Section 2
Reservoir Site Screening Process

2.1 Data Compilation and Sources

Research in the course of this study has identified over 220 major reservoir sites in Texas that have been included in State or Regional Water Plans or in significant planning studies by state or federal agencies, river authorities, water districts, or other water purveyors interested in water supply development. A tabular summary of these reservoir sites and plans in which they appear is included in the matrix screening tool described in Section 2.4 along with a reference bibliography. For the purposes of this study, a major reservoir is defined to be one having a conservation storage capacity of at least 5,000 acft. To date, reservoirs have been constructed at approximately 70 of these sites. For the remaining number of about 150 reservoir sites, consultants have conducted intensive library and archive research to compile key descriptive information including reservoir name, river basin and state water planning region location, firm yield, unit cost of raw water at the reservoir, and surface area at the proposed conservation storage pool level. In addition, shape files for use in GIS applications have been compiled or created for all of these remaining sites at which reservoirs have not been constructed. Exhibit 1 shows the locations of the reservoir sites that have been identified in plans and are considered in the matrix screening process summarized in Section 2.2.

2.2 Matrix Screening Process

In cooperation with TWDB staff, consultants developed and applied a matrix screening process with the objective of identifying potential reservoir sites most suitable for protection or acquisition by the State of Texas for the purpose of water supply development. Steps in this matrix screening process included:

(1) Identification of potential screening criteria;
(2) Selection and refinement of screening criteria in cooperation with TWDB staff;
(3) Assignment of appropriate relative importance, or weighting, to each selected screening criterion in cooperation with TWDB staff;
(4) Development and testing of a matrix screening tool;
(5) Compilation of supplemental data necessary to populate a matrix of reservoir sites and screening criteria;

(6) Application of the matrix screening tool to identify a select group of approximately 15 to 20 reservoir sites for more detailed technical evaluations as a part of this study; and

(7) TWDB staff selection of 16 reservoir sites for technical evaluation.

Information and activities relevant to each of these steps comprising the matrix screening process are described in Sections 2.3 through 2.5.

2.3 Screening Criteria

2.3.1 Criteria Identification Process

Potential screening criteria to be used in this study were first contemplated as part of an initial meeting on May 1, 2006 during which TWDB staff articulated goals for the study and critical issues to be considered in meeting these goals. With this guidance from TWDB staff, the consultants developed a preliminary list of potential screening criteria and met with TWDB staff to discuss on May 17, 2006. These discussions provided supplemental guidance leading to significant refinement of the preliminary list prior to development of the matrix screening tool. On August 14, 2006, the consultants met with TWDB staff to finalize the screening criteria and associated relative weightings as well as to demonstrate a draft version of the matrix screening tool using a sample set of nine reservoir sites. Integration of limited refinements suggested by TWDB staff resulted in the 11 criteria adopted for use in the matrix screening tool. This tool was used to assess approximately 150 reservoir sites across the state.

2.3.2 Criteria Discussion and Relative Weighting of Criteria

Eleven screening criteria and the relative weightings of these criteria were adopted by TWDB staff and the consultants prior to population and application of the matrix screening tool. These criteria are briefly discussed in the following paragraphs in the order of relative importance based on an assigned integer weighting from five (most important) to one (least important). The integer weighting factor is shown in parentheses following the criterion.

2.3.2.1 Recommended Water Management Strategy or Unique Reservoir Site in the 2007 State Water Plan (5)

One of the most important indications of a reservoir site that merits protection is its status in the current 2007 State Water Plan. As part of this planning process, each potential reservoir project recommended as a water management strategy and/or considered a unique reservoir site

has been subject to public comment and due consideration by one or more Regional Water Planning Groups representing diverse interests.

2.3.2.2 *Firm Yield (5)*

Since projected needs for additional water supply in Texas are great, the magnitude of firm yield or dependable supply during drought becomes a very important consideration. Larger reservoirs that are capable of meeting many needs may provide an economy of scale and concentration of impacts deemed beneficial from a state-wide perspective. Estimates of firm yield used in the matrix screening process are based on prior appropriation and include adjustments to reflect inflow passage for environmental flow needs.

