

REGION C WATER PLANNING GROUP

Senate Bill One Third Round of Regional Water Planning - Texas Water Development Board

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December 9, 2010

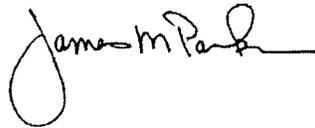
Ms. Carolyn Brittin
Texas Water Development Board
1700 N. Congress Avenue
Austin, Texas 78701

Dear Ms. Brittin:

The Region C Water Planning Group would like to formally submit a memorandum regarding errata in the 2011 *Region C Water Plan*. Based on plan review comments by the Texas Water Development Board staff, the attached memorandum and data therein shall be made part of the 2011 *Region C Water Plan*.

If you have any questions regarding this matter, please contact my office at 972/442-5405.

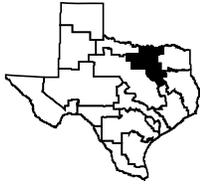
Sincerely,



JAMES M. PARKS
Chairman/Administrator

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Region C
Water Planning Group

Freese and Nichols, Inc.
Alan Plummer Associates, Inc.
CP&Y, Inc.
Cooksey Communications, Inc.

MEMORANDUM

To: Ms. Carolyn Brittin
From: Thomas C. Gooch, Freese and Nichols, Inc.
Re: Errata in the *2011 Region C Water Plan*
Date: December 8, 2010

Several errata in the *2011 Region C Water Plan* (Plan) have come to our attention, specifically:

- Lake Fastrill Replacement Water Management Strategy was associated with a number of alternate sources of supply and lacked a specific source of supply.
- Tables Z.2 (Summary of Recommended Strategies) and Z.3 (Summary of Alternate Strategies) were based on information from the TWDB database (DB12) at the time of the printing of the Plan. Subsequent adjustments were made to DB12 and new Tables Z.2 and Z.3 are presented in this memorandum.
- A number of capital costs were in error or omitted from Tables in Sections 4E and 4F. These corrections will affect the total cost of the plan in the Executive Summary text and Table ES.2.

Table 1 is a summary of the changes to the plan. The errata are described in more detail below.

Table 1 – Summary of Changes to 2011 Region C Water Plan

| Pages | Location | Description |
|------------|--|--|
| 4E.8 | End of “Lake Fastrill Replacement” section | Add paragraph to specify use of planning costs and water supply associated with Neches Run-of-River as basis for Lake Fastrill Replacement strategy, while reserving the option of substituting other alternate sources in the future. |
| 4E.9-4E.11 | Table 4E.1 | Specify Neches Run-of-River as basis for Lake Fastrill Replacement strategy. |
| 4E.12 | Table 4E.2 | Specify Neches Run-of-River as basis for Lake Fastrill Replacement strategy. Add estimated costs of Neches Run-of-the-River strategy. |
| Appendix Z | Tables Z.2 and Z.3 | Tables have been updated to reflect adjustments made to DB12. |
| Multiple | Tables in Section 4E. & 4F; Table ES.2. | Capital costs in Tables in Sections 4E and 4F should be corrected based on the Table 2 of this memorandum. Executive summary table (ES.2) will change as shown in this memo. |

Lake Fastrill

To clarify the Lake Fastrill Replacement strategy and satisfy TWDB requirements for Water Management Strategies, the following paragraph should be inserted at the end of the “Lake Fastrill Replacement” section on page 4E.8. Tables 4E.1 and 4E.2 should be updated as shown below.

For the purpose of this Regional Plan, Dallas has elected to use the planning costs and water supply associated with the Neches River Run-of-the-River strategy as a basis for the “Lake Fastrill Replacement” strategy. At any time in the future, through action by the Region C Water Planning Group, any of the other alternate strategies may be substituted into the Plan to represent the “Fastrill Reservoir Replacement”.

Table 4E.1 - UPDATED
Summary of Recommended Water Management Strategies for DWU

| Planned Supplies (Ac-Ft per Yr) | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 |
|--|----------------|----------------|----------------|----------------|----------------|----------------|
| Projected Demands | 606,630 | 688,693 | 732,512 | 786,911 | 863,119 | 994,168 |
| Existing | | | | | | |
| Elm Fork System | 184,801 | 183,733 | 182,665 | 181,597 | 180,529 | 179,459 |
| Grapevine Lake | 7,583 | 7,367 | 7,150 | 6,933 | 6,717 | 6,500 |
| Lake Ray Hubbard | 57,427 | 56,113 | 54,800 | 53,487 | 52,173 | 50,860 |
| Lake Ray Hubbard Temporary | 49,800 | 0 | 0 | 0 | 0 | 0 |
| Lake Tawakoni | 183,619 | 182,251 | 180,882 | 179,515 | 178,146 | 176,777 |
| Lake Fork | 40,581 | 41,949 | 43,318 | 44,685 | 46,054 | 47,423 |
| Direct Reuse (Golf courses) | 561 | 561 | 561 | 561 | 561 | 561 |
| White Rock Lake (Irrigation Only) | 3,500 | 3,200 | 2,900 | 2,600 | 2,300 | 2,000 |
| Return Flow* | 29,961 | 42,046 | 53,147 | 60,646 | 69,861 | 85,000 |
| Total Available Supplies | 557,833 | 517,220 | 525,423 | 530,024 | 536,341 | 548,580 |
| | | | | | | |
| Need (Demand-Supply) | 48,797 | 171,473 | 207,089 | 256,887 | 326,778 | 445,588 |
| | | | | | | |
| Water Management Strategies | | | | | | |
| Conservation (DWU Retail) | 18,432 | 26,522 | 28,154 | 34,134 | 41,528 | 52,987 |
| Conservation (Wholesale Customers) | 7,211 | 16,032 | 25,739 | 31,242 | 36,956 | 44,627 |
| Additional Dry Year Supply | 25,000 | 0 | 0 | 0 | 0 | 0 |
| Lake Ray Hubbard Operational Efficiency Supply** | 0 | 153,187 | 154,500 | 155,813 | 157,127 | 158,440 |
| Main Stem Trinity Pump Station (Lake Ray Hubbard Indirect Reuse) | 0 | 31,612 | 35,872 | 39,459 | 40,244 | 41,029 |
| Additional Direct Reuse | 0 | 20,458 | 20,458 | 20,458 | 20,458 | 20,458 |
| Additional Pipeline from Lake Tawakoni (More Lk. Fork Supply) | | 77,994 | 75,777 | 73,563 | 71,346 | 69,128 |

Table 4E.1-UPDATED, Continued

| Planned Supplies (Ac-Ft per Yr) | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 |
|---|----------------|----------------|----------------|----------------|----------------|------------------|
| Connect Lake Palestine (Integrated Pipeline with TRWD) | | 111,776 | 110,670 | 109,563 | 108,455 | 107,347 |
| Wright Patman Lake | | | | 112,100 | 112,100 | 112,100 |
| Fastrill Replacement Strategy *** | | | | | | 112,100 |
| Southwest Treated Water Pipe | | 0 | 0 | 0 | 0 | 0 |
| WTP Expansions | | | 0 | 0 | 0 | 0 |
| Total Supplies from Strategies | 50,643 | 284,394 | 296,670 | 420,519 | 431,087 | 559,776 |
| Total Supplies | 608,476 | 801,614 | 822,093 | 950,543 | 967,428 | 1,108,356 |
| Reserve or (Shortage) | 1,846 | 112,921 | 89,581 | 163,632 | 104,309 | 114,188 |

Notes:

* Includes return flows from Flower Mound, Lewisville, Denton, NTMWD and UTRWD.

** Lake Ray Hubbard Operational Efficiency Supply is not considered to be a firm yield supply and is not included in the totals.

***Estimated planning costs and water supply associated with this strategy are based on the Neches River Run-of-River strategy. This project, however is only one of several water management strategies being considered to meet these 2060 needs, and through action by the Region C Water Planning Group, any of those other strategies may be substituted into the plan to represent the 'Fastrill Reservoir Replacement' strategy. Those other strategies include: additional water conservation, Lake Texoma, Toledo Bend Reservoir, Lake O' the Pines, Lake Livingston, Ogallala groundwater in Roberts County (Region A), Marvin Nichols Reservoir, Lake Columbia, George Parkhouse Reservoir (North), George Parkhouse Reservoir (South), and Oklahoma Water.

Table 4E.2 - UPDATED
Summary of Costs for DWU Recommended Strategies

| Strategy | Date to Be Developed | Quantity for DWU (Ac-Ft/Yr) | DWU Share of Capital Costs | Unit Cost (\$/1000 gal) | | Table for Details |
|--------------------------|-----------------------------|------------------------------------|--|--------------------------------|---------------------------|--------------------------|
| | | | | With Debt Service | After Debt Service | |
| Conservation (retail) | 2010-2060 | 52,987 | \$0*** | \$0.40 | \$0.40 | Q-10 & Q-11 |
| Conservation (wholesale) | 2010-2060 | 44,677 | Included under County Summaries in Section 4F. | | | |
| Additional Ray Hubbard | 2010 | 158,440** | \$1,750,000 | N/A | N/A | None |

Table 4E.2 - UPDATED, Continued

| Strategy | Date to Be Developed | Quantity for DWU (Ac-Ft/Yr) | DWU Share of Capital Costs | Unit Cost (\$/1000 gal) | | Table for Details |
|------------------------------------|----------------------|-----------------------------|----------------------------|-------------------------|--------------------|-------------------|
| | | | | With Debt Service | After Debt Service | |
| Additional Dry Year Supply | 2010 | 25,000 | \$0 | N/A | N/A | None |
| 100 mgd WTP Expansion | 2012 | 56,050* | \$146,318,000 | \$1.28 | \$0.70 | Q-67 |
| Main Stem Trinity PS | 2013 | 41,029 | \$142,567,000 | \$0.94 | \$0.16 | Q-37 |
| Additional Direct Reuse | 2015 | 20,458 | \$82,920,000 | \$1.22 | \$0.32 | Q-65 |
| Additional Pipeline from Tawakoni | 2015 | 69,128 | \$496,243,000 | \$1.71 | \$0.29 | Q-36 |
| Southwest Treated Water Pipeline | 2016 | N/A | \$260,000,000 | N/A | N/A | None |
| Connect Lake Palestine | 2018 | 107,347 | \$887,954,000 | \$2.37 | \$0.60 | Q-41 |
| New WTP (100 mgd) | 2018 | 56,050* | \$190,125,000 | \$1.46 | \$0.70 | Q-67 |
| 100 mgd WTP Expansion | 2025 | 56,050* | \$146,318,000 | \$1.28 | \$0.70 | Q-67 |
| Wright Patman Lake | 2035 | 112,100 | \$896,478,000 | \$2.34 | \$0.56 | Q-24 |
| 100 mgd WTP Expansion | 2035 | 56,050* | \$146,318,000 | \$1.28 | \$0.70 | Q-67 |
| 100 mgd WTP Expansion | 2045 | 56,050* | \$146,318,000 | \$1.28 | \$0.70 | Q-67 |
| 100 mgd WTP Expansion | 2052 | 56,050* | \$146,318,000 | \$1.28 | \$0.70 | Q-67 |
| Fastrill Replacement Strategy **** | 2055 | 112,100 | \$1,980,278,000 | \$4.41 | \$1.13 | Q-51 |
| 100 mgd WTP Expansion | 2058 | 56,050* | \$146,318,000 | \$1.28 | \$0.70 | Q-67 |
| Total DWU Capital Costs | | | \$5,816,223,000 | | | |

* Water treatment plant expansions are needed to use the supplies developed by other strategies, but they do not develop additional supplies.

** Lake Ray Hubbard Operational Efficiency Supply is not considered to be a firm yield supply.

***DWU has already made significant capital investment to implement its conservation programs. In the future, all costs will be annual operating costs which are estimated to range from \$3.5 million in 2010 to \$7.0 million in 2060.

****Estimated planning costs and water supply associated with this strategy are based on the Neches River Run-of-River strategy. This project, however is only one of several water management strategies being considered to meet these 2060 needs, and through action by the Region C Water Planning Group, any of those other strategies may be substituted into the plan to represent the 'Fastrill Reservoir Replacement' strategy. Those other strategies include: additional water conservation, Lake Texoma, Toledo Bend Reservoir, Lake O' the Pines, Lake Livingston, Ogallala groundwater in Roberts County (Region A), Marvin Nichols Reservoir, Lake Columbia, George Parkhouse Reservoir (North), George Parkhouse Reservoir (South), and Oklahoma Water.

Appendix Z Tables

The Appendix Z tables that appeared in the final 2011 Region C Water Plan have been updated. The updated tables are shown on the following pages.

Table Z.2^{1,6}-UPDATED
Summary of Recommended Strategies
Region C WUGs and WWPs

| Recommended Strategy | Capital Cost | First Decade of Water Strategy | First Decade Water Supply Volume (acre-feet/year) | First Decade Estimated Annual Average Unit Cost (\$/acre-foot/year) | Year 2060 Water Supply Volume (acre-feet/year) | Year 2060 Estimated Annual Average Unit Cost (\$/acre-foot/year) |
|---|-------------------------|--------------------------------|---|---|--|--|
| ADDITIONAL DRY YEAR SUPPLY | \$1,750,000.00 | 2010 | 25,000 | \$0.00 | 0 | \$0.00 |
| ADDITIONAL PIPELINE FROM LAKE TAWAKONI (MORE LAKE FORK SUPPLY) | \$496,243,000.00 | 2020 | 77,994 | \$557.77 | 69,128 | \$107.79 |
| COLLIN-GRAYSON MUNICIPAL ALLIANCE SYSTEM | \$77,366,000.00 | 2020 | 3,255 | \$3,044.55 | 27,412 | \$982.38 |
| COOKE COUNTY PROJECT | \$50,280,000.00 | 2020 | 2,240 | \$1,658.04 | 4,480 | \$394.42 |
| DIRECT REUSE | \$264,783,000.00 | 2010 | 1,552 | \$691.37 | 46,250 | \$138.57 |
| DIRECT REUSE - FRISCO | \$31,448,606.00 | 2020 | 2,240 | \$1,358.93 | 5,650 | \$134.34 |
| Dallas Reuse Projects ² | \$225,487,000.00 | | 52,070 | | 61,487 | |
| <i>DWU REUSE</i> | <i>\$82,920,000.00</i> | <i>2020</i> | <i>34,902</i> | <i>\$232.78</i> | <i>50,382</i> | <i>\$41.69</i> |
| <i>MAIN STEM TRINITY PUMP STATION (LAKE RAY HUBBARD INDIRECT REUSE - DWU)</i> | <i>\$142,567,000.00</i> | <i>2020</i> | <i>17,168</i> | <i>\$730.08</i> | <i>11,105</i> | <i>\$196.04</i> |
| ENNIS REUSE | \$31,779,000.00 | 2040 | 333 | \$14,738.74 | 3,696 | \$1,327.92 |
| FACILITY IMPROVEMENTS | \$2,314,558,600.00 | 2010 | 0 | \$0.00 | 0 | \$0.00 |
| FACILITY IMPROVEMENTS- REUSE SOURCES | \$590,686,000.00 | 2010 | 0 | \$0.00 | 0 | \$0.00 |
| FANNIN COUNTY PROJECT | \$38,471,000.00 | 2020 | 1,254 | \$3,838.12 | 5,113 | \$394.68 |
| FASTRILL REPLACEMENT (REGION C COMPONENT) | \$1,980,278,000.00 | 2060 | 112,100 | \$1,724.36 | 112,100 | \$1,724.36 |
| GOLF COURSE CONSERVATION | \$0.00 | 2010 | 56 | \$278.52 | 3,121 | \$277.84 |
| GRAYSON COUNTY PROJECT | \$136,016,000.00 | 2010 | 200 | \$0.00 | 24,640 | \$140.85 |
| INDIRECT REUSE | \$0.00 | 2020 | 4,368 | \$0.00 | 4,368 | \$0.00 |
| INDIRECT REUSE - JACKSBORO FOR JACK CO MINING | \$200,000.00 | 2010 | 385 | \$0.00 | 385 | \$0.00 |
| LAKE PALESTINE CONNECTION (INTEGRATED PIPELINE WITH TRWD) | \$887,954,000.00 | 2020 | 111,776 | \$772.91 | 107,347 | \$203.86 |
| LAKE RALPH HALL | \$286,401,000.00 | 2020 | 34,050 | \$726.99 | 34,050 | \$115.92 |
| LAKE TEXOMA - AUTHORIZED (BLEND) | \$336,356,000.00 | 2030 | 69,200 | \$495.56 | 113,000 | \$87.23 |
| LAKE TEXOMA - INTERIM PURCHASE FROM GTUA | \$0.00 | 2020 | 21,900 | \$0.00 | 0 | \$0.00 |
| LOWER BOIS D ARC CREEK RESERVOIR | \$615,498,000.00 | 2020 | 54,796 | \$971.79 | 108,487 | \$78.67 |

Table Z.2-UPDATED, Continued

| Recommended Strategy | Capital Cost | First Decade of Water Strategy | First Decade Water Supply Volume (acre-feet/year) | First Decade Estimated Annual Average Unit Cost (\$/acre-foot/year) | Year 2060 Water Supply Volume (acre-feet/year) | Year 2060 Estimated Annual Average Unit Cost (\$/acre-foot/year) |
|---|--------------------|--------------------------------|---|---|--|--|
| MAIN STEM PS (ADDITIONAL EAST FORK) NTMWD | \$0.00 | 2020 | 34,900 | \$0.00 | 0 | \$0.00 |
| MANUFACTURING CONSERVATION | \$0.00 | 2010 | 1 | \$0.00 | 2,618 | \$211.38 |
| MARVIN NICHOLS RESERVOIR ³ | \$3,345,052,000.00 | 2030 | 227,400 | \$364.26 | 472,300 | \$83.04 |
| MUNICIPAL CONSERVATION-BASIC | \$1,151,575.00 | 2010 | 41,967 | \$200.40 | 264,429 | \$84.63 |
| MUNICIPAL CONSERVATION-EXPANDED | \$480,774.00 | 2010 | 4,756 | \$168.50 | 20,541 | \$395.75 |
| NEW WELLS - CARRIZO WILCOX AQUIFER | \$1,853,000.00 | 2010 | 154 | \$344.81 | 467 | \$446.30 |
| NEW WELLS - TRINITY AQUIFER | \$7,778,150.00 | 2010 | 1,882 | \$410.00 | 2,306 | \$228.85 |
| NEW WELLS - WOODBINE AQUIFER | \$14,543,000.00 | 2010 | 763 | \$662.88 | 1,932 | \$339.28 |
| OKLAHOMA WATER TO IRVING | \$194,825,000.00 | 2030 | 25,000 | \$810.28 | 25,000 | \$244.12 |
| OKLAHOMA WATER TO NTMWD, TRWD, UTRWD | \$756,044,500.00 | 2060 | 115,000 | \$290.44 | 115,000 | \$290.44 |
| OVERDRAFT TRINITY AQUIFER - EXISTING WELLS | \$0.00 | 2010 | 2,168 | \$105.25 | 0 | \$0.00 |
| OVERDRAFT TRINITY AQUIFER - NEW WELLS | \$269,000.00 | 2010 | 75 | \$493.33 | 0 | \$0.00 |
| PURCHASE FROM WATER PROVIDER (1) | \$0.00 | 2010 | 46 | \$0.00 | 0 | \$0.00 |
| REDISTRIBUTION OF SUPPLIES | \$0.00 | 2010 | 530 | \$0.00 | 58,031 | \$0.00 |
| SUBORDINATION AGREEMENT- FUTURE-ONLY SOURCES | \$8,217,000.00 | 2020 | 280 | \$2,560.71 | 215 | \$558.14 |
| SUPPLEMENTAL WELLS | \$495,381,934.00 | 2010 | 0 | \$0.00 | 0 | \$0.00 |
| TOLEDO BEND PROJECT (500,000) ⁴ | \$2,406,236,000.00 | 2010 | 363 | \$0.00 | 400,217 | \$1,072.45 |
| TRA 10-MILE CREEK REUSE PROJECT | \$14,895,000.00 | 2030 | 6,760 | \$259.17 | 6,760 | \$99.11 |
| TRA DENTON CREEK WWTP REUSE | \$9,506,000.00 | 2020 | 3,750 | \$0.00 | 3,750 | \$229.07 |
| TRA ELLIS COUNTY REUSE | \$10,384,000.00 | 2060 | 2,200 | \$505.00 | 2,200 | \$505.00 |
| TRA FREESTONE COUNTY REUSE | \$17,266,000.00 | 2050 | 6,760 | \$323.49 | 6,760 | \$323.49 |
| TRA KAUFMAN COUNTY REUSE | \$9,761,000.00 | 2020 | 1,000 | \$901.00 | 1,000 | \$192.00 |
| TRA LAS COLINAS REUSE | \$14,530,000.00 | 2020 | 7,000 | \$284.49 | 7,000 | \$133.69 |
| TRA TARRANT COUNTY PROJECT | \$59,008,000.00 | 2010 | 0 | \$0.00 | 0 | \$0.00 |
| TRWD THIRD PIPELINE AND REUSE | \$914,424,000.00 | 2020 | 105,500 | \$1,015.87 | 105,500 | \$324.48 |
| WATER TREATMENT PLANT - EXPANSION | \$19,970,000.00 | 2020 | 1,260 | \$0.00 | 2,268 | \$1,090.39 |
| WATER TREATMENT PLANT - NEW | \$308,309,400.00 | 2010 | 0 | \$0.00 | 807 | \$19,346.39 |
| WRIGHT PATMAN - REALLOCATION OF FLOOD POOL (112K) | \$896,478,000.00 | 2040 | 112,100 | \$761.95 | 112,100 | \$761.95 |
| CONVEYANCE PROJECT (1) ⁵ | \$413,884,000.00 | 2010 | 194 | \$11,560.82 | 25,178 | \$679.25 |
| CONVEYANCE PROJECT (2) ⁵ | \$69,299,100.00 | 2020 | 1,672 | \$0.00 | 1,237 | \$3,153.97 |
| CONVEYANCE PROJECT (3) ⁵ | \$6,465,400.00 | 2020 | 213 | \$6,530.52 | 2,016 | \$1,026.79 |
| GRAYSON COUNTY PROJECT ⁵ | \$146,071,000.00 | 2020 | 5,600 | \$3,693.13 | 19,600 | \$513.75 |

Table Z.2-UPDATED, Continued

| Recommended Strategy | Capital Cost | First Decade of Water Strategy | First Decade Water Supply Volume (acre-feet/year) | First Decade Estimated Annual Average Unit Cost (\$/acre-foot/year) | Year 2060 Water Supply Volume (acre-feet/year) | Year 2060 Estimated Annual Average Unit Cost (\$/acre-foot/year) |
|---|--------------------|--------------------------------|---|---|--|--|
| PURCHASE FROM WATER PROVIDER (1) ⁵ | \$164,114,900.00 | 2010 | 402 | \$0.00 | 30,103 | \$1,067.12 |
| PURCHASE FROM WATER PROVIDER (2) ⁵ | \$3,538,000.00 | 2020 | 52 | \$5,950.00 | 86 | \$609.30 |
| PURCHASE FROM WATER PROVIDER (3) ⁵ | \$65,481,250.00 | 2020 | 4,004 | \$2,384.37 | 6,417 | \$1,706.16 |
| WATER TREATMENT PLANT - EXPANSION ⁵ | \$2,708,430,000.00 | 2010 | 0 | \$0.00 | 2,618 | \$106,248.98 |
| WATER TREATMENT PLANT-EXPANSION- REUSE SOURCES ⁵ | \$32,750,000.00 | 2010 | 0 | \$0.00 | 0 | \$0.00 |

NOTES:

¹Information in this table matches the TWDB Database (DB12).

