Granted:	
Purpose:	Multiple-Use (Domestic, Municipal, Agricultural, Industrial, Mining, Recreation)	Counties:	Parmer, Castro, Swisher, Bailey, Lamb, Hale, Floyd, Cochran, Hockley, Archer, Lubbock, Crosby, Baylor, Dickens, King, Knox, Jack, Terry, Lynn, Mitchell, Chambers, Young, Garza, Throckmorton, Kent, Haskell, Stonewall, Parker, Palo Pinto, Dawson, Scurry, Borden, Fisher, Stephens, Jones, Shackelford, Johnson, Hood, Nolan, Erath, Eastland, Taylor, Callahan, Somervell, Hill, Comanche, Bosque, Brown, Freestone, Hamilton, McLennan, Limestone, Mills, Coryell, Leon, Falls, Lampasas, Robertson, Bell, Madison, Milam, Burnet, Brazos, Grimes, Williamson, Burleson, Travis, Lee, Washington, Bastrop, Waller, Harris, Austin, Colorado, Fort Bend, Galveston, Matagorda, Wharton, Fayette, and Brazoria
Watercourse:	Multiple Tributaries of the Brazos River and the Brazos River	Watershed:	Brazos River Basin; San Jacinto-Brazos Coastal Basin; and Brazos-Colorado Coastal Basin

WHEREAS, the Brazos River Authority, Applicant, owns the water rights and reservoirs authorized by Certificate of Adjudication (Certificate) No. 12-5155 (Possum Kingdom Lake), Certificate No. 12-5156 (Lake Granbury), Certificate No. 12-5165 (Lake Limestone), and Water

Use Permit 2925A (Allens Creek Reservoir in conjunction with the Texas Water Development Board and the City of Houston); and

WHEREAS, Applicant also owns the water rights and has contracts with the United States Army Corps of Engineers for storage authorized by Certificate No. 12-5157 (Lake Whitney), Certificate No. 12-5158 (Lake Aquilla), Certificate No. 12-5159 (Lake Proctor), Certificate No. 12-5160 (Lake Belton), Certificate No. 12-5161 (Lake Stillhouse Hollow), Certificate No. 12-5162 (Lake Georgetown), Certificate No. 12-5163 (Lake Granger), Certificate No. 12-5164 (Lake Somerville), and

WHEREAS, Applicant also owns the water rights authorized by Certificate Nos. 12-5166 and 12-5167, which authorize various uses of water within the Applicant's other certificates and permits; and

WHEREAS, Applicant is currently authorized, pursuant to ~~a TCEQ order~~the 1964 System Operation Order, as amended, to manage and operate its tributary reservoirs as elements of a system, coordinating releases and diversions from the tributary reservoirs with releases and diversions from the Applicant's main-stem reservoirs to minimize waste, and to conserve water in reservoirs in which the supply is short by making releases from tributary reservoirs in which the supply is more abundant; and

WHEREAS, Applicant has applied for a Water Use Permit to authorize:

- A new appropriation of state water in the amount of 421,449 acre-feet per year for multiple use purposes, including domestic, municipal, agricultural, industrial, mining, and other beneficial uses on a firm basis in the Brazos River Basin. The amount of this new appropriation of water includes the current and future return flows requested in this application. Applicant indicates that the entire amount of 421,449 acre-feet of water per year is available only if all of it is diverted at the mouth of the Brazos River, and can only be made available by the Applicant through the system operation of its water rights. To the extent water is diverted upstream, the remaining unappropriated water downstream is reduced and will itself vary depending upon the location of its diversion and use. Out of the 421,449 acre-feet per year of unappropriated water being requested, the maximum amount of unappropriated water that will be available if such water is diverted upstream at USGS gage No. 08091000 near Glen Rose, Texas is 150,538 acre-feet per year firm, and if such unappropriated water is diverted upstream at USGS gage No. 08098290 near Highbank, Texas, the maximum amount of unappropriated water that will be available at that location is 144,306 acre-feet per year firm.

- Diversion of the water authorized by this amendment, if granted, from: (i) the existing diversion points authorized by Applicant's existing water rights; (ii) the Brazos River at the USGS gage No. 08091000 near Glen Rose, Texas; (iii) the Brazos River at USGS gage No. 08098290 near Highbank, Texas; (iv) the Brazos

River at the Gulf of Mexico; and (v) at such other diversion points that may be identified and included in Applicant's proposed Water Management Plan which is subject to TCEQ's approval.

- Use of up to 90,000 acre-feet of water per year of its firm supply (part of the 421,449 acre-feet of firm water requested above) to produce, along with other unappropriated flows, an interruptible water supply of 670,000 acre-feet per year and the appropriation of that interruptible water supply. Applicant indicates that the entire amount of 1,001,449 acre-feet of water (331,449 acre-feet of firm water and 670,000 acre-feet of interruptible water) is available only if all of it is diverted at the mouth of the Brazos River, and can only be made available by the Applicant through the system operation of its water rights. To the extent water is diverted upstream, the remaining unappropriated water downstream is reduced and will itself vary depending on the location of its diversion and use. This new appropriation of water includes the current and future return flows requested in this application. Out of the 1,001,449 acre-feet of firm and interruptible water being requested, the maximum amount of firm and interruptible water that will be available if such water is diverted upstream at USGS Gage No. 08091000 near Glen Rose, Texas is 60,538 acre-feet of firm water per year and 157,000 acre-feet of interruptible water per year and if such water is diverted upstream at USGS Gage No. 08098290 near Highbank, Texas, the maximum amount of firm water is 54,306 acre-feet of water per year and 303,000 acre-feet of interruptible water per year.

- An exempt interbasin transfer authorization to transfer and use, on a firm and interruptible basis, such water in the adjoining San Jacinto-Brazos Coastal Basin and the Brazos-Colorado Coastal Basin, and to transfer such water to any county or municipality or the municipality's retail service area that is partially within the Brazos River Basin for use, on a firm and interruptible basis, in that part of the county or municipality and the municipality's retail service area not within the Brazos River Basin.

- An appropriation of current and future return flows (treated sewage effluent and brine bypass/return) to the extent that such return flows continue to be discharged or returned into the bed and banks of the Brazos River, its tributaries, and Applicant's reservoirs. Applicant indicates that such appropriation of return flows would be subject to interruption by direct ~~use~~reuse or indirect ~~use~~reuse within the discharging entity's city limits, extraterritorial jurisdiction, or contiguous water certificate of convenience and necessity boundary. Specified discharge points and amounts of water will be accounted for on a monthly basis as part of Applicant's Water Management Plan which is subject to TCEQ's approval.

- Operational flexibility to (1) use any source of water available to the Applicant to satisfy the diversion requirements of senior water rights to the same extent that those water rights would have been satisfied by passing inflows through the

Applicant's reservoirs on a priority basis; and (2) release, pump and transport water from any of the Applicant's reservoirs for subsequent storage, diversion and use throughout the Applicant's service area. (Applicant's "service area" includes all counties listed above.)

- Recognition that the System Operation Permit approved pursuant to this application will prevail over inconsistent provisions in the Applicant's existing water rights regarding system operation.

- Use of the bed and banks of the Brazos River, its tributaries and the Applicant's reservoirs for the conveyance, storage, and subsequent diversion of (i) water that the Applicant seeks to appropriate under this application; (ii) waters that are being conveyed via pipelines and subsequently discharged into the Brazos River, its tributaries or stored in the Applicant's reservoirs; (iii) surface water imported from areas located outside the Brazos River Basin for subsequent use; (iv) in-basin surface water and groundwater subject to the Applicant's control; (v) waters developed from future Applicant projects; and (vi) current and future reuse of surface and groundwater based effluent requested by this application. This bed and banks authorization is subject to Applicant, after identifying specific points of discharge and diversion and conveyance and other losses, obtaining future authorizations to satisfy the requirements of TWC § 11.042. Such points of discharge and diversion and conveyance and other losses may also be identified and included in Applicant's proposed Water Management Plan which is subject to TCEQ's approval.

WHEREAS, Applicant seeks authorization to divert and use treated effluent at multiple points in the Brazos River Basin; and

WHEREAS, until the construction of Allens Creek Reservoir is completed, Applicant requests that the System Operation Permit include special conditions which authorize:

- The Applicant to appropriate state water in the amount of 425,099 acre-feet per year for multiple use purposes, including domestic, municipal, agricultural, industrial, mining, and other beneficial uses on a firm basis in the Brazos River Basin. This amount includes the current and future return flows requested in this application. This amount is available if all of the water is diverted at the mouth of the Brazos River, and can only be made available by the Applicant through the system operation of its water rights. To the extent water is diverted upstream, the remaining unappropriated water downstream is reduced and will itself vary depending upon the location of its diversion and use. Out of the 425,099 acre-feet per year of unappropriated water being requested, the maximum amount of unappropriated water that will be available if such water is diverted upstream at USGS Gage 08091000 near Glen Rose, Texas is 150,538 acre-feet per year firm and if such unappropriated water is diverted upstream at USGS Gage 08098290

near Highbank, Texas the maximum amount of unappropriated water that will be available is, at that location, 175,306 acre-feet per year firm;

- The Applicant to use up to 90,000 acre-feet of water per year of its firm supply to produce, along with other unappropriated flows an interruptible water supply of 869,000 acre-feet per year. This amount includes the current and future return flows requested in this application. Applicant indicates that the entire amount of 1,204,099 acre-feet of water (335,099 acre-feet of firm water and 869,000 acre-feet of interruptible water) is only available if all of it is diverted at the mouth of the Brazos River, and can only be made available by the Applicant through the system operation of its water rights. To the extent water is diverted upstream, the remaining unappropriated water downstream is reduced and will itself vary depending upon the location of its diversion and use. Out of the 1,204,099 acre-feet of firm and interruptible water being requested, the maximum amount of firm and interruptible water that will be available if such water is diverted upstream at USGS Gage No. 08091000 near Glen Rose, Texas, will be 60,538 acre-feet of firm water per year and 190,000 acre-feet of interruptible water per year and if such water is diverted upstream at USGS Gage No. 08098290 near Highbank, Texas the maximum amount of firm water will be 85,306 acre-feet of water per year and 284,000 acre-feet of interruptible water per year; and

- Exempt interbasin transfer authorization to transfer and use, on a firm and interruptible basis, such water in the adjoining San Jacinto-Brazos Coastal Basin and the Brazos-Colorado Coastal Basin, and to transfer such water to any county or municipality or the municipality's retail service area that is partially within the Brazos River Basin for use, on a firm and interruptible basis, in that part of the county or municipality and the municipality's retail service area not within the Brazos River Basin.

WHEREAS, the Texas Commission on Environmental Quality (Commission) finds that jurisdiction over the application is established; and

WHEREAS, the Executive Director recommends that specific stream flow restrictions should be included in the permit to maintain the instream uses and water quality conditions of the Brazos River; and

WHEREAS, as additional factual and scientific information becomes available, it is anticipated that the interim special conditions in Paragraph ~~6.~~5.E~~.~~ below ~~are~~ relative to environmental flows will be revised, through Commission approved revisions of the Water Management Plan, to better provide for the environmental instream flow needs of the Brazos River and its tributaries and to make the maximum amount of water available for beneficial ~~uses~~use that is consistent with those needs, and

WHEREAS, the Executive Director recommends that in order to protect senior and superior water rights owners, special conditions should be included in the permit; and

WHEREAS, to avoid ambiguities between this system operation authorization and Applicant's previous system operation authorizations reflected by the System Operation Order and existing permits, the Executive Director recommends that this System Operation Permit be subject to all provisions included in the Commission's July 23, 1964 System Operation Order, as amended, ~~authorizing system operation of certain reservoirs in the Brazos River Basin and to all terms and conditions of Permittee's authorizations in Certificate Nos. 12-5155, 12-5156, 12-5165, 12-5157, 12-5160, 12-5159, 12-5164, 12-5161, 12-5163, 12-5162, 12-5158, 12-5166 and 12-5167 and Water Use Permit 2925A~~ except to the extent specifically provided otherwise by ~~this permit~~conditions in this permit regarding the total amount of water appropriated and available for storage, diversion and purposes of use, and as it may be modified in the future by Commission approval of a Water Management Plan for the Brazos River Basin; and

WHEREAS, the Commission has complied with the requirements of the Texas Water Code and Rules of the Texas Commission on Environmental Quality in issuing this permit;

NOW, THEREFORE, Water Use Permit No. ~~5851,~~5851 is issued to the Brazos River Authority, subject to the following terms and conditions:

1. USE

A. NEW APPROPRIATION

1) Permittee is authorized to impound, divert, and use not to exceed the following volumes of unappropriated water per year for multiple uses (domestic, municipal, agricultural, industrial, and mining) within ~~their~~its service area subject to special conditions:

Recommended Amounts of New Appropriation

	Volume in acre-feet	
Location	**Firm Water**	**Non-firm Water**
Glen Rose	131,363	157,000
Highbank	144,306	303,000
Richmond	~~188,095~~239,297	670,000
Gulf of Mexico	~~191,516~~243,146	670,000

2) Until such time as the ports are closed on the dam impounding Allens Creek Reservoir, authorized by Permit No. 2925A, in lieu of Paragraph 1.A.1 Permittee may impound, divert, and use not to exceed the following volumes of unappropriated water per year, subject to special conditions:

Recommended Amounts of New Appropriation without Allens Creek

	Volume in acre-feet without Allens Creek Reservoir	
Location	**Firm Water**	**Non-firm Water**

Glen Rose	131,363	190,000
Highbank	175,306	284,000
Richmond	~~237,000~~235,377	869,000
Gulf of Mexico	~~241,765~~239,181	869,000

B. USE OF BED AND BANKS

Permittee is authorized to use the bed and banks of the Brazos River below Possum Kingdom Lake, its tributaries and Permittee's authorized reservoirs for the conveyance, storage, and subsequent diversion of the water authorized herein, subject to identification of specific losses and special conditions.

C. INTERBASIN TRANSFER

Permittee is hereby granted an exempt interbasin transfer authorization to transfer and use the water authorized herein in Permittee's service area in the adjoining San Jacinto-Brazos Coastal Basin and the Brazos-Colorado Coastal Basin and to transfer such water to any county or municipality or the municipality's retail service area that is partially within the Brazos River Basin for use on a firm and ~~non-firm~~interruptible basis in that part of the county or municipality and the municipality's retail service area not within the ~~Trinity, Red, Colorado, and San Jacinto~~Brazos River ~~Basins~~Basin.

D. RETURN FLOWS

1) Based upon anticipated discharges through 2060, Permittee is authorized to impound, divert and use return flows discharged ~~from the Permittee's facilities or originating from diversions pursuant to Permittee's water rights, as indicated in the table below~~into the Brazos River Basin, not to exceed the following additional volumes per year, attributable to return flows, for multiple uses (domestic, municipal, ~~agricultural~~agriculture, industrial, mining) within ~~their~~its service area~~,~~ subject to special conditions~~ to protect water rights granted based on the presence of those return flows as well as other senior water rights~~:

Amount of Additional Appropriation from Return Flows~~ Available to Permittee~~:

~~Name~~	~~TPDES Permit #~~	~~Permitted Discharge (mgd)~~	~~Current BRA Source~~	~~Percent of Surface Water from BRA~~	~~Current Surface Water Returns (ac-ft/yr)~~	~~Current Ground-Water Returns (ac-ft/yr)~~
~~Sportsmans World MUD WTP~~	~~02461000~~	~~0.010~~	~~Possum Kingdom~~	~~100%~~	~~11.2~~	~~0~~
~~Double Diamond~~	~~02789000~~	~~0.060~~	~~Possum Kingdom~~	~~100%~~	~~67~~	~~0~~
~~Authority SWATS~~	~~02889000~~	~~2.500~~	~~Granbury System~~	~~100%~~	~~730~~	~~0~~

~~Name~~	~~TPDES Permit #~~	~~Permitted Discharge (mgd)~~	~~Current BRA Source~~	~~Percent of Surface Water from BRA~~	~~Current Surface Water Returns (ac-ft/yr)~~	~~Current Ground-Water Returns (ac-ft/yr)~~
~~City of Copperas Cove~~	~~10045003~~	~~2.500~~	~~Lake Belton~~	~~100%~~	~~923~~	~~0~~
~~City of Copperas Cove~~	~~10045004~~	~~2.500~~	~~Lake Belton~~	~~100%~~	~~1,375~~	~~0~~
~~City of Copperas Cove~~	~~10045005~~	~~4.000~~	~~Lake Belton~~	~~100%~~	~~1,600~~	~~0~~
~~City of DeLeon~~	~~10078001~~	~~0.300~~	~~Lake Proctor~~	~~100%~~	~~192~~	~~0~~
~~City of Marlin~~	~~10110002~~	~~2.000~~	~~Whitney System~~	~~16%~~	~~159.4~~	~~0~~
~~City of Harker Heights~~	~~10155001~~	~~3.000~~	~~Lake Belton~~	~~100%~~	~~2,780~~	~~0~~
~~City of Gatesville~~	~~10176002~~	~~2.200~~	~~Lake Belton~~	~~100%~~	~~1,731~~	~~0~~
~~City of Gatesville~~	~~10176004~~	~~1.000~~	~~Lake Belton~~	~~100%~~	~~703~~	~~0~~
~~City of Granbury~~	~~10178002~~	~~2.000~~	~~Granbury System~~	~~100%~~	~~1313~~	~~0~~
~~City of Lampasas~~	~~10205002~~	~~1.500~~	~~Lake Stillhouse Hollow~~	~~100%~~	~~580~~	~~0~~
~~City of McGregor (South WWTP)~~	~~10219002~~	~~0.990~~	~~Lake Belton~~	~~95%~~	~~651.7~~	~~0~~
~~City of Moody~~	~~10225001~~	~~0.200~~	~~Lake Belton~~	~~100%~~	~~157~~	~~0~~
~~BRA/LCRA BCRWSS West~~	~~10264001~~	~~3.000~~	~~Georgetown/Still-house System~~	~~100%~~	~~2,402~~	~~1,657~~
~~BRA/LCRA BCRWSS East~~	~~10264002~~	~~21.500~~	~~Georgetown/Still-house System~~	~~100%~~	~~16,767~~	~~0~~
~~City of Taylor~~	~~10299001~~	~~4.000~~	~~Granger System~~	~~100%~~	~~2,220~~	~~0~~
~~Bell County WCID#1~~	~~10351001~~	~~0.900~~	~~Lake Belton~~	~~100%~~	~~983~~	~~0~~
~~Bell County WCID#1~~	~~10351002~~	~~18.000~~	~~Lake Belton~~	~~100%~~	~~14,123~~	~~0~~
~~Bell County WCID#1~~	~~10351003~~	~~6.000~~	~~Lake Belton~~	~~100%~~	~~5,389~~	~~0~~
~~City of Brenham~~	~~10388001~~	~~3.550~~	~~Lake Somerville~~	~~100%~~	~~2,485~~	~~0~~
~~City of Dublin~~	~~10405001~~	~~0.450~~	~~Lake Proctor~~	~~100%~~	~~325~~	~~0~~
~~City of Georgetown~~	~~10489002~~	~~2.500~~	~~Georgetown/Stillhouse System~~	~~100%~~	~~1,815~~	~~0~~
~~City of Georgetown~~	~~10489003~~	~~2.500~~	~~Georgetown/Stillhouse System~~	~~100%~~	~~1,423~~	~~0~~
~~City of Georgetown~~	~~10489005~~	~~1.500~~	~~Georgetown/Stillhouse System~~	~~100%~~	~~1,389~~	~~0~~
~~City of Hamilton~~	~~10492002~~	~~0.440~~	~~Lake Proctor~~	~~100%~~	~~392~~	~~0~~
~~City of Hillsboro~~	~~10630001~~	~~1.810~~	~~Lake Aquilla~~	~~100%~~	~~1,440~~	~~0~~
~~City of Rosebud~~	~~10731001~~	~~0.250~~	~~Lake Stillhouse Hollow~~	~~100%~~	~~194~~	~~0~~
~~Bell County WCID#3~~	~~10797001~~	~~0.675~~	~~Lake Belton~~	~~100%~~	~~360~~	~~0~~
~~City of Holland~~	~~10891001~~	~~0.200~~	~~Lake Stillhouse Hollow~~	~~100%~~	~~93~~	~~0~~
~~Bell County WCID#2~~	~~11090001~~	~~0.094~~	~~Lake Belton~~	~~100%~~	~~63~~	~~0~~
~~Bell County WCID#2~~	~~11091001~~	~~0.080~~	~~Lake Belton~~	~~100%~~	~~70~~	~~0~~
~~Authority TBRSS~~	~~11318001~~	~~10.000~~	~~Lake Belton~~	~~100%~~	~~8,523~~	~~0~~
~~Acton MUD~~	~~14211001~~	~~0.600~~	~~Granbury System~~	~~100%~~	~~366~~	~~0~~
~~Acton MUD~~	~~14212001~~	~~0.490~~	~~Granbury System~~	~~100%~~	~~268~~	~~0~~
~~City of Comanche~~	~~14445001~~	~~0.600~~	~~Lake Proctor~~	~~100%~~	~~324~~	~~0~~

Volume in acre-feet	
Location	**Firm Water**
Richmond	80,850
Gulf of Mexico	82,157

Amount of Additional Appropriation from Return Flows, without Allens Creek

Volume in acre-feet	
Location	**Firm Water**
Richmond	82,509
Gulf of Mexico	83,842

2) The priority date of diversion of return flows is October 15, 2004. The storage and diversion of return flows is subject to environmental flow requirements set out in Special Condition 5.E.