2.3.2.3 *Unit Cost of Water (4)*

The unit cost of water is a composite measure of project efficiency and is computed as the annual costs of debt service on the dam and appurtenant works, land acquisition, and relocations plus operations and maintenance divided by the firm yield. Lower unit cost indicates that more dependable water supply is developed per dollar expended and is scored more favorably. Estimates of project cost obtained from older plans were updated to current dollars prior to calculation of unit cost and use in the matrix screening process.

2.3.2.4 *Special Considerations (3)*

The Allens Creek, Columbia, and Post Reservoir sites have been designated as unique by the Texas Legislature pursuant to SB1593 (76th Legislature), SB1362 (78th Legislature), and HB3096 (77th Legislature), respectively. In addition, the Brownsville Weir, Brushy Creek, and Palmetto Bend II Reservoir projects have been issued permits by the Texas Commission on Environmental Quality (TCEQ) or one of its predecessor regulatory agencies. This Special Considerations criterion provides recognition of the more advanced regulatory status of these six reservoir sites as compared to others.

2.3.2.5 *Ecologically Significant Stream Segment (3)*

The Texas Parks & Wildlife Department (TPWD) has identified a number of stream segments throughout the state as ecologically significant on the bases of biological function, hydrologic function, riparian conservation, exceptional aquatic life uses, and/or threatened or

endangered species (Figure 2.3-1) (TPWD, 1999). To date, 15 stream segments (seven in Region E and eight in Region H) have been recommended by Regional Water Planning Groups for designation as unique. Subject to this criterion, reservoir sites that do not conflict with identified ecologically significant stream segments are scored more favorably. Applications of this criterion account for differences between inundation of and indirect impacts to stream segments.

2.3.2.6 Terrestrial Impacts (2)

The U.S. Fish & Wildlife Service (USFWS) issued a report (USFWS, 1985) on the Texas Bottomland Hardwood Preservation Program in which numerous potential preservation sites, located primarily in east Texas, were identified and prioritized for protection (Figure 2.3-2). The terrestrial impacts criterion scores reservoir sites that do not conflict with these prioritized bottomland hardwood preservation sites more favorably. Applications of this criterion account for differences between reservoir sites inundating, or being located immediately upstream or some distance upstream of bottomland hardwood preservation sites. Consideration was also given to preservation site habitat quality as reflected in the priority assigned by USFWS.

2.3.2.7 Water Supply Needs within 50 Miles (2)

Reservoir sites that are geographically proximate to areas having long-term water supply needs may have advantages of lower cost for transmission facilities and lesser concerns with inter-basin transfer as well as greater opportunities for economic development and increased likelihood of local support. Projected municipal, industrial, and steam-electric power generation water supply needs at year 2060 for counties within (or partially within) a 50-mile radius of a reservoir site are summed, and sites with greater needs are scored more favorably.

2.3.2.8 Least Distance to a Major Demand Center (2)

Similar to the previous criterion, the least distance to a major demand center criterion scores reservoir sites more favorably the closer they are located to one or more of the largest current population centers in Texas (Figure 2.3-3).