²Dallas has two future reuse projects. In DB12, these two projects share the same source. The sum of these two projects' supply in the database is equal to the sum of the two projects' supply shown in Table 4E.1 of the Plan, however the distribution of the supply between the two projects in the database differs somewhat from the distribution in Table 4E.1. Consider the database to be consistent with the Plan.

³Cost shown here is for both Phase I & II for NTMWD & TRWD, but only Phase I for UTRWD. UTRWD will not need Phase II of the project until after 2060.

⁴This is the cost from the TWDB Database (DB12), which includes Sabine River Authority's portion of the the cost. Total costs in the Region C Plan (Table ES.2) only includes costs for WWPs located in Region C and does not include SRA's portion of Toledo Bend costs.

⁵Strategy supply volumes may already be listed in other strategies.

⁶A number of costs from the Region C Plan could not be entered into DB12. WUGs with no demand are not in DB12, however, historical use from some of the WUGs indicate there is a demand. The Region C Plan outlines strategies (and associated costs) for these WUGs.

Table Z.3¹ - UPDATED
Summary of Alternative Strategies
Region C WUGs and WWPs

| ALTERNATIVE Strategy | Capital Cost | First Decade of Water Strategy | First Decade Water Supply Volume (acre-feet/year) | First Decade Estimated Annual Average Unit Cost (\$/acre-foot/year) | Year 2060 Water Supply Volume (acre-feet/year) | Year 2060 Estimated Annual Average Unit Cost (\$/acre-foot/year) |
|--|--------------------|--------------------------------|---|---|--|--|
| BRAZOS GROUNDWATER PROJECT TO DWU | \$801,451,000.00 | 2040 | 100,000 | \$1,221.52 | 100,000 | \$1,221.52 |
| BRAZOS GROUNDWATER PROJECT TO NTMWD | \$913,344,000.00 | 2030 | 100,000 | \$1,415.83 | 100,000 | \$752.30 |
| COOKE COUNTY PROJECT | \$3,254,000.00 | 2020 | 200 | \$2,110.00 | 200 | \$930.00 |
| INDIRECT REUSE | \$195,183,000.00 | 2010 | 0 | \$0.00 | 26,000 | \$380.45 |
| LAKE COLUMBIA TO DWU | \$179,945,000.00 | 2040 | 35,800 | \$536.08 | 35,800 | \$536.08 |
| LAKE GEORGE PARKHOUSE NORTH FOR DWU | \$521,281,000.00 | 2040 | 112,100 | \$4,650.14 | 112,100 | \$4,650.14 |
| LAKE GEORGE PARKHOUSE NORTH FOR NTMWD | \$1,029,185,000.00 | 2030 | 203,960 | \$580.17 | 203,960 | \$156.23 |
| LAKE GEORGE PARKHOUSE SOUTH FOR DWU | \$692,921,000.00 | 2040 | 115,260 | \$567.72 | 115,260 | \$567.72 |
| LAKE GEORGE PARKHOUSE SOUTH FOR NTMWD | \$1,282,503,000.00 | 2030 | 193,480 | \$758.17 | 193,480 | \$177.26 |
| LAKE LIVINGSTON TO DWU | \$1,855,538,000.00 | 2040 | 200,000 | \$981.95 | 200,000 | \$981.95 |
| LAKE LIVINGSTON TO NTMWD | \$2,115,111,000.00 | 2020 | 200,000 | \$1,102.51 | 200,000 | \$334.21 |
| LAKE LIVINGSTON TO TRWD | \$2,084,210,000.00 | 2030 | 200,000 | \$1,119.88 | 200,000 | \$362.80 |
| LAKE O THE PINES TO DWU | \$541,534,000.00 | 2040 | 89,600 | \$705.13 | 89,600 | \$705.13 |
| LAKE O THE PINES TO NTMWD | \$402,431,000.00 | 2030 | 87,900 | \$576.46 | 87,900 | \$243.86 |
| LAKE RALPH HALL | \$143,201,000.00 | 2030 | 29,219 | \$847.19 | 29,219 | \$135.08 |
| LAKE TEHUACANA | \$746,345,000.00 | 2030 | 56,800 | \$1,117.80 | 56,800 | \$163.20 |
| LAKE TEXOMA - AUTHORIZED (DESALINATE) | \$796,532,000.00 | 2020 | 105,000 | \$994.32 | 105,000 | \$442.86 |
| LAKE TEXOMA - NOT AUTHORIZED (BLEND) | \$673,749,300.00 | 2020 | 8,400 | \$463.45 | 146,400 | \$111.86 |
| LAKE TEXOMA - NOT AUTHORIZED (DESALINATE) | \$925,918,000.00 | 2030 | 105,000 | \$1,099.15 | 105,000 | \$458.51 |
| LAKE TEXOMA TO DWU (BLEND) | \$56,334,000.00 | 2020 | 20,000 | \$305.64 | 20,000 | \$101.01 |
| MARVIN NICHOLS RESERVOIR WITH DWU | \$322,326,000.00 | 2030 | 50,000 | \$455.04 | 50,000 | \$127.20 |
| NEW WELLS - OTHER AQUIFER | \$7,000,000.00 | 2020 | 4,480 | \$219.02 | 4,480 | \$105.54 |
| NTMWD INTERIM PURCHASE FROM DWU (ALTERNATIVE STRATEGIES) | \$1,777,000.00 | 2020 | 11,200 | \$463.75 | 0 | \$0.00 |
| OKLAHOMA WATER TO DWU | \$343,934,000.00 | 2060 | 50,000 | \$702.04 | 50,000 | \$702.04 |
| PURCHASE WATER FROM LOCAL PROVIDER (ALTERNATIVE 1) | \$20,133,000.00 | 2030 | 6,726 | \$1,083.71 | 6,726 | \$866.19 |
| ROBERTS COUNTY PROJECT TO DWU | \$2,435,534,000.00 | 2040 | 200,000 | \$1,108.72 | 200,000 | \$1,108.72 |
| ROBERTS COUNTY PROJECT TO NTMWD | \$2,434,529,000.00 | 2020 | 200,000 | \$1,127.16 | 200,000 | \$242.83 |
| TOLEDO BEND PROJECT (700,000) | \$1,433,774,000.00 | 2050 | 200,000 | \$813.02 | 200,000 | \$813.02 |
| WATER TREATMENT PLANT - EXPANSION | \$14,548,000.00 | 2010 | 0 | \$0.00 | 0 | \$0.00 |
| WATER TREATMENT PLANT - NEW | \$17,000,000.00 | 2020 | 8,960 | \$259.32 | 8,960 | \$121.38 |

Table Z.3-UPDATED, Continued

| ALTERNATIVE Strategy | Capital Cost | First Decade of Water Strategy | First Decade Water Supply Volume (acre-foot/year) | First Decade Estimated Annual Average Unit Cost (\$/acre-foot/year) | Year 2060 Water Supply Volume (acre-foot/year) | Year 2060 Estimated Annual Average Unit Cost (\$/acre-foot/year) |
|---|--------------------|--------------------------------|---|---|--|--|
| WATER TREATMENT PLANT - NEW (ALTERNATIVE STRATEGIES) | \$48,972,000.00 | 2030 | 6,726 | \$1,204.28 | 6,726 | \$675.29 |
| WRIGHT PATMAN - REALLOCATION OF FLOOD POOL NTMWD (180K) | \$1,433,524,000.00 | 2030 | 230,000 | \$796.54 | 230,000 | \$227.22 |
| WRIGHT PATMAN - REALLOCATION OF FLOOD POOL TRWD (180K) | \$1,694,140,000.00 | 2030 | 180,000 | \$954.23 | 180,000 | \$270.47 |
| WRIGHT PATMAN - TEXARKANA SALE TO NTMWD | \$1,192,489,000.00 | 2030 | 150,000 | \$1,090.11 | 150,000 | \$390.48 |
| WRIGHT PATMAN - TEXARKANA SALE TO TRWD | \$1,081,475,000.00 | 2030 | 100,000 | \$1,167.40 | 100,000 | \$381.72 |
| WRIGHT PATMAN SYSTEM OPERATION | \$2,954,940,000.00 | 2030 | 298,000 | \$1,057.10 | 298,000 | \$336.72 |
| MARVIN NICHOLS RESERVOIR WITH DWU ² | \$634,154,000.00 | 2030 | 95,931 | \$661.11 | 95,931 | \$180.86 |
| WRIGHT PATMAN SYSTEM OPERATION ² | \$403,387,000.00 | 2030 | 50,000 | \$2,023.38 | 50,000 | \$581.54 |

¹Information in this table matches the TWDB Database (DB12).

²Strategy supply volumes may already be listed in other strategies.

Capital Costs

A number of capital costs were in error or omitted from Tables in Sections 4E and 4F.

Table 2 outlines the corrections to those tables.

Table 2 - Corrections to Cost Tables in 2011 Region C Water Plan

| WUG or WWP Name | Amount Shown in Plan | Correct Amount | Difference | Table in Plan | Strategy |
|--------------------------|----------------------|-----------------|-----------------|---------------|--|
| Aledo | \$0 | \$12,306,000 | \$12,306,000 | 4F.288 | Fort Worth (TRWD) |
| Alvord | \$0 | \$2,581,000 | \$2,581,000 | 4F.364 | West Wise Rural SUD (TRWD) |
| Annetta | \$0 | \$1,522,100 | \$1,522,100 | 4F.288 | Weatherford (TRWD) |
| Annetta South | \$0 | \$1,713,900 | \$1,713,900 | 4F.288 | Weatherford (TRWD) |
| Aurora | \$0 | \$1,439,000 | \$1,439,000 | 4F.364 | Rhome (TRWD through Walnut Creek SUD) |
| Bethesda | \$16,341,000 | \$17,349,000 | \$1,008,000 | 4F.344 | Additional Pipeline from Fort Worth (TRWD) |
| Blooming Grove | \$167,000 | \$1,495,400 | \$1,328,400 | 4F.269 | Groundwater |
| Bridgeport | \$0 | \$11,576,000 | \$11,576,000 | 4F.364 | Additional TRWD |
| Carrollton | \$0 | \$13,894,400 | \$13,894,400 | 4F.116 | Additional DWU supplies |
| Chico | \$0 | \$3,005,000 | \$3,005,000 | 4F.364 | Additional West Wise Rural SUD |
| Dallas | \$0 | \$1,980,278,000 | \$1,980,278,000 | 4E.2 | Lake Fasttrill Replacement |
| Decatur | \$0 | \$13,391,000 | \$13,391,000 | 4F.364 | Additional Wise County WSD |
| Denton Co Other | \$1,957,000 | \$1,639,000 | -\$318,000 | 4F.116 | Additional groundwater |
| Ellis SEP | \$11,512,000 | \$14,326,000 | \$2,814,000 | 4F.141 | Waxahachie |
| Flower Mound | \$42,000 | \$52,000 | \$10,000 | 4F.116 | Conservation |
| Irving | \$302,717,000 | \$194,825,000 | -\$107,892,000 | 4F.77 | Oklahoma (Lake Hugo) |
| Lewisville | \$0 | \$53,666,000 | \$53,666,000 | 4F.116 | WTP Expansion |
| Lewisville | \$0 | \$13,614,000 | \$13,614,000 | 4F.116 | Additional DWU supplies |
| Mansfield | \$29,504,000 | \$41,080,000 | \$11,576,000 | 4E.56 | 15 MGD NEW WTP and TRWD Supply |
| New Fairview | \$0 | \$2,518,400 | \$2,518,400 | 4F.364 | Rhome (TRWD through Walnut Creek SUD) |
| Newark | \$0 | \$2,376,000 | \$2,376,000 | 4F.364 | Rhome (TRWD through Walnut Creek SUD) |
| North Richland Hills | \$0 | \$502,000 | \$502,000 | 4E.62 | Supplemental wells |
| Northlake | \$0 | \$3,774,000 | \$3,774,000 | 4F.116 | UTRWD supplies |
| Ovilla | \$0 | \$6,169,000 | \$6,169,000 | 4F.141 | Additional DWU supplies |
| Parker Co Steam Electric | \$0 | \$2,099,000 | \$2,099,000 | 4F.288 | Additional Weatherford |
| Red Oak | \$0 | \$8,012,000 | \$8,012,000 | 4F.141 | Additional DWU supplies |
| Roanoke | \$0 | \$1,258,000 | \$1,258,000 | 4F.116 | Additional Fort Worth |
| Sardis Lone Elm | \$0 | \$9,467,000 | \$9,467,000 | 4F.141 | Rockett SUD |
| Sherman | \$33,822,000 | \$33,882,000 | \$60,000 | 4E.72 | Supplemental wells |

Table 2, Continued

| WUG or WWP Name | Amount Shown in Plan | Correct Amount | Difference | Table in Plan | Strategy |
|---------------------------|----------------------|----------------|------------------------|---------------|-------------------------------------|
| Springtown | \$0 | \$2,072,000 | \$2,072,000 | 4F.288 | Additional TRWD |
| Southwest Fannin Co SUD | \$0 | \$3,963,000 | \$3,963,000 | 4F.197 | Supplemental wells (Grayson County) |
| Dallas Co. Irrigation | \$14,530,000 | \$0 | -\$14,530,000 | 4F.77 | Las Colinas Expansion ¹ |
| Dallas Co. Steam Electric | \$14,895,000 | \$0 | -\$14,895,000 | 4F.77 | TRA Reuse ¹ |
| The Colony | \$0 | \$15,699,000 | \$15,699,000 | 4F.116 | Additional DWU supplies |
| Trophy Club | \$0 | \$1,258,000 | \$1,258,000 | 4F.116 | Additional Fort Worth (TRWD) |
| West Wise Rural | \$21,810,000 | \$4,094,000 | -\$17,716,000 | 4F.364 | Water Treatment Plant Expansion |
| West Wise Rural | \$0 | \$4,871,000 | \$4,871,000 | 4F.364 | Additional TRWD |
| Willow Park | \$0 | \$3,558,100 | \$3,558,100 | 4F.288 | Weatherford (TRWD) |
| Wise SEP | \$0 | \$4,028,000 | \$4,028,000 | 4F.364 | Additional TRWD |
| Wortham | \$6,228,000 | \$6,488,000 | \$260,000 | 4F.172 | Corsicana supplies |
| Total | | | \$2,042,316,300 | | |

¹Cost was already shown under TRA in Table 4E.14 and does not need to be shown for this WUG.

Table ES.2 - UPDATED
2060 Supplies for the Largest Wholesale Providers and for Region C

| Wholesale Water Provider | Supplies Available in 2060 from Current Sources^(a) | Supplies Available in 2060 from New Strategies^(a) | Total Supplies Available in 2060^(a) | % of Total Supply from Conservation and Reuse | Cost of Strategies (Millions) |
|---|--|---|---|--|--------------------------------------|
| Dallas Water Utilities | 548,580 | 559,802 | 1,108,356 | 22.1% | \$5,816 |
| Tarrant Regional Water District | 508,333 | 626,185 | 1,134,518 | 18.2% | \$4,735 |
| North Texas Municipal Water District | 421,405 | 631,862 | 1,053,267 | 24.4% | \$5,266 |
| City of Fort Worth | 278,645 | 340,031 | 618,676 | 14.4% | \$1,056 |
| Trinity River Authority | 125,822 | 116,441 | 242,263 | 35.8% | \$186 |
| Upper Trinity Regional Water District | 56,025 | 137,990 | 194,015 | 26.3% | \$1,129 |
| Greater Texoma Utility Authority | 19,560 | 63,736 | 83,296 | 6.0% | \$240 |
| Total for Region C^(c) | 1,774,509 | 2,207,790^(b) | 3,982,299^(b) | 23.3%^(b) | \$21,125 |

Notes:

(a) Some supplies are used by more than one supplier. For example, TRWD supplies water to TRA and Fort Worth, DWU supplies water to UTRWD, etc.

(b) These values are estimated.

(c) Total for Region C is not a sum of the numbers above. It includes other providers as well. Some supplies serve multiple suppliers.

REGION C WATER PLANNING GROUP

Senate Bill One Third Round of Regional Water Planning - Texas Water Development Board

Board Members

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Russell Laughlin, Secretary
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Danny Vance
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Dr. Tom Woodward

January 31, 2011

Ms. Carolyn Brittin
Texas Water Development Board
1700 N. Congress Avenue
Austin, Texas 78701

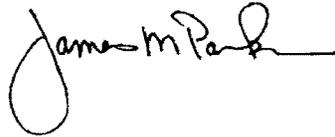
RECEIVED
JAN 31 2011
TWDB

Dear Ms. Brittin:

The Region C Water Planning Group would like to formally submit a memorandum regarding an additional errata in the *2011 Region C Water Plan*. The Lake Ralph Hall Indirect Reuse Project was inadvertently omitted from the summary Table Z.2. The attached memorandum includes the corrected version of Table Z.2. The attached memorandum and data therein shall be made part of the *2011 Region C Water Plan*.

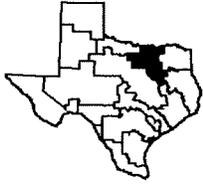
If you have any questions regarding this matter, please contact my office at 972/442-5405.

Sincerely,



JAMES M. PARKS
Chairman/Administrator

c/o NTMWD
505 E. Brown Street
P. O. Box 2408
Wylie, Texas 75098-2408
972/442-5405
972/442-5405/Fax
jparks@ntmwd.com
www.regioncwater.org



Region C
Water Planning Group

Freese and Nichols, Inc.
Alan Plummer Associates, Inc.
CP&Y, Inc.
Cooksey Communications, Inc.

MEMORANDUM

To: Ms. Carolyn Brittin
From: Thomas C. Gooch, Freese and Nichols, Inc.
Re: Additional Errata in the *2011 Region C Water Plan*
Date: January 31, 2011

An errata in the *2011 Region C Water Plan* (Plan) has come to our attention, specifically, the Lake Ralph Hall Indirect Reuse Project was inadvertently omitted from Table Z.2 (Summary of Recommended Strategies). The revised Table Z.2 is presented in this memorandum and therein shall be made part of the *2011 Region C Water Plan*.

Table Z.2^{1,6}-UPDATED
Summary of Recommended Strategies
Region C WUGs and WVPs

| Recommended Strategy | Capital Cost | First Decade of Water Strategy | First Decade Water Supply Volume (acre-feet/year) | First Decade Estimated Annual Average Unit Cost (\$/acre-foot/year) | Year 2060 Water Supply Volume (acre-feet/year) | Year 2060 Estimated Annual Average Unit Cost (\$/acre-foot/year) |
|---|-------------------------|--------------------------------|---|---|--|--|
| ADDITIONAL DRY YEAR SUPPLY | \$1,750,000.00 | 2010 | 25,000 | \$0.00 | 0 | \$0.00 |
| ADDITIONAL PIPELINE FROM LAKE TAWAKONI (MORE LAKE FORK SUPPLY) | \$496,243,000.00 | 2020 | 77,994 | \$557.77 | 69,128 | \$107.79 |
| COLLIN-GRAYSON MUNICIPAL ALLIANCE SYSTEM | \$77,366,000.00 | 2020 | 3,255 | \$3,044.55 | 27,412 | \$982.38 |
| COOKE COUNTY PROJECT | \$50,280,000.00 | 2020 | 2,240 | \$1,658.04 | 4,480 | \$394.42 |
| DIRECT REUSE | \$264,783,000.00 | 2010 | 1,552 | \$691.37 | 46,250 | \$138.57 |
| DIRECT REUSE - FRISCO | \$31,448,606.00 | 2020 | 2,240 | \$1,358.93 | 5,650 | \$134.34 |
| Dallas Reuse Projects ² | \$225,487,000.00 | | 52,070 | | 61,487 | |
| <i>DWU REUSE</i> | <i>\$82,920,000.00</i> | <i>2020</i> | <i>34,902</i> | <i>\$232.78</i> | <i>50,382</i> | <i>\$41.69</i> |
| <i>MAIN STEM TRINITY PUMP STATION (LAKE RAY HUBBARD INDIRECT REUSE - DWU)</i> | <i>\$142,567,000.00</i> | <i>2020</i> | <i>17,168</i> | <i>\$730.08</i> | <i>11,105</i> | <i>\$196.04</i> |
| ENNIS REUSE | \$31,779,000.00 | 2040 | 333 | \$14,738.74 | 3,696 | \$1,327.92 |
| FACILITY IMPROVEMENTS | \$2,314,558,600.00 | 2010 | 0 | \$0.00 | 0 | \$0.00 |
| FACILITY IMPROVEMENTS- REUSE SOURCES | \$590,686,000.00 | 2010 | 0 | \$0.00 | 0 | \$0.00 |
| FANNIN COUNTY PROJECT | \$38,471,000.00 | 2020 | 1,254 | \$3,838.12 | 5,113 | \$394.68 |
| FASTRILL REPLACEMENT (REGION C COMPONENT) | \$1,980,278,000.00 | 2060 | 112,100 | \$1,724.36 | 112,100 | \$1,724.36 |
| GOLF COURSE CONSERVATION | \$0.00 | 2010 | 56 | \$278.52 | 3,121 | \$277.84 |
| GRAYSON COUNTY PROJECT | \$136,016,000.00 | 2010 | 200 | \$0.00 | 24,640 | \$140.85 |
| INDIRECT REUSE | \$0.00 | 2020 | 4,368 | \$0.00 | 4,368 | \$0.00 |
| INDIRECT REUSE - JACKSBORO FOR JACK CO MINING | \$200,000.00 | 2010 | 385 | \$0.00 | 385 | \$0.00 |
| LAKE PALESTINE CONNECTION (INTEGRATED PIPELINE WITH TRWD) | \$887,954,000.00 | 2020 | 111,776 | \$772.91 | 107,347 | \$203.86 |
| LAKE RALPH HALL | \$286,401,000.00 | 2020 | 34,050 | \$616.09 | 34,050 | \$75.27 |
| LAKE RALPH HALL INDIRECT REUSE ⁷ | \$0.00 | 2020 | 6,129 | \$0.00 | 18,387 | \$0.00 |
| LAKE TEXOMA - AUTHORIZED (BLEND) | \$336,356,000.00 | 2030 | 69,200 | \$495.56 | 113,000 | \$87.23 |
| LAKE TEXOMA - INTERIM PURCHASE FROM GTUA | \$0.00 | 2020 | 21,900 | \$0.00 | 0 | \$0.00 |
| LOWER BOIS D ARC CREEK RESERVOIR | \$615,498,000.00 | 2020 | 54,796 | \$971.79 | 108,487 | \$78.67 |