2. ~~DISCHARGE~~

~~The points of origin and rates for Permittee's return flows are itemized below:~~

~~Name~~	~~TPDES Permit #~~	~~Discharge (mgd)~~	~~Receiving Stream~~	~~North Latitude~~	~~West Longitude~~
~~Sportsmans World MUD WTP~~	~~2461000~~	~~0.010~~	~~Bluff Creek~~	~~32.845111~~	~~-98.486972~~
~~Double Diamond~~	~~2789000~~	~~0.060~~	~~Unnamed Tributary to the Brazos River~~	~~32.8552778~~	~~98.4186111~~
~~BRA[1] SWAT[2]~~	~~2889000~~	~~2.500~~	~~Lake Granbury/Brazos River~~	~~32.4169445~~	~~97.6747223~~
~~City of Copperas Cove~~	~~10054003~~	~~2.500~~	~~Clear Creek~~	~~31.0925000~~	~~97.9072222~~
~~City of Copperas Cove~~	~~10054004~~	~~2.500~~	~~Unnamed tributary to Turkey Run~~	~~31.1297223~~	~~97.8808334~~
~~City of Copperas Cove~~	~~10045005~~	~~4.000~~	~~House Creek~~	~~31.1488889~~	~~97.9077778~~
~~City of DeLeon~~	~~10078001~~	~~0.300~~	~~Unnamed tributary to Leon River (Proctor Lake)~~	~~32.1111111~~	~~98.5238889~~
~~City of Marlin~~	~~10110002~~	~~2.000~~	~~Brazos River~~	~~31.2591667~~	~~96.9277778~~
~~City of Harker Heights~~	~~10155001~~	~~3.000~~	~~South Nolan Creek~~	~~31.0922222~~	~~97.6538889~~
~~City of Gatesville~~	~~10176002~~	~~2.200~~	~~Stillhouse Branch~~	~~31.4391666~~	~~97.7497222~~
~~City of Gatesville~~	~~10176004~~	~~1.000~~	~~Leon River~~	~~31.4261111~~	~~97.7441666~~
~~City of Granbury~~	~~10178002~~	~~2.000~~	~~Lake~~	~~32.4183334~~	~~97.7758334~~

Name	TPDES Permit #	Discharge (mgd)	Receiving Stream	North Latitude	West Longitude
			Granbury/Brazos River		
City of Lampasas	10205002	1.500	Sulphur Creek	31.1893000	98.1540000
City of McGregor (South WWTP)	10219002	.990	Unnamed tributary of South Bosque River	31.412416	97.395694
City of Moody	10225001	0.200	Unnamed tributary to Stampede Creek	31.3097222	97.3633333
BRA/LCRA[3] BCRWSS West[4]	10264001	3.000	Brushy Creek	30.5155556	97.6647222
BRA/LCRA[3] BCRWSS[4] East	10264002	21.500	Brushy Creek	30.5263889	97.6172223
City of Taylor	10299001	4.000	Mustang Creek	30.5575000	97.3883333
Bell County WCID[5] #1	10351001	0.900	Belton Lake	31.1252778	97.5152778
Bell County WCID[5] #1	10351002	18.000	South Nolan Creek	31.1075000	97.7016667
Bell County WCID[5] #1	10351003	6.000	South Nolan Creek	31.1086111	97.7036111
City of Brenham	10388001	3.550	Hog Branch	30.1711111	96.3775000
City of Dublin	10405001	0.450	Resley Creek	32.0619444	98.3369444
City of Georgetown	10489002	2.500	San Gabriel River	30.6530556	97.6613889
City of Georgetown	10489003	2.500	Unnamed tributary to Mankins Branch	30.6313889	97.6311111
City of Georgetown	10489005	1.500	Berry Creek	30.672944	97.609750
City of Hamilton	10492002	0.440	Pecan Creek	31.7094444	98.1138889
City of Hillsboro	10630001	1.810	Hackberry Creek	31.9983333	97.1444444
City of Rosebud	10731001	0.250	Salt Creek	31.0633333	96.9911111
Bell County WCID[5] #3	10797001	0.675	South Nolan Creek	31.6688889	97.603889
City of Holland	10897001	0.200	Unnamed tributary to Darr Creek	30.8808334	97.3958333
Bell County WCID[5] #2	11090001	0.094	Boggy Creek	30.9783334	97.3436111
Bell County WCID[5] #2	11091001	0.080	Unnamed tributary to Boggy Creek	30.9847222	97.3663889
BRA TBRSS6	11318001	10.000	Nolan Creek	31.0438889	97.4397222
Acton MUD	14211001	0.600	McCarty Branch	32.4372222	97.6952777
Acton MUD[7]	14212001	0.490	Brazos River	32.3591667	97.6869444
City of Comanche	14445001	0.600	Indian Creek	31.8902777	98.5933333

1 BRA – Brazos River Authority
2 SWATS – Surface Water and Treatment System (Lake Granbury)
3 LCRA – Lower Colorado River Authority
4 BCRWSS – Brushy Creek Regional Wastewater Sewage System
5 WCID – Water Control & Improvement District

~~6 SLRSS – Sugarland Regional Sewage System~~
~~7 TBRSS – Temple Belton Regional Sewage System~~
~~8 MUD – Municipal Utility District~~~~3.~~ DIVERSION

Permittee is authorized to divert and use the water authorized by this permit as follows:

A. POINTS

1) At the diversion points authorized by Permittee~~'~~'s existing water rights.

2) At United States Geological Survey (USGS) Gage No. 08091000 near Glen Rose at Latitude 31.2589°N, Longitude 97.7022°W in Somervell County.

3) At USGS Gage No. 08098290 near Highbank at Latitude 31.1339°N, Longitude 96.8247°W in Falls County.

4) At the mouth of the Brazos River at the Gulf of Mexico at Latitude 28.8783°N, Longitude 95.379111°W in Brazoria County.

5) At ~~other such~~ diversion points ~~located in the reaches specified in USE Paragraph 1.B, above, or as may be identified and~~ included in Permittee's Commission ~~-~~approved Water Management Plan, or as may be otherwise authorized in the future.

B. RATES

1) At the diversion rates authorized by the Certificates of Adjudication and Water Use ~~Permit~~Permits authorizing each of the reservoirs comprising the system operation as defined in this permit.

2) At unspecified rates at points ~~within the reaches authorized~~specified in USE ~~paragraph~~Paragraph 1.~~B,~~A or points ~~identified~~included in the Commission approved Water Management Plan, subject to Permittee's accounting/delivery plan.

~~4.~~3. PRIORITY

The priority date for the rights authorized by this permit is October 15, 2004.

~~5.~~4. CONSERVATION

Permittee shall implement water conservation plans that provide for the utilization of those reasonable practices, techniques, and technologies that will reduce on a per unit basis the consumption of water, prevent or reduce the loss or waste of water, improve the efficiency in the use of water, increase the recycling and reuse of water, and prevent the

pollution of water, so that a water supply is made available for future or alternative uses. The practices, techniques, and technologies used shall be designed to achieve a level of efficiency of use that is equal to or greater than the level provided for in Permittee's most recent water conservation plans on file with the Commission as of the date of the issuance of this permit. Such plans shall include a requirement that in every wholesale water supply contract entered into on or after the date of this permit, including any contract extension or renewal, that each successive wholesale customer develop and implement conservation measures meeting the requirements of this provision. If the customer intends to resell the water, then the contract for resale of the water must have water conservation requirements so that each successive wholesale customer in the resale of the water is required to implement water conservation measures meeting the requirements of this provision.

~~6.~~5. SPECIAL CONDITIONS

A. SPECIAL CONDITIONS RELATIVE TO ~~REUSE WATER~~USE OF RETURN FLOWS

1) Prior to the diversion of return flows authorized by this permit, Permittee must submit to and have approved by the Executive Director, a ~~reuse~~return flow accounting plan. The ~~reuse~~return flow accounting plan must be in electronic format and account, by source, for all return flows discharged ~~and subsequently diverted~~. The ~~reuse~~return flow accounting plan ~~should~~shall include amounts discharged by outfall~~, amounts of return flows used by permits granted based on the presence of these return flows, and estimated travel times and conveyance losses from discharge point to diversion point(s). If the return flows will be stored in Permittee's reservoirs, the reuse accounting plan should include any evaporative losses associated with the storage.~~ and computation of the amount of additional firm yield at the anticipated diversion location attributable to those return flows, taking into account environmental flow requirements and demands of senior water rights. Permittee's use of return flows is limited to the amount shown to be available, based upon amounts discharged, by the return flows accounting plan. Permittee shall maintain the approved ~~reuse~~return flow accounting plan in electronic format and make it available to the general public during normal business hours and to the Executive Director upon request. Modifications or changes to the ~~reuse~~return flow accounting plan must be approved by the Executive Director. The ~~reuse~~return flow accounting plan shall be included as part of Permittee's accounting/delivery plan.

~~2) The right to divert discharged return flows from plants owned by the City of Granbury (TPDES Permit No. 10178002), Acton MUD (TPDES Permit Nos. 14211001 and 10178002), Bell County WCID #2 (TPDES Permit No. 11090001), City of Georgetown (TPDES Permit Nos. 10489002 and 10489003) and the City of Holland (TPDES Permit No. 10897001) is~~

~~limited to the amount of surface water based return flows discharged from those plants that originates from water rights owned by the Permittee. Permittee is not authorized to divert groundwater based return flows discharged from these plants, except as may be authorized by Special Condition 6.A.4. Permittee must include in the reuse accounting plan the total amount discharged from the plants and the percentage of that water that is divertable under this permit.~~

2) Permittee's storage, diversion and use of surface water based return flows is subject to interruption by direct use or indirect use within the discharging entity's corporate limits, extraterritorial jurisdiction, or contiguous water certificate of convenience and necessity boundary, provided the discharging entity has applied for and been granted authorization to reuse the return flows.

3) Permittee~~ is authorized to divert historically discharged~~'s storage, diversion and use of groundwater based return flows ~~from the Brazos River Authority/LCRA BCRWSS West (TPDES Permit No. 10264001)~~is subject to interruption by direct reuse or indirect reuse provided the discharging entity has applied for and been granted authorization for reuse of groundwater based return flows.

4) ~~Future discharges of groundwater based return flows may be diverted if those return flows originate from groundwater owned by Permittee or are discharged from treatment plants owned by the Permittee. Prior to diversion, Permittee must apply for and be granted an amendment to this permit authorizing these diversions and shall submit for approval by the Executive Director a revised accounting/delivery plan addressing such new groundwater based discharges.~~

~~5) Permittee is authorized to divert only that water discharged by the City of Marlin (TPDES Permit No. 10110002) originating from water rights owned by the Permittee. Permittee shall calculate the divertable amount of the City's discharge and include this information in the reuse accounting plan.~~

~~6) Permittee shall only divert the actual annual amount of return flows discharged from the Bell County WCID #1 (TPDES Permit Nos. 10351001 and 10351002) and the City of Harker Heights (TPDES Permit No. 10155001) less up to 172 acre feet as authorized by Permit 4218, 37 acre-feet as authorized by Permit 5088 and 60 acre-feet as authorized by Permit 5089 when the aforementioned permits are being used.~~

~~7) Diversions and storage of return flows shall not occur at rates or in amounts higher than the actual daily amount of return flows discharged~~

~~into watercourses in the Brazos River Basin, after accounting for the calculated losses and travel time from the discharge point(s) to the diversion point(s) in accordance with the accounting/delivery plan. 8)~~ Prior to diversion of the water authorized herein as attributable to return flows, if sufficiently accurate measuring devices are not available, Permittee shall install and maintain measuring device(s) capable of measuring within plus or minus 5% accuracy, at the discharge point of each wastewater treatment plant (WWTP) to record the amount of return flows discharged into the Brazos River or its tributaries on a daily basis.

~~9) The priority date for diversion of up to 116,434 acre feet (103.899 mgd) of return flows is October 15, 2004.~~

~~10) The priority date for diversion of future return flows in excess of 116,434 acre feet (103.899 mgd) of discharged effluent is October 15, 2004 but is not subject to call by senior and superior permit holders in the basin and is not subject to instream flow limitations.~~

~~11) Prior to diversion of any return flows in excess of the TPDES Permit limits for each facility indicated in the table Return Flows Available to the BRA (Paragraph 1.D. RETURN FLOWS), Permittee must apply for and be granted the right to reuse those return flows. Permittee must amend the reuse accounting plan to include future return flows prior to diverting said return flows.~~

~~12) The diversion of up to 116,434 acre feet (103.899 mgd) of water is dependant upon potentially interruptible return flows or discharges and is conditioned on the availability of those discharges. The right to divert the discharged return flows is subject to revocation if discharges become permanently unavailable for diversion and may be subject to reduction if the return flows are not available quantities and qualities sufficient to fully satisfy the permit. Should any discharges become permanently unavailable for diversion, Permittee shall immediately cease diversions of these return flows and reflect such reductions in the reuse accounting plan.~~

~~13) Permittee's diversion and use of return flows is subject to interruption by direct use or indirect use within the discharging entity's corporate limits, extraterritorial jurisdiction, or contiguous water certificate of convenience and necessity boundary, provided the discharging entity has applied for and been granted authorization to reuse the return flows.~~

B. SPECIAL CONDITIONS RELATIVE TO USE OF BED AND BANKS

1) The use of the bed and banks of Allens Creek below Allens Creek Reservoir is not authorized until Permittee applies for and is granted an amendment to Permit No. 2925A authorizing such use.

2) Permittee is authorized to use the following reaches, authorized in Permittee's certificates and amendments, for conveyance of water previously appropriated to Permittee and water authorized by this permit, downstream for diversion at Glen Rose, Highbank and the Gulf of Mexico and any of Permittee's currently authorized diversion points within these reaches:

a) Brazos River from below Possum Kingdom Reservoir to the Gulf of Mexico

b) Leon River from Lake Proctor to the confluence with the Little River

c) Lampasas River from Lake Stillhouse Hollow to the confluence with the Little River

d) Little River from the confluence of Leon and Lampasas Rivers to the junction with the Brazos River

e) Yegua Creek from Lake Somerville to the confluence with the Brazos River

f) Navasota River from Lake Limestone to the confluence with the Brazos River

g) San Gabriel River from Lake Granger to the confluence with the Little River and downstream to its confluence with the Brazos River

h) North Fork San Gabriel River from Lake Georgetown to the confluence with the San Gabriel River, to its confluence with the Little River and downstream to its confluence with the Brazos River

i) Aquilla Creek from Lake Aquilla downstream to its confluence with the Brazos River

j) Allens Creek, following construction of Allens Creek Reservoir, downstream from Allens Creek Reservoir to its confluence with the Brazos River, in compliance with Special Condition 5.B.1 above

3) Prior to use of the bed and banks identified in Special Condition ~~6.~~5.B.2 above, Permittee must submit to and have approved by the Executive Director, as part of its accounting/delivery plan, a procedure to estimate

~~daily~~ deliveries of water. This procedure should be in electronic format and detail by source, type and priority date, the amounts to be conveyed and delivered, losses associated with the conveyance, specific points of diversion, associated travel times, and times of commencement and termination of transit for conveyed waters. Documentation of actual deliveries as well as the accounting/delivery plan shall be maintained by the Permittee in electronic format and made available to the general public during normal business hours and to the Executive Director upon request. Modifications or changes to the accounting/delivery plan must be approved by the Executive Director.

4) The use of the bed and banks of ~~additional~~ streams and tributaries in the Brazos River Basin for conveyance of water appropriated under this permit, or other sources available to the Permittee, is subject to Permittee, after identifying specific sources and types of water, specific points of discharge and diversion, and conveyance and other losses, obtaining future authorizations to satisfy the requirements of TWC § ~~11.042.~~11.042, which may be provided pursuant to a Commission-approved Water Management Plan.

5) The use of additional points of diversion within the reaches specified in Special Condition ~~6.~~5.B.2 above is subject to Permittee~~,~~ obtaining authorization to use those diversion points. The points of diversion may also be identified and included in Permittee's proposed Water Management Plan which is subject to Commission approval.

C. SPECIAL CONDITIONS RELATIVE TO NEW APPROPRIATION

1) Prior to diversion or storage of the ~~additional~~ water authorized by this permit, Permittee shall provide to and have approved by the Executive Director, a daily accounting/delivery plan that includes, at a minimum, the following:

a. The accounting/delivery plan shall address reservoir storage and withdrawal plans for each system reservoir and account by priority date and amounts for any inflows, evaporation, water in storage and diversions from the reservoirs under all of Permittee's priority dates and authorizations, including ~~reuse~~use of return flows.

b. A method to account for inflows to system reservoirs for purposes of compliance with special conditions requiring passage of pulse flows and estimation of those inflows.

c. An accounting for instream flow and pulse requirements to include total system storage, gage flows at the measurement points, high flow pulse volume impounded, if any, and the release schedule for

the impounded high flow pulse, and timing, magnitude and duration of pulse flows.

d. The accounting/delivery plan must detail how measurements will be taken to determine if impoundment or diversions under either Permittee's senior or junior rights can be made.

e. The accounting/delivery plan must identify, account for and distinguish between firm and non-firm water supplied or delivered from Permittee's system of reservoirs. In addition, the accounting/delivery plan must specify diversion points for this water if those diversion points are not specifically identified in this permit. Any additional diversion points must be within the reaches where use of the bed and banks is authorized. Any diversion points outside those reaches will require an amendment to this permit.

f. Permittee shall maintain the approved daily accounting/delivery plan in electronic format and make it available to the general public during normal business hours and to the Executive Director upon request. Modifications or changes to the plan must be approved by the Executive Director.

2) If the total amounts of firm water indicated above are diverted at Glen Rose or Highbank, the additional amount of firm water available below those points is reduced accordingly. ~~Permittee shall include the amount of that reduction in the accounting/delivery plan~~The Water Management Plan shall include a specific mechanism for determination of the amount of firm and non-firm water available at a given location.

3) The full additional amount of non-firm water is only available when the amount of firm water is reduced by a maximum of 90,000 acre-feet per year at Glen Rose, Highbank, Richmond or the Gulf of Mexico. Because the amounts of firm and ~~the Gulf of Mexico. If less than the full amount of non-firm water is used, the amount of the firm water reduction shall be adjusted proportionately.~~

~~4) The non-firm water authorized above includes 74,387 acre-feet of historically discharged return flows. A reduction in firm yield water is not required in order to divert these return flows. 5) The remaining 42,047 acre-feet of return flows out of the total amount of 116,434 acre-feet of return flows indicated in Paragraph 1.D. may be diverted by the Permittee so long as the total diversions under this permit for all of the authorizations do not exceed the amounts of firm water and non-firm water indicated in Paragraph 1.A.1, above unless Permittee applies for and is granted the authorization to divert additional amounts of water.~~non-firm water available under this permit are inter-related and may depend upon

location and other factors, the Water Management Plan shall control the amounts of firm and non-firm water available at any location.

~~6~~4) Permittee may not exercise a priority call on water rights in the Brazos River Basin with priority dates senior to October 15, 2004 for purposes of increasing storage in and/or diversion from Permittee's system reservoirs where drawdown of Permittee's system reservoirs is caused by ~~compliance with the terms and conditions~~delivery of water authorized by this permit.

~~7~~5) The request for operational flexibility to use any source of water available to Permittee to satisfy the diversion requirements of senior water rights to the same extent that those water rights would have been satisfied by passing inflows through the Permittee's system reservoirs on a priority basis is granted, but limited as follows:

a~~)~~. To water previously stored in Permittee's reservoirs as documented in the accounting/delivery plan required in Special Condition ~~6.~~5.C.1 above.

b~~)~~. Use of this option shall not cause Permittee to be out of compliance with Special Condition ~~6.~~5.C.1 and Special Condition ~~6.~~5.C.~~6.~~4.

~~8~~6) Permittee may divert water from storage in its permitted reservoirs and store that water in Permittee's other reservoirs for use within the Permittee's service area so long as all diversions and storage are included in and comply with the provisions of the accounting/delivery plan ~~and of the accounting/delivery plan~~ required by Special Condition ~~6.~~5.C.1 above.

~~9) The total amount of water diverted and released from Permittee's system reservoirs in any year for each authorized purpose of use may not exceed the cumulative authorized total for each purpose until Permittee applies for and is granted amendments to the underlying authorizations.~~

~~10~~7) Permittee is required to comply with the existing System Operation Order and certificates of adjudication requiring Permittee to exclude tributary reservoirs from operation of the system during any period of time in which Permittee's permitted storage space in that reservoir is less than 30% full (until all system reservoirs are below 30% capacity, at which time the reservoir can resume system operation), until such time as Permittee submits, and the Commission approves, a Water Management Plan for the Brazos River Basin which details how such limitations will be altered. Any alterations to the limitations must be in compliance with the accounting provisions required in Special Condition ~~6.~~5.C.1 above.

~~11~~8) Until such time as the ports are closed on the dam impounding Allens Creek Reservoir, authorized by Permit ~~2925,~~No. 2925A, Permittee may impound and divert additional unappropriated water as specified in Paragraph 1.A.2 subject to Special Conditions ~~6.~~5.C.1 through ~~10~~7 above.

D. WATER MANAGEMENT PLAN SPECIAL CONDITIONS

1) Permittee shall prepare and submit to the Commission, a Water Management Plan (WMP) which shall include, in addition to the specific requirements listed below in Special Condition D.4, such studies and other information as may be required by the Commission to demonstrate Permittee's compliance with and its ability to comply with all of the Special Conditions included in this permit.

2) ~~The~~With the exception of minor revisions, the initial proceedings to consider the adoption of the WMP, and any major amendment thereof, shall be conducted pursuant to contested case procedures. Provided that the approved WMP describes the specific methodologies to be utilized, addition of diversion points within the authorization of this permit, modification of volumes of return flow to account for amendments or modifications of discharge permits or new discharge authorizations, modification of the accounting/delivery plan approved by the Executive Director, and similar modifications specifically identified in the WMP are to be treated as minor revisions of the WMP. Any proceeding to consider the adoption or ~~major~~ amendment of the WMP, other than a minor revision, shall be preceded by notice and opportunity to request a hearing, in accordance with the Commission's regulations applicable to water rights permitting proceedings. The WMP shall provide an adaptive management strategy for instream flow requirements and water supply and thus may be amended from time to time upon the request of Permittee, in accordance with the schedule set out in Special Condition D.3 below, or on the Commission's own motion. The initial accounting/delivery plan shall be submitted for approval as part of the initial WMP.

3) a. An initial application for approval of the WMP shall be submitted to the Executive Director by the Permittee not later than 3 years after the date that this permit becomes final and non-appealable. The initial application shall include a statement of consultation describing the steps taken by the Permittee to work collaboratively with interested persons, including the Texas Parks and Wildlife Department (TPWD), in developing the application and supporting materials. Permittee shall make best efforts to ensure that the application is administratively and technically complete within 1 year after the initial submission of the application to the Executive Director. Deadlines established by this provision are subject to extension by the Executive Director for good cause.

b. No less frequently than every 10 years after the approval of the initial WMP, Permittee shall submit to the Executive Director an application for revision or ratification of the WMP. Such revision may include minor and major amendments, as appropriate.