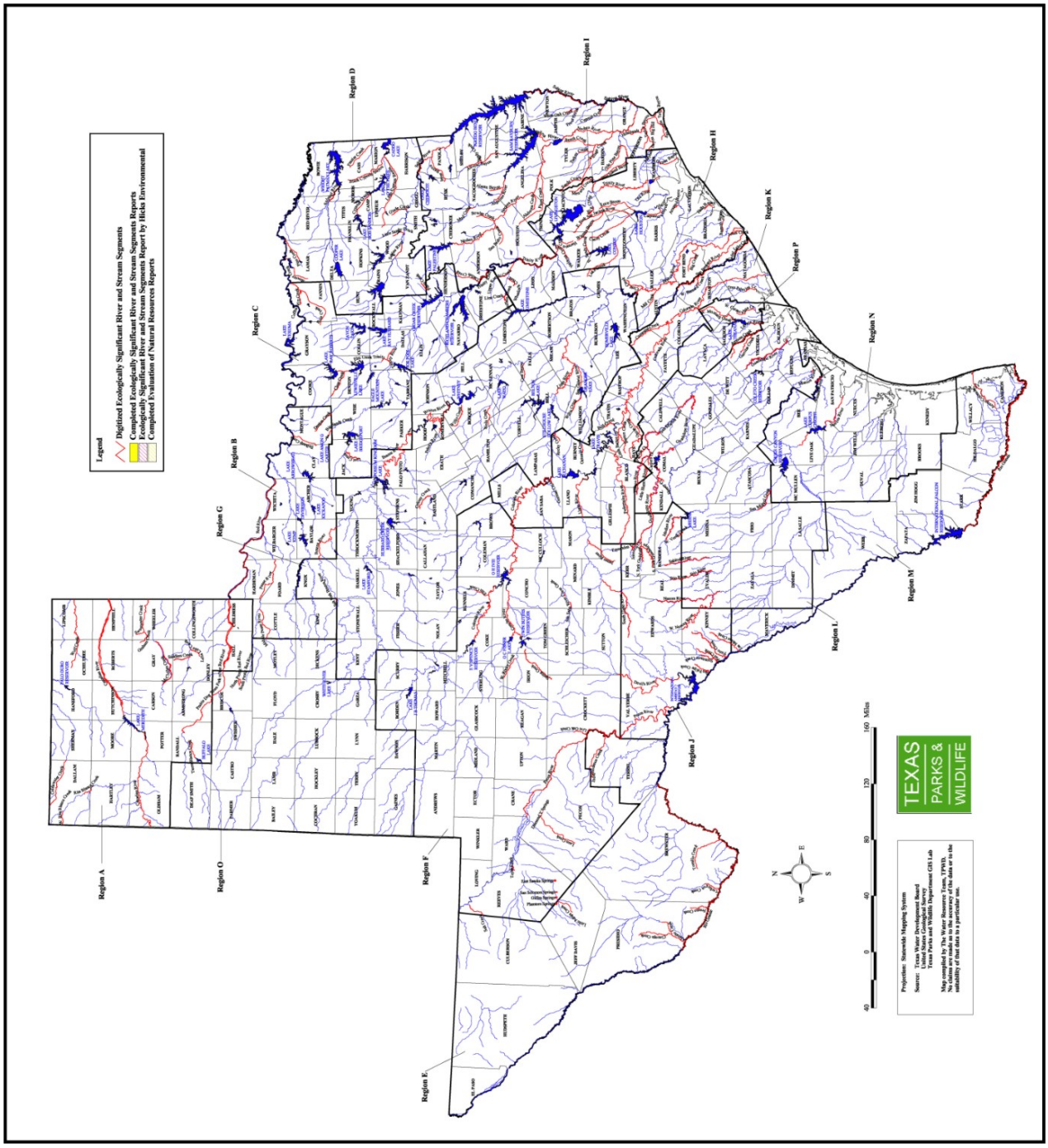

Figure 2.3-1. Ecologically Significant River and Stream Segments as Identified by TPWD