Table Z.2-UPDATED, Continued

| Recommended Strategy | Capital Cost | First Decade of Water Strategy | First Decade Water Supply Volume (acre-feet/year) | First Decade Estimated Annual Average Unit Cost (\$/acre-foot/year) | Year 2060 Water Supply Volume (acre-feet/year) | Year 2060 Estimated Annual Average Unit Cost (\$/acre-foot/year) |
|---|--------------------|--------------------------------|---|---|--|--|
| MAIN STEM PS (ADDITIONAL EAST FORK) NTMWD | \$0.00 | 2020 | 34,900 | \$0.00 | 0 | \$0.00 |
| MANUFACTURING CONSERVATION | \$0.00 | 2010 | 1 | \$0.00 | 2,618 | \$211.38 |
| MARVIN NICHOLS RESERVOIR ³ | \$3,345,052,000.00 | 2030 | 227,400 | \$364.26 | 472,300 | \$83.04 |
| MUNICIPAL CONSERVATION-BASIC | \$1,151,575.00 | 2010 | 41,967 | \$200.40 | 264,429 | \$84.63 |
| MUNICIPAL CONSERVATION-EXPANDED | \$480,774.00 | 2010 | 4,756 | \$168.50 | 20,541 | \$395.75 |
| NEW WELLS - CARRIZO WILCOX AQUIFER | \$1,853,000.00 | 2010 | 154 | \$344.81 | 467 | \$446.30 |
| NEW WELLS - TRINITY AQUIFER | \$7,778,150.00 | 2010 | 1,882 | \$410.00 | 2,306 | \$228.85 |
| NEW WELLS - WOODBINE AQUIFER | \$14,543,000.00 | 2010 | 763 | \$662.88 | 1,932 | \$339.28 |
| OKLAHOMA WATER TO IRVING | \$194,825,000.00 | 2030 | 25,000 | \$810.28 | 25,000 | \$244.12 |
| OKLAHOMA WATER TO NTMWD, TRWD, UTRWD | \$756,044,500.00 | 2060 | 115,000 | \$290.44 | 115,000 | \$290.44 |
| OVERDRAFT TRINITY AQUIFER - EXISTING WELLS | \$0.00 | 2010 | 2,168 | \$105.25 | 0 | \$0.00 |
| OVERDRAFT TRINITY AQUIFER - NEW WELLS | \$269,000.00 | 2010 | 75 | \$493.33 | 0 | \$0.00 |
| PURCHASE FROM WATER PROVIDER (1) | \$0.00 | 2010 | 46 | \$0.00 | 0 | \$0.00 |
| REDISTRIBUTION OF SUPPLIES | \$0.00 | 2010 | 530 | \$0.00 | 58,031 | \$0.00 |
| SUBORDINATION AGREEMENT- FUTURE-ONLY SOURCES | \$8,217,000.00 | 2020 | 280 | \$2,560.71 | 215 | \$558.14 |
| SUPPLEMENTAL WELLS | \$495,381,934.00 | 2010 | 0 | \$0.00 | 0 | \$0.00 |
| TOLEDO BEND PROJECT (500,000) ⁴ | \$2,406,236,000.00 | 2010 | 363 | \$0.00 | 400,217 | \$1,072.45 |
| TRA 10-MILE CREEK REUSE PROJECT | \$14,895,000.00 | 2030 | 6,760 | \$259.17 | 6,760 | \$99.11 |
| TRA DENTON CREEK WWTP REUSE | \$9,506,000.00 | 2020 | 3,750 | \$0.00 | 3,750 | \$229.07 |
| TRA ELLIS COUNTY REUSE | \$10,384,000.00 | 2060 | 2,200 | \$505.00 | 2,200 | \$505.00 |
| TRA FREESTONE COUNTY REUSE | \$17,266,000.00 | 2050 | 6,760 | \$323.49 | 6,760 | \$323.49 |
| TRA KAUFMAN COUNTY REUSE | \$9,761,000.00 | 2020 | 1,000 | \$901.00 | 1,000 | \$192.00 |
| TRA LAS COLINAS REUSE | \$14,530,000.00 | 2020 | 7,000 | \$284.49 | 7,000 | \$133.69 |
| TRA TARRANT COUNTY PROJECT | \$59,008,000.00 | 2010 | 0 | \$0.00 | 0 | \$0.00 |
| TRWD THIRD PIPELINE AND REUSE | \$914,424,000.00 | 2020 | 105,500 | \$1,015.87 | 105,500 | \$324.48 |
| WATER TREATMENT PLANT - EXPANSION | \$19,970,000.00 | 2020 | 1,260 | \$0.00 | 2,268 | \$1,090.39 |
| WATER TREATMENT PLANT - NEW | \$308,309,400.00 | 2010 | 0 | \$0.00 | 807 | \$19,346.39 |
| WRIGHT PATMAN - REALLOCATION OF FLOOD POOL (112K) | \$896,478,000.00 | 2040 | 112,100 | \$761.95 | 112,100 | \$761.95 |
| CONVEYANCE PROJECT (1) ⁵ | \$413,884,000.00 | 2010 | 194 | \$11,560.82 | 25,178 | \$679.25 |
| CONVEYANCE PROJECT (2) ⁵ | \$69,299,100.00 | 2020 | 1,672 | \$0.00 | 1,237 | \$3,153.97 |
| CONVEYANCE PROJECT (3) ⁵ | \$6,465,400.00 | 2020 | 213 | \$6,530.52 | 2,016 | \$1,026.79 |
| GRAYSON COUNTY PROJECT ⁵ | \$146,071,000.00 | 2020 | 5,600 | \$3,693.13 | 19,600 | \$513.75 |

Table Z.2-UPDATED, Continued

| Recommended Strategy | Capital Cost | First Decade of Water Strategy | First Decade Water Supply Volume (acre-feet/year) | First Decade Estimated Annual Average Unit Cost (\$/acre-foot/year) | Year 2060 Water Supply Volume (acre-feet/year) | Year 2060 Estimated Annual Average Unit Cost (\$/acre-foot/year) |
|---|--------------------|--------------------------------|---|---|--|--|
| PURCHASE FROM WATER PROVIDER (1) ⁵ | \$164,114,900.00 | 2010 | 402 | \$0.00 | 30,103 | \$1,067.12 |
| PURCHASE FROM WATER PROVIDER (2) ⁵ | \$3,538,000.00 | 2020 | 52 | \$5,950.00 | 86 | \$609.30 |
| PURCHASE FROM WATER PROVIDER (3) ⁵ | \$65,481,250.00 | 2020 | 4,004 | \$2,384.37 | 6,417 | \$1,706.16 |
| WATER TREATMENT PLANT - EXPANSION ⁵ | \$2,708,430,000.00 | 2010 | 0 | \$0.00 | 2,618 | \$106,248.98 |
| WATER TREATMENT PLANT-EXPANSION- REUSE SOURCES ⁵ | \$32,750,000.00 | 2010 | 0 | \$0.00 | 0 | \$0.00 |

NOTES:

¹Information in this table matches the TWDB Database (DB12).

²Dallas has two future reuse projects. In DB12, these two projects share the same source. The sum of these two projects' supply in the database is equal to the sum of the two projects' supply shown in Table 4E.1 of the Plan, however the distribution of the supply between the two projects in the database differs somewhat from the distribution in Table 4E.1. Consider the database to be consistent with the Plan.

³Cost shown here is for both Phase I & II for NTMWD & TRWD, but only Phase I for UTRWD. UTRWD will not need Phase II of the project until after 2060.

⁴This is the cost from the TWDB Database (DB12), which includes Sabine River Authority's portion of the the cost. Total costs in the Region C Plan (Table ES.2) only includes costs for WWPs located in Region C and does not include SRA's portion of Toledo Bend costs.

⁵Strategy supply volumes may already be listed in other strategies.

⁶A number of costs from the Region C Plan could not be entered into DB12. WUGs with no demand are not in DB12, however, historical use from some of the WUGs indicate there is a demand. The Region C Plan outlines strategies (and associated costs) for these WUGs.

⁷Capital cost of the Lake Ralph Hall Indirect Reuse project is included in the capital cost of Lake Ralph Hall. Unit costs shown for Lake Ralph Hall take into account the supply from the Lake Ralph Hall Indirect Reuse Project.

TO: Region C Planning Group Members

CC: File – NTD08492

FROM: Tom Gooch

SUBJECT: Errata for *2011 Region C Water Plan*

DATE: December 8, 2010

A memorandum regarding Errata in *2011 Region C Water Plan* was sent to the Texas Water Development Board (TWDB) on December 8, 2010. This memorandum was in response to TWDB comments regarding the Lake Fastrill Replacement strategy that was shown in the IPP and Plan. Approval of the errata (attached with this memo) will be on the agenda at the next meeting. Below is a timeline showing the sequence of events related to this.

Wednesday, December 1, 2010 – TWDB staff contacted Freese and Nichols concerning language describing the Lake Fastrill Replacement strategy that appeared in both the Initially Prepared Plan and the final Region C Plan. TWDB perceived the language as a lack of a specific strategy, and TWDB rules require specific strategies to be called out in the Plan.

Friday, December 3, 2010 – Conference call was held between Freese and Nichols, City of Dallas and TWDB to discuss acceptable language and specific project that would serve as the Lake Fastrill Replacement strategy. Freese and Nichols was given a deadline of December 8, 2010 to submit Errata.

Monday-Wednesday, December 6-8, 2010 – Multiple emails were exchanged to determine acceptable language for Errata. Language approved by City of Dallas and Region C Chairman Jim Parks.

Wednesday, December 8, 2010 – Memorandum regarding Errata was sent to TWDB.

This memorandum also contained updated tables incorporated changes to the TWDB Regional Planning Database made since the publication of the *2011 Region C Plan*. It also contained corrections to a number of tables in the Plan where some strategy costs were inadvertently omitted.

REGION C WATER PLANNING GROUP

Senate Bill One Fourth Round of Regional Water Planning - Texas Water Development Board

Board Members

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Jody Puckett, Vice-Chair
Russell Laughlin, Secretary
David Bailey
Steve Berry
Bill Ceverha
Jerry W. Chapman
S. Frank Crumb
Gary Douglas
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Howard Martin
Jim McCarter
Steve Mundt
Gary Spicer
Robert O. Scott
Connie Standridge
Jack Stevens
Danny Vance
Dr. Tom Woodward

September 6, 2012

Ms. Carolyn Brittin
Texas Water Development Board
1700 N. Congress Avenue
Austin, Texas 78701

Dear Ms. Brittin:

The Region C Water Planning Group would like to formally submit a memorandum regarding errata in the 2011 *Region C Water Plan*. There was an error in Appendix I, which has been corrected in the revised Appendix I included herein. Based on discussions with the Texas Water Development Board staff, the attached memorandum and data therein shall be made part of the 2011 *Region C Water Plan*.

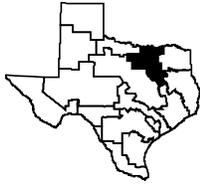
If you have any questions regarding this matter, please contact my office at 972/442-5405.

Sincerely,



JAMES M. PARKS
Chairman/Administrator

c/o NTMWD
505 E. Brown Street
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Region C
Water Planning Group

Freese and Nichols, Inc.
Alan Plummer Associates, Inc.
CP&Y, Inc.
Cooksey Communications, Inc.

MEMORANDUM

To: Ms. Carolyn Brittin
From: Thomas C. Gooch, Freese and Nichols, Inc.
Re: Errata in the *2011 Region C Water Plan*
Date: September 6, 2012

During the process to request approval of modifications to the Texas Commission on Environmental Quality (TCEQ) Water Availability Models (WAMs) for the fourth cycle of Region C water planning, some errata in Appendix I of the *2011 Region C Water Plan* (Plan) came to our attention. We edited Appendix I to correct these errata and to further clarify some of the assumptions. A revised Appendix I is attached. Changes were made to pages I.3 and I.4, specifically:

- Bullets under the “Trinity River Basin WAM” section were modified.
- Bullets under the “Red River Basin WAM” section were modified.

APPENDIX I
WATER SUPPLY AVAILABLE TO REGION C

**APPENDIX I
WATER SUPPLY AVAILABLE TO REGION C**

Table I.1 shows the overall water supply available to Region C. Table I.2 shows the overall water supply available to Region C that was reported in the *2006 Region C Water Plan* ⁽¹⁾. The rest of the appendix explains the sources of the data in Table I.1. The table represents the water supply that might be available to the region, whether it is currently connected to a water user group or not. The table is based on:

- Existing water rights ⁽²⁾
- Available supply for reservoirs
- Reliable supplies from run-of-the-river diversions
- Available supply from groundwater
- Estimated local supplies for mining and livestock
- Existing and permitted reuse supplies

Limits to water supply due to current water transmission facilities and wells are not considered in the development of Table I.1. They are considered in Appendix J, Current Supplies by Water User Group.

**Table I.1
Overall Water Supply Availability in Region C
(acre-feet per year)**

| SUMMARY | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 |
|------------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Reservoirs in Region C | 1,342,326 | 1,335,224 | 1,327,817 | 1,320,283 | 1,312,749 | 1,305,213 |
| Local Irrigation | 20,205 | 20,205 | 20,205 | 20,205 | 20,205 | 20,205 |
| Other Local Supply | 23,701 | 23,701 | 23,701 | 23,701 | 23,701 | 23,701 |
| Surface Water Imports | 598,775 | 576,120 | 552,672 | 549,222 | 545,782 | 542,352 |
| Groundwater | 146,152 | 146,152 | 146,152 | 146,152 | 146,152 | 146,152 |
| Reuse | 203,974 | 246,510 | 289,995 | 312,972 | 321,405 | 336,082 |
| REGION C TOTAL | 2,335,133 | 2,347,912 | 2,360,542 | 2,374,535 | 2,369,994 | 2,373,705 |

Table I.2
2006 Plan ⁽¹⁾ – Overall Water Supply Availability in Region C
 (acre-feet per year)

| SUMMARY | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 |
|---|------------------|------------------|------------------|------------------|------------------|------------------|
| Reservoirs in Region C | 1,165,080 | 1,155,771 | 1,146,113 | 1,135,964 | 1,125,705 | 1,111,096 |
| Local Irrigation | 20,205 | 20,205 | 20,205 | 20,205 | 20,205 | 20,205 |
| Other Local Supply | 23,701 | 23,701 | 23,701 | 23,701 | 23,701 | 23,701 |
| Surface Water Imports | 564,302 | 560,292 | 555,492 | 550,689 | 545,898 | 541,117 |
| Groundwater | 106,460 | 106,460 | 106,460 | 106,460 | 106,460 | 106,460 |
| Reuse | 99,979 | 105,810 | 104,800 | 104,175 | 103,697 | 103,429 |
| REGION C TOTAL | 1,979,727 | 1,972,240 | 1,956,770 | 1,941,194 | 1,925,666 | 1,906,007 |
| Change from 2006 Plan to 2011 Plan | 335,406 | 375,672 | 403,772 | 433,341 | 444,328 | 467,698 |

Water Supply Systems and Reservoirs

Table I.3 presents the water availability for water supply systems and reservoirs in Region C. The table also shows the water availability that was presented in the *2006 Region C Water Plan* ⁽¹⁾. In accordance with the Texas Water Development Board's (TWDB) established procedures ⁽³⁾, these surface water supplies are determined using the TCEQ-approved Water Availability Models (WAM). WAMs have been completed for each of the major river basins in Texas. The WAM models were developed for the purpose of reviewing and granting new surface water rights permits. The assumptions in the WAM models are based on the legal interpretation of water rights, and in some cases do not accurately reflect current operations. Availabilities for each water right are analyzed in priority date order, with water rights with the earliest permit date diverting first. WAM Run 3, which is the version used for planning, assumes full permitted diversions by all water rights and no return flows unless return flows are specifically required in the water right. Run 3 also does not include agreements or operations that are not reflected in the water right permits and does not account for reductions in reservoir capacities due to sediment accumulation. For planning purposes, adjustments were made to the WAMs to better reflect current and future surface water conditions in the region. Generally, changes to the WAMs included:

- Assessment of reservoir sedimentation rates and calculation of area-capacity conditions for 2000 and 2060 conditions.
- Inclusion of subordination agreements not already included in the TCEQ WAM
- Inclusion of system operation where appropriate
- Other corrections

The reliable supply from run-of-the-river diversions was assumed equal to the permitted diversion for water rights located on the main stem of the river and 75 percent of the permitted diversion for water rights located on tributaries.

Specific adjustments to the WAMs to more accurately reflect the water rights and agreements for water supply sources in Region C are:

Trinity River Basin WAM

- Modeling of Lake Jacksboro and Lost Creek Reservoir as a system.
- Modeling of Tarrant Regional Water District's West Fork reservoirs (Bridgeport, Eagle Mountain, and Worth) as a system.
- Inclusion of a minimum elevation for Lake Fairfield (305.0 ft. msl). This is the minimum operating elevation for the intake to the power plant according to the 1999 *Volumetric Survey of Fairfield Lake* prepared by the Texas Water Development Board.
- Modeling of Dallas' water rights in the Elm Fork of the Trinity River as a system with Lake Lewisville and Ray Roberts.

Red River Basin WAM

- Modeling of Lake Randell and Valley Lake as stand-alone reservoirs without Lake Texoma backups for the firm yield calculation of these two reservoirs. Backup supply for these reservoirs from Lake Texoma is included in the supplies from Lake Texoma. This prevents double counting of the makeup water from Lake Texoma. For firm yield calculations for reservoirs other than Lake Randell, Valley Lake and Lake Texoma, the backups for Lake Randell and Valley Lake were retained.
- Use of water from Lake Texoma is authorized by multiple Texas water rights and Oklahoma water rights, as well as authorizations by the US Congress and contracts with the Corps. In the TCEQ Red River WAM, each Texas water right is given its own "evaporation allocation" pool. Oklahoma's share of the lake, storage reserved for hydropower and dead storage in the reservoir are given their own pools as well. This type of modeling facilitates water availability modeling of the individual water rights but does not allow a meaningful calculation of the firm yield of the entire reservoir. To enable calculation of the overall firm yield of Lake Texoma, FNI modeled Lake Texoma as a single reservoir with multiple priority dates for the conservation storage and diversion, plus inactive storage corresponding to the

dead storage. For the firm yield calculation of other reservoirs, multiple storage pools were retained in Lake Texoma.

- Currently the U.S. Congress has allocated 450,000 acre-feet of storage in Lake Texoma for water supply use - the original 150,000 acre-feet for Texas, 150,000 acre-feet for Oklahoma, plus the 150,000 acre-feet reallocated from hydropower storage currently contracted to NTMWD and GTUA. In the TCEQ WAM, an additional 100,000 acre-feet of new storage plus 113,000 acre-feet per year of diversion was added to the Oklahoma portion of the reservoir. The reason for this addition is not clear, but it does mirror NTMWD's most recent application for a new Texas water right in the reservoir. Since this portion of the model does not reflect any existing or proposed use by the State of Oklahoma, FNI removed this portion of the model. (TCEQ currently assumes a diversion of 168,000 acre-feet per year from the existing 150,000 acre-feet of storage reserved for Oklahoma. Currently there are less than 5,000 acre-feet per year of permitted Oklahoma diversions.)
- Addition of 50,000 acre-feet of storage and 56,500 acre-feet per year of diversion from Lake Texoma corresponding to the recent water right obtained by the Greater Texoma Utility Authority. This water right has been granted by TCEQ but was not included in the Red River WAM used as the basis for the Region C model.
- Removal of diversion backups of individual Texas water rights in Lake Texoma from the hydropower pool. All Texas water rights are 100% reliable in the WAM, so these backups are not invoked in the WAM. The code was removed because it made the modeling unnecessarily complicated.

Imports to Region C

Supplies from Lake Chapman were determined using the Sulphur River Basin WAM.

Information obtained from Region D indicated that no adjustments were made to the Sabine River WAM that would impact the currently available water supplies for Region C. Therefore, the yields for Lake Fork and Lake Tawakoni were assumed to be the same as they were in the *2006 Region C Water Plan* ⁽¹⁾.

Region C has very few water supplies in the Brazos River Basin. Thus, the water availability information as determined by the Brazos G Regional Water Planning Group was adopted.

For Lake Palestine and Lake Athens, both in the Neches River Basin, the water availability information as determined by the Region I Water Planning Group was adopted. The available supply for Dallas Water Utilities from Lake Palestine was decreased based on a decreasing firm yield in the reservoir.

For Lake Livingston, the water availability information as determined by the Region H Water Planning Group was adopted.

Table I.3
Currently Available Surface Water Supplies from Reservoirs in Region C
(Not Considering Transmission Constraints)
(Acre-Feet per Year)

| | Basin | Revised Surface Water Availability | | | | | | | Surface Water Availability in 2006 Plan | | | | | | |
|--|---------|------------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|---|----------------|----------------|----------------|----------------|----------------|----------------|
| | | 2000 | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 | 2000 | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 |
| WATER SUPPLY SYSTEMS | | | | | | | | | | | | | | | |
| Lost Creek/ Jacksboro System | Trinity | 1,597 | 1,597 | 1,597 | 1,597 | 1,597 | 1,597 | 1,597 | 1,440 | 1,440 | 1,440 | 1,440 | 1,440 | 1,440 | 1,440 |
| West Fork (includes Bridgeport Local) | Trinity | 110,500 | 109,833 | 109,167 | 108,500 | 107,833 | 107,167 | 106,500 | 110,000 | 108,500 | 107,000 | 105,500 | 104,000 | 102,500 | 101,000 |
| Elm Fork/ Lewisville/ Ray Roberts (Dallas) | Trinity | 185,869 | 184,801 | 183,733 | 182,665 | 181,597 | 180,529 | 179,459 | 193,753 | 191,729 | 189,705 | 187,681 | 185,657 | 183,633 | 181,609 |
| Grapevine - Dallas | Trinity | 7,800 | 7,583 | 7,367 | 7,150 | 6,933 | 6,717 | 6,500 | 7,700 | 7,250 | 6,800 | 6,350 | 5,900 | 5,450 | 5,000 |
| Subtotal Systems | | 305,766 | 303,815 | 301,863 | 299,912 | 297,961 | 296,009 | 294,056 | 312,893 | 308,919 | 304,945 | 300,971 | 296,997 | 293,023 | 289,049 |
| RESERVOIRS IN REGION C | | | | | | | | | | | | | | | |
| Cedar Creek | Trinity | 175,000 | 175,000 | 175,000 | 175,000 | 175,000 | 175,000 | 175,000 | 175,000 | 175,000 | 175,000 | 175,000 | 175,000 | 175,000 | 175,000 |
| Richland-Chambers (TRWD) | Trinity | 210,000 | 210,000 | 210,000 | 210,000 | 210,000 | 210,000 | 210,000 | 210,000 | 210,000 | 210,000 | 210,000 | 210,000 | 210,000 | 205,650 |
| Richland-Chambers (Corsicana) and Lake Halbert | Trinity | 13,880 | 13,872 | 13,863 | 13,855 | 13,847 | 13,838 | 13,830 | 12,750 | 12,625 | 12,500 | 12,375 | 12,250 | 12,125 | 12,000 |
| Moss | Red | 7,410 | 7,410 | 7,410 | 7,410 | 7,410 | 7,410 | 7,410 | 4,500 | 4,500 | 4,500 | 4,500 | 4,500 | 4,500 | 4,500 |
| Lake Texoma (Texas' Share – NTMWD) | Red | 190,300 | 190,300 | 190,300 | 190,300 | 190,300 | 190,300 | 190,300 | 77,300 | 77,300 | 77,300 | 77,300 | 77,300 | 77,300 | 77,300 |
| Lake Texoma (Texas' Share – GTUA) | Red | 25,000 | 81,500 | 81,500 | 81,500 | 81,500 | 81,500 | 81,500 | 25,000 | 25,000 | 25,000 | 25,000 | 25,000 | 25,000 | 25,000 |
| Lake Texoma (Texas' Share – Denison) | Red | 24,400 | 24,400 | 24,400 | 24,400 | 24,400 | 24,400 | 24,400 | 24,400 | 24,400 | 24,400 | 24,400 | 24,400 | 24,400 | 24,400 |
| LakeTexoma (Texas' Share – Luminant) | Red | 16,400 | 16,400 | 16,400 | 16,400 | 16,400 | 16,400 | 16,400 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 |
| Lake Texoma (Texas' Share – RRA) | Red | 2,250 | 2,250 | 2,250 | 2,250 | 2,250 | 2,250 | 2,250 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 |
| Randell | Red | 1,400 | 1,400 | 1,400 | 1,400 | 1,400 | 1,400 | 1,400 | 5,280 | 5,280 | 5,280 | 5,280 | 5,280 | 5,280 | 5,280 |
| Valley | Red | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bonham | Red | 5,340 | 5,340 | 5,340 | 5,340 | 5,340 | 5,340 | 5,340 | 5,340 | 5,340 | 5,340 | 5,340 | 4,850 | 4,250 | 3,650 |
| Ray Roberts (Denton) | Trinity | 19,240 | 18,980 | 18,720 | 18,460 | 18,200 | 17,940 | 17,680 | 21,008 | 20,445 | 19,882 | 19,319 | 18,756 | 18,193 | 17,630 |
| Lewisville (Denton) | Trinity | 8,020 | 7,918 | 7,817 | 7,715 | 7,613 | 7,512 | 7,410 | 7,896 | 7,702 | 7,507 | 7,313 | 7,119 | 6,924 | 6,730 |