4) The issues addressed in the initial application for approval of the WMP and in the initial approved WMP shall include, but not be limited to, the following:

a. accounting/delivery plans (including the return flow accounting plan);

b. consideration of adding, deleting, or modifying the measurement points and flow levels described in special conditions 5.E.5 and 5.E.7;

c. consideration of establishing diversion rate trigger levels for high flow pulse (HFP) requirements of special condition 5.E.7, below which the requirements of Special Condition 5.E.7 would not apply;

d. establishment of a Brazos River Basin environmental flow study program identifying environmental flow studies to be conducted on specified reaches and estimated time of completion; such program shall include studies anticipated to be required for the FERC relicensing of the hydropower facility at Morris Sheppard Dam and such studies necessary to comply with Special Conditions 5.E.1 and 5.E.14; program studies shall be used to evaluate the need for instream flow protection for the mainstem Brazos River and tributaries impacted by diversions and storage authorized in this permit;

e. development of operating guidelines to manage the frequency and magnitude of reservoir level fluctuations to avoid or minimize impacts on fisheries (subject to temporary suspension if necessary for water supply purposes);

f. consideration of establishing maximum diversion rates for diversions of water appropriated by this permit;

g. development of operational and accounting criteria to address uncertainty in forecasting and accounting for HFPs in a manner that balances the risks and benefits between water supplies and environmental flow protection;

h. consideration of establishment of revised storage triggers provided for in Special Condition 5.E.4 and the process for recalculating those triggers;

i. consideration of alteration of the 30% capacity limitation on tributary reservoirs (referenced in Special Condition 5.C.7), to be followed by conforming amendments to existing water rights for System reservoirs, if necessary and approved;

j. development and implementation of a specific adaptive management strategy for meeting instream flow requirements consistent with providing water supplies, including a monitoring program for assessing impacts on instream uses, including short and long term impacts to economically and ecologically important stream fisheries and unique aquatic communities and species, and water quality;

k. establishment of a specific mechanism for determining the amount of firm and non-firm water available at a given location

5) Permittee shall consult with the U.S. Army Corps of Engineers on federal projects to determine whether overbanking flows can be safely managed to maintain a sound ecological environment. (Overbanking flows provide channel and floodplain maintenance, transport nutrients and organic materials, generate new floodplain habitat, provide cues to aquatic organisms, restore water quality in floodplain wetlands, promote seedling development, distribute seed, and purge invasive species.)

6) Prior to diversion of water appropriated by this permit below the Richmond Gage (USGS Gage No. 08114000) Permittee shall submit for the Executive Director's approval a method to extend the requirements of Special Conditions 5.E.5 and 5.E.7 below the Richmond Gage to or below the point of diversion.

7) TPWD shall have the right, following notification to Permittee, at any time, to petition the Commission to seek to amend or clarify any WMP provision related to environmental flow protection.

E. INTERIM SPECIAL CONDITIONS RELATIVE TO ENVIRONMENTAL FLOWS

1) Because the following interim conditions are preliminary and are based upon historic flow analyses, without direct relationships to the biological and environmental benefits intended to be protected, Permittee shall

conduct Instream Flow Studies (Studies) on the Brazos River and on segments of major tributaries upstream of their confluence with the Brazos River consistent with and in cooperation with the Texas Instream Flow Program (TIFP). Upon completion of the Studies, Permittee shall ~~submit an application to amend the WMP to reflect~~use the results of the ~~Instream Flow Studies.~~Studies to develop environmental flow conditions to replace the interim conditions with permit conditions for the control points identified in Special Condition 5.E.5. Depending upon the time of completion of the Studies, replacement of these interim conditions shall be approved in the initial WMP or through the amendment of an approved WMP. The Studies are not limited to the TIFP or the geographic scope of those currently defined for the TIFP. For the Middle and Lower Brazos River (mainstem downstream of Waco), TIFP studies are to be completed by 2016.

2) Seasons are defined as Spring (March–May), Summer (June-August), Fall (September-November), and Winter (December-February). The number of seasons and the months representing each season are subject to revision in the WMP based upon best available science and information at the time of such revision.

3) Total storage in Permittee's system reservoirs is a trigger for determining instream flow requirements and is subject to revision in future Water Management Plans. 7Q2 flows are to be implemented when total storage in Permittee's system reservoirs is below 60% of total capacity. "Dry" means times when the total storage in Permittee's system reservoirs is below 74%, but more than 60% of total capacity. "Average" means times when the total storage in Permittee's system reservoirs is at least 74%, but less than 96% of total capacity. "Wet" means times when the total storage in Permittee's system reservoirs is at least 96% of total capacity.

4) Storage triggers are to be recalculated every five years to ~~ensure implementation of~~promote Subsistence, Dry, Average, and Wet ~~provisions at frequencies of 2.5%, 25%, 50%, and 75%, respectively~~conditions occurring at the desired frequencies. The desired frequencies are Subsistence equal to 2.5% of the time, Dry equal to 22.5% of the time, Average equal to 50% of the time and Wet equal to 25% of the time.

5) Until such time as the Studies are completed, the interim instream flows in the following tables apply at the following USGS gauging stations. Measurement points for instream flows are subject to change in the WMP with approval of the Executive Director. The instream flow criteria in the following tables are applicable at all times. Depending upon the hydrologic condition (Subsistence, Dry, Average, or Wet), storage of

water authorized by this permit in Permittee's system reservoirs ~~upstream from the following flow gauging stations~~ and the diversion and use of water pursuant to this permit ~~at locations upstream from the flow gauging locations~~ shall be authorized only when streamflows exceed the instantaneous flow values at the station downstream of such diversion or storage, as established in the following tables:

Instream Flow (cfs)	BRAZOS RIVER NEAR GLEN ROSE - USGS #08091000			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	15.3	15.3	15.3	15.3
Dry	39.0	45.0	33.3	62.0
Average	92.0	138.0	101.5	150.0
Wet	234.0	292.8	249.5	332.0

Instream Flow (cfs)	YEGUA CREEK NEAR SOMERVILLE – USGS #08110000			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	0.1	0.1	0.1	0.1
Dry	5.6	3.9	0.4	0.3
Average	14.0	12.0	2.5	1.8
Wet	34.0	31.0	8.9	9.6

Instream Flow (cfs)	NAVASOTA RIVER NEAR EASTERLY USGS #08110500			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	7.6	7.6	7.6	7.6
Dry	7.6	10.0	7.6	7.6
Average	15.0	24.0	7.6	7.6
Wet	~~34.0~~36.0	43.0	7.6	7.6

Instream Flow (cfs)	LITTLE RIVER NEAR CAMERON – USGS #08106500			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	67.9	67.9	67.9	67.9
Dry	100.0	135.0	133.0	82.0
Average	200.0	365.0	260.5	152.0
Wet	475.0	730.0	500.0	342.0

Instream Flow (cfs)	BRAZOS RIVER NEAR HIGHBANK – USGS #08098290			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	167.1	167.1	167.1	167.1
Dry	167.1	167.1	167.1	167.1

Average	220.59	344.19	323.85	225.29
Wet	672.74	759.30	780.69	508.98

Instream Flow (cfs)	BRAZOS RIVER NEAR RICHMOND – USGS #08114000			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	743	743	743	743
Dry	885	1170	930	760
Average	1630	2030	1450	1150
Wet	2955	3670	2635	2038

6) A High Flow Pulse (HFP) is initiated when flows are greater than the 10th percentile and increase by more than 50% from the previous day, or when flows exceed the 75th percentile, regardless of the rate of change. A HFP is terminated when the flow drops below the 10th percentile or when the flow decreases from one day to the next by less than 5%, or when a succeeding pulse occurs. An entire ~~HPF~~HFP is ~~reclassified~~also classified as a small flood if the maximum rate exceeds the small flood threshold at the 1.5-year recurrence interval.

7) Pursuant to the provisions set forth below, Permittee shall meet a seasonal schedule of individual high flow pulses by refraining from storing or diverting water appropriated by this permit in order to provide qualifying HFPs as set forth below. Qualifying HFPs are defined as follows:

Pulse Flows (ac-ft)	BRAZOS RIVER NEAR GLEN ROSE - USGS #08091000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	2329.6	3208.3	2617.2	2211.6
Average	7325.0	14915.7	7265.5	7565.0
Wet	31220.8	36144.8	33064.5	28682.0

Peak Flows (cfs)	BRAZOS RIVER NEAR GLEN ROSE - USGS #08091000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	403	466	394	347
Average	1,120	2,070	1,320	1,040
Wet	4,945	5,265	4,370	3,525

Pulse Flow Schedule (days/# of events)	BRAZOS RIVER NEAR GLEN ROSE - USGS #08091000							
	Winter		Spring		Summer		Fall	
Hydrologic	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq

Condition								
Dry	6	2	4	3	4	2	4	2
Average	7	2	6	2	6	2	7	1
Wet	13	1	10	2	11	1	11	1

*Duration **Frequency

Pulse Flows (ac-ft)	YEGUA CREEK NEAR SOMERVILLE – USGS #08110000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	416.6	275.7	52.4	59.2
Average	1904.1	1225.8	239.2	372.9
Wet	8510.1	4331.3	845.2	3367.3

Peak Flows (cfs)	YEGUA CREEK NEAR SOMERVILLE – USGS #08110000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	69	51	13	10
Average	294	176	53	64
Wet	978	620	140	490

Pulse Flow Schedule (days/# of events)	YEGUA CREEK NEAR SOMERVILLE – USGS #08110000							
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq
Dry	5	2	5	2	4	2	5	1
Average	10	1	8	1	7	1	7	2
Wet	15	1	13	1	11	1	11	1

*Duration **Frequency

Pulse Flows (ac-ft)	NAVASOTA RIVER NEAR EASTERLY-USGS #08110500			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	439.3	748.3	195.9	77.1
Average	2142.1	2220.5	746.9	275.0
Wet	7927.9	8537.9	3399.7	2456.3

Peak Flows (cfs)	BRAZOS RIVER NEAR EASTERLY – USGS #08110500			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	76	124	33	11

Average	298	344	142	43
Wet	1,060	1,160	592	371

Pulse Flow Schedule (days/# of events)	NAVASOTA RIVER NEAR EASTERLY – USGS #08110500							
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq
Dry	5	2	5	3	5	2	4	2
Average	8	2	9	2	8	2	7	2
Wet	12	1	12	1	13	1	11	1

*Duration **Frequency

Pulse Flows (ac-ft)	LITTLE RIVER NEAR CAMERON – USGS #08106500			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	4194.4	5641.5	3563.3	3511.2
Average	9633.7	16251.6	9088.3	9183.5
Wet	29414.9	42034.7	25811.4	20494.2

Peak Flows (cfs)	LITTLE RIVER NEAR CAMERON – USGS #08106500			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	604	958	577	568
Average	1,600	2,545	1,875	1,630
Wet	5,190	6,405	3,665	3,723

Pulse Flow Schedule (days/# of events)	LITTLE RIVER NEAR CAMERON – USGS #08106500							
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq
Dry	5	1	4	2	4	2	4	2
Average	6	1	6	1	6	1	6	1
Wet	10	1	9	1	9	1	9	1

*Duration **Frequency

Pulse Flows (ac-ft)	BRAZOS RIVER AT HIGHBANK – USGS #08098290			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	5113.9	6040.7	4784.0	3652.4

Average	11647.1	14346.9	15135.1	11398.8
Wet	38514.1	38127.3	49810.6	39416.6

Peak Flows (cfs)	BRAZOS RIVER AT HIGHBANK – USGS #08098290			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	1471	1429	1116	714
Average	2576	2952	2566	2274
Wet	5225	6748	7703	5366

Pulse Flow Schedule (days/# of events)	BRAZOS RIVER AT HIGHBANK – USGS #08098290							
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq
Dry	3	1	3	3	3	3	3	2
Average	4	1	4	3	5	2	5	2
Wet	7	1	7	1	8	1	9	1

*Duration **Frequency

Pulse Flows (ac-ft)	BRAZOS RIVER NEAR RICHMOND – USGS #08114000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	36265.8	44667.8	38181.1	22457.9
Average	90287.6	101405.0	77176.9	56162.0
Wet	297550.4	270153.7	166115.7	146866.1

Peak Flows (cfs)	BRAZOS RIVER NEAR RICHMOND – USGS #08114000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	3,748	5,640	4,880	2,500
Average	9,670	10,200	8,830	7,730
Wet	19,500	19,150	15,300	13,175

Pulse Flow Schedule (days/# of	BRAZOS RIVER NEAR RICHMOND – USGS #08114000

events)								
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq
Dry	5	1	5	1	4	1	4	1
Average	~~6~~8	1	7	1	7	1	7	1
Wet	16	1	13	1	12	1	11	1

*Duration **Frequency

8) Except under Subsistence conditions, diversion or storage of water upstream from defined measurement points under the authority of this permit shall be authorized during a pulse when the volume, duration, and peak flow of the individual pulse exceeds the individual pulse criteria, or when the number of pulse events in that season exceeds the pulse frequency criteria. When a Qualifying HFP is passed or provided for at one of the six defined measurement points it may be used as credit for meeting one seasonal HFP frequency requirement at that measurement point.

9) For streamflow events that meet the requirements of Special Condition ~~6.~~5.E.5, Permittee may temporarily impound all flows in excess of the instream flow requirement. If the streamflow event provided a Qualifying HFP, flow may need to be passed downstream for environmental needs, subject to seasonal requirements in Special Condition ~~6.~~5.E.7 above. If it did not, then Permittee may retain the impounded water for water supply purposes. Once the required number of HFPs is met, Permittee may divert or impound all subsequent HFPs for use as water supply as long as instream flow requirements specified in Special Condition ~~6.~~5.E.5 are met.

10) For pulses that generate a volume in excess of 250% of the Qualifying HFP volume criterion, Permittee ~~must~~may provide two Qualifying HFPs with at least one week of instream flow, as required by Special Condition ~~6.~~5.E.5 above, between them. Similarly, for pulses in excess of 350% of the Qualifying HFP volume criterion, Permittee ~~must~~may provide three Qualifying HFPs with at least one week of instream flow between each pair. A similarly scaled requirement holds for larger pulses.

11) For streamflow events that meet the requirements of Special Condition ~~6.~~5.E.~~6.~~5, but do not meet the minimum requirements of a Qualifying HFP, Permittee may impound flows in excess of instream flow requirements and shall record the impounded volume in ~~their~~its accounting/delivery plan. At such time as the cumulative volume of streamflow events exceeds the volume of a Qualifying HFP, Permittee may release such a pulse to the environment. Such a release will result in a credit for a Qualifying HFP.

12) If the streamflow event is designated ~~a~~an HFP but ultimately does not meet the minimum requirements of a Qualifying HFP, the volume passed shall be recorded in the accounting/delivery plan. At such time as the cumulative volume of such pulses exceeds the volume of a Qualifying HFP, Permittee will be credited with one Qualifying HFP (even if the duration, peak flow, etc. characteristics were not met).

13) For streamflow events that meet the requirements of Special Condition 5.E.5, but do not meet the minimum requirements of a Qualifying HFP, Permittee may impound flows in excess of instream flow requirements and shall record the impounded volume in their accounting/delivery plan. At such time as the cumulative volume of streamflow events exceeds the volume of a Qualifying HFP, Permittee may release such a pulse to the environment. Such a release will result in a credit for a Qualifying HFP.

14) If the streamflow event is designated a HFP but ultimately does not meet the minimum requirements of a Qualifying HFP, the volume passed shall be recorded in the accounting/delivery plan. At such time as the cumulative volume of such pulses exceeds the volume of a Qualifying HFP, Permittee will be credited with one Qualifying HFP (even if the duration, peak flow, etc. characteristics were not met).

15) For purposes of determining satisfaction of Qualifying HFP criteria, each season is accounted for independently. There is no carry-over from season to season, either in regard to exceeding or not meeting HFP requirements. In the event there are seasons where the requisite number or volume of HFPs do not occur naturally, the Permittee is not obligated to meet the seasonal HFP requirements. In the event that a pulse extends across seasonal boundaries, it will be accounted in the season in which it ends.

~~14) All seasonal~~16) Seasonal HFP satisfy the requirements of a Qualifying HFP may be classified as both overbanking flows and ~~the water volume associated with these events shall not be used to meet HFP requirements~~an HFP.

~~15) Permittee may divert water at or downstream of USGS Gage No. 08114000, Brazos River near Richmond, without restriction during wet season pulses as defined in Special Conditions 6.E.7 when Permittee's diversion rate is less than 7,535 cfs, if Permittee also meets the applicable instream flow requirement in Special Condition 6.E.5.~~

~~16~~17) In addition to the measurement points and requirements specified in Special Conditions ~~6.~~5.E.5 and ~~6.~~5.E.7 above, Permittee is prohibited from diverting and storing water authorized by this permit upstream of the following gages unless streamflow at the following gages meets or exceeds the ~~7Q2 value as follows:~~ values as follows:

~~Gage Name~~	~~Gage #~~	~~7Q2 Value (cfs)~~
~~Brazos River near Palo Pinto~~	~~08089000~~	~~30.3~~
~~Aquilla Creek above Aquilla~~	~~08093360~~	~~0.1~~
~~Brazos River near Aquilla~~	~~08093100~~	~~30.7~~
~~Leon River near Belton~~	~~08102500~~	~~4.7~~
~~Lampasas River near Belton~~	~~08104100~~	~~4.8~~
~~N Fork San Gabriel River near Georgetown~~	~~08104700~~	~~1.5~~
~~San Gabriel River at Laneport~~	~~08105700~~	~~3.6~~

Gage Name	Gage #	7Q2 Value (cfs)
Brazos River near Palo Pinto	08089000	30.3
Aquilla Creek above Aquilla	08093360	0.1
Brazos River near Aquilla	08093100	30.7
Leon River near Belton	08102500	4.7
Leon River near Gatesville	08100500	
Lampasas River near Belton	08104100	4.8
N Fork San Gabriel River near Georgetown	08104700	1.5
San Gabriel River at Laneport	08105700	3.6

~~17) Permittee shall install and maintain a streamflow gage at Yegua Creek at Somerville.~~

18) Permittee, in cooperation with TPWD and in consultation with the commission, shall conduct Monitoring Studies to assess instream flow protection at the water

quality protection points identified in interim Special Condition 5.E.17. These Monitoring Studies will collect baseline data on the biology, habitat, water quality, hydrology, ecosystem health and other environmental factors of the stream segment between the water quality protection point and the immediate downstream matrix control point. If baseline data is sufficient to determine instream flow protection needs, and such criteria are determined to be necessary, such data shall be used to develop criteria to replace interim Special Condition 5.E.17. If additional study is warranted by the results of the Monitoring Studies, Instream Flow Studies shall be conducted to determine appropriate instream flow protection criteria for the water quality protection points; results of such Instream Flow Studies shall be used to develop criteria to replace interim Special Condition 5.E.17. Depending upon the time of completion of the Monitoring Studies or applicable Instream Flow Studies, replacement of interim Special Condition 5.E.17 shall be approved in the initial WMP or through the amendment of an approved WMP. In performing the studies and analyses required by this condition, Permittee shall perform and complete a Little River watershed study (included all points identified above within the Little River watershed) prior to filing its application for approval of the initial WMP; provided, however, if Permittee does not complete the Little River watershed study prior to filing its application for approval of the initial WMP, Permittee shall not divert or impound water under the authority of this permit in the Little River watershed until that study is completed and results considered in the next WMP revision.

~~18~~19) The requirements of these Special Conditions apply only to diversion and storage under the authority of this permit and do not address or limit diversion and storage of water authorized by other water rights held by Permittee.

~~19) These special conditions are~~20) This permit is subject to adjustment by the Commission ~~if the Commission determines, through an expedited public review process, that such adjustment is appropriate to achieve compliance with applicable environmental flow standards adopted~~ pursuant to Texas Water Code § ~~11.1471. Any adjustment shall be made in accordance with the provisions of Texas Water Code §~~ 11.147(e-1), and all modifications of environmental flow requirements are subject to the limitations of §11.147(e-1).

This permit is issued subject to all superior and senior water rights in the Brazos River Basin.

Permittee agrees to be bound by the terms, conditions and provisions contained herein and such agreement is a condition precedent to the granting of this permit.

All other matters requested in the application which are not specifically granted by this permit are denied.

This permit is issued subject to the Rules of the Texas Commission on Environmental Quality and to the right of continuing supervision of State water resources exercised by the Commission.