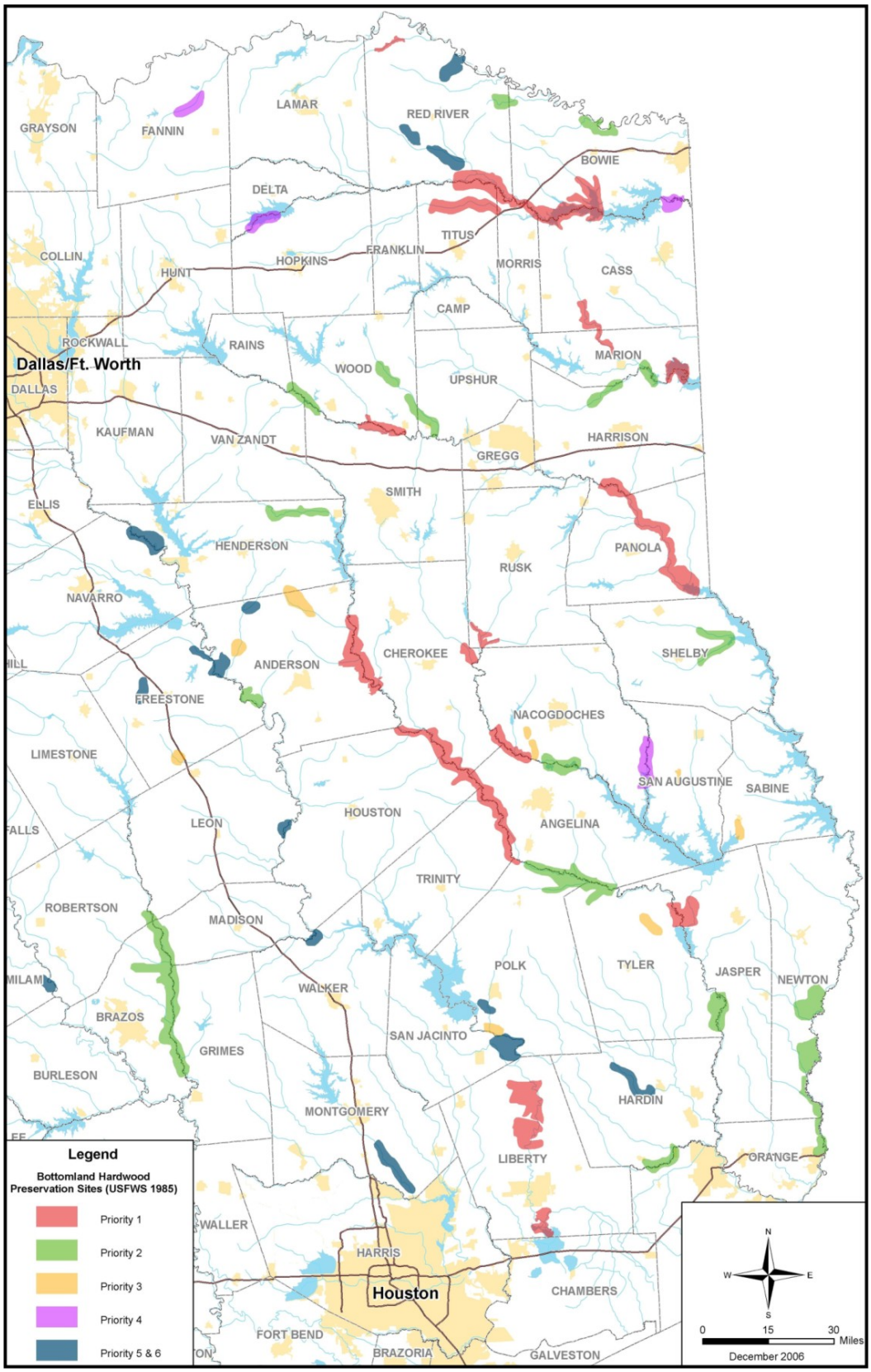

Figure 2.3-2. Bottomland Hardwood Preservation Sites as Recommended by USFWS

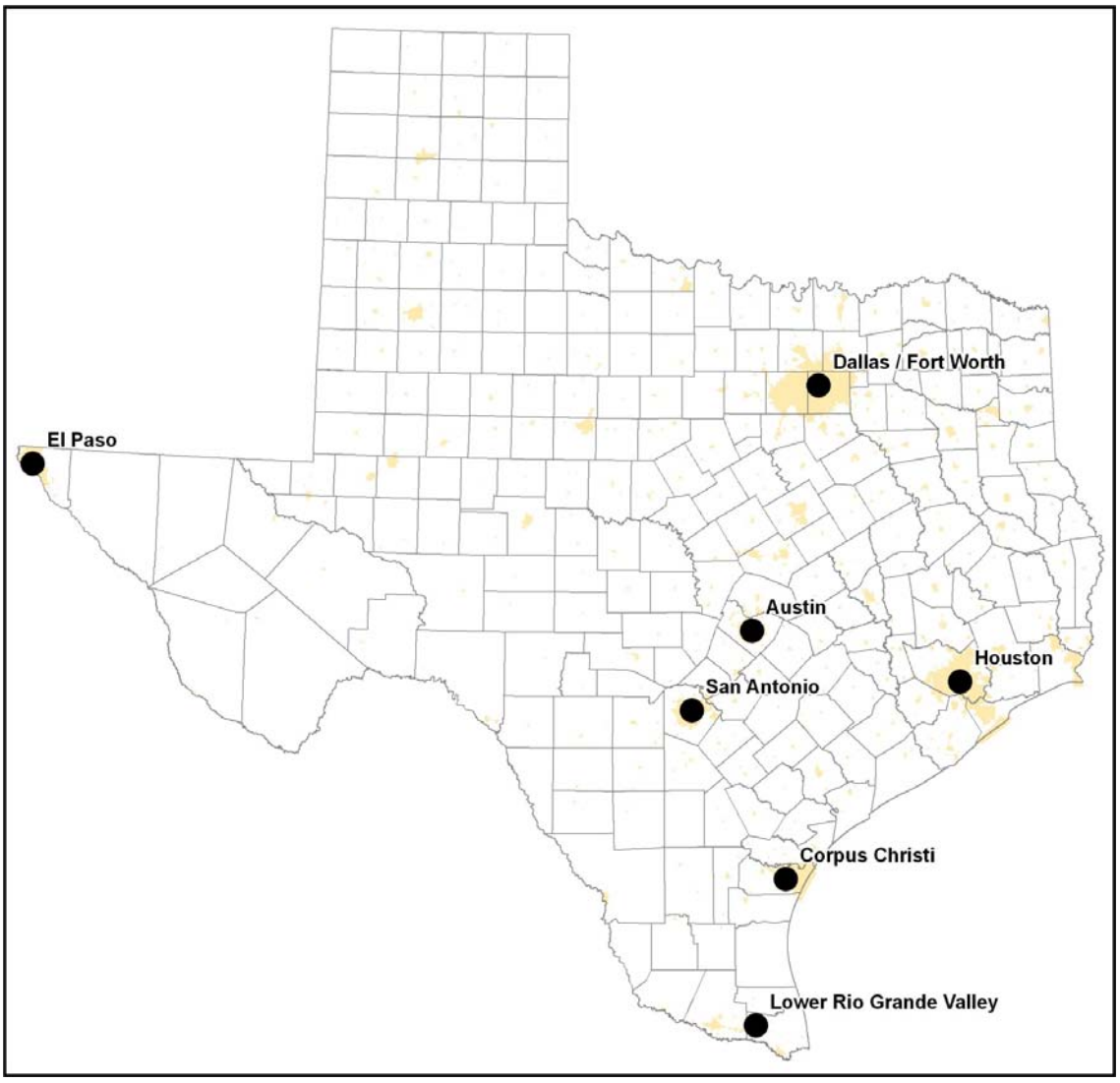

Figure 2.3-3. Major Water Demand Centers

2.3.2.9 System Operations Opportunity (2)

Numerous studies have shown that system operation of reservoirs can significantly increase firm yield from that obtained through independent operations. Hence, the system operations opportunity criterion assigns preference to reservoir sites proximate to one or more existing reservoirs or alternative water supply sources.

2.3.2.10 Water Quality Concerns (1)

Subject to the water quality concerns criterion, preference is afforded to reservoir sites for which there are no known inflow constituents likely to significantly increase difficulty and cost of treatment to drinking water standards.

2.3.2.11 Yield per Unit Surface Area (1)

The yield per unit surface area criterion provides a relative measure of reservoir site efficiency with respect to inflow, topography, and evaporation losses. Preference is given to reservoir sites for which available inflow is efficiently stored and evaporation losses are minimized, thereby maximizing firm yield.

2.4 Matrix Screening Tool Description

A matrix screening tool has been constructed in Microsoft Excel to provide for organized storage of compiled information regarding numerous reservoir sites and to expediently create a table preferentially ranking these reservoir sites based on criteria and assigned weights discussed above. The scoring system used within the matrix screening tool is briefly summarized in the following paragraphs.

Four of the criteria (Recommended to Meet Needs or as a Unique Reservoir Site in the 2007 State Water Plan, Special Considerations, System Operations Opportunity, and Water Quality Concerns) are based on a simple yes or no entry and receive a base score of 5 or 1, respectively. This base score is then multiplied by the assigned weight and added to the composite score for each reservoir site.