Table I.3, Continued

| | Basin | Revised Surface Water Availability | | | | | | | Surface Water Availability in 2006 Plan | | | | | | |
|----------------------------|---------|------------------------------------|------------------|------------------|------------------|------------------|------------------|------------------|---|------------------|------------------|------------------|------------------|------------------|------------------|
| | | 2000 | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 | 2000 | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 |
| Benbrook | Trinity | 6,833 | 6,833 | 6,833 | 6,833 | 6,833 | 6,833 | 6,833 | 6,834 | 6,834 | 6,834 | 6,834 | 6,834 | 6,834 | 6,834 |
| Weatherford | Trinity | 3,010 | 2,967 | 2,923 | 2,880 | 2,837 | 2,793 | 2,750 | 2,900 | 2,750 | 2,600 | 2,450 | 2,300 | 2,150 | 2,000 |
| Grapevine (PCMUD) | Trinity | 17,200 | 17,050 | 16,900 | 16,750 | 16,600 | 16,450 | 16,300 | 16,800 | 16,167 | 15,533 | 14,900 | 14,267 | 13,633 | 13,000 |
| Grapevine (Grapevine) | Trinity | 2,050 | 2,017 | 1,983 | 1,950 | 1,917 | 1,883 | 1,850 | 1,900 | 1,833 | 1,767 | 1,700 | 1,633 | 1,567 | 1,500 |
| Arlington | Trinity | 10,000 | 9,850 | 9,700 | 9,550 | 9,400 | 9,250 | 9,100 | 8,400 | 8,333 | 8,267 | 8,200 | 8,133 | 8,067 | 8,000 |
| Joe Pool | Trinity | 15,500 | 15,192 | 14,883 | 14,575 | 14,267 | 13,958 | 13,650 | 16,400 | 15,333 | 14,267 | 13,200 | 12,133 | 11,067 | 10,000 |
| Mountain Creek | Trinity | 6,400 | 6,400 | 6,400 | 6,400 | 6,400 | 6,400 | 6,400 | 6,400 | 6,400 | 6,400 | 6,400 | 6,400 | 6,400 | 6,400 |
| North | Trinity | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lake Ray Hubbard (Dallas) | Trinity | 58,740 | 57,427 | 56,113 | 54,800 | 53,487 | 52,173 | 50,860 | 60,700 | 60,367 | 60,033 | 59,700 | 59,367 | 59,033 | 58,700 |
| White Rock | Trinity | 3,800 | 3,500 | 3,200 | 2,900 | 2,600 | 2,300 | 2,000 | 5,900 | 5,083 | 4,267 | 3,450 | 2,633 | 1,817 | 1,000 |
| Terrell | Trinity | 2,300 | 2,283 | 2,267 | 2,250 | 2,233 | 2,217 | 2,200 | 2,300 | 2,283 | 2,267 | 2,250 | 2,233 | 2,217 | 2,200 |
| Clark | Trinity | 210 | 210 | 210 | 210 | 210 | 210 | 210 | 139 | 139 | 139 | 139 | 139 | 139 | 139 |
| Bardwell | Trinity | 9,600 | 9,600 | 9,600 | 9,295 | 8,863 | 8,432 | 8,000 | 8,980 | 8,567 | 8,153 | 7,740 | 7,327 | 6,913 | 6,500 |
| Waxahachie | Trinity | 3,010 | 2,905 | 2,800 | 2,695 | 2,590 | 2,485 | 2,380 | 2,760 | 2,667 | 2,573 | 2,480 | 2,387 | 2,293 | 2,200 |
| Forest Grove | Trinity | 8,840 | 8,767 | 8,693 | 8,620 | 8,547 | 8,473 | 8,400 | 8,600 | 8,583 | 8,567 | 8,550 | 8,533 | 8,517 | 8,500 |
| Trinidad City Lake | Trinity | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| Trinidad | Trinity | 3,050 | 3,050 | 3,050 | 3,050 | 3,050 | 3,050 | 3,050 | 3,100 | 3,067 | 3,033 | 3,000 | 2,967 | 2,933 | 2,900 |
| Navarro Mills | Trinity | 19,400 | 19,342 | 18,333 | 17,325 | 16,317 | 15,308 | 14,300 | 19,400 | 19,400 | 18,800 | 17,850 | 16,900 | 15,950 | 15,000 |
| Fairfield | Trinity | 870 | 870 | 870 | 870 | 870 | 870 | 870 | 1,700 | 1,567 | 1,433 | 1,300 | 1,167 | 1,033 | 900 |
| Bryson | Brazos | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mineral Wells | Brazos | 2,520 | 2,508 | 2,495 | 2,483 | 2,470 | 2,458 | 2,445 | 2,520 | 2,508 | 2,495 | 2,483 | 2,470 | 2,458 | 2,445 |
| Teague City Lake | Brazos | 189 | 189 | 189 | 189 | 189 | 189 | 189 | 189 | 189 | 189 | 189 | 189 | 189 | 189 |
| Lake Lavon | Trinity | 113,300 | 112,033 | 110,767 | 109,500 | 108,233 | 106,967 | 105,700 | 104,000 | 104,000 | 104,000 | 104,000 | 104,000 | 104,000 | 104,000 |
| Muenster | Trinity | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Subtotal Reservoirs | | 986,212 | 1,038,511 | 1,033,360 | 1,027,905 | 1,022,322 | 1,016,740 | 1,011,157 | 874,396 | 869,995 | 864,993 | 859,642 | 853,800 | 847,849 | 837,547 |
| TOTAL | | 1,291,978 | 1,342,326 | 1,335,224 | 1,327,817 | 1,320,283 | 1,312,749 | 1,305,213 | 1,187,289 | 1,178,914 | 1,169,938 | 1,160,613 | 1,150,797 | 1,140,872 | 1,126,596 |

WATER SUPPLY SYSTEMS

The water supply systems listed are operated as physical systems – the water they provide cannot easily be separated by individual source. The supply available is based on the calculation of the Water Availability Models (WAMs), as described above. More detailed discussions on water supply available for each system are given below.

Lost Creek/Jacksboro System (Jacksboro). Lake Jacksboro is a 2,129 acre-foot reservoir located just outside of the City of Jacksboro in the Trinity River Basin in Jack County, and Lost Creek Reservoir is an 11,961 acre-foot reservoir located 1.5 miles downstream of the Lake Jacksboro dam. The City of Jacksboro holds a water right for the combined use of both reservoirs for municipal water supply and the right to divert 1,440 acre-feet per year. The water right authorizes the reservoirs to be operated as a system, so the WAM was modified to include system operation and the subordination agreement with TRWD. According to the WAM, the firm yield from this system as of 2060 is 2,430 acre-feet per year. The available supply from this system is limited to 1,597 acre-feet per year, which is the permitted amount of 1,397 plus 200 acre-feet per year of return flows that Jacksboro is authorized to use.

West Fork including Bridgeport Local System (Tarrant Regional Water District). Tarrant Regional Water District's West Fork Reservoir system is comprised of Lake Bridgeport, Lake Worth, and Eagle Mountain Lake. The WAM was modified to include the system operation of these three reservoirs. The resulting combined system firm yield was 110,500 acre-feet per year in 2010 and 106,500 acre-feet per year in 2060.

Under current conditions, this system provides somewhat less supply than shown. With existing facilities, it is not possible to divert water from Lake Worth when the lake is drawn down more than four feet, which makes some of the water stored in Lake Worth unavailable. In addition, the Tarrant Regional Water District operates its water supplies on a safe yield basis, which provides a smaller supply than the firm yield numbers shown. (In safe yield operation, the user takes less than the firm yield in order to leave a reserve supply in the reservoir in case a drought worse than any historical drought occurs.)

Elm Fork/Lake Lewisville/Ray Roberts System (Dallas). This system, owned by Dallas, is comprised of Lake Lewisville, Lake Ray Roberts, and run-of-the-river rights from Elm Fork. The WAM was modified to include the system operation of these supplies. The resulting combined system yield was 184,801 acre-feet per year in 2010 and 179,459 acre-feet per year in 2060. The firm yield is higher than what was shown in the 2006 *Region C Water Plan* ⁽¹⁾ due to changes made in the WAM.

Lake Grapevine (Dallas). Dallas includes its portion of supply from Lake Grapevine in its system operation with Elm Fork/Lewisville/Ray Roberts. The WAM was modified to include this system operation. The resulting yield for Dallas' portion of Lake Grapevine was 7,800 acre-feet per year in 2010 and 6,500 acre-feet per year in 2060. The WAM modeling for Lake Grapevine does not include the Lake Grapevine Accounting Plan.

RESERVOIRS IN REGION C

All major reservoirs in Region C as well as some smaller reservoirs used for municipal supply are listed in Table I.3. The supply available is based on the calculation of the Water Availability Models (WAMs), which limits the supply to the lesser of the firm yield or the permit amount.

Cedar Creek. Cedar Creek Reservoir is located on Cedar Creek in the Trinity River Basin in Henderson and Kaufman Counties. The reservoir has a permitted conservation storage of 678,900 acre-feet. Tarrant Regional Water District holds a water right for diversion of 175,000 acre-feet per year. According to the WAM, the firm yield is 211,900 acre-feet per year in 2000, decreasing to 205,200 acre-feet per year by 2060. The available supply from Cedar Creek is limited to the permit amount of 175,000 acre-feet per year.

Richland-Chambers (and Lake Halbert). Richland-Chambers Reservoir is located on Richland Creek in the Trinity River Basin in Freestone and Navarro Counties. The reservoir has a permitted conservation storage of 1,135,000 acre-feet. Tarrant Regional Water District and City of Corsicana hold water rights in the reservoir (210,000 acre-feet per year for TRWD and 13,650 acre-feet per year for Corsicana). According to the WAM, the firm yield of the TRWD water right is 228,300 acre-feet per year in 2000, decreasing to 210,800

acre-feet per year by 2060. The available supply to TRWD from Richland-Chambers is limited to the permitted amount of 210,000 acre-feet per year.

Corsicana's water right in Lake Halbert is backed up by the City's water right in Richland-Chambers. The pipeline connection from Richland-Chambers to Lake Halbert was completed since the *2006 Region C Water Plan* ⁽¹⁾. Lake Halbert is located on Elm Creek in the Trinity River Basin in Navarro County. The reservoir has permitted conservation storage of 7,357 acre-feet. The City of Corsicana holds a water right in Lake Halbert for 4,003 acre-feet per year. According to the WAM, the available supply from Richland Chambers Reservoir and Lake Halbert to Corsicana as of 2060 is 13,830 acre-feet per year.

Moss. Moss Lake is located on Fish Creek in the Red River Basin in Cooke County. The reservoir has permitted conservation storage of 23,210 acre-feet. The City of Gainesville holds water rights in the reservoir for 7,740 acre-feet per year. According to the WAM, the available supply from Moss Lake in 2060 is 7,410 acre-feet per year. The available supply from Moss Lake has increased from what was shown in the *2006 Region C Water Plan* ⁽¹⁾ because the City of Gainesville increased their water right from 4,500 acre-feet per year to 7,740 acre-feet per year.

Texoma (Texas' share). Lake Texoma is located along the Texas and Oklahoma border in the Red River Basin in Grayson and Cooke Counties. The permitted conservation storage for water supply in Texas is 300,000 acre-feet. Red River Authority, Greater Texoma Utility Authority, Denison, North Texas Municipal Water District, and Luminant all hold water rights in the reservoir. Since the *2006 Region C Water Plan* ⁽¹⁾, Luminant increased its Lake Texoma water right by 6,400 acre-feet per year, GTUA increased its Lake Texoma water right by 56,500 acre-feet per year, and North Texas Municipal Water District increased its water right by 113,000 acre-feet per year and increased its permitted storage by 100,000 acre-feet. The total Texoma supply available to Region C as of 2060 is 314,850 acre-feet per year (2,250 acre-feet per year for Red River Authority; 81,500 acre-feet per year for Greater Texoma Utility Authority; 24,400 acre-feet per year for Denison; 190,300 acre-feet per year for NTMWD; and 16,400 acre-feet per year for Luminant). In the case of Texoma, the available supply is limited to the water right amount. The firm yield of Texas' share of Lake Texoma is 643,625 acre-feet per year in 2000, decreasing to 640,575 acre-feet per year by 2060.

Randell. Randell Reservoir is located on an unnamed tributary of Shawnee Creek in the Red River Basin in Grayson County. The reservoir has permitted conservation storage of 5,400 acre-feet. The City of Denison holds a water right in the reservoir for 5,280 acre-feet per year. The supply from Lake Randell is backed up by up to 24,400 acre-feet per year of diversions from Lake Texoma, which are fully reliable. The available supply from Randell Reservoir as of 2060 is 1,400 acre-feet per year without a backup from Lake Texoma. The decrease from the available supply shown in the 2006 *Region C Water Plan* ⁽¹⁾ is due to a change in how the firm yield of Randell Reservoir is reported (without a backup from Lake Texoma).

Valley. Valley Lake is located on Sand Creek in the Red River Basin in Fannin and Grayson Counties. The reservoir has a permitted conservation storage of 15,000 acre-feet. This reservoir is operated by Luminant for steam electric power cooling in conjunction with their water right in Lake Texoma. The total amount of water that can be diverted from either Texoma or Valley Lake is 16,400 acre-feet per year. During drought, it is assumed that the full permitted diversion would be taken from Lake Texoma (see Lake Texoma discussion). Therefore the available supply from Valley Lake is 0 acre-feet per year.

Bonham. Lake Bonham is located on Timber Creek in the Red River Basin in Fannin County. The reservoir has permitted conservation storage of 13,000 acre-feet. The City of Bonham holds a water right in the reservoir for 5,340 acre-feet per year. The NTMWD has an agreement with the City of Bonham to operate the lake and water treatment plant. According to the WAM, the firm yield of Lake Bonham is 6,500 acre-feet per year in 2000, decreasing to 5,800 acre-feet per year by 2060. The available supply from Lake Bonham is limited to the permitted amount of 5,340 acre-feet per year. The increase from the available supply shown in the 2006 *Region C Water Plan* ⁽¹⁾ is due to using a lower sedimentation rate, which was calculated using the 2004 volumetric survey of Lake Bonham.

Ray Roberts (Denton). Lake Ray Roberts and Lake Lewisville were modeled to find the firm yields of Denton's water rights. Lake Ray Roberts is located on the Elm Fork of the Trinity River in Denton, Cooke, and Grayson Counties. The reservoir has a permitted conservation storage of 799,600 acre-feet. The City of Dallas and the City of Denton hold combined water rights in the reservoir totaling 799,600 acre-feet per year, which is much

greater than the actual yield of the reservoir. Dallas' share of Lake Ray Roberts was discussed above under *Water Supply Systems*. According to the WAM, Denton's available supply from Ray Roberts as of 2060 is 17,680 acre-feet per year.

Lewisville (Denton). Lake Lewisville is located on the Elm Fork of the Trinity River in Denton County. The reservoir has a permitted conservation storage of 618,400 acre-feet. The City of Dallas and the City of Denton hold combined water rights in the reservoir totaling 598,900 acre-feet per year, which is much greater than the actual yield of the reservoir. Dallas' share of Lake Lewisville was discussed above under *Water Supply Systems*. According to the WAM, Denton's available supply from Lewisville as of 2060 is 7,410 acre-feet per year.

Benbrook. Lake Benbrook is located on the Clear Fork of the Trinity River in Tarrant County. The reservoir has a permitted conservation storage of 72,500 acre-feet. The authorized use from Lake Benbrook is 6,833 acre-feet per year. Tarrant Regional Water District holds the water right, which specifies use amounts for Benbrook Water and Sewer Authority, City of Fort Worth, and City of Weatherford. According to the WAM, the firm yield of Lake Benbrook is 7,280 acre-feet per year in 2000, decreasing to 6,833 acre-feet per year by 2060. The available supply from Lake Benbrook is limited to the permitted amount of 6,833 acre-feet per year. Lake Benbrook is used as terminal storage for water pumped from Cedar Creek and Richland Chambers Reservoirs. The available supply does not include water from these sources.

Weatherford. Lake Weatherford is located on the Clear Fork of the Trinity River in Parker County. The reservoir has permitted conservation storage of 19,470 acre-feet. The City of Weatherford holds a water right for consumptive use 5,220 acre-feet per year. (The permit also authorizes 59,400 acre-feet per year of non-consumptive industrial use.) According to the WAM, available supply from Lake Weatherford as of 2060 is 2,750 acre-feet per year.

Grapevine. Lake Grapevine is located on Denton Creek in the Trinity River Basin in Tarrant and Denton Counties. The reservoir has a permitted conservation storage of 161,250 acre-feet. City of Dallas, City of Grapevine, and Dallas County Park Cities MUD hold combined water rights in the reservoir totaling 161,250 acre-feet per year, which is much greater than the actual yield of the reservoir. Dallas' share of Lake Grapevine was

discussed above under *Water Supply Systems*. According to the WAM, Dallas County PCMUD's available supply from Lake Grapevine as of 2060 is 16,300 acre-feet per year, and the City of Grapevine's available supply from Lake Grapevine as of 2060 is 1,850 acre-feet per year. The increase in available supply from the available supply shown in the 2006 *Region C Water Plan* ⁽¹⁾ is due to a change made in the TCEQ Trinity WAM to reallocate reservoir evaporation.

Arlington. Lake Arlington is located on Village Creek in the Trinity River Basin in Tarrant County. The reservoir has a permitted conservation storage of 45,710 acre-feet. The City of Arlington and Luminant jointly hold a water right for 23,120 acre-feet per year (13,000 acre-feet per year for Arlington and 10,120 acre-feet per year for Luminant). According to the WAM, available supply from Lake Arlington as of 2060 is 9,100 acre-feet per year. Like Lake Benbrook, Lake Arlington serves as terminal storage for water pumped from Richland-Chambers and Cedar Creek Reservoirs. The available supply from Lake Arlington does not include water from these sources.

Joe Pool. Joe Pool Lake is located on Mountain Creek in the Trinity River Basin in Dallas and Tarrant Counties. The reservoir has a permitted conservation storage of 176,900 acre-feet. The Trinity River Authority holds a water right for 17,000 acre-feet per year. According to the WAM, available supply from Joe Pool Lake as of 2060 is 13,650 acre-feet per year. The available supply is higher than what was shown in the 2006 *Region C Water Plan* ⁽¹⁾ because a lower sedimentation rate was used.

Mountain Creek. Mountain Creek Lake is located on Mountain Creek in the Trinity River Basin in Dallas County. The reservoir has a permitted conservation storage of 22,840 acre-feet. Luminant holds a water right for 6,400 acre-feet per year. According to the WAM, the firm yield of Mountain Creek Lake is 13,300 acre-feet per year in 2000, decreasing to 11,700 acre-feet per year by 2060. The available supply from Mountain Creek Lake is limited to the permitted amount of 6,400 acre-feet per year.

North. North Lake is an off-channel reservoir located on the South Fork of Grapevine Creek in the Trinity River Basin in Dallas County. The reservoir has a permitted conservation storage of 17,100 acre-feet. Luminant holds a water right for 1,000 acre-feet per year. According to the WAM, available supply from North Lake as of 2060 is 0 acre-feet per year without backup from the Elm Fork.

Ray Hubbard. Lake Ray Hubbard is located on the Elm Fork of the Trinity River in Dallas, Kaufman, and Rockwall Counties. The reservoir has a permitted conservation storage of 490,000 acre-feet. The City of Dallas holds a water right for 89,700 acre-feet per year. According to the WAM, available supply from Ray Hubbard as of 2000 is 58,740 acre-feet per year in 2000, decreasing to 50,860 acre-feet per year by 2060. The available supply is less than what was shown in the 2006 *Region C Water Plan*⁽¹⁾ because a higher sedimentation rate based on the 2005 volumetric survey for Lake Ray Hubbard was used.

White Rock. White Rock Lake is located on White Rock Creek in the Trinity River Basin in Dallas County. The reservoir has a permitted conservation storage of 21,345 acre-feet. The City of Dallas holds a water right for 8,703 acre-feet per year. According to the WAM, available supply from White Rock Lake as of 2060 is 2,000 acre-feet per year.

Terrell. Lake Terrell is located on Muddy Cedar Creek in the Trinity River Basin in Kaufman County. The reservoir has a permitted conservation storage of 8,712 acre-feet. The City of Terrell holds a water right for 6,000 acre-feet per year. According to the WAM, available supply from Terrell as of 2060 is 2,200 acre-feet per year.

Clark. Lake Clark is located on Little Mustang Creek in the Trinity River Basin in Ellis County. The reservoir has a permitted conservation storage of 1,549 acre-feet. The City of Ennis holds a water right for 450 acre-feet per year. According to the WAM, available supply from Lake Clark as of 2060 is 210 acre-feet per year. The City of Ennis no longer uses water from Lake Clark.

Bardwell. Lake Bardwell is located on Waxahachie Creek in the Trinity River Basin in Ellis County. The reservoir has a permitted conservation storage of 54,900 acre-feet. The Trinity River Authority holds a water right for 14,729 acre-feet per year (which includes reuse of up to 5,129 acre-feet per year of return flows). According to the WAM, the firm yield of Lake Bardwell is 10,590 acre-feet per year in 2000, decreasing to 8,000 acre-feet per year by 2060. The available supply from Lake Bardwell is the smaller of the firm yield or the permitted amount of 9,600 acre-feet per year without return flows. The available supply is higher than what was shown in the 2006 *Region C Water Plan*⁽¹⁾ because a lower sedimentation rate based on the 1999 volumetric survey for Lake Bardwell was used.

Waxahachie. Lake Waxahachie is located on Waxahachie Creek in the Trinity River Basin in Ellis County. The reservoir has a permitted conservation storage of 13,500 acre-

feet. Ellis County Water Control and Improvement District #1 holds a water right for 3,570 acre-feet per year. According to the WAM, available supply from Lake Waxahachie as of 2060 is 2,380 acre-feet per year.

Forest Grove. Forest Grove Reservoir is located on Caney Creek in the Trinity River Basin in Henderson County. The reservoir has a permitted conservation storage of 20,038 acre-feet. Luminant holds a water right for 9,500 acre-feet per year (not including non-consumptive use). Presently, the dam for Forest Grove Reservoir is built, but the lake has not begun to store water. According to the WAM, available supply from Forest Grove as of 2060 is 8,400 acre-feet per year.

Trinidad City Lake. Trinidad City Lake is located on Cedar Creek in the Trinity River Basin in Henderson County. The reservoir has a permitted conservation storage of 498 acre-feet. The City of Trinidad holds a water right for 1,000 acre-feet per year. According to the WAM, available supply from Trinidad City Lake as of 2060 is 450 acre-feet per year.

Trinidad. Lake Trinidad is an off-channel reservoir located just off the Trinity River in Henderson County. The reservoir has a permitted conservation storage of 6,200 acre-feet. Luminant holds a water right for 4,000 acre-feet per year. According to the WAM, available supply from Lake Trinidad as of 2060 is 3,050 acre-feet per year. However, access to return flows in the watershed make the Lake Trinidad permitted supply reliable.