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For the Commission

ISSUED:

Document comparison done by DeltaView on Thursday, August 06, 2009 9:56:26 AM

Input:	
Document 1	file://H:/WP51/Doug/BRA/System Op Draft Permit revised 12.22.08.doc
Document 2	file://H:/WP51/Doug/BRA/System Op Draft Permit - BRA-TPWD clean (8.5.09).doc
Rendering set	Standard

Legend:	
Insertion	
~~Deletion~~	
~~Moved from~~	
Moved to	
Style change	
Format change	
~~Moved deletion~~	
Inserted cell	
Deleted cell	
Moved cell	
Split/Merged cell	
Padding cell	

Statistics:	
	Count
Insertions	219
Deletions	682
Moved from	3
Moved to	3
Style change	0
Format changed	0
Total changes	907

DRAFT-**BRA/TPWD**

WATER USE PERMIT

Permit No.	5851		TYPE §§ 11.121, 11.042 & 11.085
Owner:	Brazos River Authority	Address:	P.O. Box 7555 Waco, Texas 76714-7555
Filed:	October 15, 2004	Granted:	
Purpose:	Multiple-Use (Domestic, Municipal, Agricultural, Industrial, Mining, Recreation)	Counties:	Parmer, Castro, Swisher, Bailey, Lamb, Hale, Floyd, Cochran, Hockley, Archer, Lubbock, Crosby, Baylor, Dickens, King, Knox, Jack, Terry, Lynn, Mitchell, Chambers, Young, Garza, Throckmorton, Kent, Haskell, Stonewall, Parker, Palo Pinto, Dawson, Scurry, Borden, Fisher, Stephens, Jones, Shackelford, Johnson, Hood, Nolan, Erath, Eastland, Taylor, Callahan, Somervell, Hill, Comanche, Bosque, Brown, Freestone, Hamilton, McLennan, Limestone, Mills, Coryell, Leon, Falls, Lampasas, Robertson, Bell, Madison, Milam, Burnet, Brazos, Grimes, Williamson, Burleson, Travis, Lee, Washington, Bastrop, Waller, Harris, Austin, Colorado, Fort Bend, Galveston, Matagorda, Wharton, Fayette, and Brazoria
Watercourse:	Multiple Tributaries of the Brazos River and the Brazos River	Watershed:	Brazos River Basin; San Jacinto-Brazos Coastal Basin; and Brazos-Colorado Coastal Basin

WHEREAS, the Brazos River Authority, Applicant, owns the water rights and reservoirs authorized by Certificate of Adjudication (Certificate) No. 12-5155 (Possum Kingdom Lake), Certificate No. 12-5156 (Lake Granbury), Certificate No. 12-5165 (Lake Limestone), and Water

Use Permit 2925A (Allens Creek Reservoir in conjunction with the Texas Water Development Board and the City of Houston); and

WHEREAS, Applicant also owns the water rights and has contracts with the United States Army Corps of Engineers for storage authorized by Certificate No. 12-5157 (Lake Whitney), Certificate No. 12-5158 (Lake Aquilla), Certificate No. 12-5159 (Lake Proctor), Certificate No. 12-5160 (Lake Belton), Certificate No. 12-5161 (Lake Stillhouse Hollow), Certificate No. 12-5162 (Lake Georgetown), Certificate No. 12-5163 (Lake Granger), Certificate No. 12-5164 (Lake Somerville), and

WHEREAS, Applicant also owns the water rights authorized by Certificate Nos. 12-5166 and 12-5167, which authorize various uses of water within the Applicant's other certificates and permits; and

WHEREAS, Applicant is currently authorized, pursuant to the 1964 System Operation Order, as amended, to manage and operate its tributary reservoirs as elements of a system, coordinating releases and diversions from the tributary reservoirs with releases and diversions from the Applicant's main-stem reservoirs to minimize waste, and to conserve water in reservoirs in which the supply is short by making releases from tributary reservoirs in which the supply is more abundant; and

WHEREAS, Applicant has applied for a Water Use Permit to authorize:

- A new appropriation of state water in the amount of 421,449 acre-feet per year for multiple use purposes, including domestic, municipal, agricultural, industrial, mining, and other beneficial uses on a firm basis in the Brazos River Basin. The amount of this new appropriation of water includes the current and future return flows requested in this application. Applicant indicates that the entire amount of 421,449 acre-feet of water per year is available only if all of it is diverted at the mouth of the Brazos River, and can only be made available by the Applicant through the system operation of its water rights. To the extent water is diverted upstream, the remaining unappropriated water downstream is reduced and will itself vary depending upon the location of its diversion and use. Out of the 421,449 acre-feet per year of unappropriated water being requested, the maximum amount of unappropriated water that will be available if such water is diverted upstream at USGS gage No. 08091000 near Glen Rose, Texas is 150,538 acre-feet per year firm, and if such unappropriated water is diverted upstream at USGS gage No. 08098290 near Highbank, Texas, the maximum amount of unappropriated water that will be available at that location is 144,306 acre-feet per year firm.

- Diversion of the water authorized by this amendment, if granted, from: (i) the existing diversion points authorized by Applicant's existing water rights; (ii) the Brazos River at the USGS gage No. 08091000 near Glen Rose, Texas; (iii) the Brazos River at USGS gage No. 08098290 near Highbank, Texas; (iv) the Brazos

River at the Gulf of Mexico; and (v) at such other diversion points that may be identified and included in Applicant's proposed Water Management Plan which is subject to TCEQ's approval.

- Use of up to 90,000 acre-feet of water per year of its firm supply (part of the 421,449 acre-feet of firm water requested above) to produce, along with other unappropriated flows, an interruptible water supply of 670,000 acre-feet per year and the appropriation of that interruptible water supply. Applicant indicates that the entire amount of 1,001,449 acre-feet of water (331,449 acre-feet of firm water and 670,000 acre-feet of interruptible water) is available only if all of it is diverted at the mouth of the Brazos River, and can only be made available by the Applicant through the system operation of its water rights. To the extent water is diverted upstream, the remaining unappropriated water downstream is reduced and will itself vary depending on the location of its diversion and use. This new appropriation of water includes the current and future return flows requested in this application. Out of the 1,001,449 acre-feet of firm and interruptible water being requested, the maximum amount of firm and interruptible water that will be available if such water is diverted upstream at USGS Gage No. 08091000 near Glen Rose, Texas is 60,538 acre-feet of firm water per year and 157,000 acre-feet of interruptible water per year and if such water is diverted upstream at USGS Gage No. 08098290 near Highbank, Texas, the maximum amount of firm water is 54,306 acre-feet of water per year and 303,000 acre-feet of interruptible water per year.

- An exempt interbasin transfer authorization to transfer and use, on a firm and interruptible basis, such water in the adjoining San Jacinto-Brazos Coastal Basin and the Brazos-Colorado Coastal Basin, and to transfer such water to any county or municipality or the municipality's retail service area that is partially within the Brazos River Basin for use, on a firm and interruptible basis, in that part of the county or municipality and the municipality's retail service area not within the Brazos River Basin.

- An appropriation of current and future return flows (treated sewage effluent and brine bypass/return) to the extent that such return flows continue to be discharged or returned into the bed and banks of the Brazos River, its tributaries, and Applicant's reservoirs. Applicant indicates that such appropriation of return flows would be subject to interruption by direct reuse or indirect reuse within the discharging entity's city limits, extraterritorial jurisdiction, or contiguous water certificate of convenience and necessity boundary. Specified discharge points and amounts of water will be accounted for on a monthly basis as part of Applicant's Water Management Plan which is subject to TCEQ's approval.

- Operational flexibility to (1) use any source of water available to the Applicant to satisfy the diversion requirements of senior water rights to the same extent that those water rights would have been satisfied by passing inflows through the

Applicant's reservoirs on a priority basis; and (2) release, pump and transport water from any of the Applicant's reservoirs for subsequent storage, diversion and use throughout the Applicant's service area. (Applicant's "service area" includes all counties listed above.)

- Recognition that the System Operation Permit approved pursuant to this application will prevail over inconsistent provisions in the Applicant's existing water rights regarding system operation.

- Use of the bed and banks of the Brazos River, its tributaries and the Applicant's reservoirs for the conveyance, storage, and subsequent diversion of (i) water that the Applicant seeks to appropriate under this application; (ii) waters that are being conveyed via pipelines and subsequently discharged into the Brazos River, its tributaries or stored in the Applicant's reservoirs; (iii) surface water imported from areas located outside the Brazos River Basin for subsequent use; (iv) in-basin surface water and groundwater subject to the Applicant's control; (v) waters developed from future Applicant projects; and (vi) current and future reuse of surface and groundwater based effluent requested by this application. This bed and banks authorization is subject to Applicant, after identifying specific points of discharge and diversion and conveyance and other losses, obtaining future authorizations to satisfy the requirements of TWC § 11.042. Such points of discharge and diversion and conveyance and other losses may also be identified and included in Applicant's proposed Water Management Plan which is subject to TCEQ's approval.

WHEREAS, Applicant seeks authorization to divert and use treated effluent at multiple points in the Brazos River Basin; and

WHEREAS, until the construction of Allens Creek Reservoir is completed, Applicant requests that the System Operation Permit include special conditions which authorize:

- The Applicant to appropriate state water in the amount of 425,099 acre-feet per year for multiple use purposes, including domestic, municipal, agricultural, industrial, mining, and other beneficial uses on a firm basis in the Brazos River Basin. This amount includes the current and future return flows requested in this application. This amount is available if all of the water is diverted at the mouth of the Brazos River, and can only be made available by the Applicant through the system operation of its water rights. To the extent water is diverted upstream, the remaining unappropriated water downstream is reduced and will itself vary depending upon the location of its diversion and use. Out of the 425,099 acre-feet per year of unappropriated water being requested, the maximum amount of unappropriated water that will be available if such water is diverted upstream at USGS Gage 08091000 near Glen Rose, Texas is 150,538 acre-feet per year firm and if such unappropriated water is diverted upstream at USGS Gage 08098290

near Highbank, Texas the maximum amount of unappropriated water that will be available is, at that location, 175,306 acre-feet per year firm;

- The Applicant to use up to 90,000 acre-feet of water per year of its firm supply to produce, along with other unappropriated flows an interruptible water supply of 869,000 acre-feet per year. This amount includes the current and future return flows requested in this application. Applicant indicates that the entire amount of 1,204,099 acre-feet of water (335,099 acre-feet of firm water and 869,000 acre-feet of interruptible water) is only available if all of it is diverted at the mouth of the Brazos River, and can only be made available by the Applicant through the system operation of its water rights. To the extent water is diverted upstream, the remaining unappropriated water downstream is reduced and will itself vary depending upon the location of its diversion and use. Out of the 1,204,099 acre-feet of firm and interruptible water being requested, the maximum amount of firm and interruptible water that will be available if such water is diverted upstream at USGS Gage No. 08091000 near Glen Rose, Texas, will be 60,538 acre-feet of firm water per year and 190,000 acre-feet of interruptible water per year and if such water is diverted upstream at USGS Gage No. 08098290 near Highbank, Texas the maximum amount of firm water will be 85,306 acre-feet of water per year and 284,000 acre-feet of interruptible water per year; and

- Exempt interbasin transfer authorization to transfer and use, on a firm and interruptible basis, such water in the adjoining San Jacinto-Brazos Coastal Basin and the Brazos-Colorado Coastal Basin, and to transfer such water to any county or municipality or the municipality's retail service area that is partially within the Brazos River Basin for use, on a firm and interruptible basis, in that part of the county or municipality and the municipality's retail service area not within the Brazos River Basin.

WHEREAS, the Texas Commission on Environmental Quality (Commission) finds that jurisdiction over the application is established; and

WHEREAS, the Executive Director recommends that specific stream flow restrictions should be included in the permit to maintain the instream uses and water quality conditions of the Brazos River; and

WHEREAS, as additional factual and scientific information becomes available, it is anticipated that the interim special conditions in Paragraph 5.E below relative to environmental flows will be revised, through Commission approved revisions of the Water Management Plan, to better provide for the environmental instream flow needs of the Brazos River and its tributaries and to make the maximum amount of water available for beneficial use that is consistent with those needs, and

WHEREAS, the Executive Director recommends that in order to protect senior and superior water rights owners, special conditions should be included in the permit; and

WHEREAS, to avoid ambiguities between this system operation authorization and Applicant's previous system operation authorizations reflected by the System Operation Order and existing permits, the Executive Director recommends that this System Operation Permit be subject to all provisions included in the Commission's July 23, 1964 System Operation Order, as amended, except to the extent specifically provided otherwise by conditions in this permit regarding the total amount of water appropriated and available for storage, diversion and purposes of use, and as it may be modified in the future by Commission approval of a Water Management Plan for the Brazos River Basin; and

WHEREAS, the Commission has complied with the requirements of the Texas Water Code and Rules of the Texas Commission on Environmental Quality in issuing this permit;

NOW, THEREFORE, Water Use Permit No. 5851 is issued to the Brazos River Authority, subject to the following terms and conditions:

1. USE

A. NEW APPROPRIATION

1) Permittee is authorized to impound, divert, and use not to exceed the following volumes of unappropriated water per year for multiple uses (domestic, municipal, agricultural, industrial, and mining) within its service area subject to special conditions:

Recommended Amounts of New Appropriation

	Volume in acre-feet	
Location	**Firm Water**	**Non-firm Water**
Glen Rose	131,363	157,000
Highbank	144,306	303,000
Richmond	239,297	670,000
Gulf of Mexico	243,146	670,000

2) Until such time as the ports are closed on the dam impounding Allens Creek Reservoir, authorized by Permit No. 2925A, in lieu of Paragraph 1.A.1 Permittee may impound, divert, and use not to exceed the following volumes of unappropriated water per year, subject to special conditions:

Recommended Amounts of New Appropriation without Allens Creek

	Volume in acre-feet without Allens Creek Reservoir	
Location	**Firm Water**	**Non-firm Water**
Glen Rose	131,363	190,000
Highbank	175,306	284,000
Richmond	235,377	869,000

Gulf of Mexico	239,181	869,000

B. USE OF BED AND BANKS

Permittee is authorized to use the bed and banks of the Brazos River below Possum Kingdom Lake, its tributaries and Permittee's authorized reservoirs for the conveyance, storage, and subsequent diversion of the water authorized herein, subject to identification of specific losses and special conditions.

C. INTERBASIN TRANSFER

Permittee is hereby granted an exempt interbasin transfer authorization to transfer and use the water authorized herein in Permittee's service area in the adjoining San Jacinto-Brazos Coastal Basin and the Brazos-Colorado Coastal Basin and to transfer such water to any county or municipality or the municipality's retail service area that is partially within the Brazos River Basin for use on a firm and interruptible basis in that part of the county or municipality and the municipality's retail service area not within the Brazos River Basin.

D. RETURN FLOWS

1) Based upon anticipated discharges through 2060, Permittee is authorized to impound, divert and use return flows discharged into the Brazos River Basin, not to exceed the following additional volumes per year, attributable to return flows, for multiple uses (domestic, municipal, agriculture, industrial, mining) within its service area subject to special conditions:

Amount of Additional Appropriation from Return Flows,

Volume in acre-feet	
Location	**Firm Water**
Richmond	80,850
Gulf of Mexico	82,157

Amount of Additional Appropriation from Return Flows, without Allens Creek

Volume in acre-feet	
Location	**Firm Water**
Richmond	82,509
Gulf of Mexico	83,842

2) The priority date of diversion of return flows is October 15, 2004. The storage and diversion of return flows is subject to environmental flow requirements set out in Special Condition 5.E.

2. DIVERSION

Permittee is authorized to divert and use the water authorized by this permit as follows:

A. POINTS

1) At the diversion points authorized by Permittee's existing water rights.

2) At United States Geological Survey (USGS) Gage No. 08091000 near Glen Rose at Latitude 31.2589°N, Longitude 97.7022°W in Somervell County.

3) At USGS Gage No. 08098290 near Highbank at Latitude 31.1339°N, Longitude 96.8247°W in Falls County.

4) At the mouth of the Brazos River at the Gulf of Mexico at Latitude 28.8783°N, Longitude 95.379111°W in Brazoria County.

5) At diversion points included in Permittee's Commission-approved Water Management Plan, or as may be otherwise authorized in the future.

B. RATES

1) At the diversion rates authorized by the Certificates of Adjudication and Water Use Permits authorizing each of the reservoirs comprising the system operation as defined in this permit.

2) At unspecified rates at points specified in USE Paragraph 1.A or points included in the Commission approved Water Management Plan, subject to Permittee's accounting/delivery plan.

3. PRIORITY

The priority date for the rights authorized by this permit is October 15, 2004.

4. CONSERVATION

Permittee shall implement water conservation plans that provide for the utilization of those reasonable practices, techniques, and technologies that will reduce on a per unit basis the consumption of water, prevent or reduce the loss or waste of water, improve the efficiency in the use of water, increase the recycling and reuse of water, and prevent the pollution of water, so that a water supply is made available for future or alternative uses. The practices, techniques, and technologies used shall be designed to achieve a level of efficiency of use that is equal to or greater than the level provided for in Permittee's most

recent water conservation plans on file with the Commission as of the date of the issuance of this permit. Such plans shall include a requirement that in every wholesale water supply contract entered into on or after the date of this permit, including any contract extension or renewal, that each successive wholesale customer develop and implement conservation measures meeting the requirements of this provision. If the customer intends to resell the water, then the contract for resale of the water must have water conservation requirements so that each successive wholesale customer in the resale of the water is required to implement water conservation measures meeting the requirements of this provision.

5. SPECIAL CONDITIONS

A. SPECIAL CONDITIONS RELATIVE TO USE OF RETURN FLOWS

1) Prior to the diversion of return flows authorized by this permit, Permittee must submit to and have approved by the Executive Director, a return flow accounting plan. The return flow accounting plan must be in electronic format and account, by source, for all return flows discharged. The return flow accounting plan shall include amounts discharged by outfall and computation of the amount of additional firm yield at the anticipated diversion location attributable to those return flows, taking into account environmental flow requirements and demands of senior water rights. Permittee's use of return flows is limited to the amount shown to be available, based upon amounts discharged, by the return flows accounting plan. Permittee shall maintain the approved return flow accounting plan in electronic format and make it available to the general public during normal business hours and to the Executive Director upon request. Modifications or changes to the return flow accounting plan must be approved by the Executive Director. The return flow accounting plan shall be included as part of Permittee's accounting/delivery plan.

2) Permittee's storage, diversion and use of surface water based return flows is subject to interruption by direct use or indirect use within the discharging entity's corporate limits, extraterritorial jurisdiction, or contiguous water certificate of convenience and necessity boundary, provided the discharging entity has applied for and been granted authorization to reuse the return flows.

3) Permittee's storage, diversion and use of groundwater based return flows is subject to interruption by direct reuse or indirect reuse provided the discharging entity has applied for and been granted authorization for reuse of groundwater based return flows.

4) Prior to diversion of the water authorized herein as attributable to return flows, if sufficiently accurate measuring devices are not available, Permittee shall install and maintain measuring device(s) capable of measuring within plus or minus 5% accuracy, at the discharge point of

each wastewater treatment plant (WWTP) to record the amount of return flows discharged into the Brazos River or its tributaries on a daily basis.

B. SPECIAL CONDITIONS RELATIVE TO USE OF BED AND BANKS

1) The use of the bed and banks of Allens Creek below Allens Creek Reservoir is not authorized until Permittee applies for and is granted an amendment to Permit No. 2925A authorizing such use.

2) Permittee is authorized to use the following reaches, authorized in Permittee's certificates and amendments, for conveyance of water previously appropriated to Permittee and water authorized by this permit, downstream for diversion at Glen Rose, Highbank and the Gulf of Mexico and any of Permittee's currently authorized diversion points within these reaches:

a) Brazos River from below Possum Kingdom Reservoir to the Gulf of Mexico

b) Leon River from Lake Proctor to the confluence with the Little River

c) Lampasas River from Lake Stillhouse Hollow to the confluence with the Little River

d) Little River from the confluence of Leon and Lampasas Rivers to the junction with the Brazos River

e) Yegua Creek from Lake Somerville to the confluence with the Brazos River

f) Navasota River from Lake Limestone to the confluence with the Brazos River

g) San Gabriel River from Lake Granger to the confluence with the Little River and downstream to its confluence with the Brazos River

h) North Fork San Gabriel River from Lake Georgetown to the confluence with the San Gabriel River, to its confluence with the Little River and downstream to its confluence with the Brazos River

i) Aquilla Creek from Lake Aquilla downstream to its confluence with the Brazos River

j) Allens Creek, following construction of Allens Creek Reservoir, downstream from Allens Creek Reservoir to its confluence with the Brazos River, in compliance with Special Condition 5.B.1 above

3) Prior to use of the bed and banks identified in Special Condition 5.B.2 above, Permittee must submit to and have approved by the Executive Director, as part of its accounting/delivery plan, a procedure to estimate deliveries of water. This procedure should be in electronic format and detail by source, type and priority date, the amounts to be conveyed and delivered, losses associated with the conveyance, specific points of diversion, associated travel times, and times of commencement and termination of transit for conveyed waters. Documentation of actual deliveries as well as the accounting/delivery plan shall be maintained by the Permittee in electronic format and made available to the general public during normal business hours and to the Executive Director upon request. Modifications or changes to the accounting/delivery plan must be approved by the Executive Director.

4) The use of the bed and banks of streams and tributaries in the Brazos River Basin for conveyance of water appropriated under this permit, or other sources available to the Permittee, is subject to Permittee, after identifying specific sources and types of water, specific points of discharge and diversion, and conveyance and other losses, obtaining future authorizations to satisfy the requirements of TWC § 11.042, which may be provided pursuant to a Commission-approved Water Management Plan.

5) The use of additional points of diversion within the reaches specified in Special Condition 5.B.2 above is subject to Permittee obtaining authorization to use those diversion points. The points of diversion may also be identified and included in Permittee's proposed Water Management Plan which is subject to Commission approval.

C. SPECIAL CONDITIONS RELATIVE TO NEW APPROPRIATION

1) Prior to diversion or storage of the water authorized by this permit, Permittee shall provide to and have approved by the Executive Director, a daily accounting/delivery plan that includes, at a minimum, the following:

a. The accounting/delivery plan shall address reservoir storage and withdrawal plans for each system reservoir and account by priority date and amounts for any inflows, evaporation, water in storage and diversions from the reservoirs under all of Permittee's priority dates and authorizations, including use of return flows.

b. A method to account for inflows to system reservoirs for purposes of compliance with special conditions requiring passage of pulse flows and estimation of those inflows.

c. An accounting for instream flow and pulse requirements to include total system storage, gage flows at the measurement points, high flow pulse volume impounded, if any, and the release schedule for the impounded high flow pulse, and timing, magnitude and duration of pulse flows.

d. The accounting/delivery plan must detail how measurements will be taken to determine if impoundment or diversions under either Permittee's senior or junior rights can be made.

e. The accounting/delivery plan must identify, account for and distinguish between firm and non-firm water supplied or delivered from Permittee's system of reservoirs. In addition, the accounting/delivery plan must specify diversion points for this water if those diversion points are not specifically identified in this permit. Any additional diversion points must be within the reaches where use of the bed and banks is authorized. Any diversion points outside those reaches will require an amendment to this permit.

f. Permittee shall maintain the approved daily accounting/delivery plan in electronic format and make it available to the general public during normal business hours and to the Executive Director upon request. Modifications or changes to the plan must be approved by the Executive Director.

2) If the total amounts of firm water indicated above are diverted at Glen Rose or Highbank, the additional amount of firm water available below those points is reduced accordingly. The Water Management Plan shall include a specific mechanism for determination of the amount of firm and non-firm water available at a given location.

3) The full additional amount of non-firm water is only available when the amount of firm water is reduced by a maximum of 90,000 acre-feet per year at Glen Rose, Highbank, Richmond or the Gulf of Mexico. Because the amounts of firm and non-firm water available under this permit are inter-related and may depend upon location and other factors, the Water Management Plan shall control the amounts of firm and non-firm water available at any location.

4) Permittee may not exercise a priority call on water rights in the Brazos River Basin with priority dates senior to October 15, 2004 for purposes of increasing storage in and/or diversion from Permittee's system reservoirs

where drawdown of Permittee's system reservoirs is caused by delivery of water authorized by this permit.

5) The request for operational flexibility to use any source of water available to Permittee to satisfy the diversion requirements of senior water rights to the same extent that those water rights would have been satisfied by passing inflows through the Permittee's system reservoirs on a priority basis is granted, but limited as follows:

   a. To water previously stored in Permittee's reservoirs as documented in the accounting/delivery plan required in Special Condition 5.C.1 above.

   b. Use of this option shall not cause Permittee to be out of compliance with Special Condition 5.C.1 and Special Condition 5.C.4.