Five of the criteria (Firm Yield, Unit Cost of Water, Water Supply Needs within 50 Miles, Least Distance to Major Demand Center, and Yield per Unit Surface Area) are derived from numerical data specific to each reservoir site. Comprehensive data are not available for all reservoir sites, so techniques were integrated in the matrix screening tool to minimize potential biases resulting from missing data. Application of each of these five criteria is based on segregating the reservoir sites into five groups of similar numerical values (each group including 20 percent of the reservoir sites), and assigning an integer base score ranging from 5 (most favorable) to 1 (least favorable) to each group. This base score is then multiplied by the assigned weight and added to the composite score for each reservoir site.

The Ecologically Significant Stream Segment criterion is evaluated for each reservoir site by first assigning 1 to each yes entry as to the potential effect of a reservoir on biological functions, hydrologic functions, riparian conservation areas, exceptional aquatic life uses, and/or threatened or endangered species specifically identified by TPWD. Then, a secondary weighting factor is assigned according to whether the reservoir would actually inundate the stream segment (1.0), be located immediately upstream and indirectly impact the stream segment (0.5), or have

no significant impact upon the stream segment (0.0). The base score for each reservoir site is calculated by multiplying the number of yes entries by the secondary weighting factor and subtracting the product from 5. Therefore, base scores for this criterion may range from 5 (most favorable, no impacts) to 0 (least favorable, inundation impacts in all five categories). The base score is then multiplied by the assigned weight and added to the composite score for each reservoir site.

The Terrestrial Impacts criterion is evaluated by determining whether a reservoir site conflicts with an identified bottomland hardwood preservation site and assigning an initial score based on the priority attributed to the preservation site by USFWS. The initial score ranges from 1 for conflict with a Priority 1 bottomland hardwood preservation site up to 5 for no conflict or conflict with a Priority 5 or 6 bottomland hardwood preservation site. Then, a secondary weighting factor is assigned according to whether the reservoir would actually inundate the preservation site (1.0), be located immediately upstream (1.5), or be located some distance upstream (2.0). The base score for each reservoir site is calculated by multiplying the initial score by the secondary weighting factor and dividing by 2. Therefore, base scores for this criterion may range from 5 (most favorable, no impacts) to 0.5 (least favorable, inundation of Priority 1 preservation site). The base score is then multiplied by the assigned weight and added to the composite score for each reservoir site.

The 11 weighted criterion scores are summed to obtain a composite score for each reservoir site. This composite score is then used to rank all reservoir sites from highest to lowest in terms of favorability for protection or acquisition. Appendix E includes summary excerpts from the populated matrix screening tool showing ranking for all sites evaluated, criteria and relative weighting used to obtain this ranking, and compiled data for reservoir sites grouped by river basin. Recognizing likely interest in scoring and ranking of reservoir sites subject to a spectrum of criteria weightings, the populated matrix screening tool is set up for convenient modification of criteria weights, and routines have been installed for instant update and summary of reservoir site rankings.

2.5 Results of Matrix Screening Process

During a September 21, 2006 meeting, consultants demonstrated application of the populated matrix screening tool to TWDB staff and presented a ranking of reservoir sites based