Navarro Mills. Lake Navarro Mills is located on Richland Creek in the Trinity River Basin in Navarro County. The reservoir has a permitted conservation storage of 63,300 acre-feet. The Trinity River Authority holds a water right for 19,400 acre-feet per year. According to the WAM, available supply from Navarro Mills as of 2060 is 14,300 acre-feet per year.

Fairfield. Lake Fairfield is located on Big Brown Creek in the Trinity River Basin in Freestone County. The reservoir has a permitted conservation storage of 50,600 acre-feet. Luminant holds a water right for 14,150 acre-feet per year. According to the WAM, available supply from Lake Fairfield as of 2060 is 870 acre-feet per year with a minimum operating level of 305.0 feet msl and without backup from the Trinity River.

Bryson. Lake Bryson is located on East Rock Creek in the Brazos River Basin in Jack County. The reservoir has a permitted conservation storage of 950 acre-feet. The City of

Bryson holds a water right for 90 acre-feet per year. According to the WAM, available supply from Bryson as of 2060 is 0 acre-feet per year.

Mineral Wells. Lake Mineral Wells is located on Rock Creek in the Brazos River Basin in Parker County. The reservoir has a permitted conservation storage of 7,065 acre-feet. The City of Mineral Wells holds a water right for 2,520 acre-feet per year. According to the WAM, available supply from Mineral Wells as of 2060 is 2,445 acre-feet per year. The City of Mineral Wells no longer uses water from Lake Mineral Wells.

Teague City Lake. Teague City Lake is located on Holman Creek in the Brazos River Basin in Freestone County. The reservoir has permitted conservation storage of 1,160 acre-feet. The City of Teague holds a water right for 605 acre-feet per year. According to the WAM, available supply from Teague City Lake as of 2060 is 189 acre-feet per year. The City of Teague no longer uses Teague City Lake for water supply.

Lavon. Lake Lavon is located on the East Fork of the Trinity River in Collin County. The reservoir has permitted conservation storage of 443,800 acre-feet. North Texas Municipal Water District holds water rights for 118,670 acre-feet per year. According to the WAM, the available supply from Lake Lavon is 113,300 acre-feet per year in 2000, decreasing to 105,700 acre-feet per year by 2060. This yield does not include return flows or imported water.

UNPERMITTED YIELDS IN REGION C RESERVOIRS

According to the WAMs, there are eight reservoirs and one reservoir system in Region C with firm yields that exceed the currently permitted diversion amounts. These reservoirs with their unpermitted yields are listed in Table I.4. Note that the Oklahoma share of Lake Texoma yield is not included in the table. The unpermitted Oklahoma yield in Lake Texoma would be about 635,781 acre-feet per year in 2060.

**Table I.4
Unpermitted Yields in Region C Reservoirs**

| Reservoir | Basin | Unpermitted Yield, acre-feet per year | | | | | | |
|-----------------------------|---------|---------------------------------------|---------|---------|---------|---------|---------|---------|
| | | 2000 | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 |
| Lost Creek/Jacksboro System | Trinity | 913 | 900 | 886 | 873 | 860 | 846 | 833 |
| Cedar Creek | Trinity | 36,900 | 35,783 | 34,667 | 33,550 | 32,433 | 31,317 | 30,200 |
| Richland Chambers | Trinity | 18,300 | 15,383 | 12,467 | 9,550 | 6,633 | 3,717 | 800 |
| Lake Texoma (Texas' Share) | Red | 385,275 | 328,267 | 327,758 | 327,250 | 326,742 | 326,233 | 325,725 |
| Benbrook | Trinity | 447 | 373 | 298 | 224 | 149 | 75 | 0 |
| Bonham | Red | 1,160 | 1,043 | 927 | 810 | 693 | 577 | 460 |
| Mountain Creek | Trinity | 6,900 | 6,633 | 6,367 | 6,100 | 5,833 | 5,567 | 5,300 |
| Bardwell | Trinity | 990 | 558 | 127 | 0 | 0 | 0 | 0 |
| Navarro Mills | Trinity | 950 | 0 | 0 | 0 | 0 | 0 | 0 |

Groundwater

Groundwater in Region C is obtained from two major aquifers, four minor aquifers and locally undifferentiated formations referred to as “other aquifer”. The two major aquifers are the Trinity and Carrizo-Wilcox aquifers. The three minor aquifers are the Woodbine, Queen City, and Nacatoch aquifers.

The TWDB created sixteen Groundwater Management Areas in Texas. GMA 8 covers all of Region C except for Jack County, Henderson County, and a small portion of Navarro County. The GMAs are responsible for developing Desired Future Conditions (DFCs) for aquifers within their respective areas. The TWDB quantifies Managed Available Groundwater (MAG) based on the DFCs provided by the GMAs. If MAG numbers were available for an aquifer as of January 1, 2009, the regional water planning groups must use these estimates as the basis for existing groundwater supplies ⁽²⁾. MAG estimates were available for the Woodbine aquifer prior to the January 1st deadline. MAG estimates were available for the Trinity aquifer in March of 2009. The DFCs for the Nacatoch aquifer have been submitted, but the MAG estimates are not yet available. Neither DFCs nor MAG estimates are available for the Carrizo-Wilcox or Queen City aquifers.

There are currently seven Groundwater Conservation Districts (GCDs) that include one or more counties in Region C:

- Upper Trinity GCD (Wise and Parker Counties)

- Northern Trinity GCD (Tarrant County)
- Neches and Trinity Valleys GCD (Henderson County)
- Mid-East Texas GCD (Freestone County)
- Prairielands GCD (Ellis County)
- North Texas GCD (Collin, Cooke, and Denton Counties)
- Red River GCD (Grayson and Fannin Counties)

The available supply from the Trinity and Woodbine aquifers is based on the MAG estimates provided by the TWDB ^(4,5). The available supply from the Carrizo-Wilcox aquifer is assumed to be the same as was shown in the 2006 *Region C Water Plan* ⁽¹⁾ and is based on minimal lowering of the water table from current levels over the planning period. The groundwater availability for the other minor aquifers and “other aquifer” are also assumed to be the same as was shown in the 2006 *Region C Water Plan* ⁽¹⁾. Table I.5 details the groundwater availability for Region C.

The overall groundwater availability in Region C is 39,692 acre-feet per year greater than the availability shown in the 2006 *Region C Water Plan* ⁽¹⁾. This increase is due to the increased availability in the Trinity and Woodbine aquifers based on MAG estimates provided by the TWDB ^(4,5). The most significant increases to groundwater availability are in the western-most counties of Region C. Figure I.1 compares the Region C Trinity and Woodbine groundwater availability from the TWDB 2009 MAG estimates to the availability reported in the 2006 *Region C Water Plan* ⁽¹⁾. Figure I.2 compares the total groundwater availability in the Trinity and Woodbine aquifers for various counties in Region C. Figure I.2 also includes an estimate of total groundwater use in 2004 for each county.

**Table I.5
Groundwater Availability for Region C
(Acre-Feet per Year)**

| Aquifer | County | Basin | Revised Groundwater Availability | | | | | | | Groundwater Availability in 2006 Plan | | | | | | | Change in Groundwater Availability since 2006 Plan | | | | | | |
|----------|---------------|---------|----------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|--|--------------|--------------|--------------|--------------|--------------|--------------|
| | | | 2000 | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 | 2000 | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 | 2000 | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 |
| Other | Collin | Sabine | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other | Collin | Trinity | 134 | 134 | 134 | 134 | 134 | 134 | 134 | 134 | 134 | 134 | 134 | 134 | 134 | 134 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Trinity | Collin | Sabine | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Trinity | Collin | Trinity | 2,100 | 2,100 | 2,100 | 2,100 | 2,100 | 2,100 | 2,100 | 2,100 | 2,100 | 2,100 | 2,100 | 2,100 | 2,100 | 2,100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Woodbine | Collin | Sabine | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | (90) | (90) | (90) | (90) | (90) | (90) | (90) |
| Woodbine | Collin | Trinity | 2,469 | 2,469 | 2,469 | 2,469 | 2,469 | 2,469 | 2,469 | 2,370 | 2,370 | 2,370 | 2,370 | 2,370 | 2,370 | 2,370 | 99 | 99 | 99 | 99 | 99 | 99 | 99 |
| | Collin | | 4,748 | 4,748 | 4,748 | 4,748 | 4,748 | 4,748 | 4,748 | 4,739 | 4,739 | 4,739 | 4,739 | 4,739 | 4,739 | 4,739 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| Other | Cooke | Red | 237 | 237 | 237 | 237 | 237 | 237 | 237 | 237 | 237 | 237 | 237 | 237 | 237 | 237 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other | Cooke | Trinity | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Trinity | Cooke | Red | 1,284 | 1,284 | 1,284 | 1,284 | 1,284 | 1,284 | 1,284 | 950 | 950 | 950 | 950 | 950 | 950 | 950 | 334 | 334 | 334 | 334 | 334 | 334 | 334 |
| Trinity | Cooke | Trinity | 5,566 | 5,566 | 5,566 | 5,566 | 5,566 | 5,566 | 5,566 | 5,450 | 5,450 | 5,450 | 5,450 | 5,450 | 5,450 | 5,450 | 116 | 116 | 116 | 116 | 116 | 116 | 116 |
| Woodbine | Cooke | Red | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| Woodbine | Cooke | Trinity | 136 | 136 | 136 | 136 | 136 | 136 | 136 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 136 | 136 | 136 | 136 | 136 | 136 | 136 |
| | Cooke | | 7,241 | 7,241 | 7,241 | 7,241 | 7,241 | 7,241 | 7,241 | 6,637 | 6,637 | 6,637 | 6,637 | 6,637 | 6,637 | 6,637 | 604 | 604 | 604 | 604 | 604 | 604 | 604 |
| Other | Dallas | Trinity | 593 | 593 | 593 | 593 | 593 | 593 | 593 | 593 | 593 | 593 | 593 | 593 | 593 | 593 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Trinity | Dallas | Trinity | 5,458 | 5,458 | 5,458 | 5,458 | 5,458 | 5,458 | 5,458 | 4,400 | 4,400 | 4,400 | 4,400 | 4,400 | 4,400 | 4,400 | 1,058 | 1,058 | 1,058 | 1,058 | 1,058 | 1,058 | 1,058 |
| Woodbine | Dallas | Trinity | 2,313 | 2,313 | 2,313 | 2,313 | 2,313 | 2,313 | 2,313 | 1,100 | 1,100 | 1,100 | 1,100 | 1,100 | 1,100 | 1,100 | 1,213 | 1,213 | 1,213 | 1,213 | 1,213 | 1,213 | 1,213 |
| | Dallas | | 8,364 | 8,364 | 8,364 | 8,364 | 8,364 | 8,364 | 8,364 | 6,093 | 6,093 | 6,093 | 6,093 | 6,093 | 6,093 | 6,093 | 2,271 | 2,271 | 2,271 | 2,271 | 2,271 | 2,271 | 2,271 |
| Other | Denton | Trinity | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Trinity | Denton | Trinity | 19,333 | 19,333 | 19,333 | 19,333 | 19,333 | 19,333 | 19,333 | 10,400 | 10,400 | 10,400 | 10,400 | 10,400 | 10,400 | 10,400 | 8,933 | 8,933 | 8,933 | 8,933 | 8,933 | 8,933 | 8,933 |
| Woodbine | Denton | Trinity | 4,126 | 4,126 | 4,126 | 4,126 | 4,126 | 4,126 | 4,126 | 4,700 | 4,700 | 4,700 | 4,700 | 4,700 | 4,700 | 4,700 | (574) | (574) | (574) | (574) | (574) | (574) | (574) |
| | Denton | | 23,464 | 23,464 | 23,464 | 23,464 | 23,464 | 23,464 | 23,464 | 15,105 | 15,105 | 15,105 | 15,105 | 15,105 | 15,105 | 15,105 | 8,359 | 8,359 | 8,359 | 8,359 | 8,359 | 8,359 | 8,359 |
| Other | Ellis | Trinity | 139 | 139 | 139 | 139 | 139 | 139 | 139 | 139 | 139 | 139 | 139 | 139 | 139 | 139 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Trinity | Ellis | Trinity | 3,959 | 3,959 | 3,959 | 3,959 | 3,959 | 3,959 | 3,959 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | (41) | (41) | (41) | (41) | (41) | (41) | (41) |
| Woodbine | Ellis | Trinity | 5,441 | 5,441 | 5,441 | 5,441 | 5,441 | 5,441 | 5,441 | 4,400 | 4,400 | 4,400 | 4,400 | 4,400 | 4,400 | 4,400 | 1,041 | 1,041 | 1,041 | 1,041 | 1,041 | 1,041 | 1,041 |
| | Ellis | | 9,539 | 9,539 | 9,539 | 9,539 | 9,539 | 9,539 | 9,539 | 8,539 | 8,539 | 8,539 | 8,539 | 8,539 | 8,539 | 8,539 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |
| Trinity | Fannin | Red | 617 | 617 | 617 | 617 | 617 | 617 | 617 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 617 | 617 | 617 | 617 | 617 | 617 | 617 |
| Trinity | Fannin | Sulphur | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 601 | 601 | 601 | 601 | 601 | 601 | 601 | (601) | (601) | (601) | (601) | (601) | (601) | (601) |
| Trinity | Fannin | Trinity | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 99 | 99 | 99 | 99 | 99 | 99 | 99 | (16) | (16) | (16) | (16) | (16) | (16) | (16) |
| Woodbine | Fannin | Red | 2,676 | 2,676 | 2,676 | 2,676 | 2,676 | 2,676 | 2,676 | 2,202 | 2,202 | 2,199 | 2,199 | 2,198 | 2,198 | 2,197 | 474 | 474 | 477 | 477 | 478 | 478 | 479 |
| Woodbine | Fannin | Sulphur | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 568 | 568 | 571 | 571 | 572 | 572 | 573 | (547) | (547) | (550) | (550) | (551) | (551) | (552) |
| Woodbine | Fannin | Trinity | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 530 | 530 | 530 | 530 | 530 | 530 | 530 | 70 | 70 | 70 | 70 | 70 | 70 | 70 |
| Other | Fannin | Red | 2,919 | 2,919 | 2,919 | 2,919 | 2,919 | 2,919 | 2,919 | 2,919 | 2,919 | 2,919 | 2,919 | 2,919 | 2,919 | 2,919 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Fannin | | 6,916 | 6,916 | 6,916 | 6,916 | 6,916 | 6,916 | 6,916 | 6,919 | 6,919 | 6,919 | 6,919 | 6,919 | 6,919 | 6,919 | (3) | (3) | (3) | (3) | (3) | (3) | (3) |

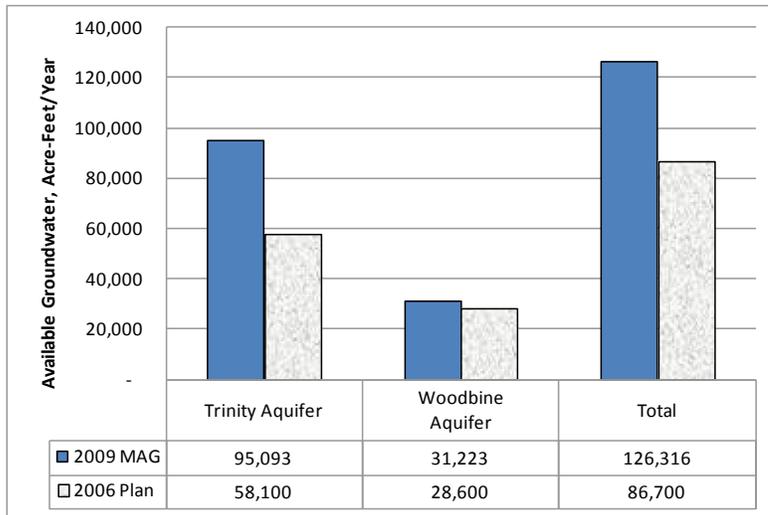
Table I.5, Continued

| Aquifer | County | Basin | Revised Groundwater Availability | | | | | | | Groundwater Availability in 2006 Plan | | | | | | | Change in Groundwater Availability since 2006 Plan | | | | | | |
|----------------|------------------|---------|----------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|--|--------------|--------------|--------------|--------------|--------------|--------------|
| | | | 2000 | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 | 2000 | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 | 2000 | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 |
| Carrizo-Wilcox | Freestone | Trinity | 5,578 | 5,578 | 5,578 | 5,578 | 5,578 | 5,578 | 5,578 | 5,578 | 5,578 | 5,578 | 5,578 | 5,578 | 5,578 | 5,578 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Carrizo-Wilcox | Freestone | Brazos | 1,075 | 1,075 | 1,075 | 1,075 | 1,075 | 1,075 | 1,075 | 1,075 | 1,075 | 1,075 | 1,075 | 1,075 | 1,075 | 1,075 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other | Freestone | Trinity | 51 | 51 | 51 | 51 | 51 | 51 | 51 | 51 | 51 | 51 | 51 | 51 | 51 | 51 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other | Freestone | Brazos | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Queen City | Freestone | Trinity | 345 | 345 | 345 | 345 | 345 | 345 | 345 | 345 | 345 | 345 | 345 | 345 | 345 | 345 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Queen City | Freestone | Brazos | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Freestone | | 7,118 | 7,118 | 7,118 | 7,118 | 7,118 | 7,118 | 7,118 | 7,118 | 7,118 | 7,118 | 7,118 | 7,118 | 7,118 | 7,118 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other | Grayson | Red | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other | Grayson | Trinity | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Trinity | Grayson | Red | 7,722 | 7,722 | 7,722 | 7,722 | 7,722 | 7,722 | 7,722 | 6,700 | 6,797 | 6,849 | 6,875 | 6,890 | 6,900 | 6,901 | 1,022 | 925 | 873 | 847 | 832 | 822 | 821 |
| Trinity | Grayson | Trinity | 1,678 | 1,678 | 1,678 | 1,678 | 1,678 | 1,678 | 1,678 | 2,700 | 2,603 | 2,552 | 2,525 | 2,510 | 2,500 | 2,499 | (1,022) | (925) | (874) | (847) | (832) | (822) | (821) |
| Woodbine | Grayson | Red | 6,590 | 6,590 | 6,590 | 6,590 | 6,590 | 6,590 | 6,590 | 6,380 | 6,310 | 6,288 | 6,277 | 6,272 | 6,267 | 6,265 | 210 | 280 | 302 | 313 | 318 | 323 | 325 |
| Woodbine | Grayson | Trinity | 5,497 | 5,497 | 5,497 | 5,497 | 5,497 | 5,497 | 5,497 | 5,720 | 5,790 | 5,812 | 5,823 | 5,828 | 5,833 | 5,835 | (223) | (293) | (315) | (326) | (331) | (336) | (338) |
| | Grayson | | 21,522 | 21,522 | 21,522 | 21,522 | 21,522 | 21,522 | 21,522 | 21,535 | 21,535 | 21,536 | 21,535 | 21,535 | 21,535 | 21,535 | (13) | (13) | (14) | (13) | (13) | (13) | (13) |
| Carrizo-Wilcox | Henderson | Trinity | 5,370 | 5,370 | 5,370 | 5,370 | 5,370 | 5,370 | 5,370 | 5,370 | 5,370 | 5,370 | 5,370 | 5,370 | 5,370 | 5,370 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nacatoch | Henderson | Trinity | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other | Henderson | Trinity | 167 | 167 | 167 | 167 | 167 | 167 | 167 | 167 | 167 | 167 | 167 | 167 | 167 | 167 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Queen City | Henderson | Trinity | 480 | 480 | 480 | 480 | 480 | 480 | 480 | 480 | 480 | 480 | 480 | 480 | 480 | 480 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Henderson | | 6,027 | 6,027 | 6,027 | 6,027 | 6,027 | 6,027 | 6,027 | 6,027 | 6,027 | 6,027 | 6,027 | 6,027 | 6,027 | 6,027 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other | Jack | Brazos | 284 | 284 | 284 | 284 | 284 | 284 | 284 | 284 | 284 | 284 | 284 | 284 | 284 | 284 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other | Jack | Trinity | 650 | 650 | 650 | 650 | 650 | 650 | 650 | 650 | 650 | 650 | 650 | 650 | 650 | 650 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Trinity | Jack | Trinity | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Trinity | Jack | Brazos | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Jack | | 1,034 | 1,034 | 1,034 | 1,034 | 1,034 | 1,034 | 1,034 | 1,034 | 1,034 | 1,034 | 1,034 | 1,034 | 1,034 | 1,034 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nacatoch | Kaufman | Sabine | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nacatoch | Kaufman | Trinity | 308 | 308 | 308 | 308 | 308 | 308 | 308 | 308 | 308 | 308 | 308 | 308 | 308 | 308 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other | Kaufman | Sabine | 124 | 124 | 124 | 124 | 124 | 124 | 124 | 124 | 124 | 124 | 124 | 124 | 124 | 124 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other | Kaufman | Trinity | 87 | 87 | 87 | 87 | 87 | 87 | 87 | 87 | 87 | 87 | 87 | 87 | 87 | 87 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Trinity | Kaufman | Sabine | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| Trinity | Kaufman | Trinity | 1,136 | 1,136 | 1,136 | 1,136 | 1,136 | 1,136 | 1,136 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,136 | 1,136 | 1,136 | 1,136 | 1,136 | 1,136 | 1,136 |
| Woodbine | Kaufman | Trinity | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Kaufman | | 1,910 | 1,910 | 1,910 | 1,910 | 1,910 | 1,910 | 1,910 | 729 | 729 | 729 | 729 | 729 | 729 | 729 | 1,181 | 1,181 | 1,181 | 1,181 | 1,181 | 1,181 | 1,181 |