6) Permittee may divert water from storage in its permitted reservoirs and store that water in Permittee's other reservoirs for use within the Permittee's service area so long as all diversions and storage are included in and comply with the provisions of the accounting/delivery plan required by Special Condition 5.C.1 above.

7) Permittee is required to comply with the existing System Operation Order and certificates of adjudication requiring Permittee to exclude tributary reservoirs from operation of the system during any period of time in which Permittee's permitted storage space in that reservoir is less than 30% full (until all system reservoirs are below 30% capacity, at which time the reservoir can resume system operation), until such time as Permittee submits, and the Commission approves, a Water Management Plan for the Brazos River Basin which details how such limitations will be altered. Any alterations to the limitations must be in compliance with the accounting provisions required in Special Condition 5.C.1 above.

8) Until such time as the ports are closed on the dam impounding Allens Creek Reservoir, authorized by Permit No. 2925A, Permittee may impound and divert additional unappropriated water as specified in Paragraph 1.A.2 subject to Special Conditions 5.C.1 through 7 above.

D. WATER MANAGEMENT PLAN SPECIAL CONDITIONS

1) Permittee shall prepare and submit to the Commission, a Water Management Plan (WMP) which shall include, in addition to the specific requirements listed below in Special Condition D.4, such studies and other information as may be required by the Commission to demonstrate

Permittee's compliance with and its ability to comply with all of the Special Conditions included in this permit.

2) With the exception of minor revisions, the initial proceedings to consider the adoption of the WMP, and any major amendment thereof, shall be conducted pursuant to contested case procedures. Provided that the approved WMP describes the specific methodologies to be utilized, addition of diversion points within the authorization of this permit, modification of volumes of return flow to account for amendments or modifications of discharge permits or new discharge authorizations, modification of the accounting/delivery plan approved by the Executive Director, and similar modifications specifically identified in the WMP are to be treated as minor revisions of the WMP. Any proceeding to consider the adoption or amendment of the WMP, other than a minor revision, shall be preceded by notice and opportunity to request a hearing, in accordance with the Commission's regulations applicable to water rights permitting proceedings. The WMP shall provide an adaptive management strategy for instream flow requirements and water supply and thus may be amended from time to time upon the request of Permittee, in accordance with the schedule set out in Special Condition D.3 below, or on the Commission's own motion. The initial accounting/delivery plan shall be submitted for approval as part of the initial WMP.

3) a. An initial application for approval of the WMP shall be submitted to the Executive Director by the Permittee not later than 3 years after the date that this permit becomes final and non-appealable. The initial application shall include a statement of consultation describing the steps taken by the Permittee to work collaboratively with interested persons, including the Texas Parks and Wildlife Department (TPWD), in developing the application and supporting materials. Permittee shall make best efforts to ensure that the application is administratively and technically complete within 1 year after the initial submission of the application to the Executive Director. Deadlines established by this provision are subject to extension by the Executive Director for good cause.

b. No less frequently than every 10 years after the approval of the initial WMP, Permittee shall submit to the Executive Director an application for revision or ratification of the WMP. Such revision may include minor and major amendments, as appropriate.

4) The issues addressed in the initial application for approval of the WMP and in the initial approved WMP shall include, but not be limited to, the following:

a. accounting/delivery plans (including the return flow accounting plan);

b. consideration of adding, deleting, or modifying the measurement points and flow levels described in special conditions 5.E.5 and 5.E.7;

c. consideration of establishing diversion rate trigger levels for high flow pulse (HFP) requirements of special condition 5.E.7, below which the requirements of Special Condition 5.E.7 would not apply;

d. establishment of a Brazos River Basin environmental flow study program identifying environmental flow studies to be conducted on specified reaches and estimated time of completion; such program shall include studies anticipated to be required for the FERC relicensing of the hydropower facility at Morris Sheppard Dam and such studies necessary to comply with Special Conditions 5.E.1 and 5.E.14; program studies shall be used to evaluate the need for instream flow protection for the mainstem Brazos River and tributaries impacted by diversions and storage authorized in this permit;

e. development of operating guidelines to manage the frequency and magnitude of reservoir level fluctuations to avoid or minimize impacts on fisheries (subject to temporary suspension if necessary for water supply purposes);

f. consideration of establishing maximum diversion rates for diversions of water appropriated by this permit;

g. development of operational and accounting criteria to address uncertainty in forecasting and accounting for HFPs in a manner that balances the risks and benefits between water supplies and environmental flow protection;

h. consideration of establishment of revised storage triggers provided for in Special Condition 5.E.4 and the process for recalculating those triggers;

i. consideration of alteration of the 30% capacity limitation on tributary reservoirs (referenced in Special Condition 5.C.7), to be followed by conforming amendments to existing water rights for System reservoirs, if necessary and approved;

j. development and implementation of a specific adaptive management strategy for meeting instream flow requirements consistent with providing water supplies, including a monitoring program for assessing impacts on instream uses, including short and long term impacts to economically and ecologically important stream fisheries and unique aquatic communities and species, and water quality;

k. establishment of a specific mechanism for determining the amount of firm and non-firm water available at a given location

5) Permittee shall consult with the U.S. Army Corps of Engineers on federal projects to determine whether overbanking flows can be safely managed to maintain a sound ecological environment. (Overbanking flows provide channel and floodplain maintenance, transport nutrients and organic materials, generate new floodplain habitat, provide cues to aquatic organisms, restore water quality in floodplain wetlands, promote seedling development, distribute seed, and purge invasive species.)

6) Prior to diversion of water appropriated by this permit below the Richmond Gage (USGS Gage No. 08114000) Permittee shall submit for the Executive Director's approval a method to extend the requirements of Special Conditions 5.E.5 and 5.E.7 below the Richmond Gage to or below the point of diversion.

7) TPWD shall have the right, following notification to Permittee, at any time, to petition the Commission to seek to amend or clarify any WMP provision related to environmental flow protection.

E. INTERIM SPECIAL CONDITIONS RELATIVE TO ENVIRONMENTAL FLOWS

1) Because the following interim conditions are preliminary and are based upon historic flow analyses, without direct relationships to the biological and environmental benefits intended to be protected, Permittee shall conduct Instream Flow Studies (Studies) on the Brazos River and on segments of major tributaries upstream of their confluence with the Brazos River consistent with and in cooperation with the Texas Instream Flow Program (TIFP). Upon completion of the Studies, Permittee shall use the results of the Studies to develop environmental flow conditions to replace the interim conditions with permit conditions for the control points identified in Special Condition 5.E.5. Depending upon the time of completion of the Studies, replacement of these interim conditions shall be approved in the initial WMP or through the amendment of an approved WMP. The Studies are not limited to the TIFP or the

geographic scope of those currently defined for the TIFP. For the Middle and Lower Brazos River (mainstem downstream of Waco), TIFP studies are to be completed by 2016.

2) Seasons are defined as Spring (March–May), Summer (June-August), Fall (September-November), and Winter (December-February). The number of seasons and the months representing each season are subject to revision in the WMP based upon best available science and information at the time of such revision.

3) Total storage in Permittee's system reservoirs is a trigger for determining instream flow requirements and is subject to revision in future Water Management Plans. 7Q2 flows are to be implemented when total storage in Permittee's system reservoirs is below 60% of total capacity. "Dry" means times when the total storage in Permittee's system reservoirs is below 74%, but more than 60% of total capacity. "Average" means times when the total storage in Permittee's system reservoirs is at least 74%, but less than 96% of total capacity. "Wet" means times when the total storage in Permittee's system reservoirs is at least 96% of total capacity.

4) Storage triggers are to be recalculated every five years to promote Subsistence, Dry, Average, and Wet conditions occurring at the desired frequencies. The desired frequencies are Subsistence equal to 2.5% of the time, Dry equal to 22.5% of the time, Average equal to 50% of the time and Wet equal to 25% of the time.

5) Until such time as the Studies are completed, the interim instream flows in the following tables apply at the following USGS gauging stations. Measurement points for instream flows are subject to change in the WMP with approval of the Executive Director. The instream flow criteria in the following tables are applicable at all times. Depending upon the hydrologic condition (Subsistence, Dry, Average, or Wet), storage of water authorized by this permit in Permittee's system reservoirs and the diversion and use of water pursuant to this permit shall be authorized only when streamflows exceed the instantaneous flow values at the station downstream of such diversion or storage, as established in the following tables:

Instream Flow (cfs)	BRAZOS RIVER NEAR GLEN ROSE - USGS #08091000			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	15.3	15.3	15.3	15.3
Dry	39.0	45.0	33.3	62.0
Average	92.0	138.0	101.5	150.0
Wet	234.0	292.8	249.5	332.0

Instream Flow (cfs)	YEGUA CREEK NEAR SOMERVILLE – USGS #08110000			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	0.1	0.1	0.1	0.1
Dry	5.6	3.9	0.4	0.3
Average	14.0	12.0	2.5	1.8
Wet	34.0	31.0	8.9	9.6

Instream Flow (cfs)	NAVASOTA RIVER NEAR EASTERLY USGS #08110500			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	7.6	7.6	7.6	7.6
Dry	7.6	10.0	7.6	7.6
Average	15.0	24.0	7.6	7.6
Wet	36.0	43.0	7.6	7.6

Instream Flow (cfs)	LITTLE RIVER NEAR CAMERON – USGS #08106500			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	67.9	67.9	67.9	67.9
Dry	100.0	135.0	133.0	82.0
Average	200.0	365.0	260.5	152.0
Wet	475.0	730.0	500.0	342.0

Instream Flow (cfs)	BRAZOS RIVER NEAR HIGHBANK – USGS #08098290			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	167.1	167.1	167.1	167.1
Dry	167.1	167.1	167.1	167.1
Average	220.59	344.19	323.85	225.29
Wet	672.74	759.30	780.69	508.98

Instream Flow (cfs)	BRAZOS RIVER NEAR RICHMOND – USGS #08114000			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	743	743	743	743
Dry	885	1170	930	760
Average	1630	2030	1450	1150
Wet	2955	3670	2635	2038

6) A High Flow Pulse (HFP) is initiated when flows are greater than the 10th percentile and increase by more than 50% from the previous day, or when flows

exceed the 75th percentile, regardless of the rate of change. A HFP is terminated when the flow drops below the 10th percentile or when the flow decreases from one day to the next by less than 5%, or when a succeeding pulse occurs. An entire HFP is also classified as a small flood if the maximum rate exceeds the small flood threshold at the 1.5-year recurrence interval.

7) Pursuant to the provisions set forth below, Permittee shall meet a seasonal schedule of individual high flow pulses by refraining from storing or diverting water appropriated by this permit in order to provide qualifying HFPs as set forth below. Qualifying HFPs are defined as follows:

Pulse Flows (ac-ft)	BRAZOS RIVER NEAR GLEN ROSE - USGS #08091000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	2329.6	3208.3	2617.2	2211.6
Average	7325.0	14915.7	7265.5	7565.0
Wet	31220.8	36144.8	33064.5	28682.0

Peak Flows (cfs)	BRAZOS RIVER NEAR GLEN ROSE - USGS #08091000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	403	466	394	347
Average	1,120	2,070	1,320	1,040
Wet	4,945	5,265	4,370	3,525

Pulse Flow Schedule (days/# of events)	BRAZOS RIVER NEAR GLEN ROSE - USGS #08091000							
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq
Dry	6	2	4	3	4	2	4	2
Average	7	2	6	2	6	2	7	1
Wet	13	1	10	2	11	1	11	1

*Duration **Frequency

Pulse Flows (ac-ft)	YEGUA CREEK NEAR SOMERVILLE – USGS #08110000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	416.6	275.7	52.4	59.2
Average	1904.1	1225.8	239.2	372.9
Wet	8510.1	4331.3	845.2	3367.3

Peak Flows (cfs)	YEGUA CREEK NEAR SOMERVILLE – USGS #08110000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	69	51	13	10
Average	294	176	53	64
Wet	978	620	140	490

Pulse Flow Schedule (days/# of events)	YEGUA CREEK NEAR SOMERVILLE – USGS #08110000							
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq
Dry	5	2	5	2	4	2	5	1
Average	10	1	8	1	7	1	7	2
Wet	15	1	13	1	11	1	11	1

*Duration **Frequency

Pulse Flows (ac-ft)	NAVASOTA RIVER NEAR EASTERLY-USGS #08110500			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	439.3	748.3	195.9	77.1
Average	2142.1	2220.5	746.9	275.0
Wet	7927.9	8537.9	3399.7	2456.3

Peak Flows (cfs)	BRAZOS RIVER NEAR EASTERLY – USGS #08110500			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	76	124	33	11
Average	298	344	142	43
Wet	1,060	1,160	592	371

Pulse Flow Schedule (days/# of events)	NAVASOTA RIVER NEAR EASTERLY – USGS #08110500							
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq
Dry	5	2	5	3	5	2	4	2
Average	8	2	9	2	8	2	7	2
Wet	12	1	12	1	13	1	11	1

*Duration **Frequency

Pulse Flows (ac-ft)	LITTLE RIVER NEAR CAMERON – USGS #08106500			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	4194.4	5641.5	3563.3	3511.2
Average	9633.7	16251.6	9088.3	9183.5
Wet	29414.9	42034.7	25811.4	20494.2

Peak Flows (cfs)	LITTLE RIVER NEAR CAMERON – USGS #08106500			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	604	958	577	568
Average	1,600	2,545	1,875	1,630
Wet	5,190	6,405	3,665	3,723

Pulse Flow Schedule (days/# of events)	LITTLE RIVER NEAR CAMERON – USGS #08106500							
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq
Dry	5	1	4	2	4	2	4	2
Average	6	1	6	1	6	1	6	1
Wet	10	1	9	1	9	1	9	1

*Duration **Frequency

Pulse Flows (ac-ft)	BRAZOS RIVER AT HIGHBANK – USGS #08098290			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	5113.9	6040.7	4784.0	3652.4
Average	11647.1	14346.9	15135.1	11398.8
Wet	38514.1	38127.3	49810.6	39416.6

Peak Flows (cfs)	BRAZOS RIVER AT HIGHBANK – USGS #08098290			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	1471	1429	1116	714
Average	2576	2952	2566	2274
Wet	5225	6748	7703	5366

Pulse Flow Schedule (days/# of events)	BRAZOS RIVER AT HIGHBANK – USGS #08098290							
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq
Dry	3	1	3	3	3	3	3	2
Average	4	1	4	3	5	2	5	2
Wet	7	1	7	1	8	1	9	1

*Duration **Frequency

Pulse Flows (ac-ft)	BRAZOS RIVER NEAR RICHMOND – USGS #08114000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	36265.8	44667.8	38181.1	22457.9
Average	90287.6	101405.0	77176.9	56162.0
Wet	297550.4	270153.7	166115.7	146866.1

Peak Flows (cfs)	BRAZOS RIVER NEAR RICHMOND – USGS #08114000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	3,748	5,640	4,880	2,500
Average	9,670	10,200	8,830	7,730
Wet	19,500	19,150	15,300	13,175

Pulse Flow Schedule (days/# of events)	BRAZOS RIVER NEAR RICHMOND – USGS #08114000							
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq
Dry	5	1	5	1	4	1	4	1
Average	8	1	7	1	7	1	7	1
Wet	16	1	13	1	12	1	11	1

*Duration **Frequency

8) Except under Subsistence conditions, diversion or storage of water upstream from defined measurement points under the authority of this permit shall be authorized during a pulse when the volume, duration, and peak flow of the individual pulse exceeds the individual pulse criteria, or when the number of pulse events in that season exceeds the pulse frequency criteria. When a

Qualifying HFP is passed or provided for at one of the six defined measurement points it may be used as credit for meeting one seasonal HFP frequency requirement at that measurement point.

9) For streamflow events that meet the requirements of Special Condition 5.E.5, Permittee may temporarily impound all flows in excess of the instream flow requirement. If the streamflow event provided a Qualifying HFP, flow may need to be passed downstream for environmental needs, subject to seasonal requirements in Special Condition 5.E.7 above. If it did not, then Permittee may retain the impounded water for water supply purposes. Once the required number of HFPs is met, Permittee may divert or impound all subsequent HFPs for use as water supply as long as instream flow requirements specified in Special Condition 5.E.5 are met.

10) For pulses that generate a volume in excess of 250% of the Qualifying HFP volume criterion, Permittee may provide two Qualifying HFPs with at least one week of instream flow, as required by Special Condition 5.E.5 above, between them. Similarly, for pulses in excess of 350% of the Qualifying HFP volume criterion, Permittee may provide three Qualifying HFPs with at least one week of instream flow between each pair. A similarly scaled requirement holds for larger pulses.

11) For streamflow events that meet the requirements of Special Condition 5.E.5, but do not meet the minimum requirements of a Qualifying HFP, Permittee may impound flows in excess of instream flow requirements and shall record the impounded volume in its accounting/delivery plan. At such time as the cumulative volume of streamflow events exceeds the volume of a Qualifying HFP, Permittee may release such a pulse to the environment. Such a release will result in a credit for a Qualifying HFP.

12) If the streamflow event is designated an HFP but ultimately does not meet the minimum requirements of a Qualifying HFP, the volume passed shall be recorded in the accounting/delivery plan. At such time as the cumulative volume of such pulses exceeds the volume of a Qualifying HFP, Permittee will be credited with one Qualifying HFP (even if the duration, peak flow, etc. characteristics were not met).

13) For streamflow events that meet the requirements of Special Condition 5.E.5, but do not meet the minimum requirements of a Qualifying HFP, Permittee may impound flows in excess of instream flow requirements and shall record the impounded volume in their accounting/delivery plan. At such time as the cumulative volume of streamflow events exceeds the volume of a Qualifying HFP, Permittee may release such a pulse to the environment. Such a release will result in a credit for a Qualifying HFP.

14) If the streamflow event is designated a HFP but ultimately does not meet the minimum requirements of a Qualifying HFP, the volume passed shall be recorded in the accounting/delivery plan. At such time as the cumulative volume of such pulses exceeds the volume of a Qualifying HFP, Permittee will be credited with one Qualifying HFP (even if the duration, peak flow, etc. characteristics were not met).

15) For purposes of determining satisfaction of Qualifying HFP criteria, each season is accounted for independently. There is no carry-over from season to season, either in regard to exceeding or not meeting HFP requirements. In the event there are seasons where the requisite number or volume of HFPs do not occur naturally, the Permittee is not obligated to meet the seasonal HFP requirements. In the event that a pulse extends across seasonal boundaries, it will be accounted in the season in which it ends.

16) Seasonal HFP requirements are to be met using streamflow events with peak flows less than the 1.5-year return interval; however, streamflow events with both peak flows that exceed the 1.5-year return interval and satisfy the requirements of a Qualifying HFP may be classified as both overbanking flows and an HFP.

17) In addition to the measurement points and requirements specified in Special Conditions 5.E.5 and 5.E.7 above, Permittee is prohibited from diverting and storing water authorized by this permit upstream of the following gages unless streamflow at the following gages meets or exceeds the values as follows:

Gage Name	Gage #	7Q2 Value (cfs)
Brazos River near Palo Pinto	08089000	30.3
Aquilla Creek above Aquilla	08093360	0.1
Brazos River near Aquilla	08093100	30.7
Leon River near Belton	08102500	4.7
Leon River near Gatesville	08100500	
Lampasas River near Belton	08104100	4.8
N Fork San Gabriel River near Georgetown	08104700	1.5
San Gabriel River at Laneport	08105700	3.6

18) Permittee, in cooperation with TPWD and in consultation with the commission, shall conduct Monitoring Studies to assess instream flow protection at the water quality protection points identified in interim Special Condition 5.E.17. These Monitoring Studies will collect baseline data on the biology, habitat, water quality, hydrology, ecosystem health and other environmental factors of the stream segment between the water quality protection point and the immediate downstream matrix control point. If baseline data is sufficient to determine instream flow protection needs, and such criteria are determined to be necessary,

such data shall be used to develop criteria to replace interim Special Condition 5.E.17. If additional study is warranted by the results of the Monitoring Studies, Instream Flow Studies shall be conducted to determine appropriate instream flow protection criteria for the water quality protection points; results of such Instream Flow Studies shall be used to develop criteria to replace interim Special Condition 5.E.17. Depending upon the time of completion of the Monitoring Studies or applicable Instream Flow Studies, replacement of interim Special Condition 5.E.17 shall be approved in the initial WMP or through the amendment of an approved WMP. In performing the studies and analyses required by this condition, Permittee shall perform and complete a Little River watershed study (included all points identified above within the Little River watershed) prior to filing its application for approval of the initial WMP; provided, however, if Permittee does not complete the Little River watershed study prior to filing its application for approval of the initial WMP, Permittee shall not divert or impound water under the authority of this permit in the Little River watershed until that study is completed and results considered in the next WMP revision.

19) The requirements of these Special Conditions apply only to diversion and storage under the authority of this permit and do not address or limit diversion and storage of water authorized by other water rights held by Permittee.

20) This permit is subject to adjustment by the Commission pursuant to Texas Water Code §11.147(e-1), and all modifications of environmental flow requirements are subject to the limitations of §11.147(e-1).

This permit is issued subject to all superior and senior water rights in the Brazos River Basin.

Permittee agrees to be bound by the terms, conditions and provisions contained herein and such agreement is a condition precedent to the granting of this permit.

All other matters requested in the application which are not specifically granted by this permit are denied.

This permit is issued subject to the Rules of the Texas Commission on Environmental Quality and to the right of continuing supervision of State water resources exercised by the Commission.

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For the Commission

ISSUED:

CD SUBMITTED SEPARATELY

Bickerstaff Heath Delgado Acosta LLP

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May 20, 2010

Robin Smith MC 173
Staff Attorney for the Executive Director
Environmental Law Division
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087

RE: Brazos River Authority Application No. 5851

Dear Robin:

Enclosed is a red-line of the February 11, 2010 draft of the System Operation Permit, reflecting changes that the Brazos River Authority (BRA) believes would be helpful or appropriate. These changes do not include the draft permit's treatment of reuse. We believe that addressing these issues prior to initiation of the contested case hearing would simplify the hearing significantly for both BRA and the Executive Director (ED).