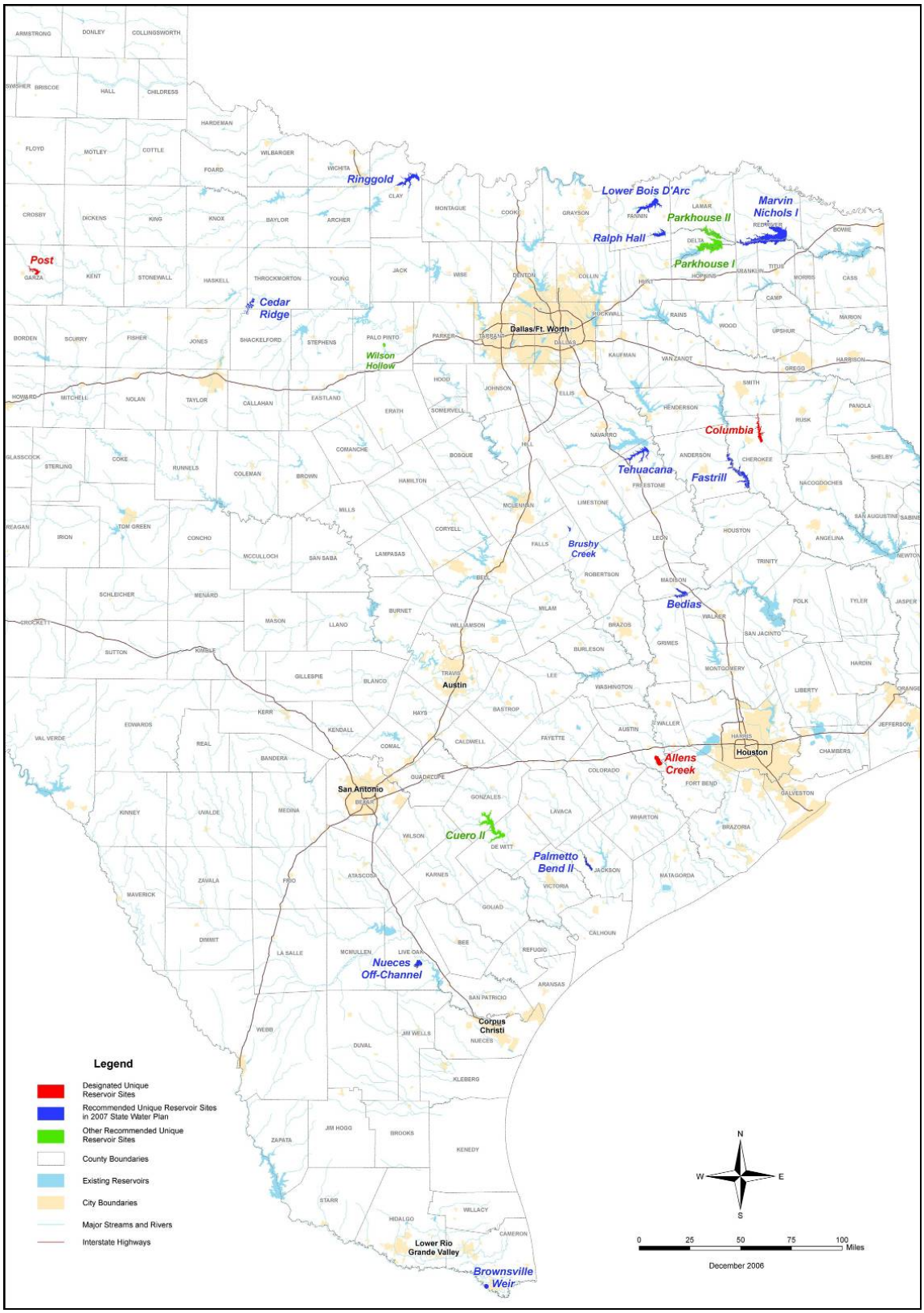

Figure 2.5-1. Designated and Recommended Unique Reservoir Sites

on criteria and weightings previously adopted. The 19 top-ranked sites for protection or acquisition are shown in Figure 2.5-1 and Exhibit 2 and are listed in alphabetical order as follows: Allens Creek, Bedias, Brownsville Weir, Brushy Creek, Cedar Ridge (Breckenridge), Columbia (Eastex), Cuero II (Sandies Creek), Fastrill (Weches), Lower Bois D'Arc, Marvin Nichols IA, Nueces Off-Channel, Palmetto Bend II, Parkhouse I, Parkhouse II, Post, Ralph Hall, Ringgold, Tehuacana, and Wilson Hollow. As indicated in Figure 2.5-1, three reservoir sites have already been designated as unique by the Texas Legislature, 12 are recommended unique reservoir sites in the 2007 State Water Plan, and four are identified as potential unique reservoir sites as a result of this study. Detailed information regarding these reservoir sites, individually and collectively, is presented in Sections 3 and 4, respectively.

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