Table I.5, Continued

| Aquifer | County | Basin | Revised Groundwater Availability | | | | | | | Groundwater Availability in 2006 Plan | | | | | | | Change in Groundwater Availability since 2006 Plan | | | | | | |
|-----------------------|-----------------|---------|----------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|---------------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|--|---------------|---------------|---------------|---------------|---------------|---------------|
| | | | 2000 | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 | 2000 | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 | 2000 | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 |
| Carrizo-Wilcox | Navarro | Trinity | 180 | 180 | 180 | 180 | 180 | 180 | 180 | 180 | 180 | 180 | 180 | 180 | 180 | 180 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nacatoch | Navarro | Trinity | 229 | 229 | 229 | 229 | 229 | 229 | 229 | 229 | 229 | 229 | 229 | 229 | 229 | 229 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other | Navarro | Trinity | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Trinity | Navarro | Trinity | 1,873 | 1,873 | 1,873 | 1,873 | 1,873 | 1,873 | 1,873 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,873 | 1,873 | 1,873 | 1,873 | 1,873 | 1,873 | 1,873 |
| Woodbine | Navarro | Trinity | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Navarro | | 2,686 | 2,686 | 2,686 | 2,686 | 2,686 | 2,686 | 2,686 | 813 | 813 | 813 | 813 | 813 | 813 | 813 | 1,873 | 1,873 | 1,873 | 1,873 | 1,873 | 1,873 | 1,873 |
| Other | Parker | Trinity | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other | Parker | Brazos | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Trinity | Parker | Trinity | 12,449 | 12,449 | 12,449 | 12,449 | 12,449 | 12,449 | 12,449 | 2,100 | 2,100 | 2,255 | 2,300 | 2,300 | 2,300 | 2,300 | 10,349 | 10,349 | 10,194 | 10,149 | 10,149 | 10,149 | 10,149 |
| Trinity | Parker | Brazos | 2,799 | 2,799 | 2,799 | 2,799 | 2,799 | 2,799 | 2,799 | 4,900 | 4,900 | 4,745 | 4,700 | 4,700 | 4,700 | 4,700 | (2,101) | (2,101) | (1,946) | (1,901) | (1,901) | (1,901) | (1,901) |
| | Parker | | 15,298 | 15,298 | 15,298 | 15,298 | 15,298 | 15,298 | 15,298 | 7,050 | 7,050 | 7,050 | 7,050 | 7,050 | 7,050 | 7,050 | 8,248 | 8,248 | 8,248 | 8,248 | 8,248 | 8,248 | 8,248 |
| Nacatoch | Rockwall | Trinity | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Trinity | Rockwall | Trinity | 958 | 958 | 958 | 958 | 958 | 958 | 958 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 958 | 958 | 958 | 958 | 958 | 958 | 958 |
| Woodbine | Rockwall | Trinity | 144 | 144 | 144 | 144 | 144 | 144 | 144 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 144 | 144 | 144 | 144 | 144 | 144 | 144 |
| Other | Rockwall | Sabine | 187 | 187 | 187 | 187 | 187 | 187 | 187 | 187 | 187 | 187 | 187 | 187 | 187 | 187 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other | Rockwall | Trinity | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Rockwall | | 1,311 | 1,311 | 1,311 | 1,311 | 1,311 | 1,311 | 1,311 | 209 | 209 | 209 | 209 | 209 | 209 | 209 | 1,102 | 1,102 | 1,102 | 1,102 | 1,102 | 1,102 | 1,102 |
| Other | Tarrant | Trinity | 207 | 207 | 207 | 207 | 207 | 207 | 207 | 207 | 207 | 207 | 207 | 207 | 207 | 207 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Trinity | Tarrant | Trinity | 18,747 | 18,747 | 18,747 | 18,747 | 18,747 | 18,747 | 18,747 | 9,200 | 9,200 | 9,200 | 9,200 | 9,200 | 9,200 | 9,200 | 9,547 | 9,547 | 9,547 | 9,547 | 9,547 | 9,547 | 9,547 |
| Woodbine | Tarrant | Trinity | 632 | 632 | 632 | 632 | 632 | 632 | 632 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 632 | 632 | 632 | 632 | 632 | 632 | 632 |
| | Tarrant | | 19,586 | 19,586 | 19,586 | 19,586 | 19,586 | 19,586 | 19,586 | 9,407 | 9,407 | 9,407 | 9,407 | 9,407 | 9,407 | 9,407 | 10,179 | 10,179 | 10,179 | 10,179 | 10,179 | 10,179 | 10,179 |
| Other | Wise | Trinity | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Trinity | Wise | Trinity | 9,282 | 9,282 | 9,282 | 9,282 | 9,282 | 9,282 | 9,282 | 4,400 | 4,400 | 4,400 | 4,400 | 4,400 | 4,400 | 4,400 | 4,882 | 4,882 | 4,882 | 4,882 | 4,882 | 4,882 | 4,882 |
| | Wise | | 9,388 | 9,388 | 9,388 | 9,388 | 9,388 | 9,388 | 9,388 | 4,506 | 4,506 | 4,506 | 4,506 | 4,506 | 4,506 | 4,506 | 4,882 | 4,882 | 4,882 | 4,882 | 4,882 | 4,882 | 4,882 |
| Region C Total | | | 146,152 | 146,152 | 146,152 | 146,152 | 146,152 | 146,152 | 146,152 | 106,460 | 106,460 | 106,460 | 106,460 | 106,460 | 106,460 | 106,460 | 39,692 | 39,692 | 39,692 | 39,692 | 39,692 | 39,692 | 39,692 |

**Figure I.1
Region C Groundwater Availability in the Trinity and Woodbine Aquifers**



Irrigation Local Supply and Other Local Supply

The local irrigation availability is based on existing run-of-the-river surface water rights for irrigation not associated with major reservoirs. The reliable supply from run-of-the-river diversions was assumed equal to the permitted diversion for water rights located on the main stem of the river and 75 percent of the permitted diversion for water rights located on tributaries.

Other local supply includes non-irrigation run-of-the-river supplies and mining and livestock local supplies that do not have a water right. Most surface water used for livestock is taken from unpermitted stock ponds or directly from streams. For livestock and mining local supply, the available supplies were assumed to be the same as shown in the 2006 *Region C Water Plan* ⁽¹⁾. Table I.6 shows the available supply for irrigation and other local supply.

Figure I.2
Region C Groundwater Availability by County in the Trinity and Woodbine Aquifers

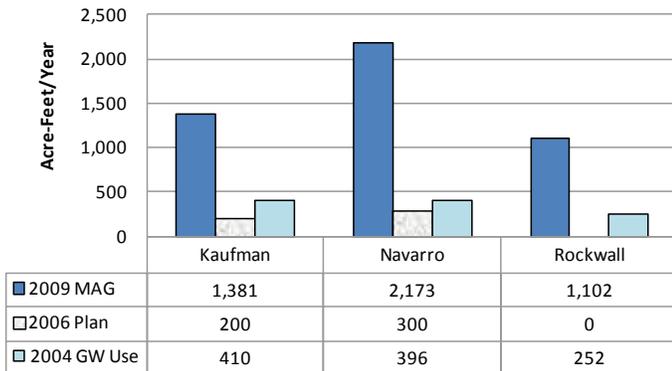
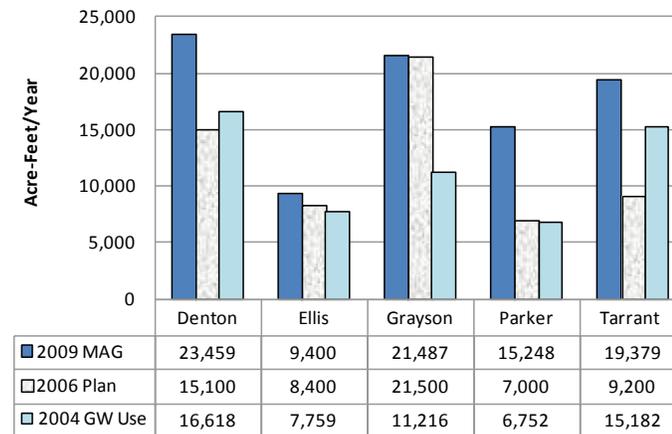
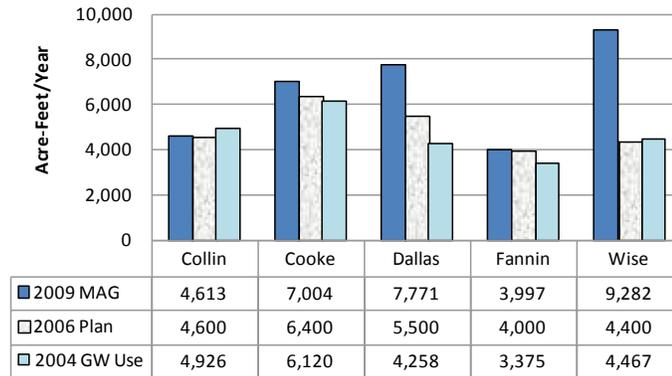


Table I.6
Summary of Local Surface Water Supplies for Region C
(Acre-Feet per Year)

| Use | County | Basin | 2000 | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 |
|---|-----------|---------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| IRRIGATION RUN-OF-THE-RIVER SUPPLIES | | | | | | | | | |
| Irrigation | Cooke | Red | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| Irrigation | Fannin | Red | 14,758 | 14,758 | 14,758 | 14,758 | 14,758 | 14,758 | 14,758 |
| Irrigation | Grayson | Red | 2,394 | 2,394 | 2,394 | 2,394 | 2,394 | 2,394 | 2,394 |
| Irrigation | Fannin | Sulphur | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Irrigation | Collin | Trinity | 408 | 408 | 408 | 408 | 408 | 408 | 408 |
| Irrigation | Cooke | Trinity | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Irrigation | Dallas | Trinity | 791 | 791 | 791 | 791 | 791 | 791 | 791 |
| Irrigation | Denton | Trinity | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Irrigation | Ellis | Trinity | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Irrigation | Fannin | Trinity | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Irrigation | Grayson | Trinity | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Irrigation | Henderson | Trinity | 415 | 415 | 415 | 415 | 415 | 415 | 415 |
| Irrigation | Jack | Trinity | 110 | 110 | 110 | 110 | 110 | 110 | 110 |
| Irrigation | Kaufman | Trinity | 64 | 64 | 64 | 64 | 64 | 64 | 64 |
| Irrigation | Navarro | Trinity | 226 | 226 | 226 | 226 | 226 | 226 | 226 |
| Irrigation | Parker | Trinity | 122 | 122 | 122 | 122 | 122 | 122 | 122 |
| Irrigation | Rockwall | Trinity | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Irrigation | Tarrant | Trinity | 549 | 549 | 549 | 549 | 549 | 549 | 549 |
| Irrigation | Wise | Trinity | 139 | 139 | 139 | 139 | 139 | 139 | 139 |
| Irrigation | Freestone | Trinity | 87 | 87 | 87 | 87 | 87 | 87 | 87 |
| Irrigation | Jack | Brazos | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Irrigation | Parker | Brazos | 117 | 117 | 117 | 117 | 117 | 117 | 117 |
| Irrigation | Freestone | Brazos | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SUBTOTAL | | | 20,205 |

Table I.6, Continued

| Use | County | Basin | 2000 | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 |
|---|-----------|---------|-------|-------|-------|-------|-------|-------|-------|
| NON-IRRIGATION RUN-OF-THE-RIVER SUPPLIES | | | | | | | | | |
| Mining | Fannin | Red | 72 | 72 | 72 | 72 | 72 | 72 | 72 |
| Mining | Wise | Trinity | 133 | 133 | 133 | 133 | 133 | 133 | 133 |
| Municipal | Fannin | Red | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Municipal | Fannin | Sulphur | 49 | 49 | 49 | 49 | 49 | 49 | 49 |
| Municipal | Freestone | Trinity | 41 | 41 | 41 | 41 | 41 | 41 | 41 |
| Municipal | Navarro | Trinity | 252 | 252 | 252 | 252 | 252 | 252 | 252 |
| Municipal | Parker | Trinity | 33 | 33 | 33 | 33 | 33 | 33 | 33 |
| Industrial | Dallas | Trinity | 368 | 368 | 368 | 368 | 368 | 368 | 368 |
| Industrial | Grayson | Red | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| Industrial | Tarrant | Trinity | 959 | 959 | 959 | 959 | 959 | 959 | 959 |
| LIVESTOCK AND MINING LOCAL SUPPLIES | | | | | | | | | |
| Livestock | Collin | Sabine | 31 | 31 | 31 | 31 | 31 | 31 | 31 |
| Livestock | Collin | Trinity | 971 | 971 | 971 | 971 | 971 | 971 | 971 |
| Livestock | Cooke | Red | 380 | 380 | 380 | 380 | 380 | 380 | 380 |
| Livestock | Cooke | Trinity | 807 | 807 | 807 | 807 | 807 | 807 | 807 |
| Livestock | Dallas | Trinity | 712 | 712 | 712 | 712 | 712 | 712 | 712 |
| Livestock | Denton | Trinity | 935 | 935 | 935 | 935 | 935 | 935 | 935 |
| Livestock | Ellis | Trinity | 1,688 | 1,688 | 1,688 | 1,688 | 1,688 | 1,688 | 1,688 |
| Livestock | Fannin | Red | 1,139 | 1,139 | 1,139 | 1,139 | 1,139 | 1,139 | 1,139 |
| Livestock | Fannin | Sulphur | 364 | 364 | 364 | 364 | 364 | 364 | 364 |
| Livestock | Fannin | Trinity | 80 | 80 | 80 | 80 | 80 | 80 | 80 |
| Livestock | Freestone | Brazos | 83 | 83 | 83 | 83 | 83 | 83 | 83 |
| Livestock | Freestone | Trinity | 960 | 960 | 960 | 960 | 960 | 960 | 960 |
| Livestock | Grayson | Red | 1,077 | 1,077 | 1,077 | 1,077 | 1,077 | 1,077 | 1,077 |
| Livestock | Grayson | Trinity | 606 | 606 | 606 | 606 | 606 | 606 | 606 |
| Livestock | Henderson | Trinity | 341 | 341 | 341 | 341 | 341 | 341 | 341 |
| Livestock | Jack | Brazos | 450 | 450 | 450 | 450 | 450 | 450 | 450 |

Table I.6, Continued

| Use | County | Basin | 2000 | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 |
|--|-----------|---------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| LIVESTOCK AND MINING LOCAL SUPPLIES (Continued) | | | | | | | | | |
| Livestock | Jack | Trinity | 1,215 | 1,215 | 1,215 | 1,215 | 1,215 | 1,215 | 1,215 |
| Livestock | Kaufman | Sabine | 98 | 98 | 98 | 98 | 98 | 98 | 98 |
| Livestock | Kaufman | Trinity | 1,524 | 1,524 | 1,524 | 1,524 | 1,524 | 1,524 | 1,524 |
| Livestock | Navarro | Trinity | 1,603 | 1,603 | 1,603 | 1,603 | 1,603 | 1,603 | 1,603 |
| Livestock | Parker | Brazos | 903 | 903 | 903 | 903 | 903 | 903 | 903 |
| Livestock | Parker | Trinity | 1,019 | 1,019 | 1,019 | 1,019 | 1,019 | 1,019 | 1,019 |
| Livestock | Rockwall | Sabine | 32 | 32 | 32 | 32 | 32 | 32 | 32 |
| Livestock | Rockwall | Trinity | 136 | 136 | 136 | 136 | 136 | 136 | 136 |
| Livestock | Tarrant | Trinity | 442 | 442 | 442 | 442 | 442 | 442 | 442 |
| Livestock | Wise | Trinity | 1,117 | 1,117 | 1,117 | 1,117 | 1,117 | 1,117 | 1,117 |
| Mining | Collin | Trinity | 195 | 195 | 195 | 195 | 195 | 195 | 195 |
| Mining | Cooke | Red | 77 | 77 | 77 | 77 | 77 | 77 | 77 |
| Mining | Cooke | Trinity | 160 | 160 | 160 | 160 | 160 | 160 | 160 |
| Mining | Dallas | Trinity | 1,525 | 1,525 | 1,525 | 1,525 | 1,525 | 1,525 | 1,525 |
| Mining | Denton | Trinity | 103 | 103 | 103 | 103 | 103 | 103 | 103 |
| Mining | Freestone | Trinity | 66 | 66 | 66 | 66 | 66 | 66 | 66 |
| Mining | Jack | Trinity | 370 | 370 | 370 | 370 | 370 | 370 | 370 |
| Mining | Kaufman | Trinity | 75 | 75 | 75 | 75 | 75 | 75 | 75 |
| Mining | Parker | Brazos | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| Mining | Parker | Trinity | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Mining | Rockwall | Sabine | 33 | 33 | 33 | 33 | 33 | 33 | 33 |
| Mining | Tarrant | Trinity | 342 | 342 | 342 | 342 | 342 | 342 | 342 |
| SUBTOTAL NON-IRRIGATION SUPPLIES | | | 23,701 |
| TOTAL RUN-OF-THE-RIVER AND LOCAL SUPPLIES | | | 43,906 |

Reuse

The reuse quantities listed in Table I.1 are limited to currently permitted and operating indirect reuse projects and existing direct reuse for irrigation or industrial purposes. Table I.7 shows the individual reuse projects that make up the total reuse amount in Table I.1. These amounts reflect the results of a detailed study of existing and potential reuse projects in Region C. The topics addressed in the study included:

- Water reuse projects being performed under a Chapter 210 notification,
- Water reuse plans for large dischargers,
- Consolidation of water reuse plans into a regional plan
- Recent water right amendments involving reuse, and
- Existing reuse quantities

The findings of this study are presented below.

Water Reuse Projects Being Performed Under a Chapter 210 Reuse Authorization

Title 30, Chapter 210 of the Texas Administrative Code establishes general requirements, quality criteria, design, and operational requirements for direct reuse of reclaimed water. Before implementing a direct reuse project, the reclaimed water provider must notify the Executive Director of the Texas Commission on Environmental Quality (TCEQ) and obtain written approval to provide the reclaimed water. Table I.8 shows Region C entities that have notified the TCEQ of their intent to provide reclaimed water (as of July 2009) and have received a reuse authorization. Authorization does not necessarily mean that an entity has followed through and developed a reuse project. Detailed descriptions of projects operating under a Chapter 210 Authorization are provided below.

Azle. The City of Azle provides reclaimed water from its wastewater treatment plant for irrigation at the Cross Timbers Golf Course in Azle.

Crandall. The City of Crandall provides reclaimed water from the Crandall Wastewater Treatment Plant (WWTP) for irrigation at the Creekview Golf Club in Crandall.

Dallas. The City of Dallas provides reclaimed water from the Central WWTP for irrigation at Cedar Crest Golf Course in Dallas. The authorization also allows the use of reclaimed water for turf and landscape irrigation, maintenance of impoundments, soil compaction, and cooling tower makeup water.

**Table I.7
Summary of Supplies Available from Reuse
(Acre-Feet per Year)**

| Provider | Project Name | User/Receiving Water | Type | County | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 |
|---------------------------------------|-------------------------------|---|----------|-----------|--------|--------|--------|--------|--------|--------|
| Alcatel Network Systems | Alcatel Network Systems Reuse | internal reuse | direct | Dallas | 20 | 20 | 20 | 20 | 20 | 20 |
| Athens | Athens Fish Hatchery Reuse | Fish Hatchery | direct | Henderson | 2,872 | 0 | 0 | 0 | 0 | 0 |
| Azle | Azle Reuse | Cross Timbers Golf Course | direct | Tarrant | 300 | 300 | 300 | 300 | 300 | 300 |
| Bryson | Jack County Reuse | Clayton Ranch Irrigation | direct | Jack | 27 | 27 | 26 | 26 | 25 | 25 |
| Country Club WSC | Country Club WSC Reuse | Cedar Creek Country Club | direct | Kaufman | 92 | 92 | 92 | 92 | 92 | 92 |
| Crandall | Crandall Reuse | Creekview Golf Club | direct | Kaufman | 484 | 666 | 666 | 666 | 666 | 666 |
| Dallas | Cedar Crest Golf Course Reuse | Cedar Crest Golf Course | direct | Dallas | 561 | 561 | 561 | 561 | 561 | 561 |
| Dallas | Indirect Reuse | Dallas | indirect | Denton | 29,961 | 42,046 | 53,147 | 60,646 | 69,861 | 85,000 |
| DCCPMUD | Grapevine Reuse | Lake Grapevine | indirect | Tarrant | 1,493 | 1,663 | 1,784 | 1,864 | 1,924 | 1,974 |
| Deer Creek Waterworks/Willow Park | Willow Park Reuse | Split Rails Links and Golf Club | direct | Parker | 11 | 11 | 11 | 11 | 11 | 11 |
| Denton | Denton Power Direct Reuse | City of Garland Steam Electric Power Plant, Denton Regional Medical Office Building, Caruthers Oil Co. Inc., Robert Donnelly, Day Surgery Center DRMC, Denton Landfill, Denton State School, Oakmont Country Club | direct | Denton | 1,233 | 2,242 | 2,690 | 3,251 | 3,924 | 4,708 |
| Denton | Denton Indirect Reuse | indirect reuse | indirect | Denton | 1,682 | 8,861 | 11,557 | 12,907 | 12,726 | 12,545 |
| Denton County FWSD#1/UTRWD/Lewisville | UTRWD Reuse | Castle Hills Golf Course | direct | Denton | 897 | 897 | 897 | 897 | 897 | 897 |
| Ennis | Ennis Reuse | Tractabel Steam Electric Power Plant | direct | Ellis | 800 | 800 | 800 | 800 | 800 | 800 |
| Fort Worth | Village Creek Reuse | Waterchase Golf Course | direct | Tarrant | 897 | 897 | 897 | 897 | 897 | 897 |
| Gainesville | Kenetso Park Reuse | City of Gainesville - Keneteso Park | direct | Cooke | 9 | 9 | 9 | 9 | 9 | 9 |

Comment [adk1]: In Table 6.5, this amount is combined with the other Lake Grapevine line shown on the next page

¹ County reflects location of reuse project.

Table I.7, Continued

| Provider | Project Name | User/Receiving Water | Type | County ¹ | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 |
|------------------|---|--|-----------------|---------------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Garland/Forney | Garland/Forney Reuse | FPLE Steam Electric Power Plant | direct | Kaufman | 8,979 | 8,979 | 8,979 | 8,979 | 8,979 | 8,979 |
| Grapevine | Grapevine Reuse | Lake Grapevine | indirect | Tarrant | 1,824 | 2,033 | 2,180 | 2,278 | 2,352 | 2,412 |
| Jacksboro | Jacksboro Reuse | City of Jacksboro Golf Course | indirect | Jack | 385 | 385 | 385 | 385 | 385 | 385 |
| Millsap WWTP | Millsap ISD Reuse | Millsap High School Athletic Fields | direct | Parker | 2 | 2 | 2 | 2 | 2 | 2 |
| NTMWD | Rowlett Creek Reuse | Los Rios Country Club, Golf Center of Plano, Pecan Hollow Municipal Golf Course | direct | Collin | 1,540 | 1,540 | 1,540 | 1,540 | 1,540 | 1,540 |
| NTMWD | Buffalo Creek Reuse | Buffalo Creek Golf Course | direct | Rockwall | 672 | 672 | 672 | 672 | 672 | 672 |
| NTMWD/Royse City | Royse City Reuse | Aaki Golf | direct | Rockwall | 112 | 112 | 112 | 112 | 112 | 112 |
| NTMWD | Wilson Creek Reuse | Lake Lavon | indirect | Collin | 50,000 | 60,941 | 71,882 | 71,882 | 71,882 | 71,882 |
| NTMWD | East Fork Reuse | Trinity River | indirect | Kaufman | 51,790 | 67,148 | 87,102 | 102,000 | 102,000 | 102,000 |
| NTMWD/Frisco | Stewart Creek West Reuse | Trails of Frisco Golf Course | direct | Collin | 307 | 307 | 307 | 307 | 307 | 307 |
| Pinnacle Club | Pinnacle Club Reuse | Pinnacle Club Golf Course | direct | Henderson | 32 | 32 | 32 | 32 | 32 | 32 |
| TRWD | Richland Chambers Reservoir Reuse Project | Richland Chambers | indirect | Navarro | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 |
| The Colony | Collin County Reuse | Stonebriar Country Club | direct | Collin | 380 | 380 | 380 | 380 | 380 | 380 |
| TRA | Ten Mile Creek WWTP Reuse | Pecan Orchard | direct | Dallas | 250 | 250 | 250 | 250 | 250 | 250 |
| TRA | TRA/Waxahachie Reuse | | indirect | Ellis | 4,998 | 5,129 | 5,129 | 5,129 | 5,129 | 5,129 |
| TRA/DCURD | Las Colinas Reuse | Las Colinas - golf course irrigation, landscape irrigation, and lake level maintenance | direct/indirect | Dallas | 8,000 | 8,000 | 8,000 | 8,000 | 8,000 | 8,000 |
| Trophy Club | Denton County Golf Reuse | Trophy Club Country Club | direct | Denton | 800 | 800 | 800 | 800 | 800 | 800 |
| UTRWD | Lake Chapman Indirect Reuse | Lewisville Lake | indirect | Denton | 6,634 | 6,634 | 6,634 | 6,634 | 6,634 | 6,634 |
| Wise County | Wise County Mining Reuse | Mining | direct | Wise | 15,930 | 14,074 | 12,152 | 10,643 | 9,236 | 8,061 |
| Total | | | | | 203,974 | 246,510 | 289,995 | 312,972 | 321,405 | 336,082 |

¹ County reflects location of reuse project.