Most of the proposed revisions are reasonably self-explanatory. However, I provide the following explanation of key revisions (listed in order of importance to BRA):

- *Storage of HFPs* – Special provision 6.E.10 appears to mandate the use of available storage space to produce multiple smaller HFPs from occasional large inflows. While the ability to do this on a permissive basis could be very beneficial, the provision simply does not work on a mandatory basis. Storage space may be unavailable; HFP requirements may have already been satisfied; all of the multiple pulses may not be needed to satisfy HFP requirements. It is also my understanding that this provision was not modeled as a mandatory requirement in the hydrology staff's determination of water availability. Therefore, BRA suggests that the provision be permissive, not mandatory. Alternatively, the provision could be deleted.

- *Allens Creek Diversions* – The Allens Creek permit limits annual diversions from the Brazos River to 202,000 af/yr. BRA modeled Allens Creek diversions under System Operation with a 2004 priority, but without the annual limit on Brazos River diversion. This produces a significantly higher firm yield for System Operation (reflected by the revisions to the New Appropriation table in ¶ 1.A.1). Apparently because diversions in excess of 202,000 af/yr would require amendment of the Allens Creek permit, the ED did not allow such diversions in his computation of the firm yield. BRA suggests that the

otherwise available water supply should be appropriated by the System Operation Permit and that the need to amend the Allens Creek permit be recognized with a special condition (see proposed 6.C.11) comparable to the one addressing the need to amend existing permits to remove or modify the 30% storage capacity limitation (see ¶ 6.C.10).

- *Historic vs. Permitted Return Flows* – I understand that in issuing bed and banks permits TCEQ typically imposes requirements for environmental flows and protection of senior rights on historically discharged return flows. The draft permit (¶¶ 6.A.9 and 6.A.10), however, imposes those requirements on all currently permitted discharges, regardless of whether the maximum permitted amount has ever been discharged. This will have a significant impact on water supply under the System Operation Permit; therefore, BRA suggests applying these restrictions only to historically discharged return flows. A listing of return flows in 2004 (the year the System Operation Permit application was administratively complete) is enclosed.

- *Water Management Plan Issues* -- ¶ 6.D.2 indicates that major amendments to the WMP will go through the notice and hearing process, but does not distinguish between major and minor amendments. Additional language has been proposed in order to address this distinction. The concept underlying the proposed revision is that the WMP could prescribe a methodology or mechanism for handling foreseeable changes (such as additional diversion points when new water supply contracts are executed or increased return flows as wastewater treatment plants are expanded and discharge permits amended). If that methodology were approved as part of initial adoption or formal amendment of the WMP, and if the appropriation of future return flows had already been made as part of the System Operation permit appropriation, revising the operating procedures, accounting and anticipated water availability to reflect those changes would be a minor amendment.

- *HFP Requirements* – As drafted, ¶ 6.E.7 simply imposes an obligation to meet season HFP requirements, without indicating what the Permittee must do to accomplish this. For clarity BRA suggests that this provision be revised to indicate that BRA must pass HFPs (i.e., not impound or divert) in order to comply with this requirement. Otherwise, it might be argued that releases from storage or managed releases from multiple reservoirs could be required for compliance with this provision.

The numerous other proposed revisions reflected by the enclosed draft are relatively straight-forward; however, I would be happy to discuss them with you or others if that would be helpful.

Thank you for your cooperation in this matter.

Sincerely,

Douglas G. Caroom

DRAFT 2-11-10

WATER USE PERMIT

PERMIT NO. 5851 TYPE §§ 11.121, 11.042 & 11.085

Permittee:	Brazos River Authority	Address:	P.O. Box 7555 Waco, Texas 76714-7555
Filed:	October 15, 2004	Granted:	
Purposes:	Domestic, Municipal, Agricultural, Industrial, ~~and~~ Mining, and Recreation	Counties:	Parmer, Castro, Swisher, Bailey, Lamb, Hale, Floyd, Cochran, Hockley, Archer, Lubbock, Crosby, Baylor, Dickens, King, Knox, Jack, Terry, Lynn, Mitchell, Chambers, Young, Garza, Throckmorton, Kent, Haskell, Stonewall, Parker, Palo Pinto, Dawson, Scurry, Borden, Fisher, Stephens, Jones, Shackelford, Johnson, Hood, Nolan, Erath, Eastland, Taylor, Callahan, Somervell, Hill, Comanche, Bosque, Brown, Freestone, Hamilton, McLennan, Limestone, Mills, Coryell, Leon, Falls, Lampasas, Robertson, Bell, Madison, Milam, Burnet, Brazos, Grimes, Williamson, Burleson, Travis, Lee, Washington, Bastrop, Fayette, Waller, Harris, Austin, Colorado, Fort Bend, Galveston, Matagorda, Wharton, and Brazoria
Watercourses:	Multiple Tributaries of the Brazos River and the Brazos River	Watersheds:	Brazos River Basin, Trinity River Basin, Red River Basin, Colorado River Basin, San Jacinto River Basin, San Jacinto-Brazos Coastal Basin, Brazos-Colorado Coastal Basin

WHEREAS, the Brazos River Authority, Applicant, owns the water rights and reservoirs authorized by Certificate of Adjudication (Certificate) No. 12-5155 (Possum Kingdom Lake), Certificate No. 12-5156 (Lake Granbury), Certificate No. 12-5165 (Lake Limestone), and Water Use Permit No. 2925A (Allens Creek Reservoir in conjunction with the Texas Water Development Board and the City of Houston); and

WHEREAS, Applicant also owns the water rights and has contracts with the United States Army Corps of Engineers for storage authorized by Certificate No. 12-5157 (Lake Whitney), Certificate No. 12-5158 (Lake Aquilla), Certificate No. 12-5159 (Lake Proctor), Certificate No. 12-5160 (Lake Belton), Certificate No. 12-5161 (Lake Stillhouse Hollow), Certificate No. 12-5162 (Lake Georgetown), Certificate No. 12-5163 (Lake Granger), Certificate No. 12-5164 (Lake Somerville); and

WHEREAS, Applicant also owns the water rights authorized by Certificates Nos. 12-5166 and 12-5167, which authorize various uses of water within the Applicant's other certificates and permits; and

WHEREAS, Applicant is currently authorized, pursuant to the 1964 System Operation Order, as amended, to manage and operate its tributary reservoirs as elements of a system, coordinating releases and diversions from the tributary reservoirs with releases and diversions from the Applicant's mainstem reservoirs to minimize waste, and to conserve water in reservoirs in which the supply is short by making releases from tributary reservoirs in which the supply is more abundant; and

WHEREAS, Applicant has indicated that their service area includes the following counties: Parmer, Castro, Swisher, Bailey, Lamb, Hale, Floyd, Cochran, Hockley, Archer, Lubbock, Crosby, Baylor, Dickens, King, Knox, Jack, Terry, Lynn, Mitchell, Chambers, Young, Garza, Throckmorton, Kent, Haskell, Stonewall, Parker, Palo Pinto, Dawson, Scurry, Borden, Fisher, Stephens, Jones, Shackelford, Johnson, Hood, Nolan, Erath, Eastland, Taylor, Callahan, Somervell, Hill, Comanche, Bosque, Brown, Freestone, Hamilton, McLennan, Limestone, Mills, Coryell, Leon, Falls, Lampasas, Robertson, Bell, Madison, Milam, Burnet, Brazos, Grimes, Williamson, Burleson, Travis, Lee, Washington, Bastrop, Fayette, Waller, Harris, Austin, Colorado, Fort Bend, Galveston, Matagorda, Wharton, Brazoria; and

WHEREAS, Applicant has applied for a Water Use Permit to authorize:

- A new appropriation of state water in the amount of 421,449 acre-feet per year for multiple uses, including domestic, municipal, agricultural, industrial, mining, and other beneficial uses on a firm basis in the Brazos River Basin. The amount of this new appropriation of water includes the current and future return flows requested in this application. Applicant indicates that the entire amount of 421,449 acre-feet of water per year is available only if all of it is diverted at the mouth of the Brazos River, and can only be made available by the Applicant through the system operation of its water rights. To the extent water is diverted upstream, the remaining unappropriated water downstream is reduced and will itself vary depending upon the location of its diversion and use. Out of the 421,449 acre-feet per year of unappropriated water being requested, the maximum amount of unappropriated water that will be available if such water is diverted upstream at USGS Gage No. 08091000 near Glen Rose, Texas is 150,538 acre-feet per year firm, and if such unappropriated water is diverted upstream at USGS Gage No. 08098290 near Highbank, Texas, the maximum amount of unappropriated water that will be available at that location is 144,306 acre-feet per year firm;

- Diversion of the water authorized by this permit, if granted, from: (i) the existing diversion points authorized by Applicant's existing water rights; (ii) the Brazos River at

the USGS Gage No. 08091000 near Glen Rose, Texas; (iii) the Brazos River at USGS Gage No. 08098290 near Highbank, Texas; (iv) the Brazos River at the Gulf of Mexico; and (v) at such other diversion points that may be identified and included in Applicant's proposed Water Management Plan which is subject to TCEQ's approval;

- Use of up to 90,000 acre-feet of water per year of its firm supply (part of the 421,449 acre-feet of firm water requested above) to produce, along with other unappropriated flows, an interruptible water supply of 670,000 acre-feet per year and the appropriation of that interruptible water supply. Applicant indicates that the entire amount of 1,001,449 acre-feet of water (331,449 acre-feet of firm water and 670,000 acre-feet of interruptible water) is available only if all of it is diverted at the mouth of the Brazos River, and can only be made available by the Applicant through the system operation of its water rights. To the extent water is diverted upstream, the remaining unappropriated water downstream is reduced and will itself vary depending on the location of its diversion and use. This new appropriation of water includes the current and future return flows requested in this application. Out of the 1,001,449 acre-feet of firm and interruptible water being requested, the maximum amount of firm and interruptible water that will be available if such water is diverted upstream at USGS Gage No. 08091000 near Glen Rose, Texas is 60,538 acre-feet of firm water per year and 157,000 acre-feet of interruptible water per year and if such water is diverted upstream at USGS Gage No. 08098290 near Highbank, Texas, the maximum amount of firm water is 54,306 acre-feet of water per year and 303,000 acre-feet of interruptible water per year;

- An exempt interbasin transfer authorization to transfer and use, on a firm and interruptible basis, such water in the adjoining San Jacinto-Brazos Coastal Basin and the Brazos-Colorado Coastal Basin, and to transfer such water to any county or municipality or the municipality's retail service area that is partially within the Brazos River Basin for use, on a firm and interruptible basis, in that part of the county or municipality and the municipality's retail service area not within the Brazos River Basin;

- An appropriation of current and future return flows (treated sewage effluent and brine bypass/return) to the extent that such return flows continue to be discharged or returned into the bed and banks of the Brazos River, its tributaries, and Applicant's reservoirs. Applicant indicates that such appropriation of return flows would be subject to interruption by direct reuse or indirect reuse within the discharging entity's city limits, extraterritorial jurisdiction, or contiguous water certificate of convenience and necessity boundary. Specified discharge points and amounts of water will be accounted for on a monthly basis as part of Applicant's Water Management Plan which is subject to TCEQ's approval;

- Operational flexibility to (1) use any source of water available to the Applicant to satisfy the diversion requirements of senior water rights to the same extent that those water rights would have been satisfied by passing inflows through the Applicant's reservoirs on a priority basis; and (2) release, pump and transport water from any of the Applicant's reservoirs for subsequent storage, diversion and use throughout the Applicant's service area. (Applicant's "service area" includes all counties listed above);

- Recognition that this System Operation Permit approved pursuant to this application will prevail over inconsistent provisions in the Applicant's existing water rights regarding system operation;

- Use of the bed and banks of the Brazos River, its tributaries and the Applicant's reservoirs for the conveyance, storage, and subsequent diversion of (i) water that the Applicant seeks to appropriate under this application; (ii) waters that are being conveyed via pipelines and subsequently discharged into the Brazos River, its tributaries or stored in the Applicant's reservoirs; (iii) surface water imported from areas located outside the Brazos River Basin for subsequent use; (iv) in-basin surface water and groundwater subject to the Applicant's control; (v) waters developed from future Applicant projects; and (vi) current and future reuse of surface and groundwater based return flows requested by this application. This bed and banks authorization is subject to Applicant, after identifying specific points of discharge and diversion and conveyance and other losses, obtaining future authorizations to satisfy the requirements of TWC § 11.042. Such points of discharge and diversion and conveyance and other losses may also be identified and included in Applicant's proposed Water Management Plan which is subject to TCEQ's approval; and

WHEREAS, until the construction of Allens Creek Reservoir is completed, Applicant requests that the System Operation Permit include special conditions which authorize:

- The Applicant to appropriate state water in the amount of 425,099 acre-feet per year for multiple use purposes, including domestic, municipal, agricultural, industrial, mining, and other beneficial uses on a firm basis in the Brazos River Basin. This amount includes the current and future return flows requested in this application. This amount is available if all of the water is diverted at the mouth of the Brazos River, and can only be made available by the Applicant through the system operation of its water rights. To the extent water is diverted upstream, the remaining unappropriated water downstream is reduced and will itself vary depending upon the location of its diversion and use. Out of the 425,099 acre-feet per year of unappropriated water being requested, the maximum amount of unappropriated water that will be available if such water is diverted upstream at USGS Gage No. 08091000 near Glen Rose, Texas is 150,538 acre-feet per year firm and if such unappropriated water is diverted upstream at USGS Gage No. 08098290 near Highbank, Texas the maximum amount of unappropriated water that will be available is, at that location, 175,306 acre-feet per year firm;

- The Applicant to use up to 90,000 acre-feet of water per year of its firm supply to produce, along with other unappropriated flows an interruptible water supply of 869,000 acre-feet per year. This amount includes the current and future return flows requested in this application. Applicant indicates that the entire amount of 1,204,099 acre-feet of water (335,099 acre-feet of firm water and 869,000 acre-feet of interruptible water) is only available if all of it is diverted at the mouth of the Brazos River, and can only be made available by the Applicant through the system operation of its water rights. To the extent water is diverted upstream, the remaining unappropriated water downstream is reduced and will itself vary depending upon the location of its diversion and use. Out of the 1,204,099 acre-feet of firm and interruptible water being requested, the maximum amount of firm and interruptible water that will be available if such water is diverted upstream at USGS Gage No. 08091000 near Glen Rose, Texas, will be 60,538 acre-feet of firm water per year and 190,000 acre-feet of interruptible water per year and if such water is diverted upstream at USGS Gage No. 08098290 near Highbank, Texas the maximum amount of firm water will be 85,306 acre-feet of water per year and 284,000 acre-feet of interruptible water per year;

- Exempt interbasin transfer authorization to transfer and use, on a firm and interruptible basis, such water in the adjoining San Jacinto-Brazos Coastal Basin and the Brazos-Colorado Coastal Basin, and to transfer such water to any county or municipality or the municipality's retail service area that is partially within the Brazos River Basin for use, on a firm and interruptible basis, in that part of the county or municipality and the municipality's retail service area not within the Brazos River Basin; and

WHEREAS, the Texas Commission on Environmental Quality (Commission) finds that jurisdiction over the application is established; and

WHEREAS, the Executive Director recommends that specific stream flow restrictions should be included in the permit to maintain the instream uses and water quality conditions of the Brazos River; and

WHEREAS, as additional factual and scientific information becomes available, it is anticipated that the interim special conditions in Paragraph 6.E. below relative to environmental flows will be revised, through Commission approved revisions of the Water Management Plan, to better provide for the environmental instream flow needs of the Brazos River and its tributaries and to make the maximum amount of water available for beneficial use that is consistent with those needs; and

WHEREAS, the Executive Director recommends that in order to protect senior and superior water rights owners, special conditions should be included in the permit; and

WHEREAS, to avoid ambiguities between this system operation authorization and Applicant's previous system operation authorizations reflected by the System Operation Order and existing permits, the Executive Director recommends that this System Operation Permit be subject to all provisions included in the Commission's July 23, 1964 System Operation Order, as amended, authorizing system operation of certain reservoirs in the Brazos River Basin and to all terms and conditions of Permittee's authorizations in Certificates Nos. 12-5155, 12-5156, 12-5165, 12-5157, 12-5160, 12-5159, 12-5164, 12-5161, 12-5163, 12-5162, 12-5158, 12-5166 and 12-5167 and Water Use Permit No. 2925A except to the extent specifically provided otherwise by this permit and as may be modified in the future by Commission approval of Applicant's Water Management Plan; and

WHEREAS, this application is subject to the Texas Coastal Management Program (CMP) and must be consistent with the CMP goals and policies; and

WHEREAS, the Commission finds that the issuance of this permit is consistent with the goals and policies of the Texas CMP; and

WHEREAS, the Commission has complied with the requirements of the Texas Water Code and Rules of the Texas Commission on Environmental Quality in issuing this permit;

NOW, THEREFORE, Water Use Permit No. 5851 is issued to the Brazos River Authority, subject to the following terms and conditions:

1. USE

A. NEW APPROPRIATION

1) Permittee is authorized to impound, divert, and use not to exceed the following volumes of unappropriated water per year for domestic, municipal, agricultural, industrial, and mining use within its service area subject to special conditions:

New Appropriation Amounts

Location	Volume in acre-feet Firm Water	Non-firm Water
Glen Rose	131,363	157,000
Highbank	144,306	303,000
Richmond	239,279~~188,005~~	670,000
Gulf of Mexico	243,146~~191,044~~	670,000

2) Until such time as the ports are closed on the dam impounding Allens Creek Reservoir, authorized by Water Use Permit No. 2925, in lieu of Paragraph 1.A.1, Permittee may impound, divert, and use not to exceed the following volumes of unappropriated water per year, subject to special conditions:

New Appropriation Amounts without Allens Creek

Location	Volume in acre-feet without Allens Creek Reservoir Firm Water	Non-firm Water
Glen Rose	131,363	190,000
Highbank	175,306	284,000
Richmond	237,920	869,000
Gulf of Mexico	241,765	869,000

B. USE OF BED AND BANKS

Permittee is authorized to use the bed and banks of the Brazos River below Possum Kingdom Lake, its tributaries and Permittee's authorized reservoirs for the conveyance, storage, and subsequent diversion of the water authorized herein, subject to identification of specific losses and special conditions.

C. INTERBASIN TRANSFER

Permittee is hereby granted an exempt interbasin transfer authorization to transfer and use the water authorized herein in Permittee's service area in the adjoining San Jacinto-Brazos Coastal Basin and the Brazos-Colorado Coastal Basin and to transfer such water to any county or municipality or the municipality's retail service area that is partially within the Brazos River Basin for use on a firm and non-firm basis in that part of the county or municipality and the municipality's retail service area within the Trinity, Red, Colorado, and San Jacinto River Basins.

D. RETURN FLOWS

Permittee is authorized to impound, divert and use return flows discharged from the Permittee's facilities or originating from diversions pursuant to Permittee's water rights, as indicated in the table below, for multiple uses (domestic, municipal, agricultural, industrial, mining) within their service area, subject to special conditions to protect water rights granted based on the presence of those return flows as well as other senior water rights:

Return Flows Available to Permittee

Name	TPDES Permit #	Permitted Discharge (mgd)	Current BRA Source	Percent of Surface Water from BRA	Current Surface Water Returns (ac-ft/yr)	Current Ground-water Returns (ac-ft/yr)
Sportsmans World MUD WTP	02461000	0.800	Possum Kingdom	100%	11.2	0
Double Diamond	02789000	0.060	Possum Kingdom	100%	67	0
Authority SWATS	02889000	2.500	Granbury System	100%	730	0
City of Copperas Cove	10045003	2.500	Lake Belton	100%	923	0
City of Copperas Cove	10045004	2.500	Lake Belton	100%	1,375	0
City of Copperas Cove	10045005	4.000	Lake Belton	100%	1,600	0
City of DeLeon	10078001	0.295	Lake Proctor	100%	192	0
City of Marlin	10110002	2.000	Whitney System	16%	159.4	0
City of Harker Heights	10155001	3.000	Lake Belton	100%	2,780	0
City of Gatesville	10176002	2.200	Lake Belton	100%	1,731	0
City of Gatesville	10176004	1.500	Lake Belton	100%	703	0
City of Granbury	10178002	2.000	Granbury System	23%	302	1,011
City of Lampasas	10205002	1.500	Lake Stillhouse Hollow	100%	580	0
City of McGregor (South WWTP)	10219002	1.100	Lake Belton	95%	651.7	0
City of Moody	10225001	0.200	Lake Belton	100%	157	0
BRA/LCRA BCRWSS West	10264001	3.000	Georgetown/Still -house System	100%	2,402	1,657

Name	TPDES Permit #	Permitted Discharge (mgd)	Current BRA Source	Percent of Surface Water from BRA	Current Surface Water Returns (ac-ft/yr)	Current Ground-water Returns (ac-ft/yr)
BRA/LCRA BCRWSS East	10264002	21.500	Georgetown/Still-house System	100%	16,767	0
City of Taylor	10299001	4.000	Granger System	100%	2,220	0
Bell County WCID#1	10351001	0.900	Lake Belton	100%	983	0
Bell County WCID#1	10351002	18.000	Lake Belton	100%	14,123	0
Bell County WCID#1	10351003	6.000	Lake Belton	100%	5,389	0
City of Brenham	10388001	3.550	Lake Somerville	100%	2,485	0
City of Dublin	10405001	0.450	Lake Proctor	100%	325	0
City of Georgetown	10489002	2.500	Georgetown/Still-house System	100%	1,815	0
City of Georgetown	10489003	2.500	Georgetown/Still-house System	100%	1,423	0
City of Georgetown	10489005	3.000	Georgetown/Still-house System	100%	1,389	0
City of Hamilton	10492002	0.880	Lake Proctor	100%	392	0
City of Hillsboro	10630001	1.810	Lake Aquilla	100%	1,440	0
City of Rosebud	10731001	0.250	Lake Stillhouse Hollow	100%	194	0
Bell County WCID#3	10797001	0.675	Lake Belton	100%	360	0
City of Holland	10897001	0.200	Lake Stillhouse Hollow	100%	93	0
Bell County WCID#2	11090001	0.094	Lake Belton	100%	63	0
Bell County WCID#2	11091001	0.160	Lake Belton	100%	70	0
Authority TBRSS	11318001	10.000	Lake Belton	100%	8,523	0
Acton MUD	14211001	0.600	Granbury System	11%	40	326
Acton MUD	14212001	0.820	Granbury System	11%	29	239
City of Comanche	14445001	0.595	Lake Proctor	100%	324	0

2. DISCHARGE

The points of origin and rates for Permittee's return flows are itemized below:

Name	TPDES Permit #	Discharge (mgd)	Receiving Stream	North Latitude	West Longitude
Sportsmans World MUD WTP	02461000	0.800	Bluff Creek	32.845111	-98.486972
Double Diamond	02789000	0.060	Unnamed Tributary to the Brazos River	32.8552778	98.4186111
BRA[1] SWATS[2]	02889000	2.500	Lake Granbury/ Brazos River	32.4169445	97.6747223
City of Copperas Cove	10045003	2.500	Clear Creek	31.0925000	97.9072222
City of Copperas Cove	10045004	2.500	Unnamed tributary to Turkey Run	31.1297223	97.8808334
City of Copperas Cove	10045005	4.000	House Creek	31.1488889	97.9077778
City of DeLeon	10078001	0.295	Unnamed tributary to Leon River (Proctor Lake)	32.1111111	98.5238889
City of Marlin	10110002	2.000	Brazos River	31.2591667	96.9277778
City of Harker Heights	10155001	3.000	South Nolan Creek	31.0922222	97.6538889
City of Gatesville	10176002	2.200	Stillhouse Branch	31.4391666	97.7497222
City of Gatesville	10176004	1.500	Leon River	31.4261111	97.7441666
City of Granbury	10178002	2.000	Lake Granbury/Brazos River	32.4183334	97.7758334
City of Lampasas	10205002	1.500	Sulphur Creek	31.1893000	98.1540000
City of McGregor (South WWTP)	10219002	1.100	Unnamed tributary of South Bosque River	31.412416	97.395694
City of Moody	10225001	0.200	Unnamed tributary to Stampede Creek	31.3097222	97.3633333

Name	TPDES Permit #	Discharge (mgd)	Receiving Stream	North Latitude	West Longitude
BRA/LCRA[3] BCRWSS[4] West	10264001	3.000	Brushy Creek	30.5155556	97.6647222
BRA/LCRA[3] BCRWSS[4] East	10264002	21.500	Brushy Creek	30.5263889	97.6172223
City of Taylor	10299001	4.000	Mustang Creek	30.5575000	97.3883333
Bell County WCID[5]#1	10351001	0.900	Belton Lake	31.1252778	97.5152778
Bell County WCID[5]#1	10351002	18.000	South Nolan Creek	31.1075000	97.7016667
Bell County WCID[5]#1	10351003	6.000	South Nolan Creek	31.1086111	97.7036111
City of Brenham	10388001	3.550	Hog Branch	30.1711111	96.3775000
City of Dublin	10405001	0.450	Resley Creek	32.0619444	98.3369444
City of Georgetown	10489002	2.500	San Gabriel River	30.6530556	97.6613889
City of Georgetown	10489003	2.500	unnamed tributary to Mankins Branch	30.6313889	97.6311111
City of Georgetown	10489005	3.000	Berry Creek	30.672944	97.609750
City of Hamilton	10492002	0.880	Pecan Creek	31.7094444	98.1138889
City of Hillsboro	10630001	1.810	Hackberry Creek	31.9983333	97.1444444
City of Rosebud	10731001	0.250	Salt Creek	31.0633333	96.9911111
Bell County WCID[5]#3	10797001	0.675	South Nolan Creek	31.6688889	97.6038889
City of Holland	10897001	0.200	Unnamed tributary to Darr Creek	30.8808334	97.3958333
Bell County WCID[5]#2	11090001	0.094	Boggy Creek	30.9783334	97.3436111
Bell County WCID[5]#2	11091001	0.160	Unnamed tributary to Boggy Creek	30.9847222	97.3663889
BRA TBRSS[6]	11318001	10.000	Nolan Creek	31.0438889	97.4397222
Acton MUD	14211001	0.600	McCarty Branch	32.4372222	97.6952777

Name	TPDES Permit #	Discharge (mgd)	Receiving Stream	North Latitude	West Longitude
Acton MUD[7]	14212001	0.820	Brazos River	32.3591667	97.6869444
City of Comanche	14445001	0.595	Indian Creek	31.8902777	98.5933333

1 BRA - Brazos River Authority
2 SWATS – Surface Water and Treatment System (Lake Granbury)
3 LCRA – Lower Colorado River Authority
4 BCRWSS – Brushy Creek Regional Wastewater Sewage System
5 WCID – Water Control & Improvement District
6 TBRSS – Temple-Belton Regional Sewage System
7 MUD – Municipal Utility District

3. DIVERSION

Permittee is authorized to divert and use the water authorized by this permit as follows:

A. POINTS

1) At the diversion points authorized by Permittee's existing water rights.

2) At United States Geological Survey (USGS) Gage No. 08091000, Brazos River near Glen Rose at Latitude 31.2589°N, Longitude 97.7022°W in Somervell County.

3) At USGS Gage No. 08098290, Brazos River near Highbank at Latitude 31.1339°N, Longitude 96.8247°W in Falls County.

4) At the mouth of the Brazos River at the Gulf of Mexico at Latitude 28.8783°N, Longitude 95.379111°W in Brazoria County.

5) At other such diversion points located in the reaches specified in USE Paragraph 1.B, above, or as may be identified and included in Permittee's Commission approved Water Management Plan, or as may be otherwise authorized in the future.

B. RATES

1) At the diversion rates authorized by the Certificates of Adjudication and Water Use Permit authorizing each of the reservoirs comprising the system operation as defined in this permit.

2) At unspecified rates at points within the reaches authorized in USE paragraph 1.B, including at the diversion points authorized by 3.A.2., 3.A.3., and 3.A.4., or points identified in the Commission approved Water Management Plan, subject to Permittee's accounting/delivery plan.

4. PRIORITY

The priority date for the rights authorized by this permit is October 15, 2004.

5. CONSERVATION

Permittee shall implement water conservation plans that provide for the utilization of those reasonable practices, techniques, and technologies that will reduce on a per unit basis the consumption of water, prevent or reduce the loss or waste of water, improve the efficiency in the use of water, increase the recycling and reuse of water, and prevent the pollution of water, so that a water supply is made available for future or alternative uses. The practices, techniques, and technologies used shall be designed to achieve a level of efficiency of use that is equal to or greater than the level provided for in Permittee's most recent water conservation plans on file with the Commission as of the date of the issuance of this permit. Such plans shall include a requirement that in every wholesale water supply contract entered into on or after the date of this permit, including any contract extension or renewal, that each successive wholesale customer develop and implement conservation measures meeting the requirements of this provision. If the customer intends to resell the water, then the contract for resale of the water must have water conservation requirements so that each successive wholesale customer in the resale of the water is required to implement water conservation measures meeting the requirements of this provision.

6. SPECIAL CONDITIONS

A. SPECIAL CONDITIONS RELATIVE TO USE OF RETURN FLOWS

1) Prior to the diversion of return flows authorized by this permit, Permittee must submit to and have approved by the Executive Director, a return flow accounting plan. The return flow accounting plan must be in electronic format and account, by source, for all return flows discharged and subsequently diverted. The return flow accounting plan shall include amounts discharged by outfall, amounts of return flows used by permits or contracts~~granted~~ based on the presence of these return flows, estimated travel times and conveyance losses from discharge point to diversion point(s), and environmental flow requirements. If the return flows will be stored in Permittee's reservoirs, the return flow accounting plan should include any evaporative losses associated with the storage of these return flows. Permittee shall maintain the approved return flow accounting plan in electronic format and make it available to the general public during normal business hours and to the Executive Director upon request. Modifications or changes to the return flow accounting plan must be approved by the Executive Director. The return flow accounting plan shall be included as part of Permittee's accounting/delivery plan.

2) The right to divert discharged return flows from plants owned by the City of Granbury (TPDES Permit No. 10178002), Acton MUD (TPDES Permits Nos. 14211001 and 14212001), Bell County WCID #2 (TPDES Permit No. 11090001), City of Georgetown (TPDES Permits Nos. 10489002 and 10489003) and the City of Holland (TPDES Permit No. 10897001) is limited to the amount of surface water based return flows discharged from those plants that originates from water rights owned by the Permittee. Permittee is not authorized to divert groundwater based return flows discharged from these plants, except as may be authorized by Special Condition 6.A.4. Permittee must include in the reuse

accounting plan the total amount discharged from the plants and the percentage of that water that is divertable under this permit.

3) Permittee is authorized to divert historically discharged groundwater based return flows from the Brazos River Authority/LCRA BCRWSS West (TPDES Permit No. 10264001).

4) Future discharges of groundwater based return flows may be diverted if those return flows originate from groundwater owned by Permittee or are discharged from treatment plants owned by the Permittee. Prior to diversion, Permittee must apply for and be granted an amendment to this permit authorizing these diversions and shall submit for approval by the Executive Director, a revised accounting/delivery plan addressing such new groundwater based discharges.

5) Permittee is authorized to divert only that water discharged by the City of Marlin (TPDES Permit No. 10110002) originating from water rights owned by the Permittee. Permittee shall calculate the divertable amount of the City's discharge and include this information in the reuse accounting plan.

6) Permittee shall only divert the actual annual amount of return flows discharged from the Bell County WCID #1 (TPDES Permits Nos. 10351001 and 10351002) and the City of Harker Heights (TPDES Permit No. 10155001) less up to 172 acre-feet as authorized by Water Use Permit No. 4218, 37 acre-feet as authorized by Permit 5088 and 60 acre-feet as authorized by Water Use Permit No. 5089 when the aforementioned permits are being used.

7) Diversions and storage of return flows shall not occur at rates or in amounts higher than the actual daily amount of return flows discharged into watercourses in the Brazos River Basin, after accounting for the calculated losses and travel time from the discharge point(s) to the diversion point(s) in accordance with the accounting/delivery plan.

8) Prior to diversion of the water authorized herein, if sufficiently accurate measuring devices are not available, Permittee shall install and maintain measuring device(s) capable of measuring within plus or minus 5% accuracy, at the discharge point of each wastewater treatment plant (WWTP) to record the amount of return flows discharged into the Brazos River or its tributaries on a daily basis.

9) The priority date for diversion of up to 61,397~~120,625~~ acre-feet (54.818~~107.639~~ mgd) of discharged return flows is October 15, 2004, and these return flows are subject to the environmental flow requirements in Special Condition 6.E..

10) The priority date for diversion of future return flows in excess of 61,397~~120,625~~ acre-feet (54.818~~107.639~~ mgd) of discharged return flows is October 15, 2004 but is not subject to call by senior and superior permit holders in the basin and is not subject to instream flow limitations.

11) Prior to diversion of any return flows in excess of the individual TPDES Permit limits indicated in Paragraph 1.D. RETURN FLOWS, Permittee must apply for and be granted the right to reuse those return flows, either by amendment of this permit or by Commission approval of the Water Management Plan. Permittee

must amend the reuse accounting plan to include future return flows prior to diverting said return flows.

12) The diversion of up to 120,625 acre-feet (107.639 mgd) of water is dependent upon potentially interruptible return flows or discharges and is conditioned on the availability of those discharges. The right to divert the discharged return flows is subject to revocation if discharges become permanently unavailable for diversion and may be subject to reduction if the return flows are not available in quantities and qualities sufficient to fully satisfy the permit. Should any discharges become permanently unavailable for diversion, Permittee shall immediately cease diversions of these return flows and reflect such reductions in the reuse accounting plan.

13) Permittee's diversion and use of return flows is subject to interruption by direct use or indirect use within the discharging entity's corporate limits, extraterritorial jurisdiction, or contiguous water certificate of convenience and necessity boundary, provided the discharging entity has applied for and been granted authorization to reuse the return flows.

B. SPECIAL CONDITIONS RELATIVE TO USE OF BED AND BANKS

1) The use of the bed and banks of Allens Creek from below Allens Creek Reservoir to the Brazos River is not authorized until Permittee applies for and is granted an amendment to Water Use Permit No. 2925 authorizing such use.

2) Permittee is authorized to use the following reaches, authorized in Permittee's certificates and amendments, for conveyance of water, previously appropriated to the Permittee and water authorized by this permit, downstream for diversion at Glen Rose, Highbank and the Gulf of Mexico and any of the Permittee's currently authorized diversion points within these reaches:

a. Brazos River from below Possum Kingdom Lake to the Gulf of Mexico;
b. Leon River from Lake Proctor to the confluence with the Little River;
c. Lampasas River from Lake Stillhouse Hollow to the confluence with the Little River;
d. Little River from the junction of Leon and Lampasas Rivers to the confluence with the Brazos River;
e. Yegua Creek from Lake Somerville to the confluence with the Brazos River;
f. Navasota River from Lake Limestone to the confluence with the Brazos River;
g. San Gabriel River from Lake Granger to the confluence with the Little River and downstream to its confluence with the Brazos River;
h. North Fork San Gabriel River from Lake Georgetown to the confluence with the San Gabriel River, to its confluence with the Little River and downstream to its confluence with the Brazos River;
i. Aquilla Creek from Lake Aquilla downstream to its confluence with the Brazos River.

3) Prior to use of the bed and banks identified in Special Condition 6.B.2 above, Permittee must submit to and have approved by the Executive Director, as part of

its accounting/delivery plan, a procedure to estimate daily deliveries of water. This procedure should be in electronic format and detail by source, type and priority date, the amounts to be conveyed and delivered, losses associated with the conveyance, specific points of diversion, associated travel times, and times of commencement and termination of transit for conveyed waters. Documentation of actual deliveries as well as the accounting/delivery plan shall be maintained by the Permittee in electronic format and made available to the general public during normal business hours and to the Executive Director upon request. Modifications or changes to the accounting/delivery plan must be approved by the Executive Director.

4) The use of the bed and banks of additional streams and tributaries in the Brazos River Basin for conveyance of water appropriated under this permit, or other sources available to the Permittee, is subject to Permittee, after identifying specific sources and types of water, specific points of discharge and diversion, and conveyance and other losses, obtaining future authorizations to satisfy the requirements of TWC § 11.042, which approval may be granted by Commission approval of the Water Management Plan.

5) The use of additional points of diversion within the reaches specified in Special Condition 6.B.2 above is subject to Permittee obtaining authorization to use those diversion points. The points of diversion may also be identified and included in Permittee's proposed Water Management Plan which is subject to Commission approval.

C. SPECIAL CONDITIONS RELATIVE TO NEW APPROPRIATION

1) Prior to diversion or storage of the water authorized by this permit, Permittee shall provide to and have approved by the Executive Director, a daily accounting/delivery plan that includes, at a minimum, the following:

a. The accounting/delivery plan shall address reservoir storage and withdrawal plans for each system reservoir and account by priority date and amounts for any inflows, evaporation, water in storage and diversions from the reservoirs under all of Permittee's priority dates and authorizations including reuse;
b. A method to account for inflows to system reservoirs for purposes of compliance with special conditions requiring passage of pulse flows and estimation of those inflows;
c. An accounting of instream flow and pulse requirements to include total system storage, gage flows at the measurement points, high flow pulse volume impounded and the release schedule for the impounded high flow pulse, and timing, magnitude and duration of pulse flows;
d. The accounting/delivery plan must detail how measurements will be taken to determine if impoundment or diversions under either Permittee's senior or junior rights can be made;
e. The accounting/delivery plan must identify, account for, and distinguish between firm and non-firm water supplied or delivered from Permittee's system of reservoirs. In addition, the accounting/delivery plan must specify diversion points for this water if those diversion points are not specifically identified in this permit. Any additional diversion points must be within the reaches where use of the bed and banks is authorized.

Any diversion points outside those reaches will require an amendment to this permit;

f. Permittee shall maintain the approved daily accounting/delivery plan in electronic format and make it available to the general public during normal business hours and to the Executive Director upon request. Modifications or changes to the plan must be approved by the Executive Director.

2) If the total amounts of firm water indicated in Paragraph 1.A.1 are diverted at Glen Rose or Highbank, the additional amount of firm water available below those points is reduced accordingly. The Water Management Plan shall include a mechanism for determining the amount of firm and non-firm water available at specific locations.

3) The full additional amount of non-firm water is only available when the amount of firm water is reduced by 90,000 acre-feet per year at Glen Rose, Highbank, Richmond and the Gulf of Mexico. If less than the full amount of non-firm water is used, the amount of the firm water reduction shall be adjusted pursuant to Special Condition 6.C.2.

4) The non-firm water authorized in Paragraph 1.A.1 includes 72,811 acre-feet of historically discharged return flows. A reduction in firm yield water is not required in order to divert these return flows.

5) The remaining 47,814 acre-feet of return flows out of the total amount of 120,625 acre-feet of return flows as specified in 1.D. may be diverted by the Permittee so long as the total diversions under this permit for all of the authorizations do not exceed the amounts of firm water and non-firm water indicated in Paragraph 1.A.1. unless Permittee applies for and is granted the authorization to divert additional amounts of water.

6) Permittee may not exercise a priority call on water rights in the Brazos River Basin with priority dates senior to October 15, 2004 for purposes of increasing storage in and/or diversion from Permittee's system reservoirs where drawdown of Permittee's system reservoirs is caused by compliance with the terms and conditions of this permit.

7) The request for operational flexibility to use any source of water available to Permittee to satisfy the diversion requirements of senior water rights to the same extent that those water rights would have been satisfied by passing inflows through the Permittee's system reservoirs on a priority basis is granted, but limited as follows:

a) To water previously stored in Permittee's reservoirs as documented in the accounting/delivery plan required in Special Condition 6.C.1 above;

b) Use of this option shall not cause Permittee to be out of compliance with Special Condition 6.C.1. and Special Condition 6.C.6.

8) Permittee may divert water from storage in its permitted reservoirs and store that water in Permittee's other reservoirs for use within the Permittee's service area so long as all diversions and storage are included in and comply with the

provisions of the accounting/delivery plan required by Special Condition 6.C.1. above.

9) The total amount of water diverted and released from Permittee's system reservoirs pursuant to the authority of Permittee's existing water rights in any year for each authorized purpose of use may not exceed the cumulative authorized total for each purpose until Permittee applies for and is granted amendments to the underlying authorizations.

10) Permittee is required to comply with the existing System Operation Order and certificates of adjudication requiring Permittee to exclude tributary reservoirs from operation of the system during any period of time in which Permittee's permitted storage space in that reservoir is less than 30% full (until all system reservoirs are below 30% capacity, at which time the reservoir can resume system operation), until such time as Permittee submits, and the Commission approves, a Water Management Plan for the Brazos River Basin which details how such limitations will be altered. Any alterations to the limitations must be in compliance with the accounting provisions required in Special Condition 6.C.1 above.

11) Permittee is required to comply with the existing limitations on diversion from the Brazos River in Permit No. 2925A until such time as Permittee submits, and the Commission approves, a Water Management Plan for the Brazos River Basin which details how such limitations will be altered. Any alterations to the limitations must be in compliance with the accounting provisions required in Special Condition 6.C.1.

12~~1~~) Until such time as the ports are closed on the dam impounding Allens Creek Reservoir, authorized by Water Use Permit No. 2925, Permittee may impound and divert additional unappropriated water as specified in Paragraph 1.A.2 subject to Special Conditions 6.C.1 through 10 above.

13~~2~~) Prior to diversion of water authorized by this permit below USGS Gage 08114000, Brazos River at Richmond, Permittee shall submit to the Executive Director, for review and approval, a method to extend the requirements of 6.E.5 and 6.E.7 to or below this point.

D. WATER MANAGEMENT PLAN SPECIAL CONDITIONS

1) Permittee shall prepare and submit to the Commission, a Water Management Plan (WMP) which shall include, in addition to the specific requirements listed below in Special Condition 6.D.4., such studies and other information as may be required by the Commission to demonstrate Permittee's compliance with and its ability to comply with all of the Special Conditions included in this permit.

2) The initial proceedings to consider the adoption of the WMP, and any major amendment thereof, shall be pursuant to contested case procedures. Any proceeding to consider the adoption or major amendment of the WMP shall be preceded by notice and opportunity to request a hearing, in accordance with the Commission's regulations applicable to water rights permitting proceedings. The

WMP shall provide an adaptive management strategy for instream flow requirements and water supply and thus may be amended from time to time upon the request of Permittee, in accordance with the schedule set out in Special Condition 6.D.3. below, or on the Commission's own motion. The initial accounting/delivery plan shall be submitted for approval as part of the initial WMP. If the approved WMP describes the specific methodologies to be utilized, subsequent addition of diversion points within the authorization of this permit, modifications of volumes of return flows to account for amendments or modifications of discharge permits or new discharge authorizations, modification of the accounting/delivery plan approved by the Executive Director, and similar modifications specifically provided for in the WMP are considered minor revisions of the WMP.

3) An initial application for approval of the WMP shall be submitted to the Executive Director not later than three years after the date that this permit becomes final and non-appealable. Permittee shall take the necessary steps to ensure that the application for the WMP is administratively and technically complete within one year after the initial submission of the application to the Executive Director. Deadlines established in this provision may be extended by the Executive Director. At minimum, every ten years after approval of the initial WMP, Permittee shall submit to the Executive Director an application for reconsideration or amendment of the approved WMP.

4) The issues addressed in the initial application for approval of the WMP shall include, but not be limited to, the following:

a. Accounting/delivery plans (including return flow accounting plans);

b. Consideration of adding, deleting, or modifying the measurement points and flow levels described in 6.E.5 and 6.E.7.;

c. Consideration of establishing diversion rate trigger levels for high flow pulse (HFP) requirements, included in 6.E.7, below which the requirements of 6.E.7 would not apply;

d. Establishment of a Brazos River Basin environmental flow study program identifying environmental flow studies to be conducted on specified reaches and the estimated time for completion of the studies. The program shall include studies anticipated to be required for the FERC relicensing of the hydropower facility at Morris Sheppard Dam and such studies necessary to comply with Special Conditions 6.E.1 and 6.E.17. Permittee shall use the program studies to evaluate the need for instream flow protection for the mainstem Brazos River and tributaries impacted by the diversion and storage of water authorized by this permit;

e. Development of operating guidelines to manage the frequency and magnitude of reservoir level fluctuations to avoid or minimize impacts on fisheries. The operating guidelines may be subject to temporary suspension if necessary for water supply purposes;

f. Consideration of establishing maximum diversion rates for diversions of water authorized in this permit;

g. Development of operational and accounting criteria, in addition to that specified in 6.A.1, 6.B.3, and 6.C.1, to address uncertainty in forecasting and accounting for HFPs in a manner that balances the risks and benefits between water supply and environmental flow protection;

h. Consideration of revised storage triggers provided for in 6.E.3 and 6.E.4, and the process for recalculating those triggers;

i. Alteration of 6.C.10 relating to capacity limitations on tributary reservoirs. Should the existing 30% limitation be modified for any of Permittee's system reservoirs, Permittee shall apply to amend the water right authorizing that reservoir;

j. Establishment of a mechanism to determine the amount of firm and non-firm water available at specific locations;

k. Development and implementation of a specific adaptive management strategy for meeting instream flow requirements consistent with providing water supplies. The adaptive management strategy shall include a monitoring program for assessing impacts on instream uses and address short and long term impacts to economically and ecologically important stream fisheries, unique aquatic communities and species, and water quality.