**Table I.8
Region C Entities That Have Received a Chapter 210 Reuse Authorization ⁽⁶⁾**

| Permittee | County | Permit Number |
|---|----------------|---------------------------|
| City of Azle | Tarrant/Parker | Pending |
| City of Crandall | Kaufman | R10834-001 |
| City of Dallas | Dallas | R10060-001 |
| City of Dallas | Dallas | R10060-006 |
| City of Denison | Grayson | R10079-005 |
| City of Denton | Denton | R10027-003 |
| City of Denton | Denton | R10027-004 |
| City of Ennis | Ellis | R10443-002 |
| City of Fort Worth | Tarrant | R10494-013 |
| City of Frisco | Collin | R10172-003 |
| City of Gainesville | Cooke | R10726-001 |
| City of Garland | Kaufman | R10090-001 |
| City of Grapevine | Tarrant | R10486-002 |
| City of Lewisville | Denton | R10662-001 |
| City of Royse City | Rockwall | R10366-001 |
| City of Runaway Bay | Wise | R10862-001 |
| City of Sanger | Denton | R10271-001 |
| City of the Colony | Denton | R11570-001 |
| City of Weatherford | Parker | R10380-002 |
| City of Weatherford | Parker | R14198-001 |
| Deer Creek Waterworks/ City of Willow Park | Parker | R13759-001/ R13834-001 |
| Millsap ISD | Parker | R13357-001 |
| Munson Point LTD | Grayson | R14487-001 |
| North Texas Municipal Water District | Collin | R10363-001 |
| North Texas Municipal Water District | Rockwall | R11894-001 |
| North Texas Municipal Water District | Rockwall | R12047-001 |
| North Texas Municipal Water District | Denton | R14008-001 |
| North Texas Municipal Water District | Collin | R14245-001 |
| North Texas Municipal Water District | Rockwall | R14469-001 |
| Town of Flower Mound | Denton | R11321-001 |
| Trinity River Authority | Dallas | R10303-001 |
| Trinity River Authority | Dallas | R10984-001 |

Denison. The City of Denison previously provided reclaimed water from its Grayson County Airport WWTP for irrigation at the Grayson County College Golf Course; however, this project has been discontinued.

Denton. The City of Denton operates a non-potable reclaimed water system that supplies reclaimed water directly from its Pecan Creek Water Reclamation Plant (WRP) to several customers, including the City landfill, the Denton Regional Medical Center, Oakmont Country Club, the Denton State School, and the City of Garland's Spencer Generating Station. Primary uses include irrigation, dust control, and cooling water for steam electric power generation. Denton plans to expand its existing direct reuse program.

Ennis. The City of Ennis provides reclaimed water from its Oak Grove WWTP for cooling water for steam electric power generation at the Suez-Tractebel power plant in Ennis.

Fort Worth. The City of Fort Worth provides reclaimed water from its Village Creek WWTP for irrigation at the Links at Waterchase Golf Course in Fort Worth. By the end of 2010 it is anticipated that the Village Creek WWTP will also provide reclaimed water to the Cities of Arlington and Euless, Dallas-Fort Worth International Airport, and additional retail customers within the Fort Worth city limits.

Frisco. Reclaimed water is provided for irrigation purposes from the Stewart Creek West WWTP in Frisco to the Trails of Frisco Golf Club. NTMWD operates the Stewart Creek West WWTP.

Gainesville. The City of Gainesville irrigates athletic fields at Keneteso Park, a municipal park, with reclaimed water from its WWTP.

Garland. The City of Garland produces reclaimed water at its Duck Creek WWTP. The City sells reclaimed water to the City of Forney, which in turn provides the reclaimed water to the FPL Energy power plant near Forney. The authorization also allows the use of reclaimed water for irrigation of golf courses, sod farms, silviculture, and food crops.

Grapevine. Although the City of Grapevine does use reclaimed water, it does so indirectly by discharging reclaimed water from its Peach Street WWTP to Lake Grapevine and using raw water from Lake Grapevine for municipal and irrigation purposes. This reuse project is permitted under a water right and is not operated under the authority of the Chapter 210 reuse authorization.

Lewisville. The City of Lewisville produces reclaimed water at its WWTP. The City sells reclaimed water to the Upper Trinity Regional Water District, which in turn provides the reclaimed water to the Denton County Fresh Water Supply District No. 1 for irrigation at the Castle Hills Golf Club. The City is permitted to provide reclaimed water for maintenance of wetlands at the Lewisville Lake Environmental Learning Area. The authorization would also allow the use of reclaimed water for irrigation of a tree nursery and of landscaped areas within the city.

Royse City. Reclaimed water is provided for irrigation purposes from the Sabine Creek West WWTP in Royse City to Aaki Golf. NTMWD operates the Sabine Creek West WWTP.

Runaway Bay. The City of Runaway Bay reuse authorization would allow the use of reclaimed water for golf course irrigation. However, the golf course currently uses raw water for irrigation and has not implemented the reuse project.

Sanger. The City of Sanger reuse authorization would allow the use of reclaimed water for agricultural and golf course irrigation. The City intends to provide reclaimed water for irrigation at a golf course that has not yet been designed or constructed.

The Colony. The City of The Colony provides reclaimed water from its Stewart Creek WWTP for irrigation at Stonebriar Country Club in Frisco.

Weatherford. The City of Weatherford's authorization would allow the use of reclaimed water for cooling tower makeup water, gas industry use, soil compaction and dust control in construction areas, irrigation of animal feed crops (other than pastures for milking animals), fire protection, golf course irrigation, and maintenance of water features. The City previously provided reclaimed water for irrigation to the Crown Valley Country Club, but this project has been discontinued. The City may expand its system in the future to serve the natural gas industry.

Deer Creek Waterworks. The City of Willow Park owns Deer Creek Water Works which has a single water reuse customer. The Deer Creek Waterworks provides reclaimed water from its WWTP for irrigation at the Split Rail Golf Links in Aledo. The authorization also allows the use of reclaimed water for athletic field irrigation and horticultural use.

Millsap ISD. The Millsap Independent School District uses reclaimed water from its WWTP to irrigate its football field and land around the athletic fields. The District irrigates the football field with reclaimed water during the off-season when the field is not in use.

Munson Point LTD. Munson Point LTD has obtained a 210 authorization for a planned residential development near Lake Texoma.

North Texas Municipal Water District. The North Texas Municipal Water District has Chapter 210 authorizations for reclaimed water from the Buffalo Creek WWTP, Rowlett Creek WWTP, Sabine WWTP, Frisco Cottonwood Branch WWTP, the Shepards Glen WWTP, and the Stewart Creek West WWTP. The District does not operate reuse projects from the Frisco Cottonwood Branch or Shepards Glen WWTPs at this time. Reclaimed water is provided for irrigation purposes to the following users: Buffalo Creek Golf Course (from Buffalo Creek WWTP), Los Rios Country Club (from Rowlett Creek WWTP), Pecan Hollow Municipal Golf Course (from Rowlett Creek WWTP), Soccer Complex (from Rowlett Creek WWTP), Aaki Golf (from Sabine Creek West WWTP via Royse City), and the Trails of Frisco Golf Club (from Stewart Creek West WWTP via the City of Frisco).

Flower Mound. The Town of Flower Mound's reuse authorization would allow the use of reclaimed water for maintenance of impoundments or natural water bodies, toilet or urinal flush water, silviculture, soil compaction or dust control in construction areas, cooling tower makeup water, and irrigation. This project has not been implemented.

Trinity River Authority. The Trinity River Authority provides reclaimed water from its Central Regional Wastewater System plant to the Dallas County Utility and Reclamation District for golf course irrigation, landscape irrigation, and lake level maintenance in Las Colinas. The Authority has also received an authorization that would allow it to supply reclaimed water from the Ten Mile Creek Regional Wastewater System plant for steam-electric power generation process water, irrigation of a pecan grove, and maintenance of impoundments. Under this authorization, the Authority currently provides reclaimed water to South Creek Ranch for irrigation and maintenance of impoundments.

Water Reuse Plans for Large Dischargers

Table I.9 lists wastewater treatment plants that currently have an annual average flowrate of two million gallons per day (mgd) or more. In addition to the dischargers listed in Table I.9, several other dischargers are permitted to discharge more than 2 mgd but currently have annual average discharges of less than 2 mgd. Of the dischargers in Table I.9, the following have provided written reuse plans (some in draft form): Dallas, Flower

Mound, Fort Worth, Lewisville, North Texas Municipal Water District, and Weatherford. These reuse plans are summarized below. In addition to these dischargers, the Cities of Irving, Frisco and Arlington have developed reuse plans.

Table I.9
Region C Wastewater Dischargers That Currently Discharge 2 MGD or More ⁽¹¹⁾

| Discharger | Plant | NPDES Number | County | 2008 Annual Average Flow (MGD) |
|--------------|--------------------|--------------|---------|--------------------------------|
| The Colony | Stewart Creek | TX0053112 | Denton | 2.40 |
| Corsicana | STP No. 2 | TX0056731 | Navarro | 2.71 |
| Dallas | Dallas Southside | TX0047848 | Dallas | 60.84 |
| Dallas | Dallas Central | TX0047830 | Dallas | 93.93 |
| Denison | Paw Paw | TX0047228 | Grayson | 2.02 |
| Denton | Pecan Creek | TX0047180 | Denton | 13.18 |
| Flower Mound | Flower Mound | TX0020711 | Denton | 4.33 |
| Fort Worth | Village Creek | TX0047295 | Tarrant | 106.35 |
| Garland | Rowlett Creek | TX0024686 | Dallas | 17.23 |
| Garland | Duck Creek | TX0024678 | Dallas | 10.17 |
| Grapevine | Peach Street | TX0032018 | Tarrant | 3.42 |
| Lewisville | Prairie Creek | TX0052892 | Denton | 7.65 |
| NTMWD | Muddy Creek | TX0123561 | Collin | 5.26 |
| NTMWD | Rowlett Creek | TX0047911 | Collin | 15.33 |
| NTMWD | Wilson Creek | TX0088633 | Collin | 36.55 |
| NTMWD | Mesquite | TX047431 | Dallas | 16.14 |
| NTMWD | Stewart Creek West | TX0103501 | Denton | 5.46 |
| Sherman | Post Oak | TX0024325 | Grayson | 7.45 |
| TRA | Denton Creek | TX0104957 | Denton | 4.67 |
| TRA | Red Oak | TX0104345 | Ellis | 2.20 |
| TRA | Ten Mile Creek | TX0022811 | Ellis | 14.50 |
| TRA | TRA Central | TX0022802 | Dallas | 131.95 |
| UTRWD | Lakeview | TX0020354 | Denton | 3.62 |
| Waxahachie | Waxahachie | TX0027537 | Ellis | 3.75 |
| Weatherford | Weatherford | TX0047724 | Parker | 2.03 |

Dallas. The City has developed a *Recycled Water Implementation Plan* ^(7,8). The plan recommends two direct reuse projects and two water supply augmentation projects (indirect reuse) for near-term implementation. Currently, the City irrigates Cedar Crest

Golf Course with reclaimed water from the Central Wastewater Treatment Plant. One direct reuse project involves extending the pipeline from Cedar Crest Golf Course to the Dallas Zoo, an industrial customer, and Stevens Golf Course. The projected average supply from this project would be 2.5 mgd. As of July 2009, the projected capital cost is \$15 million, operation and maintenance costs are estimated to be \$230,000 per year, and energy costs are expected to be \$85,000 per year. The Cedar Crest Pipeline Extension Project is currently being designed. Construction is anticipated to begin in 2011.

The second direct reuse project, the White Rock Pipeline, would involve a pipeline from the Central Wastewater Treatment Plant northward to serve customers in the White Rock Creek Basin. The projected average supply from this project would be 16.5 mgd. The projected capital cost is \$55.2 million, operation and maintenance costs are estimated to be \$1,380,000 per year, and energy costs are expected to be \$825,200 per year. DWU is planning to move forward with development of customer agreements and preliminary engineering on this project in 2013.

Water supply augmentation projects are recommended for Lake Lewisville and Lake Ray Hubbard. The Lake Lewisville augmentation project would involve pumping an annual average of 60 mgd of reclaimed water from the Central Wastewater Treatment Plant to Lake Lewisville for storage, blending, and future use. The projected capital cost for the Lake Lewisville project is \$185.7 million, and operation and maintenance costs are estimated to be \$45 million per year.

The Lake Ray Hubbard augmentation project would involve pumping an annual average of 60 mgd of reclaimed water from the Southside Wastewater Treatment Plant to Lake Ray Hubbard for storage, blending, and future use. The projected capital cost for the Lake Ray Hubbard project is \$201.3 million, and operation and maintenance costs are estimated to be \$5.0 million per year.

Flower Mound. The Town of Flower Mound has identified a potential service area that includes the corporate Town limits and the Grapevine Municipal Golf Course complex adjacent to the Town's southern limits ⁽⁹⁾. Potential reclaimed water uses include maintenance of impoundments or natural water bodies, toilet or urinal flush water, silviculture, soil compaction or dust control in construction areas, cooling tower makeup water, and irrigation. Initially, it is anticipated that reclaimed water would be delivered to

users in Lakeside Business District, for irrigation of vegetated medians along FM 2499, and for irrigation of Gerault Park.

Fort Worth. The City of Fort Worth has provided reclaimed water from its Village Creek WWTP for irrigation at the Links at Waterchase Golf Course in Fort Worth since 1999. In 2007, the City developed a *Reclaimed Water Priority and Implementation Plan* ⁽¹⁰⁾ to evaluate an additional five direct reuse projects, which would be used for local irrigation, natural gas exploration, cooling water makeup and electric power generation. The first of these projects, the Village Creek Reclaimed Water Delivery System, is anticipated to be online by the end of 2010. The Village Creek Reclaimed Water Delivery System will serve the Cities of Arlington and Euless, Dallas-Fort Worth International Airport, and other potential retail customers within the City of Fort Worth with up to 4,423 acre-feet per year of reclaimed water from the Village Creek WWTP. The remaining direct reuse projects are still in the planning phase and are described below:

The western direct reuse project involves the construction of a satellite wastewater treatment plant and conveyance facilities to provide reclaimed water to the Mary's Creek drainage basin in western Fort Worth. The Mary's Creek Direct Reuse Project would be constructed to provide a supply for non-potable water needs for the Walsh Ranch development and other nearby areas.

The central direct reuse project involves the construction of conveyance facilities to provide reclaimed water from the Village Creek WWTP to the Central Business District, including the planned Trinity River Vision Central City Project.

The northern direct reuse project involves the construction of conveyance facilities to provide reclaimed water from the Trinity River Authority's Denton Creek Regional Wastewater System to serve developments in the Alliance Airport area.

The southern direct reuse project involves the construction of a satellite WWTP and conveyance facilities to provide reclaimed water in the southern portion of the City for irrigation, cooling water, and other non-potable uses near the intersection of I-20 and I-35W.

Lewisville. The City of Lewisville has identified a potential service area that includes the City and its Extraterritorial Jurisdiction (ETJ) and selected locations outside the ETJ ⁽¹²⁾. The City plans to continue to produce reclaimed water for existing users (Denton County

Fresh Water Supply District No. 1 and the City) and may provide reclaimed water to other users including but not limited to: the Lake Park Golf Complex, the Lake Park athletic fields, a tree farm near Jones Street and Kealy Avenue, the City's Fire Training Center, a Heavy Industry Zone roughly bounded by State Highway 121 to the south, the Elm Fork Trinity River to the east, Prairie Creek and Sewage Treatment Plant Road to the north, and the Atchison, Topeka & Santa Fe Railroad to the west, Coyote Ridge Golf Club, Indian Creek Golf Course, and Riverchase Golf Club.

North Texas Municipal Water District. NTMWD utilizes return flows diverted from the East Fork of the Trinity River (East Fork) to augment existing supplies at Lake Lavon. The East Fork Raw Water Supply Project includes a 43 mile pipeline to transport treated water from a 1,840 acre constructed wetland near Seagoville to Lake Lavon. In 2007, NTMWD was granted a water rights permit authorizing the diversion and use of up to 157,393 acre-feet per year for the project. The project is currently planned to provide approximately 102,000 acre-feet per year of additional supply to Lake Lavon.

The NTMWD is now permitted to divert from Lake Lavon up to 71,882 acre-feet per year of return flows from the Wilson Creek WWTP. This plant currently provides nearly 48,000 acre-feet per year of supply for indirect reuse in Lake Lavon. In addition to these indirect reuse projects, the District plans to expand its direct reuse program.

Weatherford. The City of Weatherford has defined its potential service area as the City and its ETJ. Potential uses include cooling tower makeup water, gas industry use, soil compaction and dust control in construction areas, irrigation of animal feed crops (other than pastures for milking animals), fire protection, golf course irrigation, and maintenance of water features, and other acceptable uses where human contact with reclaimed water is unlikely to occur ⁽¹³⁾.

Dallas/North Texas Municipal Water District Collaboration. Dallas Water Utilities and NTMWD have entered into an agreement which would allow NTMWD to exchange up to 157,393 acre-feet per year of return flows from District water supplies into Lake Ray Hubbard for Dallas return flows into the mainstem Trinity River. Under this agreement, Dallas will have the right to divert the NTMWD return flows from Lake Ray Hubbard and will pump an equal amount of flow from the mainstem Trinity River to the NTMWD East Fork Water Supply Project wetland for use by NTMWD. In addition, once water rights for

Elm Fork return flows (from NTMWD return flows to the Lake Lewisville watershed) have been secured by NTMWD, NTMWD will support Dallas efforts to secure bed and banks transport, storage and diversion rights for the Elm Fork return flows. In exchange, Dallas will pump a quantity equal to NTMWD's future Elm Fork return flows to the East Fork Water Supply Project wetland for use by NTMWD.

Consolidation of Reuse Plans into a Regional Reuse Plan

All of the projects discussed in the 210 authorizations and the reuse plans are included in the current *Region C Water Plan*. Additional reuse projects were identified where possible to meet water needs. The recommended regional reuse plan is outlined in Table 4B.2 in Section 4B of the Region C plan.

Recent Water Right Amendments Involving Reuse

The Texas Commission on Environmental Quality (TCEQ) has granted reuse-based amendments to water right certificates of adjudication held by the Tarrant Regional Water District, Trinity River Authority, City of Dallas, Upper Trinity Regional Water District, City of Irving, and the North Texas Municipal Water District. These recent amendments are discussed below and summarized in Table I.10.

Tarrant Regional Water District. On February 8, 2005, the District received amendments to its water rights in Richland-Chambers Reservoir (Certificate of Adjudication 08-5035C) and Cedar Creek Reservoir (Certificate of Adjudication 08-4976C). The amended certificates allow the District to divert from the Trinity River a portion of the historic and future return flows that originate from water stored in District reservoirs. The return flows will be diverted into off-channel, wetland impoundments to improve water quality and then delivered into Richland-Chambers Reservoir and/or Cedar Creek Reservoir for storage and future diversion. The maximum annual diversion from the Trinity River shall not exceed any one of the following:

- 90,799 acre-feet per year (Certificate of Adjudication 08-4976C),
- 105,019 acre-feet per year (Certificate of Adjudication 08-5035C),
- 195,818 acre-feet per year for both certificates, or

- 70 percent of District return flows, less carriage losses.

**Table I.10
Water Right Amendments and Permit Applications Involving Reuse**

| Entity | Flow Description | Certification of Adjudication/ Permit Number | Status | Amendment Date | Additional Annual Diversion for Water Supply (ac-ft/year) |
|---------------------------------------|---|--|---------|----------------|---|
| Tarrant Regional Water District | Multiple WWTPs to Wetland/Cedar Creek Reservoir | 08-4976C | Amended | 02/08/05 | 52,500 |
| Tarrant Regional Water District | Multiple WWTPs to Wetland/Richland-Chambers Reservoir | 08-5035C | Amended | 02/08/05 | 63,000 |
| Trinity River Authority | Mountain Creek WWTP to Joe Pool Lake | 08-3404D | Amended | 06/27/05 | 4,368 |
| Trinity River Authority | Multiple WWTPs to Lake Livingston | 08-4248 | Amended | 10/12/06 | 246,960 |
| City of Dallas | Multiple WWTPs to Lewisville Lake | 08-2456E | Amended | 10/12/06 | 0 |
| City of Dallas | Multiple WWTPs to Lake Ray Hubbard | 08-2462G | Amended | 10/12/06 | 150,000 |
| Upper Trinity Regional Water District | Multiple WWTPs to Lewisville Lake | 5778 | Amended | 03/03/06 | 9,664 |
| City of Irving | Unspecified | 03-4799C | Amended | 01/06/06 | 31,600 |
| North Texas Municipal Water District | Wilson Creek WWTP to Lake Lavon | 08-2410E | Amended | 09/08/05 | 35,941 |
| North Texas Municipal Water District | Multiple WWTPs to Wetland/Lake Lavon | 08-2410F | Amended | 07/05/07 | 157,393 |

The maximum annual delivery from the Richland-Chambers wetland impoundment to Richland-Chambers Reservoir is 100,465 acre-feet per year. Similar to the operation of the Cedar Creek wetland project, the water from the Richland-Chambers wetland impoundment will augment existing storage in Richland-Chambers Reservoir for diversion under the reservoir’s original permit of 210,000 acre-feet per year, with additional authorized diversion from Richland-Chambers Reservoir up to 63,000 acre-feet per year for municipal, mining, industrial, and agricultural purposes. The Richland-Chamber Reservoir reuse project began operation in 2009.

The maximum annual delivery from the Cedar Creek wetland impoundment to Cedar Creek Reservoir is 88,059 acre-feet per year. This water will augment existing storage in Cedar Creek Reservoir for diversion under the reservoir's original permit of 175,000 acre-feet per year, plus additional authorized diversion from Cedar Creek Reservoir up to 52,500 acre-feet per year for municipal, mining, industrial, and agricultural purposes. The Cedar Creek Reservoir reuse project is expected to be completed by 2018.

Trinity River Authority. On October 12, 2006, the TCEQ granted an amendment to the Authority's Certificate of Adjudication 08-4248. The amendment allows the Authority to impound, in its share of the storage in Lake Livingston, historical and future return flows from its Central, Red Oak Creek, and Ten Mile Creek wastewater treatment plants. According to the amendment, these treatment plants have a cumulative permitted discharge of 220.5 million gallons per day (MGD). The amendment allows the Authority to impound return flows in Lake Livingston and to divert and use the return flows as authorized in the amended certificate. Lake Livingston is located in Region H.

On June 27, 2005, the Authority received an amendment to its water right in Joe Pool Lake (Certificate of Adjudication 08-3404D). The amended certificate allows the Authority to impound in and use from Joe Pool Lake an amount not to exceed 4,368 acre-feet per year of return flows from the Authority's Mountain Creek Regional Wastewater Treatment Plant. The amendment also provides a bed and banks authorization to use an unnamed tributary of Newton Branch, tributary of Soap Creek, tributary of Mountain Creek, and Joe Pool Lake to convey the discharged water to Joe Pool Lake for storage and subsequent diversion.

City of Dallas. On October 12, 2006, the TCEQ granted an amendment to the City's Certificate of Adjudication 08-2456E, an amendment to its water right in Lake Lewisville, and Certificate of Adjudication 08-2462G, an amendment to its water right in Lake Ray Hubbard. The amendments allow the diversion of historical and future return flows contributed by the City of Lewisville and Town of Flower Mound Wastewater Treatment Plants from the Elm Fork Trinity River to the City's Elm Fork and Bachman Water Treatment Plants. The amendment also provides the right to discharge, store, divert, and use historical and future return flows from the City's Central and Southside Wastewater Treatment Plants. The City plans to convey by pipeline a portion of the return flows from

the Central and Southside Wastewater Treatment Plants to Lake Lewisville and Lake Ray Hubbard. The five-year average discharges stated in the amendment from these plants are 157,030 acre-feet per year from the Central plant and 85,800 acre-feet per year from the Southside plant. The amendments require that the City leave at least 114,000 acre-feet per year of water discharged from the Central and Southside Wastewater Treatment Plants in the Trinity River to meet downstream flow requirements. The amendments also include a bed and banks authorization to convey the return flows from the pipeline discharge point to previously authorized diversion points. The amendments provide diversion authorization of up to an additional 150,000 acre-feet per year from Lake Ray Hubbard but do not request a new appropriation of water in Lake Lewisville.

Return flows covered by this request include the following:

- Dallas Trinity Basin origin water historically discharged into the Trinity River,
- Sabine River water (Lake Tawakoni) historically discharged into the Trinity River,
- Future increases in return flows originating from the Trinity River and Sabine River Basins, and
- Developed water to be transferred from the Sabine River (Lake Fork) and Neches River Basins.

Upper Trinity Regional Water District. On March 3, 2006, the TCEQ granted the District's amendment to Permit Number 5778. The amendment allows the District to divert from Lake Lewisville up to 9,664 acre-feet per year of return flows, originating from the District's Lake Chapman water, for municipal and industrial purposes. The proposed amendment authorizes the use of bed and banks to convey return flows from their points of discharge to the diversion point in Lake Lewisville.

City of Irving. On January 6, 2006, the TCEQ issued Certificate of Adjudication 03-4799C, an amendment to the City's water right in Lake Chapman. The amendment removes the requirement to return unconsumed water to the Trinity River Basin and adds an authorization to reuse its imported Sulphur River Basin water as "developed" water. The Certificate of Adjudication authorizes the City to reuse up to 31,600 acre-feet per year (less carriage losses). However, an agreement between the City and the Trinity River Authority limits this quantity to 28,000 acre-feet/year. The reuse authorization is subject to obtaining

future authorizations after identifying specific points of discharge and diversion and satisfying bed and banks requirements.

North Texas Municipal Water District (Lake Lavon). The District has been granted Certificates of Adjudication 08-2410E and 08-2410F to reuse return flows from District water supplies. Each of these is discussed below.

On September 8, 2005, the TCEQ authorized Certificate of Adjudication 08-2410E, which amended the District's water right in Lake Lavon. The amendment allows the District to divert from Lake Lavon up to an additional 35,941 acre-feet per year (for a total of 71,882 acre-feet per year) of return flows from the District's Wilson Creek Wastewater Treatment Plant. This diversion is for municipal purposes and is limited to the amount actually discharged from the treatment plant, less conveyance losses. On July 5, 2007, the TCEQ authorized Certificate of Adjudication 08-2410F, which amended the District's water right in Lake Lavon. The amendment allows the diversion of up to 157,393 acre-feet per year of return flows originating from District water supplies from the East Fork Trinity River for municipal, industrial, agricultural, and recreational purposes. This amount includes all future District return flows from wastewater treatment plants currently discharging to the watershed of the East Fork of the Trinity River with the following exceptions:

- 64 MGD of discharges from the District's Wilson Creek Wastewater Treatment Plant, which the District has appropriated through CA 08-2410E
- 30 percent of all Trinity Basin-based return flows authorized pursuant to Certificate of Adjudication No. 08-2410, as amended, which the District will leave in the East Fork Trinity River to address downstream water rights and the needs of the environment.

The amendment also includes a bed and banks authorization to use streams within the Trinity River Basin to convey District return flows to the diversion point.

Existing Reuse Quantities

During early August 2009, a survey of Chapter 210 reuse providers (Table I.11) and operating indirect reuse providers (Table 1-12) in Region C was conducted. Two significant, indirect reuse projects, the TRWD Richland-Chambers Wetland and NTMWD

East Fork Raw Water Supply Project, have both recently began operation and are not included in Table I.12 for this reason. A summary of information obtained from these surveys is included in this section.

The 2006 *Region C Water Plan*⁽¹⁾ showed the available supply from direct reuse projects included in Table 1-11 to be 35,738 ac-ft/yr by the year 2010. Over the course of the period evaluated here (2005-2008), reuse quantities ranging from 10,000 to 14,000 ac-ft/yr were used from these projects. The 2006 *Region C Water Plan*⁽¹⁾ showed the available supply from indirect reuse projects included in Table 1-12 to be 83,640 ac-ft/yr of water by the year 2010. In 2008, approximately 52,284 ac-ft/yr of reuse supplies from these projects were used.

**Table I.11
Direct Reuse Quantities by Provider**

| Sponsor | Project | Use | 2010 Available Supply (2006 Plan) (ac-ft/yr) | 2005 (ac-ft/yr) | 2006 (ac-ft/yr) | 2007 (ac-ft/yr) | 2008 (ac-ft/yr) |
|-----------------------------|-------------------------|------------------------|--|-----------------|-----------------|-----------------|-----------------|
| NTMWD | Rowlett Creek | Golf Course Irrigation | 1,540 | 383.65 | 422.59 | 140.06 | 221.95 |
| NTMWD | Buffalo Creek | Golf Course Irrigation | 672 | 187.69 | 244.99 | 145.77 | 159.34 |
| NTMWD | Royse City | Golf Course Irrigation | 112 | 112.26 | 129.00 | 0.00 | 0.00 |
| NTMWD Subtotal | | | 2,324 | 683.60 | 796.59 | 285.83 | 381.28 |
| TRA | Las Colinas | Irrigation | 8,000 | 1,684.41 | 2,192.30 | 227.16 | 1,756.72 |
| TRA | Ten Mile Creek | Irrigation | N/A | 41.93 | 46.06 | 13.42 | 35.87 |
| TRA Subtotal | | | 8,000 | 1,726.34 | 2,238.36 | 240.58 | 1,792.58 |
| Garland | Forney | Steam Electric Power | 8,979 | 6,522.64 | 8,015.82 | 7,997.97 | 7,910.11 |
| Garland Subtotal | | | 8,979 | 6,522.64 | 8,015.82 | 7,997.97 | 7,910.11 |
| Frisco | Stewart Creek | Golf Course Irrigation | 307 | 320.04 | 356.92 | 257.96 | 107.76 |
| Frisco Subtotal | | | 307 | 320.04 | 356.92 | 257.96 | 107.76 |
| Fort Worth | Waterchase Golf | Golf Course Irrigation | 897 | 438.12 | 594.36 | 304.78 | 449.44 |
| Fort Worth Subtotal | | | 897 | 438.12 | 594.36 | 304.78 | 449.44 |
| Dallas | Cedar Crest | Golf Course Irrigation | 561 | 250.61 | 232.28 | 166.04 | |
| Dallas Subtotal | | | 561 | 250.61 | 232.28 | 166.04 | 0.00 |
| Ennis | Tractabel | Steam Electric Power | 3,363 | 707.59 | 706.13 | 861.27 | |
| Ennis Subtotal | | | 3,363 | 707.59 | 706.13 | 861.27 | 0.00 |
| Gainesville | Keneteso Park | Irrigation | 9 | 0.73 | 0.94 | 3.87 | 4.05 |
| Gainesville Subtotal | | | 9 | 0.73 | 0.94 | 3.87 | 4.05 |
| Azle | Cross Timbers | Golf Course Irrigation | 811 | 242.96 | 285.20 | 32.49 | 56.10 |
| Azle Subtotal | | | 811 | 242.96 | 285.20 | 32.49 | 56.10 |
| The Colony | Stonebriar Country Club | Golf Course Irrigation | 380 | 114.96 | 326.28 | 180.23 | |
| The Colony Subtotal | | | 380 | 114.96 | 326.28 | 180.23 | 0.00 |
| Lewisville | Castlehills Golf Course | Golf Course Irrigation | 897 | 383.05 | 379.03 | 210.46 | |
| Lewisville Subtotal | | | 897 | 383.05 | 379.03 | 210.46 | 0.00 |
| Denton | City of Garland | Steam Electric Power | 3,363 | 388.15 | 644.24 | 172.78 | 108.39 |
| Denton | Oakmont Country Club | Golf Course Irrigation | 800 | 309.54 | 232.61 | 118.56 | 215.45 |
| Denton | Various | Irrigation | 6,165 | 64.49 | 106.98 | 82.08 | 69.40 |
| Denton Subtotal | | | 10,328 | 762.18 | 983.83 | 373.41 | 393.24 |
| TOTAL | | | 35,738 | 11,590 | 14,274 | 10,624 | 10,931 |

**Table I.12
Indirect Reuse Quantities by Provider**

| Sponsor | Project | 2010 Available Supply (2006 Plan) (ac-ft/yr) | 2005 (ac-ft/yr) | 2006 (ac-ft/yr) | 2007 (ac-ft/yr) | 2008 (ac-ft/yr) |
|---------------------------|------------------------|--|------------------|------------------|------------------|------------------|
| NTMWD | Wilson Creek | 71,882.00 | 4,208.37 | 43,933.45 | 50,104.20 | 42,831.31 |
| NTMWD Subtotal | | 71,882.00 | 4,208.37 | 43,933.45 | 50,104.20 | 42,831.31 |
| UTRWD | Lakeview Regional WRP | 8,441.00 | 2,686.38 | 2,691.13 | 4,264.19 | 4,070.85 |
| UTRWD | Riverbend Regional WRP | | 404.27 | 582.53 | 924.47 | 934.41 |
| UTRWD | Peninsula Regional WRP | | 75.64 | 116.37 | 147.22 | 191.44 |
| UTRWD | Celina WWTP | | 329.50 | 305.40 | 513.08 | 417.68 |
| UTRWD | | 8,441.00 | 3,495.78 | 3,695.44 | 5,848.96 | 5,614.37 |
| Grapevine | Peach St. WWTP | 3,317.00 | 3,501.68 | 3,376.64 | 3,924.26 | 3,838.40 |
| Grapevine Subtotal | | 3,317.00 | 3,501.68 | 3,376.64 | 3,924.26 | 3,838.40 |
| TOTAL | | 83,640.00 | 11,205.83 | 51,005.53 | 59,877.42 | 52,284.08 |

Desalination

Two desalination facilities are currently operated by public water systems within Region C. The City of Sherman operates a 7.50 MGD (design hydraulic capacity) electro dialysis reversal membrane plant to treat brackish water from Lake Texoma. The City of Bardwell operates a reverse osmosis facility to treat 0.036 MGD (design hydraulic capacity) of brackish groundwater. In addition, the Brazos River Authority (BRA) operates the Lake Granbury Surface Water and Treatment System (SWATS). Although Lake Granbury is located in Region G, BRA provides water from SWATS to the Johnson County SUD, which serves customers within Region C. The amount of water provided by SWATS is accounted for as an import to Region C (Table I.14).

Existing Desalination Quantities

During October 2009, a survey of operating desalination facilities in Region C was conducted. The information obtained from the City of Sherman's survey is shown in Table I.13.

**Table I.13
Desalination Quantities by Provider**

| Sponsor | 2006 (MG/year) | 2007 (MG/year) | 2008 (MG/year) | 2006 (ac-ft/yr) | 2007 (ac-ft/yr) | 2008 (ac-ft/yr) |
|-----------------|---------------------------|---------------------------|---------------------------|----------------------------|----------------------------|----------------------------|
| City of Sherman | 1,557.15 | 1,261.66 | 1,372.79 | 4,779 | 3,872 | 4,213 |

Imports

The supply available from imports is based upon the Water Availability Models (WAMs) from the TCEQ and the current contracts with the owners of the water sources. Table I.14 shows those imports. Below is a discussion of each of the imported water sources.

Table I.14
Currently Available Surface Water Supplies – Imports
(Acre-Feet per Year)

| Source | Basin of Origin | 2000 | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 | 2060 from 2006 Plan |
|---|-----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|---------------------|
| Chapman (NTMWD) ^a | Sulphur | 47,132 | 47,132 | 47,132 | 47,132 | 47,132 | 47,132 | 47,132 | 45,843 |
| Chapman (Irving) | Sulphur | 44,484 | 44,484 | 44,484 | 44,484 | 44,484 | 44,484 | 44,484 | 43,268 |
| Chapman (Upper Trinity MWD) | Sulphur | 13,268 | 13,268 | 13,268 | 13,268 | 13,268 | 13,268 | 13,268 | 12,905 |
| Tawakoni (Terrell) | Sabine | 9,790 | 0 | 0 | 0 | 0 | 0 | 0 | 9,356 |
| Tawakoni (Dallas) | Sabine | 184,991 | 183,619 | 182,251 | 180,882 | 179,515 | 178,146 | 176,777 | 176,777 |
| Fork (Dallas) ^b | Sabine | 120,000 | 120,000 | 119,943 | 119,095 | 118,248 | 117,400 | 116,551 | 116,551 |
| Upper Sabine Basin (NTMWD) ^c | Sabine | 0 | 49,718 | 29,646 | 9,573 | 9,501 | 9,428 | 9,356 | 0 |
| Palestine (Dallas) ^d | Neches | 112,700 | 112,881 | 111,776 | 110,670 | 109,563 | 108,455 | 107,347 | 108,980 |
| Livingston ^e | Trinity | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 |
| Lake Athens ^f | Neches | 3,960 | 3,908 | 3,856 | 3,804 | 3,751 | 3,699 | 3,647 | 3,647 |
| Possum Kingdom ^g | Brazos | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 |
| Lake Aquilla | Brazos | 245 | 264 | 276 | 285 | 295 | 309 | 329 | 329 |
| Lake Granbury | Brazos | 185 | 231 | 231 | 231 | 231 | 231 | 231 | 231 |
| Lake Palo Pinto | Brazos | 850 | 1,270 | 1,257 | 1,248 | 1,234 | 1,230 | 1,230 | 1,230 |
| TOTAL | | 559,605 | 598,775 | 576,120 | 552,672 | 549,222 | 545,782 | 542,352 | 541,117 |

- a. The supplies from Lake Chapman for NTMWD include NTMWD's share of Lake Chapman and sales from the City of Cooper.
- b. The import of water from Lake Fork to the Trinity Basin is limited to 120,000 acre-feet per year. The first phase of the infrastructure to transport this water to DWU is completed. The second phase is scheduled to be completed in the next five years.
- c. NTMWD acquired Terrell's supply in Lake Tawakoni with additional water from the Upper Sabine Basin for 2010 and 2020.
- d. There is no current infrastructure to transport the water from Lake Palestine to DWU.
- e. Water supply contract from Lake Livingston is for 20,000 acre-feet per year in any one year with no more than 48,000 acre-feet per year over a three year period.
- f. The amount of water from Lake Athens is the amount that is imported to Region C.
- g. The supply from Possum Kingdom Lake is for Vulcan Materials (Parker County Mining).

Chapman. North Texas Municipal Water District, the City of Irving, and the Sulphur River Water District hold water rights in Lake Chapman totaling 146,520 acre-feet per year. Of this total, 127,320 acre-feet per year can be exported for use in Region C – 57,214 acre-feet per year for North Texas Municipal Water District, 54,000 acre-feet per year for Irving, and 16,106 acre-feet per year for the Upper Trinity Regional Water District (purchased from the Sulphur River Water District). According to the Operations Plan for Lake Chapman, prepared by R.J. Brandes Company in June 2003 ⁽¹⁴⁾, the year 2000 firm yield of

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Lake Chapman is about 130,100 acre-feet per year, decreasing to 117,400 acre-feet per year by 2060. The modified Water Availability Model for the Sulphur Basin indicates that the year 2000 and year 2060 firm yield of Lake Chapman is 120,700 acre-feet per year, which is less than the permitted 146,520 acre-feet per year. Changes in the available supply since the 2006 *Region C Water Plan* ⁽¹⁾ can be attributed to extensive changes made to the TCEQ Sulphur Basin WAM.

The values in Table I.14 show Lake Chapman's computed firm yield divided proportionally among the Region C water suppliers with a share of the water. The water supply for Upper Trinity Regional Water District could reduce by 25 percent in 2050 because the City of Commerce has the option to reclaim a portion of the water it has sold to UTRWD after 2040. However, based on water projections for the City of Commerce, it is expected that Commerce may not need to exercise the option, thereby letting the water remain available to UTRWD.

Tawakoni. Lake Tawakoni is located in the Sabine River Basin. The Sabine River Authority holds water rights for 238,100 acre-feet per year. The City of Dallas has a contract for 190,480 acre-feet per year. The North Texas Municipal Water District has a contract for 10,081 acre-feet per year that was transferred from the City of Terrell since the 2006 *Region C Water Plan* ⁽¹⁾. Using the Sabine River WAM, the firm yield of Lake Tawakoni is 231,520 in year 2000, reducing to 221,240 acre-feet per year by 2060. The supplies available to the cities of Dallas and NTMWD are based on the proportion of the contracted amount to the firm yield. Adjustments were made to ensure that supplies to each customer of the Sabine River Authority were reduced proportionally. NTMWD's share of the Lake Tawakoni supply is included in the Upper Sabine Basin Supply in Table I.14.

Lake Fork (Dallas). Lake Fork is located in the Sabine River Basin. The Sabine River Authority holds water rights for 188,660 acre-feet per year. The City of Dallas has a contract for 131,860 acre-feet per year. Of this amount, 120,000 acre-feet per year can be exported to the Trinity Basin in Region C. The remainder can only be used in the Sabine River Basin. The Region I water planning group reports the firm yield of Lake Fork as 174,250 acre-feet per year in year 2000, reducing due to sedimentation to 166,960 acre-feet per year. The supply to Dallas was reduced in proportion to the reduced yield. The

total amount exported to Region C was limited to the 120,000 acre-feet per year specified in the trans-basin diversion permit.

Upper Sabine Basin Supply (NTMWD). In addition to the Lake Tawakoni supply transferred to NTMWD from Terrell, NTMWD has a temporary water right for additional supply from the Upper Sabine Basin. The additional supply is 40,000 acre-feet per year in 2010 and 20,000 acre-feet per year in 2020. The available supply to NTMWD from the Upper Sabine Basin that is shown in Table I.14 includes the temporary supply (2010 and 2020 only) and the firm yield of the Lake Tawakoni water right that was transferred from Terrell to NTMWD.

Palestine (Dallas). Lake Palestine is located on the Neches River in the Neches River Basin. The lake is owned and operated by the Upper Neches River Municipal Water Authority (UNRMWA) in conjunction with a downstream diversion point (Rocky Point). The UNRMWA holds water rights totaling 238,110 acre-feet per year from the Lake Palestine system. The firm yield of the Palestine system using the numbers provided by Region I is estimated at 222,200 acre-feet per year in year 2000, reducing to 214,600 acre-feet per year by 2060. The City of Dallas has a contract with the UNRMWA for 114,337 acre-feet per year. The supply to Dallas was reduced due to the reduced yield. Presently there is no infrastructure to transport this water from Lake Palestine to Dallas. This will be considered as a water management strategy.

Athens (Athens). Lake Athens is located in Henderson County in the Neches River Basin. The Athens Municipal Water Authority holds water rights in Lake Athens totaling 8,500 acre-feet per year. Of this amount 3,023 acre-feet per year is designated for industrial use for the Athens Fish Hatchery, which is located at the lake. The yield of Lake Athens was determined by Region I using the Neches Basin Water Availability Model and is currently 6,145 acre-feet per year. The amount that is exported to Region C for use by the City of Athens is 3,960 acre-feet per year, reducing to 3,647 acre-feet per year in 2060.

Possum Kingdom Lake (Vulcan Materials). Vulcan Materials has a contract to purchase 2,000 acre-feet per year of water originating in Possum Kingdom Lake from the

Brazos River Authority for mining use. Possum Kingdom Lake is in the Brazos River Basin in Region G. This supply is assumed to be available through the planning period.

Lake Aquilla. Lake Aquilla is located in the Brazos River Basin in Region G. The Aquilla Water Supply Corporation provides water to entities in Ellis and Navarro Counties in Region C. The total estimated supply provided to Region C from Lake Aquilla is 245 acre-feet per year in 2000, increasing to 329 acre-feet per year by 2060.

Lake Granbury. Lake Granbury is located in the Brazos River Basin in Region G. The Brazos River Authority owns and operates the lake as part of the Authority's water system. Currently, the Authority sells water from Lake Granbury to Johnson County Special Utility District (SUD). Johnson County SUD provides water to customers in both Region C and Region G. The amount of water imported to Region C is estimated at 231 acre-feet per year.

Lake Palo Pinto. Lake Palo Pinto is located in Palo Pinto County in the Brazos River Basin in Region G. A portion of Mineral Wells is in Parker County in Region C, and Mineral Wells also sells water to Millsap Water Supply Corporation (WSC), Parker County WSC, and the portions of North Rural and Santo WSCs in Parker County. All of Mineral Wells' water supply currently comes from Lake Palo Pinto. (Mineral Wells has a water right in Lake Mineral Wells in Parker County but has no plans to use that source for water supply.) The supply from Lake Palo Pinto to Region C consists of:

- All projected City of Mineral Wells demand in Parker County
- 25 acre-feet per year of demand for Parker County Manufacturing, provided through the City of Mineral Wells
- 479 acre-feet per year for Parker County Other.

APPENDIX I
LIST OF REFERENCES

- (1) Freese and Nichols, Inc., Alan Plummer Associates, Inc., Chiang, Patel & Yerby, Inc., and Cooksey Communications, Inc.: *2006 Region C Water Plan*, prepared for the Region C Water Planning Group, Fort Worth, January 2006.
- (2) Texas Commission on Environmental Quality: Water Rights Database, provided on January 22, 2009 by Marian Chervenka with TCEQ to be used in regional water planning.
- (3) Texas Water Development Board, *Exhibit C General Guidelines for Regional Water Plan Development (2007-2011)*, Austin, [Online] Available URL: <http://www.twdb.state.tx.us/wrpi/rwp/docu.htm>, September 8, 2008.
- (4) Texas Water Development Board: "GAM Run 08-14mag," Managed available groundwater estimates for the Woodbine Aquifer in Groundwater Management Area 8, Austin, December 2008.
- (5) Texas Water Development Board: "GAM Run 08-84mag," Managed available groundwater estimates for the Trinity Aquifer in Groundwater Management Area 8, Austin, March 2009.
- (6) Texas Commission on Environmental Quality: Chapter 210 Authorization Database, emailed July 17, 2009 by Sherry Smith.
- (7) Alan Plummer Associates, Inc., and Chiang, Patel & Yerby, Inc.: *Recycled Water Implementation Plan, Volume I, Final Review Draft*, prepared for Dallas Water Utilities, May 2005.
- (8) Alan Plummer Associates, Inc., and Chiang, Patel & Yerby, Inc.: *Recycled Water Implementation Plan, Volume II, Water Supply Augmentation with Recycled Water, Draft*, prepared for Dallas Water Utilities, August 2005.
- (9) Alan Plummer Associates, Inc.: *Reclaimed Water Use Notification*, prepared for the Town of Flower Mound, April 2002.
- (10) Alan Plummer Associates, Inc.: *Reclaimed Water Priority and Implementation Plan*, prepared for the City of Fort Worth, May 2007.
- (11) Environmental Protection Agency: Water Discharge Permits Query, downloaded August 2009 from http://www.epa.gov/enviro/html/pcs/pcs_query_java.html.
- (12) Alan Plummer Associates, Inc.: *Chapter 210 Reclaimed Water Use Notification*, prepared for the City of Lewisville, February 2004.

- (13) Alan Plummer Associates, Inc.: *Reclaimed Water Use Notification*, prepared for the City of Weatherford, July 2001.
- (14) R.J. Brandes Company: *Operations Plan for Lake Chapman*, June 2003.