5) Upon notification to Permittee, TPWD may petition the Commission to amend any WMP provisions related to environmental flow protection.

E. INTERIM SPECIAL CONDITIONS RELATIVE TO ENVIRONMENTAL FLOWS

1) The following interim conditions are preliminary and are based upon historic flow analyses, without direct relationships to the biological and environmental benefits intended to be protected; therefore, Permittee shall conduct Instream Flow Studies (Studies) on the Brazos River and on segments of major tributaries upstream of their confluence with the Brazos River consistent with and in cooperation with the Texas Instream Flow Program (TIFP). Upon completion of the Studies, Permittee shall use the results to develop environmental flow conditions to replace the interim conditions in this permit for the measurement points identified in 6.E.5. Depending upon the time of completion of the Studies, replacement of these interim conditions shall be approved in the initial WMP or through the amendment of an approved WMP. The Studies are not limited to the geographic scope of the studies currently defined for the TIFP.

2) Seasons are defined as Spring (March–May), Summer (June-August), Fall (September-November), and Winter (December-February). The number of seasons and the months representing each season are subject to revision in the WMP based on best available science and information at the time of such revision.

3) Total storage in Permittee's system reservoirs is a trigger for determining instream flow requirements and is subject to revision in future Water Management Plans. 7Q2 flows are to be implemented when total storage in Permittee's system reservoirs is below 60% of total capacity. "Dry" means times when the total storage in Permittee's system reservoirs is below 74%, but more than 60% of total capacity. "Average" means times when the total storage in Permittee's system reservoirs is at least 74%, but less than 96% of total capacity. "Wet" means times when the total storage in Permittee's system reservoirs is at least 96% of total capacity.

4) Permittee shall recalculate the storage triggers specified in 6.E.3 every five years to ensure that Subsistence, Dry, Average, and Wet conditions occur at the desired frequencies. The desired frequencies are Subsistence equal to 2.5% of the time, Dry equal to 22.5% of the time, Average equal to 50% of the time and Wet equal to 25% of the time.

5) Until such time as the Studies are completed, the interim instream flows in the following tables apply at the following USGS gauging stations. Measurement points for instream flows are subject to change in the WMP with approval of the Executive Director. The instream flow criteria in the following tables are applicable at all times. Depending upon the hydrologic condition (Subsistence, Dry, Average, or Wet), storage of water authorized by this permit in Permittee's system reservoirs upstream from the following flow gauging stations and the diversion and use of water pursuant to this permit at locations upstream from the flow gauging locations shall be authorized when streamflows at the next downstream gage exceed the instantaneous flow values established in the following tables:

Instream Flow (cfs)	BRAZOS RIVER NEAR GLEN ROSE - USGS #08091000			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	15.3	15.3	15.3	15.3
Dry	39.0	45.0	33.3	62.0
Average	92.0	138.0	101.5	150.0
Wet	234.0	292.8	249.5	332.0

Instream Flow (cfs)	YEGUA CREEK NEAR SOMERVILLE – USGS #08110000			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	0.1	0.1	0.1	0.1
Dry	5.6	3.9	0.4	0.3
Average	14.0	12.0	2.5	1.8
Wet	34.0	31.0	8.9	9.6

Instream Flow (cfs)	NAVASOTA RIVER NEAR EASTERLY USGS #08110500			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	7.6	7.6	7.6	7.6
Dry	7.6	10.0	7.6	7.6
Average	15.0	24.0	7.6	7.6
Wet	36.0	43.0	7.6	7.6

Instream Flow (cfs)	LITTLE RIVER NEAR CAMERON – USGS #08106500			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	67.9	67.9	67.9	67.9
Dry	100.0	135.0	133.0	82.0
Average	200.0	365.0	260.5	152.0
Wet	475.0	730.0	500.0	342.0

Instream Flow (cfs)	BRAZOS RIVER NEAR HIGHBANK – USGS #08098290			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	167.1	167.1	167.1	167.1
Dry	167.1	167.1	167.1	167.1
Average	220.59	344.19	323.85	225.29
Wet	672.74	759.30	780.69	508.98

Instream Flow (cfs)	BRAZOS RIVER NEAR RICHMOND – USGS #08114000			
	Winter	Spring	Summer	Fall
Subsistence (7Q2)	743	743	743	743
Dry	885	1,170	930	760
Average	1,630	2,030	1,450	1,150
Wet	2,955	3,670	2,635	2,038

6) A High Flow Pulse (HFP) is initiated when flows are greater than the 10th percentile and increase by more than 50% from the previous day, or when flows exceed the 75th percentile, regardless of the rate of change. A HFP is terminated when the flow drops below the 10th percentile or when the flow decreases from one day to the next by less than 5%, or when a succeeding pulse occurs. An entire HFP is also classified as a small flood if the maximum rate exceeds the small flood threshold at the 1.5 year recurrence interval.

7) Permittee shall not store or divert water appropriated by this permit if such storage or diversion would prevent meeting a seasonal schedule of qualifying~~individual~~ high flow pulses. Qualifying HFPs are defined as follows:

Pulse Flows (ac-ft)	BRAZOS RIVER NEAR GLEN ROSE - USGS #08091000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	2,329.6	3,208.3	2,617.2	2,211.6
Average	7,325.0	14,915.7	7,265.5	7,565.0
Wet	31,220.8	36,144.8	33,064.5	28,682.0

Peak Flows (cfs)	BRAZOS RIVER NEAR GLEN ROSE - USGS #08091000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	403	466	394	347
Average	1,120	2,070	1,320	1,040
Wet	4,945	5,265	4,370	3,525

Pulse Flow Schedule (days/# of events) BRAZOS RIVER NEAR GLEN ROSE - USGS #08091000

Hydrologic Condition	Winter Dura*	Winter Freq**	Spring Dura	Spring Freq	Summer Dura	Summer Freq	Fall Dura	Fall Freq
Dry	6	2	4	3	4	2	4	2
Average	7	2	6	2	6	2	7	1
Wet	13	1	10	2	11	1	11	1

*Duration **Frequency

Pulse Flows (ac-ft) YEGUA CREEK NEAR SOMERVILLE – USGS #08110000

Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	416.6	275.7	52.4	59.2
Average	1,904.1	1,225.8	239.2	372.9
Wet	8,510.1	4,331.3	845.2	3,367.3

Peak Flows (cfs) YEGUA CREEK NEAR SOMERVILLE – USGS #08110000

Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	69	51	13	10
Average	294	176	53	64
Wet	978	620	140	490

Pulse Flow Schedule (days/# of events) YEGUA CREEK NEAR SOMERVILLE – USGS #08110000

Hydrologic Condition	Winter Dura*	Winter Freq**	Spring Dura	Spring Freq	Summer Dura	Summer Freq	Fall Dura	Fall Freq
Dry	5	2	5	2	4	2	5	1
Average	10	1	8	1	7	1	7	2
Wet	15	1	13	1	11	1	11	1

*Duration **Frequency

Pulse Flows (ac-ft) NAVASOTA RIVER NEAR EASTERLY-USGS #08110500

Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	439.3	748.3	195.9	77.1
Average	2,142.1	2,220.5	746.9	275.0
Wet	7,927.9	8,537.9	3,399.7	2,456.3

Peak Flows (cfs)	NAVASOTA RIVER NEAR EASTERLY – USGS #08110500			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	76	124	33	11
Average	298	344	142	43
Wet	1,060	1,160	592	371

Pulse Flow Schedule (days/# of events)	NAVASOTA RIVER NEAR EASTERLY – USGS #08110500							
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq
Dry	5	2	5	3	5	2	4	2
Average	8	2	9	2	8	2	7	2
Wet	12	1	12	1	13	1	11	1

*Duration **Frequency

Pulse Flows (ac-ft)	LITTLE RIVER NEAR CAMERON – USGS #08106500			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	4,194.4	5,641.5	3,563.3	3,511.2
Average	9,633.7	16,251.6	9,088.3	9,183.5
Wet	29,414.9	42,034.7	25,811.4	20,494.2

Peak Flows (cfs)	LITTLE RIVER NEAR CAMERON – USGS #08106500			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	604	958	577	568
Average	1,600	2,545	1,875	1,630
Wet	5,190	6,405	3,665	3,723

Pulse Flow Schedule (days/# of events)	LITTLE RIVER NEAR CAMERON – USGS #08106500							
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq
Dry	5	1	4	2	4	2	4	2
Average	6	1	6	2	6	1	6	1
Wet	10	1	9	1	9	1	9	1

*Duration **Frequency

Pulse Flows (ac-ft)	BRAZOS RIVER AT HIGHBANK – USGS #08098290			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	5,113.9	6,040.7	4,784.0	3,652.4
Average	11,647.1	14,346.9	15,135.1	11,398.8
Wet	38,514.1	38,127.3	49,810.6	39,416.6

Peak Flows (cfs)	BRAZOS RIVER AT HIGHBANK – USGS #08098290			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	1,471	1,429	1,116	714
Average	2,576	2,952	2,566	2,274
Wet	5,225	6,748	7,703	5,366

Pulse Flow Schedule (days/# of events)	BRAZOS RIVER AT HIGHBANK – USGS #08098290							
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq
Dry	3	1	3	3	3	3	3	2
Average	4	1	4	3	5	2	5	2
Wet	7	1	7	1	8	1	9	1

*Duration **Frequency

Pulse Flows (ac-ft)	BRAZOS RIVER NEAR RICHMOND – USGS #08114000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	36,265.8	44,667.8	38,181.1	22,457.9
Average	90,287.6	101,405.0	77,176.9	56,162.0
Wet	297,550.4	270,153.7	166,115.7	146,866.1

Peak Flows (cfs)	BRAZOS RIVER NEAR RICHMOND – USGS #08114000			
Hydrologic Condition	Winter	Spring	Summer	Fall
Dry	3,748	5,640	4,880	2,500
Average	9,670	10,200	8,830	7,730
Wet	19,500	19,150	15,300	13,175

Pulse Flow Schedule (days/# of events)	BRAZOS RIVER NEAR RICHMOND – USGS #08114000							
	Winter		Spring		Summer		Fall	
Hydrologic Condition	Dura*	Freq**	Dura	Freq	Dura	Freq	Dura	Freq
Dry	5	1	5	1	4	1	4	1
Average	8	1	7	1	7	1	7	1
Wet	16	1	13	1	12	1	11	1

*Duration **Frequency

8) Except under Subsistence conditions, diversion or storage of water upstream from defined measurement points under the authority of this permit shall be authorized during a pulse when the volume, duration, and peak flow of the individual pulse exceeds the individual pulse criteria, or when the number of pulse events in that season exceeds the pulse frequency criteria. When a Qualifying HFP is passed or provided for at one of the six defined measurement points it may be used as credit for meeting one seasonal HFP frequency requirement.

9) For streamflow events that meet the requirements of Special Condition 6.E.5, Permittee may temporarily impound all flows in excess of the instream flow requirement. If the streamflow event provided a Qualifying HFP, flow may need to be passed downstream for environmental needs, subject to seasonal requirements in Special Condition 6.E.7 above. If it did not, then Permittee may retain the impounded water for water supply purposes. Once the required number of HFPs is met, Permittee may divert or impound all subsequent HFPs for use as water supply as long as instream flow requirements specified in Special Condition 6.E.5 are met.

10) For pulses that generate a volume in excess of 250% of the Qualifying HFP volume criterion, Permittee ~~shall~~may provide two Qualifying HFPs with at least one week of instream flow, as required by Special Condition 6.E.5 above, between them. Similarly, for pulses in excess of 350% of the Qualifiying HFP volume criterion, Permittee ~~shall~~may provide three Qualifying HFPs with at least one week of instream flow between each pair. A similarly scaled requirement holds for larger pulses.

11) For streamflow events that meet the requirements of Special Condition 6.E.6, but do not meet the minimum requirements of a Qualifying HFP, Permittee may impound flows in excess of instream flow requirements and shall record the impounded volume in its accounting/delivery plan. At such time as the cumulative volume of streamflow events exceeds the volume of a Qualifying HFP, Permittee may release such a pulse to the environment. Such a release will result in a credit for a Qualifying HFP.

12) If the streamflow event is designated an HFP but ultimately does not meet the minimum requirements of a Qualifying HFP, the volume passed shall be

recorded in the accounting/delivery plan. At such time as the cumulative volume of such pulses exceeds the volume of a Qualifying HFP, Permittee will be credited with one Qualifying HFP (even if the duration, peak flow, etc. characteristics were not met).

13) For purposes of determining satisfaction of Qualifying HFP criteria, each season is accounted for independently. There is no carry-over from season to season, either in regard to exceeding or not meeting HFP requirements. In the event there are seasons where the requisite number or volume of HFPs do not occur naturally, the Permittee is not obligated to meet the seasonal HFP requirements. In the event that a pulse extends across seasonal boundaries, it will be accounted in the season in which it ends.

14) Seasonal HFP requirements are to be met using streamflow events with peak flows less than the 1.5-year return interval; however, streamflow events with both peak flows that exceed the 1.5-year return interval and satisfy the requirements of a Qualifying HFP may be classified as both overbanking flows and an HFP.

15) Special Conditions 6.E.6 - 6.E.14, relating to High Flow Pulses are subject to Special Condition 6.D.4, relating to the contents of the initial application for approval of the WMP.

16) In addition to the measurement points and requirements specified in Special Conditions 6.E.5 and 6.E.7 above, Permittee is prohibited from diverting and storing water authorized by this permit upstream of the following gages unless streamflow at the following gages meets or exceeds the values as follows:

Gage Name	Gage #	7Q2 Value (cfs)
Brazos River near Palo Pinto	08089000	32.0
Aquilla Creek above Aquilla	08093360	0.1
Brazos River near Aquilla	08093100	26.0
Leon River near Belton	08102500	4.7
Leon River near Gatesville	08100500	4.7
Lampasas River near Belton	08104100	4.8
N Fork San Gabriel River near Georgetown	08104700	1.1
San Gabriel River at Laneport	08105700	3.6

17) Permittee, in cooperation with TPWD and the Commission, shall conduct Monitoring Studies to assess instream flow protection at the water quality protection measurement points identified in 6.E.16. These Monitoring Studies shall collect baseline data on the biology, habitat, water quality, hydrology, ecosystem health and other environmental factors of the stream segment between the water quality protection point and the immediate downstream measurement point. If baseline data is sufficient to determine instream flow protection needs, and such criteria are determined to be necessary, the data shall be used to develop criteria to replace the values in 6.E.16. If the results of the Monitoring Studies

indicate that additional study is needed, Instream Flow Studies shall be conducted to determine appropriate instream flow protection criteria for the water quality protection points and the results of such Instream Flow Studies shall be used to develop criteria to replace the values in 6.E.16. Depending upon the time of completion of the Monitoring Studies or applicable Instream Flow Studies, modification of the values in 6.E.16 shall be approved in the initial WMP or through the amendment of an approved WMP. As part of the study and analysis required in this provision, Permittee shall perform and complete a Little River watershed study (including all points identified in 6.E.16 within the Little River watershed) prior to filing its application for approval of the initial WMP. If Permittee does not complete the Little River watershed study prior to filing its application for approval of the initial WMP, Permittee shall not divert or impound water authorized by this permit from the Little River watershed until that study is completed and results considered in an application to amend the WMP.

18) Permittee shall consult with the U.S. Army Corps of Engineers on federal projects to determine whether overbanking flows can be safely managed to maintain a sound ecological environment.

19) The requirements of these Special Conditions apply only to diversion and storage under the authority of this permit and do not address or limit diversion and storage of water authorized by other water rights held by Permittee.

20) These special conditions are subject to adjustment by the Commission if the Commission determines, through an expedited public review process, that such adjustment is appropriate to achieve compliance with applicable environmental flow standards adopted pursuant to Texas Water Code § 11.1471. Any adjustment shall be made in accordance with the provisions of Texas Water Code § 11.147(e-1).

This permit is issued subject to all superior and senior water rights in the Brazos River Basin.

Permittee agrees to be bound by the terms, conditions and provisions contained herein and such agreement is a condition precedent to the granting of this permit.

All other matters requested in the application which are not specifically granted by this permit are denied.

This permit is issued subject to the Rules of the Texas Commission on Environmental Quality and to the right of continuing supervision of state water resources exercised by the Commission.

_____
For the Commission

ISSUED:

Bickerstaff Heath Delgado Acosta LLP

3711 S. MoPac Expressway Building One, Suite 300 Austin, Texas 78746 (512) 472 8021 Fax (512) 320 5638 www.bickerstaff.com

December 22, 2009

Mr. Ron Ellis, Project Manager
Water Rights Permitting & Availability Section
Texas Commission on Environmental Quality, MC 160
P.O. Box 13087
Austin, Texas 78711-3087

Re: Application No. 5851

Dear Mr. Ellis:

Pursuant to settlement agreements BRA has entered, or is in the process of entering, with the cities of Bryan and College Station, please accept this amendment of BRA's application to clarify that it is not applying to appropriate or divert any return flows that are subject to a bed and banks authorization granted now or hereafter by TCEQ pursuant to Texas Water Code § 11.042(b). For your information, a copy of the Settlement Agreement with the City of Bryan is enclosed. An identical agreement with College Station is in the process of being executed at this time.

Special Condition A.3., contained in the most recent draft of the permit submitted to TCEQ by BRA and Texas Parks and Wildlife Department, should be modified as follows to implement this agreement:

> Permittee's storage, diversion and use of groundwater based return flows is subject to interruption by direct reuse or for indirect reuse upon issuance of a bed and banks authorization pursuant to Texas Water Code § 11.042(b) by TCEQ to the discharging entity.

It is important that the next draft of Permit No. 5851 contain this special condition in order to avoid the necessity of participation in the contested case by Bryan and College Station.

Thank you for your attention to this matter. Please contact me is further clarification or information is required.

Sincerely,

Doug Caroom

Douglas G. Caroom

DGC/mmr
Enclosure

cc: Jim Mathews, Attorney for
City of Bryan and City of College Station

SETTLEMENT AGREEMENT

This Settlement Agreement is entered into by the City of Bryan, Texas ("Bryan") and the Brazos River Authority ("BRA"), collectively the Parties, in order to establish a resolution of disputes regarding their competing applications to use or reuse groundwater-based return flows generated at Bryan's wastewater treatment facilities.

WHEREAS, BRA has filed with the Texas Commission on Environmental Quality ("TCEQ") application number 5851 seeking, among other things, authority to appropriate, divert, and use current and future groundwater and surface water based return flows in the Brazos River Basin, including Bryan's groundwater-based return flows;

WHEREAS, Bryan has filed with TCEQ application number 5912 seeking bed and banks authorization to convey its groundwater-based return flows through watercourses in the Brazos River Basin for subsequent diversion and reuse;

WHEREAS, Bryan and BRA have each protested the other party's pending application and requested a contested case hearing;

WHEREAS, Bryan and the BRA desire to resolve their disputes regarding the right to appropriate, divert, and use or reuse groundwater-based return flows generated at the city's wastewater treatment plants by agreement and without the expense of litigation;

NOW, THEREFORE, based on the terms and conditions contained herein, which constitute good and valuable consideration, the Parties agree as follows:

1. BRA agrees that it will not divert or use Bryan's return flows that are subject to a bed and banks authorization granted now or hereafter by the TCEQ pursuant to Tex. Water Code §11.042(b).

2. On or before December 4, 2009, BRA will file with the State Office of Administrative Hearings in Docket No. 582-10-1115 a motion to withdraw its protest and request for contested case hearing concerning Bryan's bed and banks application.

3. Contemporaneous with its motion to withdraw described in paragraph 2, BRA will transmit a letter to the Executive Director of TCEQ, with copy to Bryan, amending its Application No. 5851 to state that it is not applying to appropriate, divert, or use any return flows that are subject to a bed and banks authorization granted now or hereafter by TCEQ pursuant to Texas Water Code §11.042(b).

4. BRA agrees to seek modification and use its best efforts to obtain modification of any draft permit that authorizes BRA to appropriate, divert or use return flows that are subject to a §11.042(b) authorization.

5. On or before December 4, 2009, Bryan will file with TCEQ a conditional withdrawal of protest to BRA's Application No. 5851. Bryan's withdrawal may be conditioned to allow participation in the contested case hearing if a draft permit recommended by the Executive Director would authorize BRA to appropriate, divert, or use return flows that are subject to a §11.042(b) authorization issued to Bryan.

6. Bryan and the BRA agree that no compensation is due any party under this Settlement Agreement and that each party shall bear its own cost in terms of complying with this Settlement Agreement.

7. This Settlement Agreement contains the entire agreement between the Parties and supersedes any and all prior agreements, arrangements or understandings between the Parties relating to the subject matter contained herein. No oral understandings, statements, promises or inducements contrary to the terms of this Settlement Agreement exist. This Settlement Agreement cannot be changed or modified verbally as any amendments or modifications must be in writing and agreed to and executed by the Parties or their authorized representatives.

8. This Settlement Agreement shall be binding upon and inure to the benefit of the Parties and their respective legal representatives, successors and assigns.

9. By their signatures below, the individuals signing represent and warrant that they have full authority to bind and otherwise compromise the interests of the party they represent.

CITY OF BRYAN, TEXAS

Date: December 2, 2009

By: _____

Name: D. Mark Conlee

APPROVED AS TO FORM:

_____
Bryan City Attorney

ATTEST:

_____
City Secretary

BRAZOS RIVER AUTHORITY

Date:_____

By:_____
Name: _____

Attest:_____
Name: _____

STATE OF TEXAS §
§
COUNTY OF BRAZOS §

This instrument was acknowledged before me on the 2nd day of December, 2009, by D. Mark Conlee, on behalf of the City of Bryan, Texas.

CYNTHIA A. BOWMAN
Notary Public, State of Texas
My Commission Expires
AUGUST 17, 2013

Cynthia A. Bowman
Notary Public, State of Texas

STATE OF TEXAS §
§
COUNTY OF _____ §

This instrument was acknowledged before me on the ____ day of _____, 2009, by _____, on behalf of the Brazos River Authority.

_____
Notary Public, State of Texas